

International Journal of Scientific and Research Publications

Print Version, Volume 3, Issue 1
January 2013 Edition
ISSN 2250-3153

IJSRP
www.ijsrp.org

International Journal of Scientific and Research Publications

GENERAL INFORMATION:

IJSRP, International Journal of Scientific and Research Publications publish monthly journal under ISSN 2250-3153.

ONLINE VERSION

<http://www.ijsrp.org/e-journal.html>

PRINT VERSION

<http://www.ijsrp.org/print-journal.html>

All the respective authors are the sole owner and responsible of published research and research papers are published after full consent of respective author or co-author(s).

For any discussion on research subject or research matter, the reader should directly contact to undersigned authors.

COPYRIGHT

Copyright©2012 IJSRP.ORG

All Rights Reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, scanning or otherwise, except as described below, without the permission in writing of the Publisher.

Copying of articles is not permitted except for personal and internal use, to the extent permitted by national copyright law, or under the terms of a license issued by the national Reproduction Rights Organization.

All the published research can be referenced by readers/scholars/researchers in their further research with proper citation given to original authors.

DISCLAIMER

Statements and opinions expressed in the published papers are those of the individual contributors and not the statements and opinion of IJSRP. We assume no responsibility or liability for any damage or injury to persons or property arising out of the use of any materials, instructions, methods or ideas contained herein. We expressly disclaim any implied warranties of merchantability or fitness for a particular purpose. If expert assistance is required, the services of a competent professional person should be sought.

Contact Information:

Editor: editor@ijsrp.org

Website: <http://www.ijsrp.org>

Table of Contents

Ergonomic Problems Prevalent in Handloom Units of North East India	7
Sangeeta Pandit, Prakash Kumar, Debkumar Chakrabarti	7
Phytochemical Screening of <i>Gloriosa superba L.</i> - from different Geographical Positions	14
Mariappan Senthilkumar	14
Field Hockey Better Psychological Effect through the Motivation and Stress	20
Bogiti Rajesh Jayaratnam¹, Dr.N.S.Dileep²	20
Performance Evaluations of Grigoryan FFT and Cooley-Tukey FFT onto Xilinx Virtex-II Pro and Virtex-5 FPGAs	24
Narayanam Ranganadh and Muni Guravaiah P	24
Jeans Instability of Optically Thick Quantum Plasma under the Influence of Black-Body Radiation	30
V. Shrivastava*, R. K. Pensia**, G. S. Kachhawa*, A. K. Patidar* and D. L. Sutar***	30
Implementation and Analysis of Power, Area and Delay of Array, Urdhva, Nikhilam Vedic Multipliers.....	33
Ch. Harish Kumar	33
Arbuscular Mycorrhizal Fungi: Biocontrol against Fusarium Wilt of Chickpea	38
Pradeep Kumar Singh*, Meenakshi Singh*, V. K. Agnihotri**, Deepak Vyas**	38
Model Discovery from Motor Claim Process Using Process Mining Technique	43
P.V.Kumaraguru*, Dr.S.P.Rajagopalan**	43
Modified Acousto-Electric Interactions in Colloids Laden Semiconductor Quantum Plasmas.....	47
Aartee Sharma, Nishchhal Yadav, S. Ghosh	47
Understanding the Adsorption Efficiency of Chitosan Coated Carbon on Heavy Metal Removal.....	54
¹M.Soundarrajan, ²T.Gomathi and ^{2*}P.N. Sudha	54
Sustainable Success	63
Dr. Vidhu Gaur	63
Review Paper on Various Filtering Techniques and Future Scope to Apply These on TEM Images.....	69
Garima Goyal¹, Ajay Kumar Bansal², Manish Singhal³	69
Factors Effecting Private Residential Prices in Mainland China during 2003-2009	80
Huinan Yan	80
Comparative Analysis of AES and DES security Algorithms.....	87
Sumitra	87
Oral Piercings: A constructive genius or a destructive devil??	92
Sandhyarani B*, Dayanand Huddar**	92
Fuzzy aw-Continuous Mappings	94
Manoj Mishra¹, S. S. Thakur²	94
A Natural Language Processing based Web Mining System for Social Media Analysis	97
John Selvadurai	97
Designing & Implementation of Mobile Operated Toy Car by DTMF.....	101
Sabuj Das Gupta¹, Arman Riaz Ochi², Mohammad Sakib Hossain³, Nahid Alam Siddique⁴	101
The Proportional Relations Systems of Islamic Architecture.....	108
Kadhim Fathel Khalil and Julaihi Wahid	108
Great Mosque.....	115
Status of Women: North Eastern Region of India versus India.....	120
Dr. Ira Das	120
Lossless Compression of Grayscale Images Using Dynamic Arrays for Prediction and Applied to Higher Bitplanes	128
Mayur Nandihalli*, Vishwanath Baligar**	128

Modeling, Analysis and Control of Active Suspension System using Sliding Mode Control and Disturbance Observer.....	134
Faraz Ahmed Ansari[*], RajShree Taparua^{**}	134
Radiological Evidence of Costoclavicular Joint.....	140
Anita Rani, Jyoti Chopra, Archana Rani, Arvind Kumar Pankaj, Rakesh Kumar Verma and Rakesh Kumar Dewan	140
Marital Adjustment and Mental Health among Bank Employees and Doctors during Middle Age (40-55 Years) in Delhi.....	143
Dr. Shikha Goel¹, Dr. Darshan Kaur Narang², Dr. Kavita Koradia³	143
Survey on Spatio-Temporal Database and Data Models with relevant Features.....	151
Sonia Rathee[*], Amita Yadav^{**}	151
<i>Nirmala Huidrom[*], Neha Bagoria^{**}</i>	156
Fuzzy Logic Gates in Electronic Circuits	165
Dr. G.Nirmala[*] and G.Suvitha^{**}	165
Wear Analysis of Polytetrafluoroethylene and it's Composites under Dry Conditions using Design-Expert ...	170
Deepak Bagale , Sanjay Shekhawat , Jitendra Chaudhari	170
An Assessment of Perceived Stress, Resilience and Mental Health of Adolescents Living in Border Areas....	176
Sarita Sood[*], Arti Bakhshi^{**}, Pooja Devi^{***}	176
Pleomorphic Adenoma of Hard Palate: A Case Report.....	180
Dr. S.P.Lenka[*], Dr. Subrat Kumar Padhiary[*], Dr. Santosh kumar Subudhi[*], Dr.Harshmohan Pathak[*], Dr. Sujit Sahoo^{**}	180
Phytochemical Analysis of Eight Medicinal Plants from Amravati District (MS) India	183
P. G. Dhawale	183
Comparative Study of Solifenecin Alone Versus Solifenecin with Duloxetine in Patients of Overactive Bladder	186
Anusha Vohra[*], Sanjay Khanna^{**}, Pratap Shankar^{***}, Rakesh Verma^{****}, R. K. Dixit^{*****}	186
Design and Analysis on Scramjet Engine Inlet.....	192
Aqheel Murtuza Siddiqui¹, G.M.Sayeed Ahmed²	192
An integral involving general class of polynomials with I- function	204
Jyoti Mishra[*] and Neelam Pandey^{**}	204
Studies on Mobility Indicators and the Effect of Congestion Reduction Measures on the Movement of Vehicular Traffic along G-6 Bus Route in Bangalore City using Micro Simulation Software.....	206
Harish H.S[*] and Dr. Suresha S.N^{**}	206
Threshold and Gain characteristics of Stimulated Brillouin Scattering in n-InSb Crystal	210
P. S. Malviya[*], Nilesh Nimje^{**}, Nishchhal Yadav^{**}	210
Forecasting and Management of Load for Rural Areas.....	216
Anil Kumar Sahu, Dr. Arun M. Shandilya, Dr. S. K. Bhardwaj	216
Problems of Govt. Girls High Schools of Khargone District (M.P.).....	222
Dr. Shri Krishna Mishra[*], Mr. Badri Yadav^{**}	222
Preparation and Characterization of Colon Targeted Beads of Indomethacin Using Chitosan and Chondroitin Sulphate.....	240
Jasvir Kaur[*], Gurpreet Kaur^{**}, Satvinder Kaur[*] and Anu Mahajan[*]	240
A Study Exploring the Link between Attachment Styles and Social Networking Habits of Adolescents in Urban Bangalore	250
Gayathri Rao[*], Dr. Ankur Madan^{**}	250
An Overview Study of Personalized Web Search	262
Chanchala Joshi[*], Teena Jaiswal^{**}, Himanshu Gaur^{***}	262
Screening for Anti-Microbial and Phyto Chemical Properties of Different Solvents Extracts of Leafs of Pongamia Pinnata.....	265
K.Niranjan^a, V.Sathiyaseelan^b, E.C.Jeyaseelan^a	265

Effect of Pongamia Leaf Medium on Growth of Earthworm (<i>Eudrilus eugeniae</i>)	268
Jesikha.M and M. Lekeshmanaswamy	268
A Survey: Security Perspectives of ORACLE and IBM-DB2 Databases	272
Lavanya Pamulaparty*, T. Praveen Kumar**, P. Vijaya Babu Varma**	272
Biology and Morphometrics of Cashew Stem and Root Borers (CSRB) <i>Plocaederus Ferrugenus</i> and <i>Plocaederus Obesus</i> (Coleoptera: Cerambycidae) Reared on Cashew Bark	278
Vasanthi. P*, T. N. Raviprasad**	278
Treatment of Pseudoaneurysm of Internal Maxillary Artery Resulting From Subcondylar Fracture	285
Dr.Harshmohan Pathak*, Dr.Santosh Kumar Subudhi**, Dr.Subrat Padhiary*,Dr.P.R.K.Rao**,Dr.Sujit Sahoo*	285
Adsorption Studies of Plant Base Oil and Mineral Oils on Tea Powder Waste	289
Geetha K.S and Belagali S.L	289
A Benchmark to Select Classification Algorithms for Decision Support Systems	296
Mahendra Tiwari*, Randhir Singh**	296
Lean Healthcare Practice and Healthcare Performance in Malaysian Healthcare Industry	301
Nurul Aifaa Shazali*, Nurul Fadly Habidin**, Naimah Ali*, Nur Afni Khaidir*, Noor Hidayah Jamaludin*	301
Obesity- Caused by a germ?	306
Anjum Jeelani*, Syed Afroz Ahmed*, Farah Vaqar Momin**	306
A block based Encryption Model to improve Avalanche Effect for data Security	309
¹Ganesh Patidar, ²Nitin Agrawal, ³Sitendra Tarmakar	309
A Survey of Translation Quality of English to Hindi Online Translation Systems (Google and Bing).....	313
Bhojraj Singh Dhakar, Sitesh Kumar Sinha, Krishna Kumar Pandey	313
Role of Women in Decision-making Related to Farm: A study of Jammu district of J&K State	317
Subita Sharma, P K Rao and Rajni Sharma	317
A Study of Agricultural Activities Performed by Rural Women and Problems Faced by them in Jammu District of J&K State.....	321
Hemla Aggarwal, Subita Sharma and Rajni Sharma	321
Pseudo Fuzzy Coset	324
Mrs. Shobha Shukla	324
Histological Observations on the Infundibulum of Kuttanad Duck (<i>Anas platyrhynchos domestics</i>) during Postnatal Period	326
Patki H. S*, Lucy K. M**, Chungath J. J**	326
The Assessment of the Curing effect of Mathumeha Chooranam on those Affected by Mathumeka Disease ..	335
Dr(Mrs)T.Kumutharanjan	335
The Effect of Different Cane Portions on Sprouting, Growth and Yield of Sugarcane (<i>Saccharum spp. L.</i>)....	338
Mengistu Sime	338
Effect of Different Nitrogen Rates and Time of Application in Improving Yield and Quality of Seed Cane of Sugarcane (<i>Saccharum spp. L.</i>) Variety B41/227.....	341
Mengistu Sime	341
Evaluation of Indoor Environmental Quality (IEQ) on dense Academic Building: Case Studies Universiti Tun Hussein Onn Malaysia	348
M.A Sulaiman*, W.Z. Wan Yusoff**, W.N. Wan Kamarudin***	348
Effect of Organic Manures and Chemical Fertilizers on the Yield and Macronutrient Concentrations of Green Gram	353
Saravanan P*, Sathish Kumar S**	353
Computer Based Patient Education in Central India	355
Rizwan Abdul Rasheed Shaikh*, Wasundhara A. Bhad*	355
Framework for Accelerometer Based Gesture Recognition and Seamless Integration with Desktop Applications	359

Vijay D Rajanna	359
Case Series of Complicated Incisional Hernia.....	364
Kshirsagar A Y, Patil R K, Chotai T, Bane P, Agarwal S, Patil M.	364
Time Lag recurrent Neural Network model for Rainfall prediction using El Niño indices	367
N.A.Charaniya*, Prof. Dr. S.V.Dudul **	367
An Easy Method of Spirometry for Ill and Aged Subjects.....	372
Dr. S. Meenakshi	372
Traditional Home Remedies for Common Ailments from Himayatnagar Taluka of Nanded District.....	376
Madhushree M. Routh*, Manisha P. Mangulkar**	376
Investigation of Mechanical Properties and Grain Structure of 5xxx Aluminium Alloys under Precisely Controlled Annealed Conditions.....	381
Nice Menachery*, Biju C V**, Sijo M T*	381
Change in global Climate and Prevalence of Visceral Leishmaniasis.....	385
Kumar Rajesh*, Kumar Sanjay**	385
Evaluation of Popular Rice (<i>Oryza sativa</i> L.) Hybrids for Quantitative, Qualitative and Nutritional Aspects..	387
V. Ravindra Babu¹*, K.Shreya², Kuldeep Singh Dangi², G. Usharani² and P. Nagesh³	387
Naipaul's <i>India: A Million Mutinies Now: A Political Perspective</i>	395
Bhupinder Singh	395
Assessment of Surface Roughness and Material Removal Rate on Machining of TIB2 Reinforced Aluminum 6063 Composites: A Taguchi's Approach.....	398
K.Krishnamurthy*, J.Venkatesh**	398
Evaluation of Fiber Enriched Biscuits as a Healthy Snack.....	404
Shweta Sharma*, Seema Rana*, Charu Katare*, Tara Pendharkar*, GBKS Prasad**	404
Performance Analysis of Diffraction Gain (G_d) Due to presence of Knife-Edge as Compared to Free Space E- Field and Identifying the Position of Obstacle in a Fresnel Zone.....	408
P.Sankara Rao	408
Sex Pre-selection by Quantification of Y- Chromosome Bearing Spermatozoa in Goat Species.....	415
Sureka P*, Nilani K*, Eswaramohan T* and Balasubramaniam K**	415
Synthesis, Characterization and Thermal, Electrical study of CdS-Polyaniline Nanocomposite via Oxidation Polymerization	419
J. B. Bhaiswar*, M. Y. Salunkhe*, S. P. Dongre***	419
An Effective Technique to Protecting Sensitive Information Using 2d Data Matrix.....	423
Mr.L.S.Khedekar*, Dr.A.S.Alvi**	423
A Study of the Impact of Laboratory Approach on Achievement and Process Skills in Science among Is Standard Students.....	427
Asst. Prof. Badri Yadav*, Prof. Shri Krishna Mishra**	427
Fuzzy A-Super Continuous Mappings.....	433
M. K. Mishra*, Manisha Shukla**	433
Comparative Analysis of Data Centric Routing Protocols for Wireless Sensor Networks	437
K. Karthikeyan, M.Kavitha	437
Depression among Fresh College Hostellers during Pre and Post Semester	443
Dr. K.Kajavinthan	443
Fourier Transform and Its Application in Cell Phones.....	446
Anupama Gupta	446
Cross Layer Transport Layer Approach for Multihop Wireless Sensor Network	448
Vaishali Rajput*, Tanaji Khadtare*, Atul Rohankar***	448
An Optimization Model to Generate a Finite Sequence Subject to the Given Conditions.....	453
P.Paramadevan*, W.B.Daundasekera**	453
Level of Customer Satisfaction and Usability Issues in Online Banking Websites	456
Gamage. M. P, Kodagoda. G. N.	456

Scaling Constant Estimation for Texture Segmentation using Level Sets	461
K M Sadyojatha * , Vinayadatt V Kohir ** , Subhash Kulkarni ***	461
A Retrospective Analysis of Discordant CD4 and Viral Load Responses in HIV Patients on Anti-Retroviral Therapy	466
Revati Sharma * , Chitra Pai ** , Harapriya Kar **	466
Handling of Uncertainty – A Survey	469
Lakshmi.S.Dutt* , Mathew Kurian**	469
Dialogue Initiative between Islam and West	473
Nazar Ul Islam Wani	473
Interactive Electronic Board Using ARM Processor	477
Mrs. Mayuri Joshi * , Prof. Sunil .S. Morade **	477
Intelligent Contract Management	482
Manju Pillai * , Pramila Adavi **	482
Law of Intellectual Property and Bioinformatics.....	486
Jagadish.A.T	486
Improving Efficiency of Apriori Algorithm Using Transaction Reduction	493
Jaishree Singh * , Hari Ram ** , Dr. J.S. Sodhi ***	493
Ways of Transacting Online	497
Mukta Sharma * , Dr. R.B. Garg **	497
A Study of Comparative Purification Efficiency of Two Species of <i>Potamogeton</i> (Submerged Macrophyte) In Wastewater Treatment	505
Parvaiz Ahmad Lone * , Ajay Kumar Bhardwaj ** , Fayaz Ahmad Bahar ***	505
Feasibility of training Female Health Workers to diagnose and treat reproductive tract infections of females at the community level – a study done at Christian Medical College, Vellore	510
Dr.Maneesha Godbole * , Dr.Sulochana Abraham ** , Dr.Jasmine Prasad ***	510
Modeling and Architectural Simulations of the Statistical Static Timing Analysis of the Non-Gaussian Variation Sources for VLSI Circuits.....	515
Abu M. Baker* and Yingtao Jiang*	515
Changes of Serum Lipids and Proteins during Probiotics Feeding and Its Exposure	522
JGS Ranasinghe * , SSP Silva ** , N. Herath **	522
Exploring Potentials of Marine Microbiology and Biotechnology in Developing Countries	527
Olumide Adedokun Odeyemi	527
Campus placements in Kerala-An empirical study at the selected Engineering Colleges in Kerala.....	534
Suresh Kumar N * , Prasanth MK ** , Ajith Sundaram ***	534
Minimized Routing Protocol in Ad-Hoc Network with Quality Maintenance Based on Genetic Algorithm: A Survey	540
Upasna * , Jyoti Chauhan ** , Manisha ***	540
Mobile Banking Services as Adoption and Challenges: A Case of M-Banking in India (Positive and Negative impacts, Mobile Growth in India, Adoption Models and Mobile Technology)	545
Dr. Vinod Kumar Gupta * , Renu Bagoria ** , Neha Bagoria ***	545
Anti - Microbial Plasma Membrane Activity of Daptomycin and Pantoyl Lactone against <i>Streptococcus equi</i>	551
Zidan A. Bashir^{1 2}	551
A Research Survey on Sanskrit Offline Handwritten Character Recognition	559
R. Dineshkumar¹ , Prof. Dr.J.Suganthi²	559

Ergonomic Problems Prevalent in Handloom Units of North East India

Sangeeta Pandit, Prakash Kumar, Deb Kumar Chakrabarti

Ergonomics laboratory, Department of Design, Indian Institute of Technology Guwahati,
Assam 781039, India

Abstract- Handloom is the mostly widely established cottage industry of North East India (NE) that is most wide spread throughout the region. It employs a large skilled and unskilled workforce and which, in North East, mainly consists of women workers. In the present era of commercialization, handloom sector is also witnessing changes and large number, of women are adopting the weaving activity as their profession. The activity they performed previously during their leisure time, has now been transformed to 8 hours job. But, in spite of the increased weaving time spent on loom, the workstation design remains unaltered. The paper reports the ergonomic issues related to weaving practices as adopted in NE, at present and tries to analyze them from the design perspective.

Subjective assessment, direct observation, interview with weavers and the managing bodies were used for determining the work related issues prevailing in the present handloom sector. The study identifies four broader problem areas related to seating, treadling, flying shuttle and cloth rolling operations where design modifications are required to improve work efficiency with reduced manual efforts. Addressing the issues by looking into the ergonomic aspects in existing workstation will have direct impact on quality as well as quantity of outcome thereby, improving the productivity as well as overall occupational wellness.

Index Terms- Handloom, NE India, Women Weavers, Ergonomic Issues, Ergonomic assessment, Ergonomic intervention

I. INTRODUCTION

Handloom is an important cottage industry among developing countries like India, Pakistan, Bangladesh, Iran, Turkey and China where traditional ways of weaving are still significantly practiced. The vast majority of workforce in South Asia is engaged in the informal sectors which also embraces the cottage industries. These industries are an important source of employment, especially for women^[1] and human workload assessment would be vital in such industries for improving their working conditions.

It is estimated that there are about 4.60 million handlooms in the world out of which about 3.9 million are in India^[2]. Weaving is acknowledged to be one of the oldest surviving crafts in the world. In present era of mechanization and standardization, the handloom sector provides a unique richness of diverse manual skills, representing the cultural and traditional art forms.

Handloom industry is one of the largest employments generating industry after agriculture in India and 77.9% of the workforce in this sector is reported to be women. Out of the national figure NE India reports to have the highest number (99%) women weavers^[3].

Handloom industry plays a vital role in economic development of the rural masses in the North Eastern States of India. As many small units in handloom sector have taken weaving at a commercial level, more women weavers are associating with weaving as a part time or full time profession. The activities that women performed for their domestic needs during their leisure time, has now been transformed into their professional work. The work hours spent on loom in commercial weaving is quite longer as compared to that of traditional weaving, many a times, even extending beyond 8 hours of work schedule as laid up in the norms^[4]. Hence, requirements for commercial purpose are different from that of domestic weaving. But, in spite of their changing requirements, neither the task schedule nor are the workstations modified. Moreover, no gender specific considerations, related to female built and physiology have been taken into account. The workplace design for traditional handloom remains unchanged which leads to ergonomic issues among women weavers.

Ergonomic approach of assessing the present handloom working status may help in finding some effective solutions. The studies carried out on investigating the ergonomic issues prevalent in carpet industries of Iran, witnessed improvement in quality, productivity and occupational health among the carpet menders^[5-8]. In the handloom industry of Western India, study carried out on weavers, on ergonomic issues, suggest difference in prevailing of Musculo Skeletal Disorders (MSD) among males and females^[9]. This supports the need for ergonomic study in handloom sector of NE India that mainly consists of female weavers, as no gender specific considerations, either anthropometric or physiological, is taken into account in the present design of handloom. Some work has been reported on male weavers regarding posture, repetitiveness, respiratory problems, environmental condition, in different parts of India^[9-14] but there is a lack of detailed study on ergonomic issues on women weavers. Some initial studies have been conducted in the handloom industry of NE, addressing working posture related problems faced by the female weavers at the workplace^[15].

This paper furthers the study done on the women weavers of NE and tries to figure out, in detail, the ergonomic problems and relevant scopes of ergonomic intervention to improve the existing loom workstation, aiming at improving their operational

easiness and occupational wellbeing. The observations presented in this paper can be regarded as an initiative for improving the working conditions of weavers in the handloom industry of NE, where traditional work practices have been witnessing changes. These changes are accompanied with several health related issues which required to be addressed.

On a casual observation, weaving appears to be a very simple process but in reality it involves diligent processes and stages, involving a number of ergonomic risk factors like awkward posture, high force, repetitiveness, long duration of work and high visual demand. Weaving involves a number of stages, but for study purpose weaving activity has only been considered, as, this is the major task component^[3].

Several steps have been undertaken by Government towards promoting the handloom industry, ranging from endorsing handloom products in global market, training facilities for development of weaving skills, motivating the women weavers to take up weaving as profession. Handloom product value depends on quality of production, which mainly depends upon the efficiency of the weavers. Ergonomic interventions would be vital in reducing occupational hazards which increase the efficiency of the weavers, thereby enhancing production.

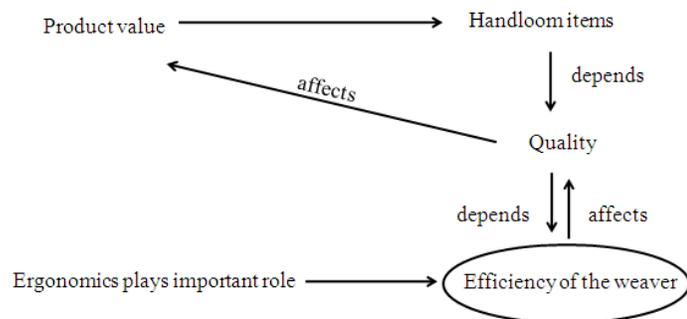


Figure 1 Role of Ergonomics in Handloom

II. RESEARCH ELABORATIONS

To investigate and assess the prevalence of ergonomic issues, cluster of handloom units in NE were visited (both in organized and unorganized sectors) and survey on general working status was conducted. Working on loom involves long static sitting posture where limbs are mostly in repetitive motion leading to stress development on the trunk. A survey was conducted between April 2012 till July 2012, in different handloom units from 10 clusters located in and around Guwahati in Assam; a state of NE India, to find out major work related problems prevailed among the women weavers. A sample of 50 subjects were chosen randomly from both organized (government, semi-government and private agencies) and unorganized (self-help group, small loom clusters which are mainly home based) sectors to understand workstation related design problems prevailed in the existing condition. Handloom units with 8 – 9 hours’ work schedule were selected for the study purpose. The workers were all females, apparently healthy without any specific physical problems. The subjects were allowed to use work schedule and duration of work-pause of their

own practice. The personal characteristics of the weaves are given in Table 1.

Table I. Personal characteristics of the weavers in the handloom units

Characteristics	Female weavers (n=50) \bar{X} (range)
Age (yrs)	26.82 (18-35)
Yrs of involvement	10.92 (5-20)
Working hours/day	8.57 (8-9)
Literacy	100%

Only one worker at a time was interviewed to avoid loss of productive time. Some of the questions were rephrased to find the consistency to the answers of the weavers.

The study was conducted in two phases, Phase 1 and Phase 2. Phase 1 was further divided into two stages, stage A and stage B, in which stage A consist of self-reported exposure assessment through questionnaire while stage B consist of workplace assessment through checklists. Phase 2 consisted of Video Event Analysis along with the subjective responses of the weavers and management.

Subjective assessment:

Subjective assessment of 50 participants, was done to quantify frequency and severity of pain in different body parts with the help of Self-report Body Discomfort rating Chart^[6] along with Borg’s 10 point rating scales^[7] and Standard Nordic questionnaire^[8]. Risk factor of weaving activity was assessed through Quick Exposure Checklist (QEC)^[9] and Occupational Repetitive Action (OCRA) checklist^[20]. Both QEC and OCRA checklist was used among 33 weavers from 10 units selected randomly from the handloom units.

Direct observation

Direct observation was carried out through video recording and replay event analysis to confirm the findings of the subjective assessment and to further investigate the work problems. 2 hours video recording was done in the field on 10 units for 8-9 hours’ work schedule (excluding lunch and tea break) and the weaving activity was analyzed in slow motion to find out each problem in details to find out the probable causes of different health problems.

III. RESULTS

The assessment of the present work condition confirmed the prevalence of ergonomic issues by identifying the different health risks and from the analysis of questionnaire and observations, it was found that there were four broader problem areas where specific ergonomic intervention could be suggested. These problem areas were related to seating, treadling, flying shuttle and cloth rolling operation. The general working operation and construct of the loom, in both organized and unorganized clusters, appear to be same, except the working hours which may be structured or unstructured.

Results of subjective assessment, Stage A, Phase 1

Subjective assessment of body pain was done through Self-report Body Discomfort rating Chart based on Borg’s 10 point rating scales along with the frequency and severity of occurrence of pain among 50 women weavers for performing weaving operation. From Figure 2, it was found that the highest number of weavers reported of having neck, low back and leg pain followed by shoulder and ankle pain. From subjective assessment for frequency of pain presented in Figure 3, it was found that most frequent pains were reported in low back, shoulders, neck and legs.

From subjective assessment for severity of pain presented in Figure 4, it was found that most severe pains were also reported in low back, shoulders, neck, knee and legs.

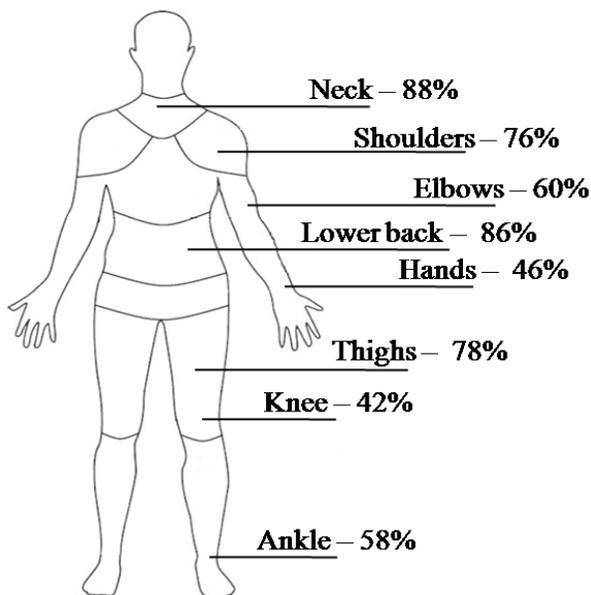


Figure 2. Subjective assessment of pains in different body parts after weaving operation

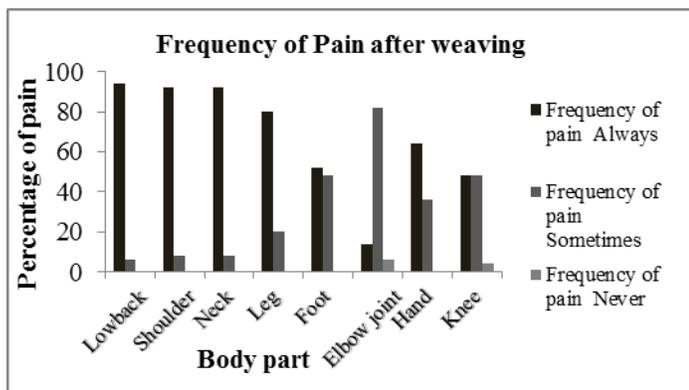


Figure 3. Subjective assessment of Frequency of pain in body parts for weaving operation

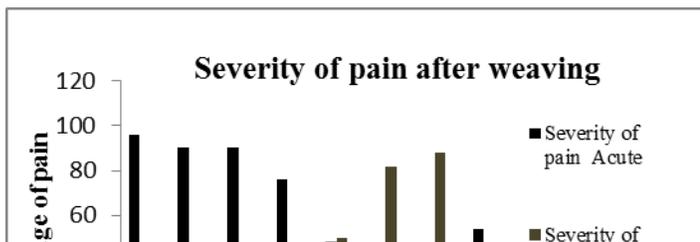


Figure 4. Subjective assessment of Severity of Pain in body parts for weaving operation

A significant percentage of weavers reported of pains after treadle operation, (Figure 2), due to inadequate foot support for ankle and toe which indicates the presence of ergonomic issues and need for ergonomic intervention.

Hence, ergonomic design approach to modify the different components of workstation which interacted with the body parts (namely low back, shoulders, neck and legs) during operation will help to reduce pain.

Risk Assessment by checklists, Stage B, Phase 1

Workers perception and observers assessment was taken into account by both QEC and OCRA checklists. It provided information for understanding the probable causes of the most severe risk factors.

QEC was used over 33 weavers from 10 units. The analysis of weaving operation using QEC gives exposure scores to specific body parts including the back, shoulder/arm, wrist/hand, and neck. The average of total QEC scores for weaving operation was found to be 145 out of 187 giving a percentage score of 77.86% (Table 2) which falls under very high risk and gives an indication that immediate ergonomic intervention are required in the workplace.

Table 2. Recommended QEC % score

Action level	The action level from QEC Intervention recommended	with recommended priority scores for different body parts [21] QEC score %
Acceptable risk	Acceptable posture	< 40%
Moderate risk	Further investigation needed; changes may be required	40-49%
High risk	Investigation and changes needed soon	50-69%
Very high risk	Investigation and changes needed immediately	>70%

Priority level for QEC scores [21]					QEC score for weaving activity Score
Body area	Low	Moderate	High	Very High	
Back (static)	8-14	16-22	24-28	30-40	31
Shoulder/ Arm	10-20	22-30	32-40	42-56	37
Wrist/ Hand	10-20	22-30	32-40	42-56	43
Neck	4-6	8-10	12-14	16-18	17

The individual QEC scores for different body parts have been shown in Table 3 obtained scores for different body regions except wrist/hand falls under very high priority levels

Occupational Repetitive Action (OCRA) checklist

OCRA checklist was used to identify the presence of risk factors for the upper limbs and classify the consequent exposure to risk factors. 33 women weavers, with right dexterity, from 10 handloom units having same working hours were selected for the study purpose. The results of the study are presented in Table 4.

Table 4. Recommended and obtained OCRA checklist score for weaving operation

OCRA Checklist	Area	Risk	Checklist score of weaving activity
Upto to 7.5	Green	Acceptable	33.6
7.6 - 11	Yellow	Borderline or Very Low	
11.1 – 14.0	Low Red	Low	
14.1- 22.5	Average Red	Average	
≥22.6	Very red or Violet	High	

From OCRA checklist, it was found that weaving activity falls under very high risk zone. For performing weaving task both the limbs are involved in two different activities. Right limb does shuttle operation and left beats the reed frame. The activity of the two arms are different but adding all the scores separately for two limbs (right and left) and multiplying with multiplier, gives same score for both the limbs.

Video Event Analyses, Phase 2

Details of the observational study through video recording analysis are summarized in Table 5.

Phase 2 was based on direct observation method which verifies the findings of subjective assessment and helped to further investigate the problems in detail where in-depth observational study of video recording was conducted to analyze the weaving task. It helped in having better insight of the situation, important for identifying the possible areas of ergonomic intervention to solve occupational health problems. Finally, four major problem areas related to seating, treading, shuttling and cloth rolling operations were identified (Figure 5).

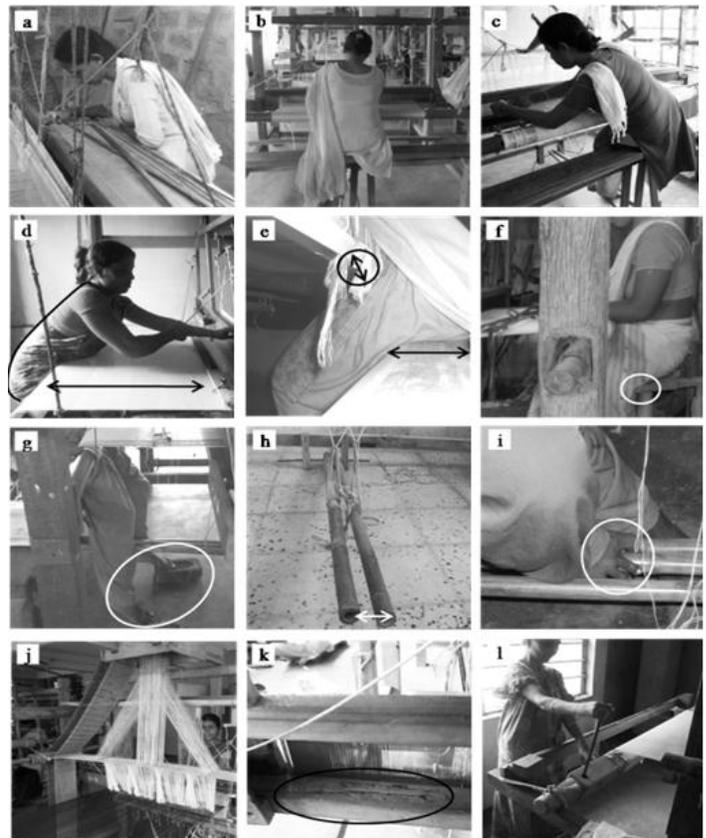


Figure 5. Some observations of video analysis method – a) Forward bending posture, b) Upright sitting posture, c) Side bending posture, d) Forward stretching posture, e) Lack of clearance space between thigh and cloth beam along with improper plank width for sitting, f) Digging of posterior thigh muscle by the hard edge of the plank, g) High seat height leading to improper support for foot, h) Insufficient gap between the two treadles, i) Small and slippery treadle surface made of bamboo sticks, j) Introduction of jacquard system enhancing force requirement for treading, k) Dented surface of race increasing the force required to push the shuttle over it and l) Adjustment of warp beam by loosening and tightening after getting out of the seat

Table 5. Findings of an in-depth observational study through video analysis

Problems	Findings/ Observations
Seating related	Weaving involves highly inspection job, where the weavers spend more than 8 hours job schedule in a narrow plank of about 13-15cm(Fig. 5e). The weavers were found to adopt different types of posture continuously and repetitively for performing weaving(Fig. 5a-d). Above all this circumstances, there is no backrest to relax during rest pauses.
	Anterior part of the thigh muscle hit the cloth beam with the upward movement of the legs for oscillatory treadle operation, as there exists no clearance space(Fig. 5e).
	Hard edge of the plank digs posterior thigh muscles with downward movement of legs while treadling(Fig. 5f). The seat height does not take into consideration the popliteal height of the women weavers and in almost every handloom unit, it was found that the foot only partially reach the ground or keep dangling in air(Fig. 5g).
Treadling related	The gap between two treadle is only about 6 to 8 cm which results single leg to operate both the treadle(Fig. 5h).
	Treadles made from thin bamboos which turns smooth and slippery due to regular use, gives minimum foot support, resulting pressure development, in ankle and toe with operational force(Fig. 5i).
	The present way of treadle operation requires moderate force but, it involves high repetition, requiring 94.67 ± 13.59 (rpm), leading to development of muscular fatigue of Rectus femoris and Bicep femoris muscles. Treadling activity makes the thigh repetitively hit against the seat edge, which digs into the posterior thigh muscle(Fig. 5f).
	With introduction of Jacquard, more force is required to push the treadle downwards, as additional tension force is developed(Fig. 5j).
Shuttling related	6.67 \pm 1.39kg pulling force is needed for shuttle operation with a repetition of 94.67 ± 13.59 rpm constantly for 10 to 15 minutes leading to the development of fatigue in Trapezius muscles. Due to the rough dented surface of the race, more force is required to operate the shuttle(Fig. 5k).
	Pulling force required for beating operation of reed frame involves highly repetitive activity involving 94.67 ± 13.59 rpm.
Warp and cloth beam related	Cloth rolling is a tiring exercise which involves many steps and have to be done after every 20- 30 minute interval. At first, the person has to get out of the seat and go to other side of the loom. The roll is then required to be unlocked followed by tightening and adjusting the cloth roll. The beam is relocked which is followed by returning and getting on to the seat. In order to avoid this whole process, they lean forward and maintain this posture during weaving, as long as possible, leading to development of severe back pain(Fig. 5l).
Organizational factors related	With increase price of raw materials, there is a heavy challenge for the survival of the industry, as a result the weavers are paid per work basis. In order to finish task in single spell the weavers spend long hours in the loom to earn more; this result in the development of multilevel occupational health problems.

IV. DISCUSSION

The findings of the study through subjective assessment of body pain, checklist analysis and direct observation suggest that there is a high prevalence of ergonomic risk factor related to the present handloom workstation in the weaving units suggesting that ergonomic intervention is require in the present work situation.

The poor seat design in the present workstation coupled with repetitive treadling operation, affects both anterior and posterior side of the thigh muscles. No thigh clearance space is been observed in the handloom units which aggravates with oscillatory treadle operation. Treadling is highly recurring activity, involving 94.67 ± 13.59 repetitions per minute. The vertical leg movement for oscillatory treadle operation, led to frequent hitting of the anterior part of the thigh with cloth beam.

Performing this type of activity for prolonged time may develop edema or hematoma in the quadriceps muscle^[22]. It may also develop pressure on fascia lata, cutaneous nerves and veins of the thigh^[23]. Hard edge of the plank, along with raised plank height, leads to the development of pressure, on posterior thigh muscle. Muscle effort and localized pressure result in a relatively short time physiological responses of muscle fatigue, impeded blood circulation and venous blood pooling resulting in edema at the ankle and feet. This situation exacerbates with small foot support space for treading due to the bamboo treadle, leading to more pressure in the ankle and toe. With the introduction of Jacquard, the load on the cervical spine, due to constant flexion for motif formation, gradually decreases. But, an additional tension develops because of jacquard, pulling the warp thread upward and an extra force is required for using the treadle, thereby increasing the pressure on leg muscle.

Different sitting postures that is forward flexed, upright and side bending, are adopted by the weavers while performing weaving task. Prolonged flexion of the spine leads to increase intervertebral joint laxity and fluid loss in the intervertebral discs^[24,25]. Studies suggest that flexed sitting posture results in extension of upper cervical and flexion of lower cervical spine^[26]. Due to motif formation and for inspection work, the weavers develop flexed posture while for constant weaving they maintain upright posture which results in isometric contraction of Hamstring muscle^[27]. The condition of flexed forward leaning posture is aggravated with poor rolling mechanism of cloth and warp beam. In order to avoid the effort needed for rolling operation, the weavers lean forward and maintain this posture as long as it is possible to weave which leads to the development of severe back pain.

To counteract the negative effect of the adopted posture during weaving operation, the backrest would be required for back muscle support during rest pauses. Seat with any backrest inclination reduces intra-discal pressure^[28,29] which increases lumbar lordosis and reduces low back pain^[30]. Backrest reduces load on the seat which eventually reduces stress on the spinal and paraspinal structure^[8]. Backrest can be provided so that the user can use it whenever required^[31]. In a similar study it was found, backrest reduces some of the trunk loads and helps to prevent vertebral strain^[32,33].

Flying shuttle involves highly repetitive activity, involving 94.67 ± 13.59 repetitions per minute with a pulling force of 6.67 ± 1.39 kg. Ergonomic intervention may reduce the frictional force between the shuttle and surface of the race which will be very effective in reducing the force as repetition cannot be hampered otherwise it will affect production. The findings of the study will be helpful in identifying the areas where ergonomic intervention is required for the weavers. Paying attention to the occupational health and safety issues prevalent in this sector will have noticeable impact on national handloom production, socio-economic condition of the weavers, thereby improving their quality of life. The study underlines the needs for further work regarding ergonomic design implementations in the present loom workstations, along with the gender specific requirements.

ACKNOWLEDGMENT

The authors like to thanks all the weavers and the managing bodies of the handloom units for their participation and their valuable suggestions.

REFERENCES

- [1] Glass B. Small enterprises and occupational health and safety. In: Encyclopaedia of occupational health and safety, Stell man JM, editor. 4th ed. Vol.1, International labour Office Geneva, Switzerland. 1998,pp.2.08-10
- [2] Feel Handloom from www.feelhandlooms.com/handloom.php accessed on October 23, 2012 at 12:32 hrs
- [3] Handloom Census of India 2009-2010 from www.ncaer.org/downloads/Reports/HandloomCensusReport.pdf
- [4] India. The *Factories Act, 1948* (Act No. 63 of 1948),as amended by the Factories (Amendment) Act, 1987 (Act 20 of 1987) Chapter VI section51 Weekly hours. from www.ilo.org/dyn/natlex/docs/WEBTEXT/32063/E87IND01.htm
- [5] Motamedzade M, Choobineh A, Mououdi MA, Arghami S : Ergonomic design of carpet weaving hand tools. International Journal of Industrial Ergonomics 37, (2007), pp.581-587.
- [6] Choobineh A, Hosseini M, Lahmi M, JazaniRK,andShahnava H: Musculoskeletal problems in Iranian Hand-woven carpet industry: Guidelines for workstation design. Applied Ergonomics 38, (2007) .pp.617-624.
- [7] Choobineh AR, Shahnava H, Lahmi MA: Major health risk factors in Iranian hand-woven carpet industry. Int. J. Occup. Safety Ergon. 10 (1),(2004) , pp.65-78.
- [8] Choobineh AR, Tosian R, Alhamdi Z, Davarzanie M: Ergonomic intervention in carpet mending operation. Appl. Ergon 35, (2004) pp. 493-496.
- [9] Nag A, Vyas H, Nag PK Gender differences, Work stressors and Musculoskeletal Disorders in Weaving Industries. Industrial Health 48, (2010), pp.339-348.
- [10] Solanki G S, Patel RS, Jhala PB, Ghosal S, Chakrabarti D: Ergonomic design of pedal operated loom to reduce work fatigue. Occupational and Environmental Ergonomics,(1993), pp. 71-76.
- [11] Tiwari RR, Zodpey SP, Deshpande SG, Ughade SN, Vasudeo ND: Respiratory morbidity in handloom weavers. Indian Journal of Occupational and Environmental Medicine. Apr-Jun; 3(2),(1999),pp. 71-73
- [12] Banerjee P and Gangopadhyay S: A study on the prevalence of upper extremity repetitive strain injuries among the handloom weavers of West Bengal. J. Human Ergol. 32, (2003), pp. 17-22.
- [13] Metgud DC, Khatri S, Mokashi MG, Saha PN : An ergonomic study of women workers in a woolen textile factory for identification of health-related problems. International Journal of Occupational and Environmental Medicine. 12(1),(2008), pp. 14-19.
- [14] Goel A, and Tyagi I: Occupational health hazards related to weaving. International Journal of Applied Mathematics and Statistical Sciences.1(1),(2012) : pp. 22-28.
- [15] Pandit S, Chakrabarti D: An ergonomic study of working posture among women weavers involved in handloom industries of Assam, Humanizing Work and Work Environment 2011conference proceeding, 32, Chennai.
- [16] Corlett EN and Bishop RP : A technique for assessing postural discomfort. Ergonomics 19 (2), (1976) , pp. 175-182.
- [17] Borg G : Borg's Perceived Exertion and Pain Scales. Human Kinetics, Champaign, IL 104, 1998.
- [18] Kuorinka I, Jonsson B, KilbomA,Vinterberg H, Biering SF, Andersson G, Jorgensen K : Standard Nordic Questionnaires for the analysis of musculoskeletal symptoms. Applied Ergon 18(3), (1987), pp. 233-237.
- [19] David G, Woods V, Buckle P, Li G : The development of the quick exposure check (QEC) for assessing exposure to risk factors for work related musculoskeletal disorders. Applied Ergonomics 39, (2008), pp. 57-69.
- [20] Occhipinti E and Colombini D : The occupational repetitive action (OCRA) methods: OCRA index and OCRA checklist. In: Handbook of human

- factors and ergonomics methods, Stanton N, Brookhuis K, Hedge A, Salas E, Hendrick H W (Eds.), (2005) ,15:1-14, CRC press, Florida
- [21] David G, Woods V, Buckle P :Further Development of the Usability and Validity of the Quick Exposure Check. HSE Books, Sudbury, Suffolk. Contract Research Report: RR211/2005. <http://www.hse.gov.uk/research/rpdf/rr211.pdf> Accessed on June 28, 2012.
- [22] Rööser B, Bengtson S, Hägglund G : Acute compartment syndrome from anterior thigh muscle contusion: a report of eight cases. J Orthop Trauma 5(1),(1991) , pp. 57-9
- [23] Anterior Thigh from home.comcast.net/wnor/antthigh.htm accessed on September 25, 2012 at 20:12 hrs
- [24] Adams MA, Dolan P, Hutton WC: Diurnal variations in the stresses of the lumbar spine. Spine 12,(1987),pp.130-7.
- [25] Adams MA and Hutton WC :The effect of posture on the fluid content of lumbar intervertebral discs. Spine 8,(1983), pp.665-71.
- [26] Black KM, McClure P, Polansky M: The influence of different sitting positions on cervical and lumbar posture. Spine 21(1), (1996),pp. 65–70.
- [27] Pheasant S and Haslegrave MC: Body space, Anthropometry Ergonomics and the design of Work, 3rd edition,126, CRC Press, New York, (2006)
- [28] Andersson GBJ, Örtengren R, Nachemson A, Elfström G Lumbar disc pressure and myoelectric back muscle activity during sitting studies on an experimental chair. Scandinavian Journal of Rehabilitation Medicine, 6(3), (1974),pp. 104-114.
- [29] Pheasant ST: Ergonomics, Work and Health. Macmillan, London1991.
- [30] Williams MM, Hawley JA, McKenzie RA, van Wijmen PM: A comparison of the effect of two sitting posture on back and referred pain. Spine 16(10), (1991), pp. 1185.
- [31] Corlett EN: Are you sitting comfortably? International Journal of Industrial Ergonomics. 24,(1999),pp. 7-12.
- [32] Corlett EN, Eklund JAE: How does a backrest work? Applied Ergonomics 15 (2), 1984.
- [33] Bendix T, Poulsen V, Klausen K, Jensen CV: What does a backrest actually do to the lumbar spine? Ergonomics 39 (4), (1996),pp. 533-542.

AUTHORS

First Author – Sangeeta Pandit, PhD scholar, Ergonomics laboratory, Department of Design, Indian Institute of Technology, Guwahati. Assam 781039 – India. email id:- sangeetapandit.zz@gmail.com

Second Author – Prakash Kumar, PhD scholar, Ergonomics laboratory, Department of Design, Indian Institute of Technology, Guwahati. Assam 781039 – India. email id:- prakash.iitg@gmail.com

Third Author – Debkumar Chakrabarti, Professor and HOD, Department of Design, Indian Institute of Technology, Guwahati. Assam 781039 – India. email id:- dc@iitg.ernet.in

Correspondence Author – Sangeeta Pandit, email: sangeetapandit.zz@gmail.com, s.pandit@iitg.ernet.in, + (91) 8011139034

Phytochemical Screening of *Gloriosa superba* L. - from different Geographical Positions

Mariappan Senthilkumar

Assistant Professor in Botany, PG and Research Department of Botany,
Government Arts College, Dharmapuri - 636705, Tamil Nadu, India

Abstract - *Gloriosa superba* Linn. is one of the important medicinal plant now in endangered list. This plant is widely used for several ethano-medicinal purposes by tribal peoples and traditional practitioners. Seeds and tubers contain valuable alkaloids viz., colchicine and colchicoside as the major constituents, which are used as an antidote for snake bites, gout and rheumatism. Present study was to evaluate the phytochemicals present in leaves, flowers, seeds and tuber samples were collected from four different places of Dharmapuri District. Preliminary phytochemical analyses were carried out by standard procedures. Methanol extract of all samples were evaluated for protein, starch, total sugar and total phenol. The screening tests also were performed for the presence of the following secondary metabolites such as alkaloid, flavonoids, glycosides, phenols, saponins, steroids, tannin and terpenoids. The results were revealed the presence of various classes of compounds in different parts of the plant. Among the five different geographically collected plant samples, the Hoganakkal Hills sample showed the maximum amount of bioactive compounds than the other samples. The result of the extract from the tuber and seed samples were yields high amount of various biologically active compounds than the leaves and flowers. These compounds could serve as potential source for traditional medicines. Further research on this plant for the specific part could be used for isolation and characterization in large scale production.

Index Terms - *Gloriosa superba*, phytochemicals, enzymes, alkaloids, glycosides, and steroids

I. INTRODUCTION

Gloriosa superba Linn. is an important medicinal plant belonging to the family Liliaceae. It is a semi-woody herbaceous branched climber reaching approximately 5 meters height, with brilliant wavy-edged yellow and red flowers [1]. Which is one of the endangered species among the medicinal plants [2]. It is extensively scattered in the tropical and sub-tropical parts of the India. It is adapted to different soil texture and climatic variation. The plant grows in sandy-loam soil in the mixed deciduous forest in sunny positions [3]. Being native form Indian especially Southern India it is known as glory lily and climbing lily- in English. In the world market glory lily considered as rich source of colchicines and gloriosine [4]. The flower has analgesic, anti-inflammatory potential, antimicrobial, larvicidal potential, antipoxviral potential, antithrombotic potential, antitumor potential, enzyme inhibition potential, and also used in treatment of snake bite, Skin disease, respiratory disorders [5, 6, 7, 8, 9].

Medicinal plants have been used as sources of medicine in virtually all cultures [10, 11]. In recent years, there has been a gradual revival of interest in the use of medicinal plants in developing countries because herbal medicines have been reported safe and without any adverse side effect especially when compared with synthetic drugs. Thus a search for new drugs with better and cheaper substitutes from plant origin is a natural choice. The medicinal values of these plants lie in some chemical substances that produce a definite physiological action on human body [12]. Different parts of *G. superba* have wide variety of uses especially in traditional system of medicine. The tuber is used for the treatment of bruises and sprains, colic, chronic ulcers, haemorrhoids, cancer, impotence, nocturnal seminal emission, and leprosy and also for including labour pains and abortions [13]. *Gloriosa superba* also used in wounds, skin related problems, Fever, Inflammation, piles, blood disorders, Uterine contractions, General body toner, Poisoning [14, 15]. Roots are acrid, anthelmintic, antipyretic, bitter, digestive, expectorant, highly poisonous and promoting expulsion of the placenta. Root paste is effective against paralysis, rheumatism, snake bite and insect bites [16]. This plant has gained the importance in medicine in recent years for the production of colchicine in large scale [17]. The aim of this study was to identify and determine the phytochemicals present in *G. superba* leaves, flowers, seeds and tubers.

II. MATERIALS AND METHODS

Plant materials

The plant samples such as leaves, flowers, seeds and tubers of *Gloriosa superba* were collected from four different geographical positions such as Hoganakkal Hills (HGS), Mookanur Hills (MGS), Sithhari Hills (SGS) and Vathal Hills (VGS) of Dharmapuri

district in Tamilnadu, India. These plants were then identified, confirmed and have been deposited in the herbarium of PG and Research Department of Botany, Government Arts College, Dharmapuri for the future reference.

Preparation of plant extract

Fresh leaves, flowers, seeds and tubers were washed thoroughly under running tap water followed by sterile distilled water and dried under shade. They were ground into coarse powder by using mechanical pulveriser. All the samples, about 100 g of the powder were repeatedly extracted with methanol in a 500 mL round bottom flask with 250 mL solvent. The reflux time for each solvent was 25 cycles for complete extraction using soxhlet apparatus [18, 19]. The filtrate was collected and concentrated by using rotary evaporator under controlled condition of temperature and pressure. The extracts were concentrated to dryness to yield crude residue. These residues were stored at -20°C, used for preliminary phytochemical screening of secondary metabolites.

Phytochemical analysis

Phytochemical screening were performed to assess the qualitative chemical composition of different samples of crude extracts using commonly employed precipitation and coloration reactions to identify the major secondary metabolites like alkaloids, flavonoids, glycosides, Proteins, phenolic compounds, saponins, starch, steroids, tannins and terpenoids. The phytochemical analyses were carried out using standard procedures [20, 21]. The methanol extracts of *G. superba* were screened for the presence of secondary metabolites using the procedures [22, 23]. The observations were recorded for total starch [24], soluble protein [25], steroids using Salkowski test [26], flavonoids and tannins using ferric chloride test [27], alkaloids by Mayer's test [28], and proteins and glycosides by Biuret and Legal tests, respectively [29, 30] and total phenol [31].

1. Screening for Alkaloids

Meyer's reagent (potassium mercuric iodide) 1.36 gm of mercuric chloride was dissolved in 60 ml of distilled water and 5 gm of potassium iodide was dissolved in 10 ml of water. These two solutions were mixed and diluted to 100 ml with distilled water. To 1 ml of the extract, a few drops of reagent were added. Formation of white or pale precipitate showed the presence of alkaloids.

2. Screening for Flavonoids

In a test tube containing 0.5 ml of extract, 5 to 10 drops of diluted HCl and small piece of ZnCl or magnesium were added and the solution was boiled for few minutes. The appearance of reddish pink or dirty brown colour indicates the presence of flavonoids.

3. Screening for Glycosides

To 5 ml of extract add 5 ml of 5% FeCl₃ and 5 ml diluted HCl. Heat for 5 min in boiling water bath. Cool and add benzene or any organic solvent and shake well. Separate the organic layer and add equal volume of diluted Ammonia. Ammonical layer shows pinkish red color indicates the presence of glycosides.

4. Screening for Saponins

In a test tube containing about 5 ml of the extract, few drops of sodium bicarbonate was added. The mixture was shaken vigorously and kept for 3 minutes. A honeycomb like froth was formed and it showed the presence of saponins.

5. Screening for Steroids

To 2.0 ml of extract, 1.0 ml of concentrated sulphuric acid was added carefully along the sides of the test tube. A red colour produced in the chloroform layer shows the presence of steroids.

6. Screening for Phenols

To 1 ml of the extract 3 ml of distilled water followed by few drops of 10% aqueous Ferric chloride solution was added. Formation of blue or green colour indicates the presence of phenols

7. Screening for Tannins

In a test tube containing about 5 ml of the extract, a few drops of 1% solution of lead acetate was added. A yellow or red precipitate indicates the presence of tannins.

8. Screening for terpenoids

To 0.5g of the extract 2ml of CHCl₃ was added. 3ml of concentrated H₂SO₄ was carefully added to form a layer. A reddish brown coloration of the interface indicates the presence of terpenoids.

9. Screening for reducing sugars

The aqueous 15ethanol extract (0.5 g in 5 ml of water) was added to boiling fehling's solution (A+B). Brick red precipitate form at the bottom of the test tube indicates the presence of reducing sugars.

Statistical analysis

Phytochemical estimation and quantification were performed in five replicates under standard procedures to ensure consistency of all conclusions. Data of all experiments were statistically analysed and expressed as Mean \pm Standard Deviation.

III. RESULTS

In the present study deals with the preliminary phytochemical screening of methanol extracts of *Gloriosa superba* samples from HGS, MGS, SGS and VGS are presented in Table 1 and 2. All the samples of leaves, flowers, seeds and tubers showed the enormous occurrence of phytochemicals. The leaf samples showed the presence of proteins, phenols, tannins, starch and terpenoids. The flowers, seeds and tubers samples showed the high content of flavonoids. Glycosides and alkaloids were found in maximum amount in seed and tubers in all samples, but they were absent in the leaves and flower extracts. Saponins were found in moderate concentration in all the samples of seeds and tubers extracts but showed the absence in all the sample extracts of leaves. When compare to the all four samples collected from different places in which the HGS sample showed the maximum occurrence of bioactive compounds then VGS samples followed by SGS samples and MGS samples.

In summary of phytochemical analysis of *G. superba*, alkaloids, glycosides and steroids were showed the maximum occurrence in HGS (90.45%, 82.45%, 56.67%) than VGS (87.25%, 78.54%, 54.25%) followed by SGS (80.45%, 75.21%, 51.31%) and MGS (75.29%, 72.54%, 50.11%) respectively. In moderated amount of flavonoids, starch, terpenoids, proteins and tannins were presence in HGS (55.92%, 47.32%, 47.58%, 40.28%, 36.25%) than VGS (52.47%, 44.68%, 45.72%, 35.22%, 35.65%) followed by SGS (50.87%, 42.35%, 43.14%, 33.11%, 32.45%) and MGS (48.67%, 42.12%, 42.10%, 33.41%, 30.66%) respectively. In lowest amount of phenols and saponins were recorded in HGS (38.64% and 21.08%) than VGS (33.54% and 18.12%) followed by SGS (30.12% and 17.56%) and MGS (30.07% and 12.34%) respectively. The result data were statistically calculated with five replicates of each sample and presented in Table 3.

IV. DISCUSSION

Plants have an almost limitless ability to synthesize aromatic substances, most of which are phenols or their oxygen-substituted derivatives [32]. Most are secondary metabolites, of which at least 12,000 have been isolated, a number estimated to be less than 10% of the total [33]. In the present study, methanol extracts of all the samples showed the maximum yield of phytochemicals. However, the methanol extract of *G. superba* showed good results for phytochemicals like phenols, alkaloids, flavonoids and tannins [34]. The plant is a well-known ethnomedicinal use in Ayurveda for its colchicine content which is used to treat arthritis. Phytochemical studies of tubers or dried roots have showed the presence of colchicines, glycoside, gloriosine, long chain fatty acids, flavonoids, tannins, alkaloids, 3-O-demethylcolchicine-3-O- α -D-glucopyranoside, 1,2-didemethyl colchicine, Glucoside, β and γ Lumicolchicines, β silosterol, Flucoside, 2,3-didemethyl colchicine, luterlin, N-formyl deacetyl colchicines, colchicocide, tannins, superbine, 2-hydroxy-6-methoxy benzoic and salicylic acid [35]. According to [36], the first formed assimilate in the plant will be the simple sugars which will be used for the plant metabolic activities and the excess be stored in their reserve organs. Increased total sugars in tubers may be attributed to the high partitioning efficiency and increased efficiency of the sink to accumulate assimilates in the tubers.

The interest of medicinal plants exploration as a source of pharmacologically active compounds has increased worldwide [37]. In most developing countries of the world, plants are the main medicinal sources used in treating infectious diseases. The various phytochemical compounds detected are known to exhibit medicinal activity as well as physiological activity [38]. There are records that show the benefits of these compounds detected from *G. superba*. For example: Many of the previous reports show that the isolated pure compounds with biological activity were alkaloids. Naturally occurring alkaloids are nitrogenous compounds that constitute the basic active principles of flowering plants. Alkaloids are formed as metabolic products and have been reported to be responsible for pharmaceutically active [39]. Some of the simplest bioactive phytochemicals consist of a single substituted phenolic ring. Phenolics are the largest group of and have been said to account for most of the antioxidant activity of plant extracts. Phenolics and alkaloids detected in the extracts are compounds that have been documented to possess medicinal properties and health-promoting effects [40, 41].

Plant steroids are known to be important for their cardiogenic activities; they possess insecticidal and anti-microbial properties. They are routinely used in medicine because of their profound biological activities. Glycosides are nonvolatile and lack fragrance and serve as defense mechanisms against predation by many microorganisms, insects and herbivores [42]. Plant saponins help humans to fight fungal infections, combat microbes and viruses, boost the effectiveness of certain vaccines and knock out some kinds of tumor cells, particularly lung and blood cancers. These compounds served as natural antibiotics, which help the body to fight infections and microbial invasion [43].

Tannins have been traditionally used for protection of inflamed surfaces of the mouth and treatment of catarrh, wounds, hemorrhoids and diarrhea. Plant tannins have been recognized for their pharmacological properties and are known to make trees and shrubs.

Flavonoids are widely distributed group of polyphenolic compounds, characterized by a common benzopyrene ring structure. The biological functions of flavonoids apart from its antioxidant properties include protection against allergies, inflammation, free radicals, platelet aggregation, microbes, ulcers, hepatoxins, viruses and tumors. Flavonoids reduced cancers by interfering with the enzymes that produce estrogen [44].

V. CONCLUSION

Plants are natural sources of bioactive compounds to treat life threatening diseases. This plant *Gloriosa superba* has showed various phytochemicals which means that it can use for treating diseases. The plant methanol extracts revealed the presence of different types of phytoconstituents. The result obtained from the present study clearly stated that HGS samples excelled in the accumulation alkaloids, glycosides, flavonoids, starch, soluble protein and total phenol in tubers. Considering all the aspects it can be concluded that the sample HGS might serve as ideal parent for developing hybrids with high seed and tuber yield. Further studies are going on these plants in order to isolate, identify, characterized and elucidate the structure of the bioactive principles to develop new antibacterial and antifungal medications.

ACKNOWLEDGMENT

The author is thankful to the Principal and Head of the Department, PG and Research Department of Botany, Government Arts College, Dharmapuri for providing facilities for this research work.

REFERENCES

- [1] R. C. Rajak, M.K. Rai, *Herbal Medicines Biodiversity and Conservation Strategies*. International Book Distributors, 1990, 75-79.
- [2] H. K. Badola. Endangered medicinal plant species in Himachal Pradesh. A report on the International Workshop on "Endangered Medicinal Plant Species in Himachal Pradesh", organized by G.B. Pant Institute of Himalayan Environment and Development at Himachal Unit, Mohal-Kullu during 18-19 March 2002. *Curr. Sci* 2002; 83: 797-798.
- [3] G. Sivakumar, K.V. Krishnamurthy, *Gloriosa superba* L. - a very useful medicinal plant. In: *Recent Progress In Medicinal Plants*, USA, 2002, pp. 465-82.
- [4] S. E. Trease, D. Evans, Colchicum seed and corn. In: *Pharmacognosy*, 12th edn. Balliere Tindall, London, 1983, pp. 593-597.
- [5] R. Ade, and M. K. Rai, Review: Current Advances in *Gloriosa superba* L, *Biodiversitas*, 2009, 10(4), 210-214.
- [6] C. Alagesabooopathi, Antimicrobial screening of selected medicinal plants in Tamilnadu, India. *Journal of Microbiology*, 2011, 5(6), 2011, 617-621.
- [7] S. Hemaiswarya, R. Raja, C. Anbazhagan and V. Thiagarajan, Antimicrobial And Mutagenic Properties Of The Root Tubers Of *Gloriosa Superba* Linn, *Pakistan Journal of Botany*, 2009, 41:1, 293-299.
- [8] Rehana banu, N. Nagarajan, Antibacterial Potential Of Glory Lily , *Gloriosa Superba* Linn, *International Research Journal Of Pharmacy*, 2011, 2(3), 139-142.
- [9] Abhishek Mathur, Satish K. Verma, Santosh K. Singh, Deepika Mathur, Prasad G.B.K.S., Dua V.K, Investigation Of Anti-Inflammatory Properties of *Swertia Chirayta* And *Gloriosa Superba*, *Recent Research in Science and Technology*, 2011, 3(3), 40-43.
- [10] S.R. Baquar, The Role of Traditional Medicine in Rural Environment. In: *Traditional Medicine in Africa*. Issaq, S.(Ed.). East Africa Educational Publishers Ltd., Nairobi, 1995, 141-142.
- [11] H.G. Anwannil, R. Atta, Trends in ethnopharmacology. *J. Ethnopharmacol.*, 2006; 100: 43-49.
- [12] H.O. Edeoga, D.E. Okwu, B.O. Mbaebie, Phytochemical constituents of some Nigerian medicinal plants. *Afr. J. Biotech.*, 2005; 4: 685-688.
- [13] C.P. Kala, Indigenous uses and sustainable harvesting of trees by local people in the Pachmarhi Biosphere Reserve of India. *Int. J. Med. Arom. Plants*, 2011, 1(2): 153-161.
- [14] K. Haroon, A.K. Murad, H. Iqbal, Enzyme inhibition activities of the extracts from rhizomes of *Gloriosa superba* Linn (Colchicaceae). *Journal of enzyme inhibition and medicinal chemistry*, 2008, 22 (6) 722-725.
- [15] U.C. Srivastava, V. Chandra, *Gloriosa superba* Linn. (Kalihari) - An important colchicine producing plant. *J. Res. Indian Med* 1977; 10: 92-95.
- [16] R. Chitra, K. Rajamani, Perise performance and correlation studies for yield and its quality characters in Glory lily *Gloriosa superba* (L). *Acad. J. Plant Sci.*, 2009, 2: 39-43.
- [17] C.K. Kokate, A.P. Purohit, S.B. Gokhale, *Pharmacognosy*, Nirali Prakashan, Pune, 2004, pp. 506.
- [18] N. Didry, L. Duberwil, F. Tratin, M. Pinkas M., Antimicrobial activity of aerial parts of *Drossera peltata* Smith on oral bacteria, *J Ethnopharmacol*, 1998, 60, 215-28.
- [19] S.A. Nirmal, G. Malwadkar, R.B. Laware, Anthelmintic activity of *Pongamia glabra*, *J Sci Technol*, 2007, 29, 755.
- [20] L.A. Sofowora. Medicinal plants and traditional medicine in Africa. Spectrum Books Ltd, Ibadan, 1993, 55-71.
- [21] G.E. Trease, W.C. Evans. *Pharmacognosy*. 13th edn. Bailliere Tindal, London. 1989, 176-180.
- [22] Harborne J.B. 1998. *Phytochemical Methods: A Guide to Modern Techniques of Plant Analysis*. 3rd Edition. Chapman and Hall Co. New York. 1-302.
- [23] C.K. Kokate, A.P. Purohit, S.B. Gohale, *Pharmacognosy*, Nirali Prakashan publishers, Pune, India. 2003, 1-624.
- [24] R.M. McCready, G.V. Silveria, Q.A.C. Owens, Deterioration of starch and amylase in vegetables. *Anal. Chem.*, 1950, 29: 1156-1158.
- [25] D.H. Lowry, N.J. Rosenbrough, A.L. Far, R.J. Randal, Protein measurement with folin phenol reagent. *J. Biol. Chem.*, 1951, 193: 265-275.
- [26] O.A. Longanga, A. Vercurryse, A. Foriers. Contribution to the ethnobotanical, phytochemical and pharmacological studies of traditionally used medicinal plants in the treatment of dysentery and diarrhoea in Lomela area, Democratic Republic of Congo (DRC). *J. Ethnopharmacol*. 2000; 71(3): 411-423.
- [27] J. Martin, M. Martin, Tannin assays in ecological studies: lack of correlation between phenolics, proanthocyanidins and protein-precipitating constituents in mature foliage of six oak species. *Oecologia*, 1982, 54(2): 205-211.
- [28] N. R. Fransworth, Biological and Phytochemical screening of plants. *J Pharm Sci*, 1966, 35: 225-276.
- [29] G. Kumar, Z. Banu, A. Murugesan, Z. Pandian, Preliminary Toxicity and Phytochemical Studies of Aqueous Bark Extract of *Helicteres isora* L. *Intl. J. Pharmacol*. 2007, 3(1): 96-100.
- [30] M. Tanira, A. Shah, A. Mohsin, A. Ageel, S. Qureshi. Pharmacological and toxicological investigations on *Foeniculum vulgare* dried fruit extract in experimental animals. *Phytotherapy Res*. 1996, 10(1): 33-36.
- [31] C. P. Malick, M.B. Singh, *Plant Enzymology and Histo Enzymology*. Kalyani Publishers, New Delhi, 1980, pp: 286.
- [32] T.A. Geissman, Flavonoid compounds, tannins, lignins and related compounds, 1963, p. 265. In M. Florin and E. H. Stotz (ed.), *Pyrolo pigments, isoprenoid compounds and phenolic plant constituents*, vol. 9. Elsevier, New York, N.Y.
- [33] R.E. Schultes, The kingdom of plants, 1978, p. 208. In W. A. R. Thomson (ed.), *Medicines from the Earth*. McGraw-Hill Book Co., New York, N.Y.
- [34] N.N. Devi, W. Femina, GC-MS analysis of *Gloriosa superba* medicinal plant of Tamilnadu. *Journal of Pharmacy Research*, 2012, 5:1, 343-345.
- [35] H. Shanmugam, R. Rathinam, A. Chinnathambi, T. Venkatesan, Antimicrobial and mutagenic properties of the root tubers of *Gloriosa superba* linn. (Kalihari), *Pak. J. Bot.*, 41(1), 2009, 293-299.

- [36] S.C. Datta, Plant Physiology. Wiley Eastern Ltd., New Delhi, India.1994.
- [37] J.L. Rios, M.C. Recio. Medicinal plants and antimicrobial activity. *J. Ethnopharmacology* 2005; 100: 80-84.
- [38] A. Sofowora, Medicinal Plants and Traditional Medicines in Africa. Chichester John Wiley & Sons New York. 1993, pp 97- 145.
- [39] J.H. Doughari, Antimicrobial activity of *Tamarindus indica* Linn. *Trop J. Pharm. Res.* 2006; 5: 597.
- [40] R.H. Liu, Potential synergy of phytochemicals in cancer prevention: mechanism of action. *J. Nutr.* 2004; 134: 3479S-3485S.
- [41] M.M. Cowan, Plant Products as Antimicrobial Agents. *Clinical Microbiology Reviews*, 1999, 564-582
- [42] M. De, A. Krishina De, A.B. Banerjee, Antimicrobial screening of some Indian spices. *Phytother Res.*; 1999, 13: 616-618.
- [43] O.A. Sodipo, Ja. Akiniyi, Ogunbanosu, Studies on certain characteristics of extracts of bark of *Pansinystalia macruceras* (K.Schem) Piere. Exbeile. *Global J. Pure Appl. Sci.*; 6: 83-87.
- [44] D.S. Ogunleye, S.F. Ibitoye, Studies of antimicrobial activity and chemical constituents of *Ximenia americana*. *Trop. J. Pharm. Res.*, 2003, 2:2, 239-241.

AUTHOR

Mariappan Senthilkumar, M. Sc., M. Phil., Ph.D., Assistant Professor in Botany, Government Arts College, Dharmapuri-636705, Tamil Nadu, India.

Corresponding Author: Dr. Mariappan Senthilkumar,
E.mail: kalaisenthilk@yahoo.com, Mobil no: 9942596862

Table 1: Preliminary phytochemical tests for the presence of compounds in *Gloriosa superba* leaves, flowers, seeds and tubers of Hogenakkal Hills (HGS) and Vathal Hills (VGS)

S. No.	Compounds	Hogenakkal hills (HGS)				Vathal hills (VGS)			
		Leaves	Flowers	Seeds	Tubers	Leaves	Flowers	Seeds	Tubers
1.	Alkaloids	-	+	++	+++	-	+	++	+++
2.	Flavonoids	+	+++	++	+	+	+++	++	+
3.	Glycosides	-	+	+++	+++	-	+	+++	+++
4.	Protein	+++	++	++	+++	+++	++	++	+++
5.	Phenols	++	++	+++	+++	++	++	+++	+++
6.	Saponins	-	-	+	+	-	-	+	+
7.	Starch	++	+	++	+++	++	+	++	+++
8.	Steroids	+	+	+++	+++	+	+	++	++
9.	Tannin	-	-	++	++	-	-	++	++
10.	Terpenoids	++	+++	+++	+++	++	+++	+++	+++

(- = negative; + = slight; ++ = moderate; +++ = High)

Table 2: Preliminary phytochemical tests for the presence of compounds in *Gloriosa superba* leaves, flowers, seeds and tubers of Sitheri Hills (SGS) and Mookanur Hills (MGS)

S. No.	Compounds	Sitheri hills				Mookanur hills (MGS)			
		Leaves	Flowers	Seeds	Tubers	Leaves	Flowers	Seeds	Tubers
1.	Alkaloids	-	-	+	++	-	-	+	++
2.	Flavonoids	1	++	++	+	+	++	++	+
3.	Glycosides	-	+	++	+++	-	+	++	+++
4.	Protein	+++	++	++	++	++	++	++	++
5.	Phenols	+	+	+	++	+	+	+	++
6.	Saponins	-	-	+	+	-	-	+	+
7.	Starch	++	+	++	+++	++	+	+	+
8.	Steroids	+	+	+	+	+	+	+	+
9.	Tannin	-	-	++	++	-	-	++	++
10.	Terpenoids	+	++	++	+++	+	+++	++	++

(- = negative; + = slight; ++ = moderate; +++ = High)

Table 3: Total percentage of bioactive compounds in *Gloriosa superba* in different places

S. No.	Compounds	HGS	VGS	SGS	MGS
1.	Alkaloids (%)	90.45 ± 7.12	87.25 ± 8.41	80.45 ± 8.12	75.29 ± 7.24
2.	Flavonoids (%)	55.92 ± 4.21	52.47 ± 3.12	50.87 ± 4.45	48.67 ± 4.26
3.	Glycosides (%)	82.45 ± 6.56	78.54 ± 5.66	75.21 ± 7.64	72.54 ± 7.25
4.	Protein (%)	40.28 ± 2.89	35.22 ± 3.85	33.11 ± 3.15	33.41 ± 4.35
5.	Phenols (%)	38.64 ± 3.55	33.54 ± 3.15	30.12 ± 2.85	30.07 ± 3.12
6.	Saponins (%)	21.08 ± 1.86	18.12 ± 1.22	17.56 ± 2.45	12.34 ± 1.17
7.	Starch (%)	47.32 ± 3.73	44.68 ± 4.15	42.35 ± 4.34	42.12 ± 4.65
8.	Steroids (%)	56.67 ± 4.10	54.25 ± 3.95	51.31 ± 5.12	50.11 ± 5.37
9.	Tannin (%)	36.25 ± 2.65	35.65 ± 2.25	32.45 ± 3.64	30.66 ± 3.12
10.	Terpenoids (%)	47.58 ± 3.34	45.72 ± 4.05	43.14 ± 4.11	42.10 ± 3.67

(Mean values for five replicates, n = 5 ± SD)

Field Hockey Better Psychological Effect through the Motivation and Stress

Boggiti Rajesh Jayaratnam¹, Dr.N.S.Dileep²

* Asso.Professor, CMR Engineering College, Hyd , India
** Professor JNTUH,Hyd,India

Abstract- In This paper we are taken these following methods ” Field Hockey better psychological performance through ACHIEVEMENT MOVITATION and STRESS” we are taken 60 players, It was concluded that twelve weeks yogic exercises significantly altered motivation and stress of the inter university hockey players. It was concluded that six weeks autogenic exercises significantly altered motivation and stress of the inter university hockey players. It was concluded that there was no significant differences between yogic exercises and autogenic training groups on motivation and stress of the interuniversity hockey players. Compare to previous work motivation is saved of 99% stress is saved of 3 % .

Index Terms- Achievement Motivation and stress, yoga, Autogenic Training.

I. INTRODUCTION

1. Autogenic Training

Emerson (1999) conducted a study to compare the efficacy in the runners of two relaxation techniques with regarded to exercise reactivity and recovery after exercise. Thirty one adult male runner were studied prospectively for 6 months in three groups practicing either meditation (n =11) or autogenic training (n =11) or serving as controls (n =10). Before and after 6 months relaxation and innervations, indicators of reactivity to exercise and metabolism after exercise (blood lactate concentration, heart rate and oxygen consumption were tested immediately after and 10minute exercise. There were no significant differences among the groups with regard to HR, vo₂, or levels of anxiety. Meditation training may reduce the lactate response to a standardized exercise bout.

Coker (1999) investigation was conducted to determine whether or not relaxation training would significantly effects the mood states of collegiate basketball players during a session of competition as measured by the profile of mood states (POMS)and the Spielberger state anxiety inventory (STAI) voluntaries forty nine male and female collegiate basketball players. Experimental group listened to antigenic relaxation tapes, while the control group met for five sessions to answers questionnaire related to stress.

Crocker and Grozelle C (1991) conducted a study was to investigate the effects of acute aerobic activity an autogenic relaxation session on reducing induced state anxiety. Eight- five university students were randomly assigned to one of three groups (a) aerobic (b) relaxation, (c) control. Each group was tested separately. The general procedure consisted of anxiety

induction, assessment, intervention and assessment. The induced affect procedure involved having subjects visualize distressing images and generating high arousal states for ten minutes (Smith and Ascough, 1985). State anxiety was assessed by states Trait Anxiety Inventory (form Y-1). The aerobic intervention lasted 40 minutes, including warm up and cool down. The relaxation intervention consisted of listening and following instructions on a tape for approximately 30 minutes (Budzyski T, 1974, “Limb Heaviness – Exercise MU-3-3”). The control group was excused after anxiety induction and told to report back in 30 minutes. The data was analyzed by a 3x2 (group by time) ANOVA with repeated measures on the last factor. The groups by times interaction was significant, $F(2, 82) = 13.07$, p less than 0.01. post-hoc analysis using Turkey with a normalized and indicated that both the aerobic and relaxation groups significantly reduce anxiety scores from pretreatment to post treatment but was not different from each other.

2. Yoga:-

Kamel et.al., (2000) examined the changes in brain waves and blood levels of serum cortisol during yoga exercise in 7 yoga instructors and found that alpha waves increased and serum cortisol decreased. These two measures were negatively correlated ($r = - 0.83$). Comparison with a control group of non practitioners is desirable.

Raju et.al.,(1997) examined the short-term effects of 4 weeks of intensive yoga practice on physiological responses in six healthy adult female volunteers were measured using the maximal exercise treadmill test. Yoga practice involved daily morning and evening sessions of 90 minutes each. Pre and post-yoga exercise performance was compared. Maximal work output (w max) for the group increased by 21% with a signification reduced level of oxygen consumption per unit work but without a concomitant significant change in heart rate. After intensive yoga tanning, at 154 w min.(-1) (corresponding to w max of the pre-yoga maximal exercise test) participants could exercise more comfortable, with significantly lower heart rate ($P < 0.05$), reduced minute ventilation ($P < 0.05$), reduced oxygen consumption per unite work ($P < 0.05$), and the significantly lower respiratory quotient ($P < 0.05$) the implications for the effects of intensive yoga on cardio respiratory efficiency are discussed, with the suggestion that yoga has has some transparently difference quantifiable physiological effects to other exercises.

M.L. Garote (1970) conducted a study to determine the “ effect of everyday and alternate day yoga training on the physical fitness of School Children”. In his study were school boys with means age of 17 years when tested with the Fleishman battery of

basic physical fitness tests showed significant improvement with six weeks yoga training given for 6 days a week as well as for 3 days a week in comparison to the control group.

II. PROPOSED WORK

2.1. Achievement motivation:-

Motivation means move to achieve. In psychology the term motivation or motive refers to activation from within in the organism.

The motivation is termed as the urge to push towards a specific goal. Motivation is a concept invented to describe the psychological state or the organism as it is affected by various influences. A person is motivated when he desires some goal, a goal that will meet his need or satisfy his interest. Many psychologists believe that all behaviors are motivated, although it is extremely difficult to isolate specific motivational variables.

According to Brayant J. Crathy, (1989) motivation as a personality characteristic related to the general state of arousal and subsequent level of attention paid to a problem or task facing of an individual.

Motivation depends not only on environmental manipulations and the individual's personality, but on the nature of the task also. For simple skills high or low motivation create the same effect. The level of motivation will affect the performance of the complex skill. According to Silva John M. and Weinberg Roberts (1984) need to achieve and fear of failure are motives aroused situational. Level of achievement motives is positively related to success. Achievement related motives may be more successful in predicting behavior in sports selling.

2.2. STRESS

The term stress is used to connote a variety of meanings both by common men and psychologists. Some psychologists have defined stress as a "stimulus" and others as a "reaction". One of the most commonly accepted definition of stress is by Hans Selye. As a stimulus, Selye has defined stress as any external event or internal drive, which threatens to upset the equilibrium of an organism. On the other hand, as a response, Selye has defined stress "as a non specific responses of the body to the demand". Stress is developed internally rather externally. (William 1983).

Psychological stress has robbed more athletics psychic energy, victory and enjoyment in sports than any other factor. Stress can destroy self-confidence by leading athletes to believe that they are incompetent. It can deny athletes the joy of demonstrating skills that they have mastered through countless hours of hard work. And it can deprive athletes of experiencing the ecstasy of low. Stress because interpersonal conflict, induces physical injury and drives athletes to early retirement. Psychological stress is an insidious disease and when sustained

manifests itself in the form of burnout- affliction not only for athletes but also for coaches as well. (Debi 1965)

Stress can either be friend or foe. It can bring or intensity heart disease, peptic ulcers, and hypertension. Unfortunately, too many people react destructively to stress. Stress can lead to significant loss in body weight. Many do not know how to deal. Medical progress in recent years has not been one that keeps man imbalance as a bio psycho social being. (Magnussion 1974)

Psychological stress produce somatic complaints that are wholly imaginary but in some other cases, emotional maladjustment contributes to an illness that is primarily organic in nature and still other cases, psychological problems actually produce genuine organic illness. These are also called psychosomatic reactions, which are disorders of adjustment that have because associated with certain bodily processes in such a way as to produce a genuine organic illness. In such cases, the chronic mal adjustment or emotional problems are and the organic disturbances are secondary.

Stressors can be considered to be beneficial when they lead to accomplishment and creativity. The stressors should be viewed as challengers and obstacles to be overcome on the path leading to success. On the other hand, when stressors control the individual, a feeling of helplessness develops in them that could result in failure.

All of us face stress at some point of time in our life. Irrespective of profession, strata of society to which we belong, or our position in which organizational hierarchy stress affects everyone. We can say that life is full of stress and strain and cope up with it is a continuous struggle. Each one of us has our own level of stress, a level of equilibrium within which stress could be stimulating experience. It is only when stress goes beyond this level it become distress and difficult to manage. 'when it happens everything appears to go wrong, in this situation, one will feel hopeless, helpless and his action become dull. This results in reducing individual efficiency and effectiveness in playing his assigned role in the family, institution, and organization, which further compounds his misery. Professional college students are no exception to this problem of stress. (Bestowitz 1955)

III. PERFORMANCE AND RESULT ANALYSIS

EFFECT OF PSYCHO REGULATIVE PROGRAMMES – ACHIVEMENT MOTIVATION AND STRESS ON PSYCHOLOGICAL VARIABLES

The data on the effect of achievement motivation and stress on psychological variable, anxiety was collected through pre and post test scores and subjected to statistical treatment using ANCOVA. Tables are shows the results obtained.

ACHIEVEMENT MOTIVATION								
Means	Yogic Group	Autogenic Group	Control Group	Source of Variance	Sum of Squares	df	Mean Squares	Obtained F
Pre Test	24.27	22.73	22.53	Between	53.96	2	26.98	1.01
				Within	2329.20	87	26.77	
Post Test	27.87	25.07	22.87	Between	376.80	2	188.40	7.72*
				Within	2122.80	87	24.40	
Adjusted	26.85	25.48	23.47	Between	170.04	2	85.02	96.91*
				Within	75.45	86	0.88	
Mean Diff	3.60	2.33	0.33					
STRESS								
Means	Yogic Group	Autogenic Group	Control Group	Source of Variance	Sum of Squares	df	Mean Squares	Obtained F
Pre Test	23.10	21.40	21.50	Between	51.4	2	25.72	3.07
				Within	477.5	57	8.38	
Post Test	24.20	23.95	23.10	Between	89.0	2	44.52	10.44*
				Within	243.2	57	4.27	
Adjusted	23.93	24.25	21.47	Between	87.8	2	43.91	10.14*
				Within	242.5	56	4.33	
Mean Diff	1.10	2.55	1.60					

Table F-ratio at 0.05 level of confidence for 2 and 56 (df) =3.15, 2 and 46(df) =3.15 .

*Significant

SCHEFFE’S POST HOC ANALYSIS RESULTS

MEANS ACHIEVEMENT MOTIVATION			Mean Difference	Required C I
Yogic Practices	Autogenic	Control		
25.09	26.43		1.34	1.35
25.09		23.18	1.91*	1.35
	26.43	23.18	3.25*	1.35

MEANS OF STRESS			Mean Difference	Required C I
Yogic Practices	Autogenic	Control		
23.93	24.25		0.31	1.65
23.93		21.47	2.47*	1.65
	24.25	21.47	2.78*	1.65

* Significant at 0.05 level

IV. CONCLUSION

Field Hockey better psychological performance through ACHIVEMENT MOVITATION and STRESS” It was concluded that twelve weeks yogic exercises significantly altered motivation and stress of the inter university hockey players. It was concluded that six weeks autogenic exercises significantly altered motivation and stress of the inter university hockey players. It was concluded that there was no significant differences between yogic exercises and autogenic training groups on motivation and stress of the interuniversity hockey players. Compare to previous work motivation is saved of 99% stress is saved of 3 %.

REFERENCES

- [1] Appollonio Let,al., gan 1995). “Sensory impairments and mortality in an elders Community population: a six years follow –up study”. Pubmed, 24(1);PP. 30
- [2] Cagatay AA. Et al, (Mar 2003), “The clinical and pharmacoeconomic analysis of invasive aspergillosis in adult patients with haematological diseases”. Pubmed.
- [3] Cancio Leopoldo C(1991) “Stress And Trainees In The Free Fall Parachuting: A Pilot Study”, American Journal Of Clinical Hypothesis, ,P.225.
- [4] Centers for Disease Control and Prevention (CDC). (Jan 2004). “Economies cost associated with mental retardation”, Pubmed, 30: 53 (3) :PP. 57-9.
- [5] Crocker PR, Crozell C (1991P “Reducing Induced State Anxiety : Effects Of The Acute Aerobic Exercise And The Autogenic Relaxation”. J sport Med phys fitness ; 31(2); PP. 277-82..
- [6] Dolka E, et, al., (Nov; 2007) “Soluble transferring receptor’s value in diagnosis infants and small children iron deficiency” Pubmed 23 (137) : PP.352-5.
- [7] Edwin Thomas Davis,(2002). “ The effect of anxiety on seventh grade students”, Dissertation Abstracts International Vol. 48 P.A.
- [8] Traite and state anxiety with game performance of rugby players” , Journal of sport psychological 19:PP. 1 76
- [9] Medic N, Starkes JL, and Young BW. (2007), “Examining relative age effects on performance achievement and participation rates in Masters athletes.”, J Sports Sci. Oct;25(12):1377-84
- [10] Noël-Jorand MC, Joulia F, and Braggard D. (2001), « Personality factors, stoicism and motivation in subjects under hypoxic stress in extreme environments.”, Aviat Space Environ Med. Apr;72(4):391-9.
- [11] Patsiaouras A. (2008), “Person-centered support and athletes' motivation for performance.”, Percept Mot Skills. Jun;106(3):849-58.
- [12] Rebot s. Weinberg and John Rogan , (1978) “Motor Performance Underthree Levels Of Trait Anxiety And Stress “, Journal Of Motor Behaviour 10: PP. 169-176.
- [13] Robert Mccomb JJ, Tacon A, Randolph P, Caldera Y, (2004) “ A pilot study to examine the effects of mindfulness based stress based stress reduction and relaxation program on levela of stress horm ones, physical functioning, sub maximal exercise responses”. J Altern complement med.; 10(5):PP. 81
- [14] Boggiti Rajesh Jayaratnam , Dr.N.S.Dileep “Field Hockey better psychological performance through the yogic training” 2012 Dec

AUTHORS

First Author – Boggiti Rajesh Jayaratnam,Asso.Professor,CMR Engineeringcollege,Hyd , India giftyboggiti@yahoo.com

Second Author – Dr.N.S.Dileep, Professor JNTUH,Hyd,India, dillnelle@yahoo.com

Performance Evaluations of Grigoryan FFT and Cooley-Tukey FFT onto Xilinx Virtex-II Pro and Virtex-5 FPGAs

Narayanam Ranganadh and Muni Guravaiah P

Department of Electronics & Communications Engineering, Bharat Institute of Engineering & Technology, Mangalpally (V), Ibrahimpatnam (M), Hyderabad, A.P., India – 501 510

Abstract- A large family of signal processing techniques consist of Fourier-transforming a signal, manipulating the Fourier-transformed data in a simple way, and reversing the transformation. We widely use Fourier frequency analysis in equalization of audio recordings, X-ray crystallography, artefact removal in Neurological signal and image processing, Voice Activity Detection in Brain stem speech evoked potentials, speech processing spectrograms are used to identify phonetic sounds and so on. Discrete Fourier Transform (DFT) is a principal mathematical method for the frequency analysis. The way of splitting the DFT gives out various fast algorithms. In this paper, we present the implementation of two fast algorithms for the DFT for evaluating their performance. One of them is the popular radix-2 Cooley-Tukey fast Fourier transform algorithm (FFT) [1] and the other one is the Grigoryan FFT based on the splitting by the paired transform [2]. We evaluate the performance of these algorithms by implementing them on the Xilinx Virtex-II pro [3] and Virtex-5 [4] FPGAs, by developing our own FFT processor architectures. Finally we show that the Grigoryan FFT is working faster than Cooley-Tukey FFT, consequently it is useful for higher sampling rates. Operating at higher sampling rates is a challenge in DSP applications.

Index Terms- frequency analysis, fast algorithms, DFT, FFT, paired transforms.

I. INTRODUCTION

In the recent decades, fast orthogonal transforms have been widely used in areas of data compression, pattern recognition and image reconstruction, interpolation, linear filtering, and spectral analysis. The suitability of unitary transforms in each of the above applications depends on the properties of their basis functions as well as on the existence of fast algorithms, including parallel ones. Since the introduction of the Fast Fourier Transform (FFT), Fourier analysis has become one of the most frequently used tool in signal/image processing and communication systems; The main problem when calculating the transform relates to construction of the decomposition, namely, the transition to the short DFT's with minimal computational complexity. The computation of unitary transforms are complicated and time consuming process. Since the decomposition of the DFT is not unique, it is natural to ask how to manage splittings and how to obtain the fastest algorithm of the DFT. The difference between the lower bound of arithmetical operations and the complexity of fast transform algorithms shows that it is possible to obtain FFT algorithms of various speed [2].

One approach is to design efficient manageable split algorithms. Indeed, many algorithms make different assumptions about the transform length. The signal/image processing related to engineering research becomes increasingly dependent on the development and implementation of the algorithms of orthogonal or non-orthogonal transforms and convolution operations in modern computer systems. The increasing importance of processing large vectors and parallel computing in many scientific and engineering applications require new ideas for designing super-efficient algorithms of the transforms and their implementations [2].

In this paper we present the implementation techniques and their results for two different fast DFT algorithms. The difference between the algorithm development lies in the way the two algorithms use the splitting of the DFT. The two fast algorithms considered are radix-2 and paired transform [2] algorithms. The implementation of the algorithms is done both on the Xilinx Virtex-II Pro [3] and Virtex-5 [4] FPGAs. The performance of the two algorithms is compared in terms of their sampling rates and also in terms of their hardware resource utilization.

Section II presents the paired transform decomposition used in paired transform in the development of Grigoryan FFT. Section III presents the implementation techniques for the radix-2 and paired transform algorithms on FPGAs. Section IV presents the results. Finally with the Section V we conclude the work and put forward some suggestions for further sampling rate improvements.

II. DECOMPOSITION ALGORITHM OF THE FAST DFT USING PAIRED TRANSFORM

In this algorithm the decomposition of the DFT is done by using the *paired transform*[2]. Let $\{x(n)\}$, $n = 0:(N-1)$ be an input signal, $N > 1$. Then the DFT of the input sequence $x(n)$ is

$$X(k) = \sum_{n=0}^{N-1} x(n)W_N^{nk}, \quad k = 0:(N-1) \quad (1)$$

which is in matrix form

$$X = [F_N]x \quad (2)$$

where $X(k)$ and $x(n)$ are column vectors, the matrix $F_N = \left\| W_N^{nk} \right\|_{n,k=(0:N-1)}$, is a permutation of X .

$$F_N = \text{diag}\{[F_{N1}], [F_{N2}], \dots, [F_{Nk}]\} [\overline{W}] [\mathcal{X}'_N] \quad (3)$$

which shows the applying transform is decomposed into short transforms F_{Ni} , $i = 1: k$. Let S_F be the domain of the transform F the set of sequences f over which F is defined. Let $(D; \sigma)$ be a class of unitary transforms revealed by a partition σ . For any transform $F \in (D; \sigma)$, the computation is performed by using paired transform in this particular algorithm. To denote this type of transform, we introduce "paired functions [2]."

Let $p, t \in$ period N , and let

$$\mathcal{X}_{p,t}(n) = \begin{cases} 1; & np = t \pmod{N}; \\ 0; & \text{otherwise.} \end{cases} \quad n = 0: (N-1) \quad (4)$$

Let L be a non trivial factor of the number N , and $W_L = e^{2\pi i/L}$, then the complex function

$$\mathcal{X}'_{p,t} = \mathcal{X}'_{p,t;L} = \sum_{k=0}^{L-1} W_L^k \mathcal{X}_{p,t+kN/L} \quad (5)$$

$t = 0: (N/L - 1)$, $p \in$ to the period $0: N-1$

is called L -paired function [2]. Basing on this paired functions the complete system of paired functions can be constructed. The totality of the paired functions in the case of $N=2^r$ is

$$\{ \{ \mathcal{X}_{2^n, 2^{n_t}}; t = 0: (2^{r-n-1} - 1), n = 0: (r-1) \}, 1 \} \quad (6)$$

Now considering the case of $N = 2^r N_1$, where N_1 is odd, $r \geq 1$ for the application of the paired transform.

a) The totality of the partitions is

$$\sigma' = (T'_{1;2}, T'_{2;2}, T'_{4;2}, \dots, T'_{2^r;2})$$

b) The splitting of F_N by the partition σ' is

$$\{ F_{N/2}, F_{N/4}, \dots, F_{N/2^r}, F_{N1} \}$$

c) The matrix of the transform can be represented as

$$[F_N] = \left(\bigoplus_{n=1}^r [F_{L_n}] \right) [\overline{W}] [\mathcal{X}'_n]$$

$$L_n = N/2^{n+1}, L_r = N_1.$$

where the $[\overline{W}]$ is diagonal matrix of the twiddle factors. The steps involved in finding the DFT using the paired transform are given below:

- 1) Perform the L -paired transform $g = \mathcal{X}'_N(x)$ over the input x
- 2) Compose r vectors by dividing the set of outputs so that the first L^{r-1} elements $g_1, g_2, \dots, g_{L^{r-1}}$ compose the first vector X_1 , the next L^{r-2} elements $g_{L^{r-1}+1}, \dots, g_{L^{r-1}+L^{r-2}}$ compose the second vector X_2 , etc.
- 3) Calculate the new vectors Y_k , $k=1:(r-1)$ by multiplying element-wise the vectors X_k by the corresponding turned factors $1, W_t, W_t^2, \dots, W_t^{t/L-1}, (t = L^{r-k}), (t=Lr-k)$. Take $Y_r = X_r$
- 4) Perform the L_{r-k} -point DFT's over Y_k , $k=1: r$
- 5) Make the permutation of outputs, if needed.

III. IMPLEMENTATION TECHNIQUES

We have implemented various architectures for radix-2 and paired transform processors on Virtex-II Pro and Virtex-5 FPGAs. As there are embedded multipliers [3] and embedded block RAMs [3] available, we can use them without using distributed logic, which economize some of the CLBs [3]. Virtex-5 [4] is having DSP48E slices As we are having DSP48E slices on Virtex-5 FPGAs, to utilize them and improve speed performance of these 2 FFTs and to compare their speed performances on Virtex-5 FPGAs and Virtex-II pro FPGAs. As most of the transforms are applied on complex data, the arithmetic unit always needs two data points at a time for each operand (real part and complex part), dualport RAMs are very useful in all these implementation techniques.

In the Fast Fourier Transform process the butterfly operation is the main unit on which the speed of the whole process of the FFT depends. So the faster the butterfly operation, the faster the FFT process. The adders and subtractors are implemented using the LUTs (distributed arithmetic). The inputs and outputs of all the arithmetic units can be registered or non-registered.

Various possible implementations of multipliers we considered are:

Embedded multiplier:

- a) With non-registered inputs and outputs
- b) With registered inputs or outputs, and
- c) With registered inputs and outputs.

Distributed multiplier: Distributed multipliers are implemented using the LUTs in the CLBs. These can also be implemented with the above three possible ways. Various considerations made to implement butterfly operation for its speed improvement and resource requirements. Basing on the availability of number of Embedded multipliers and design feasibility we have implemented both multiplication processes.

The various architectures proposed for implementing radix-2 and paired transform processors are single memory (pair) architecture, dual memory (pair) architecture and multiple

memory (pair) architectures. We applied the following two best butterfly techniques for the implementation of the processors on the FPGAs [3].

1. One with Distributed multipliers, with fully pipelined stages. (Best in case of performance)
2. One with embedded multipliers and one level pipelining. (Best in case of resource utilization)

Single memory (pair) architecture (shown in Figure 1) is suitable for single snapshot applications, where samples are acquired and processed thereafter. The processing time is typically greater than the acquisition time. The main disadvantage in this architecture is while doing the transform process we cannot load the next coming data. We have to wait until the current data is processed. So we proposed dual memory (pair) architecture for faster sampling rate applications (shown in Figure 2). In this architecture there are three main processes for the transformation of the sampled data. Loading the sampled data into the memories, Processing the loaded data, Reading out the processed data. As there are two pairs of dual port memories available, one pair can be used for loading the incoming sampled data, while at the same time the other pair can be used for processing the previously loaded sampled data. For further sampling rate improvements we proposed multiple memory (pair) architecture (shown in Figure 3). This is the best of all architectures in case of very high sampling rate applications, but in case of hardware utilization it uses lot more resources than any other architecture. In this model there is a memory set, one arithmetic unit for each iteration. The advantage of this model over the previous models is that we do not need to wait until the end of all iterations (i.e. whole FFT process), to take the next set of samples to get the FFT process to be started again. We just need to wait until the end of the first iteration and then load the memory with the next set of samples and start the process again. After the first iteration the processed data is transferred to the next set of RAMs, so the previous set of RAMs can be loaded with the next coming new data samples. This leads to the increased sampling rate.

Coming to the implementation of the paired transform based DFT algorithm, there is no complete butterfly operation, as that in case of radix-2 algorithm. According to the mathematical description given in the Section II, the arithmetic unit is divided into two parts, addition part and multiplication part. This makes the main difference between the two algorithms, which causes the process of the DFT completes earlier than the radix-2 algorithm. The addition part of the algorithm for 8-point transform is shown in Figure 4. The architectures are implemented for the 8-point, 64-point, 128-point, 256-point transforms for both Virtex-II Pro and Virtex-5 FPGAs. The radix-2 FFT algorithm is efficient in case of resource utilization and the paired transform algorithm is very efficient in case of higher sampling rate applications.

IV. THE IMPLEMENTATION RESULTS

Results obtained on Virtex-II Pro and Virtex-5 FPGAs: The hardware modeling of the algorithms is done by using Xilinx's system generator plug-in software tool running under SIMULINK environment provided under the Mathworks's

MATLAB software. The functionality of the model is verified using the SIMULINK Simulator and the MODELSIM software as well. The implementation is done using the Xilinx project navigator backend software tools.

Table 1 shows the implementation results of the two algorithms on the Virtex-II Pro FPGAs. Table 2 shows the implementation results of the two algorithms on Virtex-5 FPGAs. From Tables 1, 2 we can see that Grigoryan FFT is always faster than the Cooley-Tukey FFT algorithm. Thus paired-transform based algorithm can be used for higher sampling rate applications. In military applications, while doing the process, only some of the DFT coefficients are needed at a time. For this type of applications paired transform can be used as it generates some of the coefficients earlier, and also it is very fast.

V. CONCLUSIONS AND FURTHER RESEARCH

In this paper we have shown that both on on Virtex-II Pro and Virtex-5 FPGAs the paired transform based Grigoryan FFT algorithm is faster and can be used at higher sampling rates than the Cooley-Tukey FFT at an expense of high resource utilization.

1. In all implementations on FPGAs, the number of bits used for the data is 16-bits. So all the multipliers here are used as 16-bit multipliers. The size of the multipliers used were 18-bit multipliers. For instance, if there are some applications using only 8-bit data, then one can use the 40 dedicated multipliers as 80 multipliers, as two multiplications can be implemented by using a single embedded multiplier as long as the sum of the two products bits is less than 36 bits.

No. of points	Cooley-Tukey radix-2 FFT			Grigoryan Radix-2 FFT		
	Max. freq. MHz	No. of mult.	No. of Slices	Max.Freq. MHz	No. of mult	No. of slices
8	35	4	264	35	8	475
64	42.45	4	480	52.5	8	855
128	50.25	12	560	60	16	1248
256	55.40	24	648	68.75	48	1985

Table 1 Efficient performance of Grigoryan FFT over Cooley-Tukey FFT, on Virtex-II Pro FPGAs. Table showing the sampling rates and the resource utilization summaries for both the algorithms, implemented on the Virtex-II Pro FPGAs.

No. of points	Cooley-Tukey radix-2 FFT			Grigoryan Radix-2 FFT		
	Max. freq. MHz	No. of Slices	No. of DS P48 E slic	Max. freq. MHz	No. of Slices	No. of DS P48 E slic
8	35	4	264	35	8	475
64	42.45	4	480	52.5	8	855
128	50.25	12	560	60	16	1248
256	55.40	24	648	68.75	48	1985

			es			es
8	48	200	4	52	350	4
64	55.25	375	6	60	700	8
128	60.50	450	11	80	1000	26
256	75	560	14	85	1645	82

Table 2 Efficient performance of Grigoryan FFT over Cooley-Tukey FFT, on Virtex-5 FPGAs. Table showing the sampling rates and the resource utilization summaries for both the algorithms, implemented on the Virtex-5 FPGAs. We have utilized DSP48E slices in this, which is making us much faster than Virtex-II Pro FPGAs.

2. We are planning to implement these algorithms onto Latest TMS DSP processors, and also by utilizing MAC engines on them; and onto Some more Xilinx FPGAs for extensive verification of these two FFT algorithms. Then we would like to standardize Grigoryan FFT and apply for real time applications.

ACKNOWLEDGEMENTS

This is to acknowledge Dr. Parimal A. Patel, Dr. Artyom Grigoryan of The University of Texas at San Antonio; regarding their valuable guidance to do the first part of this research series as my (Mr. Narayanam) master’s thesis. Their blessings will always be with me to make Grigoryan FFT as a standard FFT as our patent in the industrial market. In the research of this paper we are taking the research results onto Virtex-II Pro from our research paper “Case study of Grigoryan FFT, IEEE – ICECT 2012” [5] for 8 point, 64-point FFTs and we are continuing our research onto Xilinx Virtex-II Pro FPGAs and Virtex-5 FPGAs from 8-point,64,128 to 256-point FFTs.

REFERENCES

- [1] James W. Cooley and John W. Tukey, “An algorithm for the machine calculation of complex Fourier Series”, Math. comput. 19, 297-301 (1965)
- [2] Split Manageable Efficient Algorithm for Fourier and Hadamard transforms Artyom M. Grigoryan and Sos S. Agaian, Signal Processing, IEEE Transactions on, Volume: 48, Issue: 1, Jan.2000 Pages: 172 - 183
- [3] Virtex-II Pro platform FPGAs: detailed description
- [4] http://www.xilinx.com/support/documentation/data_sheets/ds083.pdf
- [5] Virtex-5 platform FPGAs: detailed description http://www.xilinx.com/support/documentation/virtex-5_user_guides.htm
- [6] Case study of Grigoryan FFT onto FPGAs and DSPs, Narayanam Ranganadh, Parimal A Patel and Artyom M. Grigoryan. IEEE proceedings, ICECT – 2012.

AUTHORS

First Author – Mr. Ranganadh Narayanam is an Assistant professor in the department of Electronics & Communications Engineering in Bharat Institute of Engineering & Technology (BIET). This research is continuation of the research done in the

Univeristy of Texas at San Antonio under the guidance of Dr. Parimal A. Patel, Dr. Artyom M. Grigoryan, as my master’s thesis. This current research was partly funded by BIET. Mr.Narayanam, a research student in the area of “Brain Stem Speech Evoked Potentials” under the guidance of Dr. Hilmi Dajnai of University of Ottawa,Canada. He was also a research student in The University of Texas at San Antonio under Dr. Parimal A Patel,Dr. Artyom M. Grigoryan, Dr Sos Again, Dr. CJ Qian,. in the areas of signal processing and digital systems, control systems. He worked in the area of Brian Imaging in University of California Berkeley. Mr. Narayanam is having around 5+2 years of full time teaching & research experiences respectively; and more than 5 years of entry level research experience and more than 10 publications. Mr. Narayanam’s research interests include neurological Signal & Image processing, DSP spftware & Hardware design and implementations, neurotechnologies.

Second Author – Mr. P. Muni Guravaiah is an Associate Professor & Admin. Incharge of Department of Electronics & Communications Engineering in BIET. He is currently pursuing Ph.D. in Jawaharlal Nehru Technological University Hyderabad, in the area of VLSI Design. His research interests include DSP; VLSI Design. He is having around 12 years of accumulated Teaching and Research experiences..

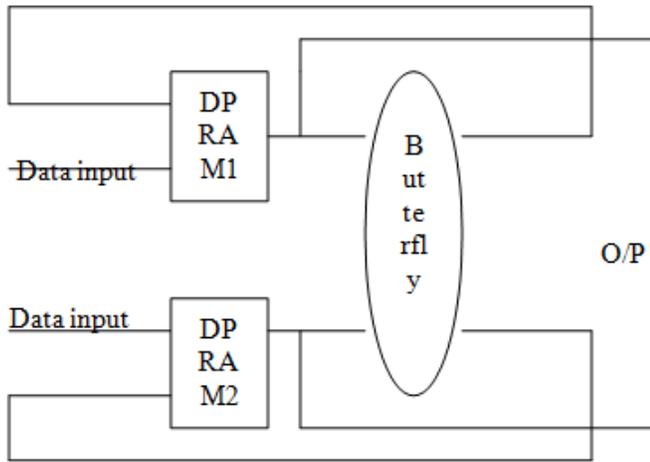


Figure 1 Single memory (pair) architecture

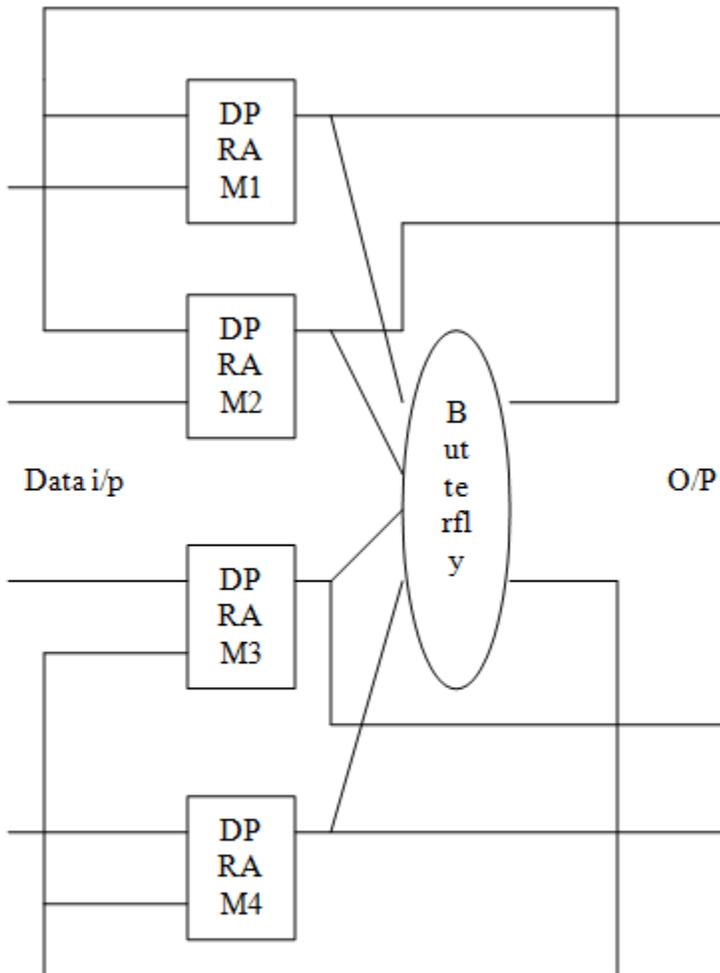


Figure 2 Dual memory (pair) architecture

(Transform length = $N = 2^n$)

(1,2);(3,4);(5,6) ---- (-,-) memory pairs for each iteration.

 ---- Butterfly unit for each iteration.

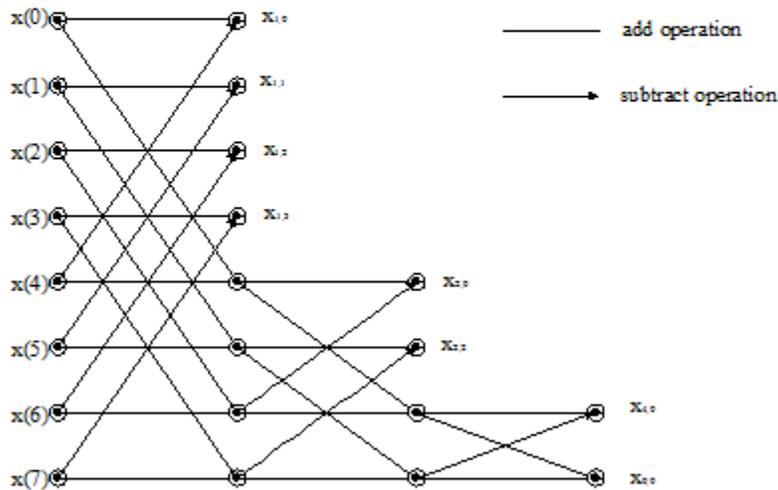


Figure 4 Figure showing the addition part of the 8-point paired transform based DFT

Jeans Instability of Optically Thick Quantum Plasma under the Influence of Black-Body Radiation

V. Shrivastava*, R. K. Pensia**, G. S. Kachhawa*, A. K. Patidar* and D. L. Sutar***

*Department of Physics, Pacific University, Udaipur India

**Department Physics, Govt. Girls College, Neemuch (M. P.) India

***Department of Physics, Mewar University, Chittorgarh (Raj.) India

Abstract- The Jeans instability of infinite homogeneous, self-gravitating quantum plasma is investigated under the assumption of optically thick medium and black body radiation. The general dispersion relation is obtained and the condition of instability is discussed.

Index Terms- Jeans instability, Quantum Plasma, Black Body Radiation, Self-Gravitating and Jeans Wave Length

PACS No. 52.35; 52.40

I. INTRODUCTION

It was first shown by James Jeans [1] that an infinite homogeneous self-gravitating fluid is unstable for all wave number which is less than critical Jeans wave number k_j and given as

$$k_j = \sqrt{4\pi\rho G / c_s^2}$$

In this formula G is the gravitational constant, ρ is the unperturbed matter density and $c_s = \sqrt{K_B/m}$, is the sound speed for adiabatic perturbation, where K_B is the Boltzmann's constant, T is the physical temperature and m is the mass of the particle. A through reconsideration of the Jeans criterion of instability is given by Chandrasekhar [2]. He has pointed out that uniform rotation and magnetic field not alter Jeans criterion whether taken separately or simultaneously. Ebert [3] has studied the problem of an isothermal gas sphere subjected to external pressure and he suggested that disturbances of length scale approximately equal to the Jeans length based on the central density were unstable to gravitational collapse. He also has shown that that O star could form in the centre of an interstellar cloud. Hunter [4] has investigated the growth of perturbations in a gravitationally contracting isothermal gas cloud and he suggested that perturbations with initial scale of the order of or less than the Jeans length grew less rapidly relative to the background density than did perturbation of substantially larger dimension. A detailed account of Jeans instability under varying assumptions of hydrodynamics has been studied by various authors [Sharma and Thakur [5], Herrengger [6], Sharma and Trilok Chand [7], Patidar *et al.* [8], Pensia *et al.* [9], Pensia *et al.* [10], Dangarh *et al.* [11], Uberoi [12].

Recently, there has been interest in understanding the role of radiative heat-loss mechanism in the star formation and molecular cloud condensation process in connection with thermal

instability. An important point to be noted in this case, that the heat-loss process is the major cause for the condensation of large astrophysical compact objects. In this paper we argue that for the case where the perturbations under heat-loss by black body radiation under the plasma correction, since radiative pressure in the internal area of the star is usually small in comparison with the gaseous pressure, in interior of hot and large plasma clouds like H_{II} regions, etc., where temperature is rather high while the density is slow, it should be important to take into account the radiative processes. The radiative heat-loss functions are similar to those of the cooling functions considered earlier by Chandrasekhar. In this way, many investigators have discussed the gravitational instability of homogeneous plasma considering the effects of heat-loss mechanism in different form {Wolfire *et al.* [13], Shadmehari and Dib [14], Prjapati *et al.* [15], Vranjes and Cadez [16], Kim and Narayan [17], and Stiele *et al.* [18]}

The consideration of quantum correction in with enhanced turbulent fluctuation can be regarded as central problem in attempting to interpret various astrophysical and laboratory plasma phenomena. The quantum plasma was first investigated by Pines [19, 20] and the kinetic model of the quantum electro dynamical properties of non-thermal plasma analyzed by Bezzerides and Du Bios [21]. Covariant Wigner function description of relativistic quantum plasmas is given by Hakim and Hayvaerts [22]. The Jeans instability of self-gravitating astrophysical quantum dusty plasma has been studied by Shukla and Stenflo [23] and this study was extended by Masood *et al.* [24] by considering a multi-component self-gravitating quantum Bohm potential and statistical terms on electrons and ions were considered. The Jeans instability in homogeneous cold quantum dusty plasma in the presence of a magnetic field and quantum correction was examined by Salimullah *et al.* [25].

In this paper the quantum correction is taken to formulate the hot molecular cloud under the black body radiation. To avoid the discussion about the additional convective instability, effects which may occur in such a system if the temperature T is a decreasing function of a coordinate, therefore, we shall assume T to be constant. As the influence of viscosity, electrical conductivity and magnetic field on the gravitational instability is studied by many authors, we are not going to discuss them here. Thus, in present work, we investigate the simultaneous effects of quantum corrections and black body radiation on Jeans instability of gaseous plasma. The result of the present study is applicable to understand the processes of star formation and condensation of molecular cloud.

II. EQUATIONS OF THE PROBLEM

Let us consider an infinite homogeneous, self-gravitating quantum plasma incorporating black body radiation. We introduced the quantum effects through the Bohm potential term in the momentum transfer equation. For simplicity of the problem, we ignore the additional convective instability, effects which may occur in such a system if the temperature T is a decreasing function of a coordinate, we shall assume T to be constant. The medium is taken optically thick and the black body radiation is assumed.

The momentum transfer equation for magnetized quantum plasma is

$$\rho \frac{d\vec{u}}{dt} = -\vec{\nabla}p + \rho \vec{\nabla}\phi + \frac{\hbar^2 \rho}{2m_e m_i} \vec{\nabla} \left(\frac{\nabla^2 \sqrt{\rho}}{\sqrt{\rho}} \right) \quad (1)$$

The equation of continuity is given by

$$\frac{d\rho}{dt} + \rho \vec{\nabla} \cdot \vec{u} = 0 \quad (2)$$

Poisson's equation for the gravitational potential is given as

$$\nabla^2 \phi = -4\pi G \rho \quad (3)$$

The radiative heat transfer equation is given as

$$\frac{dT}{T} = (\Gamma - 1) \frac{d\rho}{\rho} \quad (4)$$

where $p = p_g + p_r$ is the total pressure of the medium, $p_g = \rho RT$ is the gas pressure and $p_r = K_B T^4/3$ is the radiation pressure, K_B is the Boltzmann's constant. Also the symbols ρ , γ , \vec{v} , ϕ , G , T , Γ are denote the number density, adiabatic index, fluid velocity, gravitational potential, universal gravitational constant, temperature and radiative heat function, respectively. \hbar Planck's constant divided by 2π . m_e , and m_i are the electron and ion mass, respectively.

Adiabatic changes in an enclosure containing matter and radiation are given by equation (4) Chandrasekhar [26] has defined Γ as

$$\Gamma = 1 + \frac{\Gamma_1 - b}{4 - 3b} \quad (5)$$

$$\Gamma_1 = \frac{b + (4 - 3b)^2 (\gamma - 1)}{b + (1 - b)(\gamma - 1)} \quad (6)$$

$$b = \frac{p_g}{p_g + p_r} \quad (7)$$

If the radiation is negligible then, $\Gamma = \Gamma_1 = \gamma$, while in case of $p_g \ll p_r$ is $\Gamma = \Gamma_1 = 4/3$.

III. LINEARIZED PERTURBATION EQUATIONS

In the linearization, we write the space and time dependent physical quantities p , ρ , \vec{v} , and ϕ , in the form of the sum of the equilibrium and perturbed part as

$$\begin{aligned} \rho &= \rho_0 + \delta\rho, p = p_0 + \delta p, \phi = \phi_0 + \delta\phi, \\ \vec{v} &= \vec{v}_0 + \delta\vec{v} \end{aligned} \quad (8)$$

The terms with subscript '0' denote the equilibrium part of the physical quantities. Perturbation in fluid velocity, fluid pressure, fluid density and gravitational potential are given as $\delta\vec{v} = (0, 0, v_z)$, δp , $\delta\rho$, and $\delta\phi$, respectively.

Using equation (8) in equation (1) to (7) we write the linearized perturbation equations of infinitely conducting quantum plasma, by removing '0' from subscript in the

equilibrium quantities, for simplicity. Thus, we obtain linearized perturbation equation of the considered system as

$$\frac{\partial \delta \vec{v}}{\partial t} + \frac{RT}{\rho} \frac{\partial \delta \rho}{\partial z} + R(1 + 4R_p) \frac{\partial \delta T}{\partial z} - \frac{\partial \delta \phi}{\partial z} - \frac{\hbar^2}{4m_e m_i} \frac{\partial}{\partial z} \left(\frac{\nabla^2 \delta \rho}{\rho} \right) = 0 \quad (9)$$

$$\frac{\partial \delta \rho}{\partial t} + \rho \frac{\partial \delta \vec{v}}{\partial z} = 0 \quad (10)$$

$$\frac{\partial^2 \delta \phi}{\partial z^2} = -4\pi G \delta \rho \quad (11)$$

$$\frac{\partial \delta T}{\partial t} - (\Gamma - 1) \frac{T}{\rho} \frac{\partial \delta \rho}{\partial t} = 0 \quad (12)$$

where $v \equiv v_z$, $R_p = p_{r0}/p_{g0}$ denote the ratio of the radiation pressure and gas pressure, and Γ is assumed to be constant.

IV. DISPERSION RELATION

Let us assume the perturbation of all the quantities very as

$$\exp\{-i\omega t + ikz\} \quad (13)$$

where ω is the frequency of harmonic perturbations and k is the wave number in z -direction. Combining equations (9) to (13) we get the dispersion relation

$$\omega^2 - k^2 RT [1 + (1 + 4R_p)(\Gamma - 1)] - \frac{\hbar^2 k^4}{4m_e m_i} + 4\pi G \rho = 0 \quad (14)$$

This dispersion relation shows the combined influence of black body radiation and quantum correction on Jeans instability of optically thick quantum plasma. if we ignore the quantum correction then this dispersion relation reduces to Vranjes and Cadez [15]. Thus dispersion relation is modified by the presence of quantum correction. This dispersion relation will be able to predict the complete information about the waves and instability of radiative quantum plasma considered the constant term of equation (14) has at least one positive root, this means that at least one value of ω is positive and this gives instability. Thus, from equation (14) we note that the condition of instability of the system is

$$k^2 RT [1 + (1 + 4R_p)(\Gamma - 1)] + \frac{\hbar^2 k^4}{4m_e m_i} - 4\pi G \rho < 0 \quad (15)$$

Thus the system is unstable if

$$\frac{\lambda_l}{\lambda_c} \geq \left[\frac{1}{\gamma} \{1 + (1 + 4R_p)(\Gamma - 1)\} + \frac{\hbar^2}{4\lambda_c^2 m_e m_i} \right]^{1/2} \quad (16)$$

where $\lambda_c = 2\pi/k$ is the critical wave length and $\lambda_l = \sqrt{\pi c_s^2 / \rho G}$ is critical Jeans wave length.

Above equation (16) represents the quantum corrected condition of radiative instability. In the absence of quantum correction the above condition of instability is identical to Vranjes and Cadaze [15]. This is new condition of Jeans instability found in the present problem. It is noted here that the role of quantum correction is to stabilize the considered system by decreasing the value of critical Jeans wave length.

V. CONCLUSION

We have analyzed the Jeans instability of an infinite homogeneous self-gravitating optically thick quantum plasma

under the influence of black body radiation. The general dispersion relation is obtained with the help of relevant linearized perturbation equation. We find that black body radiation and quantum affect the Jeans instability. The black body radiation has stabilizing influence on the system which is further increased by quantum correction.

REFERENCES

- [1] J. H. Jeans, "The Stability of Spherical Nebula" *Phil. Trans. Roy. Soc. London* **199**, (1902) 53
- [2] S. Chandrasekhar "Hydrodynamics and Hydromagnetic Stability" Clarendon Press Oxford (1961)
- [3] Ebert, "Instability Ball Symmetrical Gas Distributions", *Z. Astrophysics* **42**, (1957) 263
- [4] J. H. Hunter, "The Role of Thermal Instabilities in Star Formation", *Mon. Not. Roy. Astron. Soc.* **139**, (1976) 239
- [5] R. C. Sharma, and K. P. Thakur, "The Gravitational Instability of Flow through Porous Medium For Some Systems Of Astrophysical Interest" *Astrophys. Space Sci.* **81**, (1982) 95
- [6] F. J. Herrengger, "Effects Of collisions And Gyro-viscosity on gravitational instability in a two-component plasma", *J. Plasma Physics* **8**, (1972) 393
- [7] R. C. Sharma, and T. Chand, "Gravitational Instability for some Astrophysical Systems", *Astrophys. Space Sci.* **183(2)**, (1990) 215
- [8] A. K. Patidar, R. K. Pansia and V. Shrivastava, "Gravitational Instability of a Two Component Rotating Viscous Plasma under the Effect of Arbitrary Radiative Heat-Loss Functions and Electron Inertia". *J. Pure Appl. & Ind. Phys.* **Vol.2 (3)**, (2012) 142
- [9] R. K. Pansia, A. K. Patidar, V. Shrivastava, V. Kumar and V. Prajapat, "The Role of Coriolis Force and Suspended Particles in the Fragmentation of Matter in the Central Region of Galaxy". *Journal of Bangladesh Academy of Sciences*, **Vol. 36,(1)**, (2012) 1
- [10] R. K. Pansia, A. K. Patidar and V. Shrivastava, "The Effect of Electron Inertia and Suspended Particle on the Ionosphere of the Earth". *J. Pure Appl. & Ind. Phys.*, **Vol.2(1)**, (2012) 63
- [11] B. K. Dangarh, R. K. Pansia, V. Shrivastava, and V. Prajapat, "Analysis of Jeans Instability of Partially-Ionized Molecular Cloud under Influence of Radiative Effect and Electron Inertia", *Adv. Studies Theor. Phys.* **5(16)**, (2011) 755
- [12] C. Uberoi, "Electron-Inertia Effects On The Transverse Gravitational Instability", *J. Plasma Fusion Res. Ser.* **8**, (2009) 823
- [13] M. G. Wolfire, D. Hollenbach, C. F. McKee, A. G. G. M. Tilens, and E. L. O. Baker, "The neutral atomic phases of the interstellar medium", *Astrophys. J.* **443**, (1995) 152
- [14] M. Shadmehari, and S. Dib, "Magneto-thermal condensation modes including the effects of charged dust particles", *Mon. Not. Roy. Astron. Soc.* **395**, (2009) 985
- [15] J. Vranjes and V. Cadez, "Gravitational Instability of a Homogeneous Gas cloud With Radiation, *Astrophys. Space Sci.* **164**, (1990) 329
- [16] R. P. Prajapati, R. K. Pansia, S. Kaothekar, and R. K. Chhajlani, "Self-Gravitational Instability of Rotating Viscous Hall Plasma With Arbitrary Radiative Heat-Loss Functions And Electron Inertia", *Astrophys. Space Sci.* **327**, (2010) 139
- [17] W. Kim, and R. Narayan, "Turbulent Mixing in Clusters of Galaxies", *Astrophys. J.* **596**, (2003) 889
- [18] H. Stiele, H. Lesch, and F. Heitsch, "Thermal instability in a weakly ionized plasma", *Mon. Not. R. Astron. Soc.* **372**, (2006) 862
- [19] D. Pines, "Quantum plasma physics", *J. Nucl. Energy: Part C: Plasma Phys.* **2**, (1961) 5
- [20] D. Pines, "Elementary Excitations in solid", Westview Press, (1999).
- [21] B. Bezzerides, D.F. DuBios, "Quantum electrodynamics of nonthermal relativistic plasmas: Kinetic theory", *Ann. Phys. (N.Y.)* **70**, (1972) 10
- [22] R. Hakim, J. Heyvaerts, "Covariant Wigner function approach for relativistic plasmas", *Phys. Rev. A* **18**, (1978) 1250
- [23] P. K. Shukla and L. Stenflo "Jeans instability in quantum dusty plasmas", *Phys. Lett. A* **355**, (2006) 378
- [24] W. Masood, M. Sallimullah and H. A. Shah "A quantum hydrodynamic model for multicomponent quantum magnetoplasma with Jeans term", *Phys. Lett. A* **372**, (2008). 6757
- [25] M. Sallimullah, M. Jamil, H. A. Shah and G. Murtaza "Jeans instability in a quantum dusty magnetoplasma", *Phys. Plasmas* **16**, (2009) 014502
- [26] S. Chandrasekhar "An Introduction to the study of Stellar Structure" Dover Publication, New York (1957)

AUTHORS

First Author – Vijayendra Shrivastava, Ph. D. Scholar, Department of Physics, Pacific University, Udaipur (Raj.) India
Email: - vijayendra.shrivastava@hotmail.com

Second Author – Dr. R. K. Pansia, Ph. D., Department of Physics, Govt. Girls College, Neemuch (M. P.) India
Email: - rkpansia@rediffmail.com

Third Author – G. S. Kachhawa, Ph. D. Scholar, Department of Physics, Pacific University, Udaipur (Raj.) India
Email: - kachhawagyansingh@yahoo.in

Forth Author – A. K. Patidar, Ph. D. Scholar, Department of Physics, Pacific University, Udaipur (Raj.) India
Email: - ashok_patidar341@yahoo.co.in

Fifth Author – G. L. Sutar, Ph. D. Scholar, Department of Physics, Mewar University, Chittorgarh (Raj.) India

Correspondence Author – Vijayendra Shrivastava,
Email: - vijayendra.shrivastava@hotmail.com

Implementation and Analysis of Power, Area and Delay of Array, Urdhva, Nikhilam Vedic Multipliers

Ch. Harish Kumar

International Institute of Information Technology, Pune , India

Abstract- The performance of the any processor will depend upon its power and delay. The power and delay should be less in order to get a effective processor. In processors the most commonly used architecture is multiplier. If the power and delay of the multiplier is reduced then the effective processor can be generated. The architectures for multipliers are mainly Array and Vedic multipliers. In Vedic multipliers there are two types of techniques for multiplications based on Urdhva Triyagbhyam and Nikhilam sutras. In this paper the comparison of these architectures is carried out to know the best architecture for multiplication w.r.t power and delay characteristics. The design of architectures are done in Verilog language and the tool used for simulation is Xilinx 10.1 ISE.

Index Terms- Vedic multiplier; Array multiplier; Urdhva Triyagbhyam; Nikhilam;

I. INTRODUCTION

The ancient system of Vedic Mathematics was re-introduced to the world by Swami Bharati Krishna Tirthaji Maharaj, Shan-karacharya of Goverdhan Peath. "Vedic Mathematics" was the name given by him. Bharati Krishna, who was himself a scholar of Sanskrit, Mathematics, History and Philosophy, was able to reconstruct the mathematics of the Vedas. According to his re-search all of mathematics is based on sixteen Sutras, or word-formulae and thirteen sub-sutras [10,5]. Vedic mathematics reduces the complexity in calculations that exist in conventional mathematics. Generally there are sixteen sutras available in Vedic mathematics. Among them only two sutras are applicable for multiplication operation. They are Urdhva Triyakbhyam sutra (literally means vertically and cross wise) and Nikhilam Sutra (literally means All from 9 and last from 10). The logic behind Urdhva Triyakbhyam sutra is very much similar to the ordinary array multiplier [7].

The power of Vedic mathematics is not only confined to its simplicity, regularity, but also it is logical. Its high degree of eminence is attributed to the aforementioned facts. It is these phenomenal characteristics, which made Vedic mathematics, become so popular and thus it has become one of the leading topics of research not only in India but abroad as well. Vedic mathematics' logics and steps can be directly applied to problems involving trigonometric functions, plane and sphere geometry, conics, differential calculus, integral calculus and applied mathematics of various kind.

The advantage of Vedic mathematics lies in the fact that it simplifies the complicated looking calculations in conventional

mathematics to a simple one in a much faster and efficient manner. This is attributed to the fact that the Vedic formulae are claimed to be based on the "natural principles on which the human mind works". Hence this presents some effective algorithms which can be applied to various branches of engineering [11].

Digital multipliers are the most commonly used components in any digital circuit design. They are fast, reliable and efficient components that are utilized to implement any operation. Depending upon the arrangement of the components, there are different types of multipliers available. Particular multiplier architecture is chosen based on the application [6].

In this paper the two sutra's which are used for the multiplication i.e Urdhva Triyakbhyam and Nikhilam Sutra are compared. The architecture of basic 2X2 multiplier, 8X8 multiplier for Urdhva Triyakbhyam and Nikhilam Sutra are discussed. The results are compared for 8X8, 16X16 and 32X32 multipliers. Array multiplier is also taken which is to compare the results between Vedic and conventional multipliers. The results are compared in terms of power, delay and area.

Vedic multipliers are to be the best compared to conventional ones as we know that from the earlier. Compared to Nikhilam Sutra architecture Urdhva Triyakbhyam is efficient one.

II. ARRAY MULTIPLIER

Array multiplier is an efficient layout of a combinational multiplier. In array multiplier, consider two binary numbers A and B, of m and n bits. There are mn summands that are produced in parallel by a set of mn AND gates. n x n multiplier requires n (n-2) full adders, n half-adders and n² AND gates. Also, in array multiplier worst case delay would be (2n+1) td. Array Multiplier gives more power consumption as well as optimum number of components required, but delay for this multiplier is larger. It also requires larger number of gates because of which area is also increased; due to this array multiplier is less economical. Thus, it is a fast multiplier but hardware complexity is high[2].

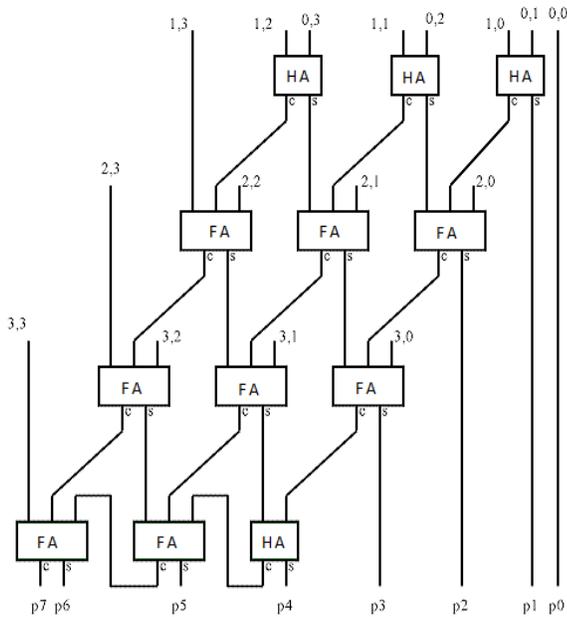


Figure 1. Array Multiplier

III. VEDIC MULTIPLICATION

A. General 2X2 Vedic Multiplier[3] :

The method is explained below for two, 2 bit numbers A and B where $A = a1a0$ and $B = b1b0$ as shown in Figure 2. Firstly, the Least Significant Bits are multiplied which gives the Least Significant Bit (LSB) of the final product (vertical). Then, the LSB of the multiplicand is multiplied with the next higher bit of the multiplier and added with, the product of LSB of multiplier and next higher bit of the multiplicand (crosswise). The sum gives second bit of the final product and the carry is added with the partial product obtained by multiplying the most significant bits to give the sum and carry. The sum is the third corresponding bit and carry becomes the fourth bit of the final product.

$$s0 = a0b0; \tag{1}$$

$$c1s1 = a1b0 + a0b1; \tag{2}$$

$$c2s2 = c1 + a1b1; \tag{3}$$

The final result will be $c2s2s1s0$. This multiplication method is applicable for all the cases. The 2x2 bit Vedic multiplier (VM) module is implemented using four input AND gates & two half-adders which is displayed in its block diagram in Figure 3.

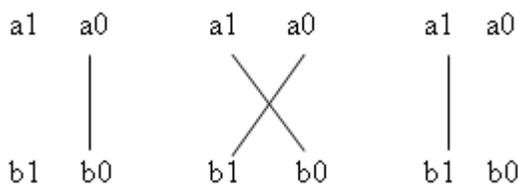


Figure 2: The Vedic Multiplication Method for two 2-bit binary numbers

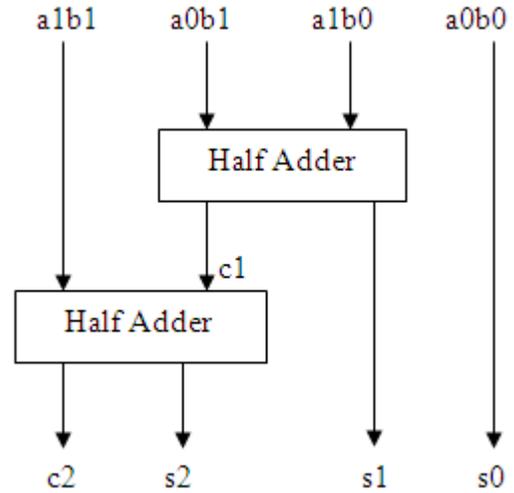


Figure 3: Block Diagram of 2x2 bit Vedic Multiplier (VM)

The same method can be extended for higher no. of input bits (say 4). But a little modification is required as discussed in section 3.2. This section illustrates the implementation of 4x4 bit VM which uses 2x2 bit VM as a basic module.

Divide the no. of bits in the inputs equally in two parts. Let's analyze 4x4 bit multiplication, say multiplicand $A=A3A2A1A0$ and multiplier $B= B3B2B1B0$. Following are the output line for the multiplication result, $S7S6S5S4S3S2S1S0$. Let's divide A and B into two parts, say "A3 A2" & "A1 A0" for A and "B3 B2" & "B1B0" for B. Using the fundamental of Vedic multiplication, taking two bit at a time and using 2 bit multiplier block.

B. Urdhva Tiryakbhyam Sutra:

The multiplier is based on an algorithm Urdhva Tiryakbhyam (Vertical & Crosswise) of ancient Indian Vedic Mathematics. Urdhva Tiryakbhyam Sutra is a general multiplication formula applicable to all cases of multiplication. It literally means "Vertically and crosswise". It is based on a novel concept through which the generation of all partial products can be done and then, concurrent addition of these partial products can be done. Thus parallelism in generation of partial products and their summation is obtained using Urdhava Tiryakbhyam. The algorithm can be generalized for n x n bit number. Since the partial products and their sums are calculated in parallel, the multiplier is independent of the clock frequency of the processor. While a higher clock frequency generally results in increased processing power, its disadvantage is that it also increases power dissipation which results in higher device operating temperatures. By adopting the Vedic multiplier, microprocessors designers can easily circumvent these problems to avoid catastrophic device failures. The processing power of multiplier can easily be increased by increasing the input and output data bus widths since it has a quite a regular structure. Due to its regular structure, it can be easily layout in a silicon chip. The Multiplier has the advantage that as the number of bits increases, gate delay and area increases very slowly as compared to other multipliers. Therefore it is time, space and power efficient. It will enhance the ALU unit also. As a result the mathematical operation which

employs multiplication is demonstrated that this architecture is quite efficient in terms of silicon area/speed.

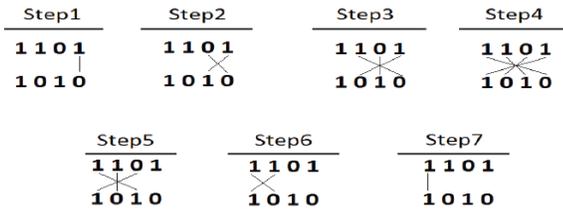


Figure 4: Using Urdhava Tiryakbhyam for binary numbers

4X4 Multiply Block:

The 4X4 Multiplier is made by using four 2X2 multiplier blocks. The multiplicands are of bit size n=4 where as the result is of 8 bit size. The input is broken into smaller chunks of size n/2= 2, for both inputs, that is a and b. These newly formed chunks of 2 bits are given to 2X2 multiplier block to get the 4 bit result. The same method is followed for the multipliers of higher bits like 8,16 and 32 bits.

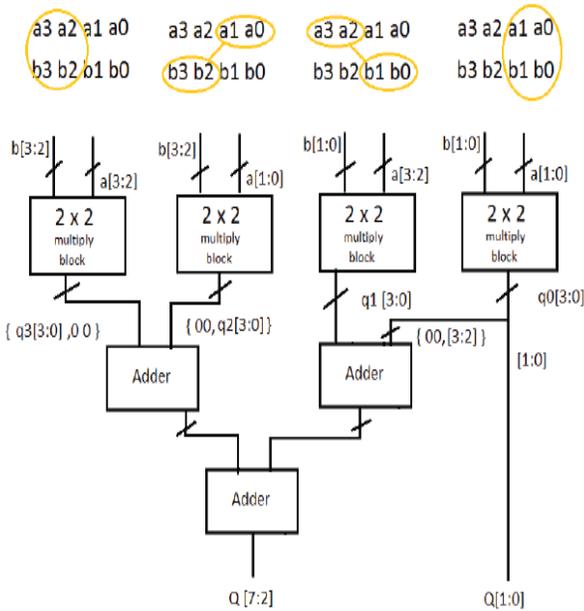


Figure 5: 4X4 Multiply Block

The equations of the 4X4 Vedic multiplier are

$$X = a3 a2 a1 a0$$

$$Y = b3 b2 b1 b0$$

$$P0 = a0.b0$$

$$P1 = a1.b0 + a0.b1$$

$$P2 = a2.b0 + a1.b1 + a0.b2 + P1(1)$$

$$P3 = a3.b0 + a2.b1 + a1.b2 + a0.b3 + P2(2 \text{ to } 1)$$

$$P4 = a3.b1 + a2.b2 + a1.b3 + P3(2 \text{ to } 1)$$

$$P5 = a3.b2 + a2.b3 + P4(2 \text{ to } 1)$$

$$P6 = a3.b3 + P5(2 \text{ to } 1)$$

$$Product = P6 \& P5(0) \& P4(0) \& P(3) \& P(2) \& P(1) \& P(0)$$

& - Concatenate

C. Nikhilam Sutra :

The example of nikhilam multiplication is shown in the below figure6. Here the nearest base is chosen first. The multiplicand and the multiplier will be subtracted from the nearest base, which is equivalent to taking two's complement. Then the product of the two's complement and the common difference will give the final result [2].

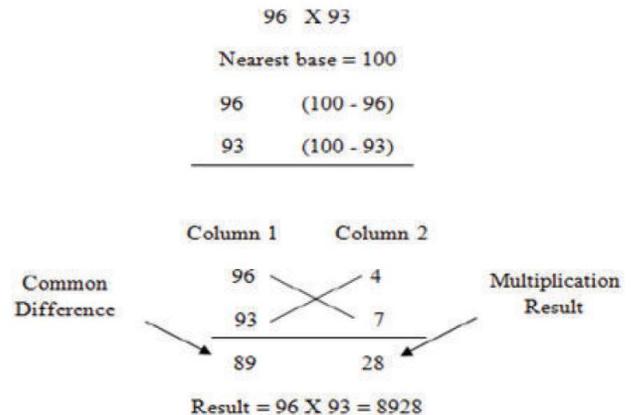


Figure 6: Multiplication using Nikhilam

The nikhilam multiplier architecture is shown in the below figure7. Here the two inputs are first complimented and those complimented results are multiplied. Here the multiplier used also plays an important role in calculating delay. We can use either vedic multiplier or array multiplier. Then the multiplier output is added to the two inputs a and b. The right hand side result of the multiplier is the R.H.S of the original product and the L.H.S result of the adder is the L.H.S of the original product.

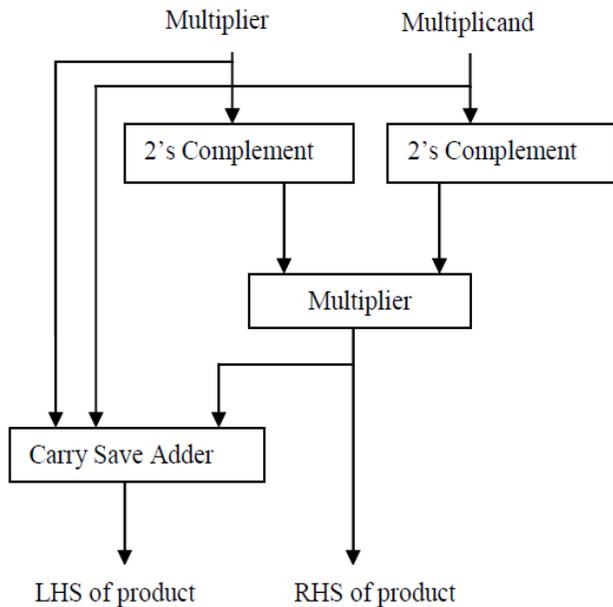


Figure 7: Nikhilam Multiplier's Architecture

IV. RESULTS

The waveforms of the multipliers of 8, 16 and 32 bits are shown in the figures 8,9,10 respectively at the bottom of the paper.

The tabular form which compares the results of power, delay and area of the array multiplier, urdhava tiryakbhyam multiplier and nikhilam multiplier are shown in the below tabular form.

Type of Unit (8-Bit)	Power (mW)	Delay (nS)	Memory (kb)
Array Multiplier	168	26.825	162752
Urdhava Tiryakbhyam	99	23.079	162752
Nikhilam	148	27.878	165824

Table 1: Results of 8-bit multiplier

Type of Unit (16-Bit)	Power (mW)	Delay (nS)	Memory (kb)
Array Multiplier	250	53.276	175168
Urdhava Tiryakbhyam	118	41.350	178752
Nikhilam	118	51.323	198528

Table 2: Results of 16-bit multiplier

Type of Unit (32-Bit)	Power (mW)	Delay (nS)	Memory (kb)
Array Multiplier	382	107.128	263232
Urdhava Tiryakbhyam	315	72.332	233344
Nikhilam	315	90.747	251776

Table 3: Results of 32-bit multiplier

V. CONCLUSION

Hence Urdhava Tiryakbhyam multiplier is the best multiplier compared to array and nikhilam's multiplier when compared to delay and power calculations.

ACKNOWLEDGMENT

I would like to acknowledge my mentor G. Vengal Rao Sir and Soma Bhanu Tej who supported me during the period in calculating my results and verifying codes.

REFERENCES

- [1] M.B. Damle, Dr. S. S. Limaye, "Low-power Full Adder array-based Multiplier with Domino Logic," IOSR Journal of Electronics and Communication Engineering (IOSRJECE), ISSN : 2278-2834 Volume 1, Issue 1 (May-June 2012), PP 18-22.
- [2] Sumit R. Vaidya, D. R. Dandekar, "Performance Comparison of Multipliers for Power-Speed Trade-off in VLSI Design," RECENT ADVANCES IN NETWORKING, VLSI and SIGNAL PROCESSING, ISSN: 1790-5117, ISBN: 978-960-474-162-5.
- [3] Pushpalata Verma, K. K. Mehta, "Implementation of an Efficient Multiplier based on Vedic Mathematics Using EDA Tool," International Journal of Engineering and Advanced Technology (IJEAT), ISSN: 2249 – 8958, Volume-1, Issue-5, June 2012.
- [4] Manoranjan Pradhan, Rutuparna Panda, Sushanta Kumar Sahu, "Speed Comparison of 16x16 Vedic Multipliers," International Journal of Computer Applications (0975 – 8887), Volume 21– No.6, May 2011.
- [5] G.Ganesh Kumar, V.Charishma, "Design of High Speed Vedic Multiplier using Vedic Mathematics Techniques", International Journal of Scientific and Research Publications, Volume 2, Issue 3, March 2012 1 ISSN 2250-3153.
- [6] Soma BhanuTej, "Vedic Algorithms to develop green chips for future", Volume 2, Issue ICAEM12, February 2012, ISSN Online: 2277-2677 ,ICAEM12,Jan20,2012,Hyderabad,India.
- [7] Sree Nivas A, Kayalvizhi N, "Implementation of Power Efficient Vedic Multiplier", International Journal of Computer Applications (0975 – 8887) Volume 43– No.16, April 2012.
- [8] Sumit Vaidya, Deepak Dandekar, "DELAY-POWER PERFORMANCE COMPARISON OF MULTIPLIERS IN VLSI CIRCUIT DESIGN", International Journal of Computer Networks & Communications (IJCNC), Vol.2, No.4, July 2010.
- [9] Pushpalata Verma, "Design of 4x4 bit Vedic Multiplier using EDA Tool", International Journal of Computer Applications (0975 – 888) Volume 48– No.20, June 2012.
- [10] Krishnaveni D., Umarani T.G., "VLSI IMPLEMENTATION OF VEDIC MULTIPLIER WITH REDUCED DELAY", International Journal of Advanced Technology & Engineering Research (IJATER) National Conference on Emerging Trends in Technology (NCET-Tech), ISSN No: 2250-3536 Volume 2, Issue 4, July 2012.
- [11] Ramachandran.S, Kirti.S.Pande, "Design, Implementation and Performance Analysis of an Integrated Vedic Multiplier Architecture", International Journal Of Computational Engineering Research / ISSN: 2250–3005.
- [12] V.Vamshi Krishna, S. Naveen Kumar, "High Speed, Power and Area efficient Algorithms for ALU using Vedic Mathematics", International Journal of Scientific and Research Publications, Volume 2, Issue 7, July 2012 ,ISSN 2250-3153.
- [13] P. Saha, A. Banerjee, A. Dandapat, P. Bhattacharyya, "Vedic Mathematics Based 32-Bit Multiplier Design for High Speed Low Power Processors", INTERNATIONAL JOURNAL ON SMART SENSING AND INTELLIGENT SYSTEMS VOL. 4, NO. 2, JUNE 2011.

AUTHORS

First Author – Ch. Harish Kumar, M.Tech-VLSI, International Institute of Information Technology, Pune , India, e-mail: harish.chhk@gmail.com

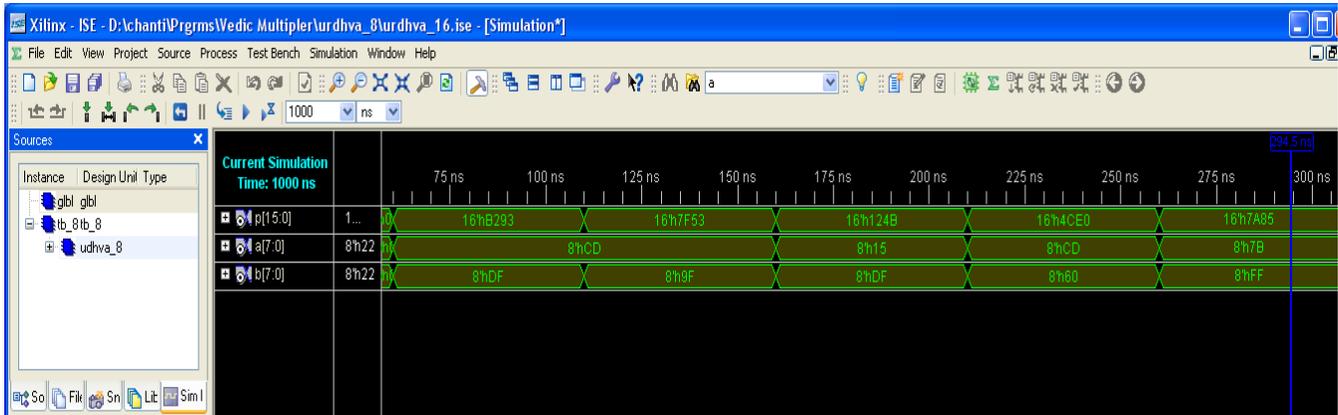


Figure 8: Waveform of 8-bit multiplier

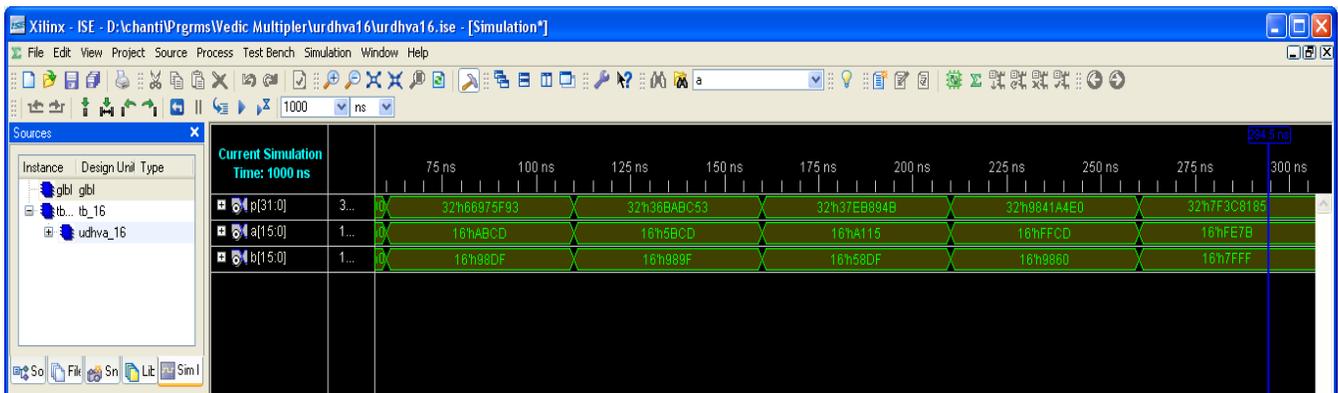


Figure 9: Waveform of 16-bit multiplier

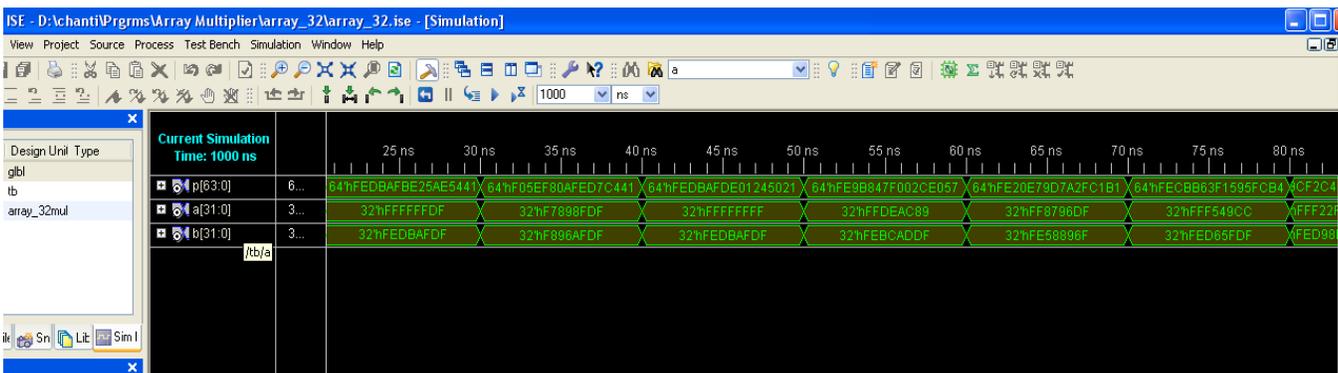


Figure 10: Waveform of 32-bit multiplier

Arbuscular Mycorrhizal Fungi: Biocontrol against Fusarium Wilt of Chickpea

Pradeep Kumar Singh*, Meenakshi Singh*, V. K. Agnihotri**, Deepak Vyas**

*Department of Botany, Guru Ghasidas University, Bilaspur, CG, India

**Department of Botany, Dr H S Gour University, Sagar, MP, India

Abstract- The present study shows the status of mycorrhization in three test varieties of chickpea. As the results revealed irrespective to the crops when arbuscular mycorrhizal fungi (AMF) were assessed under the influence of soil quality better results were obtained with unsterile soil in comparison to sterile soil. Chickpea variety ICC 11322 showed the best result against the Fusarium wilt and chickpea variety ICC 4951 was susceptible against the Fusarium wilt. *Acaulospora spinosa* showed best results with JG 74, *Glomus mosseae* with ICC 4951 and *Glomus fasciculatum* showed best results with ICC 11322. The lowest percentage mycorrhizal colonization was found on plants with the most severe disease symptoms.

Index Terms- AM fungi, Bioprotection, Chickpea, Fusarium wilt,

I. INTRODUCTION

Chickpea (*Cicer arietinum* L.) is an important source of human food and animal feed that also helps in the management of soil fertility, particularly in dry lands [1]. Fusarium wilt, caused by *Fusarium oxysporum* Schlechtend.: Fr. f. sp. *ciceris* (Padwick) Matuo & K. Sato, is one of the most important limiting factors of chickpea production in the Mediterranean Basin and Indian Subcontinent [2]. Fusarium wilt epidemics cause significant annual losses of chickpea yields [2,3] that may reach 100 % under conditions favourable for disease [3,4]. *Fusarium oxysporum* f. sp. *ciceris* is a soil-borne fungus pathogenically specialized on *Cicer* spp. that causes wilt.

Interest in biological control has increased recently fuelled by public concerns over the use of chemicals in the environment in general, and the need to find alternatives to the use of chemicals for disease control in particular. The key to achieving successful, reproducible biological control is the gradual appreciation that knowledge of the ecological interactions taking place in the soil and root environments is required to predict the conditions under which biocontrol can be achieved [5,6]. The major feature involves improving plant nutritional status, perhaps water balance and thus plant growth, biocontrol of plant pathogens is generally viewed as a secondary role [7].

II. MATERIALS AND METHODS

The experiments were conducted a factorial glasshouse experiment using plants of chickpea (*Cicer arietinum* L.) varieties ICC 4951; ICC 11322 and JG 74 which were grown as follows: (1) chickpea varieties with Foc (2) with AMF species (3) with Foc + AMF species and (4) without Foc or AMF as

control. All 4 experiments were done in both soil conditions i.e. sterile (autoclaved at 120° C for 24 h) and unsterile.

A. Fungal cultures

F. oxysporum f. sp. *ciceris* was grown on Czapek Dox agar at 25°C in dark. Under sterile conditions, fungal cultures were flooded with sterilized water and the suspension was filtered through three layers Whatman no. 1 of filter paper. The spore-suspension was concentrated by centrifugation at 3,000×g for 10 min and adjusted to 1.5×10⁷ microconidia/ml water using a haemocytometer.

B. Arbuscular Mycorrhizal Fungi

Inoculum of *Glomus mosseae* for variety ICC 4951, *G. fasciculatum* for ICC 11322 and *Acaulospora spinosa* for variety JG 74 consisted of colonized pieces of root, soil and spores, derived from pot cultures prepared with *Oxalis indica* L. grown in 1:9 soil-sand (pH 7.3) or 1:9 soil-sand (pH 5.6) to take into account pH preferences of the fungi [8]. The AMF mix was 1:1 mixture of these two inocula.

C. Planting and growth conditions

Seeds of chickpea varieties were surface sterilized in 10% sodium hypochlorite for 10 min, rinsed thoroughly with distilled water and germinated on moist filter paper in dark at 24°C for 2 d. Seedlings of the 3 varieties were transplanted to the pots in the appropriate combinations. The experiment was carried out during spring to winter (October-January, 2009–10 in an environmentally controlled glasshouse at the Department of Botany, Dr. H. S. Gour University, Sagar, India). Night-day temperature range in the glasshouse was 15–22°C. Pots were watered twice in a week with distilled water.

III. RESULTS

The three test chickpea varieties viz. ICC 4951, ICC11322 and JG 74 showed different per cent root colonization when they were treated with selected AMF species. Ten AMF species were evaluated for their root colonization under sterilized and unsterilized soil conditions (Figure 1). In ICC 4951 *Glomus ambisporum* and *G. mosseae* showed greater colonization followed by *G. clarum*, *G. heterosporum*, *G. hoi*, *G. fasciculatum*, *Acaulospora nicolsonii*, *G. lacteum*, *A. spinosa*. *Gigaspora albida* was found poor colonizer in sterilized soil condition but in unsterilized soil *G. mosseae* showed greater colonization followed by *G. hoi*, *G. heterosporum*, *G. lacteum*, *G. clarum*, *Gigaspora albida*, *A. spinosa*, *G. fasciculatum*, *A. nicolsonii* and *G. ambisporum*. *Glomus fasciculatum* showed

greater colonization in sterile soil condition with chickpea variety ICC 11322 followed *G. mosseae*, *G. hoi*, *Gigaspora albida*, *G. heterosporum*, *G. lacteum*, *A. spinosa*, *G. ambisporum*, *G. clarum* and *A. nicolsonii* whereas, *G. mosseae* showed greater per cent root colonization in unsterilized soil condition followed by *G. hoi*, *G. heterosporum*, *G. ambisporum*, *G. fasciculatum*, *G. calrum*, *G. lacteum*, *A. spinosa*, *A. nicolsonii* and *Gigaspora albida*. In variety JG 74, *A. spinosa* showed more per cent root colonization followed by *G. lacteum*, *G. mosseae*, *G. hoi*, *G. heterosporum*, *G. calrum*, *G. fasciculatum*, *G. ambisporum*, *A. nicolsonii*, and *Gigaspora albida* under sterilized soil, whereas, in unsterilized soil also *A. spinosa* was found better than *G. lacteum*, *G. fasciculatum*, *G. mosseae*, *G. hoi*, *G. heterosporum*, *G. Ambisporum*, *A. nicolsonii*, *G. calrum* and *Gigaspora albida*.

The introduction of AM fungi (*G. mosseae*, *G. fasciculatum* and *A. spinosa*) with their respective chickpea varieties i.e. ICC 4951, ICC 11322 and JG 74) in the soil suppressed the effect of pathogen in the rhizoplane as well as in the rhizosphere. The data shown in table 1 suggest that respective AM fungi played an important role to protect the plant and therefore we found that all the three varieties ICC 4951, ICC 11322 and JG 74 were well protected by their respective AM fungal inoculants. Thus, no mortality of the plants inoculated with their respective AM fungi was recorded with any case. But inoculation of pathogen alone caused 80.0% of mortality in ICC 4951, 24.0% in ICC 11322 and 26.0% in JG 74. Inoculation of respective AM fungi with pathogen reduced the detrimental effect of pathogen and therefore we observed remarkable recovery in the mortality of test plants. Therefore, the mortality rate in ICC 4951 was 43.5% in ICC 4951 per cent, 12.5% in ICC 11322 and 15.0% in JG 74. Not much influence on dry weight (g/plant) of nodules g/plant in all the three varieties of chickpea was seen. AM fungi inoculated plants showed greater nodulation in comparison to AM fungi + pathogen and pathogen treated chickpea plants.

Data on yield (i.e. dry weight of grains g/plant) are presented in the same table and the results revealed that AM fungi inoculated plants produced greater yield in all the three varieties and maximum yield was obtained in chickpea variety JG 74 followed by ICC 11322 and minimum in ICC 4951. As usual effect of pathogen (Foc) was severe, causing loss in yield in sterile soil condition in each variety. The plants inoculated with AMF and Foc together showed phytoprotection. The susceptible variety ICC 4951 did not show much increment in the yield g/plant in comparison to the resistant varieties of chickpea ICC 11322 and JG 74.

Experiment with unsterile soil suggested that there was no change in trends. Results revealed that test plants showed protection when inoculated with AMF inoculants (table 2). Phytoprotectant role of AMF can be well marked because only 39.0% mortality was recorded with pre-inoculation of by AMF in ICC 4951, 20.9% in ICC 11322, and 22.6% mortality in JG 74. AM fungi inoculation reduced the pathogenic effect of Foc, resulting reduced mortality rate even in resistant varieties 12.5% ICC 11322 and 15.0% in JG 74.

Arbuscular mycorrhizal fungi influenced nodulation in all the 3 chickpea varieties. In case of ICC 4951 and ICC 11322 it showed 0.05 g nodule wt when inoculated with AM fungi but the same varieties inoculated with Foc resulted into a significant reduction in nodules wt (0.02 g). However, when AM fungi

inoculated with pathogen Foc, recovery in nodules wt was 0.04 g. In case of JG 74 when plants were inoculated only with AM fungi the nodule wt was recorded 0.03 g, but when Foc alone was introduced, nodule wt was reduced to 0.01 g and when AMF + Foc was inoculated a recovery in nodules wt was 0.02 g.

IV. DISCUSSIONS

The results presented in the figure 1 clearly indicate response of individual AM fungi with individual chickpea variety. *G. ambisporum* and *G. mosseae* colonized 90% in ICC 4951 under sterile condition, but in unsterile condition *G. ambisporum* failed to show its potential but *G. mosseae* maintained its compatibility. This result also suggested that under unsterile condition *G. mosseae* has ability to maintain its dominance and suppressiveness against any other AM fungal species or other microbes competing for the carbon source. Poor performance of *G. ambisporum* probably might be due to its poor compatibility or grazing by other microbes [9].

In the resistant chickpea variety ICC 11322 best result was found with *G. fasciculatum* wherein 80.0% root colonization under sterile condition was recorded, followed by 70.0% root colonization of *G. mosseae* but in unsterile soil condition *G. mosseae* was better candidate and could colonize 89.0% of the root. It was deduced that host preference or root exudation influenced variable response of the AM fungi with different test varieties. JG 74 exhibited totally different responses. Here, we found that *A. spinosa* and *G. lacteum* were better which colonized 78.0 and 70.0% of the root under sterile condition, 75.0% root colonization recorded with *A. spinosa* and followed by *G. lacteum* (70.0%) under unsterile condition. These results allowed us to draw an inference that AM fungal association was regulated by host and their leachets. AM fungi are also strong candidate for providing biocontrol through competition for space by virtue of their ecological obligate association with roots [10]. Therefore, we may attribute that our results are in good accord with earlier reports made by some workers on role of AM fungi in bioprotection [11,12,13].

Our results with ICC 4951 clearly revealed that presence of native AM fungal species has good potential to protect the plant from Foc and not only they protected the host plant but also they influenced their developing nodules and percent recovery of yield loss. Mycorrhizal and nodule symbiosis often act synergistically on infection rate, mineral nutrition and plant growth [14,15]. Caron [16] observed reduction in *Fusarium* population in the soil surrounding mycorrhizal tomato roots and suggested that there was a potential role of AM fungi for biocontrol of soilborne diseases. Priming seems to be the main mechanism operating in MIR (mycorrhizal induced resistance) [17,18]. The biocontrol role of AM fungi studied here under sterile and unsterile conditions provide almost similar results. This confirms that AM fungi consortia used in this study have potential role as a biocontrol agent under any conditions they are used [19]. It will be illuminating to extend our approach to investigate the outcomes of competition between a host plants that is positively responsive to AMF colonization. A further challenge will be to scale up the findings obtained with our pot based approach to elucidate mechanisms underlying the direct and indirect effects in fields situations which involve many AMF and hence an enormous range of interactions and responses.

- [19] M. Mishra, P. K. Singh and D. Vyas, Phytoprotection role of AM fungi against the Fusarium wilt of tomato. *Biozone* 2009, 1: 98–109.

ACKNOWLEDGMENT

PKS acknowledge the DST for the financial support for the preparation of this paper.

REFERENCES

- [1] K. B. Singh and M.C. Saxena, *Winter chickpea in Mediterranean-type environments*. 1996, International Center for Agricultural Research in Dry Areas, Aleppo, Syria.
- [2] B. L. Jalali and H. Chand, *Chickpea wilt*. In: Singh US, Mukhopadhyay AN, Kumar J, Chaube M. (eds). Plant diseases of international importance, Vol. Diseases of cereals and pulses, Prentice Hall, Eaglewood Cliffs N;1992, pp. 429–444.
- [3] M.H. Halila and R. N. Strange, (1996). Identification of the causal agent of wilt of chickpea in Tunisia as *Fusarium oxysporum* f. sp. *ciceris* race O. *Phytopathology Mediterranean*, 1996, 35: 67–74.
- [4] J. A. Navas-Cortes, B. Hau and R. M. Jimenez-Diaz, Yield loss in chickpeas in relation to development of Fusarium wilt epidemics. *Phytopathology*, 2000, **90**: 1269-1278.
- [5] J. M. Whipps, Developments in the biological control of soil-borne plant pathogens. *Advances in Botanical Research* 1997, 26: 1–134.
- [6] J. M. Whipps and K. G. Davies, *Success in biological control of plant pathogens and nematodes by microorganisms*. In: G. Gurr and S. D. Wratten, eds. Measures of success in biological control. Dordrecht: The Netherlands: Kluwer Academic Publishers, 2000, pp. 231–269.
- [7] J. E. Hooker, S. Gianinazzi, M. Vestberg, J.M. Barea and D. Atkinson, The application of arbuscular mycorrhizal fungi to micropropagation systems: an opportunity to reduce chemical inputs. *Agricultural Science Finland*, 1994, 3:227–231.
- [8] S. Dickson, S. E. Smith and F.A. Smith, Characterization of two arbuscular mycorrhizal fungi in symbiosis with *Allium porrum*: colonization, plant growth and phosphate uptake. *New Phytologist* 1999, 144: 163–172.
- [9] M. M. Vazquez, S. Cesar, R. Azcon and J. M. Barea, Interactions between arbuscular mycorrhizal fungi and other microbial inoculants (*Azospirillum*, *Pseudomonas*, *Trichoderma*) and their effects on microbial population and enzyme activities in the rhizosphere of maize plants. *Applied Soil Ecology*, 2000, 15: 261–272.
- [10] P. K. Singh and D. Vyas, Biocontrol of plant diseases and sustainable agriculture. *Proceeding of National Academy of Sciences INDIA*, 2009, 79: 110-128.
- [11] J. F. Johansson, L. R. Paul and R. D. Finlay, Microbial interactions in the rhizosphere and their significance for sustainable agriculture. *FEMS Microbiology Ecology* 2004, 48: 1–13.
- [12] P. K. Singh, M. Mishra and D. Vyas (2010a). Effect of root exudates of mycorrhizal tomato plants on microconidia germination of *Fusarium oxysporum* f. sp. *lycopersici* than root exudates from non-mycorrhizal tomato plants. *Archives of Phytopathology and Plant Protection* 2010a, 43:1495-1503.
- [13] D. Vyas, M. Mishra P. K. Singh and R. K. Gupta, *Phytoprotection by arbuscular mycorrhizae*. In: Laxman HC (ed). *Bioinoculants for Integrated Plant Growth* MD Publications, New Delhi; 2010, pp. 373–420.
- [14] E. Facelli, S. E. Smith, J. M. Facelli, H. M. Christophersen and F. A. Smith, Underground friends or enemies: model plants help to unravel direct or indirect effects of arbuscular mycorrhizal fungi on plant competition. *New Phytologist*, 2010, 185: 1050–1061.
- [15] P. K. Singh, M. Singh and D. Vyas, Biocontrol of Fusarium wilt of chickpea using arbuscular mycorrhizal fungi and *Rhizobium leguminosorum* Biovar. *Caryologia*, 2010b, 63: 349-353.
- [16] M. Caron, Potential use of mycorrhizae in control of soilborne diseases. *Canadian Journal of Plant Pathology* 1989, 11: 177–179.
- [17] M. J. Pozo and C. Azcon-Aguilar, Unravelling mucorhiza-induced resistance. *Current Opinion in Plant Biology* 2007, 10: 393–398.
- [18] P. K. Singh. Role of glomalin related soil protein produced by arbuscular mycorrhizal fungi : a review. *Agricultural Science Research Journal*, 2012, 2:119-125.

AUTHORS

First Author – Pradeep Kumar Singh, Ph. D., Department of Botany, Guru Ghasidas University, Bilaspur – 495 009 (CG)
email : singhpk@hotmail.co.in

Second Author – Meenakshi Singh, Ph. D., Department of Botany, Guru Ghasidas University, Bilaspur – 495 009 (CG)
email : deeptipks@gmail.com

Third Author – V.K. Agrnihotri, Ph. D, Department of Botany, Dr H S Gour University, Sagar – 470 003 (MP)

Correspondence Author – Pradeep Kumar Singh, Ph. D., Department of Botany, Guru Ghasidas University, Bilaspur – 495 009 (CG)
email : singhpk@hotmail.co.in
contact number: 9098638780

Figure 1: Response of different AM fungi on percentage root infection in sterilize (SS) and in unsterilize (US) soil in chickpea varieties

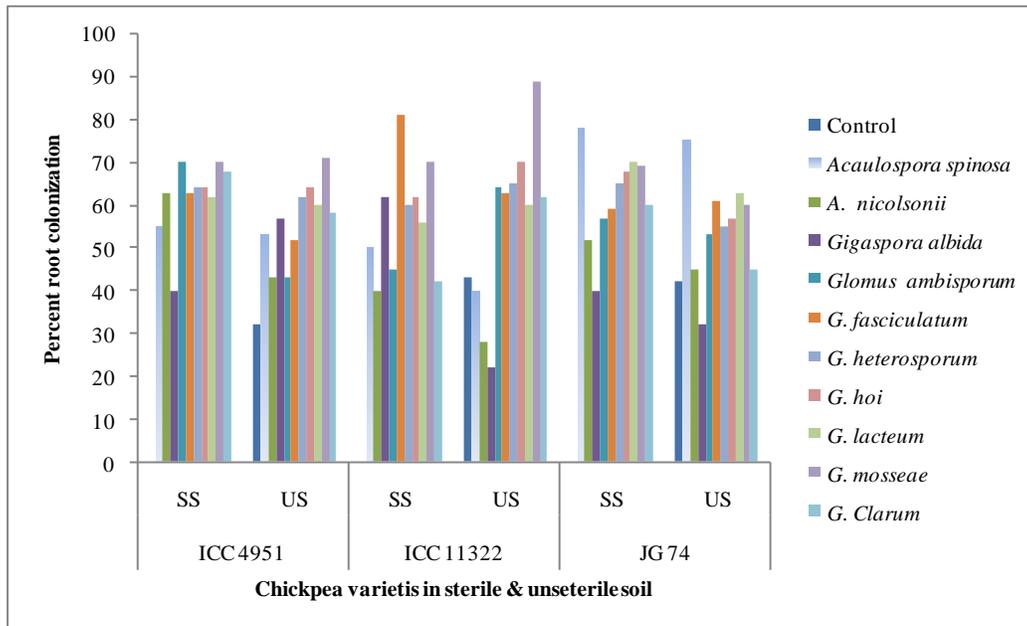


Table 1: Effect of AM Fungi and Foc inoculated alone or in combination on mortality, nodulation and yield under sterilized soils in chickpea varieties

Treatments	Chickpea Varieties								
	ICC 4951			ICC 11322			JG 74		
	Total Mortality (%)	DW of nodules (g/plant)	Yield DW of grains (g/plant)	Total Mortality (%)	DW of nodules (g/plant)	Yield DW of grains (g/plant)	Total Mortality (%)	DW of nodules (g/plant)	Yield DW of grains (g/plant)
Control	0.0	0.03	1.65	0.0	0.02	1.70	0.0	0.01	1.85
AMF*	0.0	0.03	1.85 (12.12)	0.0	0.03	2.15 (26.47)	0.0	0.03	2.25 (21.62)
Foc	80.0	0.01	0.65 (-60.61)	24.0	0.01	1.60 (-5.89)	26.0	0.01	1.75 (-2.70)
AMF + Foc	43.5	0.02	1.70 (3.03)	12.9	0.02	2.05 (20.59)	15.0	0.01	2.15 (16.21)
CD (P = 0.05)	3.25	0.07	0.25	2.02	0.01	0.34	4.00	0.01	0.50

* AM Fungi, *Glomus mosseae* for var. ICC 4951, *G. fasciculatum* for var. ICC 11322 and *Acaulospora spinosa* for var. JG 74

Data given here is the outcome of the experiment and only there results were depicted when produce best response with individual chickpea varieties.

Table 2: Effect of AM Fungi and Foc inoculated alone or in combination on mortality, nodulation and yield under unsterilized soils in chickpea varieties

Treatments	Chickpea Varieties								
	ICC 4951			ICC 11322			JG 74		
	Total Mortality (%)	DW of nodules (g/plant)	Yield DW of grains (g/plant)	Total Mortality (%)	DW of nodules (g/plant)	Yield DW of grains (g/plant)	Total Mortality (%)	DW of nodules (g/plant)	Yield DW of grains (g/plant)
Control	0.0	0.03	1.70	0.0	0.03	1.85	0.0	0.02	1.95
AMF*	0.0	0.05	2.01 (18.23)	0.0	0.05	2.20 (18.92)	0.0	0.03	2.20 (12.82)
Foc	60.0	0.02	0.90 (-47.06)	20.9	0.02	1.80 (-2.70)	22.6	0.01	1.90 (-2.56)
AMF + Foc	39.0	0.04	1.75 (2.94)	12.5	0.04	2.08 (12.43)	13.2	0.02	2.12 (8.72)
CD (P = 0.05)	1.93	0.04	0.20	1.85	0.01	0.24	1.50	0.01	0.40

* AM Fungi, *Glomus mosseae* for var. ICC 4951, *G. fasciculatum* for var. ICC 11322 and *Acaulospora spinosa* for var. JG 74

Data given here is the outcome of the experiment and only there results were depicted when produce best response with individual chickpea varieties.

Model Discovery from Motor Claim Process Using Process Mining Technique

P.V.Kumaraguru*, Dr.S.P.Rajagopalan**

* Dr. MGR Educational and research Institute University Chennai India

**Dr. MGR Educational and research Institute University Chennai India

Abstract- All the insurance industries are facing the great challenge to find the ways and means to handle the huge digital data of the event logs, which were automatically generated for every business activity. It is a great challenge before the solution providers to find a solution to manage this data explosion. Merely providing a solution to hold these digital data is not wise enough, instead converting this digital data as a boon to trace the foot prints of the process and then convert it into visual models. These models can further be enhanced, which leads to process evolution. Machine learning and data mining are the only solutions to handle this challenge properly. This paper has made an attempt to convert the event logs in to a tangible visual model.

Index Terms- Business intelligence, Data explosion, Digital universe, Event logs, process model.

I. INTRODUCTION

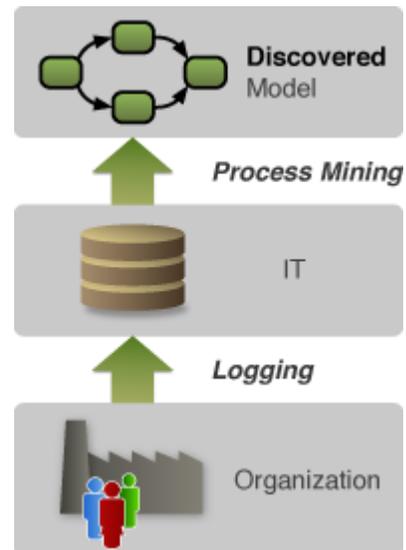
The downpour of business data of event logs has grown and become unimaginably huge and triggers many challenges not only for data handling but also for data mining, particularly for process mining. The main goal of process mining is to use event logs to extract process related information. For example, by modeling a business process and analyzing it, management may get ideas on how to reduce costs while improving service levels.

II. PROCESS MINING

Process mining is a bridge between data mining and business process management. Process mining is applicable to a wide range of systems. These systems may be pure Information systems or systems where the hardware plays a more prominent role. The only requirement is that the system produces Event Logs, thus recording the actual behavior. Process mining is practically relevant and the logical next step in Business Process Management. Process mining provides many interesting challenges for scientists, customers, users, managers, consultants, and tool developers.

Discovery: Traditionally, process mining has been focusing on discovery i.e., deriving information about the organization context, and execution properties from enactment logs. An example of a technique addressing the control flow perspective is the alpha algorithm, which constructs Petri net model describing the behavior observed in the event logs. Process mining is not limited to process models and recent process mining techniques are more and more focusing on other

perspectives e.g., the organizational perspective, performance perspective or data perspective. For example, there are approaches to extract social networks from event logs and analyze them using social network analyzer. This allows organizations to monitor how people, groups or software/system components are working together. Also there are approaches to visualize performance related information e.g., there are approaches which graphically shows the bottlenecks and all kinds of performance indicators e.g., total flow time or the time spent between two activities.



Conformance: There is an a-priori model. This model used to check if reality conforms to the model. For example there may be a process model indicating that purchase orders for very huge amount require two checks. Another example is the checking of the so-called “four-eyes” principle. Conformation checking may be used to detect deviation, to locate and explain these deviations, and to measure the severity of these deviations.

Extension: There is an a-priori model. This model is extended with a new aspect or perspective, i.e., the goal is not to check conformance but to enrich the model with the data in the event log. An example is the extension of a process model with performance data, i.e., some a-priori process model is used on which bottlenecks are projected.

III. MODEL DISCOVERY FROM MOTOR CLAIM PROCESS

Consider the processing of motor claims in an insurance company [7]. First the customer registers the claim with the insurance company (task *register the claim*). The loss is recorded in the claim register (task *examine*) and a claim form is issued to the customer. The insurance company then verifies the policy records to see if the policy is in force and also confirms 64VB clause of the Insurance Act, 1938 of India (task *Check 64 VB confirmation*). The insurance company then decides (task *decide*) and either accepts the claim (task *Honour the claim*) or rejects the claim (task *Repudiate the claim*).

The insured is required to submit a detailed estimate of repairs from any repairer of his choice. Generally, these repairs are acceptable but at times the insurance company asks the

customer to obtain repair estimate from another repairer, if they have reason to believe that the competence, moral hazard or business integrity of the first repairer is not satisfactory (task *Panel assessment*). Verification of all the claim documents by the approved loss assessor or the surveyor is the task *Check documents*.

Note: Section 64 VB of the Insurance Act, 1938 of India stipulates that no risk can be assumed without prior payment of full premium except when

- (i) The entire amount of the premium is guaranteed to be paid by a bank before the end of the first calendar month after the month in which the risk is assumed, or
- (ii) An advance deposit is made with the insurer to the credit of the Insured sufficient to cover the payment of the entire amount of premium

Table 1: A fragment of insurance event log : each line corresponds to an event

CASE ID	EVENT ID	PROPERTIES			
		TIMESTAMP		ACTIVITY	RESOURCE
		DATE	TIME		
1	4587320	11/8/2011	15:05	Register claim request	Raj
	4587321	11/8/2011	15:30	Examine	Sam
	4587322	11/8/2011	15:45	Check 64VB confirmation	Mano
	4587323	11/8/2011	16:30	Decide	Ravi
	4587324	11/8/2011	16:45	Repudiate the claim	Mani
2	4587331	26/04/2011	11:30	Register claim request	Sam
	4587332	26/04/2011	11:45	Check 64VB confirmation	Mano
	4587333	26/04/2011	12:00	Examine	Raj
	4587334	26/04/2011	12:30	Decide	Ravi
	4587335	26/04/2011	12:45	Honor the claim	Mani
3	4587341	29/06/2011	18:20	Register claim request	Raj
	4587342	30/06/2011	9:45	Examine	Ravi
	4587343	30/06/2011	10:15	Check 64VB confirmation	Mani
	4587344	30/06/2011	10:40	Decide	Mano
	4587345	30/06/2011	15:20	Panel assessment	Sam
	4587346	30/06/2011	16:00	Examine	Mano
	4587347	1/7/2011	10:00	Check documents	Sam
	4587348	1/7/2011	11:00	Decide	Mano
4587349	1/7/2011	13:15	Honor the claim	Ravi	
4	4587351	3/3/2011	10:00	Register claim request	Ravi
	4587352	3/3/2011	11:00	Examine	Mani
	4587353	3/3/2011	11:15	Check 64VB confirmation	Sam
	4587354	3/3/2011	12:10	Decide	Mano

	4587355	3/3/2011	15:25	Panel assessment	Sam
	4587356	3/3/2011	17:00	Check documents	Mano
	4587357	3/3/2011	17:45	Examine	Sam
	4587358	4/3/2011	9:30	Decide	Mano
	4587359	4/3/2011	10:15	Honor the claim	Mano
5	4587391	17/09/2011	11:30	Register claim request	Sam
	4587392	17/09/2011	11:45	Examine	Mano
	4587393	17/09/2011	12:30	Check 64VB confirmation	Mano
	4587394	17/09/2011	12:45	Decide	Ravi
	4587395	17/09/2011	15:30	Panel assessment	Mani
	4587396	17/09/2011	14:10	Check documents	Raj
	4587397	17/09/2011	15:00	Examine	Ravi
	4587398	17/09/2011	15:30	Decide	Ravi
	4587399	17/09/2011	15:45	Repudiate the claim	Mani

The above table represents the information in an event log. The bare minimum requirements for process mining are that an event can be related to both a case and an activity.

With the information from the above table we obtain the more compact information representation of the event log as shown below.

Table 2 :Trace of the event log

CASE ID	TRACE
1	(a,b,c,d,h)
2	(a,c,b,d,g)
3	(a,b,c,d,e,b,f,d,g)
4	(a,b,c,d,e,f,b,d,g)
5	(a,b,c,d,e,f,b,d,h)

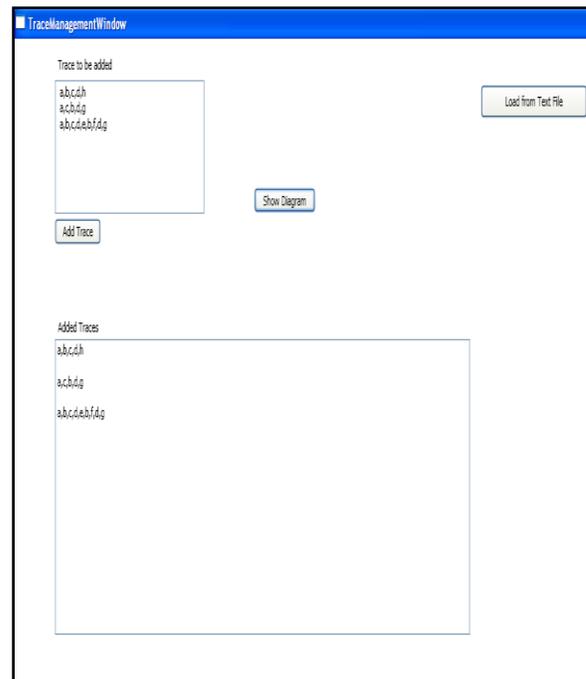
In the above table, the case is represented by a sequence of activities referred to as trace and the activity names are represented by single letter labels. The various labels mentioned in the table denotes as

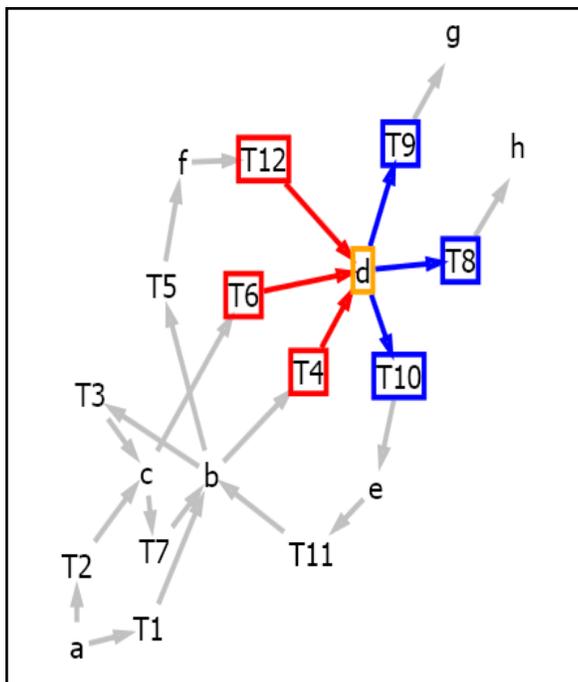
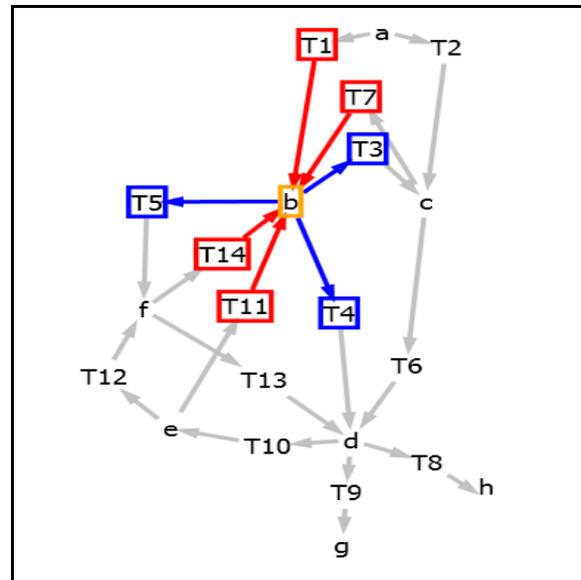
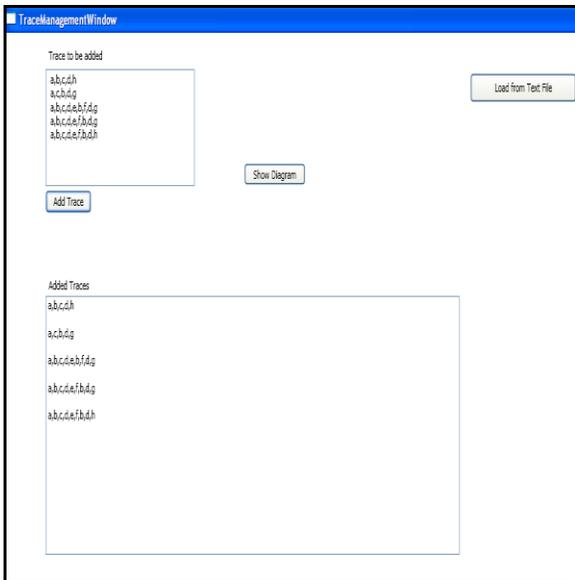
- a – Register claim request
- b – Examine
- c - Check 64VB confirmation
- d – Decide
- e - Panel assessment
- f – Check documents
- g – Honor the claim
- h – Repudiate the claim

The information given in the above table can be transformed into a process model.

IV. MODEL GENERATOR OF THE TRACE TABLE

Model generator takes input from the trace table and generates a model, where a – h are the various activities and T1 – T11 are the transition states.





V. CONCLUSION

In this paper we discussed the challenges in handling digital data by the insurance companies and the suitability of process mining techniques to handle situation was also discussed. The trace table of the motor insurance claim process has been converted into a graphical model which is tangible visual model and may be used to identify the deviations, overlap and deadlock. By eliminating this, the process may be enhanced or reengineered so as to achieve the improved throughput of the process.

REFERENCES

- [1] Wil M.P. Van der Aalst, 2010, Process Mining, Springer
- [2] W.M.P. Van der Aalst 1998 The applications of Petri Nets to work flow management , The journal of Circuits, Systems and computers
- [3] W.M.P. Van der Aalst and K.M.Van Hee. Workflow Management: Models, Methods , and system. MIT press, Cambridge, MA, 2002.
- [4] S.Kumaran and K.Raja, Modeling and simulation of Projects with Petri Nets. American journal of applied Sciences, 2008.
- [5] A.J.M.M Weijters and W.M.P Van der Aalst, Process Mining : 2001 Discovering workflow Models from Event based Data, 13th Belgium-Netherlands Conference on Artificial intelligence(BNAIC 2001).
- [6] W.M.P van der Aalst A.J.M.M. Weijters, and L. Maruster. 2004, Work flow Mining: Discovering process models from Event Logs. IEEE Transactions on Knowledge and Data Engineering

AUTHORS

First Author – P V Kumaraguru is a Research scholar of Dr. MGR Educational and research Institute University Chennai 600095 India (pvkumaraguru@gmail.com)
Second Author – Dr.S.P.Rajagopalan, Professor Emeritus, Dr. MGR Educational and research Institute University Chennai 600095 India (sasirekaraj@yahoo.co.in)

Modified Acousto-Electric Interactions in Colloids Laden Semiconductor Quantum Plasmas

Aartee Sharma, Nishchhal Yadav, S. Ghosh

School of Studies in physics, Vikram University, Ujjain-456010 (M. P.) India

Abstract- Using quantum hydrodynamic (QHD) model, a comprehensive investigation of propagation of longitudinal acousto-electric wave in colloids laden semiconductor plasmas is presented. It is noticed that the Bohm potential in the wave spectrum of the semiconductor plasma enhances the gain and also modifies the amplification characteristics of sound wave for both cases in which colloidal particles are either stationary ($\Theta_{0d} = 0$) or streaming ($\Theta_{0d} \neq 0$). The result of this investigation would be useful in understanding the characteristics of longitudinal electro-acoustic wave in magnetized n-type piezoelectric semiconductor quantum plasma and would be helpful in the fabrication of acousto-electric devices.

Index Terms- Acousto-electric interaction, Bohm potential, colloidal plasma, semiconductor plasma.

I. INTRODUCTION

Dusty plasma has opened up a completely new field of research in the domain of plasma physics. In addition to electrons, ions and neutrals in “ordinary” plasmas, dusty plasmas contain massive particles of nanometer to micrometer size. Dusty plasmas are widespread in astrophysical situations like in the rings of Saturn, in cometary tails or in interstellar clouds [1, 2]. In technological plasmas processing, dust particles grow from molecules in reactive gases to nanometer size particles [3, 4]. The removal of such plasma-grown particles is an essential issue in computer chip manufacturing. In contrast, materials with novel properties, such as solar cells with much improved efficiency, can be manufactured from thin films with incorporated dust particles.

A fascinating property of dusty plasma is that the particles can arrange in ordered crystal-like structure, so called plasma crystals [5, 6]. In the plasma, the particles acquire net negative charge equivalent to that of hundreds/thousands of elementary charges due to the inflow of electrons and ions. Then, the system becomes strongly coupled because the coulomb interaction of neighboring particles by far exceeds their thermal energies. The spatial and time scales of the particles motion allow easy observation by video microscopy. Weak frictional damping ensures that the dynamics and kinetics of individual particles becomes observable. Thus, dusty plasmas enable the investigation of crystal structure, solid and liquid plasmas, phase transitions, waves and many more phenomena on the kinetic particle level. On the other hand, the presence of dust in the plasma not only modifies the existing modes but also gives rise to new novel modes [7-11], even if dust particles do not participate in the perturbation. In most of the studies, a fluid

description is used and the dust is considered as an additional component of the plasma, which can support low-frequency perturbations.

Salimullah et al. [12] predicted, first time, the possible lattice formation of charged dust grains in piezoelectric semiconductors. Later the influence of electron-phonon coupling on the lattice formation of negatively charged colloids resulting from ion-implantation in piezoelectric semiconductor were also reported [13]. This entirely new material, where phase transition and crystalline structure are expected to be confirmed by X-rays or electron microscope, may become a valuable tool for studying physical processes in condensed matter, such as melting, annealing and lattice defects. It also provides a strong motivation for investigating the collective properties in solid-state plasma media. As per the knowledge of the authors; it is an area which has remained very rarely explored so far.

Due to the larger mass of ions compared with the mass of electrons in gaseous dusty plasma system, depletion of electron densities may be almost complete. As a result, only low frequency perturbations are seen, when the electron inertia become negligible. In semiconductors, the charge carriers (electrons and holes) have high number densities and comparable masses. Therefore, the electron density should be reduced by small amount and it is expected that low as well as high frequency perturbations can be excited in the so-called “colloids laden semiconductor plasmas”. At low frequency, all the three carrier species participate, while at high frequency, only electrons and holes can respond and the dust remains stationary in the background.

The interaction between mobile carriers and acoustic vibrations is one of the fundamental interaction processes in solids. This interaction gives useful information regarding the band structure of the host medium. The amplification of sound waves by the application of dc electric field has been commercially exploited for the fabrications of delay-lines, acousto-electric amplifiers and oscillators etc. The underlying physics of sound wave amplification in piezoelectric semiconductors is as follow: if the ion-implanted piezoelectric semiconductor is subjected to a large dc electric field below the breakdown value, a large beam of streaming electrons (due to their larger mobility than holes) will charge the neutral colloid particles to make them negatively charged colloidal ions. Thus, the semiconductor plasma will behave like dusty plasma [14] with electrons, vibrating lattice ions and dust like colloid ions.

As we know that, the temperature and density are the two basic parameters of the plasma. For quantum effects to be significant in plasmas, it is often assumed that the temperature over density ratio must be small. In such situation where density is too high and temperature is below the Fermi temperature,

quantum mechanical effect can no longer be ignored. Such a system where quantum mechanical corrections are needed to describe the system completely is referred to as “Quantum Plasma”. The peculiar property of quantum plasma is that it increasingly approaches the more collective (ideal) behavior as its density increases.

Quantum hydrodynamic (QHD) models become important and necessary to model and simulate electron transport, affected by extremely high electric fields. Generally the QHD model consists of a set of equations describing the transport of charge, momentum and energy in a charged particle system interchanging through a self consistent electrostatic potential. Mathematically, the QHD model generalizes the fluid model for plasmas with the inclusion of a quantum correction term, i.e., Bohm potential. This extra term can appropriately describe negative differential resistivity in resonant tunneling diodes. Such kind of quantum mechanical phenomena cannot be simulated by classical hydrodynamic models. The advantage of the microscopic quantum hydrodynamic model is that they are able to describe directly the dynamics of physical observable and simulate the main characters of quantum effect. This motivates the development of quantum transport model for charged particle systems.

Ghosh and his coworkers [15-18] studied the acousto-electric interactions in ion-implanted semiconductor plasmas. They have reported the origin of a number of new modes and effective modifications in the characteristic of the existing modes.

Motivated by the pioneer work of Ghosh and Khare [16-18] and the importance of the quantum effect on wave spectrum, in the following section of the present paper, we present an analytical study of the quantum modifications in wave spectrum of electro-acoustic modes in n-type piezoelectric semiconductor plasma embedded with colloidal grains.

II. THEORETICAL FORMULATION

To study the modification in longitudinal phonon-plasmon interaction using quantum hydrodynamic model (QHD), we consider an n-type piezoelectric semiconductor sample of infinite extent in the presence of colloidal particles. The medium is subjected to a dc electric field (applied along the negative z-axis) and a longitudinal magnetostatic field B_0 (applied in x-z plane) making an arbitrary angle θ with z-axis. We consider an acoustic wave to be propagating along the z-axis of the medium. The uniform flow of the electrons due to dc electric field can charge the neutral colloids negatively in the host material. The average size of the colloids is assumed to be much less than the inter-grain distance, the electron Debye radius as well as the wavelength under study, so that they can be treated as point masses [19]. Hence the material can be safely treated as the multi-component plasma consisting of electrons and negatively charged colloids under hydrodynamic limit.

For the wave, we assume all variables to be of the form $\exp[i(\omega t - kz)]$ in which (ω, k) are the frequency and wave number of the wave. The wave equation in an elastic piezoelectric medium, using Newton’s equation of lattice

vibration and other related equations, for the field geometry under study, may be written as

$$(-\rho\omega^2 + ck^2)u_x = ik\beta E_z, \quad (1)$$

where β is the piezoelectric coefficient of the medium and all other symbols have the same meanings as given by Steele and Vural [20].

In deriving equation (1), we have assumed that the considered medium has a cubic symmetry, which has simplified the involved tensor components without diluting the physical significance of the problem under study. The sound wave is taken as a shear wave that propagates along z-axis, which is $\langle 011 \rangle$ axis of the crystal. The lattice displacement \vec{u} is taken along the propagation direction. This geometry is appropriate to many piezoelectric compound semiconductors of III-V class.

In the present configuration the electrons and charged colloids acquire perturbed motion in accordance with first-order equations of motion and continuity of the quantum hydrodynamic (QHD) model which are as follows

$$m_j n_{0j} \left[\frac{\partial}{\partial t} + (\vec{g}_j \cdot \nabla) \right] \vec{g}_j + v_j \vec{g}_j = -en_{0j} \left[E + (\vec{g}_j \times B) \right] - \nabla p_j + \frac{\hbar^2}{4m_j} \nabla (\nabla^2 n_j) \quad (2)$$

$$\frac{\partial n_j}{\partial t} + \nabla \cdot (n_j \vec{g}_j) = 0 \quad (3)$$

($j = e, d$ for electrons and dust)

Here, $p_j = \frac{m_j V_{Fj}^2 n_j^3}{3n_{0e}^2}$ is the Fermi pressure and, $V_{Fj}^2 = \frac{2K_B T_{Fj}}{m_j}$ with

K_B and T_{Fj} being the Boltzmann constant and Fermi temperature of carriers. With the help of equations (2) and (3) we obtained the perturbed velocity components for electrons and charged colloids as

$$g_{ez} = \frac{i(e/m_e)E_{1z}}{F(\omega, k)} \quad (4)$$

and

$$g_{dz} = \frac{i(z_d e/m_d)E_{1z}}{G(\omega, k)} \quad (5)$$

where,

$$F(\omega, k) = \left[(\omega - k_{0e} - i\nu_e) - \frac{k^2}{(\omega - k_{0e})} V_{Fe}^2 (1 + \Gamma_e) \right] + \left[\frac{\omega_{ce}^2 \sin^2 \theta (\omega - k_{0e} - i\nu_e)}{\omega_{ce}^2 \cos^2 \theta - (\omega - k_{0e} - i\nu_e)^2} \right] \quad (6)$$

$$G(\omega, k) = \left[(\omega - k_{0d} - i\nu_d) + \frac{\omega_{cd}^2 \sin^2 \theta (\omega - k_{0d} - i\nu_d)}{\omega_{cd}^2 \cos^2 \theta - (\omega - k_{0d} - i\nu_d)^2} \right] \quad (7)$$

Here, e and $z_d e$ are the charges on electrons and colloids, respectively, in which $z_d = q_d/e$ is the ratio of the charge q_d

on a colloidal grain to the electron charge e . \mathcal{G}_{0d} and v_d are the drift velocity and momentum transfer collision frequency of the colloids. The expression for $F(\omega, k)$ contains $\Gamma_e = \frac{\eta^2 k^2}{8m_e K_B T_{Fe}}$, which represents the inclusion of quantum effect in the interaction. The colloid cyclotron frequency ω_{cd} is given by $z_d e B_0 / m_d$. All other symbols have their usual meanings as given by Steele and Vural [20] except for the subscript e which denotes the parameter for electrons.

Using equations (1) to (7) and the usual relations for the continuity and electrical displacement for a longitudinal wave, we get the dispersion relation for phonon-plasmon interactions using QHD model as

$$(\omega^2 - k^2 \mathcal{G}_s^2) \left[1 - \frac{\omega_{pe}^2}{(\omega - k \mathcal{G}_{0e}) F(\omega, k)} - \frac{\omega_{pd}^2}{(\omega - k \mathcal{G}_{0d}) G(\omega, k)} \right] = K^2 k^2 \mathcal{G}_s^2, \quad (8)$$

where, $K^2 = (\beta^2 / c\epsilon)$ is the dimensionless electromechanical coupling coefficient. The plasma frequencies for electrons and colloids are given as $\omega_{pe}^2 = \frac{e^2 n_{0e}}{\epsilon m_e}$ and $\omega_{pd}^2 = \frac{z_d^2 e^2 n_{0d}}{\epsilon m_d}$ in which $n_{0e,d}$ are the unperturbed number densities of electrons and colloids, respectively.

In absence of piezoelectricity ($\beta = 0$), the coupling parameters on RHS of equation (8) vanishes and we get two independent modes as

$$(\omega^2 - k^2 \mathcal{G}_s^2) = 0 \quad (9a)$$

and

$$\left[1 - \frac{\omega_{pe}^2}{(\omega - k \mathcal{G}_{0e}) F(\omega, k)} - \frac{\omega_{pd}^2}{(\omega - k \mathcal{G}_{0d}) G(\omega, k)} \right] = 0 \quad (9b)$$

Equation (9a) is the usual sound mode propagating through an elastic medium and equation (9b) represents the electro-kinetic mode modified due to the presence of charged colloids and quantum effect in the host material.

In absence of charged colloids ($\omega_{pd} = 0$) and quantum effect ($\Gamma_e = 0, V_F \rightarrow V_{th}$, thermal velocity), equation (8) reduces to equation (8-20) of Steele and Vural [20] and represents the phonon-plasmon interaction in magnetized piezoelectric semiconductor plasma. Hence equation (8) represents the phonon-plasmon interaction modified due to the presence of charged colloids and quantum effect in magnetized piezoelectric semiconductor plasma.

In the collision dominated regime ($\omega \ll v_e, v_d$ and $k \mathcal{G}_{0e} \ll v_e, k \mathcal{G}_{0d} \ll v_d$), equation (8) is solved with the standard approximation $k \mathcal{G}_s / \omega = 1 + i\alpha$ [21], where the gain per radian α is $\ll 1$. Therefore, one gets,

$$\alpha = \frac{\frac{1}{2} K^2 \gamma_e \left(\frac{\omega_{Re}}{\omega \phi_e} \right) \left[1 + \frac{\omega_{Rd} \phi_e \gamma_e}{\omega_{Re} \phi_d \gamma_d} + \left(\frac{k^2 V_F'^2}{\omega \phi_e} \right)^2 \frac{\omega_{Rd}}{\omega_{Re}} \frac{\phi_e}{\phi_d \gamma_e \gamma_d v_e^2} \right]}{\left(\frac{\omega_{Re}}{\omega \phi_e} \right)^2 \left[1 + \frac{\omega_{Rd} \phi_e \gamma_e}{\omega_{Re} \phi_d \gamma_d} + \frac{k^2 V_F'^2}{\omega_{Re} v_e} \right]^2 + \gamma_e^2 \left[1 - \frac{k^2 V_F'^2 \omega_{Rd}}{\omega^2 \phi_e \phi_d \gamma_e \gamma_d v_e} \right]^2} \quad (10)$$

in which

$$V_F'^2 = V_F^2 (1 + \Gamma_e), \quad \gamma_{e,d} = (\mathcal{G}_{0e,d} / \mathcal{G}_s - 1),$$

$$\omega_{Re,d} = \omega_{pe,d}^2 / v_{e,d}$$

and

$$\phi_{e,d} = \frac{1 + (\omega_{ce,d}^2 / v_{e,d}^2)}{1 + (\omega_{ce,d}^2 \cos^2 \theta / v_{e,d}^2)}$$

The subscripts 'e' and 'd' are used to represent quantities related to electrons and charged colloids, respectively. It can be infer from equation (10) that quantum effects appear in the parameter V_F' .

Sound mode amplification-

The sound wave is amplified only when gain per radian α is positive. Now we will discuss the amplification characteristics of sound wave for two distinct cases in which charged colloids are either stationary or streaming. In both the cases we will discuss the quantum correction effect on the amplification characteristics of sound mode.

CASE-1: Stationary colloids ($\mathcal{G}_{0d} = 0$)

It is a well-known fact that, unless one considers the lowest part of the grain mass spectrum and very-very low frequency modes, the conclusion is that the grain dynamics can be ignored with respect to the electron dynamics [22]. Thus, for ultrasonic frequency regime and robust colloidal grains, we can safely assume $\mathcal{G}_{0d} = 0$ and consequently $\gamma_d = -1$. Under this approximation equation (10) reduces to

$$\alpha \approx \frac{\frac{1}{2} K^2 \gamma_e \left(\frac{\omega_{Re}}{\omega \phi_e} \right) \left[1 - \frac{\omega_{Rd} \phi_e \gamma_e}{\omega_{Re} \phi_d} \left\{ 1 + \left(\frac{k^2 V_F'^2}{\omega \phi_e} \right)^2 \frac{1}{\gamma_e^2 v_e^2} \right\} \right]}{\left(\frac{\omega_{Re}}{\omega \phi_e} \right)^2 \left[1 - \frac{\omega_{Rd} \phi_e \gamma_e}{\omega_{Re} \phi_d} + \frac{k^2 V_F'^2}{\omega_{Re} v_e} \right]^2 + \gamma_e^2 \left[1 + \frac{k^2 V_F'^2 \omega_{Rd}}{\omega^2 \phi_e \phi_d \gamma_e v_e} \right]^2} \quad (11)$$

One can immediately infer from equation (11) that this mode will be amplified ($\alpha > 0$) only when

$$\gamma_e > 0 \quad (12a)$$

and

$$\omega < \frac{k^2 V_F'^2}{\phi_e \gamma_e v_e} \left[\sqrt{\frac{\omega_{Re}}{\omega_{Rd}} \frac{\phi_d}{\phi_e \gamma_e}} - 1 \right]^{-1} \quad (12b)$$

In absence of charged colloids, it was reported by White [21] that the condition for gain is $\gamma_e > 0$ or $(\mathcal{G}_{0e}/\mathcal{G}_s) > 1$. We have found that in an n-type semiconductor consisting of colloid particles an extra condition (12b) is imposed to achieve the amplifying wave. This extra condition actually comes into picture due to the presence of charged colloids and Bohm potential (i.e., quantum correction) in the fluid model of plasmas. This condition actually imposed a limit on the frequency of the wave, which may be amplified. It is also found that the value of gain is also modified by the presence of quantum correction term in the regime where colloids are stationary. Hence one gets modified longitudinal phonon-plasmon interaction in the n-type piezoelectric semiconductor quantum plasma even in presence of robust colloidal grains.

CASE-2: Streaming colloids ($\mathcal{G}_{0d} \neq 0$)

Now, if one includes dynamics of colloidal grains into consideration the expression for gain per radian will be exactly same as given in equation (10). To study the amplification characteristics of the wave, we shall discuss different velocity regimes as follows:

(a) When $\gamma_e > 0$ and $\gamma_d > 0$ i.e. $\mathcal{G}_{0e} > \mathcal{G}_s < \mathcal{G}_{0d}$:

Under this velocity regime, the expression for gain reduces to

$$\alpha \approx \frac{\frac{1}{2} K^2 |\gamma_e| \left(\frac{\omega_{Re}}{\omega \phi_e} \right) \left[1 + \frac{\omega_{Rd} \phi_e |\gamma_e|}{\omega_{Re} \phi_d |\gamma_d|} + \left(\frac{k^2 V_F'^2}{\omega \phi_e} \right)^2 \frac{\omega_{Rd}}{\omega_{Re}} \frac{\phi_e}{\phi_d |\gamma_e| |\gamma_d| v_e^2} \right]}{\left(\frac{\omega_{Re}}{\omega \phi_e} \right)^2 \left[1 + \frac{\omega_{Rd} \phi_e |\gamma_e|}{\omega_{Re} \phi_d |\gamma_d|} + \frac{k^2 V_F'^2}{\omega_{Re} v_e} \right]^2 + |\gamma_e|^2 \left[1 - \frac{k^2 V_F'^2 \omega_{Rd}}{\omega^2 \phi_e \phi_d |\gamma_e| |\gamma_d| v_e} \right]^2} \tag{13}$$

It is clear from the equation (13) that under this velocity regime the wave will always be of amplifying nature but the value of gain per radian is modified due to presence of quantum potential through the modified Fermi velocity term V_F' .

(b) When $\gamma_e > 0$ and $\gamma_d < 0$ i.e. $\mathcal{G}_{0e} > \mathcal{G}_s > \mathcal{G}_{0d}$:

In this regime equation (10) reduces to,

$$\alpha \approx \frac{\frac{1}{2} K^2 |\gamma_e| \left(\frac{\omega_{Re}}{\omega \phi_e} \right) \left[1 - \left\{ \frac{\omega_{Rd} \phi_e |\gamma_e|}{\omega_{Re} \phi_d |\gamma_d|} + \left(\frac{k^2 V_F'^2}{\omega \phi_e} \right)^2 \frac{\omega_{Rd}}{\omega_{Re}} \frac{\phi_e}{\phi_d |\gamma_e| |\gamma_d| v_e^2} \right\} \right]}{\left(\frac{\omega_{Re}}{\omega \phi_e} \right)^2 \left[1 - \frac{\omega_{Rd} \phi_e |\gamma_e|}{\omega_{Re} \phi_d |\gamma_d|} + \frac{k^2 V_F'^2}{\omega_{Re} v_e} \right]^2 + |\gamma_e|^2 \left[1 + \frac{k^2 V_F'^2 \omega_{Rd}}{\omega^2 \phi_e \phi_d |\gamma_e| |\gamma_d| v_e} \right]^2} \tag{14}$$

From equation (14) one can infer that α will be positive only when the expression within square bracket in numerator is positive. The expression within square bracket is dominantly controlled by the quantum term V_F' . Thus the gain per radian in this velocity region will be

$$\alpha \approx \frac{\frac{1}{2} K^2 |\gamma_e| \left(\frac{\omega_{Re}}{\omega \phi_e} \right)}{\left(\frac{\omega_{Re}}{\omega \phi_e} \right)^2 \left[1 - \frac{\omega_{Rd} \phi_e |\gamma_e|}{\omega_{Re} \phi_d |\gamma_d|} + \frac{k^2 V_F'^2}{\omega_{Re} v_e} \right]^2 + |\gamma_e|^2 \left[1 + \frac{k^2 V_F'^2 \omega_{Rd}}{\omega^2 \phi_e \phi_d |\gamma_e| |\gamma_d| v_e} \right]^2} \tag{15}$$

It may be concluded that even when $\gamma_d < 0$ i.e. charged colloids moves slowly in comparison with acoustic phonon speed, one gets the amplification of sound wave in a frequency regime given as

$$\omega < \frac{k^2 V_F'^2}{\phi_e |\gamma_e| v_e} \left[\sqrt{\frac{\omega_{Re}}{\omega_{Rd}} \frac{\phi_d |\gamma_d|}{\phi_e |\gamma_e|}} - 1 \right]^{-1} \tag{16}$$

This frequency regime is very much decided by the Bohm potential correction through V_F' . Hence, the gain characteristic is sharply modified by the presence of quantum correction term even in this velocity regime also.

(c) When $\gamma_e < 0$ and $\gamma_d > 0$ i.e. $\mathcal{G}_{0e} < \mathcal{G}_s < \mathcal{G}_{0d}$:

For this velocity regime, gain per radian may be expressed using equation (10) as

$$\alpha \approx \frac{\frac{1}{2} K^2 |\gamma_e| \left(\frac{\omega_{Re}}{\omega \phi_e} \right) \left(\frac{\omega_{Rd}}{\omega_{Re}} \right) \left[\frac{\phi_e |\gamma_e|}{\phi_d |\gamma_d|} + \left(\frac{k^2 V_F'^2}{\omega \phi_e} \right)^2 \frac{\phi_e}{\phi_d |\gamma_e| |\gamma_d| v_e^2} \right]}{\left(\frac{\omega_{Re}}{\omega \phi_e} \right)^2 \left[1 - \frac{\omega_{Rd} \phi_e |\gamma_e|}{\omega_{Re} \phi_d |\gamma_d|} + \frac{k^2 V_F'^2}{\omega_{Re} v_e} \right]^2 + |\gamma_e|^2 \left[1 + \frac{k^2 V_F'^2 \omega_{Rd}}{\omega^2 \phi_e \phi_d |\gamma_e| |\gamma_d| v_e} \right]^2} \tag{17}$$

Hence, for this velocity regime we found that α will be positive only when

$$\omega > \frac{k^2 V_F'^2}{\phi_e |\gamma_e| v_e} \left[\sqrt{\frac{\omega_{Re}}{\omega_{Rd}} \frac{\phi_d |\gamma_d|}{\phi_e |\gamma_e|}} - 1 \right]^{-1} \tag{18}$$

It can be inferred that in a frequency region defined by equation (18), we may get sound amplification even if the electron drift is less than the acoustic speed. From equation (17), it is found that this gain is not possible in absence of colloids ($\omega_{Rd} = 0$); therefore, this mode may be termed as colloids induced sound mode amplification in piezoelectric semiconductor. This novel mode strongly depends on the quantum correction made through V_F' .

(d) When $\gamma_e < 0$ and $\gamma_d < 0$ i.e. $\mathcal{G}_{0e} < \mathcal{G}_s > \mathcal{G}_{0d}$:

In this velocity regime one will get a decayed mode ($\alpha < 0$) always; hence it is of no importance here.

III. RESULTS AND DISCUSSION

To study absorption characteristics of sound modes in the colloid laden semiconductor quantum plasma, we may employ

the expressions for gain per radian (α) derived for different cases in the preceding section of this paper. For the same we have considered the following set of parameters for n-InSb at 77K as a representative case : $m_e = 0.014m_0$ (m_0 is the free electron mass), $m_d = 10^{-27}kg$, $\epsilon_L = 17.54$, $\beta = 0.054Cm^{-2}$, $\rho = 5.8 \times 10^3 kg m^{-3}$, $n_{0e} = 10^{19} m^{-3}$, $n_{0d} = 10^{17} m^{-3}$, $v_e = 3.5 \times 10^{11} s^{-1}$, $v_d = 3.248 \times 10^{10} s^{-1}$, $B_0 = 0.5T$. The results of our calculations are depicted in the form of curves in the Figures 1-4.

Figure 2 infers that, in homogeneous medium when $\mathcal{G}_{0e} > \mathcal{G}_s < \mathcal{G}_{0d}$, the sound mode is always be of amplifying nature. In this velocity regime, natures of variation of α for both the cases (with and without quantum effect) are identical and gain is modified due to the presence of quantum effect. This figure depicts that the gain first increases with increase in frequency and attains its maximum ($\alpha \approx 3.5 \times 10^{-5} mks$ units) at $\omega \approx 7.55 \times 10^{10} s^{-1}$ (with quantum effect) and ($\alpha \approx 3.43 \times 10^{-5} mks$ units) at $\omega \approx 7.7 \times 10^{10} s^{-1}$ (without quantum effect).

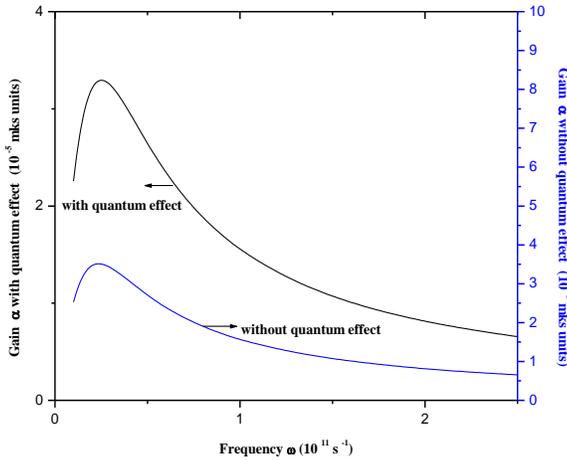


Fig.1 Variation of gain α with wave frequency ω for case (1) In which $\mathcal{G}_{0d} = 0$ (stationary colloids) and $\mathcal{G}_{0e} > \mathcal{G}_s$ at $B_0 = 0.5T$ and $\theta = 45^\circ$.

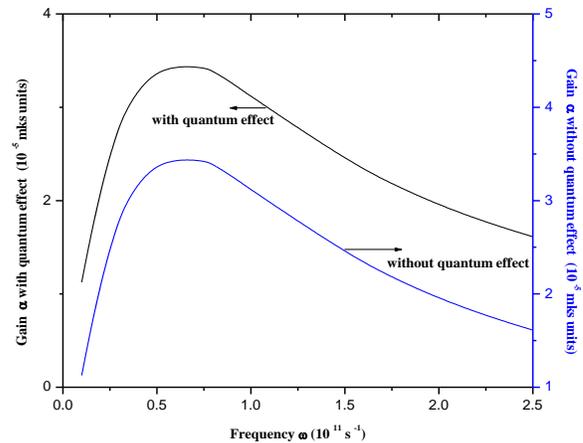


Fig.2 Variation of gain α with wave frequency ω for case 2(a) Under the velocity regime $\mathcal{G}_{0e} > \mathcal{G}_s < \mathcal{G}_{0d}$, at $B_0 = 0.5T$ and $\theta = 45^\circ$.

Figure 1 shows the dependence of gain α (with and without quantum effect) on the wave frequency ω . It is found that the gain for stationary colloids ($\mathcal{G}_{0d} = 0$) is strongly affected by the quantum corrections. For the velocity regime ($\mathcal{G}_{0e} > \mathcal{G}_s$) i.e., when the electron drift velocity is greater than the acoustic speed we always get amplification of sound wave and it is a well known fact that in absence of colloids one can achieve sound gain only when $\mathcal{G}_{0e} > \mathcal{G}_s$; hence in the presence of charged colloids one gets a new amplifying mode from phonon-plasmon interaction in piezoelectric semiconductor. Here, we also found that the inclusion of quantum effect enhances the value of gain, it is observed that in both the cases gain first increases up to $\alpha \approx 3.52 \times 10^{-5} mks$ units at $\omega \approx 2.55 \times 10^{10} s^{-1}$ (with quantum effect) and $\alpha \approx 3.1 \times 10^{-5} mks$ units at $\omega \approx 2.4 \times 10^{10} s^{-1}$ (without quantum effect) and then decays gradually with increasing value of ω and towards the high frequency spectrum it saturates. In presence of quantum correction term gain per radian is always larger than those obtained in absence of quantum effect. Hence it may be inferred from Figure 1 that the presence of Bohm potential effectively increases the magnitude of gain per radian when the implanted colloids are static.

After achieving maximum values the gains in both the cases remain stationary for a while. These portions of the curves display quasi-stationary character of the amplification curve. Beyond this region gains decrease gradually in both cases and become frequency independent towards higher value of frequency. In this velocity regime also, quantum correction is found responsible for the increment in α , the gain per radian.

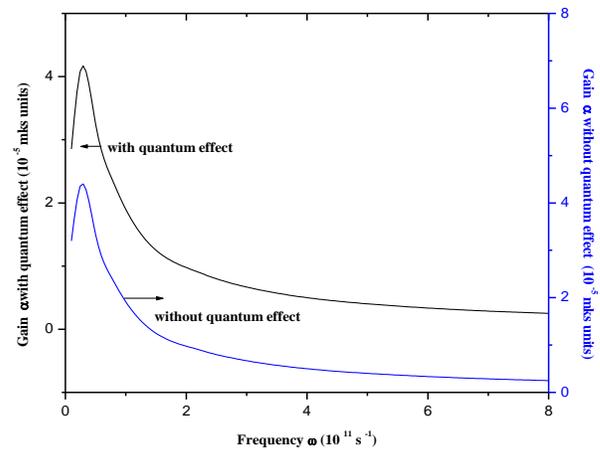


Fig.3 Variation of gain α with wave frequency ω for case 2(b)

Under the velocity regime $\mathcal{G}_{0e} > \mathcal{G}_s > \mathcal{G}_{0d}$, at $B_0 = 0.5T$ and $\theta = 45^\circ$.

Figure 3 displays the variation of gain α as a function of wave frequency ω , under the velocity regime $\mathcal{G}_{0e} > \mathcal{G}_s > \mathcal{G}_{0d}$. We have drawn two curves in presence and absence of quantum correction. When $\mathcal{G}_{0e} > \mathcal{G}_s$, we always get amplification of sound mode in both (with and without quantum effect) the cases. But colloids impose an additional condition on amplification criterion in terms of frequency as predicted by equation (16), in absence of quantum effect due to this restriction on allowed frequency range, we get amplification only upto $\omega \leq 1.4 \times 10^{11} s^{-1}$. Here gain first increases sharply with frequency achieve a maximum and then decreases sharply due to slight tuning in frequency. As soon as we include Bohm potential, the frequency range for which gain of sound mode is possible, increases enormously. The nature of variation is found to be identical with the case when quantum effect is absent. Hence in this velocity regime quantum effect not only increases the gain value but also modifies the amplification condition.

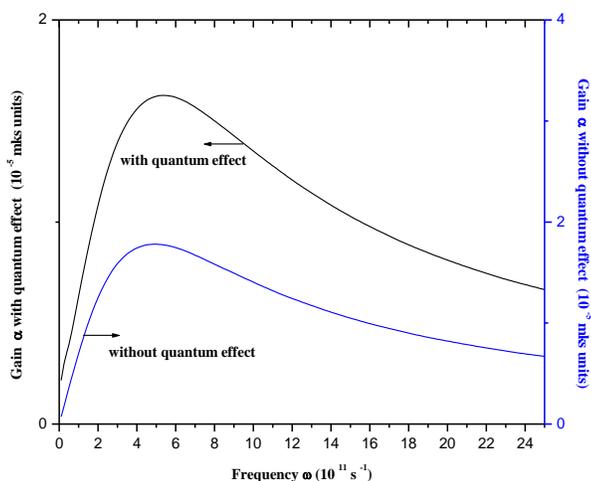


Fig.4 Variation of gain α with wave frequency ω for case 2(c) Under the velocity regime $\mathcal{G}_{0e} < \mathcal{G}_s < \mathcal{G}_{0d}$, at $B_0 = 0.5T$ and $\theta = 45^\circ$.

In colloid laden semiconductor plasma, we get amplifying sound mode even when electron velocity is less than the velocity of sound. Hence the nature of variation of gain in this interesting velocity regime ($\mathcal{G}_{0e} < \mathcal{G}_s < \mathcal{G}_{0d}$) is studied numerically by us and depicted in Figure 4. For both the cases we found that the gain first increases with frequency, achieves a maximum value and then decreases slowly with the increase in frequency. With quantum effect we always get larger gain for the sound mode throughout the frequency spectrum under study. Hence one may control the gain value by tuning the Fermi velocity of electron in the medium for colloids induced sound mode in piezoelectric semiconductors.

IV. CONCLUSION

To conclude, we have presented a novel possibility of controlling longitudinal phonon-plasmon interactions in magnetized n-type piezoelectric semiconductor quantum plasma in presence of charged colloid particles. We focused our attention on two different cases in which colloidal particles are either robust ($\mathcal{G}_{0d} = 0$) or dynamic ($\mathcal{G}_{0d} \neq 0$). We also studied the cases when quantum correction through Bohm potential is included or excluded from the interaction process. All of these cases correspond to the real laboratory experiments under different frequency regimes depending upon the size of the colloidal particles and temperature of the free electrons. We found that, there exists a strong resonant interaction between acoustic mode and quantum mechanically modified electro kinetic mode due to piezoelectric nature of the medium in presence of charged colloidal particles. Hence we hope that the present theory provides a qualitative picture of modification and amplification of sound mode in magnetized n-type piezoelectric semiconductor quantum plasma.

ACKNOWLEDGMENT

The financial assistance from the Madhya Pradesh Council of Science and Technology, Bhopal, India under a research project is gratefully acknowledged. One of the authors (Aartee Sharma) thanks Ms. Sandhaya Chaudhary for her help during the course of this work.

REFERENCES

- [1] C. K. Goertz, Dusty plasmas in the solar system, *Rev. Geophysics*. 27, 1989, pp. 271-292.
- [2] F. Verheest, "Waves in Dusty space plasmas (kluver Academic publishers, Dordrecht)", 2000.
- [3] G. S. Selwyn, J. E. Heidenreich and K. L. Haller, Rasterd lasre light scattering studies during plasma processing: Particle contamination trapping phenomena, *J. Vac. Sci. Technol.* A9, 1991, pp. 2817-2824.
- [4] *Dusty Plasmas*, edited by A. Bouchoule (John Wiley & Sons, Chichester, 1999).
- [5] J. H. Chu and L. I. Direct observation of coulomb crystals and liquids in strongly coupled rf dusty plasmas, *Phys. Rev. Lett.* 72, 1994, pp. 4009-4012.
- [6] H. Thomas, G. E. Morfill, V. Demmel, J. Goree, B. Feuerbacher and D. Mohlmann, Plasma Crystal: Coulomb Crystallization in a Dusty Plasma, *Phys. Rev. Lett.* 73, 1994, pp. 652-655.
- [7] N. N. Rao, P. K. Shukla and M. Y. Yu, Dust-acoustic waves in dusty plasmas, *Planet space Sci.* 38, 1990, pp. 543-546.
- [8] P. K. Shukla and V. P. Sillin, Dust ion-acoustic wave, *Phys. Scr.* 45, 1992, pp. 508.
- [9] M. Salimullah and M. Salahuddin, Dust-acoustic waves in a magnetized dusty plasma, *Phys. Plasmas* 5, 1998, pp. 828-829.
- [10] M. K. Islam, Y. Nakashima, K. Yastu and M. Salimullah, On low frequency dust-modes in a collisional and streaming dusty plasma with dust charge fluctuation, *Phys. Plasmas* 10, 2003, pp. 591-595.
- [11] J. Pramanik, G. Prasad, A. Sen and P. K. Kaw, Experimental Observations of Transverse Shear Waves in Strongly Coupled Dusty Plasmas, *Phys. Rev. Lett.* 88, 2002, pp. 175001-175004.
- [12] M. Salimullah, S. Ghosh and M. R. Amin, Possible lattice formation of new materials within a piezoelectric semiconductor plasma, *Pramana* 54, 2000, pp. 785-789.
- [13] M. Salimullah, P. K. Shukla, S. K. Ghosh, H. Nitta and Y. Hayashi, Electron-phonon coupling effect on wake fields in piezoelectric semiconductors, *J. Phys. D: Appl. Phys.* 36, 2003, pp. 958.

- [14] P. K. Shukla, and A. A. Mamun, “*Introduction to Dusty plasma physics* (IOP, Bristol)”, 2002.
- [15] S. Ghosh, G. R. Sharma, Pragati Khare and M. Salimullah, Modified interactions of longitudinal phonon-plasmon in magnetized piezoelectric semiconductor plasmas, *Physica B* 315, 2004, pp. 163-170.
- [16] S. Ghosh and Pragati Khare, Acousto-electric wave instability in ion-implanted semiconductor plasma, *Eurp. Phys. J. D* 35, 2005, pp. 521-526.
- [17] S. Ghosh and Pragati Khare, Effect of Density Gradient on the Acousto-Electric Wave Instability in Ion-Implanted Semiconductor Plasmas, *Acta Physica Polonica A* 109, 2006, pp. 187-197.
- [18] S. Ghosh and Pragati Khare, Acoustic wave amplification in ion-implanted piezoelectric semiconductor, *Ind. J. Pure & Appl. Phys.* 44, 2006, pp. 183-187.
- [19] K. N. Ostrikov, S. V. Vladimirov, M. Y. Yu and G. E. Morfill, Low-frequency dispersion properties of plasmas with variable-charge impurities, *Phys. Plasma* 7, 2000, pp. 461-465.
- [20] M.C. Steele and B. Vural, “*Wave Interactions in Solid State Plasmas* (Mc-Graw Hill, New York)”, 1969, pp. 134-147.
- [21] D.L. White, Amplification of Ultrasonic Waves in Piezoelectric Semiconductors, *J. Appl. Phys.* 33, 1962, pp. 2547-2554.
- [22] U. de Angelis, The physics of dusty plasmas, *Phys. Scripta* 45, 1992, pp. 465.

AUTHORS

First Author – Aartee Sharma, M.Phil., School of Studies in Physics, Vikram University, Ujjain (M. P.) 456010 India and email: aartee.sharma08@gmail.com

Second Author – Dr. Nishchhal Yadav, Ph.D., School of Studies in Physics, Vikram University, Ujjain (M. P.) 456010 India and email: somyadav@gmail.com

Third Author – Prof. Sanjay K. Ghosh, Ph.D., School of Studies in Physics, Vikram University, Ujjain (M. P.) 456010 India and email: sanjayghosh.ssp@gmail.com

Correspondence Author – Aartee Sharma, email aartee.sharma08@gmail.com, Mob. No. +91-9926583496.

Understanding the Adsorption Efficiency of Chitosan Coated Carbon on Heavy Metal Removal

¹M.Soundarrajan, ²T.Gomathi and ^{2*}P.N. Sudha

¹Research Scholar, Manonmaniam Sundaranar University, Tirunelveli, Tamil Nadu, India

²Department of Chemistry, DKM College for Women, Vellore 632001, Tamilnadu, India

(*Corresponding author: Tel: (+91) 98429 10157; e-mail: drparsu8@gmail.com)

Abstract: In the present study, the performance of chitosan coated carbon was evaluated for the removal of chromium (VI) and cadmium (II) from its aqueous solution. The chitosan coated carbon was prepared and characterized by using the various analytical tools such as FTIR, TGA, DSC and XRD. Batch adsorption experiments were performed in order to examine the effects of initial concentration, pH, and adsorbent dose and contact time for the removal process. The metal ion removal was pH-dependent. The optimum pH was found to be 5.0 for Cr (VI) and 5.5 for Cd (II). Experimental data were analyzed by Langmuir and Freundlich adsorption isotherms. The characteristic parameters for each isotherm and related correlation coefficients have been determined. The isotherm study revealed that the adsorption equilibrium is well-fitted to the Freundlich isotherm for both the metals. The kinetics study revealed that adsorption of Cr (VI) and Cd (II) onto chitosan coated carbon follows pseudo-second-order kinetics. The results showed that chitosan coated carbon were a favorable adsorbent for both the metals.

Index Terms: Chromium; Cadmium; Chitosan coated carbon; Adsorption isotherms and Kinetics.

Introduction:

The contamination of water by toxic heavy metals is a worldwide problem [1]. Mining activities, agricultural runoff, industrial and domestic effluents are mainly responsible for the increase of metallic species released into the environment [2]. The intake of polluted water may cause serious problems to all living beings. The present research work focuses on two heavy metals - chromium and cadmium, both of which are highly toxic. **Chromium (Cr)** exists in the following oxidation states (di-, tri-, penta-, and hexa) trivalent chromium together with the hexavalent state can be mainly present in the aquatic environment. Trivalent chromium acts as the micro nutrients which is essential for glycolysis whereas hexavalent chromium is 500 times toxic than trivalent chromium. It is carcinogenic and mutagenic as well as being a strong oxidizing agent which irritates the plant and animal tissues even in smaller quantities. It diffuses rapidly through the soil and aquatic environments as well as readily passes through the skin [3].

Cadmium (Cd) exists in +2 oxidation state in the polluted environment. It is carcinogenic to human and also considered to be toxic for plants [4]. A considerable amount of cadmium is present in tobacco smoke and it is reported that the amount of cadmium inhaled from each pack of 20 cigarettes is approximately 16 µg [5]. Cadmium is an industrial and environmental pollutant that creates adverse effects on a number of organs in humans [6]. It is taken up by the human body from the environment through pulmonary and renal pathways. Its harmful effects such as "itai-itai" disease, renal damage, emphysema, hypertension and testicular atrophy [7]. Kidney is one of the major targets of chronic toxicity [8] and it affects the kidney cytochrome [9]. It is also reported that high level exposure to cadmium increased the risk factor for breast cancer [10]. Hence, toxic metals should be removed from the effluent before discharging them into the soil and aquifers.

Among the various methods, adsorption is one of the effective separation processes for a wide variety of applications and is recognized as an effective, economical method for the removal of pollutants from wastewaters. Activated carbon is the most widely used adsorbent [11] which has a number of adsorptive sites that makes it a good adsorbent, but it is quite expensive and, possibly, not cost-effective in the treatment of large wastewater volumes. That is why, in the last few years, considerable attention has been paid to low-cost biosorbents-as an alternative to reduce the cost of adsorption systems.

Many naturally occurring polymeric materials (from marine waste) have been investigated for assessing their suitability in controlling water pollution. Among them chitosan, a hydrophilic natural polymer produced by alkaline de-acetylation of chitin is chosen for this study. It is characterized by a high content of nitrogen present as amine groups capable of adsorbing the metal ions through several mechanisms – including chemical interactions, such as chelation, electrostatic interactions or ion-exchange. Several studies have shown that chitosan is very efficient in removing various toxic and strategic metals, such as chromium, cadmium, mercury, molybdenum, uranium, vanadium, platinum and palladium [12],[13].

The present study is undertaken with the following objectives: (1) to prepare chitosan coated carbon by increasing the times of coating from 3 to 5 times and its characterization. (2) To investigate the use of chitosan coated carbon as an adsorbent for Cr(VI) and Cd(II); (3) to study the effect of different experimental parameters such as pH, adsorbent dose, and contact time, (4) to comprehensively evaluate the effect of several pretreatments on Cr(VI) and Cd(II) uptake by chitosan coated carbon adsorbent.

Experimental

Preparation of carbon

The coconut shell was broken into small pieces and ground well. This was burnt at a very high temperature for 2-3 hours. The surface of carbon obtained was activated by shaking the same with 7% sulphuric acid for 24 hours. The carbon was then washed several times with de-ionised water till there is no acid in the water. The sulphonated carbon was dried in hot air for over 5 hours at 110°C.

Surface coating of carbon with chitosan

About 400 ml of chitosan gel was diluted with water and heated to 40-50°C. About 400 g of activated coconut shell carbon was slowly added and mechanically agitated using a rotary shaker at 150 rpm for 24 hours. This gel coated activated carbon was washed with de-ionised water and dried. This process was repeated to get 1, 2, 3, 4 and 5th coating at chitosan on activated carbon. 3, 4 and 5th coating carbon were used for the studies.

Characterization

FTIR measurements of the prepared polymeric samples was recorded by Fourier transform infra-red spectrophotometer (FT-IR) using the Perkin Elmer 200 FTIR spectrophotometer, in the range of 400-4000 cm^{-1} at 25°C with a resolution of 4 cm^{-1} . The thermal analysis (TGA and DSC) was carried out on a Perkin Elmer thermal analysis instrument. For DSC analysis the pierced lid in the nitrogen atmosphere at a heating rate of 10° K/min was used. The XRD Pattern of the various polymeric blend samples were tested by an X-ray scattering SHIMADUZ XD-DI Diffractometer using Ni filter Cu K α radiation source ($\lambda=0.154\text{nm}$), set as scan rate =10°/min, using a voltage of 40kv and a current of 30mA.

Stock solution

A stock solution of chromium (VI) ions and cadmium (II) ions were prepared separately by dissolving the potassium dichromate and cadmium chloride of 200 mg each per liter using twice-distilled water and standardized after preparation. 1:1 hydrochloric acid and 1% sodium hydroxide solutions were used for pH adjustment. The exact concentration of each metal ion solution was calculated on mass basis and expressed in terms of mg L^{-1} . The required lower concentrations were prepared by dilution of the stock solution.

Adsorption experiments

Batch studies were performed with different concentrations of potassium dichromate to investigate the extent of adsorption. Synthetic solutions of Cr (VI) ions and Cd (II) ions were taken in separate stopper bottles and agitated with the chitosan coated carbon at 30°C in orbit shaker at a fixed speed of 160 rpm. The extent of heavy metal removal was investigated separately by changing the adsorption dose, contact time of shaking and changing the pH of the solution. After attaining the equilibrium, adsorbent was separated by filtration using filter paper and aqueous phase concentration of metal was determined with atomic adsorption spectrophotometer (Varian AAA 220FS).

Results and Discussion

FTIR:

FTIR data revealed very important information about the interaction and polymeric association between chitosan and carbon. All the samples demonstrated similar characteristic peaks showing that similar changes were taken place during the coating of carbon onto chitosan, as presented in the figures 1a – 1c. The FTIR spectrum of pure chitosan sample shows a predominant broad band at around 3440 cm^{-1} corresponding to the stretching vibration of O-H and N—H. The peaks at 2924 and 2846 cm^{-1} are typical of C—H stretch vibration, while peaks at ~1639, 1540 and 1317 cm^{-1} are characteristic of amides I, II and III, respectively and the bands at 1153 and 1088 cm^{-1} are indicative of C—O stretching vibrations of the glycoside linkage.

Now, on interpreting the FTIR spectra of chitosan coated carbon, the spectrum shows the absorption of both chitosan and carbon confirming the successful coating of chitosan using carbon. The bands at around 2924 cm^{-1} and 2857 cm^{-1} correspond to the asymmetric and symmetric stretching. The peaks in the range of 1628 cm^{-1} , 1151 cm^{-1} , 1383 cm^{-1} , 1017 cm^{-1} and 886 cm^{-1} were assigned to N-H bending, C-N stretching, O-H in plane bending, C-C-C Skeletal in the backbone and CH₃-C-OH stretching respectively. Bands around 652 cm^{-1} and 479 cm^{-1} indicate the presence of OH and C—C bending vibrations respectively.

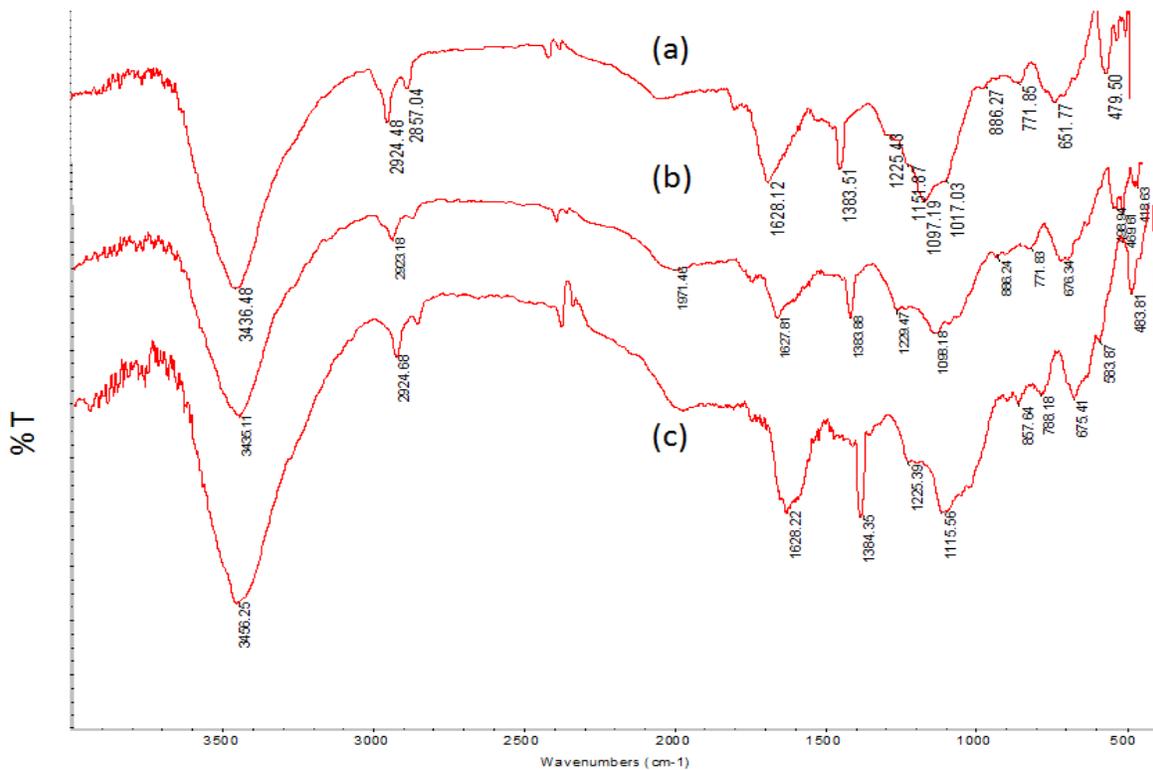


Figure 1: FTIR spectra of chitosan coated carbon (a) 3 times coated (b) 4 times coated (c) 5 times coated

DSC analysis

Figures 2a – 2c, represent the DSC details of chitosan coated carbon 3rd, 4th and 5th time. The effect of carbon coating onto the chitosan were reflected in the thermal behavior of the samples. DSC shows one broad endothermic peak for all the samples, at the temperatures of about 75.04°C, 75.04°C and 78.27°C indicating the crystallization temperature. This is due to the loss of water. The single glass transition temperature was observed at 163.31°C, 210.54°C and 180°C respectively showing the compatibility of the sample. On comparing the DSC curve of the prepared samples with pure chitosan, the samples show a shift in the glass transition temperature. From the above results, it is concluded that the coating of carbon onto the chitosan increases the thermal stability.

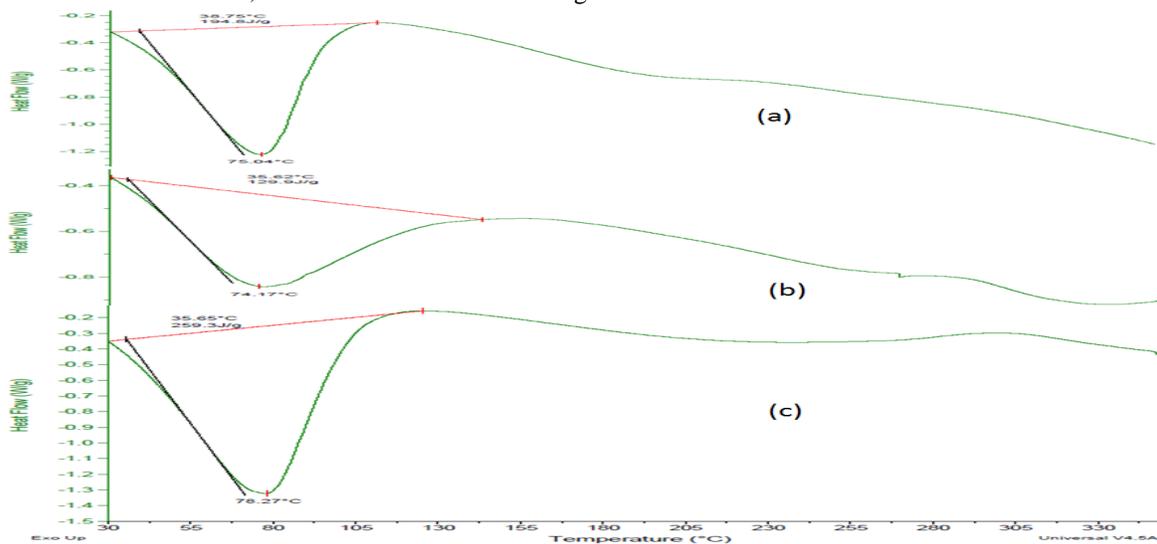


Figure 2: DSC of chitosan coated carbon (a) 3 times coated (b) 4 times coated (c) 5 times coated

TGA studies

The TGA thermogram details of chitosan coated carbon samples were represented in the Figures-3a – 3c. Generally, three stages of decomposition were attributed. The first stage of transition falls in the range of 30°C -110°C shows about 4 - 6% weight loss due to the evaporation of loosely bound water molecules from the samples. The second stage-a predominant one, was the maximum weight loss which had taken place indicating the breaking of the polymer structure. The maximum decomposition taking place at the temperature range from 150 to 450°C for the prepared samples chitosan coated with 3rd, 4th and 5th time using carbon, around

69.014%, 65.19% and 72.65% of the sample had disintegrated at the temperature of 789.96°C, 756.66°C and 743.28°C respectively. In the third stage, the breakdown of the polymeric backbone took place [14].

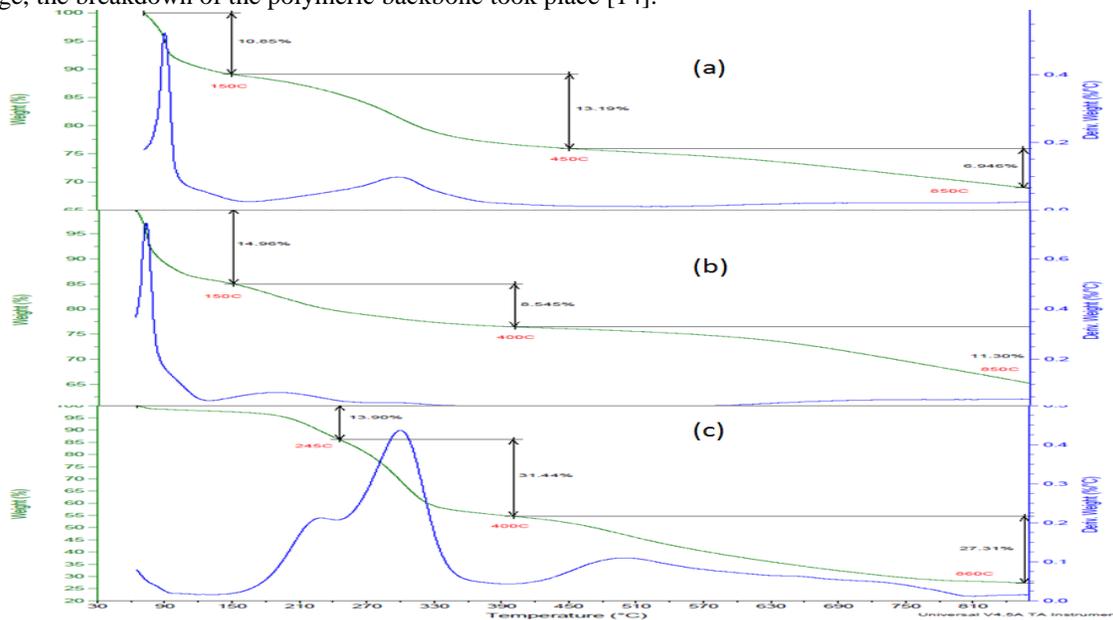


Figure 3: TGA of chitosan coated carbon (a) 3 times coated (b) 4 times coated (c) 5 times coated

XRD studies

Figure 4a – 4c displays the diffraction patterns of the chitosan coated carbon 3rd, 4th and 5th time. Similar strong reflections are observed for all the samples with $2\theta=24^\circ$ and 42° which is associated with the crystalline region. When compared to pure chitosan, the qualitative changes were observed, the 10° and 20° reflection for pure chitosan is absent confirming that the coated carbon onto chitosan changes the morphology. The broad peaks in the range of $16^\circ - 30^\circ$ and $35^\circ - 50^\circ$ shows samples having amorphous nature. The results indicate that there is a decrease in chitosan crystallization on coating with carbon. The decrease in the crystalline nature makes it the best adsorbent for the heavy metal remediation.

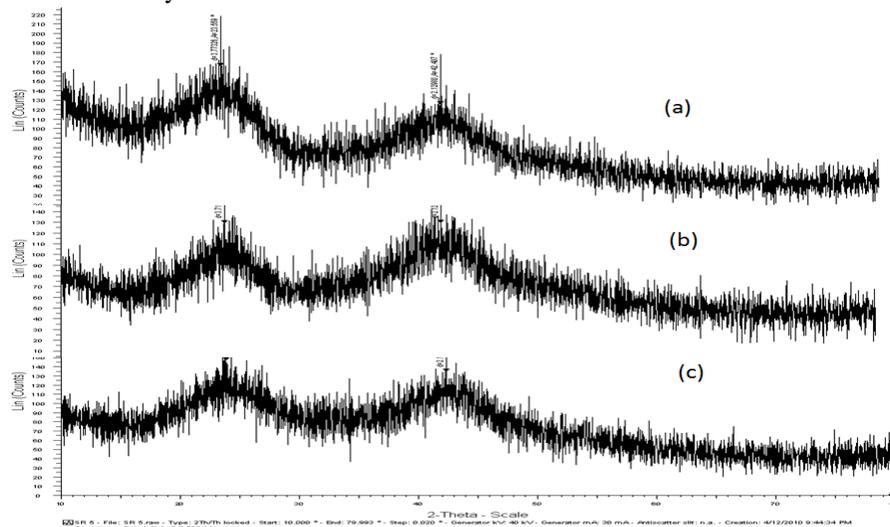


Figure 4: XRD of chitosan coated carbon (a) 3 times coated (b) 4 times coated (c) 5 times coated

Effect of contact time

It has been observed that at a constant concentration of metal ions and fixed amount of adsorbent, the adsorption efficiency increases with increasing the contact time up to a certain level and then it reaches the equilibrium. Fig.5 shows that adsorption rate first increased rapidly as the contact time increases, but after reaching the optimum time of about 300 min there is no significant increase. The effect may be due to the saturation of adsorption sites with metal ions on the solid particle. The optimum contact time

for chromium (VI) was 300 min. with 59.2% adsorption and 300 min. for cadmium (II) with 71.5% adsorption. The slight decrease in adsorption after optimum contact time may be due to the breakage of newly formed weak adsorption bonds due to constant shaking.

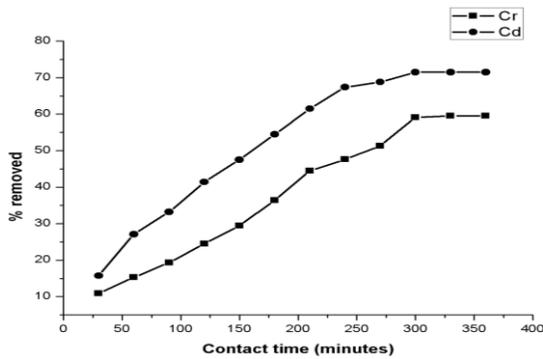


Figure 5: Effect of contact time

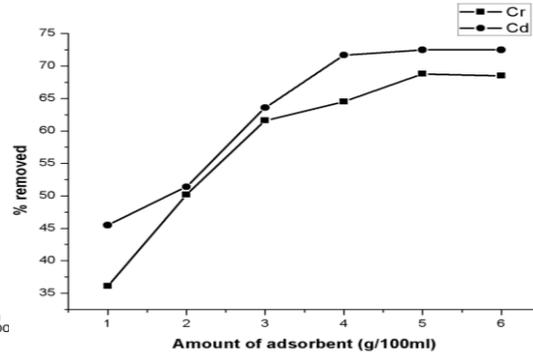


Figure 6: Effect of adsorbent dose

Effect of adsorption mass

The effect of the adsorbent dose was studied at room temperature by varying the sorbent amounts from 1 to 6 g. For all these runs, initial concentration of the metal ions was fixed. Figure 6 shows the adsorption of Cr(VI) and Cd(II) ions increase rapidly with increase in the amount of adsorbent due to greater availability of the surface area at higher concentration of the adsorbent. The significant increase in uptake was observed when the dose was increased from 1 to 4 g. Any further addition of the adsorbent beyond this, did not cause any significant change in the adsorption. This might be due to overlapping of adsorption sites as a result of overcrowding of the adsorbent particles. These results indicate that removal efficiency is directly related to the number of available adsorption sites. Once equilibrium is attained, there is no effect on adsorption efficiency.

Effect of pH

The adsorption process is strongly affected by the pH of the solution. The effect of pH change on adsorption was studied for both metals by changing the pH of the contents from 4-8, using dilute solutions of HCl and NaOH.

It has been observed from fig. 7 that maximum adsorption of both metals took place in acidic media. Maximum adsorption for Cr (VI) was observed at pH 5 and cadmium at pH 5.5. Published literature showed that at very high and very low pH values, the surface of adsorption was surrounded mainly by H^+ and OH^- ions. These positively and negatively charged ions may compete with the metal ions and as a result, adsorption decreases. That is why metal ions show low adsorption at very high and low pH [15]. On other hand, sometimes, precipitation of metal ions as hydroxide also occurs at high basic pH values, which is not feasible for good adsorption.

Influence of pH on adsorption phenomenon also related with the functional groups present on the bio-adsorbent. The potential binding sites on the bio-adsorbents might be carbohydrates, amino groups, hydroxide groups and carboxylic groups. These functional groups might dissociate or ionize at different pH values. So, the surface chemistry of the functional groups also play an important role in the adsorption process [16].

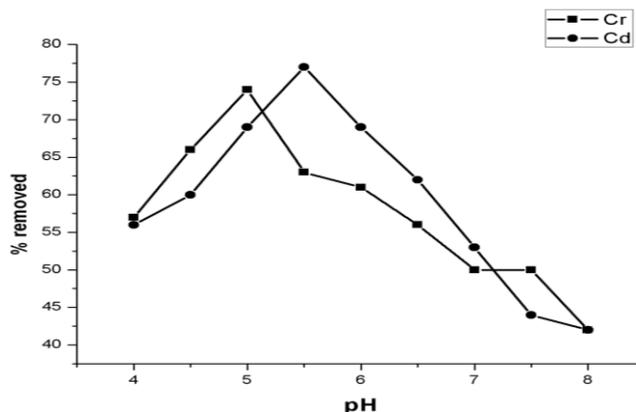


Figure 7: Effect of initial solution pH

Adsorption isotherms – Langmuir and Freundlich

The adsorption isotherm is fundamental in describing the interactive behavior between solutes and adsorbent [17],[18]. According to Ofomaja and Ho, the isotherm yields certain constant values, which express the surface properties and affinity of the adsorbent. It also plays an important role in the design of an adsorption system. The Langmuir and Freundlich models are often used to describe equilibrium adsorption isotherms. The most widely used Langmuir equation, is valid for monolayer sorption onto a surface with a finite number of identical sites. It is assumed that once a metal ion occupies a site, no further adsorption can take place at that site [19].

The Langmuir equation, which is also based on the assumption that there is no reaction between the molecules adsorbed on neighboring sites, is given by:

$$C_{eq}/C_{ads} = [1/Qb] + [C_{eq}/Q] \quad (1)$$

where Q is the maximum adsorption at monolayer ($mg\ g^{-1}$), C_{eq} is the equilibrium concentration of metal ions (ppm), C_{ads} is the amount of metal ions adsorbed per unit weight of chitosan coated carbon at equilibrium concentration ($mg\ g^{-1}$) and b is the Langmuir constant related to the affinity of binding sites ($ml\ mg^{-1}$) and is a measure of the energy of adsorption. A linearized plot of C_{eq}/C_{ads} against C_{eq} gives the Langmuir constant Q and b .

The widely used empirical Freundlich equation based on sorption on a heterogeneous surface is given by:

$$C_{ads} = K C_{eq}^{1/n} \quad (2)$$

The linearised form of this equation is expressed as

$$\log C_{ads} = 1/n \log C_{eq} + \log K \quad (3)$$

where K and n are Freundlich constants indicating adsorption capacity ($mg\ g^{-1}$) and intensity, respectively. K and n can be determined from a linear plot of $\log C_{ads}$ against $\log C_e$. The calculated results of the Langmuir and Freundlich isotherm constants are given in Table 1.

Table 1- Adsorption isotherm constant, C_{max} and correlation coefficients

Metal ions	Langmuir constants				Freundlich constants		
	K_L (dm^3/g)	b (dm^3/mg)	C_{max} (mg/g)	R^2	K	n	R^2
Cr(VI)	4.522	0.002745	1647.36	0.8107	0.2760	1.0735	0.9998
Cd(II)	3.648	0.004385	831.93	0.8496	0.3909	1.1299	0.9999

From the table, it is found that the adsorption of Cr (VI) and Cd (II) ions onto the adsorbent correlates well with the Freundlich equation as compared to Langmuir equation under the various concentration ranges studied. Also, the Freundlich constant n shows the feasibility of heterogeneous adsorption.

The essential features of a Langmuir isotherm can be expressed in terms of a dimensionless constant separation factor or equilibrium parameter, R_L that is used to predict if an adsorption system is “favourable” or “unfavourable” [20]. The separation factor, R_L is defined by:

$$R_L = 1 / (1 + bC_f)$$

where C_f is the final Cr (VI) concentration (ppm) and b is the Langmuir adsorption equilibrium constant ($ml\ mg^{-1}$). The parameter indicates the Effect of separation factor on isotherm shape

R_L value Type of isotherm

$R_L > 1$ Unfavourable

$R_L = 1$ Linear

$0 < R_L < 1$ Favourable

$R_L = 0$ Irreversible

according to Table 1 and 2 . The values of R_L calculated for different initial metal ion concentration are given in Table: 2. If the R_L values are in the range of $0 < R_L < 1$, it indicates that the adsorption of Cr (IV) and Cd (II) onto chitosan coated carbon is favourable. Thus, chitosan coated carbon is a favourable adsorbent.

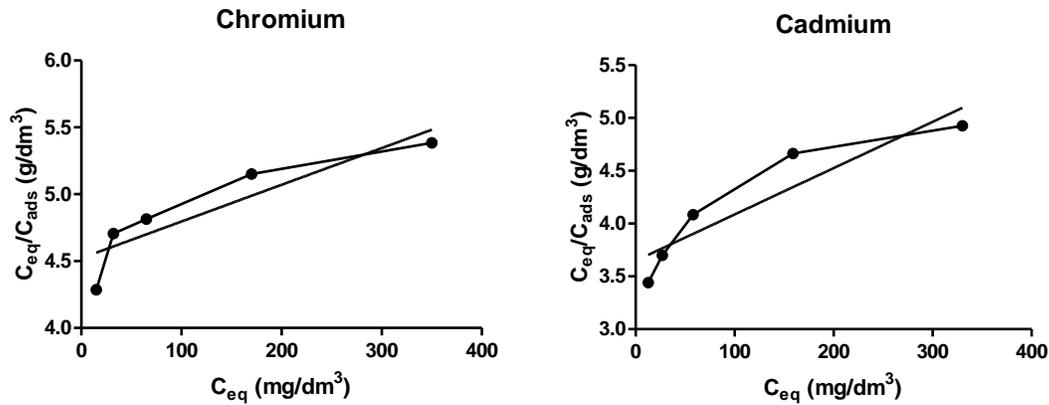


Figure 8: Langmuir isotherm for (a) Cr (VI) ion; (b) Cd (II) ion

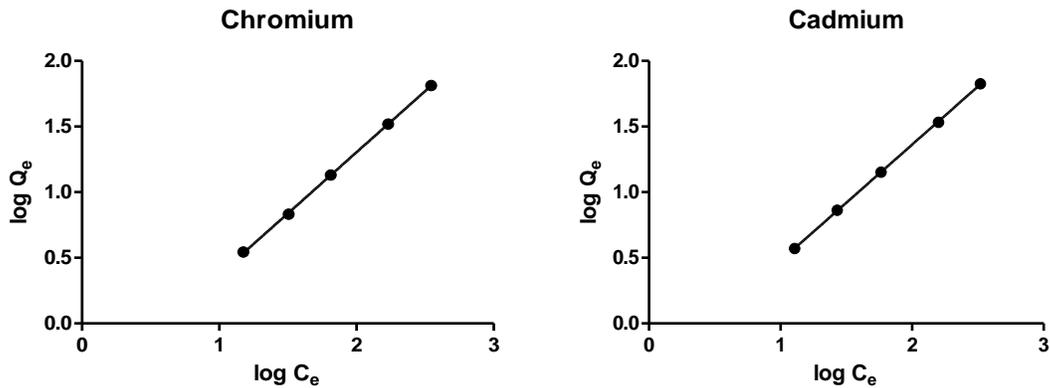


Figure 9: Freundlich isotherm for (a) Cr (VI) ion; (b) Cd (II) ion

Table 2 R_L values based on Langmuir adsorption

Metal ions	Initial concentration C_0 (mg/dm ³)	Final concentration C_f (mg/dm ³)	R_L values
Cr(VI) ion	1000	350	0.5100
	500	170	0.6818
	200	65	0.8486
	100	32	0.9192
	50	15	0.9604
Cd(II) ion	1000	330	0.4086
	500	159	0.5892
	200	58	0.7972
	100	27	0.8941
	50	12.8	0.9468

Kinetics Study:

The sorption data of Cr (VI) and Cd (II) uptake by chitosan coated carbon adsorbent is fitted using Lagergren pseudo-first-order model (Fig.10a and 10b) and pseudo-second-order model (Fig.11a and 11b). The linearized form of first order Lagergren equation is given as Eqn.4

$$\log(q_e - q_t) = \log q_e - \frac{k_{1,ads}}{2.303} t \quad (4)$$

The pseudo-second-order equation Eqn.5

$$\frac{t}{q} = \frac{1}{k_{2,ads} q_e^2} + \frac{t}{q_e} \quad (5)$$

where q_e is the mass of metal adsorbed at equilibrium (mg/g), q_t the mass of metal at time t (min.), $k_{1,ads}$ the first-order reaction rate of adsorption (per minute), $k_{2,ads}$ the pseudo-second-order rate constant of adsorption mg/g min⁻¹. A comparison between two kinetic models suggested (Table.3) that the coefficient of correlation (R^2) for the pseudo second-order kinetic model is much higher in comparison to pseudo-first-order model (2) the close agreement between the experimental q_e (mg/g) values and the estimated q_e (mg/g) values from pseudo second- order kinetic model. These facts obtained suggest that Cr and Cd kinetic data followed the pseudo-second order kinetic model which describes the biosorption as the rate limiting step [21].

Table 3 Comparison between Lagergren pseudo-first-order and pseudo-second-order kinetic models for Cr (VI) and Cd (II) sorption by chitosan coated carbon

Metal ion	Pseudo-first-order kinetic model			Experimental value	Pseudo-second-order kinetic model		
	q_e (mg/g)	k_1 (min^{-1})	R^2		q_e (mg/g)	k_2 ($\text{g mg}^{-1} \text{min}^{-1}$)	R^2
Cr(VI)	767.10	0.002924	0.9485	135	555.79	0.003217	0.7040
Cd(II)	505.70	0.004562	0.9665	148.8	206.95	0.004244	0.9757

Adsorption of Cr(VI) and Cd (II) onto chitosan coated carbon follows second order kinetics.

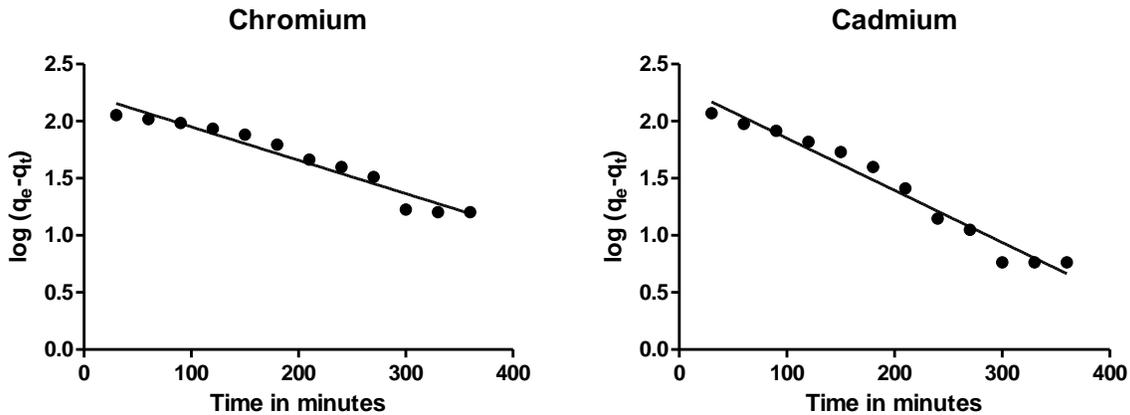


Figure 10: Pseudo-first-order kinetics plot (a) Cr (VI) ion; (b) Cd (II) ion

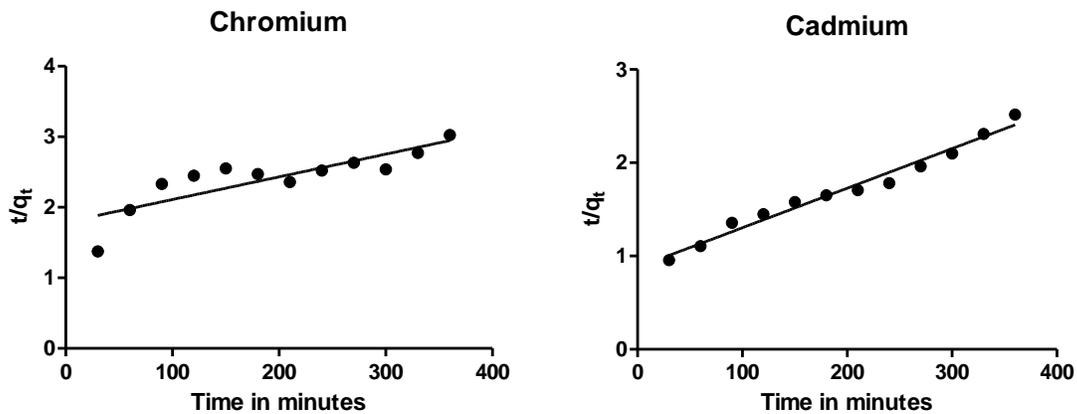


Figure 11: Pseudo-second-order kinetics plot (a) Cr (VI) ion; (b) Cd (II) ion

Free energy change (ΔG)

The change in the free Gibbs energy (ΔG) is calculated from the Langmuir constant using equation $\Delta G = -RT \ln K_L$ (where R is the universal gas constant (8.314 J/mol K), K_L is Langmuir constant and T is the absolute temperature). For Cr(VI) $K_L=4.522(\text{dm}^3/\text{g})$, and for Cd(II) $K_L= 3.648$. T= 25°C.

Hence, $\Delta G= -313.636$ KJ/mol for Cr (VI)

$\Delta G= -268.99$ KJ/mol for Cd (II)

The negative value of ΔG indicates that the adsorption process of Chromium (VI) and Cadmium (II) onto chitosan coated carbon is feasible and spontaneous.

Conclusion

The adsorption of Cr (VI) and Cd (II) ions from aqueous solutions onto chitosan coated carbon was investigated. The experiments were performed in batch system, at room temperature (25 ± 0.5 °C), on analyzing the effects of the following variables: initial solution, pH, contact time and chitosan dosage. The results lead to the following,

- The adsorption of Cr (VI) and Cd (II) onto chitosan coated carbon increases by changing the pH from acid towards neutral, while the optimum pH value for Cr (VI) removal is found to be 5.0 and for Cd (II) was found to be 5.5
- The equilibrium state of the interaction between chromium, cadmium ions and the chitosan coated carbon surface is reached after a 300 min contact time.
- The removal of both metals increases with the chitosan coated carbon dosage increase.
- The application of the Langmuir and Freundlich isotherm models for the mathematical description of Cr (VI) and Cd (II) adsorption shows that the Adsorption equilibrium data well fitted to Freundlich than the Langmuir isotherm, the maximum adsorption rate (C_{max}) – of 1647mg/g for Cr(VI) (C_{max}) – of 831.93mg/g and occurring under the experimental conditions studied.
- The negative value of the free Gibbs energy (ΔG), indicating that the adsorption process of both metal ions onto chitosan coated carbon is feasible and spontaneous.
- The adsorption process describes adequately Pseudo-second-order kinetics.

References

1. Marja E, Gonzalez R, Williams CJ, Gardiner PHE. *Environmental Science & Technology*, 2001, 35, 3025–3030.
2. Cossich ES, Tavares CRG, Ravagnani TMK. *E. Journal of Biotechnology*, 2002, 5(2), 133–140.
3. Barrera H, Nunez FU, Bilyeu B, Diaz CB. *Journal of Hazardous Materials*, 2006, 136, 846–853.
4. Deckert J. *Biometal.*, 2005, 18(5), 475–481
5. Kleszczewska E, Buraczek M, Lisowski P. *Przegl Lek.*, 2005, 62(10), 1067–1071.
6. Takiguchi M, Yoshihara S. *Environ Sci.*, 2006, 13(2), 107–116.
7. Rao MM, Ramesh A, Rao GPC, Seshiah K. *Jour. of hazardous material*, 2006, 129(1-3) 165–129.
8. Thevenod F. *Nephron Physiol.* 2003, 93(4), 87–93.
9. Plewka A, Plewka D, Nowaczyk G, Brzoska MM, Kaminski M, Moniuszko-Jakoniuk J. *Arch. Toxicol*, 2004, 78(4), 194–200.
10. Giaginis C, Gatzidou E, Theocharis S. *Toxicol Appl. Pharmacol.*, 2006, 13(3), 282–290.
11. Nadeem M, Mahmood A, Shaid SA, Shah SS, Khalid AM, McKay G. *J. Hazard. Mater.*, 2006, B138, 604–613.
12. Gerente C, Lee VKC, Lee P, McKay G. *Crit. Rev. Environ Sci. Technol.*, 2007, 37, 41–127.
13. Chang YH, Huang CF, Hsu WJ, Chang FC. *J. Appl. Polym. Sci.*, 2007, 104, 2896–2905.
14. Chen CH, Wang FY, Mao CF, Liao WT, Hsieh CD. *Int J Biol Macromol*, 2008, 43(1), 37–42.
15. Saeed A, Iqbal M. *Water Research.*, 2003, 37(14), 3472–80
16. Nadia Jamil. *Journals of the chemical society of Pakistan*, 2008, 31, No 3.
17. Chiou MS, Li HY. *Chemosphere*, 2003, 50, 1095.
18. Ofomaja AE, Ho YS. *Dyes Pigments*, 2007, 74, 60.
19. Ho YS, Huang CT, Huang HW (2002). *Process Biochem.* 2002, 37: 1421–1430.
20. Ngah WSW, Musa A. *Journal of Applied Polymer Science*, 1998, 69, 2305–2310.
21. HANIF, Muhammad Asif; NADEEM, Raziya; BHATTI, Haq Nawaz; AHMAD, Najum Rashid, ANSARI, Tariq Mahmood. *Journal of Hazardous Materials*, 2007, 139(2), 345–355.

Author's details

¹M.Soundarrajan

¹Research Scholar, Manonmaniam Sundaranar University, Tirunelveli, Tamil Nadu, India

Email: soundar1978@gmail.com

²T. Gomathi

²Department of Chemistry, DKM College for Women, Vellore 632001, Tamilnadu, India.

Email: chemist.goms@gmail.com; Mobile: +919894212668

^{2*}P.N. Sudha

^{*2}Department of Chemistry, DKM College for Women, Vellore 632001, Tamilnadu, India.

(*Corresponding author: Tel: (+91) 98429 10157; e-mail: drparsu8@gmail.com)

Sustainable Success

Dr. Vidhu Gaur

Assistant Professor, Alliance University, Bangalore

Abstract- Success is a sweet seven letter word much relished by one and all in their lives. People have been striving hard to achieve success in their chosen fields since time immemorial. Whilst a few had tasted real success, majority had to content with much less. This has been the story so far and may remain so in future too considering the competition, resources and opportunities available. Be that the case, striving is needed to gain anything worthwhile. Should that become a chore, habit, passion or an obsession depends on the mindset of the individual concerned. Many suffering from achievement syndrome believe that more work is the key to success. Time alone will reveal the truth of their belief. By that time, unfortunately, youth and even life would have ebbed away. This paper is an attempt to take a peep into the dynamics of achieving sustainable success and ecstasy in one's life – sooner than later.

Index Terms- Completeness, Master of Desires, Personal Effectiveness, Consciousness

I. INTRODUCTION

All the kings, rulers, leaders, corporate leaders, religious leaders, etc. have touted their own methods to reach success and thereby tried for their own levels of happiness. When own efforts failed, they sought the guidance of experts-gurus – consultants, networkers, brokers, connections, astrologers, and even spiritual gurus. The last category advocated very simple and direct methods which are found to be highly complicated by many viz. Learn to be free of stress, give up desires, reduce tension, live in the present, live and let live, embrace simplicity – then everything will be ok.

Here the skeptical mind is not able to accept these simple dictums. They need something esoteric and complicated, like *sheershasana*, hence their search continues for new books, training, gurus, places, hoping to get the pill, potion, mantra, method which will give them the key to success and thereby the happiness they clamor. Hence the search continues for the right key for success and happiness, which is another form of excellence and ecstasy. Today's generation has more opportunities, scope and ways to reach the pinnacle. Many are doing so. Our country has many millionaires and even a few billionaires. In the first 10 richest people in the world a few Indian names are seen. As the sky is the limit and the opportunities galore, the aiming high has become a routine in all the organizations and schools of grooming. In that process, often the aspect of spiritualism has given a go by leading to needless frustrations and lamentations. Many books are now focusing on soft skills and eventual happiness-ecstasy.

Many with everything with them seem to feel something is amiss. The growing number of divorces, attrition in organizations, discontent among the rich and affluent are

symptoms of the overall malaise among the so called successful in India and elsewhere. As the number of haves is bound to go up in the country, there is an urgent need to focus on the spiritual side to life also. As there is consensus that only a spiritual way of life will ensure a lasting happiness in this fragile world, exposing the finer aspects of life to the younger lot at an early stage will help them to lead an excellent and ecstatic life. The aim of this paper is to be a pointer in that direction and would cover points like personal effectiveness and excellence, happiness in life, grace from the supreme power, and looking ahead – Realistic outlook.

II. TRUE SUCCESS

Success in life is a topic that will attract the attention of everyone. A person is normally considered successful when he is able to fulfill his desires. So fulfilling desires is the first criteria of success. But then greed is another dimension of desire, which is not acceptable. In greed, cutting of corners is done to reach the goals. If a beggar desired a steel bowl as he is having a wooden bowl, it is a legitimate desire and he should strive to get one. But, if he steals one, then he is showing greed and that will be wrong. In other words, one should reach the goals not transgressing *Dharma*, Values, ethics as normally understood. When one fulfils the desires within the bounds of *Dharma*, one gets self approval and joy/happiness in life. If this is violated, there will not be any inner joy or peace of mind. This all of us know well. Commit a small crime; we all get agitated, thinking of the consequences, when exposed. That is what is referred to as lack of self approval. Further, to be successful, one should contribute to society. A mere consumer cannot be successful, as he is not putting back anything to the society. Through legitimate desires, ambitions, one should work hard to reach the goals that will lead to increase in products, productivity and joy in any society. No one is advocating eschewing desires in life.

Another related issue is failure in life. If achieving desires is the yardstick of success, not achieving tantamount to failures. Hence, so many stamp themselves as failure when they fail to achieve their self set goals. Some at the fag end of life say that their lives were a complete failure. This is not a correct stand. This need to be seen from the angle of fulfilling desires. Who on earth has fulfilled all his desires? Major portion of our desires remains unfulfilled. Yet we continued. Take the case. All of us desired when as children to score 100 out of 100 in all examinations, come out first in class, in competitions and what not. How many were realized? Did we stamp ourselves as failures then? No, we continued. Similarly some desires will be reached, some won't be reached. That won't make us successful or failures, more so failures. There is no need to resort to extreme actions, as being done by many. We must learn the right attitude. We should change the way of action to reach the goal. Stamping

oneself as failure is not the solution. One should have the humility to accept that we can only do action, but we cannot dictate results desired by us as that will come on its own and we should learn to accept the same in all humility to be truly successful. Managing a result of one's choice will bring in more problems than solutions. If one is hoping for peace, joy and success in the long run, no attempt should be made to transgress the boundaries of *Dharma*. When values are compromised, it will bring lasting problems to individuals, companies and even the country at large.

We should learn to manage desires, and that is the only way to lasting success. If we do not manage desires, desires will manage us. If we don't control the horses of a horse cart, horses will take us for a ride and the result will be doom. Managing desire is the way out. We are the master, and desires should be at our mercy. It is our privilege to have this desire or that. Fulfilling or not fulfilling is our wish. That in no way makes you a failure or success. We must remember that all opportunities and time should be used well knowing that once gone, many things won't come back like today, like school days, like youth, like opportunities, so use the present well. Another aspect is our deep desire to change one and all. All think they will be happy if they could change others – be it boss, spouse, children, parents, in laws, friends. It is futile to attempt to change others. Tell them, show them the way, but give them time and space to change at their pace. No need to pressurize or be impatient. Don't link your happiness with others changing the way you want. Seldom will that succeed. In sum, be a master of your desires, try to fulfill desires through value based living, that alone will give self approval/contentment, leading to a clean conscience/purity of mind which is very necessary for peace, happiness and joy. There is no quick fix to eventual success in life.

III. HAPPINESS

Be that the case, the quote from Bertrand Russell is worth pondering when he said "If there were in the world today any large number of people who desired their own happiness more than they desired the unhappiness of others, we could have paradise in a few years." What does this convey? Is that a correct evaluation of the events? Let us take a peep in to the history: We have read about the ways of people like Duryodhana, Ravana, Kansa etc, who with all the comforts and pomp/pleasure at hand resorted to such *adharmic*-unethical actions leading to total destruction of not only themselves, but also many innocent people. Can we say that they were concerned about their happiness while doing such deeds? Or did they think that by causing untold misery to others, they can have enjoyment and happiness? Recorded history shows that all such greats of different times have hit the dust sooner than later. But did those lessons give a message to the future generation? Can we say that thereafter and even now the people are focused on their happiness and working towards that?

All people have four dimensions in life – physical, mental, intellectual and spiritual. All their efforts can be brought under these four heads. There is no fifth head. It is necessary for those who are keen on happiness to repeatedly see whether their actions are in conformity with the needs of these dimensions. Take the case of one who is addicted to drug or alcohol. One can

safely say that the end will be near rather than far for such a person. Is he on a happiness trail or destruction trail that he can say even without any outside help? Like that many actions are detrimental to own and others happiness. Hence the observation of Russell. If we think on the theme there will be paradise on earth. But then who wants joy is the issue? It can be seen that many a time the people are not focused on happiness. They are not keen to discuss the subject, like exercise and health. Many say happiness is not a destination but a journey. They also add that if we make each moment happy, finally the life will be happy. If that is the way, then how many are focused on making everyday a happy day, every moment a joyful one, every meeting a pleasant one. Yes, there will be times, when one may not be able to consciously make the moment joyful, but what about other times. There is a lot of truth in the observation of Bertrand Russell. Remembering the spirit of that statement will help in achieving joy, peace and happiness to the individual, at least, provided that is the goal in life.

IV. SEARCH FOR SUCCESS

In this world, everyone wants to be successful. Everyone is in search of success. Where does this search end? This search ends when man does that which he has come to do in this world. Make yourself capable to complete the search for success. Success comes knocking at your door the moment you become capable of it. We hear many people say, "I want to be successful." Success is such a place where everyone wants to reach. They make it their aim. People have a notion about success that, only when they get everything will they attain success. But until one knows what success is, despite attaining it, one will still lead an unhappy life. Success will be very far away from us as long as we do not know ourselves. The moment we know ourselves, success will be very close to us. There is a time at 23.59.59 when we are very close to tomorrow. In a matter of a second, we enter into 'today'. Success is like that. The moment we understand ourselves, realize our own inner strengths, give proper direction to our thoughts, take advantage of the blessings bestowed by the Nature, at that moment, success will be very close to us. Thereafter, we begin to live in the present.

Many people do not become successful in their journeys to attain their aim. They leave the journey halfway through, as they do not know themselves. They are not able to believe in themselves. They lose their self-belief as a result of negative thoughts given by others. There are also some people, who come very close to success. But due to their patterns and tendencies they do not attain ultimate state despite being close to it. There are some who attain success, experience that state, but get stuck with questions like 'what next?' and lose that experience. They are unable to enjoy the present and keep thinking of the future. All these people did not have one thing by which they would have enjoyed success – positive thinking and understanding. When we attain this understanding, our thoughts, words, feelings and actions, all begin to work in the same direction. We enjoy the experience of fulfillment. If you attain that thinking and understanding, then you will realize that you are already successful. The first step to success is to understand the strength of our thoughts. Completeness and opening up are the two signs of success. The root secret of success could lie in the strength of

our thoughts, our words, wise discrimination (*vivek* – the ability to distinguish between truth and untruth), and our knowledge (that comes through ‘experience’).

V. THE SECRETS OF SUCCESS

Successful and unsuccessful are two types of people. The level of consciousness (*Chetana*) of the successful person is always high whereas, that of the unsuccessful person is always low. One is always happy; the other is always unhappy. Let us see what it is that makes the difference. Let us also understand as to what degree we are successful: and to what degree we are unsuccessful. If you learn the knack of being successful and imbibe the qualities required for success, then you will always lead a happy life and spread happiness. You will also become the cause for success for others. If you do not get rid the vice of failure then your life will be filled with darkness, unhappiness and become the cause for discomfort to others. Let us examine the characteristics of successful and unsuccessful people:

Accomplish Tasks

The first secret of success is to bring to light that which is not seen. This means to complete those jobs on time, which have not been completed. A successful person is one who does not fear work and whose motto is “Conclude the task.” His understanding tells him that on Earth one attains success only through those tasks that have been completed. Jobs that are half done are as good as not done. Labor and hard work is everyone’s duties as well as exercise. We can be successful only when we get rid of laziness and lethargy. The first pre-requisite of success is to accomplish tasks responsibly.

Right Feeling

Success is a feeling in your mind. If the mind is confident of success then this feeling of confidence will attract success towards you. A successful person constantly endeavors to make the required changes to circumstances and external situations. He is always on the look out to clear all obstacle and problems. In his mind there is no fear of failure or feeling of fear. He does not spend his lifetime waiting for changes to occur in circumstances or in the state of his mind. Instead, he fills his mind with the feeling of the joy of success. He engages himself in ‘creating’ an encouraging environment and a favorable inner state: “I will become successful very soon, not some day” is his song of success. The second secret of success is to fill you mind with the right feelings.

Control on Mood

The third secret of success is never to wait for a proper mood to come but to create it through instant action. A successful person never waits for the mood to start his work. He knows that once you start work mood will automatically come. The mood to work comes on its own. When not in a mood to work, increase the pace of your work. Walk fast, write fast, dial a phone number fast, bathe quickly, clean up quickly, and quickly keep transferring thing from one place to another. This speed will prevent the mind from becoming the slave of mood. Man becomes unsuccessful when he tends to become the slave of mood. He is unable to start his mental machine without mood.

Whereas the successful person is able to start his mind body mechanisms just like a machine. He keeps the remote control of his body with him. With just one command, his body starts working. An unsuccessful person gives his remote control to someone else, and forgets as to whom he has given it to. Every trivial thought can spoil his mood. The third secret of success is to keep your mood in your hand.

Identify Vices

The fourth secret of success is to bring to light your vices. The successful person does not leave any stone unturned in finding out his drawbacks. He becomes a professional in identifying his own drawbacks; where as in matters of his own praise he remains dumb and a novice. No one can be successful by hiding his own demerits from himself. A successful person would like to know about his mistakes from others. Some mistakes are such that you cannot spot them by yourself. But your well wishers can spot them. When his qualities are being praised and simultaneously information about his drawbacks is being given, he first gathers the information about his drawbacks. Good qualities, of course, will always be praised. However in the wake of this do not draw curtain on your vices. This is the fourth secret of success.

Focus on Solutions

A successful person always focuses on solutions to problems, on overcoming difficulties, and on answers to questions. He looks for the cause of problems within himself, and not outside. He does not shy away from responsibility by shifting the blame on to others. He does not blame fate actions of previous births, environment or the people around. He has stopped blaming ever since awareness came to him. An unsuccessful person always blames fate: “In my previous birth I committed some bad deeds for which I am now paying the price.” He relieves himself by taking refuge in such thoughts. He never ceases to blame and hence is always unsuccessful. The fifth secret of success is to listen to ‘consciousness’ and not to ‘blame’.

Courage

Man desires to live in comfort and security. In any new task, one feels uncomfortable and insecure; hence new work does not happen. Starting new work is the sixth secret of success. New does not happen, hence choose the new. Everyone anyway chooses the old. A successful person is a new person of a new era. He is always an experimentalist. He keeps on undertaking newer and newer experiments due to which he acquires the possibility of higher development. The fear of failure does not stop him from taking calculated risks. By taking calculated risks alone do new possibilities open up. Courage comes from taking calculated risks. Courage is the identity of success. An unsuccessful person always hesitates to take on new experiments. He forgets his childhood habit of experimenting. Success and courage are directly and deeply related. Hence, be brave to take up new work and attain success.

Enthusiasm

When a person talks about heaven, talks about it carelessly and unenthusiastically, his talks remind the listener of hell. When people talk about hell, giving it importance and with full of enthusiasm, from his talk the listener experiences heaven. Enthusiasm is the life of work. With the fire of enthusiasm, even boring work becomes lively. A successful person fills his fellow workers with inspiration through his enthusiasm. Thus by getting inspired from enthusiasm every person works in unison with others due to which success becomes certain in work. People nurturing the desire to attain success must remember this seventh secret of success. How does a successful person sustain his enthusiasm? He finds out a good aspect of every incident, due to which his enthusiasm never wanes.

Foresight

The eighth secret of success is to foresee all your possibilities through the power of contemplation. The one, who, by seeing the present situation anticipates the state of things to come, becomes ready for them in advance. A successful person, with several qualities, is also a visionary. This quality keeps him away from failure. He is always alert for every possibility. The unsuccessful, lazy and dull person lacks vision. He does not know the value of the present, nor can he anticipate the future by seeing the present. So practice foresight, and based on this begin to make yourself worthy.

Goal Oriented

Every small task in life is a small step taken towards success. Hence, do not look at your small jobs with disinterest. Bring interest in your very action. Link your every action with your aim. Before starting your work say to yourself, "This task, which I am going to perform, will take me towards my goal. Without this work, it is impossible to achieve my goal. Therefore, now I will take this work as a step towards my goal and will do it with interest." Even when you are having your food, you link the act of eating with your purpose by saying, "This food is meant to make my body healthy and to generate energy. This energy is very essential for my goal. I want to use this energy to attain my goal. Hence, I will eat this food in its appropriate quantity. By over-eating, I will not invite lethargy nor will I generate insufficient energy by eating less", He who desires success, believe that his every little task will take him towards his goal. He believes that his goal is his pilot. When our goal pilots our plane of life, the peak of success is easily scaled. The unsuccessful person performs each of his tasks without awareness or direction. He will have made unconsciousness his pilot. If you want to change the state of your life change the direction. Learn direction from the sunflower. The sunflower always faces the sun. Similarly, you must also, always face your aim.

Energy Savor

One who desires success must always ensure that his energy should not be wasted unnecessarily. Conservation and use of energy must take place in the right proportion. When a person is spending time in arguments, he is not only wasting time, but also his energy. If this energy was used in the right direction its fruits would have been borne in success. The application of energy in the wrong direction is equivalent to inviting failure.

The Tenth secret of success is to spend energy carefully. One should not waste his energy by indulging in unnecessary quarrels with others, in hate, jealousy, false ego, arguments and in getting lost in comparison. An alert person never involves himself in arguments and debates. In such a situation, he asks himself, "Is this argument more important than my goal?" By asking this question to himself, he raises the level of his consciousness and he also inspires others to refrain from unnecessary arguments. However, an unsuccessful person does not understand that we gain less and lose more from arguments and debates. In arguments we become unhappy and the level of our consciousness also goes down. Thus an unsuccessful person, by indulging in arguments, begins to lose even that which is left. When others try to look down upon a successful person, he never quarrels with them due to which the successful always remain successful.

Disciplined

A successful person does not stop on attaining success. He always works on the possibilities of the future. From this two benefits are obtained. First, one is able to see new possibilities and new successes. Second, the danger of slipping back is eliminated. The person, who stops after attaining success, who stops exploring new possibilities, is likely to fall behind. The person who is trying to go ahead, even if he is not able to do so, will at least not fall behind. New possibilities open up only when we learn from our detractors. If you are afraid of being criticized, then you will not attain greater success. Every successful person does not feel bad about being criticized behind his back. He analyses these criticisms and believes that these are for his development. Because he knows that no one kicks a dead animal. Only who is alive and successful is criticized. This criticism is freely available information. When an unsuccessful person is criticized behind his back he becomes disheartened. He gives a lot of importance to such criticism, and stops his work. He does not know that people, who criticize, are not disciplined. So we should always avoid criticizing others.

Improvement in Quality of Work

The best solution for success is to further improve your work, your service and the quality of the materials you sell. The urge to continuously do better work is a sign of success. Along with self-improvement one acquires the vision and knack of doing the work better. A progressive person knows that every work can be done in a better way. The secret of success is to do the present job in a better way. This belief works wonders in his life. The unsuccessful, non-progressive person does whatever he has been doing till now in the same old manner in which he had been doing it. From failure he learns to make excuses rather than learning to improve his work.

Innovative

The successful person exercises his thinking power to make it beneficial. He feeds his brain with innovative thoughts. Man does not make use of even 1/10th of his brain. 90% of the brain remains unutilized. To make maximum use of your brain, it needs exercise. Innovative thinking is food for the brain. Getting this food, man can easily make new creations. The unsuccessfully person keeps on recalling the undesirable

incidents from his memory bank and becomes disturbed. He allows the memories of unhappy incidents to get inside him and allows himself to be robbed of even his remaining level of consciousness, awareness and happiness. The successful person takes out inspiring incidents and thoughts of devotion from this bank, and increases his level of consciousness and happiness.

Wellbeing of Everyone

Some people attain success, but by felling and eliminating others. Such success gives birth to guilt in the future. A successful life belongs to one who, along with himself, has also kept in mind the success of others. The 'bright' successful person takes his decision from his heart (inner soul). His decisions are always for the wellbeing of everyone. He does only those jobs that feels right to his inner soul, which is the natural rule for attaining success. In this manner he will never have any guilt. To attain success, a greedy person does work through deception and trickery without listening to his inner voice. Due to this he bears the pain of guilt for the remainder of his life.

Careful Listening

The simple rule of success is, "Describe properly what you want. Then look for the person who has what you want. After finding such a person, ask him, and after asking him, implement what he says." The person who desires success always listens, very carefully, to people with a higher level of consciousness. At the same time, he does not cut short the talk of those with lesser degree of consciousness. He learns from everyone. He spends more time with people who are aware. Such a person easily attains success. The foolish and unsuccessful person constantly keeps on talking; He does not like to listen. He does not want to be in the company of people whose level is higher than his. He would want to always keep himself in an ever secure and safe environment thinking every slightly difficult task to be impossible, he searches for excuses for not doing them.

Good Habits

A person desirous of attaining success must always bear in mind the following:

1. Do not give advice without being asked for it. A person, who keeps giving unsolicited advice, is not given importance.
2. Be away from gossip and criticism of others. If you have to talk about others, talk about their positive aspects.
3. Devote some time towards collecting information: by this even boring subjects become entertaining and exciting.
4. Always be courteous, this pleases others. Due to this everyone becomes your friends.
5. Your enthusiasm and your liveliness should be reflected in your smile, the way you walk, talk and the way you work. An unsuccessful person does not engage himself in a boring subject. He walks at a dull pace, is unhappy and works without enthusiasm. Because of his ego, he even forgets to be courteous; as a result of which people dislike him.

Several solutions and secrets have been given above. You have to use all of them. After seeing so many things together, it is likely that the mind might look, for excuses. That is why you must tell your mind a small secret of success, "Start with little but today." This means we will begin to apply the formulae

detailed above from today itself, albeit in a small way. From today itself, start looking at some of your thoughts, actions, habits, drawbacks and dealings, today itself, remove your negative thoughts. Do little, but today itself. In this part, contemplate and implement the points that you understood and liked. Do not criticize the points that you did not like or felt to be illogical. Park them for some time. Just as you park your vehicle when not in use it, park such points. A time will definitely come when you will begin to like these points, and you will also be able to use them.

Attain completeness

You desire success means you desire completeness, because only the one who is complete is successful. What is completeness? "If you have a lot of money, a house, job, fame, power, art etc. only then can you be successful or complete..." Is it right if someone thinks so? Ask a person, who has all these things, "Are you successful? Are you complete?" In most cases in answer will be a 'NO', People expect satisfaction and happiness. Everyone desires completeness.

When you are about to leave town for a few days then you meet all the members of your family. In this process if you miss out even one person, you feel incomplete. At the station, at the last moment, you remember that person thinking, "He did not come to meet me. Meeting him remained incomplete. Even when far away, you will remember that person because you could not 'complete' without him. Incomplete jobs keep coming to your mind, since you are habituated to not completing things. When you sleep in the night, you get dreams. This is because man completes incomplete jobs in his dreams, so that the next day goes properly for him. If dreams stop, then the next day will get spoiled. If you, before going to sleep, cultivate the habit of asking yourself, whether there are any jobs incomplete for the day and if you get up at once and complete some of them, then you will see that, owing to the completing of the jobs, you sleep will change. You will begin to get sound sleep.

Decide and take decisions

According to others the definition of success and completeness are different. When you choose to do something, take a decision and start that work and complete it, then you are successful. You attain completeness when you decide to become a carpenter and become one. But others will not feel that you are successful. They will say you should become a doctor, or an engineer. They will not be satisfied since they had taken a decision about you. But you are successful when you become what you had decided for yourself.

Without 'positive thinking' no success is attained

Attain success with the power of thoughts. When you think, "I cannot do this work", you put a full stop to your thinking. When you think positively by saying, "In what way can I accomplish this task", you are giving an opportunity to your intellect to think. In this way, your intellect opens new ways for you. When the thought comes to your mind that, "I cannot purchase this thing", then immediately change it and think, "How can I buy this thing." Then start thinking on the way of buying it. In this way, the magic of optimistic outlook will start working in your life. A man's body from outside can be fat, learn, dark, fair,

short or tall. But, this does not make a difference in his ability to work, what makes the difference is only what his body is filled with – is it filled with the poison of negative thoughts, or the nectar of positive thoughts. This poison or the nectar alone decides the failure or a success of man. When you buy a box from the market, you don't buy it by seeing it from the outside, but by seeing what it contains. You will bring it only if its contents are useful. You will not buy a box whose contents you don't want or whose expiry date has passed. This is a matter of commonsense. In the same way, what is filled in every human being? What thoughts are there in him? That is important, what is filled inside him. If negative thoughts are filled in him, then these thoughts become a curse for him. So, do not leave your mind open to the influence of negative thoughts of others. When you start keeping positive thoughts, happy thoughts, it is the beginning of success.

VI. CONCLUSION

All crave for success and happiness in life. The means and methods may vary for different people or business but the final aim is more or less the same. This can be stretched to all fields of human endeavors, including achieving success and finally happiness. People are most certainly now seeking more meaning from their work and from their lives. There are increasing numbers of writers, gurus and now even a few business leaders who advocate greater love, compassion and spirituality for the formation and success of many very large and famous corporations. Some interpretations have a compassionate or spiritual foundation; others are quite rightly incorporated within wider issues of corporate social responsibility and ethical business. The paper deals with various dimensions of living for achieving excellence and success in human endeavors. Today, many of the finer aspects of life are given a go bye by the younger generation especially due to the fast paced life they are made to take up. Many so called seniors also have not been good role models, when it come to the important dimension of successful life and graceful living. Success means you desire completeness, because only the one who is complete is successful. One is successful when one becomes what he had decided for himself.

REFERENCES

- [1] Gaur, Vidhu (2012). 6th International Conference on Contemporary Business 2012 convened by IIT Delhi & Curtin University, Australia, A Refereed International Conference: Role of Inner Attributes in Improving Productivity. Delhi: IIT. Oct. 18-20, 2012.
- [2] Kalra, J. B. (2010). Self Motivation: Management and Motivating Concept. Delhi: M. S. Marknet, 127-190.
- [3] Mellowship, Dawn (2009). You can only Achieve What is Possible. Bhopal: Indra Publishing House, 1-213
- [4] Sirshree, Tejguru (2005). How to be ever Successful. Pune: Tej Gyan Foundation, 9-18.
- [5] Sirshree, Tejguru (2007). Self Encounter: Transformation. New Delhi: Macmillan, 13-46.
- [6] Sukh, Shammi (2001). How to Improve Productivity for Greater Profits. Mumbai: Better Yourself Books, 37-115.
- [7] Usha Sis. B. K. (2002). Self Managing Leadership. Mt. Abu: Literature Dept., 1-12.

- [8] Waite, Rob (2009). The Lost Art of General Management: Life Skills. Bhopal: Indra Publishing House, 93-120.

BIBLIOGRAPHICAL NOTES

Author, Dr. Vidhu Gaur, born on Aug. 29, 1981, is an eminent educationist with a doctorate degree in English Literature (PhD English) and a post graduate degree in Business Administration (MBA Marketing) and Communication Management (PGDCM). She is a member of Indian Society of Training & Development, Bangalore Chapter. She is currently employed with Alliance Business School, Alliance University, Bangalore as an Assistant Professor. She possess more than seven years of learning experience in taking and imparting education across the different states of India. Application based learning is the crux of what she teaches to students. She believes in opting for an inter-disciplinary approach for teaching and working.

AUTHORS

First Author – Dr. Vidhu Gaur, Assistant Professor, Alliance University, Bangalore, Email: vidhugaur@gmail.com
vidhu.g@alliance.edu.in

Review Paper on Various Filtering Techniques and Future Scope to Apply These on TEM Images

Garima Goyal¹, Ajay Kumar Bansal², Manish Singhal³

¹ Student-Mtech, Poornima College of Engineering

² Department of Electrical Engineering, Poornima College of Engineering

³ Department of Electronics & Communication Engineering, Poornima College of Engineering

Abstract- This is a review paper. Review is carried out in two directions. Firstly, a survey is done to know the work done on TEM images and secondly to know how and where the basic filters which led to the evolution of number of other filters are being used in number of applications over the years and the effect of these denoising filters on normal images over the years.

I. USAGE AND WORK DONE ON TEM IMAGES

The field of image processing has made significant progress in the quantitative analysis of biomedical images over the last 20 years. In certain domains, such as brain imaging, scientific papers that test clinical hypotheses using sophisticated image filtering and segmentation algorithms are not uncommon. Compared to the vast amount of research in medical imaging modalities such as MRI and CT, the number of scientific papers on electron microscopy applications in the image processing community has been very limited.

Tasdizen proposed an automatic method for estimating the illumination field using only image intensity gradients [1]. The computational analysis of neurons entail their segmentation and reconstruction from TEM images but is challenged by the heavily textured nature of cellular TEM images and typically low signal-to-noise ratios. Tasdizen proposed a new partial differential equation for enhancing the contrast and continuity of cell membranes in TEM images [2].

A microscopy image gets corrupted by noise, which may arise in the process of acquiring the image, or during its transmission, or even during reproduction of the image. Analysis and comparison of various filters were made on TEM image for denoising and was found that the performance of the Wiener Filter after de-noising for all Salt & Pepper, Poisson and Gaussian noise is better than Mean filter and Median filter. Also, the performance of the Median filter after de-noising for all Salt & Pepper noise is better than Mean filter and Wiener filter [3].

II. USE AND THE EFFECT OF VARIOUS DENOISING FILTERING TECHNIQUES OVER THE YEARS

In 1984, a method for removing impulse noises from images was proposed whereby the filtering scheme is based on replacing the central pixel value by the generalized mean value of all pixels inside a sliding window. The concepts of thresholding and complementation which are shown to improve the performance of the generalized mean filter are introduced. The threshold is derived using a statistical theory. The actual

performance of the proposed filter is compared with that of commonly used median filter by filtering noise corrupted real images. The hardware complexity of the two types of filters is compared indicating the advantages of the generalized mean filter [4].

By 1988, two algorithms using adaptive-length median filters are proposed for improving impulse-noise-removal performance for image processing. The algorithms achieved significantly better image quality than regular (fixed-length) median filters when the images are corrupted by impulse noise. One of the algorithms, when realized in hardware, requires rather simple additional circuitry. Both algorithms can easily be integrated into efficient hardware realizations for median filters [5].

By the beginning of 1995, a filter with variable window size for removal of impulses while preserving sharpness was proposed. The first one, called the ranked-order based adaptive median filter (RAMF), is based on a test for the presence of impulses in the center pixel itself followed by the test for the presence of residual impulses in the median filter output. The second one, called the impulse size based adaptive median filter (SAMF), is based on the detection of the size of the impulse noise. It is shown that the RAMF is superior to the nonlinear mean L₁ filter in removing positive and negative impulses while simultaneously preserving sharpness; the SAMF is superior to Lin's adaptive scheme because it is simpler and better performing in removing the high density of impulsive noise as well as non impulsive noise and in preserving fine details. Simulations on standard images confirmed that these algorithms are superior to standard median filter [6].

Two more fast algorithms were developed to compute a set of parameters, called Mi's, of weighted median filters for integer weights and real weights, respectively. The Mi's, which characterize the statistical properties of weighted median filters and are the critical parameters in designing optimal weighted median filters, are defined as the cardinality of the positive subsets of weighted median filters. The first algorithm, which is for integer weights, is about four times faster than the existing algorithm. The second algorithm, which applies for real weights, reduces the computational complexity significantly for many applications where the symmetric weight structures are assumed. Applications of these new algorithms include design of optimal weighted filters, computations of the output distributions, the output moments, and the rank selection probabilities, and evaluation of noise attenuation for weighted median filters [7].

In 1996 a novel median-type filter controlled by fuzzy rules was proposed in order to remove impulsive noises on signals

such as images. The filter was obtained as a weighted sum of the input signal and the output of the median filter, and the weight is set based on fuzzy rules concerning the states of the input signal sequence. Moreover, this weight is obtained optimally by a learning method, so that the mean square error of the filter output for some training signal data can be the minimum. Some results of image processing showed the high performance of this filter [8].

Givoanni in 1997 proposed the use of the median filter (MF) within the Bayesian framework which allowed to develop global methods for both image smoothing and image approximation by the MF 'roots'. Then a method for solving the approximation problem was proposed, which was based on stochastic optimization with constraints. Results of the proposed method for both simulated and real binary images were illustrated and compared to results from a known deterministic method [9].

New type of adaptive center weighted median filters was developed in year 2000 for impulsive noise reduction of an image without the degradation of an original signal. The weight in this filter is decided by the weight controller based on counter propagation networks. This controller classifies an input vector into some cluster according to its feature and gives the weight corresponding to the cluster. The parameters in the weight controller are adjustable by using the learning algorithm. The degradation of the original signal can be reduced by the proposed technique [10].

Vector median filter suitable for colour image processing was presented in 2001 and was based on a new ordering of vectors in the HSV colour space [11]. Weighted vector median filters (WVMF) emerged as a powerful tool for the non-linear processing of multi-components signals in 2002. These filters are parametrized by a set of N weights the two optimization techniques of these weights for colour image processing were introduced. Both approaches are evaluated by simulations related to the denoising of textured, or natural, colour images, in the presence of impulsive noise. Furthermore, as they are complementary, they are also tested when used together [12].

An effort was made in 2004 for improving the median-based filter to preserve image details while effectively suppressing impulsive noises and achieved its effect through a summation of the weighted output of the median filter and the related weighted input signal. The weights are set in accordance with the fuzzy rules. In order to design this weight function, a method to partition of the observation vector space and a learning approach are proposed so that the mean square error of the filter output can be minimum. Partition fuzzy filter provided excellent robustness with respect to various percentages of impulse noise in our testing examples and outperformed the present filters of the time in literature [13]. Then was developed the maximum-minimum exclusive median method to estimate the current pixel. Simulation results indicated that the proposed filter impressively outperforms other techniques in terms of noise suppression and detail preservation across a wide range of impulse noise corruption, ranging from 1% to 90% [14].

A new operator was introduced by Yuksel in year 2006 for removing impulse noise from digital images is presented. The proposed operator was a hybrid filter constructed by combining four center-weighted median filters (CWMF) with a simple

adaptive neuro-fuzzy inference system (ANFIS). The results showed that the proposed operator significantly outperforms the other operators and efficiently removes impulse noise from digital images without distorting image details and texture [15]. In the same direction a new adaptive center weighted median (ACWM) filter was proposed in 2007 for improving the performance of median-based filters, preserving image details while effectively suppressing impulsive noise. The noise filtering procedure is progressively applied through several iterations so that the mean square error of the output can be minimized [16]. Quing Hua Hang in 2008 showed that the median filters can be used for reducing interpolation error and improving the quality of 3D images in a freehand 3D ultrasound (US) system. Compared with the voxel nearest-neighbourhood (VNN) and distance-weighted (DW) interpolation methods, the four median filters reduced the interpolation error by 8.0–24.0% and 1.2–21.8%, respectively, when 1/4 to 5 [17].

The original switching median filter cannot detect the noise pixel whose value is close to its neighbors if the threshold is designed for emphasizing the detail preservation, so in 2009 was modified by adding one more noise detector to improve the capability of impulse noise removal based on the rank order arrangement of the pixels in the sliding window [18]. Yakup in 2010 showed that the performances of recursive impulse noise filters can be improved by the use of image rotation and fuzzy processing [19].

A two-phase median filter based iterative method for removing random-valued impulse noise was proposed in 2010. Simulation results indicated that the proposed method performs better than many well-known methods while preserving its simplicity [20]. Use of Median Filters are extended in year 2011 for denoising infrared images. Ozen in 2011 showed that Median filter can be used in fingerprint recognition algorithm [21]. Zhouping recently used medina gaussian filtering framework for noise removal in X-Ray microscopy image [22]. Directional weighted median filter is modified for denoising salt and pepper noise corrupted image [23]. Faster approach for noise reduction in infrared image is shown recently in January [24].

In 1961, Wiener spectra was inference from one dimensional measurements. An example was given of the use of this concept to extrapolate one-dimensional background measurements for calculation of discrimination for a scanning system [25]. A technique in 1969 for experimentally obtaining a system function satisfying the Wiener minimum mean squared error criterion was presented [26]. Wiener filtering assumes knowledge of the signal and noise autocorrelations or spectral densities. When this information is only approximately known, an optimum bounding filter can be designed for the Wiener problem. In 1975, Nahi, described the design of a filter in which the actual estimation error covariance is bounded by the covariance calculated by the estimator. Therefore, the estimator generates a bound on the unavailable actual error covariance and prevents its apparent divergence. The bounding filter can be designed to be of lower order than the Wiener filters associated with each possible set of signal and noise spectral density. Conditions for the design of the optimum (minimum mean-square-error) bounding filter within a permissible class of solutions are discussed. The same approach to the design of

bounding filters can be applied to a K/B filter version of the Wiener problem [27].

In 1979, general conditions are given for the optimality of non-linear Wiener filters which minimize the mean-square difference between the desired and actual filter outputs, which are a generalization of the Wiener-Hopf equation are applied to the Gaussian case and the kernels of the optimum realizable and unrealizable systems were derived [28]. For the estimation of a signal observed with additive white noise, Potter in 1991 showed that the optimum linear least-squares filter constrained to have its impulse response time-limited to the interval $[0, T]$ satisfies a truncated version of the Wiener-Hopf equation [29]. In 1983, the performance of Wiener filtering under spectral uncertainty was presented. For a variety of spectral uncertainty models the Wiener filter was shown to have undesirable sensitivity to even small deviations from those signal and noise spectral densities which were used to design the filter [30].

In 1990, Pancorbo showed the use of circular-aperture-like point spread function to restore scanning tunneling microscopy (STM) images [31]. The sensitivity of the inverse filter to noise is often thought to be the reason that inverse filter restorations of motion-blurred images are normally dominated by errors. In 1991 it was showed that even in the absence of noise, there is a large error component, called the edge error, that arises due to the fact that real images seldom have the periodicity implicitly assumed by discrete Fourier transform operation. The best restorations were obtained by subjecting the windowed-blurred image to a Wiener filter of large signal-to-noise ratio [32]. Use of wiener filter design for molecular bone imaging was introduced in 1993 [33]. A cumulant (higher-order statistics) based mean-square-error (MSE) criterion for the design of Wiener filters when both the given wide-sense stationary random signal $x(n)$ and the desired signal $d(n)$ are non-Gaussian and contaminated by Gaussian noise sources and was theoretically shown that the designed Wiener filter associated with the proposed criterion is identical to the conventional correlation (second-order statistics) based Wiener filter as if both $x(n)$ and $d(n)$ were noise-free measurements [34].

A new method based on transforming the Poisson noise into Gaussian additive noise, filtering the projections in blocks through the Wiener filter and performing the inverse transformation was presented. Results with real data indicated that this method gives superior results, as compared to conventional backprojection with the ramp filter, by taking into consideration both resolution and noise, through a mean square error criterion [35]. In order to enhance the defect in relation to background noise of large grained materials different algorithms have been developed.

Wiener filtering techniques have proved to be efficient for the SNR enhancement of ultrasonic signals coming from highly scattering materials. These processing algorithms are based on designing a filter that has large gain at frequencies where the SNR is high and low gain at frequencies where SNR is small. However, this technique does not consider two important ultrasonic effects: the finite-time duration of the flaw UT signal coming from a defect and the distortion of the frequency components of the traveling wave-front due to the dispersion. In this work, a time-frequency Wiener filter is proposed in 2002 that takes into account these two characteristics. Experimental

results are presented, showing that the proposed time-frequency algorithm has an excellent performance on SNR enhancement [36]. Standard Wiener filtering formulation requires an iterative estimation of the clean speech spectrum.

A non iterative faster algorithm was proposed in 2004, employing a time-varying noise suppression factor which is based on the frame-by-frame SNR, thereby the ability to suppress those parts of the degraded signal, where speech is not likely to be present and not to suppress, and hence not to distort the speech segments as much. Proposed method also outperformed well-known minimum mean-square error (MMSE) short-time spectral amplitude estimator technique in terms of subjective quality [37]. Khireddine in 2007 showed that the Wiener filter is a solution to the restoration problem based upon the hypothesized use of a linear filter and the minimum mean-square (or rms) error criterion [38]. A spectral filtering method based on hybrid wiener filter was presented in 2009 for speech enhancement [39]. Noise reduction is often formulated as a linear filtering problem in the frequency domain. With this formulation, the core issue of noise reduction becomes how to design an optimal frequency-domain filter that can significantly suppress noise without introducing perceptually noticeable speech distortion. While higher-order information can be used, most existing approaches use only second-order statistics to design the noise-reduction filter because they are relatively easier to estimate and are more reliable. Jacob in 2010 discussed the design of optimal and suboptimal noise reduction filters using both the variance and pseudo [40]. Juang utilized the Wiener filtering algorithm with pseudo-inverse technique with the key idea that the Wiener filtering algorithm can be used to process the given ultrasound signal by making the filtering less sensitive to slight changes in input conditions. And investigated the possibility of employing this approach for pre-processing ultrasound image application. When compared with median filter, mean filter and adaptive filter; the results revealed that the proposed method has the best noise filtering capability than other three methods [41].

Variation of Wiener filter was found useful for a variety of single-particle cryo-EM applications, including 3D reconstruction [42]. Recently, sub-band cross-correlation compensated Wiener filter combined with harmonic regeneration is used for speech enhancement [43], a combined multi channel wiener filter based noise reduction and dynamic range compression in hearing aids was presented [44].

In 1991 Fresh studied the wavelet transforms of self-similar random processes, of the kind assumed in the Kolmogorov (1941) theory of turbulence. It showed that, after suitable rescaling, the wavelet transform at a given position becomes a stationary random function of the logarithm of the scale argument in the transform [45]. An optical implementation of the wavelet and inverse wavelet transforms was introduced in 1992. Appropriate wavelets and their corresponding band-pass filters were selected for optical processing. A multichannel optical processing system with two gratings was set up to obtain image representation and image reconstruction [46]. The application of the wavelet transform in the determination of peak intensities in flow-injection analysis was studied in 1992 with regard to its properties of minimizing the effects of noise and baseline drift. The results indicated that for white noise and a favourable peak

shape a signal-to-noise ratio of 2 can be tolerated at the 5% error level, which means that a significant reduction in the detection limit can be obtained in comparison with the classical signal-processing methods. In this respect significant differences were observed for pure Gaussian and exponentially modified Gaussian peaks [47]. A non-parametric algorithm for detecting and locating corners of planar curves was proposed by Lee in 1993. The algorithm was based on the multiscale wavelet transform of the orientation of the curve which can effectively utilize both the information of local extrema positions and magnitudes of the transform results. Experiments depicted that our detector is more effective than the single scale corner detectors, while is more efficient than the multiscale corner detector by Rattaransi and Chin [48]. The wavelet transform gives information in both spatial and frequency domains and is a very useful tool for describing the hierarchical structures. Antoine showed that deconvolution can be done using filtered wavelet coefficients. By computing the wavelet from the point spread function, a new transform algorithm was found [49]. The basic concepts of the discrete wavelet transform (DWT) and the wavelet packet transform (WPT) were presented, illustrated and then applied to real and simulated signals. Different approaches to the WPT coefficients selection aiming at signal compression and denoising were described [50].

A method to optimize the parameters used in signal denoising in the wavelet domain was presented in 1999, based on cross-validation (CV) procedure, permits to select the best decomposition level and the best wavelet filter function to denoise a signal in the discrete wavelet domain [51]. The effectiveness of wavelet-based algorithms for data recovery was considered and a novel method based on coefficient de-noising according to WienerShrink method of wavelet thresholding was proposed in 1999. Simulation results highlighted the advantages of the de-noising method over the classical approaches based on the mean square error criterion [52]. In 2001 Dong applied Discrete wavelet transform to the electrochemical noise analysis (ENA). The experimental results demonstrated that the DWT could improve the calculation of the classic noise resistance R_n and spectrum noise resistance $R_{sn}(f)$ because it could remove the low frequency trend coupled in the potential or current fluctuations very well [53]. The presence of film grain often imposes the crucial quality choice between film enlargement and speed. An automatic technique was presented for reducing the amount of grain on film images. The technique reduced the noise by thresholding the wavelet components of the image with parameterised family of functions obtained with an initial training on a set of images [54].

In 2009 M.S. Reis introduced the methods of Fourier and wavelet analysis for enhancing the signal-to-noise ratio in typical chemometric and other measured data. Fourier analysis has been popular for many decades but is best suited for enhancing signals where most features are localized in frequency. In contrast, wavelet analysis is appropriate for signals that contain features localized in both time and frequency. It also retains the benefits of Fourier analysis such as orthogonality and computational efficiency. Practical algorithms for off-line and on-line denoising are described and compared via simple examples. These algorithms can be used for off-line or on-line data and can remove Gaussian as well as non-Gaussian noise. [55].

A New Wavelet-based image denoising using undecimated discrete wavelet transform and least squares support vector machine was proposed in 2010. Extensive experimental results demonstrated that this method can obtain better performances in terms of both subjective and objective evaluations than those state-of-the-art denoising techniques [56].

In Medical diagnosis operations such as feature extraction and object recognition will play the key role. These tasks will become difficult if the images are corrupted with noise. Many of the wavelet based denoising algorithms use DWT (Discrete Wavelet Transform) in the decomposition stage are suffering from shift variance and lack of directionality. To overcome a denoising method was proposed which uses dual tree complex wavelet transform to decompose the image and shrinkage operation to eliminate the noise from the noisy image. In the shrinkage step we used semi-soft and stein thresholding operators along with traditional hard and soft thresholding operators and verified the suitability of dual tree complex wavelet transform for the denoising of medical images. The results proved that the denoised image using DTCWT (Dual Tree Complex Wavelet Transform) have a better balance between smoothness and accuracy than the DWT and less redundant than UDWT (Undecimated Wavelet Transform). SSIM (Structural similarity index measure) along with PSNR (Peak signal to noise ratio) were used to assess the quality of denoised images [57].

An iterative fuzzy clustering technique was developed in 1985 for image segmentation. It was believed that this method represented an image segmentation scheme which can be used as a preprocessor for a multivalued logic based computer vision system [58]. T.L. Starting from ideas due to Zadeh and Sugeno Hans suggested two methods to transfer information given by fuzzy observations to fuzzy sets on the parameter region of a given explicit functional relationship: expected cardinality and fuzzy expectation [59]. The relationship between fuzzy information and Shannon's information based on the information equivalence between gray-tone images and half-tone images. Using this, the fuzzy membership function for gray level images was determined experimentally in 1988. These results showed that the membership function of gray levels has the form of an asymmetric S-function [60]. The formal rules which describe the behavior of a 'globally fuzzy' technique for image processing were discussed in 1994 [61].

Lee by the end of 1995 showed that how fuzzy reasoning techniques can be applied on smoothing filters design. It used the fuzzy concept to decide whether a pixel in an image is a noise one or not in order to achieve maximum noise reduction in uniform areas and preserve details as well [62]. In 1996, Kim showed that an additive fuzzy system can learn ellipsoidal fuzzy rule patches from a new pseudo-covariation matrix or measure of alpha-stable covariation. Mahalanobis distance gives a joint set function for the learned if-part fuzzy sets of the if-then rules. The joint set function preserves input correlations that factored set functions ignore. Competitive learning tunes the local means and pseudo-covariations of the alpha-stable statistics and thus tunes the fuzzy rules. Then the covariation rules can both predict nonlinear signals in impulsive noise and filter the impulsive noise in time-series data. The fuzzy system filtered such noise better than did a benchmark radial basis neural network [63].

A novel median-type filter controlled by fuzzy rules was proposed in order to remove impulsive noises on signals such as images. The filter was obtained as a weighted sum of the input signal and the output of the median filter, and the weight is set based on fuzzy rules concerning the states of the input signal sequence. Moreover, this weight is obtained optimally by a learning method, so that the mean square error of the filter output for some training signal data can be the minimum. Some results of image processing show the high performance of this filter [64]. A fuzzy filter for the removal of heavy additive impulse noise, called the weighted fuzzy mean (WFM) filter, is proposed in 1997. When noise probability exceeds 0.3, WFM gives very superior performance compared with conventional filters when evaluated by mean absolute error (MAE), mean square error (MSE) peak signal-to-noise-rate (PSNR) and subjective evaluation criteria. For dedicated hardware implementation, WFM is also much simpler than the conventional median filter [65]. On the design of multichannel filters, especially in color image restoration, it is not easy to simultaneously achieve three objectives: noise attenuation, chromaticity retention, and edges or details preservation.

In 1999, a new class of multichannel filters called adaptive fuzzy hybrid multichannel (AFHM) filters was presented. The AFHM filters are able to effectively inherit the merits of filtering behaviors of these three filters in color image restoration applications. This was the first paper to include human concept to design multichannel filters. Moreover, a faster convergence property of the learning algorithm is investigated to reduce the time complexity of the AFHM filters [66]. The problem of impulsive noise reduction in multichannel images was addressed in 2005. A new filter was proposed based on privileging the central pixel in each filtering window in order to replace it only when it is really noisy and preserve the original undistorted image structures. The new filter based on a novel fuzzy metric, created by combining the mentioned scheme and the fuzzy metric outperformed the classical-order statistics filtering techniques [67]. A new operator for removing impulse noise from digital images was presented. The proposed operator is a hybrid filter constructed by combining four center-weighted median filters (CWMF) with a simple adaptive neuro-fuzzy inference system (ANFIS). The fundamental advantage of the proposed operator over other operators in the literature is that it efficiently removes impulse noise while at the same time effectively preserves image details and texture [68].

The two step filtering method (entitled as Fuzzy Random Impulse Noise Reduction method (FRINR)) consisting of a fuzzy detection mechanism and a fuzzy filtering method to remove (random-valued) impulse noise from corrupted images was presented in 2007 [69]. A new impulse noise reduction method for colour images, called histogram-based fuzzy colour filter (HFC), was presented. The HFC filter is particularly effective for reducing high-impulse noise in digital images while preserving edge sharpness. Colour images that are corrupted with noise are generally filtered by applying a greyscale algorithm on each colour component separately. This approach causes artefacts especially on edge or texture pixels.

Vector-based filtering methods were successfully introduced to overcome this problem. Stefan in 2007 discussed an alternative technique so that no artefacts are introduced. The

main difference between the new proposed method and the classical vector-based methods is the usage of colour component differences for the detection of impulse noise and the preservation of the colour component differences [70,71]. Based on an integration of a simple impulse detector and a robust neuro-fuzzy (RNF) network, an effective impulse noise filter for color images was presented by Wang in 2008. It consisted of two modes of operation, namely, training and testing (filtering). The experimental results demonstrated that this filter not only has the abilities of noise attenuation and details preservation but also possesses desirable robustness and adaptive capabilities. It outperformed other conventional multichannel filters [72].

For the first time, a novel pixel classification method by using fuzzy logic and local gradients was introduced to discriminate noise and noise-free pixels from corrupted images. Then, a switching filtering scheme was employed to noisy images. Both numerical comparisons and perceptual observations are demonstrated in the experimental simulations. It was found that the proposed method achieves a fairly better performance than a number of other existing methods in noise reduction and image restoration [73]. Connected filters are widely used filters in image processing, and their implementation highly benefits from tree representations of images, called max-trees.

Extending these filters to fuzzy sets, which may be used to represent imprecision on gray levels in fuzzy gray-level images, requires frequent manipulations of these trees, Givoanni in 2010 proposed efficient algorithms to update tree representations of fuzzy sets according to modifications of the membership values. It was showed that any modification can be reduced to a series of simple changes, where only one pixel is modified at each step [74]. A fuzzy filter for the removal of random impulse noise in digital grayscale image sequences was presented by Tom in 2011. The filter consists of different noise detection and filtering steps, in which the fuzzy set theory is used. This noise detection is based both on spatial and on temporal information and has the aim to prevent the filtering of noise free image pixels. The filtering of the detected noisy pixels is finally performed in a motion compensated way [75]. A novel decision-based fuzzy averaging (DFA) filter consisting of a D-S (Dempster-Shafer) noise detector and a two-pass noise filtering mechanism was presented. A fuzzy averaging method, where the weights are constructed using a predefined fuzzy set, is developed to achieve noise cancellation. A simple second-pass filter was employed to improve the final filtering performance. Experimental results confirmed the effectiveness of the new DFA filter both in suppressing impulsive noise as well as a mix Gaussian and impulsive noise and in improving perceived image quality [76].

Madhu proposed a new fuzzy-based two-step filter for restoring images corrupted with additive noise. The goal of the first step was to compute the difference between the central pixel and its neighborhood in a selected window and to compute a fuzzy membership degree for each difference value using a Gaussian membership function. Computed fuzzy membership values are appropriately utilized as weights for each pixel and then computes the weighted average representing the modified value for the current central pixel. The second step was used as an augmented step to the first one and its goal is to improve the result obtained in the first step by reducing the noise in the color component differences without destroying the fine details of the

image. The experimental analysis showed that the proposed method gives better results compared to existing advanced filters for additive noise reduction. Both visual, quantitative and qualitative analysis have been done to prove the efficiency and effectiveness of the proposed method [77].

Most of the conventional median filters, process all the pixels without classifying whether it is noisy or noiseless. Recently, a method was proposed based on switching median filter. It consists of two stages namely detection stage and filtering stage. In the detection stage neighbourhood mapping based algorithm is used to detect the corrupted pixels. In the filtering stage, the corrupted pixels are filtered by using fuzzy membership function. The uncorrupted pixels are retained as such. The proposed method is compared with many existing algorithms. The proposed algorithm can restore images which are highly corrupted up to 90% noise density. Simulation results showed that the proposed switching median filter algorithm is better when compared to other existing techniques in terms of visual and quantitative measures such as PSNR, MSE, SSIM using MATLAB [78]. Low-dose CT imaging has been particularly used in modern medical practice for its advantage on reducing the radiation dose to patients. However, reconstructed images will distinctly degenerate along with the decrease of the radiation dose. A resolution is to deal with the noisy projection space by an effective filter. This study was performed to address this problem and a fuzzy-median filter was proposed in this paper according to the properties of the noise of low-dose CT images recently. Simulations also indicated that this spatially variant filter could suppress noise and obviously decrease streak artifacts in reconstructed images [79].

Approximate Gaussian filtering of equidistant data can be obtained by regularizing the data with Tikhonov's second order stabilizing functionals. The correspondence between the resulting cubic spline functions and Gaussian functions was first shown by Poggio. The impulse response arising from cubic spline approximation is however not positive everywhere. As an alternative, approximating cubic splines under tension was considered in 1989 by Johannes and a fast implementation was proposed that requires the same amount of calculations for all values of the spread [80]. The equivalence of minimum-norm least-squares solutions of systems of linear equations and standard iterative methods of solution is well established. On the other hand, while it is generally understood that truncated iteration is a form of regularization, comparatively few papers have formalized the relationship between direct methods of regularization and truncated iteration. A brief review of such papers was presented. It was proved that solutions by direct regularization are in fact identical to solutions of a certain type of truncated-iterative method, and conversely. This equivalence is proved by construction for a very general form of regularization method in which the coefficient matrix has full rank and is rectangular [81].

A global edge detection algorithm based on variational regularization was presented and analysed. The algorithm can also be viewed as an anisotropic diffusion method. These two quite different methods are thereby unified from the original outlook. This puts anisotropic diffusion, as a method in early vision, on more solid grounds; it is just as well founded as the well-accepted standard regularization techniques. The unification

also brings the anisotropic diffusion method an appealing sense of optimality, thereby intuitively explaining its extraordinary performance [82]. In 1992, a nonlinear regularized iterative image restoration algorithm was proposed, according to which no prior knowledge about the noise variance is assumed. The algorithm resulted from a set-theoretic regularization approach, where bounds of the stabilizing functional and the noise variance, which determine the regularization parameter, are updated at each iteration step. Sufficient conditions for the convergence of the algorithm, as well as an optimality criterion for the regularization parameter, are derived [83].

Layered architecture is proposed for solving a class of regularization problems in image processing. There are two major hurdles in the implementation of regularization filters with second or higher order smoothness constraints: (a)Stability: With second or higher order constraints, a direct implementation of a regularization filter necessitates negative conductance which, in turn, gives rise to stability problems. (b)Wiring Complexity: A direct implementation of an N-th order regularization filter requires wiring between every pair of k-th nearest nodes for all k, $1 \leq k \leq N$. Even though one of the authors managed to layout an $N = 2$ chip, the implementation of an $N \geq 3$ chip would be an extremely difficult, if not impossible, task. In 1993 the regularization filter architecture was which requires no negative conductance; and necessitates wiring only between nearest nodes [84].

In 1995, an improvement to the choice of the regularization parameter involved in a deconvolution procedure was proposed. It was based on a statistical model allowing a good estimation of the spectral signal-to-noise ratio [85]. In 1998, restoration of images that have several channels of information was considered. It used a probabilistic scheme which proved rather useful for image restoration and to incorporate into it an additional term which results in a better correlation between the color bands in the restored image. Results obtained so far are good; typically, there is a reduction of 20 to 40% in the mean square error, compared to standard restoration carried out separately on each color band [86]. In 1999, a modified version of classical regularization techniques. Instead of using regularization in order to reduce the measurement noise effect of cancelling the inverse filter singularities, and to restore the original signal, a prefiltering was performed before the regularization. This prefiltering was obtained by using a Wiener filter based on a particular modelization of the signal to be restored [87]. Hong introduced two new edge-preserving image compression approaches based on the wavelet transform and iterative constrained least square regularization approach in 2000, They utilize the edge information detected from the source image as a priori knowledge for the subsequent reconstruction. In addition, one of the approaches makes use of the spatial characteristics of wavelet coded images to enhance its restoration performance [88].

An inverse ill-posed problem was considered in 2002 coming from the area of dynamic magnetic resonance imaging (MRI), where high resolution images must be reconstructed from incomplete data sets collected in the Fourier domain. The behavior of some regularization methods such as the truncated singular value decomposition (TSVD), the Lavrent'yev regularization method and conjugate gradients (CG) type iterative methods were analyzed [89]. Color image processing is

an essential issue in computer vision. Variational formulations provide a framework for color image restoration, smoothing and segmentation problems. The solutions of variational models can be obtained by minimizing appropriate energy functions and this minimization is usually performed by continuous partial differential equations (PDEs). The problem is usually considered as a regularization matter which minimizes a smoothness plus a regularization term. In 2007, Olivier proposed a general discrete regularization framework defined on weighted graphs of arbitrary topologies which can be seen as a discrete analogue of classical regularization theory. The smoothness term of the regularization uses a discrete definition of the p-Laplace operator. With this formulation, families of fast and simple anisotropic linear and nonlinear filters which do not involve PDEs were used [90].

In 2009, for image restoration, edge-preserving regularization method was used to solve an optimization problem whose objective function has a data fidelity term and a regularization term, the two terms are balanced by a parameter λ . In some aspect, the value of λ determines the quality of images. A new model to estimate the parameter and propose an algorithm to solve the problem was established. The quality of images was improved by dividing it into some blocks [91]. Non-blind image deconvolution is a process that obtains a sharp latent image from a blurred image when a point spread function (PSF) is known. However, ringing and noise amplification are inevitable artifacts in image deconvolution since perfect PSF estimation is impossible. The conventional regularization to reduce these artifacts cannot preserve image details in the deconvolved image when PSF estimation error is large, so strong regularization is needed. A non-blind image deconvolution method was proposed which preserves image details, while suppressing ringing and noise artifacts by controlling regularization strength according to local characteristics of the image [92]. Stochastic regularized methods are quite advantageous in super-resolution (SR) image reconstruction problems. In the particular techniques, the SR problem is formulated by means of two terms, the data-fidelity term and the regularization term. The experimentation is carried out with the widely employed L2, L1, Huber and Lorentzian estimators for the data-fidelity term. The Tikhonov and Bilateral (B) Total Variation (TV) techniques are employed for the regularization term. The extracted conclusion is that in case the potential methods present common data-fidelity or regularization term, and frames are noiseless, the method which employs the most robust regularization or data-fidelity term should be used [93].

III. EFFECT OF DENOISING FILTERS ON NORMAL IMAGES OVER THE YEARS.

Tomasi and Manduchi proposed the bilateral filter in 1998 [94] as an appealing algorithm for noise removal from images. As such, this algorithm was posed as an alternative to locally adaptive well-known algorithms such as the anisotropic diffusion (AD), the weighted least-squares (WLS), and the robust estimation (RE) techniques. However, no theoretical background supporting the bilateral filter was suggested. Bayesian approach is also in the core of the bilateral filter, just as it has been for the AD, WLS, and RE.[95]. The magnified portion of the result with bilateral filtering is clearly less blurry than that of the result with

linear Gaussian filtering.[96]. If the weights are Gaussian, it can be expressed neatly as a Gaussian blur in an elevated space that encompasses both spatial location and intensity.[97] Double Bilateral filter has better performance in restoring images corrupted by the combination of Gaussian and impulse noise [98]. Bilateral filter give higher MSE when implemented and analyzed on medical images [99].

In image processing applications, linear filters tend to blur the edges and do not remove Gaussian and mixed Gaussian impulse noise effectively. Previously, a number of schemes have been proposed for Gaussian mitigation. Inherently noise removal from image introduces blurring in many cases [100]. The ideal approach is to apply the filtering technique only to noisy pixels, without changing the uncorrupted pixel values. Non-linear filters such as Adaptive Median Filter (AMF), decision-based or switching median filters [101], [102],[103] can be used for discriminating corrupted and uncorrupted pixels, and then apply the filtering technique. The performance of hybrid median filter is better than that of Lee, Kuan, Frost, Median, Truncated median filters [104]. Hybrid Max Filter performs significantly better than many other existing techniques and it gives the best results after successive iterations.[105]. Madu S. Nair applied median filter to R-, G-, and B-planes individually, and then combined to form the restored color image and the result proved much better than SMF, AMF and decision based median filters.[106].Median Filter performed satisfactorily on different medical images like MRI, Cancer, X-ray and Brain.[107].

The problem of noise reduction has attracted a considerable amount of research attention over the past several decades. Among the numerous techniques that were developed, the optimal Wiener filter can be considered as one of the most fundamental noise reduction approaches, which has been delineated in different forms and adopted in various applications [108]. Donoho presents a method for image denoising by thresholding the wavelet coefficients. He shows that this method is nearly minimax. Another denoising method in the wavelet domain consists of Wiener filtering the wavelet coefficients [109].Wiener filtering is applied on wavelet coefficients. This is with reference to [110, 111, 112] by Marian Kazubek. In this model we assume that the wavelet coefficients are conditionally independent Gaussian random variables. Wiener filter in the frequency domain is more effective than that in the space domain [113]. During the analysis of image denoising by discrete wavelet transform to study the suitability of various wavelet bases and different window sizes, it is found that modified Neighshrink gives better result than Neighshrink, Weiner filter and Visushrink [114].The performance of a Wiener filter in the wavelet domain surpass those of soft thresholding, hard thresholding, local wiener filter [115]. Denoising method based on non-local means with multi-scale dyadic wavelet transform is proposed to address the issue of image recovery from its noisy counterpart has proved much better performance than in comparison with the Wiener2, DWT-wiener, WCMS and Non-Local means algorithm [116]. The dual filtering algorithm, which is based on combination of two methods, the discrete wavelet transform and Wiener filter based group delay statistics performed good enough denoising ultrasonic signal [117]. The wavelet-based de-nosing algorithms using semi-soft thresholding

has given better performance intravascular ultrasound images [118].

The total variation has been introduced in Computer Vision first by Rudin, Osher and Fatemi [119], as a regularizing criterion for solving inverse problems. It has proved to be quite efficient for regularizing images without smoothing the boundaries of the objects. Antononin proposed a relaxation method, an alternative method that was able to handle the minimization of the minimum of several convex functionals [120]. Based on the CGM model, Chambolle (C) in [121] developed an efficient dual approach to minimize the scalar ROF model. C's algorithm is faster than CGM even if the convergence of C's scheme is linear and the CGM's scheme is quadratic. C's algorithm is faster because the cost per iteration to use CGM is higher (CGM needs to solve a linear system at each iteration).

A recent fast minimization algorithm for the scalar ROF model was proposed by Darbon and Sigelle (DS) in [122] based on graph cuts. Although C's algorithm is not as fast as the model of DS to solve the variational scalar ROF model, it is still fast and presents some advantages compared with CGM and DS. First, C's model use the exact scalar TV norm whereas CGM model regularizes it to minimize it. Then, the numerical scheme of [121] is straightforward to implement unlike the CGM and DS algorithms. Besides, the TV norm of DS is anisotropic whereas the TV norm of C is isotropic. Finally, we will see that the C's model extends nicely to color/vector images whereas the question of extension is open for the CGM model and the generalization of DS model to color images is not as efficient as in the scalar case.[123]. X. Bresson extended the Chambolle's model [121] to multidimensional/vectorial images. Unlike the proposed vectorial scheme does not regularize the VTV to minimize it. Finally, the numerical solution converges to the continuous minimizing solution in the vectorial BV space. This VTV minimization scheme to several standard applications such as deblurring, inpainting, decomposition, denoising on manifolds [124]. Paul proposed a simple but flexible method for solving the generalized vector-valued TV (VTV) functional with a non negativity constraint. One of the main features of this recursive algorithm is that it is based on multiplicative updates only and can be used to solve the denoising and deconvolution problems for vector-valued (color) images [125]. For the first time TV Regularization method was applied to fMRI data, and show that TV regularization is well suited to the purpose of brain mapping while being a powerful tool for brain decoding. Moreover, this article presents the first use of TV regularization for classification [126].

A new algorithm fuzzy histogram equalization (FHE), based on fuzzy sets and probability was presented which generates images which are sharper than the images produced by the classical approach of histogram equalization [127]. However, this technique is not very well suited to be implemented in consumer electronics, such as television, because the method tends to introduce unnecessary visual deterioration such as the saturation effect. One of the solutions to overcome this weakness is by preserving the mean brightness of the input image inside the output image. Ibrahim produced new method BPDHE which outperformed other mean brightness preserving histogram equalization methods and at the same time, maintained the mean input brightness [138].

A fuzzy filter for restoring color images corrupted with additive noise was proposed which produces better restoration of the color images compared to other filters which outperformed most of the conventional sharpening filters and other fuzzy filters to suppress multiplicative noise such as Salt & Pepper noise [129]. Brightness preserving methods are very high demand to the consumer electronic products but they tend to produce unwanted artifacts. Two methods were suggested by Chen Hee Oii to overcome these drawbacks. Both the methods outperform those conventional methods by producing clearer enhanced image with brightness and details preserving ability [129]. Many algorithms are proposed for fingerprint enhancement to improve the clarity of ridges and valleys of the input fingerprint image. The generated images are of improved quality with less noise [130, 131].

IV. CONCLUSION

This review paper shows that few filtering techniques namely bilateral filter, median filter, wavelets, wiener filter, ROF Filter, Fuzzy Filters are few of those which led to the evolution of number of other filters. Also, these filters are applied to the number of images and various imaging systems over the years and have been used in wide range of applications. So, there is scope that these filters can also be applied on nanoscopic TEM images as well.

REFERENCES

- [1] Tolga Tasdizen, Ross Whitaker, Robert Marc, Bryan Jones, "Automatic Correction of Non-uniform Illumination in Transmission Electron Microscopy Images", Scientific Computing and Imaging Institute, University of Utah.
- [2] Tasdizen T, Whitaker R, Marc R, Jones B., " Enhancement of cell boundaries in Transmission Electron Microscopy Images ", Proceeding in International Conference of Image Processing. 2005;2:129-132.
- [3] Pawan Patidar, Manoj Gupta, Sumit Srivastava, Ashok Kumar Nagawat, "Image Denoising by Various Filters for Different Noise", International Journal of Computer Applications (0975 - 8887),Volume 9- No.4, November 2010.
- [4] Kundu, Amlan and Mitra, Sanjit K. and Vaidyanathan, P. P. (1984). "Application of two-dimensional generalized mean filtering for removal of impulse noises from images", IEEE Transactions on Acoustics, Speech, and Signal Processing, 32 (3). pp. 600-609.]
- [5] H. M. Lin and A. N. Wilson, Jr., "Median filters with adaptive length," IEEE Trans. Circuits Svst., vol. 35, no. 6, June 1988.
- [6] H. Hwang and R. A. Haddad, "Adaptive Median Filters: New Algorithms and Results", IEEE Transactions on Image Processing, Vol. 4, No. 4, April 1995.
- [7] Ruikang Yang, Moncef Gabbouj, Yrjö Neuvo, "Fast algorithms for analyzing and designing weighted median filters", Signal Processing, Volume 41, Issue 2, January 1995, Pages 135-152.
- [8] Kaoru Arakawa, "Median filter based on fuzzy rules and its application to image restoration", Fuzzy Sets and Systems, Volume 77, Issue 1, 15 January 1996, Pages 3-13.
- [9] Giovanni Sebastiani, Sebastiano Stramaglia, "A Bayesian approach for the median filter in image processing", Signal Processing, Volume 62, Issue 3, November 1997, Pages 303-309.
- [10] Mitsuji Muneyasu, Nobutaka Nishi, Takao Hinamoto, "A new adaptive center weighted median filter using counter propagation networks", Journal of the Franklin Institute, Volume 337, Issue 5, August 2000, Pages 631-639.
- [11] M.I. Vardavoulia, I. Andreadis, Ph. Tsalides, "A new vector median filter for colour image processing", Pattern Recognition Letters, Volume 22, Issues 6-7, May 2001, Pages 675-689.

- [12] Laurent Lucat, Pierre Siohan, Dominique Barba, "Adaptive and global optimization methods for weighted vector median", *Signal Processing: Image Communication*, Volume 17, Issue 7, August 2002, Pages 509-524.
- [13] Tzu-Chao Lin, Pao-Ta Yu, "Partition fuzzy median filter based on fuzzy rules for image restoration", *Fuzzy Sets and Systems*, Volume 147, Issue 1, 1 October 2004, Pages 75-97.
- [14] Haixiang Xu, Guangxi Zhu, Haoyu Peng, Desheng Wang, "Adaptive fuzzy switching filter for images corrupted by impulse noise", *Pattern Recognition Letters*, Volume 25, Issue 15, November 2004, Pages 1657-1663.
- [15] M. Emin Yüksel, "A median/ANFIS filter for efficient restoration of digital images corrupted by impulse noise", *AEU - International Journal of Electronics and Communications*, Volume 60, Issue 9, 2 October 2006, Pages 628-637.
- [16] Tzu-Chao Lin, "A new adaptive center weighted median filter for suppressing impulsive noise in images", *Information Sciences*, Volume 177, Issue 4, 15 February 2007, Pages 1073-1087.
- [17] Qing-Hua Huang, Yong-Ping Zheng, "Volume reconstruction of freehand three-dimensional ultrasound using median filters", *Ultrasonics*, Volume 48, Issue 3, July 2008, Pages 182-192.
- [18] Chung-Chia Kang, Wen-June Wang, "Modified switching median filter with one more noise detector for impulse noise removal", *AEU - International Journal of Electronics and Communications*, Volume 63, Issue 11, November 2009, Pages 998-1004.
- [19] Yakup Yüksel, Mustafa Alçı, M. Emin Yüksel, "Performance enhancement of image impulse noise filters by image rotation and fuzzy processing", *AEU - International Journal of Electronics and Communications*, Volume 64, Issue 4, April 2010, Pages 329-338.
- [20] Jianjun Zhang, "An efficient median filter based method for removing random-valued impulse noise", *Digital Signal Processing*, Volume 20, Issue 4, July 2010, Pages 1010-1018.
- [21] Ayyüce M. Kızrak, Figen Özen, "A new median filter based fingerprint recognition algorithm", *Procedia Computer Science*, Volume 3, 2011, Pages 859-865.
- [22] Zhouping Wei, Jian Wang, Helen Nichol, Sheldon Wiebe, Dean Chapman, "A median-Gaussian filtering framework for Moiré pattern noise removal from X-ray microscopy image", *Micron*, Volume 43, Issues 2-3, February 2012, Pages 170-176.
- [23] Ching-Ta Lu, Tzu-Chun Chou, "Denoising of salt-and-pepper noise corrupted image using modified directional-weighted-median filter", *Pattern Recognition Letters*, Volume 33, Issue 10, 15 July 2012, Pages 1287-1295.
- [24] Chih-Lung Lin, Chih-Wei Kuo, Chih-Chin Lai, Ming-Dar Tsai, Yuan-Chang Chang, Hsu-Yung Cheng, "Novel approach to fast noise reduction of infrared image", *Infrared Physics & Technology*, Volume 54, Issue 1, January 2011, Pages 1-9.
- [25] J.A. Jamieson, "Inference of two-dimensional wiener spectra from one-dimensional measurements", *Infrared Physics*, Volume 1, Issue 2, July 1961, Pages 133-145.
- [26] W.L. Anderson, L.S. Berger, "Realization of a Wiener optical spatial filter", *Physics Letters A*, Volume 29, Issue 10, 11 August 1969, Pages 619-620.
- [27] N.E. Nahi, I.M. Weiss, "Optimum Wiener bounding filters in the presence of uncertainties", *Information and Control*, Volume 28, Issue 3, July 1975, Pages 179-191.
- [28] M. Rudko, D.D. Weiner, "Optimum non-linear Wiener filters", *Journal of the Franklin Institute*, Volume 308, Issue 1, July 1979, Pages 57-68.
- [29] J.M. Potter, B.D.O. Anderson, "Time-Limited Time-Invariant Wiener Filtering", *Information Sciences*, Volume 23, Issue 3, 1981, Pages 153-158.
- [30] Kenneth S. Vastola, H. Vincent Poor, "An analysis of the effects of spectral uncertainty on wiener filtering", *Automatica*, Volume 19, Issue 3, May 1983, Pages 289-293.
- [31] M. Pancorbo, E. Anguiano, A. Diaspro, M. Aguilar, "A Wiener filter with circular-aperture-like point spread function to restore scanning tunneling microscopy (STM) images", *Pattern Recognition Letters*, Volume 11, Issue 8, August 1990, Pages 553-556.
- [32] Hock Lim, Kah-Chye Tan, B.T.G Tan, "Edge errors in inverse and Wiener filter restorations of motion-blurred images and their windowing treatment", *CVGIP: Graphical Models and Image Processing*, Volume 53, Issue 2, March 1991, Pages 186-195.
- [33] Thomas E. Southard, Karin A. Southard, "Maxillary alveolar bone imaging: Wiener filter design", *Oral Surgery, Oral Medicine, Oral Pathology*, Volume 75, Issue 5, May 1993, Pages 645-649.
- [34] Chih-Chun Feng, Chong-Yung Chi, "Design of Wiener filters using a cumulant based MSE criterion", *Signal Processing*, Volume 54, Issue 1, October 1996, Pages 23-48.
- [35] Nelson D.A Mascarenhas, Cid A.N Santos, Paulo E Cruvinel, "Transmission tomography under Poisson noise using the Anscombe transformation and Wiener filtering of the projections", *Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment*, Volume 423, Issues 2-3, 1 March 1999, Pages 265-271.
- [36] M.A.G. Izquierdo, M.G. Hernández, O. Graullera, L.G. Ullate, "Time-frequency Wiener filtering for structural noise reduction", *Ultrasonics*, Volume 40, Issues 1-8, May 2002, Pages 259-261.
- [37] Spriet, M. Moonen, J. Wouters, "Spatially pre-processed speech distortion weighted multi-channel Wiener filtering for noise reduction", *Signal Processing*, Volume 84, Issue 12, December 2004, Pages 2367-2387.
- [38] Khireddine, K. Benmahammed, W. Puech, "Digital image restoration by Wiener filter in 2D case", *Advances in Engineering Software*, Volume 38, Issue 7, July 2007, Pages 513-516.
- [39] Huijun Ding, Ing Yann Soon, Soo Nee Koh, Chai Kiat Yeo, "A spectral filtering method based on hybrid wiener filters for speech enhancement", *Speech Communication*, Volume 51, Issue 3, March 2009, Pages 259-267.
- [40] Jacob Benesty, Jingdong Chen, Yiteng (Arden) Huang, "On widely linear Wiener and tradeoff filters for noise reduction", *Speech Communication*, Volume 52, Issue 5, May 2010, Pages 427-439.
- [41] Li-Hong Juang, Ming-Ni Wu, "Image noise reduction using Wiener filtering with pseudo-inverse", *Measurement*, Volume 43, Issue 10, December 2010, Pages 1649-1655.
- [42] Charles V. Sindelar, Nikolaus Grigorieff, "An adaptation of the Wiener filter suitable for analyzing images of isolated single particles", *Journal of Structural Biology*, Volume 176, Issue 1, October 2011, Pages 60-74.
- [43] Ch.V. Rama Rao, M.B. Rama Murthy, K. Srinivasa Rao, "Speech enhancement using sub-band cross-correlation compensated Wiener filter combined with harmonic regeneration", *AEU - International Journal of Electronics and Communications*, Volume 66, Issue 6, June 2012, Pages 459-464.
- [44] Kim Ngo, Ann Spriet, Marc Moonen, Jan Wouters, Søren Holdt Jensen "A combined multi-channel Wiener filter-based noise reduction and dynamic range compression in hearing aids", *Signal Processing*, Volume 92, Issue 2, February 2012, Pages 417-426.
- [45] M. Vergassola, U. Frisch, "Wavelet transforms of self-similar processes", *Physica D: Nonlinear Phenomena*, Volume 54, Issues 1-2, December 1991, Pages 58-64.
- [46] X.J. Lu, A. Katz, E.G. Kanterakis, Yao Li, Yan Zhang, N.P. Caviris, "Image analysis via optical wavelet transform", *Optics Communications*, Volume 92, Issues 4-6, 1 September 1992, Pages 337-345.
- [47] M. Bos, E. Hoogendam, "Wavelet transform for the evaluation of peak intensities in flow-injection analysis", *Analytica Chimica Acta*, Volume 267, Issue 1, 11 September 1992, Pages 73-80.
- [48] Jiann-Shu Lee, Yung-Nien Sun, Chin-Hsing Chen, Ching-Tsorng Tsai, "Wavelet based corner detection", *Pattern Recognition*, Volume 26, Issue 6, June 1993, Pages 853-865.
- [49] J.-P. Antoine, P. Carrette, R. Murenzi, B. Piette, "Image analysis with two-dimensional continuous wavelet transform", *Signal Processing*, Volume 31, Issue 3, April 1993, Pages 241-272.
- [50] B. Walczak, D.L. Massart, "Noise suppression and signal compression using the wavelet packet transform", *Chemometrics and Intelligent Laboratory Systems*, Volume 36, Issue 2, April 1997, Pages 81-94.
- [51] L. Pasti, B. Walczak, D.L. Massart, P. Reschiglian, "Optimization of signal denoising in discrete wavelet transform", *Chemometrics and Intelligent Laboratory Systems*, Volume 48, Issue 1, 14 June 1999, Pages 21-34.
- [52] A. Bakhtzad, A. Palazoglu, J.A. Romagnoli, "Process data de-noising using wavelet transform", *Intelligent Data Analysis*, Volume 3, Issue 4, October 1999, Pages 267-285.
- [53] Zehua Dong, Xingpeng Guo, Jiashen Zheng, Liming Xu, "Calculation of noise resistance by use of the discrete wavelets transform", *Electrochemistry Communications*, Volume 3, Issue 10, October 2001, Pages 561-565.

- [54] A De Stefano, P.R White, W.B Collis, "Film grain reduction on colour images using undecimated wavelet transform", *Image and Vision Computing*, Volume 22, Issue 11, 20 September 2004, Pages 873-882.
- [55] M.S. Reis, P.M. Saraiva, B.R. Bakshi, "Denoising and Signal-to-Noise Ratio Enhancement: Wavelet Transform and Fourier Transform", *Comprehensive Chemometrics*, 2009, Pages 25-55.
- [56] Xiang-Yang Wang, Hong-Ying Yang, Zhong-Kai Fu, "A New Wavelet-based image denoising using undecimated discrete wavelet transform and least squares support vector machine", *Expert Systems with Applications*, Volume 37, Issue 10, October 2010, Pages 7040-7049.
- [57] V. Naga Prudhvi Raj, T. Venkateswarlu, "Denoising of Medical Images Using Dual Tree Complex Wavelet Transform", *Procedia Technology*, Volume 4, 2012, Pages 238-244.
- [58] "Iterative fuzzy image segmentation", *Pattern Recognition*, Volume 18, Issue 2, 1985, Pages 131-138.
- [59] Hans Bandemer, "Evaluating explicit functional relationships from fuzzy observations", *Fuzzy Sets and Systems*, Volume 16, Issue 1, May 1985, Pages 41-52.
- [60] Wei-Xin Xie, Samuel D. Bedrosian, "Experimentally derived fuzzy membership function for gray level images", *Journal of the Franklin Institute*, Volume 325, Issue 2, 1988, Pages 155-164.
- [61] Fabrizio Russo, Giovanni Ramponi, "Nonlinear fuzzy operators for image processing", *Signal Processing*, Volume 38, Issue 3, August 1994, Pages 429-440.
- [62] Yih-Gong Lee, Yuang-Cheh Hsueh, "Fuzzy logic approach for removing noise", *Neurocomputing*, Volume 9, Issue 3, December 1995, Pages 349-355.
- [63] Hyun Mun Kim, Bart Kosko "Fuzzy prediction and filtering in impulsive noise", *Fuzzy Sets and Systems*, Volume 77, Issue 1, 15 January 1996, Pages 15-33.
- [64] Kaoru Arakawa, "Median filter based on fuzzy rules and its application to image restoration", *Fuzzy Sets and Systems*, Volume 77, Issue 1, 15 January 1996, Pages 3-13.
- [65] Chang-Shing Lee, Yau-Hwang Kuo, Pao-Ta Yu, "Weighted fuzzy mean filters for image processing", *Fuzzy Sets and Systems*, Volume 89, Issue 2, 16 July 1997, Pages 157-180.
- [66] Hung-Hsu Tsai, Pao-Ta Yu, "Adaptive fuzzy hybrid multichannel filters for removal of impulsive noise from color images", *Signal Processing*, Volume 74, Issue 2, April 1999, Pages 127-151.
- [67] Samuel Morillas, Valentín Gregori, Guillermo Peris-Fajarnés, Pedro Latorre, "A fast impulsive noise color image filter using fuzzy metrics", *Real-Time Imaging*, Volume 11, Issues 5-6, October-December 2005, Pages 417-428.
- [68] M. Emin Yüksel, "A median/ANFIS filter for efficient restoration of digital images corrupted by impulse noise", *AEU - International Journal of Electronics and Communications*, Volume 60, Issue 9, 2 October 2006, Pages 628-637.
- [69] Stefan Schulte, Valérie De Witte, Mike Nachtgeael, Dietrich Van der Weken, Etienne E. Kerre, "Fuzzy random impulse noise reduction method", *Fuzzy Sets and Systems*, Volume 158, Issue 3, 1 February 2007, Pages 270-283.
- [70] Stefan Schulte, Valérie De Witte, Mike Nachtgeael, Dietrich Van der Weken, Etienne E. Kerre, "Histogram-based fuzzy colour filter for image restoration", *Image and Vision Computing*, Volume 25, Issue 9, 1 September 2007, Pages 1377-1390.
- [71] Samuel Morillas, Valentín Gregori, Guillermo Peris-Fajarnés, Almanzor Sapena, "Local self-adaptive fuzzy filter for impulsive noise removal in color images", *Signal Processing*, Volume 88, Issue 2, February 2008, Pages 390-398.
- [72] Yueyang Li, Fu-Lai Chung, Shitong Wang, "A robust neuro-fuzzy network approach to impulse noise filtering for color images" *Applied Soft Computing*, Volume 8, Issue 2, March 2008, Pages 872-884.
- [73] Hsiang-Chieh Chen, Wen-June Wang, "Efficient impulse noise reduction via local directional gradients and fuzzy logic", *Fuzzy Sets and Systems*, Volume 160, Issue 13, 1 July 2009, Pages 1841-1857.
- [74] Giovanni Palma, Isabelle Bloch, Serge Muller, "Fast fuzzy connected filter implementation using max-tree", *Fuzzy Sets and Systems*, Volume 161, Issue 1, 1 January 2010, Pages 118-146
- [75] Tom Mélange, Mike Nachtgeael, Stefan Schulte, Etienne E. Kerre, "A fuzzy filter for the removal of random impulse noise in image sequences", *Image and Vision Computing*, Volume 29, Issue 6, May 2011, Pages 407-419
- [76] Tzu-Chao Lin, "Decision-based fuzzy image restoration for noise reduction based on evidence theory", *Expert Systems with Applications*, Volume 38, Issue 7, July 2011, Pages 8303-8310
- [77] Madhu S. Nair, G. Raju, "Additive noise removal using a novel fuzzy-based filter", *Computers & Electrical Engineering*, Volume 37, Issue 5, September 2011, Pages 644-655
- [78] V. Thirilogasundari, V. Suresh babu, S. Agatha Janet, "Fuzzy Based Salt and Pepper Noise Removal Using Adaptive Switching Median Filter", *Procedia Engineering*, Volume 38, 2012, Pages 2858-2865.
- [79] Zhi-guo Gui, Yi Liu, "Noise reduction for low-dose X-ray computed tomography with fuzzy filter", *Optik - International Journal for Light and Electron Optics*, Volume 123, Issue 13, July 2012, Pages 1207-1211.
- [80] Johannes P.F. D'Haeyer, "Gaussian filtering of images: A regularization approach", *Signal Processing*, Volume 18, Issue 2, October 1989, Pages 169-181.
- [81] Henry E. Fleming, "Equivalence of regularization and truncated iteration in the solution of ill-posed image reconstruction problems", *Linear Algebra and its Applications*, Volume 130, March 1990, Pages 133-150.
- [82] K. Niklas Nordström, "Biased anisotropic diffusion: a unified regularization and diffusion approach to edge detection", *Image and Vision Computing*, Volume 8, Issue 4, November 1990, Pages 318-327.
- [83] A.K. Katsaggelos, M.G. Kang, "Iterative evaluation of the regularization parameter in regularized image restoration", *Journal of Visual Communication and Image Representation*, Volume 3, Issue 4, December 1992, Pages 446-455.
- [84] Haruo Kobayashi, Takashi Matsumoto, Tetsuya Yagi, Takuji Shimmi, "Image processing regularization filters on layered architecture", *Neural Networks*, Volume 6, Issue 3, 1993, Pages 327-350.
- [85] S. Roques, K. Bouyoucef, L. Touzillier, J. Vignea, "Prior knowledge and multiscaling in statistical estimation of signal-to-noise ratio — Application to deconvolution regularization", *Signal Processing*, Volume 41, Issue 3, February 1995, Pages 395-401.
- [86] Daniel Keren, Anna Gotlib, "Denoising Color Images Using Regularization and Correlation Terms", *Journal of Visual Communication and Image Representation*, Volume 9, Issue 4, December 1998, Pages 352-365.
- [87] E. Sekko, G. Thomas, A. Boukrouche, "A deconvolution technique using optimal Wiener filtering and regularization", *Signal Processing*, Volume 72, Issue 1, 4 January 1999, Pages 23-32.
- [88] S.-W. Hong, P. Bao "An edge-preserving subband coding model based on non-adaptive and adaptive regularization", *Image and Vision Computing*, Volume 18, Issue 8, 15 May 2000, Pages 573-582.
- [89] E.Loli Piccolomini, F. Zama, G. Zanghirati, A. Formiconi, "Regularization methods in dynamic MRI", *Applied Mathematics and Computation*, Volume 132, Issues 2-3, 10 November 2002, Pages 325-339.
- [90] Olivier Lezoray, Abderrahim Elmoataz, Sébastien Boughleux, "Graph regularization for color image processing", *Computer Vision and Image Understanding*, Volume 107, Issues 1-2, July-August 2007, Pages 38-55.
- [91] Xiaojuan Gu, Li Gao, "A new method for parameter estimation of edge-preserving regularization in image restoration", *Journal of Computational and Applied Mathematics*, Volume 225, Issue 2, 15 March 2009, Pages 478-486.
- [92] Jong-Ho Lee, Yo-Sung Ho, "High-quality non-blind image deconvolution with adaptive regularization", *Journal of Visual Communication and Image Representation*, Volume 22, Issue 7, October 2011, Pages 653-663.
- [93] Antigoni Panagiotopoulou, Vassilis Anastassopoulos, "Super-resolution image reconstruction techniques: Trade-offs between the data-fidelity and regularization terms", *Information Fusion*, Volume 13, Issue 3, July 2012, Pages 185-195.
- [94] C. Tomasi and R. Manduchi, "Bilateral filtering for gray and color images," in *Proc. 6th Int. Conf. Computer Vision*, New Delhi, India, 1998, pp. 839-846.
- [95] M. Elad, "On the bilateral filter and ways to improve it", *IEEE Transactions on Image Processing*, vol.11, 1141-1151, 2002.
- [96] Qimei Hu, Xiangjian He and Jun Zhou Multi-Scale Edge Detection with Bilateral Filtering in Spirals Architecture Published in: *Proceeding VIP '05 Proceedings of the Pan-Sydney area workshop on Visual information processing* Pages 29-32 Australian Computer Society, Inc. Darlinghurst, Australia, Australia ©2004 table of contents ISBN:1-920682-18-X]

- [97] S. Paris, F. Durand, "A fast approximation of the bilateral filter using a signal processing approach", In Proc. European Conference on Computer Vision, 2006.
- [98] G.Vijaya V.Vasudevan A Novel Noise Reduction Method using Double Bilateral Filtering European Journal of Scientific Research ISSN 1450-216X Vol.46 No.3 (2010), pp.331-338
- [99] Ashish Verma, Bharti Sharma, "Comparative Analysis in Medical Imaging", International Journal of Computer Applications, (0975-8887) Volume1-No.13, 2010.
- [100]Ioannis Pitas, Anastasias N Venetsanopoulos. 1990. Nonlinear Digital Filters: Principles and Applications. NJ: Springer Publisher
- [101]H. Hwang and R. A. Haddad, "Adaptive median filters: New algorithms and results," IEEE Trans. Image Process., Vol. 4, No. 4, pp. 499–502, Apr. 1995.
- [102]S. Zhang and M. A. Karim, "A new impulse detector for switching median filters," IEEE Signal Process. Lett., Vol. 9, No. 11, pp. 360–363, Nov. 2002.
- [103] H.-L. Eng and K.-K. Ma, "Noise adaptive soft-switching median filter," IEEE Trans. Image Process., vol. 10, no. 2, pp. 242–251, Feb. 2001.
- [104]R. Vanithamani, G. Umamaheswari, M. Ezhilarasi, "Modified Hybrid Median Filter for Effective Salt & Pepper Reduction in Ultrasound Images" in Recent Advances in Networking, VLSI and Signal Processing.
- [105]Gnanambal Ilango, R. Marudhachalam, "New Hybrid Filtering Techniques for removal of Gaussian Noise from Medical Images" in ARPN Journal of Engineering and Applied Sciences, VOL. 6, NO. 2, FEBRUARY 2011, ISSN 1819-6608
- [106]Madhu S. Nair, K. Revathy, and Rao Tatavarti, "Removal of Salt-and Pepper Noise in Images:A New Decision-Based Algorithm" Proceedings of the International MultiConference of Engineers and Computer Scientists 2008 Vol I IMECS 2008, 19-21 March, 2008, Hong Kong.
- [107]Bhausahab Shinde, Dnyandeo Mhaske, Machindra Patare, A.R. Dani, "Apply Different Filtering Techniques to remove the Salt & Pepper Noise using Medical Images", Bhausahab Shinde, Dnyandeo Mhaske, Machindra Patare, A.R. Dani / International Journal of Engineering Research and Applications (IJERA), ISSN: 2248-9622 , Vol. 2, Issue 1,Jan-Feb 2012, pp.1071-1079
- [108]Simon Haykin, "Adaptive filter theory", Prentice Hall, 1996, ISBN 0-13-322760-X.
- [109]De-noising by soft-thresholding Donoho, D.L.; Information Theory, IEEE Transactions on , Volume: 41 ,Issue: 3 , May 1995 Pages: 613 – 627
- [110]Image Denoising via Wavelet-Domain Spatially Adaptive FIR Wiener Filtering Zhang, H.; Nosratinia,A.Wells, R.O., Jr.; Acoustics, Speech, and Signal Processing, 2000. ICASSP '00. Proceedings. 2000 IEEE International Conference on , Volume: 6 , 5-9 June 2000 Pages:2179 - 2182 vol.4
- [111] Denoising via block Wiener Filtering in wavelet domain, Strela, V.; Proc. Third European Congress of Mathematics, Progress in Mathematics series, Birkhauser Verlag, Barcelona (2000).
- [112] Wavelet domain image denoising by thresholding and Wiener filtering Kazubek, M.; Signal Processing Letters, IEEE , Volume: 10 , Issue: 11 , Nov. 2003
- [113]Hiroko Furuya, Shintaro Eda, Testuya Shimamura, "Image Restoration via Wiener Filtering in the Frequency Domain", WSEAS Transactions on Signal Processing
- [114] S.Kother Mohideen, Dr. S. Arumuga Perumal, Dr. M.Mohamed Sathik, "Image De-noising using Discrete Wavelet transform", IJCSNS International Journal of Computer Science and Network Security, VOL.8 No.1, January 2008
- [115]Nevine Jacob and Aline Martin "Image Denoising In The Wavelet Domain Using Wiener Filtering"
- [116]Gang Yu, Yong Yin, Hongjun Wang, Zhi Liu, Dengwang Li, "Image Denoising Based on Non-Local Means and Multi-scale Dyadic Wavelet Transform" Computer Science and Information Technology (ICCSIT), 2010 3rd IEEE International Conference on July 2010
- [117]Václav MATZ, Marcel KREIDL, Radislav ŠMID and Stanislav ŠTARMAN, "Ultrasonic Signal De-noising Using Dual Filtering Algorithm", 17th World Conference on Nondestructive Testing, 25-28 Oct 2008, Shanghai, China
- [118] H Lazrag, Ma Hamdi, Ms Naceur," Wavelet Filters Analysis for Salt & Pepper Reduction in Intravascular Ultrasound Images"
- [119]L.I. Rudin, S. Osher, and E. Fatemi, "Nonlinear total variation based noise removal algorithms," Physica D, Vol. 60, pp. 259–268, 1992.
- [120]Antonin Chambolle, Pierre-Louis Lions, "Image recovery via total variation minimization and related problems", Numer. Math. (1997) 76: 167–188
- [121]A. Chambolle. An Algorithm for Total Variation Minimization and Applications. Journal of Mathematical Imaging and Vision, 20(1-2):89–97, 2004.
- [122]J. Darbon and M. Sigelle. Image Restoration with Discrete Constrained Total Variation Part I: Fast and Exact Optimization. Journal of Mathematical Imaging and Vision, 26(3):277–291, 2006.
- [123]J. Darbon and S. Peyronnet. A Vectorial Self-Dual Morphological Filter based on Total Variation Minimization. In International Symposium on Visual Computing (ISVC), volume 3804, pages 388–395, 2005.
- [124]X. Bresson , T. F. Chan, "Fast Dual Minimization of the Vectorial Total Variation Norm & applications to Color Image Processing ", 2008, CAM Reports, UCLA Department of Mathematics.
- [125]Paul Rodriguez, "A Non-Negative Quadratic Programming Approach to Minimize the Generalized Vector-Valued Total Variation Functional", 18th European Signal Processing Conference (EUSIPCO-2010), Aalborg, Denmark, August 23-27, 2010
- [126]Vincent Michel, Alexandre Gramfort, Gaël Varoquaux, Evelyn Eger, Bertrand Thirion , "Total variation regularization for fMRI-based prediction of behaviour", Computer Vision and Pattern Recognition , IEEE Transactions on Medical Imaging (2011)
- [127]M. Schneider, M. Craig, On the use of fuzzy sets in histogram equalization, Fuzzy Sets and Systems, Volume 45, Issue 3, 10 February 1992, Pages 271-278, ISSN 0165-0114, 10.1016/0165-0114(92)90145-T.
- [128]Ibrahim, H.; Kong, N.S.P.; , "Brightness Preserving Dynamic Histogram Equalization for Image Contrast Enhancement," Consumer Electronics, IEEE Transactions on , vol.53, no.4 pp. 1752-1758, Nov. 2007
- [129]M.Wilscy and Madhu S. Nair, "Fuzzy Approach for Restoring Color Images Corrupted with Additive Noise", Proceedings of the World Congress on Engineering 2008 Vol I WCE 2008, July 2 - 4, 2008, London, U.K.
- [130]Chen Hee Ooi; Isa, N.A.M.; , "Adaptive contrast enhancement methods with brightness preserving," Consumer Electronics, IEEE Transactions on , vol.56, no.4, pp.2543-2551, November 2010
- [131]T.C. Raja Kumar, S. Arumuga Perumal, N. Krishnan3, and S. Kother Mohideen, "Fuzzy-based Histogram Modeling for Fingerprint Image Binarization", International Journal of Research and Reviews in Computer Science (IJRRCS) Vol. 2, No. 5, October 2011, ISSN: 2079-2557

AUTHORS

First Author – Aut Garima Goyal, Student-Mtech, Poornima College of Engineering, Email: goyal.garima18@gmail.com

Second Author – Ajay Kumar Bansal, Department of Electronics & Communication Engineering, Poornima College of Engineering, Email: ajayk.b007@gmail.com

Third Author – Manish Singhal, Department of Electrical Engineering Poornima College of Engineering, Email: manishsinghal@poornima.org

Factors Effecting Private Residential Prices in Mainland China during 2003-2009

Huinan Yan

Master of Business Administration Assumption University of Thailand

Abstract- This paper explores the most effective factors of housing price swings in recent years in Mainland China. According to the fundamental model of real estate market dynamics, housing prices together with 6 other ratios and figures were used. The sample covered 8 years from 2003 to 2009 and 31 administrative areas in Mainland China. Housing prices are considered as dependent variable, while income per capita, land prices, mortgage rates, density of population, unemployment rates, and savings are measured as independent variables. Multiple regression analysis was used for the investigation. To locate the fittest factors, both Panel Fixed Effect Model and Ordinary Least Square Model Newey-West HAC Modification were applied. The results of models indicated that the most effective factors affecting the housing prices are income per capita, land prices, and mortgage rates.

Index Terms- Housing prices, China administrative areas, real estate, metropolitan housing market, urban housing market, residential property market, income per capita, land prices, mortgage rates, density of population, unemployment rates, savings, multiple regression analysis, Panel Fixed Effect Model, Least Square Model.

I. INTRODUCTION

The first real estate company in China was founded in Beijing in the year 1980. Twelve years later, China experienced its first real estate boom for about a year. Thereafter, it suffered negative growth until the year 2000.

In the 21st century, the continuous urbanization and population movements increased the demand for housing, especially in major cities. The total value of China's residential housing market reached 91.5 trillion RMB at the end of 2009, which is nearly three times the size of China's NGDP in the same year.

In recent years, the commercial residential housing market prices (dependent variable of this research) significantly rose all over the country. Real estate prices for this market increased at a rate greater than the local economic growth and hit its peak in the year 2005.

There are various factors that can effect housing price changes in Mainland China. This research selects six independent variables and determines if there are any statistical relationship between them and housing prices changes. The six independent variables were concluded from fundamental model of housing price dynamics. And the data of six variables obtained from the National Bureau of Statistics of China (NBSC) are as follows:

1) Disposable income per capita

- 2) Land price changes
- 3) Mortgage rates
- 4) Density of population
- 5) Unemployment rates
- 6) Savings

The extent of this research covers a total of 7 years – from the year 2003 to 2009.

This research focuses on commercial housing market and not the property market as a whole. Therefore, properties used for purposes of industrial, business office, governmental and utility are excluded.

II. PREVIOUS STUDIES

DiPasquale & Wheaton (1996) defined real estate as the stock of buildings owned by a nation. These include the land where those buildings sit on and all vacant land.

Lizieri & MacGregor (2001) found that prices of residential market are determined by principles of supply and demand. It is a principle that the market always adapts to, and in this case, it is the real estate market. The supply and demand principle is further supported by the works of Quigley (1999); Case & Shiller (2003); Krainer (2005); Chen (2008).

There are various models used to determine housing prices dynamics. The model of interest here is the Fundamental Model. Some examples are GDP, rent, income, mortgage rate, tax rate, inflation rate, savings, market supply and demand, financial fluctuation and interest rate. The Fundamental model uses these determination variables to determine changes in housing prices. This model is supported by the researches of Quigley (1999); Hwang & Gary (2006). These researchers found correlations between several determination variables and fluctuations in housing prices.

With a higher level of disposable income, which is a determination variable in the fundamental model, there would be more demand for houses. Housing prices would increase in tandem to balance out the higher demand of potential house buyers. Herring & Wachter (1999) found that increases in housing prices were positively linked with real income growth. This correlation is also supported by the works of Case & Shiller (2003); Aziz (2006); Quigley (2009).

As the price of a piece of land increases, so will the total purchase price of a property on that said land. Additionally, an infrastructure that has recently been completed raises the value of the land retroactively. This rationale is supported by researches of Case & Shiller (2003); Bottelier (2010).

With a higher mortgage rate, properties that can be mortgaged would be depressed in order to entice buyers who are put off by high mortgage rates. Herring & Wachter (1999) found

that to be the case in Bangkok's property prices in 1995 when mortgage rates soared. McCarthy, Jonathan & Peach (2004) also support this notion in their research.

As a demographic factor, density of population is one of the key elements to determine the level of human settlement. A lower population density of neighborhoods would attract more house buyers in the vicinity. As a result, Yan & Knaap (2003) found a negative correlation between population density and housing values from previous market surveys. Aziz et al. (2006) found that real estate price swings were positively linked with the urban population rate in 7 developed countries. Kranier (2005) also stressed that there was an interesting relationship between demographic factors and home prices.

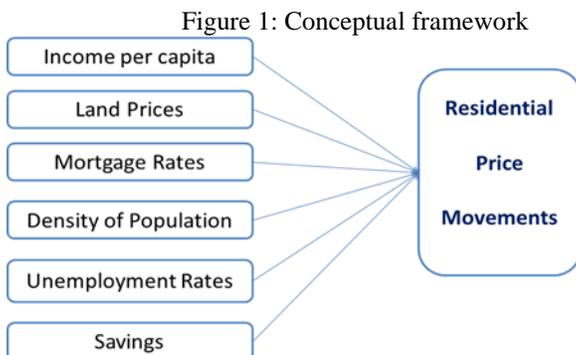
Another fundamental factor in question is unemployment rate. When the unemployment rate is high, there will be more people with less disposable income to make a house purchase. This hypothesis is supported by works of Herring & Wheaton (1996); Aziz et al. (2006).

Savings as defined by Todaro (1994) is the portion of disposable income not spent on consumption by households plus profits retained by firms. Since the purchase of a house can involve a large percentage of a household's savings, consumers need to save up a significant portion of their earnings to prepare for a purchase. As a result, higher savings would result in higher demand for properties. Gale & Sabelhaus (1999); Case & Shiller (2003) also found evidence that higher savings result in higher property prices.

III. RESEARCH FRAMEWORK

The majority of studies on the residential market adopted the fundamental model for their research analysis, such as, Malpezzi (1998), Meen (2002), Schnure (2005), and Abelson *et al.* (2005). The Fundamental Model (Gallin, 2008) assumes that the movements of the real estate market are defined by fundamental economic factors. In this research, the fundamental model is selected to determine the factors that have an effect on residential price movements.

The following figure shows the conceptual framework modified from the fundamental model to be used in this research.



Source: Constructed by author

RESEARCH METHODOLOGY

In this research secondary data was collected from the Chinese Yearbooks resource full-text database from years 2003

to 2010. This represented the market data from 2002 to 2009. The annual data are managed and published by the National Bureau of Statistic of China by which the China Central Government is represented. The researcher calculated and organized those data to match the fitness and reliability in to suit the framework's requirement.

SAMPLING PROCEDURES

The researcher used a target population which contained 31 administrative regions in Mainland China, based on geographical division. Those 31 regions are selected according to Divisions of Administrative Areas in China of the People's Republic Central Government. These 31 Administrative Areas include 22 Provinces, 5 Ethnic Minority Autonomous Regions and 4 Municipalities directly under the Central Government of People's Republic of China. Additionally, these 31 areas are controlled by the Communist Party of China, and have represent politics adopted by the China Central Government in 1949, in which year the People Republic of China was founded, up till now. The list of 31 Administrative Areas together with their code can be found in table 1 of the appendix.

DATA ANALYSIS

The researcher first conducts descriptive statistics analysis. The descriptive statistics analysis was based on each variable under the Mainland China housing market. The panel data collected a 7 year period with 31 cross-sections (administrative areas), in total 271 observations. Table 2 in the appendix shows the descriptive statistic results. All variables were measured in terms of the percentage changes in the value from the previous year's data.

Then, a multicollinearity test using the Ordinary Least Square method is applied. There will be a problem for multicollinearity when then the value of correlation is greater than 0.8 or lower than -0.8. The results can be found in table 3 in the appendix.

To check for stationarity of data, this research used the Augmented Dickey-Fuller Fisher (ADF-Fisher) unit root test to determine whether the residual of the cross-section equation exhibit a unit root. If p value > 0.05 (5%), the data is non-stationary. If p value ≤ 0.05 (5%), the data is stationary. The result of unit root test can be found in table 4 in the appendix.

Next, a multiple regression analysis was carried out to investigate the association among the indicators of housing market fundamental factors, utilising Ordinary Least Square Multiple Regression Models. To locate the most effective explanatory variables, two statistical methods were employed in this study. They are the Panel Fixed Effect Ordinary Least Square Model (fixed effect) and the Newer-West HAC (heteroscedasticity and autocorrelation consistent) standard Errors and Covariance Modification (Newer-West).

After checking for stationarity of data, the Panel Fixed Effect Ordinary Least Squares regression model with dummy variables was used to compute the data. The results are shown in table 5 in the appendix.

The second method, Least Squares Model with Newer-West HAC focused on the data structure and to determine the explainable factors. This model ignored the panel data function and emphasised on the time serial data function. Therefore,

before employing the regression, the serial correlation needed to be tested first.

This research used the Breusch-Godfrey Serial Correlation LM Test to detect how well the past fundamental values impact on the future house prices. When p value ≤ 0.05 (5%), there is no serial correlation amongst the residual orders. When p value > 0.05 (5%), there is serial correlation amongst the residual orders. The results of the serial correlation test can be found in table 6 in the appendix.

To solve the autocorrelation issue in the time serial dataset, the researcher adopted the Ordinary Least Square Newey-West standard error modification method. Since the sample size of 271 is fairly large, the researcher computed OLS with Newey-West procedure in Eviews to correct OLS standard errors, not only in situations of autocorrelation but also in cases of heteroscedasticity. The results of this test can be found in table 7 in the appendix.

Finally, the independent variables were tested against the dependent variable, which is house price.

IV. RESULTS AND DISCUSSIONS

The following are results of statistical treatment of data based on the conceptual framework of this research.

The researcher found that disposable income per capita highly contributed to house prices swings in Mainland China during the discovered period. The correlation between house prices and income per capita was proved by both of the statistical methods. The disposable income per capita was strong and positively related to house prices as well. Comparably, the disposable income per capita was the most powerful explanatory variable among all variables.

For the variable of land prices, the researcher found that land prices showed a significant increase along with the house prices uprising during the year 2003 to 2009 in Mainland China. The pair of the methods indicated the relationship between land prices and house prices was positive.

The researcher tested the correlation between mortgage rates and housing price changes and found that the mortgage rates were a considerable factor which influenced the housing prices in the research period. When the mortgage rates floated up 1 unit, the house prices had increased at least 4%.

For the next determination variable of density population, the researcher found that The Fixed Effect Model failed the null hypothesis and rejected the dynamic relationship between house prices and density of population. However, based on the stationary time serial data function, the Ordinary Least Square Newey-West HAC Modification proved the significant relationship in between these two predictors.

The next variable is unemployment. The findings of this research indicated that the unemployment rates failed to influence the housing prices movement. The results were identified by both static methods. The only significant finding here was that the unemployment rates were negatively associated with the Chinese mainland housing market prices dynamics.

The last variable is savings. The researcher found that variable saving was positively associated with residential property prices behaviors in Chinese mainland market in the

sample period. However, regardless of the evidence from none of the static methods, the correlation between the two indicators would not be proved. In other words, there was no statistically significant relationship between housing price changes and savings in Mainland China.

V. CONCLUSION AND RECOMMENDATIONS

In this research, several fundamental factors can influence price variance in residential market of Mainland China. On the demand side, income per capita, density of populations, banking mortgage rates, unemployment rates and savings have been shown to have effects on house prices. However, variables of unemployment rates and savings were insignificantly correlated with housing price dynamics in Mainland China.

On the supply side, attention has been paid to land prices. These findings were similar to the cross country study of OECD Economic working paper about recent house price developments (2005), which investigated evidence of each cointegrating vector in each of the eighteen countries examined.

The income growth alone explained the pattern of home price increases, especially in Beijing, Shanghai, and fast developing regions. Other factors included a negative correlation between house prices and changes in unemployment rates, which may reflect weaker consumer confidence in provinces that have experienced an increase in unemployment rates. However, the real interest lending rates (mortgage rates) appeared to be positively correlated with residential prices, which is the opposite expectation. This correlation may arise from the use of the consumer price index to derive real interest rates and to deflate real house prices, thereby giving rise to a spurious correlation. Density of population was negatively correlated with home prices. Savings were positively correlated with residential prices but were not statistically significant.

To the point of this research, the current residential market of Mainland China is the combination of high demand for residence and low perceived cost of homeownership. Structurally low mortgage rates, high income growth, stable savings, and lack of alternative investment and property policy all work to promote excessive residential price uprising.

Considering the intention of buying residence property, Chinese consumers are more alike natural buyers. In addition, the Chinese traditional view of wealth becomes a driving force of investing in residence. Moreover, from past experience of housing market, investing into property becomes an optimistic option for households of China. Indeed, there are less alternative investment options for Chinese investors who have stable savings and who prefer low risks.

This research attached importance to fundamental factors of housing prices. Due to the myriad of fundamental factors, there are many other factors that were not examined in this study. Future researches can be conducted with other fundamental factors not covered in this research. Additionally, China, as a single party communist country, may have policies that are unconventional and can skew consumer behavior in a way that may not follow the supply and demand principle. Future researchers can also put government policy into consideration when researching the Chinese real estate market.

APPENDIX

Table 1: 31 Administrative Areas

Provinces, Autonomous Regions and Municipalities	Code	Provinces, Autonomous Regions and Municipalities	Code
Beijing	001	Tianjin	002
Hebei	003	Shanxi	004
Inner Mongolia	005	Liaoning	006
Jilin	007	Heilongjiang	008
Shanghai	009	Jiangsu	010
Zhejiang	011	Anhui	012
Fujian	013	Jiangxi	014
Shandong	015	Henan	016
Hubei	017	Hunan	018
Guangdong	019	Guangxi	020
Hainan	021	Chongqing	022
Sichuan	023	Guizhou	024
Yunnan	025	Tibet	026
Shaaxi	027	Gansu	028
Qinghai	029	Ningxia	030
Xinjiang	031		

Source: Tabled by the author, information collected from National Bureau of Statistics of China.

Table 2: Descriptive Statistics

Variables	Mean	Median	Std. Dev.	Max.	Min.	Observations
House Price (HP)	0.1190	0.1218	0.1072	0.4563	-0.6012	217
Income per capita (INC)	0.1098	0.1095	0.0321	0.2191	-0.0534	217
Land Price (LP)	0.2247	0.2375	0.4286	2.4415	-1.7566	217
Mortgage (MORTG)	0.0257	0.2700	0.8306	0.7200	-1.8900	217
Density (DENS)	0.1403	0.0178	0.5467	3.4841	-1.9899	217
Unemployment (UNEMP)	-0.0246	-0.0100	0.2132	0.8100	-0.8800	217
Savings(SAV)	0.1573	0.1570	0.0530	0.2719	0.2719	217

Source: Eviews output, modified by author.

Table 3: Correlation Matrix of the Independent Variables

	INC	LP	MORT	DENS	UNEMP	SAV
INC	1.00	-0.09	-0.11	-0.08	-0.15	-0.13
LP	-0.09	1.00	-0.01	0.01	0.02	-0.12
MORT	-0.11	-0.01	1.00	0.16	-0.14	-0.71
DENS	-0.08	0.01	0.16	1.00	-0.06	-0.06
UNEMP	-0.15	0.02	-0.14	-0.06	1.00	0.14
SAV	-0.13	-0.12	-0.71	-0.06	0.14	1.00

Source: Eviews output, modified by author.

Table 4: Unit Root Test Output

Null Hypothesis	ADF-Fisher Test Statistic	Probability Value
HP	-6.8380	0.0000
INC	-5.1478	0.0000
LP	-6.0085	0.0000
MORT	-4.1737	0.0000
DENS	-6.5133	0.0000
UNEMP	-6.3276	0.0000
SAV	-5.5572	0.0000

Note: Test critical values at 5% level = -1.944105

Source: Eviews output, modified by author.

Table 5: Panel Fixed Effect

Cross-section fixed			
R-squared	0.2133	Mean dependent var	0.1190
Adjusted R-squared	0.0559	S.D. dependent var	0.1072
S.E. of regression	0.1042	Akaike info criterion	-1.5317
Sum squared resid	1.9528	Schwarz criterion	-0.9554
Log likelihood	203.1933	F-statistic	1.3555
Durbin-Watson stat	2.4249	Prob(F-statistic)	0.1018

Source: Eviews output, modified by author.

Table 6: Serial Correlation Test

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	5.0406	Prob. F(2,208)	0.0073
Obs*R-squared	10.0312	Prob. Chi-Square(2)	0.0066

Source: Eviews output, modified by author.

Table 7: Ordinary Least Square Newey-West HAC Modification HAC

Ordinary Least Squares (Newey-West)			
R-squared	0.1403	Mean dependent var	0.1190
Adjusted R-squared	0.1158	S.D. dependent var	0.1072
S.E. of regression	0.1008	Akaike info criterion	-1.7196
Sum squared resid	2.1339	Schwarz criterion	-1.6105
Log likelihood	193.5731	F-statistic	5.7137
Durbin-Watson stat	2.2352	Prob(F-statistic)	0.0000

Source: Eviews output, modified by author.

Table 8: Statistical significance between Income per Capita and House Prices

	Coefficient	t-Statistic	Prob.	Significant
Fixed Effect Model	0.7725	2.8118	0.0055	Yes
Least Squares Model	0.7533	2.2082	0.0283	Yes

Source: Eviews output, modified by author.

Table 9: Statistical significance between Land Prices and House Prices

	Coefficient	t-Statistic	Prob.	Significant
Fixed Effect Model	0.04	2.2666	0.0246	Yes
Least Squares Model	0.0402	1.6963	0.0913	Yes

Source: Eviews output, modified by author.

Table 10: Statistical significance between Mortgage Rates and House Prices

	Coefficient	t-Statistic	Prob.	Significant
Fixed Effect Model	0.0438	3.0187	0.0029	Yes
Least Squares Model	0.0474	4.0478	0.0001	Yes

Source: Eviews output, modified by author.

Table 11: Statistical significance between Density of Population and House Prices

	Coefficient	t-Statistic	Prob.	Significant
Fixed Effect Model	-0.0103	-0.7556	0.4509	No
Least Squares Model	-0.0138	-1.6908	0.0924	Yes

Source: Eviews output, modified by author.

Table 12: Statistical significance between Unemployment Rates and House Prices

	Coefficient	t-Statistic	Prob.	Significant
Fixed Effect Model	-0.0452	-1.1993	0.232	No
Least Squares Model	-0.0416	-0.9944	0.3212	No

Source: Eviews output, modified by author.

Table 13: Statistical significance between Savings and House Prices

	Coefficient	t-Statistic	Prob.	Significant
Fixed Effect Model	0.1895	0.7921	0.4293	No
Least Squares Model	0.2587	1.2913	0.198	No

Source: Eviews output, modified by author.

ACKNOWLEDGMENT

In the name of Allah, the Most Gracious and the Most Merciful

The highest praises to my family, all my teachers and friends. I sincerely send my special appreciation to Dr. Aaron Loh and Dr. Witsaroot Pariyaprasert for their precious constructive comments and insightful recommendations.

Special thanks to all my friends for who were always there with me when I needed help and support. My friends Desmond Chang, Bing Zhu, and Alex Osborne encouraged me when I was upset and invigorated me when I was stressful.

Foremost and last, my sincerest and deepest faithful gratitude goes to my beloved parents, grandparents, and my brothers. Without their full support, encouragement, protection, understanding and love, I would not have today's achievements.

For any errors or inadequacies that may remain in this work, of course, the responsibility is entirely my own.

REFERENCES

[1] Aziz, J., Dunnaway, S., Fedelino, A., Kuijs, L., & Members of the IMF China team. (2006). What's driving investment in China?. *IMF Working paper*, 265. Asia and Pacific Department.

[2] Bottelier, P. (2010). Beijing's new challenge: China's post-crisis housing bubble. *Carnegie Endowment for International Peace*. Policy Outlook.

[3] Case, K. E., Quigley, J. M., & Shiller, R. J. (2003). Home-buyers, housing and the macroeconomy. Prepared for the Reserve Bank of Australia Conference on Asset Prices and Monetary Policy. 149-188.

[4] Chen, S. (2008). Analysis of factors influencing China's commercial real estate housing prices and housing price predictions (Master dissertation). Graduate School of Huazhong University of Science & Technology.

[5] DiPasquale, D., & Wheaton, W. C. (1996). *Urban Economics and Real Estate Markets*. New Jersey: Regent/Prentice-Hall, Inc.

[6] Gallin, J. (2008). The long-run relationship between house prices and rents. *Real Estate Economics*, 4 (36). 635-658.

[7] Hwang, M. S., & Gary, S. (2006). Bubble, bubble, bubble...where's the housing bubble?. *Brooking Papers on Economic Activity*, 1(2006), 1-50.

[8] Herring, R. J., & Wachter, S. (1999). Real estate booms and banking busts: An international perspective. *Financial Institutions Center*. The Wharton School, University of Pennsylvania.

[9] Krainer, J. (2005). Housing markets and demographics. *FRBSF Economic Letter*, 21- 2005. Federal Reserve Bank of San Francisco.

[10] Larsen, J. E. (1994). *Real Estate Principles and Practices*. United States of America: West Publishing Company.

[11] Malpezzi, S. (1998). A simple error correction model of house prices. *The Center for Urban Land Economics Research*. School of Business, University of Wisconsin.

[12] Meen, G. (2002). The time-series behavior of house prices: A transatlantic divide. *Journal of Housing Economic*, 11.

[13] Milton, J. S., & Jesse, C. A. (1995). *Introduction to Probability and Statistics Principles and Applications for Engineering and the Computing Sciences* (3rd ed). Singapore: McGraw-Hill, Inc.

[14] OECD Economic Outlook 78. (2005). Recent house price developments: The role of fundamentals. OECD Working paper.

[15] Quigley, J. M. (1999). Real estate prices and economic cycles. *International Real Estate Review*, 1(1999, 2), 1-20.

[16] Todaro, M. P. (1994). *Economic Development* (5th. ed). New York, IL: Longman Publishing.

[17] Yan, S., & Knaap, G. J. (2003). *New Urbanism and Housing Values: A Disaggregate Assessment*. Lincoln Institute of Land Policy and the US Housing and Urban Development Department.

AUTHOR

Huinan Yan, MBA student, Assumption University of Thailand, assia.yan@gmail.com

Comparative Analysis of AES and DES security Algorithms

Sumitra

Lecturer (Computer science)
Advanced Institute of Technology & Management, Palwal

Abstract - In recent years network security has become an important issue. Cryptography has been used to secure data and control access by sharing a private cryptographic key over different devices. Cryptography renders the message unintelligible to outsider by various transformations. Data Cryptography is the scrambling of the content of data like text, image, audio and video to make it unreadable or unintelligible during transmission. Its main goal is to keep the data secure from unauthorized access.

Index Terms: AES, DES, Cryptography, Symmetric key, Asymmetric key, Encryption, Decryption

I. INTRODUCTION

The goal of cryptography is to make it possible for two people to exchange a message in such a way that other people cannot understand the message. There is no end to the number of ways this can be done, but here we will be concerned with methods of altering the text in such a way that the recipient can undo the alteration and discover the original text. The original text is usually called “clear text” and the encoded or altered text is called “cipher text”. The conversion from clear text to cipher text is called “encoding” or “enciphering”, and the opposite operation is called “decoding” or “deciphering”. Information is an asset that has a value like any other asset. As an asset, information needs to be secured from attacks. Now-a-days security becomes an essential feature in almost all area of communication. While sending a message to a person over an insecure channel such as internet we must provide confidentiality, integrity, authenticity and non-repudiation [1]. These are the four major security aspects [2] or goals.

There are a number of encryption algorithms those can be broadly classified into two categories: *Symmetric/Private key encipherment* and *Asymmetric/Public key encipherment* [3, 4]. The difference between these two is that to communicate with n people *private key cryptography* requires $(n \times (n-1))/2$ number of keys as shown in the Figure 1.1 whereas; *public key cryptography* requires only n number of key pairs (one private and one public key) .

Public key cryptography discovered nearly two decades ago has revolutionized the way for the people to communicate securely and in an authenticated way [1]. Any message (text, binary files, or documents) that are encrypted by using the public key can only be decrypted by applying the same algorithm, but by using the matching private key. Any message that is encrypted by using the private key can only be decrypted by using the matching public key. This means that you do not have to worry about passing public keys over the Internet (the keys are supposed to be public). A problem with asymmetric encryption, however, is that it is slower than symmetric encryption. It requires far more processing power to both encrypt and decrypt the content of the message.

II. Basics

Cryptography is where security engineering meets mathematics. It provides us with the tools that underlie most modern security protocols. It is probably the key enabling technology for protecting distributed systems, yet it is surprisingly hard to do right[5,6]. Cryptography has often been used to protect the wrong things, or used to protect them in the wrong way. We’ll see plenty more examples when we start looking in detail at real applications. Unfortunately, the computer security and cryptology communities have

drifted apart over the last 20 years. Security people don't always understand the available crypto tools, and crypto people don't always understand the real-world problems. There are a number of reasons for this, such as different professional backgrounds (computer science versus mathematics) and different research funding (governments have tried to promote computer security research while suppressing cryptography).

Cryptography is a method of storing and transmitting data in a form that only those it is intended for can read and process[9,10]. It is a science of protecting information by encoding it into an unreadable format. Cryptography is an effective way of protecting sensitive information as it is stored on media or transmitted through network communication paths.

Cryptography is the science of using mathematics to encrypt and decrypt data. Cryptography enables you to store sensitive information or transmit it across insecure networks (like the Internet) so that it cannot be read by anyone except the intended recipient. While cryptography is the science of securing data, *cryptanalysis* is the science[7]. Of analyzing and breaking secure communication. Classical cryptanalysis involves an interesting combination of analytical reasoning, application of mathematical tools, pattern finding, patience, determination, and luck. Cryptanalysts are also called *attackers*. *Cryptology* embraces both cryptography and cryptanalysis.

III. Types of Cryptosystems

There are three types of cryptosystems: Symmetric key, Asymmetric key and Hash Functions. Symmetric key encryption uses one key to encrypt and decrypt. Asymmetric key encryption uses two keys; when one key is used to encrypt, the other is used to decrypt. Hash functions create a message digest via an algorithm and use no key.

(a) *Symmetric key Encryption*

Symmetric key (also called private key or secret key) cryptography uses the same key to encrypt and decrypt. The name "private key" derives from the need to keep the key private. A major challenge associated with symmetric key cryptosystems is the secure distribution of keys. Common symmetric key encryption algorithms include DES (the Data Encryption Standard) and AES (the Advanced Encryption Standard).

(b) *Asymmetric Key Encryption*

Asymmetric key encryption (also called public key encryption) uses two keys: a public and a private key. Data encrypted with one key can be decrypted only with the other key. Whitfield Diffie and Martin Hellman first publicly described this approach in November 1976 in *New Directions in Cryptography*, where they announced: "We stand today on the brink of a evolution in cryptography."

IV. Comparison of AES, DES

a) *AES, DES analyzing time based on different file size using Entropy on machine1(Intel Dual core 2.4 Ghz Processor with 1 GB RAM)*

The time taken by AES, DES security algorithm on machine1 using entropy is shown below in the graph. This comparison is done on machine1 with *Intel Dual core 2.4 Ghz Processor with 1 GB RAM* configuration.

File Size	AES(Time in sec)	DES(Time in sec.)
512Kb	49.03	66.09
1Mb	44.84	67.94
1.5Mb	47.8	57.47
2.0Mb	51.14	66.29

2.5Mb	51.28	59.42
-------	-------	-------

Table 5.1 Comparison based on entropy

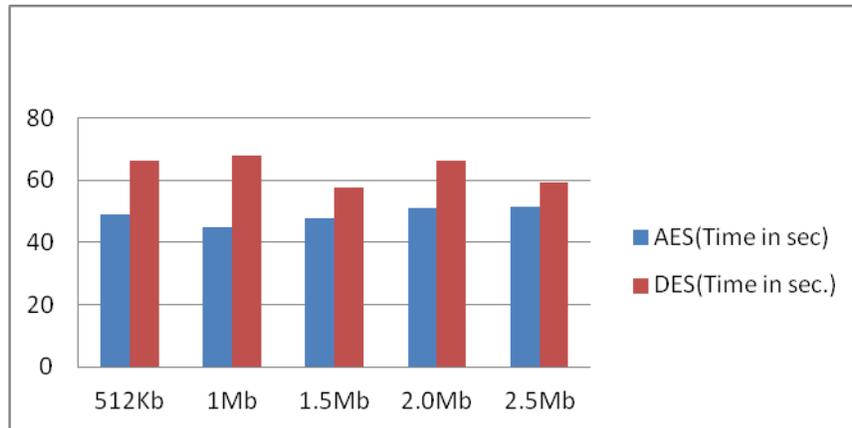


Fig. 5.1: Analyzing time based on entropy

b) AES, DES Analyzing time based on different file size using Known Plaintext on machine1(Intel Dual core 2.4 Ghz Processor with 1 GB RAM)

A simulation test was carried out over various files of different size on machine1. This comparison is done on machine1 with Intel Dual core 2.4 Ghz Processor with 1 GB RAM configuration. The result that was obtained is shown below in the graph.

File Size	AES(Time in sec.)	DES(Time in sec)
512Kb	24.68	34.64
1Mb	28.98	28.56
1.5Mb	23.38	30.47
2Mb	26.71	28.45
2.5Mb	25.31	34.67

Table 5.2: Comparison based on known plaintext

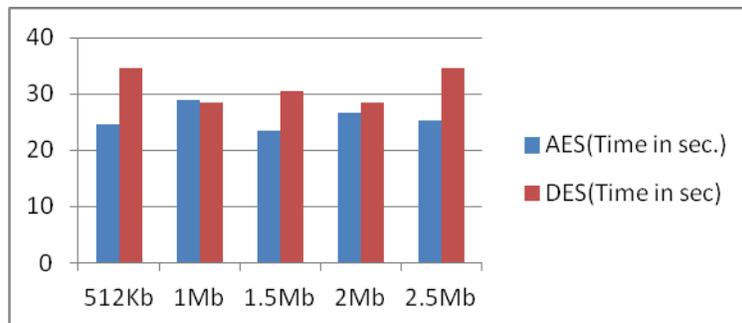


Fig.5.2: Analyzing time based on known plaintext

c) AES, Analyzing time based on different file size using Entropy on machine2(Intel core i3 processor with 2 GB RAM)

Here a machine with different configuration is used to carry out the time analysis between these algorithms. A number of files with different sizes were fed into the simulation test. The result obtained after simulation are represented in the form of graph below.

File Size	AES(Time in sec.)	DES(Time in sec)
512Kb	36.81	35.28
1Mb	32.81	45.45
1.5Mb	30.75	35.59
2.0Mb	31.15	37.7
2.5Mb	45.53	37.89

Table 5.3. Comparison based on entropy

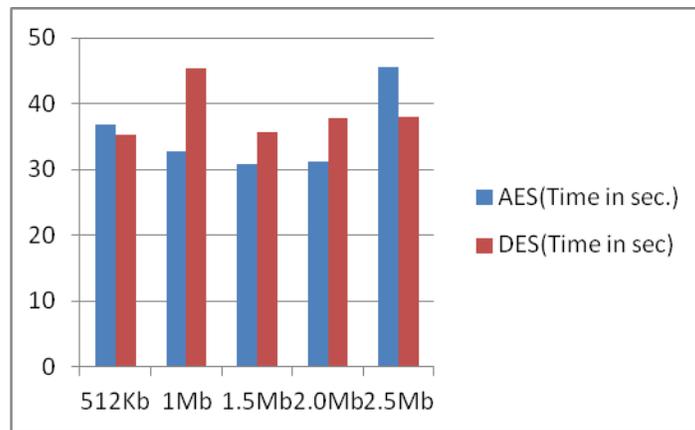


Fig.5.3. Analyzing time based on entropy

d) AES, Des and SDES Analyzing time based on different file size using Known Plaintext on machine2(Intel core i3 processor with 2 GB RAM)

This graph has shown the time being utilized by AES, DES and SDES security algorithms on a machine2 using known plaintext. With the help of graph and table the comparison of AES, DES and SDES security algorithms is shown.

File Size	AES	DES
512Kb	18.5	21.02
1Mb	19	22.7
1.5Mb	20.52	21.35
2.0Mb	19.08	22.77
2.5Mb	18.92	23.01

Table 5.4: Comparison based on known plaintext

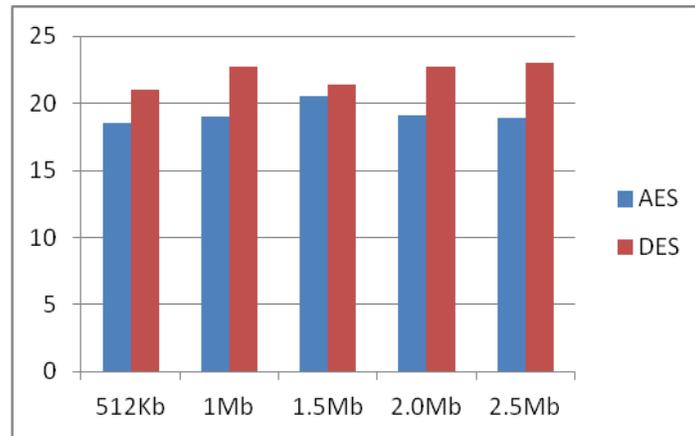


Fig.5.4: Analyzing time based on known plaintext

IV. CONCLUSION AND FUTURE SCOPE

From above work it is concluded that security is an important issue at present time .There are a no. of schemes are available for security purpose This scheme is called cryptography. In cryptography we use key called public key and private key.With the help of these keys we encrypt and decrypt the data fro make secure. Encrypted data is called ciphertext and decrypted data s called plaintext. Cryptography is of two types : a) Symmetric b) asymmetric. In this paper two symmetric key security algorithms AES and DES are compared .Symmetric key algorithms are those algorithms which have same key for encryption and decryption. All Also above work shows the performance of both algorithms .It is shown that both algorithms consume different times at different machines. Different machines take different times for same algorithm over same data packet. From above explanation it is shown that all algorithms have different speed. AES is more secure as compare to DES.

REFERENCES

- [1] Yuliang Zheng. Digital signcryption or how to achieve cost(signature encryption) cost(signature) + cost(encryption). In CRYPTO '97: Proceedings of the 17th Annual International Cryptology Conference on Advances in Cryptology, pages 165{ 179, London, UK, 1997. Springer-Verlag.
- [2] William Stallings. Cryptography and Network security: Principles and Practices. Prentice Hall Inc., second edition, 1999.
- [3] Paul C. van Oorschot Alfred J. Menezes and Scott A. Vanstone. Handbook of Applied Cryptography. CRC Press, 1996.
- [4] Behrouz A. Forouzan. Cryptography and Network Security. Tata McGraw-Hill, 2007.
- [5] William J Caelli, Edward P Dawson, and Scott A Rea. Pki, elliptic curve cryptog-raphy, and digital signatures. Computers and Security, 18(1):47 { 66, 1999.}
- [6] Lawrence C. Washington. .Elliptic Curves: Number Theory and Cryptography.CRC Press, 2003.
- [7] Surya A. E@endi R. Sutikno, S. An implementation of elgamal elliptic curves cryptosystems. pages 483 {486, Nov 1998. }
- [8] G. JULIUS CAESAR , JOHN F. KENNEDY “Security Engineering: A Guide to Building Dependable Distributed Systems ,”pages 73.
- [9] \ CISSP All-in-One Certification Exam Guide,” 200075_ch08_HarrisX 11/30/01 10:22 AM Page 495”
- [10] Phil Zimmermann ,An Introduction to Cryptography” The Basics of Cryptography”.

AUTHOR

Sumitra , M.Tech (CSE.),A.I.T.M. Palwal. Sumitra.gupta1@gmail.com

Oral Piercings: A constructive genius or a destructive devil??

Sandhyarani B*, Dayanand Huddar**

* Department of Pedodontics and Preventive dentistry, Bharati Vidyapeeth Deemed University Dental College and Hospital, Sangli

** Department of Prosthodontics, Bharati Vidyapeeth Deemed University Dental College and Hospital, Sangli

Abstract- Piercing is today's popular form of body art and self-expression. It may seem totally safe because some celebrities use piercings to flaunt their style or attitude. But piercing tongue, lips, cheeks, or uvula is not safe and may cause extreme complications and can be life threatening. This article reviews some of these complications of oral piercings.

Index Terms- Body piercings, Ludwig's angina, Oral piercings, Studs, Tongue piercings

I. INTRODUCTION

Body piercing is an ancient practice. Most items come in the form of barbells, rings or studs and are made of gold, silver or stainless steel. Sites include the ear, nose, eyebrow, nipples, genitalia and the oral cavity. ⁽¹⁾ It is defined as 'a penetration of jewelry into openings made in such body areas as eyebrows, helix of ears, lips, tongue, nose, naval, nipples and genitals.'⁽²⁾ In the United States up to 42% of male and 60% of female college students have body piercings. The incidence of piercings is increasing steadily. ⁽³⁾ It is known that piercing the body has spiritual, aesthetic and sexual connotations.⁽⁴⁾

Of significance to the dental profession is the recent increase in intraoral piercings, which is the insertion of jewelry into soft oral tissues including the lips, cheeks, uvula and tongue. ⁽⁴⁾ Piercing of oral sites may lead to a number of complications some of which are life-threatening. Dentists should be aware of the increasing number of patients with pierced intra-oral and peri-oral sites and should be prepared to offer advice and guidance to patients. Immediate post-operative complications reported were swelling and/or infections (24%-98%), pain or tenderness (14%-71%), and bleeding or hematoma. Jewelry-related complications mainly consisted of tooth fractures and wear (14%-41%) and gingival recessions (19%-68%).⁽⁵⁾

II. REVIEW OF LITERATURE

Theodossy reported a case of 28 year old female who had metal barbell around 20 mm in length traversing the tongue, with the metal ball clearly visible on the dorsal surface while the ventral surface had completely healed over embedding the barbell. The tissue under the surface of the tongue was fibrosed. ⁽¹⁾ Fleming reported 17-year-old male with bifid tongue who had a tongue ornament placed one year previously during a period of severe psychiatric disturbance. The area became infected and healed over leaving the tongue divided in the anterior midline. ⁽²⁾ A case of galvanic current during contact between the stainless

steel appliance and an extensive amalgam filling has also been reported. ⁽⁴⁾

The most serious complication to date is that reported by Perkins et al in which Ludwig's angina developed secondary to tongue piercing. This was not responsive to parenteral antibiotic treatment and required intubation to secure the patient's airway followed by extra-oral surgical decompression. ⁽⁶⁾ Aspiration of jewellery may also result in airway compromise. Infection with *Staphylococcus aureus*, and *pseudomonas spp.*, and *Neisseria endocarditis* are documented. ⁽⁷⁾ Upper airway compromise 48 hours after placement of a tongue-stud because of swelling has been reported. ⁽⁸⁾ Cerebral abscess has been linked to a tongue piercing. A case of serious bleeding resulting in hypotensive collapse has been published. ⁽²⁾

III. DISCUSSION

Body piercing, a form of body modification, is the practice of puncturing or cutting a part of the human body, creating an opening in which jewellery may be worn. The word piercing can refer to the act or practice of body piercing, or to an opening in the body created by this act or practice. Ear piercing and nose piercing have been particularly widespread and are well represented in historical records and among grave goods. The oldest mummified remains ever discovered were sporting earrings, attesting to the existence of the practice more than 5,000 years ago. Nose piercing is documented as far back as 1500 BC. Piercings of these types have been documented globally, while lip and tongue piercings were historically found in African and American tribal cultures. Nipple and genital piercing have also been practiced by various cultures, with nipple piercing dating back at least to Ancient Rome while genital piercing is described in Ancient India ca. 320 to 550 CE.

Body piercing is an invasive procedure with some risks, including allergic reaction, infection, excessive scarring and unanticipated physical injuries, but such precautions as sanitary piercing procedures and careful aftercare are emphasized to minimize the likelihood of encountering serious problems. The healing time required for a body piercing may vary widely according to placement, from as little as a month for some genital piercings to as much as two full years for the navel.

Complications and possible sequelae of oral piercing are listed by Theodossy as pain, swelling, infection (bacterial, viral, fungal) airway obstruction, bleeding, trauma to teeth and mucosa, speech impediment and swallowing problems, hypersalivation, lingual nerve damage, swallowed or inhaled jewellery, foreign body incorporation into site of piercing, radiographic artifact, calculus formation on metal surfaces,

galvanic and hypersensitivity to metal.⁽¹⁾ The possible transmission of infections such as hepatitis and HIV must also be considered. Sterile techniques, use of disposable gloves and instruments and autoclaved jewellery are necessary to limit this possibility.⁽⁹⁾ Unusual malformations may be attributable to tongue piercings. These abnormalities may occasionally present when ornaments are no longer in situ. Patients contemplating tongue jewellery should be counselled on early and late complications.

IV. CONCLUSION

Dentists must be aware of the pitfalls of orofacial jewellery. The authors feel placement of tongue studs is not part of the practice of dentistry and should be avoided in the dental setting in accordance with the principle that surgeons should above all do no harm. Although reports describing the mortality associated with tongue splitting are currently not available in the literature, the risk of complications secondary to surgical procedures is well known. Therefore, dentists are recommended to discourage patients who request the procedure by educating them the risks associated with this surgery.

REFERENCES

- [1] T Theodossy. British Dental Journal 2003;194:551 – 552.
- [2] P S Fleming & T R Flood. British Dental Journal 2005;198: 265 – 266.
- [3] Mayers LB, Judelson DA, Moriarty BW, Rundell KW. Prevalence of body art (body piercing and tattooing) in university undergraduates and incidence of medical complications. Mayo Clin Proc 2002; 77: 29–34..
- [4] De Moor RJG, De Witte AMJC, De Bruyne MAA. Tongue piercing and associated oral and dental complications. Endod Dent Traumatol 2000; 16: 232–237
- [5] Levin L, Zadik Y. Oral piercing: complications and side effects. Am J Dent. 2007;20(5):340-4.
- [6] Perkins CS, Meisner J, Harrison J. A complication of tongue piercing. Br Dent J 1997; 182: 147–148.
- [7] Tronel H, Chaudemanche H, Pechier N, Doutrelant L, Hoen B. Endocarditis due to Neisseria mucosa after tongue piercing. Clin Microbiol Infect 2001; 7: 275–276.
- [8] Keogh JJ. The hazards of intra-oral piercing. Ir Med J 2001; 94: 278–279.
- [9] Scully C, Chen M. Tongue piercing (oral body art). Br J Oral Maxillofac Surg 1994; 32: 37–38.

AUTHORS

First Author – Sandhyarani B, Assistant Professor, Bharati Vidyapeeth Deemed University Dental College and Hospital, Sangli and sandhyadayahuddar@gmail.com

Second Author – Dayanand Huddar, Associate Professor, Bharati Vidyapeeth Deemed University Dental College and Hospital, Sangli and drdayanandhuddar@rediffmail.com

Correspondence Author – Sandhyarani B, Bharati Vidyapeeth Deemed University Dental College and Hospital, Sangli, Maharashtra, India.416414. Email address: sandhyadayahuddar@gmail.com., Contact number: +91-8624896052.

Fuzzy aw-Continuous Mappings

Manoj Mishra¹, S. S. Thakur²

²Department of Applied Mathematics JEC JBP

Abstract- The purpose of present paper introduce the concepts of fuzzy aw- closed mappings and to obtain some of their basic properties and characterizations.

I. PRELIMINARIES

Let X be a non empty set and $I = [0,1]$. A fuzzy set on X is a mapping from X in to I . The null fuzzy set 0 is the mapping from X in to I which assumes only the value is 0 and whole fuzzy sets 1 is a mapping from X on to I which takes the values 1 only. The union (resp. intersection) of a family $\{A_\alpha; \alpha \in \Lambda\}$ of fuzzy sets of X is defined by to be the mapping $\sup A_\alpha$ (resp. $\inf A_\alpha$). A fuzzy set A of X is contained in a fuzzy set B of X if $A(x) \leq B(x)$ for each $x \in X$. A fuzzy point x_β in X is a fuzzy set defined by $x_\beta(y) = \beta$ for $y = x$ and $x(y) = 0$ for $y \neq x$, $\beta \in [0,1]$ and $y \in X$. A fuzzy point x_β is said to be quasi-coincident with the fuzzy set A denoted by $x_\beta qA$ if and only if $\beta + A(x) > 1$. A fuzzy set A is quasi-coincident with a fuzzy set B denoted by $A qB$ if and only if there exists a point $x \in X$ such that $A(x) + B(x) > 1$. $A \leq B$ if and only if $\overline{(A q B^c)}$.

A family τ of fuzzy sets of X is called a fuzzy topology [2] on X if $0,1$ belongs to τ and τ is closed with respect to arbitrary union and finite intersection. The members of τ are called fuzzy open sets and their complement are fuzzy closed sets. For any fuzzy set A of X the closure of A (denoted by $cl(A)$) is the intersection of all the fuzzy closed super sets of A and the interior of A (denoted by $int(A)$) is the union of all fuzzy open subsets of A .

Definition 1.1[10]: A fuzzy set A of a fuzzy topological space (X, τ) is said to be:

- fuzzy semiopen if $A \leq cl(int(A))$.
- fuzzy g-closed if $cl(A) \leq O$ whenever $A \leq O$ and O is fuzzy open set.
- fuzzy g-open if $1-A$ is fuzzy g-closed.
- fuzzy w-closed if $cl(A) \leq O$ whenever $A \leq O$ and O is a fuzzy semi open set.
- fuzzy w-open if $1-A$ is fuzzy w-closed.

Remark 1.1[10]: Every fuzzy closed set is fuzzy w-closed and every fuzzy w-closed set is fuzzy g-closed but the converse may not be true.

Definition1.2: A mapping $f: (X, \tau) \rightarrow (Y, \sigma)$ is said to be ;

- fuzzy w-continuous if the inverse image of every fuzzy closed set of Y is fuzzy closed in X [6].
- fuzzy g-continuous if the inverse image of every fuzzy closed set of Y is fuzzy g-closed in X .
- fuzzy w-irresolute if the inverse image of every fuzzy w-closed set of Y is fuzzy w-closed in X .

Remark 1.2: Every fuzzy continuous mapping is fuzzy w-continuous and every fuzzy w-continuous mapping is fuzzy g-continuous mapping but the converse may not be true.

The concepts of fuzzy w-irresolute and fuzzy continuous mapping are independent.

Definition 1.2: A fuzzy topological space (X, τ) is said to be fuzzy w- $T_{1/2}$ if every fuzzy w-closed set is fuzzy closed set in X .

II. FUZZY AW-CONTINUOUS MAPPINGS

Definition2.1: A mapping $f: (X, \tau) \rightarrow (Y, \sigma)$ is said to be fuzzy aw-continuous provided that $cl(A) \leq f^{-1}(O)$ whenever O is fuzzy semi open in Y , A is fuzzy w-closed in X and $A \leq f^{-1}(O)$.

Theorem 2.1: Every fuzzy irresolute is fuzzy aw-continuous.

Proof: Let O be a fuzzy semi open set of Y , A is a fuzzy w-closed set of X and $A \leq f^{-1}(O)$. Now f is fuzzy irresolute $f^{-1}(O)$ is fuzzy semi open set of X . Since A is fuzzy w-closed and $A \leq f^{-1}(O)$ it follows that $cl(A) \leq f^{-1}(O)$. Hence f is fuzzy aw-continuous.

Remark 2.1: The converse of theorem (3.2.1) is not true for,

Example2.1: Let $X = \{a, b\}$, $Y = \{x, y\}$ and $\tau = \{0, 1\}$ and $\sigma = \{0, A, 1\}$ be the fuzzy topologies where $A(x) = 0.3$, $A(y) = 0.4$. Then the mapping $f: (X, \tau) \rightarrow (Y, \sigma)$ be a mapping defined by $f(a) = x$, $f(b) = y$, is fuzzy aw-continuous but not fuzzy R-map. Now consider the following example.

Example2.2: Let $X = \{a, b\}$, $Y = \{x, y\}$ and $\tau = \{0, A, 1\}$ and $\sigma = \{0, 1\}$ be the fuzzy topologies where $A(a) = 0.7$, $A(b) = 0.5$. Then the mapping $f: (X, \tau) \rightarrow (Y, \sigma)$ be a mapping is fuzzy continuous but not fuzzy aw-continuous.

Remark2.2: Example (2.1) and (2.2) asserts that the concepts of fuzzy continuous and fuzzy aw-continuous mappings are independent.

Theorem 2.2: Let If $f: (X, \tau) \rightarrow (Y, \sigma)$ is fuzzy aw-continuous and fuzzy closed mappings then the image of every fuzzy w-closed set of X is fuzzy w-closed in Y .

Proof: Let A be a fuzzy w-closed set of X and $f(A) \leq O$ where O is the fuzzy semi open set in Y then $A \leq f^{-1}(O)$ and hence f is fuzzy aw-continuous $cl(A) \leq f^{-1}(O)$ which implies $f(cl(A)) \leq O$ since f is fuzzy closed we have $cl(f(A)) \leq cl(fcl(A)) = f(cl(A)) \leq O$. Hence $f(A)$ is fuzzy w-closed set in Y .

Theorem2.3: If (X, τ) is fuzzy w- $T_{1/2}$ then every mapping $f: (X, \tau) \rightarrow (Y, \sigma)$ is fuzzy aw-continuous.

Proof: Let A be a fuzzy w-closed set of X and $A \leq f^{-1}(O)$ where O is fuzzy semi open set in Y . Since X is fuzzy w- $T_{1/2}$, A

is fuzzy closed in X therefore $cl(A)=A \leq f^{-1}(O)$. Hence f is fuzzy aw-continuous.

Theorem 2.4: If $FSO(X)=FC(X)$ then a mapping $f: (X,\tau) \rightarrow (Y,\sigma)$ is fuzzy aw-continuous if and only if $f^{-1}(O)$ is fuzzy closed in X for every fuzzy semi open set O in Y .

Proof: Necessity: Let $f: (X,\tau) \rightarrow (Y,\sigma)$ is fuzzy aw-continuous by theorem(1.7) every fuzzy set of X is fuzzy w-closed (and hence fuzzy w-open) Thus for any fuzzy semi open set O of Y , $f^{-1}(O)$ is fuzzy w-closed in X . Since $f^{-1}(O) \leq f^{-1}(O)$ and f is fuzzy aw-continuous, $cl(f^{-1}(O)) \leq f^{-1}(O)$. Hence $f^{-1}(O)$ is fuzzy closed in X .

Sufficiency: Let O be a fuzzy semi open set of Y and A be a fuzzy w-closed set of X such that $A \leq f^{-1}(O)$ then $cl(A) \leq cl(f^{-1}(O))=f^{-1}(O)$, because by assumption $f^{-1}(O)$ is fuzzy closed in X , hence f is fuzzy aw-continuous.

Theorem 2.5: If $FSO(X)=FC(Y)$ then a mapping $f: (X,\tau) \rightarrow (Y,\sigma)$ is fuzzy aw-continuous if and only if it is a fuzzy irresolute.

Proof: Necessity: Let O be a fuzzy semi open set of Y , then by theorem(2.4) $f^{-1}(O)$ is fuzzy closed in X and so $f^{-1}(O)$ is fuzzy semi open in X and hence f is fuzzy irresolute.

Sufficiency: Let A be a fuzzy w-closed of X and O be a fuzzy semi open set of Y and $A \leq f^{-1}(O)$. By hypothesis $f^{-1}(O)$ is fuzzy semi open and thus fuzzy semi closed, $cl(A) \leq cl(f^{-1}(O))=f^{-1}(O)$ hence f is fuzzy aw-continuous.

Theorem 2.6: If $f: (X,\tau) \rightarrow (Y,\sigma)$ is fuzzy aw-continuous and $g: (Y,\sigma) \rightarrow (Z,\omega)$ is a fuzzy irresolute then $g \circ f: (X,\tau) \rightarrow (Z,\omega)$ is fuzzy aw-continuous.

Proof: Let A be a fuzzy w-closed of X and O be a fuzzy semi open sub set of Z such that $A \leq (g \circ f)^{-1}(O)$. Since g is a fuzzy irresolute $g^{-1}(O)$ is fuzzy semi open in Y . Since f is fuzzy aw-continuous $cl(A) \leq f^{-1}(g^{-1}(O))=f^{-1}(O)$. Hence $(g \circ f)^{-1}(O)$ is fuzzy aw-continuous.

Definition 2.2: A mapping $f: (X,\tau) \rightarrow (Y,\sigma)$ is called fuzzy aw-closed provided that $f(A) \leq int(O)$ whenever A is fuzzy semi closed in X O is fuzzy w-open in Y and $f(A) \leq O$.

Theorem 2.7: Every fuzzy w-continues and fuzzy aw-closed mappings are fuzzy w-irresolute.

Proof: A mapping $f: (X,\tau) \rightarrow (Y,\sigma)$ is called fuzzy w-continuous and fuzzy aw-closed let A is fuzzy semi closed in Y and $f^{-1}(A) \leq O$ where O is fuzzy semi -open in X . Then $1-O \leq f^{-1}(1-A)$ which implies $f(1-O) \leq (1-A)$. Since f is fuzzy aw-closed $f(1-O) \leq int(1-A)=1-cl(A)$. Hence $f^{-1}(cl(A)) \leq O$. Since f is fuzzy w-continuous $f^{-1}(cl(A))$ is fuzzy w-closed set in X . Therefore $cl(f^{-1}(cl(A))) \leq O$ which implies that $cl(f^{-1}(A)) \leq O$. Hence $f^{-1}(A)$ is fuzzy w-closed in X .

Theorem 2.8: A mapping $f: (X,\tau) \rightarrow (Y,\sigma)$ is fuzzy continuous and fuzzy aw-closed mapping then it is fuzzy w-irresolute.

Proof: Follows from theorem (2.7).

Theorem 2.9: If (Y,σ) is fuzzy $w-T_{1/2}$ then every mapping $f: (X,\tau) \rightarrow (Y,\sigma)$ is fuzzy aw-closed.

Proof: Obvious

Theorem 2.10: If $FSO(X) = FC(Y)$ then a mapping $f: (X,\tau) \rightarrow (Y,\sigma)$ is fuzzy aw-closed if and only if $f(O)$ is open for every fuzzy semi closed subset O of X .

Proof: Necessity: Let A mapping $f: (X,\tau) \rightarrow (Y,\sigma)$ is fuzzy continuous and fuzzy aw-closed mapping by theorem (1.7) ,all fuzzy set of Y are fuzzy w-closed and hence all are fuzzy w-open .Thus for any fuzzy semi closed subset O of X , $f(O)$ is fuzzy w-open in Y . Since f is aw-closed $f(O) \leq intf(O)$. Hence $f(O)$ is fuzzy open.

Sufficiency: Let O be a fuzzy semi closed set of X and A be a fuzzy w-open set of Y and $f(O) \leq A$. By hypothesis $f(O)$ is fuzzy open in Y and so $f^{-1}(O)=int(f(O)) \leq int(A)$ hence f is fuzzy aw-closed.

Definition 2.3: A mapping $f: (X,\tau) \rightarrow (Y,\sigma)$ is fuzzy pre semi closed if the image of every fuzzy semi closed set of X is fuzzy semi closed in Y .

Theorem 2.11: If $FSO(X) =FC(Y)$ then a mapping $f: (X,\tau) \rightarrow (Y,\sigma)$ is fuzzy aw-closed if and only if f is fuzzy pre semi closed .

Proof: Necessity: Let O be a semi closed set of X then by theorem (2.10) $f(O)$ is fuzzy open and fuzzy closed and hence it is fuzzy semi closed and f is fuzzy pre semi closed.

Sufficiency: Let O be a fuzzy semi closed set of X and A be a fuzzy w-open set of Y and $f(O) \leq A$. By hypothesis $f(O)$ is fuzzy semi closed in Y . Thus $f(O)$ is fuzzy semi .Hence $f(O)=int(f(O)) \leq int(A)$ and f is fuzzy aw-closed.

Theorem 2.12: Let mapping $f: (X,\tau) \rightarrow (Y,\sigma)$ is fuzzy pre semi closed and $g: (Y,\sigma) \rightarrow (Z,\omega)$ is fuzzy aw-closed then $(g \circ f)$ is fuzzy aw-closed.

Proof: Let O be a fuzzy semi closed set of X and A be a fuzzy w-open set of Z , such that $(g \circ f)(O) \leq A$ since f is fuzzy pre semi closed $f(O)$ is fuzzy semi closed in Y . Therefore $(g \circ f)(O) \leq int(A)$ because g is fuzzy aw-closed and hence $(g \circ f)$ is fuzzy aw-closed.

REFERENCES

- [1] Azad K.K , on fuzzy semi continuity, fuzzy almost continuity and fuzzy weakly continuity, Jour. Math .Anal. Appl. 82(1981)14-32.
- [2] Chang C.L. ,on fuzzy Topological space, Jour. Math Anal Appl. 24 (1968),182- 190.
- [3] El-Shafei M. E. and Zakari A. semi-generalized continuous mappings in fuzzy topological spaces J. Egypt. Math. Soc.15(1)(2007) , 57{67.
- [4] Malviya R. ,on certain concepts in fuzzy topology. Ph.D. desertion ,RDVV Jabalpur(1997).
- [5] Pu P.M. and Liu Y.M. on fuzzy topology I:Neighbourhood structure of a fuzzy point and Moor Smith convergence ,Jour .Math Anl. Appl. 76 (1980)571-599.
- [6] Tapi U. D ,Thakur S S and Rathore G.P.S. Fuzzy sg -continuous mappings Applied sciences periodical (2001) ,133-137.
- [7] Tapi U. D., Thakur S. S. and Rathore G.P.S. Fuzzy semi generalized closed sets, Acta Cien. Indica 27 (M) (3) (2001), 313-316.
- [8] Tapi U. D., Thakur S. S. and Rathore G.P.S. Fuzzy sg- irresolute mappings stud. Cert. Stii. Ser. Mat. Univ. Bacu (1999) (9) ,203-209.

- [9] Thakur S.S. & Malviya R. ,on generalized closed sets in fuzzy topology
Mathematics Note(Argentina)38(1965)137-140.
- [10] Thakur S.S. &Khre R.K.. On fuzzy regular generalized closed sets V.J.M.S.
Ujjain(M.P.) vol3No.1 (2003),65-70.
- [11] Zadeh L.A. ,on fuzzy sets ,information and control.8 (1965),338-353

AUTHORS

First Author – Manoj Mishra

Second Author – S. S. Thakur, 2Department of Applied
Mathematics JEC JBP, E-mail: drmkm1969@rediffmail.com

A Natural Language Processing based Web Mining System for Social Media Analysis

John Selvadurai

PhD Student at Indiana State University

Abstract- Social Media Monitoring and Analysis are the new trends in technology business. The challenge is to extract correct information from free-form texts of social media communication. Natural Language Processing methods are sometimes used in social media monitoring to improve accuracy in extracting information. This paper discusses a web mining system that is based on Natural Language Processing to analyze social media information. In that process, this research examines Natural Language methods that are important for such analysis. Then the traditional web mining steps are discussed along with proposed use of Natural Language Processing methods.

Index Terms- Natural Language Processing, Social Media Analysis, Web Mining, Text Mining.

I. INTRODUCTION

The advent of social media has changed traditional business methods drastically. Product development, marketing and support are increasingly conducted via social sites. Social Media allows individuals around the world to freely express their opinions without disclosing too much identity. This allows customers to provide genuine opinions about products and services in social media sites. Many business organizations interact with their customers and colleagues through social media.

As the businesses increasingly use social media, the need for better understanding of the trends and communication arises. Social media monitoring is a growing technology area in which sophisticated tools are used to monitor social interactions towards certain text terms. Applications of this technology are huge. Stock market analysis, Political campaigns, Crime monitoring, and Product research are a few of them. Competitive Intelligence is another application of social media monitoring that is receiving a lot of momentum recently. Competitive Intelligence is systematic process of gathering information about an organization's external environment.

The challenge in social media monitoring is to correctly interpret user communication. Usually, the communication entered by users in social media is unstructured free-form text. That means the data does not follow a predefined model. Because of this free-form text nature, simply searching for keywords in social media communications is not an adequate method. Certain sophisticated text mining methods are used in some systems to fulfill the need for accurate social media monitoring. Some other social media monitoring systems use Natural Language Processing methods to extract correct information. This paper discusses a system that extensively uses

Natural Language Processing and Web Mining techniques to analyze social media communications.

II. NATURAL LANGUAGE PROCESSING

Natural Language Processing (NLP) is a study in Computer Science that converts human languages into computer languages. In other words, NLP allows computers to understand human language such as English in a meaningful way. There are numerous NLP based applications that exist currently. Spelling and grammar check in word processing applications are one of the examples of NLP applications. In modern systems, NLP approaches are combined with statistical models to derive better results. NLP has many sub areas that are facilitating the interpretation of human languages. This paper discusses few NLP approaches that are essential for social media monitoring.

A. Automatic Summarization

Automatic Summarization is a technique that reduces a large text into a meaningful short paragraph. This approach retrieves the summary of large text documents. Internet search engines use this technique to identify the content of a website so that can be indexed appropriately.

In general, there are two types of approaches used in Automatic Summarization. One is Extraction which extracts few important parts from the text such as key word sentences or paragraphs [1]. Another type of approach is Abstraction which paraphrases the important points of the text. Technically, Abstraction is a more complicated system than Extraction to develop. Mainly, each Auto Summarization system's functionality can be divided into three general steps [1].

1) Analysis:

In the analysis stage, the text is analyzed and an internal representation is generated. This internal representation is produced in the way logical relationships between sentences can be established.

2) Transformation:

In Transformation stage, the internal representation is manipulated to produce an ordered text representation. In general, the ordered representation could have sentences ranked by a scoring function. The scoring method is usually based on the facts found in analysis stage. A simple example is where sentences with frequent keywords get a specific score.

3) Realization:

In Realization stage, the summary is generated based on the scoring of Transformation stage. In some systems it could be simply producing specific scored sentences from the text.

There are many auto summarizing tools available. *summry.com* is an online tool that produces summaries either by providing URL of a web page or uploading a file. *summry.com* also provides API for web developers who could use auto summarization for their developments [2].

B. Named Entity Recognition

Named Entity Recognition is the subject area that identifies entities or physical objects such as names of persons, organizations, and places in the text. For an example, Named Entity recognition of sports news would consist of names of the players, places of teams and grounds, etc. Traditionally, grammar based approaches are used to identify name and entities in the text. In the present systems, statistical models are incorporated in order to classify names and entities more precisely. In statistical approaches, initially, a set of training data will be used against the model. Based on this training data, statistics will be prepared. These statistics will be used against real documents [3]. The advantage of statistical approach is it can be continuously improved as it is used on various texts. Historical data patterns will be used in identifying new name entities.

The Natural Language Processing Group at Stanford University offers variety of solutions to NLP problems. Stanford NER is a Named Entity Recognizer which is implemented in Java platform and provides libraries with a way to identify names and entities [4].

C. Part-of-speech tagging

In this NLP approach, sentences will be tagged according to the grammatical order such as nouns, verbs and adjectives. Because of the real nature of a language, some words can have multiple tags such as both noun and verb. Part-of-Speech (POS) tagger programs use combinations of several techniques such as lexicons, rules, and dictionaries [5]. Dictionaries contain categories of words. Usually, tagging programs accurately tag the word or make a best guess. When the words are ambiguous in a sentence, POS taggers use probability approaches to tag correctly.

D. Word-sense Disambiguation

Word-sense Disambiguation is a NLP subject that identifies the correct sense of the word in a sentence where that word could have multiple meanings. This area is an important part in information retrieval because the contextual meaning of the text depends on the correct interpretation of that text. Human languages generally have many ambiguities. A human can understand the meaning of a word based on the context it is spoken and the background knowledge of the subject. However, a machine would have difficulties in identifying such correct meaning. Word-sense disambiguation methods help a machine to minimize the ambiguities of words in the text.

In general, a word-sense disambiguation approach consists of a lexical repository that contains different senses for words [6]. WordNet is a free lexical database in English that contains a large collection of words and senses [7]. The design of WordNet was inspired by the theories of human linguistic memory [8].

WordNet encloses a large volume of nouns, verbs, adjectives and adverbs in English language. In WordNet, words are grouped and interlinked by their meanings. This method allows the identification of any closer or similar meaning to a given word. Many NLP applications use WordNet as a source for processing.

E. Sentiment Analysis

Sentiment Analysis is an NLP process which identifies the attitude or contextual polarity of the writer with respect to the text. A text collection could show one or many sentiments. Sentiments can be positive, negative or neutral. Sentiment Analysis is heavily used in processing online reviews for products, movies and books. Many websites run specific algorithms to rate the reviews based on the degree of positive or negative tone.

In general, an opinion consists of two components; a target and a sentiment towards the target [9]. Usually, sentiment analysis is conducted after the text is parsed by Part-of-Speech tagging. Specific rules will be applied along with an internal dictionary to POS tags to identify the sentiment. A simple example of a sentiment rule is if two adjoining positive words are adverb and adjective then it is classified as positive sentiment. There are more sophisticated algorithms that exist in order to extract the sentiment.

III. WEB MINING

Web Mining is the technique used to extract useful information from data gathered from internet. The term mining is used to express the idea of extracting valuable substance from raw material.

Traditional Data Mining techniques are used to gather information from large scale data bases called data warehouses. Web Mining uses those Data Mining techniques to extract information from internet. This paper discusses a few Data/Text Mining approaches that could be used in Web Mining to build an intelligent system that would analyze social media information.

Web Mining can be classified into three major types; Web Usage mining, Web structure mining and Web content mining. Web usage mining is the process of capturing web user behaviors. This usage related information allows understanding the effectiveness of web sites. Generally, web usage mining involves mining the web server logs to find the user login or visits information. Web Structure mining process identifies relationship between web pages and their links. This tool helps search engines to identify and classify web pages by information. Web content mining directly deals with the content of the web. Even though, search engines attempt to provide precise content, still the information retrieved is missing high accuracy.

In general, the text mining approach consists of four steps [10]:

A. Data Gathering

In this first step, necessary data will be collected from social media. Initially, this data is considered as raw data because no valuable information is extracted at this point. Almost all the major social media sites offer API access to external developers. In industry specific analysis such as stock market analysis, only

specific keywords can be used to identify required data. The challenge is to gather historical data because many social media sites provide access to only current data up to certain number of days. Also, storing large volume of historical data is costly for many application developers. In these cases, social data providers who store historical data from social sites and licensed to resell data to application developers. GNIP is such a social data provider who resells data from major social media sites [11].

In traditional web mining, gathering data is just searching and storing. Size of social data available is so huge because millions of users around the world enter data continuously. Gathering the entire data from social media sites is costlier in terms of storage space. Therefore, this paper suggests using NLP Auto Summarizing technique to reduce the size of gathered data. Since auto summarizing reduces the size without losing the main points, this web mining tool should produce the required condensed data.

B. Preprocessing

In preprocessing step, the raw data will be processed to provide a platform for data analysis. The main purpose of this step is to classify raw sentences into a machine readable form. Generally, this machine readable form is an Attribute-Value table. In an Attribute-Value table, text and its characteristics are identified as model and its attributes. The entire document or page to be parsed will be represented as Attribute-Value table. Since social data is entered by users as free-form text, classifying the data into a table is a challenging task. In order to achieve this purpose, certain Natural Language Processing techniques such as Part-of-speech tagging and Named Entity Recognition will be used. This approach is rather expensive in terms of storage needed for entire attributes of characteristics of the document. However, a carefully parsed Attribute-Value table is essential for precise interpretation. This paper proposes to use Word-sense Disambiguation along with other NLP techniques to increase the accuracy of the resulting data classification.

C. Indexing

Preprocessed texts are indexed and stored in this step. The efficiency and performance of the program depends on the type of indices chosen in this step. Current search engines do this very efficiently. When choosing the appropriate index method, storage types, look up speeds and fault tolerance must be considered. These factors are different for each industry and organization. Cost of storage and speed of retrieval are always a concern in any commercial application. In many situations, in order to reduce storage cost few indexes are created. Even though this approach reduces the cost, it increases the possibility of fault occurrences. However, in some industries, fault tolerance cannot be acceptable. In those situations, indexing must be carefully implemented at the expense of storage cost.

Inverted index is the most common index method used in text retrievals. In inverted indexing, lists are made from terms that appear in the text collection [12]. A simple example of inverted indexing is the index published at the end of books where each word and page numbers are given.

D. Mining

This is the part where actual information will be extracted from the indexed classified data. Frequent Pattern Mining is one of the common tasks occurs in this step.

Frequent Pattern Mining is a method used to analyze frequent behaviors of persons or entities. This method was first introduced to analyze customer buying behaviors from retail transaction databases [13]. In Frequent Pattern Mining, a behavior is identified as frequent by simply finding the count of that behavior. For an example, a simple frequent pattern mining is finding milk buying pattern of customer is to count the number of times milk appeared in the transactions of that customer. Finding how many times a new movie is discussed in Twitter is another example. More complicated patterns of mining exist to find voting and stock performance behaviors. Another application consists of opinion mining which to find opinions about a product or service in social media. Finding the user opinion about a movie in social media is a simple example. This can be done by using sentiment analysis to determine how positively or negatively the movie is discussed in Twitter.

IV. CONCLUSION

This paper discussed a web mining system for social media that uses NLP techniques frequently. As part of the discussion, specific NLP techniques are listed in detail. Each of these NLP techniques can be subjected to further research. Also, this paper discussed steps in traditional web mining and proposed methods to incorporate NLP techniques for better results. Traditional web/text mining techniques are not popularly used in social media monitoring. The main reasons for this lack of interest are the free-form style and the huge volume of social media text. In this paper, NLP techniques are combined with traditional web mining techniques to suggest a social media monitoring system. This theoretical system is a base concept and many applications could be implemented from it.

REFERENCES

- [1] D.Bikel and I.Zitouni, Multilingual Natural Language Processing Applications: From Theory to Practice, USA: IBM Press, 2012, pp. 400.
- [2] A. Elmaani, (2012, Nov 27). SMMRY [Online]. Available at <http://smmry.com/api>
- [3] D.Bikel and I.Zitouni, Multilingual Natural Language Processing Applications: From Theory to Practice, USA: IBM Press, 2012, pp. 286.
- [4] The Stanford Natural Language Processing Group. (2012, Nov 15). Stanford Named Entity Recognizer (NER) [Online]. Available: <http://nlp.stanford.edu/software/CRF-NER.shtml#About>
- [5] Robin, (2012, Nov 12). Natural Language Processing: Parts-of-speech tagging, [Online]. Available: <http://language.worldofcomputing.net/pos-tagging/parts-of-speech-tagging.html>
- [6] S. Bandyopadhyay, S. Naskar and A. Ekbal. Emerging Applications of Natural Language processing, Hershey, PA, USA: IGI Global, 2013.
- [7] Princeton University. (2012, Nov 10). WordNet: A Lexical database for English [Online]. Available: <http://wordnet.princeton.edu/>
- [8] M. Song and Y. Wu, Handbook of Research on Text and Web Mining Technology, Hershey, PA, USA: IGI Global, 2009, pp. 194.
- [9] B. Liu, Sentiment Analysis and Opinion Mining, USA: Morgan and Claypool, 2012.
- [10] H. Prado and E. Ferneda, Emerging Technologies of Text Mining: Techniques and Application, Hershey, PA, USA: IGI Global, 2009, pp. 56.

- [11] GNIP. (2012, Nov 28). GNIP: The Social Media API [Online], Available: <http://gnip.com/sources>
- [12] J. Lin and C. Dyer, Data-Intensive Text Processing with MapReduce, USA: Morgan and Claypool, 2010.
- [13] M. Song and Y. Wu, Handbook of Research on Text and Web Mining Technology, Hershey, PA, USA: IGI Global, 2009, pp. 228.

AUTHORS

First Author – John Selvadurai, PhD Student at Indiana State University, MBA, M.S. Computer Science, B.S. Computer Science. sjohnandrew@gmail.com.

Designing & Implementation of Mobile Operated Toy Car by DTMF

Sabuj Das Gupta¹, Arman Riaz Ochi², Mohammad Sakib Hossain³, Nahid Alam Siddique⁴

¹Department of ECE, University of Victoria, Canada

²Lecturer, Department of EEE, American International University-Bangladesh (AIUB)

^{3,4}Student, Department of EEE, Chittagong University of Engineering & Technology (CUET)

Abstract- This paper advocates the operation of a toy car that is controlled by a mobile phone that makes a call to the mobile phone attached to the car. In the course of a call, if any button is pressed, a tone corresponding to the button pressed is heard at the other end of the call. This tone is called DTMF (dual-tone-multiple- frequency). The car perceives this DTMF tone with the help of the phone stacked in the car. The received tone is processed by the (ATmega16) microcontroller with the help of DTMF decoder MT8870. The decoder decodes the DTMF tone into its equivalent binary digit and this binary number is sent to the microcontroller. The microcontroller is programmed to take a decision for any given input and outputs its decision to motor drivers in order to drive the motors in forward direction or backward direction or left and right direction. The mobile phone that makes a call to mobile phone stacked in the car act as a remote. For that reason this paper does not require the construction of receiver and transmitter units.

I. INTRODUCTION

Dual-tone multi-frequency (DTMF) signaling is used for telecommunication signaling over analog telephone lines in the voice- frequency band between telephone handsets and other communications devices and the switching center [1]. The version of DTMF used for telephone tone dialing is known by the trademarked term Touch-Tone (cancelled March 13, 1984), and is standardized by ITU-T Recommendation Q.23. It is also known in the UK as MF4 [2]. Other multi-frequency systems are used for signaling internal to the telephone networks a method of in-band signaling. DTMF tones were also used by cable television broadcasters to indicate the start and stop times of local commercial insertion points during station breaks for the benefit of cable companies. Until better out-of-band signaling equipment was developed in the 1990s, fast, unacknowledged, and loud DTMF tone sequences could be heard during the commercial breaks of cable channels in the United States and elsewhere [3]. The conventional wireless controlled toy car user circuits have drawbacks of limited working range, limited frequency range and limited control. However, these limitations can be overcome by using the mobile phone technologies in this purpose. It provides the advantages to control, working range as large as the coverage area of the service provider, no interference with other controllers and up to twelve controls [4].

II. LITERATURE REVIEW

This propeller-driven radio controlled boat, built by Nikola Tesla in 1898, is the original prototype of all modern-day uninhabited aerial vehicles and precision guided weapons. In fact, it is among all remotely operated vehicles in air, land or sea [5]. Powered by lead-acid batteries and an electric drive motor, the vessel was designed to be maneuvered alongside a target using instructions received from a wireless remote-control transmitter. Once in position, a command would be sent to detonate an explosive charge contained within the boat's forward compartment. The weapon's guidance system incorporated a secure communications link between the pilot's controller and the surface-running torpedo in an effort to assure that control could be maintained even in the presence of electronic counter measures [6]

During World War II in the European Theatre the U.S. Air Force with three basic forms radio-control guided weapons. In each case, the weapon would be directed to its target by a crew member on a control plane. The first weapon was essentially a standard bomb fitted with steering controls. The next evolution involved the fitting of a bomb to a glider airframe, one version, the GB-4 having a TV camera to assist the controller with targeting. The third class of guided weapon was the remote controlled B-17. It's known that Germany deployed a number of more advanced guided strike weapons that saw combat before either the V-1 or V-2. They were the radio-controlled Herschel's Hs293A and Ruhrstahl's SD1400X, known as 'FritzX,' both air-launched, primarily against ships at sea [5].

DTMF is the most common telecommunications signaling method used in Australia. DTMF stands for Dual Tone Multiple Frequency; it is used to send information through phone lines to and from local exchange. Dual Tone Multiple Frequency (DTMF) is also known as Touch-tone, Tone Dialing, VF Signaling and MF Dialing [7]. Each DTMF tone consists of two simultaneous tones (one from the high group and one from the low group), which are used to indicate which number or symbol that is pressed on the telephone's keypad. For example if number 5 is pressed in telephone's keypad, the tones that will hear are 1336 Hz and 770 Hz played simultaneously.

Dual Tone Multiple Frequency is the basis of voice communications control. Modern telephone circuits use DTMF to dial numbers, configure telephone exchanges (switchboards) from remote locations, program certain equipment and so on. Almost any mobile phone is capable of generating DTMF, providing a connection has already been established. This is for

the use of phone banking; voicemail services and other DTMF controlled applications. DTMF was designed so that it is possible to use acoustic transfer. The DTMF tones can be sent from a standard speaker and be received using a standard microphone (providing it is connected to a decoding circuit of some type). DTMF tones are simply two frequencies played simultaneously by a standard home phone/fax or mobile phone. Each key on your telephone's keypad has a unique frequency assigned to it. When any key is pressed on your telephone's keypad the circuit plays the corresponding DTMF tone and sends it to your local exchange for processing. DTMF tones can be imitated by using a White Box or Tone Dialer. It is also possible to record DTMF tones using a tape recorder or computer microphone and then played into the mouthpiece of your telephone to dial numbers. However if there is a significant amount of background sound behind the recorded DTMF tones, the tones may not work properly and cause problems when trying to dial numbers.

Below is a Dual Tone Multi Frequency (DTMF) map for a 4X4-matrix keypad, the map shows each unique frequency which is assigned to each key on a standard 4X4 telephone keypad. The frequencies are exactly the same for a 3X4 matrix keypad, without the keys A, B, C and D.

	1209Hz	1336Hz	1477Hz	1633Hz
697Hz	1 A	2 ABC	3 DEF	A
770Hz	4 GHI	5 JKL	6 MNO	B
852Hz	7 PQRS	8 TUV	9 WXYZ	C
941Hz	* D	0	#	D

Fig-1: Dual Tone Multi Frequency (DTMF) map.

However, this is not a standard keypad. This keypad has 4 more keys than a standard keypad (3X4-matrix). The keys A, B, C and D are not commonly used on standard home phone/fax, office phone or payphone. Each of the keys A, B, C and D are system tones/codes and are mainly used to configure telephone exchanges or to perform other special functions at an exchange. For example, the corresponding tone/code assigned to the A key is used on some networks to move through various carriers (this function is prohibited by most carriers).

Filter is one of the very important devices of this DTMF technology. When DTMF was created individual and unique frequencies were chosen so that it would be quite easy to design frequency filters and so that the tones could easily pass through telephone lines (the maximum guaranteed bandwidth for a standard telephone line extends from around 300 Hz to 3.5 kHz). DTMF was not intended for data transfer; it was designed for control signals only. With a standard DTMF encoder/decoder, it is possible to signal at a rate of around 10 tones/signals per second. A standard DTMF tone should always be played for at least 50ms with a further 50ms space duration for maximum reliability. The contemporary mobile keypad is laid out in a 3x4 grid, although the original DTMF keypad had an additional column for four menu selector keys. When used to dial a

telephone number, pressing a single key will produce a pitch consisting of two simultaneous pure tone sinusoidal frequencies. The row in which the key appears determines the frequency, and the column determines the high frequency. For example, pressing the key will result in a sound composed of both 697 Hz and 1209 Hz tone [8, 15]. The original keypads had levers inside, so each button activated two contacts. The multiple tones are the reason for calling the system multi frequency. These tones are then decoded by the switching center to determine which key was pressed.



Fig-2: A DTMF Mobile Keypad.

Table 1: DTMF Keypad Frequencies (With Sound Clips).

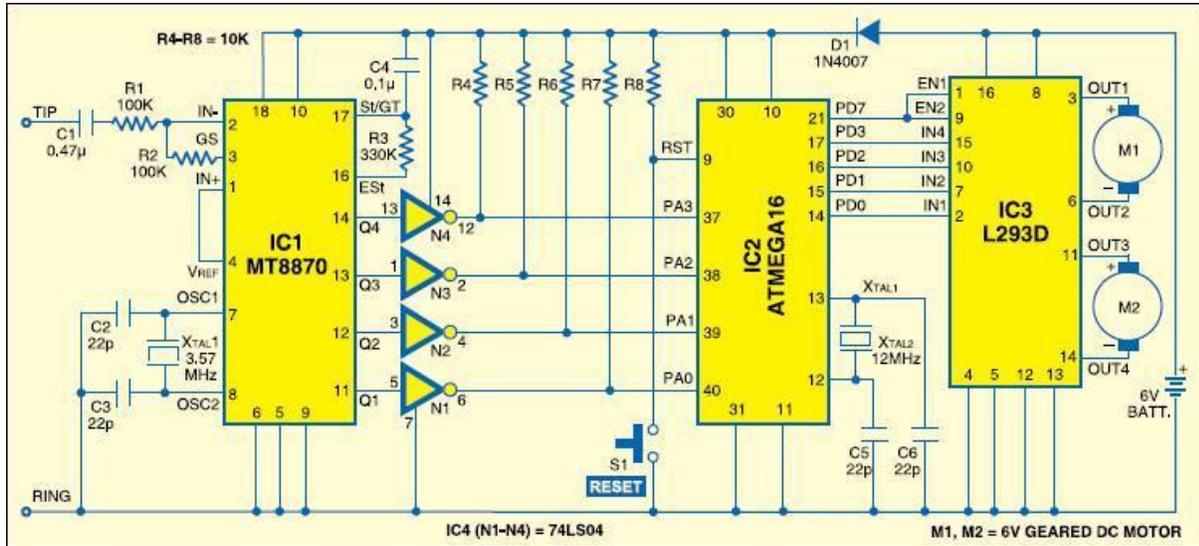
	1209 Hz	1336 Hz	1477 Hz	1633 Hz
697 Hz	1	2	3	A
770 Hz	4	5	6	B
852 Hz	7	8	9	C
941 Hz	*	0	#	D

III. CIRCUIT DESIGN

The important components of this car are DTMF decoder, microcontroller and motor driver. An MT8870 series DTMF decoder is used here. All types of the MT8870 series use digital counting techniques to detect and decode all the 16 DTMF tone pairs into a 4-bit code output. The built-in dial tone rejection circuit eliminates the need of pre-filtering. When the input signal given at pin 2(IN-) in single-ended input configuration is recognized to be effective, the correct 4-bit decode signal of the DTMF tone is transferred to (pin11) through (pin14) outputs. The pin11 to pin14 of DTMF decoder are connected to the pins of microcontroller (pa0 to pa3).The ATmega16 is a low power, 8-bit CMOS microcontroller based on the AVR enhanced RISC architecture. It provides the following features: 16kb of in-system programmable flash program memory with read-while-write capabilities, 512 bytes of EEPROM, 1kb SRAM, and 32 (I/O) lines. Outputs from port pins PD0 through PD3 and PD7 of the microcontroller are fed to the inputsIN1 through IN4 and enable pins (EN1 and EN2) of motor driver L293D IC, respectively to drive two geared dc motors. Switch S1 is used for manual reset. The microcontroller output is not sufficient to drive the dc motors, so Current drivers are required for motor rotation. The L293D is a quad, high- current, half-h driver designed to provide bidirectional drive currents of up to 600mA at voltages

from 4.5V to 36V. It makes it easier to drive the dc motors. The L293D consists of four drivers. Pins IN1 through IN4 and OUT1 through OUT4 are the input and output pins respectively, of driver 1 through driver 4. Drivers 1 and 2, and driver 3 and 4 are enabled by enable pin 1(EN1) and pin 9 (EN2), respectively. When enable input EN1 (pin1) is high, drivers 1 and 2 are

enabled and the outputs corresponding to their inputs are active. Similarly, enable input EN2 (pin9) enables drivers 3. The complete circuit diagram is illustrated in figure-3 below.



In order to control the toy car, a call need to make to the cell phone attached to the toy car (through headphone) from any phone, which sends DTMF tunes on pressing the numeric buttons. The cell phone in the car kept in 'auto answer' mode. So after a ring, the cell phone accepts the call. Now particular button may press on the mobile phone for pre defined desired action. The DTMF tones thus produced are received by the cell phone in the car. These tones are fed to the circuit by headset of the cell phone. The MT8870 decodes the received tone and sends the equivalent binary number to the microcontroller. According to the program in the microcontroller, the car starts moving. When the number key '2' (binary equivalent 00000010) is pressed on the mobile phone, the microcontroller outputs '10001001' binary equivalent. Port pins PD0, PD3 and PD7 are high. The high output at PD7 of the microcontroller drives the motor driver (L293D). Port pins PD0 and PD3 drive motors M1 and M2 in forward direction (as per table). Similarly, stop

condition as per the condition. Details conditions are shown in the flow chart diagram.

The primary objective of this project was to build a cell phone link between a transmitter and a dumb car and provide the capability to operate the car from a remote location. The purpose of using the cell phone was to make the operation possible from any remote location in the world where cell phone use is available. The product would include two interface systems. One interface would operate between the transmitter and a sending cell phone, and a second interface would operate between the receiving cell phone and the dumb car. The interface on the sending side would allow production and encoding of signals suitable for transmission via a cell phone. The interface on the receiving end would process the signals received by the cell phone and control the dumb car. The simple diagram below illustrates the concept of the project.

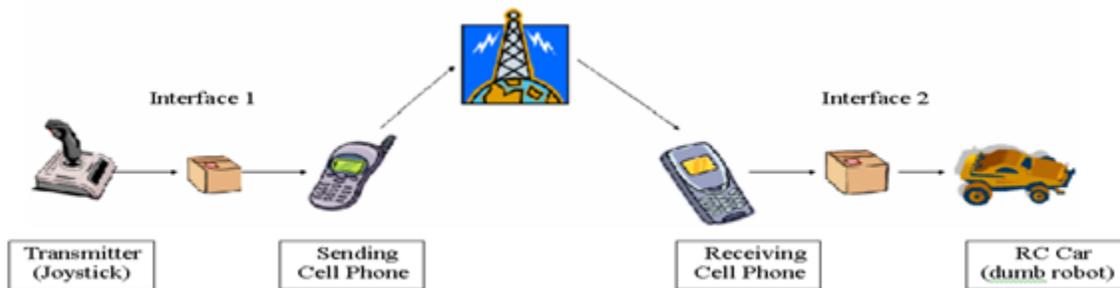


Fig-4: Pictorial representation of the complete system.



Fig-5: Practical Implementation of the system.

In order to the work properly this system, certain specifications are made. They are:

- The system must have an interface between the transmitter, the sending phone and another interface between the receiver phone and the robot.
- The cell phones should be any common cell phone. However, a specific model can be chosen because of hands free set connection type.
- Very negligible delay compare to the operation of the off-the-shelf unit one.
- The system should be a low power device.
- Both mobile phones should have activated DTMF service for controlling the robot from a remote location.

The working procedure for this model is very simple. At first, the robot needs to turn ON by giving power supply of 10v battery. Now dial a mobile number that is connected with robot at remote location. Then after ringing the remote mobile connected with robot, it will automatically connected by Auto-Answer option in mobile phone just like an internet connection established between two systems. It needs to be ensured that DTMF tones sending facility should be active between both mobiles. After connection establishment the keyboard need to use to operate the robot car in particular direction. The flow chart of the whole circuit is very helpful for the complete comprehending of the working principle of this model. For that purpose the flow chart is shown below.

Identify the constructs of a Journal – Essentially a journal consists of five major sections. The number of pages may vary depending upon the topic of research work but generally comprises up to 5 to 7 pages. These are:

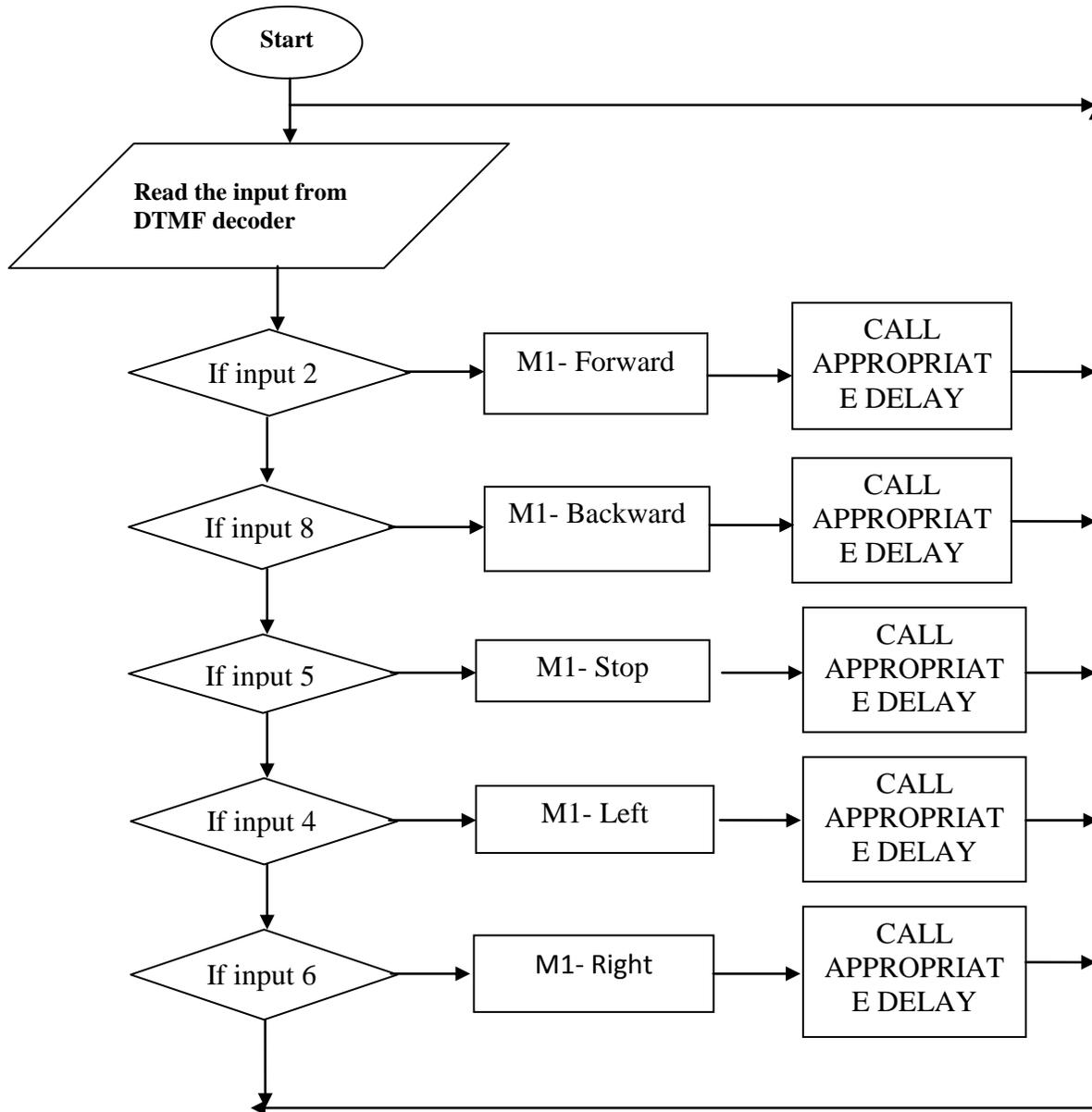


Fig-6: Flow chart of the model.

There are 3 main parts of this system. They are the decoder, microcontroller and the motor driver. The following paragraph explains about their working procedure in briefly. The MT-8870 DTMF DECODER IC is a full DTMF Receiver that integrates both band split filter and decoder functions into a single 18-pin DIP or SOIC package. Manufactured using CMOS process technology, the M-8870 offers low power consumption (35mW max) and precise data handling. Its filter section uses switched capacitor technology for both the high and low group filters and for dial tone rejection. Its decoder uses digital counting techniques to detect and decode all 16 DTMF tone pairs into a 4-bit code. External component count is minimized by provision of an on-chip differential input amplifier, clock generator and latched tri-state interface bus. Minimal external components required include a low-cost 3.579545 MHz color burst crystal, a timing resistor, and a timing capacitor. The M-8870-02 provides a “power-down” option which, when enabled, drops

consumption to less than 0.5mW [10]. The M-8870-02 can also inhibit the decoding of fourth column digits. M-8870 operating functions include a band split filter that separates the high and low tones of the received pair and a digital decoder that verifies both the frequency and duration of the received tones before passing the resulting 4-bit code to the output bus [12].

The low and high group tones are separated by applying the dual-tone signal to the inputs of two 6th order switched capacitor band pass filters with bandwidths. That corresponds to the bands enclosing the low and high group tones. The filter also incorporates notches at 350 and 440 Hz, providing excellent dial tone rejection. Each filter output is followed by a single-order switched capacitor section that smoothes the signals prior to limiting. Signal limiting is performed by high gain comparators provided with hysteresis to prevent detection of unwanted low-level signals and noise. The comparator outputs provide full-rail logic swings at the frequencies of the incoming tones. Decoder

the M-8870 uses a digital counting technique to determine the frequencies of the limited tones and to verify that they correspond to standard DTMF frequencies [11]. A complex averaging algorithm is used to protect against tone simulation by extraneous signals (such as voice) while tolerating small frequency variations. The algorithm ensures an optimum combination of immunity to talk off and tolerance to interfering signals (Third tones) and noise. When the detector recognizes the simultaneous presence of two valid tones (known as signal condition), it raises the Early Steering flag (Est.) [12]. Any subsequent loss of signal condition will cause Est. to fall.

As the microcontroller used in this system is a very popular one hence the details about this microcontroller is show explained here. However, information about the ATMEGA16 microcontroller can be found on [13,16].

The L293D IC (Motor Driver) Device is a monolithic integrated high voltage, high current four channel driver designed to accept standard DTL or TTL logic levels and drive inductive loads (such as relays solenoids, DC and stepping motors) and switching power transistors [14]. To simplify use as two bridges each pair of channels is equipped with an enable input. A separate supply input is provided for the logic, allowing operation at a lower voltage and internal clamp diodes are included. This device is suitable for use in switching application at frequencies up to 5 kHz. The L293D is assembled in a 16 lead plastic Package which has 4 center pins connected together and used for heat sinking. The L293DD is assembled in a 20 lead surface Mount which has 8 centre pins connected together and used for heat sinking. A circuit connection of the motor driver is shown.

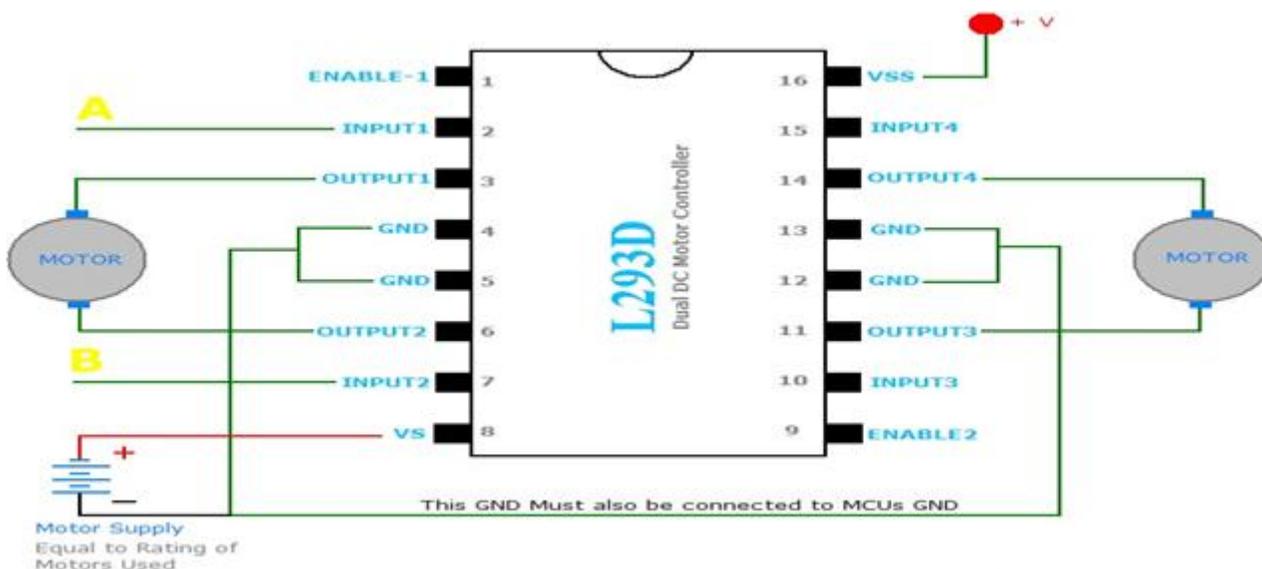


Fig-7: Circuit Configuration of L293D.

IV. APPLICATION

- It can also be used to make mobile bomb by making some modification.
- If we use the switching IC instead of the driver IC we can turn on and off any appliances connected to this toy car.
- This toy car can carry in their capacity.
- This can be fitted in an attractive form of a toy car for child pleaser.
- Adding a camera could highly increase its popularity.
- Password protected systems have used in many war conditions and so on.

V. CONCLUSION

In this project, the toy car is controlled by a mobile phone that makes a call to the mobile phone attached to the car. In the course of a call, if any button is pressed, a tone corresponding to the button pressed is heard at the other end of the call. This is a wireless controller toy car hence the limitation of wired is

completely overcome by using latest technology of mobile phones. However, there are still lots of scopes to improve the stability and ability of this system. The mobile phone that makes a call to mobile phone stacked in the car act as a remote. Hence this project does not require the construction of receiver and transmitter units. It is undoubtedly true that, this model can be a very significant device in case of the information acquisition from the remote areas where direct interference of human being is quite impossible hence it would be a very crucial topic to do further research on it.

APPENDIX

The programming codes for this model are done in the programming language C and are given below.

```
void main(void)
{
    unsigned int k, h;
    DDRC=0x00;
    DDRD=0xFF;
    while (1)
```

```
{
k =~PINC;
h=k & 0x0F;
switch (h)
{
case 0x02: //if I/P is 0x02
{
//O/P 0x89 ie Forward
PORTD2_bit = 1;
PORTD3_bit = 0;
PORTD7_bit = 1;
break;
}
case 0x08: //if I/P is 0x08
{
//O/P 0x86 ie Backward
PORTD2_bit = 0;
PORTD3_bit = 1;
PORTD7_bit = 1;
break;
}
case 0x04:
{
// Left turn
PORTD0_bit = 1;
PORTD1_bit = 0;
PORTD7_bit = 1;
break;
}
case 0x06:
{
// Right turn
PORTD0_bit = 0;
PORTD1_bit = 1;
PORTD7_bit = 1;
break;
}
case 0x05:
{
PORTD=0x00; // Stop
break;
}
}
}
```

REFERENCES

- [1] Awab Fakh, Jovita Serrao, Cell Phone Operated Robotic Car. International Journal of Scientific & Engineering Research, ISSN 2229-5518.
- [2] L. Schenker, "Pushbutton Calling with a Two- Group Voice-Frequency Code", The Bell System Technical Journal, 39(1), 1960, 235-255, ISSN 0005-8580
- [3] Siegmund M. Redl, Matthias K. Weber, Malcolm W. Oilphant, GSM and Personal Communications Handbook, Artech House Boston, London.
- [4] V. Subramanyam, Electric Drives (Mc-Graw Hill, 1996)
- [5] Information available at the following link, <http://www.tfcbooks.com/special/missiles.htm>
- [6] Leland Anderson, Nikola Tesla —Guided Weapons & Computer Technology', Tesla Presents Series Part 3.

- [7] Analog Telephony Compliance Requirements Overview, Hermon Laboratories TI Ltd. 2009.
- [8] Hector of SCP, Dual Tone Multiple Frequency A guide to understanding and exploiting Australians most common telecommunications signaling method. December 10th 2003
- [9] S. A. Nasar, I. Boldea, Electric Drives (CRC/Taylor and Francis, 2006)
- [10] M-8870 DTMF Receiver, Information available at the following link, www.datasheetcatalog.org/datasheet/clare/M-8870-01SMTR.pdf
- [11] Milove H. Kothari, Telephonic Control Of Electrical Equipment. Electrical Engineering From L.D. College Of Engineering.
- [12] "DTMF Tester", Electronics For You' Magazine, Online Edition (June 2010).
- [13] Introduction to the Atmel ATmega16 Microcontroller, San José State University Dept. of Mechanical and Aerospace Engineering, 6th.September, 2010.
- [14] J. Banuchandar, V. Kaliraj, P. Balasubramanian, S. Deepa, N. Thamilarasi, Automated Unmanned Railway Level Crossing System, International Journal of Modern Engineering Research (IJMER), Vol.2, Issue.1, Jan-Feb 2012 pp-458-463 ISSN: 2249-6645.
- [15] Edwin Wise, Robotics Demystified (Mc-Graw Hill, 2005)
- [16] K. J. Ayala, 8051 Microcontroller (Delmar Learning, Thomson, 3rd Edition).

AUTHORS

First Author – Sabuj Das Gupta is currently doing graduate study at University of Victoria, BC, Canada. He worked as a lecturer of EEE department in American International University-Bangladesh from 2009 to 2012. He has completed his Masters from University of Technology, Sydney, Australia in 2011. His major was in Energy Planning & Policy. He finished his bachelor degree in Electrical and Electronics Engineering from American International University-Bangladesh with a major in Electrical Engineering in 2009. He can be reach at sdgupta@uvic.ca, aadi@aiub.edu, aadi6600@gmail.com

Second Author – Arman Riaz Ochi has finished his bachelor degree in Electrical and Electronics Engineering from American International University-Bangladesh in 2011. He can be reach at arman_riaz@aiub.edu

Third Author – Mohammad Sakib Hossain has finished his bachelor degree in Electrical and Electronics Engineering from Chittagong University of Engineering & Technology in 2009. He can be reach at shahin_8943@yahoo.com

Fourth Author – Nahid Alam Siddique has finished his bachelor degree in Electrical and Electronics Engineering from Chittagong University of Engineering & Technology in 2009. He can be reach at punam0027@yahoo.com

Correspondence Author – Sabuj Das Gupta, sdgupta@uvic.ca, aadi@aiub.edu, Mobile: +8801714094191

The Proportional Relations Systems of Islamic Architecture

Kadhim Fathel Khalil and Julaihi Wahid

School of Housing, Building and Planning, University Sains Malaysia, 11800 Penang

Abstract- The problem of the current research has been represented by the lack of studies on the foundations of forming the proportional relations in the Islamic architecture. The objective of the study was defined in an attempt to reveal the concepts and the items of the system of proportional relations in the Islamic architecture. The proportion in architecture either derived from the mathematical matrix or other disciplines are always concerned on the spatial system through measurement and form's relations. The obtained conclusions show the authenticity of the system of proportional relations in the Islamic architecture which was based on two factors, the aesthetic sense related to the symbolic aesthetic systems and the acquired knowledge related to the mathematical geometrical systems of Muslims. Hence, the Islamic architecture compositions are correlated even though the functional types and the architectural styles of its architectural models are differentiated by a unified view of the constructs underlying the proportional relations system.

Index Terms- proportional relations, the aesthetic sense, the acquired knowledge, architectural styles.

I. INTRODUCTION

Proportional relations system is considered to be among the basic rules of form or the internal system of the form, as it indicates the nature of the tangible relations that is resulted from the correlation of the parts and the wholes of the form components. It is based on items that are regarded as the fundamental characteristics or rules of the form where the basic attributes of the architectural typify¹ are embodied.

Plato has considered the proportional relation as being a symphonic construct contingent to a dynamic symmetry and associated with a rhythm in time and space. This view was originated from the Pythagoras notion on musical harmony. The Greek have given the name Analogia to proportionality i.e. symmetry. Vitruvius has expressed proportionality within the concept of Symmetry, yet it implied the meaning of proportionality. Symmetry, in this place, lies in the reciprocal

¹ The typify concept is meant to identify a set of architectural works that have the same architectural characteristics, such that are perceived to belong to the same group (Mitchell: 83:95).

relationship among different elements, i.e. the parts, then between these parts and the whole (Ghyka: introduction).

Gedal has defined the science of amount or what is referred to as, at present, the Science of Proportion as being the body of knowledge that concerns about studying the spatial system through measurement and form's relations. Before considering it as a Pure Theoretical science, the science of amount represented the body of applied knowledge which had proven being more useful in the architectural design for many ancient civilizations like those of Mesopotamia, Egypt and India. Geometric principles have become familiar for Islamic schools in the middle ages through the book of Euclid, translated by Alhadjj Bin Yousif Bin Matar in 790 A.D. (Gedal: 20).

II. THE NOBLE PROPORTIONS

The Muslims believed that Allah, the Almighty has no partner and no counterpart, Allah is One in reality and all other livings are two at a time composed and created. He is the one in reality and responsible for the composition and creation of all living things. All creations are perfected and the proportion are more than the image beyond composition. In everyday items also to cussed on symmetry and proportion for example a house, the symmetrical design of each elements of the compositions also show the proportion. Generally speaking, everything made of something of a contradictory nature, conflicting forces or different shapes, the most perfect of which is the one whose parts' composition and organs' structure are at the best proportion. The noble proportions as determined by Ikhwan Alsafa are as follows: the equivalent, the equivalent and the half, the equivalent and the third, the equivalent and the quarter and the equivalent and the eighth Table: 1 (Ikhwan Alsafa: 222-255).

Table 1: Noble Proportions at Ikhwan Alsafa.

The Proportion Increase	The Proportion Decrease
1:1	1:1
1:1.5	1:0.66
1:1.33	1:0.75
1:1.25	1:0.80
1:1.125	1:0.90

Alarmwe restricts the proportions of numbers to each other and infers their dimensions while using the proportions from the proportions and the ranks of their amounts in terms of consistency, inconsistency as well as the names given to them. He states that there is a proportion between every two numbers by the way of quantity and this proportion is confined to twelve

segments if the greatest is proportioned to the smallest, which is either equation proportion, the equivalent and the part proportion or the equivalent and the parts or the double, the double and the part, the double and the parts or the equivalent, the equivalent and the part, the equivalent and the parts or the doubles, the doubles and the part or the doubles and the parts Table: 2 (Alrijab: 37).

Table 2: Noble Proportions at Alarmwe.

The Proportion Increase	The Proportion Decrease
1:1	1:1
1:2	1:0.5
1:1.5	1:0.66
1:1.33	1:0.75
1:1.25	1:0.80

(Alrijab: 37).

Alarmwe confirms that the most noble proportions is the double, then the three to the two which are the first ranks of the equivalent and the part which I have known as being the whole and half of the whole. Next, the equivalent and the third proportion, then the quarter and what follows on the order according to this scale. What could be found of dimensions on the equivalent proportion is concurrent and what is found on the equivalent and the part proportion or the double, the double and the part or the third equivalents, the third equivalents and the part or the doubles, the doubles and the part are considered as concurrent dimensions Table: 3 & 4 (Alrijab: 51:54).

Table 3: Noble Proportions of Dimensions that are Consistent at Alarmwe.

The Proportion Increase	The Proportion Decrease	The Proportion
1:1	1:1	1:1
1:1.33	1:0.75	3:4
1:1.66	1:0.6	2:3
1:2	1:0.5	1:2
1:2.3	1:0.42	4:9
1:2.6	1:0.37	3:8
1:3	1:0.33	1:3

(Alrijab: 51).

Table 4: Noble Proportions of Dimensions that are Consistent at Alarmwe.

The Proportion Increase	The Proportion Decrease
1:1	1:1
1:2	1:0.5
1:1.5	1:0.66
1:1.66	1:0.60
1:1.6	1:0.625
1:1.62	1:0.615
1:1.615	1:0.619

(Alrijab: 54).

Alarmwe suggests that the first proportion that should be considered is the two to one proportion which is the double. This dimension is the most noble concurrent, consistent and intermingled dimensions if the soul wasn't in a state of mental confusion that necessitates a perception pause in delivering someone's saying that the two is the double of the one which is similar to the state of mental confusion when it is said that this number is the equivalent of five sixth, its similar to the number (611). The soul is before a mental confusion followed by spiritual pain to the lack for perception speed for perfection which has no actual occurrence in that situation. Further, the soul is also-through the sense of hearing- might be in a sense of imperfection in that situation, such that finds it not good to be heard for the above mentioned reason although the cause in that isn't reasoned Table: 5 (Alrijab: 37).

Table 5 : Mattresses and Percentage of Number at Alarmwe.

The Proportion
1:1
4:3
5:3
6:3
7:3
8:3
9:3
10:3
11:3
12:3
13:3
14:3

(Alrijab: 38).

III. TYPES OF PROPORTIONAL RELATIONS IN ARCHITECTURE

Ching maintains that proportions are three types (Ching: 285:286) as follow:

- 3.1. Arithmetic proportion like (3:2:1) , (1,2,3) $c/c = c-b/b-a$
- 3.2. Geometric proportion like (4:2:1) , (1,2,4) $c/b = c-b/b-a$
- 3.3. Harmonic proportion like (6:3:2) , (2,3,6) $c/a = c-b/a-b$

IV. SYSTEMS OF PROPORTIONAL RELATIONS IN ARCHITECTURE

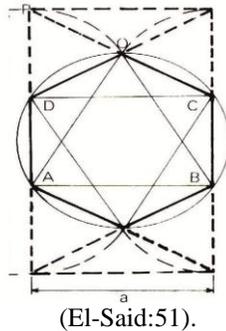
The studies that dealt with proportionality in architecture presented a number of systems that control proportional relations in architecture (Langhein: 3) as follows:

4.1. Triangulation

Triangulation system is obtained by drawing two circles with a constant curve where each circle intersects the center of the other one. Through this simple process, Langhein & Al-Said confirm that the building, like the Islamic architecture, during the middle centuries has three important results as follows: a right angle, an equilateral triangle and a (3:1) ratio. If one continues drawing curve-shaped circles, he would only need to reiterate that five times to form a hexagon, which can be made square like

the triangle and the regular square to completely pave a surface
 Figure: 1 (Langhein: 7).

Figure 1: Systems of Proportional Relations in Architecture: Triangulation.

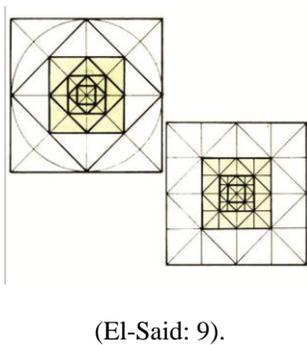


4.2. Quadratue

Langhein suggests that quadratue might be the most commonly used and flexible proportional systems as it allows multi groups of integers in the horizontal and vertical lines. Diagonal organizing lines could be also made in quadratue system. Quadratue proportions usually give an impression of calmness, welfare and full satisfaction of life.

Quadratue proportions have prevailed in the ruins of the Romans, in the civilizations of the middle ages up to the Gothic age as well as in the Indian, the Buddhist and the Islamic civilizations Figure: 2 (Langhein: 6:8).

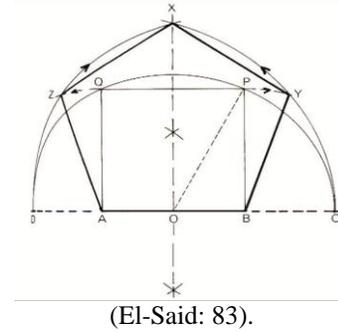
Figure 2: Systems of Proportional Relations in Architecture: Quadratue.



4.3. Quinture

The dimension of the quinture or the pentagon system is based on the quinquilateral and the pentagonal shape which is the proportion of the Golden Mean and ambiguity. This shape used to be the greatest secrets of Pythagoreans which he used to call Luca Pacioli the Divine Proportion. There are mathematical and physical riddles, secrets of cultural traditions surrounding the quinture, the quinquilateral, the pentagonal and the pentagonal star Figure: 3 (Langhein: 8).

Figure 3: Systems of Proportional Relations in Architecture: Quintur.

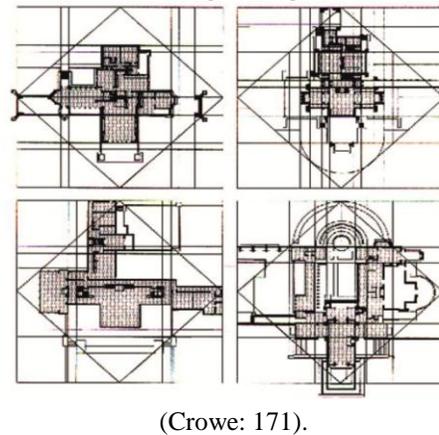


V. THE MAIN ORGANIZING LINES - LINEAMENTS

Achieving the notions of typify and unity is done through the processes of designing. Perhaps, the most important among these processes is working out the main lines or as Alberti called them "Lineamenta". This includes the creation of a matrix of lines with a space of three dimensions aiming at emptying the total shape of the building and the relations of the constituting elements with each other, such that the lineaments identify walls' thickness and locations or the like, the size of the constructional holes-the space between the elements bearing the weight. Thus, they draw up the required number, the dimensions and the relations among each other and away from others, i.e. drawing up the proportional relations (Crowe: 170).

Lineaments are rarely connected parts, and reading them isn't a solution for the puzzle since we are all set with an unconscious ability to distinguish and identify them. The most common lineaments which are related to the main constructs-the whole- of the building are the main diagonal connecting points and the constructional diameters, besides the main lengths of the construct where the eye connects any elements that are placed along those lines by the whole Figure: 4 (Langhein: 7).

Figure 4: The Main Organizing Lines - Lineaments.



5.1. The System of Dimensions: The Standard Module

The digital system, upon which the proportional relations system is based, rests on the concept of standard module or the "Datum Dimension" as Vitruvius called it however, Abdulrahman, in his study entitled: "Design Module and

Proportions in Architecture", prefers to use the term "Design Module". Though evident differences are noticed in this term, all the studies agree that the standard module, upon which the majority of proportional relations are based, is a dimension whereby different parts of the building-or any other work of art-are reiterated. In other words, it is a module of constant dimensions which itself or its multiples reiterate whether by an increase or a decrease as a foundation for any construct in order to -eventually- achieve the total consistency of the emerging group whether it was functional or aesthetic (Tansey: 11) (Abdulrahman: 75).

5.2. The System of Relations: The Reciprocal Relation

The system of relations, upon which the system of proportional relations is based, rest on the concept of the reciprocal relation between the whole and the part. P.H. Scholfeild confirms that the domination over most of the systems used in establishing the architectural proportionality, is the attempt to create an evident system through the system of relations between the part and the whole which depends on the principles of frequency, symmetry, balance, gradation for similar forms and shapes compatible with generating the orders of mathematical proportional relations among the linear dimensions of the design (Steadman: 222).

El-Said suggests that the process of using the basic geometrical forms is achieved by certain proportional relations, confirming that they aim at forming varied types based on unified proportional foundations, as those proportional relations are founded on a system of relations between the part and the whole through the principles of frequency, symmetry, balance, and gradation (El-Said: 115:127).

VI. HYPOTHESES FORMATION

6.1. Hypotheses Related to the System of Dimensions

6.1.1. Proportional relations in the Islamic architecture are based on the system of favorite dimensions which is founded on the system of the noble proportions systems.

6.1.2. Proportional relations unify through the system of favorite dimensions among the part, the parts and the whole levels throughout different shapes and measurements of the Islamic Architectural composition, regardless the classifications of functional type and architectural style of the construct.

6.2. Hypotheses Related to the System of Relations

6.2.1. Proportional relations in Islamic architecture rest on the system of favorite relations which is based on frequency, symmetry, balance, and gradation.

6.2.2. Proportional relations are combined through the system of favorite relations among the part, the parts and the whole levels of various forms and measurements of the architectural Islamic composition, regardless the classifications of the functional type and the architectural style of the construct.

VII. APPLIED STUDY

The major items upon which the system of proportional relations rests have been identified in order to be measured and specified. They are represented by the system of dimensions and favorite relations achieved at the part, the parts and the whole levels. These items occupy a special position for the fundamental role they play in the construct of proportional relations and the possibility of recognizing the nature of those relations through them. Besides, these items represent the formal aspect of the architectural construct, such that could be measured on the Islamic architectural models (Al Ali: 125).

17 Islamic architectural samples were chosen for study and analysis, taking into consideration their different ages and regions to prove that a certain system for proportional relations had been used in such architect as a part of the Islamic culture (Al Ali: 121:125).

The final selection of the samples was done within the following: Table: 6, Figures: 6,7&8.

7.1. The chosen architectural models represented the three levels the part, the parts and the whole to study the proportional relations. So, there has been integration in the relation among the levels, regardless of the measurement incorporated in the reflection of proportional relations of the part into the whole and vice versa.

7.2. The chosen architectural models are not subjected to certain conditional determinants of time and place since the formal stylistic diversity in various places and times is combined by a unified formal type.

7.3. Focus is going to be on the public Islamic buildings such as mosques, schools and shrines which are considered as being typical ones arose in the Islamic culture or for the special nature they acquired during the Islamic period that didn't appear in later periods. Ancient none-Islamic buildings like the Roman's and the Christian's, for instance, weren't used to meet Islamic functions, unless certain modifications are made on churches and other religious temples to be converted into mosques like the mosques of Damascus and Jerusalem. Yet, that modification was rare and the image of the building after modification was completely different from the original Roman or the Hellenistic structure (Schacht & Bosworth: 375).

7.4. The architectural models were chosen from the golden periods of the Islamic architecture not in its early or late periods, because earlier periods were characterized by focusing on establishing the Islamic thought in the society more than building the architectural aspects. Thus, most of the buildings were simple and reduced to their primary basic elements as in the construction of the prophetic mosque. As to the late historical periods, local effects related to symbolic origins of the ancient local culture of pre-Islamic periods are evident.

7.5. The chosen architectural models are not subjected to physical qualitative, non-quantitative determinants or what is referred to as the type of construct, such as the horizontal projection of the whole the mass including the courtyard: square, rectangle, circle, octagon..., types of spatial compilation: central,

longitudinal, radial..., the types of an axis-symmetric, two axis-symmetric outlines..., the existence or non-existence of the courtyard..., as the type of construct is the parameter of form-function relation that resulted in types characterized by flexibility in the Islamic architecture and imparted unity and divvy without losing its suitability for the purposes behind its foundation².

The considerations behind choosing the architectural models have turned to be in harmony with studying and analyzing as much as possible of the remaining Islamic architectural models taking into account their different ages and regions to prove that a certain system for proportional relations was used in the Islamic architecture as being a part of the Islamic culture.

VIII. RESULTS DISCUSSION

8.1. Discussing the Results of the Geometrical Analysis of the Architectural Models Geometrically

8.1.1. Discussing the Results of Analyzing the System of Dimensions of the Lineaments

The results attained through analyzing the system of dimensions of the main lines organizing the architectural models geometrically Table: 7 show that, although the projects of the architectural constructs vary in shapes, volumes and the level of their study; they are combined through the system of dimensions of the main lines organizing them. It is also found that this system isn't confined to a certain proportional system or a certain proportion, as we noted that the same model has several proportional systems just as the other architectural models have, in the chosen architectural models in general. Those systems were organized into seventeen grades relative to the increase and the decrease shown in Table: 7 and whose compatibility could be noted with what has been presented about ratio and proportionality amongst Muslims and which shows that the most important proportion for them is equality, then the other proportions that follow. By increasing the maximum variations, which are: multiple, the equal plus a part, the equal plus parts, multiple, multiple plus a part, multiple plus parts.... Or by decreasing the minimum variations, which are: the half, the third, the quarter, the fifth, the sixth, the seventh.... These proportions turned to express the nature of the proportional relation whether in a successive -connected- or non-successive -disconnected- proportionality by one increasing or decreasing relation. Therefore; the proportional relation derived from the equality relation -the equal- would be either a -halving, tripling... relation or a multiplication, equalization.. relation, the most of which starts out -at the construct of Islamic architecture- from the relation of the diameter with its chords and perimeter and the relation of the square side with its diameter Figure: 5.

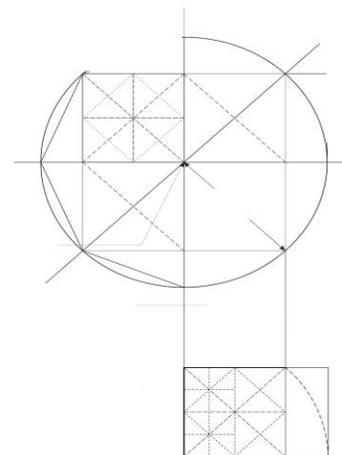
²Islamic buildings are characterized by flexibility in terms of the traditionalism of their architecture and the change of their functions and forms. If we moved from Samarqand to Andalusia, we'll find that an idea found in one building could be found in other places and finds its way to it. Yet, it isn't meant to assimilate the function only, but to be in harmony with the idea of place as well, where the extremely flexible basic type exists, such that the same form is wide enough for different functions (Almaliki:148).

Table 7: The Proportion Increase and Decrease for the Relations System of Lineaments of the Architectural Models.

The Proportion Increase	The Proportion Decrease
1:1	1:1
1:1.25	1:0.9
1:1.4	1:0.87
1:2	1:0.83
1:1.25	1:0.8
1:1.33	1:0.75
1:1.5	1:0.66
1:1.66	1:0.6
1:2	1:0.5
1:2.3	1:0.42
1:2.6	1:0.37
1:3	1:0.33
1:3.3	1:0.3
1:3.6	1:0.27
1:4	1:0.25
1:4.3	1:0.23
1:4.6	1:0.21

(Source: The Researcher).

Figure 5: Formative Basis of Proportional Relationships in Islamic Architecture.



(Source: The Researcher).

8.1.2. Discussing the Analysis of the Relations System of Lineaments

The results attained from analyzing the relations system of the lineaments for building the architectural models geometrically Table: 7 shows that, although the projects of the architectural constructs vary in shapes, volumes and the levels of study, the system of relations of the main lines gives them a formal unity.

Obviously, that system includes common characteristics regarding its basic attributes constituting the architectural construct order Repetition, Symmetry, Balance, and Gradation in terms of their type and nature for various architectural models, the most of which starts out -at the construct of Islamic architecture- from the relation of the diameter with its chords and

perimeter and the relation of the square side with its diameter. We find that the formal structure of the Islamic architectural construct includes the following:

1. Frequency of certain formal modules in a straight linear sequence where the frequency of these formal modules is inclusive, so it is the same for all the parts of the construct.
2. Constant symmetry for constant symmetrical formal modules. Symmetry might be dynamic based on the type of the rotational symmetry by separating the circular shape of the dominant foundation. Or the construct might be of a two-axis-symmetry or one-axis symmetry for all the parts of the construct.
3. Constant balance for formal modules leads to achieving centralization. The balance might be dynamic as a result of the relation between the constant-shaped square and the dynamic shape of the circle. Still, both cases include the type of formal balance for all the parts of the construct.
4. Gradation from what is considered secondary to what is considered principal towards the center; the construct is based on formal proliferated modules aligned in gradation towards the center which is regarded as the general foundation for all the parts of the construct.

8.2. Discussing the Results of the Geometrical Analysis of the Architectural Models Statistically by Applying Minitab 11, Stimulant 3.08

8.2.1. Discussing the Unilateral Analysis of Variables

Through the results attained on the statistical description of the unilateral analysis of variables, the following is evident: Islamic architectural constructs have approximate proportionalities made clear by the large convergence of the arithmetic means of those proportions which are within the noble proportions that unify at all levels and for all the architectural models that have been classified in accordance with functional types, architectural styles, geographical locations as well as through the major lines aligning the architectural models which indicates the fact of form invariability in the Islamic architectural constructs along with function variance at the levels boundaries of the whole, the most significant parts and even at the level of the part. The unity of the proportional relations system that leads the designing process in Islamic architecture is a general attribute for all the architectural models with all its functional types, architectural styles and levels. The variance in volumes and different dimensional variables of those models neither affect the determination of the proportional relation system used, nor making it different.

8.2.2. Discussing the Results of Analyzing the Close Relation among Variables

A unilateral analysis of variables paves the way for the statistical study that examines analyzing and studying the close relation among variables. Correlation coefficient was deduced through finding out the correlation matrix that clarifies the relations of all variables –the lineaments- among each other as follows:

1. The correlation matrix of the architectural models, in order to be classified over their geographical locations, is in direct

relation with each other. The correlation ranges between middle and close correlation in general and sometimes are strongly correlated.

2. The correlation matrix of the architectural models classified per functional types shows that all the types are in direct relation with each other and show an extremely close correlation among mosques, schools and shrines, whereas schools and shrines were in a middle value correlation.
3. The correlation matrix of the architectural models classified per architectural styles shows that all the styles are in direct relation with each other and each style is correlated with the remaining ones ranges between middle and very close in certain cases and extremely strong in general.
4. The aforementioned shows that the Islamic architecture constructs are correlated with each other through their geometrical building and mainly through proportional relations among them.

8.2.3. Discussing the Results of Analyzing the Nature of the Relation among Variables

Obviously, the lineaments system of the Islamic architecture constructs that is related to the length, the width and the radius of the construct, represents the most important variables at the part, the parts and the whole levels where they show their closest relations with other variables through equations, such that indicating inclusiveness and integration of the designing process and confirming, as well, that the designing process begins from the whole followed by a gradation of the part towards the whole and vice versa. Altogether, the equations attained had considerably participated in the process of anticipating the lost parts of any artistic or architectural constructs in case there is no sign indicating its form when an attempt is made to recognizing and documenting them.

8.2.4. Discussing the Results of Analyzing Variables Frequency

The aforementioned as a whole is oriented in the statistical study that examines the analysis of proportions frequency of the variables where the proportions of the proportional relations - the lineaments - for all variables. The results attained show the following:

1. A considerable convergence was found in the most frequent proportions of the chosen architectural models at all levels. Proportions are represented as follows: (1:0.2, 1:0.3, 1:0.4, 1:0.5, 1:0.6, 1:0.7, 1:0.8, 1:1).
2. Matching was found in the most frequent proportions for the chosen architectural models classified per functional types at all levels. Proportions are represented as follows: (1:0.5, 1:0.6, 1:0.7, 1:0.8, 1:1).
3. A considerable convergence was found in the most frequent proportions of the chosen architectural models classified per architectural styles at all levels. Proportions are represented as follows: (1:0.5, 1:0.6, 1:0.7, 1:0.8, 1:1, 1:0.2, 1:0.3).
4. A considerable convergence was found in the most frequent proportions of the chosen architectural models classified per geographical locations at all levels. Proportions are represented as follows: (1:0.6, 1:0.7, 1:0.8, 1:1, 1:0.2, 1:0.3, 1:0.5).

5. Matching was found in the most frequent proportions for the lineaments related to the radius of the construct, the width and the length. Proportions are represented as follows: (1:0.5, 1:0.6, 1:0.7), (1:0.7, 1:0.5, 1:0.6), as for those related to the height, they were as follows: (1:0.3, 1:0.4, 1:0.5). The frequency of the most frequent proportions of the lineaments related to the constructs height and width has corresponded with the remaining variables and height. Proportions are represented as follows: (1:0.5, 1:1) for the remaining variables. The following proportions are related to the height (1:0.2, 1:0.3, 1:1).

It is obvious from the aforementioned issues, although the architectural models and their functional types, architectural styles and geographical locations are variant; they are unified through the system of proportional relations, i.e. through using certain and specified proportional systems. The unification of variant types and styles is asserted by reiterating the same proportions and how it is reflected on the part, the parts, the whole levels of the constructs of architectural models, particularly those related to the lineaments related to the length, width and radius of the constructs which are considered as the most important variables upon which the lineaments are based and where most frequent proportions are related and matched with the proportions by which they are aligned at different levels. This might confirm the existence of the conceptual foundation that directs those proportional relations by adopting and reiterating those proportions only, represented by the noble proportions in particular.

IX. CONCLUSIONS

The conclusions show that there is a mutual relation among the levels of the architectural work the part, the parts and the whole in different forms and measurements of Islamic architecture constructs, such as making the system of proportional relations unified and characterized by inclusiveness and integration through the following:

9.1. Proportional relations in Islamic architecture lean on the system of favorite dimensions which is characterized by the unity of its system variables proportions that imparted unity on the architectural constructs through the alignment of variables that determine the dimensions system in certain proportions extremely convergent in all the architectural models represented by the noble proportions.

9.2. The proportional relations in the Islamic architecture that depends on the favorite relations is based on the following:

9.2.1. Repetition: Characterized by following a standard module reiterated by the multiplications and the parts of the standard module of the same construct. A capacity for expansion is available by multiplying the volumes which, in turn, results in the continuity of construct structure as a whole by multiplying itself with a different measurement -inclusive repetition- in a straight linear shape, such that constituting a net of reiterated modules that are -combined with the same reproducing module without being combined in size and measurement- around a

given center of the construct, such that distinguishing the Islamic constructs with the potentiality of addition or reduction.

9.2.2. Symmetry: Characterized by adopting regular pure geometrical shapes for the entire construct around a point -a central position- or around axis with constructional relations per constant system of dimensions.

9.2.3. Balance: Characterized by adopting the formal and imparts the visual balance to the construct amongst the dynamic shapes like the circle and the stable ones like the square per constant system of dimensions.

9.2.4. Gradation: Characterized by adopting the progression idea from what is considered secondary towards what is regarded a principal whether as a result of orienting towards what is being principal for its strategic subscription or for its extraordinary measurement through the gradation of relations among the part, the parts and the whole, such as confirming the elaborate integration in those relations in Islamic architecture constructs.

All of it introduces a cultural species for the Islamic architecture that is characterized by a unified system for the dimensions that include the noble proportions, a unified system for the relations which has the characteristic of constructional flexibility through frequency, high centralization plus preserving balance and evident symmetry.

After all, it is obvious that the analytical and the applicable findings of the study support the validity of the research hypotheses which have been checked out by finding out the evidence - conclusions - and whose validity have been verified through scientific and practical interpretation of the research problem.

Table 6: Islamic Architectural Models Elected According to Geographical Location, Functional Type, and Style.

Functional Type	Architectural Model	Geographical Location	Year of Achievement	Style
Mosques	Dome Of The Rock Mosque	Jerusalem	685/86-692	Umayyad
	Al-Mutawakkil Mosque	Samarra	848/49-852	Abbsid
	Ibn-Tulun Mosque	Cairo	876/77-879	Abbsid
	Great Mosque	Qayrawan	838-1016/62	Abbsid
	Al-Hakim Mosque	Cairo	990/91-1002/13	Fatimids
	Baybars Mosque	Cairo	1267-1269	Ayyubids
	Bibi Khanum Mosque	Samarkand	1399-1404	Persia
	Ulu Cami Mosque	Bursa	1396/1400	Ottoman
	Uc Serefeli Cami Mosque	Edirne	1438/47	Ottoman
	I-Shah Mosque	Mashhad	1638	Safavid
Schools	Al-Mustansiriya School	Baghdad	1233	Abbsid
	Sultan Hassan School	Cairo	1356-1359	Manluks
	Muradiye School	Bursa	1414	Ottoman
Shrines	Qubbat Al-Salaybiyah Shrine	Samarra	826	Abbsid
	Mashhad Sharif Shrine	Cairo	934	Fatimids
	Nur Al-Din Shrine	Damascus	1172	Ayyubids
	Yesil Turbe Shrine	Bursa	1413-1424	Ottoman

(Source: The Researcher).

Figure 6: The Geometrical Analysis of the Architectural Models Geometrically.

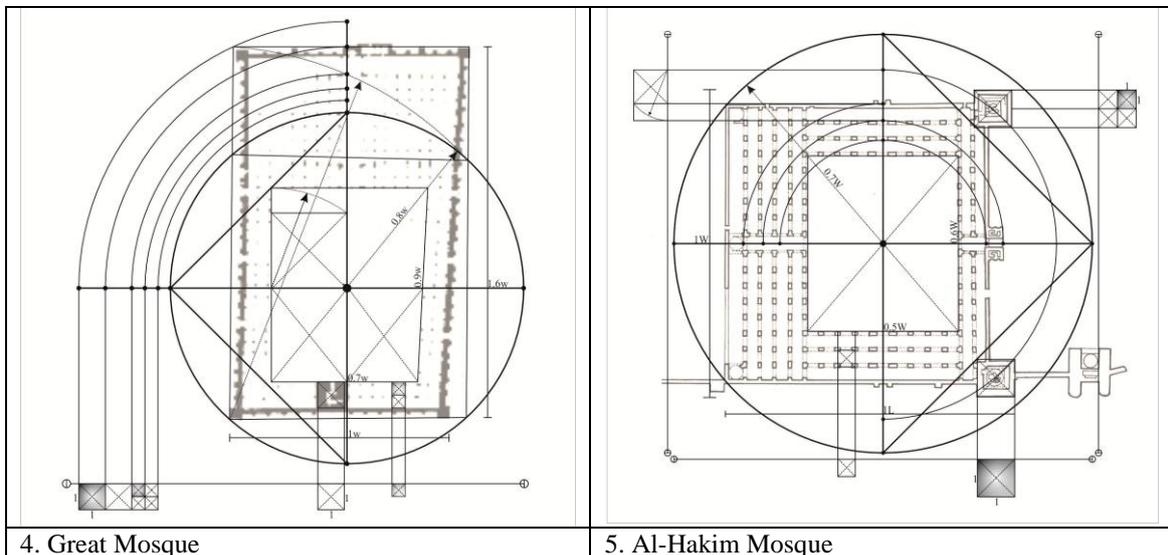
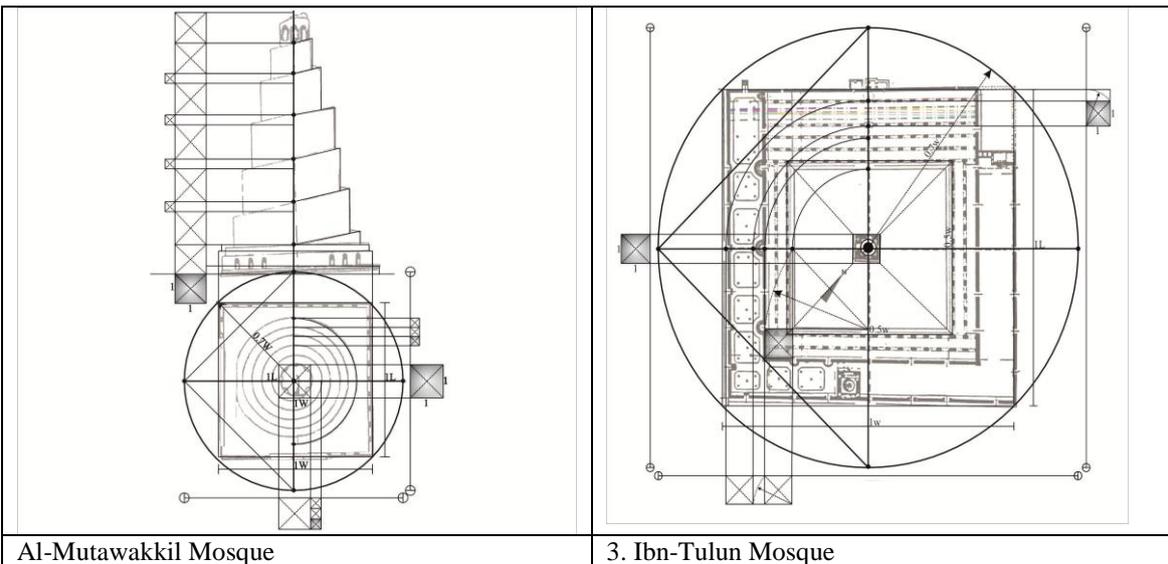
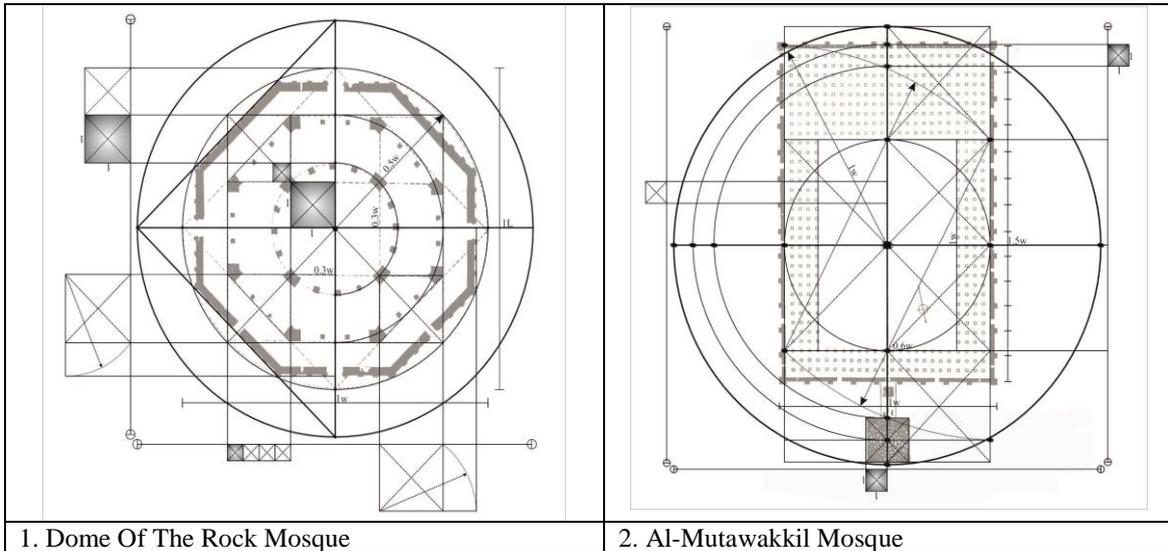


Figure 7: The Geometrical Analysis of the Architectural Models Geometrically.

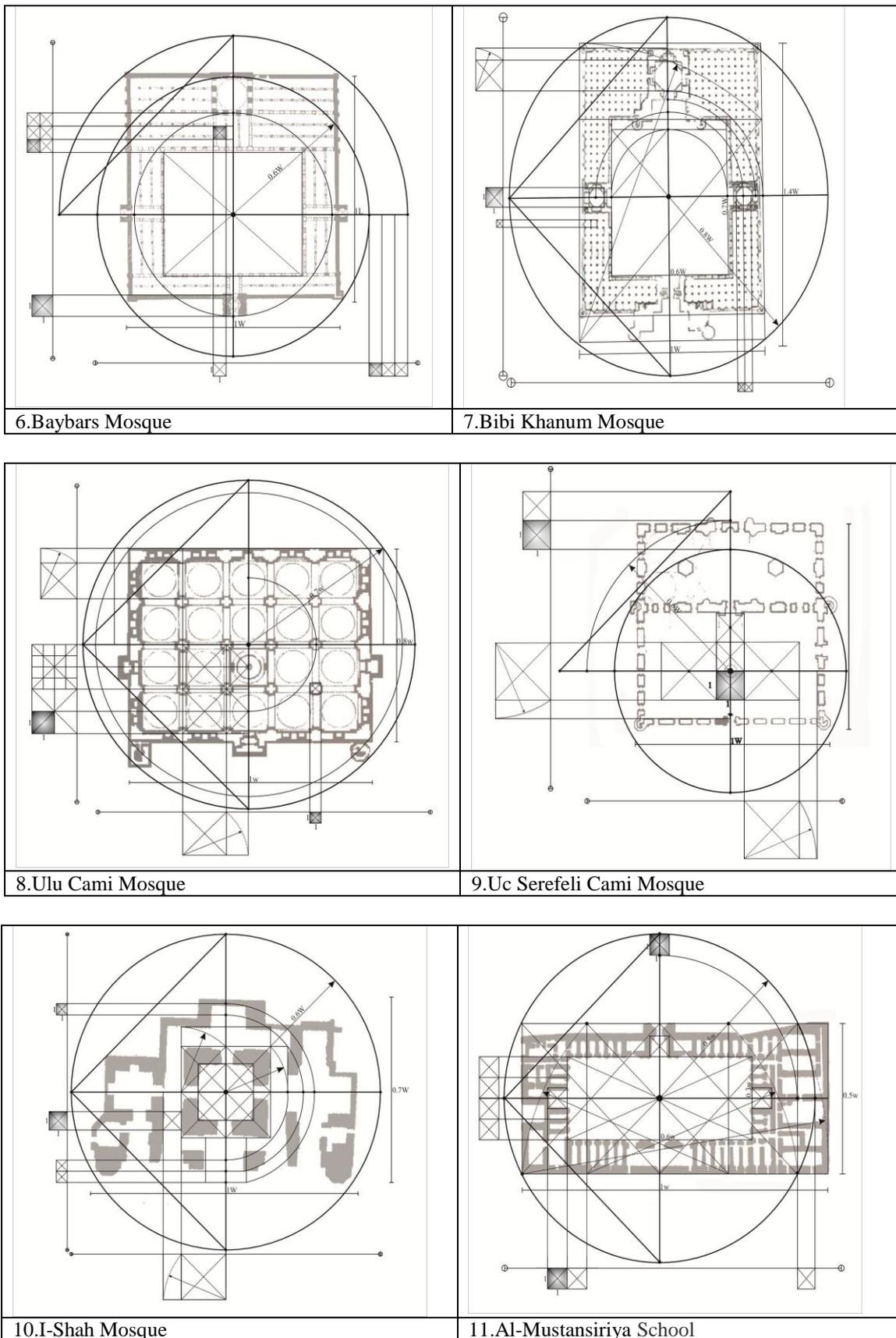
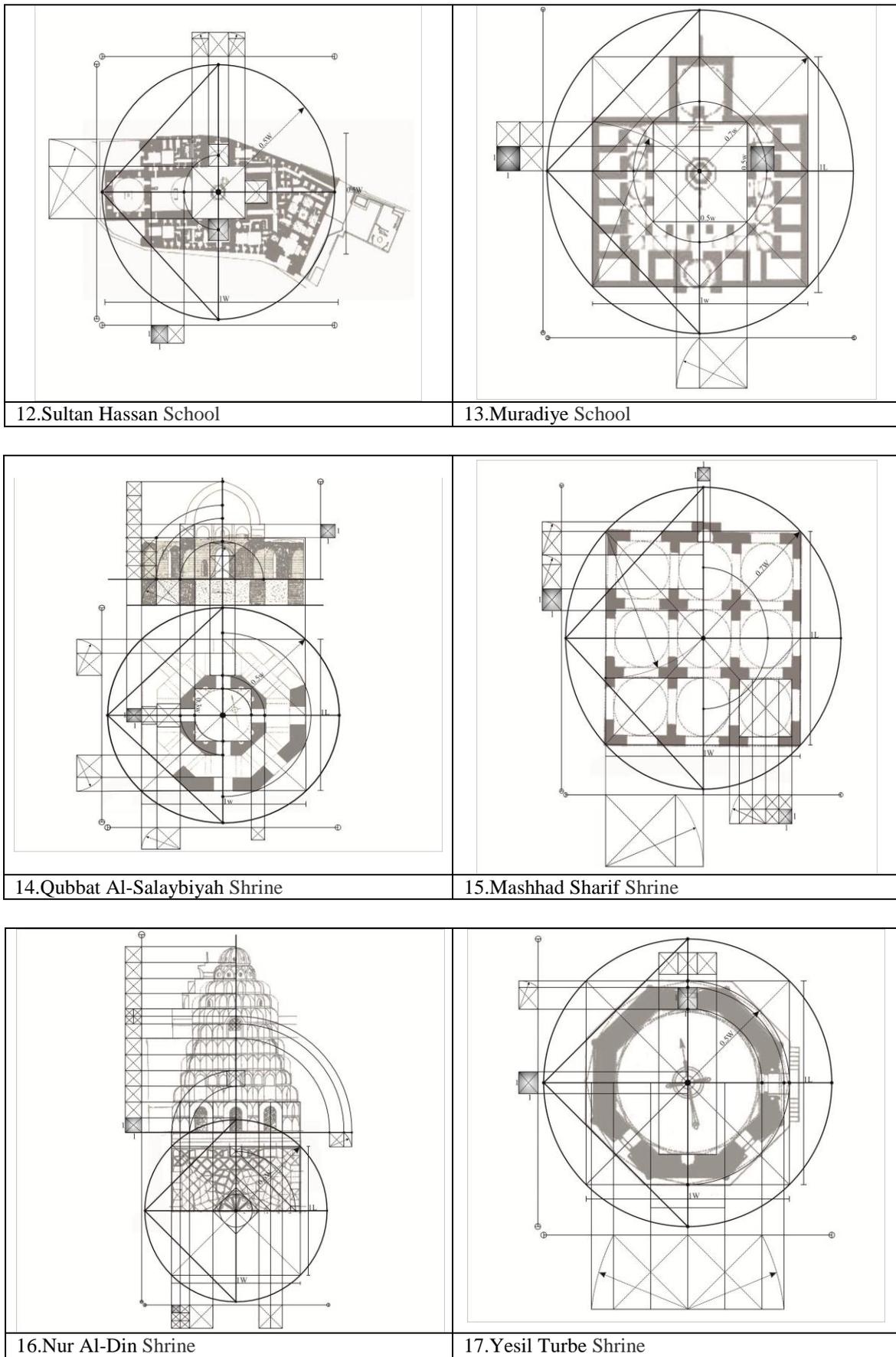


Figure 8: The Geometrical Analysis of the Architectural Models Geometrically.



REFERENCES

- [1] Abdulrahman, Osama Mahmoud (1993): Unit Ratios in the Design and Architecture. Architecture Magazine, Issue 7, Egypt.
- [2] Al Ali, Kadhim (2004): The Relations of Proportionality in Islamic Architecture. Unpublished MSc Thesis, Department of Architecture, University of Mosul.
- [3] Al-Farabi, Abu Nasr Muhammad Ibn Muhammad Ibn Muhammad Ibn Tarafan (1956): Great Book of Music. Explain Ghatas Abdul Malik, Review and Export: Mohamed Ahmed Hanafi, The Arab Book House, Cairo.
- [4] Almaliki, Kabela Fares (1996): Proportionality and Proportional Systems in the Arab-Islamic Architecture :An Analytical Study of the Abbasid Architecture in Iraq - From the Mid Eighth Century AD to the Mid Thirteenth Century. PhD Unpublished Thesis, Department of Architecture, Faculty of Engineering, University of Baghdad.
- [5] Alrijab, Alhaji Mohammed Hashim (1982) : Alresala Alsharafia in Alnesab Altalefeya – for Safi al-Din Abd al-Mu'min ibn Yusuf ibn al-Baghdadi Fakher Alarmwe) Dar Al Rashid, Ministry of Culture and Information, Heritage Books series 119, Iraq.
- [6] Ching, Francis D.K. (2002): Architecture: Form, Space, & Order. Second Edition. Van Nostrand Reinhold, ITP, A Division of International Thomson Publishing Inc.U.S.A.
- [7] Crowe, Norman (2003): Nature & The Idea of a Man - Made World: An Investigation Into the Evolutionary Roots of Form and Order in the Built Environment. The M.I.T. Press, Cambridge, Massachusetts, London.
- [8] El-Said, Issam & Parman, Ayse (1976): Geometric Concepts in Islamic Art. Scorpion Publishing Limited World of Islam Festival Trust, Guildford, England.
- [9] Gedal, Najib (1993): The Great Mosque of Qayrwan - Geometric Analysis - Architecture & Development in Islamic World. Edited by Sultan Barakat, Institute of Advanced Architectural studies, University of York.
- [10] Ghyka, Matila (1977): The Geometry of Art and Life. Dover Publications Inc., New York.
- [11] Ikhwan Alsafa(1957) : Rasael Ikhwan Alsafa wa Khalan Alwafa. Volume I, Section Sports, House of Beirut for the Printing and Publishing House Issued for Printing and Publishing, Beirut.
- [12] Langhein, Joachim (2002) : On the Path to a General Proportion Theory – Research Perspective for The 21st.Century. [http :/ www. Design community. com / students / 4563.html](http://www.Designcommunity.com/students/4563.html).
- [13] Mitchell, William J. (1992): Types and Vocabularies: The Logic of Architecture: Design, Computation and Cognition. M.I.T. Press, Cambridge.
- [14] Schacht, C. E.& Bosworth, J. (1974): The Legacy of Islam. Clarendon Press.
- [15] Steadman, Philip & March, Lionel (1971): The Geometry of Environment: An Introduction to Spatial Organization in Design. RIBA Publications Limited, London.
- [16] Tansey, Richard G. & Gardner, Helen (1991): Art Through the Ages. Harcourt Brace Jovavich, College Publishers.

AUTHORS

First Author – Kadhim Fathel Khalil, School of Housing, Building and Planning, University Sains Malaysia, 11800 Penang
Second Author – Julaihi Wahid, School of Housing, Building and Planning, University Sains Malaysia, 11800 Penang

Status of Women: North Eastern Region of India versus India

Dr. Ira Das

Assistant Professor, Department of Economics, Pragjyotish College, Guwahati-09, Assam, India

Abstract- Geographically, men and women share the same space, but everywhere in the world, women are accorded a lower status than men. The North Eastern Region of India has been considered as a backward region in terms of growth in per capita income. However, there is a perception that the status of women is higher in the North Eastern Region of the country in comparison with the status of women in all India average. In this study, an attempt has been made to examine the status of women in the North Eastern Region in comparison with all India average. It is found from the analysis that the status of women in the region is comparatively better than the rest of the country only in some selected indicators. The indicators reveal that women have a very low degree of freedom of movement and low level of control over themselves in North Eastern Region.

Index Terms- India, North Eastern Region, Status, Women

I. INTRODUCTION

‘Status of Women’ refers to the position of women in society in relation to men. Although, geographically, men and women share the same space, yet they are not treated equally in the world. In reality, there exists inequality in women’s access to education, health care, physical and financial resources and opportunities in the political, economic, social and cultural field. Everywhere in the world, women are accorded a lower status than men. According to Mohiuddin (1995), women’s lower status is manifested in women’s low wage rates than men in all occupational fields and industries, in their limited upward mobility, and in their greater family responsibilities due to divorce, abandonment, etc. in the developed countries. In the developing countries, women’s lower status is reflected not only in their work being underpaid, unrecognised, but also in their limited access to productive resources and support services such as health and education.

The status of women can be judged by some indicators. To measure the status of women a composite index is constructed by the Population Crisis Committee (PCC) and used by the World Bank and the United Nations which focuses on indicators measuring health, education, employment, marriage and childbearing and social equality. Mohiuddin (1995) argues that these indicators have a poverty-bias and measure women’s status in terms of structural change rather than in terms of their welfare vis-a-vis men. Therefore, he formulated an Alternative Composite Index (ACI) of the status of women, based on many more indicators reflecting women’s issues in both developed and developing countries. The ACI is based on several indicators in eight sectors: health, schooling, adult education, labour force

participation, conditions of employment, domestic life, political representation and legal rights. Rustogi (2004) tried to measure women’s status with the help of a diverse set of indicators. She selected some broad indicators across Indian states namely education, health, survival, participation in private/public decision making and safety/security to measure the status of women in the society.

The region located on the north east part of India are regarded as the North Eastern Region (NER) and it consists of Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Tripura, and Sikkim. The NER of India has been considered as a backward region in terms of growth in per capita income. In 2007-08, the per capita income of the state at constant (2004-05) prices was Rs.20, 279 against the per capita income for the country of Rs. 33, 731 (Government of Assam, 2010-11). Generally, it is thought that the status of women is comparatively better in tribal society (Handsdak, 2012; Burman, 2012). The tribal people are more in numbers in the NER. The scheduled tribe are 94.75 per cent in Mizoram, 87.70 per cent in Nagaland, 85.53 per cent in Meghalaya, 63.66 per cent in Arunachal Pradesh, 34.41 per cent in Manipur, 30.95 per cent in Tripura, and 12.82 per cent in Assam (Zahol, 2010). Moreover, there is matrilineal system (The matrilineal societies are those societies where property is transmitted from mother to daughter) in Meghalaya. Therefore, there is a perception that the status of women is better in the states of the North Eastern Region of the country in comparison with the status of women in rest of India. In this study, an attempt has been made to examine the Status of Women in North Eastern Region in comparison with the all India average. This paper is organised in four parts. The introductory part introduces the study problem and presents the objectives of the study. The second part describes the data source and methodology of the study. While results and discussion are presented in the third part, conclusion is presented in the final part.

II. DATA SOURCE AND METHODOLOGY

The study is based on secondary data. The data are mainly collected from the Census reports of the government, National Sample Survey Organisation (NSSO), Registrar General of India etc.

The status of women in North Eastern Region in comparison with the rest of India is examined on the basis of different indicators, namely Female Literacy (FL), Female Workforce Participation Rate (FWPR), Gross Enrolment Ratio, Dropout Rates, Sex Ratio, Female Infant Mortality, Age at Marriage, and Women’s Participation in Decision-

making/Women Empowerment. Mostly, status is examined with the help of the method of ranking of states in different indicators. Rankings are assigned from the best to worst performing states. However, in case of the negative indicators like dropout rates, infant mortality etc. (where high values are unfavourable for the society), rankings are given from worst to best performing states.

III. RESULTS AND DISCUSSION

The status of women in NER is examined on the basis of the following indicators.

3.1 Female Literacy and Gender Gap

The female literacy and the gender gap of NER along with the other states of the country are presented in Table 1. Ranking of the states in the table depicts the picture that the states with high women literacy rates are the states of NER (except Arunachal Pradesh), and Kerala. These are also the states where the gap in literacy rates between men and women is low. Both non-economic and economic factors are discussed in the literature to explain the prevalence of the gender gap in literacy rates.

Table 1. Female Literacy and Gender Gap in Literacy Rates (GLR)

State	Rank in Female Literacy	Rank in GLR	State	Rank in Female Literacy	Rank in GLR
Kerala	1	2	Assam	13	9
Mizoram	2	3	India	14	15
Lakshadweep	3	5	Orissa	15	17
Tripura	4	7	Chhattisgarh	16	22
A & N Islands	5	6	Madhya Pradesh	17	20
Goa	6	8	Andhra Pradesh	18	13
Nagaland	7	4	Arunachal Pradesh	19	11
Maharashtra	8	12	Uttar Pradesh	20	18
Meghalaya	9	1	Jammu & Kashmir	21	19
Manipur	10	10	Jharkhand	22	23
Uttarakhand	11	16	Bihar	23	24
Gujarat	12	14			

Source: Census of India (Provisional Data), 2011

3.2 Female Work Participation Rate

The female workforce participation rate of the states of NER in comparison with the rest of India is presented in Table 2. The table reveals the fact that female work participation rates (FWPR) are higher in most of the NER states with hilly regions and those inhabited by tribals than other states of rest of India, even in Kerala. Except Assam, Manipur and Tripura, the FWPR are higher than all India average for many NER states. These are

also the states where there are low gender disparities in terms of work participation. Higher FWPR can be partially explained by the fact that community-based organisation of subsistence production requires a high level of women's labour participation. Some scholars have linked higher participation of women with rice cultivation. Another factor associated with better work participation levels is educational attainment.

Table 2. Female Work Participation Rate (FWPR)

States/Uts	Rank	FWPR	States/Uts	Rank	FWPR
Chattisgarh	1	62.7	Madhya Pradesh	13	41.1
Himachal Pradesh	2	58.8	Jharkhand	14	39.8
Nagaland	3	56.5	Jammu and Kashmir	15	38.4
Andhra Pradesh	4	52.7	Gujarat	16	37.9
Meghalaya	5	51.4	Orissa	17	37.8
Rajasthan	6	46.2	Uttarkhand	18	36.6
Mizoram	7	45.4	India		35.6
Arunachal Pradesh	8	45.1	Manipur	19	31.5
Karnataka	9	43	Kerala	20	27.3
Maharashtra	10	42.9	Punjab	21	26.3
Sikkim	11	41.2	Assam	22	20.8

Tamil Nadu	12	41.1	Tripura	23	15.6
------------	----	------	---------	----	------

Source: Based on calculations from NSSO (2010).

3.3 Gross Enrolment Ratio

The gross enrolment ratio of the states of NER with the other states of India is presented in Table 3. When the enrolment rates of Class I-VIII of Schools for General Education in

different states of India are compared, it is seen that the enrolment rates are comparatively higher in NER than some states of the rest of India like Bihar, Goa, U.P and Chandigarh.

Table 3. Gross Enrolment Ratio in Class I-VIII of Schools for General Education

States/UTs	Classes I-VIII (6-13 years)			States/UTs	Classes I-VIII (6-13 years)		
	Girls	Boys	Total		Girls	Boys	Total
Andhra Pradesh	90.11	90.18	90.15	Orissa	104.68	105.62	105.16
Arunachal Pradesh	138.1	146.31	142.26	Punjab	100.6	102.84	101.83
Assam	84.9	82.21	83.54	Rajasthan	98.71	109.97	104.63
Bihar	86.03	100.79	93.72	Sikkim	123.37	118.82	121.08
Goa	86.13	88.75	87.5	Tamil Nadu	114.07	114.32	114.2
Gujarat	106.04	108.88	107.56	Tripura	121.74	123.56	122.66
Haryana	87.58	84.31	85.79	Uttar Pradesh	96.27	94.65	95.42
Himachal Pradesh	109.38	110.37	109.9	West Bengal	110.74	107.16	108.92
Jammu & Kashmir	104.27	104.67	104.48	A&N Islands	73.04	75.62	74.34
Karnataka	97.66	99.81	98.76	Chandigarh	64.71	62.62	63.55
Kerala	97.11	98.58	97.86	D&N Haveli	101.98	105.24	103.69
Madhya Pradesh	130.18	133.32	131.81	Daman & Diu	83.48	72.35	77.1
Maharashtra	96.4	99.82	98.18	Delhi	116.35	116.31	116.33
Manipur	147.73	155.44	151.64	Lakshadweep	75.68	73.99	74.83
Meghalaya	141.86	135.15	138.49	Puducherry	100.39	95.6	97.87
Mizoram	133.58	142.98	138.33	India	101.09	103.75	102.47
Nagaland	83.45	83.2	83.32				

Source: Government of India (2012), *Data for use of Deputy Chairman*, Planning Commission, 10 April.

3.4 Dropout Rates

The disgusting point revealed by Rustogi (2004) on the basis of the Government of India (2001) data is that the dropout rates are very high in the states of NER than many states of rest of India. Rustogi (2004) opined that the use of girls in sibling care, as additional hands for helping mothers in the household, farm and off-farm work and so on operate to reduce the availability of formal education for them. Given low retention at the primary level, very few girls reach middle and secondary school or higher levels of education. Lower literacy also impacts

upon women's awareness levels regarding their own health needs, thereby foreclosing the possibility of improving their access to the available services for their well-being.

Here, the dropout rate of the states of the NER is compared with the dropout rates of the other states of the country and accordingly ranking is assigned in Table 4. The table shows that the dropout rates of the states of the North East are higher than the all India average for 2010 data. These findings are in line with the findings of Rustogi (2004) for the 2001 data.

Table 4.State wise Dropout Rates in Classes I-X (6-16 years) in India

States & UTs	Total	Girls	Rank	States & UTs	Total	Girls	Rank
Sikkim	80.73	79.36	1	India	52.76	51.97	
Assam	77.6	77.82	2	Karnataka	46.62	46.33	17
Meghalaya	77.89	76.46	3	Jammu & Kashmir	44.3	40.63	18
Bihar	77.56	76.06	4	Punjab	40.42	39.45	19
Nagaland	74.86	73.97	5	Goa	34.3	32.63	20
Rajasthan	71.64	73.42	6	Tamil Nadu	34.06	30.28	21
Madhya Pradesh	65.71	71.32	7	Daman & Diu	35.93	29.75	22
West Bengal	71.83	70.7	8	A&N Islands	30.06	27.07	23
Orissa	68.19	65.91	9	Lakshadweep	25.13	22.67	24
Gujarat	62.14	64.41	10	Haryana	19.84	19.46	25
Arunachal Pradesh	64.86	64.7	11	Himachal Pradesh	20.65	18.93	26
D&N Haveli	58.83	63.48	12	Uttar Pradesh	23.83	15.09	27
Tripura	62.9	62.34	13	Delhi	1.97	9.15	28
Mizoram	62.87	60.72	14	Chandigarh	3.78	7.86	29
Manipur	56.79	55.71	15	Puducherry	7.34	1.39	30
Andhra Pradesh	53.36	54.02	16	Kerala	-4.06	-5.2	31

Source: Government of India (2012), *Data for use of Deputy Chairman*, Planning Commission, 10 April.

3.5 Sex Ratios

A decline in the proportion of women in the populations of many countries in the world has been witnessed over the years. Researchers have linked many factors like son preference to gender bias against girls in healthcare, nutrition, food allocation etc. to explain the declining sex ratio. The Census, 2011

(provisional) data reveals the low proportion of girls in the states of Haryana, Punjab, Gujarat, Rajasthan and Uttar Pradesh and comparatively higher proportion of girls in the states of NER (refer Table 5).

Table 5.Child Sex Ratio among the States of India

Serial Nos.	States	2011	Rank	Serial Nos.	States	2011	Rank
1	Andhra Pradesh	992	3	15	Maharashtra	925	18
2	Arunachal Pradesh	920	19	16	Manipur	987	6
3	Assam	954	14	17	Meghalaya	986	5
4	Bihar	916	21	18	Mizoram	975	8
5	Chhattisgarh	991	4	19	Nagaland	931	16
6	Goa	968	10	20	Orissa	978	7
7	Gujarat	918	20	21	Punjab	893	23
8	Haryana	877	26	22	Rajasthan	926	17
9	Himachal Pradesh	974	9	23	Sikkim	889	24
10	Jammu & Kashmir	883	25	24	Tamil Nadu	995	2
11	Jharkhand	947	15	25	Tripura	961	13
12	Karnataka	968	11	26	Uttar Pradesh	908	22
13	Kerala	1084	1	27	Uttarakhand	963	12
14	Madhya Pradesh	930	17	28	West Bengal	947	15

Source: Census of India, 2011 (Provisional data).

3.6 Age at Marriage among Females

The age of marriage among female of the states of the country is compared and ranking is done in Table 6. Despite the legally stipulated minimum age of 18 years at marriage, girls still

get married before attaining this age in the states of Madhya Pradesh, Rajasthan, Andhra Pradesh, Bihar, and Uttar Pradesh which is not the case with the states of NER.

Table 6. Mean Age at Marriage among Females (MAMF)

States	Rank	MAMF	States	Rank	MAMF
Rajasthan	20	16.6	Tripura	11	19.3
Madhya Pradesh	19	17.0	Arunachal Pradesh	10	19.6
Bihar	18	17.2	Assam	9	19.7
Andhra Pradesh	17	17.5	Tamil Nadu	8	19.9
Uttar Pradesh	17	17.5	Sikkim	7	20.2
Haryana	16	18.0	Meghalaya	6	20.5
India		18.3	Punjab	6	20.5
West Bengal	15	18.4	Kerala	5	20.8
Maharashtra	14	18.8	Manipur	4	21.5
Karnataka	13	18.9	Nagaland	3	21.6
Orissa	13	18.9	Mizoram	2	21.8
Gujarat	12	19.2	Goa	1	22.2

Source: Census of India, 2001

3.7 Anaemia among Women

Anaemia among women in different states of India is presented in Table 7. The majority of women in India are anaemic. Iron deficiency is particularly pronounced among

women inhabiting in the eastern and almost all of the NER states (except Manipur).

Table 7. Women Suffering from Anaemia in India

States	Pregnant women age 15-49 who are anaemic (%)	Ranking	States	Pregnant women age 15-49 who are anaemic (%)	Ranking
Assam	72.0	1	Madhya Pradesh	57.9	14
Haryana	69.7	2	Maharashtra	57.8	15
Jharkhand	68.4	3	Tripura	57.6	16
Jammu & Kashmir	68.3	4	Tamil Nadu	54.6	17
Orissa	68.1	5	Arunachal Pradesh	51.8	18
Chhattisgarh	63.1	6	Mizoram	51.7	19
West Bengal	62.6	7	Uttar Pradesh	51.6	20
Sikkim	62.1	8	Uttaranchal	50.8	21
Rajasthan	61.7	9	Punjab	41.6	22
Gujarat	60.8	10	Nagaland	n.a	
Karnataka	60.4	11	Himachal Pradesh	39.2	23
Bihar	60.2	12	Goa	36.9	24
Meghalaya	60.2	12	Manipur	36.4	25
Andhra Pradesh	58.2	13	Kerala	33.8	26
India	57.9		Delhi	29.9	27

Source: NFHS-3

3.8 The Female Infant Mortality Rate

Generally, male infants are known to be more susceptible to death than females due to biological and genetic reasons. However, in India, the female infant mortality rate surpasses that of males, which reflects socio-cultural influences on mortality (Rustogi, 2004). The female infant mortality rate of the states of

India is presented and ranking is done in Table 8. Although the position of NER regarding IMRF is improving for some states of NER, the IMR of female is still high in Assam and Meghalaya and is significantly higher than all India average.

Table 8. Infant Mortality Rates (per 1000 live births) among Females (IMRF)

States	IMRF	Rank	States	IMRF	Rank
Kerala	14	21	Jharkhand	44	11
Goa	15	20	J & K	45	10
Manipur	16	19	Gujarat	47	9
Tamil Nadu	24	18	Andhra Pradesh	47	9
Nagaland	28	17	Himachal Pradesh	47	9
Tripura	29	16	India	49	
Maharashtra	29	16	Haryana	49	8
Delhi	31	15	Bihar	50	7
West Bengal	32	14	Chattisgarh	54	6
Arunachal Pradesh	32	14	Meghalaya	56	5
Sikkim	32	14	Rajasthan	57	4
Punjab	35	13	Assam	60	3
Mizoram	39	12	Orissa	61	2
Karnataka	39	12	Uttar Pradesh	63	1

Source: Sample Registration System (SRS) ,2012

3.9 Women's Participation in Decision-making/Women Empowerment

As reported by Rustogi (2004) in the last eight general elections from 1977 to 1999, 51 to 59 per cent of women have participated as voters. Of the few contestants among women, the winning rate is higher than that of men. Therefore, women's participation in public decision-making is gradually improving. The percentage of currently married women who usually

participate in household decisions is more in the states of the NER than the national average. However, the percentage of women who are allowed to go alone to three places (market, health facility, and outside the community) is less in Assam, Meghalaya and Nagaland. Similarly, the percentage of women having a bank or savings account that they themselves use is less in Assam, Manipur, Mizaoram and Nagaland than the national average (refer Table 9).

Table 9. Women's Participation in Decision Making

States	Currently married women who usually participate in household decisions (%)	Women of age 15-49 who are allowed to go alone to three places (market, health facility, and outside the community)(%)	A bank or savings account that they themselves use (%)	States	Currently married women who usually participate in household decisions (%)	Women of age 15-49 who are allowed to go alone to three places (market, health facility, and outside the community)(%)	A bank or savings account that they themselves use (%)
Andhra Pradesh	40.4	37.3	18	Manipur	69.4	53.5	8
Arunachal Pradesh	53.5	40.2	19	Meghalaya	77.3	28.1	16.9
Assam	60.9	35.3	11.7	Mizoram	70.4	75.4	8.1
Bihar	32.7	25.2	8.2	Nagaland	73.1	25.4	7.4
Chhattisgarh	26.8	17.9	8.1	Orissa	41.8	18.7	9.8

Delhi	52	36.6	30.4	Punjab	37.4	39	14.6
Goa	47	56.8	42.4	Rajasthan	22.8	31.6	7.6
Gujarat	36.6	47.3	19.9	Sikkim	58.7	50.9	20.9
Haryana	41.7	40.7	12.4	Tamil Nadu	48.8	54.2	15.9
Himachal Pradesh	39.2	60.4	22.2	Uttar Pradesh	33.7	23.4	13.2
Jammu & Kashmir	25.2	51	21.9	West Bengal	23.9	32.3	14.1
Karnataka	35.2	30.6	22.1	India	36.7	36.8	16.2
Kerala	47.2	34.7	27	Tripura	30.2	36.8	18.7
Madhya Pradesh	29.4	25.7	8.9	Uttaranchal	36	42.8	20.1
Maharashtra	45.4	40.2	20.3	Jharkhand	41.8	36.6	14.4

Sources:NFHS-3, Kishore and Gupta (2009)

IV. CONCLUSION

From the foregoing discussion it is clear that the status of women in the states of NER is better in some indicators than the status of women in rest of India. However, puzzling contradictions occur within each state. For example, the sex ratio is high in the states of NER implying more females in the state. However, infant mortality rate for female is high in Assam. Similarly the literacy rate is high but at the same time high dropout rate shows a different picture of the states of NER. In Assam and Nagaland, the female literacy levels are above average and the gap in literacy levels strikingly low; however, enrolment rates for girls are low than the national average. Sometimes the different sources of data may create the problems of compatibility.

Workforce participation is only one of the variables to empower the women in the society. High female employment rate may satisfy 'Practical Gender Needs' (e.g provision of water, healthcare, employment etc.) only not the 'Strategic Gender Needs' (e.g power and control, protection from domestic violence, equal wage, and control over own body etc.). The decision on what to cook, about their own healthcare, and staying with their parents/siblings, the extent of mobility and women's ability to make these choices to go to the market or visit friends/relatives without seeking permission are also important. This study shows that the percentage of currently married women who usually participate in household decisions is more in the states of the NER than the national average. However, the percentage of women who are allowed to go alone to the market, health facility, and outside the community is less in three states, namely Assam, Meghalaya and Nagaland. Similarly, the percentage of women having a bank or savings account that they themselves use is less in Assam, Manipur, Mizaoram and Nagaland than the national average. These indicators reveal that women have a very low degree of freedom of movement and low level of control over themselves and ability to make change in NER. Economic development does not guarantee gender equality. In informal sector the status of women is more vulnerable. Only gender aware policies of the policy makers and change of the mindset of the people can help in this regard. Although the FWPR has increased in some states of NER, however, in what type of work the women are engaged is a big

question. The other study reflects more casualisation of the female employment in the states in both rural and urban areas which needs serious concern. There is a criticism that only highly qualified people are getting dignified jobs after economic reform in this competitive world and the people of the rural sector are lagging far behind. A rise in the share of regular wage employment could signify an improvement in the quality of female employment only if this rise is faster than the rise in the share of other two categories namely, self-employed and casual worker (Sethuraman, 1998).

Therefore, it requires state specific own individual policy to achieve gender development and gender equality within its borders. A detailed examination of women's status even at the district level is necessary to have the right information for effective planning and implementation of government policy.

REFERENCES

- [1] Burman, J.J Roy, "Status of Tribal Women in India", *Mainstream*, Vol. L, No.12, 2012, March 10.
- [2] Census of India, Provisional Population Totals, Registrar General of India, New Delhi, 2011
- [3] Government of Assam, *Economic Survey Assam 2010-11*, Directorate of Economics and Statistics, Assam, 2010-11.
- [4] Government of India, *Women and Men in India 2000*, Central Statistical Organisation, Ministry of Statistics and Programme Implementation. New Delhi, 2001.
- [5] Government of India, *Data for use of Deputy Chairman*, Planning Commission, 10 April, 2012 [online] Available: planningcommission.nic.in/data/datatable/0904/comp_data0904.pdf. (September 24, 2012).
- [6] Kishor, Sunita & Gupta, Kamala (2009). *A Report on Gender Equality and Women's Empowerment* on the basis of National Family Health Survey (NFHS)-3, Mumbai, India.
- [7] Mohiuddin, Yasmeen (1995).Country Rankings of Women's Status: an Alternative Index, *Pakistan Development Review*, Winter.
- [8] NSSO (2010). Employment and Unemployment Situation in India, 2007-08, Report No.531,NSS 64th Round, Ministry of Statistics & Programme Implementation, May.
- [9] Rustogi, Preet (2004).Significance of Gender-related Development Indicators: An Analysis of Indian States, *Indian Journal of Gender Studies*, Vol. 11, No.3, Sage Publications, pp.291-343,[on line] Available: <http://www.dise.in/Downloads/Use%20of%20Dise%20Data/Preet%20Rustagi.pdf> (February 26, 2012).
- [10] Sample Registration System (2012). *SRS Bulletin*, 46(1), December, New Delhi: RegistrarGeneral of India.

- [11] Zahol, Lucy Vashum (2010).Status of Tribal Women, [on line], Available: <http://dspace.nehu.ac.in/bitstream/1/2733/1/Status.pdf> (October 7, 2012).
- [12] Hansdak, Eva Margaret (2012).The Status of Tribal Women, in Fr. Agapit Tirkey (ed.), Responding to India's Social Challenges- Promoting Tribal Rights & Culture, [on line] Available:<http://www.holycrossjustice.org/pdf/Asia/IndiasSocialChallenges/PromotingTribalRights/TheStatusoftribalWomen.pdf> (October 7, 2012)

AUTHORS

First Author – Dr. Ira Das, M.Sc. in Economics (Gauhati University), PhD (Economics) (From IIT Guwahati, Assam) Assistant Professor, Department of Economics, Pragjyotish College, Guwahati-09, Assam., E-mail: iramirza15@gmail.com ira@iitg.ernet.in

Lossless Compression of Grayscale Images Using Dynamic Arrays for Prediction and Applied to Higher Bitplanes

Mayur Nandihalli*, Vishwanath Baligar**

* Dept. of Computer Science and Engineering B.V.Bhoomraddi College of Engineering and Technology Hubli, India

** Dept. of Computer Science and Engineering B.V.Bhoomraddi College of Engineering and Technology Hubli, India

Abstract- This paper presents a novel way of predicting pixel values of grayscale images using dynamic arrays. It is shown that the predicted values are always near to zero and this method does use a sign bit. Predicted values are compressed using bitplane method starting from 8th bitplane to 5th bitplane. The results shown are encouraging and comparable with the existing results.

Index Terms- RLE (run length encoding), bitplane, MSBs (Most Significant Bits).

I. INTRODUCTION

The discrete cosine transforms [1] in one dimension and two dimensions through which DCT coefficients were obtained from pixel values. These coefficients were further quantized and applied IDCT(Inverse) equation to reconstruct the original values. 6.4 % error was introduced between original and reconstructed values.

From 1990-1992, Pennebaker, Mitchell, Wallace and Zhang [1] conducted experiments on jpeg image compression. Color images were transformed from RGB to luminance/chrominance color space followed by down sampling of chrominance components which reduced the image to half of its original size. Pixels of each color components were organized into groups of 8x8 pixels. DCT was applied to these data units to obtain frequency components which were divided by a separate number called quantization coefficient and rounded to an integer. The quantized coefficients were encoded using run length encoding and Huffman coding. Very high compression ratios were obtained. In 1996, Weinberger et al. [1] found that a pixel can be predicted using its previous neighbors by assigning a probability distribution to them. Prediction error was also encoded.

In 1993, Howard and Vitter assigned variable size codes to each pixel based on the values of two of its previous neighbors [1]. The two neighbors with different intensities were selected based on the position of the current pixel. They assigned a variable size code based on the position of current pixel with respect to the neighbors selected. Wu in 1996 predicted a pixel using pixels all around it and also encoded the error values. Sayood and Anderson in 1992 found that image can be compressed by comparing each pixel P to a reference pixel which was one of its previously encoded immediate neighbors and encoded P in two parts prefix and suffix. A prefix which is the number of most significant bits of P that are identical to those of reference pixel and a suffix which is remaining least significant

bits of P. In 1998, Gilbert and Brodersen conducted experiments for lossless compression of discrete-tone images by scanning the image row by row and dividing the image into set of blocks of variable sizes namely copied blocks, solid fill blocks and punts. This method works by searching for a copy of current block and encoding the current block as width, height and location of copy block using Huffman codes.

This paper presents a new algorithm for lossless compression of grayscale images. The higher bitplanes are compressed using a new technique. This algorithm initializes arrays for every block of 8 X 8 pixels in a particular fashion. For every pixel in the block, a match is found in its respective array and storing the index value of the match in a new image file and later followed by dynamic shifts in the array. This new image file is named as encoded image. It also uses run length encoding for efficient compression. In section I and II, we explain compression of higher bitplanes and encoding of higher bitplanes respectively. In section III, the algorithm is explained in detail with an example. Finally in section IV, we conclude our study and summarize our results.

II. COMPRESSION OF HIGHER BITPLANES

Higher bitplanes indicate 8th, 7th, 6th and 5th bitplanes which represent 8th, 7th, 6th and 5th bits of each pixel respectively. Higher bitplanes are compressed using run length encoding which are based on the raster scan of each bitplane. The degree of randomness of adjacent pixels is very low in higher bitplanes. Therefore, reasonable compression ratios are achieved in these bitplanes using run length encoding. The compressed versions of these bitplanes consists of numbers which represent the length of run of consecutive similar pixels. The figures Fig 1, Fig 2 and Fig 3 are the standard 512 x 512 images used for experimentation. The 8X8 matrix representing pixels is shown in

TABLE I.



Fig 1. Lena

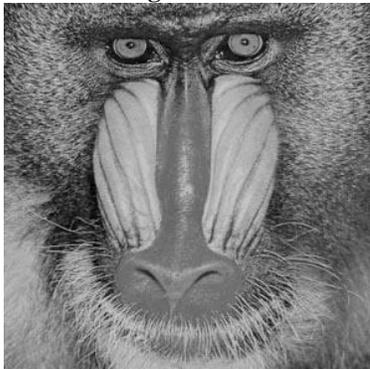


Fig 2. Baboon

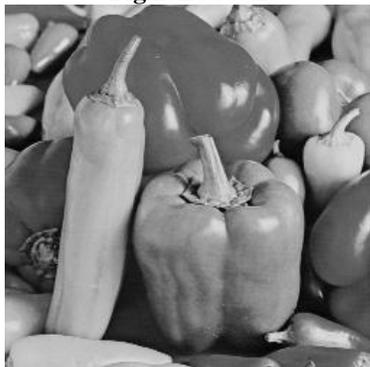


Fig 3. Peppers

A. Matrix Scan of Higher Bitplanes

Instead of going for raster scan, we prefer matrix scan which reduces the degree of randomness from pixel to pixel. The higher bitplanes are scanned as 8 x 8 matrices. The matrix scan reduces the degree of randomness of pixels within the matrix.

Let us consider an example of matrix scan. A random 8 x 8 matrix of pixel values of fig 1. is shown in

TABLE I. These values range from 0 to 255. For the values in

TABLE I the match for each pixel is found in the array corresponding to its predicted value and index value of the match is fetched.

TABLE II shows the index values of the match found in arrays.

TABLE I
8 X 8 MATRIX REPRESENTING PIXEL VALUES

162	162	162	161	162	157	163	161
162	162	162	161	162	157	163	161
162	162	162	161	162	157	163	161
162	162	162	161	162	157	163	161
162	162	162	161	162	157	163	161
164	164	158	155	161	159	159	160
160	160	163	158	160	162	159	156
159	159	155	157	158	159	156	157

B. Assignment of Arrays
 Each pixel value in

TABLE I ranges from 0 to 255. For each of the values from 0 to 255, arrays are assigned in a typical fashion which are different for each value. Length of each array assigned is 256 which consists of all the values from 0 to 255. This assignment is repeated for every 8 X 8 pixels. The pattern of assigning the arrays is as follows. For any pixel p from 0 to 255, the first element of its respective array is p followed by incrementing p and storing it into alternate positions in the array. Now, the other pair of alternate positions with index values 1, 3, 5, 7, 9....., 255 are empty. These positions are filled with the value one less than the first pixel followed by successively decrementing it for every new position. These values are being stored in a circular fashion i.e., either during incrementing or decrementing, if 0 appears, the next value will be 255 and vice versa.

C. Operation on Arrays

When pixels are matrix scanned, for each pixel except the pixels in the first column of the image, the predicted value is the previous pixel. For pixels in the first column, the predicted value is 128. In the original image of resolution 512 X 512, number of pixels in the first column are only 512. For these 512 pixels present in the first column of original image, the predicted value is 128. When a pixel is scanned, its respective predicted value's array is taken into consideration followed by finding a match for current pixel in that array. When a match is found, the index value of match is considered for encoding. This index value plays a vital role in the compression of higher bitplanes. The index value of the match which ranges from 0 to 255 is stored in a new image file by considering the index as a pixel value. After storing the index value in a new file, the matched value in the array is inserted at the beginning of array from its original position, followed by successive shifts by one position till the original position of match is filled. If the match is found in the beginning of array, the values of array remain unchanged. In this manner, the values of arrays corresponding to the predicted value of each pixel keeps varying throughout the scan.

TABLE II
INDEX VALUES OF THE MATCH FOUND IN ARRAYS
OF CORRESPONDING PREDICTED VALUES IN
BINARY FORM

68	0	0	0	1	2	9	12
0	2	0	2	0	2	0	0
0	2	0	2	0	2	0	0
0	2	0	2	0	2	0	0
0	2	0	2	0	2	0	0
72	0	11	5	12	3	0	2
66	0	6	9	5	5	6	5
65	2	7	5	3	4	2	2

III. ENCODING OF HIGHER BITPLANES

Once the whole image is matrix scanned, for each pixel, the index value of its match is stored in a new image file as shown in

TABLE II. The encoded image file consists of index values which represent each pixel of the original image. In the encoded image file, the degree of randomness of higher bitplanes is too low. After all the pixels are scanned and encoded as index values, the adjacent most significant bits are highly correlated. The result of compression of higher bitplanes is shown in **TABLE XIII.** The encoded image of Fig 1. is shown in Fig 4. This encoded image consists of index values of the match as pixel values. The degree of randomness in the encoded image is comparatively low. Fig 5 to Fig 8 shows 5th, 6th, 7th and 8th bitplanes of encoded Lena respectively. These higher bitplanes are run length encoded to achieve very high compression ratios.

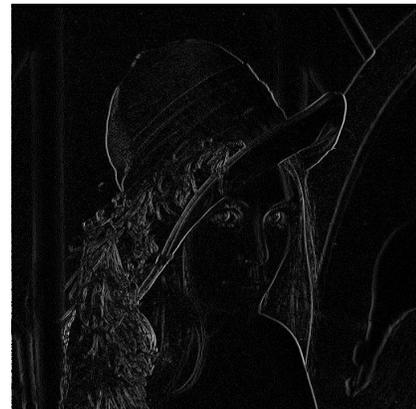


Fig 4. Encoded Image of Lena



Fig 5. 5th bitplane of encoded Lena



Fig 6. 6th bitplane of encoded Lena



Fig 7. 7th bitplane of encoded Lena

Fig 8. 8th bitplane of encoded Lena

TABLE III
 VALUES OF ARRAY CORRESPONDING TO VALUE 0

0	255	1	254	2	253	3	252	-----	129	127
---	-----	---	-----	---	-----	---	-----	-------	-----	-----

TABLE IV
 VALUES OF ARRAY CORRESPONDING TO VALUE 1

1	0	2	255	3	254	4	253	-----	130	128
---	---	---	-----	---	-----	---	-----	-------	-----	-----

TABLE V
 VALUES OF ARRAY CORRESPONDING TO VALUE 2

2	1	3	0	4	255	5	254	-----	131	129
---	---	---	---	---	-----	---	-----	-------	-----	-----

TABLE VI
 VALUES OF ARRAY CORRESPONDING TO VALUE 3

3	2	4	1	5	0	6	255	-----	132	130
---	---	---	---	---	---	---	-----	-------	-----	-----

TABLE VII
 VALUES OF ARRAY CORRESPONDING TO VALUE 4

4	3	5	2	6	1	7	0	-----	133	131
---	---	---	---	---	---	---	---	-------	-----	-----

TABLE VIII
 VALUES OF ARRAY CORRESPONDING TO VALUE 5

5	4	6	3	7	2	8	1	-----	134	132
---	---	---	---	---	---	---	---	-------	-----	-----

TABLE IX
 VALUES OF ARRAY CORRESPONDING TO 128 AFTER SCANNING FIRST PIXEL

162	128	127	129	126	130	125	131	-----	1	255
-----	-----	-----	-----	-----	-----	-----	-----	-------	---	-----

TABLE X
 VALUES OF ARRAY CORRESPONDING TO 162 AFTER SCANNING SECOND PIXEL

162	161	163	160	164	159	165	158	-----	35	33
-----	-----	-----	-----	-----	-----	-----	-----	-------	----	----

TABLE XI
 VALUES OF ARRAY CORRESPONDING TO 162 AFTER SCANNING FOURTH PIXEL

161	162	163	160	164	159	165	158	-----	35	33
-----	-----	-----	-----	-----	-----	-----	-----	-------	----	----

TABLE XII
 VALUES OF ARRAY CORRESPONDING TO 161 AFTER SCANNING FIFTH PIXEL

162	161	160	159	163	158	164	157	-----	34	32
-----	-----	-----	-----	-----	-----	-----	-----	-------	----	----

IV. OPERATIONS IN DETAIL

The tables numbered from TABLE III to TABLE VIII shows the initial values of arrays for 0 to 5 respectively. Same array initialization pattern is followed to assign all the arrays from 0 to 255. These arrays are initialized for every 8 X 8 matrix of pixels.

To understand the operations in detail, let us take an example by considering the pixel values specified in

TABLE XIII
 RESULTS OF COMPRESSION OF HIGHER BITPLANES

Image name	Bitplane number	Original size(bits)	Compressed size(bits)	Compression ratio
Lena	8	262144	14177.60	18.49 : 1
	7	262144	48455.45	5.41 : 1
	6	262144	117553.36	2.23 : 1
	5	262144	188592.80	1.39 : 1
Baboon	8	262144	8700.43	30.13 : 1
	7	262144	25303.47	10.36 : 1
	6	262144	123652.83	2.12 : 1
	5	262144	211406.45	1.24 : 1
Peppers	8	262144	17000.25	15.42 : 1
	7	262144	36308.03	7.22 : 1
	6	262144	110144.53	2.38 : 1
	5	262144	200109.92	1.31 : 1

TABLE XIV
 OVERALL COMPRESSION RATIO OF HIGHER BITPLANES

Image name	Original size (bits)	Compressed size (bits)	Compression ratio
Lena	1048576	368779.21	2.84 : 1
Baboon	1048576	369063.18	2.84 : 1
Peppers	1048576	363562.73	2.88 : 1

TABLE I. The first pixel is 162 and as it is the pixel of first column, its predicted value will be 128. Match for 162 should be found in the array corresponding to 128. After the match is found, the matched value is shifted to the first position followed by successive shifts to fill the matched position in the array. The values of array corresponding to 128 after scanning of first pixel is shown in TABLE IX. Second pixel in the matrix is 162 again. Its predicted value is the previous pixel i.e. 162. Match for 162 should be found in the array corresponding to 162. As the match for 162 in the array corresponding to 162 is found in the first position, no shifting takes place which is shown in TABLE X. Third pixel is again 162 and its predicted value is the previous pixel which is 162. So no changes are made in the array as the match is found in first position. Fourth pixel is 161 whose predicted value will be the previous pixel 162. Match for 161 in the array corresponding to 162 is found in the second position. TABLE XI shows the values of array after scanning fourth pixel. The next pixel in the matrix is 162 whose predicted value will be 161. The match for 162 is found in the array corresponding to 161 which is found at third position and shifting operations takes place. TABLE XII shows the values of array corresponding to 161 after scanning of fifth pixel. This process continues for all the pixels in every matrix. When a match is found, the index value of match is stored in an image file. This file consists of index values of all the matches which is shown in Fig 4. whose higher bitplanes are run length encoded.

TABLE XIII shows the results.

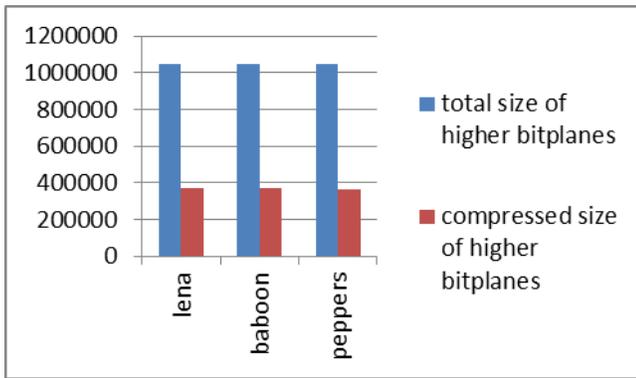


Fig 9. Final Results of Compression of Higher Bitplanes

Fig 9 shows graphical representation of compression of higher bitplanes of all the three sample images. **TABLE XIV** shows overall compression ratios of higher bitplanes for all the sample images.

**TABLE XV
 JPEG-LS COMPRESSION RATIO**

Image name	Original size (bits)	Compressed size (bits)	Compression ratio
Lena	2097152	1239016	1.69 : 1
Baboon	2097152	1212024	1.73 : 1
Peppers	2097152	1297968	1.61 : 1

V. CONCLUSION

In this paper we established a new method for lossless compression of higher bitplanes for grayscale images. This new method uses arrays whose index values are used to encode the image followed by shifting the array values dynamically after each match to obtain highly correlated adjacent values which is further encoded using run length encoding. This method results in efficient compression of higher bitplanes for grayscale images.

REFERENCES

- [1] David Salomon, *Data Compression*, 3rd ed., New York: Springer-Verlag, 2005.
- [2] Weinberger, M.J., G. Seroussi and G. Sapiro, "LOCO-I Low Complexity Context Based Lossless Image Compression Algorithm" in proceedings of data compression conference, 1996, pp. 140-149.
- [3] Heath, F.G. "Origins of the Binary Code" *Scientific American*, 1972 August, 227(2): 76.

AUTHORS

First Author – Mayur Nandihalli, Dept. of Computer Science and Engineering B.V.Bhoomraddi College of Engineering and Technology Hubli, India, Email: mayurs09@gmail.com

Second Author – Vishwanath Baligar, Dept. of Computer Science and Engineering B.V.Bhoomraddi College of Engineering and Technology Hubli, India, Email: vpbaligar@bvb.edu

Modeling, Analysis and Control of Active Suspension System using Sliding Mode Control and Disturbance Observer

Faraz Ahmed Ansari*, RajShree Taparia**

* Electronics Department, University College of Engineering, RTU, Kota, India

** Electronics Department, University College of Engineering, RTU, Kota, India

Abstract- The purpose of this paper is to construct an active suspension control for a quarter car model subject to excitation from a road profile using an improved sliding mode control with an observer design. The sliding mode is chosen as a control strategy, and the road profile is estimated by using an observer design. The objective of a car suspension system is to improve the riding quality without compromising the handling characteristic by directly controlling the suspension forces to suit the road and driving conditions. However, the mathematical model obtained suffers from few uncertainties. In order to achieve the desired ride comfort, road handling and to solve the uncertainties, a sliding mode control technique is presented. A nonlinear surface is used to ensure fast convergence of vehicle's vertical velocity. The nonlinear surface changes the system's damping. The effect of sliding surface selection in the proposed controller is also presented. Extensive simulations are performed and the results obtained shows that the proposed controller perform well in improving the ride comfort and road handling for the quarter car model using the hydraulically actuated suspension system. The main motivation for designing an active suspension system is to improve the ride comfort by absorbing the shocks due to a rough and uneven road.

Index Terms- Active suspension System, Disturbance Observer, Sliding Mode Control, Road Profile

I. INTRODUCTION

For many years vehicle dynamics engineers have struggled to achieve a compromise between vehicle handling, ride comfort and stability. The results of this are clear in the vehicles we see today. In general, at one extreme are large sedan and luxury cars with excellent ride qualities but only adequate handling behavior. At the other end of the spectrum are sports cars with very good handling but very firm ride quality. In between is any number of variations dictated by the vehicle manufacturer and target customer needs? Every automotive suspension has two goals: passenger comfort and vehicle control. Comfort is provided by isolating the vehicle's passengers from road disturbances like bumps or potholes. Control is achieved by keeping the car body from rolling and pitching excessively, and maintaining good contact between the tire and the road.

Today's vehicle suspensions use hydraulic dampers (shock absorbers) and springs that are charged with the tasks of absorbing bumps, minimizing the car's body motions while

accelerating, braking and turning and keeping the tires in contact with the road surface. Typically, these goals are somewhat at odds with each other.

A typical vehicle suspension is made up of two components: a spring and a damper. The spring is chosen based solely on the weight of the vehicle, while the damper is the component that defines the suspensions placement on the compromise curve. Depending on the type of vehicle, a damper is chosen to make the vehicle perform best in its application. Ideally, the damper should isolate passengers from low-frequency road disturbances and absorb high frequency road disturbances. Passengers are best isolated from low-frequency disturbances when the damping is high.

However, high damping provides poor high frequency absorption. Conversely, when the damping is low, the damper offers sufficient high-frequency absorption, at the expense of low-frequency isolation. The need to reduce the effects of this compromise has given rise to several new advancements in automotive suspensions. Three types of suspensions that will be reviewed here are passive, fully active, and semi-active suspensions. A conventional passive suspension is composed of a spring and a damper. The suspension stores energy in the spring and dissipates energy through the damper. Both components are fixed at the design stage.

There has been a widespread interest in using advanced control techniques to improve the performance of vehicle suspension system. Performance of the suspension system has been greatly increased due to increasing vehicle capabilities. Several performance characteristics have to be considered in order to achieve a good suspension system. These characteristics deal with regulation of body movement, regulation of suspension movement and force distribution. Ideally the suspension should isolate the body from road disturbances and inertial disturbances associated with cornering and braking or acceleration [1]. During the design of a suspension system, a number of conflicting requirements have to be met [2]. The suspension must be able to minimize the vertical force transmitted to the passengers for passengers comfort. These objectives can be achieved by minimizing the vertical car body acceleration. Also, optimal contact between wheel and road surface is needed in various driving conditions in order to maximize safety [3]. An early design for automobile suspension systems was focused on unconstrained optimizations for passive suspension system which indicate the desirability of low suspension stiffness, reduced unsprung mass, and an optimum damping ratio for the best controllability [4]. Thus the passive suspension system, which

approach optimal characteristics had offered an attractive choice for a vehicle suspension system and had been widely used for passengers. However, the suspension spring and damper do not provide energy to the suspension system and control only the motion of the car body and wheel by limiting the suspension velocity according to the rate determined by the designer. To overcome the above problem, active suspension systems have been proposed by various researchers. Active suspension systems dynamically respond to changes in the road profile because of their ability to supply energy that can be used to produce relative motion between the body and wheel. Typically, suspension systems include sensors to measure suspension variables such as body velocity, suspension displacement, and wheel velocity and wheel and body acceleration [5]. An active suspension is one in which the passive components are augmented by actuators that supply additional forces. These additional forces are determined by a feedback control law using data from sensors attached to the vehicle. In real dynamical system, it is impossible to avoid uncertainties due to modeling and due to other external disturbances. So the crucial is a solution to the robust control problem for uncertain systems.

II. ACTIVE SUSPENSION SYSTEM NONLINEAR MODEL

The concept of active suspension system was introduced as early as 1958. Since the vibration suppression capabilities of the traditional passive and semi-active suspension systems are restricted, an active suspension system with additional control force to suppress the oscillations is one of the major development fields in recent vehicle industry. The difference compare to conventional suspension is active suspension system able to inject energy into vehicle dynamic system via actuators rather than dissipate energy. In active suspension system actuator are placed between the unsprung mass and the sprung mass to produce control force to cope with a variety of road disturbances in real time. The main motivation for designing an active suspension system is to improve the ride comfort by absorbing the shocks due to a rough and uneven road. In the active suspension system, the force actuator is able to both add and dissipate energy from the system. This Results in the capability of the suspension system to control the attitude of the vehicle, to reduce the effects of braking and to reduce the vehicle roll during cornering and braking in addition to increasing the ride comfort and vehicle handling. Figure 1 shows a quarter car model for active suspension system.

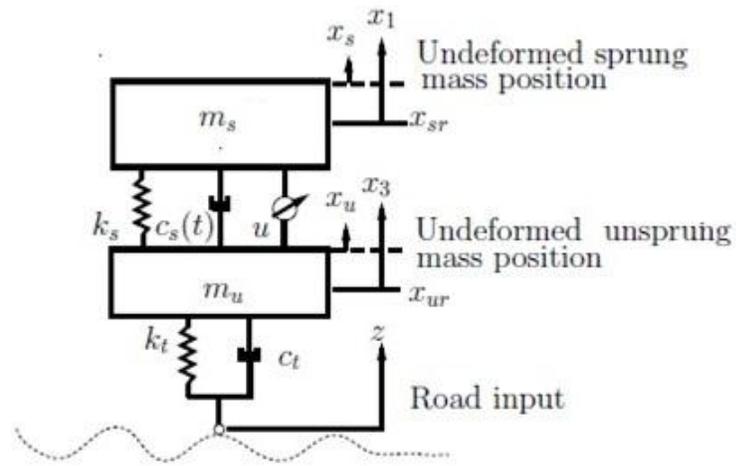


Figure 1: A quarter-car model of active suspension system.

The sprung mass m_s represents the mass of the car body, frame, internal components that are supported by the suspension. The unsprung mass m_u is the mass of the assembly of the axle and the wheel, k_s and $c_s(t)$ are respectively the spring and time-varying damper coefficients of the passive components of the suspension system. The spring coefficient k_s comprise of linear stiffness coefficient k_{1s} and nonlinear stiffness coefficient k_{2s} . The coefficient k_s and $c_s(t)$ are unknown because k_s changes as per the loading condition and $c_s(t)$ is a time varying damping coefficient. The coefficients k_t and c_t are respectively the unknown linear spring and damper coefficients of the tyre model. The control force generated by actuator connected between sprung and unsprung masses is denoted by u while z denotes the road disturbance input acting on the unsprung mass. The vertical displacements of the sprung mass and unsprung mass with respect to their undeformed suspension positions are denoted by x_s and x_u respectively.

III. MATHEMATICAL MODELING OF ACTIVE SUSPENSION SYSTEM

According to Newton's second law and free body diagram approach, the equations of motion for the system are written as For sprung mass-

$$m_s \ddot{x}_s = -k_{1s}(x_s - x_u) - k_{2s}(x_s - x_u)^3 - c_s(t)(\dot{x}_s - \dot{x}_u) + u - m_s g_r \quad (1)$$

For unsprung mass-

$$m_u \ddot{x}_u = k_{1s}(x_s - x_u) + k_{2s}(x_s - x_u)^3 + c_s(t)(\dot{x}_s - \dot{x}_u) - k_t(x_u - z) - c_t(\dot{x}_u - \dot{z}) - u - m_u g_r \quad (2)$$

Where g_r is the acceleration due to gravity. The static tyre deflection due to the nominal road denoted by x_{ur} is given by

$$x_{ur} = -\frac{(m_u + m_{sm})}{k_t} g_r \quad (3)$$

The reference position of the unsprung mass is considered to be x_{ur} while the reference position of the sprung mass denoted by x_{sr} is defined as

$$x_{sr} = x_{ur} + \delta_0 \quad (4)$$

Where $\delta_0 < 0$ is the static spring deflection.

Next we express the dynamic model of the suspension system (1) and (2) into the state variable form. Let the state $x=[x_1 \ x_2 \ x_3 \ x_4]^T$ be defined as,

$$\begin{aligned} x_1 &= x_s - x_{sr} \\ x_2 &= \dot{x}_s \\ x_3 &= x_u - x_{ur} \\ x_4 &= \dot{x}_u \end{aligned} \quad (5)$$

For convenience of expression and interpretation of the equation, first we define function $f(x, t)$ and $g(t)$ given by the equations,

$$\begin{aligned} f(x, t) &= \frac{1}{m_s} [-k_{1s}(x_1 - x_2 + \delta_0) - k_{2s}(x_1 - x_2 + \delta_0)^2] + \\ &\frac{1}{m_s} [-c_s(t)(x_2 - x_4) - m_s g_r] \end{aligned} \quad (6)$$

$$g(t) = \frac{1}{m_s} \quad (7)$$

It may be noted that these functions are uncertain and that the function $f(x, t)$ depends on all the four states of the suspension system.

$$g(t) = g_m \Delta g \quad (8)$$

Where g_m is the nominal value and Δg is the multiplicative uncertainty. The bounds of $g(t)$ are not known. hence

$$\dot{x}_1 = x_2 \quad (9)$$

$$\dot{x}_2 = f(x, t) + g(t)u \quad (10)$$

$$\dot{x}_3 = x_4 \quad (11)$$

$$\dot{x}_4 = \frac{m_s}{m_u} (f(x, t) + g_r) - \frac{1}{m_u} (u + k_t(x_3 + x_{ur} - z) + c_t(x_4 - \dot{z}) + m_u g_r) \quad (12)$$

The parameters of the passive suspension are unknown and nonlinear. Further, the vehicle is subjected to uneven road profile about which no a priori information is available. We assume that even the bounds of these uncertainties are not known. The objective is to control the deflection of the sprung mass in order get good ride comfort using the measurements of x_1 and x_2 only. The motivation for using only these measurements is to simplify the implementation by avoiding the deployment of sensors on the wheel and tyre assembly.

IV. SLIDING SURFACE AND CONTROL DESIGN

In this section we select sliding surface as a function of x_1 and x_2 and design a scheme of control using disturbance observer which estimates the lumped uncertainty.

a. Sliding Surface

In this section we select sliding surface as a function of x_1 and x_2 and design a scheme of control using disturbance observer which estimates the lumped uncertainty.

$$\sigma = Sx_1 + x_2 \quad (13)$$

Where S is a user chosen constant.

$$\dot{\sigma} = Sx_2 + f(x, t) + g(t)u \quad (14)$$

By using (4.8) in (4.14) and rearranging,

$$\dot{\sigma} = Sx_2 + f(x, t) + g_m(\Delta g - 1)u + g_m u \quad (15)$$

$$= Sx_2 + e(x, t) + g_m u \quad (16)$$

Where $e(x, t)$ is the lumped uncertainty, given by the equation

$$e(x, t) = f(x, t) + g_m(\Delta g - 1)u \quad (17)$$

Assumption 1: The lumped uncertainty $e(x, t)$ is such that

$$\left| \frac{de(x,t)}{dt} \right| < \mu \quad (18)$$

Where μ is a small positive number.

To compensate for the uncertainty and to get good ride comfort, sliding mode control in combination with disturbance observer which estimates the lumped uncertainty $e(x, t)$ is used. In the sequel, at times we denote $e(x, t)$ by simply e .

b. Design of Control

We split control u to be designed into two parts viz. u_{eq} to compensate for known terms and u_n to compensate for the estimate of the lumped uncertainty. The scheme is to estimate the uncertainty by disturbance observer and then to use opposite of it in u_n .

$$u = u_{eq} + u_n \quad (19)$$

With

$$u_{eq} = -\frac{1}{g_m}(Sx_2 + K\sigma) \quad (20)$$

where K is a positive number. Using (19) and (20) in (16)

$$\dot{\sigma} = -K\sigma + e + g_m u_n \quad (21)$$

Now selecting

$$u_n = -\frac{1}{g_m} \hat{e} \quad (22)$$

Where \hat{e} be the estimate of uncertainty e . substituting (22) in (21), we get

$$\dot{\sigma} = -K\sigma + e - \hat{e} \quad (23)$$

Define the estimation error as

$$\tilde{e} = e - \hat{e} \quad (24)$$

And substituting in (4.23), we get

$$\dot{\sigma} = -K\sigma + \tilde{e} \quad (25)$$

If the estimate \hat{e} is such that \tilde{e} goes to zero, sliding variable σ will go close to zero, thereby reducing the displacement of the sprung mass and improving the ride comfort.

c. Modified Control

It can be seen from (4.25) that addition of a discontinuous component to the control (4.19) will help bring σ closer to 0. However in view of the Assumption 1, a pure discontinuous component will not work. Therefore, as commonly done in sliding mode control, we add a discontinuous component u_s with its smooth approximation. We propose a control

$$u = u_{eq} + u_n + u_s \quad (26)$$

With u_s given by

$$u_s = -k_{st} \text{sat}(\sigma) \quad (27)$$

Where k_{st} is a positive constant to be chosen by the designer. Under the modified control, the dynamics of σ is given by

$$\dot{\sigma} = -K\sigma - k_{st} \text{sat}(\sigma) + \ddot{e} \quad (28)$$

V. DISTURBANCE OBSERVER

We use the term ‘disturbance Observer’ for an estimator that gives an estimate of the lumped uncertainty $e(x, t)$. Next, we design a disturbance observer.

Let the estimate of the lumped uncertainty $e(x, t)$ be given by

$$\hat{e} = \hat{d}(t) + p(\sigma) \quad (29)$$

Where $p(\sigma)$ is some linear or nonlinear scalar function of σ . Now, $\hat{d}(t)$ is to be updated in such a way that the estimation error $\tilde{e} = e - \hat{e}$ goes to zero. Differentiating (29) we get,

$$\dot{\hat{e}} = \dot{\hat{d}}(t) + \frac{\partial p}{\partial \sigma} \dot{\sigma} \quad (30)$$

Substituting $\dot{\sigma}$ from (21)

$$\dot{\hat{e}} = \dot{\hat{d}}(t) + \frac{\partial p}{\partial \sigma} (-K\sigma + e + g_m u_n) \quad (31)$$

This suggests an update law for $\hat{d}(t)$ as

$$\dot{\hat{d}}(t) = -\frac{\partial p}{\partial \sigma} (-K\sigma + \hat{e} + g_m u_n) \quad (32)$$

Giving

$$\dot{\hat{e}} = \frac{\partial p}{\partial \sigma} \tilde{e} \quad (33)$$

Subtracting both sides of (33) from $\dot{\hat{e}}$, we get

$$\dot{\tilde{e}} = -\frac{\partial p}{\partial \sigma} \tilde{e} + \dot{\hat{e}} \quad (34)$$

This suggests that the choice of $p(\sigma)$ be such that $\frac{\partial p}{\partial \sigma}$ is a positive function.

A. Stability of the System during Sliding Mode

During the sliding mode, the uncertain system with mismatched condition is stable provided the following theorem is satisfied.

Theorem 1:

Consider a candidate Lyapunov function

$$V(\sigma, \tilde{e}) = \frac{1}{2} \sigma^2 + \frac{1}{2} \tilde{e}^2 \quad (35)$$

Taking the derivative of $V(\sigma, \tilde{e})$ along (25) and (34)

$$\dot{V}(\sigma, \tilde{e}) = -K\sigma^2 + \sigma\tilde{e} - \frac{\partial p}{\partial \sigma} \tilde{e}^2 + \tilde{e}\dot{\tilde{e}} \quad (36)$$

Using young’s inequality $ab \leq \frac{1}{2}(a^2 + b^2)$ and the assumption 1 and simplifying

$$\dot{V}(\sigma, \tilde{e}) \leq -\left(K - \frac{1}{2}\right) \sigma^2 - \left(\frac{\partial p}{\partial \sigma} - 1\right) \tilde{e}^2 + \frac{1}{2} \mu^2 \quad (37)$$

The control parameters can be chosen so that $\left(K - \frac{1}{2}\right) > 0$ and $\frac{\partial p}{\partial \sigma} - 1 > 0$. From (37) it can be seen that the dynamics of σ and the estimation error \tilde{e} is not asymptotically stable but is ultimately bounded.

VI. RESULTS AND CONCLUSION

Figure 2 and 3 shows the response of passive suspension system for unit step and two bump road profile respectively. The

Response of passive suspension system shows that the system is stable but need some time to settle down for unit step input and in case of two bump road disturbances; the passive suspension system could not attenuate the given force. This cause sprung mass deflection occur in the system.

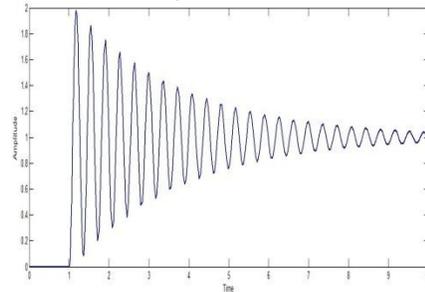


Figure 2: Sprung mass displacement of passive suspension system for unit step road profile

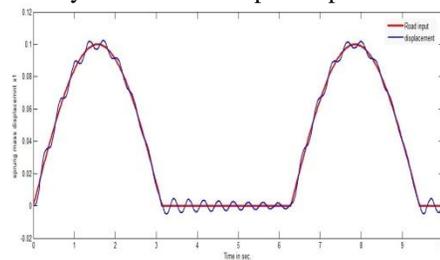


Figure 3: Sprung mass displacement of passive suspension system for two bump road profile

Next, we investigate the performance of active suspension system. Figure 4 and figure 5 shows the response of active suspension system for unit step and two bump road profile. The figure shows that the proposed system is successful in attenuating the deflection and acceleration of the sprung mass which demonstrates the efficacy of the system in improving the ride comfort.

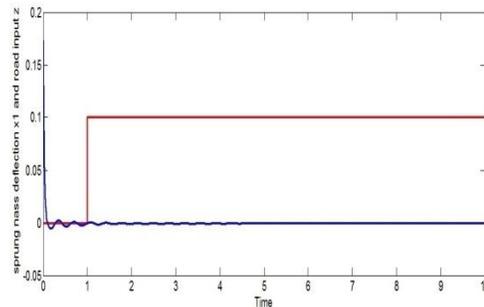


Figure 4: Sprung mass deflection x1 and road profile z

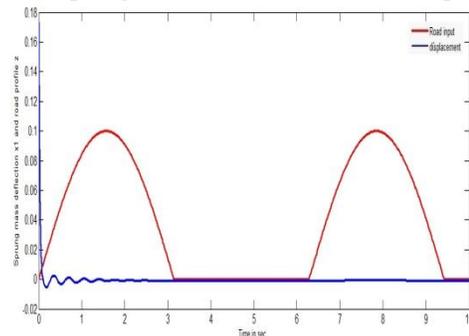


Figure 5: Sprung mass deflection x1 and road profile z

Figure 6 and 7 shows the control during sliding mode control for unit step and two bump road profile.

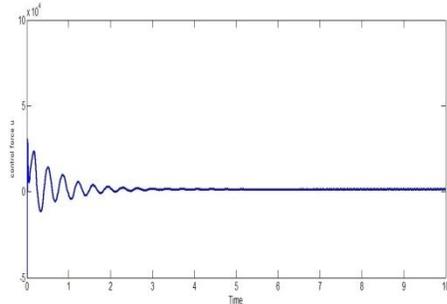


Figure 6: Control Force u for unit step disturbance

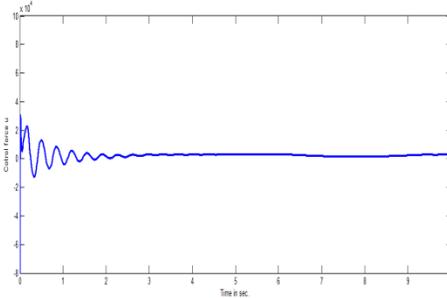


Figure 7: Control Force u for two bump disturbance

From the results it is proven that by using disturbance observer, active suspension will response much better than without observer and also passive suspension system. Passive suspension is the weakest suspension to absorb any disturbance exerted to the system. In this chapter the performance of proposed observer and SMC with disturbance observer has been investigated. It has been shown that the SMC with disturbance observer improved the ride comfort and road handling performances of quarter car active suspension system compared to passive suspension system with disturbance observer control technique. The proposed sliding mode control with disturbance observer is robust to various types of disturbance. Furthermore, the chattering problem has been overcome by using the continuous switching function and the boundary layer that can be adjusted by varying the sliding gain in the controller.

REFERENCES

- [1] P.G. Wright. "The Application of Active Suspension to High Performance Road Vehicles", *Microprocessors in Fluid Engineering IMechE Conference Publications* (1984).
- [2] M. M. Fateh, and Seyed S. Alavi, "Impedance control of an active suspension system," *Journal on Mechatronics*, vol. 19, pp. 134-140, 2009.
- [3] J.S. Lin, and I. Kanellakopoulos, "Nonlinear design of active suspension," *In: 34th IEEE Conference 1995*, vol. 17, pp. 45-59, 1995.
- [4] A. Alleyen and J. K. Hedrick, "Nonlinear adaptive control of active suspensions," *IEEE Trans. Contr. Syst. Technol.*, vol. 3, no. 1, pp. 845-860, Mar. 1995.
- [5] E. Esmailzadeh, and H. D. Taghirad, "Active vehicle suspensions with optimal state feedback control", *Journal of Mechanical Science*, vol. 200, no.4, pp. 1-18, 1997.
- [6] Yao-Wen Tsai, Kai-Hsin Mai, and Kuo-Kai Shyu, "Sliding mode control for unmatched uncertain systems with totally invariant property and exponential stability," *Journal of the Chinese Institute of Engineers*, vol. 29, no. 1, pp. 179-183, 2006.

- [7] V. I. Utkin, "Variable Structure Systems with Sliding Modes," *IEEE Transaction on Automatic Control*, vol. 22, pp. 212-222, 1977.
- [8] C. Edwards, and S. K. Spurgeon, *Sliding Mode Control: Theory and Applications*, Taylor and Francis Ltd. 1998.
- [9] J. Y. Hung, W. B. Gao, and J. C. Hung, "Variable Structure Control: A Survey," *IEEE Transaction on Industrial Electronics*, vol. 40, no. 1, pp. 2-22, feb 1993.
- [10] W. B. Gao, M. Cheng and D. B. Sen, "Variable structure control of nonlinear systems," *Contr. Decision*, vol. 4, no. 4, pp. 1-6, 1989.
- [11] P. C. Chen and A. C. Huang, "Adaptive sliding mode control of nonautonomous active suspension systems with time-varying loading," *Jnl of Sound and Vibration*, vol. 282, pp. 1119-1135, 2005.
- [12] V. Utkin and K.D. Young, "Methods of constructing discontinuity plane in multidimensional variable structure system", *Automation and remote Control*, vol. 39, pp. 1466-1470, 1979.
- [13] C. M. Dorling A.S.I. Zinobar, "two approaches to hyperplane design in multivariable control structure systems", *Int. J. Control*, vol. 44, pp. 65-82, 1986.
- [14] C. M. Dorling A.S.I. Zinobar, "Robust hyperplane design in multivariable structure control system", *Int. J. Control*, vol. 48, pp. 2043-2053, 1988.
- [15] H.G. Kwantny and H. Km, "variable structure control of partially linearizable dynamics", *in Proceeding of the 1989 American Control Conference, (Pittsburg, PA)*, pp.1148-1153, 1989.
- [16] K.D. Young and U. Ozguner, " Frequency shaping compensator design for sliding mode", *Int. J. Control*, vol. 57, no. 5, pp. 1005-1019, 1993.
- [17] W.C. Su, S.V. Drakunov and U. Ozguner, "Constructing discontinuity surfaces for variable structure systems: a Lyapunov approaches", *Automatica*, vol. 32, No. 6, pp. 925-928, 1996.
- [18] A. F. Flippov, "Differential equation with right side continuous on intersecting surfaces", *Differents. Uraven*. Vol. 15, no. 10, pp. 1814-1823, 1979.
- [19] V. Utkin, "Sliding Modes and their Application in Variable Structure Systems", Moscow: Mir, 1978.
- [20] H. Hashimoto, V.I. Utkin, J.X.Xu, H. Suzuki and F. Hiroshima, "VSS Observer for Linear Time Varying System", *IECON'90* pp. 34-39, 1990.
- [21] S.V. Drakunov, D.B. Izosimov, A.G. Luk'ayonov and V. I. Utkin, "The Block Control Principle", *Automation and Remote control*, vol. 51, no. 6, pp. 737-746, 1992.
- [22] S.V. Drakunov, V. Utkin, "Sliding Mode Observers Tutorial", in proceeding of the 34th IEEE conference on Decision and Control (CDS), (New Orleans, LA), pp. 3376-3378, 1995.
- [23] J.J. Slotine and S.S. Sastry, "Tracking control of nonlinear system using sliding surface with application to robotic manipulators", *Automatica*, vol. 18, no. 4, pp. 385-400, 1982.
- [24] K. D. Young and H. G. kwantny, "Variable Structure Servomechanisms", *Systems and Control Letters*, vol. 18, no. 4, pp. 385-400, 1982.
- [25] H. Asada and J. J. Slotine, "Robust Analysis and Control", 1986.
- [26] K. D. Young and S. Drakunov, "Sliding mode control with chattering reduction", *in Proceeding of the 1992 American Control Conference, (Chicago, IL)*, pp. 1291-1292, 1992.
- [27] J. O'Reilly, "observer For Linear Systems", Academic Press, department of Electrical and Electronics Engineering, The University of Liverpool, 1983.
- [28] S. Sarpurk, Y. Istefanopulos and O. Kayank, "On the stability of discrete time sliding mode control and system", *IEEE Trans. Automat. Contr.*, vol. AC-32, no. 10, pp. 930-932, 1987.
- [29] U. Kotta, "Comments on "On the stability of discrete time sliding mode control systems"", *IEEE Trans. Automat. Contr.*, vol. AC-34, no. 9, pp. 1021-1022, 1989.
- [30] V. Utkin and S.Drakunov, "On discrete time sliding mode control", *in Proceedings of IFAC Symp. On Nonlinear Control Systems (NOLCOS)*, (Capri, Italy), pp. 484-489, 1989.

AUTHORS

First Author – Faraz Ahmed Ansari, M.Tech Scholer,
University College of Engineering, Rajasthan Technical
University, Kota, (Rajasthan), India,
faraz21487@yahoo.com

Second Author – Rajshree Taparia, Associate Professor,
University College of Engineering, Rajasthan Technical
University, Kota, (Rajasthan), India,
callrajshree@rediffmail.com

Correspondence Author – Faraz Ahmed Ansari,
email: faraz21487@yahoo.com,

+(91) 9887240189

Radiological Evidence of Costoclavicular Joint

Anita Rani, Jyoti Chopra, Archana Rani, Arvind Kumar Pankaj, Rakesh Kumar Verma and Rakesh Kumar Dewan

Department of Anatomy, King George's Medical University, Lucknow, Uttar Pradesh, India

Abstract- Sometimes the ligamentous connection between clavicle and first rib can be converted into a diarthrodial union and a new joint: costoclavicular joint comes into existence. Very scanty literature is available documenting the presence of faceted apophysis on the under surface of clavicle at the attachment area of costoclavicular ligament, suggesting an articular area for costoclavicular joint. It is said that when such type of joint is present, the costoclavicular ligament acts as a joint capsule. 120 CT scout films (cervical and thoracic region) and 245 digital chest X-ray films (postero-anterior view) were observed. Out of 365 radiological images (males =202, females=163), 10 cases (2.7%) showed approximation of clavicle and ossified first costal cartilage at site of attachment of costoclavicular ligament, suggesting presence of costoclavicular joint.

Index Terms- clavicle, costoclavicular joint, costoclavicular ligament, first rib.

I. INTRODUCTION

Costoclavicular joint is an anomalous articulation, which if present, exists between medial end of clavicle and first rib or its cartilage. Earliest description of the this articulation was given by Buchanan (1946), who said that in 10% subjects a joint exist between clavicle and first costal cartilage, in that case costoclavicular (rhomboid) ligament forms part of joint capsule.¹ Cave in 1961 carried out an extensive study on the morphology of costoclavicular ligament and reported an incidence of 2.61% of this joint.² Almost half a century later in an osteological study faceted apophysis at the attachment area of costoclavicular ligament on clavicle was observed in 19.47% cases, whereas in only 9.24% cases such facet was observed on the corresponding area on first rib. The authors suggested that this joint can even exist between clavicle and ossified first costal cartilage.³ To the best of our knowledge, single study, till date, has been published reporting two cases of costoclavicular joint in anteroposterior radiograph of lower cervical region of 2 patients.⁴

With the advancement in radiological techniques, this particular joint could be visualized and if radiologists are not

aware of the existence of this joint they can very easily misdiagnose it.

This radiological study was conducted to confirm the presence of costoclavicular joint in the native population.

II. MATERIAL & METHODS

In the present study, 120 CT scout films (cervical and thoracic region) and 245 digital chest X-ray films (postero-anterior view) were observed. These radiological images were obtained from Radiology Department of King George's Medical University, Lucknow, UP. Out of 365 radiological images, 202 were of males and 163 of females. Age of patients ranged between 8 months to 73 years. Presence of a joint like space between the facet like elevation on the inferior margin of clavicle near its medial end and reciprocal facet on superior surface of first rib and or its ossified costal cartilage was considered as evidence of costoclavicular joint. Sternoclavicular joint was identified on both sides. The inferior margin of medial end of clavicle and superior margin of anterior end of first rib and its ossified costal cartilage was observed carefully for the presence of any reciprocal elevations intervened by joint like space.

III. RESULTS

Careful observation of 365 radiological images of concerned area revealed that in majority of cases undersurface of medial end of shaft of clavicle and superior surface of first rib or its ossified costal cartilage were separated by a wide gap (Fig. 1a). In 2.7% cases the two surfaces were closely approximated suggesting presence of costoclavicular joint (Fig.1b). In all the cases joint was present between clavicle and ossified first costal cartilage and not between clavicle and first rib. Joint was observed on left side in 7 cases and on right side in 3 cases (Table). In none of the case joint was present bilaterally. In two cases inferior surface of medial end of shaft of clavicle, at the site of attachment of rhomboid ligament exhibited an elevation but no corresponding facet on first costal cartilage could be commented upon as the costal cartilage was unossified (Fig. 1c).

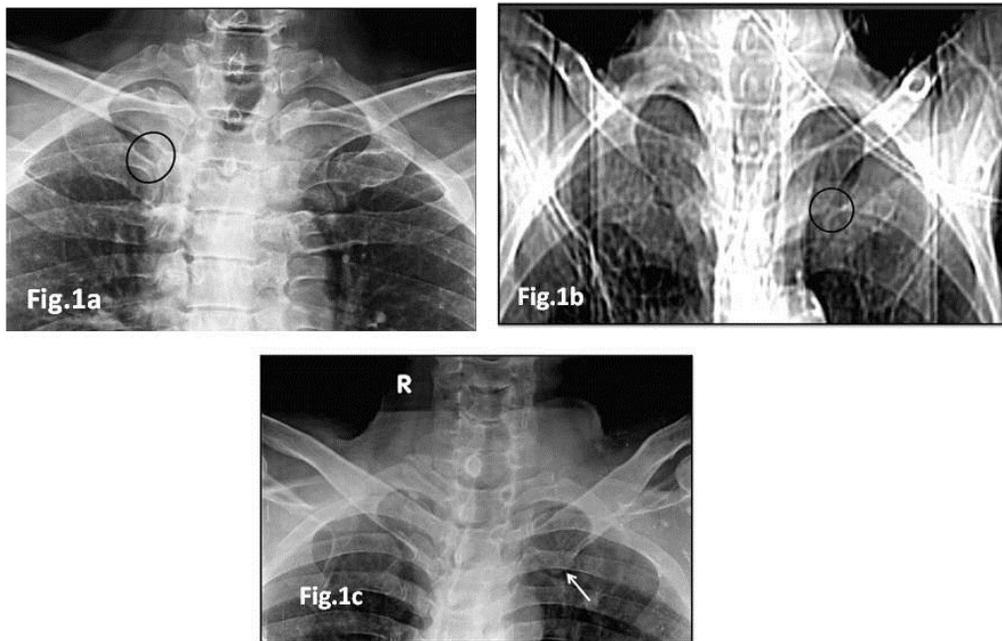


Figure 1: Postero-anterior lower cervical radiograph showing (a) absence of costoclavicular joint (encircled area); (b) presence of costoclavicular joint on left side (encircled area); (c) facet like elevation on under surface of clavicle (arrow) and unossified first costal cartilage.

Table: Incidence of costoclavicular joint in studied population

	Right	Left	Total
Male (n=202)	2 (0.99%)	5(2.47%)	7(3.46%)
Female (n=163)	1 (0.61%)	2(1.23%)	3(1.84%)
Total(n=365)	3(0.82%)	7(1.91%)	10(2.7%)

IV. DISCUSSION

Apart from forming sternoclavicular and acromioclavicular joints clavicle may also form diarthrodial articulation with first rib (costoclavicular joint) or coracoids process of scapula (coracoclavicular joint). These two unusual joints are formed due to modification in already existing fibrous connections between respective bones.

Coracoclavicular joint is a true synovial joint which is occasionally present not only in humans but also in non human primates.⁵ The incidence of this joint varies from 0.8%-10%.^{6,7} Diarthrodial costoclavicular articulation is said to be a modification of ancestral syndesmosis. In Galogo and Loris costoclavicular ligament was not a separate unit, but was part of

sternoclavicular joint capsule. In Gibbon, Orang and Chimpanzee it became a separate entity. Further, in Perodictius the costoclavicular ligament became bifascicular. In humans this ligament is larger in size, fibres are conical or cylindrical and comprises of anterior and posterior lamina with an intervening constant bursa suggesting an attempt towards formation of synovial joint.^{1,2,8} It is proposed that the development of an emphatic type of costoclavicular ligament or a synovial type of costoclavicular joint is secondary to wide range of clavicular movements. So, probably it is a next step in the evolution.² Other possible factors responsible for the development of such variation could be attributed to environment, genetic constitution, rate and pattern of growth and type of bone remodeling.^{9,10} Till date only one study has been published in which evidence of both the anomalous articulations of clavicle ie costo and coracoclavicular joints were observed in the form of facets at the area of attachment of costo and coracoclavicular ligaments respectively.¹¹

In the present study an incidence of 2.7% of costoclavicular joint was observed. In all the cases the joint existed between under surface of clavicle and ossified first costal cartilage. In two cases though clavicle exhibited facet but it was not possible to comment on the presence of joint as first costal cartilage was unossified. In the later part of twentieth century Redlund-Johnell provided radiological evidence of the costoclavicular joint in anteroposterior radiographs of lower cervical region of two patients, out of 950 patients, he observed.⁴

While studying the morphological features of area of attachment of costoclavicular ligament on 153 clavicles of European origin, Cave observed smooth, elevated, circumscribed facet like area in 2.6% cases and regarded it as evidence of

existence of synovial variety of costoclavicular joint.² Recently similar study was conducted on the dried specimens of adult clavicles (118) and first ribs (184) of Indian origin. In 19.47% clavicles facet was observed at the area of attachment of costoclavicular ligament where as on corresponding area of first rib demifacet was observed in 8.15% cases and complete facet in only 1.09% ribs. They also reported presence of demi as well as complete facet on ossified first costal cartilage. It can be inferred from the above study that costoclavicular articulation may exist between (i) clavicle and first rib (ii) clavicle and first costal cartilage (iii) clavicle and first rib and its costal cartilage.³ In the present study all the observed joints were between clavicle and ossified first costal cartilage. To overcome the limitations of the present study, ie non visibility of unossified costal cartilage, authors strongly recommend to further investigate the existence of this unusual joint by magnetic resonance imaging technique. Pathological involvement of costoclavicular joint may cause pain in this region which will be very difficult to differentiate from the pain due to involvement of sternoclavicular joint. Therefore, orthopaedic surgeon must have in mind the fact that this particular joint could exist and should be considered as one among many possible causes of pain in this region. Further, author wants to make aware the anesthetists and intensive care interventionists about the presence of costoclavicular articulation as it may cause narrowing of costoclavicular space, which can increase the risk of compression of subclavian catheter during intravenous catheterization.

V. CONCLUSION

In the present radiological study, a 2.7% incidence of costoclavicular joint was observed suggesting transformation of fibrous type of joint into a synovial variety. The knowledge of this joint is clinically important for radiologists, orthopedicians, anaesthetists and cardiologists.

ACKNOWLEDGEMENT

We would like to thank Dr Neera Kohli, Professor, Department of Radiology, King George's Medical University, Lucknow, UP for providing CT Scans and digital chest X- rays and giving expert advice regarding the presence of anomalous articulation.

REFERENCES

- [1] Wood Jones F, "The Bones of the Upper Limb. In Buchanan's Manual of Anatomy". 7th ed. Bailliere Tindall and Cox, London, 1946, pp. 268.
- [2] Cave AJE, "The nature and morphology of the costo-clavicular ligament", *J Anat*, vol 95, pp. 170-179, 1961.
- [3] Anita Rani, Jyoti Chopra, Archana Rani, Suniti Raj Mishra, AK Srivastava, PK Sharma, Rakesh Diwan, "A Study of Morphological Features of Attachment Area of Costoclavicular Ligament on Clavicle and First Rib in Indians and its Clinical Relevance", *Biomedical Research*, vol 22(3), pp. 349-354, 2011.
- [4] Johnell IR, "The costoclavicular joint", *Skeletal Radiol*, vol 15, pp.25-26, 1986.
- [5] Haramati N, Cook RA, Raphael B, Mcnamara TS, Staron RB & Feldman F, "Coracoclavicular joint: normal variant in humans. A radiographic

demonstration in the human and non human primate", *Skeletal Radiol*, vol 23(2), pp.17-19, 1994.

- [6] Nalla S & Asvat R, "Incidence of the coracoclavicular joint in South African populations", *J Anat*, vol 186, pp. 645-9, 1995.
- [7] Nehme A, Tricoire JL, Giordano G, Rouge D, Chiron P & Puget J, "Coracoclavicular joints: Reflections upon incidence, pathophysiology and etiology of the different forms", *Surg. Radiol Anat*, vol 26(1), pp. 33-8, 2004.
- [8] Williams PL, Bannister LH, Berry MM, Collins P, Dyson M, Dussek JE and Ferguson MWJ, "Skeleton System In: Gray's Anatomy", 38th ed. Churchill Livingstone, Edinburgh, 1995, pp. 621.
- [9] Humphrey LT, Dean MC, Stringer CB, "Morphological variation in great ape and modern human mandibles". *J Anat*, vol 195, pp. 491-513, 1999.
- [10] Wood BA, Li Y Willoughby C, "Intraspecific variation and sexual dimorphism in cranial and dental variables among higher primates and their bearing on the hominid fossil record" *J Anat*, vol 174, pp. 185-205, 1991.
- [11] Rani A, Mishra S.R, Chopra J, Rani A, Manik P, Kumar N & Dewan RK, "Coracoclavicular and costoclavicular joints at a common juncture: A rare phenomenon" *Int. J. Morphol*, vol 27(4), pp.1089-1092, 2009.

AUTHORS

First Author-Anita Rani, MS (Anatomy), Associate Professor, King George's Medical University, Lucknow, Uttar Pradesh, India. Email: anita72rani@yahoo.co.in

Second Author-Jyoti Chopra, MS (Anatomy), Associate Professor, King George's Medical University, Lucknow, Uttar Pradesh, India. Email: chopra71jyoti@yahoo.co.in

Third Author- Archana Rani, MS (Anatomy), Associate Professor, King George's Medical University, Lucknow, Uttar Pradesh, India. Email: archana71gupta@yahoo.co.in

Fourth Author- Arvind Kumar Pankaj, MS (Anatomy), Lecturer, King George's Medical University, Lucknow, Uttar Pradesh, India. Email: drarvindpankajcsmmu@yahoo.com

Fifth Author- Rakesh Kumar Verma, MS (Anatomy), Lecturer, King George's Medical University, Lucknow, Uttar Pradesh, India. Email: rakesh_gsvm@yahoo.co.in

Sixth Author- Rakesh Kumar Dewan, MS (Anatomy), Assistant Professor, King George's Medical University, Lucknow, Uttar Pradesh, India. Email: dewanrakesh80@yahoo.com

Correspondence Author – Dr Anita Rani, Associate Professor, Department of Anatomy, King George's Medical University, Lucknow, U.P, India, Mobile no. 9839604340, e- Mail address: anita72rani@yahoo.co.in

Marital Adjustment and Mental Health among Bank Employees and Doctors during Middle Age (40-55 Years) in Delhi

Dr. Shikha Goel¹, Dr. Darshan Kaur Narang², Dr. Kavita Koradia³

¹ Bhagini Nivedita College, University of Delhi, New Delhi

² Department of Home Science, University of Rajasthan, Jaipur.

Abstract- The present research was taken up with broad objective to study the marital adjustment and mental health in middle aged couples (40-55 years) from Delhi, India. The sample comprised of 100 working couples (n=200) which are bank employees and doctors, within the age range of 40-55 years from Delhi, India. It was seen that in bank employees, autonomy was positively correlated with family adjustment, positive self evaluation and financial adjustment. In middle aged doctors, autonomy was positively correlated with family adjustment and social adjustment; whereas integration of personality was found correlated with role distribution. On the other side, perception of reality was negatively correlated with recreational adjustment and role distribution. A significant interactive affect of job and age, was found on marital adjustment, mental health of middle aged couples.

Index Terms- India, Marital adjustment, Mental health, Middle age.

I. INTRODUCTION

From birth, human beings go through a series of transitions that have been referred to variously as "stages," "passages," and "seasons." These terms typically define a specific time period with physical, mental, behavioural or other characteristics that are presumed to characterize, that period. "Adulthood" or "Middle age" is one of them. Middle age is generally considered to extend from age forty to age 60 year. It is an especially difficult time in one's life; adjustment to it is greatly dependent on the foundation laid earlier. The period of middle age is typically marked with physical changes; as, well as new responsibilities of caring for younger children and grand children, and also older parents. A central issue in the lives of young adults in the anxiety and anticipation of a "mid-life transition" as they enter middle adulthood. Marriage is one of the most important events of a person's life. Marriage is a social security for all the individuals, i.e. society through marriage system provides security of needs and cares thereby its existence and prosperity is secured. Marriage is for pleasure, happiness and peace of mind on account of satisfaction through interactions with others, trust, understanding and fulfilling social obligations and enriching personality development. A marriage relationship is a delicate, Kaleidoscopic and complex phenomena. It may be very difficult to disentangle anyone particular casual element. Besides Marital Satisfaction or dissatisfaction or "Marital

Adjustment or Maladjustment," "mid-life-crisis" also have some other thoughts to include: Worries about the future, inability to enjoy leisure time, a feeling that health is deteriorating, a negative evaluation of work life, and stress arising from taking care of the elderly.

Rational

Human beings constantly have to adjust to various roles, environmental demands and pressures. Throughout the course of life, human beings strive for well-being and happiness in various spheres of life - personal, social, economic, marital and work. Achievement and success in these spheres lead to satisfaction in life, whereas inadequacy to do the same leads in frustration. In the present modern era, professionals like bank employees and doctors have to spend more time at their work place and are more indulge in activities related to their career and professions. They have less time to fulfil their family responsibilities which may lead to dissatisfaction. Marital maladjustments are the consequences of dissatisfaction, especially in middle aged couples (40-55 years) who are becoming more inclined towards extra-marital relationships and divorce. So, the broad objective of the research was to explore the factors influencing the marital adjustment during middle age as well as the mental health of couples.

Marital Adjustment

Marital adjustment is a life long process; although in the early days of marriage one has to give serious consideration. As Lasswell (1982) points out, "understanding the individual trait of the spouse is an ongoing process in marriage; because even if two people know each other before or at the time of marriage, there is a possibility that people change during the life cycle. Marital adjustment, therefore, calls for maturity that accepts and understands growth and development in the spouse. If this growth is not experienced and realized fully, death in marital relationship is inevitable. Sinha and Mukerjee (1990) defines marital adjustment as, "the state in which there is an over all feeling between husband and wife, of happiness and satisfaction with their marriage and with each other." It, therefore, calls experiencing satisfactory relationship between spouses characterized by mutual concern, care, understanding and acceptance.

Sexual compatibility and mutual enjoyment is an important factor contributing to the success of most marital relationship, Job of spouse, shape families in a variety of ways. Two major aspects of work directly affect family life: (1) the level of

economic rewards associated with work and (2) the conditions associated with performing a job.

Marital Conflicts

No matter how satisfactory and inevitable marriage is, some conflict theorists assert that marital relationships reflect and reinforce gender inequalities (Degler, 1980). Examples that support such an assertion are: (1) until the past few years, a husband could rape his wife and not be charged; (2) in traditional marriage vows the bride is given away to the groom; and (3) the woman has traditionally taken the surname of the husband after marriage. Conflict theory helps to explain the extent of violence in families, where care and cooperation are supposed to exist – something not easily explained by functionalist theory. Good communication skills do not prevent conflict. Actually a conflict, followed by a confrontation, can produce positive results.

Fujihara (1998) did a study on 153 married couples which showed that marital adjustment was significantly correlated with subcategories of social adjustment (1) household adjustment (except the spouse), (2) external family adjustment, (3) work adjustment, (4) social leisure adjustment and (5) general adjustment. Thus, marital adjustment may be a part of social adjustment for women, but the two may be discrete for men. A study, made on 1,609 couples from the Russian Army, found that marital dissatisfaction from husband will cross over to the wife directly, whereas the indirect crossover, when a stressor, such as economic hardship or a negative life event increases the strain of a partner, is mediated the impact of the wife's social undermining behaviour on her husband (Westman, Vinokur, Hamilton & Roziner, 2004).

Eng, Kawachi, Fitzmaurice and Rimm (2005), studied 38,865 men aged (40-75) to examine the affect of change in marital status on health behaviours among men and found Marital termination (Remarriage, widowhood and unmarried) may adversely affect health and dietary behaviours of men.

Vohs, Catanese, and Baumeister (2004) ended that, consistent with the traditional sexual script, research has consistently shown that men have a stronger sexual motivation than do women. Further, Sprecher (2002) found that relationship satisfaction (but not sexual satisfaction) negatively predicted the likelihood of relationship breakup for women but not for men. In contrast, sexual satisfaction (but no relationship satisfaction) negatively predicted the likelihood of relationship dissolution for men but not for women. Thus, perhaps for men decreased sexual satisfaction leads to decreased relationship satisfaction, whereas for women, the reverse is true.

Mental Health

The concept of mental health includes subjective well-being, perceived self-efficacy, autonomy, competence, intergenerational dependence, and self-actualization of one's intellectual and emotional potential among others. From a cross-cultural perspective it is nearly impossible to define mental health compressively. Mental health is a state of well being in which the individual realizes his or her own abilities, can cope with the normal stresses of life, can work productively, fruitfully and is able to make a contribution to his/her community (The world health reports 2001). Mental health covers an elusive and

diffuse field and the term in itself encompasses a multiplicity of meaning.

Blanofield (1967) defined mental health as a composite of attitude towards oneself, ability to realize once potential through action, degree of independence from social influence and the ability to perceive realistically the world around. Ferguson (1965) stated that mental health is the ability to cope with one's environment in such a way that one's institutional drives are gratified. They considered that mental illness and mental health, are two opposite ends of the continuum on which any individual can be placed depending on the soundness of his mind. There is a general agreement that two terms mental health and mental illness refer to behaviors which are interpersonal in nature and to mental illness is judged to be dysfunctional according to the norms of an observer.

Matsuoka (1996) conducted a study on 58 middle aged people to determine the degree to which family cohesion accounted for different outcome measures of mental health among native Hawaiian families on an island on the verge of major tourism development. This development will cause economic changes that will pose major challenges for the native agrarian families. A series of interviews of focus groups elicited qualitative information on the relationship between family cohesion and mental health. The findings show a clear relationship between family cohesion and mental health status.

Willitts, Benzeval, and Stansfeld (2004) interviewed 2127 men and 2303 women aged less than 65 to describe the mental health of men and women with differing histories of partnership transitions. They came to the conclusion that partnership protects mental health. The negative outcomes of splitting partnership for health are long lasting in women.

Tiffin, Pearce and Parker (2005) studied 503 subjects from a birth cohort to investigate the affect of socio-economic status throughout the life course on self reported mental health at age 50 years and land up with the conclusion that a downward socio-economic trajectory over the whole life course is associated with poorer self reported mental health in men but not in women.

Research has shown that engaged workers report well mental and psychosomatic health (Demerouti et al., 2001). Furthermore, they exhibit personal initiative, proactive behavior and learning motivation (Sonnetag, 2003; Schaufeli and Salanova, 2007).

On the basis of the previous researches the hypothesis tested in this study is as follow: "Marital Adjustment will be significantly and positively related to Mental Health in middle age couples".

II. OPERATIONAL DEFINITIONS

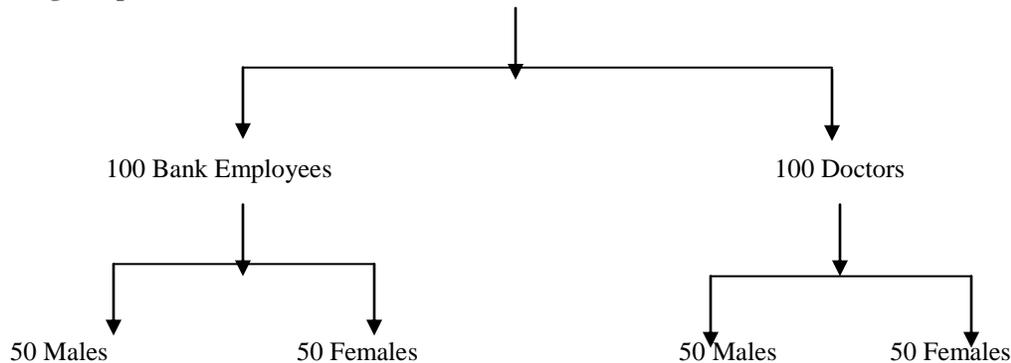
Marital adjustment - Landis (1975) cites the following factors in the beginning and development of any love relationship that leads to marriage (a) physical attraction (b) satisfaction of certain personality needs like: someone to understand; to respect the ideals; to appreciate what one wishes to achieve; to understand the moods; to help one make decisions; to stimulate the ambition; to give self confidence; to look at; to appreciate and admire; to back in difficulties; to relieve the loneliness, (c) sharing together the special interests and cares, (d) same life goals.

On the bases of the above factors the definition of marital adjustment for the present study includes family adjustment, financial adjustment, social adjustment, recreational adjustment, role distribution and sexual adjustment.

Mental health - Mental health include subjective well-being, perceived self-efficacy, autonomy, competence, intergenerational dependence, and self-actualization of one's intellectual and emotional potential, among other.

Research Design

100 Working Couples (N=200)



The following statistical tests were computed:

- Mean and Standard Deviation were computed.
- Pearson's 'r' was computed.

Criteria for sample selection

- Couples must belong to the upper middle socioeconomic status.
- Both the spouses must be working.
- The age range of the couples should fall between (40-55 years).
- Minimum working hours of men and women should be 6 to 8 hours per day.
- Both the spouses must be either doctors or working with the banks only.

Bank employees and doctors are used to have long working hours in the today's scenario as the private sector jobs have changed the trend from seven to eight hours job. It has been changed to 10 to 12 hour job. It is open for both male and females also. So, they have to make adjustments to their family responsibilities and married life according to their tight schedules. Thus, the Bank employees and Doctors have been chosen for the study.

Tools for Measurement

Two tools were used for the measurement of the Marital adjustment and Mental health. Those are:

- **Marital adjustment Questionnaire**

Marital Adjustment Questionnaire was developed by the researcher (2004) to assess the marital adjustment in the couples during middle age. Pilot study was conducted by researcher on the 10% subjects of total sample (N=20) of the research. Necessary corrections were made to tool after the pilot study. The reliability and validity scores respectively are .96 and .74. Some basic needs of successful marriage during middle age were

III. METHODOLOGY

The sample comprised of 100 working couples (n=200) which are bank employees and doctors, within the age range of 40-55 years, selected through convenient sampling technique. The data were collected from Delhi state, India. Equal number of males and females were taken.

used as points of references for rating. Those are Family adjustment, financial adjustment, Emotional adjustment, Sexual adjustment, Recreational adjustment, Role distribution, Social adjustment. Marital adjustment questionnaire consisted of 42 items with a five point scale. Items of the scale are in statement form seeking information for each in any of the five options, which are "Very Rare", "Rare", "Sometimes", "Often", and "Very often". The weight given is 1,2,3,4 and 5 respectively. The test is having reverse key also. Higher the score higher is the adjustment, lower the score poor will be the adjustment.

Mental health Inventory

Mental Health Inventory is a self-reporting four point scale and developed by Dr. Jagdish and Dr. A.K. Srivastava (1984). Validity and reliability of Mental Health Inventory is .54 and .73 respectively. The six dimensions have been inculcated in the scale are Positive self - evaluation (PSE), Perception of Reality (PR), Integration of Personality (IP), Autonomy (AUTO), Group Oriented Attitudes (GOA), Environmental Mastery (EM). The items of the scale are in statement form seeking information for each in any of the four options, which are Always, Most of Times, Sometimes, and Never. The weight is 4, 3, 2 and 1 respectively. Therefore, the higher the score on the scale, higher the status / level of mental health or vice versa.

IV. RESULTS

Table 1: Inter-correlation (Pearson’s ‘r’) among different dimensions of Marital Adjustment and Mental Health in middle aged bank employees (n=100)

Variables	PSE	PR	IP	AUTO	GOA	EM
FMY	-.143	.078	.122	.207*	.158	.003
FIN	-.233*	.068	-.015	.092	.096	-.084
EMO	-.077	-.014	.136	.129	.110	.077
SEX	-.163	.007	.121	.160	.138	-.078
REC	-.018	.132	.014	.122	-.115	.148
RD	-.171	.078	.056	.117	.116	-.040
SOC	-.098	.058	.193	.113	.193	-.023

(n=100) FMY-family adjustment, FIN- financial adjustment, EMO- emotional adjustment, SEX- sexual adjustment, REC- recreational adjustment, RD- role distribution, SOC- social adjustment, PSE- positive self evaluation, PR- perception of reality, IP- integration of personality, AUTO- autonomy, GOA- group oriented attitude, EM- environmental mastery

* Significant at .05 level.

A glimpse at the table one depicts that family adjustment is positively correlated to the autonomy of middle aged bank employees (r=. 207). Positive self evaluation is negatively correlated with financial adjustment (r=-. 233). Bank employees are having high level of self confidence, self-acceptance, self identity, feeling of self worth, realization of one's potentialities. They trust themselves more than anybody else regarding financial matters. They can be more argumentative and accountable and believe in budget keeping. Autonomy/ independence leads to good family adjustment between the spouses, since they are free of taking decisions, making developments and not interfering in each other's affairs but are supportive of each other. It can be ended that higher level of adjustment within the family members results in good stable set of internal standards for one's action and dependence for own development on own potentialities rather than dependence on other people.

Table 2: Inter-correlation (Pearson’s ‘r’) among different dimensions of Marital Adjustment and Mental Health in middle aged doctors (n=100)

Variables	PSE	PR	IP	AUTO	GOA	EM
FMY	.122	-.050	.110	.203*	.013	-.126
FIN	.099	-.076	-.035	.059	-.018	-.111
EMO	-.063	-.110	.082	.052	-.055	-.054
SEX	.077	-.131	.028	.184	.038	-.052
REC	.065	-	.055	.084	.00	.042

		.215*				
RD	.00	-	.260**	.129	-.031	-.127
		.242*				
SOC	.070	-.102	.092	.236*	.022	-.056

(n=100) FMY-family adjustment, FIN- financial adjustment, EMO- emotional adjustment, SEX- sexual adjustment, REC- recreational adjustment, RD- role distribution, SOC- social adjustment, PSE- positive self evaluation, PR- perception of reality, IP- integration of personality, AUTO- autonomy, GOA- group oriented attitude, EM- environmental mastery

* Significant at .05 level

** Significant at .01 level

Table two clearly shows that autonomy is positively correlated with family adjustment and social adjustment (r=. 203, r = .236) in doctors of middle age. On the other side, perception of reality is negatively correlated with recreational adjustment and role distribution (r=-. 215, r=-. 242) in doctors. Beside this, the integration of personality is positively correlated with role distribution (r=. 260) in middle aged doctors.

Doctors show high level of inner urge to be with their spouse and love to be a part of social gatherings and functions jointly but still they are independent in moving and attending social functions as per their convenience and time availability. This shows that perception of reality is free from need distortion, absence of excessive fantasy and a broad outlook on the world, which affects the sharing of special activities and interests negatively, who are spending less time together, and not much interested in household activities such as rearing up of grandchildren or vice versa. They need to distribute their roles and responsibilities with their spouses and family members to plan and enjoy recreational and leisure time activities together. It will also lead to sound mental health and marital adjustment. Balance of psychic forces in the doctors which also include the ability to understand and to share other's emotions. Since doctors have highly committed jobs with long working hours, so they need to devote time to fulfil their family responsibilities through proper role distribution. The more they share their responsibilities the better family relationship and marital relationship will be developed consequently creating balance at job and home and will be motivated to take part in several activities.

After marriage individuals have to adjust to each other. Adjustment means literally to move towards what is fitting appropriate or necessary for both parties. It is a blending, marking, an accommodating, and a fitting together of two personalities on every level by sharing the deepest emotions and dreams to the practicalities of life, however, is not submission. It means a full willingness to recognize, accept and promote the unique potential of one partner (Reddy, 1986).

Table 3
Analysis of variance of Marital adjustment (N=200)

Source of variance	S.S.	d.f.	M.S.S.	F	Tabulated F	
					5%	1%
Family adjustment						
Effect of treatment	285.987	11	25.999	1.95 ^{NS}	2.00	2.48
Interactive effect of job and age	137.807	2	68.903	5.191**	2.99	4.61
Error	3822.560	288	13.273			
Financial adjustment						
Effect of treatment	205.237	11	18.658	1.846 ^{NS}	2.00	2.48
Error	2910.160	288	10.105			
Emotional adjustment						
Effect of treatment	139.317	11	12.665	1.55 ^{NS}	2.00	2.48
Error	2346.080	288				
Sexual Adjustment						
Effect of treatment	147.610	11	13.419	1.54 ^{NS}	2.00	2.48
Error	2507.760	288	8.707			
Recreational adjustment						
Effect of treatment	274.907	11	24.992	2.97**	2.00	2.48
Effect of age	40.333	1	40.333	4.801*	3.84	6.63
Interactive effect of job and age	79.707	2	39.853	4.744**	2.99	4.61
Error	2419.280	288	8.400			
Role distribution						
Effect of treatment	173.397	11	15.763	1.889 ^{NS}	2.00	2.48
Effect of age	34.003	1	34.003	4.075*	3.84	6.63
Error	2403.040	288	8.344			
Social adjustment						
Effect of treatment	171.627	11	15.602	1.911 ^{NS}	2.00	2.48
Error	2351.040	288	8.163			

NS = Non significant
 * Significant (0.05)
 ** Highly significant (.01)

Table three clearly reveals that interactive effect of job and age, was found highly significant on family adjustment (F=5. 19) (P=<. 01) and recreational adjustment (F=4. 74) (P=<. 01). Recreational adjustment was found significantly affected by age (F=4. 80) (P=<. 05). Other dimensions of marital adjustment, which are financial adjustment, emotional adjustment, sexual adjustment and role distribution, were found non significant, they were not found affected by job and age.

Results are also supported by following studies.

Blood and Wolfe's (1979) studied the social structure of families by power positions of husbands and wives and the division of labour. They viewed the division of labour as separate

from, through not unrelated to, their measure of family power. Their conclusions regarding the power structures are based on the wives reporting of "who usually makes the final decision about" eight areas of family life. The eight decision areas pinpointed were selected to meet the criteria of importance, universality and representativeness of masculine verses feminine sphere. The inclusion of the last criterion reflects a separate but equal ideology that is in itself questionable.

Mani (1984) reported that love and happiness of married life depend on the choice of a right person as marriage partners, a venginous and harmonious sex life and good psychological attitude of partner.

Table 4
Analysis of variance of Mental Health (N=200)

Source of variance	S.S.	d.f.	M.S.S.	F	Tabulated F	
					5%	1%
Positive self evaluation						
Effect of treatment	204.107	11	18.555	2.302*	2.00	2.48
Effect of job	118.167	2	59.083	7.331**	2.99	4.61
Error	2321.041	288	8.059			

Perception of reality						
Effect of treatment	79.507	11	7.228	1.617 ^{NS}	2.0	2.48
Error	1287.440	288	4.470			
Integration of Personality						
Effect of treatment	37.907	11	3.446	0.656 ^{NS}	2.00	2.48
Error	1517.680	288	5.270			
Autonomy						
Effect of treatment	94.347	11	8.577	2.837**	2.00	2.48
Effect of age	28.213	1	28.213	9.331**	3.84	6.63
Interaction of job and age	22.447	2	11.223	3.712*	2.99	4.61
Error	870.800	288	3.024			
Group oriented attitude						
Effect of treatment	215.147	11	19.559	3.181**	2.00	2.48
Effect of job	74.107	2	37.053	6.026**	2.99	4.61
Interaction of job and age	45.680	2	22.840	3.715*	2.99	4.61
Error	1770.800	288	6.149			
Environmental mastery						
Effect of treatment	16.787	11	14.799	2.237*	2.00	2.48
Effect of job	91.527	2	45.763	6.919**	2.99	4.61
Error	1904.880	288	6.614			

NS = Non significant

* Significant (0.05)

** Highly significant (.01)

Table four shows that interactive effect of job and age, was found significant on autonomy (F=3. 712) (p=<. 05) and group oriented attitude (F=3. 71) (P=<0.05). Individual affect of job was found highly significant on positive self evaluation (F=7. 33) (P=<0.01), group oriented attitude (F=6. 02) (P=<0.01) and environmental mastery (F=6. 91) (P=<0.01). Affect of age was found highly significant only on autonomy (F=9. 33) (P=<0.01).

Results are also supported by following studies.

Olson (1974) discusses the structural aspect of marital and family theory as involving the dimension of cohesion that they see as representing the emotional bonding that the members of the family group have with one another and the degree of individual autonomy a person experiences in a family system.

Bhatia (1982) considers mental health as the ability to balance feelings, desires, ambitions and ideals in one's daily living. It means the ability to face and accept the realities of life. Keown and Keown (1982) state that the successful women executives have the positive attitude towards themselves, their families and their work environment.

V. DISCUSSION AND CONCLUSION

The study hypothesized that "marital adjustment will be significantly and positively related to mental health in middle age couples and finds partial support for this hypothesis. This can be supported by Powers, Myers and Tingle (2004) studied 83 individuals (42 couples) living in medical marriage. Results revealed that resident spouses scored higher than the general married population on wellness, mattering, and satisfaction with shared marriage values and scored lower on work satisfaction and realistic beliefs. Barling (1986) in a study on "inter role conflict and marital functioning" found that conflict regarding work and family roles was associated with lower levels of marital

adjustment among dual earner couples. In a study concerning medical resident's wives (Alexander, 1985) a primary problem in the marital relationship was the small amount of time the husbands could spend on family activities. Kumar and Rahatogi (1984) identified certain personality correlates of marital adjustment in 300 married couples of Jodhpur city. Because of their scores they were divided in two groups as a criterion of adjustment, which are, the high adjusted (top 25%) and low adjusted (bottom 25%). The comparison of the two groups selected shows the husbands with high adjustment and their wives, were more intelligent with capacity for thinking, understand, organize and show better capacity for taking decisions, and possessed higher interest, were open, approachable, outgoing, and socially mobile as compared to the couples showing low adjustment. For the dominance variables a differential relationship with adjustment in marriage was observed in the two groups.

Neary, Terrence and Joseph (1985) interpreted for good marital adjustment. They stated that age is the significant factor in marital adjustment. Elderly couples are happy and have the good marital adjustment.

Dubey and Kumar (1986) conducted a study which shows that the current miserable condition of the society and its mental health is alarming; tension and stress have become a part of life. The twentieth century was branched as the age of stress and anxiety. Coping mechanisms of family to adjust because of excessive tension and stress in the society. The cause may vary from faulty learning, confliction objective, and unclear philosophy of life, dualism, false ego and fast changing values. Women who are balanced or committed across roles, regardless of the number of roles they occupy, will likely report greater life satisfaction and mental health (Marks & MacDermid ; Perry Jenkins, Repetti & Crouter, 2000).

Byers (2005) found that relationship of satisfaction partly mediates the association between self-disclosure and sexual

satisfaction. The authors interpreted this finding as showing that self-disclosure leads to greater relationship satisfaction, which in turn, leads to higher sexual satisfaction.

The research can be **concluded** that:

- **Not much difference is there in the marital adjustment and mental health of Bank employees and Doctors.** It can be assumed that bank employees and doctors are very ambitious; career oriented and spends more time outside the family. So, they have to make adjustment within the family responsibilities and work roles. This can have an impact on their marital adjustment and mental health. Chiu (1998) investigated 497 professionals. The findings indicated that work and family conflicts as well as inter role conflict affected job satisfaction and marital satisfaction.
- **Females are having better marital adjustment than males.** Even if, working females play dual roles and are over burdened but still they try to make adjustments in family and are satisfied and cool under all circumstances. They participate in family matters, cooperate more and make themselves available when ever required for family matters. They try to seek recreation and satisfaction out of successful management.

It is also supported by the following research studies:

Role balance theory acknowledges that different roles might come into conflict with each other, but women's ability to adjust their entire system of roles to accommodate potential conflicts will likely produce more rewarding results (Marks and MacDermid, 1996).

Prior investigators have reported that women balance multiple roles differently then do men and that woman in the workplace are often mothers who face personal and societal ambivalence about the desire to succeed as both a professional and a parent (Marks, 2001; Martire et al., 2001).

- **In contrast, males are more mentally healthy than females.** A great importance of balance of psychic forces in the males showing sound mental health. Ability to understand and to share other people's emotions, the ability to concentrate at work and interest in several activities in middle aged males results in good adjustment with spouse and with the family members. They always have an inner feeling to spend quality time with their spouse, take care of and satisfy sexual needs of the partner. They have concern and feel responsible for needs of the family members and for smooth functioning of the family, they are able to make equal role distribution among the family members. They try to maintain balance between family and society. During middle age the males have less family responsibilities (as the children are grown up or settled down) and would also desire to spend some time for social work or welfare activities. It leads to their over all life satisfaction.

Hill (2005) conducted a study on 1,314 individuals and found that work to family facilitation was positively related to job satisfaction and life satisfaction, and negatively related to individual stress. Family to work facilitation was positively related to marital satisfaction, family satisfaction and life

satisfaction, and negatively related to organizational commitment. Working fathers reported long work hours (49 hours / week), major involvement in household responsibilities (46 hours / week), and a work culture less supportive of their family life than working mothers reported. However, working fathers reported less individual stress, and greater family satisfaction, and life satisfaction than working mothers.

Practical Implications of the Study

This study has very deep social implications to strength the marital bonds between the working couples. This can help / suggest

1. The middle aged couples to develop patience and tolerance and understanding for each other.
2. The importance of recreation, role distribution for smooth functioning marriage life.
3. Working couples to owe respect and equality rights to each other regarding financial and family matters with special reference to females.
4. The young ambitious working couples with highly demanding jobs in private sector to bring stability in their married life through spending quality time with each other.

REFERENCES

- [1] Alexander, P.A. (1985) The forgotten other: A study of medical residents' wives (Doctoral dissertation, California school of Professional Psychology). Dissertation Abstracts International, 46 (4B), 1323 .
- [2] Barling, J. (1986) "Inter role conflict and marital functioning", Journal of occupational behaviour. 24,18-25.
- [3] Blood, R.O. and Wolfe, D. (1960) "Husbands and Wives: The Dynamics of Marriage Living."New York: Free Press.
- [4] Chiu, R.K. (1998) Relationship among role conflicts, role satisfactions and life satisfaction : Evidence from Hongkong. (www.findarticles.com).
- [5] Demerouti, E., Bakker, A.B., De Jonge, J., Janssen, P.P.M. and Schaufeli, W.B. (2001), "Burnout and engagement at work as a function of demands and control", Scandinavian Journal of Work, Environment & Health, Vol. 27 (4), pp. 279-86.
- [6] Dubey, S.L. and Kumar, H. (1986) The current mental health state of population. Indian Journal of Clinical Psychology, September, 13 (2), p 115-160.
- [7] Eng P.M., Kawachi I. Fitzmaurice, G. and Rimm, E.B. (2005) "Effects of marital transitions of changes in dietary and other health behaviour in US male health professionals". Journal of epidemiology and Community Health; 59: 870-872.
- [8] Hill, E.J. (2005) Work-family facilitation and conflict, working fathers and mothers, work-family stressors and support. Journal of family issues, Vol. 26, No. 6, 793-819 (www.jfi.sagepub.com).
- [9] Keown, C.F. Jr & Keown, A.L. (1982) "Success factors for corporate women executives", Group and Organizational Studies, 7 (4).
- [10] Kumar, P. and Rohatogi, K. (1984) Certain personality correlates of marital adjustment. The Indian Journal of Social work. Vol38 (b) 67-70.
- [11] Lasswell, M.E. and Lasswell, T.E. (1982) Marriage and the family. Washington D.C.: Health and Company.
- [12] Mani, P.G. (1984) Making the best or worst marriage is in your hands". Social Welfare, 31 (1), 7-9.
- [13] Marks, S.R. & MacDermid, S.M. (2000) Multiple roles and the self: A theory of role balance. Journal of Marriage and the family, 58, 417-432
- [14] Marks, S.R. & MacDermid, S.M. (1996) Multiple roles and the self: A theory of role balance. Journal of Marriage and the family, 58, 417-432 (www.thefreelibrary.com).
- [15] Marks, S.R. (2001) Role balance among white married couples. Journal of marriage and the family, 63, 1088-1098 (www.thefreelibrary.com).

- [16] Matsuoka, Jon K. and Benson, Melaine (1996) "Economic Change, Family Cohesion and Mental Health in a Rural Hawaii Community". *Families in Society*, February, 77 (2), pp. 108-116.
- [17] Neary, Terrence & Joseph (1985) Change in the process of marital adjustment, vol. 46, (1), p. 1938.
- [18] Olson, D.H.; Rabytsky, C. (1974) *Journal of Marriage and Family* Vol. 34,224-235.
- [19] Perry-Jenkins, M., Repetti, R.L. & Crouter, A.C. (2000) Work and family in the 1990's *Journal of Marriage and the family* 62, 981-998 .
- [20] Reddy, C.R. (1986) Changing status of educated working women. A case study Delhi: B.R. Publishing Corporation. pp. 205-224.
- [21] Schaufeli, W.B. and Salanova, M. (2007), "Work engagement: an emerging psychological concept and its implications for organizations", in Gilliland, S.W., Steiner, D.D. and Skarlicki, D.P. (Eds), *Research in Social Issues in Management (Volume 5): Managing Social and Ethical Issues in Organizations*, Vol. 5, Information Age Publishers, Greenwich, CT, pp. 135-77.
- [22] Sprecher, S. (2002). Sexual satisfaction in premarital relationships: Associations with satisfaction, love, commitment, and stability. *The Journal of Sex Research*, 39, 190-196.
- [23] Tiffin P.A., Pearce M.S. and Parker L. (2005) "Social mobility over the life course and self reported mental health at age 50 : prospective cohort study". *Journal of epidemiology and community health*, 59 : 870-872.
- [24] Vohs, K. D., Catanese, K. R., & Baumeister, R. F. (2004). Sex in "his" versus "her" relationships. In J. H. Harvey, A. Wenzel, & S. Sprecher (Eds), *Handbook of sexuality in close relationships* (pp. 455-474). Mahway, NJ: Lawrence Erlbaum.
- [25] Westman, M. Vinokur, A.D. Hamilton V.L. & Roziner, I. (2004) "Crossover of Marital Dissatisfaction during Military Down / Sizing Among Russian Army Officers". *Journal of Applied Psychology*, Vol. 89, 769-779.
- [26] Willitts M., Benzeval M. and Stansfeld S. (2004) "Partnership history and mental health over time". *Journal of Epidemiology and Community Health*, 58 : 53-58.

AUTHORS

First Author – Dr. Shikha Goel, M.Sc. , Ph.D.(Human Development), NET, Email: drshikhagoelphd@gmail.com
Second Author – Dr. Darshan Kaur Narang, M.Sc., Ph.D.(Child Development), Associate Professor, Department of Home Science, University of Rajasthan, Jaipur.
Third Author – Dr. Kavita Koradia M.Sc., Ph.D.(Child Development), Associate Professor, Department of Home Science, University of Rajasthan, Jaipur.

Correspondence Author – Dr. Shikha Goel,
drshikhagoelphd@gmail.com, gargshikh@gmail.com, Phone no. 9958249333

Survey on Spatio-Temporal Database and Data Models with relevant Features

Sonia Rathee*, Amita Yadav**

* Computer science & Engineering, Maharaja Surajmal Institute of Technology, New Delhi, India
** Computer science & Engineering, Maharaja Surajmal Institute of Technology, New Delhi, India

Abstract- Spatio-temporal data is the abstract of the spatio-temporal characteristics and process of the real world. Spatio-temporal database modeling on the earlier stages attempted to capture the state of real world objects or the physical event upon them, on the time line. The spatio-temporal data models integrates time and space so it can truly describe the reality. In this paper, we have reviewed the different types of spatio-temporal data models that have been proposed in the literature as well as new theories and concepts that have emerged.

Index Terms- Temporal Database; Spatial Database; Temporal Model; Spatial Model; Spatio-Temporal Data Models

I. INTRODUCTION

A database management system is responsible for the storage and processing of huge amounts of information. The data stored by these database systems refers to information valid at present time, valid now. It concerns data that is believed to be true in reality at the present moment. Past data refers to information that was stored in the database at an earlier time, data that is believed to have existed in the past, valid at some time before now. Future data refers to information considered to be valid at a future time instance, data that will be true in the near future, valid at some time after now [1].

Different types of Database systems (as shown in Fig.1) :-

1. Relational database :- Stores data in tables, known as relation.
2. Object oriented database :- stores data about entities in object. Sets of objects of the same type are called collections. Thus an object oriented database contains a set of collections.
3. Spatial Database :- concerning the storing of data in relation to space. It offers spatial data types and stores information relating to geometric or geographical space. The spatial database stores a collection of space related data.
4. Temporal database :- stores data relating to time instance. It offers temporal data types and stores information relating to past present and future e.g. The history of the stock market or the movement of the employee with an organization. Thus a temporal database stores a collection of time related data. [2]

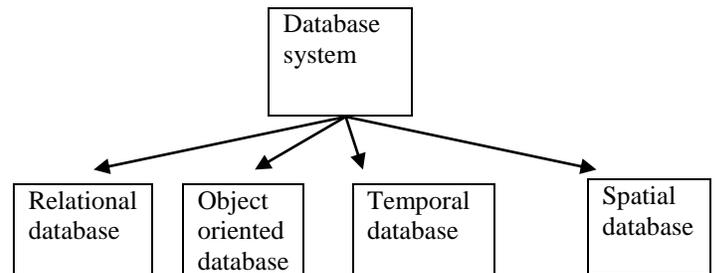


Figure 1: Types of Database

From the above listed four database models, the two models namely: Temporal database, Spatial database will be used in the present work. The description of these two models are explained below.

II. TEMPORAL DATABASE

Temporal data is any data that contains temporal information, where time can be either real or logic. To categorize temporal data, one can adopt different criteria. Below we list several commonly used categorizations for temporal data [3].

Partially Temporal vs. Fully Temporal:- A temporal dataset is partially temporal if it contains data items whose temporal relationships such as *before* and *after* are undecidable. For instance, web log is partially temporal, as it is often impossible to decide the exact access time to the same web page from different web sessions. In contrast, in a fully temporal dataset, the temporal relationship between every pair of data items is decidable:-

Regularly Timestamped vs. Irregularly Timestamped:- In regularly timestamped data, measurements are recorded at equal-spaced time points. Otherwise, the data is irregularly timestamped.

Univariate vs. Multivariate:- Univariate temporal data describes the temporal behavior of one variable. Multivariate temporal data on the other hand describes the temporal behavior of more than one variable.

Uni-subject vs. Multi-subject:- A uni-subject temporal data involves only one subject. Whereas a multi-subject temporal data involves more than one subject.

III. SPATIAL DATABASE

Spatial data consists of three components: *map(s)*, *spatial objects or entities*, and *auxiliary information*. The first component, *map(s)*, typically defines a universal reference space for all the involved objects. More than one map can be involved in a spatial dataset. For instance, it is common for data in geographic information systems to consist of maps of multiple cities. Each map contains a set of spatial objects, where each object can be uniquely identified by its location. Auxiliary information, the third component of spatial data, usually contains supplementary data, for instance, proprietary information. To represent spatial data, we have the following two major representation schemes: *raster* and *vector* [4]. The raster scheme is attribute-oriented, it transforms spatial data into a collection of pixel-based layers. Each layer is associated with one object attribute of interest (e.g. object size) and is constructed in the following manner. For each object, it first identifies all the pixels that are occupied by the object, and then assigns each identified pixel the attribute value of the said object.

Thus a layer represents the spatial distribution of all the objects in a given map with respect to the layers associated attribute. In contrast to the raster scheme, the vector representation scheme is object-oriented. It considers each spatial object as a whole, and represents it as a vector of attributes of interest. The main features of spatial data are:-

- Spatial Correlation or Autocorrelation[5].
- Complex Spatial Relationships [6]
 - Topological relations
 - Directional relations
 - Metric relations
 - Set oriented relations
- Large Data Volume [7]
- Expensive Spatial Operations

IV. SPATIAL AND TEMPORAL DATA MODEL

TEMPORAL DATAMODEL:- The temporal model(shown in Figure 2) , presents the qualitative and quantitative aspects of time references using the de facto standard model [8] with the granularity concepts studied in theoretical works [9], making it possible to partition the temporal domain in thematic contexts, each of them with its granularity, and to make quantitative and qualitative temporal references.

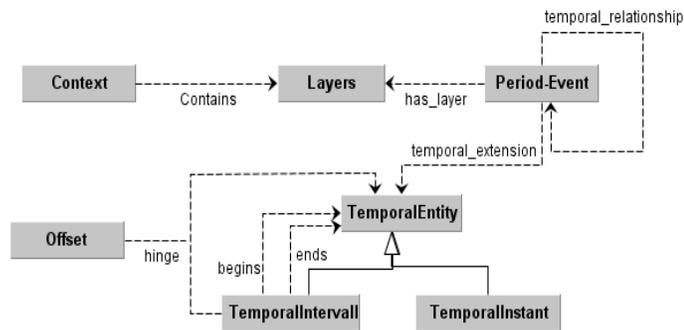


Figure2: Temporal Model

Each Layer contains Period-Events, expressing the Temporal Reference of an object. If the Temporal Reference is quantitative, then the Period-Event has a **temporal_extension** property that refers to a Temporal-Entity object. A Temporal-Entity can be a Temporal-Instant or a Temporal-Interval. A Temporal-Interval can begin and/or end with a precise dating or with other Temporal-Entities, or can be an Offset hinging on another Temporal-Entity. If the Temporal Reference is qualitative, then the Period-Event object has a **temporal_relationship** property that refers to another Period-Event object in the same Context[10].

SPATIAL DATAMODEL:- The spatial model (as shown in Figure 3) aims at managing two aspects of spatial entities:

1. Places that evolve in time (i.e. for name or shape);
2. Hierarchical and stratified spatial domains, ie thematic contexts with a stratified granular structure similar to the temporal dimension . [11]

We consider the entity *Place* as an abstract entity with only semantic meaning, having an Id, a name and a description. A *Place* can change its spatial extension over time, i.e. it can change its boundaries. In order to manage this *ChangeShape* object we introduce the entity “*ST-Place-Instance*”, having the *Place* as external reference, the *Period-Event* of validity and a reference to the *OGC Geometry* by means of which it is spatially represented. Users can organize the spatial domain with different semantic meaning e.g. with thematic maps. Similarly to the temporal dimension, also the spatial domains are organized in thematic contexts. Each *Context* has a spatial domain partitioned into *Layers*.

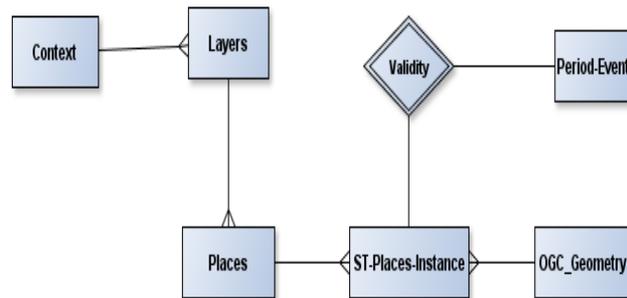


Figure 3:- Spatial Model

V. SPATIO-TEMPORAL DATABASE & DATA MODELS

Spatio-temporal databases deal with applications where data types are characterized by both spatial and temporal semantics. Development and research in this area started decades ago, when management and manipulation of data, relating to both spatial and temporal changes, was recognized as an indispensable assignment. However, spatio-temporal data handling was not a straightforward task due to the complexity of the data structures requiring careful analysis in structuring the

dimensions, together with the representation and manipulation of the data involved. Therefore, the earlier work in this area began from separate research in both temporal [3] and spatial [10] databases. This effort later became the basis for spatio-temporal database models.

Spatio-temporal datamodels are the core of a Spatio-Temporal Information System (STIS); they define object data types, relationships, operations and rules to maintain database integrity. Spatio-temporal data is usually modeled by extending temporal database or spatial database. That is, spatio-temporal data is modeled in two ways. First we can add spatial properties and operations in temporal databases. The second way is to add temporal properties and operations in spatial databases. A rigorous data model must anticipate spatio-temporal queries and analytical methods to be performed in the STIS. Spatio-temporal database models are intended to deal with real world applications, where spatial changes occur over the time line. A serious weakness of existing models is that each of them deals with few common characteristics found across a number of specific applications. Thus the applicability of the model in different cases, fails to explain the behavior of spatio-temporal data which is not anticipated by the application used for the initial model development[12].

Spatial-Temporal Integration A rigorous data model must be able to manage and foresee any required spatio-temporal query and analytical method[13]. The proposed classification, inspired by previous works [14,15, 16], considers the temporal dimension to be dynamic and based on two binary dimensions:

- *Spatial Position*: the object spatial location changes over time.
- *Spatial Extension*: the object shape (geometry) changes over time.

From these two dimension four classes of spatio-temporal object are obtained (Figure 4):

- *ST-Event*: objects that do not change neither their position nor shape over time but that could change their descriptive component.
- *Moving-Object*: objects that change their position but not their shape over time.
- *Change-Shape*: objects that can change their shape (geometry) but not their position.
- *Evolution-Object*: objects changing their shape and position over time.

Dimensions	Change Positions	Change shapes
ST object	No	No
Moving object	Yes	No
Evolution object	Yes	Yes
Change shapes	No	Yes

Figure 4: Spatio-Temporal Classification

VI. CLASSIFICATIONS OF SPATIO-TEMPORAL DATA MODELS

Spatio-temporal data models [17] are classified into the following ten classes:

The snapshot model: where spatio-temporal data is modeled as a sequence of pure spatial data recorded at different time moments.

The space-time composite model: which is based on the principal that every line in space and time can be projected to the spatial plane and be intersected with each other to create a polygon mesh.

Data models based on simple time-stamping, where each object is simply tagged with two timestamps associated with the object's creation and cessation.

The event-oriented model, where events are of major concern and spatial objects are only participants of events.

The three-domain model: which identifies semantics, spatial domain, and, temporal domain for spatio-temporal data. The links between space and time are described through different semantics.

The history graph model: the main purpose of this type of models is to identify all types of changes. Thus it manage both events and objects.

The spatio-temporal entity-relationship model: which extends the well-known Entity-Relationship (E-R) data model to spatio-temporal data.

The object-relationship model, where processes that cause different changes are abstracted as a type of relationship among spatio-temporal objects.

The spatio-temporal object-oriented model, where a spatio-temporal object is defined as a unified object with both spatial and temporal extents.

The moving object data model, where spatio-temporal data is abstracted as a collection of moving objects including points and regions. It models time as an integral part of spatial entities and captures both changes and movements.

FEATURES OF SPATIO-TEMPORAL DATA MODEL:-

The spatio-temporal data models [18] are describe with the following features in table 1 :-

- **Formalisation**: This factor shows if the model has been formally defined or not.
- **Implementation**: This criterion depicts if the model has been implemented or not.
- **Tool**: If the model has been implemented, the name of the tool developed is listed here.
- **Application**: The case study used to analyse and develop the model.
- **Spatial model**: The spatial model used as the basis for the development of the corresponding spatio-temporal model.
- **Temporal model**: The temporal model used to define and develop the spatio-temporal model.

Spatio-Temporal datamodels	Formalisation	Implementation	Tool	Application	Spatial Model	Temporal Model
Snapshot	No	No	None	LIS	GIS	N/A
STC	No	No	None	LIS	GIS	N/A
Simple Time Stamping	No	No	None	Historical cadastral database	US spatial data transfer standard	N/A
Event Oriented	Yes	Yes	TEMPEST	LIS	GIS with event dates	Ordered time models
3-Domain	Yes	No	None	LIS	Relational spatial database	Relational version tables
History Graph	No	No	None	LIS	N/A	Graphs
STER	Yes	No	None	Cadastral application	Spatial indicator	Temporal indicators
O-R	Yes	Yes	MADS	Rural urban land use application	MEOSIG	MODUL-R POLLEN
O-O	Yes	Yes	Geo-OM	LIS	ERT model	Temporal base model
STUML	Yes	No	None	Regional health care example	Spatial indicator	Temporal indicators
Moving Objects	Yes	Yes	SECONDO module	Multimedia scenario, Forestfire control management	Abstraction of spatial data types & Oracle Spatial	Abstraction of temporal data types &TAU types

Table:-1

*GIS Geographic Information System
*LIS Land Information System

VII. CONCLUSION

Spatio-temporal database modeling on earlier stages attempted to capture the state of real world objects or the physical events upon them ,on the time line. The investigation is done in the real world application which brought out new directions and requirements for further developments. On the time line the process is continuous changes and were investigated and models to capture them were proposed .The spatio temporal models are more concerned with conceptual notation of spatio temporal data . In future the next step in spatio temporal data base development is the testing stage where the models proposed and run on different applications to identify further requirements and research directions.

REFERENCES

[1] C.S. Jensen, J. Clifford, R. Elmasri, S.K. Gadia, P. Hayes and S. Jajodia, eds., "A Glossary of Temporal Database Concepts" *ACM SIGMOD Record*, vol. 23, no. 1, pp. 52-64, Mar. 1994.
[2] H.F. Korth and A. Silberschatz, *Database System Concepts*. McGraw-Hill Advanced Computer Science Series. McGraw-HillBook Co., 1986
[3] P. J. Brockwell and R. A. Davis. "Introduction to Time Series and Forecasting". Springer, ISBN: 0-387- 95351-5, 2003.

[4] O. Guenther and A. Buchmann. ``*Research Issues in Spatial Databases*'', SIGMOD Record, Vol. 19:61-68,1990.
[5] H. Yang, K. Marsolo, S. Parthasarathy, and S. Mehta. "Discovering spatial relationships between approximately equivalent patterns". In *BIOKDD04: Workshop on Data Mining in Bioinformatics (with SIGKDD04 Conf.)*, August 2004 .
[6] M. J. Egenhofer and J. R. Herring. "Spatial and Temporal Reasoning in Geographic Information Systems", Oxford University Press ,New York,1998.
[7] A.G. Cohn and S.M. Hazarika. "Qualitative spatial representation and reasoning: An overview", *Fundamental Informatics*, 46(1-2):1-29, 2001
[8] M. Koubarakis, T.K. Sellis et al.(eds.),"Spatio-Temporal Databases: The Chorochronos approach" Springer-Verlag LNCS 2520, 2003.
[9] C. Bettini, X. S. Wang, and S. Jajodia, "A general framework and reasoning models for time granularity", *Proceedings of Third International Workshop on Temporal Representation and Reasoning (TIME '96)*, pp. 104-11,1996.
[10] James F Allen, "Time and Time Again: The Many Ways to Represent Time" *Journal of Intelligent Systems*, vol. 6, pp. 341-355, July 1991
[11] Max J Egenhofer ," what is special about spatial database requirements for vehicles navigation in geographic space ", *SIGMOD Rec.*,vol.22,no. 2, pp.398-402,june 1993.
[12] T. Abraham and J. F. Roddick. "Survey of spatio-temporal databases". *Geoinformatica*, 3(1):61-99, 1999.
[13] M. Yuan, "Temporal GIS and Spatio-Temporal Modeling " in *Proceedings of Third International Conference on Integrating GIS and Environmental Modeling*, Santa Fe, New Mexico, USA, 1996.
[14] Viveca Asproth, Anita H.kansson, and Peter RÅvay, "Dynamic information in GIS systems," vol. 19, pp. 107 - 115, 1995
[15] S.Kisilevich,F.Mansmann, M.Nanni, and S.Rinzivillo, "Spatio-temporal clustering," pp. 855-874, 2010

- [16] S. Nadi and R.D. Mahmoud, "*Spatio-Temporal Modeling of Dynamic Phenomena in GIS*," in ScanGIS'2003 - The 9th Scandinavian Research Conference on GIS, 4-6 June 2003- Proceedings, Espoo, Finland , pp. 215-225,2003.
- [17] N. Pelekis, B. Theodoulidis, I. Kopanakis, and Y. Theodoridis. "*Literature review of spatio-temporal database models*". Technical report, Center of Research in Information Management (CRIM), Department of Computation, UMIST; Department of Informatics, University of Piraeus, 2005.
- [18] C. Bettini, X. S. Wang, and S. Jajodia, "*A general framework and reasoning models for time granularity*," in Proceedings of Third International Workshop on Temporal Representation and Reasoning (TIME '96), pp. 104-111,1996.

AUTHORS

First Author – Sonia Rathee, Computer science & Engineering
Maharaja Surajmal Institute of Technology, New Delhi ,India
soniasinghpanghal@gmail.com

Second Author – Amita Yadav, Computer science &
Engineering, Maharaja Surajmal Institute of Technology, New
Delhi ,India, Amita_ay@gmail.com

Clustering Techniques for the Identification of Web User Session

*Nirmala Huidrom**, *Neha Bagoria***

* Department of Computer Science and Engineering, Jodhpur Institute of Engineering and Technology

** Department of Computer Science and Engineering, Jodhpur Institute of Engineering and Technology

Abstract- The web user-session can be defined as a set of several TCP connections generated by a single user while surfing the web during a given time frame. An activity period, i.e. session, is terminated by a long silent period. This activity period is comprised of several TCP connections which may be used to transfer data. However, identification of active and silent period is not trivial. Correct identification of session is the main goal of our study. Traditional method used threshold-based mechanism for the identification of web user-sessions which required a priori definition of the threshold value. This method is very sensitive to the threshold value, which is very difficult to set correctly. By using clustering techniques, web user-sessions can be identified without requiring a priori definition of threshold values. This paper is based on the definition and identification of web user-sessions. The main goal of this paper is to exploit the property of clustering techniques to group TCP connections in order to identify web user sessions and to compare the performance with that of the threshold-based mechanism.

Index Terms – Clustering method, session identifications, similarity measurement, web server log.

I. INTRODUCTION

Nowadays, World Wide Web (www) becomes a powerful platform to distribute and to retrieve information. They can be accessed by companies, governments, universities, students, teachers, businessmen and some users. Because of the rapid growth of the web, the field related to web becomes an important research area. One such research area includes retrieval of useful information from the web server log. Web server log is a text file created by web server which record activity of users on the servers. Log file come in several different formats. One such format looks like this:

```
128.159.122.137 - - [01/Aug/1995:11:01:04 -0400] "GET /finance/main.htm HTTP/1.0" 200 1974.
```

Each record contains IP address, username, timestamp, access request, result status code and bytes transferred. Log file may contain one to ten thousands records of requests every day. To retrieve the useful information from this large amount of information, log entries should be grouped into session by using some techniques. The most commonly used technique for identifying session is the timeout method. In this method, if the inter-arrival time between two TCP connections is smaller than the pre-defined threshold value then the connections are part of the same session and if the inter-arrival time is larger than the threshold value than the second connections is the first element of a new session. The main limitation of this method is that they are very sensitive to the threshold value and required a priori definition of the threshold value. If the threshold value is not correctly set then the following errors may occurs:

- If the threshold value is too large then the condition for combining two unrelated connections in the same session may arrive.
- If the threshold value is too small then the condition for separating two related connections into two different sessions may arrive.

To overcome the limitations of the threshold-based mechanism, most researchers used different clustering techniques to identify web user-sessions. Informally, clustering is the process of dividing the given data into groups of similar objects in such a way that objects in the same cluster are similar to each other but different from objects of other clusters. The clustering is also known as cluster analysis, data clustering, segmentation analysis, unsupervised classification or taxonomy analysis. Clustering is widely used in numerous applications such as pattern recognition, data analysis, image processing etc.

The main aim of this paper is to exploit the property of clustering techniques to identify the web user sessions. Performance is compared with that of the threshold based mechanism and concludes that algorithm that used clustering technique is more robust than the threshold based mechanism.

The remainder of this paper is organized as follows: First, the section, related work, contains a brief overview of the methods that have been applied till date for the identification of web user session. Then, in the next section, clustering techniques is described in detail. The method for identifying web user session by using clustering techniques is explained in the section "Using clustering techniques on web server log". In the section, performance analysis, the performance of the algorithm is presented and compared it with that of the threshold based mechanism. The last section of this paper provides the conclusions and future works.

I. RELATED WORK

There are several definitions and session identification methods reported in the literature. In [1], web user session is defined based on the four stages: submission of query, IR component invocation, selection and navigation and reformation. In [2], web user session is defined as a set of TCP connections created by a given user while surfing the web during a given time frame. The author of [4] used three approaches for defining session. The first approach is IP and cookies, the next approach is IP, cookies and a temporal limit on intra session interactions and the last approach is IP, cookies and query reformulation patterns. The first and second methods are system oriented variables and the third method is the combination of user-oriented variables and system-oriented variables. For the first method they used the IP and cookies to identify unique users, the second method used a threshold of 30 minutes which was used to define two distinctive sessions of the same unique user. For the last method, the IP and cookies were used to identify unique users and the query reformulation pattern to identify the limit between two sessions considered as determined by a query which no term in common with the precedent one.

The most common and simplest method for the session identification is the threshold based mechanism, which is also known as the timeout method. In this method, a session is identified between two requests if the inter-arrival time between the two requests is greater than the predefined threshold value. The author of [5] used the threshold value of 100 sec, while the author of [6] used the threshold value of 1 sec. The result of this method is affected with different threshold value. This method is works well if the threshold value is correctly matched to the values of connections and session inter-arrival times. In [7], the authors used the timeout method on two web logs. Initially they set large threshold value and then gradually decreased. They concluded that the optimal threshold was found in the range of 10-15 minutes.

Other authors used different types of methods to identify web user session. The author of [3] developed an algorithm for session identification. They used page threshold with Frame page to develop the algorithm for identifying web user-session. They first identify specific users and then filter the frame page. The next and last step is to combine the contents of each page and all web structure forming actual session. In [8], the author used IP address, browsing agent, intersession and intra-session timeouts, immediate link analysis between referred pages and backward reference analysis to develop a technique for identifying user-session boundaries. They analyze with different server's logs and show that their technique identifies user session boundaries and generate all relevant user session sequences. The author of [10] develops an algorithm for session identification by using statistical language modeling.

II. CLUSTERING TECHNIQUES

This section describes the overview of the clustering techniques. Informally, clustering can be defined as the process of dividing the given data into groups of similar objects in such a way that objects in one cluster are similar to each other and different from those objects which are in the other clusters. Clustering techniques are described in detail in [9]. The goal of this paper is to exploit this property of clustering to group connections to identify web user sessions.

Let X denotes the metric space, a set containing notions of metric or distance. This metric space is also known as sampling space. Let a set of samples which have to be grouped to form K cluster be

$$S = \{x_1, x_2, x_3, \dots, x_N\}$$

Where x_i belong to $X; i=1, 2, 3 \dots N$.

The main purpose of this work is to find the partition $C = \{C_1, C_2, C_3, \dots, C_K\}$ such that $\cup_i C_i = S$ and $C_i \cap C_j = \emptyset$. $C_1, C_2, C_3, \dots, C_K$ are clusters. Clusters contain similar samples while samples in the different clusters should be dissimilar. The measurement of similarity between two samples or two clusters plays an important role in clustering method since every clustering techniques depends on the similarity or dissimilarity between two data points. Clustering methods are of no used if there is no measure of similarity or dissimilarity between two data points.

To determine the dissimilarity between two objects, it is common to used distance measure. The Euclidean distance is commonly used for distance measure which is given by:

$$d_{euc}(x, y) = \left[\sum_{j=1}^d (x_j - y_j)^2 \right]^{\frac{1}{2}}$$

A. The Hierarchical Agglomerative Approach

The hierarchical agglomerative methods are based on measures of distance between clusters. This method merges those two clusters that are nearest to form a reduced number of clusters. This is repeated, each time merging the two closest clusters, until just one cluster, of all the data points, exists. Before the procedure starts, each sample is associated to a different cluster, i.e., $C_i = \{x_i\}$, thus the number of cluster N_c is equal to $N = |S|$. Then, the nearest clusters are merged. This process is repeated and the procedure ends when all the given samples are merged to the same cluster i.e. $C = S = \{x_1, x_2, \dots, x_N\}$ and $N_c = 1$. At each step, the quality indicator function $\gamma^{(s)}$ is evaluated. Finally, the set S is clustered by using the optimal number of clusters $N_c = N - (i - 1)$ such that $\gamma^{(i)} - \gamma^{(i-1)}$ is maximized. The quality indicator function measures the distance between the two closest clusters at step i . A sharp increase in the value of quality indicator function indicates the merging of two clusters which are too far apart.

B. The Partitional Approach

k -means algorithm is an algorithm of a partitioning clustering technique. In this algorithm, the number of clusters is fixed. This algorithm starts by selecting an initial partition with k clusters containing randomly chosen samples. Then we compute the centroids of the clusters. By generating a new partition, we assign each sample to the closest cluster center. Then we calculate new cluster centers as the centroids of the clusters. Centroid is defined as the mean value of the cluster samples.

$$i.e \quad \hat{c}_i^k = \frac{1}{|C_i|} \sum_{x \in C_i} x^k \quad k=1, 2, \dots, n.$$

Where n is the size of the sampling space.

This process is repeated until the number of samples which are moved to different cluster is negligible.

III. THRESHOLD BASED ALGORITHM

Threshold based algorithm is the simplest method that was used by many researchers for the identification of user-session. This algorithm is also known as the timeout method. The threshold based algorithm required to select a threshold value before running the algorithm. Based on this value, the algorithm identifies the sessions.

So, the result of this algorithm is different for different threshold value i.e. threshold based algorithm depends on proper selection of threshold value. Threshold based algorithm gives accurate session if the pre-defined threshold value is correctly set. That's mean that optimal threshold value gives almost accurate session.

The algorithm works as follows:

The procedure starts with the proper selection of threshold value. Based on this value, the following condition is checked:

- If the inter-arrival time between the consecutive connections is less than the threshold value, then the two connections are in the same session.
- If the inter-arrival time between the consecutive connections is greater than the threshold value, then the two connections are in different sessions i.e. the first connection is the last element of the current session and the second connection is the first element of the next session.

The main limitation of this algorithm is that it requires a priori definition of the threshold value which is very difficult to set correctly. If the threshold value is too small, then the condition for separating two related connections in different sessions may occur. On the other hand, if the threshold value is too large then the condition for merging two unrelated connections in the same session may arrive. So, this algorithm is difficult to use in practice.

IV. USING CLUSTERING TECHNIQUES ON WEB SERVER LOG

The log file used in our experiments was extracted from NASA website that can be freely downloaded from the link <http://ita.ee.lbl.gov/html/contrib/NASA-HTTP.html>. Before running the algorithm, the first step is to perform data cleaning for removing the irrelevant and redundant log entries. There are three main kinds of irrelevant information to be removed. First, embedded file which embedded in the web page should remove. A request made by a user to view a particular page usually results in several log entries because some embedded file such as graphics and scripts are downloaded along with the web page. It is unnecessary to include the file requests that the user did not explicitly request. Elimination of such information can be done by checking the suffix of the URL name. So, those entries which have the type extensions: .GIF, .JPEG and .JPG etc. are removed. The second irrelevant information to be removed is error's request. This can be removed by checking the status of request. There are four classes of status code. They are success (200 series), redirect (300 series), failure (400 series) and state error (500 series). Those entries that correspond to the status code which is not equal to 200, are removed. The last irrelevant information to be removed is the entries with the 'HEAD' method. The next step is to identify users. For user identification, we consider each IP address as a single user and we select those users which have more than 800 TCP connections for our experiment.

After user identification, the next step is to select a proper clustering technique for session identification. Hierarchical clustering technique is easy to implement but this technique does not scale well with large number of samples. Whereas partitional clustering technique require a priori knowledge of the number of clusters in advance which is not easy to predict but this technique is relatively efficient. In order to take the advantages and to avoid the limitations of both methods, we used both algorithms i.e. hierarchical and partitional algorithms. First partitional algorithm is used to obtain an initial clustering. This is performed by selecting a large number of clusters. But the number of clusters must be less than the number of samples. The next step is to apply hierarchical agglomerative clustering algorithm to the result obtained from first step. The hierarchical agglomerative clustering technique is used to combine the clusters in order to obtain a good estimation of the final number of clusters. To get a fine definition of number of clusters, a partitional clustering algorithm is used as a last step. The detail description of each step is given below.

A. Partitional clustering approach

The first step starts with k -mean clustering method with k cluster. The k cluster is chosen as large as possible but it should be less than the number of samples. The distance between any two adjacent samples is then calculated. Farthest ($k-1$) couples are taken according to the distance metric to determine k intervals. Let T_{int} be

the inferior bounds of the intervals and T_{sup} be the superior bound of the intervals. Then the centroid of each cluster is calculated as

$$centroid = (T_{sup} + T_{int}) / 2$$

The partitional algorithm is then iteratively run to obtained k initial clusters. Each cluster C is represented by a small subset $R(C)$ of samples. $|R(C)|$ may be less than or equal to 2 since the metric space is R . The representative samples $R(C)$ may be either the cluster centroid or single linkage procedure.

B. Hierarchical agglomerative approach

A hierarchical agglomerative algorithm is iteratively run using representative samples obtained from step 1. The number of steps is k since the procedure starts with k initial clusters. Hierarchical agglomerative procedure merges the two closest clusters at each step. After merging the two clusters, distances between clusters are recomputed. This process is repeated. The process ends after k iterations.

The clustering quality indicator function which measures the distance between the two closest clusters is used to select the best clustering among those determined in the iterative process. Quality indicator function is denoted by $\gamma^{(s)}$. At each step s , the clustering quality is calculated to find if the optimal number of clusters has been found. Let $C_j^{(s)}$ denote the j^{th} cluster of step s . At each step, the procedure evaluates the quality indicator function $\gamma^{(s)}$:

$$\gamma^{(s)} = \frac{d_{min}^{(s)} - d_{min}^{-(s)}}{d_{min}^{-(s)}}$$

$$d_{min}^{(s)} = \min_{j, k \neq j} d(C_j^{(s)}, C_k^{(s)}),$$

$$d_{min}^{-(s)} = \frac{1}{s-1} \sum_{l=1}^{s-1} d_{min}^{(l)},$$

Where

A sharp increase in the value of $\gamma^{(s)}$ indicates that the merging procedure is artificially merging two clusters which are too far apart.

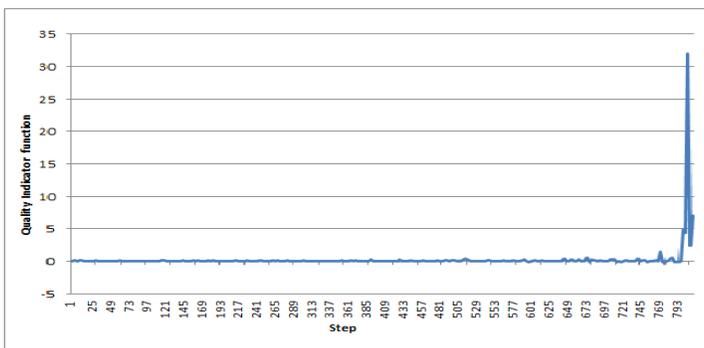


Figure 1: Sample plot of the quality indicator function.

The optimal number of clusters N_c is determined as:

$$N_c = N - (\text{argmax}_s (\gamma^{(s)} - \gamma^{(s-1)}) - 1)$$

C. Final clustering creation

The last step is to find a fine definition of N_c clusters. In this step, a partitional clustering algorithm is run over the original data which contain all samples to get a final refinement of the clustering definition.

V. PERFORMANCE ANALYSIS

In this section, the correctness properties of the clustering scheme are described and compared it with that of the threshold-based mechanism. The percentage of misidentified sessions is used as the performance metric. Two types of errors may occur: (i) to erroneously separate in two or more clusters or (ii) to merge two or more distinct sessions. The percentage of errors is defined as 100 times the total number of observed errors divided by the total number of connection arrival times.

Proper choice of threshold value gives almost real session [7]. We consider this value as optimal threshold value. If the clustering algorithm is more accurate, then its graph (i.e. T_{off}- error percentage graph) must be parallel to x-axis when we assume x-axis as the optimal threshold graph.

In this section, we first determine the optimal threshold value from the web server log. Then, the threshold based algorithm is run using optimal threshold value. After that, threshold based algorithm is again run with different threshold value and the results are compared with that of the sessions that is obtained by using optimal threshold value in order to get the misidentified session. Similarly, clustering algorithm is run to identify sessions and compared with that of the sessions obtained by using optimal threshold value to get the misidentified sessions. By using these misidentified sessions as the performance metric, we compared the clustering algorithm and threshold based algorithm.

A. Determination of optimal threshold value:

We used iteration number of a session as the number of TCP connections in a session. For example, if the iteration number of a session is five, then the session has five connections. A sequence of connections is grouped into a session if and only if

- The connections are from the same user ID or IP address
- The time interval between two adjacent connections is less than or equal to the session interval in use.

By grouping the sessions with the same iteration number, we can see the distribution of various sessions. The distributions show the percentages of sessions with a particular iteration in relation to the total number of sessions. This was done because different session intervals cut the logs into different number of sessions, and so a percentage comparison was more meaningful.

Our experiment and analysis focused on monitoring only the distributions of the session with less than or equal to 6 iterations because their total covers a very large percentage of sessions.

Table I: The results of session interval from the web logs.

Session interval (in sec)	Percentage of 1 iteration	Percentage of 2 iteration	Percentage of 3 iteration	Percentage of 4 iteration	Percentage of 5 iteration	Percentage of 6 iteration
60	80%	13%	3%	1%	0%	0%
80	72%	16%	5%	1%	0%	0%
100	71%	17%	6%	2%	1%	0%
120	68%	18%	6%	2%	1%	0%
140	65%	18%	8%	2%	1%	1%
160	64%	18%	8%	3%	1%	1%
180	62%	19%	8%	3%	1%	1%

200	61%	19%	9%	3%	1%	1%
220	59%	19%	9%	4%	2%	1%
240	57%	19%	10%	4%	2%	1%
260	56%	19%	10%	4%	2%	1%
280	55%	20%	10%	5%	2%	1%
300	54%	20%	10%	5%	2%	1%

We took 60 to 300 seconds as a range of session interval. After 300 second, graphs of all iterations are almost stable. More importance is given to the graph with smaller number of connections in a session while observing optimal session interval. Sudden dramatically change indicates the existence of optimal session interval. Iteration graph increase gradually from 300 second to 80 second. From 80 second, it increases dramatically. Similarly other graphs shows stable from 300 second to 80 second, after 80 second, it shows sudden decrease.

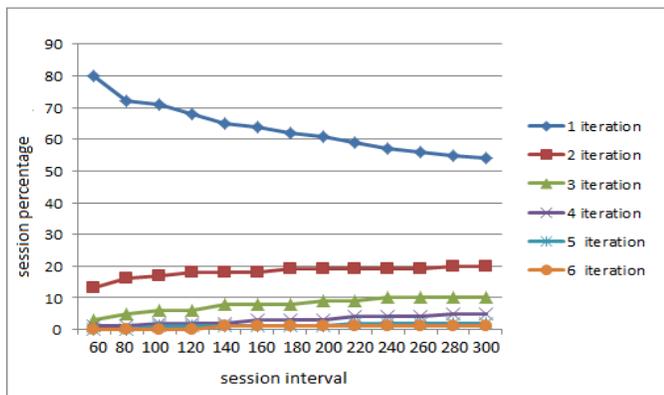


Figure 2: The result of session interval from the web logs.

The optimal threshold value should not be too large nor too small. The results of the experiment show that most sessions were not affected when the session interval is larger than 80 seconds. When the session interval is less than 80 seconds, most sessions are affected. When the session interval becomes smaller, the percentage of sessions with 1 iteration increases dramatically whereas the percentages of sessions with 3-6 iterations, decreases dramatically. This shows that the optimal session interval is nearly 80 seconds. Hence, we take the optimal threshold value to be 80 seconds.

B. Parameter sensitivity:

In our clustering algorithm, initial k value (i.e. number of clusters) is assigned in order to run the algorithm. But its value is replaced when we run the final partitional algorithm with the value from hierarchical agglomerative algorithm. Therefore, k-value must be independent of its selection.

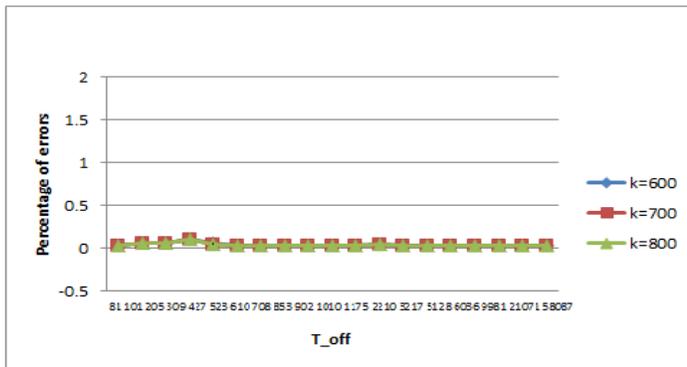


Figure 3: Clustering sensitivity to the initial number of clusters k .

Figure 3 shows the error probability of clustering algorithm by taking initial number of cluster, $k=600$, 700 and 800 . This graph shows that error probability is independent from the value of k , since graphs are superimposed. Hence, initial number of cluster is not a critical parameter.

C. Percentage of misidentified sessions:

We consider the percentage of sessions misidentified by the clustering procedure to assess the quality of the results. The result thus obtained is compared with that of the threshold based mechanism.

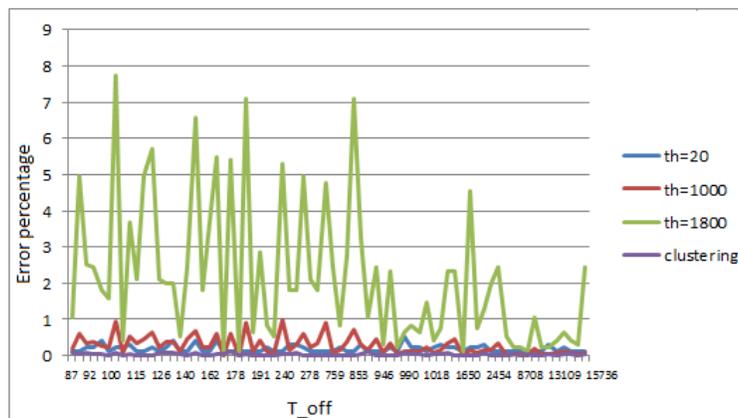


Figure 4: Percentage of errors obtained by running clustering and threshold based mechanism.

The above figure shows the percentage of errors obtained by running threshold based scheme and clustering scheme. Performance of the threshold based mechanism is evaluated by taking threshold value of 20 , 1000 and 1800 seconds. From the above figure, we see that clustering graph is almost parallel to x -axis which shows that it is less error than other threshold algorithms. Threshold algorithms (except optimal threshold) give irregular graph to the x -axis.

From this, we conclude that threshold based mechanism may not perform well if the threshold value is not correctly set. Its error probability is much larger than the clustering scheme. When the value of threshold is too large, the percentage of errors is high which is due to the result of merging two subsequent different sessions. Small value of threshold value also induces high percentage of error which is due to the result that T_{off} goes below a given value. Hence, the percentage of errors for clustering scheme is always less than 0.5% and it is less sensitive to the variation of T_{off} .

VI. CONCLUSION

Clustering techniques are used for inferring web user-session. In order to identify the web user session, a combination of the hierarchical and partitional clustering techniques is used. First, a k -mean partitional

algorithm is used to obtain an initial clustering. After getting the initial clustering, a hierarchical agglomerative clustering technique is run to the representative samples obtained from the first step to obtain the final number of clusters. Finally, partitional clustering is applied to the real data to obtain the fine definition of clusters. This process for identification of web user-session can deal with large amount of data. The effectiveness and robustness of the clustering techniques was used to show its ability in the identification of web user-sessions without requiring any a priori definition of threshold values. This may be used in characterizing web user-sessions and in the study of internet traffic properties.

There are some limitations which could be directions for future work. First of all, the resulting algorithm is applied only to the web traffic. So, this work can be extended in order to apply to different types of traffic and to deal with other types of user sessions which are not related to the web. After the identification of user-session, second identification is required to remove errors in the session pages and unrelated pages so that it can improve the quality of identified session.

ACKNOWLEDGMENT

Many thanks to the Head Of Department, faculty members of Department of Computer Science and Engineering of JIET college for their motivation and constant encouragement. The authors would like to thank the family members and friends who rendered their support throughout this research work.

REFERENCES

- [1] Mat-Hassan M. and Levene M, "Associating search and navigation behavior through log analysis", Journal of the American society for information science and technology, vol. 56(9), pp. 913-934, 2005.
- [2] Bianco, A. Mardente, G. Mellia, M. Munafo, M. and Muscariello, L., "Web User-Session Inference by Means of Clustering Techniques," Networking, IEEE/ACM Transactions on , vol.17, no.2, pp.405-416, April 2009.
- [3] Fang Yuankang and Huang Zhiqi, "A session identification algorithm based on frame page and page threshold", Computer Science and Information Technology (ICCSIT), 3rd IEEE International Conference, 2010.
- [4] Jansen B. , Spink A. , Blakely C. and Koshman S., "Defining a session on web search engines", Journal of the American society for information science and technology, vol. 58(6), pp.862-8871, 2007.
- [5] C. Nuzman, I. Saniee, W. Sweldens, and A. Weiss, "A compound model for TCP connection arrivals, with applications to LAN and WAN," *Computer Networks, Special Issue on Long-Range Dependent Traffic*, vol. 40, no. 3, pp. 319–337, Oct. 2002.
- [6] F. D. Smith, F. H. Campos, K. Jeffay, and D. Ott, "What TCP/IP protocol headers can tell us about the web," *SIGMETRICS Perform. Eval. Rev.*, vol. 29, no. 1, pp. 245–256, 2001.
- [7] He D. and Goker A., "Detecting session boundaries from web user logs", In proceedings of the BCS-IRSG 22nd annual colloquium on information retrieval research, Cambridge, UK, pp. 57-66, 2000.
- [8] Arumugam G. and Suguna S., "Optimal algorithms for generation of user session sequences using server side web user logs", Network and service security, International Conference on 24-26 June 2009.
- [9] Guojun Gan, Chaoqun Ma, Jianhong Wu, "Data Clustering: Theory, Algorithm and Applications", ISBN: 0898716233, Society for Industrial and Applied Mathematics (SAM), 2007.
- [10] Xiangji Huang, Fuchun Peng, Aijun An, Dale Schuurmans, "Dynamic Web Log Session Identification With Statistical Language Models", Journal of the American Society for Information Science and Technology, 2004.

AUTHORS

First Author- Nirmala Huidrom, M.Tech student, Department of Computer Science and Engineering, Jodhpur Institute of Engineering and Technology, Jodhpur, India.
e-mail: nirmala_huidrom@yahoo.co.in

Second Author- Neha Bagoria, Asst. Professor, Department of Computer Science and Engineering, Jodhpur Institute of Engineering and Technology, Jodhpur, India.

Fuzzy Logic Gates in Electronic Circuits

Dr. G.Nirmala* and G.Suvitha**

*Associate Professor, P.G & Research Department of Mathematics, K.N.G Arts College for Women (Autonomous),
Thanjavur- 613007. Tamil Nadu, India. Email Id: nirmalamanohar11@yahoo.com

**Assistant Professor, Department of Mathematics (science & Humanities), Sri Sai Ram Institute of Technology, West Tambaram,
Chennai-600044.Tamil Nadu,India. Email Id: Suvitha_g@yahoo.co.in

Abstract- In this paper, we can see a brief description to fuzzy logic operation and Logic gates. Here we see how Fuzzy Logic extends and generalizes classical logic with propositional logic. Proposition logic deals with finding truth values of formulas containing atomic propositions, whose truth value is either zero or one, connected by “and” (\wedge) “or” (\vee), implication (\rightarrow) etc...Finally we find truth values of formulas using a t-norm for \wedge and a t-co norm for \vee .

Index Terms- Propositional logic, t-norm, t-co norms, Logic gates

I. INTRODUCTION

Fuzzy set were first proposed by Lofti.A.Zadeh in his 1965 paper entitled none other than Fuzzy set. This is the foundation for all fuzzy logic that followed by mathematically defining fuzzy set and their properties. The basic assumption upon which classical logic (or two valued logic) is based that every proposition is either true or false has been questioned since Aristotle. In his treatise “on Interpretation”, Aristotle discusses the problematic truth status of matters that are future contingent. Propositions about future events, he maintains are neither actually true nor false, but potentially either hence their truth value is undetermined at least prior to the event. It is that proposition whose truth status is problematic are not strictly restricted to future events.

Logic is the analysis of methods of reasoning. The propositional fuzzy Logic is a Logic which deals with proposition. A proposition is a sentence which is either true or false. The “true” and “false” are called truth values. They are denoted by 1 or 0. Then to any sentence is assigned only 1 or 0. The propositional fuzzy Logic based on this pre assumption is said to be the two valued or Classical propositional Logic.

2.FUZZY OPERATORS

Definition 2.1: A proposition is a declarative sentence that is either true (denoted either T or 1) or false (denoted either F or 0).

Notation: Variables are used to represent propositions. The most common variables used are p and q.

Definition 2.2: Unary Operator Negation: “not p”, $\neg p$

Definition 2.3: Binary Operators

- (a) **Conjunction:** “p and q”, $p \wedge q$.
- (b) **Disjunction:** “p or q”, $p \vee q$.
- (c) **Exclusive or:** “exactly one of p or q”, “p xor q”, $p \oplus q$.
- (d) **Implication:** “if p then q”, $p \rightarrow q$.
- (e) **Biconditional:** “p if and only if q”, $p \leftrightarrow q$.

Definition 2.4: The functions used for intersection of fuzzy sets are called t-norms. A t-norm T is a function $z = T(a, b)$, $0 \leq a, b, z \leq 1$, having the following four properties.

1. $T(a, 1) = a$;
2. $T(a, b) = T(b, a)$;
3. If $b_1 \leq b_2$, then $T(a, b_1) \leq T(a, b_2)$;
4. $T(a, T(b, c)) = T(T(a, b), c)$.

Definition 2.5: The functions used for union of fuzzy sets are called t- co norms. A t-co norm C is a function $z = C(a, b)$, $0 \leq a, b, z \leq 1$, having the following four properties.

1. $C(a, 0) = a$;
2. $C(a, b) = C(b, a)$;
3. If $b_1 \leq b_2$, then $C(a, b_1) \leq C(a, b_2)$;
4. $C(a, C(b, c)) = C(C(a, b), c)$.

3.TRUTH TABLES AND CONCEPTS OF PROPOSITIONAL FUZZY LOGIC

Example 3.1: Negation

p : I like blue color
 $\neg p$: I hate blue color

Table I: Truth Table for Negation

p	$\neg p$
T	F
F	T

Example 3.2 : Conjunction

P : I like blue color q : I will eat ice-cream
 $p \wedge q$:I like blue color, and I will eat ice-cream.

Table II: Truth Table for Conjunction

p	q	$p \wedge q$
T	T	T
T	F	F
F	T	F
F	F	F

Example 3.3 : Disjunction

P : I like blue color q : I will eat ice-cream
 $p \vee q$:I like blue color, or I will eat ice-cream.

Table III: Truth Table for Disjunction

p	q	$p \vee q$
T	T	T
T	F	T
F	T	T
F	F	F

Example 3.4 : Exclusive or

P : I like blue color q :I will eat ice-cream
 $p \oplus q$: Either i like blue color, or I will eat ice-cream, but not both.

Table IV: Truth Table for Exclusive OR

p	q	$p \oplus q$
T	T	F
T	F	T
F	T	T
F	F	F

Example 3.5 : Implication Operator

P: I like blue color q:I will eat ice-cream
 $p \rightarrow q$: If I like blue color, then I will eat ice-cream.

Table V: Truth Table for Implication Operator

p	q	$p \rightarrow q$
T	T	T
T	F	F
F	T	T
F	F	T

4:Fuzzy Logic Gates:

Fuzzy Logic gates perform basic logical functions and are the fundamental building blocks of digital integrated circuits. Most fuzzy logic gates take an input of two binary values and output a single value of a 1 or 0. Some circuits may have only a few logic gates, while other such as microprocessors may have millions of them. There are seven different types of logic gates.

In the following examples each logic gates except NOT gate has two inputs P and Q , which can either be 1(True) or 0 (False).The resulting output is a single value of 1 if the result is true or 0 if it is false.

1. **NOT** - True if input is false, false if input is True.
2. **AND** - True if P and Q are both True.
3. **OR** - True if either P or Q are True.
4. **XOR** - True if either P or Q are True, but False if both are True.
5. **NAND** - AND followed by NOT: False only if P and Q are both True.
6. **NOR** - OR followed by NOT: True only if P and Q are both false.
7. **XNOR** - XOR followed by NOT: True if P and Q are both True or both False.

4.1 t-norms:

The basic t-norms are

$$\begin{aligned}
 T_m(a,b) &= \min(a,b) && [T_m \text{ is standard intersection}] \\
 T_b(a,b) &= \max(0, a+b-1) && [T_b \text{ is the bounded sum}] \\
 T_p(a,b) &= a \cdot b && [T_p \text{ is the algebraic product}] \\
 T^*(a,b) &= \begin{cases} a, & \text{if } b=1 \\ b, & \text{if } a=1 \\ 0, & \text{otherwise} \end{cases} && [T^* \text{ is the drastic intersection}]
 \end{aligned}$$

$T^*(a,b) \leq T_b(a,b) \leq T_p(a,b) \leq T_m(a,b)$, for all a,b in [0,1] then
 $T^*(a,b) \leq T(a,b) \leq T_m(a,b)$.

4.2 t- co norms:

The basic t co -norms are

$$\begin{aligned}
 C_m(a,b) &= \min(a,b) && [C_m \text{ is standard union}] \\
 C_b(a,b) &= \max(0,a+b-1) && [C_b \text{ is the bounded sum}] \\
 C_p(a,b) &= a \cdot b && [C_p \text{ is the algebraic product}] \\
 C^*(a,b) &= \begin{cases} a, & \text{if } b=1 \\ b, & \text{if } a=1 \\ 0, & \text{otherwise} \end{cases} && [C^* \text{ is the drastic union}] \\
 C^*(a,b) &\leq C_b(a,b) \leq C_p(a,b) \leq C_m(a,b), && \text{for all } a,b \text{ in } [0,1] \text{ then,} \\
 C_m(a,b) &\leq C(a,b) \leq C^*(a,b)
 \end{aligned}$$

5.Applications & Results:

Traditional *Bivalent fuzzy* logic uses the Boolean operators AND, OR, and NOT to perform the intersect, union and complement operations. These operators work well for bivalent sets and can be essentially defined using the following truth table

Table VI: Truth Table for Logic Gates AND, OR & NOT

x	y	x AND y	x OR y	NOT x
0	0	0	0	1
0	1	0	1	1
1	0	0	1	0
1	1	1	1	0

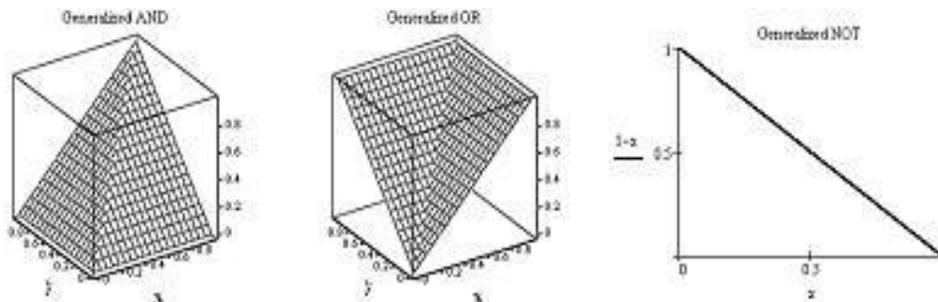


Figure 1: AND, OR & NOT Visualization

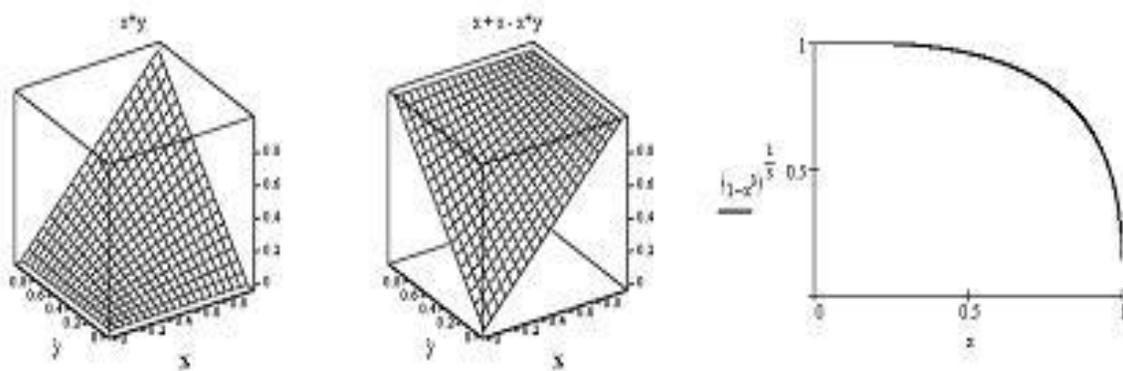


Figure 2: t-norms, t-conorms & negation Visualization

The truth table above works fine for bivalent logic but fuzzy logic does not have a finite set of possibilities for each input; this makes for an infinitely large truth table. The operators need to be defined as functions for all possible fuzzy values, that is, all real numbers from 0 to 1 inclusive. Fuzzy logic is actually a superset of bivalent logic since it includes the bivalent options (0,1) as well as all real's in between, so a generalized form of these operators will be use full. The generalized form for these three operators are given in the table VII.

Table VII: Fuzzy Logic Gates and their Generalized forms

x AND y	$\min(x,y)$
x OR y	$\max(x,y)$
NOT x	$1 - x$

Using these definitions they can be applied to all of the bivalent combinations above as well as some fuzzy number combinations. The truth table for this can be seen below:

Table VIII: Application examples for Bivalent and Fuzzy Number Combinations

x	y	$\min(x,y)$	$\max(x,y)$	$1 - x$
0	0	0	0	1
0	1	0	1	1
1	0	0	1	0
1	1	1	1	0
0.3	0.7	0.3	0.7	0.7
0.6	0.4	0.4	0.6	0.4
0.9	0.9	0.9	0.9	0.1

CONCLUSION

From the above discussion we can come to a conclusion that fuzzy proposition are equivalent to Logic gates in Electronics Circuits. Mathematical definitions of the AND operator are called triangular norms or t-norms, this name is derived from the shape of the generalized AND. A t-norm is, by definition, a binary operator with both operand and the result in [0,1], is commutative, associative, has 1 as an identity, and is increasing in each variable. Mathematical definitions of the OR operator have all the same properties of t-norms except that they have 0 as an identity; they are called t-conorms. The NOT operator can be redefined as long as it is a continuous, strictly decreasing function within [0,1]

REFERENCES

[1] Kosko, Bart. *Fuzzy Thinking* . New York : Hyperion, 1993.
 [2] Nguyen, Hung T., Nadipuram R. Prasad, Carol L. Walker, and Elbert A. Walker. *A First Course in Fuzzy and Neural Control* . Boca Raton , FL : Chapman & Hall/CRC, 2003.
 [3] Dorf, Richard C., and Robert H. Bishop. *Modern Control Systems* . 9th ed. Upper Saddle River , NJ : Prentice Hall, 2001.
 [4] Witold, Pedrycz. *Fuzzy Sets Engineering*. Boca Raton , FL : CRC Press, 1995.
 [5] Zadeh, L. (1965):*Fuzzy sets*. Information and Control 8 (1965), 338-353.
 [6] Springer :An introduction to Fuzzy Logic and Fuzzy Sets,2002.
 [7] Zadeh, L. A.: Fuzzy Sets, Information and Control 8 (1965), pp. 338–353.
 [8] Zadeh, L. A.: Fuzzy Sets as a Basis for a Theory of Possibility, Fuzzy Sets and Systems 1 (1978), pp. 3–28.
 [9] George J.Klir/Bo Yuan :Fuzzy sets and Fuzzy Logic:Theory and Applications,1995.
 [10] Cooper, R.G., “Third-generation new product Processes”, Journal of Product Innovation Management 11, 1, 1994, pp. 3-14.
 [11] L.A. Zadeh. “Fuzzy Sets”. Information and Control (1965) 8, 338-353.
 [12] M.M. Gupta and J. Oi, Theory of T-norms and fuzzy inference methods, Fuzzy Sets *and System* 40 (3) (1991) 431-450.

AUTHORS

First Author - Dr. G. Nirmala, Associate Professor, P.G & Research Department of Mathematics, K.N.G Arts College for Women (Autonomous), Thanjavur- 613007.Tamil Nadu, India. Email Id: nirmalamanohar11@yahoo.com

Correspondence Author – G.Suvitha, Assistant Professor, Department of Mathematics, Sri Sai Ram Institute of Technology, West Tambaram,Chennai-600 044-Tamil Nadu,India. Email Id: Suvitha_g@yahoo.co.in. Mobile. No:+91 9965478748.

Wear Analysis of Polytetrafluoroethylene and its Composites under Dry Conditions using Design-Expert

Deepak Bagale , Sanjay Shekhawat , Jitendra Chaudhari

Department of Mechanical Engineering
SSBT'S COET, Bambhori, Jalgaon, Maharashtra, India

Abstract- In this paper, the effects of load, velocity of sliding and sliding distance on sliding friction and sliding wear of polymer material made of polytetrafluoroethylene (PTFE) and PTFE composites with filler materials such as 40% bronze and 40% carbon are studied. The experimental work is performed on pin-on-disc apparatus and analyzed with the help of Design-Expert 7 software. The results of experiments are presented in tables and graphs which shows that the addition of bronze and carbon filler to the virgin PTFE decreases wear rate significantly and there is marginal increase in coefficient of friction. The highest wear resistance was found for 40% carbon filled PTFE followed by 40% bronze filled PTFE and virgin PTFE. Through this study, we can design and develop a best bearing material for industrial application..

Index Terms- Design-Expert, Polymer, PTFE, Sliding wear

I. INTRODUCTION

Polytetrafluoroethylene (PTFE) is an important polymer based engineering material. When rubbed against a hard surface, PTFE exhibits a low coefficient of friction but a high rate of wear. It is white or gray in color. It is an ideal bearing material for heavy and light load pressures with medium and low surface speeds. PTFE has all qualities of bearing alloy like compatibility, conformability, embedability, load capacity, fatigue strength, corrosion resistance and hardness [1]. The low-friction characteristics of PTFE are largely responsible for the inception of this paper.

PTFE is a popular polymer solid lubricant because of its resistance to chemical attack in a wide variety of solvents and solutions, high melting point, low coefficient of friction, and biocompatibility. It is commonly used in bearing and seals applications. Unfortunately, PTFE suffers from poor wear resistance [2]. Because of the relative softness of PTFE, it is logical to expect that its load-carrying ability and its wear resistance might be improved by the addition of suitable fillers. Accordingly, several fillers are tried by researchers in combination with this plastic, including graphite, molybdenum disulfide, fiber glass, carbon, bronze, dental silicate, silicon, titanium dioxide, silver, copper, tungsten and molybdenum [3].

There are different opinions in literature about the reducing wear of polymer by incorporating the different types of filler. H.Unal et al.[4] study and analyze the influence of test speed and load values on the friction and wear behavior of pure polytetrafluoroethylene (PTFE), glass fibre reinforced

(GFR), bronze and carbon (C) filled PTFE polymers. Adding glass fiber, bronze and carbon fillers to PTFE were found effective in reducing the wear rate of the PTFE composite. Jaydeep Khedkar et al.[5] they study the tribological behavior of Polytetrafluoroethylene (PTFE) and PTFE composites with filler materials such as carbon, graphite, E glass fibers, MoS₂ and poly-p-phenyleneterephthalamide (PPDT) fibers. The present filler additions found to increase hardness and wear resistance in all composites studied. U.Sen et al.[6] based on the experimental and regression analysis results of dry friction and wear tests are presented. The specific wear rate for 25% bronze filled PTFE composite increases with an increase in load and are in the order of 10^{-4} – 10^{-5} mm³/N m. S.Basavarajappay et al.[7] they study the influence of wear parameters like applied load, sliding speed, sliding distance and percentage of reinforcement on the dry sliding wear of the metal matrix composites. A plan of experiments, based on techniques of Taguchi, was performed to acquire data in controlled way. An orthogonal array and the analysis of variance were employed to investigate the influence of process parameters on the wear of composites. Talat Tevruz [8] has studied that the coefficient of friction and the wear are strongly influenced by the thickness and composition of these films depending on the adhesion between steel and composite surfaces, the cohesive properties of the polymer used, pressure and the sliding distance.

II. EXPERIMENTAL TOOLS AND TECHNIQUES

A. DESIGN OF EXPERIMENT

It is methodology based on statistics and other discipline for arriving at an efficient and effective planning of experiments with a view to obtain valid conclusion from the analysis of experimental data. Design of experiments determines the pattern of observations to be made with a minimum of experimental efforts. More specifically, the use of orthogonal Arrays (OA) for DOE provides an efficient and effective method for determining the most significant factors and interactions in a given design problem.

B. TAGUCHI METHOD

As the number of factors considered at multi-levels increases, it becomes increasingly difficult to conduct the experiment with all treatment combinations. To reduce the number of experiments to practical level, only a small set from all the possibilities is selected. The method of selecting a limited number of experiments, which produces the most information, is known as a

practical fractional experiment, but there are no general guidelines for fractional experiments that cover many applications. This method uses a special set of arrays called orthogonal arrays. These standard arrays stipulate the way of conducting the minimal number of experiments, which could give the full information of all the factors that affect the performance parameter. The crux of the orthogonal arrays method lies in choosing the level combinations of the input design variables for each experiment. A full factorial design will identify all possible combinations for a given set of factors. If an experiment consist of m number of factors & each factor at levels X, then Number of trails possible is given by (Treatment Combination) = X^m .

C. A TYPICAL ORTHOGONAL ARRAY (OA)

While there are many standard orthogonal arrays available, each of the arrays is meant for a specific number of independent design variables and levels. Standard notation for orthogonal Arrays is, $L_n(X^m)$ Where,

- n=Number of experiments to be conducted
- X=Number of levels
- m= Number of factors

III.EXPERIMENTAL DESIGN PROCEDURE

1. Statement of experimental problem:

Analysis of plain PTFE and composite PTFE material consist 40% carbon filled and 40% bronze filled, using Pin-on-Disc wear and friction testing machine < Fig.1 > considering the following point.

- Study of friction behavior of PTFE material.
- Study of wear of PTFE material under different varying condition
- Comparison of wear of Plain PTFE with Bronze filled and Carbon filled PTFE by considering varying conditions.

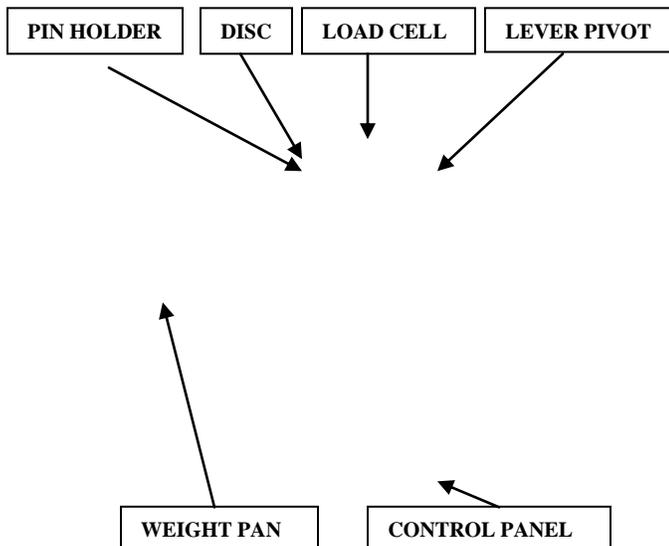


Figure 1: Experimental Setup of Friction and Wear test rig

2. Choice of response variable:

Wear is taken as the response variable in present investigation work.

3. Choice of factors levels and ranges:

In this investigation work, which is carried out for 3 factors (load, velocity of sliding and sliding distance), each factor at 3 levels, an $L_9(3^4)$ orthogonal array is chosen for conducting the experiments. The fourth factor can be deleted. The assignments of levels to the different independent factors used in investigation and it's a coding and designation of materials are shown in < Table I-III >.

Table I: Assigning of Levels to the variable as Applicable to Pin on-Disc machine

Level→	Low	Medium	High
Load (Kg) A	1	2	3
Speed (RPM) B	500	700	900
Sliding distance (m) C	1500	3000	4500
Code	-1	0	+1

Table II: Designation for PTFE materials

Material	Composition in Wt.%
I	Plain PTFE
II	40% Bronze filled PTFE
III	40% Carbon filled PTFE

Level→	Low	Medium	High
Load (kg) (A)	1	2	3
Velocity of Sliding (m/s) (B)	2.62	3.66	4.71
Sliding distance (m) (C)	1500	3000	4500
Code	-1	0	+1

Table III: Assigning of Levels to the Variable as Applicable Practically

4. Selection of DOE:

Design of experiments (DOE) offers a systematic approach to study the effects of multiple variables or factors on products or process performance by providing a structural set of analysis in a design matrix which is shown in < Table IV >.

5. Performing the experiments:

Conducting the experiments as per the design matrix and recording the response parameters as shown in < Table V >.

6. Data analysis:

7. Analysis of results and conclusions:

8. Confirmation test:

To test the accuracy of the model the confirmation tests were performed. The comparison of wear results from the mathematical model equation developed in the present work < Table VI > with the values obtained experimentally has shown in < Table VII >.

Table IV: Design matrix of L₉ (3⁴) Orthogonal Array

Trial No.	Factor A	Factor B	Factor C	Factor D	Response Y
1	-1	-1	-1	-1	Y1
2	-1	0	0	0	Y2
3	-1	+1	+1	+1	Y3
4	0	-1	0	+1	Y4
5	0	0	+1	-1	Y5
6	0	+1	-1	0	Y6
7	+1	-1	+1	0	Y7
8	+1	0	-1	+1	Y8
9	+1	+1	0	-1	Y9

Table V : Layout of L₉ (3⁴) Orthogonal Array for Experimentations

Trail No.	Load (Kg)	Velocity (m/s)	SD (m)
1	1	2.62	1500
2	1	3.66	3000
3	1	4.71	4500
4	2	2.62	3000
5	2	3.66	4500
6	2	4.71	1500
7	3	2.62	4500
8	3	3.66	1500
9	3	4.71	3000

Table VI: Mathematical model equation of all material

Material	Wear equation
I	Wear (gm/m) = -19.69174 + 13.55277×Load + 8.83728×Velocity of Sliding + 3.30416×SD - 4.74803×Load×Velocity of Sliding + 2.66856×Load×SD - 1.21962×Velocity of Sliding×SD
II	Wear (gm/m)= -19.23989 + 11.18184×Load + 8.98735×Velocity of Sliding - 1.83946×SD - 4.68456×Load×Velocity of Sliding + 3.27900×Load×SD - 0.52316×Velocity of Sliding×SD

Material	V _r	L	SD	Actual wear	Predicted wear	Variation
	m/s	Kg	Km	(gm/m) X 10 ⁻⁵	(gm/m) X 10 ⁻⁵	%
I	1.5	2	2	19.3333	20.0491	- 3.70
	2.8	3.5	2.5	29.4444	29.0296	1.41
II	1.5	2	2	10.8889	10.4187	4.32
	2.8	3.5	2.5	20.5555	19.5829	4.73
III	1.5	2	2	3.4444	3.7030	-4.15
	2.8	3.5	2.5	6.1111	6.3461	-3.84

III	Wear (gm/m) = -4.47723 + 3.34108×Load + 2.37343 × Velocity of Sliding - 0.85120×SD - 1.41006×Load×Velocity of Sliding + 1.02987×Load×SD - 0.082974×Velocity of Sliding×SD
-----	---

Table VII: Confirmation test

IV. RESULTS AND DISCUSSION

1) One can observe from < Fig. 2-4 >, that as laod and sliding distance increases wear of all material goes on increasing where as velocity of sliding increases wear of all material goes on decreasing.

2) It is observed from < Table VIII > that the wear of material III is less than material I and II and pure PTFE has higher wear rate and bronze filled PTFE has higher Wear rate than carbon filled PTFE.

3) < Table IX > shows the percentage contribution of each factor on the total variation indicating their degree of influence on the result. One can observe from the above table that the sliding distance (46.95%) has great influence on the wear; followed by velocity of sliding for all materials. However, the interaction between the velocity of sliding and sliding distance (0.44%) has negligible influence on the wear.

Figure 4: Wear v/s Sliding distance

Table VIII: Comparative wear data of all material

Material	Total Wear rate (I) in (gm/m)	Average Coefficient of friction (μ)
I	157.7776×10^{-5}	0.2047
II	91.2221×10^{-5}	0.2107
III	29.5555×10^{-5}	0.2217

Figure 2: Wear v/s Load

Table IX: Effect List

Term	% Contribution		
	I	II	III
A-load	16.17	18.73	18.37
B-velocity	26.06	20.67	23.18
C-sliding distance	46.95	45.01	45.24
AB	4.34	4.73	3.54
AC	6.01	10.72	9.64
BC	0.44	0.14	0.035

Figure 3: Wear v/s Velocity of sliding

V. CONCLUSIONS

- Addition of filler materials such as bronze and carbon to PTFE causes an increase in wear resistance, while the coefficient of friction is slightly affected.
- Wear of 40% carbon filled PTFE is less than 40% bronze filled PTFE and Pure PTFE.
- Wear of Pure PTFE is decreased about 42% by adding 40% bronze and 81% by adding 40% carbon.
- It is observed that the addition of carbon filler to plain PTFE improves wear resistance significantly as compared to bronze filler.
- From Confirmation test it is observed that the percentage of Variation is for wear is between 1 to 4.73% which tells that the mathematical model developed for all three materials is significant.
- Depending upon load, velocity of sliding and sliding distance, material used in this study can be ranked as 40% carbon filled PTFE > 40% bronze filled PTFE > Pure PTFE for their wear Performance and as Pure PTFE > 40% bronze filled PTFE > 40% carbon filled PTFE for their friction Performance.

ACKNOWLEDGMENT

I would like to express my sincere thanks and appreciation to Mechanical Department of S.V.P.S.'s B.S.Deore College of Engineering, Dhule for valuable support and kind co-operation during experimentation work .

NOMENCLATURE

PTFE	Polytetrafluoroethylene
SD	Sliding Distance
DOE	Design of Experiment
OA	Orthogonal Array
Vr	Velocity of Sliding (m/s)
I	Wear Rate (gm/m)
μ	Coefficient of Friction
L	Load (Kg)

REFERENCES

- [1] S. K. Biswas and Kalyani Vijayan, "Friction and wear of PTFE - a review", *Wear*, vol. 158, 1992, pp. 193-211.
- [2] W. Gregory Sawyer, Kevin D. Freudenberg, Praveen Bhimaraj, Linda S. Schadler, "A study on the friction and wear behavior of PTFE filled with alumina nanoparticles", *Wear*, vol. 254, 2003, pp. 573-580.
- [3] M. Xanthos, *Functional Fillers for Plastics*, in: *Polymers and Polymer Composite*, WILEY-VCH, 2005, pp.1-16.
- [4] H. Unal, A. Mimaroglu, U. Kadioglu, H. Ekiz, "Sliding friction and wear behaviour of Polytetrafluoroethylene and its composites under dry conditions", *Materials and Design*, vol. 25, 2004, pp. 239-245.
- [5] Jaydeep Khedkar, Ioan Negulescu, Efsthios I. Meletis, "Sliding wear behavior of PTFE composites", *Wear*, vol. 252, 2002, pp. 361-369.
- [6] H. Unal, U. Sen, A. Mimaroglu, "An approach to friction and wear properties of Polytetrafluoroethylene composite", *Materials and Design*, vol. 27, 2006, pp. 694-699.
- [7] S.Basavarajappay and G.Chandramohan, "Wear Studies on Metal Matrix Composites:A Taguchi Approach", *J. Mater. Sci. Technol.*, vol. 21, 2005, pp.845-850.
- [8] Talat Tevrüz, "Tribological behaviors of carbon filled Polytetrafluoroethylene (PTFE) dry journal bearings", *Wear* , vol. 221, 1998, pp. 61-68.

AUTHORS

First Author – Deepak Bagale

B.E. , M.E. pursuing
Department of Mechanical Engineering
SSBT'S COET, Bambhori, Jalgaon,
Maharashtra, India.
E-Mail: deepak_bagale@rediffmail.com

Second Author –Sanjay Shekhawat

B.E. , M.E. Ph.D pursuing
Department of Mechanical Engineering
SSBT'S COET, Bambhori, Jalgaon,
Maharashtra, India.
E-Mail: spshekhawat@rediffmail.com

Third Author – Jitendra Chaudhari

B.E. , M.E. Ph.D pursuing
Department of Mechanical Engineering
SSBT'S COET, Bambhori, Jalgaon,
Maharashtra, India.
E-Mail: jrchaudhari@yahoo.com

Correspondence Author – Deepak Bagale

E-Mail:deepak_bagale@rediffmail.com

Tel.: +918237508213

An Assessment of Perceived Stress, Resilience and Mental Health of Adolescents Living in Border Areas

Sarita Sood*, Arti Bakhshi**, Pooja Devi***

* Lecturer, P G Department of Psychology, University of Jammu, Jammu

** Head, P G Department of Psychology, University of Jammu, Jammu

*** Student, M A Psychology, IGNOU

Abstract- This study was carried out to find out the level of perceived stress, resilience and mental health of adolescents living at international border in Jammu and Kashmir, India. Further an attempt was made to explore the relationship between these variables. A random sample of 100 adolescents in the age group 13-18 years was drawn from villages falling within five kilometers from the actual border. Data was obtained through administering Perceived Stress Scale, Resilience Scale, and Mental Health Inventory. Sample was dichotomized using median values for perceived stress and resilience. Difference in mental health of participants with low and high resilience was analyzed using t test. Pearson's correlation revealed negative meaningful correlation between perceived stress and mental health. However, positive correlation became evident between perceived stress and anxiety as well as psychological distress. Resilience and mental health was also related signifying better mental health in resilient adolescents in border areas. Positive correlation was observed in resilience and general positive affect, emotional ties, and psychological well being. Negative association was found in resilience and loss of emotional control. Steps should be taken to build up resilience to enhance mental health of adolescents living with great stress in border areas.

Index Terms- Perceived stress, resilience, mental health, adolescents, border area

I. INTRODUCTION

There are certain situations that are not harmonious fit between person and environment and in which resources of the person are employed requiring the person to struggle or cope (Lazarus, 1966). At times events are assumed to be stressful and are regarded as potentially stressful and harmful. Self appraisal is carried out and when an individual feels an inability in managing the stressor either due to inadequate abilities or resources, stress is perceived (Monroe & Kelly, 1997). Perceived stress occurs when an individual feels inability to control the situation or manage emotional response to it.

Resilience is an ability of people to recover from misfortune (Wandberg, 2001) and to withstand stressors and not to manifest psychological dysfunction even in the face of adversities. It provides protection from various mental health conditions. Resilience is associated with mental health. Resilience brings desirable outcomes and adjustment, despite exposure to considerable risk (Luthar, 1993; Rutter, 1985). It is multidimensional in nature (Luthar, Doemberger, & Zigler,

1993). Resilience is situational and the reactions of an individual to different stresses do not remain same forever (Rutter, 1981).

There are millions of people living in the border belts of Jammu and Kashmir (India). For the residents firing and shelling is an order of the day. The turbulence along the border does not let the residents heave sigh of relief. The fear of landmines looms large too. The residents fear collapse of ceasefire. People constantly fear the war which brings loss of security, unpredictability and the lack of structure in daily life (Machel, 2001; Stichick & Bruderlein, 2001). Insecurity is likely to persist long after the conflicts have ended and people try to regain normalcy and cope (Baingana, Bannon, & Thomas, 2005). People try to adjust to the circumstances around them, cope with loss, and regain a sense of normalcy. Unpredictable conditions such as these create perceived stress in the residents. Resilient people experience positive emotions which act as moderator for the magnitude of adversity experienced by people and helps in coping with the future. There is catastrophic effect of war and conflict on the mental health of civilian population. Several studies have examined the impact of exposure to violent events as stressor affecting the mental health in war situations (Eapen, Swadi, Sabri, & Abou-Saleh., 2001; Helene, 2001; Thabet, Karim, & Vostanis., 2006; Zakrison, Shahen, Mortaja, & Hamel, 2004). Cardozo et al (2004) found significant relationship between the mental health status and traumatic events. Symptoms of both anxiety and depression were reported in the people after the war in Afghanistan (Cardozo et al, 2004; Scholte et al., 2004). Similar findings were reported in a study on Karenni refugees living in Thai-Burmese border camps (Cardozo, Alley, Burton, & Crawford, 2004). In a study carried out to assess behavioural and emotional problems in preschoolers in Palestine it was found that both direct as well as indirect exposure to war trauma gives rise to poor mental health (Thabet, Karim, & Vostanis., 2006). According to Murthy and Lakshminarayana (2006) there is resilience in people even in the face of the worst trauma in war situations. During the exposure to stressful situations or life events, resilient people appear to develop healthy psychosocial functioning (Conrad, 1998; Dybdahl, 2001; Horning, 2002; Lieberman, van Horn, Ozer, 2005).

Adolescence is the period of great strain and strife. The adolescents might be vulnerable to negative effects of stress experienced by them (Chassin, Ritter, Trim, & King, 2003; Little & Garber, 2004). Unless these issues are addressed adolescents are at risk for compromised mental health as adults (Loeber & Farrington, 2000). Since border residents are specifically living under stressful situations and this study was taken up with an

objective of assessment of perceived stress, resilience and mental health of adolescents living in border areas and also to explore the relationship between these variables.

II. METHOD

Sample

The sample consisted of 100 adolescents residing in the villages in the border area Jaurian of Jammu and Kashmir. The villages from which sample was drawn were situated within the range of five kilometer from the actual border between India and Pakistan. The participants were in the age range of 13 to 18 years with the mean age of 14.21. Of these 45 of 100 (45%) were male and 55 of 100 (55%) were female.

Procedure

Data collection was done using random sampling. Purpose of study was made clear to the participants and tools were administered. Help was provided to the participants in case they found any of the items difficult to comprehend. Results were obtained and analyzed by SPSS 17 and used in the current study.

Measures

Perceived Stress Scale (Cohen, Kamrack, & Mermelstein, 1983): It is a 10 item scale measuring the perception of stress on a 5 point scale from never to quite often. Questions are directed on feelings and thoughts during the last month.

Resilience Scale (Wagnild & Young, 1987): It is 26 item scale on 7 point scale from strongly disagree to strongly agree. The score ranges from 25 to 175.

Mental Health Inventory (Veit & Ware, 1983): It is 38 item inventory used for assessment of mental health of non clinical adolescents. It assesses both psychological well being as well as psychological distress and five factors i.e. anxiety, depression, loss of behavioral/emotional control, emotional ties, and general positive affect.

III. RESULTS AND DISCUSSION

To analyze an extent of perceived stress in adolescents residing in border areas the sample was dichotomized on the basis of median of scores on perceived stress which came out to be 19. Two groups were generated showing the level of perceived stress, i.e. low perceived stress and high perceived stress. 59 of 100 participants (59%) reflected low perceived stress whereas 41 of 100 participants (41%) had high perceived stress. Similarly the sample was dichotomized on the basis of median score 123.5 for resilience. The two groups thus formed were low resilience (n=50) and high resilience (n=50). Mean and S.D. were computed and *t* test was applied to compare the participants having low resilience (n=50) and high resilience (n=50) on the mental health and its dimensions.

Table 1: Differences in mental health of adolescents having high resilience and low resilience

Variables	Low Resilience (N=50)		High Resilience (N=50)		t value	P
	Mean	S.D.	Mean	S. D.		
Overall Mental Health	148.500	15.616	155.500	14.380	2.332*	.022
Anxiety	26.360	6.552	27.640	6.736	.963	.338
Depression	10.800	4.208	10.680	3.266	.159	.874
Loss of Emotional Control	26.560	5.303	23.060	5.092	3.366**	.001
General Positive Affect	37.780	6.519	40.860	8.518	2.030*	.045
Emotional Ties	8.380	2.739	9.300	2.305	1.817	.072
Life Satisfaction	4.060	1.235	4.320	1.268	1.038	.302
Psychological Distress	68.160	12.425	66.900	13.129	.493	.623
Psychological Well Being	55.200	11.279	58.360	10.191	1.470	.145

*Significant at .05 level and ** Significant at .01 level

The mean for overall mental health of adolescents having low resilience ($M=148.500$, $SD=15.616$) was lower than those having high resilience ($M=155.500$, $SD=14.380$). This difference was statistically significant, $t(98)=2.332$, $p=.022$ (Table 1). Therefore, it could be said that the adolescents living in border areas having low resilience has poorer mental health than those having high resilience.

On the dimension wise analysis of mental health of adolescents having low and high resilience it was found that of the eight dimensions of mental health the participants differed only on two dimensions. Results from independent samples *t* test indicated that adolescents with low resilience ($M=26.560$, $SD=5.303$) scored much higher on the dimension loss of

emotional control than those having high resilience ($M=23.060$, $SD=5.092$), $t(98)=3.366$, $p=.001$. The mean scores for the loss of emotional control are presented in Table 1. The difference between the two groups in loss of emotional control appeared to be highly significant. Comparison reveals that the participants having lower resilience had greater loss of emotional control. Similarly ($M=37.780$, $SD=6.519$) and ($M=40.860$, $SD=8.518$) for low resilience and high resilience groups respectively was found to be statistically different $t(98)=2.030$, $p=.045$ for the dimension general positive affect (Table 1). The adolescents having high resilience had better general positive affect.

Table 2: Correlation Matrix of Perceived Stress, Resilience and Mental Health

Variables	1	2	3	4	5	6	7	8	9	10	11
Perceived Stress	1										
Resilience	-.017	1									
MH Index	-.253*	.251*	1								
Anxiety	.292**	.081	-.607**	1							
Depression	.218*	.005	-.378**	.218*	1						
Loss of emotional control	-.001	-.282**	-.547**	.289**	-.008	1					
General positive affect	-.091	.278**	.499**	.074	-.082	-.323**	1				
Emotional ties	.090	.283**	.346**	.193	-.103	-.054	.467**	1			
Life satisfaction	.024	-.069	.049	-.017	.073	-.008	.031	-.022	1		
Psy distress	.283**	.012	-.705**	.731**	.391**	.506**	-.020	.071	.068	1	
Psy well being	-.140	.288**	.405**	.161	-.107	-.144	.790**	.516**	-.100	-.099	1

Table 2 represents correlation matrix of perceived stress, resilience and mental health variables. It shows that there is a negative meaningful correlation between perceived stress and mental health. It means that higher the perceived stress in adolescents residing in border areas poorer will be the mental health. On dimension wise analysis of mental health scores positive correlation became evident between perceived stress and anxiety as well as psychological distress. This reflects that with increase in perceived stress level of depression as well as psychological distress in adolescents is likely to increase. Previous studies have reported an association between perceived stress and negative mental health outcomes in children and adolescents (Martin, Kazarian, & Breiter, 1995; Mayberry & Graham, 2001).

Resilience and mental health is also related (Table 2) signifying better mental health in resilient adolescents in border areas. Positive correlation is also observed in resilience and general positive affect, emotional ties, and psychological well being. Negative association is found in resilience and loss of emotional control. Similar findings were reported in previous studies (Hjemdal, Aune, Reinfjell, Stiles, & Friborg, 2007; Hjemdal, Vogel, Solem, Hagen, & Stiles, 2011; Ziaian, de Anstiss, Antoniou, Baghurst, & Sawyer, 2012).

Important finding of this study was that adolescents having higher levels of resilience had shown lesser mental health problems and better psychological well being, emotional ties, and general positive affect. This could be indicative of the role that resilience plays in safeguarding mental health of those who are residing in border areas from development of mental health problems. Future studies might be focused on assessment of resilience as a predictor of mental health in adolescents living in border areas or in similar stressful conditions. Investigation in this aspect would enable in designing interventions to enhance resilience and ultimately the mental health.

REFERENCES

[1] Baingana, F., Bannon, I., & Thomas, R. (2005). Mental health and conflicts: Conceptual framework and approaches. HNP Discussion paper. Available

at <http://siteresources.worldbank.org/INTCPR/214578-1111741001753/20482321/-BainganaMH-ConflictFinal.pdf>

[2] Cardozo, B. L., Alley, L., Burton, A., & Crawford, C. (2004). Karenni refugees living in Thai-Burmese border camps: Traumatic experiences, mental health outcomes, and social functioning. *Social Science and Medicine*, 58, 2637-2644.

[3] Cardozo, B. L., Bilukha, O. O., Crawford, C., et al. (2004). Mental health, social functioning, and disability in postwar Afghanistan. *The Journal of American Medical Association*, 292, 575-584.

[4] Chassin, L., Ritter, J., Trim R. S., & King, K. M. (2003). Adolescent substance use disorders. In E. J. Mash & R. A. Barkley (Eds.), *Child Psychopathology*, 2nd ed., (pp. 199 – 230). New York: Guilford Press.

[5] Cohen, S., Kamarck, T., & Mermelstein, R. (1983). A global measure of perceived stress. *Journal of Health and Social Behavior*, 24, 386-396.

[6] Conrad, B. S. (1998). Maternal depressive symptoms and homeless children's mental health: Risk and resiliency. *Archives of Psychiatric Nursing*, 12, 50-58.

[7] Dybdahl, R. (2001). Children and mothers in war: An outcome study of a psychosocial intervention program. *Child Development*, 72, 1214-1230.

[8] Eapen, V., Swadi, H., Sabri, S., & Abou-Saleh, M. (2001). Childhood behavioural disturbance in a community sample in Al-Ain, United Arab Emirates. *Eastern Mediterranean Health Journal*, 7, 428-434.

[9] Helene, B. (2001). Children and war: Current understandings and future directions. *Public Health Nursing*, 18, 243-252.

[10] Hjemdal, O., Aune, T., Reinfjell, T., Stiles, T. C., & Friborg, O. (2007). Resilience as a predictor of depressive symptoms: A correlational study with young adolescents. *Clinical Child Psychology and Psychiatry*, 12(1), 91-104.

[11] Hjemdal, O., Vogel, P. A., Solem, S., Hagen, K., & Stiles, T. C. (2011). The relationship between resilience and levels of anxiety, depression, and obsessive-compulsive symptoms in adolescents. *Clinical Psychology and Psychotherapy*, 18(4), 314-321.

[12] Horning, L. (2002). Resilience in preschoolers and toddlers from low-income families. *Early Childhood Education Journal*, 29, 155-159.

[13] Lazarus, R. S. (1966). Psychological stress and the coping process. New York: McGraw-Hill.

[14] Lieberman, A. F., van Horn, P., & Ozer, E. J. (2005). Preschooler witnesses of marital violence: Predictors and mediators of child behavior problems. *Development and Psychopathology*, 17, 385-396.

[15] Loeber, R., & Farrington, D. P. (2000). Young children who commit crime: Epidemiology, developmental origins, risk factors, early interventions, and policy implications. *Development and Psychopathology*, 12, 737 – 762.

[16] Luthar, S. S. (1993). Annotation: Methodological and conceptual issues in research on childhood resilience. *Journal of Child Psychology and Psychiatry*, 34(4), 441-453.

[17] Luthar, S. S., Doemberger, C. H., & Zigler, E. (1993). Resilience is not a unidimensional construct: Insights from a prospective study of inner-city adolescents. *Development and Psychopathology*, 5, 703-718.

- [18] Machel, G. (2001). The impact of war on children. London: Hurst & Company.
- [19] Martin, R. A., Kazarian, S. S., & Breiter, H. J. (1995). Perceived stress, life events, dysfunctional attitudes, and depression in adolescent psychiatric inpatients. *Journal of Psychopathology & Behavioral Assessment*, 17, 81 – 95.
- [20] Mayberry, D. J., & Graham, D. (2001). Hassles and uplifts: Including interpersonal events. *Stress and Health*, 17, 91 – 104.
- [21] Monroe, S., & Kelly, J. M. (1997). Measurement of stress appraisal. In S. Cohen, R. C. Kessler, L. U. Gordon, eds. *Measuring stress: A guide for health and social scientists*. New York: Oxford University Press, 123-47.
- [22] Murthy, R. S., & Lakshminarayana, R. (2006). Mental health consequences of war: a brief review of research findings. *World Psychiatry*, 5(1), 25-30.
- [23] Rutter, M. (1981). Stress, coping and development: Some issues and some questions. *Journal of Child Psychology and Psychiatry and Allied Disciplines*, 22(4), 323-356.
- [24] Rutter, M. (1985). Resilience in the face of adversity: Protective factors and resistance to psychiatric disorder. *British Journal of Psychiatry*, 147, 598–611.
- [25] Scholte, W. F., Olf, M., Ventevogel, P., et al. (2004). Mental health symptoms following war and repression in Eastern Afghanistan. *The Journal of American Medical Association*, 292, 585–593.
- [26] Stichick, T., & Bruderlein, C. (2001). Children facing insecurity: New strategies for survival in a global era; Policy paper produced for the Canadian Department of Foreign Affairs and International Trade, The Human Security Network, 3rd Ministerial Meeting; Petra, Jordan. 11–12 May, 2001.
- [27] Thabet, A. A., Karim, K., & Vostanis, P. (2006). Trauma exposure in pre-school children in a war zone. *British Journal of Psychiatry*, 188, 154–158.
- [28] Veit, C., & Ware, J. (1983). The structure of psychological distress and well-being in general populations. *Journal of Consulting and Clinical Psychology*, 51, 730-742.
- [29] Wagnild, G. M. & Young, H. M. (1987). The Resilience Scale. Available at <http://www.resilience-scale.com>
- [30] Wandberg, R. (2001). Resilience: Bouncing Off, Bouncing Back. Capstone Press, Minnesota.
- [31] Zakrison, T. L., Shahan, A., Mortaja, S., & Hamel, P. A. (2004). The prevalence of psychological morbidity in West Bank Palestinian children. *Canadian Journal of Psychiatry*, 49, 60–62.
- [32] Ziaian, T., de Anstiss, H., Antoniou, G., Baghurst, P., & Sawyer, M. (2012). Resilience and its association with depression, emotional and behavioural problems, and mental health service utilization among refugee adolescents living in South Australia. *International Journal of Population Research*. doi:10.1155/2012/485956

AUTHORS

First Author – Dr Sarita Sood, MA Psychology (Gold Medalist), B. Ed., Ph. D., Lecturer in Psychology, P. G. Department of Psychology, University of Jammu, Jammu, (J&K). email sarita.sood@yahoo.com

Second Author – Prof Arti Bakhshi, MA Psychology, M. Ed., Ph. D., Head, P. G. Department of Psychology, University of Jammu, Jammu, (J&K). email artibakhshi@gmail.com

Third Author – Pooja Devi, MA Psychology, Student, IGNOU.

Correspondence Author – Dr Sarita Sood, email sarita.sood@yahoo.com

Pleomorphic Adenoma of Hard Palate: A Case Report

Dr. S.P.Lenka*, Dr. Subrat Kumar Padhiary*, Dr. Santosh kumar Subudhi*, Dr. Harshmohan Pathak*, Dr. Sujit Sahoo**

* Assistant Professor, Department of OMFS, BBSR, INDIA.

** Assistant Professor, Department of Oral Pathology, BBSR, INDIA.

I. INTRODUCTION

The pleomorphic adenoma otherwise called as benign mixed tumor, is the most common salivary neoplasm.¹ It accounts for 53% to 77% of parotid tumors, 44% to 68% of submandibular tumours and 33% to 43% of minor gland tumors.² Pleomorphic adenomas are derived from a mixture of ductal and myoepithelial elements.^{2,3} The terms pleomorphic adenoma and mixed tumor both represent attempts to describe the tumor's unusual histopathologic features, neither term is entirely accurate.⁴ The tumor often has a prominent mesenchyme appearing stromal component; it is not truly a mixed neoplasm that is derived from more than one germ layer.^{1,4}

This paper describes a case of pleomorphic adenoma of minor salivary gland in palate of a middle aged male patient who was treated with wide surgical excision showing no evidence of recurrence 2 years post operative follow up.

II. CASE REPORT

A 35 year male patient reported to the department of oral and maxillofacial surgery with a slow growing right hard palate mass that had been present for the past one year. The non tender mass was exerting pressure on the patient's tongue and this prompted him to seek medical attention. On general examination, all the vital signs were within the normal range with no history of diabetes or hypertension.

On examining intraorally, a diffuse roughly oval in shape swelling was present in relation to the left side of the hard palate measuring roughly about 3 x 2 cm. Anteroposteriorly, the swelling extended from the distal aspect of left first premolar to the left side maxillary tuberosity area. Mediolaterally, it extended from mid palatal area to the lingual surface of maxillary molar teeth. On palpation of the lesion intraorally, the swelling was non tender, firm in consistency, did not show any fluctuations. Hard tissue examination revealed mobility of teeth. CT showed a well circumscribed right hard palatal mass. Under general anaesthesia, an incision was given and dissection done and the whole tumor mass was excised along with mucoperiosteum. The entire mass was sent for histopathology study. In the meantime the patient was under antibiotic coverage and NSAIDs.

Grossly, the lesion was in the form of an ovoid well demarcated, partially encapsulated, gray-white partly myxoid, partly rubbery mass, measuring 2.5 x 1.7 x 1.5 cm, with solid cut surface (Figure 3). On histology, a well-circumscribed growth was seen. The neoplastic proliferation had biphasic populations of epithelial and mesenchymal cells. The former was composed of glandular structures lined by round, oval cells having large

hyperchromatic nuclei, pink cytoplasm and myoepithelial basal cell layer. The stroma was myxoid, hyaline and chondroid. No mitotic figures or necrosis were seen (Figure 4 & 5). Postoperative period was uneventful. The patient was followed up over a period of for 2 years and no recurrences were observed. The final histopathology report confirmed the diagnosis as benign pleomorphic adenoma of minor salivary gland of hard palate.

III. DISCUSSION

Pleomorphic adenoma appears as a painless slowly growing firm mass. The tumor can occur at any age but it is most common in young and middle aged adults between the ages of 30 – 60. It is the most common salivary gland tumor, with a slight female predilection.^{1,2,3} The tumor is movable in the initial stages but later as it grows in size, it becomes less mobile. The palate is the most common site for minor gland mixed tumor.^{5,6} Palatal tumors almost are always found on the posterolateral aspect of the palate, presenting as smooth surface, dome shaped masses.⁷ The pleomorphic adenoma is typically a well circumscribed, encapsulated tumor. The capsule may be incomplete or show infiltration by tumor cells. This lack of complete encapsulation is more common for minor gland tumor.^{5,7}

The tumor is composed of mixture of glandular epithelium and myoepithelial cells within a mesenchyme like background. The epithelium often forms ductal and cystic structures or may occur as islands or sheets of cells.⁸ Keratinising squamous cells and mucous producing cells can also be seen. Myoepithelial cells sometimes appear as angular or spindle and some are rounded and demonstrate eccentric nucleus and eosinophilic hyalinised, thus resembling plasma cells.⁹ The highly characteristic 'stomal' changes are believed to be produced by myoepithelial cells. In many tumors, the stroma exhibits area of an eosinophilic, hyalinised changes. Occasionally, salivary gland tumors are seen that are composed almost entirely of myoepithelial cells with no ductal elements. Such tumors are often called as myoepitheliomas.^{8,9,10}

Treatment of choice is surgical excision. For the ones present in superficial lobe of parotid gland, superficial parotidectomy is done with preservation of facial nerve.¹¹ Local enucleation of lesion is avoided for lesions in the deep lobe, total parotidectomy is done and if possible with preservation of facial nerve. The tumors of the hard palate usually are excised down to periosteum, including the overlying mucosa.^{12,13}

The prognosis is excellent, with a cure rate of more than 95%. The risk of recurrence is low for tumors of minor glands.¹⁴ Tumors with a predominantly myxoid appearance are more

susceptible to recur than those with other features. Malignant degeneration is a potential complication, resulting in carcinoma ex pleomorphic adenoma. The risk of malignant transformation is only 5% of all cases.^{15,16}

To conclude, pleomorphic adenoma of minor salivary gland is relatively rare and therefore its diagnosis requires a high index of suspicion. Complete wide surgical excision is the treatment of choice. Recurrence after many years of surgical excision as well as malignant transformation should be a concern and therefore long-term follow-up is necessary.



FIGURE 1: Palatal swelling extending from distal aspect of left first premolar to maxillary tuberosity area



FIGURE 3: Gross appearance of the excised specimen showing an encapsulated mass

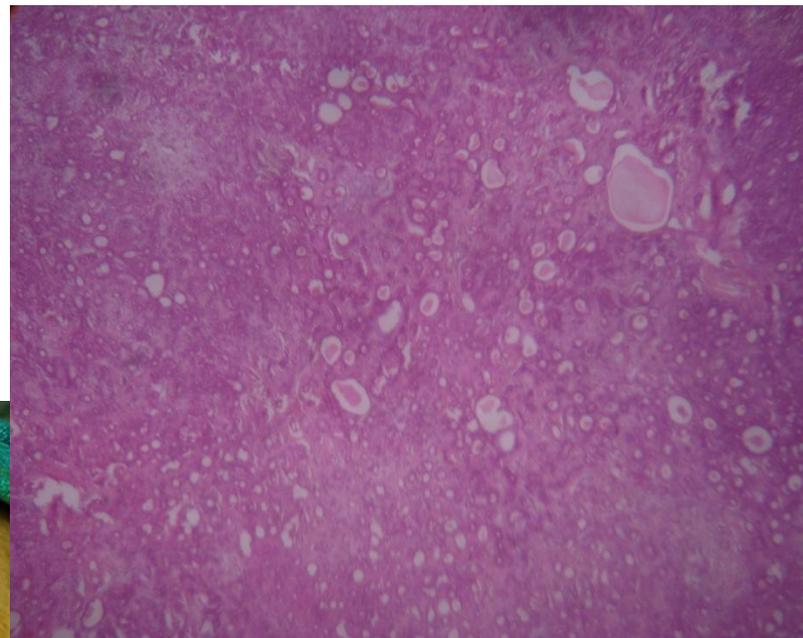
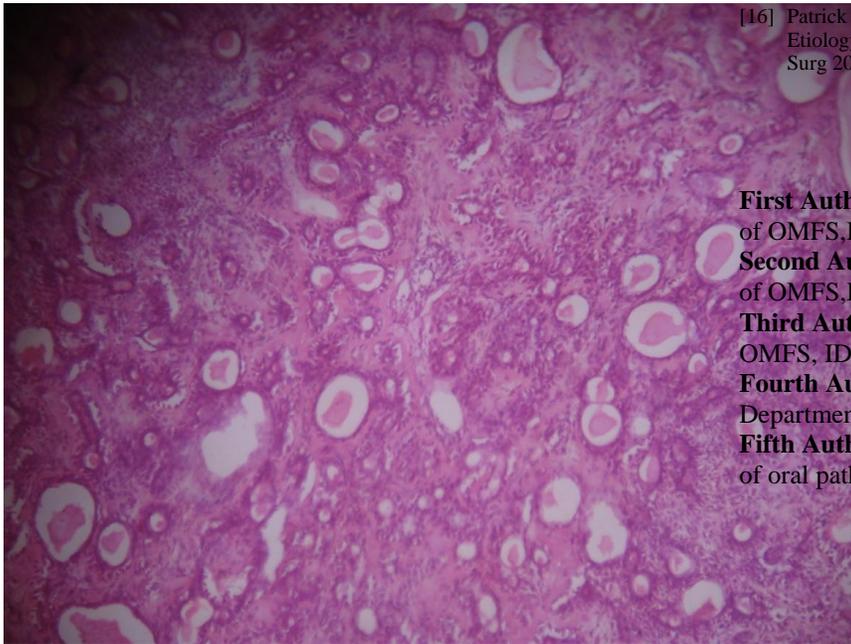


FIGURE 4: Pleomorphic adenoma with typical cellular and ductal areas, surrounded by hyaline and mixoid matrix (H&E, 10X)



FIGURE 2: Intra-operative view



[16] Patrick J, Bradley M. Recurrent salivary gland pleomorphic adenoma: Etiology, management, and results. *Curr Opin Otolaryngol. Head Neck Surg* 2001;9:100-8.

AUTHORS

First Author – Dr.S.P.Lenka, Assistant Professor, Department of OMFS,IDS,BBSR,INDIA.

Second Author – Dr.S.P.Lenka, Assistant Professor, Department of OMFS,IDS,BBSR,INDIA.

Third Author – Dr.Santosh Subudhi, Professor, Department of OMFS, IDS,BBSR,INDIA.

Fourth Author – Dr.Harshmohan Pathak , Assistant Professor, Department of OMFS,BBSR,INDIA.

Fifth Author – Dr.Sujit Sahoo, Assistant Professor, Department of oral pathology,BBSR,INDIA.

FIGURE 5: Histologic of the tumor showing the ductal epithelial and myoepithelial elements with chondromyxoid stroma (H&E, 20X)

REFERENCES

- [1] Waldron CA, Gnepp TR. Tumors of the intraoral minor salivary glands: a demographic and histology study of 426 cases. *Oral surg. Oral med. Oral pathol* 1998 ;66:323-33.
- [2] Lucas RB. Pathology of tumors of the oral tissues. 4th ed. Edinburgh : Churchill livingstone,1984.p. 298.
- [3] Frezell EL. Clinical aspects of tumors of the major salivary glands. *Cancer* 1984;42(7):637-42.
- [4] Torske K. Benign neoplasm of the salivary glands. In: Thompson LDR(ed.) head and neck pathology, 1st edn. Elsevier, Philadelphia, 2006.p. 295-300.
- [5] Seifert GD. Multiple tumors of the salivary glands: terminology and nomenclature. *Eur J Cancer. Oral oncol* 1996;32:3-7.
- [6] Compagno JW. Intranasal mixed tumor. *Am J Clin Pathol* 1977;68: 213-8.
- [7] Vellios F, Shafer WG. Tumors of minor salivary gland. *Surg gynecol Obstet* 1959;108:450-6.
- [8] Toida M, Shimokava K, Makita H, Kato K, Kobayashi A, Kusunoki Y. Intraoral minor salivary gland tumors: A clinicopathological study of 82 cases. *Int J Oral Maxillofac Surg* 2005;34:528-32.
- [9] Gnepp DR. Salivary gland (major and minor) and lacrimal gland. In: Gnepp DR (ed) Diagnostic surgical pathology of the head and neck, 2nd edn, W B Saunders, Philadelphia,2009. p. 434-49.
- [10] Ogata H, Ebihara S, Mukai K. Salivary gland neoplasms in children. *Jpn J Clin. Oncol* 1994;24:88-93.
- [11] Tian Z, Li L, Hu Y, Li J. Salivary gland neoplasm in oral and maxillofacial regions: a 23 year retrospective study of 6982 cases in an eastern Chinese population. *Int J Oral maxillofac Surg* 2009;39:235-42.
- [12] Wang D, Li Y, He H, Liu L, Wu L, He Z. Intraoral minor salivary gland tumors in a Chinese population: a retrospective study on 737 cases. *Oral surg Oral med Oral pathol Oral radiol Endod* 2007;104:94-100.
- [13] Daniels JS, Ali I, Al Bakri IM, Sumangala B. Pleomorphic adenoma of the palate in children and adolescents: A report of 2 cases and review of the literature. *J Oral Maxillofac Surg* 2007;65:541-9.
- [14] Frable WJ, Elazy RP. Tumors of minor salivary glands. A report of 73 cases. *Cancer* 2008;4:932-41.
- [15] Krolls SO, Boyers RC. Mixed tumor of salivary glands: Long term follow up. *Cancer* 2009;30:276-81.

Phytochemical Analysis of Eight Medicinal Plants from Amravati District (MS) India

P. G. Dhawale

Department of Botany, Shri Shivaji College, Akola (MS) India- 444 001

Abstract- The preliminary phytochemical analysis of eight medicinal plants from Amravati District (MS) was done. The plants were *Abutilon indicum* L. (Swart), *Euphorbia hirta* L., *Ficus hispida* L. f., *Melia azedarach* L., *Phyllanthus reticulatus* Poir., *Psidium guajava* L., *Vitex negundo* L., *Vitex pinnata* L. Qualitative phytochemical analysis of these plants confirms the presence of various phytochemicals like alkaloids, flavonoids, steroids and terpenoid. The presence of these phytochemicals can be correlated with medicinal potential of these plants.

Index Terms- Medicinal plants, Phytochemical analysis, alkaloids, flavonoids, steroids and terpenoid

I. INTRODUCTION

World plant biodiversity is the largest source of herbal medicine and still about 60 – 80 % world population rely on plant based medicines which are being used since the ancient ages as traditional health care system. It is now clear that, the medicinal value of these plants lies in the bioactive phytochemical constituents that produce definite physiological effects on human body. These natural compounds formed the base of modern drugs as we use today Edeoga et al., (2005), Akinmo-laudn et al., (2001), Rout et al., (2009).

Phytoconstituents are the natural bioactive compounds found in plants. These phytoconstituents work with nutrients and fibers to form an integrated part of defence system against various diseases and stress conditions. Phytochemicals are basically divided into two groups, i.e. primary and secondary constituents; according to their functions in plant metabolism. Primary constituents comprises common sugars, amino acid, proteins and chlorophyll while secondary constituents consists of alkaloids, terpenoids, steroids and flavonoids, so on. The present study revealed the qualitative phytochemistry of seven medicinal plants used by the peoples of Amravati district (MS) India, to cure various ailments.

II. MATERIAL AND METHODS

1. Material collection and sample processing :

The plant material was collected from the local area and identified taxonomically in the Department of Botany, Shri Shivaji College, Akola (MS). The voucher specimens were deposited in the Departmental herbarium.

A small scale extraction was carried out view of preliminary analysis. The dried plants materials (1-5g) was extracted with methanol at room temperature the methanol was decanted after 24 hours and extraction repeated three times. The pooled extracts were filtered and then concentrated under vacuum using rotary evaporator at 40 °C .

2. Qualitative Analysis of Phytoconstituents :

Preliminary phytochemical tests of methanol extracts/ powdered sample of each plant was carried out as described by Harborne (1973) , Edeoga et al., (2005) and Krishnaiah et al ., (2009) .

III. RESULTS AND DISCUSSION

The present investigation was carried out on eight plants to study the presence of medicinally active phytochemicals in the medicinal plants from Amravati District (MS) India (Table-1). The results are summarized in table 2 . Alkaloids are found in *A.indicum* L. (Sweet), *F. hispida* L.f., *M. Azedarach* L ., flavonoid are present in *E. hirta* L., *M. azedarach* L., *P. guajava* L . The steroids their presence in *A. indicum* L. (Sweet), *E. hirta* L., *M. azedarach* L., *P. reticulatus* Poir., *P.guajava* L., *V.negundo* L., *V.pinnata* L. and Terpenoid are present in *A. indicum* L. (Sweet), *F. hispida* L. f., *M. azedarach* L., *P. Reticulates* Poir., *V. negundo* L., *V. pinnata* L. (Table-2).

The above results indicate that, the plants investigated are rich in alkaloids, flavonoids, steroids, terpenoids. They are known to show medicinal potential and physiological activities (Sofowara.1993). Our results are also in analogy with previous reports . Edeoga et al.,(2005),Jigna et al., (2005) , Okwu et al ., (2001) ., Kawale et al ., (2009) ,Koche et al ., (2010) . Thus the plants under investigation showed their medicinal potential and can be a source of useful drugs.

Table 1
Medicinal uses of plants under investigation

Botanical Name	Family	Uses to cure
<i>Abutilon indicum</i>	malvaceae	Leprosy , ulcer , headache, bladder infection , incrses semen in men, act as tonic .
<i>Euphorbia hirta</i>	Euphorbiaceae	Asthma,antipruritic, carminative.
<i>Ficus hispida</i>	Verbinaceae	Diabetes .
<i>Melia azedarch</i>	Meliaceae	Stomach irritation , vomiting ,diarrhoea .
<i>Phyllanthus reticulatus</i>	Euphorbiaceae	Anaemia , burn, leaf use as diuretic .
<i>Psidium guajava</i>	Myrtaceae	Diarrhoea, dysentery , stomach upset andregular menstrual periods .
<i>Vitex negundo</i>	Verbinaceae	Cough , bronchitis,asthma ,act as tonic .
<i>Vitex pinnata</i>	Verbinaceae	Stomch ache ,fever .

Table 2
Preliminary Photochemistry of seven selected medicinal plants

Plant Extacts	Part	Alkaloid	Flavonoid	Steroid	Terpenoid
<i>A. indicum</i>	Rt	+	-	+	+
<i>E. hirta</i>	Lf	-	+	+	-
<i>F. hispida</i>	Ft	+	-	-	+
<i>M.azedarch</i>	Lf	+	+	+	+
<i>P. reticulatus</i>	Lf	-	-	+	+
<i>P. guajava</i>	Lf	-	+	+	-
<i>V. negundo</i>	Lf	-	-	+	+
<i>V. pinnata</i>	Lf	-	+	+	+

Ft: fruit , Lf : leaf , Rt : root .

(+) Indicate presence of phytochemicals and (-) Indicate absence of phytochemicals.

REFERENCES

- [1] Edeoga, HO, Okwu , DE and Mbaebie, BO(2005) Phytochemical constituents of some Nigerian medicinal plants, African J. Biotech 4(7): 685- 688.
- [2] Akinmo-laudn, AC, Ibukun, EO, Afor, E, Obuotor, EM and Farombi, EO (2007) Phytochemical constituents and antioxidant activity of extracts from leaves of *O. Gratissimum* , Sci. Res. Essay, 2: 163-166.
- [3] Rout, SP, Choudhary, KA, Kar, DM, Das, L and Jain, A (2009) Plants in traditional medicinal system- future source of new drugs, Internl. J. Pharmacy & Pharmaceurical Sci. 1 (1) : 1-23.
- [4] Harborne, JB (1973) Phytochemical methods , London, Chapman & Hall Ltd. Pp. 49-188.
- [5] Krishnaiah, D, Devi, T, Bano, A and Sarbatly, R (2009) Studies on phytochemical constituents of six Malaysian medicinal plants, J. Medicinal PI Research 3(2):67-72.
- [6] Jigna, P, Rathish, N and Sumitra P (2005) Preliminary screening of some folklore medicinal plants from western India for potential antimicrobial activity, Indian J.Pharmac. 37 (6): 408-409.
- [7] Okwu, DE (2001) Evaluation of chemical composition of indigenous species and flavoring agents, Global J. Pure & Appl. Sci. 7 (3): 455-459.
- [8] Kawale, MV and Choudhary, AD (2009) Phytochemistry of *Phyllanthus niruri*. Bioinfolets 5(2): 8-9. [9]
- [9] Koche, D , Shirsat , R , Imran , S and Bhadange , D ,G (2010) Phytochemical screening of eight traditionally used ethnomedical plants from Akola district (MS) India, Internl. J. Pharma and Bio Sci., 1(4): 256-260.

AUTHORS

First Author – P. G. Dhawale, Department of Botany, Shri Shivaji College, Akola (MS) India- 444 001, Email: purudhawale@gmail.com

Comparative Study of Solifenecin Alone Versus Solifenecin with Duloxetine in Patients of Overactive Bladder

Anusha Vohra^{*}, Sanjay Khanna^{**}, Pratap Shankar^{***}, Rakesh Verma^{****}, R. K. Dixit^{*****}

^{*}Assistant Professor Pharmacology Mahatma Gandhi Medical College Jaipur

^{**}Assistant Professor Pharmacology Hind Institute of Medical Sciences Barabanki

^{***}Ph.D Pharmacology King George's Medical University Lucknow

^{****}Lecturer Pharmacology R.I.M.S Safai Etawah

^{*****}Professor Pharmacology King George's Medical University Lucknow

Abstract- Aims and Objective- Present study was undertaken to see and compare the effect of solifenecine alone and solifenecine with duloxetine therapy in patients with overactive bladder.

Material Methods:- The study was done on the patients with overactive bladder. The patients were diagnosed clinically by the physician and urologists. Before enrolling in the study each patient was asked to give a written consent. The outcome measures were evaluated in form of reducing the frequency, urgency and other clinical symptoms. Simultaneously we also measured the quality of life of the patients using accepted scale.

Results and Conclusion:- Present study showed that addition of duloxetine with solifenecine has definitely produced better clinical improvement in patients as well as the quality of life was also improved. Though minor side effects increased by this addition but overall quality of life was better in patients on combination therapy as compared to the single solifenecine treatment.

Index Terms- Overactive bladder, Quality of life, Duloxetine, Solifenecine

I. INTRODUCTION

Overactive bladder (OAB) is defined as a "symptom syndrome suggestive of lower urinary tract dysfunction" characterized by "urgency, with or without urge incontinence, usually with frequency and nocturia (Wein AJ. et al., 2002; Abrams P, et al. 2002) [1,2]. Typically occurring without a recognizable underlying etiologic factor, OAB is a diagnosis of exclusion, intuitively considered to be related to detrusor overactivity (DO). OAB has significant negative impact on the quality of life (QOL). As such, QOL issues encompass physical, psychological and social functioning, overall life satisfaction, perception of health status, and pain (Lieberman JN. et al., 2001; Chancellor M. B., et al. 2008; Abrams P, et al. 2000) [3,4,5]. The World Health Organization (WHO) estimated that urinary incontinence affects nearly 200 million people worldwide (Stewart WF. et al., 2003)[6]. OAB is a common condition that affects millions of people worldwide and OAB-associated urge urinary incontinence (UUI, 'wet' OAB) is especially prevalent in older women (Rovner and Wein 2002)[7]. OAB occurs as a result of abnormal and involuntary contractions of the detrusor

muscle in the bladder, which is embedded by muscarinic receptors (M_2 and M_3 subtypes). Stimulation of M_2 and M_3 receptors by acetylcholine causes bladder contractions that lead to urination (Chu FM. et al., 2006; Erdem N. et al., 2006)[8,9]. Normally, the detrusor muscle remains at rest as the bladder is filled by urine (filling phase). However, it contracts during the filling phase in patients with OAB. Therefore, muscarinic receptor antagonists (antimuscarinic agents) are considered the mainstay of pharmacologic treatment for OAB.

Solifenecine belongs to a class of medications called anticholinergics. It is a bladder-selective, muscarinic (M_1 and M_3) receptor antagonist. Solifenecine works by relaxing the bladder muscles to prevent urgent, frequent, or uncontrolled urination, by competitively inhibiting acetylcholine from binding to cholinergic receptors. It reduces smooth muscle tone in the bladder, allowing the bladder to retain larger volumes of urine and reducing the number of micturition, urgency and incontinence episodes. As it is highly receptor (M_3) specific, it has lesser incidence of side effects like dry mouth and constipation (Cardozo L. et al., 2004; Smulders RA. et al., 2004; Ohtake A. et al., 2004) [10,11,12].

Duloxetine, the dual serotonin (5-HT)/ nor epinephrine (NE) reuptake inhibitor, modulates lower urinary tract function through selective inhibition of 5-HT and NE reuptake sites. It works centrally at Onuf's nucleus to increase activity of the pudendal nerve. It facilitates sphincter activity during urine storage but not during voiding, maintaining the bladder-sphincter synergy (Norton PA. et al., 2004) [13]. Treatment planning for patients with OAB must be based on clinical evidence of efficacy for the drugs chosen, individual patient psychological illness, and an assessment of the probable benefits of treatment versus its associated adverse effects. The present study aimed at evaluating better treatment with more efficacy, better safety profile and positive impact in quality of life in patients of OAB. The objective of this study was to assess and compare the effects of solifenecine alone versus solifenecine with duloxetine in patients suffering from over active bladder.

II. MATERIALS AND METHODS

Study design

This was an open, parallel, prospective and randomized study and was carried out in outpatient in the department of medicine of Era's Lucknow Medical College and Hospital (ELMC&H), Lucknow and department of urology of Chatrapati Shahuji Maharaj Medical university (CSMMU) Lucknow, to compare the effect, quality of life and safety profile in patients suffering from over active bladder treated with Solifenacin alone versus Solifenacin with Duloxetine. The total duration of the study was 18 months (Fig. 1).

Eligibility of patients

The clinical criteria for the diagnosis of over active bladder were accordingly as recommended by Wein and Abrams (Abrams P.et al., 2003) [14]. Possibility of OAB due to other causes was excluded by clinical history, clinical examination and investigations of the patients.

Parameters of study

(A) **OAB-V8 Questionnaire** asks about how much patient have been bothered by selected bladder symptoms during the past 4 weeks with 8 questions (OAB-V8 Questionnaire). Scoring was given from 0 to 5 where 0 indicates no symptom at all and 5 indicates a very great deal of symptom (Coyne K.et al., 2002); (B) **OAB-q short form symptom bother** includes questions which assess the effect of OAB on quality of life and interference with daily activities. It uses 13 items to assess interference with activities of daily life (OAB-q short form symptom bother). Each question uses a 6-point interference scoring from 1 to 6 where 0 indicating no interference and 6 indicating complete interference). After completing all the questions we took the mean of all the parameters by adding the score and dividing them by 13. This mean score of OAB-q short form symptom bother was later on used for statistical comparisons (Coyne K.et al., 2002) [15]and (C) **Safety assessment study noted** all the adverse events in each treatment group. Safety of treatment was assessed by using list of adverse events in both the treatment groups.

Initial evaluation

The patients were included in the study after proper diagnosis and fulfilling the inclusion/exclusion criteria with informed consent. A standardized initial evaluation, which included a complete clinical history, clinical examination, investigations were done at initial screening visit and assessment of OAB and assessment of QOL was done at the time of 1st visit (day0).

Treatment groups with drugs studied

Eligible patients fulfilling the mentioned criteria were randomized by card method into two treatment groups (Groups A and B) depending on the drugs prescribed. In Group A, eligible 35 patients (20 males and 15 females) were given tablet solifenacin, 5 mg available as tablet Solitan, manufactured by Ranbaxy Pharmaceuticals, once daily after breakfast for 8 weeks. In Group B, eligible 37 patients (20 males and 17 females) were given tablet solifenacin, 5mg once daily after breakfast and duloxetine 40 mg available as capsule Duzela, manufactured Sun Pharmaceuticals, twice daily after breakfast and after meal at night for 8 weeks.

Follow-ups for clinical assessment

Patients were requested to come after 4 weeks and again the same assessment of OAB and QOL were done at the IInd visit. Adverse events in each treatment group were noted at the IInd visit. Repetition of the same work was done after 8 weeks at the IIIrd visit.

Outcome measures

Comparison of responses obtained by group A (solifenacin) and group B (solifenacin + duloxetine) on day 0, after 4 weeks and after 8 weeks were done within the groups and in between the groups. There were two types of comparisons:

1- Intra group's comparison (within A and B groups): Visit I (day 0) versus Visit II (after 4 weeks); Visit I (day 0) versus Visit III (after 8 weeks); Visit II (4 weeks) versus Visit III (after 8 weeks).

2-Inter group's comparison (in between A and B groups): Visit I (solifenacin) versus Visit I (solifenacin + Duloxetine); Visit II (solifenacin) versus Visit II (solifenacin + Duloxetine); Visit III (solifenacin) versus Visit III (solifenacin + Duloxetine).

Statistical methods

Data were summarized as Mean \pm SD. Groups were compared by using two factor repeated measures analysis of variance (RMANOVA) and the significance of mean difference within and between the groups was done by Newman-Keuls post hoc test. Discrete (categorical) data were subjected with χ^2 test. A two-tailed ($\alpha=2$) probability $p<0.05$ was considered to be statistically significant. All analyses were performed on STATISTICA (version 6.0) while graphs were done on Graph Pad Prism (version 3.0). For each treatment, a percent mean change (from initial to final or final to initial) was also calculated as:

$$\% \text{ change} = \frac{\text{Mean}_1 - \text{Mean}_2}{\text{Mean}_1} \times 100$$

where, $\text{Mean}_1 > \text{Mean}_2$ and $\text{Mean}_1 =$ Mean of Ist group; $\text{Mean}_2 =$ Mean of IInd group.

III. RESULTS

All 72 eligible patients (40 males and 32 females) aged ≥ 18 were divided into two groups, Group A with 35 patients (20 males and 15 females) were given tablet solifenacin 5 mg once daily after breakfast for 8 weeks and Group B with 37 patients (20 males and

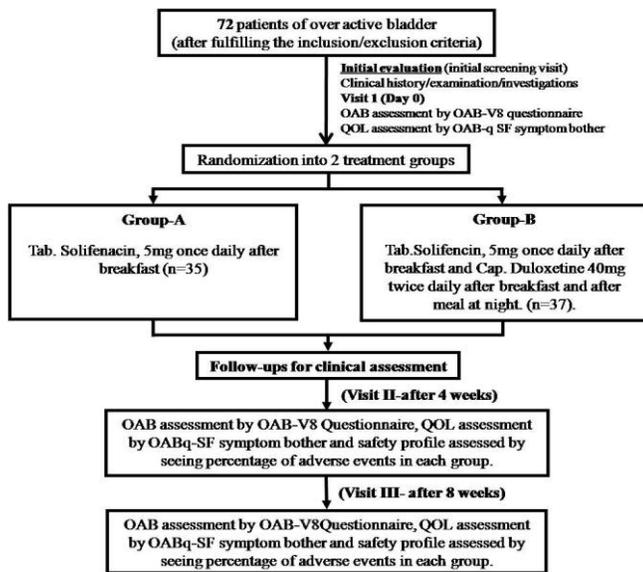


Fig. 1: Flow Chart of the study

17 females) were given tablet solifenacin, 5mg once daily after breakfast and duloxetine 40 mg twice daily after breakfast and after meal at night for 8 weeks. In the patients of OAB three main assessments were done in each group:-

A. Assessment of OAB by OAB-V8 questionnaire

OAB-V8 questionnaires in patients of two treated groups over the periods showing comparison of scores of all the 8 conditions (i. frequent urination during day time hrs?; ii. an uncomfortable urge to urinate?; iii. a sudden urge to urinate with little or no warning?; iv. accidental loss of small amount of urine?; v. night time urination?; vi. waking up at night to urinate?; vii. an uncorrelated urge to urinate? and; viii. urine loss associated with a strong desire to urinate?). On the basis of above scores the total (overall) scores of OAB-V8 questionnaires in patients of two treated groups over the periods were summarized. In both the treatments, the mean scores of total OAB-V8 questionnaires decreases with the time (wks) and the decrease (improvement) was evident more in patients those who received the Duloxetine + Solifenacin (64.2%) than those who received the Solifenacin (37.4%) (Table 1 & Fig. 2). In other words, the effect size of Duloxetine + Solifenacin was 1.7 times higher than the Solifenacin alone.

Table 1: OAB-V8 questionnaire scores summary (Mean ± SD) of two groups

Treatment groups	Periods			% mean change (day 0 - 8 wks)
	day 0	4 wks	8 wks	
Solifenacin (n=35)	4.41 ±0.29	3.49 ±0.34	2.76 ±0.29	37.4%
Duloxetine + Solifenacin (n=37)	4.45 ±0.30	2.51 ±0.47	1.59 ±0.24	64.2%

n= number of patients

For each treatment, comparing the mean scores of OAB-V8 questionnaires between the periods (within groups), the mean scores of OAB-V8 questionnaires decreased significantly (p<0.05 or p<0.01) in both the treatments at 4 wks and 8 wks as compared to day 0. Further, in both the treatments, the means of OAB-V8 questionnaire also decreased significantly (p<0.05) at 8 wks as compared to 4 wks. Similarly, for each period, comparing the mean scores of OAB-V8 questionnaires between the treatments (between groups), the mean scores of OAB-V8 questionnaires in two treatments did not differed (p>0.05) at day 0 while differed (p<0.05 or p<0.01) at both 4 wks and 8 wks. In other words, the mean scores of OAB-V8 questionnaire at both 4 wks and 8 wks lowered more in subjects those who received the Duloxetine + Solifenacin than those who received the Solifenacin. Improvement (reduction in OAB scores ≥2) in each individual questions asked in OAB-V8 questionnaire is seen in two groups from beginning to end of treatment. The data obtained is assessed and comparison is done in between the two groups. This shows that improvement in questions 4, 7 and 8 does not show much difference in between the two groups as compared to other questions.

Overall OAB-V8 questionnaire scores

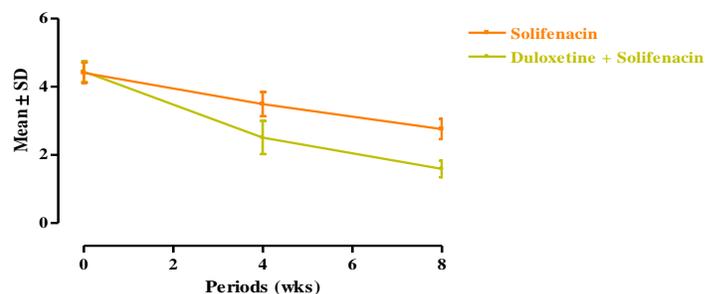


Fig. 2: Mean (± SD) scores of OAB-V8 questionnaires over the periods in patients treated with Solifenacin and Duloxetine + Solifenacin.

B. Assessment of Overall Quality of Life by OAB-q short form symptom bother

In both the treatments, the overall quality of life (QOL) scores improves (decrease) with the time (wks) and the improvement was evident more in patients those who received the Duloxetine + Solifenacin (69.5%) than those who received the Solifenacin (49.4%). In other words, for improvement in overall QOL, the Duloxetine + Solifenacin was 1.4 times more better than the Solifenacin. For each treatment, comparing the mean QOL scores between the periods (within groups), the overall QOL scores improved significantly (p<0.05 or p<0.01) in both the treatments at both 4 and 8 wks as compared to day 0. Further, in both the treatments, the overall QOL scores also improved significantly (p<0.05 or p<0.01) at 8 wks as compared to 4 wks. Similarly, for each period, comparing the mean QOL scores between the treatments (between groups), the overall QOL scores in two treatments did not differed (p>0.05) at day 0 while differed (p<0.01) at both 4 wks and 8 wks. In other words, the overall QOL scores at both 4 wks and 8 wks improved more in subjects those who received the Duloxetine + Solifenacin than those who received the Solifenacin.

C. Assessment of safety by using list of adverse events

At 4th week and 8th week, the adverse events in patients of two groups were assessed and summarised. In both the groups, the adverse events especially, metabolism and nutrition disorder, skin and subcutaneous tissue disorder, immune system disorders, respiratory disorder and vascular disorder were negligible. However, both the groups showed adverse events such as gastrointestinal disorders, genitourinary disorders, nervous system disorders, eye disorders and psychiatric disorders and were evident higher in patients those who received the Duloxetine + Solifenacin than those who received the Solifenacin. As compared to 8th week, adverse events were evident higher at 4th week in Duloxetine + Solifenacin. However on comparing the adverse events, the proportions of its in two groups were found to be the same i.e. did not differed significantly ($p > 0.05$).

IV. DISCUSSION

The present study aimed at evaluating better treatment with more efficacy, better safety profile and positive impact in quality of life in patients of OAB. The objective of this study was to assess and compare the effects of solifenacin alone versus solifenacin with duloxetine in patients suffering from over active bladder.

For the assessment of OAB, Group A (solifenacin) having baseline mean OAB score 4.41 ± 0.29 . Significant improvements ($p < 0.05$ or $p < 0.01$) in overall OAB scores were observed in all patients at 4th and 8th week (20.9% and 37.4% improvement - table 9) in the form of reduction in frequency (21.9% and 34.8%), urgency (21.8% and 34.2%), urinary incontinence (22.5% and 47.1%) and nocturia (19.18% and 33.6%), respectively when compared with baseline scores. While the previous studies showed improvements in OAB scores were 9 Gittelman, et al. (2003) [16] comparing solifenacin with placebo in large number of patients of OAB ($n = 850-1050$). This study shows that solifenacin 5 or 10mg once daily significantly reduced the mean number of voids per 24 hours versus placebo. Across study, there was 2.19–2.81 (with solifenacin) and 1.2–1.59 (with placebo) fewer voids per 24 hours than at baseline (baseline mean values 11–12). There were significantly greater reductions from baseline in the daily incidence of incontinence (47–67% vs. 28–41%, $p < 0.001$) or urge incontinence (58–66% vs. 35–43%, $p < 0.05$) for recipients of solifenacin 5 or 10mg once daily versus placebo recipients. Solifenacin 5 or 10mg once daily significantly increased the volume of urine voided per micturition versus placebo (by 25–30% vs. 4–11%, $p < 0.01-0.001$). Solifenacin 10 mg/day (but not 5 mg/day) significantly decreased the number of episodes of nocturia per 24 hours compared with placebo. There were 0.71 fewer nocturnal voids per 24 hours (a reduction of 39%) shown. Some differences in results of present study compared to these studies appeared to be clinically important and the power of the analysis to detect differences was limited both by small sample size of present study and by the variability of the measures used in the studies. Group B patients for the assessment of OAB treated with solifenacin + duloxetine the baseline mean OAB scores in this

group of patients was 4.45 ± 0.30 . Significant improvements ($p < 0.05$ or $p < 0.01$) in overall OAB scores were observed in all patients at 4th and 8th week (43.6% and 64.2% improvement) in the form of reduction in frequency (43.4% and 62.0%), urgency (42.1% and 65.6%), urinary incontinence (41.3% and 59.9%) and nocturia (40.8% and 71.3%), respectively when compared with baseline scores. While the previous studies showing the similar positive efficacy. Thor K B, et al. (1995)[17]. In a 12 weeks study conducted by Steers WD, et al. (2007)[18] on 306 women patients efficacy of duloxetine (80-mg/day for 4 weeks increased to 120-mg/day for 8 weeks) was compared with placebo shows significant improvement over those randomized to placebo. There is decrease in voiding episodes (16.8% vs. 5.9%VE/24hrs) and UI episodes (43.5% vs. 9.7%IE/24hrs) and increase in the daytime voiding interval (25.9% vs. 5.4%VI/24hrs). In a study conducted by K. B. Thor, et al. (2007)[19] duloxetine compared with placebo for treating women with symptoms of overactive bladder shows that it is a suitable compound for the treatment of OAB as incontinence, depression and pain share common biochemical imbalances. Mulcahy JJ, et al. (1996) [20], in a study showed no treatment differences between duloxetine 20 mg/day (nine patients) and placebo (eight) in patients with urge UI, after 3 weeks of treatment. A second study compared duloxetine (30 or 40 mg/day) and placebo (16 patients each) treatments for 1 week in patients with neurogenic and non-neurogenic DOA. This study showed no significant differences in the Detrusor Activity Index from an ambulatory urodynamic study at 1 week. The final study (total 68 patients) compared duloxetine (30 or 40 mg/day), oxybutynin (7.5 or 10 mg/day) and placebo treatments for 4 weeks in patients in a crossover design study. There were no significant treatment differences between active treatment and placebo after 4 weeks. The lack of response to duloxetine in these studies was probably the result of the low doses used, and guided the selection of higher doses in subsequent studies.

For the assessment of QOL in group A patients treated by solifenacin alone were having baseline mean QOL scores 5.13 ± 0.23 . Significant improvements ($p < 0.05$ or $p < 0.01$) in overall QOL scores were observed in all patients at 4th and 8th week (27.3% and 49.4% improvement), respectively. While previous studies showing the similar positive impact on QOL of patients of OAB were Haab F, et al. (2005); Cardozo Kelleher CJ, et al. (2005) [21,22]. These studies show the improved quality of life experienced by patients with OAB who received solifenacin 5 or 10mg once daily for 12 weeks was maintained and even further improved during the extension study conducted by. This shows that with 52 weeks of treatment with solifenacin, the quality of life of patients receiving solifenacin improved by 35–48% from baseline in almost all domains. In Group B patients for the assessment of QOL treated with (solifenacin + duloxetine) the baseline mean QOL scores in this group of patients was 5.21 ± 0.29 . Significant improvements ($p < 0.05$ or $p < 0.01$) in overall QOL scores were observed in all patients at 4th and 8th week (38.9 and 69.5% improvement), respectively. While earlier study showing the similar positive impact on QOL of patients of OAB is Steers WD, et al. (2007). It is a 12 weeks study on 306 women patients. In it, efficacy of duloxetine (80-mg/day for 4 weeks increased to 120-mg/day for 8 weeks) and its effect on QOL of OAB patients was compared with placebo.

Which shows significant improvement over those randomized to placebo in I-QOL scores (14.7%) at both doses of duloxetine.

For the assessment of Safety in Group A patients treated with solifenacin the adverse effects observed were mainly dry mouth (5.7%), constipation (5.7%) and dry eyes (5.7%). Similar adverse effects were observed by earlier 12 weeks studies showing the tolerability profile of solifenacin 5 or 10mg once daily. These studies show that solifenacin was generally well tolerated. The most frequently reported adverse events with 5 and/or 10mg administered once daily in short term study and long term study conducted by were dry mouth, constipation and blurred vision, which were mostly of mild or moderate intensity. The incidence of adverse events is numerically greater with solifenacin 10mg once daily than with 5mg once daily in short- or long-term studies. Dry mouth was reported 10%-21% of patients receiving solifenacin 5 or 10 mg once daily, numerically higher incidence in 10 mg group, constipation occurred in 10% and blurred vision in 7% of patients. In Group B for the assessment of safety patients treated with solifenacin + duloxetine the adverse effects observed in this group were mainly dry mouth (18.9%), nausea (21.6%), constipation (10.8%), dizziness (10.8%), vision blurred (8.1%), and dry eyes (8.1%). The safety profile of duloxetine in this study is nearly identical to the safety profile established in women with SUI shown in a study conducted by Hurley DJ, et al. (2006)[23].

Some differences in percentage of adverse events as compared to present study may be due to combination therapy with solifenacin, small sample size and by the variability of the measures used in the studies. On comparing individually each symptom of OAB in OAB-V8 questionnaire, the improvement in scores ≥ 2 in patients taking solifenacin alone versus patients taking duloxetine + solifenacin from day 0 to 8th week shows that 4th (accidental loss of small amount of urine), 7th (An uncorrelated urge to urinate) and 8th (urine loss associated with a strong desire to urinate) symptoms does not show much variation between the two groups. Will adding some other drug instead of duloxetine show much more improvement in these symptoms? Other drugs can be further studied either alone or in combination with solifenacin which may show much more improvement in above symptoms of OAB.

REFERENCES

- [1] Wein AJ, Rovner ES (2002). Definition and epidemiology of overactive bladder. *Urol* 60(1):7-12.
- [2] Abrams P, Cardozo L, Fall M et al. (2002). The standardization of terminology of lower urinary tract function: report for the standardization subcommittee of the International Continence Society. *Neurourol Urodyn* 21:167-78.
- [3] Liberman JN, Hunt TL, Stewart WF (2001). Health-related quality of life among adults with symptoms of overactive bladder: results from a US community-based survey. *Urol* 57(6):1044-1050.
- [4] Chancellor MB, et al. (2008). A comparison of the efficacy of darifenacin alone vs. darifenacin plus a Behavioural Modification Programme upon the symptoms of overactive bladder. *Int J Clin Pract* 62(4):606-613.
- [5] Abrams P, Kelleher C, Kerr LA, Rogers RG (2000). Overactive bladder significantly affects quality of life. *Am J Manag Care* 6:S580-90.
- [6] Stewart WF, Van Rooyen JB, Cundiff GW (2003). Prevalence and burden of overactive bladder in the United States. *World J Urol* 20:327-336.

- [7] Rovner ES, Wein AJ (2002). Incidence and prevalence of overactive bladder. *Curr Urol Rep* 3:434-438.
- [8] Chu FM, Dmochowski R (2006). Pathophysiology of overactive bladder. *Am J Med* 119:3S-8S
- [9] Erdem N, Chu FM (2006). Management of overactive bladder and urge urinary incontinence in the elderly patient. *Am J Med* 119:29S-36S.
- [10] Cardozo L, Lisek M, Millard R, et al. (2004). Randomized, double-blind placebo controlled trial of the once daily anti-muscarinic agent solifenacin succinate in patients with overactive bladder. *J Urol* 172(5):1919-24.
- [11] Smulders RA, Krauwinkel WJ, Swart PJ, Huang M (2004). Pharmacokinetics and safety of solifenacin succinate in healthy young men. *J Clin Pharmacol* 44(9):1023-1033.
- [12] Ohtake A, Ukai M, Hatanaka T (2004). In vitro and in vivo tissue selectivity profile of solifenacin succinate (YM905) for urinary bladder over salivary gland in rats. *Europ J Pharmacol* 492(2-3):243-250.
- [13] Norton PA, Zinner NR, Yalcin I et al (2004). Duloxetine versus placebo in the treatment of stress urinary incontinence. *Am J Obstet Gynecol* 187:40-48.
- [14] Abrams P, Cardozo L, Fall M, et al. (2003). The standardization of terminology in lower urinary tract function: report from the standardization sub-committee of the international continence society. *Urol* 61:37-49.
- [15] Coyne K, Lal J, Zyzanski T, Kopp Z, Avery K, Abrams P. (2002). An overactive bladder symptom and quality of life, short form: Development of the overactive bladder questionnaire (OAB-Q) short form (sf). *Urol* 61(6):563-574.
- [16] Gittelman M, Chu FM, Klimberg I (2003). Two randomized, double-blind, placebo-controlled, parallel-group, fixed-dose, multicenter studies assess the efficacy and safety of daily oral administration of 10 mg YM905 versus placebo in male and female subjects with overactive bladder. *J Urol* 169: 349.
- [17] Thor KB, Katofiasc MA (1995). Effects of duloxetine, a combined serotonin and norepinephrine reuptake inhibitor, on central neural control of lower urinary tract function in the chloralose-anesthetized female cat. *J Pharmacol Exp Ther* 274:1014.
- [18] Steers WD, Herschorn S, Kreder KJ, Moore K, Strohhahn K, Yalcin I, Bump RC (2007). Duloxetine OAB Study Group: Duloxetine compared with placebo for treating women with symptoms of overactive bladder. *BJU Int* 100(2):337-45.
- [19] Thor KB, Morgan C, Nadelhaft I et al. (2007). Duloxetine for urinary incontinence, depression and pain. *Int J Clin Pract* 61(8):1349-1355.
- [20] Mulcahy JJ, Laddu AR, Faries DE (1996). Efficacy and safety of duloxetine in stress incontinence patients. *Neurourol Urodyn* 15:395-396.
- [21] Haab F, Cardozo L, Chapple C (2005). Long-term open-label solifenacin treatment associated with persistence with therapy in patients with overactive bladder syndrome. *Eur Urol* 47(3):376-84.
- [22] Kelleher CJ, Cardozo L, Chapple CR (2005). Improved quality of life in patients with overactive bladder symptoms treated with solifenacin. *BJU Int* 95(1):81-85.
- [23] Hurley DJ, Turner CL, Yalcin I, Viktrup L, Saygani SK (2006). Duloxetine for the treatment of stress urinary incontinence: an integrated analysis of safety. *Eur J Obstet Gynecol Reprod Biol* 125:120-128.

AUTHORS

First Author – Anusha Vohra, Assistant Professor
Pharmacology Mahatma Gandhi Medical College Jaipur
Second Author – Sanjay Khanna, Assistant Professor
Pharmacology Hind Institute of Medical Sciences Barabanki
Third Author – Pratap Shankar, Ph.D Pharmacology King
George's Medical University Lucknow
Fourth Author – Rakesh Verma, Lecturer Pharmacology
R.I.M.S Safai Etawah
Fifth Author – R. K. Dixit, Professor Pharmacology King
George's Medical University Lucknow

Correspondence Author – Pratap Shankar, Ph.D (Department of Pharmacology and Therapeutics), K.G.M.U. Lucknow.226003, Email. – pratap.mbi@gmail.com, Mobile-9454691251

Design and Analysis on Scramjet Engine Inlet

Aqheel Murtuza Siddiqui¹, G.M.Sayed Ahmed²

¹ Research Assistant, Muffakham Jah College of Engineering & Technology., Hyderabad-500034

² Senior Assistant professor, Muffakham Jah College of Engineering & Technology., Hyderabad-500034

Abstract- Generally a Scramjet Engine starts at a hypersonic freestream Mach no. 5.00. In order to propel to those speeds, we use turbojet engines which propel to around 3.00-4.00 Mach and from there the ramjet picks upon and starts to propel to start the scramjet engine. If we reduce the scramjet engine starting Mach number to say 3.50 or 4.00, we can eliminate one propulsion engine, i.e., ramjet engine and thus reducing weight and complexity. The design for such a scramjet engine is carried out in this project considering only the inlet designs and the flow analysis is carried out in CFD. A two dimensional analysis is carried out in this project. GAMBIT is used to create a model. FLUENT is used to cover the flow analysis.

Index Terms- CFD Analysis , Design of Scramjet, Mach Number 4.00, Inlet Ramps, k-ε Turbulence Model, Manipulation of Pure Scramjet, Scramjet Engine, Shock Capturing.

I. INTRODUCTION

In order to provide the definition of a scramjet engine, the definition of a ramjet engine is first necessary, as a scramjet engine is a direct descendant of a ramjet engine. Ramjet engines have no moving parts, instead operating on compression to slow freestream supersonic air to subsonic speeds, thereby increasing temperature and pressure, and then combusting the compressed air with fuel. Lastly, a nozzle accelerates the exhaust to supersonic speeds, resulting in thrust. Due to the deceleration of the freestream air, the pressure, temperature and density of the flow entering the burner are “considerably higher than in the freestream”. At flight Mach numbers of around Mach 6, these increases make it inefficient to continue to slow the flow to subsonic speeds. Thus, if the flow is no longer slowed to subsonic speeds, but rather only slowed to acceptable supersonic speeds, the ramjet is then termed a ‘supersonic combustion ramjet,’ resulting in the acronym *scramjet*. Figure 1 below shows a two-dimensional schematic of a scramjet engine.

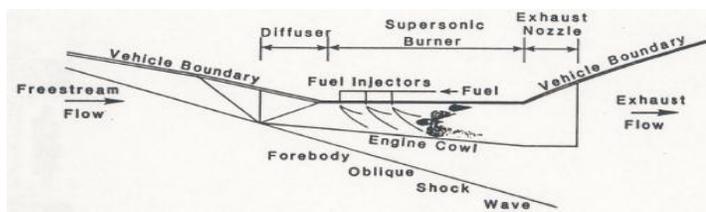


Fig 1: Two-dimensional Schematic of a Scramjet Engine

As in ramjets, a scramjet relies on high vehicle speed to forcefully compress and decelerate the incoming air before combustion (hence *ramjet*), but whereas a ramjet decelerates the air to subsonic velocities before combustion, airflow in a

scramjet is supersonic throughout the entire engine. This allows the scramjet to efficiently operate at extremely high speeds.

II. LITERATURE SURVEY

The scramjet is composed of three basic components: a converging inlet, where incoming air is compressed and decelerated; a combustor, where gaseous fuel is burned with atmospheric oxygen to produce heat; and a diverging nozzle, where the heated air is accelerated to produce thrust. Unlike a typical jet engine, such as a turbojet or turbofan engine, a scramjet does not use rotating, fan-like components to compress the air; rather, the achievable speed of the aircraft moving through the atmosphere causes the air to compress within the inlet. As such, no moving parts are needed in a scramjet. In comparison, typical turbojet engines require inlet fans, multiple stages of rotating compressor fans, and multiple rotating turbine stages, all of which add weight, complexity, and a greater number of failure points to the engine. The parts described above can be seen in figure below.

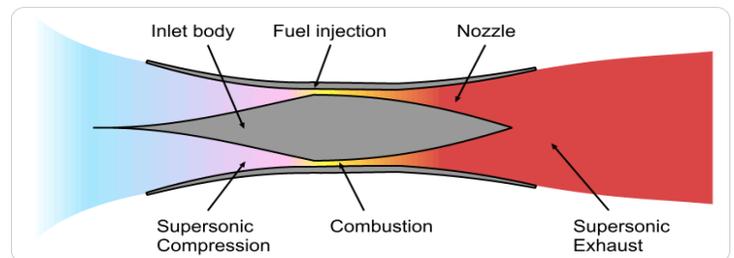


Fig 2: A two dimensional image of a Scramjet Engine

Due to the nature of their design, scramjet operation is limited to near-hypersonic velocities. As they lack mechanical compressors, scramjets require the high kinetic energy of a hypersonic flow to compress the incoming air to operational conditions. Thus, a scramjet powered vehicle must be accelerated to the required velocity by some other means of propulsion, such as turbojet, railgun, or rocket engines. While scramjets are conceptually simple, actual implementation is limited by extreme technical challenges. Hypersonic flight within the atmosphere generates immense drag, and temperatures found on the aircraft and within the engine can be much greater than that of the surrounding air. Maintaining combustion in the supersonic flow presents additional challenges, as the fuel must be injected, mixed, ignited, and burned within milliseconds. While scramjet technology has been under development since the 1950s, only very recently have scramjets successfully achieved powered flight.

III. DESIGN PRINCIPLES

Scramjet engines are a type of jet engine, and rely on the combustion of fuel and an oxidizer to produce thrust. Similar to conventional jet engines, scramjet-powered aircraft carry the fuel on board, and obtain the oxidizer by the ingestion of atmospheric oxygen (as compared to rockets, which carry both fuel and an oxidizing agent). This requirement limits scramjets to suborbital atmospheric flight, where the oxygen content of the air is sufficient to maintain combustion. Scramjets are designed to operate in the hypersonic flight regime, beyond the reach of turbojet engines, and, along with ramjets, fill the gap between the high efficiency of turbojets and the high speed of rocket engines. Turbomachinery-based engines, while highly efficient at subsonic speeds, become increasingly inefficient at transonic speeds, as the compressor fans found in turbojet engines require subsonic speeds to operate. While the flow from transonic to low supersonic speeds can be decelerated to these conditions, doing so at supersonic speeds results in a tremendous increase in temperature and a loss in the total pressure of the flow. Around Mach 3–4, turbomachinery is no longer useful, and ram-style compression becomes the preferred method. Ramjets utilize high-speed characteristics of air to literally 'ram' air through an inlet nozzle into the combustor. At transonic and supersonic flight speeds, the air upstream of the nozzle is not able to move out of the way quickly enough, and is compressed within the nozzle before being diffused into the combustor. The lack of intricate turbomachinery allows ramjets to deal with the temperature rise associated with decelerating a supersonic flow to subsonic speeds, but this only goes so far: at near-hypersonic velocities, the temperature rise and inefficiencies discourage decelerating the flow to the magnitude found in ramjet engines. Scramjet engines operate on the same principles as ramjets, but do not decelerate the flow to subsonic velocities. Rather, a scramjet combustor is supersonic: the inlet decelerates the flow to a lower Mach number for combustion, after which it is accelerated to an even higher Mach number through the nozzle. By limiting the amount of deceleration, temperatures within the engine are kept at a tolerable level, from both a material and combustive standpoint. Even so, current scramjet technology requires the use of high-energy fuels and active cooling schemes to maintain sustained operation, often using hydrogen and regenerative cooling techniques. In a typical ramjet, the supersonic inflow of the engine is decelerated at the inlet to subsonic speeds and then reaccelerated through a nozzle to supersonic speeds to produce thrust. This deceleration, which is produced by a normal shock, creates a total pressure loss which limits the upper operating point of a ramjet engine. For a scramjet, the kinetic energy of the freestream air entering the scramjet engine is large comparable to the energy released by the reaction of the oxygen content of the air with a fuel (say hydrogen). Thus the heat released from combustion at Mach 25 is around 10% of the total enthalpy of the working fluid. Depending on the fuel, the kinetic energy of the air and the potential combustion heat release will be equal at around Mach 8. Thus the design of a scramjet engine is as much about minimizing drag as maximizing thrust. Usable dynamic pressures lie in the range 20 to 200 kilopascals (2.9 to 29 psi), where

$$q = \frac{1}{2} \rho v^2$$

Where,

q is the dynamic pressure of the gas

ρ is the density of the gas

v is the velocity of the gas

To keep the combustion rate of the fuel constant, the pressure and temperature in the engine must also be constant. Because air density reduces at higher altitudes, a scramjet must climb at a specific rate as it accelerates to maintain a constant air pressure at the intake. This optimal climb/descent profile is called a "constant dynamic pressure path". It is thought that scramjets might be operable up to an altitude of 75 km. Fuel injection and management is also potentially complex. One possibility would be that the fuel be pressurized to 100 bar by a turbo pump, heated by the fuselage, sent through the turbine and accelerated to higher speeds than the air by a nozzle. The air and fuel stream are crossed in a comb like structure, which generates a large interface. Turbulence due to the higher speed of the fuel leads to additional mixing. The minimum Mach number at which a scramjet can operate is limited by the fact that the compressed flow must be hot enough to burn the fuel, and have pressure high enough that the reaction be finished before the air moves out the back of the engine.

IV. CURRENT SCRAMJET ENGINE CHALLENGES

There are three main areas that these problems lay in, namely Air Inlet, Combustor, and Structures and Materials. Problems within these areas vary from inlet starting problems to the inherent difficulty of the ignition of the fuel in a supersonic flow, as the possibility of failure exists anywhere from the fuel not igniting to the possibility that the ignition could take place outside of the combustor due to the extraordinary velocity of the air in the engine. Additionally, structures that can withstand the extreme temperatures experienced during hypersonic flight combined with the additional temperatures experienced during combustion are necessary. Despite the wide range of applications possible with scramjet technology, the vehicle must first be propelled to a high enough Mach number for the scramjet to start. This requires, depending on the needed application, one or two additional propulsion systems to propel the vehicle to the needed scramjet start velocity. Current scramjet designs target the start of supersonic combustion to be between Mach 5&6. However, if the necessary scramjet starting Mach number is reduced, a reduction in the number of required additional propulsion systems is possible, as the gap is bridged between the maximum possible velocity of the low speed engine(s) and the scramjet start velocity. This would have direct advantages from the resulting reduction in overall vehicle weight, the lower mass fraction required for the propulsion system (thereby resulting in more available payload weight), and fewer systems that must work in succession reliably, thereby increasing overall vehicle safety. The focus of this project is to address this issue of reducing the starting Mach number.

Unstart in Scramjet engine is characterized by the formation of a strong normal shock wave in the combustor. This

shock wave propagates upstream towards the inlet and eventually reduces significantly the mass flow rate and the thrust generated by the engine. Another expected result is that unstart is more likely if the incoming stream is at a lower Mach number. For the amount of fuel burnt, parameterized by K_c (Fraction of completed combustion); although obviously high values of K_c are more likely to lead to thermal choking, few unstarted realizations with $K_c < 0.85$ were observed. Unstart in a scramjet engine is also characterized by the following reasons: Firstly, since when a supersonic flow is compressed it slows down, the level of compression must be low enough (or the initial speed high enough) not to slow the gas below Mach 1. If the gas within a scramjet goes below Mach 1 the engine will "choke", transitioning to subsonic flow in the combustion chamber. This effect is well known amongst experimenters on scramjets since the waves caused by choking are easily observable. Additionally, the sudden increase in pressure and temperature in the engine can lead to an acceleration of the combustion, leading to the combustion chamber exploding. Secondly, the heating of the gas by combustion causes the speed of sound in the gas to increase (and the Mach number to decrease) even though the gas is still travelling at the same speed. Furthermore forcing the speed of air flow in the combustion chamber under Mach 1 in this way called "thermal choking".

V. SOFTWARES USED

The software's used in this project are GAMBIT and FLUENT. **Gambit** is the program used to generate the grid or mesh for the CFD solver whereas **Fluent** is the CFD solver which can handle both structured grids, i.e. rectangular grids with clearly defined node indices, and unstructured grids. Unstructured grids are generally of triangular nature, but can also be rectangular. In 3-D problems, unstructured grids can consist of tetrahedral (pyramid shape), rectangular boxes, prisms, etc. Fluent is the world's largest provider of commercial computational fluid dynamics (CFD) software and services. Fluent covers general-purpose CFD software for a wide range of industrial applications, along with highly automated, specifically focused packages. FLUENT is a state-of-the-art computer program for modelling fluid flow and heat transfer in complex geometries. FLUENT provides complete mesh flexibility, including the ability to solve your own problems using unstructured meshes that can be generated about complex geometries with relative ease. Supported mesh types include 2D triangular/quadrilateral, 3D tetrahedral/ hexahedral/ pyramid/ wedge/ polyhedral, and mixed (hybrid) meshes. FLUENT is ideally suited for incompressible and compressible fluid-flow simulations in complex geometries.

VI. PROBLEM DESCRIPTION AND SCOPE OF CURRENT WORK

A critical path issue in scramjet development is for scramjet operability to be extended to lower Mach numbers. Specifically, scramjet start should be reduced to "Mach 3.50 while maintains performance at higher Mach numbers within the same flowpath" with minimal variable geometry features and the

use of hydrocarbon fuel. A turbojet engine can provide for thrust from takeoff to a speed of Mach 3 or 4. Therefore, if a scramjet were designed with a starting Mach number of about 3.50, presumably only two propulsion systems would be needed for the entire mission, whether that is up to Mach 8-10 for a hydrocarbon-powered scramjet or up to Mach 15-20 for a hydrogen-powered scramjet. The advantage of this technology is the resulting reduction in overall vehicle weight, lower mass fraction required for the propulsion system, and fewer systems that must work in succession reliably, thereby increasing overall vehicle safety. The method best suited for the current project is then selected.

A. Scramjets: Options for Lowering the Starting Mach Number

The project seeks to lower the starting Mach number to 3.50 and to determine the main factors influencing this ability. There are a number of possible ways to lower the starting Mach number of the scramjet. The methods discussed in the literature are listed and briefly explained here in turn. The method best suited for the current project is then selected.

i. Variable Geometry

In a variable geometry scramjet, the flowpath is changed according to the freestream Mach number to ensure high performance values throughout a wide range of Mach numbers. An example of a program which employed this technique is the HRE program which developed a flight-weight hydrogen-fuelled scramjet designed to operate from Mach 4 to 7 using variable geometry. Though this technique ensures high performance, it is highly complex and instills a high level of inherent risk, as it relies on a large number of moving parts which require large actuation forces.

ii. Hypersonic Dual-Combustor Ramjet (DCR)

The concept of this type of scramjet engine is that a portion of the captured air in the engine is "diverted to a small, embedded subsonic dump combustor into which all of the fuel is injected". The fuel and air are then mixed to a sufficient level in the subsonic combustor, which, essentially, acts as a "hot, fuel-rich gas generator for the main supersonic combustor".

iii. Manipulation of "Pure" Scramjet Engine Key Design Parameters

There are a few key parameters of the "pure" scramjet engine—that is, a scramjet with one combustor and a non-variable flowpath—that are able to be varied and manipulated to perhaps lower the starting Mach number of a scramjet. For instance, as the cycle static temperature ratio (T_3/T_0) increases, the Mach number of the flow entering the burner (M_3) decreases. Thus, T_3/T_0 directly affects the free stream Mach number (M_0) at which the flow entering the burner (M_3) becomes supersonic. Due to this, it is possible that the manipulation of T_3/T_0 would yield a lower free stream Mach number at which supersonic combustion can occur. Additionally, the key design parameters of fuel selection and fuel-to-air ratio (f) for the scramjet may have an impact on the starting scramjet Mach number. A minimal variable geometry features should be used; therefore, exploring the use of variable geometry as a solution to the problem is not an option. Though the concept of the DCR engine may prove effective at lowering the starting Mach number of the scramjet, determining whether the starting Mach number of a

“pure” scramjet can be accomplished should be the first task. Therefore, of these three possible avenues for investigation, the manipulation of the pure scramjet’s key design parameters is the best approach for the current project.

B. Analysis of Key Design Parameters to Reduce Scramjet Starting Mach No.

The goals of this section are as follows: determine what impact the driving design parameters for a scramjet have in lowering the starting Mach number and assess whether a starting Mach number of 3.50 is currently possible or feasible in the future. Table 1 lists the one-dimensional stream thrust performance analysis inputs and how they are determined. As seen in the table, the vast majority of the inputs are set by the freestream Mach number, are properties that remain constant for air, earth, etc., or are assumed based on reasonable values within a typical range. The values for the constant and assumed inputs can be seen in Table 2 below. These values are used throughout the paper for all analysis calculations as needed unless otherwise noted. All assumed values were chosen based on recommendations from reference paper 1. Additionally, all constants were determined based on information in reference paper 1.

Table 1: Performance Analysis Inputs and Corresponding Determination Methods

Performance Analysis Inputs	How Determined
M_0, V_0, T_0, p_0	Set by Mach Number
$C_{pc}, R, C_{pb}, C_{pe}, h_f, g_0$	Constant
$V_{fx}/V_3, V_{fi}/V_3, C_f(A_w/A_3), \eta_c, \eta_b, \eta_e, T^0, p_{10}/p_0, \gamma_c, \gamma_e, \gamma_b$	Assumed
$T_3/T_0, f, h_{pr}$	Variation

For one-dimensional flow analysis, there are only three inputs that are able to be varied to alter performance results. These are the cycle static temperature ratio (T_3/T_0), the fuel selected, and the fuel-to-air ratio (f). But here we are concentrating only on cycle static temperature ratio (T_3/T_0).

Table 2: Stream Thrust Inputs: Values for Constant and Assumed Values

Constants [1]	
C_{pc}	1090.00 J/kgK
R	289.3 (m/s) ² /K
C_{pb}	1510.00 J/kgK
C_{pe}	1510.00 J/kgK
h_f	0.00
g_0	9.81 m/s ²
Assumed Values [1]	
V_{fx}/V_3	0.50
V_{fi}/V_3	0.50
$C_f \cdot A_w/A_3$	0.10
η_c	0.90
η_b	0.90
η_e	0.90
T^0	222.00 K
p_{10}/p_0	1.40
γ_c	1.362
γ_e	1.238
γ_b	1.238

C. Preliminary Calculation of Cycle Static Temperature Ratio T_3/T_0 Necessary for Starting Mach Number of 3.50

Due to the large design impact of T_3/T_0 , this subsection will present the theory and governing equations that the preliminary investigation of this parameter requires. The largest factor in changing the freestream Mach number at which supersonic combustion begins is the cycle static temperature ratio, T_3/T_0 . As T_3/T_0 increases for a given freestream Mach number (M_0), the Mach number of the flow entering the combustor decreases. Thus, T_3/T_0 directly affects the M_0 at which the flow entering the burner (M_3) becomes supersonic. So, with a range of freestream Mach numbers, the necessary T_3/T_0 can be determined based on M_0 and the ratio of specific heats at compression (γ_c) where $M_3=1$ by the following equation.

$$M_3 = \sqrt{\frac{2}{\gamma_c - 1} \left\{ \frac{T_0}{T_3} \left(1 + \frac{\gamma_c - 1}{2} M_0^2 \right) - 1 \right\}} \dots \quad (1)$$

The following subsection will detail methods which will more accurately weigh all of the design parameters’ influences.

D. Analysis: Variation Of Cycle Static Temperature Ratio Influence: Impact on Lowering the Starting Scramjet Mach Number

The cycle static temperature ratio (T_3/T_0) has a powerful impact on the starting Mach number of a scramjet. As Equation 1 shows, T_3/T_0 , the ratio of specific heats during compression (γ_c), and the freestream Mach number (M_0) are the only variables which determine the burner entry Mach number (M_3). The specific heat ratio can be considered constant in the compression component. With the requirement that $M_3 > 1$ to ensure supersonic combustion, lowering M_0 can apparently be achieved by lowering T_3/T_0 . Therefore, T_3/T_0 has perhaps the greatest impact on whether it is possible to lower the scramjet starting Mach number. Thus, it is necessary to determine what the required value of T_3/T_0 is to achieve a starting scramjet Mach number of 3.50. Using Equation 1 with a range of freestream Mach numbers, and $\gamma_c=1.36$, the necessary T_3/T_0 for each freestream starting Mach number can be determined where $M_3 \geq 1$. According to the calculations in the reference papers, with generic values chosen for the fuel properties and the fuel-to-air ratio, the maximum T_3/T_0 for a scramjet with a starting Mach number of 3.50 to maintain supersonic combustion is 1.25 (with no available margin), which hardly requires any compression at all. Although a T_3/T_0 value exists for lowering the starting scramjet Mach number to 3.50, the overall performance values are quite low. Though scramjet overall efficiencies are commonly around 50%, and are often as low as 30%, the overall efficiency here is only 9%. This is a very low efficiency and one that severely impedes any possible benefits for starting the scramjet at $M_0=3.50$. Also, the values of specific impulse and specific thrust are significantly reduced with a value of T_3/T_0 this low. Therefore, this section has shown that further investigation of the remaining design parameters is needed to aid in lowering the scramjet starting Mach number, so that the T_3/T_0 value may be selected at a higher value closer to the value of 2.75. On the

other hand, it is found out that a Mach no. of 4.00 is both feasible and practicable. Hence we take Mach 4.00 as the free stream Mach no. and carry out our analysis. The design of compression systems is characterized by the cardinal number of oblique shock waves available to produce a specified cycle static temperature ratio at a specified Mach number and in the cases when more than one shock wave is specified, all oblique shock waves must provide equal amounts of geometric turning of the flow. The compression sequence is assumed to begin at the leading edge of the vehicle. The input values are M_0 , T_3/T_0 , γ , and the number of desired oblique shock waves. The number of oblique shock waves has a direct impact on the compression efficiency (η_c). It is from these values and plotting the graph that an educated guess can be made as to how many shock waves are necessary based on the M_0 , T_3/T_0 , and the desired compression efficiency. It should be noted that the higher the number of oblique shock waves, the longer the compression system will be. Also, with more oblique shocks, more off-design complications will exist.

VII. DESIGN OF A SCRAMJET WITH STARTING MACH NUMBER OF 4.00

It is from the calculations from previous equations that concluded that a scramjet with a starting freestream Mach number of 4.00 is both currently feasible and worthwhile. The scramjet will be designed to operate from Mach 4.00 to Mach 10. Though Mach 3.50 would provide more of a margin, a Mach 4.00 starting scramjet is still a feasible choice, as a turbojet engine is capable of providing “thrust from takeoff up to a Mach of 3-4”. Therefore, the benefits of having a lower starting Mach number scramjet would still be possible as a vehicle using this system would only require two propulsion systems, therefore reducing overall vehicle weight and complexity. Mach 10 is still used as the upper limit for the design of the flowpath. Waltrup states that the “maximum freestream Mach number of a hydrocarbon-fuelled scramjet-powered vehicle flying at 47.88 MN/m² trajectory would be between Mach 9 and 10”. Therefore, in order to ascertain the overall vehicle performance of a Mach 4.00 starting scramjet across the entire possible performance range, Mach 10 is used as the upper limit of the flight path. This section will detail the design process for the flowpath of a scramjet with a starting $M_0=4.00$, $T_3/T_0=2.80$ obtained from reference papers. The design process includes the design of the compression system, isolator, combustion system, and expansion system. This section will detail the theory and equations behind the design process conducted for inlet/compression system of the scramjet engine component. The combustion system and expansion system are not in the scope of this project as this project only deals with the inlet part. The values and other data are directly taken from reference papers. The inlet part will be discussed here, and the other data are directly taken from other reference papers.

A. Compression System and Inlet Design

The goal of the compression system in a scramjet engine is to “provide the desired cycle static temperature ratio (T_3/T_0) over the entire range of vehicle operation in a controllable and reliable manner with minimum aerodynamic losses (i.e., maximum compression efficiency or minimum entropy increase”. This

compression, for the one-dimensional analysis used throughout this project, relies on oblique shock waves. Normal shock wave compression is reserved for ramjets as it is able to offer “reasonable performance for $0 < M_0 < 3$,” whereas for Mach numbers greater than 3, the “normal shock losses become unacceptably high and oblique shock compression becomes necessary”.

There are three options for the application of oblique shock waves in a scramjet, as listed and defined below: *Internal Compression*: All oblique shock compression waves occur inside of the engine’s inlet. This is difficult to design and complex flows are produced at off-design Mach numbers *External Compression*: All oblique shock compression waves occur outside of the engine’s inlet, utilizing the vehicle’s forebody. The waves generally focus on and terminate at the cowl lip. *Mixed Internal and External Compression*: Mixtures of internal and external oblique shock compression waves are used. Compared to external compression, this method has, in general, less of an entropy increase, but the overall length required for the shock system is greater. This method “decouples[s] the engine cowl angle from the amount of compression and can result in a cowl that is parallel to the freestream flow”. As an internal compression system is highly complex in design, the choice for this project is between an external compression system and a mixed internal and external compression system. The decision between these two options is generally based on practical integration issues. Since this project is a preliminary analysis based on one-dimensional flow and integration issues are not yet visible, mixed internal and external compression will be used as it allows for a cowl that is parallel to the free stream flow. Due to the complex nature of flow in a compression system, CFD analysis or physical experiments are often needed. However, for a preliminary study, estimation will suffice. Therefore, the following assumptions are made for the compression system design process: **1.** One-dimensional flow; boundary layer is represented only by its average effect on flow properties. **2.** Air is represented as a calorically perfect gas. **3.** Heat transfer to or from the wall will be neglected. With these assumptions, the software tool HAP (Gas Tables) can be used to calculate the performance of the resulting compression system. This tool accompanies the Reference 1 text and calculates the compression system’s oblique shock wave configuration for the given number of oblique shock waves, the freestream Mach number, and the static cycle temperature ratio specified. The output is the resulting properties at the exit of the compression system (Station 2), the required turning angle for each shock wave to turn the flow through to accomplish the overall required compression, the static pressure ratio, the adiabatic compression efficiency, and the kinetic energy efficiency.

VIII. SCRAMJET DESIGN WITH FREESTREAM STARTING MACH NO. 4.00

The starting Mach number also serves as the on-design case or the engine flowpath as it is the limiting operation Mach number. This section will integrate the three components of the scramjet engine

Inlet Compression System Height and Length

Determining the height of the compression system as it varies axially is found by using two equations. Before these two equations are discussed, however, please refer to Fig-3 for the coordinate axes convention utilized for all ensuing equations and calculations.

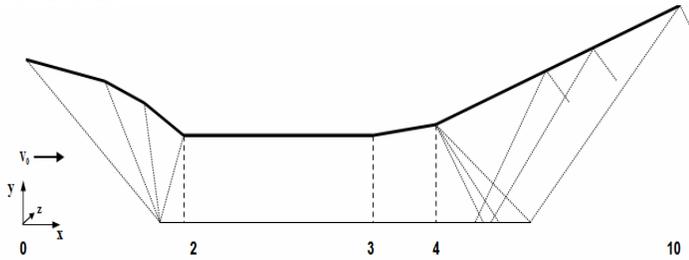


Fig 3: Coordinate Axes Convention for Scramjet Engine Designed & Conceptual Diagram of Four Oblique Shock System for Scramjet

With this convention in place, it is possible now to display the equations used for calculating the height h along the y -axis as it varies axially, that is, along the x -axis.

$$h_n = \frac{A_n}{A_2} (h_2) \quad \dots (2)$$

Where, n = point on the x -axis; A = area.

Equation 3 is valid when the depth into the page (d) is constant for the length between two given station numbers. In other words, it is valid when $d_2 = d_n$ along the z -axis due to the following:

$$\text{For } \frac{A_n}{A_2} = \frac{h_n d_n}{h_2 d_2},$$

when $d_2 = d_n$,

$$\frac{A_n}{A_2} = \frac{h_n}{h_2} \quad (3)$$

Therefore, using Equation 2, it is possible to calculate the height of the inlet at any given point along the compression system if the ratio of the area at that point to the area at the beginning of the isolator (A_n/A_2) is known. In the design of the inlet compression system, an output parameter produced by HAP (Gas Tables) is the area ratio of the area after each oblique shock to the inlet area at Station 0 (A_n/A_2). This information can be used to generate A_n/A_2 after each oblique shock using Equation 4 below.

$$\frac{A_n}{A_2} = \frac{A_n/A_0}{A_2/A_0} \quad (4)$$

With the value of A_n/A_2 determined, the height of the compression system as it varies axially can therefore be determined by using Equation 2 above and the value of h_2 , which is equal to 0.152 m, a value determined during the combustor design process.

The determination of the compression system length is an approximation using simple geometry and the properties of the compression system as depicted in Figure 3

The first three oblique shocks converge on the cowl lip of the engine, as seen in Figure 3 above. The value of x_0 as depicted in the figure provides a good estimation of the length of the first three oblique shocks at $M_0=4.00$ using Equation 5

$$x_0 = h_0 \tan(90 - \beta_1)$$

(5)
 Where, β_1 = wave angle of first oblique shock;
 h_0 = height of engine inlet.

In order to find the best estimate of the length of the compression system, the length covered by the fourth and last oblique shock must be determined. This is done by Equation 6 below.

$$x_1 = \frac{h_0}{\sin \delta}$$

(6)
 Where, δ = degrees each oblique shock turns flow through

Once x_0 and x_1 have been determined, the total estimated length of the compression system can be determined by summing these two values. The axial distance after each shock wave along the flowpath can then be determined by simple geometry, using the results for the height as described above. Performing the necessary calculations for both the height and length of the compression system, the data in Table 3 is obtained.

Table 3: Inlet Compression System Axial Height and Length for a Design Point of Mach 4.00

i	x (m)	A/A ₂	h (m)
0	0.000	7.622	1.159
0a, after OS 1	2.534	3.679	0.559
0b, after OS 2	3.017	2.087	0.317
0c, after OS 3	3.149	1.355	0.206
0d, after OS 4	3.190	1.000	0.152

Plotting the height as a function of axial location shows the two-dimensional view of the scramjet's inlet compression system.

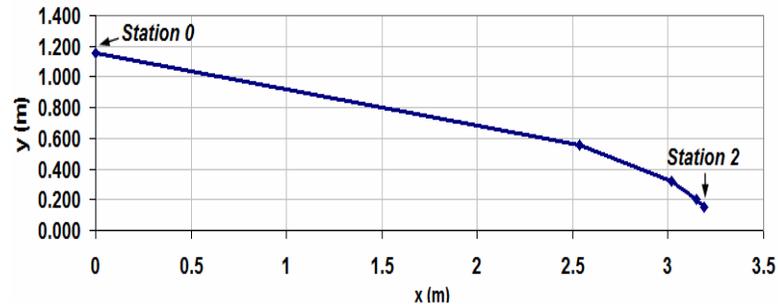


Figure 4: Inlet Compression System Two-Dimensional Schematic for a Design Point of Mach 4.00

IX. CFD METHOD

Modelling is the representation of a physical system by a set of mathematical relationships that allow the response of the system to various alternative inputs to be predicted. In Computational Fluid Dynamics, we model the physical system involving fluid flow within the definite boundaries by the set of mathematical equations usually in differential form and obtain the numerical solution of these governing equations describing the fluid flow by the use of computational methods. The governing equations may include: the set of the Navier-Stokes equations, continuity equation, and any additional conservation equations, such as energy or species concentrations. The fluid flow is modelled by the governing equations, which show the effect of the governing phenomena on the fluid flow. These governing phenomena may include: conduction, convection, diffusion, turbulence, radiation and combustion. The following is brief description of the governing equations.

A. Governing Equations

Continuity Equation

Considering the law of conservation of mass the continuity equation,

$$\frac{\partial \rho}{\partial t} + u \cdot \text{div}(\rho) + \rho \cdot \text{div}(u) = 0 \quad \text{---- (7)}$$

In the given equation the first term is the rate of change of density. In the second and the third terms the divergence div is the flux density or flux/volume. The first two terms show the two ways the density of the fluid element changes. If we assume the incompressibility condition i.e. density of the fluid is constant, the above equation reduces to, $\text{div}(u) = 0$.

Momentum Equations

Also known as Navier and Stokes equations, these are derived for a viscous flow and give the relationships between the normal/shear stresses and the rate of deformation (velocity field variation). We can obtain these equations by making a simple assumption that the stresses are linearly related to the rate of deformation (Newtonian fluid), the constant of proportionality for the relation being the dynamic viscosity of the fluid. The Navier and Stokes equation for i -th coordinate direction can be stated as

$$\frac{\partial(\rho u_i)}{\partial t} + \frac{\partial(\rho u_i u_j)}{\partial x_j} = -\frac{\partial p}{\partial x_i} + \frac{\partial \tau_{ij}}{\partial x_j} + F_i \quad \text{---- (8)}$$

Where τ_{ij} is the viscous force tensor and F_i represents a body force in the i -th coordinate direction. In practical situations of combustion, all fluids are assumed to be Newtonian and the viscous stress tensor is:

$$\tau_{ij} = \mu \left\{ \frac{\partial u_i}{\partial x_j} + \frac{\partial u_j}{\partial x_i} \right\} - \frac{2}{3} \mu \delta_{ij} \left\{ \frac{\partial u_k}{\partial x_k} \right\} \quad \text{---- (9)}$$

Where μ is the molecular viscosity which depends on the fluid.

The Kronecker delta is $\delta_{ij} = 1$, if $i = j$, 0 otherwise.

k-ε Turbulence Model

Turbulent flows are characterized by fluctuating velocity fields. These fluctuations mix transported quantities such as momentum, energy, and species concentration, and cause the transported quantities to fluctuate as well. The simplest of “complete models” of turbulence are two-equation models in which the solution of two separate transport equations allows the turbulent velocity and length scales to be independently determined. The standard k - ϵ model in FLUENT falls within this class of turbulence model and has become the workhorse of practical engineering flow calculations in the time since it was proposed by Launder and Spalding. Robustness, economy, and reasonable accuracy for a wide range of turbulent flows explain its popularity in industrial flow and heat transfer simulations. It is a semi-empirical model, and the derivation of the model equations relies on phenomenological considerations and empiricism. The standard k - ϵ model is a semi-empirical model based on model transport equations for the turbulence kinetic energy (k) and its dissipation rate (ϵ). The model transport equation for ‘ k ’ is derived from the exact equation, while the model transport equation for ‘ ϵ ’ was obtained using physical reasoning and bears little resemblance to its mathematically exact counterpart. These two quantities are related to the primary variables and can give a length scale and time scale to form a quantity with dimension of ν_T , thus making the model complete (no more flow-dependent specifications are required).

The turbulence kinetic energy, k , and its rate of dissipation, ϵ , are obtained from the following transport equations:

$$\frac{\partial}{\partial t}(\rho k) + \frac{\partial}{\partial x_j}(\rho k u_j) = \frac{\partial}{\partial x_j} \left[\left(\mu + \frac{\mu_t}{\sigma_k} \right) \frac{\partial k}{\partial x_j} \right] + G_k + G_b - \rho \epsilon - Y_M + S_k \quad \text{---- (10)}$$

$$\frac{\partial}{\partial t}(\rho \epsilon) + \frac{\partial}{\partial x_j}(\rho \epsilon u_j) = \frac{\partial}{\partial x_j} \left[\left(\mu + \frac{\mu_t}{\sigma_\epsilon} \right) \frac{\partial \epsilon}{\partial x_j} \right] + \rho C_{1\epsilon} S_\epsilon - C_{2\epsilon} \rho \frac{\epsilon^2}{k + \sqrt{\nu \epsilon}} + C_{3\epsilon} \frac{\epsilon}{k} G_b + S_\epsilon \quad \text{---- (11)}$$

- G_k represents the generation of turbulence kinetic energy due to the mean velocity gradients, G_b is the generation of turbulence kinetic energy due to buoyancy,
- Y_M represents the contribution of the fluctuating dilatation in compressible turbulence to the overall dissipation rate
- $C_{1\epsilon}$, $C_{2\epsilon}$ and $C_{3\epsilon}$ are constants. σ_k and σ_ϵ are the turbulent Prandtl numbers for k and ϵ , respectively. S_k and S_ϵ are user-defined source terms.

X. GAMBIT MODELLING AND FLUENT ANALYSIS OF SCRAMJET ENGINE WITH STARTING MACH NUMBER OF 4.00

The analysis is carried out by initially creating the design in “Gambit” and meshing in the same and then is transferred to “Fluent” for analysis. The model which was obtained, will be

created in GAMBIT by the regular procedure. The model in this project is a 2-d model. In Gambit the key thing for analysis is meshing. The meshing had to be dense near the inlet of the engine when compared to the rest of the domain. For creating a model, the tables 3 & 4 will help us create the Inlet and Combustion sections. The height of the exhaust as discussed earlier is 2.8175m. The length of the exhaust is also mentioned in that section as 8.15m and therefore the data for modelling the main (upper) part of the engine is done. Now for the other part of the engine (lower part), it extends from the end of x_0 and beginning of x_1 in the inlet part in figure 5 to the point where l_4 culminates and where l_{10} in the exhaust part starts as shown in figure 6.

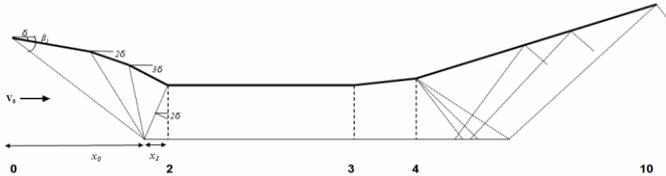


Fig 5: Conceptual Diagram of Four Oblique Shock System for Scramjet

The length x_1 is calculated using geometrical relations for 2δ , x_1 and h_2 . Using geometry, we can write the relation as:
 $\tan 2\delta = x_1 / h_2 \dots (12)$

We know that δ value is 17.52 from θ - β -M relations for $\beta=30^\circ$. And the value of β is derived geometrically from the figure 5 as the heights of h_0 and h_1 are known to us. Using the 2δ value, we substitute in equation 12 and we derive x_1 .

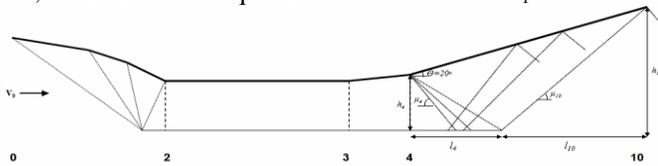


Fig 6: Expansion System Conceptual Diagram for Calculating Length

Thus as we know the values, with the help of tables derived earlier, we can summarize the values for the geometry as:

❖ INLET VALUES:

Upper Body:

1. (X, y): (0, 1.159) - 0.3)
2. (X, y): (2.534, 0.559) - 0.3)
3. (X, y): (3.017, 0.317) - 0.8)

Lower Body:

1. (X, y): (3.1138, - 0.3)
2. (X, y): (8.5190, - 0.3)
3. (X, y): (4.4651, - 0.8)

4. (X, y): (3.149, 0.206) - 0.8)
5. (X, Y): (3.190, 0.152)

4. (X, y): (7.1677, - 0.8)

❖ COMBUSTOR VALUES:

1. (X, y): (3.190, 0.152)
2. (X, y): (4.104, 0.152)
3. (X, y): (4.107, 0.152)
4. (X, y): (5.019, 0.283)

❖ EXHAUST VALUES:

1. (X, y): (13.169, 2.8175)

INLET RAMPS

Four different models are created in the analysis, namely: Single Ramp, Double Ramp, Tri Ramp and Four Ramps. The ramp angles were obtained in the analysis part in earlier and the ramps are varied in the following way: For a Single ramp engine model, all inlet values will not be considered, inlet values (upper body) of 1 and 5 will directly be joined and values 2, 3 and 4 are not taken into account. 1 and 5 points are directly joined and the line joining points 1 and 5 is the single ramp of the engine model. For Double ramp engine model, inlet values (upper body) of 1, 2 and 5 are joined and values 3 and 4 are not taken into account. Lines joining points 1-2, 2-5 form two ramps of the engine model. For a Tri ramp engine model, inlet values (upper body) of 1, 2, 3 and 5 are joined and 4th value is not considered. Lines joining the points 1-2, 2-3, 3-5 form three ramps of the engine model. For Four ramp engine model, all inlet values (upper body) are joined. Lines joining 1-2, 2-3, 3-4 and 4-5 form four ramps of engine model.

Using these values, we create the desired model, domain and mesh it. The lower part of the inlet is same for all the models, be it Single/Double/Tri/Four ramp model. The denser the mesh is, the more precise is the result we achieve. As this project is on the inlet part of the engine, we dense the mesh more on the inlet part than in other areas of the domain. Few domains were tried out in the process and a couple of them were found to be appropriate for the project. The final product of the design in GAMBIT is transferred to FLUENT. Results are captured for mach numbers, pressure and temperature. The efficiency and performance of the models are discussed based on Compression efficiency and temperature ratio (T_3/T_0).

CFD ANALYSIS

Initially analysis was done with less dense mesh in Gambit and the results were not in any way closer to the analytical values. Therefore in order to get more precise values, we mesh the model denser to around 100,000 elements for all the four ramps individually.

Initially analysis was done with less dense mesh in Gambit and the results were not in any way closer to the analytical values. Therefore in order to get more precise values, we mesh the model denser to around 100,000 elements for all the four ramps individually.

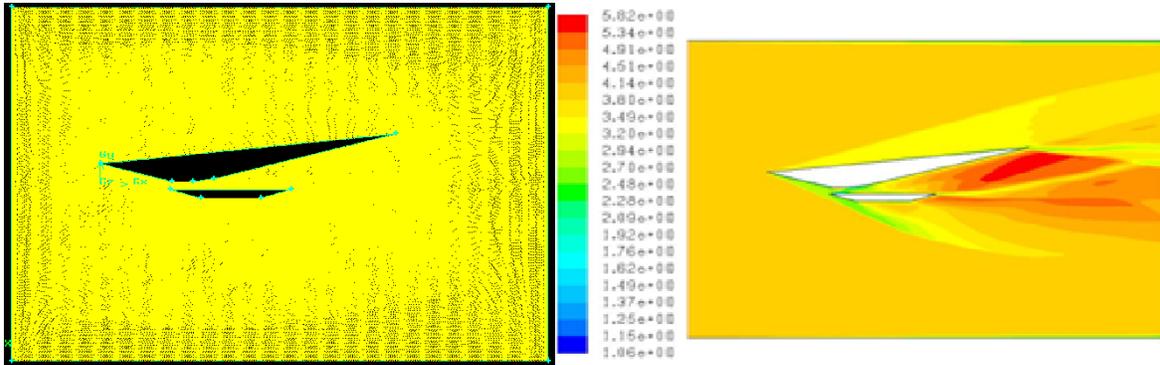


Fig 7: Model for Single Ramp with around 100,000 elements in GAMBIT & Velocity Contour for the above model in FLUENT

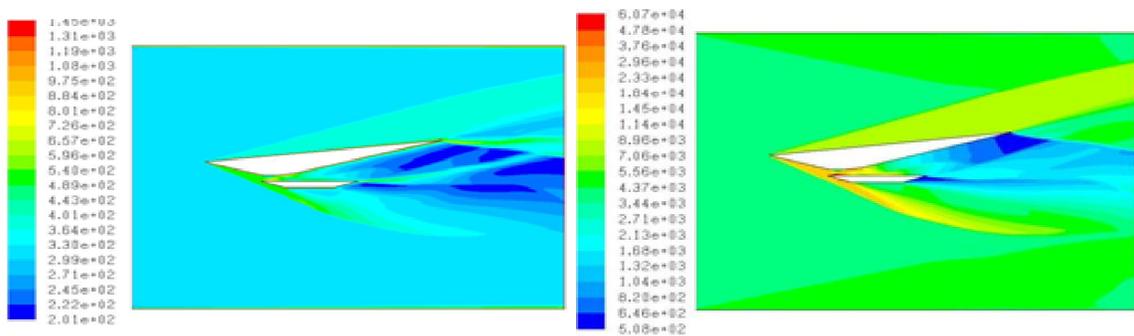


Fig 8: Temperature & Pressure Contour for single ramp for above model

From the above four figures shocks can be visualised due to which the change in flow parameters like Mach number, pressure and temperature can be obtained. The above model is with single ramp such that single shock is obtained but the compression efficiency is very less. So, to increase the

compression efficiency it is desired to increase the number of oblique shocks by increasing the number of ramps. The next model is with double ramp to get two shocks. After analysing the following flow contours have been captured

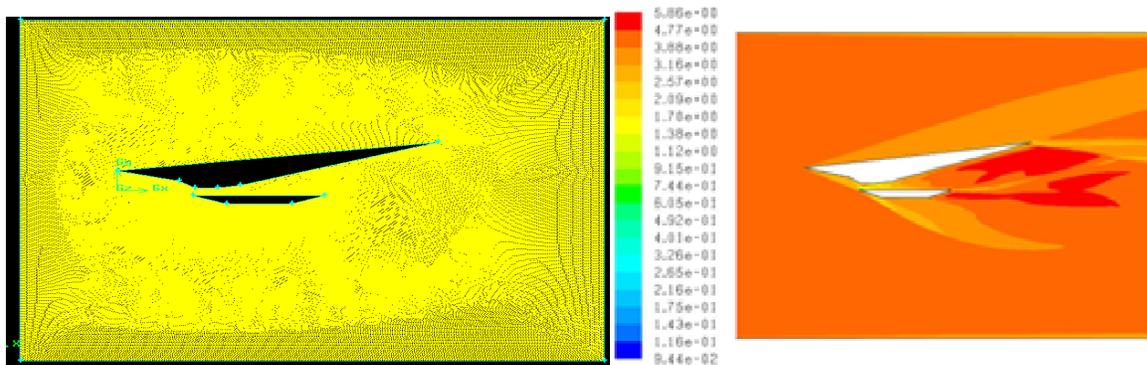


Fig 9: Model for Double Ramp with around 100,000 elements in GAMBIT and Velocity Contour for the above model in FLUENT

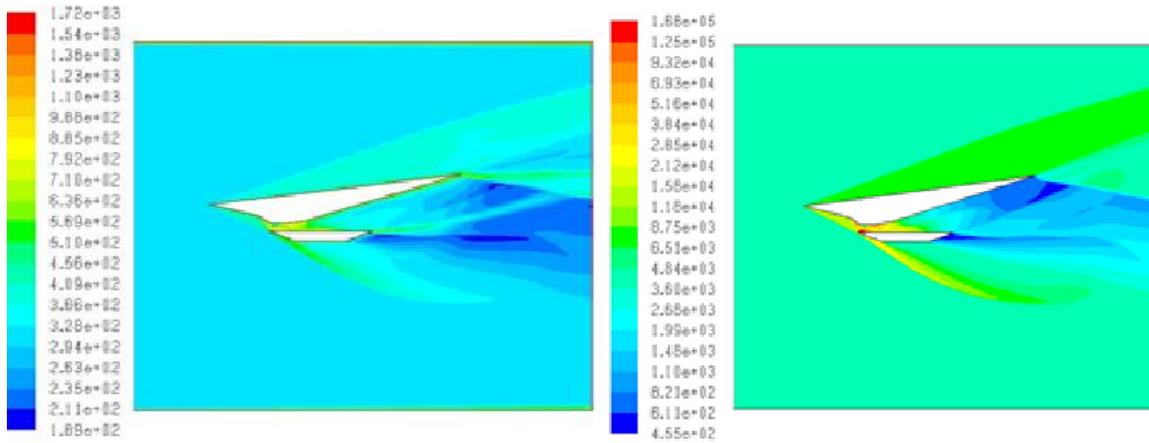


Fig 10: Temperature & Pressure Contour for double ramp for above model

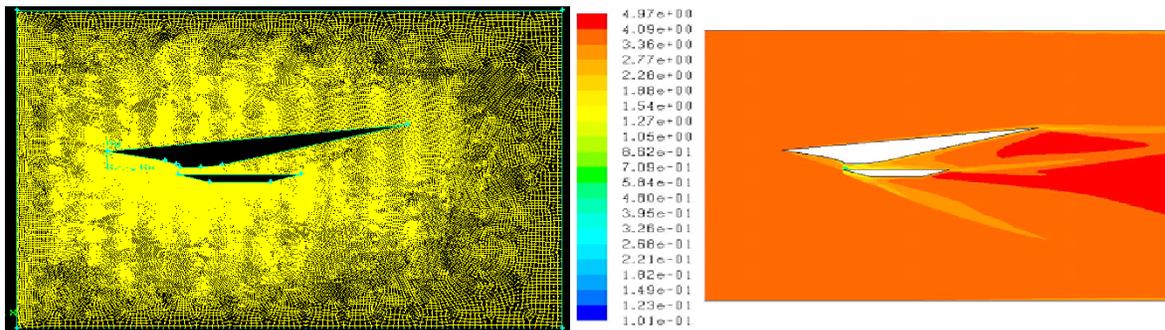


Fig 11: Model for Tri Ramps with around 100,000 elements in GAMBIT and Velocity Contour for tri ramp for above model.

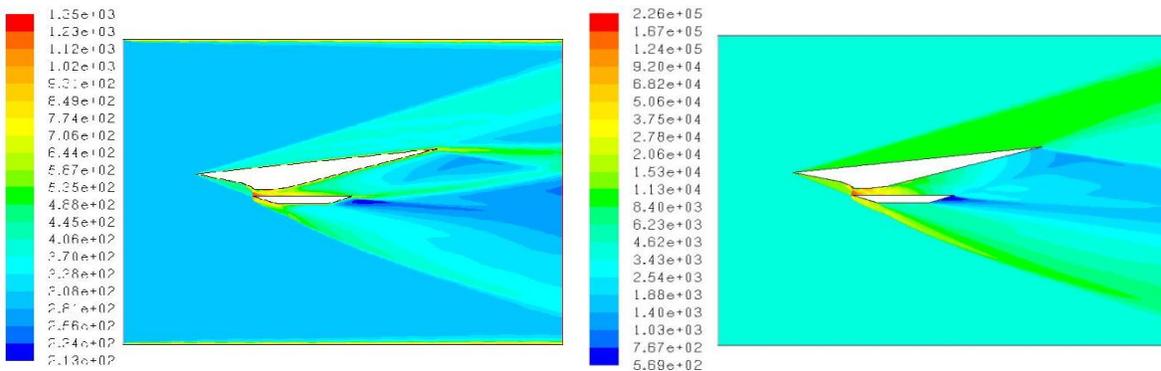


Fig 12: Temperature & Pressure Contour for tri ramp for above model

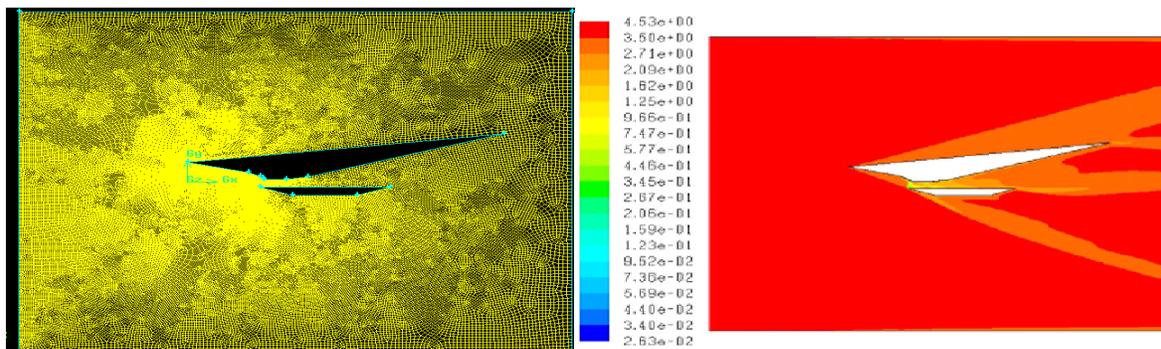


Fig 13: Model for Four Ramps with around 100,000 elements in GAMBIT and Velocity Contour for four ramp for above model

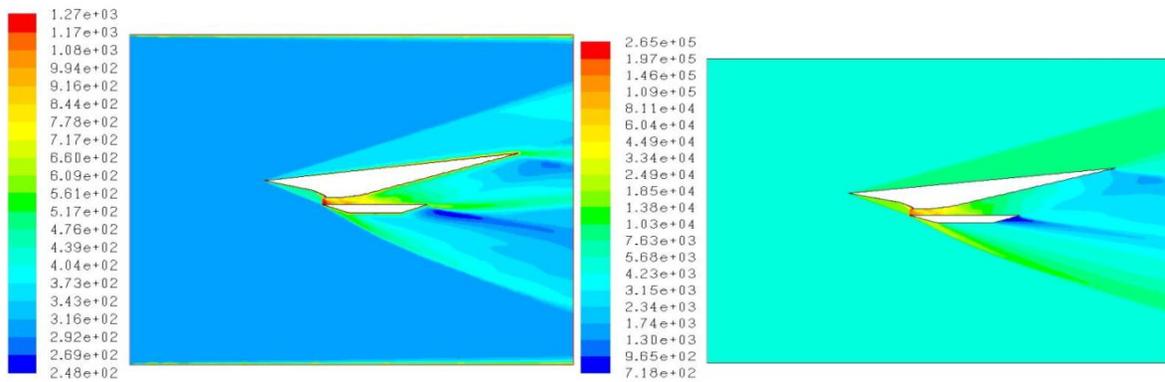


Fig 14: Temperature & Pressure Contour for four ramp for above model

The results of all the above models are tabulated in the table 4 below. Further discussions are made after the table

Table 4: Result Summary of all the models discussed above

Ramps	Mach No. CFD	Mach No. Analytical	T ₃ /T ₀ CFD	T ₃ /T ₀ Analytical	P ₃ /P ₀ CFD	P ₃ /P ₀ Analytical
Single	2.62	3.1	2.07	1.41	13.4	8.3
Double	2.21	2.45	2.25	1.86	21.8	19.7
Tri	1.81	1.93	2.64	2.32	29.23	29.4
Four	1.51	1.47	2.85	2.8	35.4	34.69

We can observe that the final model, i.e., four ramp model with around 175,000 elements is very close to the theoretical result of M₃=1.58. It was evident from the analysis that results were better achieved with four ramps amongst all tried ramps. As discussed earlier, a turbojet engine can provide thrust from take off to a speed of Mach 3 or 4. Therefore, if the scramjet is designed applied to a hypersonic cruiser it could

presumably allow for a reduction in total propulsion system. The analysis done also supports the theory with concrete evidence in the results tabulated above with small difference in values. Off-design conditions were also checked out with four ramp model with Mach Numbers 3,6,8,10 but the results were not desirable and moreover, Mach number 3 and 10 gave unstart related problems.

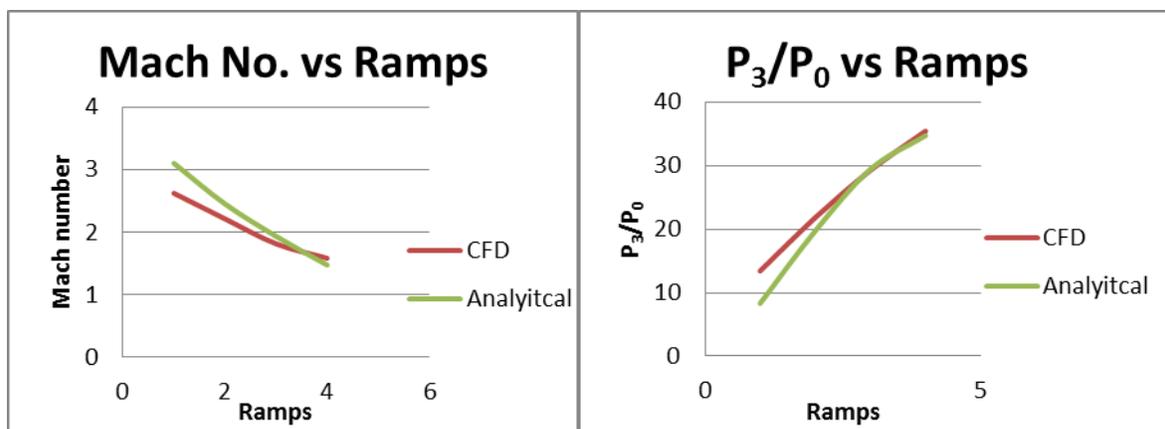


Fig 15: Mach number vs Ramps & P₃/P₀ vs Ramps

XI. CONCLUSION& RECOMMENDATIONS

The purpose of this paper was to determine at which lower freestream Mach number the Scramjet Engine will start so as to reduce the weight of the craft by eliminating one of the propulsion system while performance is maintained in the same

flowpath at the higher, off-design Mach numbers and to define how it could be accomplished. Hence, a Scramjet engine was then modelled in GAMBIT and analysis was carried out in FLUENT for the same with different design models. It was found out that a model with starting Mach number of 4.00 was feasible as it matched the theoretical values with CFD values. Amongst all designs, a design with four ramps yielded better results than

the other designs. By this Analysis we can conclude the “K-epsilon turbulence model exactly simulates the flow field characteristics in supersonic and hypersonic conditions” in capturing shocks at leading edges and shock trains in the isolator and etc. The present analysis shows that with this design Starting Mach number of Scramjet can be reduced to Mach number 4 but with the same design Scramjet is facing the unstarting conditions for off design Mach number of 3 and 10.

At the closing of this report, it is evident that there are important areas which call for future research and analysis. The first of these is that analysing three dimensional scramjet inlet and the next is application of a fully designed expansion system employing the use of method of characteristics or CFD codes. This will enable more precise calculations of performance, as well as provide more realistic overall engine lengths to be obtained, as the nozzle does not have to be fully expanded to freestream conditions to gain a satisfactory amount of thrust. As for the practical design of this scramjet, the use of cavity-based fuel injectors should be explored. Additionally, the method of fuel-air mixing, combustion time required, and overall potential benefit of cooling scramjet with the fuel should be explored. For the next step in the design of this particular scramjet, higher fidelity analysis methods should be employed, to ensure that frictional effects would prove interesting and provide direction towards the application of this engine.

Second Author – G.M.Sayeed Ahmed, Senior Assistant professor, Muffakham Jah College of Engineering & Technology. Hyderabad-500034, gmsa609@yahoo.com

REFERENCES

- [1] Heiser, William H., David T. Pratt, Daniel H. Daley, and Unmeel B. Mehta. Hypersonic Airbreathing Propulsion. Washington, D.C.: American Institute of Aeronautics and Astronautics, 1994.
- [2] Curran, Edward T., "Scramjet Engines: The First Forty Years." Journal of Propulsion and Power, Volume 17, No. 6, November-December 2001.
- [3] Fry, Ronald S. "A Century of Ramjet Propulsion Technology Evolution." Journal of Propulsion and Power, Volume 20, No. 1, January-February 2004: 27-58.
- [4] Waltrup, Paul J. "Upper Bounds on the Flight Speed of Hydrocarbon-Fuelled Scramjet-Powered Vehicles." Journal of Propulsion and Power, Volume 17, No. 6, November-December 2001: 1199-1204.
- [5] Builder, C.H. "On the Thermodynamic Spectrum of Airbreathing Propulsion." AIAA 1st Annual Meeting, Washington, D.C., June 1964. AIAA Paper 64-243.
- [6] Heiser, William H., David T. Pratt, Daniel H. Daley, and Unmeel B. Mehta. Brief Description of the HAP Software Package. "ReadMe" File for Hypersonic Airbreathing Propulsion Software Package. Washington, D.C.: American Institute of Aeronautics and Astronautics, 1994.
- [7] Zucrow, Maurice J., and Joe D. Hoffman. Gas Dynamics. Vol. 1. New York: John Wiley & Sons, Inc., 1976.
- [8] Anderson, Jr., John D. Modern Compressible Flow with Historical perspective. 2nd Ed. New York: McGraw-Hill Company, 1990. \
- [9] Analysis And Design Of A Hypersonic Scramjet Engine With A Starting Mach Number Of 4.00 By Kristen Nicole Roberts. August 2008

AUTHORS

First Author – Aqheel Murtuza Siddiqui, Research Assistant, Muffakham Jah College of Engineering & Technology. Hyderabad-500034, EmailID: aqheelm@yahoo.com

An integral involving general class of polynomials with I-function

Jyoti Mishra* and Neelam Pandey**

Department of Mathematics, Gyan Ganga College of Technology, Jabalpur*

Model Science College, Rewa**

Abstract- In the present paper we derive an integral involving general class of polynomials whose integrand contains product of I-function and a general class of polynomials. The integral evaluated is quite general in nature and we can derive from them by a large number of integrals involving simpler functions as their particular cases.

Index Terms- I-function, general class of polynomials, Fox H-function.

I. INTRODUCTION

The I-function of one variable introduced by Saxena [1982], will be represented and defined in the following manner:

$$I_{p_i, q_i; r}^{m, n} [x]_{[(a_j, \alpha_j)_{1, n}], [(a_{ji}, \alpha_{ji})_{n+1, p_i}], [(b_j, \beta_j)_{1, m}], [(b_{ji}, \beta_{ji})_{m+1, q_i}]} = \frac{1}{2\pi i} \int_L \theta(s) z^s ds. \tag{1.1}$$

Where

$$\omega = \sqrt{-1}, (z \neq 0)$$

is a complex variable and

$$z^s = \exp[s\{\log|z| + \omega \arg z\}]$$

in which $\log|z|$ represent the natural logarithm of $|z|$ and $\arg|z|$ is not necessarily the principal value. An empty product is interpreted as unity.

$$\theta(s) = \frac{\prod_{j=1}^m \Gamma(b_j - \beta_j s) \prod_{j=1}^n \Gamma(1 - a_j + \alpha_j s)}{\sum_{i=1}^r [\prod_{j=m+1}^{q_i} \Gamma(1 - b_{ji} + \beta_{ji} s) \prod_{j=n+1}^{p_i} \Gamma(a_{ji} - \alpha_{ji} s)]}$$

z is not equal to zero and an empty product is interpreted as unity; m, n and $p_i \forall i \in (1, \dots, r)$ are non-negative integer

satisfying $0 \leq n \leq p_i, 0 \leq m \leq q_i$: for all $(i = 1, \dots, r) a_{ji} (j = 1, \dots, p_i; i = 1, \dots, r)$ and

$\beta_{ji} (j = 1, \dots, q_i; i = 1, \dots, r)$ are assumed to be positive quantities for standardization purpose.

Also $a_{ji} = (j = 1, \dots, p_i; i = 1, \dots, r)$ and $b_{ji} (j = 1, \dots, q_i; i = 1, \dots, r)$ complex numbers.

A general class of polynomial $S_V^U[x]$ occurring in the paper was introduced by Srivastava [4] is defined and represented in the following manner:

$$S_V^U[x] = \sum_{k=0}^{[V/U]} \frac{(-V)_{UK} A(V, K)}{K!} x^k, \quad V = 0, 1, 2, \dots \text{ where } U \text{ is an arbitrary positive integer and coefficients}$$

$A(V, K) (V, K \geq 0)$ are arbitrary constant, real or complex.

II. MAIN RESULT

$$\int_0^\infty y^{\lambda-1} [y + t + (y^2 + 2ty)^{1/2}]^{-\nu} I_{p_i, q_i; r}^{m, n} [x \{y + t + (y^2 + 2ty)^{-\gamma}\}] S_V^U [Z \{y + t + (y^2 + 2ty)^{1/2}\}^{-\xi}] dx = 2a^{-\nu} \left(\frac{a}{2}\right)^\lambda \Gamma(2\lambda) \sum_{k=0}^{V/U} (-V)_{UK} A(V, K) \left(\frac{Z/a^\alpha}{K!}\right)^K I_{p_i+2, q_i+2; r}^{m, n+2} [xa^{-\gamma} | \dots, \dots, (1-\nu-wk, r), (-\nu-wk-\lambda, r)] \tag{2.1}$$

Where

$$(1) \gamma > 0, \operatorname{Re}(\lambda, \nu, w) > 0 \quad (2) \operatorname{Re}(\lambda) - \operatorname{Re}(\nu) - \nu \min \operatorname{Re}\left(\frac{b_j}{\beta_j}\right) < 0$$

We shall require the following elementary integral for the evaluation of our main integral

$$\int_0^\infty x^{z-1} [x + a + (x^2 + 2ax)^{1/2}]^{-\nu} dx = 2\nu a^{-\nu} \left(\frac{1}{2}a\right)^z [\Gamma(1 + \nu + z)]^{-1} \Gamma(2z) \Gamma(\nu - z) \quad 0 < \operatorname{Re}(z) < \nu$$

Proof :To obtain the result (2.1) , we first express I-function involved in its left -hand side in terms of contour integral using eq.(1.1)

and general class of polynomials $S_V^U[x]$ given by in eq.(1.2) and Interchanging the order of integration and summation (which is permissible under the conditions stated) with (2.1) and evaluating the y-integral with the help of the result from given by equation (2.2) so we arrive at the main result (2.1) after a little simplification:

5 Particular case : It may be noted that on account of generalized nature of the I -function, several new interesting result can be derived with proper choice parameters. Hence formulae establish in this paper are of general character.

Two particular cases should be mentoined here:

(i) In equation (2.1) setting r=1 and using (1.2) we obtained the result integrals involving Fox H-function.

(ii) In equation (2.1) by taking r=1 and $\alpha_j = \beta_j = 1$ so we obtained the result integrals involving Meijer's G-function.

REFERENCES

- [1] Raiville , E. D., Special Function , Macmillan and Co. N. Y. 1967
- [2] Oberhettinger F, Tables of Mellin transforms (Berlin , Heidelberg , New York: Springer-Verlag)(1974)p.22.
- [3] H.M.Srivastava and M. Garg ,Some integrals involving a general class of polynomials and the multivariable H-function, Rev.Roumaine Phys.,32(1987), 685–692.
- [4] H.M.Srivastava, A contour integral involving fox's H-function , Indian J. Math. 14(1972), 1 – 6
- [5] Mridula Garg and Shweta Mittal, On a new unified integral, Indian Acad. Sci. (Math. Sci.) Vol.114, No.2, 2004, pp.99 – 101
- [6] Shrivastava, H. M. ,Gupta ,K.C. and Goyal, s.p. The H- function of one and two Variables with Applications , South Asian Publishers, New Delhi 1982.
- [7] Shrivastava, H. M., Manocha HC (1984). A Treatise on generating functions, Ellis Horwood Ltd . Chickester, John Wiley and Sons , Newyork.
- [8] ical style—Submitted for publication),” *IEEE J. Quantum Electron.*, submitted for publication.

AUTHORS

First Author – Jyoti Mishra, Department of Mathematics, Gyan Ganga College of Technology, Jabalpur
 Email id - jyoti.mishra198109@gmail.com.

Second Author – Neelam Pandey, Model Science College, Rewa Email id - pandeypadra@gmail.com

Studies on Mobility Indicators and the Effect of Congestion Reduction Measures on the Movement of Vehicular Traffic along G-6 Bus Route in Bangalore City using Micro Simulation Software

Harish H.S* and Dr. Suresha S.N**

* Assistant Professor, Dept. of Civil Engineering, Jyothy Institute of Technology, Bangalore, India.

** Assistant Professor, Dept. of Civil Engineering, National Institute of Technology Karnataka, Suratkal, India.

Abstract- Bangalore is one of the most important cities in India as it has rapid growth in the IT sector. As a direct result of rising population, the number of vehicles in the city has been increasing considerably. What adds to the traffic pressure in Bangalore is that there is very little scope for expansion of roads. This has led to massive congestion in the arterial roads of the city. The ill effects of congestion may reach highly undesirable proportions very rapidly. Traffic congestion is characterised by slower speeds, longer trip times, and increased queuing.

The main objective of the present study is to estimate the travel time and travel delay along the selected bus route i.e. BIG10 route number G6 - from Shantinagar bus stop (SNBS) to Kengeri satellite town bus stop (KSTBS) and analyse improvements to same through several congestion reduction measures using traffic micro simulation modelling and mobility indicators. The information and data necessary for making improvements in vehicular movement along this corridor is gathered together and considered. This data includes traffic volume data, road inventory data, travel times for various modes of travel and signal timings of all signalized intersections. The data so collected is used to simulate the vehicular flow using micro-simulation software. Changes with respect to road infrastructure, signal timings and various other possible solutions to reduce congestion is simulated and a cost benefit analysis is conducted.

Index Terms- Transportation, Congestion, Travel time, Travel delay, VISSIM.

I. INTRODUCTION

Urban traffic congestion is widely recognized as one of the greater maladies of life in large cities. As such, most research effort has gone into devising measures for alleviating, or at least dealing with, this problem. An attempt to relieve congestion and decrease travel time through suitable measures is of high priority. It is widely recognized that the success of alleviating congestion depends on the quality and accuracy of the information provided. Congestion means continuous speed changes (decelerations and accelerations) and a low average speed in traffic flow. The speed changes cause the engines of vehicles to be continuously in a transient state. As a consequence many of the extra impacts in terms of fuel consumption and

pollutant emissions are created by the congestion. Additionally, driving time, noise, etc. may increase remarkably depending on degree of congestion.

Also, it is very useful and important to know not only verbally, but in numeric amounts the congestion impacts. This becomes even more significant in a rapidly growing metropolitan city like Bangalore, where there is a steep increase in population over the past decade. The number of people living per square kilometre in the city has increased to 4,378 in 2011 from 2,985 in 2001, according to the census data released by Karnataka's directorate of census operations (Livemint, 2011)^[1].

II. REVIEW OF LITERATURE

The prominent traffic features in these developing countries are mixture of non motorised vehicles and motorised vehicles on road, which makes the task of analysis much more complex, due to the presence of heterogeneous traffic. This forms the basis for the need of equivalent passenger car units. The mixture of nm-vehicles and m-vehicles makes serious decrease of the speed, and even causes traffic congestions (Gupta, 1986)^[2]. The presence of bottlenecks is bound to reduce the speed of the vehicles and may also result in unnecessary delays in case of high traffic density. It was reported that the capacity of a two-lane road can drop by 28% when the lane width changed from 3.7 to 2.75 m (Stropher, 2004)^[3]. It was also found out that, the conversion of a shoulder to an additional travel lane could be expected to increase the average speed of a two-lane highway by about 5% for volumes exceeding 150 vehicles per hour.

Another option is to provide importance to public transport vehicles by giving priority to buses, which considerably reduces the use of private vehicles (Khaled, 2006)^[4].

Thorough analysis about the impact of various congestion reduction strategies on the traffic performance (Liu, 2009)^[5] was conducted. Based on these studies and literature, different parameters were chosen which actually effect or contribute to the methodology and analysis of the present investigation.

III. RESEARCH METHODOLOGY

The methodology of the present investigation consists of EIGHT steps:

Step 1: In the selected BIG10 route (G6) leading into and out of the city, it is proposed to measure the quantum of vehicular movement at evenly spaced locations from point A to point B (say) at various times of the day, sampled over many days. Together, this survey will provide preliminary data to document the vehicular volume and broad patterns of flow during peak hour.

Step 2: Volume counts are taken manually at 6 major junctions both during peak and off-peak hours along the selected road stretch as shown in Fig.1 and the volume on the road is determined.

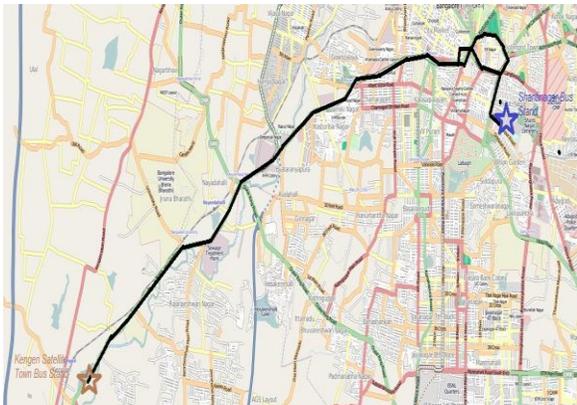


Fig.1: G-6 Bus Route

Step 3: The road inventory data i.e. road features and road geometrics of the selected stretch which are noted down for the purpose of analysis are carriageway width, shoulder width, footpath, location name, bus stops, humps, potholes, junction.

Step 4: The travel times of different classes of vehicles are found by performing several trial runs along the G-6 route and their mean is tabulated. The journey starts at KST bus stop and ends at Shantinagar bus stop. Return journey from Shantinagar towards KST bus stop starts within fifteen minutes of reaching Shantinagar bus stop.

Step 5: The signal timings of all the major junctions are collected from Traffic Management Centre and also manually.

Step 6: All the collected data is then inputted into visualization and analysis platform, using simulation software {it may be microscopic, mesoscopic or macroscopic modelling} like VISSIM.

Step 7: The results are then evaluated through different mobility indicators like travel time index and congestion index. Various sections of the selected route will be differentiated using some parameters like distance from the origin, traffic congestion and street geometry.

Step 8: Cost benefit analysis is performed in order to assess the feasibility and value of congestion reduction measures.

IV. DATA COLLECTION

The data collection process when conducted in an orderly manner ensures that data gathered is both defined and accurate. The collected data provides a baseline for further analysis. The processes involved in data collection required for the analysis of travel times and travel delays are traffic volume studies, road

inventory studies, travel times for various modes of travel, signal timings of all major junctions.

Traffic volume studies are conducted to determine the number, movements, and classifications of roadway vehicles at a given location. Six major locations where the traffic volume survey was conducted are:

- A) Near RV college
- B) Rajarajeshwari Nagar Junction
- C) BHEL Junction
- D) Near TOTAL mall
- E) Town hall Junction
- F) Double Road Junction

Traffic volume data is collected near all the major junctions along this route and later converted to equivalent passenger car units as shown in Table 1 using IRC 106-1990.

TABLE 1: EQUIVALENT PASSENGER CAR UNITS

Sl. No.	Vehicle Type	Equivalent PCU	
		Factors	
		% composition of Vehicle type in Traffic Stream	
		5%	>=10%
1	2-Wheelers	0.5	0.8
2	Car	1.0	1.0
3	Auto	1.2	2.0
4	LCV	1.4	2.0
5	Truck/Bus	2.2	3.7
6	Tractor	4.0	5.0

Reconnaissance Survey was carried out along the Corridor and at the Junctions and the physical characteristics of the corridor and junctions such as road geometrics, pavement details, traffic Controls (signs, signals, road markings and parking restrictions), sidewalks, shoulders, adjacent land use were observed.

Along the G-6 route (From Shantinagar Bus Stand TO Kengeri Satellite Town Bus Stop), for every 250 meters, the road parameters like carriageway width(See Fig.4.14), shoulder width, footpath, location name, bus stops, humps, potholes, junction were noted down.

The travel times of various modes of travel like two wheeler, three wheeler, cars and buses were obtained by performing several trial runs along the G-6 route. The journey started at KST bus stop and ends at Shantinagar bus stop. Return journey from Shantinagar towards KST bus stop started within fifteen minutes of reaching Shantinagar bus stop.

Three trials were conducted for each category as explained in section 3 of the present investigation and their mean was calculated.

The signal timings of major junctions along G-6 bus route in Bangalore city are collected from Traffic Management Centre

and also manually. The signal timings of all the major junctions along G-6 bus route in Bangalore city are shown in Table 4.

V. RESULTS AND ANALYSIS

Some indicators of congestion that confirm the congestion trend in G-6 bus route in Bangalore City are travel time index and congestion index given by:

$$\text{Travel Time Index} = \frac{\text{Actual Travel Time}}{\text{Ideal (free flow) Travel Time}} \dots\dots (1)$$

$$\text{Congestion index} = 1 - (A / M) \dots\dots (2)$$

Where,

M: Desirable ideal average journey speed on major road networks of a city during peak hour, which is assumed as 40 KMPH as per DULT (Directorate of Urban Land Transport, Karnataka) standards set in the year 2009.

A: Average journey speed observed on major corridors of the city during peak period.

In ideal condition congestion index is zero. The congestion index at Kalingrao Junction and Satellite bus stop junction were found to be most congested places having a congestion index of 0.82 and 0.79 respectively as shown in figure 2.

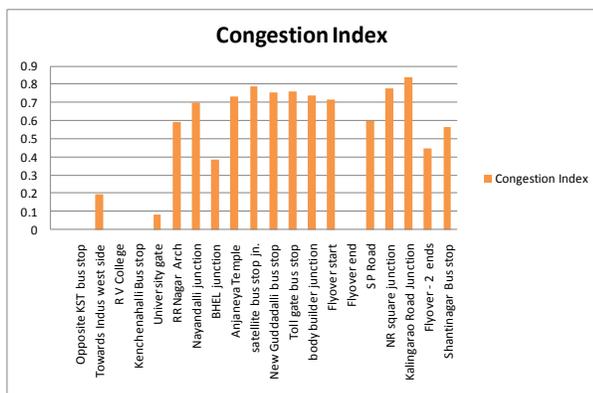


Fig. 2: Congestion Index (From KSTBS to SNBS)

For micro-simulation analysis, a do-nothing model is developed by inputting all the collected data into the traffic micro-simulation software VISSIM. After calculating cumulative hourly volume of vehicles, the peak hour, where the flow of vehicles is maximum is considered for evaluation. This is done to test whether VISSIM validates the travel times that was collected in the field. The basic data required as inputs for the preparation of a traffic simulation model using VISSIM are number of vehicles, classes of vehicles, number of lanes, width of the carriageway, signal cycle time.

The savings in travel time by the application of these congestion reduction measures is also evaluated using benefit cost analysis. The objective is to obtain insights regarding the effects of varying the existing conditions by providing suitable traffic improvement measures using micro simulation modelling and also analyse the viability of these measures. Using IRC: SP: 30-2009 (Manual for Economic evaluation of Highway Projects in India) and traffic volume data, the benefits of taking up these

infrastructure improvement measures can be quantified through cost saved per minute.

Approximate cost required to implement different congestion reduction measures are shown in Table 2.

The cost required to modify the signal timings is comparatively very low. The travel times observed using VISSIM traffic simulator and the savings in time by adopting congestion mitigation measures and the corresponding savings in cost are presented in Table 3.

TABLE 2: COST FOR IMPLEMENTING MEASURES

SI	Congestion measure reduction	Approx. Amount Spent in Cr.(Rs.)
1	Road Widening (3.7 Kms)	3.37
2	Providing Junction free corridors	
	a)Chord Road to Mysore road(500 m)	25.62
	b)Nayandalli Grade Separator(750 m)	38.43
	c)NR Square Junction(600 m)	30.75
3	Combination of Junction free corridors	94.81
4	Flyover from Sirsi Circle to BU gate(10 Kms)	512.5

Note: The above costs exclude land acquisition costs.

TABLE 3: VISSIM ANALYSIS

SI	Model Type	Time in minutes		Savings in Time(min.)	
		From KSTBS	From SNBS	From KSTBS	From SNBS
1	Basic Model	54.42	54.98		
2	Road Widening	46.98	43.62	7.43	11.37
3	Change in Signal Timings	47.78	54.10	6.63	0.88
4	Flyover (Sirsi circle to BU gate)	41.65	39.95	12.77	15.03
5	Removal of Humps and potholes	47.25	45.25	7.17	9.73
6	Junction free corridors	47.00	48.10	7.42	6.88
7	2,3,5 & 6	35.83	38.47	18.58	16.52
8	2,3 & 5	42.73	41.12	11.68	13.87

VI. CONCLUSIONS

The present study used mobility indicators as a criterion to establish massive delays of vehicles and microscopic simulation technology was used as a tool to evaluate the congestion mitigation measures, i.e. Removal of Bottlenecks and Road widening, Modification and offsetting of Signal Time, Removal of Humps and Potholes, Junction free corridors and also combined measures.

By calculating cumulative hourly volume of vehicles, it is safe to state that, the peak hour volume along this corridor cannot be associated with a particular time. This gives a clear indication

Second Author – Dr.Suresha S.N, Assistant Professor, Dept. of Civil Engineering, National Institute of Technology Karnataka, Suratkal, India.

VII. FUTURE SCOPE

This study is an initial work and opens the door for several future studies. In the future, further research might explore more strategies, such as congestion pricing, could be evaluated using the micro simulation tool. Scenarios with different incident locations could also be tested. Finally, dynamic demand and various incident occurrence times could be examined.

ACKNOWLEDGEMENT

The satisfaction and euphoria that accompany the successful completion of any task would be incomplete without mentioning the people who made it possible, whose constant guidance and encouragement crowned my efforts with success. I wish to express my deep sense of gratitude to Prof.T.G.Sitharam (Chairman, CiSTUP, IISc, Bangalore) and Dr.Deepak Baindur for their able guidance and useful suggestions, which helped me in completing this research paper.

REFERENCES

- [1] Livemint, Livemint.com (2011). "Karnataka population growth slows, Bangalore gets more crowded", retrieved on 09-08-2011 from <http://www.livemint.com/2011/04/06233223/Karnataka-population-growth-sl>
- [2] Gupta, A.K., and Khanna, S.K. (1986). "Mixed traffic flow analysis for developing countries", World Congress on Transport Research, pp. 1521–1534.
- [3] Stropher, R., (2004). "Reducing road congestion: a reality check", Journal of transport policy, Vol.11, No. 4, pp.117-131.
- [4] Khaled, F.A., Ahmed, F.A., Hani, S.M., and Akmal, S.A. (2006). "Modelling Bus Priority Using Intermodal Dynamic Network Assignment-Simulation Methodology" "Journal of Public Transportation, Vol. 9, No. 5, pp.1-22.
- [5] Liu, Z., Chunyan, L., Li, C. (2009). "Traffic impact analysis of congestion charge in mega cities" "Journal of Transportation Systems Engineering and Information Technology" Vol. 9, No. 6, pp.123-142
- [6] Nedal, T. R., and Rahman, S. M. (2009). "A comparative analysis of currently used microscopic and macroscopic traffic simulation software", The Arabian Journal for Science and Engineering, Vol. 34, No. 1B, pp. 121-134.

AUTHORS

First Author – Harish H.S, Assistant Professor, Dept. of Civil Engineering, Jyothy Institute of Technology, Bangalore, India.

Threshold and Gain characteristics of Stimulated Brillouin Scattering in n-InSb Crystal

P. S. Malviya*, Nilesh Nimje**, Nishchhal Yadav**

* Govt. J.N.S. P.G. College, Shujalpur (M.P.)-465333

** School of Studies in Physics, Vikram University, Ujjain (M.P.)-456010

Abstract- Based upon the electromagnetic treatment, Stimulated Brillouin scattering (SBS) in a strain dependent n-InSb crystal which is subjected to a transverse magnetic field is investigated analytically. The origin of this nonlinear interaction is considered to be found in the third-order nonlinear optical susceptibility arising due to nonlinear current density and strain dependent polarization of the medium. The threshold condition is obtained for onset of the SBS process. The effective Brillouin susceptibility and gain is determined using coupled mode scheme of interacting waves. The effects of magnetic field and doping on threshold and SBS gain are studied. Numerical estimations are made at 77K duly shined by a pulsed 10.6 μm CO₂ laser. In the highly doped regime the transverse magnetic field effects a significantly decrease in the threshold and an appreciable enhancement in the SBS gain is obtained. When cyclotron frequency is nearly equal to the applied field frequency minimum threshold and maximum gain of SBS process is achieved. The numerical value of third-order nonlinear optical susceptibility by our analysis is well agreed with previously obtained theoretical as well as experimental values.

Index Terms- Nonlinear interaction, Semiconductor plasma, Stimulated Brillouin Scattering, Strain dependent dielectric constant, Piezoelectricity, Polar optical phonon

I. INTRODUCTION

In the present work we have studied some interesting and important nonlinear (NL) effects related to propagation of electromagnetic waves with gaseous and solid state plasmas, a number of nonlinear phenomena play important role on the propagation and coupling of the electromagnetic waves with plasmas. Due to vast technological utility, large numbers of reports were made on the nonlinear interactions in semiconductor plasma [1-10]. But very few reports were made on the nonlinear interactions in materials with strain dependent dielectric constants.

Here we intend to put the method developed by Ghosh and Saxena [11] for third order optical nonlinearities to test possible third order interactions such as stimulated Brillouin scattering etc. in semiconductor plasmas.

The object of our present work is two fold: one to look whether the said method is tenable for all possible third order interactions and second to achieve steady state gain in suitable semiconductors. In most of previous studies in nonlinear effects, the dielectric constant of the material is assumed to be constant, but such assumption is not justified and dielectric constant

depend upon the deformation of material; which can be true for both piezoelectric active as well as inactive materials. Taking this effect in to account Ghosh and Saxena [11] have pointed out that in case of nonlinear interactions, the large growth rates can be achieved in materials with high dielectric constants, which are otherwise not possible with piezoelectric materials.

II. SCOPE OF THE PRESENT WORK

Here we have investigated potentially useful nonlinear interactions of electromagnetic waves with semiconducting plasmas. During the interactions, the dielectric constant of the materials does not remains constant and infacts depends upon the deformation of the materials. Due to this dependency of the dielectric constants on the deformation of the material shows that the interaction is a result of strain dependent dielectric constant (SDDC) in such materials with piezoelectric interactions [11, 12]. Thus the substances having large dielectric constant can be more efficient in the study of nonlinear interaction than piezoelectric substances. So we have confined our self to the study of substances having large dielectric constants.

In the earlier studies we found that propagation of pump wave infinite semiconductor plasma must have components that are both parallel and perpendicular propagation direction [13-14]. On this account we have considered a case in which hybrid mode is propagating obliquely to the external magnetic field. As for as our study, know such attempt has been made to determine the third order susceptibility arising due to induced current density and other material properties in semiconductor plasma with strain depend dielectric constant.

By the proper selection of material the electric density distribution and deformation by nuclear motion as well as interaction of ions with other elementary excitation can be studied by nonlinear susceptibility.

Motivated by the intense interest in the field stimulated scattering, we have reported the analytical investigation of stimulated Brillouin scattering for different parameters depending upon SDDC in medium.

III. THEORETICAL FORMULATION

This section deals with the theoretical formulation of third order effective nonlinear optical susceptibility $\chi^{(3)}$, for the signal electromagnetic waves in magnetized semiconductor plasma. Here we consider sample of n-type Centro symmetric semiconductors, viz., n-InSb immersed in a uniform magneto

static field \vec{B}_s applied along z-axis. The semiconductor is assumed to be the source of a homogeneous and infinite plasma which is subjected to an externally driven large amplitude spatially uniform electromagnetic wave (pump wave) viz. a high frequency laser or micro propagating along x-axis. The electric field of the spatially uniform pump wave is described by $E_o = E_o \exp(-i\omega t)$. Here authors have chosen Centro symmetric crystal so that the nonlinearities originated due to piezoelectricity and electro-optical effects can safely be ignored. Here we have considered the well known hydro dynamical model of homogenous one component plasmas. In order to study the effective nonlinear susceptibilities, we consider the propagation of an electromagnetic pump waves.

$$E_o = E_o \exp.[i(kx - \omega t)] \quad (3.1)$$

Here we also employed the couple mode scheme to obtain the nonlinear polarization. Thus the dielectric constant of the medium is given by

$$\epsilon = \epsilon_o(1 + gS) \quad (3.2)$$

Where ϵ is dielectric constant in absence of any strain S

$$g \left(= \frac{\epsilon_o}{3} \right)$$

and the coupling coefficient is due to strain dependent dielectric constant. The basic equation consider for analysis are

$$\frac{\partial v_o}{\partial t} + \omega_o = \frac{e}{m} [E_o + v_o \times B_o] = \frac{e}{m} E_{eff} \quad (3.3)$$

$$\frac{\partial v_1}{\partial t} + \omega_1 + \left(v_o \frac{\partial}{\partial x} \right) v_1 = \frac{e}{m} [E_1 + v_1 \times B_o] \quad (3.4)$$

$$\frac{\partial n_1}{\partial t} + n_o \frac{\partial v_1}{\partial x} + v_o \frac{\partial n_1}{\partial x} = 0 \quad (3.5)$$

$$\frac{\partial E_1}{\partial x} = \frac{n_1 e}{\epsilon} - \left(\frac{g E_{eff} \epsilon_o}{\epsilon} \right) \frac{\partial^2 u^*}{\partial x^2} \quad (3.6)$$

$$\rho \frac{\partial^2 u}{\partial t^2} + 2\gamma\rho \frac{\partial u}{\partial t} = C \frac{\partial^2 u}{\partial x^2} - (\epsilon_o g E_{eff}) \frac{\partial E^*}{\partial x} \quad (3.7)$$

where,

$$E_{eff} = E_o + \mathcal{G} \times B_o$$

Equation (3.3) and (3.4) are the momentum transfer equation for the electrons under the influence of pump and product wave, respectively. In which e, m and v are the charge, effective mass and phenomenological collision frequency of the

electrons. Equation (3.5) is the continuity equation with n_o and n_1 as equilibrium and perturbed carriers density respectively. Equation (3.6) represent the Poisson's equation where ϵ is

dielectric constant of the semiconductor, ϵ_o is absolute permittivity of the crystal and \mathcal{G} is coupling constant due to SDDC. Equation (3.7) shows the equation of motion lattice in the crystal here C, ρ are linear elastic modulus of the crystal and mass density respectively, γ is the phenomenological damping constant. The last terms of RHS of equation give the contribution due to SDDC. In equation (3.4) we have neglected the effect due to $(v_o \times B_o)$ by assuming that the acoustic phonon mode is propagating along such a direction of the crystal, which produces

a longitudinal electric field, e.g. if k_a is taken along (011) and the lattice displacement u is along (100), the electric field induced by the wave is longitudinal field. At very high frequencies of the field, which is quite large as compared to the frequencies of motion of the electrons in the medium, the polarization of the medium is considered on neglecting the interactions of the electrons with one another and with the nuclei of the atoms. Thus the electric induction in the presence of the external magneto static field [15] is given by

$$D = \epsilon E_{eff}$$

On differentiating equation (3.5) with respect to time and using equation (3.3) and (3.4) we get

$$\frac{\partial^2 n_1}{\partial t^2} + v \frac{\partial n_1}{\partial t} + \omega_p^2 n_1 + \frac{n_o e k_a^2 (\epsilon_o g E_{eff}) u^*}{m \epsilon} = - \bar{E} \frac{\partial n_1}{\partial x} \quad (3.8)$$

$$\omega_p = \left[\omega_p^2 \left(\frac{v^2}{v^2 + \omega_c^2} \right) \right]^{1/2}, \quad \bar{E} = \frac{e}{m} E_{eff}$$

Where $\omega_p = \left(\frac{e^2 n_o}{m \epsilon} \right)^{1/2}$ and $\omega_c = \left(\frac{e B_o}{m} \right)$ are the plasma frequency and cyclotron frequency of the electron respectively. Here we have neglected the Doppler shift under assumption that $\omega_o \gg v \gg k_o v_o$.

The perturbed electron density produced in the medium will have two components which may be recognized as fast and slow components. The fast component n_f correspond to the stocks component of the scattered light and varies as $\exp.[i(k_1 x - \omega_1 t)]$, whereas the slow component n_s is associated with the acoustic waves and varies as $\exp.[i(k_a x - \omega_a t)]$. Such that $n_1 = n_f + n_s$. From equation

(3.8) we obtain the following coupled wave equation under the rotating wave approximation.

$$\frac{\partial^2 n_f}{\partial t^2} + v \frac{\partial n_f}{\partial t} + \omega_p^2 n_f + \frac{n_0 e k_a^2 (\epsilon_0 g E_{eff}) u^*}{m \epsilon} = -\bar{E} \frac{\partial n_s}{\partial x} \quad (3.9)$$

$$\frac{\partial^2 n_s}{\partial t^2} + v \frac{\partial n_s}{\partial t} + \omega_p^2 n_s = -\bar{E} \frac{\partial n_f}{\partial x} \quad (3.10)$$

Thus, generated acoustic wave and stocks component coupled each other by the pump Centro symmetric medium. The slow component n_s may be obtained from equation (3.7) and (3.10) as

$$n_s^* = \frac{n_0 k \epsilon_0 g (\epsilon_0 g E_{eff}^*) E_1}{\varphi (\delta_a^2 - 2i\gamma\omega_a)} \left[1 - \frac{(\delta_1^2 - i\nu\omega_1)(\delta_a^2 - i\nu\omega_a)}{k^2 |\bar{E}|^2} \right]^{-1} \quad (3.11)$$

$$A = \left[1 - \frac{(\delta_1^2 - i\nu\omega_1)(\delta_a^2 - i\nu\omega_a)}{k^2 |\bar{E}|^2} \right]^{-1}$$

Where

Now, stocks component of induced current density may be obtained from the relation

$$J_1 = e v_{0x} n_s \quad (3.12)$$

$$J_1 = \frac{-ik^2 \omega_p^2 \epsilon_0^2 g^2 \omega_0^3 E_0 E_0^* E_1}{\rho (\omega_0^2 - \omega_c^2)^2 (\delta_a^2 - 2i\gamma\omega_a^2)} (A)$$

which yields,

$$(3.13)$$

The induced polarization may be expressed at the time integral of the induced current density. The Polarization may therefore be obtained from equation (3.13) as

$$P_{cd} = \frac{k^2 \omega_p^2 \epsilon_0^2 g^2 \omega_0^3 E_0 E_0^* E_1}{\rho \omega_1 (\omega_0^2 - \omega_c^2)^2 (\delta_a^2 - 2i\gamma\omega_a)} (A) \quad (3.14)$$

which yield to the third order optical susceptibility as,

$$P_{cd} = \epsilon_0 \chi^{(3)} E_0 E_0^* E_1 \quad (3.15)$$

$$\chi^{(3)} = \frac{\epsilon_0 k^2 \omega_p^2 g^2 \omega_0^3 E_0 E_0^* E_1}{\rho \omega_1 (\omega_0^2 - \omega_c^2)^2 (\delta_a^2 - 2i\gamma\omega_a)} (A) \quad (3.16)$$

and strain dependent Polarization can be given as

$$P_{sd} = -\frac{k^2 \epsilon_0^2 g^2 \omega_0^4 E_0 E_0^* E_1}{\rho (\omega_0^2 - \omega_c^2)^2 (\delta_a^2 - 2i\gamma\omega_a)} \quad (3.17)$$

In a Centro symmetric semiconductor the total Polarization can be written as,

$$P = P_{cd} + P_{sd} \quad (3.18)$$

Then we get,

$$\chi^{(3)} = -\frac{\epsilon_0 k^2 g^2 \omega_0^4}{\rho (\omega_0^2 - \omega_c^2)^2 (\delta_a^2 - 2i\gamma\omega_a)} \times \left[1 + \left(\frac{\omega_p^2}{\omega_0 \omega_1} \right) (A) \right] \quad (3.19)$$

The threshold pump amplitude for the onset of stimulated Brillouin scattering may be obtained as

$$E_{oth} = m / ek \left(1 - \frac{\omega_c^2}{\omega_0^2} \right) \left[(\delta_1^2 - i\nu\omega_1)(\delta_a^2 - i\nu\omega_a) \right]^{1/2} \quad (3.20)$$

$$\text{where } \delta_1^2 = \omega_p^2 - \omega_1^2 \quad \text{and} \quad \delta_a^2 = \omega_p^2 - \omega_a^2$$

In order to investigate the effective Brillouin gain we used the following relation,

$$g_{eff} = -\frac{k}{2\epsilon_1} [\chi_{eff}^{(3)}] |E_0|^2 \quad (3.21)$$

Carrier heating and temperature dependence of electron collision frequency to inside SBS, the fundamental requirement is to apply the pump field above the threshold value. Intense pump when passes threwh a high mobility semiconductor, ions rema passive on account of their large inertia while due to low effective masses, the electron interacts with the pump and gain energy. As a result, the electron temperature (T_e) starts rising above the lattice temperature (T_o). The electron temperature T_e may be determined from the energy balance equation under steady state conditions.

Following Sodha et al. [16] for the said geometry, the power absorbed per electron from the pump is

$$e/m R_e (v_0 \cdot E_0^*) = \frac{e^2 v}{2m} \left[\frac{(\omega_c^2 + \omega_0^2)}{(\omega_c^2 + \omega_0^2)^2 + 4\nu_0^2 \omega_0^2} \right] E_0 E_0^* \quad (3.22)$$

Where * denotes a complex conjugate of the quantity while R_e stands for the real part of the quantity concerned. The x component of v_0 used in the above relation may be evaluated from equation (3.3).

The electron lose that energy in collision with polar optical phonon following Conwell's [17] the average power loss per electron in the polar optical phonon scattering is given by

$$\langle P \rangle_{pop} = \left[\frac{2k_{\beta}\theta_D}{m\pi} \right]^{\frac{1}{2}} eE_{po}x_e^{\frac{1}{2}}k_0\left(\frac{x_e}{2}\right) \times \exp\left(\frac{x_e}{2}\right) \frac{\exp(x_0-x_e)-1}{\exp(x_e-1)}, \quad (3.23)$$

where, $x_{e,o} = \left(\frac{\eta\omega_l}{k_{\beta}T_{o,e}} \right)$ in which $\eta\omega_l$ is the energy of polar optical phonon (pop) given by $\eta\omega_l = k_{\beta}\theta_D$; θ_D being Debye

temperature of the medium. $E_{po} = \frac{m\eta\omega_l}{\eta^2} \left(\frac{1}{\epsilon_{\infty}} - \frac{1}{\epsilon_1} \right)$ is the

field of pop scattering potential in which ϵ_1 and ϵ_{∞} are the respective static and high frequency permittivity of the medium.

$k_0\left(\frac{x_e}{2}\right)$ is the zero order Bessel function of first kind.

Equation (3.23) infers that with rise in electron temperature, power lost per electron in collisions with the pop also increases. A steady state is therefore, reached when the power lost in the pop scattering {equation (3.23)} becomes equal to the power gained {equation (3.22)} from the pump. Consequently, the electron plasma attains a steady temperature (T_e) somewhat above the lattice temperature (T_0). Hence using equations (3.22) and (3.23), one readily obtains

$$\frac{T_e}{T_0} = 1 + \frac{e^2v_0\tau(\omega_c^2 - \omega_0^2)}{2m[(\omega_c^2 - \omega_0^2)^2 + 4v_0^2\omega_0^2]} E_0E_0^* \quad (3.24)$$

$$\tau^{-1} = \left(\frac{2k_{\beta}\theta_D}{m\pi} \right)^{\frac{1}{2}} eE_{po}x_e^{\frac{3}{2}}k_0\left(\frac{x_0}{2}\right) \frac{\exp\left(\frac{x_0}{2}\right)}{\exp(x_0)-1}$$

where (3.25)

Thus, the pump energy dependent electron collision frequency (ECF) may be given by

$$v = v_0 \left(\frac{T_e}{T_0} \right)^{\frac{1}{2}}, \quad (3.26)$$

where, T_e is the effective temperature of electron, T_0 is the lattice temperature, and the ECF when $T_e = T_0$.

IV. RESULTS AND DISCUSSION

A close look at equation (3.21) reveals that the effective Brillouin susceptibility is a sensitive function of carrier concentration via plasma frequency ω_p and momentum transfer

collision frequency through the factor (A) . At lower concentration this magnitude of $(\chi_{\beta})_{eff}$ is lowered by about five orders and become potentially non-usable for the fabrication of cubic NL devices. The magnitude of the third order susceptibility due to total current density (conduction as well as diffusion) agrees reasonably well with experimentally observed [18] and theoretically quoted values [19] using conduction current only.

A detailed numerical analysis of Brillouin gain is made in a Centro symmetric III-V semiconductor crystal at 77 K dully shined by 10.6 μm nanosecond CO₂ Laser. The material constant are taken as: $m = 0.015m_0$ (m_0 being the free electron

$$\text{mass}), \rho = 5.8 \times 10^3 \text{ kgm}^{-3}, \\ v = 3 \times 10^{11} \text{ sec}^{-1}, \omega_0 = 1.78 \times 10^{14} \text{ sec}^{-1}, \eta = 3.9 \\ v_a = 4.8 \times 10^3 \text{ msec}^{-1}, \text{ and } \omega_a = 10^{12} \text{ sec}^{-1}.$$

Figure 1 shows the dependence of threshold on carrier concentration via plasma frequency. Figure shows that the threshold electric field decreases with increase in plasma frequency ω_p , at the resonant condition $\omega_p^2 \approx \omega_l^2$, the threshold electric field attains its minimum value at $\omega_p \approx 3.8 \times 10^{13} \text{ s}^{-1}$ or $E_{oth} \approx 0.01 \times 10^4 \text{ Vm}^{-1}$. Further when we increase plasma frequency via carrier concentration beyond this critical value the threshold required for stimulated Brillouin Scattering increases.

In figure 2, we have plotted threshold pump amplitude as

a function of magnetic field B_0 (In terms of $\frac{\omega_c}{\omega_0}$). It is clear from figure 2 that the threshold pump amplitude decreases continuously with increasing ω_c up to $\omega_c > \omega_0$. At resonance $\omega_c = \omega_0$, it attained its minimum value. Above this value of ω_c ($\omega_c > \omega_0$), the threshold pump amplitude increase with ω_c .

In figure 3, we shows the dependence of Stimulated Brillouin scattering gain (SBSG) on the carrier density (concentration) (in terms of ω_p) for $k \approx 2.5 \times 10^8 \text{ m}^{-1}$ and $\omega_c \approx 3.14 \times 10^{13}$ and $E_0 = 10^7$. It is found that the gain of stokes mode (i.e. SBSG) in both the cases increases with increase in carrier concentration of the medium via ω_p . Hence, enhanced SBS gain of stokes mode can be achieved by increasing the carrier concentration of the medium by n-type doping. Therefore, it may be concluded that the heavily doped semiconductors are most suitable host for achieving the SBS process in semiconductor crystal.

Variation of SBSG with magnetic field (in terms of $\frac{\omega_c}{\omega_0}$) is depicted in figure 4 at $E_0 = 10^7$ when $n_0 = 10^{24} m^{-3}$ and $k = 2.5 \times 10^8 m^{-1}$. From figure 4, it is clear that for weak magnetic field ($\omega_c \ll \omega_0$) the SBSG are nearly independent but suddenly shows characteristic $\omega_c \rightarrow \omega_0$. At the resonant condition $\omega_c \approx \omega_0$, SBSG attains its maximum value ($g \approx 1.73 \times 10^{13}$). Further if we increase ω_c ($\omega_c > \omega_0$), SBSG decrease sharply with ω_c .

V. CONCLUSION

Based on the above discussion on may arrive to the following conclusion –

1. Threshold pump electric field required for the incite the stimulated Brillouin scattering process can be minimized by adjusting the carrier density and applied magneto static field.
2. By controlling the magnitude of externally applied magnetic field one may time the magnitude of Brillouin gain. It is found that when cyclotron frequency is nearly equal to applied pump frequency maximum gain of SBS process is achieved.

The present analysis on SDDC provides a model most appropriate for the finite laboratory semiconductor plasma. It is expected that the experimental study based on this phenomena would open a new vista of energy conversion devices for developing potentially useful Brillouin cells, high speed optoelectronic, instrumentation etc.

VI. ACKNOWLEDGEMENT

I wish to express my sincere thanks to University Grants Commission (UGC), New Delhi, for providing me an opportunity to move ahead in this field through the project. I also acknowledge the encouragement and co-operation received from Dr. R. Saxena, Assistant Professor, Benezir College Bhopal (M.P.).

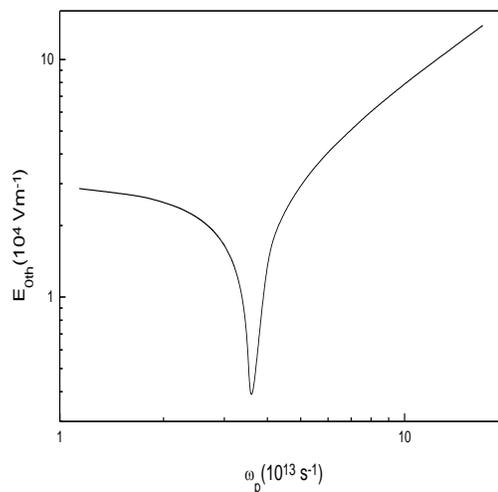


Figure 1: Nature of dependence of threshold pump field E_{0th} on carrier concentration (Through plasma frequency ω_p) in n-InSb crystal.

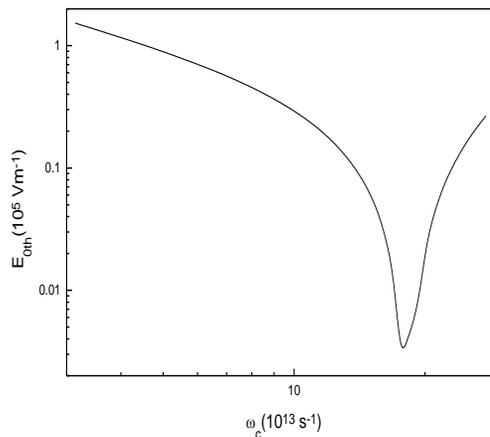


Figure 2: Variation of threshold pump field E_{0th} with cyclotron frequency ω_c

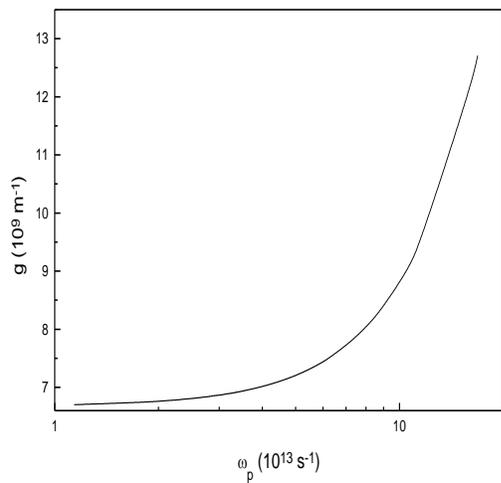


Figure 3: Variation of SBS gain with plasma Frequency ω_p

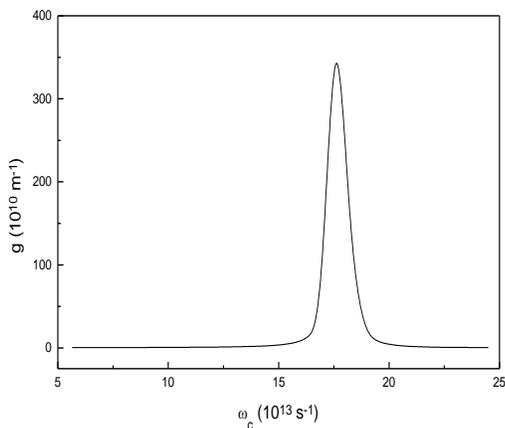


Figure 4: Variation of SBS gain with cyclotron frequency ω_c

- [12] Saxena R., Acustica Vol. 77,(1992).
- [13] P. Gadkari and S. Ghosh, Phy. Stat. Sol. (b) 172, 709 (1992).
- [14] M. Steel and B. Vural, Waves interactions in solid state plasmas, (Mc-Graw Hill, New York, 1996) pp 105-11.
- [15] L.D. Landau and E.M. Lifshitz, Electrodynamics of continuous media (Pergamon Press, Oxford, 1963) pp 337.
- [16] M.S. Sodha, A.K. Ghatak and V.K. Tripathi, Progress in optics, vol. XIII, edited by E. Wolf (North Holland, Oxford, 1976).
- [17] E.M. Conwell, high field transport in semiconductors, Suppl. I,(Academic, NewYork, 1967) P.159.
- [18] A.V. Muravjov and V.N. Shastin, Optical and Quantum Electronics, 23 (1991), pp. 5313.
- [19] G. Flytzanis, "Third order optical susceptibilities in IV-IV and III-V semiconductors", Phys. Lett., A31(1970) p. 273.

AUTHORS

First Author – P. S. Malviya, Govt. J.N.S. P.G. College, Shujalpur (M.P.)-465333, Email: psm_sehore@rediffmail.com
Second Author – Nilesh Nimje, School of Studies in Physics, Vikram University, Ujjain (M.P.)-456010
Third Author – Nishchhal Yadav, School of Studies in Physics, Vikram University, Ujjain (M.P.)-456010

REFERENCES

- [1] Ghosh, S.and Saxena, R.B., Phys. Stat. Sol. (b) 127,557 (1985).
- [2] Neogi, A. and Ghosh, S., Phys. Stat. Sol.(b) 156,705 (1989).
- [3] Jat, K.L., Mukherjee, S. and Ghosh, S., Physica Scripta, Vol.50, 507-513, (1994).
- [4] Neogi, A., J. Opt. Soc. Am. B/Vol. 11, 11(1994).
- [5] LIU Shi-bing, CHEN Shi-gang, Chin. Phys. Lett. Vol.14, 11(1997) 861.
- [6] Gupta, G.P. and Sinha, B.K., Plasma Phys. Control fusion 40 (1998) 245-254,UK
- [7] Bandulet, H.C., Labaune, C., Lewis, K.and Depierreux, S., Phys.Rev.Lett., Vol.193, 3 (2004)
- [8] Yong K.Kim and Chung Yu, International Journal of Comp. Sc.and Network Security, Vol. 6, 6 (2006).
- [9] Singh M., Aghamkar P. and Sen P.K., Indian Journal of Pure & Appl. Phys. Vol.45 (2007).
- [10] Ghosh S. and Yadav N., Arabian Journal for Science and Engineering, Vol.33, 2A (2008).
- [11] Ghosh, S. and Saxena, R.B., Phys. Stat. Sol. (a) 96, 111 (1986).

Forecasting and Management of Load for Rural Areas

Anil Kumar Sahu, Dr. Arun M. Shandilya, Dr. S. K. Bhardwaj

Department of Electrical Engineering, Maulana Azad National Institute of Technology, Bhopal

Abstract- In a remote areas supply of energy from national grid is insufficient for a sustainable development. Integration and optimization of local alternative renewable energy sources is an optional solution of the problem. The needs of rural electricity is met by conventional approaches is limited. In economic perspective, non-conventional forms of rural electrification may least-cost, particularly where villages are some distance from each others. In this paper the renewable energy reduces the burden on electricity supply shortfalls and the urgency of costly grid extension. In this paper we will bring in some new concepts associates with renewable energy forecasting.

Energy plays a significant role in the economic and technological advancement of modern society and plays crucial role in human life standard. In hilly regions energy situation in terms of availability and demand is very different from that in the urban areas. Large parts of hilly and remotely located regions remain un-electrified.

The studies are carried out for load management during a typical rainy, winter and a summer seasons. The results with using matlab for the rainy, winter and summer seasons scenarios are present in this paper. This paper presents a how manage the load forecasting of rural areas.

Index Terms- Load Management, Load forecasting, Renewable Energy and Hybrid System

I. INTRODUCTION

Energy flows from many sources, exists in a variety of interchangeable forms, and drives all systems. It is fundamental to the quality of our lives and today, we are dependent on an abundant and uninterrupted supply of energy for living and working [2]. Due to their geographical location and the lack of critical mass, rural areas are mainly suitable for renewable energy off grid application, systems which are connected to a battery via a charge controller, which stores the electricity generated and acts as the main power supply [6]. Access to electricity is still a dream for 20% of the world's population. Most of them are about 85%, live in rural areas where the extension of utility grid is either complex or very expensive. This is due to the features of rural populations, which are remote and disperse, have small incomes and whose electric consumption is low. The International Energy Agency (IEA) foresees that if current policies do not change by 2030 there will still be 1.2 billion people without access to electricity [11].

The most of the population in India lives in villages and a large number of villages are not served by the national grid due to the high cost involved in erection and maintenance of transmission lines in comparison to low power consumption in such areas. Rapid depletion of fossil fuel resources necessitated

an urgent search for alternative energy sources to fulfill the demand of present day. New and renewable energy sources are economically suitable for the remote areas. These alternative energy sources such as solar, wind, biomass, small hydro etc. have attracted energy sectors to generate power on large scale. But the above renewable energy sources alone cannot provide continuous supply of energy due to seasonal and periodic variations. The effort of doing in this direction, so that the result in a high cost of the system. In this situation, the possible solution is hybrid energy systems. These systems combine two or more renewable sources along with a back-up source as per the availability of resources and load demand in those remote areas [3].

In India a very large proportion of Indian citizens continue to live with no access to electricity and other forms of commercial energy. More than 50 percent of the population has little or no commercial energy access in their daily lives. So the daily life is affected of that peoples of remote areas are shifted from remote to the urban areas for their employment opportunities, education, and health problem etc. Renewable energy can make a substantial contribution in each area. It is only the solution of Renewable energy to the nations for satisfying their energy needs. In terms of all renewable energy categories, India is currently ranked fifth in the world with 15,691.4 MW grid-connected and 367.9 MW off-grid renewable-energy based power capacity. As on March 31, 2012, installed capacity of renewable energy based power generation was 24,503 MW, which is about 12 percent of the total installed capacity of 199,626 MW. That is possible only by major renewable energy sources and integration of these sources [12].

Many alternative energy sources including wind, PV, diesel system, and biogas, small hydro can be used to build a hybrid energy system. The major renewable energy sources used and reported are Wind, solar and biogas power generation in any remote areas. Due to the intermittent nature of wind and solar energy, stand-alone wind and PV energy systems normally require energy storage devices or some other generation sources to form a hybrid system. The storage device can be a battery bank, super capacitor bank [7]. A battery bank is also used in the system for short-time backup to supply transient power. The different energy/storage sources in the proposed system are integrated through an ac link bus. Simulation studies have been carried out to analysis of load management under seasons of rainy, winter and summer using practical load curve [7].

Renewable energy technologies avoid greenhouse emissions, have low operation and maintenance costs, generate employment and allow decentralized production of the rural areas. In rural areas, they are capable of electrify homes, villages, farms and small industries as well as being used for telecommunication, water supply and irrigation. The use of these technologies in rural areas reduces the need for candles, kerosene

and battery charging and higher quality of lamps than kerosene and also improving the standard of life in the rural areas. [6] The basic objectives of the development of renewable energy is ensuring energy security and reducing emissions. [6] The sustainable energy production is to be found in renewable energy sources that are clean, cheap and green [2].

For electrification of remote areas/rural electrification started shecheme of the government like Kutir Jyoti Program (KJP) , Pradhan Mantri Gramodaya Yojna (PMGY), Rajiv Gandhi Grameen Vidyutikaran Yojna, Jawaharlal Nehru National Solar Mission scheme [13]. Rajiv Gandhi Gramin Vidyutikaran Yojana (RGGVY)-The basic purpose of the Rajiv Gandhi Gramin Vidyutikaran Yojana (RGGVY) Programme is to provide 100% electrification of all villages and habitations in the country, electricity access to all households , free of cost electricity connection to BPL (Below Poverty Line) households through renewable energy sources in those unelectrified remote census villages, unelectrified hamlets of electrified census villages where grid connectivity is either not feasible or not cost effective & and electrified villages/hamlets where power availability is less than 6 hours per day averaged over the year. Jawaharlal Nehru National Solar Mission- the National Solar Mission is a major initiative of the Government of India and State Governments to promote ecologically sustainable growth while addressing India's energy security challenge. The basic purpose of the National Solar Mission is to establish India as a global leader in solar energy by creating the policy conditions for its diffusion across the country as quickly as possible [13].

These schemes are used for rural electrification but not sufficient to provide electricity for 24 hours. So that the solution is how to manage the load, according to demand of rural areas. This paper presents how to manage the load and forecasting of remote areas according to rainy, winter and summer seasons in yearly on the basis of data collection of remote areas. For sustainable development of rural electrification the integration of renewable energy sources (hybrid system) is needed. The results for load management are shown in this paper for remote area.

II. HYBRID SYSTEM

The performance of hybrid system is dependent on the environmental conditions, analysis is considered in the given study area to investigate the associated cost and component size. The alternative/renewable energy sources such as solar energy, wind energy and biogas power plant have the greater potential to generate power for system utilities. The abundant energy available in nature can be converted to electricity in a sustainable and clean way to supply the necessary power to remote areas for the living standards of people without access to the electricity grid. If stability is concerned with available voltage and power

variation, these problems can be solved by integrating the possible renewable energy sources [1].Based on the availability and potential of renewable energies in the remote areas cluster of village consisting of a hybrid energy system wind, solar PV and biogas system along with a DG back-up, battery storage and power conditioning equipment [3].

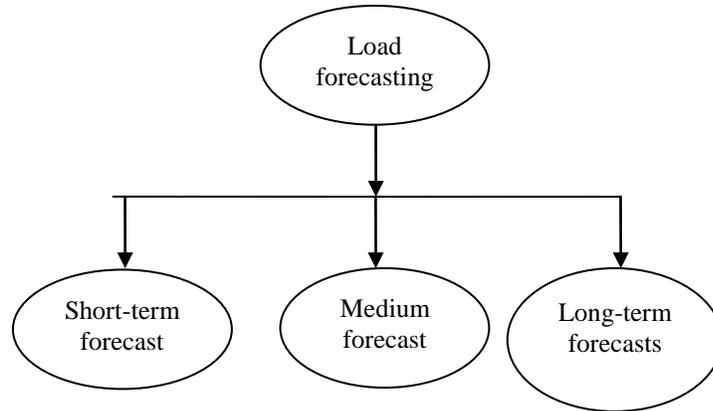
The main advantages of hybrid systems as reduced operational cost due to lower fuel consumption and low PV maintenance, improved reliability through diversifying power sources and continuous power supply, as well as increased operational life due to fewer generator operating hours. The system is environmentally friendly due to reduced emissions and noise pollution, and smoothes out seasonal weather fluctuations, resulting in improved energy services, and extended battery life [4]. The role of integrating renewable energy in hybrid energy system is primarily to save diesel fuel. The renewable energy sources commonly used in hybrid configurations are small wind turbines, photovoltaic systems and biogas. The integrated approach makes a hybrid system to be the most appropriate for isolated communities of a rural remote area [8]. For systems employing totally clean renewable energy, high capital cost is an important barrier. We can produce green power by adding different renewable energy sources to diesel generator and battery, which is also called a hybrid system. This kind of system can compromise investment cost, diesel fuel usage cost and also operation and maintenance costs [8].

The diesel generators have been the solution for decentralised electricity supply because of their low initial capital cost. Apart from environmental concerns, the diesel generator has high operating costs as a result of high consumption of fuel and high maintenance costs. The amount of power produced by renewable energy devices such as photovoltaic cells and wind turbines varies significantly on an hourly, daily and seasonal basis due to the variation in the availability of sunshine, wind and other renewable resources. This variation means that sometimes power is not available when it is required and on other occasions there is excess power [4].

III. LOAD FORECASTING

Load forecasting is very important for electric utilities in a competitive environment created by the electric industry deregulation, planning and operational decision [5]. From the perspective of the system operators and regulatory agencies, the medium term forecasting is a source of primary information for the safe and reliable operation of the system. The basic tool for determining the optimal utilization of generators and power stations, some facilities are more efficient than others.

Load forecasting is classified as-



IV. LOAD SURVEY OF RURAL AREA

The load survey of the rural areas is achieved by taking the interview of sarpanch, school teachers, members of rural area etc. The following constraints are considered during the load survey of nearby villages up to 5 to 12 km distance from each other in the district of Sehore (MP). The load survey of rural area depends on-

- (1) Number of villages of rural area
- (2) Number of houses of rural area
- (3) Population of rural area
- (4) Demand of domestic load
- (5) Demand of street lighting load
- (6) Demand of commercial load
- (7) Demand of agriculture load
- (8) Average energy consumptions
- (9) Others demand.

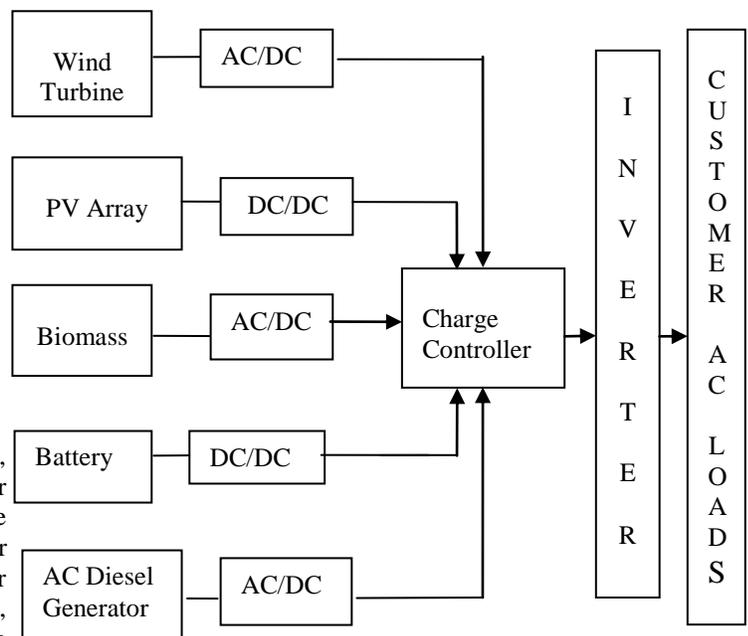
V. ENERGY DEMAND AND RESOURCES

The electrical loads of the area are classified as domestic, agricultural, commercial and street light. The domestic sector needs electricity for electrical appliances such as TV, fan, Tube light, washing machine, mixer, fridge, water heater and motor for pumping.. The agricultural load includes irrigation and motor for water pumping. The commercial load includes schools, shops, flour mill, small scale industries, and village panchayat office buildings [1].

The connected load determination of the average connected load of households in the hilly rural area, which is not yet electrified, has been made feasible by the estimation method. The expected consumption pattern of the area throughout the year has been estimated, keeping in mind demographic characteristics of the local population, land features, density of population in each village, prevailing climate and social requirements of inhabitants. For load estimation in that rural area has been a great help in determining the load requirement for this rural hilly area [3].

VI. OVERALL POWER MANAGEMENT STRATEGY

An overall control strategy for power management among different energy sources in a multi-source energy system is needed.



The block diagram of overall control strategy for the proposed hybrid alternative energy system.

The power difference between the generation sources and the load demand is calculated as-

$$P_{net} = P_{wind} + P_{pv} + P_{biogas} + P_{load} \dots (1)$$

Where -

P_{wind} is the power generated by the WECS,

P_{pv} is the power generated by the PV energy conversion system,

Pbiogas, is the power generated by the biogas energy conversion system

Pload is the load demand.

VII. RESULTS FOR LOAD MANAGEMENT

In order to analysis of the load performance under different situations, the studies have been carried out using practical load demand data with the help of matlab depending on seasons (rainy, winter summer seasons). As discussed in this paper the system is considered to supply electric power demand of 100 houses in the any rural areas.

A typical hourly load demand for a house in the rural areas reported with survey of rural areas and study of that area. The total hourly load demand profile of 100 houses over 24 h is shown in the form of load curve of rainy, winter and summer season.

The studies are carried out for load management during a typical rainy, winter day and a summer day. The results with the help of matlab for the rainy, winter and summer season's scenarios are shown in the fig. 2, fig. 3, fig. 4

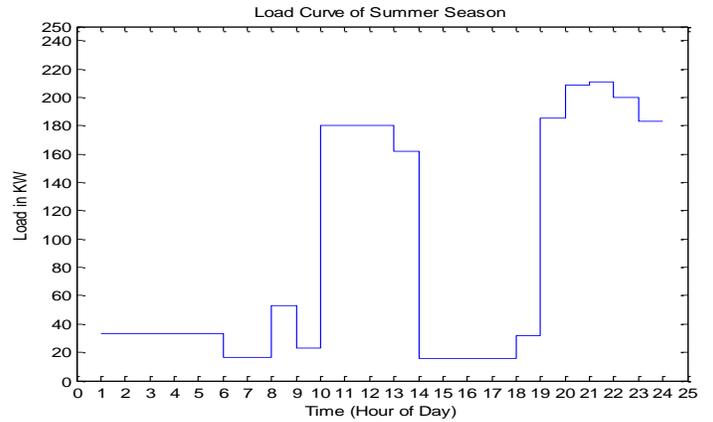


Fig. 4

The studies are carried out for load management during a typical rainy, winter and a summer season after adjustment of the load. The results with the help of matlab for the rainy, winter and summer season are shown in the fig. 5, fig. 6, fig. 7.

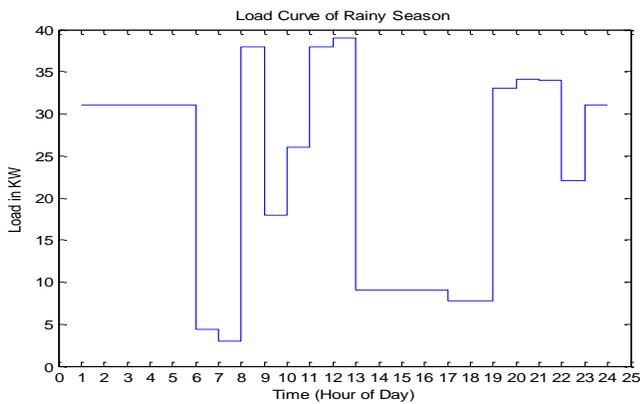


Fig. 2

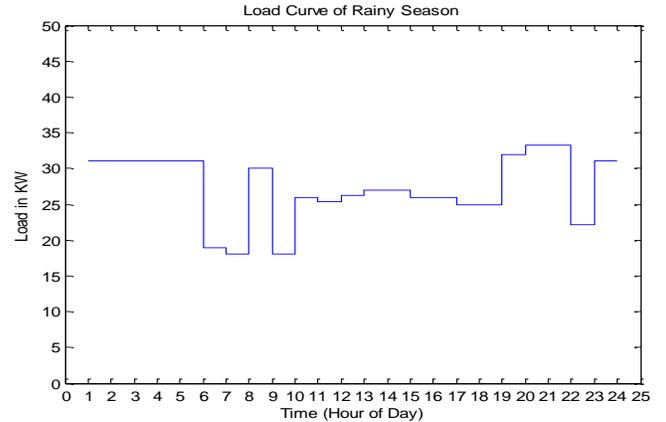


Fig. 5

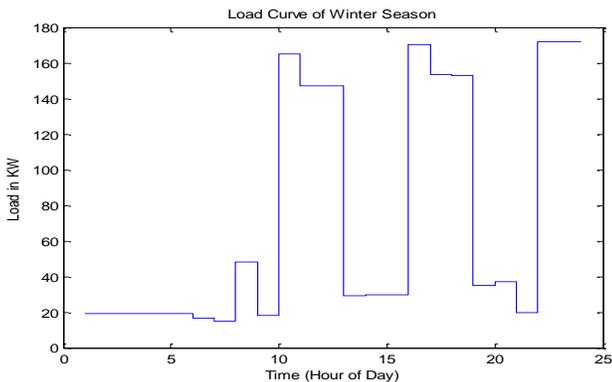


Fig. 3

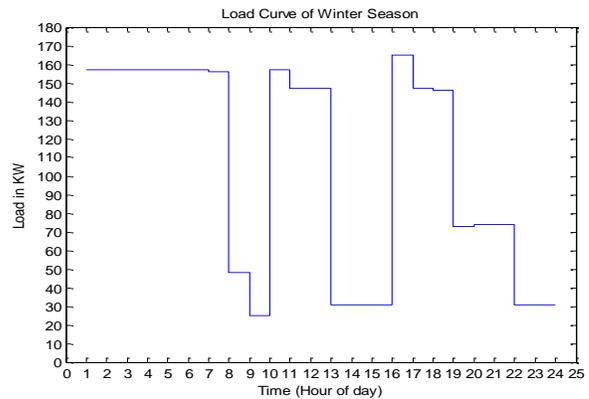


Fig. 6

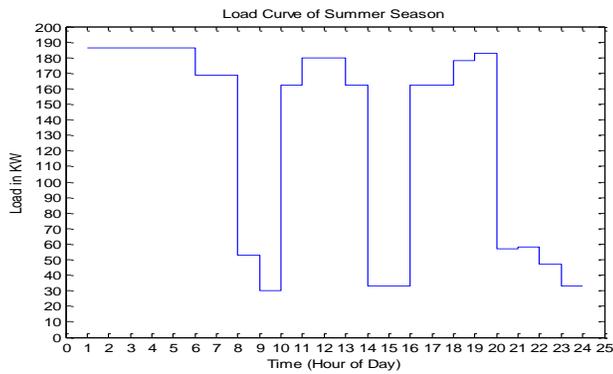


Fig. 7

The studies are carried out for load management during a typical rainy, winter and a summer season after distribution of agriculture loads in weekly. Agriculture load for rainy season is considered zero. So that the results with the help of matlab for the winter and summer season are shown in the fig. 8, fig. 9, fig. 10, fig. 11.

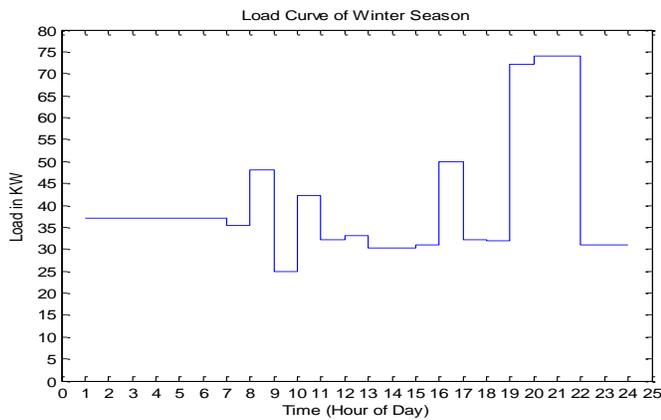


Fig. 8

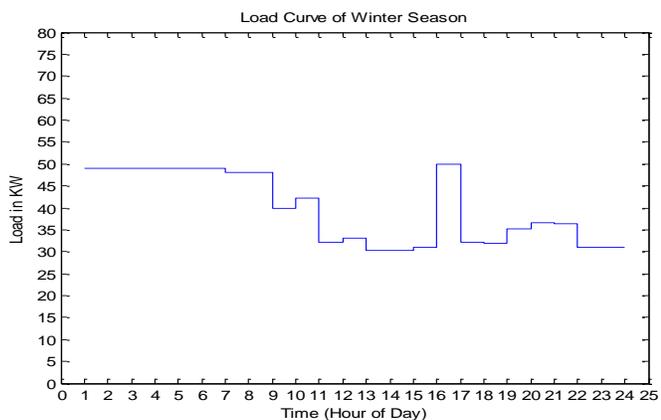


Fig. 9

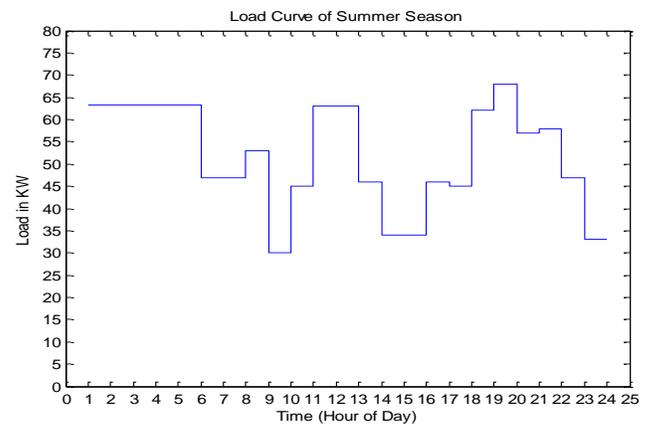


Fig. 10

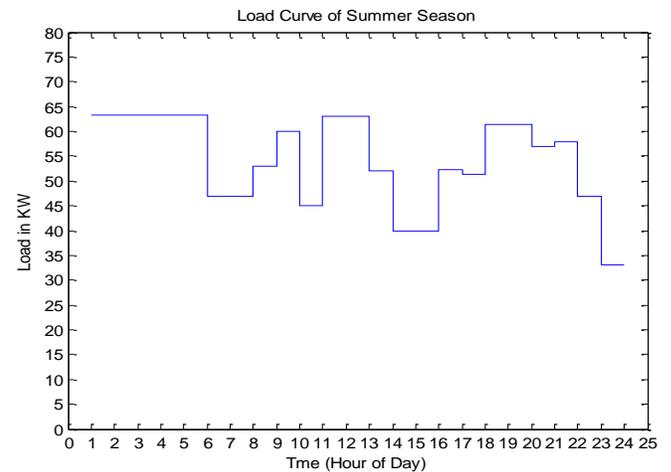


Fig. 11

VIII. CONCLUSION

In this paper, an ac-linked stand-alone Wind/PV/Biogas alternative energy system is proposed. The wind, PV generation and biogas systems are the main power generation devices in any rural areas.

The model of the hybrid system has been discussed in this paper. The studies have been carried out to verify the load performance under different scenarios using matlab the practical load curve profile in the remote areas. The results, with the help of matlab to given for a rainy, winter and a summer seasons scenario, show the effectiveness of the overall load management strategy and the feasibility of the proposed hybrid alternative energy system.

REFERENCES

- [1] Deepak Kumar Lal, Bibhuti Bhusan Dash, and A. K. Akella " Optimization of PV/Wind/Micro-Hydro/Diesel Hybrid Power System in HOMER for the Study Area", International Journal on Electrical Engineering and Informatics , Volume 3, Number 3, Aug. 2011, pp. 307-325.

- [2] Dr. M. M. Qurashi & Engr. Tajammul Hussain, "Renewable Energy Technologies for Developing Countries Now and to 2023"
- [3] A. Rajoriya & E. Fernandez, "Sustainable energy generation using hybrid energy system for remote hilly rural area in India", International Journal of Sustainable Engineering, Vol. 3, No. 3, Sept. 2010, pp. 219–227.
- [4] Henerica Tazvinga, Tawanda Hove, "A technical model for optimising PV/diesel/battery hybrid power systems", Proceedings of the 3rd Biennial Conference of the Council for Scientific & Industrial Research (CSIR): Science Real and Relevant Conference, Pretoria, South Africa, Aug. 2010, pp. 1-10.
- [5] Eugene A. Feinberg, Load Forecasting, State university of New York, stony brook, Applied Mathematics for Power System, pp-269-283.
- [6] Renewables Global Status Report 2006 Update REN21 published 2006, accessed 2007-05-16
- [7] Caisheng Wang, and M. Hashem Nehrir, "Power Management of a Stand-Alone Wind / Photovoltaic / Fuel Cell Energy System", IEEE Transactions on Energy Conversion, Vol. 23, No. 3, Sept. 2008, pp. 957-967.
- [8] A. Gupta, R. P. Saini and M. P. Sharma, "Design of an Optimal Hybrid Energy System Model for Remote Rural Area Power Generation", Proceedings of the International Conference on Electrical Engineering (ICEE), Lahore, Apr. 2007, pp. 1-6.
- [9] S.N. Singh, "Electrical Load Survey & Load Forecast For A Stand Alone Small Hydropower Station", Senior Scientific Officer, AHEC, Indian Institute of Technology Roorkee, Himalayan Small Hydropower Summit (October 12-13, 2006), Dehradun, pp-301-306.
- [10] Ministry of New and Renewable Energy [www.mnre.gov.in]
- [11] Olatz Azurza, Iñaki Arranbide and Itziar Zubia, "Rural electrification based on renewable energies. A Review", International Conference on Renewable Energies and Power Quality (ICREPQ'12), Spain, March 2012.
- [12] The Potential for Renewable Energy in India -2012 www.gyananalytics.com
- [13] Vijay Modi , "Improving Electricity Services in Rural India", CGSD Working Paper No. 30, Working Papers Series Center on Globalization and Sustainable Development, The Earth

AUTHORS

First Author – Anil Kumar Sahu, E-mail:

anil_sahu2@rediff.com

Second Author – Dr. Arun M. Shandilya , Professor, Department of Electrical Engineering, MANIT, Bhopal

Third Author – Dr. S. K. Bhardwaj, Professor, Department of Electrical Engineering, MANIT, Bhopal

Correspondence Author – Anil Kumar Sahu, E-mail:

anil_sahu2@rediff.com

Problems of Govt. Girls High Schools of Khargone District (M.P.)

Dr. Shri Krishna Mishra*, Mr. Badri Yadav**

* Principal, Shri Kanwartara Institute for Teacher's Training, Shri Nagar Colony, Mandleshwar, Tehsil-Maheshwar, Dist.Khargone (M.P.), India 451221

** Asst. Professor, Shri Kanwartara Institute for Teacher's Training, Shri Nagar Colony, Mandleshwar, Tehsil-Maheshwar, Dist.Khargone (M.P.), India 451221

Abstract- The importance of education in our country is an important point of discussion today. Education is a life long process. It begins from the mother's womb. Home is the first school of a child. It is important to co-ordinate life in home and the school as recognized by all educationists. The importance of formal education is basic and fundamental in the sense that on it the whole educational superstructure is built up.

In this modern era of science and technology nobody denies the importance of girl's education. NPE (1986) emphasized that women education should be carried out all over the country in priority basis.

In the proceeding chapters, the complete account of the work done has been given. Now the present chapter is devoted to provide a summary of the entire study, which includes a brief outline of the major objective, methodology and procedure followed in different phase of the study. This study was undertaken to know the views of teachers, students and parents on the girl's education in Govt. Girls High Schools.

Index Terms- The problem of the study, Problems of Govt. Girls High schools.

I. INTRODUCTION

“Education of boys is education of one person, but Education of a girl is the education of the entire family”, said Jawaharlal Nehru while underlying the importance of women's education. In other words of the Indian Education Commission (1964-66) “For full development of our human resources, the improvement of homes, and for molding the character of children during the most impressionable years of infancy, the education of woman is of even greater importance than that of man”. This perhaps sums up the important place which education of woman occupies, particularly in the present context. Educational reconstruction is one of the present system to spread enlightenment and combat mass illiteracy has caused much misgiving and has focused public consciousness on some of the outstanding defects. A highly discouraging feature has been the unsatisfactory state of girls' education, the importance of which has been considerably enhanced by the recent changes in the economic and political status of women. These new privileges have brought and old time prejudices. The sphere of women's activities has broadened and civil life is no longer confined to the gossip which centered round the village well. A spirit of service and a burning design for national progress are animating India's womanhood. This is reflected in the field of

education in an insistent demand for reform and for a programme of studies more in keeping with the genius and characteristics of the Indian people. Whatever group of religion one might belong to, education is essential. Education has mainly two aspects, the cultural aspect which makes a person grow, and the productive aspect which makes a person do things. Both are essential.

Everybody should be a producer as well as a good citizen and not a sponge on another person even though the other person may be one's own husband or wife. That is the way we are developing and persons who do not wake up to this fact and prepared themselves for it will just be left behind. So it is highly necessary that we should develop our education, especially among our girls.

The primary aim of education should be the removal of illiteracy and it is important to note that illiteracy % of girl's is always higher than boys. As per 2001 census the literacy % of (male-75.35% and female-50.51%) for Orissa. The financial aspect of the problem bristles with difficulties. The masses are poor and the Government is always short of money, private enterprise is too inadequate. In this context girls are more effected when there is financial problem in the family. “The importance of the education of girls and women in India”, can not be overrated. It affects vitally the range and efficiency of all education. The education of the girl is the education of the mother and through her of her children. The middle and high classes of India have long suffered from the dualism of an educated manhood and an ignorant womanhood -a dualism that lowers the whole level of the home and domestic life and has its reaction on personal and national character.

The education of women, especially in the higher stages will make available to the country a wealth of capacity that is now largely wasted through lack of opportunity. It is only through education that Indian women will be able to contribute in increasing measure to the culture, ideals and activities of the country.

Equality of the opportunity access to education is necessary if more women are to become the agents of change. Therefore, education of women is an important key to improving health, nutrition and education in the family, and also empowering them of participate in decision-making, investment, both in formal and non-formal education of the girl child is expected to yield exceptionally high social and developmental returns.

Globalization is marginalizing girls further in education in relation to access to English medium education. With globalization, the demands for fluency in English have increased in the job market. More boys are being sent to private English

schools where possible, whereas girls continue to attend cheaper or free vernacular schools. Language has become a marker of discrimination against girls in the context of employment, and this new form of discrimination needs to be addressed seriously.

The problem of girl's education has been examined by various committees and commissions appointed from time to time. The measures suggested by them in the field of education have been reiterated as a future course of action for solving various problems-responsible for the slow progress of women's education. But, whatever may be problem arising out of women's education, every girl in free India should be educated because a woman has to play a lot of role in home front and in our national mainstream.

The importance of female education was recognized by the Directors of the East India company in their Dispatch of 1854, in which they declared that "the importance of female education in India can not be over-rated". It further said; "our Governor General in council has declared in a communication to the Government of Bengal that the Government ought to give to native female education in India its frank and cordial support; the problem, then, of female education is substantially the same, although more aggravated in form, as that of boys' education, via, how to attract the children to school, and when they came, how to retain them for a sufficiently long time to give them a sound grounding in the rudiments of the three R's.

Time after time the Government have given liberal grants for the extension of female education. The yearly reports of education recorded slow advances, but did not hold out any bright prospects for the near future. At last, in 1905, the Government felt that something should be done, and realized that in this sphere the sympathy and co-operation of Indian gentlemen was essential for any appreciable advance. As a result, a committee consisting of influential officials and non-officials was appointed to advise the Government as to the best means of advancing female education.

The National Committee on Women's Education has suggested a number of programmes for expanding the education of girls at the secondary stage.

1. Free education to all girls till they complete the secondary stage.
2. Provision of separate girls schools because co-education will not be accepted except by a small minority of parents at this stage.
3. Provision of hotels in all girls schools, and the provision of free or subsidized transport where necessary, with a view to attracting girls from areas where secondary schools do not exist.
4. Provision of scholarships and stipends to cover at least the incidental expenditure on education such as purchase of books and writing materials and school uniforms.
5. The preparation and appointment of women teachers in increasing numbers.

These are many difficulties which hindered the progress of girls education in the Orissa State conservation of parents; general reluctance of parents to send grown-up girls to schools; lack of sufficient number of women teachers, teachers quarters and hostels for girls, lack of proper security measures for girl students and women teachers; lack of secondary schools for girls students; inadequacy of funds. In Orissa Women's education can be traced with the establishment of the Ravenshaw Hindu Girl's

school way back in 1873. However the development of girl's education is a slow progress due to certain factors, such as preference of boys rather than girls for education, lack of awareness about the girls child education value by the parents. As of 2010 India Census Khargone has an average literacy rate of females 62.85%. The progress of girls education in this district is still in progressive period and many hurdles need to be tackled in the educational field.

Education has been perceived to be a significant instrument in improving the status of women and consequently there have been efforts to improve the access of girls and women to education. For a country which has accepted the goal of a democratic egalitarian society, promotion and development of women's education is foregone commitment. Policy maker have recognized that apart from the political structure, corrective legislation and economic transformation, the formal education system has to be made more democratic and change oriented. For modernizing India hopes have been pinned in education as positive significant determinant of aspiration, technology, productivity and mobility. In fact it is a fundamental pre-requisite for participation in the various developmental activities of society the level of recognition of the crucial significance of education for girls is dependent upon social expectation of women's ruler.

In the modern world the role of women goes much beyond the home and the bringing up of children. She is now adopting a career of her own and sharing equality with man, the responsibility for the development of society in all aspects. This is the direction in which we shall have to move. In the struggle for freedom Indian women fought side by side with men. This equal partnership will have to continue in the fight against hunger, poverty and ignorance and ill health.

So every effort must be made to enhance women's education with all available resource and with careful planning. Once women are educated in the right way will contributed positively to build up strong nation.

II. IMPORTANCE OF GIRL'S EDUCATION

Educationists are of the views that mother is the first teacher of the child. Education of women is very important unless the mothers of the race are enlightened citizens, we can not enlighten the spirit of the citizen of the country. The new education policy has given a great importance for development and improvement of women's education in the country.

The University Education Commission (1948) obtained that there can not be educated people without educated women. If the general education has to be limited to men the women will suffer, hence opportunity should be given to women.

The importance of primary education in the educational set up needs no affirmations. In dealing with a system of education it is necessary to start with primary education may be conceived, as a minimum of knowledge and skills considered necessary for the future generation of a community for continuity of culture and for meeting the demands of everyday living. As a matter of fact, primary education is one of the whole some factors for benefit of masses and for improving the conditions under which they live.

It is noted that the problem of girl's education has been examined by various committees and commissioners appointed

from time to time. The measures suggested them in the field of education have been reiterated as a future course of action for solving various problems responsible for the slow progress of women's education. India should be educated because women has to play a lot of role in home and also in our national mainstream.

III. VIEWS OF GREAT PEOPLE ABOUT GIRL'S EDUCATION

In course of history of the role of women changes from time to time depending upon the economic conditions and political structure of society. In the vedic literature we find that one of the remarkable features or ancient India was the high level of cultures and social status which women enjoyed. The vedic women were allowed access to different branches of knowledge. There are evidences to suggest that the gifted ones among them often took part even in religious and philosophical discussions.

The education of women has ever been a matter of great debate, opinion expressed about it have often been reactionary. Sometimes abused and occasionally extraordinary insetting. It comes as an surprise that Dr. Johnson said that "a man is better pleased when he has a good dinner upon his table than when his wife talks Greek".

Rabindra Nath Tagore one had said that "the union of man and women will represent a perfect co-ordination on the building up human history on equal terms in every department of life".

Mahatma Gandhi also said that women's education I am not sure whether it should be difference from men's and when it should begin. But I am strongly of the opinion that women should have the same facilities as men and even social facilities may be provided where ever necessary.

Sri Aurobindo also said that "Indeed, if the education is to have its maximum result, it must begin even before birth. The part of education which the mother has to go thought is to see that her thought are always beautiful and pure, her feelings always noble and fine, her material surroundings as harmonious as possible and full of a great simplicity." Dr. Sarvapalli Radhakrishna has very emphatically stated about the significance of women education. He said "Women are human beings and have as much right as men have. The position of women in any society is a true index of its cultural and spiritual level."

IV. EDUCATIONAL STATUS OF WOMEN'S IN INDIA

Educational status of women is measured in term of level of literacy or literary rate which is defined as the percentage of literate women to the total women of a given geographical area at given point of time. The level of literacy for a general population as women is generally regarded as an indicator or socio-economic development of a society. It really plays an important role in socio-economic and cultural transformation in human society from one generation to another. While lighting the importance of literacy in our society, it has been rightly been remarked "Literacy is one of the important sociological variables according to which rural and urban societies may be fully differentiated. It may be regarded as an instrument of social change in human society as it brings social consciousness among the people in society, makes changes in norms customs and

traditional ways of life in social environment, socio-economic and cultural changes occurring in the society may be directly be attributed to the impact of rising level of literacy.

Female literacy or educational status of women may play an important role in fertility performance and acceptance of family planning methods. It is the education which can make the women aware about their rights and duties, importance of small family norm, care and guidance for their children. It is the education which can make aware about the ways and means of controlling their fertility, behavior and spacing of births and motivate them indirectly to have small size of family for their happy, prosperous and healthy life.

It is the education which may help them in adopting innovative ideas by learning traditional ways of thinking and living and thus making them modernized women.

STATEMENT OF THE PROBLEM

The present study is stated as "Problems of Government Girls High Schools of Khargone District".

Objectives of the Study

- To find out the problems of learners, parents and teachers of Govt. Girls High Schools of Khargone District.
- To findout the infrastructure requirements of Govt. Girls High Schools of Khargone District.

Research Questions

- What are the problems faced by learners parents and teachers of Govt. Girl's high schools, of Khargone District?
- What are the infrastructure requirements of Govt. Girl's high schools of Khargone District?

Delimitations of the Study

- i) The study is confined to Khargone District only.
- ii) The study is limited to a sample of 5 govt. girls high schools of Khargone District.

V. REVIEW OF RELATED LITERATURE

Jhakkar (1976) studied the development of "Female education in Gujarat" during post independence period and found that :

- Wastage and stagnation were very high among the girls both at primary and secondary stage.
- Inspite of advancement of girls' education its value was not recognized by the society.
- Economic and social factors were responsible for the backwardness of girl's education.

Bhonslay (1985) conducted study on "The development of women's education in rural areas of Maharashtra state especially in Nasik District (1961 to 1979). The objectives of the study were :

- To study the development of women's education in Nasik district of Maharashtra from 1961 to 1979.
- To study the general problems of women's education.

- To find out the status of women in rural areas during the period.

The major findings were :

- Facilities for pre-primary education in rural areas were inadequate.
- The ratio of women's teacher was very low in this area.
- There were 72% illiterate women and 45% illiterate men.
- In rural areas a women gets a secondary place in family as well as in society.
- In the secondary education, the enrolment of boys and girls in fifth year plan was 36.3% and 14.1% respectively.
- The reasons for wastage and low proportion of recruitment in rural areas were household work, poverty, general apathy about education and early marriage.

VI. METHODOLOGY

Research in education is a search for knowledge. It is not a search that yields infallible truths, but it is rather a search that provides knowledge for the solution of problems in the field of education. Therefore, a knowledge of the research methodology is essential. In any research work, method of study plays an important role. In fact, for a particular study the suitable method must be determined at the first instance. In the present study, the investigator has adopted the "survey method". The methodology used for the study is presented below under the titles of design of the study, sample, tools, construction and tools used for the

study, procedure of data collection and statistical techniques used.

Design of the Study

Research design is the plan, structure and strategy of investigation of obtain answers to research questions in the study. In fact, research design is a blue print of research study and helps the researcher as a guide as to how to conduct research and gives immediate overview of the research to its reader. The present study is a survey type research. In the present study "Problems of Govt. Girls High Schools of Khargone District" has been studied.

Sample

Sampling is the process by which a relatively small number of individuals on objects on events is selected and analyzed in order to find out something about the entire population from which it is selected.

The present study was undertaken in Khargone District of Orissa. Purposive random sampling method was followed to select sample for the study.

For the study, 5 Govt. Girls High Schools from different blocks of Khargone District were selected. In addition to the above, 100 girls, 20 teachers, 20 parents were selected randomly from 5 Govt. Girls High Schools of Khargone District. The details are given below –

- Mandleshwar Govt. Girls High School
- Maheshwar Govt. Girls High School
- Kasrawad Govt. Girls High School
- Dhargaon Govt. Girls High School
- Pipliya Govt. Girls High School

Table: Name of the Sample

Sl. No.	Name of the School	No. of Girls		No. of Teachers	No. of Parents	Total
		IX	X			
1.	Mandleshwar Govt. Girls High School	10	10	4	4	28
2.	Maheshwar Govt. Girls High School	10	10	4	4	28
3.	Kasrawad Govt. Girls High School	10	10	4	4	28
4.	Dhargaon Govt. Girls High School	10	10	4	4	28
5.	Pipliya Govt. Girls High School	10	10	4	4	28
		50	50	20	20	140

Tools Used

After the selection of the sample, the next task for the researcher was to prepare and use appropriate tools for the collection of data.

The following tools were used to collect data for the purpose –

- Questionnaire/ interview schedule was prepared for students, teachers, parents, to know the problems of Govt. Girls High Schools.
- School record schedule was collected and studied to know enrollment, retention and achievement of girls of Govt. Girls High Schools.

- Questionnaire/interview schedule was prepared to know about infrastructure facility of Govt. Girls High Schools.

Procedure of Data Collection

After development of questionnaire or interview schedule, the investigator went to Govt. Girls High Schools at the delimited areas. The questionnaire for teachers were administered to the sample teachers of Govt. Girls High Schools. The interview for girls were administered to the sample students.

Before administration of the questionnaire/interview, head mistress, teachers as well as girls were explained in details on how to proceed in answering the questions.

Then, the interview schedule for parents were administered to the sample parents. Before that parents were explained that how to proceed and how to answer the questions.

Statistical Techniques Applied

After administering the questionnaire / interview to teachers, girls and parents, their percentage were obtained as statistical measures.

VII. ANALYSIS AND INTERPRETATION OF DATA

After the information was collected, the researcher paid attention to analyze the collected data. Analysis of data involves closely related operations that are performed to get answer to reach questions. Data collected are to be processed and analyzed for scientific conclusions and ensuring that all relevant data are used for making completed comparisons and analysis. Processing of data implies editing, coding, classification and tabulation of the collected data so that they are amenable to analysis.

In this chapter, an attempt has been made to examine how for the NPE and POA have been effective in evaluating the status of girls in the society as far as education is concerned.

Education has always considered as important instrument for bringing change in any social set up. Realizing the importance of this aspect NPE (1986) has emphasized that education will be used as an agent of basic change in the status of girls. In order to neutralize the accumulated distortion of the past, there will be a well conceived edge in favour of the women. It has assured that the National Education System will play positive, interventionist, role in the empowerment of women.

Once the research data are selected and analysis have been made, the researcher can proceed to the stage of interpreting the results. The process of interpretation is not a routine and mechanical process. It calls for careful, logical and critical examination of the results obtained after analysis, keeping in view the limitations of sample choose and the tools selected and used in the study.

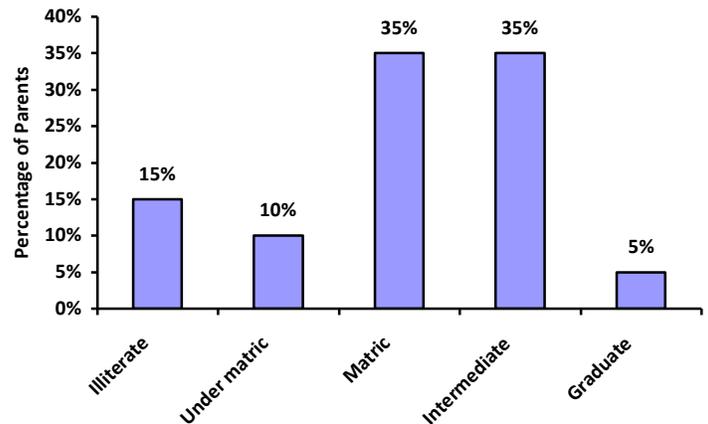
The first step in the analysis is the classification. Classification implies arranging data in different classes or groups according to similarities and dissimilarities. The following are the description and interpretation of the different dimensions.

Table-4.1: Literacy Rate of Parents

Level of Education	Parents (N=20)	%
1. Illiterate	03	15%
2. Under matric	02	10%
3. Matric	07	35%
4. Intermediate	07	35%
5. Graduate	01	5%

From the above table-4.1, it is seen that literacy rate of parents are vary from level of education to education. The literacy rate of parents of metric and intermediate qualification are 35% respectively. The under metric parents rate of literacy is 10%.The illiterate parents are 15%. Graduate parents rate of literacy is 5%.

Thus, it can be concluded that the girls who have taken admission in GGHS, their parents are mostly metric and intermediate level.



(i) Bar graph shows, educational qualification of parents.

Employment Status of Parents :

Occupation of the father helps in strengthening the financial status of the family. Occupation is almost very low as compared to the normal income of the family. Socio-economic and family status play a vital role for the academic achievement of the child. The economic condition of the people is generally indicated by their employment status. The economic condition of the family has a great influence on the education of their children. So, it is necessary to study the employment status of parents.

VIII. PARENTS CONSCIOUSNESS REGARDING THEIR CHILDREN’S EDUCATION

In today’s competitive world all parents are becoming more and more conscious regarding their child’s education, as they want that their child should do better and be placed in a high position in the society in future as far as occupational status is concerned. But how far parents are conscious regarding education of their girls is to be taken into account.

Table-4.2 : Parent’s consciousness regarding their girls education

Opinion	Number of Girls (N=100)
Yes	60 (60%)
No	40(40%)

From the table-4.2, it is seen that majority of parents are not conscious about their girl’s education and most of the parents are not conscious due to their socio-economic problems. In view of this parent-child relationship also affects considerably and also linked with their achievement in school.

Table-4.3: General Information Related to the views of parents about GGHS

Questions	Opinion to 'Yes'		Opinion to 'No'		Total
	No	%	No	%	
1. Do you know about GGHS?	20	100%	00	00%	20
2. Does the girls of your family has taken admission on GGHS?	20	100%	00	00%	20
3. Do you feel that girl's education is necessary now-a-days?	20	100%	00	00%	20
4. Do you satisfy about the education of girls in GGHS?	16	80%	04	20%	20

From the table 4.3, it is known that 100% parents know about the GGHS. From the selected sample of parents it is noticed that 100% parents have given admission in GGHS. 100% parents feel that girls education is necessary now-a-days. 80%

parents are satisfied with the education provided to girls but 20% are not satisfied.

Table-4.4: Views of parents about GGHS

Question	From neighbours	From friends	From Advertisement	From social worker	From other sources
[14] How did you know about GGHS?	17 (85%)	3 (15%)	00 (0.00%)	00 (0.00%)	00 (0.00%)

From the table 4.4 it is noticed that 85% parents know about GGHS from their neighbours, 15% know from friends.

Table-4.5 : General information related to the views of Girls about GGHS

Questions	Opinion to 'Yes'		Opinion to 'No'		Total
	No	%	No	%	
1. Does GGHS organize entrance test?	00	00%	100	100%	100
2. Have you been at any other school before coming to GGHS?	32	32%	68	68%	100
3. Are you being provided with bridge class?	00	0.00%	100	100%	100
4. Are you aware of the facilities available here?	63	63%	37	37%	100

From the above table-4.5, it is known that 100% girls have said that there is no entrance test to take admission, 32% girls have come from another school whereas 68% girls have taken admission in GGHS fresh.100% girls said that there is not a

facility of bridge course. 63% girls were aware about the facilities available in GGHS but 37% girls were not known about GGHS.

Table-4.5.1

Question	From Parents	From neighbours	From friends	From social worker	From Panchayat	From advertisement	Others
How did you know about GGHS	74 (74%).	22 (22%)	04 (4%)	00 (0.00%)	00 (0.00%)	00 (0.00%)	00 (0.00%)

From table 4.5.1, it is noticed that 74% girls know about friends. GGHS from their parents, 22% from neighbours, 4% from

Table-4.5.2

Question	Parents	Teachers	Friends	Neighbours	Others
[15] Who encouraged you to take admission at GGHS?	41 (41%)	52 (52%)	07 (07%)	00 (0.00%)	00 (0.00%)

From the table 4.5.2, it is known that 41% girls were encouraged by their parents, 52% by teachers, 07% by friends.

From the above discussion, it is concluded that there is no entrance test in GGHS. The ratio of girls who had come from

another schools and girls who has taken admission in GGHS is 1:2. The bridge course classes are not provided in GGHS. They are encouraged to take admission by parents and teachers.

Table-4.6 : General information related to the views of teachers about GGHS

Questions	Opinion to 'Yes'		Opinion to 'No'		Total
	No	%	No	%	
1. Is there any provision of entrance test to take admission?	00	0.00%	20	100%	20
2. Are they get any bridge course?	00	0.00%	20	100%	20
3. Is bridge course prepared by DIET?	00	0.00%	20	100%	20

From the above table-4.6 it is known that 100% teachers have said that there is no entrance test to take admission. All

teachers have agreed that they do not provide bridge courses to the girls.

Table-4.7 : Views of parents about infrastructure facilities of GGHS

Questions	Opinion to 'Yes'		Opinion to 'No'		Total
	No	%	No	%	
1. Are there sufficient classroom for you?	05	25%	15	75%	20
2. Is there hostel facilities for girls?	00	0.00%	20	100%	20
3. Does GGHS provide game and sports facilities to the child?	15	75%	05	25%	20
4. a) Does the child get school uniform?	20	100%	00	0.00%	20
b) Does the child get sports uniform?	00	0.00%	20	100%	20
5. Is there any toilet facilities in GGHS?	06	30%	14	70%	20
6. Do the child get fresh drinking water?	08	40%	12	60%	20
7. Is GGHS gives text books to the child?	09	45%	11	55%	20
8. Are you satisfied with infrastructure facilities provided in the school?	06	30%	14	70%	20

From the table-4.7 it is known that 25% parents said that there are sufficient classroom but 75% said that there is no sufficient classroom. 100% parents said that there is not a hostel facilities for girls. 75% parents said that GHS provides games and sports facilities to the child. 100% parents agreed that al girls get school uniform but not in proper time. 30% parents told that toilet facility is available but these are not in good condition and there is no proper sanitation. 40% parents told that there is a

provision of fresh drinking water but there is no supply water facility. 45% parents agreed that school gives textbook to the child.30% parents are satisfied about infrastructure facilities whereas 70% are not satisfied about the infrastructure facility of GGHS.

Thus it is concluded that the parents are not satisfied of the infrastructure facility of GGHS which also affects the education of girls.

Table-4.8 : Views of girls on the infrastructure facilities of GGHS

Questions	Opinion to 'Yes'		Opinion to 'No'		Total
	No	%	No	%	
1. Are there sufficient classroom for you?	37	37%	63	63%	100
2. Are there separate hostel for you?	00	0.00%	100	100%	100
3. Do you get safe drinking water in the school?	60	60%	40	40%	100
4. Do you have a clear understanding about your syllabus and books?	68	68%	32	32%	100
5. Books are given or not?	70	70%	30	30%	100
6. Books are given in beginning of the school?	00	00%	100	100%	100
7. Books are given at the middle of the session.	60	60%	40	40%	100
8. Books are given at the end of the session.	00	0.00%	100	400%	100
9. School uniform are given?	100	100%	00	0.00%	100
10. Sports uniforms are given	00	0.00%	100	100%	100
11. Food facilities are given?	100	100%	00	0.00%	100
12. Is there separate kitchen in your school?	00	00%	100	100%	100
13. Is there any toilet facility in your school?	70	70%	30	30%	100
14. Is the toilet clean?	70	70%	30	30%	100

From the table-4.8 it is known that 37% girls told that there are sufficient classroom whereas 67% have not agreed to it. 60% girls told that they are getting fresh drinking water whereas 40% have not agreed to it 68% girls know their books and syllabus. All books are given at the middle of the session.100% girls have

school uniform and no one have sports uniform.100% girls told that they are provided with mid day meal. 100% girls told that there is no separate kitchen. 70% girls told that there is toilet facility, 30% girls told that there is no toilet facility, 70% girls told about the cleanliness of toilet.

Table 4.8.1

Question	Bench and desk	Light	Mat.	Blackboard	Window
[16] What are facilities available in your class-room?	60 (60%)	10 (10%)	00 (00%)	22 (22%)	08 (8%)

From the table 4.8.1 it is of the opinion of girls that bench, desks, light, black board and windows facilities are available in classroom except mat.

Table 4.8.2

Question	20	30	40	50	More than 50
[17] How many girls / students can sit in a class?	13 (13%)	19 (19%)	23 (23%)	20 (20%)	25 (25%)

About sitting arrangement from the table 4.8.2 it is known that more than 50 students can sit in the class.

Thus, it can be concluded that there is no classroom and sitting arrangement which can accommodate more than 50 students.

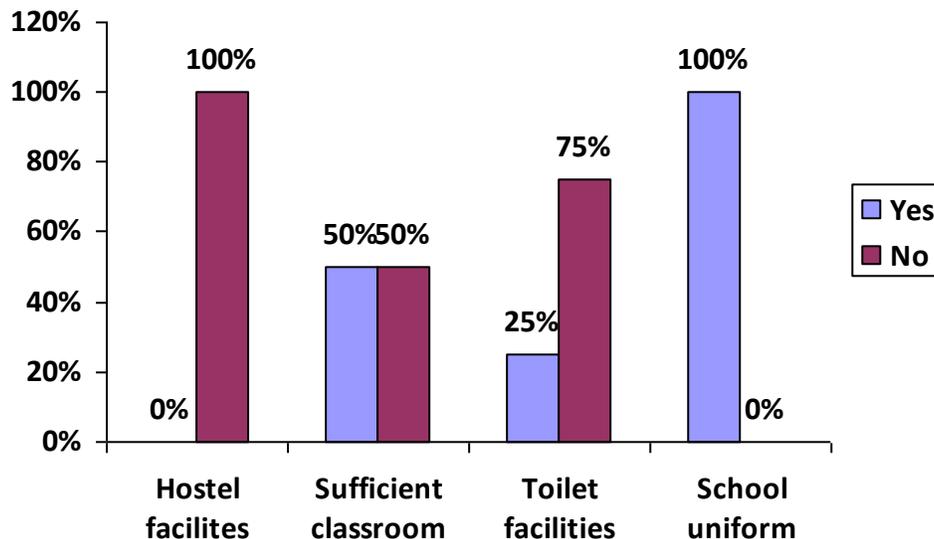
Table-4.9 : Views of Teachers on the Infrastructure Facilities of GGHS

Questions	Opinion to 'Yes'		Opinion to 'No'		Total
	No	%	No	%	
1. Is there sufficient classroom for the child ?	10	50	10	50	20
2. Is there separate toilet facilities for the girls ?	5	20	15	75	20
3. Does Govt. Girls high school provide school uniform?	20	100	0	0.00	20
4. Are there any test for measuring the knowledge of the students?	20	100	0	0.00	20

From the table-4.9 it is known that 50% teachers are satisfied with classroom and classroom facilities but rest are not. 25% teachers told that there is sufficient toilet facility but 75% teachers told that there is no sufficient toilet facility. All teachers have agreed that there is a school uniform facility for

girls. 100% teachers told that there is a provision of monthly test to measure the knowledge of girls.

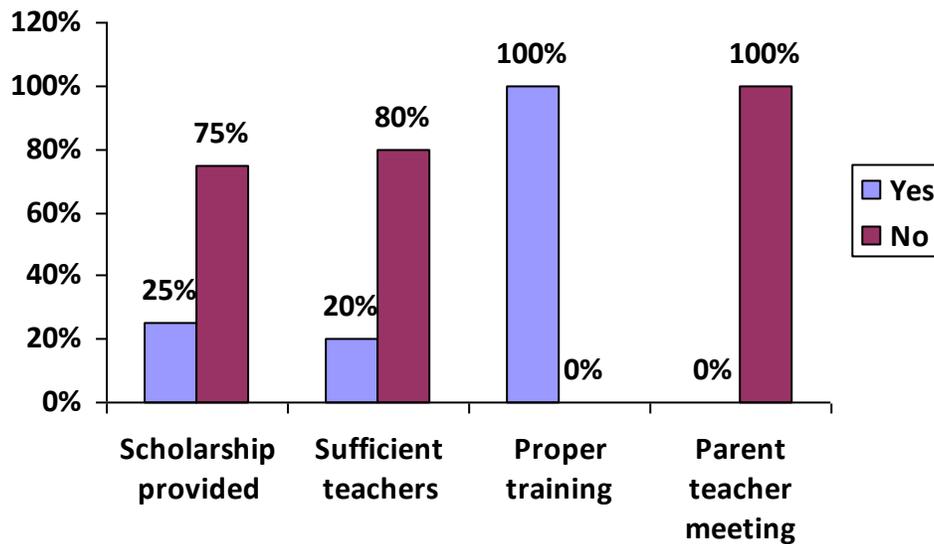
Thus, it is concluded that teachers are not satisfied with the classroom facilities. The toilet facilities are unsatisfactory condition. Monthly tests are concluded that it can help to improve the academic clarity of the students.



(ii) Bar Graph shows, views of teachers on the infrastructure facilities of GGHS.

Table-4.10 : Views of Parents on the Teacher’s Training and Teaching-Learning Process of GGHS.

Questions	Opinion to ‘Yes’		Opinion to ‘No’		Total
	No	%	No	%	
1. Is any scholarship provided to the children on GGHS?	05	25%	15	75%	20
2. Are there sufficient teachers in GGHS?	04	20%	16	80%	20
3. Are the teachers trained ?	20	100%	0	0%	20
4. Is there any parent teacher meeting held in GGHS?	0	0%	20	100%	20



(iii) Bar graph shows, views of parents on the teachers training and teaching learning process of GGHS.

From table-4.10, it is cleared that 25% parents are agreed that scholarship is provided to the girls. 20% parents told that there is sufficient teachers but 80% are not agreed. 100% parents

gave their views that teachers are well trained. 100% parents gave their views that there is no parent teacher meeting.

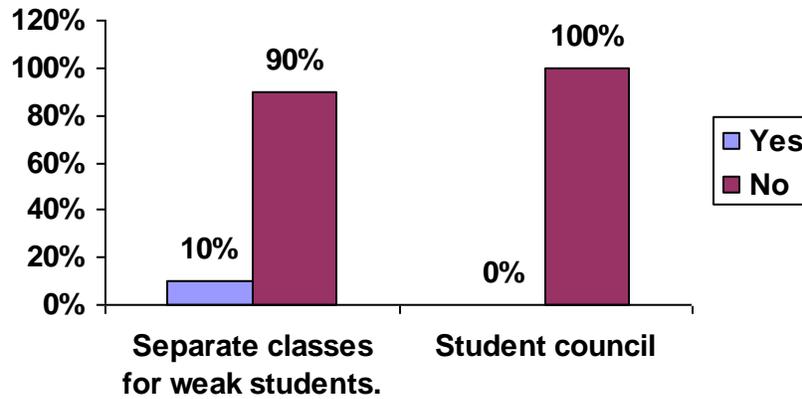
From the above discussion, it is concluded that parents are partially satisfied with the teaching-learning process.

Table-4.11 : Views of Girls on Teaching-Learning Process of GGHS

Questions	Opinion to ‘Yes’		Opinion to ‘No’		Total
	No	%	No	%	
1. Do your teacher take remedial measures for weak students?	10	10%	90	90%	100
2. Does your school have any student council?	00	00%	100	100%	100

From the table-4.11, it is shown that 10% students are agreed that teachers have taken remedial measures for weak

students while 90% are not agreed with this. All students gave their views that there is no student council in GGHS.



(iv) Bar graph shows, views of girls on teaching learning process of GGHS.

Table-4.11.1

Question	Language	Maths	General Science	Social Science
[18] Which subject do you find more difficult?	50 (50%)	40 (40%)	10 (10%)	00 (0.00%)

From the table 4.11.1, it is clear that 50% girls have faced difficulties in language (English), 40% girls have faced difficulties in Maths and 10% girls have faced difficulties in General Science.

Table-4.11.2

Question	Good	Very Good	Bad
[19] How is the teacher's method of teaching?	85 (85%)	00 (0.00%)	15 (15%)

From the table 4.11.2, it is noticed that 85% girls gave their positive views that teacher's adopt different method of teaching. While 15% gave negative views on method of teaching.

From the above discussion, it is concluded that there is no facilities for weak students no separate classes are arranged for them although they have faced difficulties in language (English) and Math's subjects due to lack of teachers.

Table-4.12 : Views of Teachers on the Teaching-Learning Process in GGHS

Questions	Opinion to 'Yes'		Opinion to 'No'		Total
	No	%	No	%	
1. Have you attend any inservice training?	00	00%	20	100%	20
2. Do you face any difficulty while teaching?	17	85%	03	15%	20
3. Is there any student council in the school?	00	00%	20	100%	20
4. Are there any productive activities undertaken in the leisure time?	00	00%	20	100%	20
5. Are there special teachers for each vocational course?	12	60%	08	40%	20

From the above table 4.12, it is known that 100% teachers have not attended in-service training to teach the students, 85% teachers faced the problems while teaching. 100% teachers told that there is no students council. 100% teachers said that productive activities are not undertaken in leisure time. 60% have agreed that there are special teaches for vocational courses.

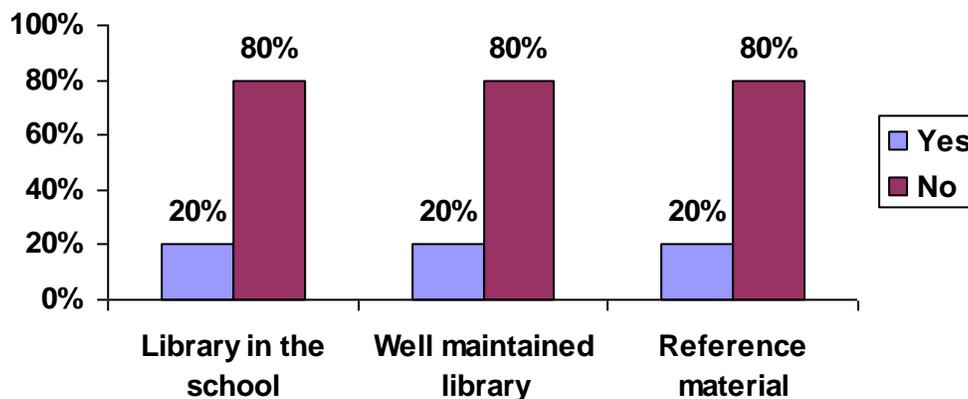
From the above discussion, it is concluded that teachers of Govt. Girls high schools are trained teachers but they faced the difficulty while teaching in classroom. They provide vocational courses for girls so that they will become able to do their own work with self-confidence and they will become self-independent.

Table-4.13: Views of Girls about Library facilities of GGHS

Questions	Opinion to 'Yes'		Opinion to 'No'		Total
	No	%	No	%	
1. Is there a library in the school?	20	20%	80	80%	100
2. Is the library well maintained?	20	20%	80	80%	100
3. Does the library support you with enough reference material?	20	20%	80	80%	100

From the table-4.13, it is known that 20% girls have said that there is no library in the school. 80% girls have said that the

library did not have well maintain. 80% girls have said that library does not support with enough reference material.



(v) Bar graph shows, views of girls about library facilities.

Table-4.14: Views of Teachers about Library facilities of GGHS.

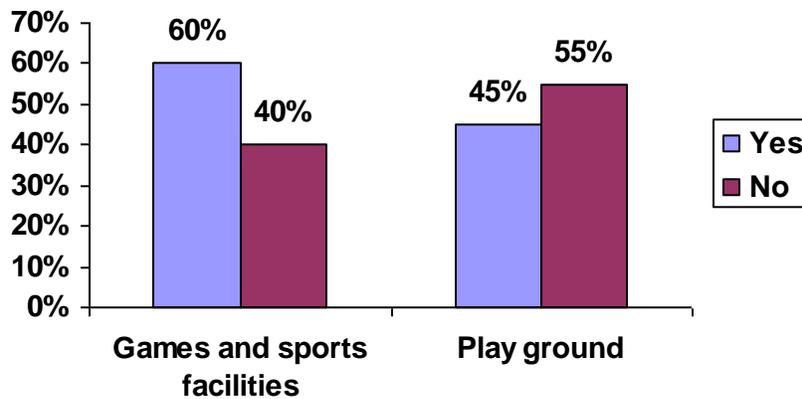
Questions	Opinion to 'Yes'		Opinion to 'No'		Total
	No	%	No	%	
1. Is there a library in the school?	4	20%	16	80%	100
2. Is the library well maintained?	4	20%	16	80%	100
3. Does the library support you with enough reference material?	4	20%	16	80%	100

From the table-4.14, it is known that 80% teachers have said that there is no library in the school. 80% teachers have said that the library did not have well maintain and without enough reference material.

Table-4.15 : Views of Parents about Games and Sports of GGHS.

Questions	Opinion to 'Yes'		Opinion to 'No'		Total
	No	%	No	%	
1. Does the GGHS provide game and sports facilities to the child?	12	60%	08	40%	20
2. Does the school has any playground?	09	45%	11	55%	20
3. Does the school provide sufficient sports equipment?	10	50%	10	50%	20

From the table-4.15 it is known that 60% parents gave the information that GGHS provides games and sports facilities to the child while 45% parents told that there is play ground and 55% parents told that there is no playground. 50% parents opinion that child gets sports equipments whereas 50% said that no sports equipments are given to the girls. From the above discussion, it is concluded that parents are not satisfied with the games and sports facilities. So GGHS must improve the games and sports facilities for the better improvement of girls.



(vi) Bar graph shows, views of parents about games and sports of GGHS.

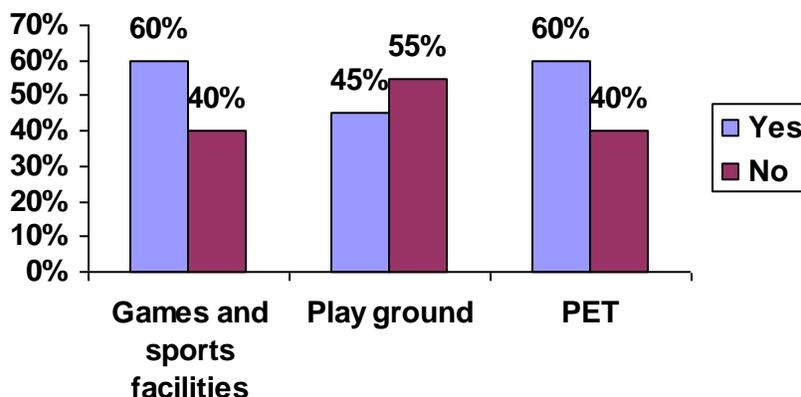
Table-4.16 : Views of Girls about Games and Sports facilities of GGHS.

Questions	Opinion to 'Yes'		Opinion to 'No'		Total
	No	%	No	%	
1. Does your school provide you games and sports facility?	55	55%	45	45%	100
2. Does you school have any play ground?	45	45%	55	55%	100
3. Is there any physical education teacher (PET) at your school?	60	60%	40	40%	100

From the table-4.16, it is known that 55% girls have provided games and sports facilities and 45% students are not

agreed with this view. 45% girls said that schools have playground, 55% girls said that schools have not playground. 60% girls told that there are PET in their schools.

From the above discussion, it is concluded that GGHS provides PET to strengthen games and sports activities which is helpful for growth and development of girls and maintain their physical fitness.



(vii) Bar graph shows, views of girls about games and sports facilities of GGHS.

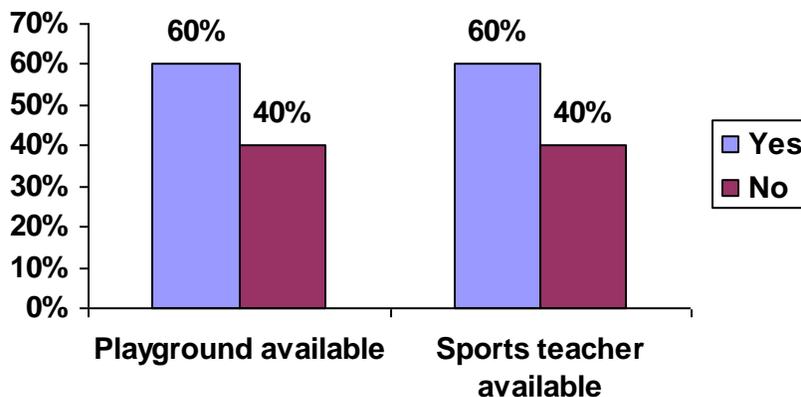
Table-4.17: Views of teachers about Games and sports facilities of GGHS.

Questions	Opinion to 'Yes'		Opinion to 'No'		Total
	No	%	No	%	
1. Is there any facilities of playground for the girls.	12	60%	08	40%	20
2. Is there any sports teachers in GGHS.	12	60%	08	40%	20

From the above table-4.17 it is shown that 60% teachers gave their view that there exists playground facilities, sports facilities and sports teacher and 40% teachers gave their view

that there is not exist playground facilities, sports facilities and sports teacher.

Thus, it is concluded that teachers are not fully satisfied with the facility of games and sports.



(viii) Bar graph shows, views of teachers about games and sports facilities of GGHS.

Table-4.18 : Views of parents on Food (mid-day meal).

Questions	Opinion to 'Yes'		Opinion to 'No'		Total
	No	%	No	%	
1. Do the girls get sufficient food?	20	100%	00	0.00%	20

From the table 4.18 it is known that all the parents are satisfied with the food facility.

Table-4.19 : Views of Girls about Food (Mid-day meal)

Questions	Opinion to 'Yes'		Opinion to 'No'		Total
	No	%	No	%	
1. Do you have separate kitchen.	00	0.00%	100	100%	100
2. Does the cook has any helper.	00	0.00%	100	100%	100

100% girls have said that there is no a separate kitchen for cooking the mid-day meal. 100% have agreed that there is not a helper for cook.

Table-4.20 : Views of teachers about food items (mid-day meal)

Questions	Opinion to 'Yes'		Opinion to 'No'		Total
	No	%	No	%	
1. Does the girls get sufficient amount of food?	20	100%	00	0.00%	20
2. Does your help needed for the preparation of food?	05	25%	15	75%	20

All teachers have agreed that girls get sufficient amount of food. However 25% teachers have said that some times headmistress helps in preparation of food.

Table-4.21: Views of parents about health and hygiene of girls.

Questions	Opinion to 'Yes'		Opinion to 'No'		Total
	No	%	No	%	
1. Is there regular health check-up of girls?	00	00%	20	100%	20
2. Is the children have facility of health card ?	00	00%	20	100%	20

It is noticed that 100% parents have said that there is no regular monthly health check-up of girls. 100% parents opined that the children have no facility of health card.

Table-4.22: Views of Girls on Health and Hygiene

Questions	Opinion to 'Yes'		Opinion to 'No'		Total
	No	%	No	%	
1. Does your school provide regular health check-up?	00	0.0%	100	100%	100
2. Does you have the facility of health card?	00	0.0%	100	100%	100

Table-4.23: Views of Teachers on Health and Hygiene

Questions	Opinion to 'Yes'		Opinion to 'No'		Total
	No	%	No	%	
1. Is thee regular health check-up in your school?	00	0.0%	20	100%	20
2. Is the all girls have health card?	00	0.0%	20	100%	20

All the teachers have also opined that there is not a regular monthly health check up in GGHS. 100% teachers have opined that the girls do not have health card views of parents on security of Girls.

Table-4.24: Views of parents on security of Girls

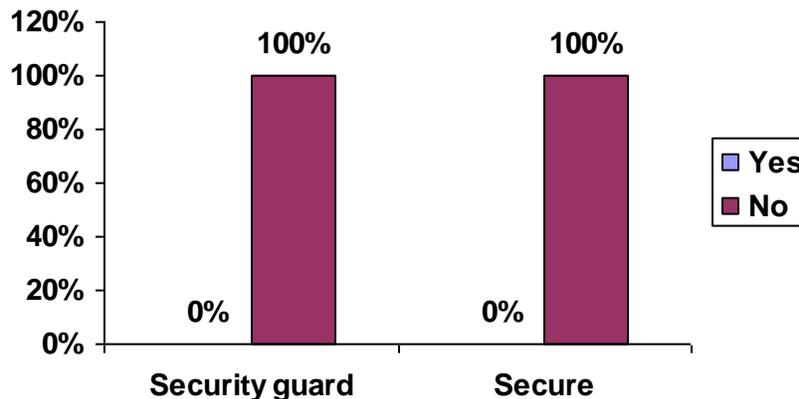
Questions	Opinion to 'Yes'		Opinion to 'No'		Total
	No	%	No	%	
1. Do schools have security guard?	00	0.0%	20	100%	20
2. Does the girls feel secure ?	00	0.0%	20	100%	20

The parents have expressed their opinion that the school do not have security guard but the girls do not feel secure in school.

Table-4.25: Views of girls on security

Questions	Opinion to 'Yes'		Opinion to 'No'		Total
	No	%	No	%	
1. Does your school has any security guard ?	00	0.00%	100	100%	100
2. Do you feel secure at your school.	00	0.00%	100	100%	100

From the table-4.25, it is noticed that girls are not satisfied with the school without security guard. Teachers are very co-operative with their students.



(ix) Bar graph shows, views of girls on security.

Table No.4.26: Views of teachers on security of Girls.

Questions	Opinion to 'Yes'		Opinion to 'No'		Total
	No	%	No	%	
1. Does your school has any security guard ?	00	0.0%	20	100%	20
2. Do the girls feel secure ?	00	0.0%	20	100%	20

From the table-4.26, 100% teachers have viewed that there is not a security guard and girls do not feel secure.

iii) Teachers are happy in the process of helping girls to get education in GGHS.

General Information

- i) Parents are aware about girls education even though they are illiterate. 80% parents are satisfied with the provision of education of girls in Govt. Girls High schools.
- ii) Girls had taken admission with the help of teachers.

ii. Infrastructure

- i) Parents are not satisfied with the existing infrastructure facilities of Govt. Girls High Schools. The toilet facility is not adequate.

- ii) Girls are not happy with the existing infrastructure facilities of GGHS. Number of classrooms are not sufficient.
- iii) Teachers are also not satisfied with the infrastructure facilities of GGHS. Fresh drinking water is not available. Supply water is also not available in time. So they depend on tubewell. Toilet facilities are also not in good conditions, which causes for the infection problem of girls.

iii. Games and Sports

- i) 60% parents agreed that there are facilities of games and sports in GGHS.
- ii) 55% girls agreed that school provides games and sports facilities to them. 45% girls agreed that they have playground in school.
- iii) 60% teachers also opined that schools have play ground.
- iv) Teachers also opined that GGHS provides games and sports facilities to girls.

IV. Teaching-Learning Process

- i) 80% parents are opined that there are not sufficient numbers of teachers in GGHS. Teachers are trained but there is not a single parent teacher meeting held in the GGHS.
- ii) 50% Girls opined that they have faced problem in language (English). 40% Girls have faced difficulties in Mathematics. They do not have student council facilities. Teachers do not take separate classes for weak students. Scholarship is not provided to all.
- iii) All the teachers are trained but, they have faced difficulties while teaching. 60% teachers opined that there are special teachers for vocational courses.

V. Library Facilities

- i) 80% girls have said that there is no library in the school.
- ii) 80% teachers said that there is no library in the school.

VI. Food / Mid-day Meal

- i) Parents are agreed that girls get sufficient food.
- ii) Girls themselves are satisfied with the food facility of GGHS. There is not a separate kitchen for cooking.
- iii) All teachers have agreed that girls get sufficient amount of food (mid-day-meal) in GGHS. There is no helper for cooking.

VII. Health and Hygiene

- i) 100% parents are agreed that there is not a regular health check-up in GGHS. There is not a provision of health card.
- ii) 100% girls have pointed out that GGHS does not provide regular health check-up. Girls have no health card.
- iii) Teachers opined that there is not a regular health check-up of girls.

VIII. Security

- i) All parents agreed that school have not security guard and girls do not feel secure.
- ii) All girls said that there is no security guard, so they did not feel secure.
- iii) All teachers agreed that there is no security guard.

IX. CONCLUSION

From the tabulation and finding the following conclusion have been drawn :

1. From the opinion of parents, and teachers, it is concluded that parents are satisfied with the education facilities provided to girls.
2. From the opinion of parents, teachers and girls, it is concluded that they are not satisfied with the infrastructure facilities of GGHS. Toilet facility for girls students are not sufficient hygienic. It is in very worst condition. The supply water is not available. So girls face lots of problems for drinking water. Some girls are having skin diseases and other infections diseases. Books are available at the middle of the session uniform facility is available in GGHS.
3. From the opinion of parents and teachers it is known that sports facilities are provided in GGHS.
4. From the opinion of parents and teachers, it is concluded that teachers are trained teachers. But there is lack of subject teacher.
5. From the opinion of parents, teachers and girls it is known that girls get sufficient food (mid-day meal) but there is not a regular monthly health check-up of girls.
6. From the opinion of parents, teachers and girls, it is concluded that there is no security guard.
7. Both teachers and parents have played significant role in relation to increase enrollment, to stop drop-out, help in construction of school building.

REFERENCES

- [1] Basu (1975) Female Education in Bihar from 1904 A.D to the present day, Ph.D. Education, Patna University.
- [2] Bokil (1989) Education of Rural Women, Ph.D. Education, Pune University.
- [3] Biswas, A. and Agrawal, S.P. (1985). Development of Education of India, Concept Publishing Company, New Delhi.
- [4] Bandyopadhyay, and Ramya (2008). Gender Equity in Education A Review of Trends and Factors, Project Report, Consortium for Research on Educational Access, Transitions and Equity (CREATE), Falmer, U.K.
- [5] Bhatt, B.D. and Sharma, S.R. (1992), Women's Education and Social Development, Delhi. Kanishka Publishing House.
- [6] Chabaud, Jaqueline (1970), "The education and advancement of Women", France : United Educational, Scientific and Cultural Organization.
- [7] Chaurasia, G. (1977). Challenges and innovations in Education. Sterling Publishers Pvt. Ltd., New Delhi.
- [8] Das, D. and Guladi, K. (2007). National Evaluation of KGBV scheme in Orissa and Andhra Pradesh, Submitted to MHRD, Dept. of School Education and Literacy, New Delhi.
- [9] Karlekar Malvika, (1987), Education for women and society in India, Ajanta Publishers, New Delhi.
- [10] Kartick, C. Mukherjee (1967). Under development Educational Policy ad Planning, Asia Publishing House, Bombay.
- [11] Kumari, S. Ranjan (1987). The Indian Year book of Education, NCERT Publication, New Delhi.
- [12] Malhotra, P.L., Prakash, B.S.L. Mishra, C.H.K. (1986). School education in India-Present Status and Future needs, NCERT Publication, New Delhi.
- [13] Mishra, P.K. (1994). A Study on Dropout in school of Keonjhar District in Orissa, with special reference to Schedule Tribes.
- [14] Mitra (2006). The Status of Tribal Girls in India, Dept. of Economics, University of Oklahoma.
- [15] Mohanty, J. (1992). Current issues in Education, Cosmo-Publications, New Delhi.

- [16] Mukherji, Dr. S.N. (1961). History of Education in India, Ambala Cont. 133001, Indira Publication.
- [17] Naik, J.P. (1965). Elementary education in India-The Unfinished task Asia Publishing House, Bombay.
- [18] Nayak, P.B.K. (1975). The Schedule Castes and Schedule Tribes High School Students in Kerala, Deptt. of Soe, Ker. University.
- [19] Nayak, A.K. and Singh, Uttam Kumar (1997). "Women Education " , New Delhi, Common Wealth Publishers.
- [20] Newson (1948). The Education of Girls, Faber and Faber Ltd. London.
- [21] NIEPA (1986). Retention, Failure, Repetition and Dropout in primary education, A Cohoral analysis of SC/ST students, National Profile, New Delhi.
- [22] Oak, A.W. (1988). Status of Women in Education, Amballa Const., 1330001.
- [23] Ramchandran (1963). Women and Education, Tata Institute of Social Sciences, Bombay.
- [24] Rao, G. Sambasiva (1979), "Problems of Women's Literacy", Mysore :Vidyasagar Printing and Publishing House".
- [25] Sharma, Usha and (1995), Girls' Education, Commonwealth Publishers.
- [26] Sharma Savitri (1979), Women Students in India Status and Personality, New Delhi :Concept Publishing Company.
- [27] Shrimati, K.L. (1965). Education in Changing India, Asia Publishing House.

AUTHORS



First Author – Dr. Shri Krishna Mishra,
Principal, Shri Kanwartara Institute for Teacher's
Training, Shri Nagar Colony, Mandleshwar,
Tehsil-Maheshwar, Dist.Khargone (M.P.), India
451221, Email: shreekrishnamishra@gmail.com ,
shrikanwartaracollege060@gmail.com , Mobile:

9669696249, 9589560135



Second Author – Mr. Badri Yadav, Asst.
Professor, Shri Kanwartara Institute for Teacher's
Training, Shri Nagar Colony, Mandleshwar, Tehsil-
Maheshwar, Dist.Khargone (M.P.), India 451221,
Email: badriyadav9@gmail.com ,
shrikanwartaracollege060@gmail.com , Mobile:

9753222771

Preparation and Characterization of Colon Targeted Beads of Indomethacin Using Chitosan and Chondroitin Sulphate

Jasvir Kaur*, Gurpreet Kaur**, Satvinder Kaur* and Anu Mahajan*

* GHG Khalsa College of Pharmacy, Gurusar Sadhar (Ludhiana) 141104.

** Punjabi University, Patiala.

Abstract- Targeted therapy is a cutting edge technology that deals with drugs that target some specific pathways in the growth and development of tumors. The cells of this category include polyps, precancerous lesions, premalignancies and other aberrant phenotype which may progress to cancerous state. Some non-steroidal anti-inflammatory drugs (NSAIDs) like Indomethacin have been reported to shrink the polyps by inhibiting proliferation and inducing apoptosis in colorectal cancer cells via a variety of COX-dependent and/or COX-independent mechanisms. It has been reported that indomethacin can inhibit the growth of transplanted human colorectal tumor through inhibition of vascular endothelial growth factor. Effectiveness of Indomethacin to treat colon polyp can be increased if it is targeted directly to colon. So the present study is aimed to prepare colon specific beads of Indomethacin to target directly to colon. An interpolymers complex of polymers like chitosan and Chondroitin sulfate in different ratio are used to prepare the beads. The results confirmed that specific delivery of Indomethacin to colon can sustain the release for a long duration in comparison to marketed product.

Index Terms- Indomethacin, Colon targeted, chitosan, Chondroitin sulfate and beads.

I. INTRODUCTION

High levels of PG's are found in tumoral cells and reduction in 15-PGDH activity, by Indomethacin in tumor cells, may be regarded as a mechanism of tumor suppression¹. It has been reported that Indomethacin can inhibit the growth of transplanted human colorectal tumor through inhibition of vascular endothelial growth factor². Indomethacin treatment has also been reported to significantly upregulate the expression of tumor suppressor gene PTEN, the MAP kinase phosphatase-3 (MKP-3) and protein tyrosine phosphatase (SHP-2). As a consequence of increased expression of phosphatases and dephosphorylation of kinases, Indomethacin can negatively regulate the EGF/ PDGF pathways in colon cancer³. Indomethacin, an anti-inflammatory drug, is a dual-COX inhibitor. Due to COX-1 inhibition various adverse effects are associated with oral delivery of Indomethacin such as upper GIT toxicity. However the adverse effects can be minimized if the drug is directly delivered to the colon. In the light of above facts, it appears that colon-targeted delivery of Indomethacin can reduce the number of polyps and also the dosing frequency. Colonic drug delivery refers to those dosage

forms which upon oral administration pass the stomach and small intestine in intact form and release the drug only in the large intestine. Although, designing of orally administered colonic delivery system is very complicated because the colon, located at the end of alimentary canal, is difficult to access. In the recent times, the colon-specific delivery systems are gaining importance for the delivery of proteins and peptide drugs due to unprecedented rapid development of biotechnology and genetic engineering, which results in the availability of these drugs at a reasonable cost. These drugs are destroyed and inactivated in the acidic environment of the stomach and/or by the pancreatic enzymes in the small intestine⁴. Hence, these drugs are usually administered by parental route, which is associated with complications such as thrombophlebitis and tissue necrosis that may lead to poor patient compliance. Colon is considered to be more suitable for delivery of peptide and proteins in comparison to small intestine due to negligible activity of brush-border membrane peptidases and also less activity of pancreatic enzymes⁵. Besides peptide and proteins, colon is also a good site for the absorption of many other drugs which are not stable in the acidic environment of the stomach, cause gastric irritation (e.g. aspirin, iron supplements) or are degraded by small intestinal enzymes. Many such drugs are found to be absorbed from large intestine and can be investigated for better bioavailability through colon-specific delivery. These drugs are glibenclamide⁶, diclofenac⁷, ibuprofen⁸, diltiazem hydrochloride⁹, metoprolol¹⁰, theophylline¹¹ and nifedipine¹².

Local treatment is desirable for conditions such as ulcerative colitis and crohn's disease (anti-inflammatory agents e.g. 5-ASA and its prodrugs glucocorticoids), constipation (stimulant laxative e.g. senna, cascara glycoside), colorectal cancer (antineoplastic drugs), spastic colon (anticholinergics)¹³, and amoebiasis (metronidazole)¹⁴. Drug targeting to colon would prove useful when intentional delayed drug absorption is desired from therapeutic point of view in the treatment of diseases that have peak symptoms in the early morning such as nocturnal asthma, angina and arthritis¹⁵. Colorectum is the portion of the GI tract most frequently affected by tumors. Colorectal cancer is the 4th most common cancer in the world with approximately 875,000 new cases per year worldwide (WHO 1996) and is the second leading cause of cancer death among US men and women. The majority of colonic tumors are benign epithelial polyps. The most common polyp and the only one that can become an adenocarcinoma are the adenomatous polyps. These polyps are precursors to more than 95% of all colorectal cancer.

Both the size and the degree of villous features are predictive of risk of malignancy within the polyp.

Several studies have been undergone on the basis of the activity of colonic bacteria in polysaccharide based carrier systems. The different polysaccharides that are used under evaluation as carrier for colonic drug delivery includes pectin and its salts, chondroitin sulfate, chitosan, inulin and guar gum etc..This work is aimed to prepare colon specific beads of Indomethacin using chondroitin sulfate and chitosan in different ratio. Oral administration of these beads can provide colon specific delivery of Indomethacin in sustained manner so reduction in dosing frequency.

II. MATERIALS

Indomethacin is 1-(4-chlorobenzoyl)-5-methoxy-2-methyl-3-indolylacetic acid. Indomethacin used in this study was a gift sample from Venus Remedies, Panchkula. Chitosan was purchased from Central Institute of Fisheries Technology, Cochin. Chondroitin sulfate is a mucopolysaccharide, which consists of D-glucuronic acid linked to N-acetyl-D-galactosamide. It was obtained as a gift sample from Panacea Biotech, Lalru.

III. METHODS

1. Interaction study between chitosan and chondroitin sulfate

80 mg of chondroitin sulfate was dissolved in 10 ml of distilled water and 20 mg of chitosan was dissolved in 10 ml of 2% v/v acetic acid. Upon mixing the solutions a solid mass was formed which was subjected to IR spectroscopy.

Similarly, interaction study was done between other ratios of chitosan and chondroitin sulfate used in the study.

2. Preparation of empty beads

200 mg of chitosan was dissolved in 100 ml of acetic acid (2% v/v). Chitosan solution was dropped through a disposable plastic syringe into a gently agitated 100 ml solution of acetone:H₂O :: 3:1 mixture containing 800 mg of chondroitin sulfate. Water used contained 0.05% w/v of NaTTP, the final concentration of NaTTP used was 0.00625% w/v. The beads were prepared at the rate of 30 beads/ minute. The beads were separated after one hour of curing time by decantation and were rinsed twice with distilled water. The beads were dried at room temperature for 24 hours and used for further studies. Different ratio of composition of chondroitin and chitosan are as given in Table 1.1.

3. Preparation of drug loaded beads

For preparation of drug loaded beads 750 mg of Indomethacin was dispersed in chitosan solution. Beads were prepared by same method as described above.

Table 1.1 – Composition of Chondroitin Sulfate and Chitosan Used for Different Batches of Beads

Batch Name	Composition by Ratio Chondroitin : Chitosan
I	4.5 : 0.5
II	4.0 : 1.0
III	3.5 : 1.5
IV	3.0 : 2.0
V	2.5 : 2.5

4. Bead characterization

a. Encapsulation Efficiency

The Indomethacin contents in the beads was calculated from the difference between the total amount of Indomethacin added and the amount lost in the external phase¹⁶. The concentration of Indomethacin in decanted solution and two washings was determined by measuring the absorbance at 319 nm using Beckman USA DU-640 UV-visible spectrophotometer. Using a series of different concentrations of Indomethacin, in solution of mixture of acetone: water and acetic acid (2% v/v), as standard, the amount of Indomethacin lost in solution was quantified. The encapsulation efficiency (EE) was calculated from the following expression:

$$EE (\%) = \frac{\text{Total amount of drug used} - \text{Amount lost} \times 100}{\text{Total amount of drug used}}$$

b. Bead Diameter

Diameter of 20 beads from each batch was determined by using electronic digital caliper.

5. *In vitro* drug release studies

In vitro drug release studies were carried out using USP II (paddle method) dissolution apparatus at 37±0.2°C with constant stirring rate of 50 rev./min. Beads containing Indomethacin (equivalent to 75mg) were tested for drug release firstly in buffer pH 1.2 (900ml) for 2 hours as the average gastric emptying time is about 2 hours. The dissolution medium was then replaced with pH 7.4 PBS (900ml) and the drug release study was carried out for further 3 hours. Finally, the dissolution medium was replaced with phosphate buffer pH 6.8 (900ml) and the dissolution was continued until a maximum amount of incorporated drug was released. A sample volume of 3 ml was withdrawn from each

dissolution vessel at regular intervals and replaced with equal volume of fresh dissolution medium. The sample was filtered and 1 ml of filtered sample was diluted suitably with respective dissolution medium. At the end of the study the beads were crushed in the pestle and mortar to determine the residual drug content of beads. Amount of drug released was determined spectrophotometrically at 319 nm. All the dissolution studies were carried out in triplicate and standard deviation was applied.

6. Preparation of rat caecal content medium

Spargue-dawley rats weighing 200-300 g maintained on normal diet were used for the study. Rats were treated with chitosan dispersion and chondroitin sulfate aqueous solution for inducing the enzymes specifically acting on these polymers. The procedure involved oral treatment of rats with 1 ml of 1% (w/v) dispersion of chitosan for five days and on fifth day of treatment 1 ml of 20% (w/v) aqueous solution of chondroitin sulfate. Thirty minutes before the commencement of drug release studies, five rats were killed by spinal traction. The abdomen were cut opened, caecum were ligated at both ends and cut loose. The formed caecal bags were immediately transferred into phosphate buffer pH 6.8, previously bubbled with CO₂. The caecal bags were opened, their contents were weighed, pooled and suspended in phosphate buffer pH 6.8 under CO₂ atmosphere.

7. *In vitro* drug release studies in the presence of rat caecal content

Selected batches were subjected to drug release studies in the presence of rat caecal contents to confirm the susceptibility of chitosan-chondroitin sulfate complex to the colonic bacteria. Drug release studies were carried out in 500 ml phosphate buffer pH 6.8 containing 1.25% w/v caecal contents after completing the first five hours of study in buffer pH 1.2 (900 ml; 2 hours) and PBS pH 7.4 (900ml; 3 hours). Drug release studies were carried out under continuous supply of CO₂ at 37±0.2°C with a constant stirring rate of 50 rev/ minute. Sample (3 ml) was withdrawn at regular intervals and replaced with fresh dissolution medium containing 1.25% w/v rat caecal content maintained under continuous supply of CO₂. The sample was filtered and 1ml sample was diluted suitably with dissolution medium. Amount of drug released was determined spectrophotometrically at 319 nm. All dissolution studies in the presence of rat caecal contents were carried out in triplicate and standard deviation was applied.

Wavelength scanning of 0.0025% w/v solution of Indomethacin, in methanol: 1N HCl (9:1) mixture, in a 1 cm cell from 350 nm to 300 nm exhibited absorbance maxima at 319 nm. Purity of the sample calculated using ϵ value as 0.45 was found to be 99.2% which is within pharmacopoeial limits i. e. 98.5-101.0% (IP 1996).

Standard plots were constructed in pH 1.2, PBS pH 7.4 and phosphate buffer pH 6.8. The mean absorbance value of experiments performed in triplicate for different concentration of Indomethacin in various dissolution media.

Wavelength scan of drug sample (25 µg/ml) solution in 1 cm cell from 350 nm to 300 nm was done in presence of chondroitin sulfate and chitosan to ascertain that these materials do not alter the absorbance maxima of the drug. During this study the sample exhibited absorbance maxima at 319 nm which is same as before (in the absence of chondroitin sulfate and

chitosan). Therefore, it can be assumed that these substances do not alter the absorbance maxima of the drug.

IV. RESULTS

1. Confirmation of Complex Formation

In order to confirm the chitosan-chondroitin sulfate interaction samples were analysed by IR spectroscopy. IR spectra of Chitosan showed a sharp peak of strong intensity at 1570.3 cm⁻¹ which is the characteristic peak of amino group in Chitosan while in case of chondroitin sulfate sharp peaks in range of 1378.8 cm⁻¹ to 1257.9 cm⁻¹ indicated the presence of carboxyl groups. Secondary amide in chondroitin sulfate is indicated by broad peak at 1646.9 cm⁻¹ due to NH bend. IR spectra of complex showed sharp peaks of strong intensity at 2358.9 cm⁻¹ and 1400 cm⁻¹. These peaks could be attributed to -NH₃⁺ ion and COO⁻ formed as a result of ionic interaction between amino groups of chitosan and carboxyl groups of chondroitin sulfate. Similarly appearance of absorption band at around 2500 cm⁻¹ has been reported due to ionic interaction between amino groups of chitosan and carboxyl groups of sodium hyaluronate¹⁷.

2. Optimization of Bead Formation

Dropwise addition of chitosan solution into chondroitin sulfate solution resulted into lump formation as reaction between chitosan and chondroitin sulfate was rapid. To control the rate, addition of water miscible organic solvent i.e. acetone was done¹⁸. The use of mixture of acetone and water in ratio of 3: 1 lead to bead formation but still it was found that after curing time of 1 hour the beads started bursting so a cross-linker NaTPP (0.00625% w/v) was added to get intact beads.

3. Bead Characterization

The encapsulation efficiency, expressed as a percentage of the amount of Indomethacin entrapped in the beads, of the formulated batches was found to vary from 94.54% to 90.68%. The mean values are tabulated in Table 1.2. The beads produced all had good spherical geometry. There was no significant variation in bead diameter among the different batches of beads, the mean diameter varied from 1.83 ± 0.15 to 1.99 ± 0.13(n = 20). Table 1.3 summarizes the mean diameter of beads in each batch.

4. *In Vitro* Dissolution Studies

Beads of Indomethacin were prepared as described before. In preliminary dissolution studies, the amount of drug released from each batch over a predetermined period of time was followed through dissolution studies in pH progression medium, pH 1.2 for 2 hours, PBS pH 7.4 for 3 hours and phosphate buffer pH 6.8 till end of the study. Comparative data obtained from dissolution studies of different batches using pH progression medium, and drug release profiles are depicted in Fig 1.1, 1.2, 1.3 & 1.4 and Table 1.4.

In Batches I to IV drug release started after 1 hour while in case of Batch V drug release started after 30 minutes. The batch releasing minimum amount of drug in the pH 1.2 and PBS pH 7.4 and at the same time releasing maximum amount of incorporated drug was selected as best batch. Batch I and II were selected according to this criterion (Fig 1.4).

To simulate *in vivo* enzyme activity of colonic flora, *in vitro* dissolution studies of selected batches (I and II) were

carried out in the presence of rat caecal contents (1.25% w/v in 500 ml of phosphate buffer pH 6.8). Out of these two batches, Batch II releasing only 3.78% and 7.15% of drug in pH 1.2 and PBS pH 7.4 respectively and also 98.45% of drug after a total 24 hours of study was selected as the best batch. (Fig 1.4).

In vitro dissolution profile of marketed sustained release capsules of Indomethacin shows that drug release starts within thirty minutes and a large amount of drug released in pH 1.2 (2 hours) and PBS pH 7.4 (3 hours) and also sustained drug release only for 13.5 hours (Fig 1.5). So these results confirmed that prepared beads can sustain the release for a long duration upto 23

hours in comparison to marketed product which release only upto 13.5 hours.

The Batch II was selected as best batch as it released minimum amount of incorporated drug in dissolution medium pH 1.2 and pH 7.4 PBS. In case of Batch I large amount of drug got released in dissolution medium pH 1.2 and pH 7.4 PBS as compared to Batch II. It might be assumed that in case of Batch I, chitosan available for complex formation with chondroitin sulfate was less than optimum and the unreacted chondroitin sulfate remained dissolved in solution.

Table 1.2 – Encapsulation Efficiency of Beads

Sr. No.	Batch Name	Encapsulation Efficiency (%)
1.	I	94.54±0.54
2.	II	92.23±0.08
3.	III	92.35±0.15
4.	IV	91.85±0.54
5.	V	90.68±0.61

Each chondroitin sulfate, chitosan value represents Mean ± S.D. (n=3)

Table 1.3 – Diameter of Bead

Sr. No.	Batch Name	Diameter (mm)
1.	I	1.96 ±0.11
2.	II	1.83 ±0.15
3.	III	1.92 ±0.17
4.	IV	1.99 ±0.13
5.	V	1.92 ±0.16

Each value represents Mean ± S.D. (n=3)

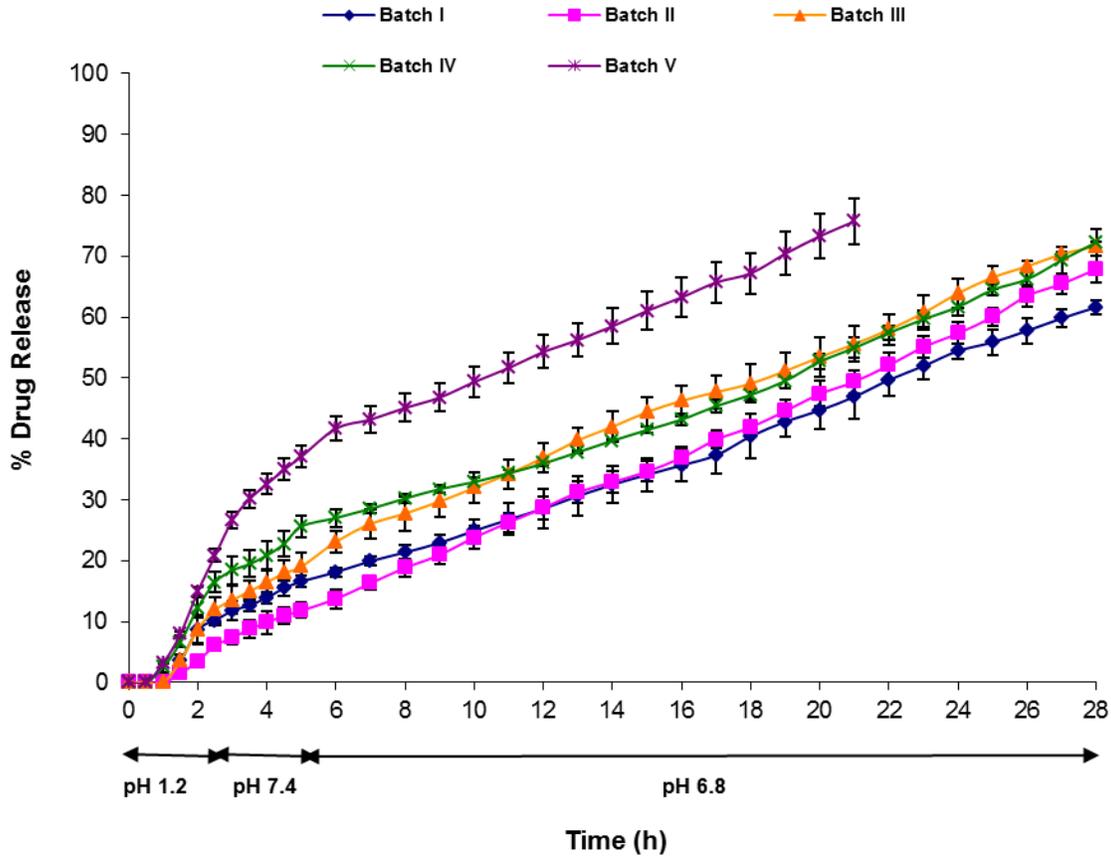


Figure 1.1 – Percent of Indomethacin Released from Investigational Batch I, II, III, IV and V in pH Progression Media.
Each Value Represents Mean \pm S.D. (n=3)

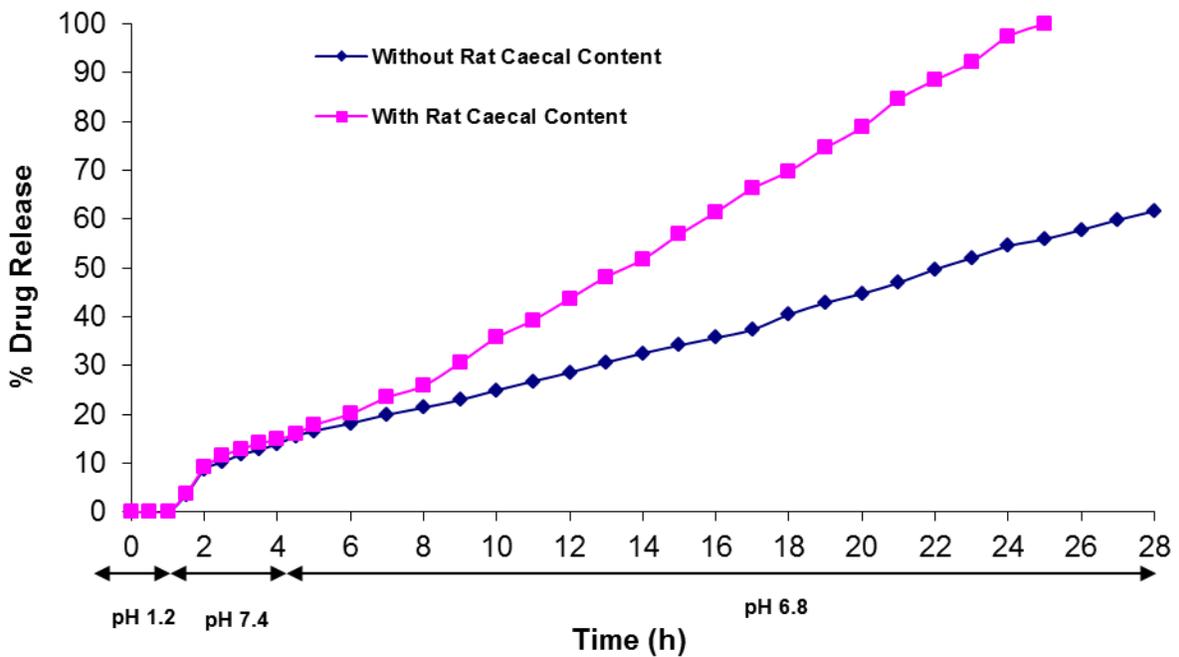


Figure 1.2 – Percent of Indomethacin Released from Investigational Batch I with and without Rat Caecal Content.

Each Value Represents Mean \pm S.D. (n=3)

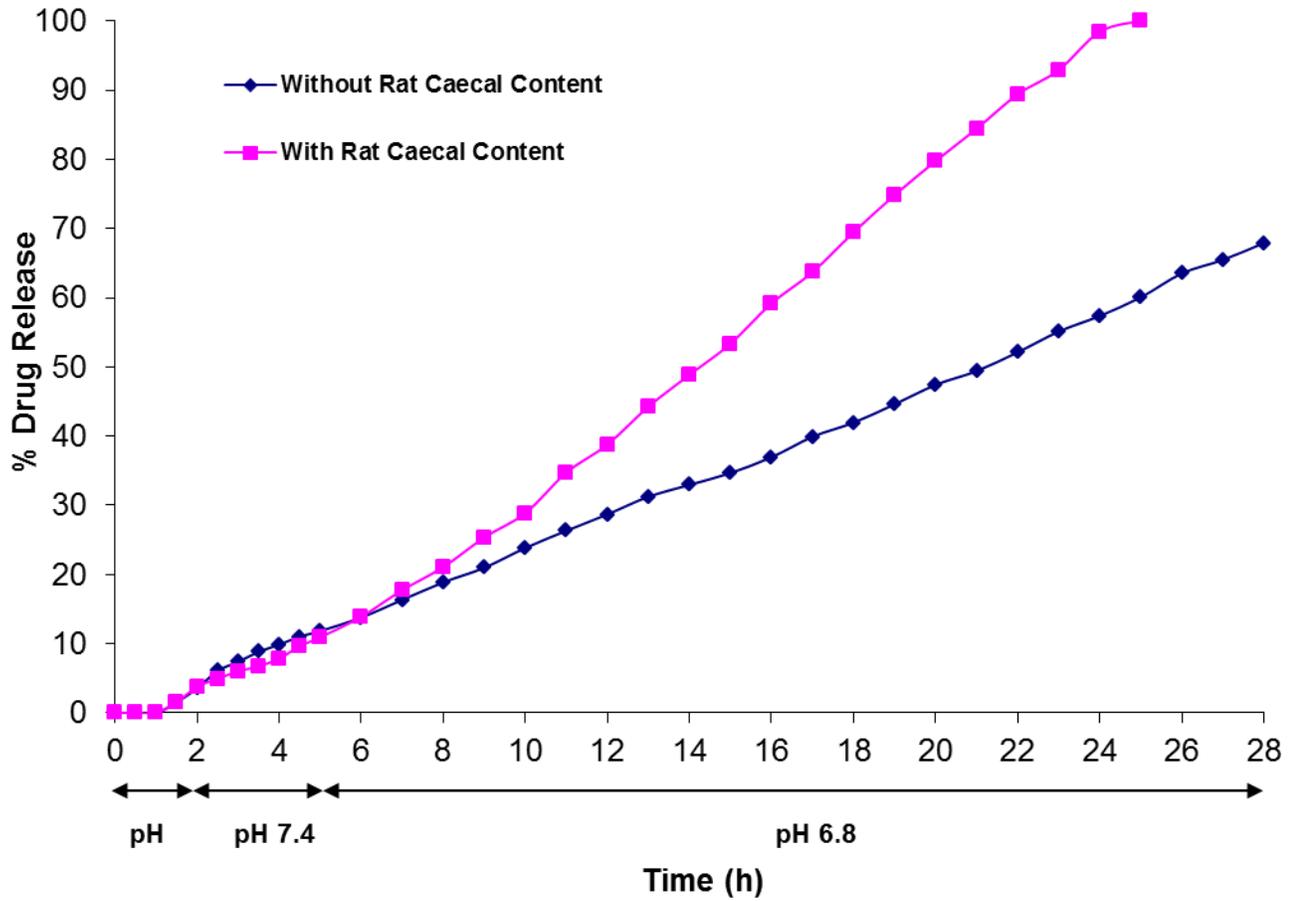


Figure 1.3 – Percent of Indomethacin Released from Investigational Batch II with and without Rat Caecal Content.

Each Value Represents Mean \pm S.D. (n=3)

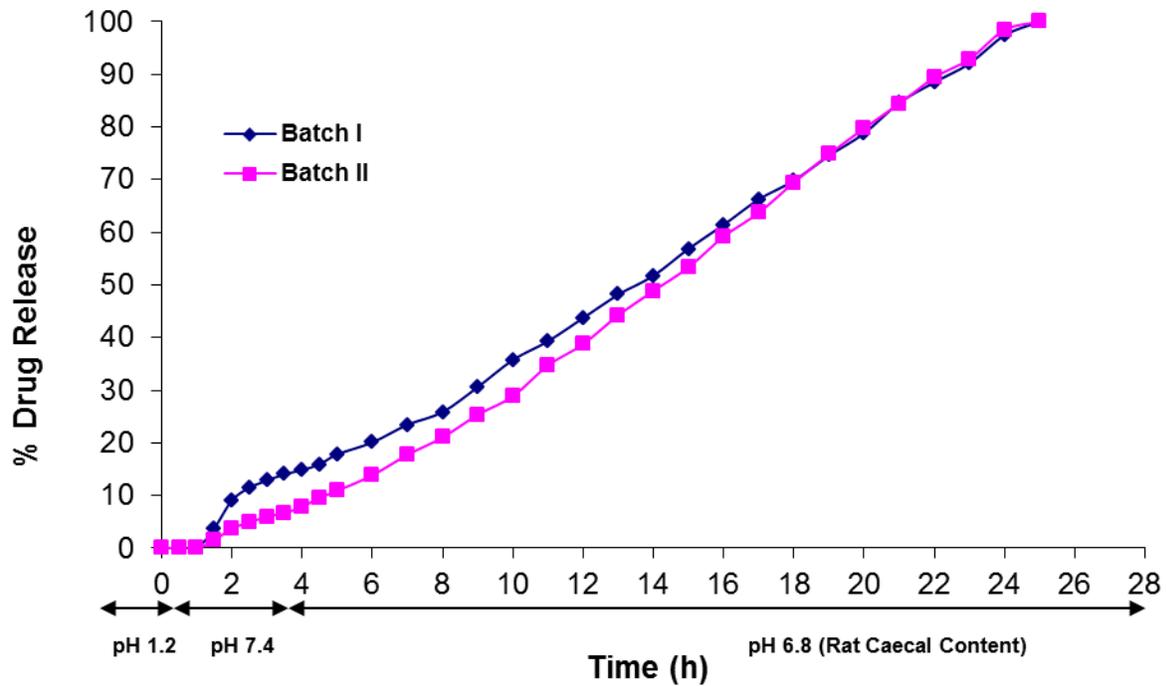


Figure 1.4– Percent of Indomethacin Released from Investigational Batch I and Batch II with Rat Caecal Content.
 Each Value Represents Mean \pm S.D. (n=3)

Table 1.4 – Selection of the Best Batch

Sr. No.	Batch Name	% Drug Released			Total % age of drug released
		pH 1.2 (For 2 hr.)	pH 7.4 PBS (For 3 hr.)	pH 6.8 (Till end of study)	
Without rat caecal contents					
1.	I	8.70	7.91 (16.61 in 5h)	45.04 (In 23 hours)	61.65
2.	II	3.55	8.28 (11.83 in 5h)	56.08 (In 23 hours)	67.91
3.	III	8.77	10.30 (19.07 in 5h)	52.60 (In 23 hours)	71.67
4.	IV	12.33	13.34 (25.66 in 5h)	46.65 (In 23 hours)	72.31
5.	V	14.97	22.17 (37.14 in 5h)	38.64 (In 16 hours)	75.76
With rat caecal contents					
6.	I	9.09	8.75 (17.84 in 5h)	79.57 (In 20 hours)	97.41
7.	II	3.78	7.15 (10.93 in 5h)	87.52 (In 20 hours)	98.45

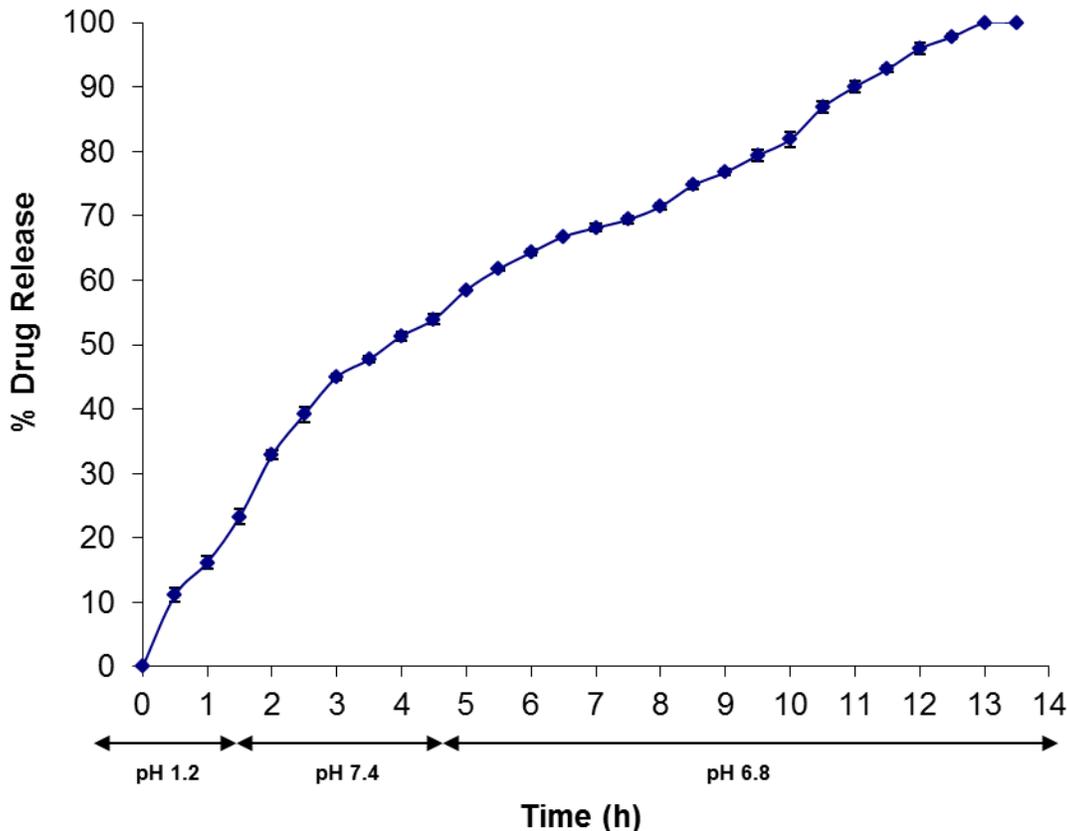


Figure 1.5 – Percent of Indomethacin Released from Marketed Sustained Release Capsules in pH Progression Medium.
 Each Value Represents Mean ± S.D. (n=3)

Mechanism of Drug Release

To determine the mechanism of drug release from different formulations the data were treated according to power model equation¹⁹. The equation is

$$M_t/M_\infty = Kt^n \quad \text{(eq. 1)}$$

Where,

- M_t = amount of drug release
- t = release time
- M_∞ = amount of drug release after infinite time
- K = kinetic constant incorporating structural and geometric characteristics of the formulation
- n = diffusional exponent indicative of the mechanism of drug release.

To clarify the release exponent for different batches of beads, the log value of percentage drug dissolved was plotted against the log time for each batch according to equation 2²⁰, which is derived from equation 1²¹.

$$\text{Log } (M_t/M_\infty) = \text{Log } k + n \text{ Log } t \quad \text{(eq. 2)}$$

Where M_t/M_∞ is the percent of drug dissolved.

Value of the kinetic constant (k) and the release exponent (n) were determined from the graph between log percentage drug release Vs log time. Value of release exponent (n) determines the mechanism of drug release from different batches (Table 1.5)

Table 1.5: Effect of polymers ratio on the drug release and the release rate from the formulation.

Batches	Rate constant (Log k)	Release exponent (n)	r ²	Order of Release
I	0.6890	0.7372	0.9951	Non-fickian
II	0.2936	1.0678	0.9972	Super case II
III	0.7352	0.7732	0.9985	Non-fickian

IV	0.9112	0.6273	0.9923	Non-fickian
V	1.0791	0.6097	0.9794	Non-fickian
Marketed Formulation	1.3721	0.5537	0.9961	Non-fickian
In presence of rat caecal contents				
I	0.5834	0.9927	.09923	Non-fickian
II	0.1101	1.3621	0.9981	Super case II

The value of release exponent n ranged between 0.5537 to 0.7732 except Batch II, for which the value was 1.3621. As all these n values are greater than 0.45, the mechanism of drug releases distinctly non-fickian diffusion for Batch I, II, IV and V while mechanism of drug release follow super case II transport for Batch II. Release mechanism for marketed formulation followed non-fickian diffusion as n value for that was 0.5537.

V. DISCUSSIONS

Chondroitin sulfate is a polysaccharide that is used for colon-specific delivery system. However, chondroitin sulfate is water soluble and therefore it is unable to protect the drug release in upper GI tract. Chitosan is also a very promising polysaccharide for colon-specific delivery, but it is soluble in the acidic environment of the stomach, hence it cannot be used alone for colon targeting.

In the present study an interpolymer complex of chitosan and Chondroitin sulfate were prepared using different ratio of polymers. Interpolymer complexation was confirmed by IR spectroscopy which revealed an ionic interaction between anionic (chondroitin sulfate) and cationic (chitosan) polymer.

Indomethacin, a NSAID has the potential to reduce the number and size of polyps in colorectal cancer by upregulating the expression of tumor suppressor genes (PTEN, MAP-kinase phosphatase-3 and protein tyrosine phosphatase) and by induction of 15-LOX and 15-PGDH. Therefore colon-specific Indomethacin beads were formulated using inter-polymer complex of chondroitin sulfate and chitosan as a carrier.

In vitro dissolution studies of Indomethacin beads were carried out in pH progression media i.e. pH 1.2 for 2 hrs, pH 7.4 PBS for 3 hrs and pH 6.8 till end of the study. Best batch was selected on the basis of minimum drug release in pH 1.2 and pH 7.4 PBS and maximum amount of drug release at the end of study. Batch 1 (chondroitin sulfate: chitosan:: 4.5:0.5) and batch 2 (chondroitin sulfate: chitosan :: 4.0:1.0) were selected as best batches. Batch I released 8.70% drug in pH 1.2 for 2 hours, 16.61% pH in 7.4 PBS till end of 5 hours and 61.65% in pH 6.8 till end of the study (23 hours). Batch II released 3.55% of drug in pH 1.2, 11.83% in pH 7.4 PBS till end of 5 hours and 67.91% in pH 6.8 till end of the study (23 hours).

Batch I and batch II were then subjected to *in vitro* dissolution studies in the presence of rat caecal contents. Here, the same criterion was used for the selection of the best batch. Batch II was selected as best batch as it was releasing 3.78% and 7.51% of drug in pH 1.2 and pH 7.4 PBS respectively and a total drug release of 98.45% at the end of the study. Release mechanism of all the batches was determined by using Peppas equation. The best batch selected i.e. batch II showed the Super case II transport of release mechanism.

In vitro dissolution study of marketed formulation of Indomethacin in pH progression media revealed a large amount of drug release i.e. 32.86% in pH 1.2 (2 hours) and 58.49% in pH 7.4 PBS (till end of 5 hours) and it sustained drug release only for 13.5 hours.

VI. CONCLUSIONS

Thus it can be concluded from the study that interpolymer complex formed between chondroitin sulfate and chitosan was able to overcome the problems associated with both of the polymers i.e. solubility in upper GI tract. *In vitro* dissolution studies of batch II, prepared by using chondroitin sulfate and chitosan in the ratio of 4.5: 0.5 released minimum amount of drug in the upper GI tract, indicated the optimum ratio of polymers for complex formation. *In vitro* dissolution studies in the presence of rat caecal contents revealed that colonic enzymes can still act upon chondroitin sulfate and chitosan and degrade them despite the cross linking of both of the polymers. The drug release was 67.91% and 98.45% in absence and presence of rat caecal contents respectively in case of batch II.

In vitro dissolution data (in presence and absence of rat caecal content) demonstrated that batch II is able to carry the drug to the colon with minimum release in upper GI tract and upon reaching the colon, maximum drug is released.

REFERENCES

- [1] Frenkian, M., Segond, N., Pidoux, E., Cohen, R. and Jullienne, A. (2001). Indomethacin, a Cox-inhibitor, enhances 15-PGDH and decreases human tumoral C cells proliferation. *Prostaglandins Other Lipid Mediat.*, **65**, 11-20.
- [2] Wang, H.M. and Zhang, G.Y. (2004). Experimental study of the inhibitory effect of indomethacin on the growth and angiogenesis of human colon cancer xenografts. *Di Yi Jun Yi Da Xue Bao.*, **24**, 184-187.
- [3] Eric, C.Chu, Jianyuan, Chai and Andrzej S. Tarnawski. (2004). NSAIDs activate PTEN and other phosphatases in human colon cancer cells: novel mechanism for chemopreventive action of NSAIDs. *Biochemical and Biophysical Res. Communications*, **320**, 875-879.
- [4] Hastewell, J., Antonin, K.H., Fox, R. and Mackay, M. (1995). The colonic absorption of human calcitonin: the effects of increasing local concentration and co-administration with a protease inhibitor. *Int. J. Pharm.*, **126**, 245-251
- [5] Bai, J.P.F., Chang, L.L. and Guo, J.H. (1995). Effects of polyacrylic polymer on the luminal proteolysis of peptide drugs in the colon. *J. Pharm. Sci.*, **84**, 1291 - 1294.
- [6] Brockmeier, D., Grigoleit, H.G. and Leonhardt, H. (1985). Absorption of glibenclamide from different sites of the gastrointestinal tract. *Eur. J. Clin. Pharmacol.*, **29**, 193-197.
- [7] Gleiter, C.H., Antonin, K.H., Bieck, P., Godbillon, J., Schonleber, W. and Malchow, H. (1985). Colonoscopy in the investigation of drug absorption in healthy volunteers. *Gastrointest. Endosc.*, **31**, 71-73.
- [8] Wilson, C.G., Washington, N., Greaves, J.L., Kamali, F., Rees, J.A., Sempik, A.K. and Lampard, J.F. (1989). Bimodal release of ibuprofen in a

- sustained-release formulation: a scintigraphic and pharmacokinetic open study in healthy volunteers under different conditions of food intake. *Int. J. Pharm.*, **50**, 155-161.
- [9] Klokkers-Bethke, K. and Fischer, W. (1991). Development of a multiple unit drug delivery system for positioned release in the gastrointestinal tract. *J. Control. Rel.*, **15**, 105-112.
- [10] Vila, J.I., Calpena, A.C., Obach, R. and Domenech, J. (1992). Gastric, intestinal and colonic absorption of a series of beta-blockers in the rat. *Int. J. Clin. Pharmacol. Ther. Toxicol.*, **30**, 280-286.
- [11] Sommers, D.K., Van Wyk, M., Snyman, J.R. and Moncreiff, J. (1992). The absorption characteristics of six sustained release theophylline preparations. *S. Afr. Med. J.*, **81**, 20-22.
- [12] Prasad, Y.V.R., Krishnaiah, Y.S.R. and Satyanaryana, S. (1996). Trends in colonic drug delivery: a review. *Indian Drugs*, **33**, 1-10.
- [13] Friend, D.R. and Tozer, T.N. (1992). Drug glycosides in oral colon-specific drug delivery. *J. Controlled Release*, **19**, 109-120.
- [14] Chourasia, M.K. and Jain, S.K. (2004). Design and development of multiparticulate system for targeted drug delivery to colon. *Drug Delivery*, **11**, 201-207.
- [15] Yang, L., Chu, J. and Fix, J. (2002). Colon-specific drug delivery: new approaches and *in vitro/in vivo* evaluation. *Int. J. Pharm.*, **235**, 1-15.
- [16] Zhang, H., Ibrahim, A.A. and Neau, S.H. (2002). An *in vitro* evaluation of a chitosan-containing multiparticulate system for macromolecule delivery to the colon. *Int. J. Pharm.*, **239**, 197-205.
- [17] Takayama, K., Hirata, M., Machida, Y., Masada, T., Sannan, T. and Nagai T. (1990) Effect of Interpolymer complex formation on bioadhesive property and drug release phenomenon of complex tablet consisting of Chitosan and Sodium Hyaluronate. *Chem. Pharm. Bull.*, **38**, 1993-1997
- [18] Yan, X., Khor, E. and Lim, L.Y. (2000). PEC films prepared from chitosan-alginate coacervates. *Chem. Pharm. Bull. (Tokyo)*, **48**, 941-946
- [19] Ritger P.L. and Peppas, N.A. (1987) A simple equation for description of solute release. II Fickian and anomalous release from swellable devices. *J. Control. Rel.*, **5**, 37-42.
- [20] Korsmeyer, R.W., Gurny, R., Docler, E., Buri, P. and Peppas, N. A. (1983) Mechanism of solute release from porous hydrophilic polymers. *Int. J. Pharm.*, **15**, *Pharm.*, **92**, 105-114.
- [21] Peppas, N.A. (1985). Analysis of Fickian and non-Fickian Drug Release from Polymers. *Pharm. Acta. Helv.*, **60**, 110-111.

AUTHORS

First Author – Jasvir Kaur, M. Pharm, GHG Khalsa College of Pharmacy, Gurusar Sadhar (Ludhiana) 141104

Second Author – Gurpreet Kaur, M. Pharm, Ph. D, Punjabi University, Patiala

Third Author – Satvinder Kaur, M. Pharm, GHG Khalsa College of Pharmacy, Gurusar Sadhar (Ludhiana) 141104

Correspondence Author – Anu Mahajan, M. Pharm, GHG Khalsa College of Pharmacy, Gurusar Sadhar (Ludhiana) 141104, anumahajan78@gmail.com, rahul.jindal1@gmail.com, 09988673735

A Study Exploring the Link between Attachment Styles and Social Networking Habits of Adolescents in Urban Bangalore

Gayathri Rao*, Dr. Ankur Madan**

* Department of Psychology, Christ University, Bangalore, India

** Department of Psychology, Christ University, Bangalore, India

Abstract- While attachment has been a topic of extensive research in developmental psychology, its impact in the context of the technological changes in the 21st century and the changing dynamics of familial structures and relationships have not been so extensively explored. The present research examined the attachment styles of 95 adolescents varying from 14 to 17 years of age, from reputed English medium schools all over Bangalore. They were given the Inventory of Parent and Peer Attachment and then categorized into those who use Facebook for more than 7-8 hours a day and those who don't. Five securely attached adolescents and five insecurely attached adolescents with heavy Facebook use were selected randomly and were interviewed to investigate the reasons for Facebook use. Results indicated that there existed substantial differences in the reasons for Facebook use by those securely and insecurely attached adolescents. The insecurely attached adolescents showed patterns of low confidence and negative view of others and situations. They enjoyed the privacy and independence that came hand in hand with Facebook use and believed Facebook was not meant for the older generation. They also believed that their need for affection and their need to belong, was met by the use of Facebook, which otherwise would not have been possible. Popularity rated high as a consequence of using Facebook and the effects of peer pressure were not undermined. Securely attached adolescents on the other hand, did not view privacy and independence as big issues revolving solely around Facebook use. They also enjoyed the presence of their family members on Facebook along with them. Popularity still scored high as a result of Facebook use, as so did the need to fit in and belong. On the whole there came to light differences that existed between the securely and insecurely attached adolescents on the reasons for Facebook use.

Index terms- attachment, attachment styles, facebook, social networking, adolescents.

I. INTRODUCTION

Adolescence is considered the most difficult phase in the lifespan of man. It is also the most volatile and unstructured and the most moldable. Adolescents can be shaped by innumerable things at this point in their lives and in today's world; technology has no less influence on adolescents than their friends. Another great influencer of an adolescent's relationships would be his attachment styles that are determined by his early childhood caregiver experiences.

Attachment

Attachment is an affective bond or tie that develops between an infant and its caregiver. Such bonds are usually reciprocal between two adults, but between a child and its caregiver, this bond is usually based on security, safety and protection. The child's tie to its caregiver is called the "attachment" and the caregiver's reciprocal tie is called the "care-giving bond". The two way process requires on the part of the mother to engage in lively social interaction and respond to signals and approaches from the infant. Some infants direct attachment behaviour towards more than one attachment figure almost as soon as they start to show discrimination between caregivers; most come to do so during their second year. These figures are arranged hierarchically, with the principal attachment figure at the top. Bowlby also conceived attachment as an evolutionary mechanism, necessary for the survival of the species by helping offspring maintain close proximity to a caregiver. Attachment serves the biological aim of survival through genetic replication and the psychological aim of security.

Attachments lie at the heart of family life. They create bonds that can provide care and protection across the life cycle (Ainsworth, 1991). Attachments can also evoke the most intense emotions and create problems if the individual becomes insecure (Byng 1995). The central theme of attachment theory is that, mothers who are available and responsive to their infant's needs establish a sense of security. The infant knows that the caregiver is dependable, which creates a secure base for the child to then explore the world. He also shares the psychoanalytic view, that early childhood experiences heavily influences development and behaviour later on in life.

The quality of attachment evolves over time as the infant interacts with his/her caregivers. The type of attachment, or attachment status of the infant toward the caregiver is partly determined by the interaction between the two and partly by the state-of-mind of attachment (that is of their own attachment figure) of the caregiver. As the caregiver affects the infant, the child also affects the caregiver. Attachment is also viewed as central to the capacity of emotion regulation.

There are four major attachment styles observed: secure, anxious resistant, anxious avoidant and disorganized attachment styles.

1. Secure Attachment styles: Child protests caregiver's departure and seeks proximity and is comforted on return. The child then returns to exploration. The child may also be comforted by the stranger but shows clear preference for the

caregiver. This is significantly related to maternal sensitivity.

2. Anxious Resistant Attachment styles: The child is unable to use caregiver as a secure base, seeking proximity before separation occurs. He is also distressed on separation with ambivalence, anger, reluctance to warm to caregiver and return to play on return.
3. Anxious Avoidant Attachment styles: Little affective sharing in play. Child shows little or no distress on departure, little or no visible response to return, ignoring or turning away with no effort to maintain contact if picked up and treats the stranger similarly.
4. Disorganized Attachment Style: Lack of coherent attachment strategy shown by contradictory, disoriented behaviors such as approaching but with the back turned to the caregiver. [Stereotypes](#) on return such as freezing or rocking.

Children with insecure attachment styles are seen to have elevated levels of anxiety symptoms and increased levels of worry (Muris et al 2000). Robert Weiss was one of the first researchers to suggest a link between loneliness and attachment styles.

The existence of attachment is usually manifested in three ways: Proximity seeking, Secure base phenomena and Separation protest.

1. *Proximity Seeking* refers to the desire to be near the people the infant is attached to.
2. *Secure Base Phenomena* is when the attachment figure acts as a base of security from which the child can explore the surrounding environment.
3. *Separation Protest* is the anxiety that occurs in the absence of the attachment figure.

The Attachment Theory is in essence a spatial theory revolving around the availability of the primary caregiver. The infant knows that the caregiver is dependable, which creates a secure base for the child to then explore the world. Attachment theory is a [psychological](#), [evolutionary](#), and [ethological](#) theory concerning [relationships between humans](#). The most important tenet of attachment theory is that a young child needs to develop a relationship with at least one primary caregiver for social and emotional development to occur normally.

There are several important similarities and differences between the attachments that occur in childhood and adulthood. Shaver and Hazan (1989) point out six similarities between childhood and adult (and adolescent) attachments. First, is that the quality of the attachment is dependent upon the reciprocation, sensitivity and responsiveness of the attachment figure/ caregiver. Second, securely attached individuals (infants/adults) are generally happier and more adaptive than insecurely attached individuals. Third, the attachment mechanism of maintaining proximity to the attachment figure is displayed in both adult and infant attachments. Fourth, separation from an attachment figure causes extreme distress (separation distress), and the initiation of attachment behaviors in an attempt to regain contact with the attachment figure. Fifth, in both adults and infants, there is an "intense sensitivity" when displaying discoveries and achievements to the attachment figure

for approval. And lastly, both attachments entail a certain degree of baby talk or motherese type communication.

Feeney et al. (1999) note that there are two important differences between childhood attachment and adult attachment. The first is that childhood attachments are asymmetrical, meaning that the relationship is usually complimentary than reciprocal. Second, there is almost always a sexual component involved in adult attachments.

Relationships with peers have an influence on the individual that is distinct from that of parent-child relationships, though the latter can influence the peer relationships they form. Although peers become important in middle childhood and, the evidence suggests peers do not become attachment figures, though children may direct attachment behaviors at peers if parental figures are unavailable. Attachments to peers tend to emerge in adolescence, although parents continue to be attachment figures. With adolescents, the role of the parental figures is to be available when needed while the adolescent makes excursions into the outside world. Children usually begin to develop a single general model of attachment relationships during [adolescence](#), although this may occur in middle childhood

Attachment and Adolescents

In adolescence, unlike childhood and adulthood, the meaning and the importance of the construct of attachment for social functioning is derived primarily from theoretical inference and from a few studies examining its correlates within unusual samples. Yet, attachment organization appears likely to be integrally related to a range of domains of psychosocial functioning in adolescence both because it reflects core aspects of the ways adolescents process affect in social relationships and because it is also likely to be associated with qualities of ongoing relationships with parents ([Allen & Hauser, 1996](#); [Allen & Land, in press](#)). The formation of meaningful peer relationships is one of the developmental tasks of adolescents, which could possibly be the strongest theoretical links to attachment behaviour. Peer relationships increase markedly in intensity during adolescence and in some cases may in themselves become attachment relationships.

Weiss (1973,1989) believed that secure adolescents attached high importance to both attachment and affiliation goals in friendship, anxious-ambivalent adolescents overemphasized attachment goals, and avoidant adolescents gave low importance to the two types of goals. In addition, whereas secure adolescents were responsive to affiliation and attachment contexts, insecure adolescents showed less responsiveness to these contexts and their habitual working models guided their responses (Mario et al, 2001)

Social Networking

One can define a social network site as a web-based service that allow individuals to

- (1) Construct a public or semi-public profile within a bounded system,
- (2) Articulate a list of other users with whom they share a connection, and
- (3) View and traverse their list of connections and those made by others within the system. The nature and nomenclature of these connections may vary from site to site.

Facebook is the most visited social networking site in India, according to (ComScore, 2011). According to a study by web analytics, Facebook.com grabbed the number one ranking among social networking sites in India for the first time in July 2010 with 20.9 million visitors, up 179 per cent, as compared to 7.47 million in 2009. These sites have been integrated into daily practice because of their affordability and reach.

Social networking sites have attracted millions of users, with a majority of them being youngsters most of whom have integrated these sites as their daily practices. It's popularity could be due to the concept of "[real-time web](#)", a process where individual can contribute content and it's being broadcasted as it's being uploaded, which is analogous to television and radio broadcasts, increases popularity of Facebook. And the popularity of a social networking site is not just based on how many people it has, but how frequently they engage with others on it. Boyd and Ellison 2007 believe that social networking sites designs are egocentric, meaning that the individual user is the centre of their network. Facebook also helps to organize events and send invites to friends.

Self representation is of immense importance. Social networking revolves around false identities and virtual relationships, creating a safe haven for youngsters to explore their potentials. Its relationship to attachment styles is varied and diverse. Adolescents especially have a huge advantage.

Jeff Hancock (2009), of the [Cornell University](#) says that "Most people believe that given the opportunity, everything else equal, people will lie more online than they would face-to-face," Hancock called this the "cues heuristic," which means the fewer deception-detecting signals at our disposal, the less we'll trust someone. At the same time, research indicated that technology, which allows us craft picture-perfect social networking profiles or e-mail, in sick, when we're lounging on the beach, isn't tempting us to lie any more than we normally do. So thus it becomes a matter of whether we lie because we want to, or whether we lie because we are able to.

The Internet is more exciting and challenging as a research environment than earlier media because it is a complex, virtual, *social*, and physical world that children and adolescents participate in and co-construct, rather than something that is merely watched or used such as television or personal computers. It becomes a complex virtual universe behind a small screen on which developmental issues play out, offering new views into the thoughts, feelings, and behaviors of children and adolescents. (Greenfield & Van, 2006, p. 393). Valkenburg and Schouten 2006 studied the negative effects of online social networking sites on self worth and happiness among 10 to 19 year olds and found that positive responses to user profiles improved these measures and negative responses decrease them. With social networking sites becoming more of a substitute for families, it is the women who are most affected by it, as they derive their self worth from relationships with others and Facebook compels them to acquire hundreds of friends.

The framework in the present study is based on the assumptions drawn from John Bowlby's attachment theory. According attachment theorists, the child who receives responsive and sensitive parenting from the primary caregiver forms an internal working model of that caregiver as trustworthy

and dependable when needed and develops a model of the self as someone who is worthy of such care (Bowlby, 1973, 1982).

II. REVIEW OF LITERATURE

1) Social networking and its usage

Today, online social networking in the present 21st century cannot be undermined as 55% percent of teenagers' online, use and create online social networking profiles (Lehnhart & Madden, 2007). Also studies by Sheri and Tanisha (2009) show that traffic on social networking sites have increased in recent years. Despite the debate on the efficacy of online networking, there has been a tenfold increase.

One of the main reasons for it's popularity would be because of the many benefits such as the provision for self expression, connectivity and creation and also how individuals have the freedom to create and recreate themselves, as found by a study conducted by Takahashi in 2010, by reviewing nearly 5000 profiles on popular social networking sites. Themes much spoken about were explored by Williams and Merten in 2008, who found that adolescents post information regarding family and *social* issues, risk behaviors, disclosure of personally identifiable information, and frequent peer interaction.

Of late, the implications of heavy use of networking sites have been the focus of some researches. Studies have been conducted to see the various detrimental effects of these sites. Buffardi and social psychologist W. Keith Campbell (2009), ran 130 Facebook users through the Narcissistic Personality Inventory (NPI). People, who score high on the NPI are more likely to cheat and game-play in relationships, monopolize resources and are excessively materialistic. What emerged is that online narcissists behave much like offline ones, amassing numerous but shallow relationships and engaging in ceaseless self-promotion. Concern has been expressed over the years, regarding the ability of youngsters learning relationship skill that could be hampered by excessive use of online social networking and Stefanone (2011) found that a majority of the women using online social networking sites, base their self worth on the appearance of their profile pictures and their self esteem is directly proportional to the attention they receive for it.

On the other hand, Valkenburg et al (2009), believes that social networking sites have created a more intimate atmosphere where teens and young adults are more likely to connect with peers and discuss personal issues in a positive way. And Julia Porter et al (1996) found that the use of Facebook to share scientific information and knowledge is used to "increase both their learning and their flexibility in ways that would not be possible within a self-contained hierarchical organization."

Many authors agree that four major factors distinguish computer mediated Communication (CMC) from Face to Face (FtF) communication; greater anonymity, the reduction of the importance of physical cues, greater control over the time and place of the interaction and the ease of finding similar others (Amichai-Hamburger 2007; McKenna, Green & Gleason). Together these factors "create a unique psychological environment for the user" (Amichai-Hamburger 2007) and attract researchers to computer mediated communication. But in contrast along-term study conducted by psychologists at the University of Virginia, found that the interactions young adults

are having on their Facebook and MySpace pages are more similar to than different from the interactions they have in their face-to-face relationships,"

2) Adolescents and social networking

Adolescence is a time of heightened stress, with as many as one in four young people experiencing a mental health problem; appropriate care is required to reduce the impact of mental illness on their transition into adulthood and subsequent adult life. In a study conducted by Ullas (2011), 28% of those who fall in the 15-19 age group considered online social networking as their top priority and 28% of them indulged in it to escape boredom.

Gentzler et al (2011) found that students who report more frequent phone conversations with parents also report more satisfying, intimate, and supportive parental relationships, but those students who use a social-networking site to communicate with parents report higher levels of loneliness, anxious attachment, as well as conflict within the parental relationship. Ong et al (2011) found that individuals who had participated in online chatting exhibited greater familial loneliness than those who had not because the time spent in online chatting reduced the time spent in familial relationships. Social loneliness was related to the quality of Internet relationships rather than to the time spent online. Individuals who participated in online chatting had less romantic loneliness because of a greater ease of maintaining romantic relationships online.

Online social networking seeks to not only increase an individuals contacts and maintain them, but also plays a crucial role in grieving for lost friends. As Williams and Merton(2009) found that when dealing with grief, not only does social networking sites prolong an attachment with the deceased, but it "also facilitates a teenagers" coping in a way that grants unlimited freedom and opportunity to reflect back over their relationship with the deceased."

Reich in 2010 found that typical **adolescent** uses of Social Networking Sites represent networked individualism, rather than online communities.

A study done by Woodhouse, Warner et al in 2010 show that adolescent attachment moderated the connection between parent and adolescent symptoms; in most cases attachment security was more protective if both parents were high on anxiety symptoms or if one parent was high on anxiety but the other parent was low on depressive symptoms. Meditational analyses indicated that representations of their mothers as a secure base.

In response to the available literature, this study has focused on the variables of secure attachment and insecure attachment styles and their reasons for the use of online social networking sites.

The present study is an investigation into the relationship between attachment styles and use of social networking sites and also elaborates on the reasons that may underlie it.

III. RESEARCH ELABORATIONS

The present research attempts to examine and explore the link between Attachment Styles and Online Social Networking Habits of adolescents in Bangalore. An attempt was

also made to obtain an in-depth understanding of the relationship between different styles of attachment and Facebook use.

A. Objectives

1. To study Attachment styles of adolescents.
2. To explore social networking habits of adolescents in Urban Bangalore
3. To find linkages, if any, between attachment styles and social networking habits

B. Hypotheses

Based on the review of literature, the following hypotheses were stated:

1. A secure style of attachment in adolescents leads to a greater emotional bond with parents and peers and a lesser use of social networking sites.
2. An insecure style of attachment in adolescents, leads to a less emotional bond with parents and peers, and greater use of social networking sites.

C. Research Design

This study used the empirical research design. It made use of both the quantitative and qualitative approaches. The participants were first administered questionnaires. The results were obtained, scored and interpreted. This was followed by an in-depth interview with some of the participants, for further information. These interviews were subjected to thematic analysis, to obtain a comprehensive view.

D. Sample

In this research study, quantitative data was collected through the convenient sampling procedure, while the sample for the interview, selected from the larger sample was used to collect qualitative data.

A total of 93 adolescents, between the ages of 13-16 years from Bangalore participated. The sample consisted of 41 female and 54 male participants. They were administered the Inventory of Parent and Peer Attachment (IPPA) (Armsden & Greenberg,1987) with their voluntary consent. A group of 10 participants were then selected for an in-depth interview.

E. Assessment Tools

To measure attitude styles of adolescents, the **Inventory of Parent and Peer Attachment (IPPA)** was used.

This inventory was developed by Mark T. Greenberg and Gay Armsden in 1987, to assess adolescents' perceptions of the positive and negative affective/cognitive dimension of relationships with parents and close friends, particularly how well these figures serve as sources of psychological security. The theoretical framework is attachment theory. Three broad dimensions assessed are: degree of mutual trust, quality of communication, and extent of anger and alienation.

Scores on the IPPA have been found to be associated with a number of personality variables. Among late adolescents, parent and peer attachment are correlated with positiveness and stability of self-esteem, life-satisfaction, and affective status (depression, anxiety, resentment/alienation, covert anger, and loneliness) (Armsden & Greenberg, 1987; Armsden, 1986). The

relationship of attachment and affective status holds even when degree of negative life-change is controlled (Armsden & Greenberg, 1987). Quality of attachment to parents and to a lesser extent, peers, is associated with self-reported tendencies toward the use of more problem-solving coping strategies relative to emotion-managing efforts in stressful situations (Armsden, 1986). Among early to middle adolescents, parent attachment, and to a lesser extent, peer attachment, were found to be associated with lesser hopelessness and less externally oriented locus of control and with greater self-management (coping) skills (Armsden et al., 1987; Lewis et al., 1987).

F. Administration

The subjects were given the instructions as well as the questionnaires, in the school campus. There was no time limit to fill out the questionnaire. Once the respondents finished answering, the questionnaires they were collected and the results were tabulated for interpretation. The subjects were seated comfortably and rapport was established. The subjects were then given the instructions as well as the questionnaires, in the school campus. There was no time limit to fill out the questionnaire. Once the respondents finished answering, the questionnaires they were collected and the results were tabulated for interpretation. Once tabulated, 10 participants were selected randomly from the two categories obtained from the questionnaires. The interview followed a semi structured format and was conducted a week after the initial assessment. Thematic analysis was used to decode the interview obtained from the data. The transcripts were also given to co-researchers, for validation.

G. Statistical Tools

The statistical tools of Mean, Median, and SPSS (Statistical Package for the Social Sciences) were used for statistical analysis of the quantitative data.

IV. RESULTS

An analysis of the results, gives us an understanding of the prevalence of attachment styles among teenagers in the city, their social networking habits and also the ‘whys’ of Facebook use. This research also seeks to expand on the differences in reasons, given by the securely and insecurely attached adolescents, on their use of Facebook.

No. of Participant	Gender		Age Range 14 – 17 years
95	Female	41	Mean = 15.76
	Male	54	SD =7.72

Table I: Distribution of sample based on age and gender.

Gender	High Facebook Use	Low Facebook Use
Boys	31	23
Girls	27	14

From the table we see that the total number of participants for

the present study was 95 adolescents, 41 girls and 54 boys all ranging from 14 years to 17 years and the mean age of the participants was 15.76 years. The participants were from various school and colleges from Bangalore and were all from upper and upper middle socio-economic backgrounds.

After permission was obtained from the respective schools, the Facebook Use Questionnaire and the Attachment Styles Questionnaire were administered to measure the extent of use of online social networking and their attachment styles. The questionnaires were scored and interpreted. Out of these participants, five adolescents who measured ‘high’ (7-8 hrs or more daily) on the use of social networking and five who measured ‘low’ (less than 7-8 hrs daily) on the use of social networking were selected and were then shortlisted for an in-depth interview.

On analysis, it was found that a total of 58 participants were ‘high’ users of Facebook and 37 of the participants scored ‘low’ on the amount of Facebook usage.

Table II: The distribution Facebook use among adolescents, according to gender.

From the above table we see that a total of 31 boys and 27 girls were high users of Facebook. The low Facebook users consisted of 23 boys and 14 girls. This present study did not take into account gender differences in the use and the reasons for use of Facebook.

Table III: The distribution of high Facebook use among Insecurely and Securely Attached Adolescents

HIGH Facebook Use			
Insecurely attached Adolescents		Securely Attached Adolescents	
Girls	73.3%	Girls	45.45%
Boys	71.4%	Boys	42.30%

Table IV: The distribution of high Facebook use among Insecurely and Securely Attached Adolescents.

LOW Facebook Use			
Insecurely attached Adolescents		Securely Attached Adolescents	
Girls	26.66%	Girls	54.54%
Boys	28.57%	Boys	53.57%

From the above tables, we find that among the ‘High’ users of Facebook, 42 of the adolescents were scored as insecure (22 girls and 20 boys) and 16 were identified as secure adolescents (5 girls and 11 boys). Among the Low users of Facebook, 21 of them were secure adolescents (6girls and 15 boys) and 16 adolescents (8 girls and 8 boys) were scored as insecure.

From the present study, an analysis of the numerical data, gives us an insight into prevalent attachment styles and use of social networking sites. It was found that a majority of the insecure adolescents spent more time on Facebook. The findings are similar to those found by Eloise Zoppos (2009), who said that individuals with attachment styles related issues, take to Facebook more, than those without attachment style related issues. This could be mainly attributed to the fact that those with attachment issues spend less time and effort in forming and maintaining relationships in real life. They instead spend progressively large amounts of time on online social networking sites, in order to compensate for the lack of real face to face relationships. These methods of forming relationships provides them with the convenience of staying in a less threatening environment and still form relationships with people outside their immediate environment. Thus we see that Facebook or any online social networking site for that matter, are the most popular with those who have attachment related issues and who are insecure. Zoppos (2009) also found that 43.5% of secure individuals were high users of Facebook and 66.5% of those with attachment related issues were high users of Facebook.

The results of the present study also indicate that around 39% of the adolescents were insecure. This could be due to changes in parenting, the unavailability of a secure supporting family system, in cases where both parents are working, and infants are usually thrust to a non family member to be baby sat. This is of immense importance as it is believed, an infant’s early childhood experiences with their caregivers, serves as an important predictor for future styles of attachment (Bowlby, 1969). In previous literature, it has been found that approximately 35% of individuals are insecure. Children are also missing out on a major chunk of their childhood that they spend with their parents or grandparents, as they are sent to day care centers or crèches because the parents are too busy generating income for the family. Most adolescents participating in the study came from affluent backgrounds, with educated parents and occupational history of repute. Thus different styles of parenting and the possibility of lack of quality time spent with the infants could be the reason for the huge numbers of individuals with attachment style related issues later on in life.

In this present study, it was found that a majority of them (61%) however do not have any attachment related issues, meaning that they do not have problems forming relationships with people in the real world. Their attachment bonds are intact and they relate and adjust well with people around them. They are able to initiate and maintain close and intimate relationships with people around them. These results are similar to those from previous research, where it is estimated that approximately 65% of the population is securely attached.

The prevalence of those who used online social networking sites in the current study, was a whopping 100%. In 2009, Lehnhart found that 59% of the teenagers who use the net have accounts on social networking sites. There is a marked difference

in the results found here. This could mainly be attributed to the socio-demographic profile of the respondents, where the majority of the respondents belonged to the upper socio-economic status or the upper middle socio-economic status and are all currently studying in reputed International and English medium schools.

It was expected that the adolescents who are securely attached, would have a negative relationship with Facebook and this was supported; with only 27.5% of them being high users of Facebook and a stunning 72.35% of the adolescents who were insecurely attached, emerged as high users of Facebook. This can mean that securely attached individuals have a lesser degree of need to turn to social networking sites to form close meaningful relationships because as found in previous studies, securely attached individuals have reported holding positive views of both themselves and of others (Pietromonaco & Barret 1997). They have less interpersonal problems, than insecurely attached individuals (Horowitz et al, 1993), and are also less likely to develop problematic internet use (Fleming & Harrison 2007). Secure individuals have less self doubt than those who are insecurely attached.

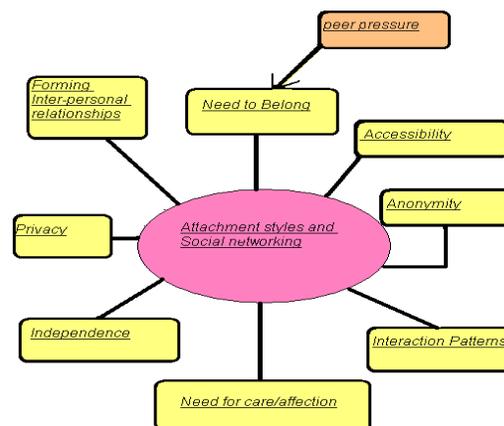
An in-depth interview was conducted on 10 adolescents, five who were securely attached (two girls and three boys) and five who were insecurely attached (one girl and four boys).

From the analysis of the interviews various themes were identified. Many that related directly to the objectives of the study and some that provided insight into nuances that may require further research.

The main themes that ran in the interviews of those insecurely attached, ranged from insecurities to low self esteem to differences in types of leisure activities engaged in, to changes in patterns of interaction and levels of privacy and independence needed.

The following Thematic Network was developed using the themes that were found underlying the interviews.

Fig. 3: A diagrammatic representation, of the underlying themes in the in-depth interviews.



Anonymity

Adolescents like to spend a lot of their online time chatting with friends and unknown people: A feature of a majority of the insecurely attached adolescents. One adolescent claimed that “While we chat with strangers, we can share stuff that is dear to us without feeling embarrassed that our friends

will come to know.” As one insecure adolescent said, “There’s a greater level of comfort when talking to strangers and I feel less inhibited to share information about myself.” As strangers are also better able to look at the problem objectively insecure adolescents feel more secure. Added to that is the fact that these are people the adolescents have never seen and will never meet in their whole life. This gives them added benefits of not being judged and getting sympathy. They are allowed to put up a fake front in order to be ‘liked’ by others and “the sympathy that we get is whole.” “Strangers are capable of giving unbiased advice and are very sympathetic.” As one adolescent puts it, “Half the time my problems revolve around my friends or family, and telling my friends about these problems will make them think I’m a sissy, so I don’t talk to my friends about matters like these.” Insecurely attached individuals also feel safe talking to strangers because “There’s no fear of them blurting out the wrong information to the wrong people.” And another opines that “my family and friends don’t care enough, to be bothered about my problems.”

Securely attached people on the other hand, shared their issues, more with family and friends than with strangers. “I feel better talking to my friends if I have any problems. They care for me and will help me out whenever I need help.” Another securely attached adolescent opines that I don’t bug my online pals with my troubles, I just maintain a cordial relationship with them.” Another adolescent believes that he doesn’t need stranger friends to unburden himself to. As they believe “friends and family are there to share your problems with. Another securely attached individual opines “how can I go and just tell some stranger about my problems?” While the securely attached adolescents spend time chatting with mostly friends and family members, they do sometimes talk to strangers but only to make new acquaintances and not to share their distressing issues.

Thus substantial differences were found in the way in which securely attached and insecurely attached adolescents weaved their interaction with their online peers. Clear differences emerged in the way in which the securely and insecurely attached adolescents interacted with strangers online and the way in which they shared their problems and issues. While the insecurely attached were more willing to share their problems with strangers, the securely attached would rather befriend strangers to turn them into friends rather than confide in them. The insecurely attached individuals were more bothered about being judged than the securely attached individuals.

Interaction Patterns

An underlying theme of interaction in terms of conversing with family members and friends was evident and differences were seen in the way in which the securely attached adolescents interacted and the way the insecurely attached adolescents interacted. These differences covered a wide ground of interaction with friends, with family members and online. The interaction patterns varied across a wide spectrum of situations and individuals. The pattern of interaction with their friends was found to be different from that of the interaction with parents and family members. One adolescent believed that she could ‘talk to her friends about anything, but there are certain things she cannot talk to her parents about.” Another adolescent was of the opinion

that “It’s easier to talk to friends, because you can use short forms and they will understand and you can also use bad words.” “But with parents you have to be very careful because I’m not allowed to use bad words.” “With friends, they know what you are talking about and they understand without you having to tell them ever thing directly.” Another adolescent was of the opinion that “Friends know what would have happened the previous day so, they understand faster.” One insecurely attached adolescent was of the opinion that she cannot express herself in front of her parents. Words come to me better in front of my friends.” Another reason for differences in patterns of interaction was that a majority of the insecurely attached adolescents feel that parents are very strict, friends on the other hand are not.” And also “friends are going through similar things like us, so they can understand better than adults who belong to a different generation.” These patterns show that insecurely attached adolescents feel the lack of communication between parents and themselves and it also emphasizes their lack of willingness to bridge that gap.

Securely attached individuals on the other hand, agreed that there are certain things one cannot talk to your parents about, for example the topic of boyfriends and girlfriends are a big no. But most of them spoke to their parents about literally anything and if they couldn’t approach their parents or family members their friends were always there. Basically there is no dearth of people that the secure individuals have to talk to. They also do not feel hesitant talking to family members about most issues.

This difference could mainly be because adolescents themselves do not view parents as friends. Securely attached adolescents see their parents as more approachable and view them as someone they can share things with.

Need to Belong

There was also a need to belong that came out strongly in the interaction with family and friends whether online or face to face. This is especially high among insecure adolescents which guides their behavior and interaction online and in face to face interaction. One young adolescent says, “What will my friends think of me, if I don’t use Facebook?” Another opines that only “Nerds” don’t use Facebook. It’s all about trying to fit in. To not be left behind in one’s circle of friends. As one adolescent puts it “I am part of my group because I use Facebook and we don’t accept people who don’t have an account there.” Having a Facebook account is also mandatory when you want to share pictures with friends. So technically to be someone who gets noticed and wants to be popular has to use Facebook. And not just use Facebook, but be a regular user of it. Another adolescent is of the opinion that it’s “cool” to use Facebook and “If you haven’t logged in the previous evening you had better have a good excuse for it.” One adolescent claims “It’s embarrassing to tell your crush or anyone that you don’t have a Facebook account.” “It’s like not knowing what the in thing is.” Another crucial aspect of using Facebook is the public display of connections. Thus one’s friends’ list is visible to all and has to be impressive to attract attention.

Peer Pressure

Peer pressure is an important factor that influences the need to belong. As the need to belong is an internal motivation to

comply with a particular group, peer pressure on the other hand, is an external factor that pushes an individual to conform to a particular group. Another adolescent believes that "You won't have too many friends if you are not on Facebook." An insecurely attached adolescent thinks that Facebook is the "Perfect thing to keep in touch with friends and should be made compulsory." Friends need each other online to share in the joys and sorrows of life. One of the securely attached adolescents believes that the longer your list of virtual friends, the more popular you are. Facebook is literally seen as a measure of popularity among today's generation.

Among the securely attached adolescents, the importance of having a Facebook account doesn't decrease, and the reasons for having one, does not differ considerably. It is still considered "cool" to use Facebook. It acts as a platform on which they can share pictures and information with everyone, only because it is very convenient." It also is used as a tool to keep in touch with friends and family members.

One of the main reasons for this could be that adolescence is in itself a stage of 'trying to fit in' and 'be like the rest'. Thus irrespective of their individual attachment styles, adolescents universally do what is required of them to belong and be part of their peer group. Hence Facebook serving as a medium of 'fitting in' has adolescents of all styles taking to it.

Many of the insecure adolescents, when asked to describe their profile pictures, stated they uploaded pictures of themselves alone. The securely attached adolescents on the other hand, uploaded a mix of single profile pictures and also pictures that had images of themselves along with other friends. This has a lot to do with their levels of confidence, probably fearing that their friend in the profile picture might get more attention than them.

Privacy and Independence

There is an interesting pattern of privacy that most adolescents voiced when talking about "Facebooking" and unanimously agreed that adults, at least parents should not be allowed on Facebook." One adolescent opined that "Facebook is the only place where I can be myself". My parents aren't constantly looking at me and criticizing me. I'd die if my parents joined Facebook." Another believed that "My parents are very nosy and they have problems with everything I do. So I normally don't introduce my friends or show them pictures of us when we go out and all, but if they joined Facebook, they will see all my pictures and comments and will definitely have something bad to say about my friends and our things." Another adolescent opined that parents have their own friends, so why should they come trying to make friends with my friends?" Generally among the insecurely attached adolescents, a parent being on Facebook is a big no. They "feel on edge" if one of their parents is on Facebook, and are constantly wondering if they are checking their (adolescents) profiles and pictures and comments. Despite detesting the parent's presence on Facebook, having a sibling or more on their friend's list is absolutely fine. "My siblings usually know what's going on in my life and I know what's happening in their life. We just don't tell our parents, it's a mutual agreement" Most adolescents enjoy the feelings of privacy Facebook has to offer and a majority of the

adolescents' share the view that Facebook is meant only for the "Younger Generation" and that "Parents have no right impinging on their personal space." They enjoy the fact that they can be whom ever they want and talk to whomever they want from the comfort of their own homes without parents knowing. The secrecy with which they change character and identity is appealing to them and creates a sense of power, generally found missing in their real life relations. The insecure adolescents, especially resent it if the "Grown ups want to know why they spend so much time on Facebook." "Why should they come poking their nose there?" they ask. It's a widely held belief that the older generation is not welcome on Facebook and even if they do venture, they are "Too dumb to understand". "The intricacies of Facebook would be much too difficult for them" said a 15 year old adolescent.

What comes out rather strongly here is there innate fear of being judged by anyone- from their parents to friends to complete strangers. Adolescents hide behind a mask of what they want to be, conveniently made available by Facebook. A lack of confidence is also seen on a very subtle note, where they lack confidence in who they are, resulting in them wanting to be someone they are not.

With the growing need for independence, adolescents are increasingly trying to explore and experiment with new avenues and forums for self discovery, self expression and independence. Both the secure and insecure adolescents use Facebook for just such purposes with hardly any difference between them. They also exercise independence over what they share on Facebook especially regarding personal information. Independence is a long sought after state for all adolescents, secure or insecure, and Facebook brings this out beautifully. Many adolescents exercise independence in the number of hours they will spend online, the pictures they upload, the statuses they update and the comments they post. The fact that most parents are not on Facebook, allow the adolescent to be 'free'. One adolescent believed that "it's more fun interacting this way because parents are not breathing down your back about how you are dressed, what language you are using, how your hair looks and how you present yourself." Another opines that "parents have an old retarded way of looking at how we behave and are, and it just doesn't belong in the present century, so Facebook offers you freedom from stuff like that." It's a lot of fun this way and I like it more." There isn't much difference in the way insecure and secure adolescents react to the independence they get from using Facebook.

Accessibility

Accessibility is another main criterion for its popularity with adolescents. In today's world, most homes belonging to the middle to upper middle socio-economic status have at least one computer at home with access to the internet. Even if an individual doesn't have access to Facebook from home, there are innumerable internet cafes across the country.

With Facebook being free, it is accessible to all age groups irrespective of their socio-economic background. It requires little or almost no money to create and maintain an account and is accessible from anywhere that has a computer and internet access. The fact that today's children do not grow up without a computer at home or even access to a computer, using

Facebook is very easy. Most of the youth today know how to use a computer and using Facebook offers no resistance on the part of the adolescents. Many adolescents claim Facebook to be a source of recreation, when they are 'jobless'. One adolescent says "I log onto Facebook every time I take a break because it's very refreshing." Another opines that using Facebook doesn't require anything elaborate and is relatively easy to use." Another individual opines that "Using Facebook doesn't leave behind a trail of mess that needs to be cleaned up later and is therefore very convenient." Another individual opines that she has nothing else to do at night, so Facebook it is." "Chatting is another feature that most enjoy on Facebook." As one puts it, "Facebook is a single forum that brings all my friends together, unlike GTalk and MSN, so it's very convenient and I can choose whom I want to chat with."

Currently Facebook Mobile is in vogue, allowing individuals to access Facebook from their mobile phones from where ever they are, whether in school or at home, without even a computer with internet access. Thus one's access to their Facebook account is extremely easy and requires hardly any other equipment other than a Mobile Phone.

Most of the girls enjoying playing free games on Facebook, and the boys look down on Facebook games and would rather use their Xbox.

There doesn't seem to be any striking difference between the insecure and secure adolescents, in the use of Facebook because of its accessibility.

Need for Affection

Need for affection has emerged as a strongly prevalent underlying pattern in the interviews of all the insecurely attached adolescents. A majority of the insecurely attached adolescents said that they took to Facebook because they had been rebuked by their parents or family members." Sometimes I try talking to my mother, but she always says she's too busy, so I end up logging onto Facebook and I talk to my friends instead." Another opined that my friends are always willing to listen to me, so I end up sharing things with them." One adolescent says my friends "always love me." Implying that his parents don't. They seek to get the attention of parents and feel pushed away when ignored. As one adolescent said, "Sometimes I know my family doesn't want me around, that's when I take to Facebook." Another adolescent said, "My parents are usually too busy for me, and instead of getting under their feet, I use Facebook."

Some adolescents also don't like spending time with their family members as they consider it "a waste of time" and would rather use that time to spend with their friends. There is total disregard for their family members and prefer spending time with their friends. They did not consider spending time with their family members a proper utilization of their spare time.

Many of them spoke about their relationship with their family members and how they consider online social networking an escape from family members and duties as one participant said, "I don't like my parents joining Facebook. That is the only place I get freedom from my parents." They don't mind. But with parents you have to be very careful because I'm not allowed to use bad words." "With friends, they know what you are talking about and they understand without you having to tell them ever thing directly." Another adolescent was of the opinion that

"Friends know what would have happened the previous day so, they understand faster." One insecurely attached adolescent was of the opinion that she cannot express herself in front of her parents. Words come to me better in front of my friends." Another reason for differences in patterns of interaction was that a majority of the insecurely attached adolescents feel that parents are very strict friends on the other hand are not." And also "friends are going through similar things like us, so they can understand better than adults who belong to a different generation."

The insecurely attached adolescents believed "it's easier forming relationships with people online than in real life." "I don't fight with these people." "I can be whoever I want to be and no one can make out if I lie." I put up whichever pictures I want and people don't even know it's me, so it's great." "They needn't know everything about me" they claim. "It's easier online because they don't ask too many questions." The level of judging a person and forming an impression on first interaction on social networking sites differs from that in face to face interactions. It is purely left to the physical appearance of usually the profile pictures and the other information one uploads. The process of getting to know the person is done later on only if you want to and is left to your discretion. The insecure adolescents feel more comfortable forming relationships online especially with strangers than in face to face relationships. They believed an element of 'rawness' leaves him exposed in face to face relationships that makes him feel awkward.

On analysis, many themes appeared that throw light on the links between attachment styles and levels of social networking, as assumed earlier. The reasons for the higher use of Facebook by insecurely attached individuals have been highlighted in various themes that ran through the interviews.

One of the major reasons for the popularity of Facebook would definitely be its availability and the ease with which it can be used. For the easier it is to use, the more it will be used. Creating and maintaining an account on Facebook requires just a computer with internet access and in today's world a computer is a necessity in most homes. The ability to access Facebook through mobile phones has just made access easier for those on the move. Thus one requires not just being at home with a computer but having a mobile phone with GPRS facility, allows one to access their Facebook accounts from just about anywhere. The fact that being at home and not having anything to do, most adolescents turn to Facebook. It can be accessed during exam times, at any time of the night or day, and even when they have relatives at home.

The privacy that Facebook provides its users is a refreshing change from badly kept secrets and back stabbing friends. Facebook assures utmost secrecy and for adolescents hiding things from their parents finds it the safest refuge. With the right mix of hiding and showing information, adolescents are immersed in creating different identities of themselves and managing who sees what information about themselves. Facebook allows certain individuals access to certain information, while certain people can be hidden from accessing all the information. With today's craze for partying and enjoying with friends, and with parents not approving of their lifestyle, evidence of the night before, cannot be shown to the parents. So adolescents like to put it up on Facebook, where their friends

have access to them, but not the parents. Thus privacy settings on Facebook are of convenience to the adolescents.

Adolescence is a crucial stage of development and comes with its own set of problems and issues. There are various changes that take place during this time and it's also the time for experimentation. Friends are the most crucial to an adolescent's life. The need to belong is one of the most pressing needs during adolescence and this is influenced by peer pressure. At this age most adolescents are willing to go that extra mile to fit in and belong to their peer group. Thus Facebook is another means through which peers exercise their control over the other members of their peer groups. Adolescents create and maintain accounts in order to 'belong' to their groups and to share the same experiences. In early adolescence they are still exploring the ways of the world and are easily influenced especially by their friends. Hence the need to belong comes across very strongly in the interviews that were conducted. This need is mainly a 'within force' and peer pressure is more an 'outside force'. Thus peer pressure would influence an individual's need to belong.

Another need that Facebook caters to is the need for care and affection. Most adolescents believe that Facebook is an adequate compensation for family affection. They escape to Facebook probably because they believe log onto Facebook as soon as they come home. Their friends care for them more than their family. This would not be hard to believe as the family members rarely have time to spend with them at home and the children usually feel more comfortable with their friends.

Adolescents also state they feel more comfortable with their friends and can 'talk to them about most things.' This may be due to the fact that family members are still a little old fashioned and topics like sex, boyfriends and girlfriends are still taboo and should not be spoken about. Hence adolescents feel more comfortable talking to friends who don't share the same views as their parents. In addition to that friends also have similar problems, so talking to an experienced friend is of immense help because they feel they can be given practical advice.

Not only do adolescents prefer talking to their friends about various issues, their style of interaction varies from parents to friends. Adolescents prefer using slang with their friends because they consider it cool to talk like that and parents would not appreciate it. Though parents try their best to lead them away from talking slang, teenagers retain it and take pride in their increase in vocabulary. It's also easy to fit in if one uses slang and offers a higher level of popularity. Members of the older generation do not understand certain terms and figures of speech, and it's more convenient using it with their friends group.

Individuals also experience a greater level of independence while using Facebook. As this is the age for self-expression and discovery, adolescents are experimenting with their identity. Facebook provides independence in terms of changing their identity uploading and changing personal information viewable by others. This freedom to control their information, allows adolescents with a sense of independence not possible in real life.

Forming inter-personal relations online is easier for those with attachment related issues. Adolescents can physically stay in a comforting, secure environment and reach out to others

beyond their immediate environment. Research shows that individuals with attachment related issues, lack social skills that are necessary to form relationships in the real world. Hence the ease with which an individual can form relationships online is a much more attractive option, than facing the anxiety, ridicule and embarrassment that goes into forming real relationships.

V. CONCLUSIONS

Adolescence is considered the most difficult phase in the lifespan of man. It is also the most volatile and unstructured and the most moldable. Adolescents can be shaped by innumerable things at this point in their lives and in today's world; technology has no less influence on adolescents than their friends. Another great influence on an adolescent's relationships would be his attachment styles that are determined by his early childhood caregiver experiences.

This study primarily focused on the interaction of an adolescent's attachment styles with their use of Social Networking Sites, especially Facebook, in order to give us an understanding of the prevalence of attachment styles among teenagers in the city, their social networking habits and also the differences in their reasons given for Facebook use.

This study was conducted on a sample of 95 adolescents all ranging between the ages of 14 to 17 years, from the city of Urban Bangalore. The results of this study indicate that 44% of the sample was identified as insecurely attached and 66% of the sample was securely attached. Out of this a total of 72% of the insecurely attached adolescents were found to be high users of Facebook and only 44% of the securely attached adolescents were heavy users of Facebook.

In-depth interviews were conducted to get into the 'whys' of Facebook use. From the interviews many themes such as accessibility, anonymity, interaction patterns, independence, privacy, need to belong and the need for care and differences in interaction patterns were discovered. Many of these themes throw light directly on the research objectives and some that provide insight into the developmental issues of the adolescent period. These themes question our understanding of their levels of self confidence or the lack of it, their supposed understandings of parental rejection and peers as lifelong companions.

Thus in conclusion we can say that adolescents take to online social networking not only to pass their time, but it serves as a basic tool to fill in a void that they find in their real lives. The more active one is on Facebook, the more isolated from real life they become. As 'Facebooking' requires no social skills to build relationships, one needs just a computer and internet access to build bonds and maintain relationships. It bridges the gap between who they are and who they want to be and it offers the insecurely attached a chance to be just as popular and have the same number of friends as a securely attached individual.

One can argue if virtual friends can really take the place of real friends? Can they provide the same warmth that you would feel, when being hugged by a friend, or the same satisfaction coming from a friend physically whipping away a tear? Do virtual friends like you, for who you actually are or do they like you for who you are pretending to be? Can the world survive on virtual friends? Further research could seek to answer

some of these questions and find solutions to improve the quality of our relationships.

It is hoped that his study has brought to light recently developing issues in the field of Psychology in the broader framework of the 21st century, and that these new concepts will continue to be studied in relation to bettering human relationships.

The sample for this study, mainly hails from an upper socio-economic or upper middle socio-economic background and this reduces the generalizability of the study. The major limitation to this study was that the study was conducted on only adolescents, and a wider variety of age groups could not be incorporated. The fact that the current study focused only on a sample purely Bangalore reduces its generalizability.

APPENDIX

Interview guideline

1. Can you describe why you like using Facebook?
2. How do you feel when you are not able to log in as often as you like?
3. How do you feel when you are logged in?
4. Do you feel “special/happy/unique” when you are online? In what way?
5. In what way do you feel special when you are online?
6. While chatting, what do you generally chat about?
7. With whom and why?
8. Why do you enjoy chatting?
9. Do you find something missing in you that you find in Facebook?
10. Does Facebooking make your day better? In what way?
11. Describe how you feel when someone ‘likes’ or comments’ on your uploaded pictures and your statuses or ‘writes on your wall’.
12. How much it’s connected to real life?
13. How they view themselves and how they want others to view them
14. If they had the power to change any feature, what would it be?
15. What role does Facebook play in their social and academic lives?
16. Without Facebook how would things have been?
17. Is Facebook interaction as good as face to face interaction?
18. Social issues
19. How much of the information they share is inappropriate (according to them)

ACKNOWLEDGEMENT

I would like to take this opportunity to express my sincere gratitude to Dr. Ankur Madan, without whom this research would have been just a dream, and whose tireless patience saw me through all my obstacles.

I would like to thank all the participants in this study, who made this real for me.

I would also like to extend my gratitude to my family, without whose support, this research would not have taken shape.

Finally I’d like to thank my friends-the ego boosters, for their unflinching support, and belief in my abilities!

REFERENCES

1. <http://web.ebscohost.com/ehost/detail?vid=5&hid=105&sid=b5dec608-045e-4398-bc88-787225781656%40sessionmgr110&bdata=JnNpdGU9ZWwhvc3QtbGl2ZQ%3d%3d> - [bib3up](#) Baumgarten, M. (2003). *Kids and the Internet: A developmental summary*. *ACM Computers in Entertainment*, 1, 1-10. Doi. 2133-j378/SO0.73
2. Cherry, K. (2010). *Attachment Styles*. Retrieved on 19th December 2010, from <http://psychology.about.com/od/loveandattraction/ss/attachmentstyle.htm>
3. Disalvo, D. (2010). Are social Networks Messing With Your Head? *Scientific American Mind*, 20(7), 48-55. Doi. 36ew/370-8273.76.55
4. <http://web.ebscohost.com/ehost/detail?vid=5&hid=105&sid=b5dec608-045e-4398-bc88-787225781656%40sessionmgr110&bdata=JnNpdGU9ZWwhvc3QtbGl2ZQ%3d%3d> - [bib1up](#) Erikson, E. (1968). *Identity: Youth and crisis*. New York: Norton.
5. Facebook fuels friendship addiction and users insecurity (2008) retrieved on February, 6th 2011, from: http://www.thaindian.com/newsportal/india-news/facebook-fuels-friendship-addiction-and-users-insecurity_100110661.html
6. Feeney, J. A., & Noller, P. (1990). Attachment Style as a Predictor of Adult Romantic Relationship. *Journal of Personality and Social Psychology*, 58(2), 281-291. doi 0022-3514/90/SO0.75
7. <http://web.ebscohost.com/ehost/detail?vid=5&hid=105&sid=b5dec608-045e-4398-bc88-787225781656%40sessionmgr110&bdata=JnNpdGU9ZWwhvc3QtbGl2ZQ%3d%3d> - [bib2up](#) Fox, S., & Madden, M. (2005, December). *Generations online (Memo)*. *Pew Internet and American Life Project Retrieved October 22, 2010 from www.pewInternet.org*.
8. Goldberg, S., Muir, R., & Kerr, J. (Ed). (2000). *Attachment Theory: Social, Developmental and Clinical perspectives. (find publishers)*
9. Hoover, J. (2004). John Bowlby on Human Attachment. *Reclaiming Children and Youth*, 11(1), 58-60. doi 0022-3514/90/SO0.75
10. Ma, C. Q., Huebner, E. S. (2008). [Attachment relationships and adolescents' life satisfaction: Some relationships matter more to girls than boys](#). *Journal of Psychology and Behavioral Sciences*, 45(2), 177-190. Doi: 3474-3764/45/SO0.75
11. Martínez, M. A., Alemán, & Wartman, K. L., (2009) *Online Social Networking on Campus: Understanding what Matters in Student Culture*, London: Routledge Publications.
12. Rosenstein, D. S., Horowitz, A. (1986). Adolescent Attachment and Psychopathology. *Journal of Consulting and Clinical Psychology*. 64(2), 244-253.
13. Reich, S. M. (2010). [Adolescents' sense of community on myspace and facebook: a mixed-methods approach](#). *Journal of Community Psychology*, 38 (6), 688-705, DOI: 10.1002/jcop.20389
14. Scharf, M., Maysless, O., Kivenson-Baron, I. (2004). Adolescents' Attachment Representations and Developmental Tasks in Emerging Adulthood. *Developmental psychology*, 40(3), 430-444. Doi. 3433/34u-0.8
15. Stern, D. (1985) Interpersonal World of the Infant. *Journal of Adolescent Studie.*, 45 (2), 110-118. doi 4567-8735/98/SO1.75
15. Sue, A., Camila, B., Louise, M. B., Karl-Heinz, B., Marie, D., Earl, B., Heyno, A., Hughes, D. & Perry, A.(Eds.). (2009). *Teenagers and Attachment: Helping Adolescents Engage with Life and Learning*. Worth Publishing.
16. Tanaka, Nao,H., Chieko, U., Masayo,H., Hidetoshi,C., Zi,S., Noriko,K. & Toshinori (2008) Correlates of the categories of adolescent attachment styles: Perceived rearing, family function, early

- life events, and personality. *Journal of Psychiatry & Clinical Neurosciences*, 20 (4), 107-118. doi.4567-8735/98/SO1.75
17. Tucker, J. H. (2010). Status Update: I'm So Glamorous. *Scientific American*, 303(5), 32-32. Doi. 6r53v798/63iup
18. Ullas, S. S.(2011, Jan 13). Less networking equals high frustration. *The Times of India*. Retrieved from: [Less networking equals high frustration - The Times of India http://timesofindia.indiatimes.com/city/bangalore/Less-networking-equals-high-frustration/articleshow/7272034.cms#ixzz1DkjlAHD](http://timesofindia.indiatimes.com/city/bangalore/Less-networking-equals-high-frustration/articleshow/7272034.cms#ixzz1DkjlAHD)
19. Williams, A. L. & Merten, M. J. (2008). A Review Of Online Social Networking Profiles By Adolescents: Implications For Further Research And Intervention. *Wall Street Journal*, 43(170), 253-274.
20. **Williams, A, Merten, M.J, (2009)** Adolescents' Online Social Networking Following the Death of a Peer
doi: [10.1177/0743558408328440](https://doi.org/10.1177/0743558408328440)Journal of Adolescent ResearchJanuary 2009 vol. 24 no. 1 67-90
21. Woodhouse, S. S., Ramos-Marcuse, Fatima, Ehrlich, Katherine B., Warner, S., Cassidy, J.(2010), [The Role of Adolescent Attachment in Moderating and Mediating the Links Between Parent and Adolescent Psychological Symptoms](#). *Journal of Clinical Child & Adolescent Psychology*, 39 (1),51-63. DOI: 10.1080/15374410903401096
22. Zimmermann, P., Mohr, C., Spangler, G. (2009). [Genetic and attachment influences on adolescents' regulation of autonomy and aggressiveness](#). *Journal of Child Psychology & Psychiatry*, 50 (11), 1339-1347, 9. DOI: 10.1111/j.1469-7610.2009.02158.x
23. Zoppos., E. (2009). Attachment Style and Facebook usage: Can Facebook be Used to Overcome Attachment Style Related Issues. *Journal of Adolescent Studies*, 3(10), 123-129. Doi: 2476-6327/33/SO1.73

AUTHORS

First Author – Gayathri Rao, M.Sc Psychology (Clinical), Christ University, 5gayathrirao@gmail.com

Second Author – Dr. Ankur Madan, Assistant Professor, Christ University, ankur.madan@christuniversity.in

Correspondence Author – Gayathri Rao
5gayathrirao@gmail.com
wezenerrai@yahoo.com

An Overview Study of Personalized Web Search

Chanchala Joshi*, Teena Jaiswal**, Himanshu Gaur***

* Institute of Computer Science, Vikram University, MP, India

** Govt Kalidas Girls College, Vikram University, MP, India

*** Department of Civil Engineering, Dire Dawa University, Ethiopia

Abstract- Personalized web search is one of the growing concepts in the web technologies. Personalization of web search is to carry out retrieval for each user incorporating his/her interests. For a given query, a personalized Web search can provide different search results for different users or organize search results differently for each user, based upon their interests, preferences, and information needs. There are many personalized web search algorithms for analyzing the user interests and producing the outcome quickly; User profiling, Hyperlink Analysis, Content Analysis and collaborative web search are some of the instances for that kind of algorithms. In this paper we are analyzing various issues of personalized web search.

Index Terms- Personalized Web Search, Information Retrieval, User profile

I. INTRODUCTION

Current web search engines are built to serve all users, independent of the special needs of any individual user. With the exponential growth of the available information on the World Wide Web, a traditional search engine, even if based on sophisticated document indexing algorithms, has difficulty meeting efficiency and effectiveness performance demanded by users searching for relevant information. Personalization of web search is to carry out retrieval for each user incorporating his/her interests. Personalized web search differs from generic web search, which returns identical results to all users for identical queries, regardless of varied user interests and information needs. When queries are issued to search engine, most return the same results to users. In fact, the vast majority of queries to search engines are short and ambiguous. Different users may have completely different information needs and goals when using precisely the same query. For example, a biologist may query “mouse” to get information about rodents, while programmers may use the same query to find information about computer peripherals. When such a query is issued, search engines will return a list of documents that mix different topics. It takes time for a user to choose which information he/she wants. The concept behind personalized search is that by knowing some things about user, a search engine might refine user results to make them more relevant. A teenager searching for music might get different matches than a senior citizen. A man looking for flowers might see different listings than a woman.

II. APPROACHES TO PERSONALIZE SEARCH RESULTS

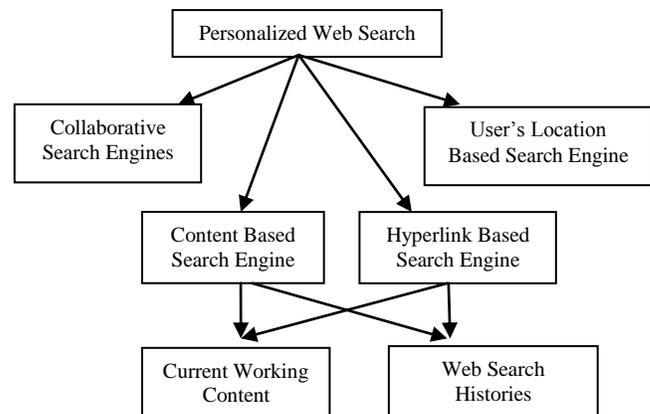


Figure 1: Personalized Web Search Approach

Collaborative Search Engines (CSEs) are an emerging trend for Web search and Enterprise search within company intranets. CSEs let users concert their efforts in information retrieval (IR) activities, share information resources collaboratively using knowledge tags, and allow experts to guide less experienced people through their searches. Collaboration partners do so by providing query terms, collective tagging, adding comments or opinions, rating search results, and links clicked of former (successful) IR activities to users having the same or a related information need. Examples of CSEs are <http://www.scuup.net/>, <http://isedb.com>, and <http://www.eurekster.com>.

Personalized web search can be achieved by checking content similarity between web pages and user profiles. Some work has represented user interests with topical categories. User's topical interests are either explicitly specified by users themselves, or can be automatically learned by classifying implicit user data. Search results are filtered or re-ranked by checking the similarity of topics between search results and user profiles.

Most generic web search approaches rank importance of documents based on the linkage structure of the web. An intuitive approach of personalized web search is to adapt these algorithms to compute personalized importance of documents. A large group of these works focuses on personalized PageRank. The fundamental motivation underlying PageRank is the recursive notion that important pages are those linked-to by many important pages.

There is a huge amount of searches on the Web has local intent, meaning that they are searching for things in a particular area, like restaurant, job listings, shopping centre, etc. This kind

of queries is considered as implicit local intent queries. For such queries, users expect personalized search results that are customized to their locations. Thus, identifying implicit local intent queries and finding out the location information for the users are particularly useful to improve user search experience.

III. BASICS OF PERSONALIZED SEARCH

A. *Creation of User Profile*

To provide personalized search results to users, personalized web search maintains a user profile for each individual. A user profile stores information about user interests and preferences. It is generated and updated by exploiting user-related information. Such information may include:

- Information about the user like age, gender, education, language, country, address, interest areas, and other information.
- Search history, including previous queries and clicked documents.
- Other user documents, such as bookmarks, favorite web sites, visited pages, and emails.

B. *Server-Side and Client-Side Implement*

Personalized web search can be implemented on either server side (in the search engine) or client side (in the user's computer or a personalization agent) [1]. For server-side personalization, user profiles are built, updated, and stored on the search engine side. User information is directly incorporated into the ranking process, or is used to help process initial search results. The advantage of this architecture is that the search engine can use all of its resources, for example link structure of the whole web, in its personalization algorithm. Also, the personalization algorithm can be easily adapted without any client efforts. This architecture is adopted by some general search engines such as Google Personalized Search. The disadvantage of this architecture is that it brings high storage and computation costs when millions of users are using the search engine, and it also raises privacy concerns when information about users is stored on the server. For client-side personalization, user information is collected and stored on the client side (in the user's computer or a personalization agent), usually by installing a client software or plug-in on a user's computer. In client side, not only the user's search behavior but also his contextual activities (e.g., web pages viewed before) and personal information (e.g., emails, documents, and bookmarks) could be incorporated into the user profile [2]. This allows the construction of a much richer user model for personalization. Privacy concerns are also reduced since the user profile is strictly stored and used on the client side. Another benefit is that the overhead in computation and storage for personalization can be distributed among the clients. A main drawback of personalization on the client side is that the personalization algorithm cannot use some knowledge that is only available on the server side (e.g., PageRank score of a result document). Furthermore, due to the limits of network bandwidth, the client can usually only process limited top results.

IV. CONTENT V/S HYPERLINK BASED ANALYSIS

A. *Content Based Personalized Search*

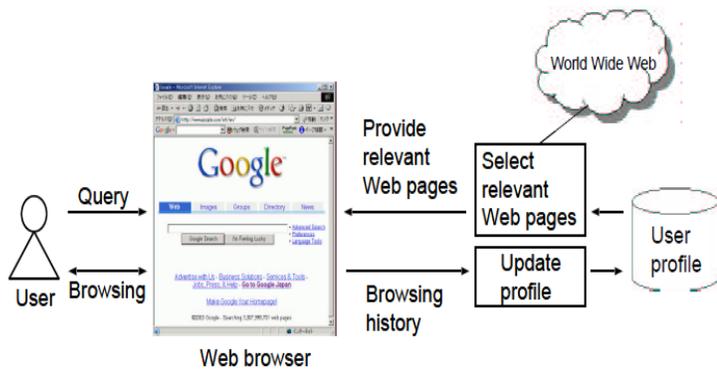
By checking content similarities between web pages and user profile personalized search can be improved [3]. User's interests can be automatically learned by classifying implicit user data. Search results are filtered or re-ranked by checking the similarity of topics between search results and user profiles. User-issued queries and user-selected documents are categorized into concept hierarchies that are accumulated to generate a user profile. When the user issues a query, each returned result is also classified. The documents are re-ranked based upon how well the document categories match user interest profiles. Chirita et al. [4] use the ODP (Open Directory Project, <http://www.dmoz.org/>) hierarchy to implement personalized search. User favorite topics nodes are manually specified in the ODP hierarchy. Each document is categorized into one or several topic nodes in the same ODP hierarchy. The distances between the user topic nodes and the document topic nodes are then used to re-rank search results.

B. *Hyperlink Based Personalized Search*

Hyperlink Analysis significantly improves the relevance of the web search results so that all major search engines claim to use some type of hyperlink analysis. Web information retrieval mainly focuses on hyperlink structures of the Web, like with Web search engine Google. In personalized Web searches, the hyperlink structures of the Web are also becoming important. The use of personalized PageRank to enable personalized Web searches was first proposed in [6], where it was suggested as a modification of the global PageRank algorithm, which computes a universal notion of importance of a Web page. The computation of (personalized) PageRank scores was not addressed beyond the original algorithm. Experiments[7] concluded that the use of personalized PageRank scores can improve a Web search.

Crawling (process of gathering the web pages by the search engine) and ranking are the main uses of hyperlink analysis. In this approach, web crawler which is a software program to browse WWW in automated methodical manner find more and more web pages linked to the source page with the assumption of nearly all the linked web pages are on same topic. This process repeats for each set of web pages until no more linked pages. Then crawler of the search engine orders the web pages by the quality. To judge high quality pages, hyperlink analysis is used. In this case, search engine assumes that the source page pointed to many pages is of higher quality than a source page pointed to few numbers of pages. For this ranking process, hyperlink analysis involves with connectivity-based ranking, PageRank and HITS (Hyperlink-Induced Topic Search) algorithms etc.

In addition to produce a quality and relevant web results, hyperlink analysis have several advantages like finding mirrored hosts, web page categorization and identify the geographical scope of the search etc. But in this approach, search engine has to deal with more details consist even with unnecessary stuffs also. It becomes wastage of the resources.



V. TECHNOLOGIES AND ENVIRONMENT FOR PERSONALIZED WEB SEARCH

A. 5.1 Web Search engine technology

The main purpose of search engine is that searching web resources from Internet and present a list of them to the user. Web crawling is one of the most important operations of the search engine. Web crawler follows the resources of WWW in an automated way or orderly fashion. It copies the all the visited pages for searching rapidly in future. Another functionality of search engine is indexing which collects and stores data to optimize the speed of information retrieval for a given a search query. Most of search engines support full-text, natural language data, audio, video and graphics also.

B. 5.2 PageRank

In 1998, Larry Page and Sergey Brin who were the founders of Google introduced a new linking analysis method named as PageRank. PageRank is a probabilistic distribution used to represent the likelihood that a person randomly clicking on links will arrive at any particular page [9]. Main advantage of this PageRank analysis is usability for collections of documents of any size. One of the main goal of PageRank is to improve the quality and scalability of search. Google makes efficient use of storage space to store the index. This allows the quality of the search to scale effectively to the size of the Web as it grows.

VI. CONCLUSION

There are number of researches which are conducting to minimize some of the drawbacks of Personalized Web Search.

Hyperlink based personalization algorithms work only for repeated queries, they are simple and stable. The topical interest-based personalized search algorithms implemented were not as stable as the click-based. They could improve search accuracy for some queries, but they harmed performance for more queries. Personalized Web search yields significant improvements over generic Web search for queries with high click entropy. For the queries with low click entropy, personalization methods performed similarly or even worse than generic search. As

personalized search had different effectiveness for different kinds of queries, queries should not be handled in the same manner with regard to personalization. No personalization algorithms can outperform others for all queries. Different methods have different strengths and weaknesses.

The violation of privacy is also a well know issue in Personalized Web Search approach. It generates ethical and security problems. Another limitation in this method is that users' needs are not static, it changes continuously. As well as there are some occasions, users do searching for others needs also. So there is problem to search engines to distinguish these scenarios.

Some of experiments consider doing Personalized Web Search by considering geographical location of the users and use social tagging to query expansion by using social networks and collaborative tagging system.

REFERENCES

- [1] Ji-Rong Wen, Zhicheng Dou, Ruihus Song, "Personalized Web Search", Microsoft Research Asia, Beijing, China, 2009
- [2] P.A. Chirita, C. Firan, and W. Nejdl, "Summarizing Local Context to Personalize Global Web Search", Proc. ACM Int'l Conf. Infor. and Knowledge Management (CIKM), 2006.
- [3] Zhongming Ma, Gautam Pant and Olivia R. Liu Sheng, "Interest-Based Personalized Search," ACM Transactions on Information Systems, Vol 25, Issue 2, Article 5, February 2007.
- [4] Chirita P.A., Nejdl W., Paiu R., and Kohlschütter C. "Using ODP metadata to personalize search". In Proc. 31st Annual Int. ACM SIGIR Conf. on Research and Development in Information Retrieval, 2005, pp. 178-185.
- [5] Aktas M. S., M. A. Nacar and F. Menczer, 2004. "Using hyperlink features to personalize web search". Adv. Web Mining Web Usage Anal., 3932: 104-115.
- [6] Page L., Brin S., Motwani R., and Winograd T. "The Pagerank Citation Ranking: bringing order to the Web", Technical report, Stanford Dig. Lib. Tech. Project, 1998.
- [7] K. Sugiyama, K. Hatano, and M. Yoshikawa. "Adaptive web search based on user profile constructed without any effort from users". In Proceedings of the 13th international conference on World Wide Web, pages 675-684, 2004.
- [8] Sergey Brin and Lawrence Page, "The Anatomy of a Large-Scale Hypertextual Web Search Engine", Computer Networks and ISDN Systems Journal, 30, pages 107-117, 1998.

AUTHORS

First Author – Chanchala Joshi, Master of Philosophy in Computer Science, Institute of Computer Science, Vikram University, Ujjain, M.P. India, chanchala.joshi@gmail.com

Second Author – Teena Jaiswal, Master of Science in Computer Science, Govt. Kalidas Girls College, Ujjain, M.P. India, teenajaiswal99@gmail.com

Third Author – Himanshu Gaur, Master of Technology in Construction Management, DireDawa University, Ethiopia, himanshugaur82@gmail.com.

Screening for Anti-Microbial and Phyto Chemical Properties of Different Solvents Extracts of Leafs of *Pongamia Pinnata*

K.Niranjan^a, V.Sathiyaseelan^b, E.C.Jeyaseelan^a

^aDepartment of Botany, University of Jaffna, Sri Lanka.

^bUnit of Siddha Medicine, University of Jaffna, Sri Lanka

Abstract- Plants based natural products have been widely used as curative agents for variety of ailments since immemorial time. In this study, powered plant material, leaves of *Pongamia pinnata* sequentially extracted using petroleum ether, ethyl acetate, ethanol, methanol and water and the extracts were concentrated to dryness by evaporating the solvent at 40°C. In vitro antibacterial activities of these extracts were studied by agar well diffusion method against gram positive *Staphylococcus aureus* and gram negative *Escherichia coli*. Streptomycin and different solvent extracts (petroleum ether, ethyl acetate, ethanol, methanol and water) were used as standard and control respectively. Phytochemical analysis also done to report the presence of biomolecules. This study demonstrated that the ethyl acetate extracts was higher antibacterial activity against tested bacterial pathogens than other extracts. All these extracts were able to inhibit the growth of *S.aureus* except aqueous extract. Phytochemical screening of the methanol, ethanol and aqueous plant leaf extracts revealed the presence of saponins and terpenoids. The tannin was present in methanol extract and flavonoids was also present in methanol and ethanol extracts. The results also indicated the less antibacterial activity of different solvent extracts to standard, streptomycin and control also rather than didn't reveal any antibacterial activity against the pathogens. This present study concluded that the antibacterial activity of various extracts of leaves of *P.pinnata* was carried in attempt to support the use by medicinal practitioner for the treatment of various diseases. However, further studies should be needed for the isolation and characterization of these active compounds.

Index Terms- Antibacterial activity, *P.pinnata*, different solvent extracts.

I. INTRODUCTION

Various medicinal plants have been used for many years in daily life to treat disease in all over the world. In fact, plants produce a diverse range of bioactive molecules, making them a rich source of different types of medicines. Natural products play an important role in drug development programs in the pharmaceutical [1].

Pongamia pinnata (L.) [syn. *Pongamia glabra*(Vent); *Derris indica*(Lamk.)] belongs to family Leguminosae. It is a medium sized glabrous, perennial tree grows in the littoral regions of South eastern Asia, especially it is an exotic species to Sri Lanka. This plant contains alternate, odd pinnately

compound, 2 to 4 inches, evergreen, hairless leaves. All parts of this plants have medicinal properties and traditionally used as medicinal plants. They have been used as crude drug for the treatment of tumors, piles, skin diseases, wounds and ulcers [2]. Besides this, the plant possess anti-inflammatory, anti plasmodial, anti nonceptive, anti- lipidperoxidative, anti- diarrhoeal, anti-ulcer, anti-hyperammonic and anti oxidant activity.[3]. Particularly, leaves have anthelmintic, digestive and laxative used for inflammations, piles and wounds [4], and juice of the leaves is taken for cold, cough, diarrhoea, dyspepsia, flatulence, gonorrhoea and leprosy [5].

Today there is wide spread interest in drugs obtained from natural plant products for their potential antibacterial activity. Therefore in the present study an attempt was made to find out the phytochemical constituents and antibacterial effects of leaves of *P.pinnata* (L.), against *E.coli* and *S.aureus*.

II. MATERIALS AND METHODS

Preparation of plant extracts

The healthy plant leaves were collected from Unit of Siddha medicine, University of Jaffna, Sri Lanka and Fresh leaves were washed under running tap water and dried in shade. Dried leaves were ground into fine powder using electric blender. The powder was successively extracted using solvents of increasing polarity according to Arokiyaraj *et al* (2009) with some modifications. 15 g powder was initially soaked in 60ml of petroleum ether in air tight conical flask for two days and then it was first filtered through double layered muslin cloth and then filtered through Whatman no 1 filter paper and filtrate was collected into sterile air tight bottle. Similar process was repeated twice with fresh petroleum ether and the filtrate was collected together. After all, petroleum ether was removed from the filtrate at 40°C using oven and the extract was stored at the refrigerator for further studies. Likewise, the above dried residue was used for sequential extraction of ethyl acetate, ethanol, methanol and water.

Phytochemical analysis

The extracts were subjected to phytochemical analysis to detected the presence of following biomolecules using the standard qualitative procedures as described by Trease and Evans (1989) [6].

a) Test for tannins

To 0.5 ml of extract solution, 1 ml of distilled water and 1-2 drops of ferric chloride solution were added and observed for brownish green or a blue black coloration.

b) Test for terpenoids

5 ml of extract was mixed with 2 ml of CHCl₃ in a test tube. 3 ml of concentrated H₂SO₄ was carefully added to the mixture to form a layer. An interface with a reddish brown coloration was formed for the presence of terpenoids.

c) Test for saponins

5 ml of extract was shaken vigorously to obtain a stable persistent froth. The frothing was then mixed with 3 drops of olive oil and observed for the formation of emulsion, which indicated the presence of saponins.

d) Test for flavonoids

A few drops of 1% NH₃ solution was added to the extract in a test tube. A yellow coloration was observed for the presence of flavonoids.

e) Test for cardiac glycosides

1 ml of concentrated H₂SO₄ was taken in a test tube. 5 ml of extract was mixed with 2 ml of glacial CH₃CO₂H containing 1 drop of FeCl₃. The above mixture was carefully added to the 1 ml of concentrated H₂SO₄. Presence of cardiac glycosides was detected by the formation of a brown ring.

f) Test for phlobatannins

10 ml of extract was boiled with 1% HCl in a boiling tube. Deposition of a red precipitate indicated the presence of phlobatannins.

g) Test for Alkaloids

1ml of 1% HCl was added to 3ml of extract in a test tube and was treated with few drop of Meyer's reagent. A creamy white precipitate indicated the presence of alkaloids.

h) Test for Resins

5ml of copper was added to 5ml of extract. The resulting solution was shaken vigorously and allowed to separate. A green colored precipitate indicated the presence of resin.

i) Test for Glycosides

10ml of 50% H₂SO₄ was added to 1ml of extract in a boiling tube. The mixture was heated in boiling water for 5min. 10ml of Fehling's solution (5ml of each solution A and B) was added and boiled. A brick red precipitate indicated presence of glycosides.

j) Test for Anthraquinones

Extract was mixed well with benzene, and then half of its own volume of 10% ammonia solution was added. Presence of a pink, red or violet coloration in the ammonial phase indicated the anthraquinones.

hours and stocked at 4oC on nutrient agar slant. Sub culture were prepared from the stock before the bioassay.

Determination of antibacterial activity by agar well diffusion method

20 ml molten nutrient agar media were mixed with 1 ml of (10⁶ cfu/ml) each test bacteria and poured in sterile Petri dishes separately. After complete solidification, 8mm diameter wells were made using sterile cork borer and filled with 100µl of (30mg) petroleum ether; (30mg) ethyl acetate, (30mg) ethanol, (30mg) methanol extract and aqueous extracts of *Pongamia pinnata*. (30mg) streptomycin and different solvents (100µl of petroleum ether, acetone, ethanol, ethylacetate, methanol and water) were used as standard and control respectively.

Then the plates were incubated at 37°C for 24 hours and antibacterial activity was determined by measuring the diameter of clear zone around the well [7].

IV. RESULTS AND DISCUSSION

Table 1: Phytochemicals constituents of different leaf extract of *Pongamia glabra*

Phytochemicals	Methanol	Ethanol	water
Glycosides	-	-	-
Alkaloids	-	-	-
Saponins	+	+	+
Cardiac glycosides	-	-	-
Tannins	+	-	-
Phlobatannins	-	-	-
Resins	-	-	-
Flavonoids	+	+	-
Terpenoids	+	+	+
Anthraquinones	-	-	-

(+) – Presence (-) – Absence

The qualitative test for the presence of phytochemicals revealed that the methanol, ethanol and aqueous extracts of *P.pinnata* posses few type of phytochemicals.

Terpenoids and saponins were present in all three solvent extracts. Among these three solvent extracts, methanol and ethanol extracts revealed the presence of flavonoids and tannin was present only in the methanol extracts.

Unfortunately, cardiac glycosides, alkaloids, Resins, glycosides, phlobatannins, anthraquinones were not present in any of the tested extracts.

III. TEST MICROORAGANISMS

Test bacteria Gram negative *E.coli*, and Gram positive *Staphylococcus aureus* were procured from bacterial culture collection, Department of Botany, University of Jaffna. The bacteria were rejuvenated on nutrient agar medium at 37°C for 24

Table 2: Yield percentage of different solvent extracts of *P.pinnata*

Extracts	Yield(g)	Yield percentage
Petroleum ether	0.2959	1.97
Ethyl acetate	0.5135	3.42
Ethanol	0.4450	2.97
Methanol	0.7294	4.86
Water	0.6337	4.22

Table 3: Antibacterial activity of different form of solvent extracts of *P.pinnata* leaf.

Test extract	Diameter of inhibition zone (mm)*	
	<i>E.coli</i>	<i>S.aureus</i>
Petroleum ether	-	14
Ethyl acetate	16	16
Ethanol	15	13
methanol	12	12
water	-	-
streptomycin	28	-

- No activity, *Zone of inhibition includes the diameter of well (8mm)

High percentage of yield was obtained from methanol extracts followed by aqueous, ethyl acetate, ethanol and petroleum ether extract (Table 2). But methanol extracts revealed lower inhibitory effects on tested organisms compared to other extracts. It indicates that the inhibitory effect doesn't depend on the yield percentage.

The ethyl acetate, ethanol, methanol and petroleum ether were able to inhibit the growth of both while the petroleum ether extract failed to inhibit the growth of *E.coli*.

Out of five extracts, four extracts showed better inhibitory effect on *S.aureus* where ethanol extract produced better inhibitory effect on *E.coli* rather than *S.aureus*. But *P.pinnata* petroleum ether and aqueous extracts haven't any antibacterial activity against *E.coli*.

Interestingly ethyl acetate and methanol extracts contributed in equal antibacterial against *S.aureus* and *E.coli* which were found to be 12mm and 16mm respectively.

Both organisms were highly inhibited by ethyl acetate leaf extract of *P.pinnata* compared to other extracts. Ethanol extract

was slightly higher antibacterial against bacterial pathogen than methanol extract.

The standard antibiotic streptomycin exhibited excellent inhibitory effect on tested organisms. Aqueous extract of *P.pinnata* and controls were revealed no inhibitory effect on both of the organisms.

V. CONCLUSION

This study has proved that leaf extracts of *P.pinnata* shows antibacterial activity and phytochemical constituents. Further studies should be need to isolation of bioactive compounds that could be used to formulate new and more potent antimicrobial drugs of natural origin.

REFERENCES

- [1] Baker JT, Borris RP, Carte B et al, 1995. Natural products drug discovery and department: New perspective on internal collaboration. *jNat prod* 58:1325-1357.
- [2] Tanaka T, linuma M, Fujii Y, Yuki K, Mizuno M, 1992. Flavonoids in root bark of *Pongamia pinnata*. *Phytochemistry*, 31:993-98.
- [3] Chopade VV, Tankar AN, Pande VV, Tekade AR, Gowekar NM, Bhandari SR, Khandake SN, 2008. *Pongamia pinnata*: Phytochemical constituents, traditional uses and pharmacological properties: A review. *Int J Green Pharm*, 2:72:5
- [4] Sangwan S, Rao D.V and Sharma R.A, 2010. A Review on *Pongamia pinnata* (L.) Pierre: A Great Versatile Leguminous Plant. *Nature and Science*, 8(11):130-139.
- [5] Ambasta, S.P., Ramchadran, K., Kashyapa K., Chand R, 1992. The Useful Plant of India. Council of Science and Industrial Research (CSIR), New Delhi.
- [6] Trease, G.E. and W.C Evans, 1989. *Phytochemical screening*. In: *Textbook of Pharmacognosy*, Trease, G.E. and W.C Evans (Eds.). 10th Edn., bailliere Tindal Limited, London, pp: 541.
- [7] Jeyaseelan E.C., M.K.Pathmanathan, and J.P.Jeyadevan, 2010. Inhibitory effect of different solvent extracts of *Vitex negundo* L. and *Allium sativum* L. on phytopathogenic bacteria. *Archives of Applied Science Research*, 2 (6):325-331

AUTHORS

First Author – K.Niranjan, Department of Botany, University of Jaffna, Sri Lanka

Second Author – V.Sathiyaseelan, Unit of Siddha Medicine, University of Jaffna, Sri Lanka

Third Author – E.C.Jeyaseelan, Department of Botany, University of Jaffna, Sri Lanka

Effect of Pongamia Leaf Medium on Growth of Earthworm (*Eudrilus eugeniae*)

Jesikha.M and M. Lekeshmanaswamy

PG and research Department of Zoology, Kongunadu Arts and Science College, Coimbatore-29, Tamil Nadu, India

Abstract- The growth of *Eudrilus eugeniae* (Kingberg) in cattle waste and Pongamia leaf waste was studied. The wastes were prepared as separate media for growing worms. The worm's growth in the form of weight has been recorded in every week. The results of both media in total weight were gradually increased. The highest total weight 1,287mg in cow dung medium and followed by Pongamia leaf medium 1,098mg. The maturation of worms also recorded in 8th and 9th week in cow dung and Pongamia leaf media respectively. The growth gain and growth rate were also observed in both media. The waste can be composed by earthworms to form excellent fertilizers but the Pongamia leaf includes some chemical substances that distress the growth and maturation of earthworm *Eudrilus eugeniae*.

Index Terms- Pongamia leaf medium, *Eudrilus eugeniae*, Growth gain, Maturation.

I. INTRODUCTION

The processing of organic waste into organic fertilizers via vermicomposting has been used to address the issues of environment pollution. In recent years, the use of earthworms in waste degradation has spurred interest in processing large quantities of waste materials. Although, animal dung and agriculture wastes are recognized as a suitable earthworm culture media, but other organic waste material from industries have also proved successful. Several earthworm species e.g. *Eisenia fetida*, *Eisenia andrei*, *Eudrilus eugeniae*, *Perionyx excavatus* have been identified as potential candidates for managing organic waste resources (Edwards, 1998). However, in tropical and sub-tropical conditions earthworm: *E.eugeniae* appeared as best vermicomposting species (Viljoen and Reinecke, 1992). In order to utilize this species successfully for outdoor vermicomposting of different animal wastes, its survival, growth and fecundity in different wastes should be known.

The biology of composting earthworms had been investigated in terms of their certain growth, reproduction parameters of earthworms. According to Edward 1998, the type, quality and quantity of the organic wastes were very important to determining the rates of growth of earthworms. In general, for large-scale vermiculture practices the knowledge of biological requirement of candidate species must be pre-determined and their optimum requirement concerning nutritional factors might be an active field of research in earthworm biotechnology (Butt, 1997). But influence of culture material on their growth parameters is less considered (Suthar, 2007b).

In this paper, the Pongamia leaf waste used as raw material in composting (laboratory-based culture) and its effects on

different growth parameters of earthworm *Eudrilus eugeniae* were discussed.

II. MATERIALS AND METHODS

In this study, wastes such as Pongamia leaf (L) and cow dung (C) were utilized for composting and its effects on different growth parameters of earthworm *Eudrilus eugeniae* were studied.

Wastes were dried, powdered and amended with soil in 3:1 ratio for culture media. The culture media were maintained with moisture by sprinkling water in proper intervals. The two sets of culture media maintained with four replicates within controlled environment. The media were kept about two weeks and introduced weighted new baby worms. Growth performances of *Eudrilus eugeniae* in two media were studied in the form of total growth, weight gain and growth rate.

The total weight of earthworms in all media was calculated in every week for 10 weeks experiment duration.

The growth rate is the growth of a single worm in a day (mg/worm/day). The weight gains and growth rate for specific periods were calculated by the method of Parthasarathi, 2007.

III. RESULTS AND DISCUSSION

There was a gradual and continuous increase in total weight on the weekly growth of the cultured earthworms from both of cow dung and Pongamia leaf media (Fig.1). Throughout the experiment period, earthworms cultured in the cow dung (C) substrate had the highest final weekly weight of 1,287mg/worm and in Pongamia leaf medium (P) about 1,098mg/worm. Reineck *et al.*, (1992) reported, continuous growth and maximum weight up to 21 weeks at 25° C. *Eudrilus eugeniae* increased in total biomass much more rapidly than *E.fetida*, a species which grows relatively well in most organic wastes. Suthar (2007b) studied the earthworm *E.eugeniae* growth performance in kitchen waste and the worm reached 0.982mg at 9th week. In straw medium, the weight was 0.813mg and 0.762mg in farmyard manure.

The weight gain of both media was increased continuously (fig.2). The weight gain of *E.eugeniae* in C medium was decreased in the 8th week and 9th week in P medium. The worm weight was increased in both of the media after that fluctuation. The weight reduction because of that time was the earthworm attained the matured stage. So it utilized the energy for mating and other reproduction purpose. In cow dung medium the worms are matured at 8th week itself. In Pongamia medium the worms matured at 9th week, so after it has been reduced because of reproduction purpose. The shortest time from producing cocoons to sexual maturity for *E.eugeniae* was 7-8th week (Dominguez *et*

al., 2001). The time from hatching to sexual maturity was 47±3 days, which agree with the results of Reineck *et al.*, (1992) who reported that is a shorter than the 7-8 weeks quoted for *E.fetida* and the 51 days reported for *E.eugeniae*. It is very much less than the 29-42 weeks quoted for the soil-dwelling species *Allolobophora chlorotica*, 10-24 months for *Millsonia anomata* and 12-24 months for *Bimastos zeteki*.

The growth rate of worms also continuously increased up to 8th and 9th week in cow dung medium and Pongamia medium respectively and after that the growth rate decreased (fig. 3). This fluctuation was because of the energy utilized by reproduction purpose. The worm increased in weight and again decreased because of the energy was utilized by cocoon formation as well as in that time the worm laying eggs.

Growth rates were superior in cow dung medium compare than on control and leaf medium. Final mean biomass was also greater in worms which grown in cow dung medium (Bhatia, 2000). Growth rates of *M.posthuma* were lower in comparison to the *Eisenia fetida* fed on wet activated sludge (14mg/worm/day). According to Fayolle (Fayolle *et al.*, 1997) among the different variables necessary for earthworm production, it seems that the type of food is most important.

The growth of earthworms in plant derived materials could be retarded due to presence of some chemical substances e.g. polyphenols (Suthar, 2007a). Comparatively, in the present study the earthworm showed least biological potential on leaf residues, and it could be due to presence of some polyphenols and related substances. Besides to high concentrations of nutrient in plant origin wastes, some secondary metabolites are also important, which directly or indirectly influence the composting potential as well as growth patterns of earthworm species during vermicomposting practices. It concludes that the feeding material mainly consists of crop residues, the concentration of polyphenols and related compounds were more important for controlling earthworm activities.

REFERENCES

- [1] S. Bhatia. Sonu, Earthworm and Sustainable Agriculture: Study of the Role of Earthworm in Production of Wheat Crop. Ph.D Thesis Awarded by University of Rajasthan, Jaipur, India, 2000.
- [2] K. R. Butt, Reproduction and growth of the earthworm *Allolobophora chlorotica* (Savigny, 1826) in controlled environments. *Pedobiologia* 41, 1997, 369-374.
- [3] J. Dominguez, A. Clive, Edwards and John Ashby, The biology and population dynamics of *Eudrilus eugeniae* (Kinberg) (Oligochaeta) in cattle waste solids, *Pedobiologia* 45, 2001, 341–353
- [4] C. A. Edwards, C.A., The use of earthworms in the breakdown and management of organic wastes. In: Edwards, C.A. (ed.): *Earthworm Ecology*. St. Lucie Press, Boca Raton, 1998, pp. 327-351.
- [5] L. Fayolle, H. Mitchell, H. Cluzeau and D. Stawiec, Influence of temperature and food source on the life cycle of the earthworm *Dendrobaena veneta* (Oligochaeta). *Soil Biology and Biochemistry* 29, 1997, 747-750.
- [6] K. Parthasarathi, Life cycle of *Lampito mauritii* (Kinberg) in comparison with *Eudrilus eugeniae* (Kinberg) cultured on different substrates, *Journal of Environmental Biology*, 28(4), 2007, 803-812.
- [7] A. J. Reinecke, S. J. Viljoen and R. J. Saayman, The suitability of *Eudrilus eugeniae*, *Perionyx excavatus* and *Eisenia fetida* (Oligochaeta) for vermicomposting in Southern Africa in terms of their temperature requirements. *Soil Biology and Biochemistry*, 24, 1992, 1295–1307.
- [8] S. Suthar, Vermicomposting potential of *Perionyx sansibaricus* (Perrier) in different waste materials. *Biores. Technol*, 98 (6), 2007a, 1231– 1237.

- [9] S. Suthar, Influence of different food sources on growth and reproduction performance of composting epigeics: *Eudrilus eugeniae*, *Perionyx excavatus* and *Perionyx sansibaricus*. *Applied ecology and Environmental Research*, 5(2). 2007b, 79-92.
- [10] S. A. Viljoen and A. J. Reinecke, The temperature requirement of the epigeic earthworm species *Eudrilus eugeniae* (Oligochaeta) - A laboratory study. *Soil Biology and Biochemistry*, 24, 1992, 1345-1350.

AUTHORS

First Author – Jesikha.M, PG and research Department of Zoology, Kongunadu Arts and Science College, Coimbatore-29, Tamil Nadu, India, Email: Khajesi@yahoo.co.in
Second Author – M. Lekeshmanaswamy, PG and research Department of Zoology, Kongunadu Arts and Science College, Coimbatore-29, Tamil Nadu, India, Email: Khajesi@yahoo.co.in

FIGURES

Fig 1: Total weight of earthworm in two different media

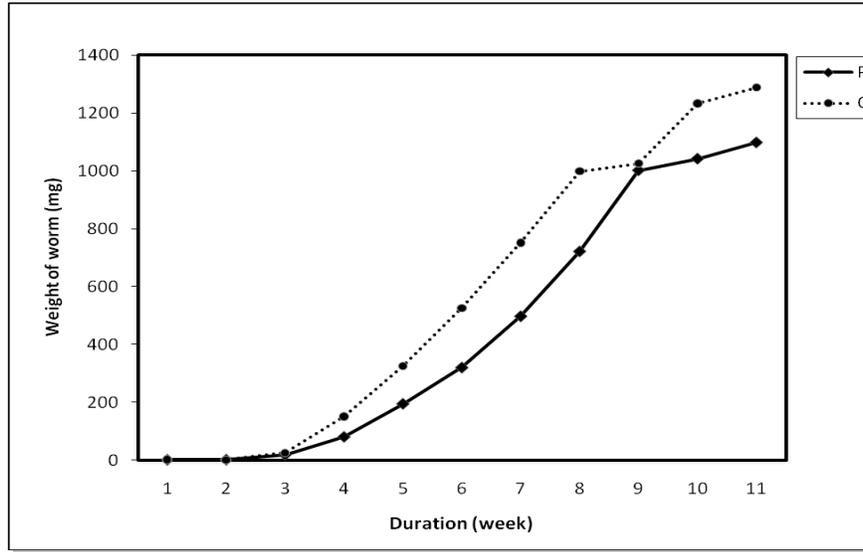


Fig 2: Weight gain of earthworm in two different media

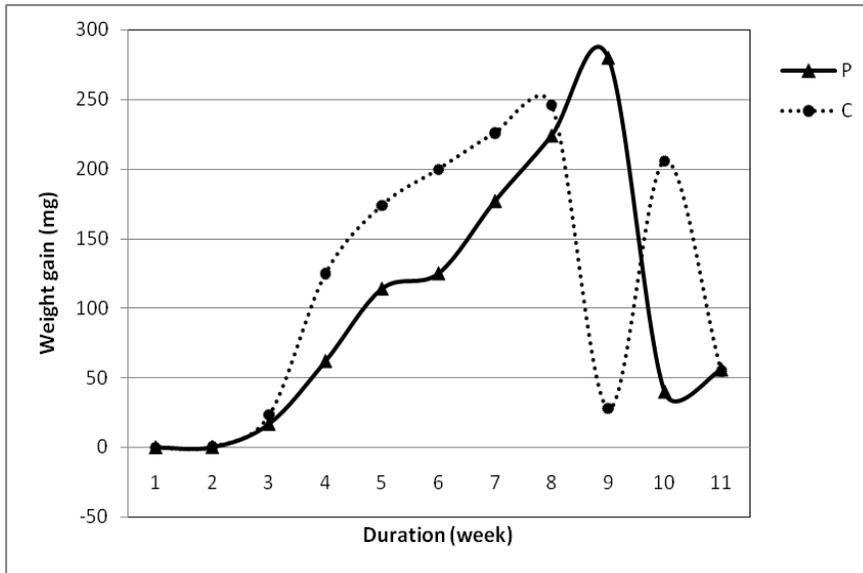
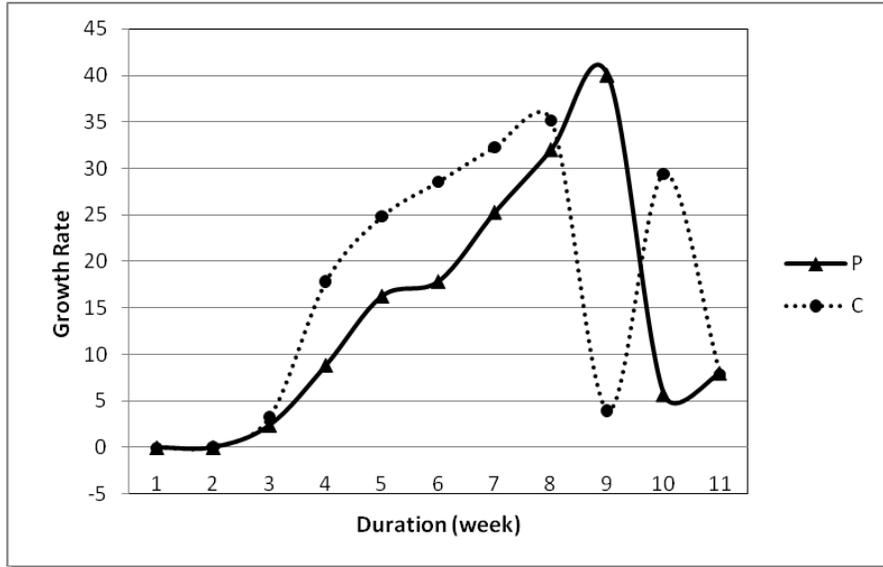


Fig 3: Growth rate of earthworm in two different media



A Survey: Security Perspectives of ORACLE and IBM-DB2 Databases

Lavanya Pamulaparty*, T. Praveen Kumar**, P. Vijaya Babu Varma**

* Associate Professor and Head of CSE, Methodist College of Engineering. & Technology.

** Assistant Professor, Dept. of CSE, Methodist College of Engineering. & Technology.

*** Assistant Professor, Dept. of CSE, Methodist College of Engineering & Technology.

Abstract- As storage of data plays an integral part of databases, security issues becomes major concerns. Relational databases hold a significant portion of data stored in software, therefore today's database purchase decisions revolve around how secure the product is. This paper provides a categorical feature comparison between Oracle9i Database (Oracle) and IBM DB2 Universal Database (DB2), in addition to examining features provided in the SecureWay product line from Tivoli, an IBM subsidiary [7]. It explores the impact of IBM's and Oracle's security models on users seeking to protect their critical information systems and contrasts IBM's strategy of building security outside of the DB2 database against Oracle's strategy of securing information in the database server[6]. In addition to the security issues we explore some of the strategical issues arises in database migration.

Index Terms- Database security, Oracle Security, DB2 Security, Tivoli SecureWay, Database Migration [6].

I. INTRODUCTION

IBM and Oracle differ sharply in their fundamental approaches to security. On one hand, Oracle endeavors to build security features and solutions into each of its products, particularly the database server, where data is stored. This approach means that customers get out-of-the-box security when they install and configure Oracle. Security is at the core of the coding practices employed by the development staff that builds the Oracle database, resulting in the delivery of a secure product [7]. Oracle recognizes that they must ship a certified, provably-secure database. Such assurance is afforded by independent security evaluations against established security criteria. Assurance is a large part of Oracle's approach to security, and it differentiates Oracle from other database vendors. On the other hand, IBM addresses security by delivering it outside of the database and relying on the operating system or Tivoli's product line to secure DB2 and other IBM products. The most obvious result is that data stored in DB2 is not inherently protected; one must deploy Tivoli SecureWay products to protect DB2 [6].

Another outcome is that IBM's strategy interjects IBM Global Services into security purchases because service is often required to integrate the DB2 and Tivoli product sets. These outcomes have financial implications as well: customers must spend additional dollars on Tivoli products to secure DB2, and IBM Global Services involvement increases the cost of implementing security in a DB2 environment. Further, IBM lacks

independent assurance of the security built into DB2. Whereas Oracle has undergone multiple evaluations of its database, IBM has failed to have independent experts formally evaluate DB2, making it difficult to qualify their assertions about their security implementations. Oracle's business model is to secure products out-of-the-box, and IBM's is to make customers pay to secure the products they purchase. This divergence in approach demonstrates the value of security to these database competitors and the resulting security built-in to their customers' deployments [7].

II. IMPACT ON CUSTOMERS

IBM's Approach towards Customers

IBM's security business is solid. They understand security, participate in standards committees, and, in fact, IBM researchers developed the Data Encryption Standard (DES). The security model they choose to secure the database, however, has flaws that impact their customers. The DB2 security model favored by IBM hurts customers in three ways:

- A less secure database, more vulnerable to users or hackers subverting the security due to the security model that adds security after the fact. It is difficult to add layers of security after a product has been designed, coded and shipped [7].
- Higher up-front costs because of the additional products necessary to secure DB2. Customers must purchase a database that includes little out-of-the-box security, then augment the purchase with other products.
- Higher long-term cost of ownership because customers must pay for the database product, the security product and required services— plus upgrades and support services for multiple products over the years.

Oracle's Approach towards Customers

Oracle has an excellent, long-standing reputation in security, as witnessed by Oracle's dominant market share among the most security-conscious customers in the world. The Oracle security purchase is more straightforward than that of IBM because Oracle integrates security features into each of its products. The Oracle9i Database (both the Standard and Enterprise Editions) provides industry leading security features in the products, rendering it difficult to subvert security. Unlike DB2, Oracle security stands on its own without requiring customers to license products for such advanced features as granular access control and customizable auditing (though Oracle provides security options to further enhance its security

offerings). The feature-for-feature comparison later in this paper substantiates this point. Further, independent security evaluations examine the security of Oracle without extra-cost options. These independent evaluations validate the Oracle database itself, without the help of features supplied in add-on options. Finally, because Oracle includes security functionality, Oracle's customers are not obliged to purchase add-on products for fundamental but essential security features, nor must they pay for upgrades and support for such additional products. [6] The following table summarizes the impact on customers of the two companies' divergent approaches

High long-term cost of ownership because customers must pay for the database product, security products and required services— plus upgrades and support services for all those products.	Customers are not obliged to purchase add-on products for key security features, nor pay for upgrades and support for such products.
---	--

Table.1 Impacts on Customers

IBM	Oracle
Security outside of database makes DB2 more vulnerable to users subverting security.	Oracle provides industry-leading security features within the database product, rendering it difficult to subvert security.
Customers purchase a database with little out-of-the-box security, then augment the purchase with security products. Required products and services result in higher up-front prices.	Oracle database security stands on its own without requiring customers to license separate security products for essential, evaluated security features.
No independent validation of DB2.	Independent security evaluations validate proper implementation of security in the Oracle RDBMS.

III. STATE OF SECURITY IN ORACLE AND DB2

A. Feature Comparison

To best understand Oracle versus IBM security, let's look at a feature-for-feature comparison of their complete offerings. Because IBM builds little security into the DB2 database products, the comparison takes into account features in the DB2 family of database servers, the Tivoli SecureWay product line, as well as those supplied by the OS. On the Oracle side, the comparison looks at security features included in the database license, along with features provided by extra-cost database options. [9]

B. User Authentication

The basis for system security is strong user identification and authorization. If you cannot establish, with certainty, who a user is, then it is impossible to hold users accountable for their actions, and difficult to ensure that users only have access to the data they need to do their jobs, but no more. DB2 provides basic authentication and authorization support. Installation requires the administrator's username, password, and group name (and DB2 provides a default for each of these to the user doing the install). Users are defined by user ID in DB2 or the underlying operating system, and IBM supports most of the popular authentication methods. That is, users can be authenticated using DB2 passwords, by relying on the server, the operating system, Kerberos, or Distributed Computing Environment (DCE) credentials. Oracle supports a number of choices for user authentication: Oracle-based (by password, or by industry-standard digital certificates), host-based (by the underlying operating system), or third-party based (network authentication services Kerberos, CyberSafe and DCE, token cards, smart cards and biometric devices).⁷ Oracle provides built-in password management facilities to enable administrators to enforce minimal password length, ensure password complexity, and disallow passwords that are easily guessed words. Both IBM and Oracle provide adequate basic user identification and authentication support[3].

C. Authorization and Access Control Privileges

A user's authorizations determine what data he should have access to and what types of operations he can perform on those objects. A user can only perform an operation on a database object (such as a table or view) if that user has been

authorized to perform that operation. A privilege is an authorization to perform a particular operation; without explicitly granted privileges, a user cannot access any information in the database[1]. To ensure data security, a user should only be granted those privileges that he needs to perform his job functions. This is known as the principle of “least privilege.” To ensure data security, both DB2 and Oracle use authorizations to enable users to access the appropriate database objects and resources. Both use the same definition of privileges and use standard SQL. For example, to assign Scott the select privilege on the employee table in DB2 or Oracle, the syntax is the same: grant select on employee to user scott Both databases enable a grouping of privileges in roles. [5]

Views for Access Control

Views allow you to further limit the data that a user can access within an object. A view is a subset of one or more tables (or views). You can define, for example, a view that allows a manager to view only the information in the employee table that is relevant to employees in her own department. The view may contain only certain columns from the base table (or tables), such as employee name and salary. Views can also limit the subset of the rows accessible in the base table, such as a view of the employee table which contains records for employees assigned to department 10 [1].

Granular Access Control

A foundation of security is controlling access to data. Who would consider opening production systems, such as order entry, inventory and customer support, to customers and partners without the ability to strictly limit data access? Internet-based systems have a strong requirement for access control at a very fine level of granularity, often to the level of individual customers or users [2].

Virtual Private Database

In 1999, Oracle8i set a new standard in database security with the introduction of Virtual Private Database (VPD), unique to Oracle. The Virtual Private Database enables, within a single database, per-user or per-customer data access with the assurance of physical data separation. VPD is the aggregation of server-enforced, fine-grained access control, together with a secure application context in the Oracle database. By dynamically appending SQL statements with a predicate, VPD limits access to data at the row level and ties the security policy to the table (or view) itself. Security is stronger because it is enforced by the database, no matter how a user accesses data. Security is no longer bypassed by a user utilizing an ad hoc query tool or new report writer. [8]

Examples of VPD customers include:

- Several large banks and financial services companies use it to separate customer or employee access to financial data.
- Security-conscious U.S. Federal government organizations use it for even the most rigid implementations.
- A financial services company uses it to apply a set of rules based on user identity and position in the organization.

IBM has no comparable feature set beyond its basic authorization and access control mechanisms (the very features Oracle felt were not enough for today’s demanding customer requirements). Neither Tivoli’s security applications nor IBM’s operating systems provide such functionality. This is one area in which IBM Global Services may get involved to develop custom code. “Custom code developed by IBM allows [the customer] to monitor which users access case documents.

RACF

DB2 takes advantage of Resource Access Control Facility (RACF) for access control in a mainframe environment. Without RACF underlying other DB2 databases, such as in the DB2 product for Unix/NT/Linux, administrators cannot secure all instances of DB2 in the same way. When the software does not natively support a feature or service, and this is a fine example, IBM relies on Global Services consultants to custom build a solution for the customer. RACF on the mainframe augments Oracle’s internal database security because Oracle supports RACF for customers running the Oracle database on mainframes [7].

D. Encryption

The Internet poses new challenges in information security, and encryption leads the pack of solutions used to address the traditional list of security threats. It is becoming more important every day to encrypt especially sensitive data in the database as well as packets flowing over any network. [2]

Encryption in the Database

IBM has delivered an introductory database encryption capability in the most recent release, DB2 UDB 7.2, available since June 2001. DB2 has functions that enable an application to encrypt and decrypt data using an RC2 block cipher with a 128-bit key and using an MD2 message digest. It provides column-level encryption, enabling all values in a column to be encrypted with the same key— an encryption password. First delivered in Oracle8i in 1999, Oracle provides an encrypt/decrypt interface to encrypt especially sensitive data in the database server. Oracle has been enhancing the database encryption solution over the years, adding in Triple-DES encryption and MD5 cryptographic checksums in a subsequent Oracle8i release. The first Oracle9i release enhanced the Random Number Generator (RNG) to use a FIPS 140 Level 2-certified RNG, another example of security with assurance. In the current release, Oracle provides DES (56-bit), 2-key and 3-key Triple-DES (112- and 168-bits, respectively) in an encryption toolkit package that enables applications to encrypt data within the database. The IBM solution is password-based; the user supplies a password as the encryption key to encrypt and decrypt data. This is an elegant solution; however it does have certain drawbacks. First, there has been no independent certification of implementation (e.g., FIPS 140). Second is implementation. While there is a minimum password length, DB2 SQL Reference documentation warns, “It is the user’s responsibility to perform password management”¹⁰ because there’s nothing to stop a user from never changing a weak password which may be susceptible to a dictionary attack. [6]

Network Encryption

DB2 database itself does not provide network encryption to secure communications between any client and the database, but IBM does support DES and RC2 in the network. For example, IBM encrypts the network in the z/OS mainframe, has an OS/390 Virtual Private Network, and the Tivoli Management Framework supports SSL and DES. Customers must purchase additional IBM products to encrypt various network layers, but with the appropriate products in place, they can secure the network on which DB2 sits. Oracle offers Oracle Advanced Security to protect all communications with the Oracle Database. Wherever the database is available, Oracle9i Advanced Security is available and ships on the same media as the database software. To encrypt network traffic, it provides Secure Sockets Layer (SSL). [11] the Internet standard, and offers:

- RC4 in 256-bit, 128-bit, 56-bit, and 40-bit key lengths,
- DES in 56-bit and 40-bit key lengths,
- 2-key or 3-key Triple-DES (3DES) with 112-bit and 168-bit keys, respectively, which is especially high-strength encryption.

These cryptographic modules have undergone the laborious certification process to claim Federal Information Processing Standard (FIPS 140-1) Level 2 compliance, providing assurance of the implementation— down to the randomness of key generation. To prevent modification or replay of data during transmission, Oracle uses an MD5 or SHA-1 message digest included in each network packet. The encryption and data integrity capabilities protect Oracle clients and middle tier servers in communications over Net8, Net8/SSL, IOP/SSL, and also secure Thin Java Database Connectivity (JDBC) clients. In short, Oracle provides a variety of ways to encrypt communications over all protocols with any database communications. Wherever the database runs, the network traffic can be protected with encryption. IBM and Oracle take different approaches to securing network traffic. Oracle’s implementation is tied more closely to its database, but both provide ample solutions for the demanding customer requirements stemming from the susceptibility of clear text data flowing over corporate networks, intranets, and the Internet. [15]

E. Auditing

Auditing is a passive, albeit important, security mechanism. A critical aspect of any security policy is maintaining a record of system activity to ensure that users are held accountable for their actions. To address this requirement, both DB2 and Oracle provide extensive audit facilities. [10]

Fine-grained Auditing

Fine-grained auditing allows organizations to define audit policies, which specify the data access conditions that trigger the audit event. Administrators can use a flexible event handler to notify them that the triggering event has occurred. For example, an organization may allow HR clerks to access employee salary information, but audits access when salaries greater than \$500K are accessed. The audit policy ("where SALARY > 500000") is applied to the EMPLOYEES table through an audit policy interface (a PL/SQL package). In addition, the event handler sets a triggering audit event to be written to a special audit table for

further analysis, or it could activate a pager for the security administrator. DB2 offers no support for such granular and customizable auditing. In general, auditing does not capture the data returned to the user because audit logs would become too large. Fine-grained auditing captures the exact SQL text of the audited statement, and when used in combination with Oracle’s Flashback Query feature, you can recreate the exact records returned to a user. This combination defends against the user who tries to subvert the auditing mechanisms by issuing hard-to-detect queries that may hide the intent of the query.

Oracle produces a graphical user interface tool, Oracle Selective Audit, to automate auditing management and analysis. The tool integrates auditing with database logs, LogMiner, and Flashback Query to capture and display all relevant queries. It provides a graphical way to detect suspicious activities, such as a user attempting to login as administrator after hours or accessing more data than he should because a DBA inadvertently assigned him incorrect privileges. With the click of a mouse, auditors can view DDL and DML statements, view the exact SQL text issued, and even play back rows returned to the user at the time of the query— even if the database has changed dramatically since the issuing of the query. No database vendor apart from Oracle offers such a comprehensive auditing picture.

SecureWay Auditing

SecureWay Security Manager and SecureWay PKI are Tivoli products which provide auditing facilities to enhance the auditing features in DB2. SecureWay Security Manager audits user login and access to various resources, and it presents audit reports to the auditor. It enables auditors to log, view, and report security administrative actions.13 SecureWay PKI, in addition to providing PKI services, creates a separate audit trail of administrator activities. These auditing capabilities in the Tivoli SecureWay product line are useful additions to the IBM’s DB2 auditing story. Oracle and IBM both provide a host of auditing solutions, though the scope and granularity of auditing features shipped inside Oracle9i Database leads all of its database competitors. Customers with a need to log and inspect database access without taking on high overhead, those with corporate auditing mandates, and those with industry regulations (such as HIPAA in health care) use these advanced auditing capabilities innovated by Oracle.[7]

Table.2 Security Features

Feature or Area	Oracle	IBM-DB2	Tivoli SecureWay
Authorization	Yes	Yes	Yes
Basic Auditing tools	Yes	Yes	Yes
Fine-grained Auditing	Yes	No	No
Data Encryption	Yes	Yes	Not Applicable
Fine-grained Access Control	Yes	No	No
PKI Support	Yes	NO	Yes
Evaluated RDBMS	Yes	No	Yes

RACF Support	Yes(No MainFrames)	Yes	Yes
Network Encryption	Yes	No	Yes

F. Migration Strategies

Migration from Oracle Database to IBM DB2 is not completely seamless and must be planned carefully. Administrators may face issues when migrating from Oracle to DB2 due to locking differences between the two databases. However, these issues can be mitigated to a great extent. One of the key locking behavior differences between Oracle and DB2 is that Oracle does not hold any locks on a row while reading, and DB2 does. This difference can lead to a high probability of increased lock waits and issues such as deadlocks and timeouts in applications migrated from Oracle to DB2. To handle locking issues, mitigation strategies are required at the database, application, and operational levels.

Database-level strategies

Several types of database design changes can help mitigate locking issues:

- **Row-level locks.** Override the default DB2 page-level lock setting and reset so that the table uses row-level locking to increase concurrency. Row-level locks should be implemented carefully, since there could be increased overhead due to the growing number of locks, and the potential for lock escalation increases if not properly handled.
- **Index and query tuning.** Read queries, which might require a table scan, would not cause a problem in Oracle but would be an issue in DB2 on z/OS because they would lock the entire table. To mitigate this problem, ensure that all queries are optimized in terms of index and access path so there are no unnecessary table scans, especially for tables that are accessed in online transactions.
- **Partitioning.** Concurrency can be increased a great deal, especially for batch runs, by introducing partitioned table spaces in DB2 for z/OS. Data can be segregated into different partitions by identifying a partitioning key and having the data reside on different partitions based on the range of values of the key. When running a batch, multiple threads can be initiated based on the partitioning key value, so that the different threads access different partitions and provide higher concurrency.

Application-level strategies

Some of the key application design changes that can help mitigate locking issues include:

- **Skip locked data.** You may have a situation in which different transactions are going against the same table and you need to access only the rows that are not currently locked in any given table. In these cases, DB2 provides an option to query only the rows that are not locked by using the SKIP LOCKED DATA option in

the SELECT, UPDATE, and DELETE clauses. This option applies only when the isolation levels of Cursor Stability (CS) and Read Stability (RS) are in place and also applies only to row-level and page-level locks.

- **Uncommitted read.** In cases where it is acceptable for the response from a read query to have uncommitted data, try using the WITH UR option in read queries in DB2, since this does not hold any shared locks. This option is very helpful for user queries run by application testers or business analysts in the user acceptance testing or production regions. These queries could contend with application queries, which can be avoided by running the user queries using the WITH UR clause.
- **Table access ordering.** Increases in locking contentions can also occur when migrating from Oracle to DB2 for z/OS due to improper ordering of access to tables in parallel transactions. Consistent access ordering can help avoid this problem. For example, if transaction 1 accesses table A first and then table B, subsequent transactions should use the same order when accessing the same tables.

Operational-level strategies

Contention can occur due to different types of workloads going against the same table—for example, batch and online workloads accessing tables at the same time, or different batches accessing the tables at the same time. In these scenarios, one option is to make operational-level changes such as rescheduling the conflicting transactions. It may be possible to run a batch at off-peak hours when the online workload is not running. In case of two batches running parallel, try running one after the other, or put dependencies in place so that one cannot run when the other is running, and vice versa.

IV. CONCLUSION

At first glance, Oracle and IBM appear to offer similar security solutions, but with closer inspection, it is plain to see that the two companies approach security differently and ship solutions at vastly different levels of maturity. Independent evaluations and feature-for-feature comparisons prove that the Oracle9i Database is more secure than IBM's DB2 Universal Database. Overwhelming evidence supporting this assertion, as established in this paper, proves that Oracle security is far superior to DB2 security. The Oracle database builds-in security and stands on its own; the database itself has achieved nine independent evaluations performed by industry experts. IBM has not completed any evaluations of DB2. While IBM has a good reputation in security in general, they provide no independent gauge of DB2 security implementations. There are several key locking differences between Oracle and DB2 on z/OS that can lead to locking issues with applications migrated from Oracle to DB2. However, this paper demonstrates options that are available at the database, application, and operational strategic levels to greatly mitigate any issues that might arise.

REFERENCES

- [1] Rashid, Z.; Basit, A.; Anwar, Z.; "TRDBAC: Temporal reflective database access control" 6th International Conference on Emerging Technologies (ICET), 2010
- [2] Zheng-Fei Wang; Ai-Guo Tang; "Implementation of encrypted data for outsourced database" Computational Intelligence and Natural Computing Proceedings (CINC), Volume 2, 2010
- [3] Yan Zhao; Yongcheng Luo; Jian Wang; Jiabin Le; "A novel privacy preserving approach for database security" ICTM Volume 1, Pages 408-411, 2009.
- [4] Anbalagan, P.; Vouk, M.; "Towards a Unifying approach in Understanding Security Problems", ISSRE, pages 136- 145, 2009.
- [5] Michel Abdalla, Emmanuel Bresson, Olivier Chevassut, Bodo Möller and David Pointcheval, "Strong Password-Based Authentication in TLS using the Three-Party Group Diffie-Hellman Protocol", International Journal of Security and Networks, vol. 2, numbers 3/4, pp. 284-296, Inderscience, 2007.
- [6] Oracle Technical Documentation - <http://www.oracle.com>
- [7] IBM-DB2 Technical Documentation - <http://publib.boulder.ibm.com/infocenter/>
- [8] Shehab, M.; Bertino, E.; Ghafoor, A.;" Watermarking Relational Databases Using Optimization-Based Techniques" IEEE transactions on Data Engineering, Volume 20, Issuer 1, 2006.
- [9] Bertino, E.; Sandhu, R.;" Database security- concepts, approaches, and challenges" IEEE transactions on Secure Computing, Volume 2, Issue 1, pages 2-19, 2005.
- [10] Ramasubramanian, P.; Kannan, A.;"An active rule based approach to database security in e-commerce systems using temporal constraints", TENCON 2003. Conference on Convergent Technologies for Asia-Pacific Region, Volume 3, pages 1148-1152, 2003.
- [11] D.Taylor; "SSL for TLS Authentication" IETF draft- ietf-tls-srp-01.txt (work in progress) June 29, 2001
- [12] S. Halevi and H. Krawczyk;"Public-key cryptography and password protocols" ACM Transactions on Information and Systems Security (TISSEC), Vol. 2, August 1999.

AUTHORS

First Author – Lavanya Pamulaparty, Associate Professor and Head of CSE, Methodist College of Engineering. & Technology.

Second Author – T. Praveen Kumar, Assistant Professor, Dept. of CSE, Methodist College of Engineering. & Technology.

Third Author – P. Vijaya Babu Varma, Assistant Professor, Dept. of CSE, Methodist College of Engineering & Technology.

Biology and Morphometrics of Cashew Stem and Root Borers (CSRB) *Plocaederus ferrugenus* and *Plocaederus Obesus* (Coleoptera: Cerambycidae) Reared on Cashew Bark

Vasanthi. P*, T. N. Raviprasad**

* Research Scholar, Directorate of Cashew Research, (Indian Council of Agricultural Research) Puttur- 574 202, Dakshina Kannada, Karnataka, India

** Principal Scientist (Agrl. Ent.) Directorate of Cashew Research, (Indian Council of Agricultural Research) Puttur- 574 202, Dakshina Kannada, Karnataka, India

Abstract- The biology of cashew stem and root borers *Plocaederus ferrugenus* L. and *P.obesus* Gahan (Coleoptera: Cerambycidae) was studied on cashew bark under laboratory conditions. In case of *Plocaederus ferrugenus* L the mean grub period was recorded 163.10 ± 20.55 and 168.37 ± 30.32 days, mean pupal period was 144.33 ± 29.57 and 145.16 ± 29.10 days for males and females, respectively. The total development period ranged between 261-363 days (male) and between 242-356 days (female). In case of *Plocaederus obesus* Gahan., mean grub period was 152.75 ± 31.35 and 158.49 ± 33.26 days, mean pupal period was 142.90 ± 22.57 and 152.34 ± 38.46 days for males and females, respectively. The total developmental period ranged from 226 to 379 days and 247 to 347 days for males and females respectively. The duration of grub stage was more than 40 per cent of the total life duration of *Plocaederus* spp.

The details of adult morphometrics of *P.ferrugenus* L. indicated that in case of males, the mean body length was 38.8 mm; mean body width being 8.76 mm and mean body weight being 0.89 g; the females had mean body length of 33.5mm; mean body width of 10.29 mm and mean body weight of 1.39g .

The morphometric details of adults of *P.obesus* males indicated a mean body length of 38.6 mm; mean body width of 8.63 mm and mean body weight of 1.4 g, while females had mean body length of 36.6 mm; mean body width of 9.31 mm and mean body weight 1.76 g.

In both the species, the length of pro, meso and meta thoracic legs did not differ significantly, wing to elytra length was in the ratio of 1: 0.9.

Index Terms- Biology Cashew stem and root borers, morphometrics, *Plocaederus ferrugenus*, *P.obesus*.

I. INTRODUCTION

The cashew stem and root borers (CSRB) *Plocaederus* spp. are major pests of cashew in all cashew growing tracts of India (Abraham, 1958, Pillai, 1976, Rao, E.V.V.B., 1998) and a few other cashew growing countries (Asogwa *et.al.*, 2008) and pose a serious problem in realizing the maximum yield potential of cashew nut. The grubs form irregular tunnels in the cashew bark of the stem and roots, thereby damage vascular tissues resulting in gradual yellowing of the foliage of yielding trees and

subsequently lead to death of trees, thereby reducing the tree population. The presence of grubs can be recognized by the exudation of frass and gum in the infested region, usually in the collar zone in early stages and gum as well as coarse frass, yellowing canopy at the later stage of infestation.

Morphometrics of immature stages of *P. ferrugenus* L. was reported earlier by Senguttuvan and Mahadevan (1998). However, detailed morphometrics of all the developmental stages of both the species of *Plocaederus* have not been recorded. Keeping in view the lacuna of information particularly on these species, the present studies were undertaken at the Directorate of Cashew Research (DCR), Puttur, India from 2010-12 under laboratory conditions by rearing these species on the natural host, cashew bark in order to understand the life cycle and duration of the developmental stages and morphometrics of all the stages of both the species of CSRB.

II. RESEARCH ELABORATIONS

A. Field survey and collection of CSRB grubs

The grub stages of the pest species were collected from infested trees in the experimental plots of Directorate of Cashew research (DCR) Kemminje, Karnataka, India, from March 2010 to August 2012. These CSRB grubs were reared individually using cashew bark in rearing bottles which was replaced regularly at intervals of 8-10 days with spraying of water to conserve moisture. (Raviprasad and Bhat,2000). The grubs were reared till pupation which was identified by smearing of calcium on the walls of the rearing bottles.

B. Adult rearing

The rearing bottles containing the cocoons were observed daily for collection of emerging adult beetles. The emerging beetles were transferred to acrylic cages (30x30x30 cm), containing cotton wad dipped in honey solution (20%) as feed. A total of 150 beetles of *P.ferrugenus* and 50 beetles of *P.obesus* were used for these studies on adult biology and morphometrics. The adult beetles selected for recording morphometrics were inactivated by keeping them under refrigeration for 30-40 min at 0°C. The body length (in mm), body width (in mm) and body weight (in g), length of antenna and antennomere, length of the legs, wings and elytra were

recorded. Longevity was recorded from date of adult emergence till death of the beetle.

C. Egg collection

A stout cashew stick (30 cm long and 2.0 cm dia.) wound snugly with a cotton tape was provided in the oviposition cage as standardized by Raviprasad and Bhat;2007, to facilitate oviposition by the pest beetle. Details of adult longevity, pre-oviposition period, oviposition period were estimated and the oviposition index was calculated for both the species as follows: Oviposition index = Oviposition life span of a female / total life span.

The cadaver of the female beetles was dissected for the presence of any unlaidd eggs and this was also considered to calculate the fecundity. Pre-oviposition period was recorded from date of adult female emergence till first oviposition. Eggs laid beneath the cotton tape were collected daily by unwinding the cotton tape. The number of eggs and date of oviposition were recorded. The length, width (at the longest and widest part, in mm) and weight (in g, using an electronic balance) of the eggs were recorded. (100 eggs were randomly used) Eggs obtained from lab cultures were placed in petri plates and the number of eggs and date of oviposition were marked suitably on these petri plate. A few cashew bark pieces (1 x 1 cm) were placed as feed for the nascent grubs, in order to check mortality due to lack of food. The eggs obtained were placed daily in separate petri plates and labeled with the date of oviposition.

D. Rearing of nascent grubs

Observations on egg hatching were done twice a day during 10.00 am and 3.00 pm. The date of first to last hatching was recorded for all the batches. The nascent grubs were weighed, measured and transferred into small incision on 1 x 1cm bark to facilitate feeding and entry by the grubs. These bark pieces with the nascent grubs inside were placed at 10 no.s per petri plate (15 cm dia.). Moisture content of the cashew bark was maintained by spraying clean water daily. Subsequently, after 15 days of hatching, the grubs were carefully removed from the bark pieces and transferred to individual rearing bottles to avoid cannibalism.

E. Feed change during rearing

Fresh cashew bark pieces were replaced regularly at ten days interval as per the standardized rearing technique (Raviprasad and Bhat, 2000). In order to obtain the percentage weight increase of the grubs they were weighed using an electronic balance simultaneously during the process of feed change. The mean percentage weight gain was calculated as follows:

$$\text{Net weight gain (N)} = \text{Final weight (F)} - \text{Initial weight (I)}$$
$$\% \text{ difference in body weight} = \frac{F - I}{I} \times 100$$

The rearing bottles were observed daily for the moulting of the grubs which could be confirmed by the presence of exuvium of the previous grub stage on the date of observation. The weight (in g) and morphometric details viz. length, prothoracic shield (PTS) width (in mm) of every instar of the CSRБ grubs were recorded with the help of a vernier slide caliper. (Raviprasad and

Bhat 2010) (A batch of 100 grubs was randomly observed for this purpose).

Observations were also done for the presence of pupation symptoms such as smearing of calcareous material in the rearing bottle. Date of pupation was labeled on the rearing bottle. Such bottles having indication of pupation were screw capped with porous cap to prevent the escape of the adult CSRБ beetles after emergence.

After one month of pupation the calcareous cocoons were carefully detached by prying out using a blunt tool from the sides of the rearing bottles and the morphometric details viz. weight (g), the length, width at the broadest part, were recorded. The cocoons were left without disturbing for future adult emergence in the rearing bottles.

III. RESULTS

A. Morphometrics of different stages of *P.ferrugineus*

a. Egg

The eggs were creamy white in colour, oval in shape, resembled rice grains, and were laid singly or rarely in groups of 3-5. The eggs were of 3.73 mm (range 3.0 - 4.2 mm) in length and 1.0 mm (range 0.8 - 1.1mm) in width and weighed 0.01 g (range 0.004-0.007).The incubation period was recorded to vary, in case of eggs leading to males it ranged from 3 – 12 days (Mean 6.6 ± 0.68) and in case of eggs leading to female it ranged from 4-8 days (mean 6.3 ± 1.3).



Egg of *P.ferrugineus*

b. Grub

It was observed that the CSRБ grubs passed through five instars as indicated by the moulting and increase in prothoracic shield width.(Raviprasad and Bhat 2010) The grubs were oval in cross section with the distal end tapering slightly, with cream coloured body having segmental protrubances. The head capsule was strongly sclerotised, deeply retracted into the prothorax. The grubs had prognathus mouthparts with strong, short, stout mandibles. There was a pro-thoracic shield with two crescent shaped markings, with three pro thoracic prolegs; 10 segmented abdomen with short abdominal ampullae ventrally. In total, nine bilabiate type spiracles were observed with one being mesothoracic and the rest eight being abdominal. The CSRБ grubs were found to be highly cannibalistic. PTS width and weight were correlating with age of the grub @ $p=0.01$ ($r = 0.956$ and $r = 0.972$ respectively) though constant increase was not observed.

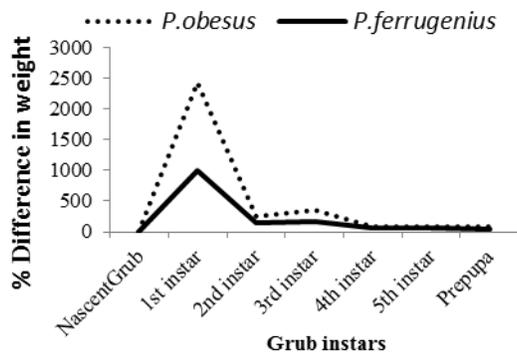
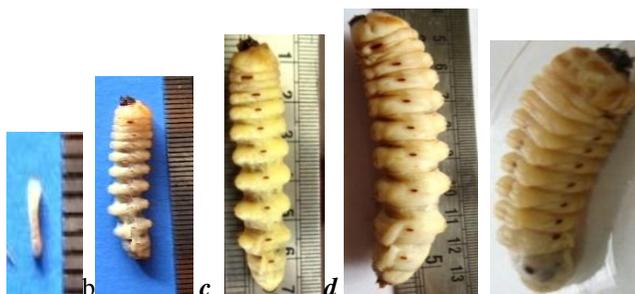


Fig 1. Mean percentage difference in weight of the CSRB grubs



Grub stages of *Placaederus* spp. (a to e, first instar to prepupa)

The mean percentage difference in weight of the both the species of CSRB grubs were high initially but later it was reduced (Fig 1). Grub stage extended in certain conditions of environment. The availability of feed influenced the number of instars in the grub stages. Under conducive rearing conditions the grubs had shown 5- 6 instars followed by a pre-pupa which had shorter body length due to stopping of feeding and excretion of gut content and later moved to the bottom part of the rearing bottle and constructed a calcareous cocoon, by smearing regurgitated calcium on to the nearby frass and on the surface of rearing bottle which hardened gradually to turn light creamy yellowish hard cocoon. The pupation of the grub was identifiable by the presence of white calcium smearing on the inner wall of the rearing bottle. Among the morphometric measurements of the developmental stages are mentioned in Table 1. Length and weight were significantly high in the 4th and 5th instars Fig 2.

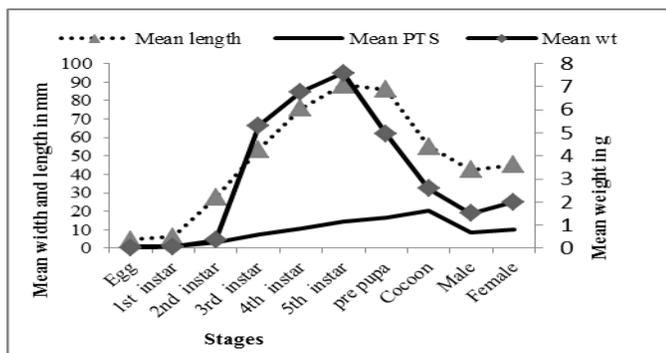


Fig2. Variation of different morphometric parameters in different biological stages of *P.ferrugineus*

TABLE1. Morphometric details of *Placaederus ferrugineus* L

Stage of development	Weight (g)		Width (mm)		Length (mm)	
	Mean	SEM	Mean	SEM	Mean	SEM
Egg	0.01	0.01	1.01	0.01	3.73	0.11
1st instar*	0.07	0.01	1.03	0.01	5.20	0.15
2nd instar	0.35	0.02	3.15	0.15	24.40	0.35
3rd instar	5.32	0.23	7.70	0.21	45.80	0.94
4th instar	6.76	0.30	10.60	0.17	65.05	0.75
5th instar	7.58	0.31	14.40	0.29	73.95	0.56
pre pupa	4.95	0.20	16.69	0.38	69.38	1.37
Cocoon **	2.58	0.15	20.40	0.42	34.80	1.19
Adult(Male)	1.51	0.06	8.76	0.34	33.79	0.60
Adult(Female)	2.00	0.07	10.29	0.41	34.79	0.47

*= PTS width was measured for the grub stages ** = Cocoons and adults were measured at the broadest region

c. Cocoon

The prepupa moulted to an exarate pupa inside the calcareous cocoon. The metamorphosis was completed inside the cocoon after which the adult beetle lay quiescent till emergence. The morphometrics of the cocoon is listed in Table 1. The duration of pupal stage was not significantly different in two sexes. (Table 2)



Cocoon and pupa of *Placaederus* spp.

TABLE 2. Duration of biological stages of *Placaederus ferrugineus* L.

Developmental stage	Mean ± SD (Days)	
	Male	Female
Egg (Incubation period)	6.60 ± 2.35	6.30 ± 1.34
1st instar	21.55 ± 5.67	21.90 ± 8.01
2nd instar	29.10 ± 8.96	29.75 ± 8.37
3rd instar	33.60 ± 6.54	33.60 ± 9.76

4th instar	34.47 ± 4.19	34.23 ± 4.32
5th instar	40.29 ± 11.63	35.85 ± 11.47
Pre-pupa	20.90 ± 14.73	17.00 ± 7.40
Grub period	163.10± 20.55	168.37± 30.32
Pupal period	144.33± 29.57	145.16 ± 29.10
Total	307.33± 29.03	313.53 ± 28.36

d. Adult

The adult beetles of *P. ferrugineus* were chestnut red coloured longicorn beetles, males with antenna more than double of the length of the body (mean 62.67 ± 6.09mm) whereas, in case of females, the antenna was more or less of the same length as that of the body (mean 35.38 ± 7.66mm). The antenna was filiform with scape in antennifer, pedicel comprising of nine antennomere. The antennal segments contributed variously for the length of the flagellum. (Table 3). The beetles, when disturbed produced sound by scraping of the back edge of the pronotum against a file on the mesonotum. The beetles displayed high level of aggregation.

Longevity was 21-56 days (mean 32.60 ± 12.06) in female while male longevity was 20 to 37 days (mean 33.64 ± 12.21) under laboratory conditions. The female adults had a higher body weight (2.00 g) than the males (1.51 g). The duration of different stages of development were recorded (Table 2) and percentage duration of developmental stages in life cycle was calculated. Fig 3.

TABLE 3. Antennal morphometrics of *Plocaederus ferrugineus* L.

Segment	Male		Female	
	Mean Length mm	% Contribution by respective antennomere	Mean Length (mm)	% Contribution by respective antennomere
Scape	5.02± 0.62	8±0.004	0.68±0.24	19±0.003
Pedicel	5.5±0.40	8.8±0.08	3.04±0.14	9±0.021
F1	4.86±0.91	7.7±0.01	4.81±1.03	13.7±0.014
F2	5.85±0.58	9.3±0.001	4.03±0.88	11.4±0.007
F3	5.85±0.58	9.3±0.001	3.26±0.81	9.1±0.05
F4	5.85±0.58	9.3±0.001	3.26±0.81	9.1±0.05
F5	5.85±0.58	9.3±0.001	3.26±0.81	9.1±0.05
F6	5.85±0.58	9.3±0.001	3.26±0.81	9.1±0.05
F7	5.85±0.58	9.3±0.001	3.26±0.81	9.1±0.05
F8	5.85±0.58	9.3±0.001	3.26±0.81	9.1±0.05
F9	6.36±0.94	10.2±0.012	3.26±0.81	9.1±0.05
Total antenna	62.67±6.09	1.00	35.38±7.66	100

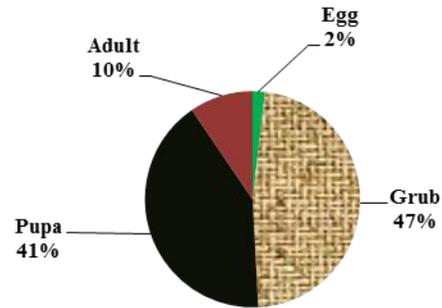


Fig 3. Percentage duration of biological stages in *Plocaederus ferrugineus* L.



Fig. *P.ferrugineus* female and wing



Fig.Male *P.ferrugineus*



Fig.Elytra of *P.ferrugineus*

d. Mating

The beetles were nocturnal and repeated matings were observed during morning hours and late evening hours. The aggression among the males in securing the mate led to loss of body parts especially, antennae and legs. Sex ratio indicated the male to female ratio to be generally 1.05: 1.0. (Field collected), 1.02:1 (lab reared)

e. Fecundity

The mean pre-oviposition period was 2.5 ± 0.5 (range 2-5days), mean longevity 51days with an oviposition index

96.07%.The female beetles laid varied number of eggs, mean oviposition period 49.5 days, mean fecundity 54.94 ± 12.58 .

B. Morphometric details of *Plocaderus obesus* Gahan

a. Egg

Physical appearance was similar to *P.ferrugenus* eggs, but showed significant difference in length (LSD @ 0.05= 0.2989); , width and weight, had a mean length 2.13mm (range 1.5 – 3.0 mm), width 0.6 mm (range 0.4-0.8mm) and weighed 0.002 g (range 0.001-0.004).Incubation period, in case of eggs leading to males it ranged from 3 – 10days (Mean 5.77 ± 1.44) and in case of eggs leading to female it ranged from 4-8 days (mean 6.1 ± 1.29) in female .



Fig. eggs of *P.obesus*.

b. Grub

The grubs of *P .obesus* passed through five instars as indicated by the moulting and increase in prothoracic shield width. The grubs were morphologically similar to that of *P.ferrugenus* grubs; the morphometric measurements of the grubs are mentioned in Table 4 and their variations over different stages is compared in Fig 3.

All the grub instars of *P.ferrugenus* and *P.obesus* were statistically on par different in morphometrics of the various instars. Statistical analysis was done in SAS software under DMRT. Grub stage was found to dominate. The duration of different stages are listed in the Table 5 and Fig 4

TABLE 4. Morphometric details of bark reared *Plocaderus obesus* Gahan

Stage of development	Weight (g)		Width (mm)		Length (mm)	
	Mean	SEM	Mean	SEM	Mean	SEM
Egg	0.0058	0.0002	1.02	0.001	2.10	0.1003
1st instar*	0.07	0.0049	1.03	0.002	3.13	0.05
2nd instar	0.35	0.024	3.15	0.15	24.15	0.40
3rd instar	5.32	0.23	7.70	0.21	49.45	1.60
4th instar	6.76	0.30	10.60	0.17	65.75	0.59
5th instar	8.61	0.27	14.40	0.3	74.65	0.66
pre pupa	4.95	0.20	16.69	0.38	68.06	0.94
Cocoon **	2.58	0.15	21.35	0.65	36.10	0.77
Male	1.46	0.22	8.63	0.30	38.80	1.68
Female	1.76	0.07	9.31	0.30	33.50	1.26

*= PTS width was measured for the grub stages ** =The cocoons and adults were measured at the broadest region *** Staisitically different @p=0.05 from the egg of *P.ferrugenus* as indicated by DMRT.

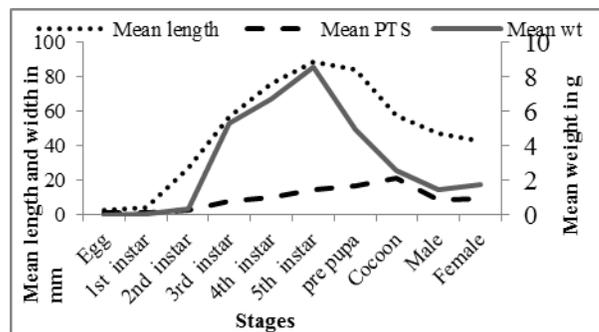


Fig4. Comparison of different morphometric parameters in CSRB *P.obesus*

c. Cocoon

The duration of pupal stage varied among the sexes. (Table 5) Pupal sages of both the species of *Plocaderus* were statistically on par in all of the morphometric parameters.

d.Adult

The adult beetles of *P. obesus* were dull grey brown coloured longicorn beetles, males had the antenna more than double of the length of the body (mean 57.62 ± 6.80 mm) whereas, in case of females, the antenna was more or less of same length as that of the body (mean 35.39 ± 7.67 mm). The antenna was filiform with scape, in antennifer, pedicel comprising of nine antennomeres with dark bands at the junction of antennomeres. The antennal segments contributed variously for the length of the flagellum. (Table 6) The beetles, when disturbed produced sound by scraping of the back edge of the pronotum against a file on the mesonotum. The beetles displayed high level of aggregation .The longevity of male beetles was statistically significantly different from *P.ferrugenus* (LSD=2.739@ p=0.05) but females were on par in longevity. The female adults had a higher mean body weight ($1.76 \text{ g} \pm 0.07$) than the males ($1.46 \text{ g} \pm 0.22$).The duration of developmental stages were found to vary (Table 5) and percentage contribution of each stage of development was different and dominance of grub stage was observed (Fig 5) .The adult female and male beetles of two species of *Plocaderus* had shown statistically significant difference in the antennal morphometric details (LSD=1.795@p=0.05). The other parameters viz. body length, body weight were on par in both the sexes of both the species.



Fig. *P.obesus* Female and male

e. Mating

Mating behaviour was more or less similar to *P.ferrugenus*, the beetles were nocturnal and showed the aggregation behaviour and concealed under dry leaves. Sex ratio

indicated the male to female ratio to be generally 1.14: 1.0. (Field collection) 1.21:1(Lab reared)

f . Fecundity

The mean pre-oviposition period was found to be 2.5 ± 0.5 (range 2 - 5days), with an oviposition index 76.19%. The female beetles laid varied number of eggs. Further, the mean fecundity was 74.17 ± 8.25 .

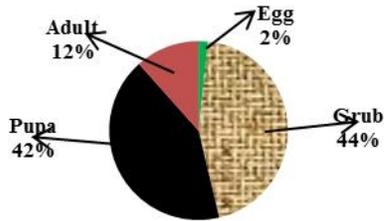


Fig 5 .Duration of life stages in *Plocaeaderus obesus* Gahan.

TABLE5. Duration of biological stages of *Plocaeaderus obesus* Gahan:

Developmental stages	Mean \pm S.D (Days)	
	Male	Female
Egg (Incubation period)	5.77 \pm 1.44	6.1 \pm 1.29
1st instar	20.24 \pm 4.68	26.45 \pm 7.54
2nd instar	21.48 \pm 6.15	28.2 \pm 6.69
3rd instar	31.10 \pm 5.4	25.5 \pm 3.07
4th instar	29.78 \pm 4.37	34.04 \pm 5.01
5th instar	22.88 \pm 7.28	27.44 \pm 7.38
Prepupa	16.25 \pm 7.09	20.25 \pm 12.52
Total Grub period	152.75 \pm 31.35	158.49 \pm 33.26
Pupal period	142.9038 \pm 22.57	152.34 \pm 38.46
Total	294.43 \pm 42.55	306.23 \pm 30.49

TABLE 6 Antennal morphometrics of *Plocaeaderus obesus* Gahan.

Segment	Male		Female	
	Mean Length mm	% Contribution by respective antennomere	Mean Length mm	% Contribution by respective antennomere
Scape	4.584 \pm 0.84	8 \pm 0.008	0.68 \pm 0.25	2 \pm 0.003
Pedicel	5.24 \pm 0.49	9 \pm 0.005	3.05 \pm 0.14	9 \pm 0.02
F1	4.11 \pm 1.02	7 \pm 0.01	4.82 \pm 1.03	14 \pm 0.01
F2	5.40 \pm 0.55	9 \pm 0.002	4.04 \pm 0.89	11 \pm 0.007
F3	5.41 \pm 0.55	9 \pm 0.002	3.26 \pm 0.82	9 \pm 0.005
F4	5.41 \pm 0.55	9 \pm 0.002	3.26 \pm 0.82	9 \pm 0.005

F5	5.41 \pm 0.55	9 \pm 0.002	3.26 \pm 0.82	9 \pm 0.005
F6	5.41 \pm 0.55	9 \pm 0.003	3.26 \pm 0.82	9 \pm 0.005
F7	5.41 \pm 0.55	9 \pm 0.002	3.26 \pm 0.82	9 \pm 0.005
F8	5.41 \pm 0.55	9 \pm 0.002	3.26 \pm 0.82	9 \pm 0.005
F9	5.41 \pm 0.55	1.0 \pm 0.003	3.26 \pm 0.82	9 \pm 0.005
Total	57.62 \pm 6.80 *		35.39 \pm 7.67	

*= Statistically different from the antenna of *P.ferrugineus* @p=0.05 under DMRT

C. Morphometrics of legs and wings of *Plocaeaderus* spp.

The pro, meso and meta thoracic legs did not show significant difference in length in both the species. (Table 7)

TABLE 7. Legs and wings of *Plocaeaderus* spp.

Structure	Mean Length in mm \pm SD			
	<i>Plocaeaderus ferrugineus</i>		<i>Plocaeaderus obesus</i>	
	Male	Female	Male	Female
Fore leg; Coxa	1.09 \pm 0.03	1 \pm 0	1.09 \pm 0.03	0.96 \pm 0.08
Trochanter	0.69 \pm 0.03	0.5 \pm 0	0.7 \pm 0.03	0.5 \pm 0
Femur	5.9 \pm 0.3	5 \pm 0	6.8 \pm 0.76	5.19 \pm 0.77
Tibia	6.9 \pm 0.31	6 \pm 0	6.9 \pm 0.30	6 \pm 0
Tarsus	5.9 \pm 0.31	4 \pm 0	5.9 \pm 0.30	4 \pm 0
Claws	Present, bifid	Present, bifid	Present, bifid	Present, bifid
Mid leg; Coxa	1 \pm 0	1 \pm 0	1.05 \pm 0.22	0.5 \pm 0
Trochanter	0.5 \pm 0	0.5 \pm 0	0.5 \pm 0	0.32 \pm 0.1
Femur	8 \pm 0	8 \pm 0	9.45 \pm 0.88	9.05 \pm 1.5
Tibia	6 \pm 0	6 \pm 0	6 \pm 0	5.76 \pm 0.5
Tarsus	5 \pm 0	4 \pm 0	5 \pm 0	4.15 \pm 0.6
Claws	Present, bifid	Present, bifid	Present, bifid	Present, bifid
Hind leg; Coxa	1 \pm 0	1 \pm 0	0.8 \pm 0.25	0.8 \pm 0.25
Trochanter	1 \pm 0	1 \pm 0	1 \pm 0	1 \pm 0
Femur	5 \pm 0	10 \pm 0	9.6 \pm 1.04	9.6 \pm 0
Tibia	6 \pm 0	10 \pm 0	6 \pm 0	6 \pm 0
Tarsus	6 \pm 0	5 \pm 0	6 \pm 0	6 \pm 0
Claws	Present, Bifid	Present, Bifid	Present, Bifid	Present, Bifid
Elytra	37.4 \pm 3.5	27.9 \pm 2.57	36.05 \pm 2.93	34.45 \pm 1.39
Wing	40.4 \pm 3.5	31.4 \pm 2.51	39.05 \pm 2.93	37.95 \pm 1.39

The wings and elytra had shown proportionately same difference in length in them (0.9: 1). The results agree with the earlier report on the cucurbit longicorn beetle *Apomecyna saltator* F. (Khan 2012).



Fig . *P.obesus*- wing, elytra and antenna

IV. DISCUSSION AND CONCLUSIONS

CSRB were primarily bark feeders. The eggs were visible on the tree trunk as white rice grain like structures. The eggs hatched into an invisibly segmented nascent grub that penetrated the bark by tunneling, developed to a considerably damaging stage with its cryptic tunneling habit. The morphological structure and behavior of grubs was well suited for the bark feeding habit and the subterranean life. The major destructive stage was the grub stage. In both the species of *Plocaederus* grub stage was found to dominate in the life history. The grub and pupa were found within the tunnels and need to be excavated and removed with minimum injury to the infested bark. The adult beetles were nocturnal. Biology of this pest species matched with earlier report regarding multiple mating among cerambycid beetles (Altaf Hussain Mir; 2012). The above pest also showed intermittent mating. The adults aggregate and conceal beneath the dry cashew leaf or any other hiding place in the weed grown cashew plantations during day as the pest species is nocturnal. The PTS widths of the grubs in its successive stages was in correlation with the age. This agrees with the earlier report on the age estimation technique for the field collected CSRB grubs (Raviprasad and Bhat 2010) It is reasonable to assume therefore that molting in softbodied insects is a device that allows them to increase the size of their mouthparts and optimize their rate of feeding. Senguttuvan and Mahadevan (1998) reported the morphometrics of immature stages of *Plocaederus ferrugineus* L. and the grubs had 6-7 instars in the life history and stated that the grub did not obey the growth laws of Dyar and Prazibram. The results of the above observations evidenced that proportional weight increase did not remain constant in the moulting stages. But the pro thoracic shield (PTS) showed increase in width after every moult. The prepupa recorded a decrease in length and weight, stopped feeding and pupation was by regurgitation of the gut secretion. The host plant range and morphometrics of CSRB *Plocaederus ferrugineus* L were reported by Asogwa *et al* .2008 The larva (grub) had a mean body length of 2.72mm, while an average pupal length of 3.66mm was recorded. He reported that, the adult *P. ferrugineus* was a medium sized dark grey beetle, 2.91cm long and 0.92cm wide at the base of the abdomen. They had longer antennae (3.58cm), which was significantly longer ($P < 0.05$) than their body (2.91cm). The findings of this study did not exactly match with the report. The present study indicated the morphometrics of the different stages of *P.ferrugineus* and *P.obesus*.

ACKNOWLEDGEMENTS.

The first author is indebted to the University Grants Commission for providing fellowship under Faculty Development Programme to undertake this trial as a part of PhD studies and to the Director, Directorate of Cashew Research (ICAR), Puttur, Karnataka, INDIA for providing the necessary facilities to carry out this work.

REFERENCES

- [1] ABRAHAM, E. V. 1958: Pests of cashew (*Anacardium occidentale* L). Indian Journal of Agric Sciences (India). 28(4): 531-543
- [2] ALTAF HUSSAIN MIR. 2012: Mating Behavior of *Apriona germari* Hope (Coleoptera: Cerambycidae: Lamiinae) *Journal of American Science*; 8(8).
- [3] ASOGWA E. U., ANIKWE, J. C. NDUBUAKU, T. C. N., OKELANA, F. A. AND HAMMED L. A 2009: Host plant range and morphometrics descriptions of an emerging insect pest of cashew, *Plocaederus ferrugineus* L. in Nigeria: A Preliminary report *J. Innov. Dev. Strategy*. 3(2):21-26
- [4] ASOGWA, E.U.; J.C. ANIKWE; T.C.N. NDUBUAKU AND F.A. OKELANA. 2008: Distribution and damage characteristics of an emerging insect pest of cashew, *Plocaederus ferrugineus* L. (Coleoptera: Cerambycidae) in Nigeria: A preliminary report. *African Journal of Biotechnology*. 7(24)
- [5] BHASKARA RAO, E.V.V. 1998. Integrated production practices of cashew in India. RAP FAO Corporate Document Repository. Available on line at www.fao.org/docrep/005/ac451e/ac451e04.htm. 12pp.
- [6] KHAN, M.M.H. 2012: Morphometrics of cucurbit longicorn (*Apomecyna saltator* F.) Coleoptera: Cerambycidae, reared on cucurbit vines *Bangladesh J. Agril. Res.* 37(3): 543-546
- [7] PILLAI G.B.; O.P. DUBEY AND V. SINGH (1976): Pests of cashew and their control in India: A review of current status. *J. Plant Crops* 4: 37-50.
- [8] RAVIPRASAD, T. N. AND BHAT, P. S. 2007: Standardization of egg collection technique and laboratory rearing of young grub of cashew stem and root borers (CSRB). National Seminar on Research, Development and Marketing of Cashew. Nov. 20-21 pp 76-77.
- [9] RAVIPRASAD, T.N AND BHAT, P.S. 2000: Rearing technique for cashew stem and Root Borers(*Plocaederus* spp.) under laboratory condition. *Recent Advances in Plantation Crops Research* , 2000 pp 346-351.
- [10] RAVIPRASAD, T.N AND BHAT, P.S. 2010: Age estimation technique for field collected grubs of cashew stem and root borer (*Plocaederus ferrugineus* Linn.) *Journal of Plantation Crops* 38(1):36-41
- [11] SENGUTTUVAN, T. AND MAHADEVAN N.R. 1998: Morphometrics of Cashew stem and root borer, *Plocaederus ferrugineus* L. *The Cashew* 12(2) pp: 4-8

AUTHORS

First Author – Vasanthi.P, Research Scholar, Directorate of Cashew Research, (Indian Council of Agricultural Research) Puttur- 574 202, Dakshina Kannada, Karnataka, India
E-mail 1 = vasan_gsch@yahoo.co.in
Second Author – T.N Raviprasad, Principal Scientist (Agril. Ent.) Directorate of Cashew Research, (Indian Council of Agricultural Research) Puttur- 574 202, Dakshina Kannada, Karnataka, India

Treatment of Pseudoaneurysm of Internal Maxillary Artery Resulting From Subcondylar Fracture

Dr.Harshmohan Pathak*, Dr.Santosh Kumar Subudhi**, Dr.Subrat Padhiary*,Dr.P.R.K.Rao**,Dr.Sujit Sahoo*

* Department of Oral and Maxillo- facial Surgery, Institute of dental sciences.

** Department of oral medicine and radiology, Institute of dental sciences.

Abstract- Aneurysm is a localized pathological dilation of a blood vessels. False aneurysm is discontinuity in the vascular wall leading to an extravascular hematoma that freely communicates with the intravascular space producing pulsatile hematoma. In false aneurysm wall is ruptured and there is collection of blood(hematoma) that is bounded externally by adherent extravascular tissue. However any vessel may be affected by a wide variety of disorders that weaken the wall , including trauma(traumatic aneurysm), infection ,congenital defects such as potentiating berry aneurysm.

Sporadic cases of false aneurysm following fractures of the facial bone have been reported but are few. aneurysm and pseudoaneurysm are complication of maxillo-facial trauma but sometimes occurs a result of isolated mandibular condylar fracture.

Index Terms- aneurysm, internal maxillary artery, sub-condylar fracture, trauma.

I. INTRODUCTION

Internal Maxillary Artery Pseudoaneurysm are rare events that may be caused as possible complication of trauma^{1,2,3,4}, infection⁵, occurring as result of maxillomandibular surgery, therapeutic or diagnostic arterial wall needle puncture. More rarely, internal maxillary artery pseudoaneurysm may result from postradiation vasculopathy or tumor invasion.²

Most aneurysm of the internal maxillary artery occur in its terminal pterygopalatine segment, while it is very rare in the first or mandible segment of the internal maxillary artery as in our case.⁹

Research elaboration:-

A 23yr old male patient reported to the Out patient department with complain of swelling with throbbing pain in the right side of face in front of ear, following trauma due to fall on the point of the chin hitting a stone, a fortnight earlier from the date of presentation. There was some motor weakness in all the branches of the facial nerve of the affected site. Immediately following trauma patient was admitted to the dept of emergency surgery where some manoeuvre was done and details of which were unavailable and followed by facial nerve deficit. Patient was then discharged after 3 days with haemodynamic stability.

There was no history of unconsciousness ,altered sensorium ,vomiting after trauma.No history of bleeding from ear or nose after trauma.

Past medical and dental history didn't revealed anything significant.

On examination there was a swelling in right preauricular region, around 3-4 cm

Fig No.1



Fig No .2



Fig No .3



On palpation swelling was firm,tender and pulsatile with arterial bruits on auscultation which coincided with systole.(Vide Fig No .1 & 2)

There was facial nerve deficit of right side.

Mouth opening was restricted(Interincisal opening less than 20mm).(Vide Fig No .3) There was no deviation of mandible on mouth opening and no occlusal derangement.

Aspiration with wide bore needle yielded bright red blood.

Fig No.4

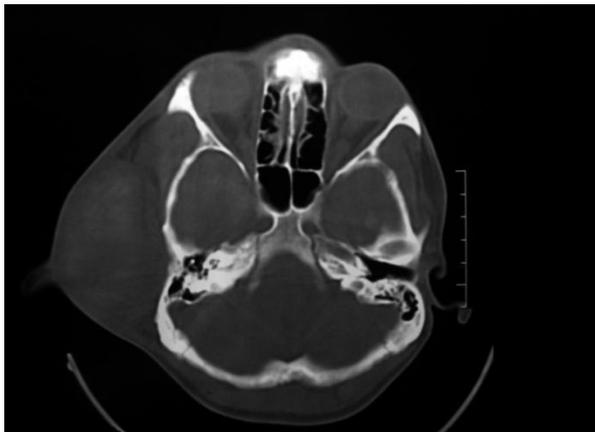
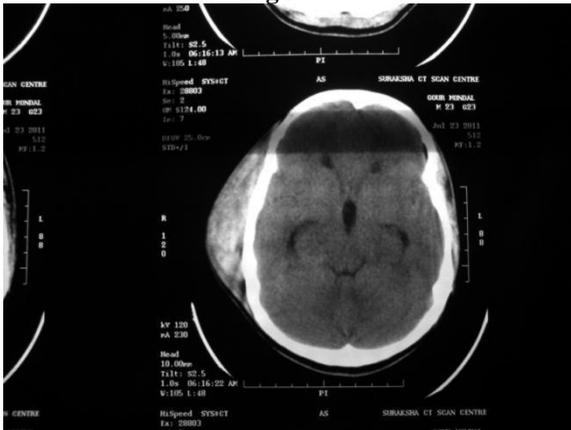
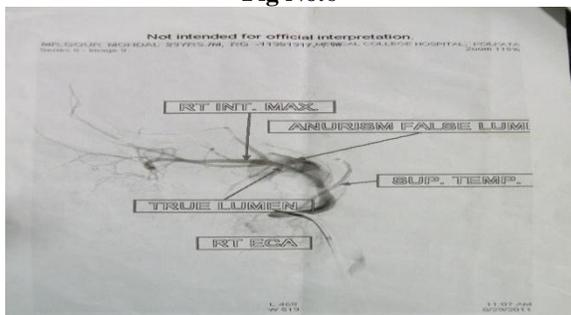


Fig No.5



A CT Scan of head showed hyperdense lesion in right preauricular region. The lesion emerged at the posterior border of the mandible(Vide Fig No .4 & 5)

Fig No.6



Angiogram was advised to the patient following CT Scan finding, which revealed pseudoaneurysm of Internal maxillary artery distal to bifurcation of External Carotid Artery into terminal branches-Superficial temporal artery & Internal maxillary artery. No other feeding vessel or collateral was seen.(Vide Fig No .6)

A treatment plan was chalked out as surgical excision of the aneurysmal sac after External Carotid artery ligation under GA via nasotracheal intubation.

An extended submandibular incision was given extending from anterior border of right sternocleidomastoid to submental region.Incision was deepened through skin, subcutaneous tissue, platysma. After blunt dissection through superficial layer of cervical fascia anterior border of sternocleidomastoid was exposed, which was retracted posteriorly. Following this posterior belly of diagastric and stylohyoid retracted superiorly. Upper part of the carotid sheath was exposed. Bifurcation of the Common Carotid artery was exposed by dissection .External carotid artery was identified by its various branches it gives in the neck. External carotid artery was ligated above superior thyroid artery.(Vide Fig No .7)

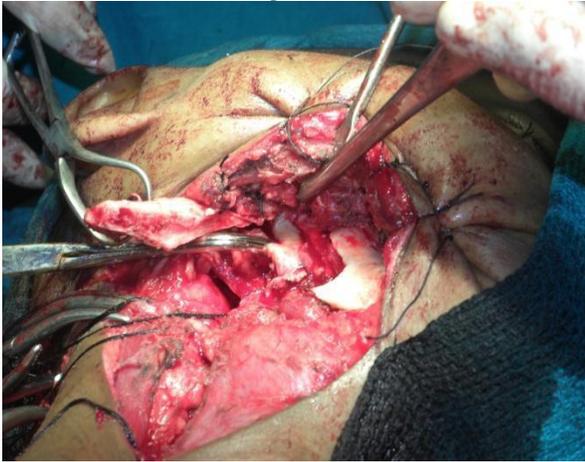
Fig No.7



Following ligation of ECA whole lateral surface of ramus with condyle was exposed by furthe dissection. Aneurysmal sac was seen lying over the lateral surface of ramus and condyle extending into the mass of the superficial lobe of the parotid gland.

To expose the deeper part of aneurysmal sac in total a vertical ramus access osteotomy was done and the proximal fragment was swung out laterally. (Vide Fig No .8) Once the sac was completely exposed it was dissected out taking extra care and meticulous sharp and blunt dissecting techniques.(Vide Fig No.10)Brisk haemorrhage started during the manoeuvre which was controlled by vascular clamps and ligation. A sharp fracture fragment was removed from medial part of the ramus (which ,possibly, would have cause the puncture of the arterial wall).

Fig No .8



Final the osteotomised segment was fixed with a 6 hole mini plate and screws.

Figure: 9



Fig No .10



A vacuum drain was placed and wound closed in layers.(Vide Fig No .9)

Post operative pain ,oedema ,trismus subsided considerably within a couple of days.

Interventional physiotherapy by galvanic stimulation was used to facilitate nerve function recovery. Facial nerve deficit improved considerably.

II. RESULTS AND DISCUSSION

Pseudoaneurysm is a rare clinical entity. Undiagnosed and Untreated it carries the risk of life threatening haemorrhage if the wall of the sac ruptures.

Presence of pulsatile sac with audible bruit coinciding with systole on clinical examination with the history of trauma should raise the suspicion of traumatic pseudoaneurysm and prompt for further evaluation through various investigations.¹⁰ CT Scan and MRI can be valuable aid in diagnosis. USG and Colour Doppler can also be helpful investigation tool. But angiography remains the confirmatory¹⁰ and most important diagnostic procedure with invaluable added benefit in treatment planning. Angiography may be combined with CT Scan or MRI. Angiography will confirm the location of aneurysm with its feeding vessel.¹¹

After establishing the diagnosis, there are two treatment modalities to choose from-Endovascular therapy and Surgical management.¹²

Endovascular therapy is the primary treatment modality in many centres. The use of transcatheter intervention has improved access to surgically inaccessible vessels and has reduced the need for GA and Surgery and associated morbidity and mortality.¹³The added benefit of performing endovascular therapy during angiography has increased its use in trauma patients and as well as an adjunct prior to definitive surgical management.

Transcatheter interventions can be categorised into embolisation, stents, stent grafts.

Embolisation therapy involve the use of agents to occlude vessel lumen. There are numerous embolisation agents used like Gelfoam, isobutylcyanoacrylate, balloons,coils (made of Dacron or nylon fibres).¹¹

Stents and stent grafts have advantage that they maintain the patency of vessel lumen.^{14,15} However the presence of extensive collateral between vessels of the right side and left side of the face & various anastomosis between internal & external carotid artery, the embolisation or surgical ligation of external carotid artery does not cause any clinical significant compromise of blood supply to the peripheral tissues.

Endovascular therapy though a very attractive & modern approach, is not without certain disadvantages.

Endovascular therapy requires skilled & experienced interventional radiologist to perform the procedure. The various collaterals between branches of external & internal carotid artery may result in embolus being passed into branches of internal carotid artery with dangerous complications.^{16,17}

The arterial wall may get punctured during transcatheterisation causing brisk haemorrhage. Moreover embolisation with coils may not occlude the large aneurysmal sac completely.

Surgical management remains the gold standard of treatment, especially for large aneurysm and when non invasive approach fails. Moreover the lack of infrastructure and skilled expertise may favour the choice of surgical management.

III. CONCLUSION

Treatment planning of traumatic aneurysm of internal maxillary artery thus needs proper decision making through a team work involving surgeons & interventional radiologists.

Fourth Author – Dr.P.R.K.Rao,MDS, Institute of Dental sciences,Bhubaneswar.

Fifth Author – Dr.Sujit Sahoo,MDS, Institute of Dental sciences,Bhubaneswar

REFERENCES

- [1] Rich NM, Spencer FC, Vascular trauma.WB Saunders Co: Philadelphia; 1978. P 233-59
- [2] Schwartz HC, Kendrick RW, Pogorel BS- False aneurysm of maxillary artery.An unusual complication, of closed facial trauma.Arch Otolaryngology 1983; 109:616-8
- [3] D Orta JA, Shatney CH. Post traumatic pseudoaneurysm of the internal maxillary artery. J Trauma 1982; 22:161-4
- [4] Rogers SN, Patel M, Berne JC, Nixon TE- Traumatic aneurysm of the maxillary artery; The role of interventional radiology. J Oral Maxillofacial Surg 1995; 24:336-9
- [5] Lanigan DT, Hey JH, West RA. Major vascular complications of orthognathic surgery: False aneurysm and arteriovenous fistulas following orthognathic surgery. J Oral Maxillofacial Surg 1991; 49:571-7
- [6] Chaloupke JC, Putman CM,Ci Tardi MJ, Ross DA, Sasaki, CT. Endovascular therapy for the carotid blowout syndrome in head and neck surgical patients: Diagnostic and managerial considerations, AJNR Am J Neuroradiol
- [7] Cameron HS, Laird JJ, Carroll SE: False aneurysms, complicating closed fractures, J Trauma 1972; 12: 67-74
- [8] Gerbino G, Roccia F, Grosso M, Regge, D. Pseudoaneurysm of the internal maxillary artery and Frey syndrome after blunt facial trauma. J Oral Maxillofacial Surg 1997; 55:1485-90
- [9] Luo CB, Teng MM,Chang FC, Chang CY, Role of CT and endovascular embolization in managing pseudoaneurysms of the intrernal maxillary artery. J Chin Med Assoc 2006;69:310-6
- [10] Karanth SK, Jagannathan M,Mahesh SG, Devale M. Internal maxillary artery pseudoaneurysm in a case of mandibular fracture. Indian J Plast Surg 2007; 40:51-3
- [11] Kenji Kawano ,Mandibular Arteriovenous Malformation treated by transvenous coil embolization, JOMS 2001; 10.1053
- [12] Kuehne JP, Weaver FA, Papanicolaou G,Yellin AE: “ Penetrating trauma of the internal carotid artery” Arch Surg 1996 131:942-947
- [13] Chandler JP, Sekhar LN: “Intravascular stents and cerebrovascular disease” Crit Rev Neurosurg 1997, 7:315-323
- [14] SN Rogers, M Patel, JC Beirne and TE Nixon, Traumatic aneurysm of maxillary artery: the role of interventional radiology. Int J Oral Maxillofacial Surg 1995 pp. 336-339
- [15] JT. Hong, SW Lee, YK Lha, BC Son, JH Sung and IS Kim et al,Traumatic pseudoaneurysm of the superficial temporal artery treated by endovascular coil embolization 2006 pp. 86-88
- [16] Tsumoto T, Natakakita K, Hayashi S, Terada T: “Bone defect associated with middle meningeal arteriovenous fistula treated by embolization- case report” Neuro Med Chir 2001,41:42-47
- [17] Satoh T, Sakurai M, Yamamoto Y, Asari S: “Spontaneous closure of a traumatic middle meningeal arteriovenous fistula” Neuroradiology 1983,25:105-109

AUTHORS

First Author – Dr.Harshmohan Pathak,MDS,Institute of Dental sciences,Bhubaneswar, e-mail Id: dr.pathakharsh@gmail.com

Second Author – Dr.Santosh kumar Subudhi,MDS, ,Institute of Dental sciences,Bhubaneswar, e-mail Id:santosh.subudhi1976@yahoo.com

Third Author – Dr.Subrat padhiary,MDS, Institute of Dental sciences,Bhubaneswar,email id: subrat.padhiary@gmail.com

Adsorption Studies of Plant Base Oil and Mineral Oils on Tea Powder Waste

Geetha K.S and Belagali S.L

DOS in Environmental Science, Manasagangothri, University of Mysore-570006, Karnataka, India.

Abstract- The natural plant based adsorbent (Tea powder) was activated by heating and treating it with 2N HCl and dried at 150°C for 2 hrs, stored and used for adsorption studies. The Groundnut oil, Coconut oil, Gingelly oils and Hydrocarbons like Hexane, Benzene, Kerosene, Petroleum ether and Toluene were selected for adsorption studies. The pH and heat had no effects on oil as it is inert to the same, at room temperature. The contact time and dose had effect on the adsorption which increases the adsorption with increase in the time and dose. The XRD spectral study of adsorbent before and after adsorption, confirms the adsorption process. The percentage of adsorption was calculated using spectrophotometry.

Index Terms- Adsorption, Tea powder, Mineral oil, Plant base oil, Contact time, XRD.

I. INTRODUCTION

One of the most challenging environmental problems today is the removal of oil from waste water and storm water. A large amount of waste water is generated by industrial companies that produce or handle oil and other organic compounds, both immiscible and miscible in water. Some of these organic materials are discharged into the environment for example, offshore oil spills and oils released during oil well extraction.

Oily waste water discharged into the environment causes serious pollution problems since the biodegradability of oil is very low and oily waste water hinders biological processing at sewage treatment plants (Jose *et al.*, 2009). Petroleum and petrochemical plants are potential oil sources for polluting inland water caused by runoff from oil fields, refineries and process effluents (Johnson *et al.*, 1973).

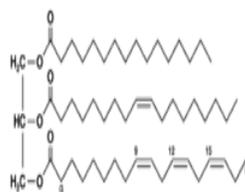
Removing oil contamination from water is a common problem with water from oilfields storm water run-off. Typical storm water run-off is often contaminated with oil, benzene, toluene, fuels and other contaminants from rooftops and pavement.

Current technologies for oil removal include Skimming, filtration, gravity separation, induced flotation, ultra filtration, adsorption and biological treatment. An oil and water mixture can be classified as free oil (Manual, 1969) for oil droplets larger than 150µm, dispersed oil with oil droplets in the range of 20-150µm and emulsified oil with oil droplets smaller than 20µm (Manning and Snider, 1983). Waste water, where the oil in the oil-water mixture is not present in the form of droplets. Biological treatment of oil-water mixtures is limited only to low concentrations of oil in water since the microorganisms do not tolerate high oil concentrations and therefore its use is limited to

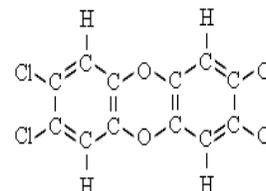
very specific applications. With the increase of population and development of society, waste water treatment became necessary in most places. Pollutants removal is the main objective in this situation (Zhang Guangming, 2011).

In the present day scenario, one of the key point of prevention and minimization of pollution is recycling of starting materials. This separation process may not only solve the economy but will potentially help keeping the environment clean (Pal Anjali, 2008). In this paper, we have made an attempt to remove the oil from water using natural adsorbent i.e, Tea waste. The oils selected for our study are Gingili, Coconut, Ground nut, Hexane, Petroleum ether, Benzene, Toluene, Kerosene as plant and mineral oils.

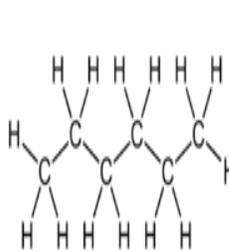
Structures of Plant base oil and Mineral oil.



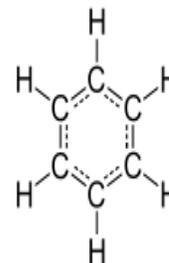
Triglyceride (Plant oil)



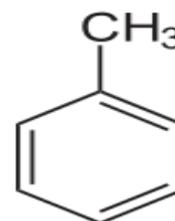
Kerosene



Hexane



Benzene



Toluene

II. MATERIALS AND METHODS

Processing of Tea waste for adsorption:

Tea waste was cleaned with tap water then treated with 2N HCl. Once again it was washed and pH was maintained at neutral condition, heated for 2 hrs and used for adsorption study.

Preparation of oil solution:

The plant and mineral oils like Coconut oil, Ground nut oil, Gingelly oil, Benzene, toluene, Petroleum ether and Kerosene were selected for adsorption study.

1ml of oil was directly added to 100 ml of distilled water. The immiscible solution was mechanically churned (Emulsified) and immediately initial optical intensity was noted for all the oils. Solution was used for adsorption process.

The percentage of adsorption was calculated by the formula:

$P = \frac{I_0 - I}{I_0} \times 100$, where, I_0 is the Final optical density, I is the Initial optical density.

Batch Experiment:

Oil adsorption was conducted with 50ml stock solution. The variables studied were adsorbent dose, concentration of adsorbate, pH and contact time.

III. RESULT AND DISCUSSION

The effects of parameters like pH, dose of adsorbent and contact time on the removal of oil in aqueous media was investigated with respect to tea waste (natural adsorbent).

- i. Effect of pH: Oil does not get affected either by acid or alkali unless heat was applied.
- ii. Effect of temperature: Oil was heat resistant. But reacts with acid or base while heating.
- iii. Effect of dose: 50 ml of 1% oil solution was taken in series of beakers, 2-5g of adsorbent was added and kept for adsorption for 48 hrs. The result showed that, as dose increases, adsorption increases (graph-1).
- iv. Effect of contact time: 50 ml of 1% oil solution was taken, 2g of adsorbent was added and kept for adsorption. As contact time increased adsorption increased.

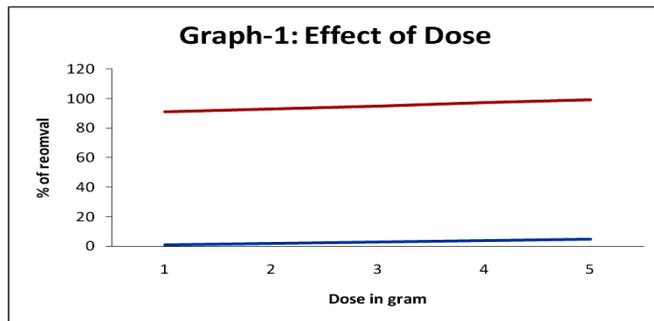
Note: i. The adsorbent and adsorbate should be agitated for higher removal efficiency.

ii. Tea powder has low density than water and floats on surface of water. When tea powder comes in contact with oil, oil get adsorb on surface of tea powder, then the density of tea powder increases and settles at bottom which confirms the saturation point (adsorption) of tea powder.

Fig-1: The immiscible oil before and after adsorption using tea waste.



Fig-2: The graph showing relation between dose and adsorption.



Statistical analysis for Dose Vs Contact time(R value).

The correlation coefficient value 0.976 shows favorable relation with increase in dose and time of all the oils with that of adsorbent.

Oil removed	Percentage removal (Initial reading/Final reading X 100)
Ground nut oil	90.96 %
Gingelly oil	85.72 %
Coconut oil	93.44 %
Petroleum ether	80.55 %
Toluene	83.63 %
Benzene	80.55 %
Hexane	82.27 %
Kerosene	72.82 %

Table-1: Percentage removal of different types of oils.

IV. DISCUSSION AND CONCLUSION

Comparing diffraction patterns from the tea surface before and after the adsorption of oils, it was confirmed the adsorption and the intensity was as follows:

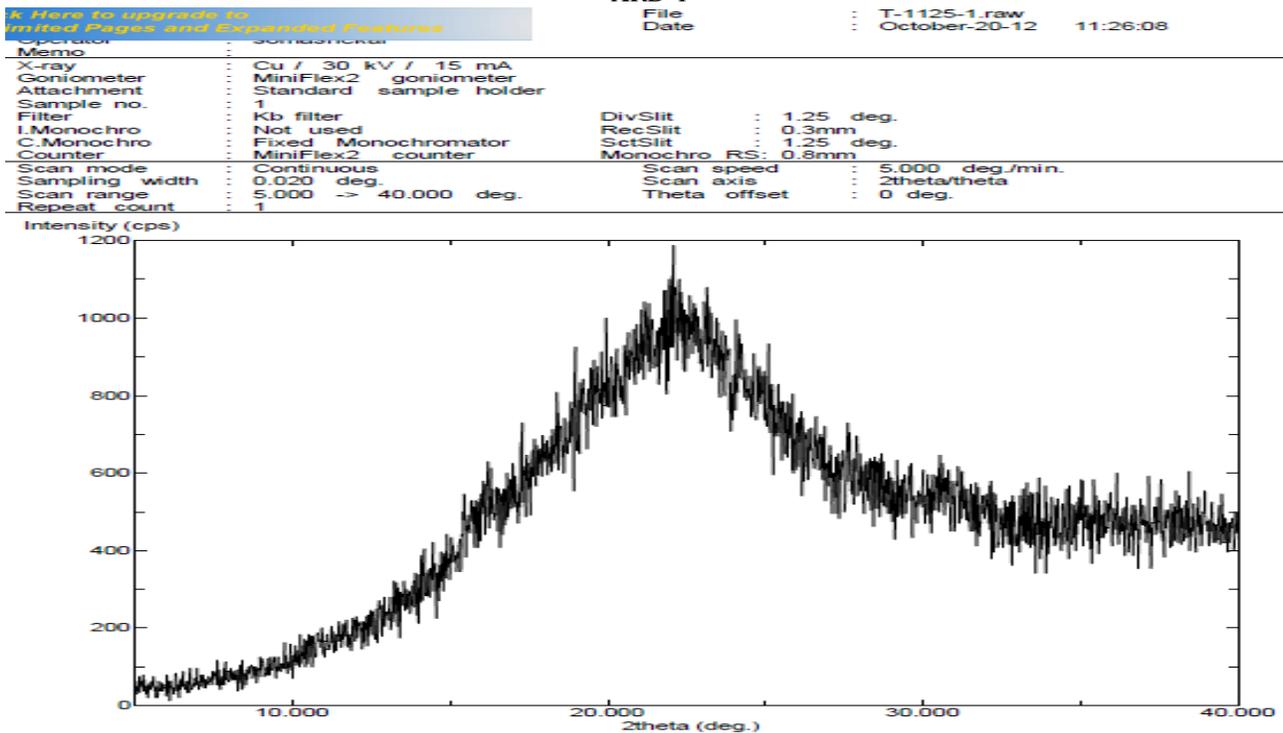
The intensity of the tea powder without adsorption was 1100 cps in XRD spectrum-1, when compared with the XRD spectra of waste Tea powder adsorbed with Gingili oil (XRD-2), Coconut oil (XRD-3), Ground nut oil(XRD-4), Benzene(XRD-5), Kerosene (XRD-6), Petroleum ether (XRD-7), Toluene (XRD-8) and Hexane (XRD-9) showed the peaks at the intensity of 900, 1750, 1600, 1100, 1750,1500, 1000 and 1200 cps respectively.

Hence the tea powder waste can be used as adsorbent for the removal of plant base and mineral oils from oil contaminated water.

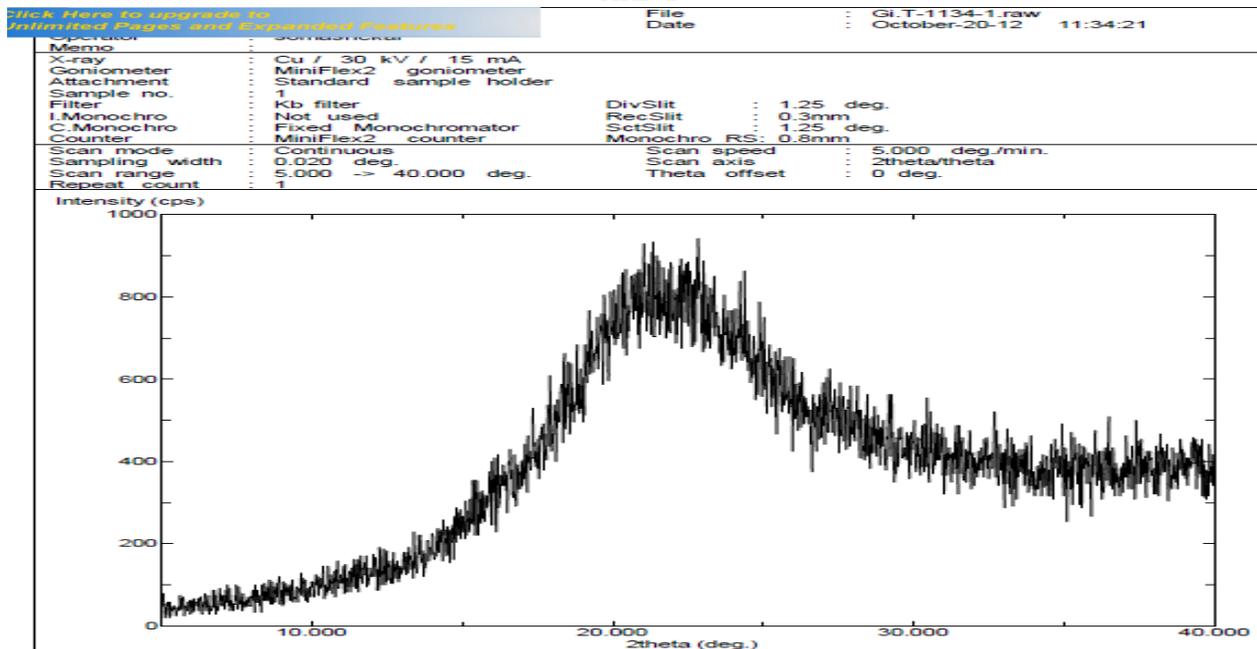
APPENDICES

XRD spectra of Tea powder before and after adsorption of the plant oils and Hydrocarbon:

XRD-1



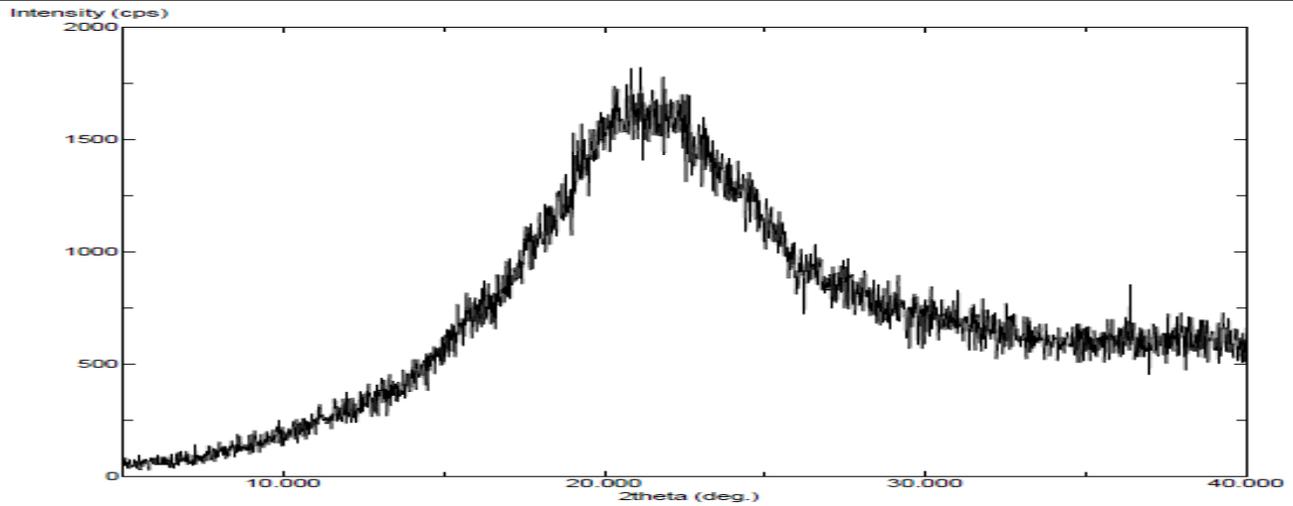
XRD-2



XRD-3

Click Here to upgrade to unlimited Pages and Expanded Features

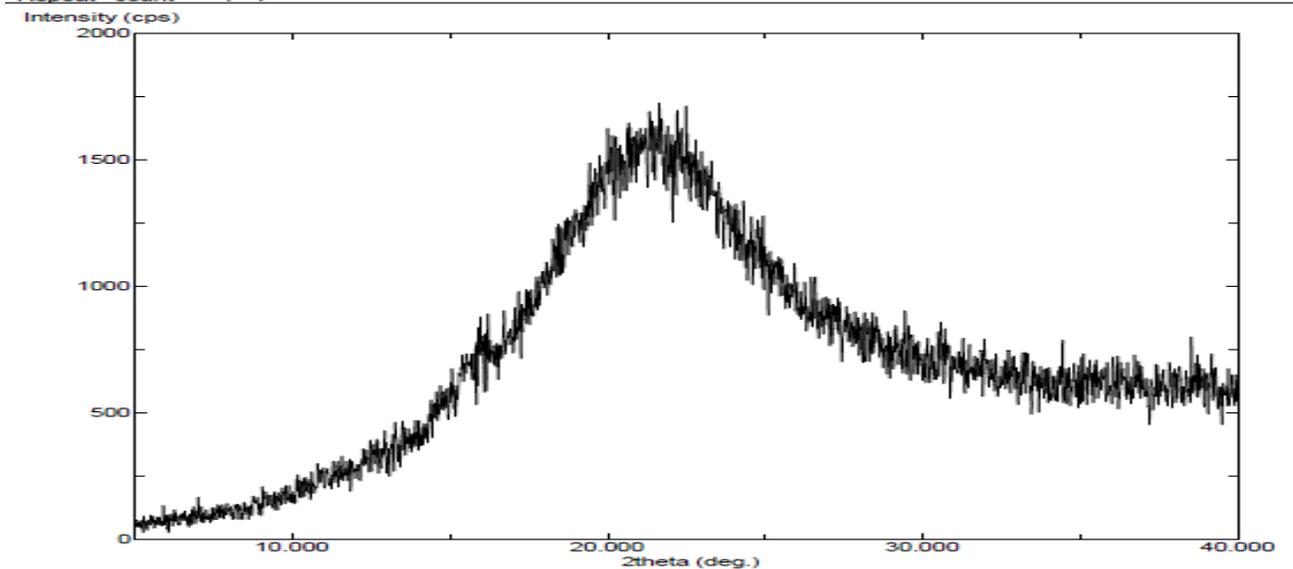
Operator	somashickal	
Memo		
X-ray	Cu / 30 kV / 15 mA	
Goniometer	MiniFlex2 goniometer	
Attachment	Standard sample holder	
Sample no.	1	
Filter	Kb filter	DivSlit : 1.25 deg.
I.Monocho	Not used	RecSlit : 0.3mm
C.Monocho	Fixed Monochromator	SctSlit : 1.25 deg.
Counter	MiniFlex2 counter	Monochro RS: 0.8mm
Scan mode	Continuous	Scan speed : 5.000 deg./min.
Sampling width	0.020 deg.	Scan axis : 2theta/theta
Scan range	5.000 -> 40.000 deg.	Theta offset : 0 deg.
Repeat count	1	



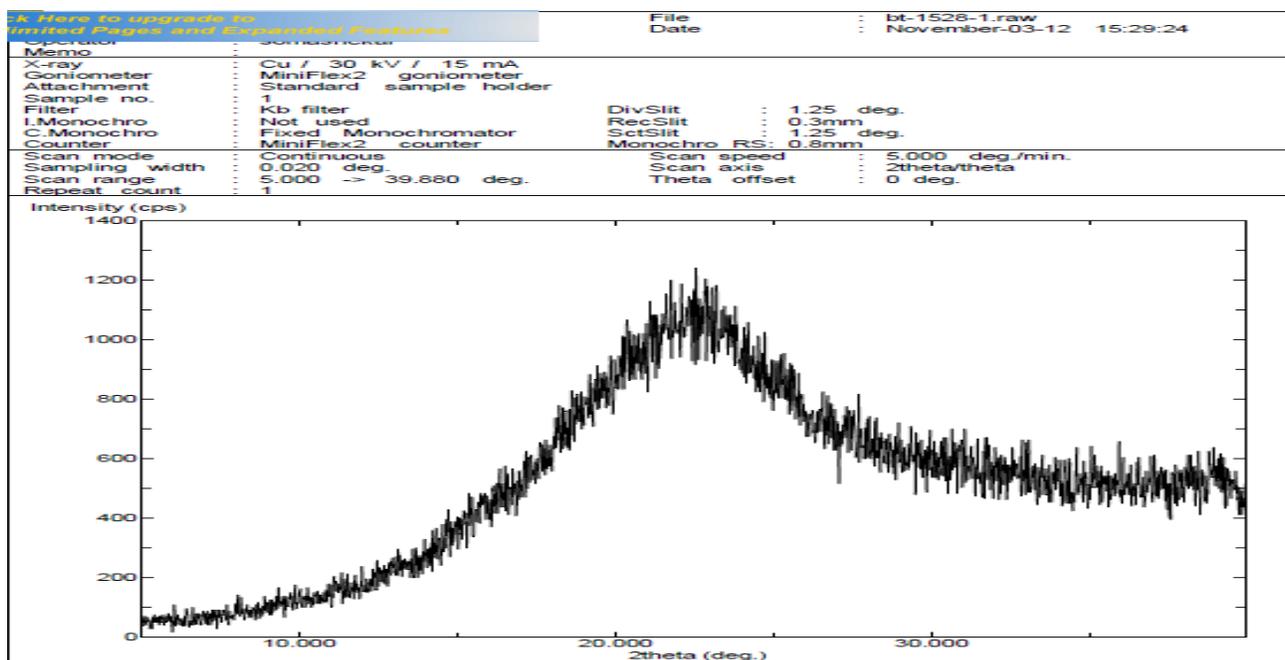
XRD-4

Click Here to upgrade to unlimited Pages and Expanded Features

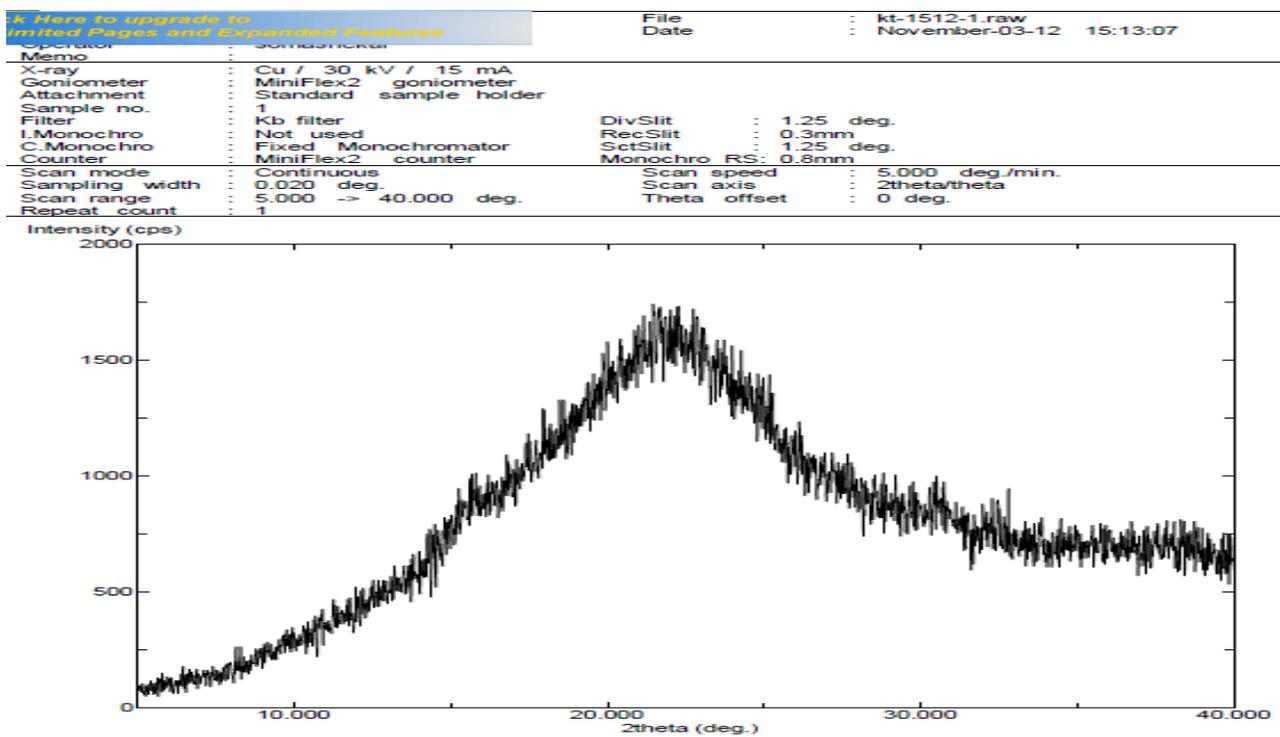
Operator	somashickal	
Memo		
X-ray	Cu / 30 kV / 15 mA	
Goniometer	MiniFlex2 goniometer	
Attachment	Standard sample holder	
Sample no.	1	
Filter	Kb filter	DivSlit : 1.25 deg.
I.Monocho	Not used	RecSlit : 0.3mm
C.Monocho	Fixed Monochromator	SctSlit : 1.25 deg.
Counter	MiniFlex2 counter	Monochro RS: 0.8mm
Scan mode	Continuous	Scan speed : 5.000 deg./min.
Sampling width	0.020 deg.	Scan axis : 2theta/theta
Scan range	5.000 -> 40.000 deg.	Theta offset : 0 deg.
Repeat count	1	



XRD-5

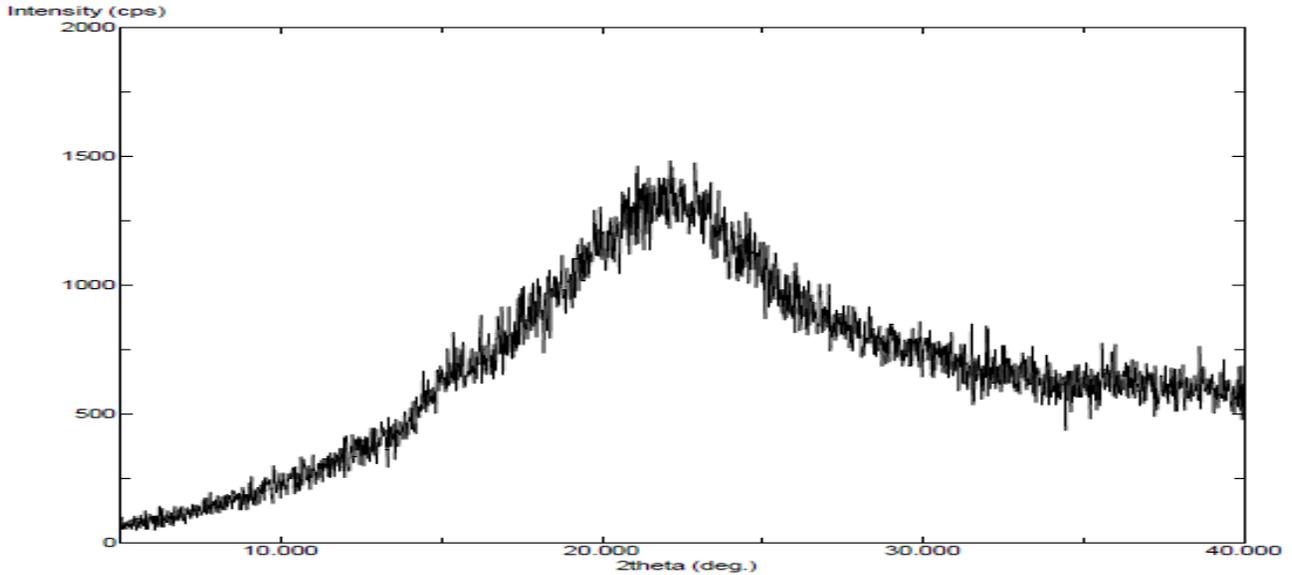


XRD-6



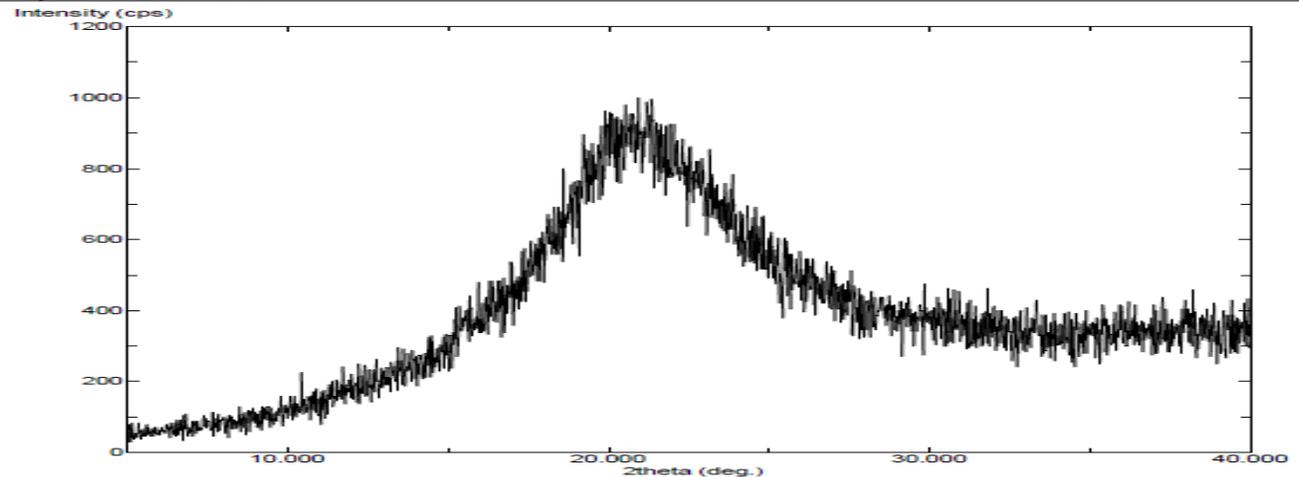
XRD-7

Click Here to upgrade to limited Pages and Expanded Features		File	: pet-1503-1.raw
Operator : somashekar		Date	: November-03-12 15:04:25
Memo			
X-ray	: Cu / 30 kV / 15 mA		
Goniometer	: MiniFlex2 goniometer		
Attachment	: Standard sample holder		
Sample no.	: 1		
Filter	: Kb filter	DivSlit	: 1.25 deg.
I.Monochro	: Not used	RecSlit	: 0.3mm
C.Monochro	: Fixed Monochromator	SctSlit	: 1.25 deg.
Counter	: MiniFlex2 counter	Monochro RS:	: 0.8mm
Scan mode	: Continuous	Scan speed	: 5,000 deg./min.
Sampling width	: 0.020 deg.	Scan axis	: 2theta/theta
Scan range	: 5.000 -> 40.000 deg.	Theta offset	: 0 deg.
Repeat count	: 1		

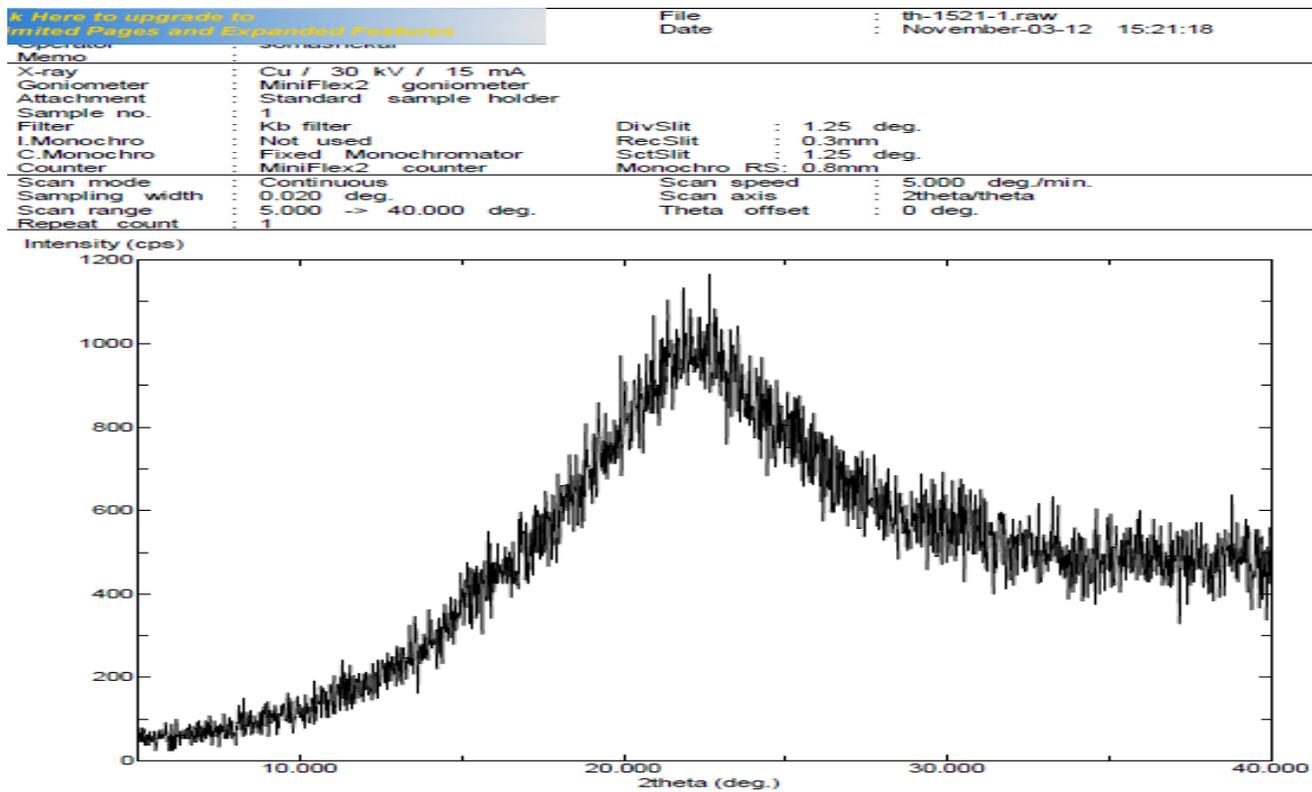


XRD-8

Click Here to upgrade to limited Pages and Expanded Features		File	: T.T-1151-1.raw
Operator : somashekar		Date	: October-20-12 11:52:06
Memo			
X-ray	: Cu / 30 kV / 15 mA		
Goniometer	: MiniFlex2 goniometer		
Attachment	: Standard sample holder		
Sample no.	: 1		
Filter	: Kb filter	DivSlit	: 1.25 deg.
I.Monochro	: Not used	RecSlit	: 0.3mm
C.Monochro	: Fixed Monochromator	SctSlit	: 1.25 deg.
Counter	: MiniFlex2 counter	Monochro RS:	: 0.8mm
Scan mode	: Continuous	Scan speed	: 5,000 deg./min.
Sampling width	: 0.020 deg.	Scan axis	: 2theta/theta
Scan range	: 5.000 -> 40.000 deg.	Theta offset	: 0 deg.
Repeat count	: 1		



XRD-9



ACKNOWLEDGMENT

One of the authors Miss Geetha K.S. is grateful to UGC, New Delhi for Financial support, Prof. R. Somashekar and Research Scholars, Physics Department, Manasagangothri, University of Mysore, Mysore-6 for providing XRD spectra of the samples.

Second Author – Prof. Belagali S.L., Professor, DOS in Environmental Science, University of Mysore, Manasagangothri, Mysore-570006, Karnataka, India.

REFERENCES

- [1] Jose. A. Quevedo, Gaurav Patel and Robert Pfeffer, Removal of oil from water by Inverse Fluidization of Aerogels, *J. Ind. Eng. Chem. Res.* **2009**, *48*, 191-201.
- [2] Johnson R.F, Manjrekar T.G, Halligan, H.R. Removal of oil from water surfaces by sorption on unsaturated fibers. *Environ. Scie.Technology*, **1973**, *7*, 439-443.
- [3] Manual on Disposal of Refining Wastes, *American Petroleum Institute, Washington, D.C., 1969, Vol. 5*, pp5-15.
- [4] Manning F, Snider E.H. Assessment data base for petroleum refining wastewater and residues, U.S.Department of Commerce, NTIS, Washington, D.C, **1983**, *9*, 4-101.
- [5] Zhang Guangming, Wastewater treatment, beyond pollutants removal, *Res J. chem. Environ*, **2011**, *15*(4), 3-4.
- [6] Pal Anjali, Adosubilization of organic pollutants, *Res. J. Chem. Environ*. **2008**, *12* (4), 3-4.

AUTHORS

First Author – Geetha K.S., Research scholar, DOS in Environmental Science, University of Mysore, Manasagangothri, Mysore-570006, Karnataka, India., E-mail: geethasmruthi@gmail.com.

A Benchmark to Select Classification Algorithms for Decision Support Systems

Mahendra Tiwari*, Randhir Singh**

* Research Scholar, UPRTOU, Allahabad

** Asstt. Professor, UIM, Allahabad

Abstract- Decision Support System is developing from its starting as a support tool and it is becoming the common resource in an organization. Decision Support System serve the management level of an organization for support to make decisions. Data Mining and DSS can lead to the improved performance and can enable to handle new types of problems. Classification is main task of Data Mining, various types of classification algorithms have been proposed and compared to determine the trends on data.

There has been no single algorithm are to be superior over all others for data sets. Robustness and scalability must be considered for judging the suitable algorithm for any data, In this paper two decision tree algorithm, one algorithm are tested and compared.

Index Terms- Classification, DSS, DM

I. INTRODUCTION

Decision Support System is a computer based support system for management decision makers who deal with unstructured or semi-structured problems. DSS becomes more essential in the area of large scale database design, we are rapidly and increasingly aware of the hidden treasure of new knowledge quietly residing in our data and face difficulties when attempting to get it. Data Mining is defined as the extraction of hidden knowledge, exceptional patterns and new findings from huge database. Integration of Data Mining and Decision Support System can enhance the performance of various applications which faces new types of problem.

II. CLASSIFICATION ALGORITHM

Decision Tree: Decision tree induction is the learning of decision trees from class-labeled training tuples. A decision tree is a flowchart-like tree structure, where each internal node (non leaf node) denotes a test on an attribute, each branch represents an outcome of the test, and each leaf node (or terminal node) holds a class label. The topmost node in a tree is the root node.

Naïve Bayesian: Bayesian classifiers are statistical classifiers. They can predict class membership probabilities, such as the probability that a given tuple belongs to a particular class Bayesian classification is based on Bayes' theorem. Naive Bayesian classifiers assume that the effect of an attribute value on a given class is independent of the values of the other attributes. This assumption is called class conditional independence. It is made to simplify the computations involved

and, in this sense, is considered "naive" Bayesian belief networks are graphical models

III. DETAILS OF DATA SET

I used 2 data set for evaluation with classifier on WEKA ,both of them from UCI Data repository that are labor data set and supermarket data set inbuilt in WEKA 3-6-6 and are in arff file format.

Table 1: Detail of data set

Data set	Type of file	No of attributes	No of instances	Attribute characteristics	Dataset characteristics	Missing value
Labor	ARFF	17	57	Categorical	Multi-variate	No
Supermarket	ARFF	217	4627	Categorical	Multi-variate	No

3.1 Data set:- Labor data

Instances: 57

Attributes: 17

Duration, wage-increase-first-year, wage-increase-second-year, wage-increase-third-year, cost-of-living-adjustment, working-hours Pension, standby-pay, shift-differential, education-allowance, statutory-holidays, vacation, longterm-disability-assistance contribution-to-dental-plan, bereavement-assistance, contribution-to-health-plan, class

3.2 Data set:- Supermarket data

Instances: 4627

Attributes: 217

Departments, Baby needs, Bread & cake, Baking needs, coupons, juice-sat-cord-ms, tea, biscuits, canned fish-meat, canned fruit, canned vegetables, breakfast food, cigs-tobacco, cigarette cartons, cleaners, coffee etc

IV. EVALUATION OF CLASSIFIERS ON DIFFERENT DATA SET

we tried to evaluate the performance of various classifiers on two test mode 10 fold cross validation and percentage split with different data sets at WEKA 3-6-6,

Parameter for Comparison:

- I. Test mode: It is defined as cross-validation test mode and percentage split test mode for evaluation.
- II. Time to build model: It is a term that describes how much time taken to build classifier model
- III. Correctly classified instances: It is defined as how many instances are correctly classified
- IV. Incorrectly classified instances: It is defined as how many instances are not classified.

4.1 Test mode

Cross validation-Labor data:-

Table 2: classifiers with cross validation test mode

Classifier	Classifier model	Test mode	Correctly classified instances	In correctly classified instances	Mean absolute error
Lazy-IBK	Full training set	Cross-validation	47/57 (82.45%)	10/57 (17.54%)	0.1876
Lazy-KStar	Full training set	Cross-validation	51/57 (89.47%)	6/57 (10.52%)	0.0948
Naive Bayes	Full training set	Cross-validation	51/57 (89.47%)	6/57 (10.52%)	0.1042
Rules-OneR	Full training set	Cross-validation	43/57 (75.43%)	14/57 (24.56%)	0.2456
Rules-ZeroR	Full training set	Cross-validation	37/57 (64.91%)	20/57 (35.08%)	0.4574
Function-SMO	Full training set	Cross-validation	51/57 (89.47%)	6/57 (10.52%)	0.1053
Tree-CART	Full training set	Cross-validation	45/57 (78.94%)	12/57 (21.05%)	0.2709
Tree-Decision stamp	Full training set	Cross-validation	46/57 (80.70%)	11/57 (19.29%)	0.2102

Percentage split-Labor data:-

Table 3:Classifiers with percentage split test mode

Classifier	Classifier model	Test mode	Correctly classified instances	In correctly classified instances	Mean absolute error
Lazy-IBK	Full training set	Percentage Split	17 (89.47%)	2 (10.52%)	0.1053
Lazy-KStar	Full training set	Percentage Split	16 (84.21%)	3 (15.78%)	0.154
Naive Bayes	Full training set	Percentage Split	15 (78.94%)	4 (21.05%)	0.225
Rules-OneR	Full training set	Percentage Split	16 (84.21%)	3 (15.78%)	0.1579
Rules-ZeroR	Full training set	Percentage Split	13 (68.42%)	6 (31.57%)	0.4539
Function-SMO	Full training set	Percentage Split	17 (89.47%)	2 (10.52%)	0.1432
Tree-CART	Full training set	Percentage Split	16 (84.21%)	3 (15.78%)	0.1997
Tree-Decision stamp	Full training set	Percentage Split	18 (94.73%)	1 (5.26%)	0.0774

Cross validation-Supermarket data:-

Table 4: Classifiers with cross validation test mode

Classifier	Classifier model	Test mode	Correctly classified instances	In correctly classified instances	Mean absolute error
Function-SMO	Full training set	Cross-validation	2948 (63.71%)	1679 (36.28%)	0.3629
Naive Bayes	Full training set	Cross-validation	2948 (63.71%)	1679 (36.28%)	0.4624
Rules-ZeroR	Full training set	Cross-validation	2948 (63.71%)	1679 (36.28%)	0.4624

Classifier	Training Set	Validation Set	Correctly Classified Instances	Incorrectly Classified Instances	Mean Absolute Error
Rules - OneR	Full training set	Cross-validation	3110 (67.21%)	1517 (32.78%)	0.3279
Lazy-IBK	Full training set	Cross-validation	1718 (37.12%)	2909 (62.87%)	0.6218
Trees-CART	Full training set	Cross-validation	2948 (63.71%)	1679 (36.28%)	0.4624
Trees-Decision stamp	Full training set	Cross-validation	2980 (64.40%)	1647 (35.59%)	0.4212
Function-SMO	Full training set	Cross-validation	2948 (63.71%)	1679 (36.28%)	0.3629

4.2 Correctly Classified instances:

Table 6: correctly classified instances of labor and supermarket data set

Classifier	Data Set			
	Labor	Correctly classified (cross validation)	Supermarket	Correctly classified (cross validation)
Lazy-IBK	57	47/57 (82.45%)	4627	2909 (62.87%)
Lazy-KStar	57	51/57 (89.47%)	4627	----
Naïve Bayes	57	51/57 (89.47%)	4627	2948 (63.71%)
Rules-OneR	57	43/57 (75.43%)	4627	3110 (67.21%)
Rules-ZeroR	57	37/57 (64.91%)	4627	2948 (63.71%)
Function-SMO	57	51/57 (89.47%)	4627	2948 (63.71%)
Tree-CART	57	45/57 (78.94%)	4627	2948 (63.71%)
Tree-Decision stamp	57	46/57 (80.70%)	4627	2980 (64.40%)

Percentage split-Supermarket data:-

Table 5: Classifiers with percentage split test mode

Classifier	Classifier model	Test mode	Correctly classified instances	In correctly classified instances	Mean absolute error
Function-SMO	Full training set	Percentage split	986 (62.68%)	587 (37.31%)	0.3732
Naïve Bayes	Full training set	Percentage split	986 (62.68%)	587 (37.31%)	0.4639
Rules-ZeroR	Full training set	Percentage split	986 (62.68%)	587 (37.31%)	0.4639
Rules-OneR	Full training set	Percentage split	1030 (65.48%)	543 (34.52%)	0.3452
Lazy-IBK	Full training set	Percentage split	602 (38.27%)	971 (61.72%)	0.6111
Trees-CART	Full training set	Percentage split	986 (62.68%)	587 (37.31%)	0.4639
Trees-Decision stamp	Full training set	Percentage split	1027 (65.28%)	546 (34.71%)	0.4221
Function-SMO	Full training set	Percentage split	986 (62.68%)	587 (37.31%)	0.3732

4.3 Incorrectly classified instances:

Table 7: Incorrectly classified instances of labor and supermarket data set

Classifier	Data Set			
	Labor	Incorrectly classified (cross validation)	Supermarket	Incorrectly classified (cross validation)
Lazy-IBK	57	10/57 (17.54%)	4627	2909 (62.87%)
Lazy-KStar	57	6/57 (10.52%)	4627	
Naïve Bayes	57	6/57 (10.52%)	4627	1679 (36.28%)
Rules-OneR	57	14/57 (24.56%)	4627	1517 (32.78%)
Rules-ZeroR	57	20/57 (35.08%)	4627	1679 (36.28%)
Function-SMO	57	6/57 (10.52%)	4627	1679 (36.28%)
Tree-	57	12/57	4627	1679

CART		(21.05%)		(36.28%)
Lazy-IBK	57	10/57 (17.54%)	4627	2909 (62.87%)

4.4 Time taken to build model:

Classifier:-OneR(Rules)
Test mode:-cross validation

=== Classifier model (full training set) ===
wage-increase-first-year:
< 2.9 -> bad
>= 2.9 -> good
(48/57 instances correct)

Time taken to build model: 0 seconds
=== Stratified cross-validation ===
Correctly Classified Instances 43 75.4386 %
Incorrectly Classified Instances 14 24.5614 %
Kappa statistic 0.4209
Mean absolute error 0.2456
Root mean squared error 0.4956
Relative absolute error 53.6925 %
Root relative squared error 103.7961 % Total Number of Instances 57

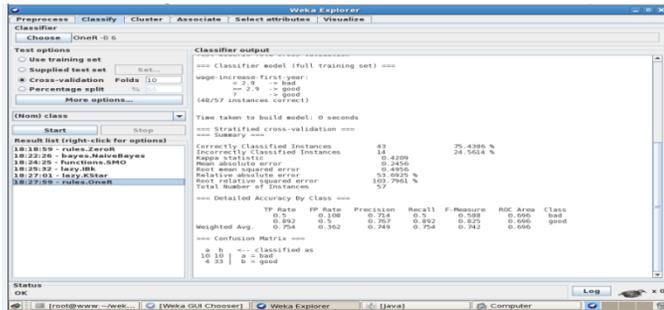


Fig. 1 : One R classifier on Letter image data set with cross validation

Classifier:-Naïve Bayes
Test mode:-percentage split
Data set:- Labor data

Time taken to build model: 0 seconds
=== Evaluation on test split ===
Correctly Classified Instances 18 94.7368 %
Incorrectly Classified Instances 1 5.2632 %
Kappa statistic 0.8725
Mean absolute error 0.0774
Root mean squared error 0.2486
Relative absolute error 17.0566 %
Root relative squared error 53.0567 %
Total Number of Instances 19

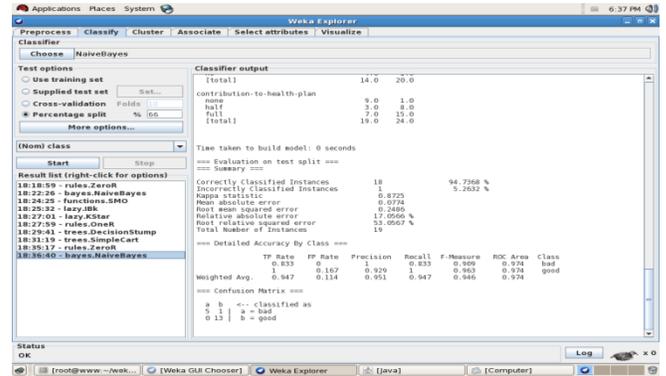


Fig. 2 : Naïve Bayes on Labor data set with percentage split

Classifier:-ZeroR(Rules)
Test mode:-cross validation
Data set:-Supermarket data

Time taken to build model: 0 seconds
=== Stratified cross-validation ===
Correctly Classified Instances 2948 63.713 %
Incorrectly Classified Instances 1679 36.287 %
Kappa statistic 0
Mean absolute error 0.4624
Root mean squared error 0.4808
Relative absolute error 100 %
Root relative squared error 100 %
Total Number of Instances 4627

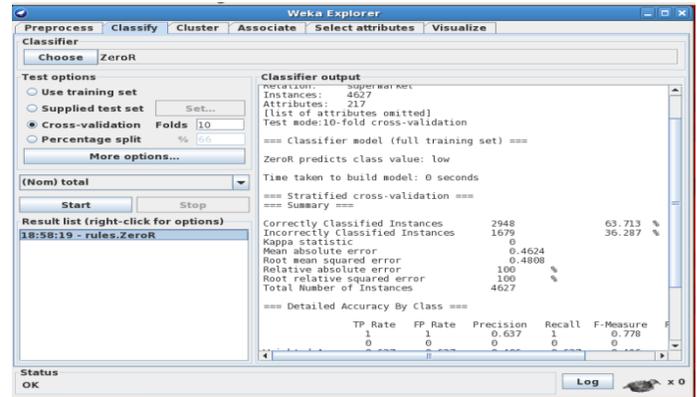


Fig. 3 : Zero R on Supermarket data set with cross-validation

Classifier:-OneR(Rules)
Test mode:-percentage split
Data set:-Supermarket data

Time taken to build model: 0.03 seconds
=== Evaluation on test split ===
Correctly Classified Instances 1030 65.48 %
Incorrectly Classified Instances 543 34.52 %
Kappa statistic 0.2267
Mean absolute error 0.3452
Root mean squared error 0.5875
Relative absolute error 74.4136 %
Root relative squared error 121.4181 %
Total Number of Instances 1573

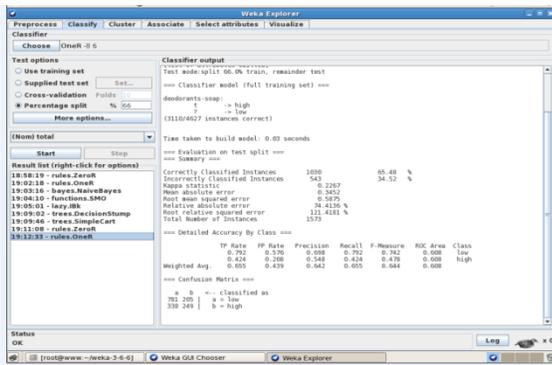


Fig 4: One R on Supermarket data set with percentage split

- [22] C. Ling and C. Li, (1998) "Data mining for direct marketing: Problem and solutions," in Proc. of the 4th international Conference on Knowledge Discovery & Data Mining, pp. 73-79
- [23] John, F., Elder iv and Dean W.(1998) A comparison of leading data mining tools, fourth International conference on Knowledge discovery and data mining pp.1-31

AUTHORS

First Author – Mahendra Tiwari, Research Scholar, UPRTOU,Allahabad
Second Author – Randhir Singh, Asstt. Professor, UIM,Allahabad

V. CONCLUSION

Lazy-kstar algorithm most successfully classified instances of labor data set with cross validation test mode, while Naïve Bayes worked best with percentage split test mode on labor data. Rules OneR performed very well in both the test modes for supermarket data.

REFERENCES

- [1] www.boirefillergroup.com/...KDD_CONFERENCE_PAPER_AUG2006.pdf
- [2] www.dcc.fc.up.pt/~ricroc/aulas/0708/atdmlp/material/paper_dmbiz06.pdf
- [3] www.ecmlpkdd2006.org/ws-pdmaec.pdf
- [4] http://www.linkedin.com/in/federicocesconi
- [5] www.linkedin.com/in/federicocesconi
- [6] www.footwearsinfolinethree.tripod.com/indian_retail_industry_its_growth_
- [7] Open source Initiative: The open source definition(2007) www.Opensource.org/docs/definition_plain.html
- [8] Retail and Consumer Worlds, Pricewaterhousecoopers, January, 2009
- [9] Bose B.S. (2003), "Handbook of Marketing Management", Himalaya Publish in house, New Delhi.
- [10] Bishop. C.M. (1995) Neural Networks for pattern Recognition. New York: Oxford University Press
- [11] Bigus, J.P. (1996) Data Mining with Neural Networks: Soling Business Problem- from Application Development to Decision Support. New York: McGraw-Hill.
- [12] Jiawei han, Micheline Kamber, Data mining : concepts & Techniques (2nd edition).
- [13] Decision Trees for Business Intelligence & Data Mining: using SAS Enterprise minor.
- [14] DB2 Intelligent miner library(2002), Using the intelligent miner for data ,IBM, version 8 release 1.
- [15] SAS Enterprise miner documentation, what's new in SAS enterprise miner 5.1 SAS Institue Inc.
- [16] SPSS Inc,(2005), maximize your returns with data mining and predictive analysis, Clementine.
- [17] Peter M. chen and David A.(1993), storage performance-metrics and bench marks, Proceeding of the IEEE, 81:1-33
- [18] M.Chen, J. Han, and P. Yu. (1996) Data Mining Techniques for marketing, Sales, and Customer Support. IEEE Transactions on Knowledge and Data Eng., 8(6)
- [19] Agrawal R, Mehta M., Shafer J., Srikant R., Aming (1996) A the Quest on Knowledge discovery and Data Mining, pp. 244-249..
- [20] Chaudhuri, S.Dayal, U. (1997) An Overview of Data Warehousing and OLAP Technology. SIGMOD Record 26(1) 65-74
- [21] John F. Elder et all, (1998) A Comparison of Leading Data Mining Tools, Fourth International Conference on Knowledge Discovery & Data Mining

Lean Healthcare Practice and Healthcare Performance in Malaysian Healthcare Industry

Nurul Aifaa Shazali*, Nurul Fadly Habidin**, Naimah Ali*, Nur Afni Khaidir*, Noor Hidayah Jamaludin*

** Department of Management and Leadership, University Pendidikan Sultan Idris, Tanjung Malim, Perak, MALAYSIA

*Department of Accounting and Finance, University Pendidikan Sultan Idris, Tanjung Malim, Perak, MALAYSIA

Abstract- Recently, Malaysia healthcare industry has been continuously vigilant about healthcare system. The increase the number of medical schools showed that Malaysia is serious about providing quality healthcare. Healthcare system is faced with challenges and opportunities from a rapidly changing operating environment, including increasing expectations on the quality of healthcare. Hence, this paper attempts to review and proposed structural relationship model of lean healthcare practices (LHP) and a healthcare performance. A structural relationship model using Structural Equation Modeling (SEM) has been proposed. Based on the proposed conceptual model and reviewed, research hypotheses are being developed. The paper culminates with suggested future research work.

Index Terms- Lean healthcare practice, performance measurement, healthcare performance, healthcare industry

I. INTRODUCTION

Healthcare in Malaysia is mainly under the responsibility of the government's Ministry of Health. Malaysia healthcare system is divided into two sectors consisting of both a government healthcare system and private healthcare system. Healthcare is one of the 12 National Key Economics Areas (NKEA) under the 10th Malaysia Plan (2011-2015). Contribution and investment in healthcare industry expected to help high income nation of year 2020 [1]. In addition, Malaysia has been continuously vigilant about effective healthcare system. The increase the number of medical schools is showed that Malaysia is serious about providing quality healthcare, not only to its citizens, but also to expatriates, tourists, migrants, and visitors.

Healthcare system is faced with challenges and opportunities from a rapidly changing operating environment, including increasing expectations on the quality of healthcare. Lean concept originally developed in the automotive industry to deliver high quality product and services while improving organizational performance and satisfying customers [2]. However, some organizations have begun adapting these concepts for the healthcare industry. Rexhepi and Shrestha [3] mentioned that there is need of lean in the healthcare sector. This is not only applicable in hospitals, but also in the private clinics or nursing home. Hagg *et al.*, [4] has been state that lean is an effective tool for identifying and eliminating waste from process. The benefit and goal of applying lean in healthcare is to best approach to reduce waste, as well as reducing wait times and unnecessary travel, while building quality, speed, and flexibility into the organization [2].

Therefore, if the Malaysia is serious about providing better quality in healthcare, they need to consider implement lean healthcare practice (LHP). So, the purpose of this paper are (1) to identify the LHP and HP measures for Malaysian Healthcare Industry and (2) to develop research model of the LHP and HP measures relationship for Malaysian Healthcare Industry. As a result, this research want to investigating what does LHP that are contribute to HP in Malaysian Healthcare Industry. In this research, there are four domain categories of LHP that are considered: LHP are Leadership (L), Employee Involvement (EI), Organizational Culture (OC) and Customer Focus (CF) while the three elements of HP: Financial Performance (FP), Customer Satisfaction (CS) and Employee Performance (EP).

II. LITERATURE REVIEW

Figure 1 present the LHP framework which developed in this research. The framework proposes that LHP will have an impact on HP directly. LHP is conceptualized as a three-dimensional constructs as well as three performance outcomes (HP). Four dimensions for LHP are Leadership (L), Employee Involvement (EI), Organizational Culture (OC) and Customer Focus (CF) while three dimensions for HP are: Financial Performance (FP), Customer Satisfaction (CS) and Employee Performance (EP).

Lean Healthcare Practice

Many healthcare organizations adopt the Toyota Production Systems as the practices and performance improvement that often called the Lean Healthcare management system [5]. Lean initiative does not focus on large scale investments, but it gives healthcare organizations an alternative methodology for achieving improvement without high investments [6]. Dahlgard *et al.*, [7] defines LHP is to develop hospital culture characterized by increased patient and other stakeholder satisfaction and everybody participate in identifying and reduce waste.

Leslie *et al.*, [2] defined LHP as a lean is a strategy focused on efficiencies and thereby allowing more time for patient care activities while Doss and Orr [8] has been state LHP as a process elimination waste in every area of operations for reducing inventory, cycle times and cost to delivering higher quality patient services. In addition, Poksinska *et al.*, [5] state that LHP is a system designed to provide the tools for people to continually improve their work and add value to the service they are deliver.

Meanwhile, the service organization such as healthcare industry, lean is applicable to organizations that have limited information and face interruption on task performance. This is because, the services encounter high costs with slow processes because of non value added activities, which lead to poor quality and low customer satisfaction [3].

Previously, there are several key factors that influencing the success of lean implementation. Identifying Critical Success Factors (CSFs) are very important in ensuring the successful of lean practice implementation and to avoid the failure risk such as will create lost to organization's cost, time and employee's effort [9]. Besides that, by identify the critical success factors, it can be ensure a positive outcome of the lean implementation in healthcare. Below are the summaries and construct factors influencing the successful implementing lean practices.

Table 1: The Summary for CSFs of Lean Practice Implementation

Authors	L	OC	EI	CF	CI
Harmon [10]			*		
Achanga [11]	*	*			
Doss and Orr [8]	*				
Kuo <i>et al.</i> [12]			*	*	
Vermaak [13]	*		*		
Kumar <i>et al.</i> [14]	*	*		*	
Hamid [9]	*	*	*	*	
Papadopoulos [15]					*
Folinas and Faruna [16]					*
Steed [17]	*				
Najem <i>et al.</i> , [18]	*	*			
Kundu and Manohar [19]	*	*			
Total	8	5	4	3	2

A. Leadership

According to Rexhepi and Shrestha [3] top management is the most important of the critical success factor of lean implementation. Implementation of lean is not possible without management support. Therefore, leadership is recognized as critical aspects for implementation of lean and other quality systems [18]. Referred to the previous studies, organization cannot succeed in lean unless it has healthy culture, skilled workers, the buy-in from the top management and strong leadership [18]. Angueloy *et al.*, [20] also found that the level of continuous leadership commitment to lean is a factor that considerably affected the outcome of lean practice.

B. Employee Involvement

Abdullah *et al.*, [21] emphasized that employee involvement is one of the important factor to drive the positive impact on quality improvement. This is because, employee behavior plays an important role on customer's perception of service quality [22]. Moreover, educate and empower staff is one of the process improvement in healthcare sector by involving all employee in the process. According to Harmon *et al.*, [10] high involvement works systems were associated with both greater employee satisfaction and lower patient service cost in 146 Veterans Health Administration centers. Besides that, increased in staff involvement were impact of increased job satisfaction, commitment, patient satisfaction and patient outcomes [23].

C. Organizational Culture

Managing organizational culture is increasingly viewed as an important part of healthcare reform [24]. Organizational culture is recognized as a critical aspect for implementation of lean and other quality systems [18]. According to Shahzad *et al.*, [25] a positive and strong culture can make an average individual perform and achieve brilliantly thus can impact on the employee's job performance. It also can improve in the productivity and enhance the organizational performance. Carney [26] identified that organizational culture influence to deliver quality of care. Thus, hospital with the best workplace cultures had the highest patient satisfaction and loyalty [27].

D. Customer Focus

More of the objective of any lean initiative is to focus on customer needs to the maximum level by identifying and ultimately eliminating the wastes [18]. The healthcare units recognized the patient as a primary customer and as a critical factor to be taken into consideration when designing process and delivering care [5, 25, 29, 30]. Furthermore, hospitals should provide higher quality health care services and give greater attention to patients by focusing always on their needs when implementing lean in hospital [3]. Studies show that orienting health care around the preferences and needs of patients has the potential to improve patients' satisfaction with their care, as well as their clinical outcomes. Thus, hospital that provide patient-centered care will have some of financial benefits such as lower cost per case, decrease adverse events, higher employee retention rates, reduced operating cost, decreased malpractice claims and increased market share [31].

Healthcare Performance

Performance measurement is instrument to promote the achievement of health system objectives [32]. According to the theory of quality management, the improvement initiatives have a significant positive correlation with performance [9]. According to previous study, an effective performance measurement will help to guide an organization to evaluate key process and effect positive change to improve care [33]. Outcome is useful to establish performance benchmarks, which identify the best performance in the industry and assessing the effectiveness, quality and value of healthcare service. In this paper, more focus on three performance construct such as Financial Performance (FP), Customer Satisfaction (CS) and Employee Performance (EP).

A. Financial Performance

Most of the healthcare industries aim to reduce cost while improving patient satisfaction and outcomes when implementing lean in healthcare. This is because unnecessary operational inefficiency can increase cost in healthcare. Koning *et al.*, [34] found in their study that implementing lean in healthcare can control healthcare cost increase. This supported by Papadopoulos [15]; Rexhepi and Shrestha, [3]; Folinas and Faruna, [16] successful in implementing lean in healthcare can increase higher income and lower cost for organization. Therefore, financial performance is one important performance measurement in healthcare.

B. Patient Satisfaction

Patient satisfaction is an important for evaluating and improvement of healthcare service. Patient satisfaction is providing the evidentiary basis for measuring patient, clinicians and organizational outcomes [35]. Therefore, patient outcome is a major key of performance measurement in healthcare [35]. Besides that, patient’s satisfaction from healthcare decides the healthcare delivery system and hence needs to be periodically measured to enhance the quality of service [36]. Thus, better outcome for patient usually imply more accessible care with shortened treatment time and waiting time [5].

C. Employee Performance

Lean initiative in healthcare can influence on employee and work environment. Therefore, employee can increase attention to waste and more productive attitude to problem solving [5]. Besides that, lean healthcare make staff are more receptive to patient demands [37]. Furthermore, employee can reduce stress and increased their morale by implementing lean in healthcare [3, 15].

III. RESEARCH HYPOTHESES

The lean healthcare practice framework developed in this study proposes that LHP has a direct impact on HP. Therefore, based on literature review and the research framework, the following hypotheses of the study have been developed:

H1: There is a positive and direct significant relationship between of LHP and HP in the Malaysian healthcare industry.

Lean service has shown great success in healthcare system [3]. Recent studies have explored the relationship between lean healthcare practice and healthcare performance. There are many studies proven that implementation lean in healthcare given positively result for healthcare performance. Study by Koning *et al.*, [34] found that lean can controlling healthcare cost increase, improving quality and providing better in healthcare. According to finding by Erfan [38] that applied the lean initiative in the healthcare sector in Libya had achieved significant improvement in the overall performance which allowed be more productive, flexible, smooth and with high quality service. From Institute of Healthcare Improvement, two healthcare organizations in the US showed positive impact on productivity, cost, quality and timely delivery of services after applied lean through organization [39]. Table 2 showed the benefits of LHP in healthcare industry.

Table 2: Benefits of Lean Practice in Healthcare Industry

Authors	Hospital	Benefits
Papadopoulos [3]	Pathology Unit of NHSCO hospital in UK NHS	<ul style="list-style-type: none"> • Improvements in turnaround times for all specimens inpatients, outpatients and doctors • Staff morale • Lower costs • Help in quicker clinical decisions • More efficient patient care
Rexhepi and Shrestha [15]	Rheumatology Department in University Clinical Center Of Kosovo.	<ul style="list-style-type: none"> • Reduced waiting times • Reduced stress for employees • Increased patient satisfaction • Higher income for organizations
Folinas and Faruna [16]	Three major hospital in the Federal Capital Territory, Abuja and Nigeria	<ul style="list-style-type: none"> • Stoppage of unnecessary movement within the hospital • Reduced waiting time • Increased patient satisfaction • Reduced the cost • Striving to perfection for flow of service by eliminating wastes

IV. RESEARCH METHODOLOGY

In this study, sampling method by using structured questionnaire. The population of this study comprised in Malaysian Healthcare Industry. Questionnaires will distribute to manager in Malaysian Healthcare Industry. To analyze the data, two statistical techniques were adopted. Structural Equation Modeling (SEM) techniques were utilized to perform the required statistical analysis of the data from the survey. Exploratory factor analysis, reliability analysis and confirmatory factor analysis to test for construct validity, reliability, and measurements loading were performed. Having analyzed the measurement model, the structural model was then tested and confirmed. The statistical Package for the Social Sciences (SPSS) version 17 was used to analyze the preliminary data and provide descriptive analyses about thesis sample such as means, standard deviations, and frequencies. SEM using AMOS 6.0 will use to test the measurement model.

V. A PROPOSED RESEARCH MODEL

Based on the literature review, many previous studies were explored LHP, and HP. The research aims at analyzing of the relationship between LHP and HP for Malaysian Healthcare Industries. This model is called proposed research model as presented in Figure 1.

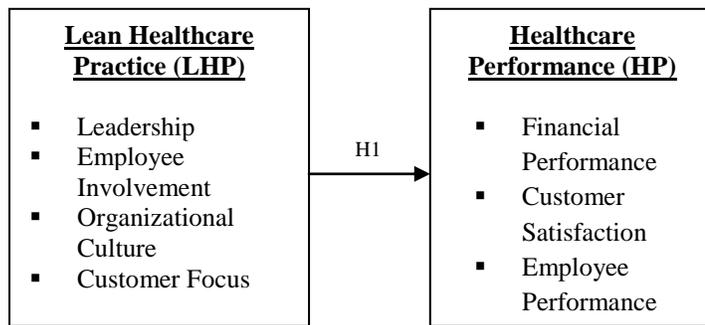


Figure 1: Research Model

V1 CONCLUSION AND FUTURE RESEARCH

LHP has become most important for HP. Previous studies have been performed to identify critical success factors for successful implementation of lean. However, limited empirical study tried to investigate the relationship between LHP and HP especially in Malaysian Healthcare industries. Based on proposed model and a previous study, research hypotheses are being developed. The next step of this study is to design a questionnaire, which will be used for pilot study data collection in Healthcare Industries in Malaysia. Hopefully in future research agenda, the findings study can be benefited, used and contribute not only to academic but also to the industry, especially to the Malaysian Healthcare industries.

ACKNOWLEDGEMENT

The researchers would like to acknowledge the Ministry of Higher Education (MOHE) for the financial funding of this research thought Fundamental Research Grant Scheme (FRGS), Research Management Centre (RMC), UPSI for Research University Grant (RUG).

REFERENCES

- [1] MGCC, "Market Watch 2011" The Healthcare Sector in Malaysia. Malaysian-German Chamber of Commerce & Industry, 2011.
- [2] M. Leslie, C. Hagood, A. Royer, C. P. Reece, and S. Maloney, "Using Lean Methods to Improve OR Turnover Times," *Aorn Journal*, vol. 84, no. 5, pp. 849-855, 2006.
- [3] L. Rexhepi, and P. Shrestha, "Lean Service Implementation in Hospital: A Case study conducted in University Clinical Centre of Kosovo, Rheumatology department", Master Thesis, Umea School of Business, Umea University, Sweden, 2011.
- [4] H. Hagg, D. Suskovich, J. Workman, S. Scachitti, and B. Hudson, Adaption of Lean Methodologies for Healthcare Applications. RCHE Publications, vol. 24, 2007.
- [5] B. Poksinska, "The Current State of Lean Implementation in Health care: Literature Review," *Manage Health Care*, vol. 19, no. 4, pp. 319-329, 2010.
- [6] J. A. Bahensky, J. Roe, R. Bolton, "Lean Sigma-will It Work for Healthcare?," *Journal Healthcare Information Managemant*, vol. 19, no. 1, pp. 39-44, 2005.
- [7] J. J. Dahlgaard, J. Pettersen, and S. M. Dahlgaard-Park, "Quality and lean health care: a system for assessing and improving the health of health organisations," *Total Quality Management*, vol. 22, no. 6, pp. 673-689, 2011.
- [8] R. Doss, and C. Orr, "Lean Leadership in Healthcare," White Paper, 2007.
- [9] R. A. Hamid, "Factor Influencing The Success of Lean Services Implementation: Conceptual Framework," *International Conference on Business and Economic Research Proceeding*, 2011.

- [10] J. Harmon, D. J. Scotti, S. Behson, G. Farias, R. Petzel, J. H. Neuman, and L. Keashly, "Effects of High Involvement Work Systems on Employee Satisfaction and Service Costs in Veterans Healthcare," *Journal of Healthcare Management*, vol. 48, no. 6, pp. 393-407, 2003.
- [11] P. Achanga, E. Shehab, R. Roy, G. Nelder, "Critical Success Factors for Lean Implementation Within SMEs," *Journal of Manufacturing Technology Management*, vol. 17, no 4, pp 460-471, 2006.
- [12] T. Kou, J. Shen, Y. Chen, "A Study on Relationship Between Lean Production Practices and Manufacturing Performance," *International Symposium Of Quality Management, Kaohsiung, Taiwan*, 2008.
- [13] T. D. Vermaak, "Critical Success Factors For The Implementation of Lean Thingking in South African Manufacturing Organizations," Faculty Mangement at The University of Johannesburg, 2008.
- [14] M. Kumar, J. Antony, and A. Douglas, "Does Size Matter for Six Sigma Implementation? Findings from The Survey In UK SMEs", *The TQM Journal*, vol. 21, pp. 623-635, 2009.
- [15] T. Papadopoulas, "Continuous Improvement and Dynamic Actor Associations," *Leadership in Healthcare Service*, vol. 24, no. 3, pp. 207-227, 2011.
- [16] D. Folinas, and T. Faruna, "Implementing Lean Thinking Paradigm Practices In Medical Set Up," *Business Management Dynamics*, vol. 1, no. 2, pp. 61-78, 2011.
- [17] A. Steed, "An exploration of the leadership attributes and methods associated with successful lean system deployments in Acute Care Hospitals," *Quality Manage Health Care*, vol. 21, no. 1, pp. 48-58, 2012.
- [18] M. AL Najem, H. N. Dhakal, N. Bennett, "The Role Of Culture and Leadership in Lean Transformation : A Review and Assessment Model," *International Journal of Lean Thinking*, vol 3, no. 1, pp. 119-138, 2012.
- [19] G. Kundu, and B. M Manohar, "Critical Success Factors For Implemeting Lean Practices in IT Support Service," *International Journal for Quality research*, 2012.
- [20] Z. Angueloy, D. Vetterick, A. Eller, S. Sigh, "Use of Lean in the Emergency Department: A Case Series of 4 Hospitals," *Annals of Emergency Medicine*, 2009.
- [21] M. M. Abdullah, J. Uli, and J. J. Tari, "The Influence of Soft Factors on Quality Improvement and Performance: Perceptions from Managers," *The TQM Journal*, vol. 20, no. 5, pp. 436-452, 2008.
- [22] H. Liao, and A. Chuang, "A Multilevel Investigation of Factors Influencing Employee Service Performance and Customer Outcomes," *Academy of Management Journal*, vol. 47, no. 1, pp. 41-58, 2004.
- [23] D. M. Neuhauser, "Impact of Staff Engagement on Nurse Satisfaction/Retention and Patient Outcomes of Patient Satisfaction and Ndnqi® Indicators," Master Thesis, Faculty of The Graduate School of Western Carolina University, 2011.
- [24] T. Scott, R. Mannion, H. T. O. Davies, M. N. Marshall, "Implementing culture change in health care: theory and practice," *International Journal for quality in Health Care*, vol. 15, no. 2, pp. 111-118, 2003.
- [25] F. Shahzad, R. A. Luqman, A. R. Khan, and L. Shabbir, "Impact of Organizational Culture on Organizational Performance: An Overview," *Interdisciplinary Journal of Contemporary Research Business*, vol. 3, no. 9, pp. 975-982, 2012.
- [26] M. Carney, "Influence of organizational culture on quality healthcare delivery," *International Journal of Health Care Quality Assurance*, vol. 24, no. 7, pp. 523-539, 2011.
- [27] T. Olivo, "The Connective Link Between Organizational Culture and Performance in Healthcare Organization," White Paper, 2007.
- [28] S. Endsley, M. K. Magill, M. M. Godfrey, "Creating a Lean Practice," *Family Practice Management*, vol. 13, no. 4, pp. 34-38, 2006.
- [29] D. Ben-Tovim, J. Bassham, D. Bolch, M. Martin, M. Dougherty, and M. Szwarcbord, "Lean Thinking Across A Hospital: Redesigning Care At The Flinders Medical Centre," *Australia Health Review*, vol. 31, no. 1, pp. 10-15, 2007.
- [30] D. Fillingham, "Can lean save lives?," *Leadersh Health Service*, vol. 20, no. 4, pp. 231-241, 2007.
- [31] , P. A. Charnel and S. B. Frampton, "Building the Business Case for Patient-Centered Care," Healthcare Financial Management Association, 2008B.
- [32] P. C. Smith, E. Mossialos, I. Papanicolas, and S. Leatherman, "Performance Measurement for Health System Improvement: Experiences, Challenges and Prospects," World Health Organization 2008 and World Health Organization, 2008.
- [33] D. Nadzam, and M. Nelson, "The Benefits of Continuous Performance Measurement, Nursing Clinics of North America, vol 32, no 3, pp. 543-559, 1997.

- [34] H. D. Koning, J. P. S. Verver, J. V. D. Heuvel, S. Bisgaard, and R. J. M. M. Does, "Lean Six Sigma in Healthcare," *Journal of Healthcare Quality*, vol. 28, no. 2, pp. 4-11, 2006.
- [35] M. Cowing, C. M. D. Ramay, K. Ramaya, and J. Szmerkovsky, "Health Care Delivery Performance: Service, Outcomes, and Resource Stewardship," *The Permanente Journal*, vol. 13, no.4, pp. 72-77, 2009.
- [36] I. Ahamd and S. U. Din, "Patients' Satisfaction from The Health Care Services," *Gomal Journal of Medical Sciences*, vol. 8, no. 1, pp. 95-97, 2010.
- [37] M. Balle, A. Regnier, "Lean as A Learning Systems in Hospital Ward," *Leadership Healthcare Service*, vol 20, no 1, pp. 33-41, 2007.
- [38] O. M. Erfan, "Application of Lean Manufacturing to Improve The Performance of Healthcare Sector in Libya," *International Journal of Engineering & Technology*, vol. 10, no. 6, pp. 117-128, 2010.
- [39] D. Miller, "Going Lean in Health Care, Institute for Healthcare Improvement, Cambridge, MA, 2005.

AUTHORS

First Author – Nurul Aifaa Shazali, A Master Candidate at Department of Accounting and Finance, Faculty of Management and Economics, University Pendidikan Sultan Idris, nurulaifaa89@yahoo.com

Second Author – Nurul Fadly Habidin, Lecturer Department of Management and Leadership, University Pendidikan Sultan Idris, fadly@fpe.upsi.edu.my

Third Author – Naimah Ali, A Master Candidate at Department of Accounting and Finance, Faculty of Management and Economics, University Pendidikan Sultan Idris, naimah_ali89@yahoo.com

Fourth Author – Nur Afni Khaidir, A Master Candidate at Department of Accounting and Finance, Faculty of Management and Economics, University Pendidikan Sultan Idris, nurafnikhaidir@yahoo.com

Fifth Author – Noor Hidayah Jamaludin, A Master Candidate at Department of Accounting and Finance, Faculty of Management and Economics, University Pendidikan Sultan Idris, noorhidayahjama@yahoo.com

Correspondence Author – Nurul Fadly Habidin, fadly@fpe.upsi.edu.my

Obesity- Caused by a germ?

Anjum Jeelani *, Syed Afroz Ahmed*, Farah Vaqar Momin**

* Department of Oral & Maxillofacial Pathology, Sri Sai College of Dental Surgery, Vikarabad, India

** Department of Periodontology, Dr D Y Patil Dental College, Lohegaon, Pune, India

Abstract- Obesity has reached epidemic proportions in India in the 21st century, affecting majority of the country's population both young and old. The pathophysiology of obesity has been attributed to various etiological factors such as hormones, diet, genetic and inflammatory nature. The microbiota in the mouth have a significant impact on both the oral and general health. The salivary microbiota is a potential diagnostic indicator of several diseases. Recent research suggests that the composition of salivary bacteria changes in overweight subjects, and it is likely that *Selenomonas noxia* could serve as biological indicator of a developing overweight condition.^{1, 2} Culture –independent techniques are required to study the salivary microbial community since many of its members have not been cultivated³.

Recently an infectious nature of obesity is being explored and the role of single bacterial species (*Selenomonas noxia*) in saliva has been suggested in pathology that leads to obesity. *Selenomonas noxia* is a normal commensal of the oral cavity,⁴ however its count has been reported to have increased significantly in obese individuals, suggesting its direct or indirect role in the etiology of obesity.

Hence, the present study was conducted to evaluate the salivary populations of *Selenomonas noxia* in obese individuals, in order to explore their reliability as a biological indicator of obesity. Quantitative bacterial population were measured by Real-time PCR based on SYBR-Green I fluorescence in the saliva of obese and non-obese individuals.

Index Terms- Obesity, *Selenomonas noxia*, Real time PCR based on SYBR Green I fluorescence four.

I. INTRODUCTION

Obesity is one of the greatest health challenges of our time affecting a vast majority of the population of all age groups and is increasing at an alarming rate. Obesity rates have doubled in adults and tripled in children and adolescents over the last two decades⁵. It is a growing epidemic in many developed countries, and is arousing concern in developing countries.⁵

Obesity results from alterations in the body's regulation of energy intake, expenditure, and storage. Obesity is also caused by excessive calorie intake combined with inadequate amounts of physical activity. Obesity can also be caused by metabolic disorders.⁶

Recent evidence, primarily from investigations in animal models, suggests that the oral microbiota affects nutrient acquisition and energy regulation^{6, 7}. Obesity has also been shown repeatedly to be associated with an increased risk of mortality. Though a

number of treatment modalities have been suggested but none of them guarantees a permanent relief. Obesity is characterized by the abnormal or excessive deposition of fat in the body. It not only has adverse metabolic effects on health but also enhances oxidative stress.

The microbiota in the mouth has a significant impact on both the oral and general health. The bacteria of the oral cavity can be altered in disease conditions such as oral cancer and dental caries. These associations can be useful in diagnosis and potentially reflect an underlying etiology.¹ The salivary level of the bacterium *Selenomonas noxia* which is a motile, crescent-shaped, nonspore-forming, Gram-negative bacteria correlates with obesity^{1, 3}.

With the recognition of *Selenomonas noxia* as a potential contributor to obesity, quantitative bacterial population was measured by Real-time PCR based on SYBR-Green I fluorescence in the saliva of obese individuals and was compared with the levels of the same in the saliva of the non obese individuals.

II. MATERIALS AND METHODS

The present study was conducted on 21 obese subjects between the ages of 20 and 45 yrs. Age and sex matched individuals served as controls. All the subjects were recruited from the outpatient department of our institute. Individuals with chronic illness and long term medication were not included in the study.

Ethical clearance for undergoing the study was obtained from the Institutional Ethical Clearance Committee.

The obese group constituted of 21 individuals with body mass index (BMI) ranging from 27 and 32. Whereas 23 individuals with BMI < 27, with no known systemic diseases were recruited as controls.

2 to 3ml of unstimulated saliva was obtained from each subject in a sterile bottle by expectoration. Quantitative salivary bacterial population of overweight and control subjects was measured by Real-time PCR based on SYBR-Green I fluorescence. It is an assay based on SYBR-Green I binding that is quick, reliable, easily optimized and demonstrates its general applicability by measuring copy number in different genetic contexts⁹

III. STATISTICS

Data analysis was carried out using the statistical software package. The level of significance was accepted at *P* values <0.001 (Table 1). For statistical analysis ANOVA, and χ^2 test were used.

IV. RESULTS

As part of the study, salivary bacterial populations in 21 obese and 23 control individuals were measured targeting *Selenomonas noxia* by Real-time PCR based on SYBR-Green I fluorescence assay. It was observed that (*Selenomonas noxia*) microbial profiles differed markedly between obese individuals and controls and this difference was statistically significant. ($P < 0.001$) (Table 1)

Table 1: Characteristics of the subjects

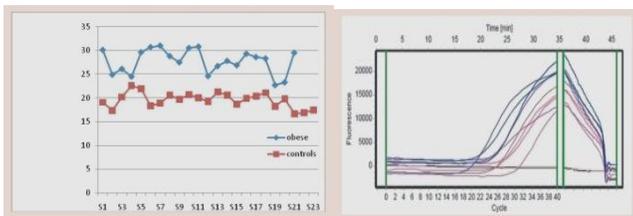
Variables	Obesity	Controls	p value
	(n=21) Mean (s.d.)	(n=23) Mean (s.d.)	
Male/female	12/9	13/10	1.000*
Age (years)	34.71 (1.31)	34.13 (1.33)	0.378+
Weight (kg)	86.28 (10.28)	60.69 (4.23)	<0.001+
Height (m)	1.66 (0.10)	1.64 (0.11)	0.345+
BMI (kg/m ²)	31.04 (2.10)	18.21 (1.9)	<0.001+
<i>Selenomonas noxia</i>	27.72 (2.56)	19.6 (1.61)	<0.001+

* Chi square test χ^2 as statistical method
+ ANNOVA as statistical method

This study reveals that specific bacteria (*Selenomonas noxia*) levels in the human mouth are higher in obese individuals when compared to that of non obese. (Table 2) Thus, *selenomonas noxia* species of bacteria may have some role, direct or indirect in the etiology of obesity.

Our results are in accordance with the observations made by **Goodson et al 2009**, who concluded that *Selenomonas noxia* levels in saliva may serve as biological indicator of obesity.¹ **Cecilia et al 2012**, studied association between obesity and sum of bacterial cells in the oral subgingival biofilm indicates a possible link between oral microbiota and obesity in adolescents.⁸

Table 2: *Selenomonas noxia* levels in obese and non obese group.



V. DISCUSSION

Analysis of the salivary microbiome may have implications in diagnostics e.g. in detection of microorganisms and viruses without designing specific tests for each pathogen². Bacteria that live in the human mouth may act as biological indicators of gaining excess weight, and may even participate in the disease process that leads to obesity.

The results of this study suggest that *Selenomonas noxia* profiles differed in saliva of overweight individuals when compared to

with the levels in the saliva of healthy individuals and were statistically significant.

Selenomonas noxia could be considered a disease candidate. The genus *Selenomonas* in general, are motile, crescent-shaped, non-spore-forming, Gram-negative bacteria which actively ferment glucose to produce propionic acid, and are obligate anaerobes found in both the mouth and the gastro-intestinal tract.¹

As reported by **Di Baise et al 2008**, several findings indirectly support the hypothesis that oral bacteria could be related to obesity.⁶

Studies conducted on animals demonstrated that gut microbiota promoted absorption of monosaccharides in mice, which resulted in lipogenesis. The authors hypothesized that individuals predisposed to obesity may have gut levels of Firmicutes that promote more efficient extraction and/or storage of energy from a given diet, compared with lean individuals, and that intentional manipulation of gut microbiology may be useful for controlling weight in overweight individuals^{1,6}.

Although these studies focused on gut bacteria, all gastrointestinal bacteria pass through the oral cavity at some time, and some of those transients might be located in, if not seeded from the oral cavity.^{1,6}

Selenomonas noxia were significantly higher in tissue surfaces other than saliva, lateral and dorsal surface of tongue (**Mager DL et al. 2003**)⁴.

In a different context, investigators suggested that obesity may spread in social networks in a quantifiable and discernable pattern that depends on the nature of social ties. They studied the social interactions between overweight and non-overweight humans (**Nicholas and Christakis, 2007**) and found that obesity appears to spread through social associations. This was true of siblings and spouses, but not of neighbours.^{1,9}

Researchers from Forsyth Institute, Boston, and Piracicaba Dental School, State University of Campinas, Piracicaba, São Paulo, Brazil conclude that it seems likely that these bacterial species could serve as biological indicators of a developing overweight condition.^{1,2} Future research will investigate the role oral bacteria plays in the pathology that leads to obesity^{1,5}

Tumor necrosis factor- α (TNF α) is one of many pro-inflammatory cytokines produced by diseased periodontal tissues that could be a pivotal inflammatory cytokine encouraging obesity. TNF α increases insulin resistance, induces C-reactive peptide production, and inhibits adiponectin, an important anti-inflammatory adipokine.¹ TLRs and adapter proteins were overexpressed in peripheral blood mononuclear cells (PBMCs) from obese subjects, which correlated with increased expression of TNF- α and IL-6. This association may explain a potential pathophysiological link between obesity and inflammation leading to insulin resistance. (**Rasheed Ahmed et al 2012**)¹⁰

Periodontal treatment is effective in reducing blood levels of TNF- α and C-reactive protein. By this mechanism, periodontal bacteria would be seen to stimulate the formation of

inflammatory cytokines such as TNF α that divert energy metabolism to lipid synthesis may contribute to obesity.^{1, 11}

The scientists (**Goodson et al 2009**)¹ suggests three possibilities: first oral bacteria may increase metabolic efficiency, reducing the amount of food the body burns – a speculative process called “infectobesity”.

Another possibility is that the oral bacteria can increase weight gain by increasing appetite – by stimulating your desire to chow down, the bacteria get more to eat, too.

A third hypothesis is that oral bacteria facilitate insulin resistance, screwing with your cellular metabolism so your body stores food as fat instead of burning it off.

Any small excess in calorie consumption with no change in diet or exercise could result in unacceptable weight gain by any of these mechanisms.¹ *Selenomonas noxia* represented a large percentage of the oral bacterial population and were significantly higher in tissue surfaces other than saliva, lateral and dorsal surface of tongue (**Mager et al., 2003**)^{1,4}.

As suggested by **Goodson et al 2009** it is not justified to suggest that *S. noxia* infections have an etiologic role in obesity.^{1,2} However, based on the data obtained in our study and several other similar studies, it is reasonable to suggest that *S. noxia* may be an indicator of change in oral microbial ecology.

The reasons for a relationship between obesity and oral bacteria are undoubtedly complex and varied. The relationship may be circumstantial, as being related to diet. It could be opportunistic, such as proliferation driven by metabolic changes that have occurred in the host. It could also be causal, as participating in initiation or propagation of the disease. Whatever the reason, it is clear that the parallel microbiological universe that travels with man changes, as man changes, and appears to be affected by a tendency to gain weight.^{1,2}

VI CONCLUSION

Thus, from our study it may be concluded that even in Indian population, there is a definite increase in levels of *Selenomonas noxia* in saliva of obese people when compared to those of non obese. This implies that, these bacteria may have some role, either direct or indirect in the etiology of obesity. However, further studies on larger sample size and individuals with different socioeconomic status may be required to clarify this relationship between oral bacteria (*Selenomonas noxia*) and obesity.

REFERENCES

- [1] Goodson JM, Groppo D, Halem S, Carpino E: Is obesity an oral bacterial disease? J Dent Res 2009, 88: pp.519-523.
- [2] Is obesity an oral bacterial disease? <http://www.sciencedaily.com/releases/2009/07/090708153240.htm>
- [3] Lazarevic et al. Analysis of the salivary microbiome using culture independent techniques. Journal of Clinical Bioinformatics 2012, 2:4, pp.1-9
- [4] Mager DL et al. Distribution of selected bacterial species on intraoral surfaces. J Clin Periodontol 2003; 30: pp. 644–654
- [5] Patients with Bells palsy do not benefit from antiviral agent. JADA 2009 ;140(9):pp108

- [6] DiBaise JK, Zhang H, Crowell MD, Krajmalnik-Brown R, Decker GA, Rittmann BE (2008). Gut microbiota and its possible relationship with obesity. *Mayo Clin Proc* 83: pp460-469
- [7] Kevin C. Costley, Timothy Leggett: Childhood Obesity: A Heavy Problem. April 1, 2010
- [8] Cecilia et al. Microbiota in the Oral Subgingival Biofilm is Associated with obesity in adolescence. (*Pediatric Obesity* 2012), 0, pp. 57-64
- [9] Nicholas A. Christakis, M.D., Ph.D., M.P.H., and James H. Fowler, Ph.D. The Spread of Obesity in a Large Social Network over 32 Years. *N Engl J Med* 2007;357: pp.370-9.
- [10] Rasheed Ahmad et al 2012. Elevated expression of the toll like receptors 2 and 4 in obese individuals: its significance for obesity-induced inflammation. *Journal of Inflammation* 2012, 9:48
- [11] Ritchie CS (2007). Obesity and periodontal disease. *Periodontol* 2000 44: pp154-163.

AUTHORS

First Author – Anjum Jeelani, Post graduate Student, Dept of Oral Pathology, Sri Sai College of Dental Surgery, Vikarabad, Email address: drje.anjum@gmail.com.

Second Author – Syed Afroz Ahmed, MDS, Professor and Head , Department of Oral Pathology, Sri Sai College of Dental Surgery Vikarabad, Email address: drsyedafroz@yahoo.com.

Third Author – Farah Vaqar Momin, MDS, Professor, Dept of Periodontology, , Dr D Y Patil Dental College, Lohegaon, Pune, India. drfarahmomin@yahoo.com

Correspondence Author – Dr Syed Afroz Ahmed, drsyedafroz@yahoo.com, duredent07@yahoo.com , + (91) 9849110905

A block based Encryption Model to improve Avalanche Effect for data Security

¹Ganesh Patidar, ²Nitin Agrawal, ³Sitendra Tarmakar

M.Tech. Scholar, CSE NIIST, Bhopal, patidar_g23@yahoo.co.in
Asst Prof CSE NIIST, Bhopal, seonitin79@gmail.com
Coordinator M.Tech NIIST, Bhopal, sitendra.tamrakar@yahoo.co.in

Abstract- Encryption is widely used to ensure security in public networks like the internet. Any type of data has its own attribute; therefore, various algorithms should be used to protect confidential data from unauthorized access. Mostly the available encryption algorithms are used for text data. However, due to large data size and real time constraints, algorithms that are good for textual data. In this research, a block-based encryption model is proposed for information security using a combination of logical and mathematical operation. This model will be used as a pre-encryption technique to confuse the relationship between the original data and the generated ones. The generated data are then fed to the proposed encryption model. Efficiency, Avalanche Effect, and Execution Time have been used to measure the security level of the data. The experimental results have shown that the existing algorithms resulted in a lower efficiency, a higher execution time, and a more uniform efficiency. This implies a high similarity and a good quality of the retrieved data compared to the original one. Another feature of the proposed model is its generality; it can be applied with any other traditional algorithm to enhance its performance. Experimental results have shown that using the proposed model along with the other algorithms resulted in a better performance compared to using the other algorithms alone.

Index Terms- Encryption, Decryption, Cryptography, Avalanche Effect

I. INTRODUCTION

In Usage of Cryptography or the art of hiding messages dates back to 1st century B.C. Ancient ciphers used the process of scrambling of the message to encipher. One serious drawback with this method is that it is prone to brute force attack. Modern methods are less affected by brute force attack because of the usage of keys. The use of the symmetric key encryption is common to ensure data integrity. Symmetric key encryption code can be divided into the block cipher and stream one, and block cipher algorithm has been developed extensively. In symmetric block ciphers, substitution and diffusion operations are performed in multiple rounds using sub-keys generated from a key generation procedure called key schedule. The key schedule plays a very important role in deciding the security of block ciphers. Currently, famous block cipher algorithms were made by the public project such as AES (Advanced Encryption Standard), DES (Data Encryption Standard, Triple Data Encryption Standard (TDES), International Data Encryption Standard (IDEA) Blow-Fish (BF) and RC6. Hardware and software implementation can be done of the existing algorithms, the important thing which type of implementation

is more useable in this field. Hardware implementation is too fast but implementation is very difficult and not easy to understand, so most of the user have preferred software implementation of the existing algorithm, proposed research has also concentrate on the software implementation. The block cipher can be categorized into Feistel structure and SPN (Substitution Permutation Network) one. Feistel structure has an advantage of the same algorithm between encryption and decryption, and the feature of SPN structure is that it has a different algorithm between encryption and decryption. In particular, the SPN structure has a disadvantage that its area increases twice compared with the Feistel one when SPN structure is implemented via hardware. Commonly all most all existing algorithm require 128-bit and variable-length block cipher encryption algorithm except DES (64) and TDES (192). Proposed encryption model has a modified Feistel structure and a advantage that it has no different algorithm between encryption and decryption. Thus, the proposed encryption model no needs for any extra space compared with the same structure of encryption and decryption at the time of implementation on software. The proposed encryption model has the same structure of encryption and decryption. We devise our model by inserting a symmetric layer using simple rotation and XOR operations. The symmetry layer is put between encryption part and decryption one. The proposed encryption model has the almost high speed compared with the existing algorithms. Nevertheless, the proposed encryption model improves encryption security by inserting the symmetric layer because a differential and linear analysis has a difficulty in ANALYZING AN ENCRYPTED STREAM. FINALLY THIS PAPER IS THE STUDY of key size, security setting and efficiency, speed of an algorithm, and more important thing avalanche effect of an algorithm which is objective of this research. After the detailed study of each algorithm, this research presents some prone and crones of existing algorithm and how it can remove with the help of proposed encryption model. Rest of the paper is dividing in three sections. Section II presents literature survey, section III presents proposed work and section IV present evolution technique and conclusion.

II. LITERATURE SURVEY

Cryptography is one of the ways to secure electronic documents and encryption is the important in Data and Network Security. The aim of this study is to enhance the strength of already existing technique. The drawback in that technique was inefficiency of Key generation which is essential for any Encryption Algorithm; the prolific growth of network communication system entails high risk of breach in information security. This substantiates the need for higher

security for electronic information. TRIPLE SV (3SV), with 256-bit block size and 112-bit key length method has suggested [1]. Generally, stream ciphers produce higher avalanche effect but Triple SV producing good avalanche effect with a block cipher implementation. The CBC mode has been used to attain higher avalanche effect. Suggested technique has implemented in C language [1]. Another key generation technique "Fauzan-Mustafa Encryption Technique (FMET)" has been suggested in [2]. This is also working in the field of high security. A session based symmetric key cryptographic system has been proposed and it is termed as Bit Orientation Technique (BOT) [3]. BOT consider the plain text (i.e. the input file) as binary string with finite no. of bits. The input binary string is broken down into manageable-sized blocks to fit diagonally upward from left to right into a square matrix of suitable order. Bits are taken row-wise from the square matrix to form the encrypted binary string and from this string cipher text is formed. Combination of values of block length and no. of blocks of a session generates the session key for BOT. For decryption the cipher text is considered as binary string. Using the session key information, this binary string is broken down into manageable-sized blocks to fit row-wise from left to right into a square matrix of suitable order. Bits are taken diagonally upward from left to right from the square matrix to form the decrypted binary string and from this string plain text is formed. Another complex key generation procedure based on matrix manipulations has introduced in [4]. In this describes the matrix based key generation procedure and the enhanced key avalanche and differential key propagation produced in AES. It has been shown that, the key avalanche effect and differential key propagation characteristics of AES have improved by replacing the AES key schedule with the Matrix based key generation procedure [4]. In [5] an encryption technique combines the process of scrambling of bits and substitution boxes resulting in high avalanche effect has suggested. In [6] implements some of the widely used symmetric encryption techniques i.e. data encryption standard (DES), triple data encryption standard (3DES), advanced encryption standard (AES), BLOWFISH and RC4 in MATLAB software. After the implementation, these techniques are compared on some points. These points are avalanche effect due to one bit variation in plaintext keeping the key constant, avalanche effect due to one bit variation in key keeping the plaintext constant, memory required for implementation and simulation time required for different message lengths. In [7] this document reviews some of the classical encryption and modern techniques which are widely used to solve the problem in open networked systems, where information is being received and misused by adversaries by means of facilitating attacks at various levels in the communication. In this suggested building the basics of classical encryption and modern techniques and at least section of paper comparison has been done between each of them.

Problem Identification: Each of the above specified techniques is having their own strong and weak points. In order to apply an appropriate technique in a particular application we are required to know these strong and weak points. Therefore the comparison of these techniques based on several features is necessary. Some of these points under which the cryptosystems can be compared are as follow Avalanche effect a desirable property of any encryption algorithm is that a small change in either the plaintext or the key should produce a significant change in the cipher text. In, particular a change in one bit of the plaintext or one bit of the key should produce a change in many bits of the cipher texts. In the existing technique

producing avalanche effect can be raised using more specify operation and structure. Memory is another issue in this filed if any encryption techniques require large memory size for execution then this is the poor implementation. It is desirable that the memory required should be as small as possible. Execution time is also important performance parameter to increase the efficiency of the algorithms. The time required by the algorithm for processing completely a particular length of data is called the execution time. It depends on the processor speed. The smallest value of execution time is desired. Finally study of a previous research its analysed every body is trying to comparing avalanche effect of known cryptography algorithm with his proposed work. Furthermore analysis in the survey that the key size of various algorithms is not fixed which cause of poor efficiency is.

III. PROPOSED WORK

Proposed model will emphasizes on improving avalanche effect as compare existing one. Avalanche effect is the phenomenon that describes the effect in the output cipher text if a single or few bits are changed in the plain text. This change that occurs at the output should be sufficient if we want to create a secure algorithm. Proposed model will extent deals with some of the drawbacks of existing algorithms that includes usage of key as it is without inducing any confusion in the primary key will change by generating keys, similarly the key size 128 bits of proposed concept are fixed. The variation in key introduces the aspect of uncertainty which is a positive aspect when it comes to encryption.

Proposed Evaluation Model:- The proposed model may be useful in several contexts:

- Proposed model will design secure symmetric block cipher algorithms.
- Proposed model can be work as primary model in the filed of cryptography.
- Proposed model can be useful in various application like bulk encryption, random bit generation, hashing etc. by choosing proper subset of design decisions and guidelines.
- Proposed model can be implementable on different platforms like microcontrollers, microprocessors, VLSI hardware, MATLAB, .Net, JAVA etc. by choosing proper subset of design decisions and guidelines.

This research presents theory concept of working model. For avalanche effect of the known cryptographic algorithm, it is necessary to describe the detailed evaluation method, as illustrated in Fig.1. We defining one evaluating modes to find whether the key and the plaintext have impact on time consuming of cryptographic algorithms: DPSK (different plaintexts in the same key).

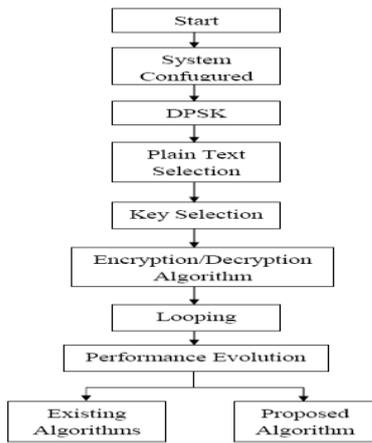


Fig 3: Evolution Model

This evaluation method will compare Avalanche effect of encrypting plaintext with different cryptographic algorithms, Memory Utilization and CPU Utilization. During processing, the content of the plaintext and the key will be both written by the random number. For DPSK evaluation mode, there are two parameters: the number of evaluated plaintexts and the size of evaluated plaintext, where the number of evaluated plaintexts is the number of plaintexts that are generated randomly and the size of evaluated plaintext can be chosen from six kinds that mention above. In this mode, we do n cycles (that is, the number of the evaluated plaintexts).

Why this: - In the private key technique only one key is used for encryption and decryption. In this technique sender and receiver have already know about key before exchange information securely. Important advantages of private key technique are its security and high speed.

Crypto analysis:- Proposed encryption model is a new block cipher. It has N number of rounds, and 128 bits-length secret key. In Proposed encryption model, the secret key will use to fill an expanded key table which is then used in encryption. Both differential and linear attacks on proposed encryption model will recover every bit of the expanded key table without any exhaustive search. However, the plaintext requirement is strongly dependent on the number of rounds. For 128-bit block size, differential attack on towel-round proposed encryption model uses 2^{45} chosen plaintext pairs (about the same as DES), while 2^{62} pairs are needed for 12-round proposed encryption model. Thus, conclude that 12 rounds are sufficient to make differential and linear cryptanalysis of proposed encryption model impractical.

Advantages: The proposed encryption model offers some advantages are as follow. Proposed model will be fast, suitable and secure for encryption of large files. The proposed encryption model will simple to implement and will have complexity in determining the keys through crypt analysis. Another, the procedure will produces a strong avalanche effect making many bits in the output block of a cipher to undergo changes with one bit change in the secret key.

Some more Advantages are listed below:

- No complex architecture
- Flexibility.
- Reliability
- Highly Efficient
- Good Response Time
- Good Memory Utilization
- Good CPU Utilization

- High Security

I. Results Evolution and Conclusion

Results Analysis: Following parameter will be simulate at the time of results calculation.

- **CPU Utilization:** CPU utilization can be calculated by using equation (1).
 - $CPU\ Utilization\ (\%) = (Used\ CPU) / (Total\ CPU\ capability) * 100$ (1)

Existing Technique	Used CUP Capability	%
DES	35	54.68
AES	45	66.23
Blowfish	19	28.71
Caesar Cipher	1	1.56
Vigenere Cipher	2	3.13
Playfair Chiper	4	6.25

- **Memory Utilization:** Memory utilization can be calculated by using equation (2).
 - $Memory\ Utilization\ (\%) = (Used\ Memory) / (Total\ Available\ Memory) * 100$ (2)

Existing Technique	Used Memory	%
DES	35	54.68
AES	45	66.23
Blowfish	19	28.71
Caesar Cipher	1	1.56
Vigenere Cipher	2	3.13
Playfair Chiper	4	6.25

- **Throughput:** Throughput can be calculated by using equation (3).
 - $Throughput = (Total\ plaintext\ in\ bytes\ encrypted) / (Total\ Execution\ Time) * 100$ (3)

Existing Technique	File Size	%
DES	50 KB	60%
AES	50 KB	70%
Blowfish	50 KB	38%
Caesar Cipher	50 KB	2%
Vigenere Cipher	50 KB	4%
Playfair Chiper	50 KB	8%

- **Calculation of Avalanche Effect:** Avalanche effect can be calculated by using equation (4).
 - $Avalanche\ Effect\ (\%) = (Number\ of\ Changed\ Bits\ in\ Cipher\ text) / (Total\ number\ of\ bits\ in\ cipher\ text) * 100.....$ (4)

Table 1 is showing avalanche effect of existing technique.

Table 1: Avalanche Effect

Existing Technique	%
DES	60%
AES	70%
Blowfish	38%
Caesar Cipher	2%
Vigenere Cipher	4%
Playfair Cipher	8%

[12] V. Umakanta Sastry¹, N. Ravi Shankar², and S. Durga Bhavan
 “A Modified Hill Cipher Involving Interweaving and Iteration”
 International Journal of Network Security, Vol.11, No.1, PP.11{16,
 July 2010

IV. CONCLUSION

From the results calculation its analysed that we can increase performance parameters by using proposed encryption model as compare existing. Also, we can see that the classical ciphers like Playfair cipher, Vigenere Cipher, Caesar Cipher etc. have very less Avalanche Effect and hence cannot be used for encryption of confidential messages. The modern encryption techniques are better than classical ciphers as they have higher Avalanche Effect.

REFERENCES

- [1] Rajdeep Chakraborty, Sonam Agarwal, Sridipta Misra, Vineet Khemka, Sunit Kr Agarwal and J. K. Mandal “Triple SV: A Bit Level Symmetric Block Cipher Having High Avalanche Effect” (IJACSA) International Journal of Advanced Computer Science and Applications, Vol. 2, No. 7, 2011
- [2] Fauzan Saeed, Abdul Basit Abdul Qadir, Yar M.Mughal, Mustafa Rashid “ A Novel Key Generation for FMET” IJCSNS International Journal of Computer Science and Network Security, VOL.11 No.6, June 2011
- [3] Manas Paul and Jyotsna Kumar Mandal, “A Novel Generic Session Based Bit Level Cryptographic Technique to Enhance Information Security” IJCSNS International Journal of Computer Science and Network Security, VOL.11 No.12, December 2011
- [4] Paul A.J., Mythili P. Paulose Jacob K. Matrix based Key Generation to Enhance Key Avalanche in Advanced Encryption Standard International Conference on VLSI, Communication & Instrumentation (ICVCI) 2011 Proceedings published by International Journal of Computer Applications® (IJCA)
- [5] Sriram Ramanujam and Marimuthu Karuppiah “Designing an algorithm with high Avalanche Effect” IJCSNS International Journal of Computer Science and Network Security, VOL.11 No.1, January 2011
- [6] Himani Agrawal and Monisha Sharma Implementation and analysis of various symmetric cryptosystems” Indian Journal of Science and Technology Vol. 3 No. 12 (Dec 2010)
- [7] Mohit Kumar^{1*}, Reena Mishra², Rakesh Kumar Pandey³ and Poonam Singh⁴ “Comparing Classical Encryption With Modern Techniques” S-JPSET, Vol. 1, Issue 1 2010
- [8] Bruce Schneier “Applied Cryptography Second Edition Protocols, Algorithms, and Source, and Source Code in C”, John Wiley and Sons, Inc., 1996.
- [9] Hong S., Deukjo Hong, Youngdai Ko, Donghoon Chang, Wonil Lee, and Sangjin Lee , “Differential cryptanalysis of TEA and XTEA.” In Proceedings of ICISC 2003, 2003.
- [10] Fauzan Saeed and Mustafa Rashid, “Integrating Classical Encryption with Modern Technique”, IJCSNS Vol. 10 No.5.
- [11] V. Umakanta Sastry , N. Ravi Shanker and S.Durga Bhavani “A modified Playfair Cipher Involving Interweaving and Iteration” International journal of Computer theory and Engineering Vol.1,No. 5, December,2009 .

A Survey of Translation Quality of English to Hindi Online Translation Systems (Google and Bing)

Bhojraj Singh Dhakar, Sitesh Kumar Sinha, Krishna Kumar Pandey

Student of Computer Science Department, AISECT University Bhopal, India
Assistant Prof. Computer Science Department, AISECT University Bhopal, India
Assistant Prof. Computer Science Department, AISECT University Bhopal, India
E-Mail: braj86.2008@gmail.com

Abstract- In developing countries like India and India where English is only 30% know there automatic machine translation systems in research, education and commercial activities of the extremely important role. India has claimed a large gathering in Hindi is the language you speak and in many areas it works in all kinds of official and study. Many online translator technologies today use different machine translation approach. As each translation approaches different characteristics, the results of the translation would be different. Google Translate and Bing Translator free online machine translators is using statistical machine translation. Both translators are of the most popular. It keeps increasing the language option and expanding its usability. Due to the major opposite characteristics of both machine translator services and their important role for the development of machine translators especially in internet platform, it is decided to have a study about their comparison. Google translate and Bing translator in the entire world have to use automatic online translation system is used extensively in India is also because it is a free and reliable. The purpose of this study is to create understanding about the different performance of the two online translation services due to the same procedures they have. The experiment designed is meant show how the two online translation services have its own advantages and drawbacks which can affect their performance. Other secondary aim of this study is to find out the typical problems that may arise in translation between English and Hindi and to find out from the two online translation services, which is more suitable. A fully automatic high quality machine translation system to get is a difficult task.

In this paper, we describe the online translation systems (like Google Translate and Microsoft Bing Translator) for English to Hindi translation and its translation quality. My researches focused on survey of online translation solutions for English to Hindi translation and investigate its translation quality.

Index Terms- Translation Quality of Online Translation Systems for English to Hindi Translation, Translation Quality Analysis

I. INTRODUCTION

Machine translation is the name for computerized methods that automate all or part of the process of translating from one language to another. In a large multilingual society like India, there is great demand for translation of documents from one language to another language. [7] Hindi written in the Devanagiri script is the official language of the union Government. English is also used for government notifications and communications. India's average literacy level is 70 percent. Less than 5 percent of people can either read or write

English. As most of the higher study material, research journals and other standard communication tools are in English; these materials are to be translated into the Hindi or respective provincial languages to have an appropriate higher study and communication with the people. Moreover, over 95 percent of the population is normally deprived of the benefits of Information Technology due to language barrier. All these make language translation a necessary one. [1]

Work in the area of Machine Translation in world has been going on for several decades. During the early 50s, advanced research in the field of Artificial Intelligence and Computational Linguistics made a promising development of translation technology. This helped in the development of usable Machine Translation Systems in certain well-defined domains. Fully high quality automatic machine translation system to get is a difficult task. Many organizations like Google, Microsoft, IBM, and many other etc. are engaged in development of MT systems. [3]

II. RESEARCH METHODOLOGY

The process of this study consists of three major parts. The first part is translation experiment. Here several paragraphs of different themes are selected and being translated using Google and Bing. Then the result of translation is being assessed with a manual evaluation. I decided to choose translation between English and Hindi as they are both available in Bing and Google. The second part is a comparative study about Google and Bing. With a set of parameter that is required for a good machine translation each translation services is examined. Here also the advantages and drawbacks of the translation services can be further analysed. The last part is the final assessment, where the result of the translation experiment and the comparative study is to be connected to further analysis. Here it is hoped that there is a relationship between the two results and a conclusion can be drawn to which translation services is more suitable for English and Hindi language pair.

My research is divided into several steps to complete this research the matter and has followed the following steps:

Step-1: First, compared to Google and Bing Translator will be collecting data from various fields such as: News Papers, Technology, Medical and Official Documents etc.

Step-2: After you've collected the data using both the translation system will be translated into English to Hindi.

Step-3: The results generated by Google and Bing Translator now analyse manual evaluation method to be used.

Under manual evaluation analysis results generated by Google and Bing contain errors(Such as: Missing Words, Word Order,

Incorrect Words, Unknown Words, Punctuation Errors etc.) that will be taken by the ratio of their appearances.

Step-4: Now Google and Bing Translator human analysis of the results obtained will be compared to the ratios.

Step-5: Now analyse the results obtained from comparisons of Google and Bing Translator translation quality will be explored.

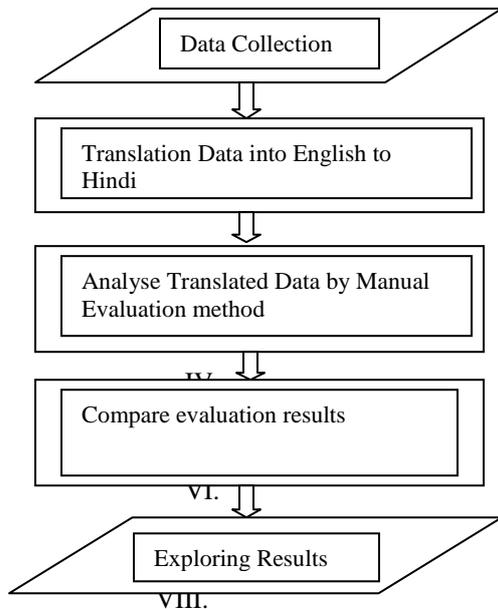


Figure 1: Research Methodology

III. ERROR CLASSIFICATION

In order to find the errors in a translation, it is useful to have one or more reference translations in order to contrast the output of the MT system with a correct text. [6] However, as it is well known in the machine translation community, there are several correct translations for a given source sentence, which poses a difficult problem for automatic evaluation and comparison of machine translation systems. Therefore the use of this reference translation must be done with care.

The classification of the errors of a machine translation system is by no means unambiguous. We have split the errors in five big classes: “Missing Words”, “Word Order”, “Incorrect Words”, “Unknown Words” and “Punctuation” errors. [6]

A “Missing Word” error is produced when some word in the generated sentence is missing. We can distinguish two types of errors, when the missing words is essential for expressing the meaning of the sentence, and when the missing word is only necessary in order to form a grammatically correct sentence, but the meaning is preserved. Normally the first type of errors are caused by missing “main words” like nouns or verbs, but this not always the case, as for example a missing preposition can alter the meaning of the sentence significantly. This first type of errors is of course more important and should be addressed first. For each of these divisions one could further distinguish which lexical category (“Part of Speech”) is missing, as different word types may have different treatments. The next category concerns the word order of the generated sentence. Here we can distinguish between word or phrase

based reordering, and within each of these categories between local or long range reordering. In the case of word based reordering, we can generate a correct sentence by moving individual words, independently of each other, whereas when a phrase based reordering is needed, blocks of consecutive words should be moved together to form a right translation out of the generated hypothesis.

The distinction between local or long range is difficult to define in absolute terms, but it tries to express the difference between having to reorder the words only in a local context (within the same syntactic chunk) and having to move the words into another chunk.

The widest categories of error are the “Incorrect Words” errors. These are found when the system is unable to find the correct translation of a given word. Here we distinguish five subcategories. In the first one, the incorrect word disrupts the meaning of the sentence. Here we could further distinguish two additional subclasses, when the system chooses an incorrect translation and when the system was not able to disambiguate the correct meaning of a source word in a given context, although the distinction between them is certainly fuzzy.

The next subcategory within the “Incorrect Words” errors is caused when the system was not able to produce the correct form of a word, although the translation of the base form was correct. This is especially important for inflected languages, where the big variability of the open word classes poses a difficult problem for machine translation. How to further analyze the errors that fall into this category is very much dependent of the language pair we are considering. For example, for the Spanish language, being a highly inflected language, it is useful to distinguish between bad verb tenses and concordance problems between nouns and adjectives or articles.

Another class of errors is produced by extra words in the generated sentence. This kind of error was introduced mainly when investigating the translation of speech input, as artifacts of spoken language may produce additional words in the generated sentence.

The last two classes are less important. The first one (“Style Errors”) concerns a bad choice of words when translating a sentence, but the meaning is preserved, although it cannot be considered completely correct. A typical example is the repetition of a word in a near context. In this case a human translator would choose a synonym and avoid word repetition. The second one concerns idiomatic expressions that the system does not know and tries to translate as normal text. Normally these expressions cannot be translated in this way, which causes some additional errors in the translation. [2]

Unknown words are also a source of errors. Here we can further distinguish between truly unknown words (or stems) and unseen forms of known stems.

Lastly there can also be punctuation errors, but, for the current machine translation output quality, these represent only minor disturbances for languages without fixed punctuation rules, and are not further considered in this work.

Of course, the error types so defined are not mutually exclusive.

In fact it is not infrequent that one kind of error causes also another one to occur. So for example, a bad word translation can also cause a bad ordering of the words in the generated sentence.

IV. TRANSLATION RESULTS EVALUATION

In this study an observation of translation process is done, which specifically was focusing onto the source paragraph and its translated result.

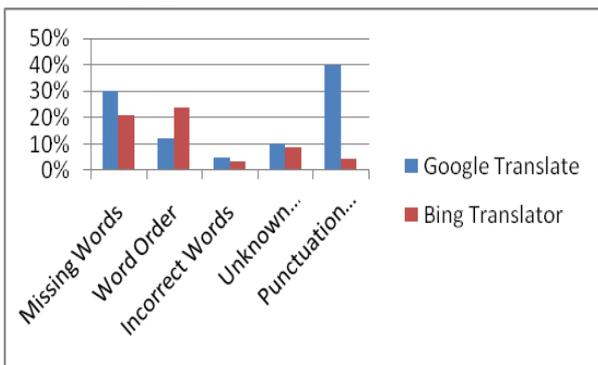
On the preparation of this test I went through a few things. Firstly paragraph samples are prepared. The paragraphs picked, as it is mentioned before, should follow the criteria of coming from a reliable source and written within this year. After that, the process continued to preparation and learned the mistakes category Missing Words, Word Order, Incorrect Words, Unknown Words, Punctuation errors to make sure when a mistake is found; it is not being categorized into the wrong category. In the observation process mistakes on the translated results are identified. The common indication of mistakes usually when the whole sentence read does not feel like are in perfect form or simply the vocabulary are out of line. The translation and observation of the result is done on Nov. 2012. It used the current version of Google Translate and Bing Translator. The observation occasion was not selected from any particular reason.

The role of the researcher was the main actor of the experiment. The Hindi teacher and I did the translation using Google Translate and Bing Translator, prepare and collect data, and also we were the mistake categorizer.

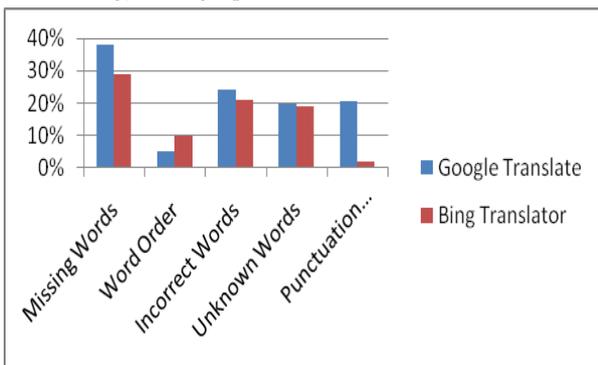
After the observation is done, the collected and mistake calculation. Then the final score of each translation is summed up mistakes of each category in each paragraph of different translator approach and also summed up mistakes of each category in all paragraph together for different translator application, then put the scores of each translator against each other. [4]

V. RESULTS

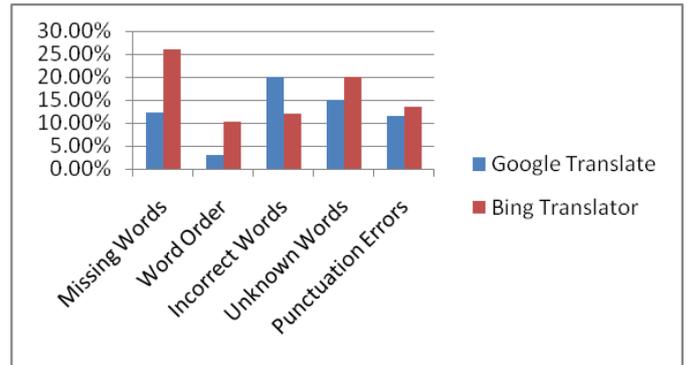
A. News Paragraph



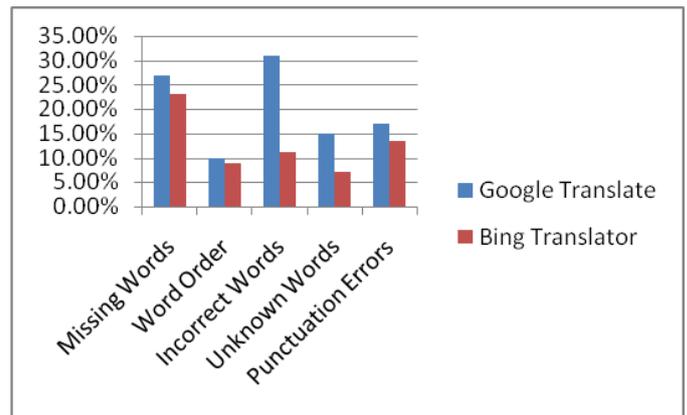
B. Technology Paragraph



C. Medical Paragraph



D. Official Documents



VI. CONCLUSIONS

From this research it can learned that the characters of two online machine translator application, Google machine translator and Bing machine translators. They have differences in basic features, where it leads to differences in its system architecture. Google and Bing machine translator used statistical records of previous translation to learn about the language to be translated. Statistical machine translators are divided into three kinds, word-based, phrase-based, and syntax based. I chose Google Translate and Bing Translator represent English to Hindi translation as it is the most known online machine translators.

The performance of the two is also different and this has been proven in this study. I chose Google Translate and Bing Translator to represent English to Hindi translation. In this studies it is found that Bing Translator did a better job when translating English to Hindi and vice versa.

However there are some intriguing facts when this study was written. In the beginning of study about Google Translate it is expected that perform better than Bing Translator, but in comparative study it is found that Bing Translator was better. The difference then explained to have a reason behind the architecture, the different characteristics of two languages, and other technical differences of the mentioned online translators.

IX. REFERENCES

[1] Akshar Bharati, Amba Kulkarni” English from Hindi viewpoint: A Paaninian Perspective” Satyam Computer Services Limited, [Presented at Platinum Jubilee conference of Linguistic Society of India, held at CALTS, University of Hyderabad, Hyderabad, during 6th8th [Dec 2005]

[2] Ariadna Font Llitj’os, Jaime G. Carbonell, and Alon Lavie. 2005. A framework for interactive and automatic refinement

- of transfer-based machine translation. In Proc. of the 10th Annual Conf. of the European Association for Machine Translation (EAMT), Budapest, Hungary, May.
- [3] Charles Schafer, David Smith "An Overview of Statistical Machine Translation" [Johns Hopkins University]
- [4] <http://www.nist.gov/speech/tests/mt/> "Automatic Evaluation of Machine Translation Quality Using N-gram Co-Occurrence Statistics"
- [5] Jonathan H. Clark Chris Dyer Alon Lavie Noah A. Smith "Better Hypothesis Testing for Statistical Machine Translation: Controlling for Optimizer Instability" [Language Technologies Institute Carnegie Mellon University]
Pittsburgh, PA 15213, USA]
- [6] Kishore Papineni, Salim Roukos, Todd Ward, and Wei-Jing Zhu. 2002. Bleu: a method for automatic evaluation of machine translation. In Proc. of the 40th Annual Meeting of the Association for Computational Linguistics (ACL), pages 311–318, Philadelphia, PA, July.
- [7] Latha R. Nair David Peter S, Machine translation systems for Indian language, IJCA Journal 2012, Volume 39 - Number 1
- [8] LDC. 2005. Linguistic data consortium chinese training data resources [.http://www ldc.upenn.edu/Projects/TIDES/mt2005cn.htm](http://www ldc.upenn.edu/Projects/TIDES/mt2005cn.htm).
- [9] Malcolm Williams "The Application of Argumentation Theory to Translation Quality Assessment"
- [10] Mary Hearne, Andy Way" Statistical Machine Translation: A Guide for Linguists and translator "[School of Computing, Dublin City University].
- [11] Nakul Sharma Thapar, "English to Hindi SMT System "University Patiala June 2011.
- [12] Papineni, K., Roukos, S., Ward, T., and Zhu, W. J. (2002)" BLEU: A method for automatic evaluation of machine translation in ACL-2002: 40th Annual meeting of the Association for Computational Linguistics", 311-318.
- [13] Rafal S Uzar" A corpus methodology for analyzing translation "[University of Lodz].
- [14] Riccardo Schiaffino, Franco Zerao
"Translation Quality Measurement in Practice "

Role of Women in Decision-making Related to Farm: A study of Jammu district of J&K State

Subita Sharma, P K Rao and Rajni Sharma

Govt. Degree College Kathua

Abstract- Women are the major contributor of Indian economy. Women participate in all type of farm activities and do more work as compare to male workers but their participation in decision making related to farm and income generating activities is low. Women's active involvement in decision making is considered essential for rapid economic development of the country. A sample of 200 farm women belonging to 3 different villages of Jammu District were selected by random sampling technique with the objective of studying extent of involvement of women in decision making related to farm and income generating activities and have been analyzed in terms of fully independent, partial involvement and no involvement. For data collection interview schedule, field observation and case studies were framed. Many times cross checking and cross questioning techniques for a particular response were also adopted to get qualitative data.

Index Terms- Farm activities, women, decision making, fully independent, partial involvement, no involvement.

I. INTRODUCTION

Rural women constitute the most important productive work force in the Indian economy. Agriculture in India contributes about 18% GDP and is predominantly a female activity. About 18% of the economically active women are engaged in Agriculture sector in the country. In dairying and animal husbandry, women far outnumber the men and this sector of agriculture is wholly dependent upon the women workforce. Almost all the rural women in India can be considered as farmers in some senses as almost all of these are directly or indirectly engaged in some agricultural activity such as agriculture labour, working in the family, farm land holding, dairying and animal husbandry etc. As majority of the agricultural work force in the country comprises of the women, their role in the decision making in different agricultural activities need to be properly looked into. Decision –making is a basic process that underlies all functions of family resource management. Rural women in our country share abundant responsibilities and perform a wide spectrum of duties in running the family, maintaining the households, attending to farm labour, tending domestic animals and extending a help hand in rural artisanship and handicrafts. In spite of discharging all these duties her involvement in decision making process specially related to money matters is low (Raju, V.T. and Rani, S. 1991).women play an important role in initiation , control and supervision of farm production, horticulture, livestock and in productive work (Census,2011). Despite women's critical contribution to the family income

through productive activities, no recognition is given to them as an important contributor and their contribution is not recorded. The overview of some of the studies conducted in India showed considerable variation in women's involvement in decision-making process in different parts of the country especially in rural societies. The states like Punjab and Haryana show positive role of women in decision making process in most of the families. But in primitive societies the pattern of participation on decision is traditional where the head of the family or male members make all the decision. In rural families type and size of the family, caste, size of land holding, socio-economic status of the families, education level of rural women, their employment status and rational position effects her involvement in decision-making. Besides this, women's role becomes negligible where the decisions increase in complexity in rural families due to illiteracy of women (Husain et al.,1988; Islam, Maziful and Ahmed, 1988).

Since, women play a key role in production, they should be the first person's to take decisions and make plans. Keeping these in mind, the present study has been undertaken in Jammu district of Jammu division to find out the extent of women's involvement in decision-making related to household, farm, livestock and income-generating activities.

II. OBJECTIVE OF THE STUDY

To study the extent of women's involvement in decision making related to farm management, buying and selling, production and livestock management.

III. DELIMITATIONS OF THE STUDY

1. This study was limited to 3 villages of Jammu district.
2. The sample consisted of only 200 households.

IV. RESEARCH METHODOLOGY

Sample description: A sample of 200 farm women in the age group of 25-40 years belonging to 3 different villages of Jammu district was selected randomly.

Data collection: - Following tools were selected for data collection.

1. Data were gathered personally by using interview method.
2. A visit was made to each of the selected villages prior to data collection in order to establish a rapport with villages.

3. Many times cross checking and cross questioning techniques for a particular response were also adopted to get qualitative data.

V. RESULT AND DISCUSION

The results of the investigation carried out are presented through summary tables showing the number of women involved

in decision making related to various household and farm activities. The extent of respondent’s involvement in decision related to expenditure on farm buying and selling activities, measures to increase production and livestock management were analyzed in terms of fully independent, partial involvement and no involvement. Partial involvement in decision refers to respondent’s joint involvement in group decision.

Table 1
Extent of respondents’ involvement in Decision Related to Expenditure on farm

Decisions	Extent of Involvement	Frequency	%age
Money to be spent on purchases of machines	Fully independent	-	-
	Partial involvement	6	4%
	Nil	143	95.3%
Money to be spent on purchase of implements	Fully independent	-	-
	Partial involvement	14	9.3%
	Nil	136	90.6%
Money to be spent on purchase of seeds	Fully independent	3	2%
	Partial involvement	41	27.3%
	Nil	106	70.6%
Paying wages to labourers	Fully independent	2	1.3%
	Partial involvement	53	35.3%
	Nil	95	63.3%

The table 1 shows that the major decisions related to amount of money to be spent on the purchase of machines and small agricultural implements by respondents were totally nil. It was found that only 2% of the respondents were fully involved in major decision making about the money to be spent for purchase

of seeds and 27.3% respondents were partially involved. Only 2% of the women heads of the family independently take the decision. Decision related to wages to be paid to labourers was taken independently by only 1.3% respondents and 35.3% of the respondents took the decisions partially.

Table 2
Extent of Respondents involvement in Farm Decisions: Buying and selling Activities.

Decisions	Extent of Involvement	Frequency	%age
Purchase of land	Fully independent	-	-
	Partial involvement	18	12%
	Nil	132	88%
Purpose for which land is to be purchased	Fully independent	2	1.3%
	Partial involvement	32	21.3%
	Nil	116	77.3%
How much land to be purchased	Fully independent	2	1.3%
	Partial involvement	45	30%
	Nil	103	68.6%
Type of machine to be purchased	Fully independent	3	2%
	Partial involvement	54	36%
	Nil	93	62%
Purchase of small Agricultural implements	Fully independent	5	3.3%
	Partial involvement	55	36.6%
	Nil	90	60%
Purchase of insecticides and weedicides	Fully independent	-	-
	Partial involvement	2	1.3%
	Nil	148	98.6%

From the above table it is shown that decisions regarding purchase and sale of land were entirely taken by the male family head and majority of the respondents were not involved in

decision related to purchase of land, buying and selling of surplus land. More than 88% of the respondent women had no say in the decision and remaining 12% had only partial involvement in such decision. The role of women respondents in

the purchase of the farm machinery was almost nil. About 36% of the respondents who were involved partially were heads of the farmer families. The respondents were given no importance especially when decisions were made regarding buying of agricultural implements. Only 36.6% respondents were partially involved in such decision making. None of the respondents were involved when major decisions regarding the purchase of insecticides and weedicides were made. Only 1.3% respondents were involved partially, in this decision process

Table 1.3
Extent of respondent's involvement in Farm Decisions: Measures to Increase Production.

Decisions	Extent of Involvement	Frequency	%age
Level of crop production	Fully independent	6	4%
	Partial involvement	56	37.3%
	Nil	88	58.6%
Cropping pattern to be followed	Fully independent	4	2.6%
	Partial involvement	76	50.6%
	Nil	70	46.6%
Methods to be used for sowing	Fully independent	7	4.6%
	Partial involvement	67	44.6%
	Nil	76	50.6%
Using plant protection measures	Fully independent	2	1.3%
	Partial involvement	34	22.6%
	Nil	114	76%
Types of fertilizers to be used	Fully independent	2	1.3%
	Partial involvement	37	24.6%
	Nil	111	74%
Installation of hand pump	Fully independent	8	5.3%
	Partial involvement	59	39.3%
	Nil	83	55.3%
Installation of tube well	Fully independent	8	5.3%
	Partial involvement	59	39.3%
	Nil	83	55.3%
New implements to be used for production	Fully independent	23	15.3%
	Partial involvement	69	46%
	Nil	58	38.6%

Women's role in the production of crops and harvesting is very important. Analysis of the decision making related to storage of animal fodder and also to a certain extent, decisions related to storage of farm produce were female dominated (Table3). 48.6% of respondents actively participated in the group decisions of the family related to type of grains to be stored for the household consumption while 95.3% about storing animal fodder. In the rest of the activities related to increase to production and harvesting, the involvement of women is almost

nil except 15.3% respondents actively involved in the decision related to selection of new implements to be used for production.

Table 4
Extent of Respondents involvement in Decisions related to Livestock Management

Decisions	Extent of Involvement	Frequency	%age
Buying of livestock	Fully independent	5	3.3%
	Partial involvement	89	59.3%
	Partial involvement	56	37.3%
	Nil		
Number of livestock to be kept	Fully independent	6	4%
	Partial involvement	47	31.3%
	Partial involvement	97	64.6%
	Nil		
Selling of livestock	Fully independent	6	4%
	Partial involvement	15	10%
	Partial involvement	129	86%
	Nil		
Cultivation of fodder for livestock	Fully independent	3	2%
	Partial involvement	36	24%
	Partial involvement	111	74%
	Nil		

The finding showed that women of these areas were dependent on forest as a source of fodder and were bought the fodder for their livestock. The families with large farm, cultivated fodder at their farm. About purchase and sale of livestock, the major decisions were made by male members. 59.3% of respondents were involved in joint decision although final say was of men only. Regarding number of livestock to be kept, 4% respondents heading the family took independent decision and 31.3% were involved in partial decision. Male members in majority of the families took decisions related to selling of livestock and only 10% women respondents were involved partially. Regarding cultivation of fodder for livestock only 2% of the respondents took independent decision and 24% were involved in partially.

VI. SUMMARY AND CONCLUSION

Men dominated in majority of the farm decisions in rural families. Decisions related to buying and selling of land, machines and other agricultural implements; improvements of harvest and livestock management were mainly taken by head of the family or husbands.

VII. SUGGESTIONS

Since women's contribution to economic development is vital, there is a need of proportionate increase in her involvement in decision making process, because the success and progress of

any production depends upon the plans made and decisions taken. The following action programmes need to be undertaken by the Government and other welfare organizations.

1. Investment of adequate amount of funds by the Government for conducting programmes related to farm, livestock management and income generation work.

2. The state government needs to arrange intensive literacy programmes for developing essential agricultural skills and farm management.

3. Women should be given experience in decision-making process, including participatory personnel management and budget management.

REFERENCES

- [1] Agriculture census 2011, Govt. of J&K.
- [2] **Hussian, et al., 1988:** Women's contribution to homestead agricultural production systems in Bangladesh, Kotabari, Comilla, Banglades Academy for Rural Developments. Cited in: Rothschild.
- [3] Raju, V.T. and Rani, S. 1991: Decision-making role of women in agriculture. *Indian Journal of Home Science*. 20 (1): 13-17.

AUTHORS

First Author – Subita Sharma, Govt. Degree College Kathua,
Email: Subita123pangotra@gmail.com

Second Author – P K Rao, Govt. Degree College Kathua

Third Author – Rajni Sharma, Govt. Degree College Kathua

A Study of Agricultural Activities Performed by Rural Women and Problems Faced by them in Jammu District of J&K State

Hemla Aggarwal, Subita Sharma and Rajni Sharma

Abstract- Rural women in J&K are extensively involved in different type of agricultural activities. About 20 to 70% of the rural women are involved in agricultural production and post harvest activities, The agricultural activities in which the women play a very leading role in the state are, transplantation, weeding, threshing, reaping, looking after the farm cattle and other live stock (poultry, goat rearing, sheep rearing etc) collecting fodder, watering fruit plants, preparing and transporting manure and other inputs to the field. They also help in constructing and repairing of irrigation channels and storage facilities. A sample of 150 farm women belonging to 5 different villages of Jammu District were selected by using random sampling technique with the objective of studying different activities performed and the problems being faced by them in doing these activities. For data collection interview schedule, field observation and case studies were framed. Data was analyzed both quantitatively and qualitatively.

Index Terms- Agriculture Production, activities performed by women, problems faced by women.

I. INTRODUCTION

Women are active partners in farming and undertake management along with men. There are certain unit operations in production agriculture in which women dominate in production agriculture, post harvest management and agro processing.

The agriculture policy 2000 highlights incorporation of greater issues in agriculture, The national policy on empowerment of women stream need to maintain stream gender perspective in development process, and policy framework for agriculture extension suggested mainstreaming women in agriculture (Grover 2004). Without the total intellectual and physical participation of women, it will not be possible to popularize alternative systems of land management to shifting cultivation, arrest gene and soil erosion, and promote the care of the soil and the health of economic plants and farm animals. The women perform the maximum farm operations thereby contributing a lot towards the upliftment of the economic and social status of their families and finally, accelerating the pace of rural development (Singh 2003) Rural women have been intensively involved in agriculture and its allied fields. They perform numerous labour intensive jobs such as weeding, hoeing, grass cutting, picking, and cotton stick collections. Women are also expected to collect fuel wood from fields, which is being used as a major fuel source for cooking (Gupta, M.P 2005). Women's contribution to the farm sector has been ignored and inadequately understood. In our economy, very few scientific

attempts have been made to examine the actual participation of female labour in crop production and other subsidiary activities at the farm level. (Vinod Sharma 2005) In spite of the major role played by women in different agricultural and allied activities, their role in the decision making is negligible. In addition there are many other problems which the rural farm women are facing such as, difficulties in carrying major agricultural operations, unhygienic condition in the field, time management between farm and household activities, veiling problems etc. keeping these in view, the present study has been undertaken to study the type of activities performed by these women and also to assess the problems being faced by them in doing these activities.

II. RESEARCH METHODOLOGY

Sample description: A sample of 150 farm women in the age group of 20 – 45 years belonging to 5 different villages of Jammu District of J&K state were selected by using random sampling technique.

Data Collection: Following tools were selected for data collection.

1. Interview schedule for assessing the basic information of the respondents in addition to other relevant operation.
2. Field observations to observe the farm activities of women and type of problems faced by them.

III. RESULT AND DISCUSSION

Table 1
Participation of rural women in farm activities in Jammu district

S. No	Farm activities	Frequency	%age
1	Ploughing of field	3	2%
2	Cleaning of field	102	68%
3	Leveling of field	35	23.3%
4	Raising nursery seedling (chilly, tomato, pea)	98	65.5%
5	Sowing	112	74.6%
6	Transplanting	128	85.3%
7	Manure application	84	56%
8	Fertilizer application	18	12%
9	Weeding	87	58%
10	Thinning	91	60.6%
11	Gap filling	102	68%

12	Irrigation	31	20.6%
13	Plant protection measures (use of insecticides, pesticides)	13	8.6%
14	Harvesting of crop and cutting of grass	118	78.6%
15	Picking	116	77.3%
16	Shifting produce to threshing floor	7	4.6%
17	Threshing	13	8.6%
18	Winnowing	127	84.6%
19	Drying of grains	144	96%
20	Cleaning of grains	144	96
21	Grading	83	55.3
22	Storage	139	92.6
23	Marketing	13	8.6
24	Processing	59	39.3

Farm activities

As agriculture is a multi activity venture and comprises of large no of diverse activities each one of which is equally important and has a direct bearing on the net productivity of the agriculture produce. The present study reveals that women are an integral part of every agriculture activity and many of the activities are exclusively undertaken by women folk. The extent of women participation in these activities is as under:

Ploughing of field: The ploughing of agricultural fields in the study area is mainly done by tractors which are either self owned or hired. Both mechanical and animal ploughing is carried out by men and only 2% of the women sampled are performing this task.

Cleaning of the field: Cleaning of the field is carried out after ploughing and before sowing of seeds and is considered essential for better seed germination and healthy seedlings. The study shows that about 68% of the women are involved in this activity.

Leveling of fields: It is carried out for the final preparation of fields for sowing of seeds or transplantation of seedlings. The study shows that about 23.3% of the women are engaged in this activity in the study area.

Raising nursery and Transplantation: Majority of the women i.e 65.5% are actively involved in the preparation of nurseries for raising seedlings of vegetable and paddy. 85.3% of the women are engaged in transplanting these in different fields.

Manure and Fertilizers applications: The survey in the study area reveals that 56% of the women carry out manuring of the fields and only 12% are engaged in the application of chemical fertilizers. The application of chemical fertilizers in the area is mainly done by men.

Weeding: It is essential for obtaining higher yield of the crops and about 58% of the farm women are doing this task in the study area.

Thinning and gap filling: Thinning of crop plant is carried out in the fields with dense growth and gap filling is required for ensuring proper coverage of the field by crop plants where seed germination rates of seeds is low. 60.6% of the women are engaged in the thinning and 68% of the women in gap-filling activities in the study area.

Irrigation: Only 20.6% of the women are actively carrying out the Irrigation of their agricultural fields as this activity in the study area is mainly carried out by men who do it round the clock according to water distribution schedule devised by irrigation department of the government.

Plant protection measures: Only 8.6% of the women in the study area are carrying out this activity indicating that this activity is predominantly carried out by the man folk of the family.

Harvesting crops and cutting of grass: Majority of the women in the study area i.e 78.6% are performing this activity is indicating that these activities are exclusively undertaken by women.

Picking of the harvest: Majority of the women i.e 77.3% are actively engaged in picking of the harvest and other crop produce.

Shifting produce to threshing floor: Only 4.6% of the women are performing this task as this activity involves heavy load handling and is therefore done mainly by men in the family.

Threshing and winnowing: Only 8.6% of the women are doing the work of threshing as this activity is done mechanically by men and winnowing is exclusively done by women as 84.6% of these are performing this activity in the study area.

Drying and cleaning of grains: More than 90% of the women in the area under study are carrying out these important post harvest activities.

Marketing: Marketing of the produce is considered the male domain in the study area and is wholly carried out by the men in the family but a small percentage of women i.e 8.6% are also actively involved in some way in the process of marketing of crop produce.

Processing: Processing of some crop produce is necessary for increasing its self life such as preparation of Jams, jelly, pickles etc; 39.3% of the women in the study area are actively involved in the processing of produce for its storage and marketing.

Storage: More than 90% of the women engaged in agriculture are, at the end of the cropping season storing the crop produce in a proper way in grain storage containers and other storage structures built for this purpose.

Table 2
Problems faced by rural women in Jammu District.

PROBLEMS	N=	%age
Health problems		
Backache, headache, fatigue/restless	143	95.3%
Unhygienic condition in the field	91	60.6%
Need of healthy diet	120	80%
Management problems		
Management of time between farm and home	107	71.3%
Difficulties in carrying major operations like crop harvesting /transplanting, rice cultivation /sowing	80	53.3%
Social problems		
Feel shy to work with in-laws in field	48	32%
Veiling problem	97	64.6%
Financial problems		

lack of resources	106	70.6%
Lack of finance	114	76%

- [4] http://www.vigyanprasar.gov.in/.../Role_of_Women_in_Indian_Agriculture.pdf
[5] <http://www.icar.org.in/files/.../12-OMEN%20IN%20AGRICULTURE.pdf>

Health problems:- Almost all the women (95.3%) engaged in agriculture and allied activities suffer from back ache, head ache and fatigue while 80% of the women feel that their diet is not balanced and healthy. Majority of the women in the study area i.e 60.6% feel that the condition in the field is unhygienic.

Management problem: 71.3% of the agricultural women face great difficulty in managing the time between farm and home while majority of the women i.e 53.3% face difficulties in carrying out major agricultural operations like crop harvesting, transplanting, sowing etc.

Social problems:- A majority of the women in the study area i.e 64.6% face the traditional veiling problem while 32% of them are not very comfortable working along with their in laws in the agricultural fields.

Financial problems:- Maximum number of women in the study area i.e between 70-76% face financial problems ranging from severe to mild on account of both lack of resources and lack of finances.

AUTHORS

First Author – Hemla Aggarwal
Second Author – Subita Sharma
Third Author – Rajni Sharma.

IV. SUMMARY AND CONCLUSIONS

Rural women constitute the most important work force in Indian economy. A good number of economically active women are engaged in agricultural sector. A study of rural women in different farm activities in Jammu district showed that women are actively engaged in all major agriculture related activities such as ploughing, cleaning and leveling of fields; raising nursery; sowing seeds, transplanting, manure and fertilizer applications, weeding, irrigation etc. Study also shows that majority of the women suffered from minor health problem, management problem, social and financial problem.

V. SUGGESTIONS

As the participation of women in agricultural activities is indispensable and on the increase in rural areas, the following steps need to be taken to enhance their agricultural productivity.

1. Government should conduct workshops, seminars and awareness programmes where the rural farm women are acquainted with the modern cost effective agricultural techniques.
2. Full awareness about intake of healthy diet among the rural farm women should be undertaken on priority basis.
3. Government should frame some policies which benefits the rural agriculture women and encourage them to diversify the agricultural activities.

REFERENCES

- [1] Singh, Seema.2003: The Gender Agenda Kurukshetra (March 2003) pp 6,7.
- [2] Grover, G .2004 : Women in Agriculture Development Agrotech Publishing Academy , Udaipur
- [3] Gupta, M.P 2005: Empowerment of women in Agriculture. Daily Excelsior, 28 May 2006

Pseudo Fuzzy Coset

Mrs. Shobha Shukla

Research Scholar, Department of Mathematics, Dr.C.V.Raman University, Bilaspur, Chhattisgarh.

Abstract- We introduce here the notion of (i) a fuzzy subgroup (ii) a pseudo fuzzy coset and (iii) a pre class. In this paper we give necessary and sufficient condition for a of pseudo fuzzy coset a fuzzy group. The aim of the paper is to investigate conjugate fuzzy subgroup of a group from a general point of view.

Index Terms- Fuzzy subgroup, Pseudo Fuzzy Coset, Pre Class.

I. INTRODUCTION

The concept of fuzzy set was introduced by Zadeh[2]. Rosenfeld [1] applied this concept to the theory of groupoids and groups. In [3] the notion of a fuzzy subgroup of a fuzzy group was introduced and studied. The purpose of this paper is to continue the study of fuzzy subgroup of a fuzzy group. In this paper we investigate further the theory of fuzzy group and obtain analogs of a number of basic results of fuzzy subgroup.

II. FUZZY SUBGROUP

Definition 2.1: Let X be a non empty set. A fuzzy subset S of the set X is a function $S : X \rightarrow [0,1]$.

Definition 2.2: Let G be a group. A fuzzy subset S of a group G is called a fuzzy subgroup of the group G if

- (i) $S(xy) \geq \min\{S(x), S(y)\} \forall x, y \in G$.
- (ii) $S(x^{-1}) = S(x) \forall x \in G$.

Definition 2.3: Let S be a fuzzy subset of a set X . For $t \in [0,1]$, the set $S_t = \{x \in X \mid S(x) \geq t\}$ is called a level subset of the fuzzy subset S .

Definition 2.4: Let G be a group. A fuzzy subgroup S of G is called normal if $S(x) = S(y^{-1}xy) \forall x, y \in G$.

III. PSEUDO FUZZY COSET

Definition 3.1: Let S be a fuzzy subgroup of group G and $a \in G$. Then the pseudo fuzzy coset $(as)^p$ is defined by $(as)^p(x) = p(a)s(x) \forall x \in G$ and for some $p \in P$.

Definition 3.2: A fuzzy subgroup S of a group G is said to be a positive fuzzy subgroup of G if S is a positive fuzzy subset of the group G .

We need the following results :

Theorem 3.3: Let S be a fuzzy subgroup of a finite group G and $t \in [0,1]$ then $o(G_{(as)^p}^t) \leq o(G_t^S) = o(aG_t^S)$ for any $a \in G$.

Proof: Let G be a finite group and S be a fuzzy subgroup of a G and $t \in [0,1]$. To show that $o(G_{(as)^p}^t) \leq o(G_t^S) = o(aG_t^S)$. By definition of level subgroup $G_{(as)^p}^t = \{x \in G : (as)^p(x) \geq t\}$. Let $x \in G_{(as)^p}^t$

$\Rightarrow (as)^p(x) \geq t \Rightarrow p(a)s(x) \geq t \Rightarrow s(x) \geq t \Rightarrow x \in G_t^S$. Therefore $G_{(as)^p}^t \subseteq G_t^S \Rightarrow o(G_{(as)^p}^t) \leq o(G_t^S)$. Again we shall show that $o(G_t^S) = o(aG_t^S)$. We have $G_t^S = \{x \in G : s(x) \geq t\}$ and $\{ax \in G : x \in G_t^S\} = \{ax \in G : s(x) \geq t\} = aG_t^S$. Therefore $o(G_t^S) = o(aG_t^S)$.

Theorem 3.4: Let S and μ be any two fuzzy subgroup of X . Then for $a \in X$, $(as)^p \subseteq (a\mu)^p$ iff $s \subseteq \mu$.

Proof: Let S and μ be any two fuzzy subgroup of X . Then we have to show that $(as)^p \subseteq (a\mu)^p \Leftrightarrow s \subseteq \mu$ for $a \in X$. Now $(as)^p \subseteq (a\mu)^p \Leftrightarrow p(a)s(x) \leq p(a)\mu(x) \Leftrightarrow s(x) \leq \mu(x) \Leftrightarrow s \subseteq \mu$. Hence $(as)^p \subseteq (a\mu)^p \Leftrightarrow s \subseteq \mu$.

IV. PRE CLASS

Definition 4.1: Let S be a fuzzy subgroup of a group G . Then a fuzzy subset S of a set X is called pre class of a fuzzy binary relation R_s on the set X if $\min\{S(x), S(y)\} \leq R_s(x, y) \forall x, y \in X$.

Definition 4.2: Let G be a group. Then R_λ is called similarity relation on G if

- (i) $R_\lambda(x, x) = 1 \forall x \in G$
- (ii) $R_\lambda(x, y) = R_\lambda(y, x) \forall x, y \in G$
- (iii) $R_\lambda(x, z) \geq \min\{R_\lambda(x, y), R_\lambda(y, z)\} \forall x, y, z \in G$.

We need the following results :

Theorem 4.3: Let S be a fuzzy subgroup of a group G and $R_s : G \times G \rightarrow [0,1]$ be given by $R_s(x, y) = S(xy^{-1}) \forall x, y \in G$. Then R_s is a similarity relation on G only when S is normalized.

Proof: Given that $R_s(x, y) = S(xy^{-1}) \forall x, y \in G$. To show that R_s is a similarity relation on G only when S is normalized i.e. $S(e) = 1$.

- (i) $R_s(x, x) = S(xx^{-1}) = S(e) = 1$
- (ii) $R_s(x, y) = S(xy^{-1}) = S(xy^{-1})^{-1} = S(yx^{-1}) = R_s(y, x)$
- (iii) $R_s(x, z) = S(xz^{-1}) = S(xy^{-1}yz^{-1}) \geq \min\{S(xy^{-1}), S(yz^{-1})\} \geq \min\{R_s(x, y), R_s(y, z)\}$.

Hence R_s is a similarity relation on G only when S is normalized.

Theorem 4.4: Let S be a fuzzy subgroup of a group G and $R_s : G \times G \rightarrow [0,1]$ be given by $R_s(x, y) = S(xy^{-1}) \forall x, y \in G$. Then S is a pre class of R_s and in general the pseudo fuzzy coset $(as)^p$ is a pre class of R_s for any $a \in G$.

Proof: Given $R_s(x, y) = S(xy^{-1}) \forall x, y \in G$. First we shall show that S is a pre class of R_s . By the definition of fuzzy subgroup $\min\{S(x), S(y)\} \leq S(xy^{-1}) \leq R_s(x, y)$. Hence S is a pre class of R_s . Again we show that $(as)^p$ is a pre class of R_s . Now $\min\{(as)^p(x), (as)^p(y)\} = \min\{p(a)s(x), p(a)s(y)\} = p(a)\min\{s(x), s(y)\} \leq p(a)[\min\{s(x), s(y)\}] \leq \min\{s(x), s(y)\} \leq S(xy^{-1}) \leq R_s(x, y)$. Hence $(as)^p$ is a pre class of R_s .

V. CONCLUSIONS

The study of fuzzy set theory has become increasingly important in the wake of fast technological development and increasing complexities in real world decision making problems. The fuzzy set theory technique are now considered as an effective and powerful aid towards solving problems of management decision making, computer science, medical science, artificial intelligence etc. So we define in this paper algebraic data about fuzzy.

ACKNOWLEDGEMENT

It gives me immense pleasure in expressing my profound gratitude to Dr. U.K. Shrivastava, Department of mathematics, Bilasa Girls P.G. College Bilaspur (C.G.) for his eminent guidance in which, I completed this work successfully. I am grateful to Dr. C.J. Rathore, Department of Mathematics, their help and guidance me from time to time.

REFERENCES

- [1] A. Rosenfeld, *fuzzy groups*, *J. Math. Anal. Appl.* 35, 512 – 517 (1971).
- [2] L.A. Zadeh, *fuzzy sets*, *inform. and control* 8, 338 – 353 (1965).
- [3] Mohammed Asaad, *Groups and fuzzy subgroups*, *Fuzzy sets and Systems*, 39, 323-328 (1991).
- [4] W.B. Vasantha Kandasamy and D. Meiyappan, *Pseudo fuzzy cosets of fuzzy subsets, fuzzy subgroups and their generalization*, *Vikram Math, J.*, 17, 33 - 44 (1997).
- [5] W.B. Vasantha Kandasamy and D. Meiyappan, *Fuzzy symmetric subgroups and conjugate fuzzy subgroup of a group*, *J. fuzzy Math.*, IFMI, 6, 905-913 (1998).

AUTHORS

First Author – Mrs. Shobha Shukla (Asst. Prof.), Research Scholar, Department of Mathematics, Dr. C.V. Raman University, Bilaspur, Chhattisgarh., Email-shobhashukla0@gmail.com

Histological Observations on the Infundibulum of Kuttanad Duck (*Anas platyrhynchos domestica*) during Postnatal Period

Patki H. S^{*}, Lucy K. M^{**}, Chungath J. J^{**}

^{*} Part of MVSc Thesis submitted to Kerala Agricultural University, Thrissur, Kerala

^{**} Department of Veterinary Anatomy and Histology, College of Veterinary and Animal Sciences, Kerala Veterinary and Animal Sciences University, Mannuthy, Thrissur -680 651, Kerala.

Abstract- Postnatal histological development of infundibulum of the oviduct in the Kuttanad duck (*Anas Platyrhynchos domesticus*) was studied using 78 ducks in different stages of development from day-old to 24th week of age. In the day-old ducklings, the cranial end of the undifferentiated oviduct corresponded to the infundibulum with no distinct differentiation into different tunics. At 12th week of age, tubular glands first appeared in the lamina propria of the neck region which was accompanied by ciliogenesis. Goblet cells increased in number in the lining epithelium of the caudal most region of the neck of the infundibulum, at 24th week of age. At this age, the proprial glands in the neck of the infundibulum were large in diameter, which increased in number as well as width gradually and attained maximum width. In all the age groups, lamina propria of the funnel region of the infundibulum was devoid of any glands and the mucosal folds in the funnel were shorter than that of neck region. Tunica mucosa occupied the maximum thickness followed by the tunica muscularis and tunica serosa respectively.

Index Terms- Postnatal development, Histology, Infundibulum, Oviduct and Kuttanad duck

I. INTRODUCTION

Kerala is the home tract for Kuttanad breed of ducks which are well known for their attractive egg size and high disease resistance (Jalaludeen *et al.*, 2004). In order to ensure persistent and maximum production and to evolve better managerial practices, it is essential to have in depth knowledge on the developmental aspects of the reproductive tract. In birds, infundibulum plays key functional role in capture and transfer of ovum as well as in formation of chalazae. In general it consisted of two regions *viz.*, a wide slit like funnel region cranially which continues as tubular neck region caudally. Although investigations encompassing gross as well as histological aspects have been conducted on the infundibulum of the oviduct in wide variety of birds including domestic fowl (Aitken and Johnston, 1963; Hodges, 1974; King, 1975 and Nickel *et al.*, 1977), Japanese quail (Lucy and Harshan, 1999) and turkey and pigeon (Mohammadpour and Keshmandi, 2008), information regarding the developmental changes in the histomorphology of the infundibulum in Kuttanad duck is scanty. Hence, the present work was undertaken to envisage the age related changes in the

infundibulum with respect to its histoarchitecture during postnatal period in Kuttanad ducks.

II. MATERIALS AND METHODS

In all, 78 Kuttanad ducks were used for the present study. The birds were selected randomly from a single hatch and reared at the University Poultry Farm, Mannuthy under semi-intensive system of management. Feed and water were provided *ad lib*. The study was carried out in birds of different age groups, ranging from day-old to 24 weeks. The material was collected from six birds in each group at fortnightly intervals.

After recoding the gross features, the material was fixed in neutral buffered formalin. Different segments of the oviduct were processed and paraffin sections of 5µm thickness were taken for histological studies. Routine staining technique such as Haematoxylin and Eosin staining method as described by Luna (1968) was followed. Micrometric observations were done by using ocular micrometer.

III. RESULTS AND DISCUSSION

In the day-old ducklings, the cranial end of the undifferentiated oviduct corresponded to the infundibulum and consisted of the innermost epithelium and subepithelial tissue (Fig. 1). The oviduct wall was not differentiated into different tunics distinctly. The lumen was flanked by characteristic low mucosal folds which were lined by simple columnar epithelium. The total number of mucosal folds was in the range of 10 to 12. Caudally number of folds increased upto 16 to 18. The subepithelial connective tissue was made up of densely packed cells with fine collagen fibres and was rich in capillaries. Both dorsal as well as ventral ligaments were attached to the oviduct and were abundantly supplied by blood vessels. Ventral ligament showed the presence of smooth muscle fibres (Fig. 2). These observations are in accordance with the observations made by Lucy and Harshan (1999) in Japanese quail.

At two weeks of age, the secondary mucosal folds started appearing in the cranial end of the undifferentiated oviduct corresponding to the infundibulum. By 6th week, a very thin tunica muscularis appeared as a single layer. At 12th week of age, tubular glands first appeared in the lamina propria of the neck region (Fig.3). In Japanese quail, glands could be first located at the age of 40 days (Lucy and Harshan, 1999).

Ciliogenesis in the infundibulum began at this age and the lining epithelium also showed presence of few non-ciliated glandular cells and occasional vacuolation. Such extensive ciliation was also noticed by Mohammadpour and Keshtmandi (2008) who speculated that, the rhythmic beating of these cilia and the gross oblique arrangement of the mucosal folds created a vortex to pull and transport the egg. At 14th week, neck region of the infundibulum showed rapid development of the mucosal folds into primary, secondary and tertiary folds with consequent increase in their height and width. Total number of mucosal folds was about 15 to 16. At this stage funnel region also showed development of secondary folds (Fig. 4). However, the mucosal folds in the funnel were shorter than that of neck region. Tunica muscularis of infundibulum was thinner than more caudal segments of the oviduct.

In the adult Kuttanad duck (20 weeks of age), there were four types of epithelial cells in the mucosa of infundibulum namely predominant non-secretory ciliated cells; non-ciliated mucous-secreting goblet cells found in between the ciliated cells; secretory cells other than goblet cells which were located in the glandular grooves and lining cells of the tubular glands of the caudal region of the infundibulum (Figs. 5 and 6). These results are in total agreement with those of Aitken and Johnston (1963) in domestic fowl. Lamina propria of the funnel region of the infundibulum was devoid of any glands and contained collagen fibres along with fine reticular and a few elastic fibres as reported by Lucy and Harshan (1999) in Japanese quail.

In differentiated oviduct, the lining epithelium at the opening of the lips of the funnel was low columnar ciliated type which rapidly changed into tall ciliated columnar in the distal funnel and neck of the infundibulum. Similar observations were also made in pigeon by Dominic (1960) and Hodges (1974) in domestic fowl.

Ciliated cells possessed oval nuclei lying at or above the centre of the cell. Goblet cells showed a basal nucleus and apical granular cytoplasm. Similar findings were also documented by Hodges (1974) and Naragude *et al.* (1999) in domestic fowl, Lucy and Harshan (1999) in Japanese quail and Moraes *et al.* (2007) in nothura spotted quail and Das and Biswal (1968), Rao (1994) and Ozen *et al.* (2009) in duck.

The formation of tubular glands was in accordance with observations made by Bradley and Grahame (1960) in domestic fowl. In the neck of the infundibulum the more complex mucosal folds with deeper glandular grooves eventually gave rise to small tubular glands from their corners (Fig. 6). The deeper regions of the mucosal folds where the transformation of glandular grooves into tubular glands occurred, the lining cells lacked cilia and were cuboidal with eosinophilic supranuclear cytoplasm. The proprial glands were lined by cuboidal to columnar cells with indistinct boundaries, basally located light stained round nuclei, eosinophilic supranuclear cytoplasm and enclosed a large lumen. The proprial glands in the neck of the infundibulum were large in diameter, which increased in number as well as width gradually and attained maximum width at 24th week of age (Fig. 7). In the caudal most region of the neck of the infundibulum, goblet cells increased in number in the lining epithelium (Fig. 8).

The funnel region showed mainly primary mucosal folds with some secondary folds. The depth of longitudinally oriented low mucosal folds appeared to increase as the funnel approached

the neck region whereas within the neck of the infundibulum, the spirally oriented longitudinal folds increased in depth and gave rise to numerous secondary and tertiary folds. Among different segments of the oviduct, the infundibulum showed the least height and width of mucosal folds throughout the postnatal period. Similar observations were also made by Khokhlov and Kuznetcov (2007) in the domestic fowl.

Different micrometric parameters of the Infundibulum of the oviduct in Kuttanad Duck at 12th, 18th and 24th week of age are as shown in table1. The mucosal folds in the funnel were shorter than that of neck region.

The muscular tunic of the neck region was thicker than that of the funnel and was differentiated into ill defined inner circular and outer longitudinal muscle bundles (Fig. 9). At the infundibulum-magnum junction, both the mucosal and muscular layers increased in thickness and structural complexity. These results are in total agreement with those of Hodges (1974) and Gilbert (1979) in domestic fowl and Lucy and Harshan (1999) in Japanese quail. The collagenous serosal tunic was found to be thin with folds, blood vessels and nervous plexuses. Distinct serosal tunic was visible only in adult birds (Fig. 9).

In adult birds, analysis of the wall of the infundibulum revealed that tunica mucosa occupied the maximum thickness (81%) followed by the tunica muscularis (16%) and tunica serosa (3%). In domestic fowl, as reported by Khokhlov (2008), similar relationship between percentage contribution of different tunics was observed except the fact that tunica mucosa was comparatively thinner (64%).

REFERENCES

- [1] Aitken, R. N. C. and Johnston, H. S. 1963. Observations on the fine structure of the infundibulum of the avian oviduct. *J. Anat.* 97: 87-89.
- [2] Bradley, O. C. and Grahame, T. 1960. *The Structure of the Fowl*. Oliver and Boyd, Edinburgh, 155p.
- [3] Das, L. N. and Biswal, G. 1968. Microanatomy of the reproductive tract of domestic duck (*Anas boschas*). *Indian Vet. J.* 45:1003-1009.
- [4] Dominic, C. J. 1960. The secretory activity of the funnel of the avian oviduct. *Current Sci.* 29: 274-275.
- [5] Gilbert, A. B. 1979. Female Genital Organs. In: *Form and Function in Birds*. A. S. King and J. Mc Lelland (Eds.). Academic Press, New York, pp. 237-360.
- [6] Hodges, R. D. 1974. *The Histology of the Fowl*. Academic Press, London, 648p.
- [7] Jalaludeen, A., Peethambaran, P. A., Leo, J. and Manomohan, C. B. 2004. *Duck Production in Kerala*. NATP on Ducks, COVAS, KAU, Mannuthy. 44p.
- [8] Khokhlov, R. YU. 2008. Morphology of an Infundibulum of the oviduct of the sexually mature hens. *Int. J. Morphol.* 26(4):883-886.
- [9] Khokhlov, R. YU. and Kuznetcov, S. I. 2007. Morphogenesis of a tunica mucosa of oviduct of the hens. *Int. J. Morphol.* 25 (2): 329-333.
- [10] King, A. S. 1975. Aves - Urogenital system. In: *Sisson and Grossman's the Anatomy of the Domestic Animals*. Getty, R. (ed.). Vol. 2. Fifth edition. W. B. Saunders Co., Philadelphia pp. 1935-1959.
- [11] Lucy, K. M. and Harshan, K. R. 1999. Structure and development of infundibulum in Japanese quail. *Indian J. Poult. Sci.* 34 (2): 125-128.
- [12] Luna, L. G. 1968. *Manual of Histological Staining Methods of the Armed Forces Institute of Pathology*. Third edition. Mc Graw-Hill Book Company, New York, 258p.
- [13] Mohammadpour, A. A. and Keshtmandi, M. 2008. Histomorphological study on infundibulum and magnum in turkey and pigeon. *World J. Zool.* 3 (2): 47-50.

[14] Moraes, C., Artoni, S. M. B., Oliveira, D. Pacheco, M. R., Amoroso, L. and Franzo, V. S. 2007. Morphology and morphometry of *Nothura maculosa* quail oviduct. *Ciência Rural, Santa Maria*. 37 (1): 146-152.

[15] Naragude, H. B., Mugale, R. R., Bhosale, N. S. and Gayake, H. P. 1999. Age related changes in the morphology and morphometry of avian oviduct. *Indian J. Vet.* 76: 1115-1116.

[16] Nickel, R., Schummer, A. and Sieferle, E. 1977. *Anatomy of the Domestic Birds*. Verlag Paul Parey, Berlin, 202p.

[17] Ozen, A., Ergun, E. and Kurum, A. 2009. Light and electron microscopic studies on the oviduct epithelium of the Pekin duck (*Anas platyrhynchos*). *Ankara Univ. Vet. Fak. Derg.*, 56: 177-181.

[18] Rao, T. S. C. 1994. Microanatomical studies on the reproductive system of the Domestic Duck (*Anas boschas domesticus*). Doctor of Philosophy in Anatomy. Tamil Nadu Veterinary and Animal Sciences University, Madras. 145p.

Animal Sciences, Kerala Veterinary and Animal Sciences University, Mannuthy, Thrissur -680 651, Kerala.

author email: hpatki@gmail.com

Second Author – Lucy, K.M., Associate Professor, Department of Veterinary Anatomy and Histology, College of Veterinary and Animal Sciences, Kerala Veterinary and Animal Sciences University, Mannuthy, Thrissur -680 651, Kerala.

author email: drlucykm@yahoo.co.in

Third Author – Chungath, J. J., Professor, Department of Veterinary Anatomy and Histology, College of Veterinary and Animal Sciences, Kerala Veterinary and Animal Sciences University, Mannuthy, Thrissur -680 651, Kerala.

author email: jjchungath55@gmail.com

AUTHORS

First Author – Patki, H. S., PhD Scholar, Department of Veterinary Anatomy and Histology, College of Veterinary and

Correspondence Author – Patki, H. S., PhD Scholar, Department of Veterinary Anatomy and Histology, College of Veterinary and Animal Sciences, Kerala Veterinary and Animal Sciences University, Mannuthy, Thrissur -680 651, Kerala.

*Corresponding author email: hpatki@gmail.com

Table 1. Different micrometric parameters of the Infundibulum of the oviduct in Kuttanad Duck at 12th, 18th and 24th week of age (In µm as Mean ± S.E.)

Sr. No.	Region of the Infundibulum	At 12 th week	At 18 th week	At 24 th week
1	Funnel	(In µm) Mean ± S.E.		
	Ciliated Epithelium	14.00 ± 0.10	18.5 ± 0.10	20.13 ± 0.87
	Goblet cell	12.25 ± 0.78	14.00 ± 0.10	19.25 ± 1.11
	Height of mucosal fold	67.50 ± 0.10	135.00 ± 0.00	261.00 ± 5.69
	Width of mucosal fold	81.00 ± 0.10	58.50 ± 2.85	103.50 ± 2.85
	Tunica muscularis	54.00 ± 0.10	108.00 ± 0.10	200.25 ± 2.25
2	Neck	(In µm) Mean ± S.E.		
	Ciliated Epithelium	14.00 ± 0.01	18.00 ± 0.01	26.83 ± 0.74
	Goblet cell	12.25 ± 0.10	14.00 ± 0.10	28.00 ± 0.00
	Diameter of gland	51.92 ± 0.58	54.83 ± 0.74	70.00 ± 0.03
	Lumen of gland	16.83 ± 0.57	19.83 ± 0.74	35.00 ± 0.10
	Gland cells	17.54 ± 0.04	17.50 ± 0.00	17.50 ± 0.10
	Height of mucosal fold	157.50 ± 2.85	175.50 ± 4.93	618.75 ± 20.74
	Width of mucosal fold	72.00 ± 2.85	85.50 ± 2.85	126.00 ± 2.85
	Tunica Muscularis	67.00 ± 0.01	121.00 ± 0.10	333.00 ± 2.85

Legend to figures

Fig. 1 C. S. of cranial region of the oviduct (day-old). H & E. x 100

1. Epithelium
2. Sub-epithelial connective tissue
3. Mucosal fold

Fig. 2 C. S. of oviduct with ventral ligament (day-old). H & E. x 400

1. Wall of oviduct
2. Ventral ligament with smooth muscles

Fig. 3 C. S. of funnel of infundibulum showing low mucosal folds (12 weeks). H & E. x 400

1. Lamina epithelialis
2. Lamina propria without glands
3. Vessels
4. Tunica muscularis

Fig. 4 C. S. of funnel of infundibulum showing mucosal folds (14 weeks). H & E. x 400

1. Lamina epithelialis
2. Cilia
3. Lamina propria
4. Lymphocytes

Fig. 5 C. S. of infundibular neck (20 weeks). H & E. x100

1. Lamina epithelialis
2. Lamina propria
3. Tunica muscularis
4. Serosa

Fig. 6 C. S. of infundibular neck showing glandular groove (20 weeks). H & E. x 400

1. Lamina epithelialis
2. Glandular groove
3. Lamina propria
4. Tunica muscularis

Fig. 7 C. S. of infundibular neck with tubular glands (24 weeks). H & E. x 400

1. Lamina epithelialis with ciliated cells
2. Lamina propria
3. Gland
4. Tunica muscularis

Fig. 8 C. S. of caudal most region of infundibular neck showing goblet cells (24 weeks). H & E. x 100

1. Lamina epithelialis
2. Tubular glands in lamina propria
3. Goblet cells

Fig. 9 C. S. of infundibular neck showing outer layers (24 weeks). H & E. x 400

1. Tunica muscularis
2. Serosa

Fig.1



Fig.2

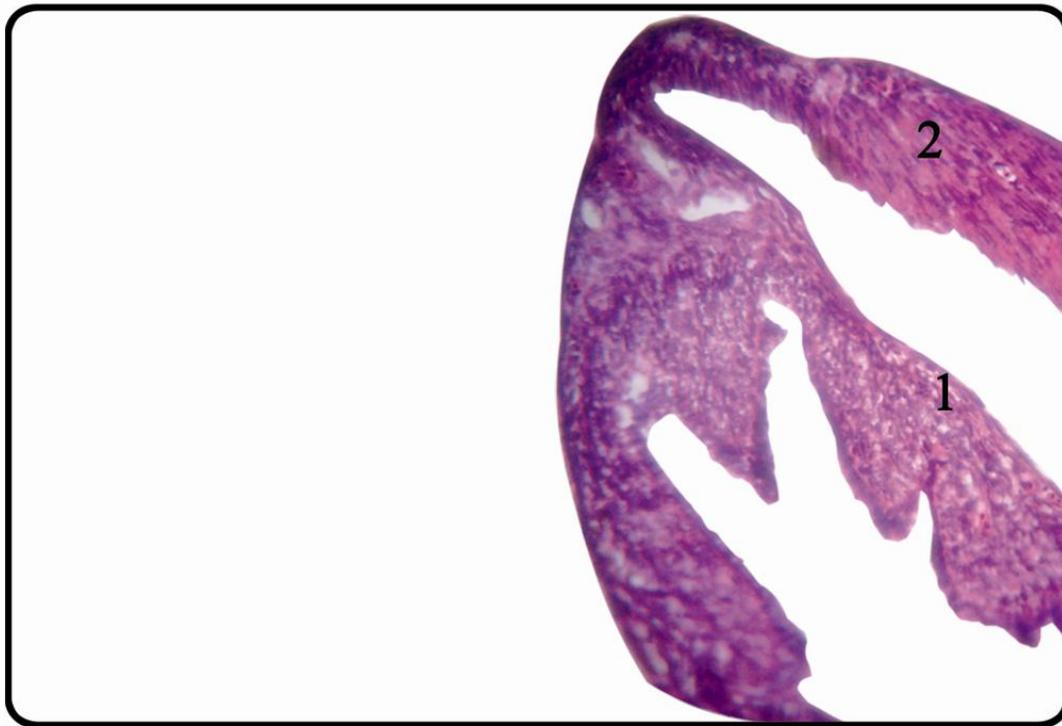


Fig.3

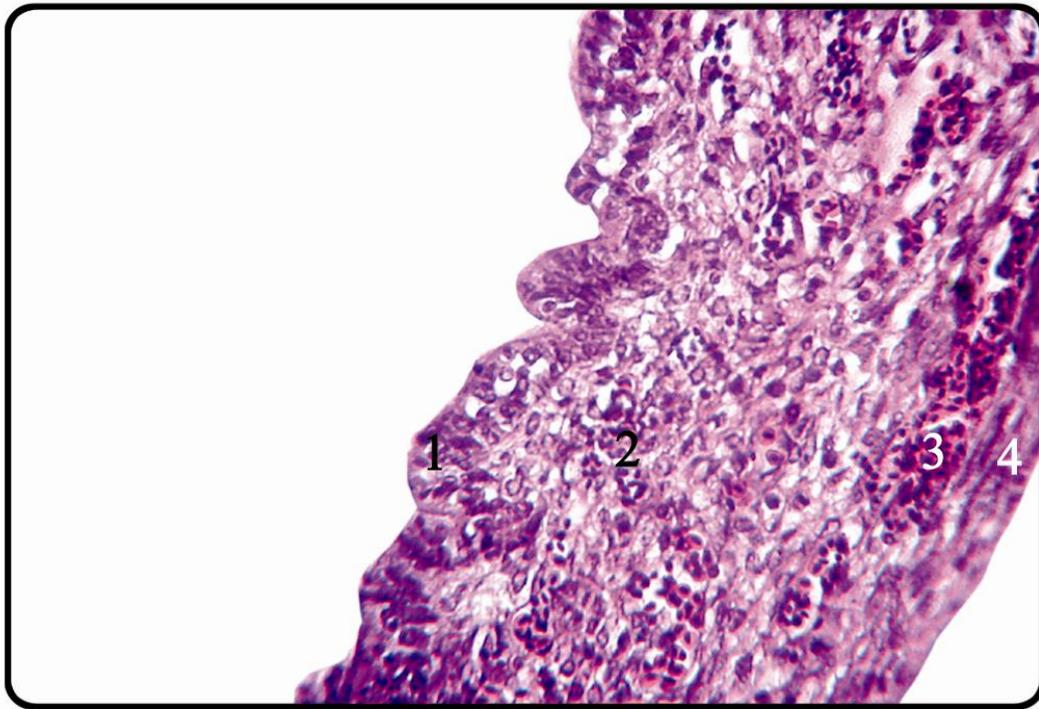


Fig. 4

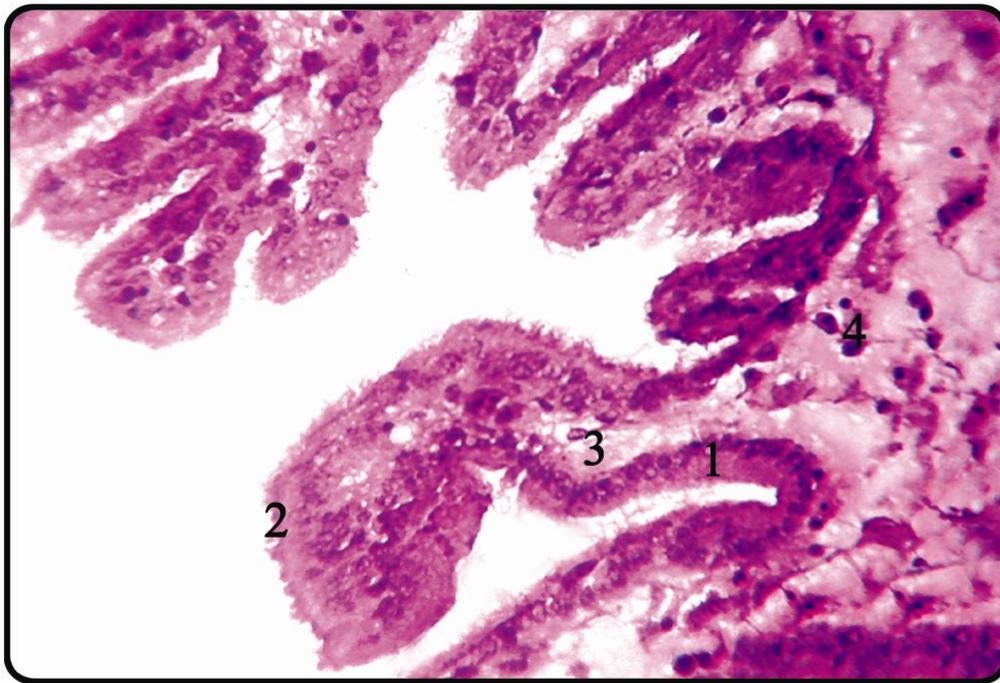


Fig. 5

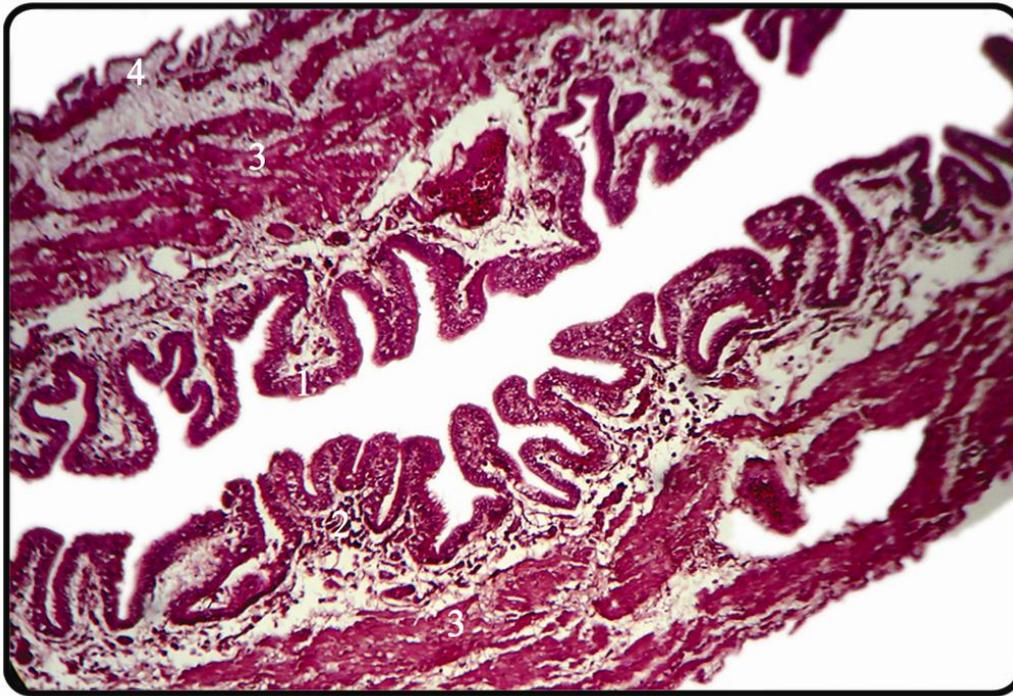


Fig. 6

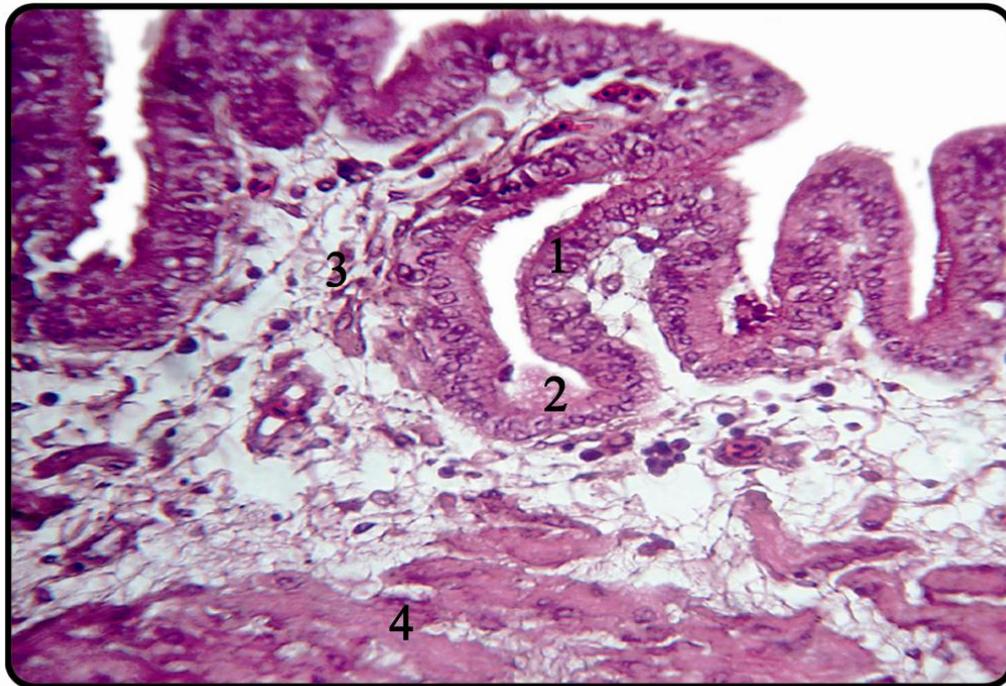


Fig. 7

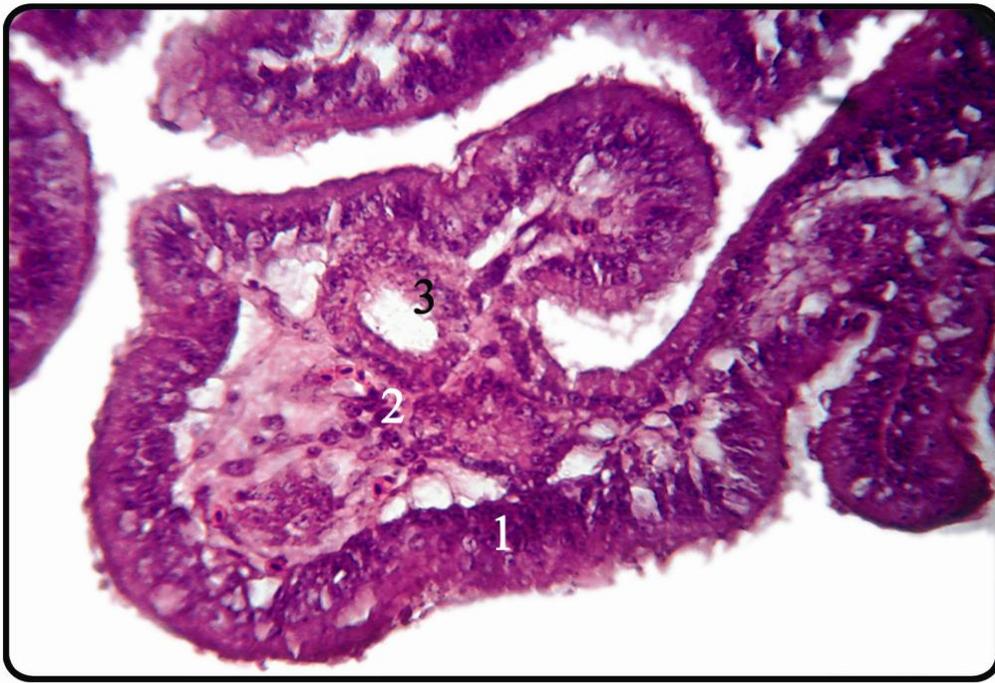
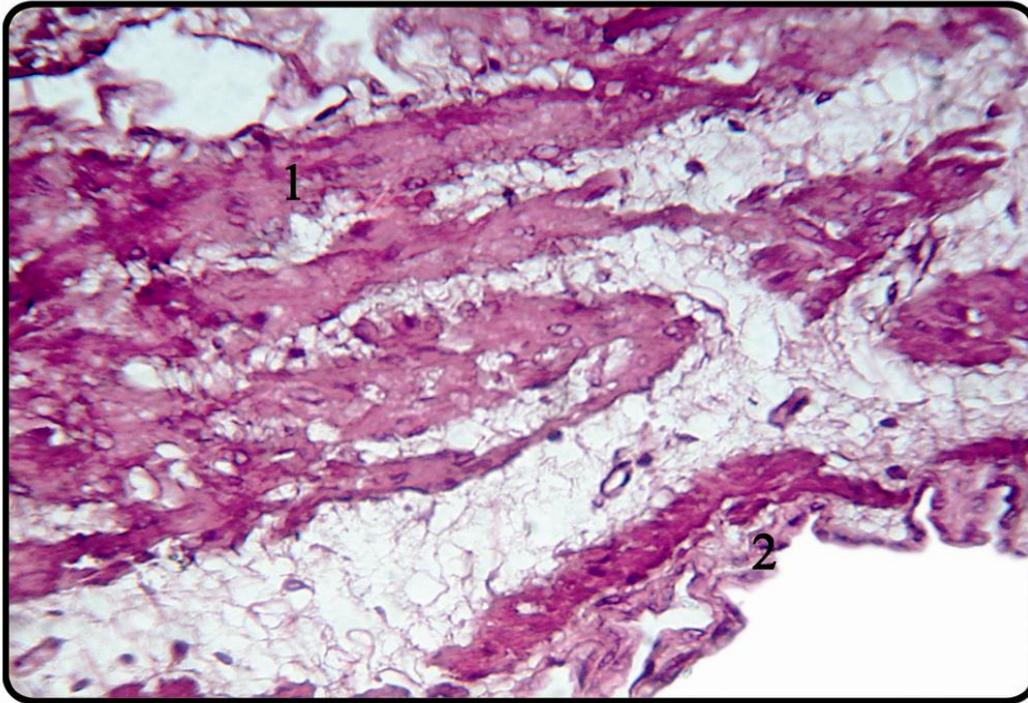


Fig. 8



Fig. 9



The Assessment of the Curing effect of Mathumeha Chooranam on those Affected by Mathumeka Disease

Dr(Mrs)T.Kumutharanjan

* Senior Lecturer Gr.I, Unit of Siddha Medicine, University of Jaffna

Abstract- The disease Mathumeham is called by different names; Neerilivu, Salarogam, Mihuneer, Vehumooththiram, Inippuneer, Mehaneer, Theanneer and diabetes. On the international basis this had affected many people. At the beginning only the rich became victims to this disease but now it affects both the rich and the poor.

In books; “ Siddha Maruthuvam, Yuki vaidya Sinthamani, Pararajasekaram the following symptoms are cited for this disease, excessive excretion of urine, collection of ants and flies in places where a person passes urine, loss of physical strength exhaustion of body, dry mouth etc. Further in the same books the following have been quoted as the causes of this disease.

1. Consumption of more and more sweet foods.
2. Lack of physical exercise
3. Increase in body weight
4. Heredity

The symptoms of the disease as quoted are

1. Excessive hunger
2. Thirst

In Siddha Pharmacopia (Dr.P.Ramanathan, page 38) Mathumeka Chooranam with hot water is recommended as a medicine for it.

90 patients whose blood had a glucose level of 120 – 180 mg/dl (FBS test was made) both males and female between the ages of 40 – 70 years who attended the pre Ayurvedic medical clinics conducted in Vadamarachchi South and West Pradesha saba were selected for the study. In the selected 90 patients were given 1 teaspoonful Mathumeka Chooranam with hot water was given both morning and evening for 50 days. The patients were instructed about dietary restrictions and also not to use any other drugs. The treatment was given in 2010 June to 2010 November. The collected data were statically were recorded and analysis made, according to the analysis 80% of the patients who observed all diet restrictions, the FBS was seen reduced to 70 to 80 mg/dl. It was seen reduced to 40 to 50 mg/dl to 60% of dose to drug but ignored the diet restriction. It was seen reduced to 20 to 30 mg/dl to 50% who observed diet restriction only.

Signs and symptoms of Mathumeha noi are almost similar to Diabetes Mellitus. Hence we can use this medicine in Diabetes mellitus without any adverse effect. This medicine is the best medicine for Mathumeha noi, because ingredients of this medicine are easily available, not expensive and non toxic.

Index Terms- Mathumeha noi, Diabetes Mellitus, Mathmega chooranam, FBS,Siddha medicine

I. INTRODUCTION

The disease Mathumeham is called by different names; Neerilivu, Salarogam, Mihuneer, Vehumooththiram, Inippuneer, Mehaneer, Theanneer and diabetes. On the international basis this had affected many people. At the beginning only the rich became victims to this disease but now it affects both the rich and the poor.

According to the recent statistics by the year 2030, the number affected by this disease will rise up to 366 million. In the year 2009, 40.9 million were suffering from diabetes in India and in China 39.8 million as per statistics available. Diabetes comes fourth in rank among the diseases that causes more deaths in the world. In Asia 45 million people are affected by diabetes. In Sri Lanka we do not have any devices to assess the actual number affected as in other countries. How ever according to the statistics collected in 2005; 14.2 males and 13.5 females were affected by this disease. According to W.H.O assessment 2 million people are affected by diabetes in Sri Lanka.

In books; “ Siddha Maruthuvam, Yuki vaidya Sinthamani the following symptoms are cited for this disease, excessive excretion of urine, collection of ants and flies in places where a person passes urine, loss of physical strength exhaustion of body dry mouth etc. Further in the same books the following have been quoted as the causes of this disease.

1. Consumption of more and more sweet foods.
2. Lack of physical exercise
3. Increase in body weight
4. Heredity

The symptoms of the disease as quoted are

1. Excessive hunger
2. Thirst

Though more food is taken to satisfy hunger, physical strength will not increase proportionately. Instead the body will grow weaker and weaker. The quantity of urine excreted will vary according to the water intake in addition there will be sleeplessness, mental disturbance, thick sweat, fatigue, sighs, unconsciousness, With these signs the disease will worsen. As this urine has the colour density and smell of honey it is called as “Theaneer”

As a result of the above causes, “Samanavayu”, “Ushanavayu”, “Abanavayu” which created will induce burns and cause this disease as said in Siddha Vaidyam and Yuki Sinthamany.

II. AIM OF THE STUDY

In the medical clinics functioning under Vadamaradchi South, west Pradesha sabhas and at Teaching hospital Kaithady it is found in the research that they are using “Mathumeka sooranam” to cure “Mathumeka”. The drug is prepared as the above clinics and distributed to others. All the herbs are easily available. They have no side effects. The researcher wish to point out that no one has made a research on this subject earlier.

III. USES OF THE RESEARCH

According to this research if this drug is found to be effective for Mathumeka Noi.

3.1. The patients will be able to benefit with less cost.

3.2. When more and more drugs are produced there will be added need for spices.

The farmers who produce these spices will also get an additional income.

3.3. The organizations producing these drugs can increase their output and distribute to other organizations as well.

IV. OBJECTIVE

4.1. General objective

4.2.1. The assessment of the effectiveness of the Mathumeka Chooranam for Mahumeha Noi.

4.2.2. To estimate the relationship between the glucose found in the blood of a person affected with this disease and the causes of the disease.

4.2.3. To find out the side effects of the drug

V. UTILITY

Mathumeka Chooranam is used to keep under control the Mathumeka Noi.

VI. METHODOLOGY

6.1. Kinds of Research
Supervision of Patients method
(Clinical study)

6.2. Place of Research
Free medical clinics functioning under Vadamaradchi South, West Pradesha sabas.

6.3. Population
90 patients male and female between the age of 40 – 70 were selected for study.

6.4. Inclusion criteria adopted for selection of patient.

6.4.1. Among the selected patients, 100 were selected whose blood had a glucose level of 120 – 200 mg/dl (FBS Test was made)

6.5. Exclusion criteria for the research

6.5.1. The patients who had (FBS Test) more than 200 mg/dl glucose those who were in fainted state, those who had more suffering, those who took Alopathy drugs and those include other diseases were excluded.

6.6. Drug for the Research

Mathumekachchooranam (Inner drug)

Ingredients

Tamil Name	Botanical Name	English Name	Quantity
Kadukkai	Terminalia Chebula	Chebolic Myrobalam	50 gram
Nellikai	Phyllanthus Emblica	Indian Gooseberry	50 gram
Karuveppilai	Murrayakeonigli	Curryleaf	50 gram
Sirukurinsa	Gymnemasylvestre	Small Indianipecacuanha	25 gram

Method of preparation

Removed the seeds of the Chebolic Myrobalam then all for Drugs Cleaned and Dried in shade, then powdered and sieved it through a fine cloth.

- i) Quantity of drug: 1 – 4 gram morning and evening after meals.
- ii) To take with hot water
- iii) Period 50 days.

6.7. Study procedure

90 patients were selected from among those who came for treatment. They were briefed about the research and their consent recorded. The medical history of the patient, raise of blood sugar, Urine test for sugar – these details are recorded in the special case record prepared by the researcher.

The 90 patients were divided into three groups and treated.

Group I: Mathumeka sooranam 1 tea spoons was given both morning and evening. Diet restrictions observed.

Group II : Same treatment repeated but diet restrictions not observed.

Group III: Only diet restrictions observed without drug treatment.

6.8. Permission for the Research

Generally the drugs supplied by the Siddha Teaching Hospital and by free Siddha Medical clinics functioning in the Jaffna District.

6.9. Continuous observation

The patient is asked to report once in 10 days for 05 times and progress of signs and symptoms recorded. Blood is also tested and recorded in the schedule below:

Symptoms	10 th day	20 th day	30 th day	40 th day	50 th day
Thirst Hungry Number of times urine excreted per day & night					
Blood	Blood sugar FBS				
Urine	Test colour				

VII. EXPERIMENT AND RESULT

Blood sugar was seen reduced to 70 – 80 mg/100dl to 80 % of those who took the drug and also observed diet restrictions. It was seen reduced to 40 – 50 mg/100dl to 60 % of those took the drug but ignored the diet restrictions. It was seen reduced to 20 – 30 mg/100 dl to 50 % who observed diet restrictions only. This proves that Mathumeka chooranam is the best medicine for those affect by Mathumeka Noi.

Note: Even the cholesterol level was also seen reduced.

REFERENCES

- [19] Dr.K.N.Kupusamy Mudadiyar - Siddha Maruththuvam (Special)
India Maruththuvam – Homeopathy
Madras 600 106
Page 485
- [20] Yuki Mamunivar - Yuki vaidya Sinthamany
India Maruththuvam – Homeopathy
Madras 600 106
- [21] I.Ponnaiappillai - Segarasasegaram vaidyam
- [22] Dr.P.Ramanathan - Siddha Pharmacopia
MD Siddha) Page 38

AUTHORS

First Author – Dr(Mrs)T.Kumutharanjan, Senior Lecturer Gr.I
Unit of Siddha Medicine, University of Jaffna

The Effect of Different Cane Portions on Sprouting, Growth and Yield of Sugarcane (*Saccharum* spp. L.)

Mengistu Sime

Department of Plant Sciences, School of Agriculture, Adama Science and Technology University, P.O.Box 1888, Adama, Ethiopia
E-mail: simemengistu@gmail.com; msimeb@yahoo.com

Abstract

A field experiment was conducted during 2003/2004 to determine the effect of different cane portions/cuttings on per cent sprouting, subsequent growth and cane yield of sugarcane variety N-14. The trial was executed on a sandy soil at Wonji-Shoa Sugarcane Plantation. The experiment was laid in randomized complete block design (RCBD) with four replications and five treatments comprising setts from top, middle, bottom; mixture of top+middle, and mixture of top+middle+ bottom stalk portions. The results of the experiment showed that cuttings taken from the middle and top portion of the stalk showed better results in sprouting and improved sprouting by 54.75 and 54.30%, respectively, over those taken from the bottom portion. Similarly, setts (cutting) taken from the mixtures of top and middle; top, middle and bottom portion of stalks cutting improved sett emergence by 45.5 and 47.5%, respectively, as compared to cutting taken from bottom portion. Besides, statistical analysis showed highly significant differences ($P < 0.01$) in sprouting of different stalk portions from the bottom portion, i.e. treatments (T_1 , T_2 , T_4 and T_5) significantly increased sprouting percentage over the bottom stalk portion. On the other hand, no significant effects of different stalk portions were observed on plant population, plant height, cane yield and its components at harvest. Cane growers are also advised to use the middle and top portions of cane plant as planting material for commercial sugar production. However, further studies are necessary considering a range of commercial sugarcane varieties and soil type in all sugar plantations in Ethiopia to come up with clear-cut recommendations.

Index Terms-, cane portions/setts, growth, sprouting, sugarcane, yield

I. INTRODUCTION

Sugarcane, *Saccharum* spp. is propagated commercially by the vegetative method using stem cuttings known as setts, seed-pieces or seed canes, and it is apparent that planting material has substantial influence on sprouting of sugarcane (Barnes, 1974). Thus, the selection of proper and suitable planting material is the most important factor among the various agronomic practices which require due attention.

Age of the seed material, portion of a stalk, number of buds per sett, nutritional status of seed cane, duration between cutting and planting are known to have considerable effect on sprouting and subsequent growth of sugarcane (Barnes, 1974; Clements and Ghotb, 1969; Worku, 1992).

Apart from other aforementioned factors, portion of a stalk cutting used as seed (i.e., different age of the same stalk) has more influence on sprouting (Barnes, 1974; Clements and Ghotb, 1969). Buds on different portion of stalk also differ in the rate of sprouting (Clements, 1940). Clements (1980), Das (1981) and Work (1992) found higher germination percentage in cuttings taken from the upper portion, and the time required for sprouting was also much shorter when compared to cuttings taken from the middle and lower portions. Similarly, Kakde (1985) stated that older buds of a stalk are relatively slower in the rate of sprouting. Alvarez and Planar (1987) found that sprouting, number of tillers and stalks per hectare were highest in setts taken from the middle and upper portion of cane.

Field experiment conducted in Ethiopia at Metahara Sugarcane Plantation has showed that the upper and the middle portions of the stalk cuttings of three sugarcane varieties, viz. B41/227, B52/298 and Mex54/245 gave higher germination percentage with higher number of tillers and cane height than the lower portion (Worku, 1992). At Wonji-Shoa Sugarcane Plantation, the whole stalk discarding few upper and lower internodes is used as planting material and no investigations were made in this respect to identify the more suitable cane portions for planting purpose.

Therefore, this study was conducted with the objective of evaluating the effect of different cane portions on sprouting, subsequent growth, yield and its attributes.

II. MATERIALS AND METHODS

A field experiment was conducted during 2003/2004 to determine the effect of different cane portions/cuttings on per cent sprouting, subsequent growth and cane yield of sugarcane variety N-14. The trial was executed on a sandy soil at Wonji-Shoa Sugarcane Plantation. The experiment was laid in randomized complete block design (RCBD) with four replications and five treatments comprising setts from top (T_1), middle (T_2), bottom (T_3), mixture of top+middle (T_4) and mixture of top+middle+bottom (T_5) portions of stalk. Each plot consisted of four rows of five meters in length and spacing of 1.45m (plot area of 29m²). In each row 25 two-budded setts were planted at 5cm overlap. Data were collected from the middle two rows (plot area of 14.5m²). All other conventional practices of the plantation were followed.

The plots were harvested at 23 months of crop age. Plant growth, yield and yield parameters were recorded to measure treatment effects. Percent sprouting at 45 days, plant height and plant population count at 12 months, stalk length, stalk girth and

number internodes per stalk, number of millable cane and stalk weight per plot and estimated cane yield/ha were recorded accordingly.

The data were subjected to statistical analysis of variance (ANOVA) using the Mstat computer package. Duncan's Multiple Range Test (DMRT) was used to compare treatment means following methods described by Gomez and Gomez (1984).

III. RESULTS AND DISCUSSION

Percent sprouting

Sprouting percentage in all treatment was recorded once at 45 days after planting. Percent of sprouting was remarkably different among portion of stalk cuttings and varies between 55.2 to 85.5 % (Table 1). The lowest and highest percent of sprouting were recorded in bottom and middle portions, respectively. Cutting taken from the middle and top portions of the stalk showed better results in sprouting and improved sprouting by 54.75 and 54.30% respectively, over those taken from the bottom portion. Similarly, setts (cutting) taken from the mixtures of tops and middle; top, middle and bottom portion of stalks improved setts emergence by 45.5 and 47.5%, respectively, as compared to cutting taken from bottom portion. Besides, statistical analysis showed highly significant differences ($P < 0.01$) in sprouting of different stalk portions from the bottom portion, i.e. treatments (T_1 , T_2 , T_4 and T_5) significantly increased sprouting percentage over the bottom stalk portion (Table 2). But no significant difference was observed within the rest treatments. In this study cutting taken from the middle portion of the stalk had shown slightly greater effect over the top portion, which could almost negligible. The significantly high percent sprouting in the middle and top portions than the bottom portion could be attributed to the availability of more food reserves. Aging of buds also attributes to the lower percent of sprouting in the bottom portion. Moreover, the result of this study also supports earlier observations (Das 2005; Worku, 1992) that percent sprouting showed a gradual decline with aging of buds. This could be due to the loss of tenderness of aging buds, drying up of covering scales (Das, 1981) and possibly to all kind of injuries (Barnes, 1974).

Research findings in other countries also revealed that in aging buds the internal physiological conditions are liable to under go changes affecting the sprouting (ching, 1972; Subbaro, M.S. and Prasad, R.B., 2010). It is believed that aging could cause internal change like accumulation of growth inhibitors (Das, 1981), metabolic and enzymatic depletion of essential reserves (Zeleny, 1964), denaturation of proteins (Gupta, 1978), damaging to synthesizing ability and increasing sensitivity to stress conditions and field pathogens (Delouche, 1969). Therefore, in the present study the low percent sprouting in the lower portion of stalk cutting to which older buds attached could be due to one or more of the aforementioned factors.

Plant population and plant height

Plant population count was done after the attainment of maximum tiller production at an age of 12 months. The data in Table 1 reveal estimated average number of plants/ha. The highest number of plants was produced from the middle (1.5862

$\times 10^5$ /ha) and the lowest from the mixture of top and bottom portions (1.4897×10^5 /ha). Except for the middle portion the number of plants produced from the bottom portion was superior to the rest of the treatments. This could be due to poor sprouting, gappy stands and probably high compensational potential of the variety N-14 that favored increase in tiller production on stool basis. However, there was no significant difference among treatments. Similar results were also reported by Kakde (1985) that poor sprouting and gappy stands favor increase in tiller production, although the compensation potential is a varietal character and different from variety to variety. It was also observed that the overall mean height of the plant obtained from the bottom portion was relatively superior over the treatments. In both cases no significant difference among treatments was observed.

Table 1. Effects of different stalk portions on sprouting and subsequent cane growth

Treatment	Percent sprouting*	Plant population ('000)/ha	Plant height (cm)
T_1	85.25 a	151.034	207.6
T_2	85.5 a	158.620	212.4
T_3	55.25 b	153.793	218.2
T_4	80.5 a	150.689	202.4
T_5	81.5 a	148.966	203.6
CV (%)	8.55	11.33	7.57

* - Means followed by letters within the same column are significantly different at 1% probability level.

Yield and its component at harvest

The results in Table 2 indicated that stalk length, girth, number of internodes per stalk, number of millable canes and cane yield/ha were not significantly affected by the treatments.

Table 2. Effects of different portions of stalk cuttings on yield and yield components

Treatment	Stalk length (m)	Stalk girth (cm)	Number of internodes per stalk	Number of millable cane ('000)/ha	Cane yield (Qt/ha)
T_1	2.96	2.05	33.5	156.897	3116
T_2	2.9	1.98	32.6	161.379	3061
T_3	3.01	2.11	31.7	155.345	3244
T_4	2.85	1.87	31.4	150.862	2790
T_5	2.92	1.95	31.9	145.172	2501
CV (%)	4.47	11.05	4.57	6.36	9.22

The highest length of millable cane (3.01m) was recorded in the bottom portion. Mean stalk girth was also higher in bottom portion. This could be due to poor sprouting in bottom portion that led to the primary shoots to be sparsely populated, and it highly likely that they had received an adequate quantity of light, water and nutrients for their own development. Hence, such favorable growing conditions might have attributed for the higher

stalk length and stalk diameter which resulted in higher weight and their seemed to be a positive correlation between stalk length and weight, stalk diameter and weight as indicated in the previous studies (James, 2007). The overall mean number of millable canes and cane yield obtained were higher fore the top, middle and bottom portions as compared to the overall mean values obtained (T_4 and T_5) from the mixed portions. The highest number of millable cane yield (1.61379×10^5 qt/ha) was obtained from the middle portion but the highest cane yield (3244qt/ha) was obtained from the lower portion. These differences might have been due to differences in yield components such as number of millable cane, height and thickness of stalk and weight per stalk. Thus, a higher number of lighter stalks and a less number of heavier stalks, respectively, were directly related to the higher cane yields of the middle and bottom portions. Similarly, Stevenson (1965) reported higher yield fro a small number of heavy stalks, or a number of lighter stalks. The relative influence of various yield components on cane yield has been studied by other investigators (James and Miller, 2009) have reported that the number of millable cane found to be the most important component of cane yield; and the non-significant higher yield obtained from the bottom portion in the present study could be attributed, at least in part, to higher stalk length and diameter as compared to the other treatments.

IV. CONCLUSIONS AND RECOMMENDATION

The results of this study suggest that stalk cuttings taken from the middle and top portions significantly improved sprouting over the matured bottom portion. On the other hand, no significant effect of different stalk portions was observed on plant population, plant height, cane yield and its components at harvest. Cane growers are also advised to use the middle and top portions of cane plant as planting material for commercial sugar production. However, further studies are necessary considering a range of commercial sugarcane varieties and soil type in all sugar plantations in Ethiopia to come up with all encompassing recommendations.

REFERENCES

- [1] Alvarez, F. and Planar, R., 1987. The influence of different stalk cuttings on the dynamics of tillering and stalk population of sugarcane variety C187-68. *Cultivos Tropicales (Cuba)*. Vol. 8(2) p73-83.
- [2] Barnes, A.C., 1974. *The sugarcane*. 2nd edition. Leonard Hill, Ltd., Lomdon.
- [3] Clements, H.F., 1940. Factors affecting germination of sugarcane. *Hawaiian Planters. Recrd44*: 117-146.
- [4] Clements, H.F., 1980. *Sugarcane crop logging and crop control principles and practices*. Hawaii; Honolulu, pp. 510.
- [5] Clements, H.F. and Ghotb, A. 1969. The numbering of leaves and internodes for sugarcane nutrition studies. *Proceedings 13th Congress, International Society of Sugarcane Technologists, Taiwan* pp 569-584.
- [6] Ching, T. M. 2000. Metabolism of germinating seeds. In *seed biology* Vol. II pp 103-205.
- [7] Das, S.D., 2005. Influence of aging of seed cane on germinabilty and vigor of seedlings of sugarcane. *Seed Research* V. 9(2) 162-166.
- [8] Delouche, J.C., 1969. Planting seed cane quality. *Proceeding Belt-wide. Cotton production Conference, New Orleans*. Pp 16-18.
- [9] Gupta, V.S., 1978. *Crop physiology*. Oxford and IBH Publishing Co. LTD., New Delhi. PP 42-43.

- [10] Kakde, J.K., 1985. *Sugarcane and production*. Akola, Metroplitan Book Co., LTD., New Delhi. 384p.
- [11] Herbert, L.P., 1967. Association between yield components and yield of sugarcane varieties in Louisiana. *International Society of Sugarcane Technologists*. p. 760-763.
- [12] James, N.J. 2007. Yield components in random and selected sugarcane varieties. *Crop science*. V. 11(6): pp245-248.
- [13] James, N.J. and Miller, J.D., 2009. Selection in two seedlings of four sugarcane progenies. *Crop science*. 11(6): 245-248.
- [14] Stevenson, G.C., 1965. *Genesis and breeding of sugarcane*. Longman. London.
- [15] Subbaro, M.S., and Prasad, R.B., 2010. Studies in India on the germination of sugarcane. *Indian journal of plant physiology*. V. 3(2):181-194.
- [16] Worku Burayu, 1992. The influence of different portions of the stal cuttings and number of buds per set on sprouting, tillering and yield of sugarcane, M.Sc thesis. Alemaya University of Agriculture, Ethiopia.

Effect of Different Nitrogen Rates and Time of Application in Improving Yield and Quality of Seed Cane of Sugarcane (*Saccharum spp. L.*) Variety B41/227

Mengistu Sime

Department of Plant Sciences, School of Agriculture, Adama Science and Technology University, P.O.Box 1888, Adama, Ethiopia
E-mail: simemengistu@gmail.com; msimeb@yahoo.com

Abstract- A two-phase field experiment on the effect of N application was studied on growth, yield and quality of seed cane of sugarcane variety, B41/227 at Finchaa Sugarcane Plantation during 2000/2001 and 2002/2003 cropping years. Thirty two treatments comprised of four N levels – 0, 46, 92 and 138kg/ha, and applied at 2¹/₂, 5 and 7¹/₂ months after planting in whole and split applications were used in RCBD with three replications. The source of fertilizer is urea (46%N), which is the commonly used fertilizer in the plantation. The results of the experiment showed that application of high N rate resulted in better plant height, stalk population, stalk length as well as higher sett yield and improved sprouting of buds. In phase-1 experiment, significantly higher sett yield was obtained for the highest rate of 138kgN/ha applied in single, double and triple doses over the control. Apart from other treatments, application of 138kgN/ha in two doses at two and half and five months significantly increased stalk population and sett yield by 39.1 and 51.7%, respectively, over the control. In the second phase, seed setts obtained from seed cane plants treated with the same rate gave sprouting performance of average quality. Significantly higher sprouting performance was recorded for seed setts from seed cane plants treated with N rates applied at mid and late crop ages. Therefore, to get higher sett yield of average quality it is advisable that urea be applied to seed cane plants of sugarcane variety B41/227 at the rate of 300kgN/ha in two splits of 200 and 100kgN/ha at two and half and five months of crop ages, respectively. Besides, as this study is the first by its kind under Finchaa condition, it paves an opportunity for further investigation including major sugarcane varieties under cultivation in the study site and other sugarcane plantations in the country.

Index Terms- Fertilization, nitrogen, seed cane/sett, sett yield, sugarcane

I. INTRODUCTION

Sugarcane is propagated commercially by vegetative method, which involves the planting of the stem cuttings of immature cane about 8 to 12 months old, grown with special care are recommended for seed cane (Fauconnier, 1993). Herbert (1956) asserted that planting sound seed pieces with high germination capacity is very essential in order to maintain a uniform stand of sugarcane that ultimately produces high cane and sugar yield. Thus it is a point of due consideration that seed cane plants should receive high nitrogen (N) fertilization with balanced phosphorus (P) and potassium (K). According to Russell (1988) N occupies the highest place in the nutrition of sugarcane. N fertilization enhances and increases the growth of sugarcane and enables the plants to take up other nutrients (Barnes, 1974). Increasing the level of nitrogen to the optimum requirements of

the seed cane plants correspondingly increases sett yield and quality (Herbert, 1956). Kakde (1985) also reported application of N as high dose 50% greater than that applied to the commercial cane. Various review reports (Humber, 1963; Clements, 1980) indicated that N fertilizer applications at two to six weeks before the cane is cut for seed is useful to improve germination, tillering and induce early vigour.

The foregoing reviews at the formerly established sugarcane plantations of Wonji-Shoa and Metahara suggest that N fertilization of seed cane plants has a potential to improve yield and quality of setts, which in turn gives a foundation for good crop stand (Tadesse, 1993, 2004) whereas no research results are available on seed cane fertilization under Finchaa condition, which may differ from Wonji-Shoa and Metahara in fertility status and climatic conditions.

At Finchaa Sugarcane Plantation the practices of seed cane fertilization is the same to the commercial cane fields despite the difference in the purpose of production. Usually, fields of light red chromic Luvisols have been allocated for seed cane production. Therefore, this study was initiated to investigate the influence of different N rates on growth, yield and quality of seed cane of sugarcane variety understudy.

II. MATERIALS AND METHODS

The study was carried out at Finchaa, which is located at about 330km west of Addis Ababa. Its elevation is about 1350-1600m.a.s.l. with long years' annual mean maximum and minimum temperatures of 30.6 and 14.5°C, respectively. Long years annual mean rainfall of the area is about 1310mm and mean maximum and minimum relative humidity is 83.8% and 38%, respectively.

The experiment was conducted during 2000/2001 and 2002/2003 cropping years on sugarcane variety, B41/27. The study was classified into two experimental phases and repeated over two years on red chromic Luvisols. In phase-1, seed cane plants were fertilized with different N levels at three application times. In phase 2, quality of the setts obtained from the treated seed cane plants was tested.

Phase-1

The experiment was laid in randomized complete block design (RCBD) with three replications. Thirty two treatments comprised of four N levels: 0, 46, 92, and 138kgN/ha and applied at 2¹/₂, 5 and 7¹/₂ months after planting in single and split doses were used. The source of N is urea (46%N), which is the commonly used fertilizer in the plantation. Each plot consists of four furrows of each five meters long and a spacing of 1.45m. In

each furrow 35 two-budded setts were planted at five centimeters overlap. Data were collected from the middle two furrows. Other cultural practices were executed according to the standard norms of the plantation.

To determine soil physico-chemical properties of the study site, composite soil samples were collected from the two soil depths (0-30 and 30-60cm) before planting. The samples were analysed for texture, pH, organic C, total N, available P and K, CEC and EC following the procedures outlined in FAO (Cottenie, 1980) and IITA (1979) laboratory manuals.

Growth and yield parameters were recorded at nine months of crop age to measure treatment effects. Plant height measurement of randomly selected 10 plants and stalk population count were done. Plant heights were measured from the ground level to the top visible dewlap (TVD).

At cutting the plants for seed cane, final stalk population count was done. Ten randomly selected sample stalks per the middle two rows were collected and average stalk weight, stalk length and girth, number of internodes per stalk were recorded. Finally, estimated sett yield per hectare and juice quality parameters for reducing sugar were computed.

Sett yield per hectare was calculated using the formula: $Y = N-1/2 * P$, where Y = number of two-budded setts/ha, N = number of internodes/stalk and P = stalk population/ha

Phase-2

The influence of different N levels and time of application on the quality of seed material as measured by

germination/sprouting was studied. Planting materials prepared from seed cane plants of phase-1 were planted in this phase. The samples were thoroughly mixed and then planting of the composite sample was executed. Field layout as well as arrangement and size of experimental plots were the same as in phase-1. At about 45 days after planting final sprouting count was conducted.

In both cases, the collected data were subjected to combine analysis of variance (ANOVA) over years using the Mstat computer package. Treatment means that showed significant differences were separated by Duncan's Multiple Range Test (DMRT).

III. RESULTS AND DISCUSSION

Soil physico-chemical characteristics of the study site

Results of soil analysis of the study site shows that low level of total N was observed at both top and sub-soil layers.

Phase-1

Plant height/stalk elongation

The results in Table 1 below indicated that plant height at nine months of crop age was not significantly affected by different N levels and time of application. Though, the lowest plant height was observed for the control.

Table 1. Average plant height as affected by different N rates

Trt. No.	N Rate (kgN/ha)	Time of Application	Plant height at nine month of crop age (cm)
T1	0	-	150.2
T2	46	2 ¹ / ₂	199.8
T3	46 (23, 23)	2 ¹ / ₂ , 5	201.9
T4	46	5	186.6
T5	46 (23, 23)	5, 7 ¹ / ₂	176.5
T6	46 (23, 23)	2 ¹ / ₂ , 7 ¹ / ₂	186.6
T7	46	7 ¹ / ₂	188.4
T8	46	2 ¹ / ₂	206.8
T9	92 (46, 46)	2 ¹ / ₂ , 5	195.9
T10	92	5	204.6
T11	92 (46, 46)	5, 7 ¹ / ₂	160.6
T12	92 (46, 46)	2 ¹ / ₂ , 7 ¹ / ₂	174.2
T13	92	7 ¹ / ₂	149.5
T14	138	2 ¹ / ₂	212.5
T15	138 (69, 69)	2 ¹ / ₂ , 5	202.7
T16	138	5	219.9
T17	138 (69, 69)	5, 7 ¹ / ₂	176.5
T18	138 (69, 69)	2 ¹ / ₂ , 7 ¹ / ₂	205.0
T19	138	7 ¹ / ₂	170.1
T20	138 (46, 46, 46)	2 ¹ / ₂ , 5, 7 ¹ / ₂	199.1
T21	138 (46, 92)	5, 7 ¹ / ₂	198.9
T22	138 (46, 92)	2 ¹ / ₂ , 7 ¹ / ₂	199.8
T23	138 (92, 46)	2 ¹ / ₂ , 7 ¹ / ₂	205.6
T24	138 (92, 46)	5, 7 ¹ / ₂	197.9
T25	138 (46, 92)	2 ¹ / ₂ , 5	203.1
T26	138 (92, 46)	2 ¹ / ₂ , 5	202.3
T27	138 (69, 46, 23)	2 ¹ / ₂ , 5, 7 ¹ / ₂	209.4
T28	138 (69, 23, 46)	2 ¹ / ₂ , 5, 7 ¹ / ₂	213.4
T29	138 (46, 69, 23)	2 ¹ / ₂ , 5, 7 ¹ / ₂	211.1
T30	138 (46, 69, 23)	2 ¹ / ₂ , 5, 7 ¹ / ₂	217.5
T31	138 (23, 69, 46)	2 ¹ / ₂ , 5, 7 ¹ / ₂	202.5
T32	138 (23, 69, 46)	2 ¹ / ₂ , 5, 7 ¹ / ₂	185.9
CV (%)			11.7

Stalk characteristics at harvest

Average stalk population, length and girth, and number of internodes per stalk are presented in Table 2. Statistically significant differences between treatments were observed for stalk population and length (P<0.01). Significantly higher stalk population (144 793) was recorded for high N rate, i.e., 138kg N/ha (T26) and increased stalk population by 39.1% over the control (104 096) but with no significant differences from most the treatments. Regarding stalk length, significantly higher stalk lengths of 161.4 to 168.7cm were recorded for T₁₄, T₁₈, T₂₀, T₂₆,

T₂₇ and T₂₈ against control (125.cm). On the other hand, variations among stalk girth and number of internodes per stalk were not significant for different N rates studied. From the quantitative aspect of seed cane production, except stalk population and number of internodes, other parameters such as stalk length and girth do not affect sett yield but may have influence on setts quality. Research findings conducted in Egypt also revealed that increasing nitrogen level increased stalk height, stalk diameter and quality of setts/seed cane as compared with the lowest rate (Azzay *et al*, 2008).

Table 2. Stalk population, stalk length, stalk girth and number of internodes/stalk as affected by different N rates at harvest (at nine months of crop age)

Trt. No.	N Rate (kgN/ha)	Time of Application	Stalk population per ha*	Stalk length (cm)*	Stalk girth (mm)	Average no. of internodes/stalk
T1	0	-	104 096 fg	125.5 e	25.0	12.7
T2	46	2 ^{1/2}	128 830 abcdefg	153.8 abcde	25.2	13.0
T3	46 (23, 23)	2 ^{1/2} , 5	116 689 abcdefg	140.2 abcde	26.3	13.3
T4	46	5	120 736 abcdefg	146.0 abcde	25.9	13.3
T5	46 (23, 23)	5, 7 ^{1/2}	107 246 defg	132.4 cde	27.0	12.3
T6	46 (23, 23)	2 ^{1/2} , 7 ^{1/2}	105 222 efg	134.5 bcde	26.1	13.0
T7	46	7 ^{1/2}	101 175 g	134.9 bcde	27.4	14.0
T8	46	2 ^{1/2}	126 354 abcdefg	152.1 abcde	27.6	13.3
T9	92 (46, 46)	2 ^{1/2} , 5	118 936 abcdefg	155.3 abcde	27.0	13.0
T10	92	5	126 354 abcdefg	151.0 abcde	26.9	13.3
T11	92 (46, 46)	5, 7 ^{1/2}	114 665 bcdefg	146.6 abcde	27.6	13.7
T12	92 (46, 46)	2 ^{1/2} , 7 ^{1/2}	110 168 bcdefg	151.8 abcde	25.2	13.7
T13	92	7 ^{1/2}	110 841 bcdefg	139.6 abcde	27.1	13.0
T14	138	2 ^{1/2}	132 877 abcde	161.4 abcd	25.8	12.7
T15	138 (69, 69)	2 ^{1/2} , 5	117 588 abcdefg	156.7 abcde	26.7	14.0
T16	138	5	108 819 defg	137.0 abcde	26.9	13.0
T17	138 (69, 69)	5, 7 ^{1/2}	109 044 defg	129.3 de	25.9	13.3
T18	138 (69, 69)	2 ^{1/2} , 7 ^{1/2}	131 304 abcdefg	164.4 abc	26.2	14.0
T19	138	7 ^{1/2}	106 571 defg	136.4 abcde	26.3	13.0
T20	138 (46, 46, 46)	2 ^{1/2} , 5, 7 ^{1/2}	133 326 abcde	164.1 abc	26.7	14.0
T21	138 (46, 92)	5, 7 ^{1/2}	133 776 abcde	147.2 abcde	27.2	13.0
T22	138 (46, 92)	2 ^{1/2} , 7 ^{1/2}	121 410 abcdefg	156.9 abcde	26.4	13.0
T23	138 (92, 46)	2 ^{1/2} , 7 ^{1/2}	120 736 abcdefg	154.8 abcde	26.3	13.0
T24	138 (92, 46)	5, 7 ^{1/2}	115 115 abcdefg	137.7 abcde	25.6	13.0
T25	138 (46, 92)	2 ^{1/2} , 5	140 070 ab	154.7 abcde	26.0	13.0
T26	138 (92, 46)	2 ^{1/2} , 5	144 793 a	166.7 ab	26.1	12.7
T27	138 (69, 46, 23)	2 ^{1/2} , 5, 7 ^{1/2}	127 930 abcdefg	163.2 abc	26.3	13.3
T28	138 (69, 23, 46)	2 ^{1/2} , 5, 7 ^{1/2}	134 450 abcd	168.7 a	26.2	13.3
T29	138 (46, 69, 23)	2 ^{1/2} , 5, 7 ^{1/2}	138 947 abc	142.9 abcde	26.4	12.7
T30	138 (46, 69, 23)	2 ^{1/2} , 5, 7 ^{1/2}	119 387 abcdefg	153.3 abcde	25.9	12.7
T31	138 (23, 69, 46)	2 ^{1/2} , 5, 7 ^{1/2}	111 068 cdefg	150.2 abcde	27.6	13.7
T32	138 (23, 69, 46)	2 ^{1/2} , 5, 7 ^{1/2}	110 393 defg	146.5 abcde	26.4	13.0
CV(%)			8.97	8.43	4.05	7.0

* - Means followed by different letters within the same column are significantly different at 1% probability level.

Sett yield

Data in Table 3 shows significant differences between treatments (P<0.01) for sett yield. Significantly higher sett yield was obtained for T₁₄, T₁₈, T₂₅, T₂₆ and T₂₈, i.e., for the higher rate of 138kg N/ha in whole and split doses as compared to other treatments but with no difference among them. However, the highest and lowest sett yield 868 758 and 572 528 were recorded for T₂₆ and the control respectively. N rate of 138kg N/ha in two

doses (92 and 46) applied at 2^{1/2} and 5 months, respectively, had shown sett yield advantage and increased sett yield by 51.7% over the control as compared with the rest treatments. Moreover, the result of this study also supports earlier observations (Tadesse, 1993, 2004) that N fertilization of seed cane plants has a potential to improve yield and quality of setts, which in turn gives a foundation for good crop stand.

Table 3. Setts yield as affected by different N rates

Treatment No.	N Rate (kgN/ha)	Time of Application	Estimated number of two-budded setts per ha*
T1	0	-	572 528 c
T2	46	2 ^{1/2}	772 980 bc
T3	46 (23, 23)	2 ^{1/2} , 5	700 134 bc
T4	46	5	724 416 bc
T5	46 (23, 23)	5, 7 ^{1/2}	589 853 c
T6	46 (23, 23)	2 ^{1/2} , 7 ^{1/2}	631 332 bc
T7	46	7 ^{1/2}	657 637 bc
T8	46	2 ^{1/2}	758 638 bc
T9	92 (46, 46)	2 ^{1/2} , 5	713 616 bc
T10	92	5	758 124 bc
T11	92 (46, 46)	5, 7 ^{1/2}	745 323 bc
T12	92 (46, 46)	2 ^{1/2} , 7 ^{1/2}	716 092 bc
T13	92	7 ^{1/2}	665 046 bc
T14	138	2 ^{1/2}	797 262 ab
T15	138 (69, 69)	2 ^{1/2} , 5	764 322 bc
T16	138	5	652 914 bc
T17	138 (69, 69)	5, 7 ^{1/2}	654 264 bc
T18	138 (69, 69)	2 ^{1/2} , 7 ^{1/2}	853 470 ab
T19	138	7 ^{1/2}	639 426 bc
T20	138 (46, 46, 46)	2 ^{1/2} , 5, 7 ^{1/2}	733 293 bc
T21	138 (46, 92)	5, 7 ^{1/2}	735 768 bc
T22	138 (46, 92)	2 ^{1/2} , 7 ^{1/2}	728 460 bc
T23	138 (92, 46)	2 ^{1/2} , 7 ^{1/2}	724 416 bc
T24	138 (92, 46)	5, 7 ^{1/2}	690 690 bc
T25	138 (46, 92)	2 ^{1/2} , 5	840 420 ab
T26	138 (92, 46)	2 ^{1/2} , 5	868 758 a
T27	138 (69, 46, 23)	2 ^{1/2} , 5, 7 ^{1/2}	767 580 bc
T28	138 (69, 23, 46)	2 ^{1/2} , 5, 7 ^{1/2}	806 700 ab
T29	138 (46, 69, 23)	2 ^{1/2} , 5, 7 ^{1/2}	833 682 bc
T30	138 (46, 69, 23)	2 ^{1/2} , 5, 7 ^{1/2}	716 322 bc
T31	138 (23, 69, 46)	2 ^{1/2} , 5, 7 ^{1/2}	721 942 bc
T32	138 (23, 69, 46)	2 ^{1/2} , 5, 7 ^{1/2}	662 358 bc
CV (%)			15.76

* - Means followed by different letters within the same column are significantly different at 1% probability level.

Phase-2

Sprouting/germination percentage

Sprouting percentages were remarkably different among treatment and varies between 47.1% and 80.7%. The highest sprouting percentages were recorded for T₁₁ (80.7%) and T₁₉ (80.0%), i.e., plants grown from seed cane plants treated with application of 92kg N/ha in two equal split doses at five, and seven and half months, and single application of 138kg N/ha applied at seven and half month, respectively. The lowest sprouting percentage was recorded for T₁₄ – single application of 138kg N/ha at early crop age (two and half month); in view of the fact that N applied at early growing stage, regardless of the

rate, it could be utilized for vegetative growth and may have not been enough to produce reserve nutrients for the sprouting buds as compared to late application. Figures presented in Table 5 revealed that significantly higher sprouting percentages (P<0.01) were recorded for T₁₁ and T₁₉ and improved shoot emergence by 39.5 and 38.3%, respectively, over the control. On the contrary, no significant difference between the rest treatments and the control was observed. Similarly, Tadesse (2004) reported high sprouting percentage with nitrogen level increased as compared with the lowest rate (the control). This is possibly due to the fact that single or double application of high rate of N fertilizer at middle and late ages have made the applied N available for the sprouting buds to be easily utilized for emergence.

Table 4. Average plant height as affected by different N rates

Trt. No.	N Rate (kgN/ha)	Time of Application	Sprouting/germination %age*
T1	0	-	57.8 bcd
T2	46	2 ¹ / ₂	62.6 abcd
T3	46 (23, 23)	2 ¹ / ₂ , 5	64.5 abcd
T4	46	5	59.8 bcd
T5	46 (23, 23)	5, 7 ¹ / ₂	68.1 abc
T6	46 (23, 23)	2 ¹ / ₂ , 7 ¹ / ₂	69.1 abc
T7	46	7 ¹ / ₂	72.9 abc
TT8	46	2 ¹ / ₂	70.7 abc
T9	92 (46, 46)	2 ¹ / ₂ , 5	64.5 abcd
T10	92	5	77.1 ab
T11	92 (46, 46)	5, 7 ¹ / ₂	80.7 a
T12	92 (46, 46)	2 ¹ / ₂ , 7 ¹ / ₂	68.8 abc
T13	92	7 ¹ / ₂	73.8 abc
T14	138	2 ¹ / ₂	47.1 d
T15	138 (69, 69)	2 ¹ / ₂ , 5	54.5 cd
T16	138	5	77.1 ab
T17	138 (69, 69)	5, 7 ¹ / ₂	71.2 abc
T18	138 (69, 69)	2 ¹ / ₂ , 7 ¹ / ₂	58.1 bcd
T19	138	7 ¹ / ₂	80.0 a
T20	138 (46, 46, 46)	2 ¹ / ₂ , 5, 7 ¹ / ₂	61.4 abcd
T21	138 (46, 92)	5, 7 ¹ / ₂	76.7 ab
T22	138 (46, 92)	2 ¹ / ₂ , 7 ¹ / ₂	65.2 abcd
T23	138 (92, 46)	2 ¹ / ₂ , 7 ¹ / ₂	59.3 bcd
T24	138 (92, 46)	5, 7 ¹ / ₂	73.6 abc
T25	138 (46, 92)	2 ¹ / ₂ , 5	68.3 abc
T26	138 (92, 46)	2 ¹ / ₂ , 5	63.1 abcd
T27	138 (69, 46, 23)	2 ¹ / ₂ , 5, 7 ¹ / ₂	58.8 bcd
T28	138 (69, 23, 46)	2 ¹ / ₂ , 5, 7 ¹ / ₂	59.3 bcd
T29	138 (46, 69, 23)	2 ¹ / ₂ , 5, 7 ¹ / ₂	67.1 abc
T30	138 (46, 69, 23)	2 ¹ / ₂ , 5, 7 ¹ / ₂	64.5 abcd
T31	138 (23, 69, 46)	2 ¹ / ₂ , 5, 7 ¹ / ₂	72.8 abc
T32	138 (23, 69, 46)	2 ¹ / ₂ , 5, 7 ¹ / ₂	77.1 ab
CV (%)			10.9

* - Means followed by different letters within the same column are significantly different at 1% probability level.

IV. CONCLUSION AND RECOMMENDATIONS

In this study, it was found that effects of different N rates were noted to be reflected both on sett yield and quality parameter. Application of 138kg N/ha (300 kg urea/ha) in two doses of 92 and 46kg N/ha at two and half and five months, respectively, resulted in good growth, population, stalk length as well as higher sett yield in phase-1. In phase-2, however, per cent of shoot emergence of seed setts treated with this rate gave seed cane of average quality with no significant difference from that of zero N level and the rest treatments. This is possibly due to the fact that applications of adequate amount of N fertilizer at early and middle growth stages enhanced better vegetative growth as compared to late applications but may not have been enough to produce seed setts of higher quality. Therefore, adequate applications of N fertilizer at early and middle crop ages resulted in higher sett yield and ultimately seed cane of average quality.

Accordingly, based on the results obtained and out of it, the following recommendations are forwarded: Biological yield of sugarcane for seed production required more N than what is being applied to attain its maximum. Hence, to get higher sett yield and ultimately seed cane of average quality it is recommended that Urea be applied to seed cane plants of sugarcane variety under study at the rate of 300kg/ha in two doses of 200 and 100kg/ha at two and half and five months after planting, respectively. Hence, as this study is the first by its kind under Finchaa condition, it paves a way for further investigation including major sugarcane varieties under cultivation in the study site and other sugarcane plantations in the country.

REFERENCES

- [1] Azzay, N.B., Elham, A.D., Effect of nitrogen fertilization on yield and quality of two sugarcane promising varieties. *Egyptian Journal of Agricultural Research* 2000. Vol.78 No. 2 pp. 745-758.
- [2] Barnes, A.C., 1974, 76. *The sugarcane*. Leonard Hill Books, London.
- [3] Cottenie, A., 1980. Soil and plant testing as a basis of fertilizer recommendation, *FAO Soils Bulletin*, 38:61-100.
- [4] Fauconnier, R., 1993. *Sugarcane*. The Tropical Agriculturalist. The MACMILLAN Press Ltd. London.
- [5] Hebert L.P., 1956. Effect of seed pieces and rate of planting on yield of sugarcane, and of N fertilization on yield of seed cane in Louisiana. *Proc. IX Congr. ISSCT*. 1:301-310.
- [6] Humbert, P.R., 1963. *Planting of sugarcane*. Elsevier Pub. Comp. Amsterdam.
- [7] International Institute of Tropical Agriculture (IITA), 1979. *Selected methods for soil and plant analysis*, Ibadan, Nigeria.
- [8] Kakde, J.R., 1985. *Sugarcane Production*. Renu Printers, New Delhi.
- [9] Tadess Negi, 1993. The effect of rate and time of application on growth parameters and quality of setts of seed cane plants of sugarcane at Wonji-Shoa. M.Sc. Thesis. Alemaya University of Agriculture, Alemaya, Ethiopia.
- [10] Tadess Negi, 2008. Effect of N application on seed cane yield and quality. Research report (Unpublished). Ethiopian Sugar Industry Support Centre Sh. Co., Research and Training Service, Wonji, Ethiopia.
- [11] Russell E.W., 1988. *Soil condition and plant growth*. English Language Book Society. Longman London.

Evaluation of Indoor Environmental Quality (IEQ) on dense Academic Building: Case Studies Universiti Tun Hussein Onn Malaysia

M.A Sulaiman^{*}, W.Z. Wan Yusoff^{**}, W.N. Wan Kamarudin^{***}

^{*} Faculty of Technology Management, and Business Universiti Tun Hussein Onn Malaysia

^{**} Faculty of Technology Management, and Business Universiti Tun Hussein Onn Malaysia

^{***} Faculty of Chemical Engineering Universiti Technology Malaysia

Abstract- Indoor environmental quality (IEQ) is a key component in the evaluation for meeting the concept of green building that aims towards sustainable development. Imbalance of IEQ contributes to sick building syndrome (SBS). The study focused on identifying the framework in the evaluation of IEQ in the context of academic buildings at institutions of higher education. The investigations include two factors; the level of IEQ and the level of users' satisfaction in the academic buildings. Survey and on site scientific measurement approaches have been carried out for data collection. The data then analyze using Statistical Package for Social Science (SPSS). Experimental studies on the academic building focused on a propose IEQ evaluation framework based on four main elements IEQ; thermal (temperature and humidity) and noise comfort, indoor air quality (air movement CO₂ concentration) and lighting. Experimental results obtain are compared with Malaysia Standard MS 1525:2007. The results showed that the element of temperature, air movement and the CO₂ concentration are at accepted level. Meanwhile the elements of relative humidity, sound and lighting are below prescribed standards. The framework that has been developed as the measurement model can be used in the evaluation of indoor environmental quality (IEQ) at any academic building in Malaysia.

Index Terms- Indoor Environmental Quality, measurement framework, sick building syndrome, academic buildings.

I. INTRODUCTION

Indoor environmental quality (IEQ) is rarely considered as a priority in most development planning and management. IEQ elements account for 21% of green building evaluation criteria for non-residential building such as academic buildings in higher education intuitions [1]. An imbalance of IEQ can also give negative impact to facilities, building and occupants. Many factors contribute to the IEQ. It is not limited for air pollution, thermal conditions, humidity, sound, lighting and odor, but also includes the use of energy, design, and natural ventilation [4].

Imbalance of IEQ contributes to sick building syndrome when, a building unable to function well in terms of ventilation, relative humidity, and so on. This contributes to the health quality of occupant and the case of academic building will affect the teaching and learning process [5]. Thus, the study of IEQ on dense academic building institutions is important to look

at how far the levels of the IEQ [2]. It also found that indoor environmental quality not only concern air pollution, but also involve other factors such as comfort, noise, lighting, ergonomic stress and pressure of workers [2].

Thermal comfort is closely related to temperature and humidity, whereas indoor air quality (IAQ) considers volatile organic compound (VOC) and air speed. The presence of VOC such as CO₂, CO or biological impurities is also a main factor that influences IAQ [3]. Therefore, an effective ventilation system and proper maintenance of heating, ventilation and air conditioning equipment are factors that can improve IAQ [6]. Noise Comfort closely related to the ability of buildings to reduce or remove excessive noise from the outside and reduce the noise level within and occupied space or room. Lighting is an effort to maximize the lighting during dark while minimizing glare and heat. The arrangement of space the use of wall color, materials used in furniture and any other equipment is in a space is also part of the factors that may influence the IEQ [8].

Sick Building Syndrome is a broad definition that includes a variety of symptoms considered to be experienced when the occupants spent time in a particular building. A building can be categorized as a sick building when more than 30 % occupants have complained of related symptoms [9]. In this particular study, the IEQ of academic buildings of Universiti Tun Hussein Onn Malaysia (UTHM) is evaluated. The campus is located in a mixed development area which includes a long established industrial area. The study is important as it will reflect the quality and health of building occupants which may directly give impact to teaching and learning,

Objectives of the research are to identify framework for to evaluate the IEQ, secondly is to evaluate the quality of indoor environment (IEQ) based on users perception UTHM academic building and lastly to measure the level of IEQ UTHM campus buildings. Scope for This study only focused on G3 Lecture Complex.

II. RESEARCH METHODOLOGY

This study involved the three research questions. Firstly, what is IEQ measurement framework in the evaluating of IEQ in academic building, secondly, what are the perception of IEQ the main users on G3 complex on IEQ, lastly, what are the level of IEQ of the academic buildings. The main purpose of this research is find out problem issue in this matter.

The study

The main campus of Universiti Tun Hussein Onn Malaysia is located in a mixed development Parit Raja, Johor. Less than 1 km from the main campus is an industrial park, business centre and residential area. The study focuses on the main academic complex of UTHM known as G3 lecture complex. This is the largest complex for teaching and learning, and is used by all faculties of the university.

Method of Study

The methodology of the study involves scientific measurement, questionnaire and references. In the scientific measurement process, three levels of the process were used to obtain high quality data to be applied as evidence and support in to strengthen the arguments and views related to this study. Firstly, Preliminary investigation, where initial the observation was done in getting the whole idea of G3 lectures complex design. In this case, the whole environment in a building space was identified for used when making advanced search later. Then, that the relevant building plans such as electrical and mechanical plans, and structure building, that gives some understanding of the technical procedures such as ventilation, lighting and other element that were studied. Scientific measurement was performed using special equipment to test the variables that have been determined. . All data collected were recorded and analyzed.

For questionnaire development, it is involves two types of data, namely primary and secondary data collections. Primary data collection involves survey forms to distribute to the respondents. Questionnaire has been developed based on research objectives to collect research data. Secondary data is data collection from various sources such as reference books, journals, articles, internet, newspaper reports and all sources of publications. Its purpose is to strengthen the validity of the primary data and to achieve the objectives of the study. After all the data were obtained, the data were analyzed using quantitative methods. A program *Statistical Package for Social Science (SPSS)* was used in the analysis of the data.

III. RESULT AND DISCUSSION

a) Measurement Framework

Analytical method for the first objective is to identify the IEQ measurement framework for university academic building through reference from literature. The main references based on Department of Standards Malaysia, Ministry of Science, Technology and Innovation and Code of Practice for Energy Efficiency and Renewable Energy Consumption for non-residential buildings (MS1525: 2007). In the evaluation of IEQ for non-residential buildings, four elements have been chose to become the framework of IEQ evaluation.

i) Thermal comfort

Thermal comfort divides to two main elements. The elements are temperature and relative humidity. For Non-residential building, the indoor temperature must be within a 23

°C-26 °C. Relative humidity level building set between 55% - 70% [7].

ii) Lighting

Lighting intensity level for classroom or teaching and learning process should at level 300-500 lux [7].

iii) Noise Comfort

For buildings used for educational purpose proposed noise level of comfort within 50-70 dB [5].

iv) Indoor Air Quality (IAQ)

Two basic elements of a measurement of indoor air quality (IAQ) are VOC and air speed. For VOC the main elements considers for classroom is concentration of carbon dioxide (CO₂) set at a level below 1.000 ppm. Meanwhile the air movement in a space between 0:15 to 0:50 meters per second (m/s) [7].

b) Evaluation UTHM user perception on the level of indoor environmental quality (IEQ)

The method of achieving this objective was to gauge the perception and opinion of the main users academic building UTHM (students and academic staff). In order to analyze perception of the IEQ element at UTHM, 370 respondents have been selected to answer the questionnaire. 55 % are women while then remaining is male.

Perception of Temperature, 35 respondents (9.5%) indicated that the temperature is very cold, 135 people (36.5%) were cold, 115 (31.1%) said medium, 60 people (16.2%) stated that summer, 18 people (4.9 %) said very hot and 7 people (1.9 %) said they were not sure.

About Perception of humidity, a total of 5 (1.4 %) of respondents expressed very low, 23 (6.2%) respondents said low, 209 (56.4%) of respondents expressed moderate, 78 respondents (21.1%) said high, 21(5.7%) of respondents expressed very high and 34 respondents (9.2%) said they were not sure.

Perception of respondents on light intensity 11 (3%) respondent said the intensity of light in very dim, 85 (23%) respondent stated that dim, 166 (44.9%) people expressed modest 99 people (26.8%) said brightly, 7 people(1.9%) said very bright and 2 (0.5%) respondent are not sure with the level of light intensity.

Perception of respondents on noise comfort A total of 10 (2.7%) person said it was very noisy, 50 (13.5%) people or stated that noise, 276 people (74.6%) state modest, 29 people (7.8%) said quietly, one people (0.3%) said very quietly and 4 respondent (1.1%) said they were not sure.

Perception respondents on indoor air quality (IAQ) have been found. 6 people (1.6%) mention very good, 63 people (17 %) said good, 153 people (41.4%) said modest state, 115 respondent (31.1%) state poor, 29 people (7.8%) were very poor and 4 people (1.1%) were unsure .

The respondents view on the overall IEQ level of academic buildings UTHM.

Of the 370 total respondents, 9 (2.4%) people said very good, 77 people(20.8%) said good, 166 people (44.9%) state

average, 88 people (23.8%) were good, 30 people (8.1%) state very poor state.

The respondent's opinion on effect IEQ to the teaching and learning process.

For this part, 330 (89%) people from 370 respondents said Yes, 29 (8%) persons indicated no effect and a total of 11 (3%) respondent said they were not sure.

Opinion of respondents on the influence of IEQ to the health impact of the respondents

For this question, 292 (79%) persons indicated yes, 49 (13%) people expressed no and 30 (8%) people express uncertain.

Findings and recommendations

Respondents' views and suggestions for improvement efforts for improved IEQ, 124 persons (33.5%) give their views and proposals relating to maintenance. 48 people (13%) stated that it is related to green technology, 25 people (6.8%) give a control relating to consumer behavior in class, 107 people (28.9%) give depictions of the industrial area located next to UTHM, 31 people (8.4%) give a related layout in the classroom. The remaining 35 persons (9.5%) did not express any opinion.

c) Measurement of indoor Environmental Quality (IEQ) of University.

Measurement has been made in a few selected classrooms, lecture halls and academic multimedia laboratory in G3 lecture complex. Measurements were made during the process of learning and teaching to obtain a more accurate reading. Each element of measurement readings was taken five times to get an average reading.

Overall average temperature reading in G3 lecture complex was 23°C. This means that the indoor temperature G3 academic buildings are in good condition as the standards set between 23-27 °C. The total average relative humidity reading of G3 lecture complex is 73 %, which is higher than the standards set by between 55-70%. While reading the entire G3 lecture complex sound intensity is at 76.4 decibels (dB). This means that sound comfort in bad condition because decibels beyond the prescribed limit of 50-70 decibels (dB). For lighting, the average reading level is 251 lux intensity. This reading indicates a slightly low level of light intensity because, for lighting the standards set are between 300-500 lux. The average reading level of air movement in G3 lecture complex was at a speed of 0.4 meters per second (m/s). Standard set between 0.15 to 0.50 meters per second (m/s). The average reading level of carbon dioxide (CO₂) concentration in the atmosphere is 513ppm (*part per*

million). This means that it is in good condition because the concentration of CO₂ in air must be below 1000 ppm reading.

IV. CONCLUSION AND RECOMMENDATION

Based on data obtained from the measurement process in the field study, it can be concluded on overall the quality of indoor environment (IEQ) in the Academic Building UTHM are to be below the prescribed standard. For example, reading for lighting element of 251 lux is below the average standard lighting recommended for learning space 300 lux. Similarly, the sound intensity readings show readings of 76.4 decibels (dB) exceeds the standard set of 50-70 decibels (dB). The other elements measured have shown satisfactory level as compared against the recommended standard.

REFERENCES

- [1] GBI organization, www.greenbuildingindex.com
- [2] <http://www.cdc.gov/niosh/topics/indoorenv/>
- [3] Edwin HW Chan, KS Lam, WS Wong, Evaluation on indoor environment quality of dense urban residential buildings.
- [4] Aliffadillah bin Jaffar, The impact of the environmental indoor residential-industrial Neighbourhood industrial estate at Paka Terengganu
- [5] UNESCO: 1983, Quality of Life: Problems of Evaluation and Measurement (UNESCO, Paris).
- [6] <http://www.epa.gov/eftpages/airindoorairpollusickbuildingsyndrome.html>
- [7] Malaysia Standard: Code Of Practice On Use Of Energy Efficiency And Renewable Energy For Non-Residential Buildings (First Revision) MS 1525:2007
- [8] Mustafa Kamal Bin Mohd. Shariff, 2001 Building environmentally friendly. Article Green Era part 4
- [9] Mohammad Zainal Md Yusof, 2011 "Getting to Know Our Buildings Better: Ventilation, Thermal Comfort, Air Freshness, Indoor Air Quality (IAQ), Sick Building Syndrome (SBS).

AUTHORS

First Author – M.A Sulaiman, Faculty of Technology Management, and Business Universiti Tun Hussein Onn Malaysia, Email: kolonel.azwan@gmail.com

Second Author – W.Z. Wan Yusoff, Faculty of Technology Management, and Business Universiti Tun Hussein Onn Malaysia, Email: zahari@uthm.edu.my

Third Author – W.N. Wan Kamarudin, Faculty of Chemical Engineering Universiti Technology Malaysia, Email: sha_snoomy@yahoo.com

Table 1.1: Summary of Standard Elements IEQ measurements

IEQ measurement element	Reading set
Temperature	23-26 ° C
Relative humidity	55-70%
Sound	50-70 dB
Light	300-500 lux
Air movement	0:15 to 0:50 m / s
Concentration of CO ₂	Below 1000 ppm

Table 1.2: Perception of respondents on temperature

Perception of temperature	Frequency	Percent
Very cool	35	9.5
Cold	135	36.5
Simple	115	31.1
Hot	60	16.2
Very hot	18	4.9
Not sure	7	1.9
Total	370	100

Table 1.3: Perception of respondents on humidity

Level of humidity	Frequency	Percent
Very Low	5	1.4
Low	23	6.2
Simple	209	56.4
High	78	21.1
Very high	21	5.7
Not sure	34	9.2
Total	370	100

Table 1.4: Perception of Light

level of lighting	Frequency	Percent
Very dim	11	3.0
Dim	85	23.0
Simple	166	44.9
Bright	99	26.8
Very bright	7	1.9
Not sure	2	0.5
A mount	370	100

Table 1.5: Perception of Sound

The sound level	Frequency	Percent
Very noisy	10	2.7
Noise	50	13.5
Simple	276	74.6
Silent	29	7.8
Very quiet	1	0.3
Not sure	4	1.1
Total	370	100

Table 1.6: Perception of ventilation

Level of ventilation	Frequency	Percent
Very good	7	1.9
Good	94	25.4
Simple	177	47.8
Less well	80	21.6
Very bad	9	2.4
Not sure	3	0.8
Total	370	100

Table 1.7: Results of IEQ measurements in G3 lecture complex

room	temperature	Relative humidity	Sound level (DB)	Lighting lux	Air movement	CO2 concentration
E4	24	66	73.3	277	0.3	442
E3	26	68	73.5	289	0.3	489
E2	24	71	75.9	281	0.7	424
E1	24	73	75.1	251	0.4	515
Hall F4	23	80	83.1	202	0.8	804
M.Multi media 1	20	74	75.1	212	0.3	528
M.Multi media 2	22	77	71.0	220	0.4	388
B10	23	67	74.4	257	0.5	517
B6	23	77	86.5	266	0.3	514
AVERAGE	23	73	76.4	251	0.4	513

Effect of Organic Manures and Chemical Fertilizers on the Yield and Macronutrient Concentrations of Green Gram

Saravanan P*, Sathish Kumar S**

* Department of Biotechnology, St. Joseph's College (Autonomous), Trichy-2

** Department of Botany, St. Joseph's College (Autonomous), Trichy-2

Abstract- The study was carried out to investigate the effect of organic manure and chemical fertilizers on the yield attributes and macronutrient levels of green gram. The maximum number of pods and pod length was observed in treatment which received FYM+10%NPK whereas number of seeds was maximum in FYM+CCP 2:1 treatment. Macro nutrients such as Calcium, Phosphorus, Iron, Sodium and Potassium were estimated both in fresh and dry seeds. In which the integrated approach recorded better availability of these nutrients in fresh and dry seeds of green gram than the individual application.

Index Terms- CCP – Composted Coir pith, FYM-Farm Yard Manure

I. INTRODUCTION

Green gram is the third important pulse crop cultivated throughout India for its multipurpose uses as vegetable, pulse, fodder and green manure crop. It is a rich source of protein and by virtue of its nitrogen fixing ability it plays vital role in sustaining soil fertility₁. However the productivity of these crops is very low because of their cultivation on marginal and sub marginal lands of low soil fertility where little attention is paid to adequate fertilization. Incorporation of organic manure with chemical fertilizers increase the soil organic carbon content, infiltration rate, water retention, aggregation and aggregate stability in water₂. Hence, the present study was planned with an objective to investigate the effect of selected organic manures and chemical fertilizers on the yield attributes and levels of macro nutrients in green gram.

II. MATERIALS AND METHODS

2.1 Experimental Design

The experiment was laid out in a completely randomized block design comprising of nine treatment combinations with control each replicated three times. About 30 genetically pure green gram seeds were sown in each pot and after germination and establishment 12 healthy plants were maintained.

The treatments were as follows.

C - Control

T1 - Farmyard manure @ 12.5t ha⁻¹

T2 - Composted Coir pith @ 12.5t ha⁻¹

T3 - 100 percent NPK 20:60:20 kg ha⁻¹

T4 - FYM @ 12.5t ha⁻¹ + CCP @ 6.25t ha⁻¹

T5 - FYM @ 6.25t ha⁻¹ + CCP @ 12.5t ha⁻¹

T6 - FYM @ 6.25t ha⁻¹ + CCP @ 6.25t ha⁻¹

T7 - Farmyard manure @ 6.25t ha⁻¹ + 10%NPK

T8 - Composted coir pith @ 6.25t ha⁻¹ + 10%NPK

T9 - FYM@ 6.25t ha⁻¹ +10% NPK+CCP@ 6.25t ha⁻¹

Table 1 Yield parameters of Green gram

Treatments	Number of pods/plants	Pod length (cm)	Number of seeds/pod
C	7.50	4.25	7.50
T1	10.00	4.75	9.50
T2	11.50	4.85	9.50
T3	9.50	5.10	10.50
T4	11.00	5.45	12.50
T5	10.50	5.30	10.00
T6	8.00	5.00	8.00
T7	12.50	5.85	8.50
T8	10.00	5.75	8.50
T9	11.50	5.10	9.50
SEd	0.7071**	0.0837**	0.6325**
CD (P= 0.05)	1.5755**	0.1864**	1.4092**

Yield characters such as number of pods per plant, pod length and number of seeds per pod were studied 65 days after sowing. Macro nutrients such as calcium, phosphorus, Iron, Sodium and Potassium were analyzed in the fresh and dry seeds of green gram.

III. RESULTS AND DISCUSSION

Table 1 depicts the yield parameters of green gram. T7 (FYM+10%NPK) recorded maximum number of pods and pod length. Maximum number of seeds were observed in T4 (FYM+CCP 2:1) where as control showed the minimum yield attributes. Aura and Fatima₃ reported that the combination of organic manure and inorganic fertilizer yielded higher than either organic manure or inorganic fertilizer applied alone.

The macro nutrient content was found to be higher in the dry seeds of green gram in all the treatments than in the fresh seeds. The phosphorus content was maximum in T4 (FYM+CCP, 2:1) of fresh seeds and T7 (FYM+10%NPK) of dry seeds. T7

also recorded the highest value of iron content in both fresh and dry seeds. The highest value of calcium was found in T4 (FYM+CCP) 2:1 and T9 (FYM+CCP+10%NPK) in fresh seeds and T4 (FYM+CCP) 2:1 in dry seeds. Control plants showed the minimum mineral content.

Bhatia₄ reported that calcium level was increased along with phosphorus because both are metabolic twins of each other. Previous studies supported that NPK in combination with FYM registered the highest uptake of phosphorus by both grain and straw.

The data presented in Table 2 showed the sodium and potassium content of fresh and dry seeds.

Table 2 Sodium and Potassium content of Greengram

Treatments	Sodium (mg %)			Potassium (mg %)		
	Fresh seeds	Dry seeds		Fresh seeds	Dry seeds	
C	9.90	22.80		625.0	820.0	
T1	14.40	19.95		518.0	1110.0	
T2	14.40	17.20		625.0	1150.0	
T3	6.05	22.80		557.0	1082.0	
T4	8.85	11.60		608.0	1179.0	
T5	11.60	20.00		751.0	1208.0	
T6	14.40	8.85		722.0	1178.0	
T7	8.80	22.80		732.0	1043.0	
T8	3.30	28.35		721.0	926.0	
T9	14.40	22.80		868.0	946.0	
SEd	T**	S**	TxS**	T**	S**	T x S
CD (P=	4.61	2.06	6.52	19.46	8.79	**
0.05)	9.62	4.29	13.59	40.59	18.15	27.52
						57.41

Sodium content was found to be maximum in fresh and dry seeds of tripartite combination. Potassium content was maximum in tripartite association of fresh seeds and dual combination of T5 (FYM+CCP 1:2) in dry seeds. Singh₅ *et al* reported that organic farming increase the mineral content in rice grain and further indicated that their use not only maintained the soil productivity but also improved the grain quality.

IV. SUMMARY AND CONCLUSION

The results indicated that yield attributes were maximum in FYM+10% NPK, which also recorded maximum phosphorus and iron content in the seeds. Tripartite association showed increased amount of Calcium, Sodium and Potassium in the seeds. The findings revealed that macronutrients in green gram were influenced by integrated applications of organic manure and chemical fertilizers suggesting that soil amendment with organic manure enhance the macronutrients in green gram seeds.

REFERENCES

- [1] Kanoja,R.K.,Singh,V.K. and Kanoja, S.K.,Growing summer mung bean; A profitable approach.Indian farmers digest,2000,11 – 12
- [2] Divya,U.K.Relevance of vermiculture in sustainable agriculture. Kisan World, 2001, 28(7):9-12

- [3] Taura,D.W. and Fatima,M.S., Effect of organic and Inorganic fertilizers on the vegetative and reproductive parts of some selected varieties of Cowpea (*Vigna unguiculata*), African journal of general agriculture,2008 vol.4 (2) 79-86.
- [4] Bhatia,A. Nutrition and Dietetics,Anmol publication Pvt Ltd.,2000, 262-303
- [5] Singh,Y.V.,Singh,B.V.,Pabbi,S.and Singh,P.K. Impact of organic farming on yield and quality of Basmati rice and soil properties, Wissengchaftstagung Okologischer Lanbau,2007

AUTHORS

First Author – Saravanan P, Department of Biotechnology, St. Joseph’s College (Autonomous), Trichy-2., Email: sarwan1971@yahoo.co.in

Second Author – Sathish Kumar S, Department of Botany, St. Joseph’s College (Autonomous), Trichy-2., Emil: svssathishkumar105@yahoo.com

Computer Based Patient Education in Central India

Rizwan Abdul Rasheed Shaikh*, Wasundhara A. Bhad*

* Department Of Orthodontics & Dentofacial Orthopedics,
Government Dental College & Hospital, Nagpur, Maharashtra, India

Abstract

Aim: This study aims to find awareness of healthcare practitioners and students about computer based patient education in central India.

Methods: This study is based on questionnaire survey with a list of 8 questions. 250 doctors and medical students belonging to different areas of specialty were selected randomly from four different cities of central India. They filled out a questionnaire.

Results: It is found that 100% doctors and 97% students of central India are aware of the use of computer in health science. 96% of all healthcare workers are aware of computer based patient education method, however only 24% of them use the computer based patient education in their practice. 81% of doctors and 86% students agreed about high cost of computer based patient education. 49% doctors and 58% students agreed that patient to patient variations in psychology, socioeconomic status and education are the main reasons because of which computer based patient education is not used by them.

Conclusions: Healthcare practitioners and students of central India are aware of computer based patient education, but majority of them are not using it in their own practice. Hence healthcare practitioners of central India should be encouraged to use it. Undergraduate medical students found less aware about computer based patient education, so increase in awareness of undergraduate students is required in central India.

Index Terms- Computer based patient education, patient education, modern medicine, computers in medicine.

I. INTRODUCTION

Healthcare practitioners are always surrounded with different machines. Computer is one of the machine on which a healthcare practitioner is dependent. Computer is used for various purposes in medicine and dentistry e.g. for maintaining patient records, for radiodiagnosis purpose, for patient communication purpose, for academic uses, etc. Till few decades back manual and conventional patient education methods were preferred, but in present era computer based patient education is first choice of healthcare practitioners. Lewis, D. (1999) concluded in his review article that computer based patient education has been shown to be very effective [1]. More patient understanding and interest is with the computer base patient education system regardless of their age, socioeconomic status and education [2]. Computer based instructions helps doctors to meet their educational responsibilities without decrement to the relationship of patient and doctors [3]. Computers based patient

education help patients to take better care of their conditions by providing access to the necessary information [4]. Increase in patient understanding is found with computer based patient education [4]. Computerized patient education methods are more efficient for doctors with busy clinical schedules having limited amount of time which they can spend with a single patient [4]. Because of multimedia, computer based patient education appears useful to educate patients [5]. This indicates that computer based patient education is very useful and comfortable to use in healthcare practice.

This study is performed to find the awareness of healthcare workers about computer based patient education method in central India and to find percentage of users of this patient education method. This study is also to reveal reasons of not using computer based patient education method.

II. MATERIALS & METHODS

From 4 different cities of central India 75 doctors, 75 postgraduate students and 100 undergraduate students belonging to different branches of medicine and dentistry were selected randomly and a questionnaire survey is performed. Out of those 250 healthcare workers 175 participants belong to various branches of medicine and 75 participants belong to dentistry. As a part of survey the doctors and students filled out a questionnaire containing 8 questions that could be answered in "Yes" or "No".

The questions were

1. Are you aware of use of computer in field of medicine and Dentistry?
2. Do you know how a computer is used for patient education?
3. Do you feel computer based patient education is easier and useful than manual techniques of patient education?
4. Do you use computers for patient education?
5. Does cost of the computer based education system is a reason not to use it in clinical practice?
6. Do you feel that manual techniques are more useful than computer based patient education due to patient to patient variations in psychology, socioeconomic status and education in central India?
7. Are you interested to know different methods of computer base patient education?
8. Do you want to use computer based patient education method in future?

Question 1 & 2 were to find awareness of health science personals about use of computer in field of health science. Question 3 & 4 were to find use and benefit of use of computer in field of medicine and dentistry for patient education. Question 5 & 6 were to find reasons of not using a computer for patient education and question 7 & 8 were to find their interest to learn recent methods and to use computer based patient education system in future.

III. RESULTS

Ninety-eight percent of health science persons were aware of use of computers in the field of medicine and dentistry (Fig 1). Out of them all the doctors and postgraduate students belonging to both medical and dental faculty were known with use of computers in their fields. 96% medical undergraduate students and 92% dental undergraduates were aware of use of computers in medical science. This shows that health science workers in central India have good awareness about use of computers in field of medical science.

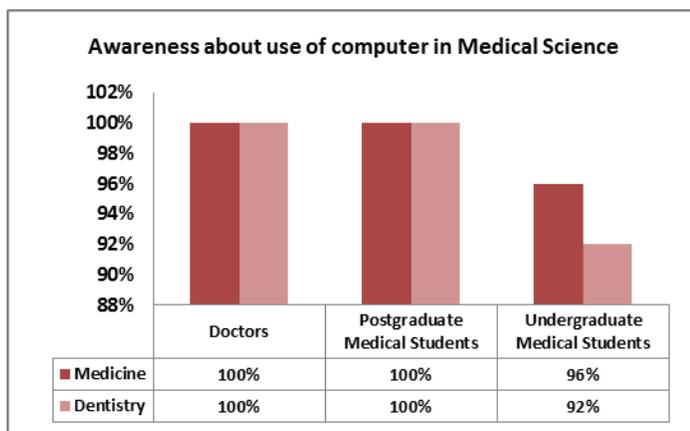


Fig 1 For those who answered “Yes” to the question: “Are you aware of use of computer in field of medicine and Dentistry?” (n=245)

Ninety-six percent medical science persons were aware of computer based patient education method (fig 2). 98% Medical Doctors and Postgraduate students knew how to use computer to educate a patient, while all the dental postgraduate students were aware of this. 96% of medical undergraduates and dentists were found familiar with knowledge of computer based patient education. While only 88% percent dental undergraduate students knew about usefulness of computer in patient education. This reveals the fact that more awareness programs are required so that undergraduate dental students get aware of usefulness of computers in Patient education.

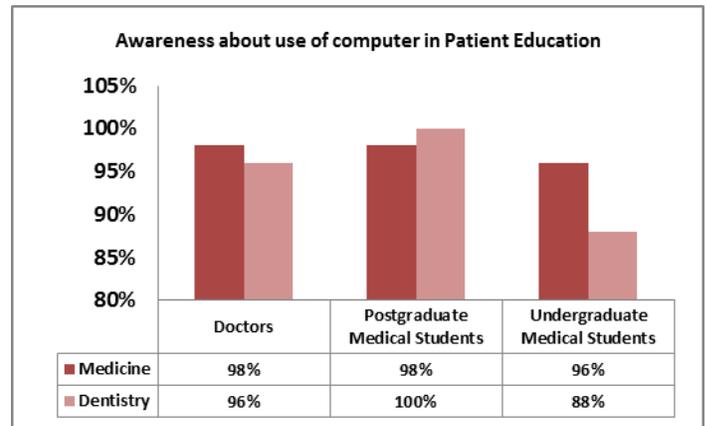


Fig 2 For those who answered “Yes” to the question: “Do you know how a computer is used for patient education?” (n=241)

In this survey 100% dental postgraduate accepted the fact that computer based patient education is more easy as well as useful (fig 3). But acceptance of usefulness of this patient education method was found less in undergraduate students, only 91.5% undergraduates accepted that it is more useful. This leads to conclusion that undergraduate medical students of central India require more awareness about usefulness of computer based patient education.

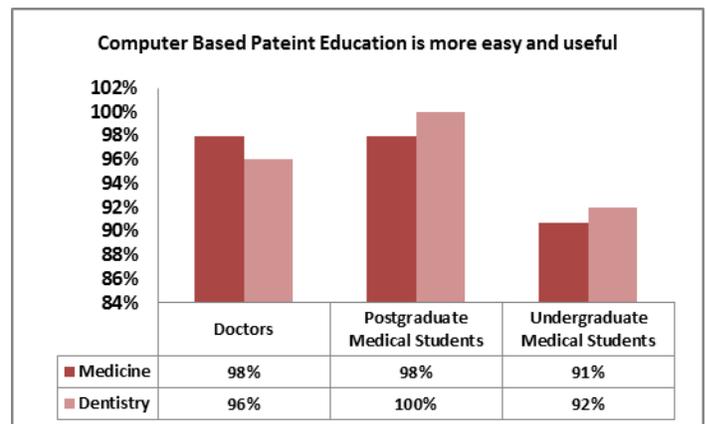


Fig 3 For those who answered “Yes” to the question: “Do you feel computer based patient education is easier and useful than manual techniques of patient education?” (n=238)

Figure 2 shows that 96% healthcare workers were aware of computer based patient education, figure 3 shows that 95% healthcare workers accepted the usefulness of this method. However figure 4 shows that in central India only 24% doctors and health science students use computers to educate the patients. Here, 20% medical while 32% dental doctors use computers for patient education in their practice. Same situation is with undergraduate and postgraduate students, only 26% of them use computer base patient education method.

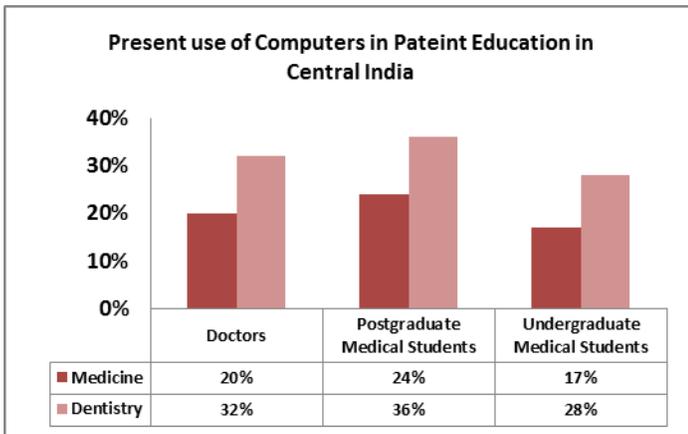


Fig 4 For those who answered “Yes” to the question: “Do you use computers for patient education?” (n=59)

Out of 96% aware healthcare workers only 24% use computer based patient education method. But the 5th question in list revealed the fact that 81% doctors feel that computer based patient education is costly as compared to manual methods while 86 percent of all students also have same thinking (fig 5). This leads to conclusion that cost of computer based education system is a really big problem for healthcare workers of central India.

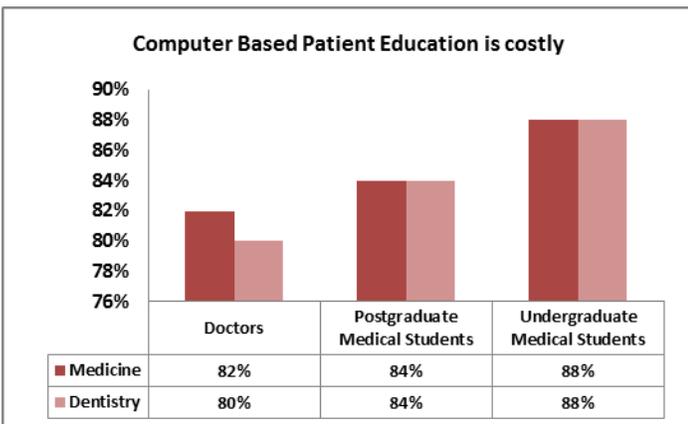


Fig 5 For those who answered “Yes” to the question: “Does cost of the computer based education system is a reason not use it?” (n=212)

Survey also revealed the fact that because of wide patient to patient variations in psychology, socioeconomic status and education level of patients, 49% doctors prefer to use conventional and manual methods of patient education, similarly 58% students found with same feelings (fig 6).

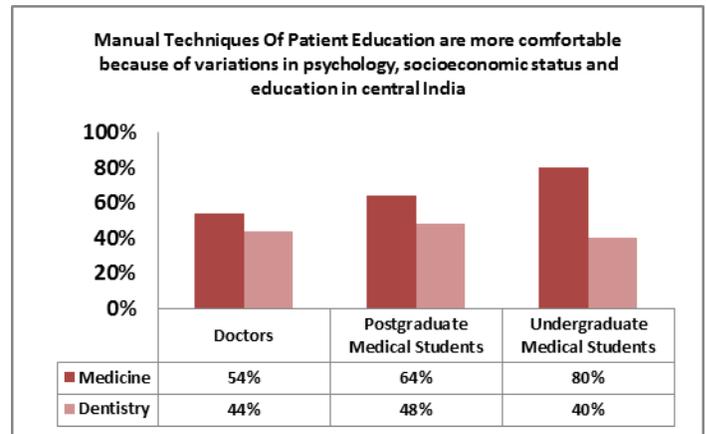


Fig 6 For those who answered “Yes” to the question: “Do you feel that manual techniques are more useful than computer based patient education due to patient variations in psychology, socioeconomic status and education in central India?” (n=152)

This survey also clears that irrespective of cost of computer based patient education system and patient to patient variations, all the doctors of central India are very interested to know and to learn different computer based patient education methods, while 96% percent all students showed the same interest (fig 7).

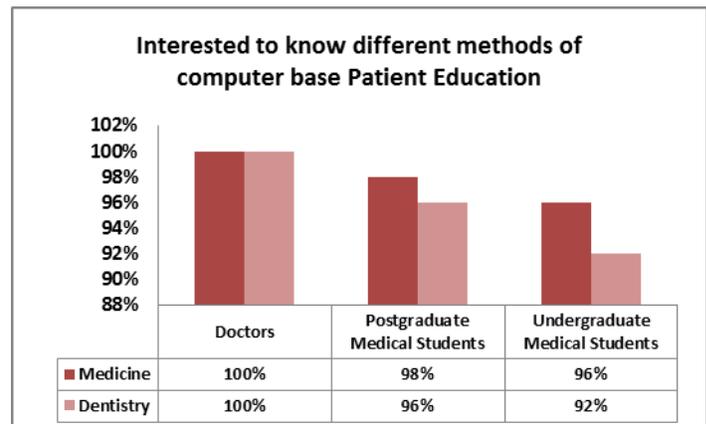


Fig 7 For those who answered “Yes” to the question: “Are you interested to know different methods of computer base patient education?” (n=243)

Although in central India cost of computer based patient education is more and there are wide variations in patient to patient psychology, socioeconomic status and education, 78% doctors and 88% students promised that they will start using computer based patient education techniques very soon in future (fig 8).

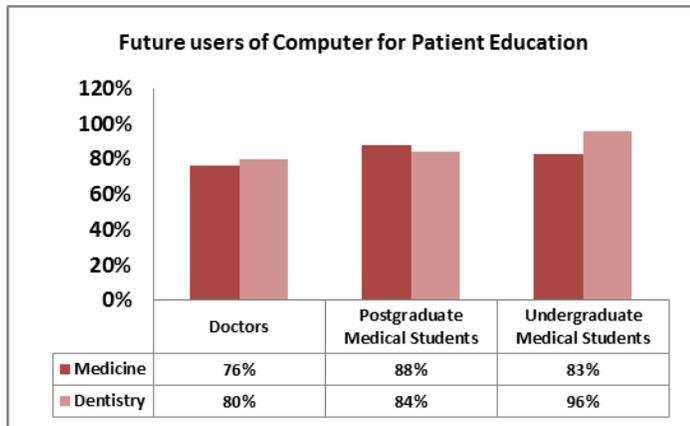


Fig 8 For those who answered “Yes” to the question: “Do you want to use computer based education method in future?” (n=209)

IV. DISCUSSION & CONCLUSIONS

This study shows that in central India almost all doctors and students are aware of computer and its use in medical science. Ninety-six percent healthcare workers know about computer based patient education method. And about 95% participants accept that computer patient education is a better choice. But only 24% of healthcare practitioners use computer based patient education. According to 85% participants high cost of computer based patient education system is a reason of not using this and 61% participants thought that there is a wide range of variations in psychology, socioeconomic status and education level of patients because of which they ignore to use computer based patient education method. But on the other hand they accept the usefulness of this method. And almost all are interested to know new and recent computer based patient education methods with the promise of using computer based patient education very soon in future. This study reveals the fact that health practitioner of central India should be encouraged to use computer based patient education and there is need of more awareness about usefulness of computer based patient education in undergraduate health science students of central India.

REFERENCES

- [1] Lewis, D. (1999). "Computer-based approaches to patient education: a review of the literature." *Journal of the American Medical Informatics Association* 6(4): 272-82.
- [2] Kahn, G. (1993). Computer-based patient education: a progress report. *MD Computing* 10(2): 93-9.
- [3] Shaw, M. J., T. J. Beebe, et al. (2001). "A randomized, controlled trial of interactive, multimedia software for patient colonoscopy education." *Journal of Clinical Gastroenterology* 32(2): 142-7.
- [4] Krishna, S., E. A. Balas, et al. (1997). "Clinical trials of interactive computerized patient education: implications for family practice." *Journal of Family Practice* 45(1): 25-33.
- [5] Doak C.C., Doak L.G. & Root J.H. (1996) *Teaching Patients with Low Literacy Skills*, 2nd edn. J.B. Lippincott, Philadelphia, PA.

AUTHORS

First Author:

Rizwan Abdul Rasheed Shaikh,
Intern Doctor,
Department Of Orthodontics & Dentofacial Orthopedics,
Government Dental College & Hospital, Nagpur 440003,
Maharashtra, India.
Email: rizsk123@gmail.com

Second Author:

Dr. (Mrs.) Wasundhara A. Bhad,
Head Of Department,
Department Of Orthodontics & Dentofacial Orthopedics,
Government Dental College & Hospital, Nagpur 440003,
Maharashtra, India.

Correspondence:

Rizwan Abdul Rasheed Shaikh,
104, Department Of Orthodontics & Dentofacial Orthopedics,
Government Dental College & Hospital,
Government Medical College Campus,
Medical Square,
Nagpur 440003
Maharashtra, India.
Email address: rizsk123@gmail.com,
Contact number: (+91) 9561101768.

Framework for Accelerometer Based Gesture Recognition and Seamless Integration with Desktop Applications

Vijay D Rajanna

National Instruments, R&D Division Bangalore, M.S. Software Systems. BITS Pilani, India

Abstract- Accelerometer is one of the prominent sensors which are commonly embedded in new age handheld devices. Accelerometer measures acceleration forces in three orthogonal axes X, Y, Z. The raw acceleration values obtained due to the movement of device in 3D space which is hosting accelerometer can be used to interact and control wide range of applications running on the device and can also be integrated with desktop applications to enable intuitive ways of interaction.

The goal of the project is to build a generic and economic, gesture recognition framework based on accelerometer sensor and enable seamless integration with desktop applications by providing natural ways of interaction with desktop applications based on the gesture information obtained from accelerometer sensor embedded in Smartphone device held in user's hand.

This framework provides an alternative to the conventional interface devices like mouse, keyboard and joystick. With the integration of gesture recognition framework with desktop applications user can remotely play games, create drawings, control key and mouse event based applications. And since this is a generic framework, it can be integrated with any of the existing desktop applications irrespective of whether the application exposes APIs or not, or whether it is a legacy or a newly programmed application.

A communication protocol is required to transfer Accelerometer data from handheld device to desktop computer, and this can be achieved either through Wi-Fi or Bluetooth communication protocol. The project achieves data transmission between handheld device and desktop computer through "Bluetooth" protocol.

Once the Accelerometer data is received at desktop computer, the raw data is initially filtered and processed into appropriate gesture information after many computations through multiple algorithms. The key event publisher will take the processed gestures as input and converts them into appropriate events and publishes them on to the target applications to be controlled.

This framework makes interaction with desktop applications very natural and intuitive. And it also enables game and application developers to build creative games and applications which are highly engaging.

Index Terms- Gesture, Smart phone, Bluetooth, Sensors, Accelerometer, Pervasive Computing, Human Computer Interaction, Machine learning

I. INTRODUCTION

With the unparalleled advances in chipsets, sensors, computing technologies, we can change the way we interact virtually with the physical world around us. Each minute information associated with our day to day life is now modeled as living information and integrated into our professional and personal lives. Many of the novel ideas which were once though impossible to productize are now realized into tangible solutions by embedding sensors in hand held devices that can detect many number of events like location shift, minor displacement, barometric pressure, weather changes, light intensity, magnetic field proximity of objects etc. [6]

Cell phones can also impact the world around us in ways we cannot see, at least physically. The use of mobile devices in augmented reality has marked an era of innovative mobile solutions for the modern world. The augmented reality helps people to leave behind virtual artifacts like text, photos, video, avatars, and game clues for people to discover with their phones.

As an example, you can enter a building, view the lobby through your cell phone, and see messages and art pieces left behind by others for you to see and enjoy. Or, if you're at a conference in some place, you can view a nearby restaurant or bar through a mobile device and see comments made by other diners on food, service, atmosphere, or anything that they want to leave behind. [6]

These days sensors have become integral part of mobile devices, people use mobile devices beyond just for calling and messaging services. All the augmented reality solutions wouldn't have been possible if mobile devices were just a piece of hardware without sensors. These sensors are basically Micro-Electro-Mechanical Systems, or MEMS, which is a technology that in its most general form can be defined as miniaturized mechanical and electro-mechanical elements.

Gesture recognition framework implemented in this project, functions based on continuous stream of accelerometer values due to static and dynamic acceleration of the device.

II. OUTLINE

The project aims at building a comprehensive generic framework which enables a naive user to control any desktop computer application using simple and intuitive gestures processed based on accelerometer data which is embedded in handheld device.

This is achieved by combining and processing data from three major systems. Firstly the data from accelerometer is obtained, which is then transmitted from Smartphone to desktop computer through Bluetooth communication protocol and finally this raw data is converted into useful gesture information which controls various applications.

III. ACCELEROMETER

Accelerometer is an electromechanical device that will measure acceleration forces. These forces may be static, like the constant force of gravity pulling at your feet, or they could be dynamic forces caused by moving or vibrating the accelerometer.

Accelerometer sensor measures the linear acceleration in X, Y and Z directions based on the movement of hand

held device. It simply measures acceleration due to motion, relative to gravity. These can be used to measure acceleration in one, two, or three orthogonal axes. They are typically used in one of three modes. [5]

- As an inertial measurement of velocity and position
- As a sensor of inclination, tilt, or orientation in 2 or 3 dimensions, as referenced from the acceleration of gravity ($1\text{ g} = 9.8\text{m/s}^2$);
- As a vibration or impact (shock) sensor.

Most accelerometers are Micro-Electro-Mechanical Sensors (MEMS). The basic principle of operation behind the MEMS accelerometer is the displacement of a small proof mass etched into the silicon surface of the integrated circuit and suspended by small beams. Consistent with Newton's second law of motion ($F = ma$), as an acceleration is applied to the device, a force develops which displaces the mass. The support beams act as a spring, and the fluid (usually air) trapped inside the IC acts as a damper, resulting in a second order lumped physical system. This is the source of the limited operational bandwidth and non-uniform frequency response of accelerometers. [1],[2],[5]

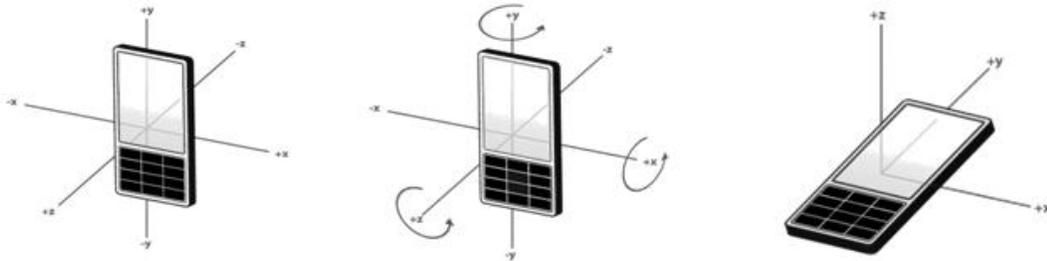


Figure 1: Accelerometer Axes - Courtesy - qt.nokia.com

IV. BLUETOOTH

Bluetooth is a short-range communications technology that is simple, secure, and everywhere. You can find it in billions of devices ranging from mobile phones, computers to medical devices and in home entertainment products. It is intended to replace the cables, which connects devices to enable data transfer, while maintaining high levels of security. In the current project Bluetooth is used to transmit accelerometer data from Smartphone device to the desktop computer at a constant rate, making it a completely wireless system.

The key features of Bluetooth technology are robustness, low power and low cost. The Bluetooth specification defines a uniform structure for a wide range of devices to connect and communicate with each other. [3],[4]

SETTINGUP A BLUETOOTH SERVER

- Selecting a destination device to be connected to, which sometimes involves device discovery?
- Agreeing on a protocol to be communicated.
- Making an outgoing connection or accepting an incoming connection.
- Establishing connection for a published service on a port specified.

SETTING UP BLUETOOTH CLIENT

- Search for published services with specific UUID
- Make an outgoing connection with the peer Bluetooth device with the same UUID as client.
- Start exchanging data through client server sockets.

V. DESIGN OF GESTURE RECOGNITION FRAMEWORK

The high level architecture of gesture recognition framework is modularized into two major components.

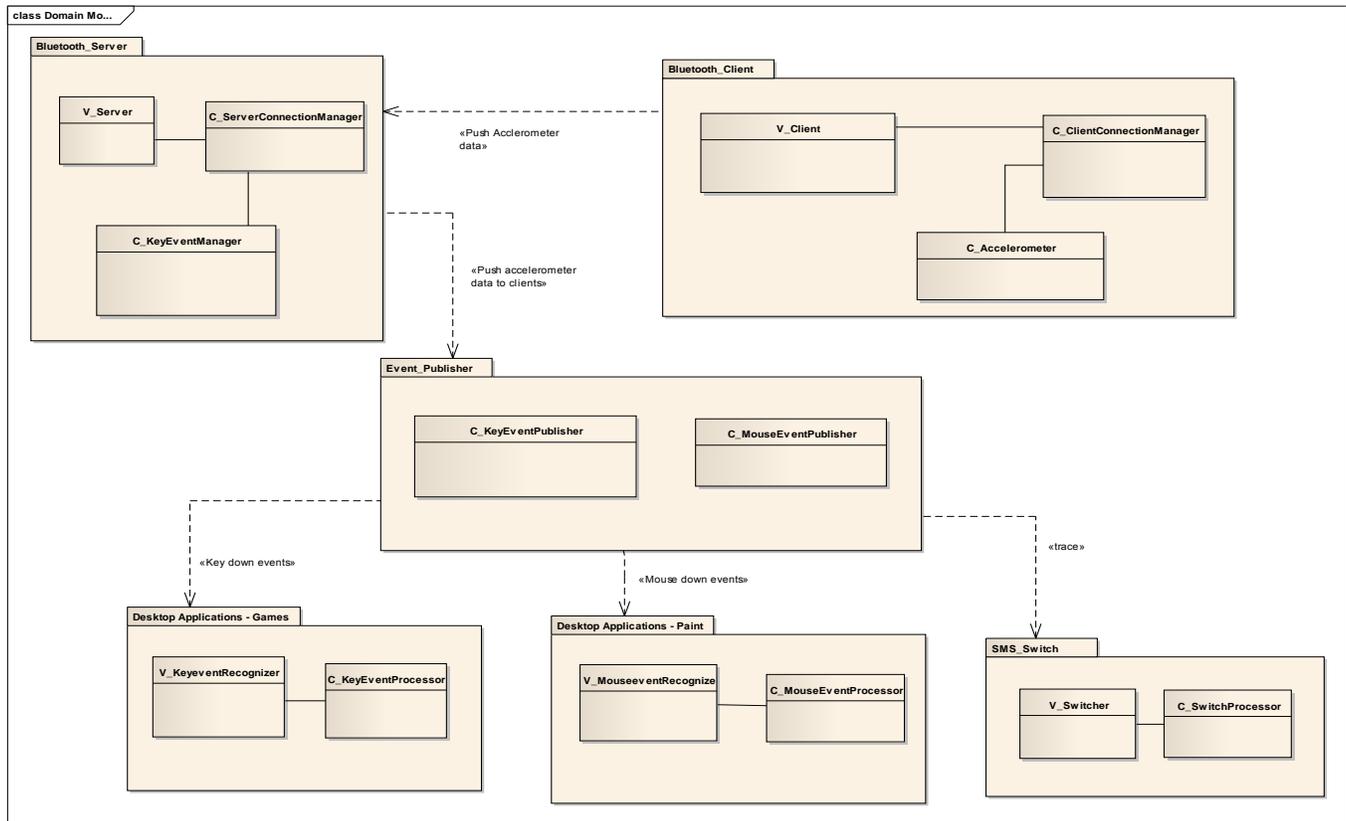


Figure 2: Domain Model

1. GESTURE GENERATOR

Gesture generator module is responsible for transferring the gesture information in the form of raw accelerometer values from user's handheld device to desktop computer, which is running the target application to be controlled. Gesture generator further comprises of two independent modules.

1.1. ACCELEROMETER INITIATOR

The accelerometer initiator module running on user's hand held device will initiate accelerometer hardware by setting up initial values, time interval for each sample and starts listening to accelerometer output data which returns the acceleration due to gravity of the device in three dimensions. This is helpful in understanding which way the user is moving or tilting the phone, and based on this information it is programmatically possible to control applications and games running on user's PC

1.2. BLUETOOTH CLIENT

Bluetooth client running on hand held device will search for peer Bluetooth servers publishing various services, In this case the client will search for file or text transfer services. After

discovering the server which is publishing file/text services client makes an outgoing connection with Bluetooth server and starts sending accelerometer data to server using series of "send" function calls.

2. GESTURE RECOGNIZER AND APPLICATION CONTROLLER

Gesture recognizer is responsible for receiving raw accelerometer data from Bluetooth client, filtering out redundant information, and running an intelligent algorithm to convert raw accelerometer data into useful gesture information. Once raw accelerometer data is processed into gesture information, this is fed to Application controller module which directly controls target applications through emulating key and mouse events. Gesture recognizer comprises of three independent modules.

2.1. BLUETOOTH SERVER

Bluetooth server running on user's PC will publish text/file transfer services, and waits for an incoming connection from the client. The published services are discovered by Bluetooth client application running on user's hand held device. Once the service

is discovered the client will establish a connection with the server and starts pushing accelerometer data into server socket. Server will continue to receive Bluetooth client data through a series of "Receive" function calls.

2.2. GESTURE PROCESSOR

Gesture processor receives raw accelerometer data from Bluetooth server module. Accelerometer generates continuous stream of data, but not all of the information generated is essential for the applications. Hence in the first stage of processing all the redundant accelerometer data is filtered out and only those values which indicate significant change in the position of the device is retained. And in the second stage filtered data is fed into an intelligent algorithm to convert raw accelerometer data into useful gesture information.

2.3. APPLICATION CONTROLLER

Application controller module receives processed gesture information from gesture processor module and converts them into appropriate events. The intelligence is built into the application controller so that it takes control of the target application's key and mouse event handlers and starts feeding the application with emulated keyboard and mouse events. This makes it possible to achieve expected functionality from the target application using gesture information.

I. IMPLEMENTATION OF GESTURE RECOGNITION FRAMEWORK

As mentioned in the earlier part, the objective of the project is to build generic and economic gesture recognition framework to bridge the gap and enable seamless interaction between desktop applications and sensors embedded in hand held devices.

Accelerometer being the sensor of interest, the project uses accelerometer sensor available on Nokia mobile phones. Nokia phones run on Symbian Operating system, and Symbian Operating system provides access to all the embedded sensors in two ways.

1. Native Symbian APIs to access the sensors.
2. Through Qt framework APIs.

This current implementation uses Qt framework to access phone's accelerometer. Qt framework was chosen over native Symbian APIs since Qt framework provides a well-established framework to work with these sensors and also exposes significant amount of functionality of these sensors and finally, Qt framework is developer friendly.

To demonstrate the integration of gesture recognition framework with existing desktop applications, the project was successful in integrating this gesture recognition framework with, Need For Speed game and Windows Paint application on Windows Operating System.

1. RACING GAMES

Racing games are a category of games which require users to control and steer the virtual racing object through keyboard or joystick interface. The gaming applications should be able to interpret gestures and execute desired functionality, the state of the racing objects continues to be in its last well known state

until a new gesture is received and interpreted. With the integration of gesture recognition framework, user will be able to control racing objects through gestures generated from handheld device. User will be able to steer the racing object to left, right, accelerate, decelerate and brake just by corresponding gestures from handheld device. The integration consists of four modules.

- Accelerometer module on mobile device
- Bluetooth server running on user's PC
- Bluetooth Client running on mobile device
- Gesture Recognition Framework for Gaming

1.1 DEMONSTRATION OF WORKING MODEL

The video of the demonstration of working model, which shows integration of gesture recognition framework with Need For Speed racing game, can be found here.

<http://youtu.be/EYsi7V2p1m4>

2. PAINT BURSH

Paint Brush is an accelerometer controlled painting application which is an integration of gesture recognition framework with windows paint application. Paint brush enables user to draw basic line diagrams in 2D space. Input for the application are the gestures generated from user's handheld device, as the user tilts or waves his handheld device in the air. The integration consists of four modules.

- Accelerometer module on mobile device
- Bluetooth server running on user's PC
- Bluetooth client running on mobile device
- Gesture Recognition Framework for Painting

2.1 DEMONSTRATION OF WORKING MODEL

The video of the demonstration of working model, which shows integration of gesture recognition framework with windows paint application can be found here.

<http://youtu.be/sunhfFyPYJs>

VI. FUTURE ENHANCEMENTS

The generic nature of framework enables its integration with various applications and games from multiple domains and across different platforms. Below are the few feasible future enhancements.

- Gesture to voice conversion
- Gesture based multiplayer games,
- Economic smart class solutions,.
- NFC integration,
- Photo viewer,
- Controlling power point presentation

ACKNOWLEDGEMENT

I would like to thank, Birla Institute of technology and the faculty members, Prof. Neena Goveas and Prof. Mangesh Bedekar who guided me with valuable suggestions during the course of project.

I offer my sincere gratitude to my mentor Mr. Ashwin Rao, and colleagues Mr. Anand Reddy and Mr. Santhosh Rao at

NOKIA who shared all their expertise and experience at each stage while I worked on this project.

I am indebted to all those forum members on MSDN, Qt group, Code guru and Code Project, who answered my every query and provided valuable guidance.

Finally I would like to thank my organization NOKIA who allowed me to carry out this project.

REFERENCES

- [1] Uwe Hansmann, Lothar Merk, Martin Nicklous (2004) "Principles Of Mobile Computing", Wiley India.
- [2] Tan tran Duc(2009), "Modeling And Simulation Of The Capacitive Accelerometers", Grin Verlag,
- [3] Muller J N, (September 8, 2000) "Bluetooth Demystified", McGraw-Hill Professional.
- [4] Lawrence Harte (September, 2007), "Bluetooth Essentials for Programmers", Cambridge University Press.
- [5] <http://sensorwiki.org>
- [6] <http://www.last100.com>
- [7] Dee Bakker, Diane McMichael Gilster, Ron Gilster. Bluetooth End to End. Wiley. January , 2002.
- [8] Ville Kaajakari. Practical MEMS: Design of microsystems, accelerometers, gyroscopes, RF MEMS, optical MEMS, and microfluidic systems. Small Gear Publishing. March, 2009.
- [9] QT, Cross platform application and UI framework document.
- [10] QT Mobility Project Reference Documentation.

AUTHORS

Vijay Dandur Rajanna, National Instruments, R&D Division
Bangalore., M.S. Software Systems. BITS Pilani, India,
E-Mail : mail2vijaydr@gmail.com

Vijay Dandur Rajanna received his Master of Science degree from Birla Institute of Technology and Science, Pilani in "Software Systems", and his Bachelor of Engineering degree in "Computer Science and Engineering" from Visvesvaraya Technological University. Before joining National Instruments, Vijay worked with Robert Bosch and Nokia Research and Development divisions, majorly working on research projects. His areas of research interests include "Artificial Intelligence, Human Computer Interaction and Pervasive Computing".

Case Series of Complicated Incisional Hernia

Kshirsagar A Y, Patil R K, Chotai T, Bane P, Agarwal S, Patil M.

Krishna Institute of Medical Sciences, Karad, District Satara, Maharashtra 415110, India

Abstract- Background: The incisional hernia can present in various clinical presentations which require emergency surgery for better outcome and survival. We want to share our experience in the management of incisional hernias.

Methods: 100 patients were treated for incisional hernias. All patients were treated with intraperitoneal mesh repair except patients with enterocutaneous fistula, who were treated with anatomical repair. Observations were made with regards to presentation at the time of admission like skin necrosis, type of incision, obstruction and strangulation, enterocutaneous fistula, post-operative complications, hospital stay and recurrence were also observed.

Results: In our series of 100 patients 42 were males and 58 were females. Sites of hernia were pfannenstiell incision in 30 patients, colostomy closure incision in 19 patients. 10 patients presented with skin necrosis, 25 patients presented with strangulation and obstruction and 19 patients presented with enterocutaneous fistula. All patients were followed up for a period of 6 months after surgery, with recurrence seen in 2 patients.

Conclusion: The treatment of complicated incisional hernia by intraperitoneal method is preferred as it has less complications and less chances of recurrences. In cases with enterocutaneous fistula where infection is already settled and anatomical repair is preferred to mesh repair.

I. BACKGROUND

This article guides a stepwise walkthrough by Experts for writing a successful journal or a research paper starting from inception of ideas till their publications. Research papers are highly recognized in scholar fraternity and form a core part of PhD curriculum. Research scholars publish their research work in leading journals to complete their grades. In addition, the published research work also provides a big weight-age to get admissions in reputed varsity. Now, here we enlist the proven steps to publish the research paper in a journal.

Surgery performed for various hernias are the most common surgeries performed by any surgeon worldwide. Incisional hernia is a complication occurring after various abdominal surgeries at the operation site [1].

Risk factors for incisional hernia are age >45 years, male preponderance, BMI >25, associated with previous laparotomies [2]. The main aim of incisional hernia repair is tension free repair, thus the use of mesh decrease reoccurrence chances.

There are various modalities available for treatment of incisional hernias which vary depending on presentation, time of onset, patient's age; each has his own merits and demerits. The aim of this study was to report our experience in the treatment of incisional hernia.

II. MATERIALS AND METHODS

A retrospective study was performed by studying the clinical history record and patient were evaluated for type of incision, skin necrosis, enterocutaneous fistula, obstruction and strangulation, post-operative complications, hospital stay and recurrence.

100 patients were studied (42 males, 58 females); the patients were treated with intraperitoneal prolene mesh repair except in cases with enterocutaneous fistula were treated with anatomical repair. Observations were made with regards to presentation at the time of admission and all cases were followed upto six months after discharging from hospital.

III. RESULTS

Out of total 100 patients taken up for hernia repair 30 presented with hernia associated with pfannenstiell incision, 19 (4 females, 16 males) patients were of colostomy closure incision, rest were midline laparotomy incisions. 10 (4 females, 6 males) presented with Ulcerated skin with associated necrosis, 25 (10 females, 15 males) patient came with obstructed and strangulated incisional hernia. The surgical technique carried out was prolene mesh which was placed intraperitoneally. The mesh was fixed with non- absorbable sutures. The anatomical repair method was used for 16 (10 females, 6 males) cases presented with enterocutaneous fistula. (Table)

The complication noted was 4 wound suppuration, 3 wound hematomas, and 1 cutaneous necrosis and in six month follow up 2 reoccurrences were noticed (Illustration).

IV. DISCUSSION

Incisional hernia is protrusion of viscera through defect at surgical scar. Common sites of incisional hernias are midline incision, lower transverse incisions in gynecological operations. They are also seen in different sites of incisions on anterior abdominal wall. Complications seen are cutaneous atrophy and necrosis, hernia sac thickening and adhesions, obstruction, strangulation, enterocutaneous fistula. [3].

Hernia sac protrudes through the defect at the scar; it is situated in the subcutaneous tissue layer forming a cavity. Minor injuries to swelling leads to collection of small hematomas. Stretching of the skin over the swelling leads to necrosis. Cavity can be obliterated preventing hematomas and edema by placing one or two subcutaneous drains.

Synthetic mesh is used commonly for the repair of incisional hernia. Mesh is secured between abdominal wall and peritoneum. [4, 5]. In large hernia, the defect is approximated

with suturing mesh between abdominal wall muscles and rectus sheath [6].

If abdominal wall cannot be sutured due to tissue loss, prosthesis is placed over abdominal contents suturing it to muscles.

This method minimizes dissection. The plane is open and allows easy placement of mesh [7, 8]. Complications like hematoma and seroma formation are reduced. Any infection occurring in the subcutaneous plane does not affect the mesh. The prosthesis adheres to the peritoneum and renders it inextensible, permitting no further herniation. The prosthesis in this plane cannot be dislodged or ruptured by intraabdominal pressure [9].

Mesh repair for incisional hernias using inlay technique is preferred in all cases except in cases where enterocutaneous fistula is developed. Edematous fascial layer and tissue loss makes it difficult to anchor the mesh to abdominal wall. The sutures taken through the fascial layer cut through the fragile edematous tissue. Dissecting through the fascial layer becomes

difficult leading to further tissue loss. Handling of the muscle, aponeurosis and fascia during dissection will lead to further edema of tissue [10]. This further leads to increase in the incidence of complications like secondary infection, dehiscence of incision.

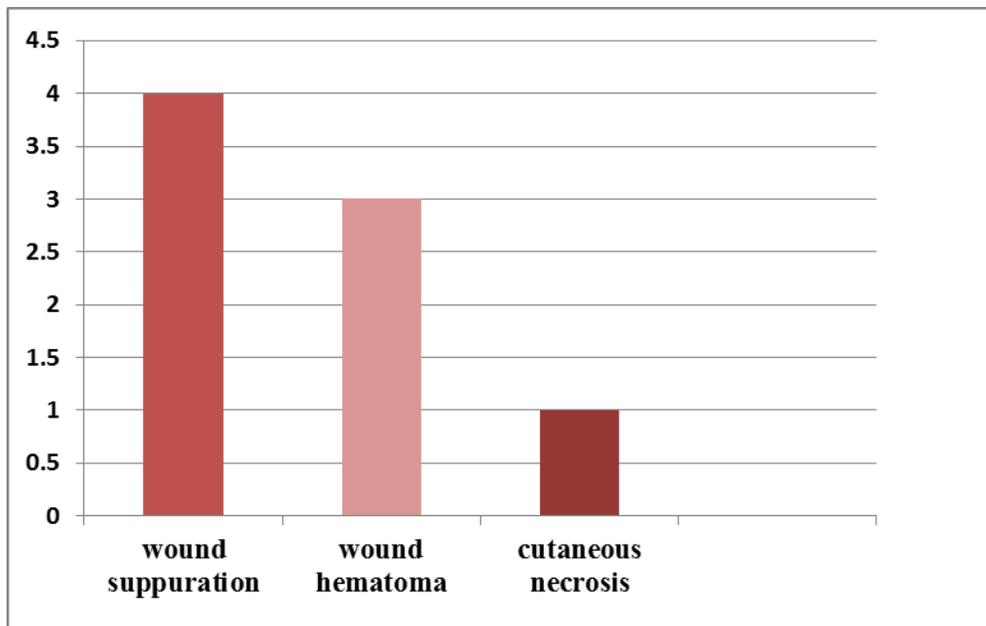
Trimming of tissue just before suturing, anatomical repair using absorbable suture material and healing of subcutaneous tissue layer and skin by primary intension will reduce complications.

V. CONCLUSION

The treatment of complicated incisional hernias by intraperitoneal method is preferred as it has less complications and less chances of recurrences. In cases with enterocutaneous fistula where infection is already settled and anatomical repair is preferred to mesh repair.

Table: Comparison of presentation in males and females:

Presentation	Female	Male	Total
Pfannestial incision	30	-	30
Colostomy closure incision	4	15	19
Skin Necrosis	4	6	10
Obstruction and strangulation	10	15	25
Enterocutaneous fistula	10	6	16



FAIS, Contact no. 0091-9422400435, E-mail-
kshirsagarashok007@gmail.com

DECLARATION

Author declare that there is no conflict of interest
There was no financial liability.

REFERENCES

- [1] Dur AH, den Hartog D, Tuinebreijer WE (2009) Low recurrence rate of a two-layered closure repair for primary and recurrent midline incisional hernia without mesh. *Hernia* 13: 421-426
- [2] Höer J, Lawong G, Klinge U, Schumpelick V (2002) Factors influencing the development of incisional hernia. A retrospective study of 2,983 laparotomy patients over a period of 10 years. *Chirurg* 73: 474-480
- [3] Gargiulo A, Grifi M, Zoppe C (1981) Laparoceli complicati. *Arch Ed Atti S.I.C. Roma* 1184.
- [4] Stoppa R, Henry X, Canarelli JP, Largueche S, Verhaeghe P, Abet D, Ratsivalaka R (1979) Indications for selective operative procedures in the treatment of post-operative eventrations of the anterolateral abdominal wall. *Chirurgie* 105: 276-286.
- [5] Stoppa R, Henry X, Odimba E, Verhaeghe P, Largueche S, Myon Y (1980) Dacron tulle prosthesis and biological glue in the surgical treatment of incisional hernias. *Nuov Presse Med* 9: 3541-3545.
- [6] Rives J, Pire JC, Flament JB, Palot JP, Body C (1985) Treatment of large eventrations. New therapeutic indications apropos of 322, cases. *Chirurgie* 111: 215-225.
- [7] Trivellini G, Danelli PG, Cortese L, Sollini A, Rossi R (1991) L'impiego di due protesi in contemporanea nella riparazione delle grosse perdite di sostanza reale della parete addominale. *Chirurgia* 4: 601-606.
- [8] Temudon T, Siadati M, Sarr M (1996) Repair of complex giant or recurrent ventral hernia by using tension-free intraparietal prosthetic mesh (Stoppa technique): Lessons learned from our initial experience. *Surgery* 120: 738-744.
- [9] Francesco La Mura, Roberto Cirocchi, Eriberto Farinell (2009) Emergency treatment of complicated incisional hernias: a case. *Annals of Surgical Innovation and Research* 3: 15
- [10] Brown GL, Richardson JD, Malangoni MA, Tobin GR, Ackerman D, Polk HC Jr (1985) Comparison of prosthetic materials for abdominal wall reconstruction in the presence of contamination and infection. *Ann Surg* 201: 705-711.

AUTHORS

First Author – Kshirsagar A Y, Krishna Institute of Medical Sciences, Karad, District Satara, Maharashtra 415110, India

Second Author – Patil R K, Krishna Institute of Medical Sciences, Karad, District Satara, Maharashtra 415110, India

Third Author – Chotai T, Krishna Institute of Medical Sciences, Karad, District Satara, Maharashtra 415110, India

Fourth Author – Bane P, Krishna Institute of Medical Sciences, Karad, District Satara, Maharashtra 415110, India

Fifth Author – Agarwal S, Krishna Institute of Medical Sciences, Karad, District Satara, Maharashtra 415110, India

Sixth Author – Patil M, Krishna Institute of Medical Sciences, Karad, District Satara, Maharashtra 415110, India

Correspondence Author – Dr Ashok Kshirsagar MS, FICS,

Time Lag recurrent Neural Network model for Rainfall prediction using El Niño indices

N.A.Charaniya*, Prof. Dr. S.V.Dudul **

*Associate Professor, Department of Electronics and Telecommunication, B.N.College of Engg.

**Professor and Head Applied Electronics Department S.G.B. Amravati University

Abstract- Indian summer monsoon rainfall is a process which is dependent on number of environmental and geological parameter. This makes it very hard to precisely predict the monsoon rainfall. As India is agriculture based country, a long range monsoon rainfall prediction is crucial for proper planning and organization of agriculture policy. Severe hydrological events, such as droughts, may result in decline of agricultural output, affecting both inhabitants and national economy of the country. El Niño and Southern Oscillation (ENSO) play an important role in the success or collapse of Indian monsoon development. The year-to-year variability in monsoon rainfall could cause extreme droughts and floods in the country. El Niño is an oscillation of the ocean-atmosphere system in the tropical Pacific having important consequences for weather around the globe. Understanding the relationship between ENSO and Indian monsoon rainfall is crucial to reduce negative impact or to take benefit of positive conditions. In this paper, a focused time lag recurrent neural network model has been proposed in order to determine the temporal relationship between ENSO and Indian summer monsoon rainfall.

Index Terms- Recurrent Neural network, Rainfall, prediction, El Niño

I. INTRODUCTION

India is an agriculture based country where the major population is dependent on agriculture. Due to lack of irrigation system, most of the farming is dependent on rainfall. The all-India summer monsoon rainfall (ISMR), is defined as the rainfall received during the month of June to September over India. The ISMR has a huge impact on not only the agriculture growth but also related economic activities of the country, and prediction of the interannual variability of ISMR is thus a matter of great concern for the economic growth of country. If a drought year is predicted well in advance, proper agriculture planning and management can be done so that the losses are less. Rainfall is a random process which is dependent upon various ecological and geographical parameters hence it is very difficult to predict it. Researchers have been working on this problem since the late 1800s. Much research work has been undertaken to predict ISMR variation[1][2]. El Niño and Southern Oscillation (ENSO) has been known to exert the most important external forcing on ISMR [3][4][5][6].

El Niño is an oscillation of the ocean-atmosphere system in the tropical Pacific having important consequences for weather

around the globe. As Walker noticed long ago, the anomalous high pressure over the western Pacific–eastern Indian Ocean and anomalous low pressure over the eastern and central Pacific associated with El Niño do influence the ISMR. Krishna Kumar *et al.* [7], propose that El Niño/La Niña results in deficit/excess of rainfall by suppressing/enhancing the convection over the Indian region.

Reason *et al.* [8] showed that when an El Niño occurred during the summer, the Indian Ocean was characterized by a slight warming of sea surface temperature (SST) as compared to normal, which was associated with weaker wind magnitudes than normal and reduced cloudiness. After the summer monsoon season, they observed a clear influence of El Niño over the Indian Ocean; the SST over the entire basin was significantly warmer than normal. At this time, large negative wind speed anomalies around the equator were seen in the Indian Ocean, with an increase in cloudiness over the western Indian Ocean, and a decrease over the eastern Indian Ocean. They also demonstrated that the opposite configuration occurred during La Niña events. Work conducted by Kripalani and Kulkarni [9] concluded that the state of ENSO does not explain all the inter annual variability of ISMR. For example, in spite of the occurrence of strong El Niño events in 1914, 1963, 1976, 1983, and 1997, these years did not experience deficiencies in ISMR (Figure 1). Kripalani and Kulkarni pointed out the existence of the inter decadal variability of ISMR and found that when ISMR was in the above normal inter decadal phase, even strong El Niño events did not bring severe droughts to India.

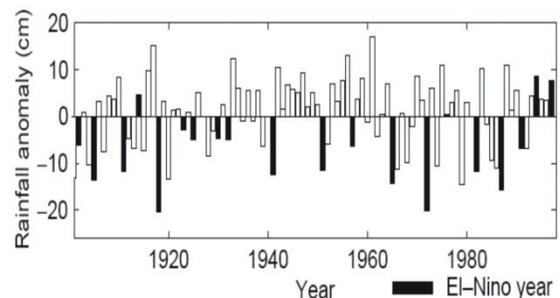


Fig.1. Year of El Niño

Prediction of Indian monsoon rainfall is an important matter for Indian economy. For a proper prediction of rainfall, a better understanding of the ENSO related factors, affecting monsoon rainfall is required. It can improve the ability to forecast rainfall in the country thereby allowing to manage things with greater

success. Assessing this relationship with climate modeling could be a useful tool to comprehend processes in El Niño

Artificial Neural Networks (ANN), which replicate the parallel distributed processing of the human nervous system, have proven to be very powerful tool in dealing with complicated problems, such as pattern recognition and function approximation. Hornik et al. [10] has shown that an ANN with adequate complexity is capable of approximating any function to a greater accuracy. In addition, ANNs are computationally robust, in the way that they have the ability to learn and give correct output even if the input contains error [11]. For prediction based upon past input, a time delay recurrent neural network model is more efficient [12].

In this paper a time lag recurrent neural network model is proposed which can be used as tool to comprehend processes in El Niño teleconnection with Indian Summer Monsoon. A time lagged recurrent network has the static Processing elements (PEs) substituted by PEs with short term memories, such as the gamma, the Laguarre or the tap delay line. Memories can be appended to any layer in the network, producing very sophisticated neural topologies very useful for time series prediction and system identification.

II. DATA

The following data sets are used in this study:

(1) All India monthly Rainfall data : All-India rainfall during 1950–2006 is acquired from www.iitromset.com. Out of which 60 percent is used for training the neural network model and 15 percent for cross validation and 25 percent for testing the model.

(2) ENSO index: we have taken NINO index time series for a period of 1950-2006,

- i. Nino 1+2 i.e. the Sea surface temperature (SST) anomaly averaged over the region (90–150°W, 5°N–5°S).

Data of Nino1+2 SST was taken from **Ocean Observations Panel for Climate** (OOPC) site, <http://ioc-goos-oopc.org/>.

III. NEURAL NETWORK MODEL

To determine the temporal relation between the El Niño and ISMR a focused time lag neural network with gamma memory has been used. Time is an essential dimension of learning. We may incorporate time into the design of a neural network implicitly or explicitly [13]. A straightforward method of implicit representation of time is to add a short-term memory structure in the input layer of a static neural network [14] (e.g., multilayer perceptron). This memory structure is used to store the past information, which can be used to analyze the data in a more efficient way. The element in the memory structure can be varied as per requirement. The resulting configuration is called as focused time lagged feedforward network (TLFN).

teleconnection with Indian Summer Monsoon.

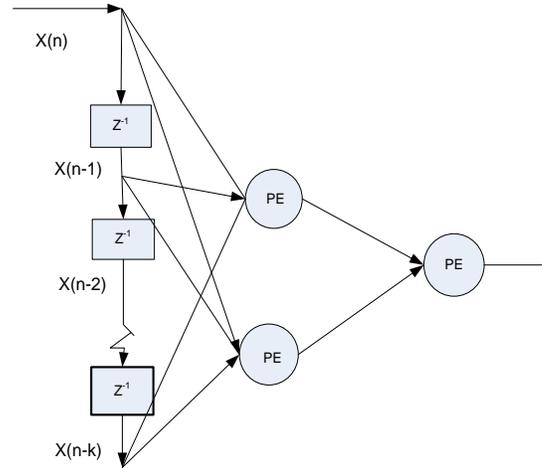


Fig 2. A focused TDNN with one hidden layer and a tap delay line with k+1 taps

The short-term memory structure may be implemented in one of two forms, as described below:

1. Tapped-Delay-Line (TDL) Memory: This is the most commonly used form of short-term memory. It consists of p unit delays with $(p + 1)$ terminals, which may be viewed as a single input–multiple output network. A focused TLFN network using the combination of a TDL memory and multilayer perceptron. The unit-delay is denoted by z^{-1} . The memory depth of a TDL memory is fixed at p , and its memory resolution is fixed at unity, giving a depth resolution constant of p .
2. Gamma Memory: We may exercise control over the memory depth by building a feedback loop around each unit delay, as illustrated in Fig.3. Effectively, the unit delay z^{-1} of the standard TDL memory is replaced by the transfer function[15]

$$G(z) = \frac{\mu z^{-1}}{1 - (1 - \mu)z^{-1}}$$

where μ is an adjustable parameter. For stability, the only pole of $G(z)$ at $z = (1 - \mu)$ must lie inside the unit circle in the z plane. This, in turn, requires that we restrict the choice of μ to the following range of values:

$$0 < \mu < 2$$

The overall impulse response of the gamma memory, consisting of p sections, is the inverse z transform of the overall transfer function.

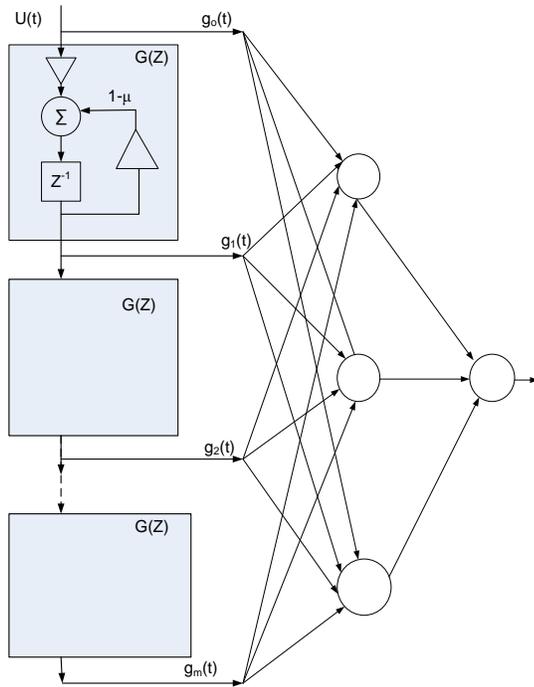


Fig 3. Time lag recurrent neural network with gamma memory.

IV. Development of Neural network model

A focused time lag recurrent neural network is developed to determine the temporal relationship between Indian monsoon rainfall and historical value of El Niño. El Niño has a great impact on the Indian monsoon rainfall. We have tried to develop a neural network model to predict the rainfall one month ahead based upon historical El Niño indices.

A three layer Focused Time Lag Recurrent Neural network(2-16-1) model has been designed with Gamma memory and conjugate gradient back propagation learning algorithm. The training of a neural network model is usually accomplished by using a backpropagation (BP) algorithm. Input data presented to the system was monthly values of El Niño and average monthly rainfall, The system was designed to predict rainfall over one month period based upon the rainfall and El Niño indices for past few months. The amount of past data used for predicting the rainfall for next month is dependent upon the number of lags and Gamma parameter of the model. Data was partitioned into three parts with 60 percent for training, 15 percent as cross validation for evaluating the model performance and 25 percent for testing the model on data not seen before. Model was designed and tested rigorously for various number of lag, number of neuron at hidden layer and with different values of gamma parameter.

Performance of the model is evaluated on the basis of correlation coefficient, root mean square error and maximum absolute error.

Correlation coefficient (R^2) is defined as

$$R^2 = \frac{\sum_{i=1}^N (x_{act}(i) - \bar{x}_{act})(x_{pre}(i) - \bar{x}_{pre})}{\sqrt{\sum_{i=1}^N (x_{act}(i) - \bar{x}_{act})^2 \sum_{i=1}^N (x_{pre}(i) - \bar{x}_{pre})^2}}$$

Normalized Root Mean Square Error (NRMSE) is defined as

$$NRMSE = \frac{\sqrt{\frac{1}{N} \sum_{i=1}^N (x_{act}(i) - x_{pre}(i))^2}}{(Max(x_{pre}) - Min(x_{pre}))}$$

Maximum Absolute error is defined as

$$MAE = Max(Abs(x_{act}(i) - x_{pre}(i)))$$

Where $x_{act}(i)$ is actual rainfall and $x_{pre}(i)$ is predicted rainfall value at point i

\bar{x}_{act} and \bar{x}_{pre} are the mean value of actual and predicted rainfall series.

N is the sample size.

$Max(x_{pre})$ is maximum value of predicted rainfall ,

$Min(x_{pre})$ is minimum value of predicted rainfall.

V RESULT AND DISCUSSION

During the development of the alternative ANNs, various network configurations were explored in order to determine the effect of number of neuron in hidden layer., number of lags and various values of gamma parameter. Numbers of neurons in hidden nodes were varied were from 4 to 32 and NMSE was calculated. The result is shown in table.1. Eight number of neuron in the hidden are found to be optimum in order to have best performance. Number of lags was varied from 4 to 24 and the best result was found at sixteen lag as shown in table.2. Number of tap decides the amount of delay required i.e. data from previous inputs. Table.3 shows the variation in the performance parameter of the model with the changes in gamma parameter. Minimum NMSE is found at gamma parameter equal to 0.8. Gamma parameter decides the amount of feedback to be taken from the various taps. The results are shown in the table given below. A plot between actual rainfall and predicted rainfall is shown in the fig.4. The plot is linear with residual given in the below figure.

Number of Taps	NMSE	Max Abs Error	Correlation Coefficient
4	0.14685	0.07201	0.93733
8	0.13298	0.06966	0.94084
12	0.14557	0.07403	0.93861
16	0.17348	0.07863	0.92301
24	0.17686	0.07513	0.93097
32	0.16601	0.07380	0.92773

Table 1. Performance parameter at different Number of neuron in the hidden layer

Number of Lag	NMSE	Max Abs Error	Correlation Coefficient
4	0.20911	0.08376	0.89842
8	0.13794	0.06934	0.93245
12	0.13813	0.06932	0.93687
16	0.13298	0.06966	0.94084
18	0.16869	0.07540	0.92507
20	0.20620	0.08993	0.91550
24	0.16629	0.08015	0.92719

Table 2. Performance parameter at different Tap number

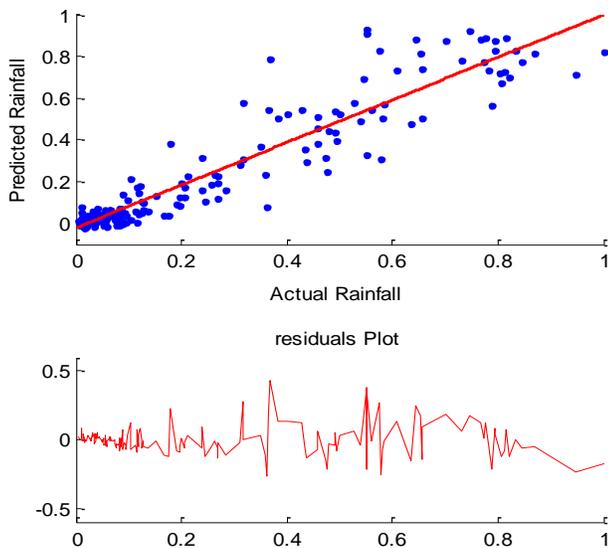


Fig 4. Scatter plot between actual and predicted rainfall and residual plot

REFERENCES

[1] K. Krishna Kumar, B.Rajagopalan and M. A Cane, "Epochal changes in Indian monsoon ENSO Precursors," *Science*, 1999, 284, pp. 2156–2159.
 [2] E. M. Rasmusson, T. H. Carpenter, "The relationship between eastern equatorial Pacific sea surface temperature and rainfall over India and Sri Lanka," *Mon. Weather Rev.*, 1983 vol. 111, pp. 517–528.
 [3] C.F. Ropelewski, M.S. Halpert, "Global and regional-scale precipitation associated with El Nino/Southern Oscillation," *Mon.Weather.Rev.*, 1987 vol. 115, pp. 1606-1626.
 [4] P.J. Webster, and S.Yang, " Monsoon and ENSO: Selectively interactive Systems", *Quart.J.Roy.Met.Soc.*, 1992, vol.118, pp. 877-926.
 [5] N.C. Lau, M.J. Nath, "Impact ENSO on the variability of the Asian-Australian Monsoons as simulated in GCM experiments," *Journal of Climate* 2000 vol. 13(24) pp. 4287–4309.
 [6] B.Wang, R.Wu, T.Li, "Atmosphere–warm Ocean interaction and its impacts on Asian–Australian monsoon variation," *Journal of Climate* 2003 vol. 16(8) pp.1195–1211.
 [7] K.Krishna Kumar, B.Rajagopalan, M.Cane, "On the weakening relationship between the Indian monsoon and ENSO", *Science*, 1999 vol. 284, pp. 2156-2159.
 [8] C.J.C. Reason, R.J. Allan, J.A. Lindesay, T.J. Ansell, " ENSO and climatic signals across the Indian Ocean Basin in the global context: part I,

Gamma Parameter	NMSE	Max Abs Error	Correlation Coefficient
0.20	0.24665	0.09502	0.88780
0.40	0.18667	0.08427	0.91519
0.60	0.15908	0.07429	0.92897
0.70	0.17163	0.07371	0.94222
0.80	0.14386	0.07027	0.94052
0.90	0.13946	0.06946	0.94038
1.00	0.16600	0.08151	0.92128
1.20	0.19806	0.09441	0.92692

Table 3. Performance parameter at different values of Gamma Parameter

interannual composite patterns", *International Journal of Climatology* , 2000 vol. 20(11) pp. 1285–1327
 [9] R.H. Kripalani, A.Kulkarni, "Climatic impact of El Nino/La Nina on the Indian monsoon: a new perspective," *Weather* 1997 vol. 52 pp. 39–46.
 [10] K. Hornik, M. Stinchcombe and H. White, "Multilayer feedforward networks are universal approximators," *Neural Networks* 1989 vol. 2, pp. 359-366.
 [11] F. Sven Crone, " A Business Forecasting Competition Approach to Modeling Artificial Neural Networksfor Time Series Prediction," *IC-AI* 2004 pp. 207-213.
 [12] D.W. Patterson, K.H.Chan, C.M.Tan, " Time Series Forecasting with neural nets: a comparative study," *Proc. the international conference on neural network applications to signal processing. NNASP*, 1993 Singapore pp 269-274.
 [13] M.French, W. Krajewski and R.R. Cuykendall, "Rainfall forecasting in Space and time using a neural network," *Journal of Hydrology* 1992 vol.137 pp.1-31
 [14] I.W. Sandberg, and L.Xu, "Uniform approximation and gamma networks," *Neural Networks*, 1997 vol. 10, pp. 781–784.
 [15] B. deVries and J. C. Principe, "The gamma model—A new neural model for temporal processing," *Neural Networks*, 1992 vol. 4, pp. 565–576.

AUTHORS

First Author – N.A. Charaniya, M.Tech (IIT, Delhi), Babasaheb Naik College of Engg, Pusad Email: na_charaniya@rediffmail.com.

Correspondence Author – N.A.Charaniya, email: na_charaniya@rediffmail.com, nacharaniya@indiatimes.com, +919764996850.

Second Author – Dr. S.V.Dudul, P.hd., Sant Gadge baba Amravati University, Amravati. Email: svdudul@gmail.com.

An Easy Method of Spirometry for Ill and Aged Subjects

Dr. S. Meenakshi

*Professor of Physiology, Tagore Medical College & Hospital, Rathnamangalam, Chennai 600048

Abstract- Recording of forced expiration from tidal breathing referred to as forced expiratory capacity (fec) and its volume for first sec. Referred to as (fec1) appears to be a simple convenient technique than the conventional forced vital capacity manoeuvre (fvc). From fec tracings volume expelled for the first sec and its % can be measured (fec1%) such spirometric recording obtained from tidal breathing to residual volume may be referred to as spirometric recording at low lung volume. Asthmatics and old subjects find this manoeuvre easier to perform than the conventional manoeuvre of forced vital capacity (fvc) fec recording offers no discomfort to subjects as it does not involve maximal inspiration before forced expiratory effort in its procedure as seen in conventional spirometry recording of FVC. FEC recording is a simple, reliable and sensitive test for evaluation of early airway obstruction in asymptomatic smokers and therefore may be utilised in clinical and epidemiological survey.

I. INTRODUCTION

F_{vc} manoeuvre has been widely recognized as an important ventilatory spirometric tracing for evaluation of airway obstruction (Tiffeneau 1976) but bronchoconstriction after deep inspiration becoming a common feature of asthma has been demonstrated (by Naddetal 1961, Butler 1960 and Gimeno et al 1972). Also in asthmatics and COPD maximal inspiration reduces the bronchial patency (Herxheimer et al 1946). Therefore the functional studies of asthmatics is biased by the conventional technique of fvc recording (Gayraud et al 1975)

There is increasing emphasis on the need for detection of airway obstruction at an early stage. Airways <2mm in diameter are the sites where obstruction process begins first. Because of the large total cross sectional area of these smaller airways, considerable increase in resistance is required before forced expiratory volume for first sec. And its % (FEV₁ & FEV₁%) obtained from fvc recording becomes abnormal and mostly patients with presumed disease of smaller airways will have normal FEV₁ and FEV₁% (Morris et al 1975; Morris 1976) therefore conventional spirometric tracings of fvc, FEV₁ and FEV₁% is insensitive to small airway disease. Flow abnormalities in these smaller or peripheral airways may be well appreciated if spirometric tracings are made at low lung volumes (Richard et al 1975) in the present study an attempt was made to record forced expiration at low lung volume without maximal inspiration i.e. forced expiration to RV from tidal breathing. The forced volume (fec) corresponds to tidal volume (TV) and forced expiratory reserve volume (FERV) and volume expelled for the first sec and its % is referred to as fec₁ and fec₁%. This recording has been found to be useful for early detection of small airway disease in asymptomatic smokers.

II. MATERIALS AND METHODS

The study included totally 3 groups of subjects. 1st group comprised of 62 healthy normal subjects (39 males & 23 females) between 18—35 years of age with the mean age of 25 years, who are non-smokers and not having any cardiac and respiratory disease and no persistent cough with no history of recent respiratory illness and no occupational history of exposure to dust or fumes.

1st group included 73 asthmatics (41 males and 32 females) with the history of episodic attack of acute airway obstruction resolving spontaneously or on treatment with BD, with persistent minimal or little disability in between and with absence of any cardiovascular disease. Among them 16 were diagnosed as having Bronchitis and 6 having chronic bronchitis with emphysema. Their ages ranged from 22-62 yrs with the mean age of 42.8 yrs. The reversibility of their airways were checked with spirometric tracings recordings before and after BD therapy.

1st group comprised of 2 sub groups - of smokers and non-smokers. Smoker group included 22 male subjects with the smoking history of >10 cigarettes/day for more than a minimum of 5 yrs to a maximum of 7 yrs who are asymptomatic with no persistent cough and no exertional dyspnoea. Their ages ranged from 18-40 yrs with the mean of 31 yrs.

2nd set of sub group comprised of equal number of normal subjects of similar age group, body build and with no cardiovascular disease who are non-smokers were selected for the study.

Conventional Spirometric recordings, its volume for first sec, and its percentage i.e. (FVC, FEV₁, FEV₁%) so also FEC, FEC₁ AND FEC₁% FROM TIDAL BREATHING WITHOUT DEEP INSPIRATION BEFORE FORCED EXPIRATORY FLOW WAS ALSO MEASURED FOR ALL THE SAME subjects. FEFR 75 was recorded from FVC tracings.

The pre and post BD effect were evaluated for patients with airway obstruction by making them inhale two breaths of Salbutamol 100 micrograms /puff from pressurized canister for a total dose of 200 micrograms. The two puffs were taken at 1-2 mins interval starting below FRC and continuing to TLC and holding the breaths for 10 secs. Within 15-20 mins after BD therapy pulmonary function studies were repeated.

III. RESULTS & OBSERVATIONS

Mean values of FVC recordings (FVC, FEV₁ & FEV₁%) of Group 1 were compared with those of FEC recordings (FEC, FEC₁, FEC₁%) in Table 1.

The normal patency exhibited by FEV₁ and FEV₁% has been clearly brought out by similar results obtained with FEC₁

and FEC1%. And FEC1 shows a significant correlation with FEV1 (p<01)

The degree of airway obstruction shown by a fall in FEV1 and FEV1% in GROUP11 has been equally well demonstrated to the same degree by similar fall in FEC1 and FEC1% (in Table4.)

FEC1% is almost the same as FEV1% in females. Whereas FEC1 and % is much more reduced in males as the flow recording at low lung volume reflects the greater proportion of total airway resistance contributed by small airway disease. (table 2) % of improvement with BD therapy is shown in Table 4 for asthmatics in which the significant improvement seen in FVC, FEV1 & FEV1% after BD correlates well with the improvement shown by FEC, FEC1 & FEC1%. BD has been found to be not very effective in reversing the broncho constriction in chronic bronchitis and COPDS (.table5)

Mean FEV1 and FEV1% of asymptomatic smokers (subgroup1) and non-smokers (subgroup11) of Group111 are found to be normal and almost the same. Whereas FEC1 and FEC1% of smokers (subgroup1) is significantly reduced (p<.05) compared to that of non-smokers (subgroup11) and FEFR75 obtained from conventional spirometry is also reduced in smokers compared to non-smokers (Table3) .

IV. DISCUSSION

Lim and Omeha1972 and Lim 1973 pointed out the usefulness of spirometric recording at low lung volume for early detection of stasis of peripheral airways. The resistance offered by smaller airways increasing sharply at lower distending volume and pressure of the lungs has been demonstrated by Morris 1975 and Richard et al 1975 Similarly a fall in FEF75 in patients with small airway disease had also been documented by Hill et al 1972. Significant reduction in FEF75 in smokers illustrating the involvement of smaller airways has been already reported (Morris 1975, Maloet.al 1975).

Reduction in FEC1 and its % in smokers observed in the present study confirm the diagnosis of smaller airway involvement in these smoker subjects.

Hence it may be concluded that recording at low lung volume is a simple but most reliable sensitive test for epidemiologic survey for screening large population for prevalence of small airway disease .It produces no discomfort, provides equally all and more informations obtained from FVC maneuver and therefore may be applied for evaluating geriatric and asthmatic patients for routine check up in pulmonary function laboratories.

**TABLE-1
 MEAN SPIROMETRIC VALUES—GROUP1**

CONVENTIONAL				NEW METHOD		
SEX	FVC(LIT)	FEV1(LIT)	FEV1%	FEC(LIT)	FEC(LIT)	FEC1%
MALE(39)	4.17	3.68	88.2	1.80	1.58	87.7
SD	0.40	0.30	7.0	0.15	0.12	9.0
FEMALE(23)	3.60	3.18	88.4	1.33	1.18	88.6
SD	0.39	0.30	6.0	0.19	0.13	7.5

**TABLE 2
 VENTILATORY INDICES IN OBSTRUCTIVE PATIENTS—GROUP11**

CONVENTIONAL				NEW METHOD		
SEX	FVC	FEV1	FEV1%	FEC	FEC1	FEC1%
MALE(41)	2.55	1.94	76	1.42	0.95	66.8
SD	0.43	0.31	5.3	0.26	0.16	8
FEMALE(32)	1.70	1.26	74.4	0.91	0.67	73.8
SD	0.41	0.32	5.1	0.16	0.15	7.5

TABLE—3
PULMONARY FUNCTION TESTS FOR SMOKERS AND NON-SMOKERS- GROUP111

INDICES	UNITS	SMOKERS		NON-SMOKERS	
		MEAN	SD	MEAN	SD
FVC	LIT	3.69	0.44	3.82	0.51
FEV1	LIT	3.24	0.41	3.33	0.55
FEV1%	%	88	5.52	87	5.71
FEFR75	LIT/SEC	0.9	1.41	2.24	0.89
FEC	LIT	1.2	0.48	1.67	0.36
FEC1	LIT	0.98	0.31	1.39	0.30
FEC1%	%	82.7	12.7	83.4	11.7

TABLE—4
EFFECT OF BD IN ASTHMATICS (51NOS)
GROUP11—SUB GROUP 1

INDICES	UNITS	PRE BD	POST BD	% RESP	P.VALUE
FVC SD	LIT SD	2.95 SD	3-13 SD	10	NS
FEV1	LIT	1.70 0.20	2.29 0.18	22	0.05
FEV1%	%	59 7	72 6	9	0.05
FEFR75	L/S	0.05 0.02	0.97 0.40	23	0.05
FEC	LIT	1.11 0.08	1.96 0.91	22	.01
FEC1	LIT	0.15 0.075	1.12 0.89	17	.01
FEC1%	%	76.6 7	71.8 11	11	0.01

TABLE 5
GROUP11---SUB GROUP11
EFFECT OF BRONCHODILATOR IN COPDS—22NOS
(16-CHRONIC BRONCHITIS & 6 EMPHYSEMATIC)

INDICES	UNIT	PRE BD	POST BD	% RESPE	P VALUE
FVC SD	LIT	2.65 0.22	2.85 0.26	11	NS
FEV1 SD	LIT	1.32 0.18	1.69 0.22	12	NS
FEV1%	%	48 7	59 11	9	NS
FEFR75	L/S	0.65 0.12	0.71 0.9	5.9	NS
FEC	LIT	0.78 0.03	0.82 0.05	3	NS
FEC1	LIT	0.63 0.06	0.71 0.07	4.5	NS
FEC1%	%	81 7	86.5 11	7	NS

REFERENCES

- [1] Butler J, Caro C G Alcala R Dubois AB 1960 Physiological factors affecting airway resistance in normal subjects and in patients with obstructive respiratory disease. *clin. Invest.* 39. 584
- [2] GimenoF, Berg W.C S ,leriter H.J Tammeling G.J 1972 Spirometry induced broncho constriction *Ameri. Rev. Respir. Dis.* 105.68.
- [3] Herhexemier H 1946 Hyperventilation asthma *Lancet*1.83
- [4] Hill. D.J, Landen L.L., PhelanP.D 1972 Small airway disease in asymptomatic asthmatic adolescents. *Ameri. Rev. Respir. Dis* 106. 873
- [5] Lim.T.pK, Omeha1972 Assessment of airway obstruction by end tidal spirogram *Chest* 62. 370
- [6] Lim T.P.K, 1973 Airway obstruction in high school students. *Ameri. Rev. Respir. Dis.* 108.905
- [7] Malo.J.L., IEBLAN C.P.1975 Functional abnormalities in young asymptomatic smokers with special reference to flow-volume curves, breathing various gases. *Ameri. Rev. Respir. Dis*11.623
- [8] Morris J.F., Arthur Koski, Brease J.D 1975 Normal values of evaluation of forced end expiratory flow. *Ameri. Rev. Respir. Dis.*111.755
- [9] Morris J.F.1976 Spirometry in the evaluation of pulmonary function *Medical Progress* 125.110
- [10] Nadel J.A , Tierney D.F 1961. Effect of previous deep inspiration on airway resistance in man. *J.Appl. Physiol.*16.717
- [11] Gayrard P. OreheckJ, GrimandC. Charpin J 1975 Bronchodilator effects of deep inspiration in patients with asthma. *Ameri. Rev. RespirDis*111.433
- [12] Richard. R .M David L. Paul. B Macklem P.T 1975. The early detection of airway obstruction 111.119
- [13] Tiffeneau. R, Pinelli.A.1947. *Paris. Med.* 133.624 referred by Morris J. F. *Medical PROGRESS*, 1976. 125.110

AUTHORS

First Author – Dr. S. Meenakshi, Professor of Physiology,
Tagore Medical College % Hospital, Rathnamangalam, Chennai
600048

Traditional Home Remedies for Common Ailments from Himayatnagar Taluka of Nanded District

Madhushree M. Routh*, Manisha P. Mangulkar**

*Madhushree M. Routh, M. Sc, Ph. D, *DST-FIST Sponsored School of Life Sciences, S.R.T.M. University, Nanded (MS) India.

** Manisha P Mangulkar, M. Sc, Hutatma Jaywantrao Patil College, Himayatnagar, Nanded (MS) India.

Abstract- Medicinal plants form the largest segment of the biodiversity used by indigenous people. The objective of this study was to preserve the perishing knowledge of traditional home remedies for health care in villages of Maharashtra state of India. Men and women from nineteen villages were interviewed and information collected were documented. Crude drug samples were collected. The rural people used medicinal plants available locally for health care. Plants were used as raw, cooked or decoction forms. All the plants used were identified upto species level. Digital and written documentation were made as well as herbaria are prepared. This study gives scope for use of their time tested remedies by the future generation. In addition it gives scope for reverse pharmacological studies.

Index Terms- traditional knowledge; health care; home remedies; medicinal plants

I. INTRODUCTION

Plants for health care form the largest segment of the biodiversity used by indigenous people for basic needs. The local uses of plants as a cure are common particularly in those areas, which have little or no access to modern health services such as the innumerable villages in India [1, 2]. Their knowledge about home remedies was handed down from one generation to the next by an oral tradition that is part of our social heritage [3, 4]. This work concentrates on ethno medicinal value of plants and herbs commonly used by common village people to cure their health problems they generally face. The ethnomedicinal use of barks of some plants is reported for certain health disorders [5]. In South Kerala, medicinal plants are used for pre and post natal care, specially focusing on the health care management in the form of nutraceuticals [6]. In Jalgaon district of Maharashtra ethnomedicinal uses of tree bark is common for ailments [5]. Indian Council for Medical Research task force reported that still in rural parts of India, people seek traditional medicine practitioners or follow some home remedies to get rid of various ailments because they feel that these therapies are time tested and mainly they have no side effects like modern medicine [7]. In China, there is a long history of treating common disorders with traditional home remedies [9]. In Northern Peru, Asteraceae family plants are more commonly used to treat many diseases [10]. Luke warm extracts of Boriginaceae family members are reported to be used to increase lactation in Kashmir [11].

Even though Western medicine is readily available in Japan, 60-70% of population believes in their traditional

medicinal plants. In China, this accounts for about 40-50 % [12]. In Africa, up to 80% of population use traditional medicinal knowledge for various health problems, which they have learnt from their forefathers. [8, 13]. In Pakistan this number is even high[14].

Many ethnobotanical studies are done on the medicinal use of herbals but very few studies are available on home remedies for health care from Marathwada region. Fortunately, the tradition of using home remedies for health is still alive. However these home remedies are not documented. The creation of nuclear families where grand mothers are absent, migration to cities, easy availability of synthetic drugs and access to primary health centers are some of the reasons which are accelerating the loss of traditional knowledge on home remedies. In this study, we have documented the traditional knowledge related to common health problems from villages of Himayatnagar taluka of Nanded district of Maharashtra state of India.

II. MATERIALS AND METHODS

Study area

The study area at Himayatnagar is about 80 km east of Nanded, the district head quarters and positioned on latitude 19° 38'026" and longitude 77° 9'868".

Ethnobotanical Survey

A questionnaire survey method was employed in thirty eight villages of Himayatnagar taluka of Nanded District of Maharashtra State of India, to collect information on traditionally practiced home remedies by rural people for health care. We have not interviewed any traditional medicine practitioners in this study. One hundred and twenty persons were interviewed using a structured questionnaire. The questionnaire had prompts for the source of information, identity of the plant materials, methods of preparation, prescription and administration. People were interviewed from the age group of 25 to 70 years over a period of three months. In most cases they were interviewed twice. The people interviewed include Hindus, Muslims, Buddhists and believers of local spiritual traditions and other non religious groups. Out of 120 men and women only fifty were literate upto senior secondary level. Few were having formal education of primary school level and the rest were illiterate.

Identification of medicinal plants

The medicinal plants were collected and identified according to their habit, habitat and floral characteristics

following the guidelines described in Flora of Marathwada [15]. The data were recorded and then the plants were identified [Table 1] by the help of village people who were interviewed. Digital photographs were taken. Herbariums were prepared.

III. RESULTS

Table 1: Plants used in this study

Plant name	Family name	Ailment	Method of administration
<i>Aloe barbadensis</i>	Xanthorrhoeaceae	Stomach ache	Crushed aloe leaves mixed in curd is given twice daily.
<i>Acacia catechu</i>	Fabaceae	Bleeding gum Throat and mouth ulcers	Paste of heart wood is eaten with leaves of <i>Piper bettle</i> (Pan) for treatment of bleeding gum, throat and mouth ulcers.
<i>Achyranthus aspera</i>	Amaranthaceae	Whooping cough	Seeds decoction is used.
<i>Aegle marmelos</i>	Rutaceae	Stomach ache Anti diarrhoeal Enteric infections	Ripe fruit juice prepared with water or milk is taken orally.
<i>Alium sativum</i>	Liliaceae	Skin infections	Bulblets are crushed and paste is applied on skin.
<i>Arachis hypogaea</i>	Fabaceae	Drying of skin	Ground nut oil is heated slightly and applied on the body.
<i>Colocasia esculanta</i>	Araceae	Blood coagulation	Leaf paste is used for blood coagulation in small injuries
<i>Coriander sativum</i>	Apiaceae	Vomiting	Powdered coriander seeds are boiled in a glass of milk/water for about 5 minutes, sugar is added and given once a day.
<i>Carum carvi</i>	Apiaceae	Stomach ache and Gastric problem	Powdered cumin seeds are taken with a glass of lemon juice.
<i>Citrus aurantifolia</i>	Rutaceae	Diarrhea	(1)Black tea is prepared to which lime juice is added and given once.
		Vomiting	(2)Lemon juice with sugar is given once per day.
<i>Calotropis procera</i>	Asclepiadeceae	Asthma and cough	Powder of flowers with black pepper is taken orally
<i>Datura stramonium</i>	Solanaceae	Tooth ache	Root paste is applied on gums overnight.
<i>Elettaria cardamomum</i>	Zingiberaceae	Urinary calculi	Eliaichi and seeds of melon are made into powder and consumed with waterfor one month.
<i>Citrus vulgaris</i>	Cucurbitaceae		
<i>Ficus bengalensis</i>	Zingiberaceae	Stomach ache	Powdered and burnt banyan leaves are mixed in

			a glass of water and taken once a day.
<i>Ficus recemosa</i>	Moraceae	Urinary calculi	Five gm of leaf ash of Umber is taken orally with water regularly for fifteen days.
<i>Lawsonia inermis</i>	Lythraceae	Coloring of hair	Dried heena leaf powder is soaked in tea decoction overnight and applied on hair.
<i>Ferula assafoetida</i>	Apiaceae	Gastric and acidity	consumed in hot milk without sugar in empty stomach.
<i>Glycerrhiza glabra</i>	Fabaceae	Diarrhea	Paste of liquorice, sandal and a few drops of water by rubbing on a stone is mixed with 1 tsp of honey and given twice daily.
<i>Santalum album</i>	Santalaceae		
<i>Punica granatum</i>	Lythraceae	Diarrhea	Pomegranate leaf juice added to a glass of butter milk is given three times a day.
<i>Solanum indicum</i>	Solanaceae	Cold and Cough	Root juice is consumed with honey
<i>Solanum nigrum</i>	Solanaceae	Whooping cough	Root juice is consumed morning in empty stomach.
<i>Terminalia bellerica</i>	Combretaceae	Dandruff	seed powder in the form of paste is also applied on scalp.
<i>Mimosa pudica</i>	Fabaceae	Piles	Leaf juice with milk is used as a good remedy for piles.
<i>Mangifera indica</i>	Anacardiaceae	Cracked heels	Mango tree gum is applied on cracked heels.
<i>Nyctanthes arborristis</i>	Oleaceae	Dandruff	seeds in the form of a paste is applied on the head for 2 to 3 hrs and then washed.
<i>Myristica fragrans</i>	Myristicaceae	Stomach ache	Powdered nutmeg mixed with ghee is given once a day.
		Sleeplessness	A pinch of jaifal powder is mixed in luke warm milk and consumed in the night.
<i>Musa paradistica</i>	Musaceae	Loose motion	Mashed banana mixed with roasted Bengal gram (Chick pea) powder is given twice a day.
<i>Cicer arietinum</i>	Fabaceae		

<i>Ocimum sanctum</i>	Lamiaceae	Cold and cough	Leaf juice is mixed with equal amount of honey and given twice daily.
<i>Zingiber officinalis</i>	Zingiberaceae	Cold	One tea spoon of ginger juice is mixed with two to three drops of honey and consumed at bed time.

* All the reported plants used for home remedies of common ailments by respondents are presented here with informations like botanical name, family name, and mode of preparation and administration.

IV. DISCUSSION

In India, 70 % of its population resides in villages. In spite of the accessibility to western medicine, people in these villages still continue to depend on herbal remedies, for treatment of their health problems. Plant species have long been the principal ingredients of traditional medicine, and their use dates back to the beginning of human civilization. Traditional medicine has clearly recognizable therapeutic benefits [16, 17].

From the collected data a list of 32 plants distributed into 21 families with their traditional uses and mode of administration is given in Table 1. Among the major findings use of *Colocasia esculanta* leaves for blood coagulation, *Mimosa pudica* leaf juice for piles relief, use of *Acacia catechu* heart wood paste for treatment of bleeding gums, throat and mouth ulcers are prominent and interesting to note. The medicinal plant preparations were applied through different routes of administration like oral, topical or dermal etc. However oral application was the highest and most commonly used route followed by topical or dermal applications. The formulations are mostly paste, powder and decoctions.

The respondents in the study have expressed several reasons for non-usage of indigenous medicinal plants as home remedies. Among those, a majority have mentioned about the easy accessibility to Primary Health Centers, migration to cities, higher level of education, easy availability of synthetic drugs, break down of joint families, and absence of elders in the family. One of the major drawbacks of indigenous medicines is that they are not documented, although Ayurvedic texts do mention the healing properties the old texts are not accessible to common man for easy reference. So it is high time to document these age old traditional home remedies which consist of a major part of our cultural and societal structure.

ACKNOWLEDGMENT

We thank the men and women of all the villages for sharing their knowledge with us.

REFERENCES

- [1] Darshan S. Conserving the Medicinal Plants of India. The Need for a Biocultural Perspective. J Altern Complement Med, 1996, 2 : 349-358.
- [2] Boer HD, Lamxay V. Plants used during pregnancy, child birth and postpartum healthcare in Lao PDR: A comparative study of the Bro, Saek and Kry ethnic groups. J Ethnobiol and Ethnomed, 2009, 5/1/25.
- [3] Ekbal B. "Women's Health Care : A Picture of Discrimination". Samyukta, 2002, 2: 45-50.
- [4] Unnikrishnan P. Role of Traditional Medicine in Primary Health Care. World Health Report (WHO), 2009, 724-743. <http://www.who.int/whr/2006/en/>

- [5] Pawar S, Patil DA. Ethnomedical uses of bark in Jalgaon district. Nat Prod Rad, 2007, 6: 341-346.
- [6] Rajith NP, Navas M, Thaha AM, Manju MJ, Anish N, Rajasekharan S, George V. A Study on traditional mother care plants on rural communities of South Kerala. Indian J Trad Knowledge, 2010, 9: 203-208.
- [7] Kombo IP, Dhillon BS, Singh P, Saxena BN, Saxena NC. Self reported gynaecological problems from twenty three districts of India (An ICMR Task Force Study). Indian J. of Commun Med, 2003, 28: 67-73.
- [8] Lans C. Ethenomedicines used in Trinidad and Tobago for reproductive problems. J. Ethnobiol and Ethnomed, 2007, 13: 1-13.
- [9] Zhou J, Qu F. Treating gynaecological disorders with traditional Chinese medicine: A review. Afr. J. Trad. CAM, 2009, 6: 494-517.
- [10] Bussmann RW, Sharon D. Traditional medicinal plant used in Northern Peru: tracking two thousand years of healing culture. J. Ethnobiol Ethnomed, 2006, 47: 1-18.
- [11] Tantray M A, Tariq K A, Mir M M, Bhat M A, Shawl A S. Ethnomedicinal survey of Shopian, Kashmir (J&K), India. Asian Journal of Traditional Medicines, 2009, 4: 1-6.
- [12] Bussmann RW, Glen A. Medicinal plants used in Northern Peru for reproductive problems and female health. J. Ethnobiol Ethnomed, 2010, 6:30.
- [13] Burford G, Rafiki MY, Nglia LO. The forest retreat of Orpul: A holistic system of health care practiced by Masai tribe of East Africa. The Journal of Alternative and Complementary Medicine, 2001, 7: 547-551.
- [14] Shaikh SH, Mallik F, James H, Abdul H. Trends in the use of complementary and alternative medicine in Pakistan : A population -based survey. The J. Altern Complement Med, 2009, 15: 545-550.
- [15] Naik VN. Flora of Marathwada. 2nd ed. Amrut Prakashan, Station Road, Aurangabad, India, 1998.
- [16] Mashelkar R A. Intellectual property rights and the third world. Current Sci, 2001, 81: 955-965.
- [17] Joshi, K., Chauhan, P., Warude, D., Pattawardhan, B., 2004. Molecular marker in herbal drug technology. Current Sci, 87: 159-165.

FOOTNOTES

Table 1: All the reported plants used for home remedies of common ailments by respondents are presented here with information's like botanical name, family name, and mode of preparation and administration.

Table legends

Table 1: Plants used in this study

AUTHORS

First Author – Madhushree M. Routh, M. Sc, Ph. D, *DST-FIST Sponsored School of Life Sciences, S.R.T.M. University, Nanded (MS) India.

Second Author – Manisha P. Mangulkar, M. Sc, Hutatma Jaywantrao Patil College, Himayatnagar, Nanded (MS) India., E

mail: madhushreemanas@gmail.com, Contact number:
9423693246

Investigation of Mechanical Properties and Grain Structure of 5xxx Aluminium Alloys under Precisely Controlled Annealed Conditions

Nice Menachery*, Biju C V**, Sijo M T*

*Department of Mechanical Engineering, SCMS School of Engineering and Technology, Kerala, India

**Department of Mechanical Engineering, Jyothi Engineering College, Kerala, India

Abstract- An attempt has been made to investigate the influence of micro structure on mechanical properties such as tensile strength, elongation, hardness, and elongation of the 5xxx alloys under different annealed conditions. Pure Aluminium material does not possess sufficient strength hence the application are limited to a few. The alloying element Magnesium added to pure Aluminium enhances the mechanical properties through solid solution and leads to improve strain hardening ability. The large strength to weight ratio of 5xxx alloys find applications in aircraft industries. The experiments were carried out for a composition of Al 5xxx alloy having 92.47 % of Al and 6.46% of Mg in the form of rod produced by extrusion process. The correlation of mechanical properties with grain structure is established in the study.

Index Terms- 5xxx series alloy, Al-Mg alloy, heat treatment, mechanical properties, grain structure.

I. INTRODUCTION

Aluminium is remarkable for its low density and ability to resist corrosion. Due to inadequate strength, pure aluminium is not usually used for structural applications. Hence for structural applications instead of pure Aluminium, it is found to be necessary to add other alloying elements to aluminium. Such alloys exhibit excellent combination of strength, fatigue resistance, formability and high corrosion resistance which is highly essential for aerospace industry. The most important Aluminium alloy of 5xxx series is obtained by adding Magnesium as the alloying element to form solid solution have been reported [1] as high corrosion resistant material, which finds application in offshore structures.

Heat treatment of Al-Mg alloys modifies the micro structure of alloys and the resulting phase transformation influences the mechanical properties such as strength, ductility, toughness, hardness and wear resistance thus making them even more suitable for the manufacture of aircraft components. The addition of alloying elements to aluminium is the principal method used to produce a selection of different materials that can be used in a wide assortment of structural applications.

The influence of various kinds of annealing conditions on grain size and corresponding mechanical properties of Aluminium alloys has been reported [2]. A predominant shift from strain induced grain boundary to nucleation followed by

growth grain boundary can be obtained under controlled annealing conditions [3].

The phenomenon of solidification of alloys to fine grain boundaries in the annealing process was observed by others [4,5]. It is established that mechanical properties of Aluminium alloys can be improved by heat treatment processes [6].

The present research tests this hypothesis by investigating the variation of grain structure and mechanical properties when 5xxx Aluminium alloy subjected to different annealed conditions, under precisely setting the temperature gradient under controlled environment.

II. METHODS AND MATERIALS

The characterization of the specimen was carried out in spectrometer (German made, foundry master) connected with Wasag Lab Software is shown in figure 1. It was identified the major constituents of 5xxx alloy as 92.47% Al and 6.46% Mg by weight. Using 20HP constant torque centre lathe (VDF - Heidenreich & Harbeck) all the specimens were machined under identical conditions (feed : 0.30 mm/ rev, depth of cut : 0.25 and rpm : 220) to ASTM B557 standard shape and size (12.5 mm diameter, 100 mm long) is shown in figure 2



Figure 1: Spectrometer

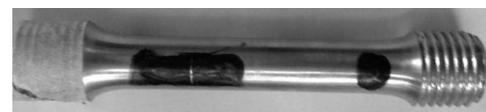


Figure 2: Specimen machined as per standard

The heat treatment of the alloy was done in a Muffle Furnace with advanced electronic temperature controller attached with digital timer has shown in the figure 3. The initial temperature of the furnace was set at 330°C and 150 minutes soaking time was set as per the standards available for 5xxx alloys.



Figure 3: Muffle Furnace

The computer based active closed loop temperature control system of the furnace maintains the temperature uniformity of the chamber and assures isolation of the material from the surroundings. All the four samples were treated identically in the muffle furnace and following four types of annealing process were conducted in the study.

Annealing was carried out in four conditions, namely (1) air cooling, (2) furnace cooling, (3) Cold compressing and (4) re-annealing followed by air cooling. The details of the annealing conditions are as follows,

- One of the specimen was allowed to air cool (AC) in the room temperature (33°C).
- Another three specimens were kept it in muffle furnace for furnace cooling (FC).
- One among the above three was subjected to furnace cooling and it was cold compressed at 5 % by upsetting in the axial direction (FCC).
- The second furnace cooled specimen was re-annealed at the same conditions and allowed to cool in the room temperature (FCRAA).

An extensive study on four significant mechanical properties - Hardness, Tensile stress, Proof stress and percentage of elongation of 5xxx alloy were conducted to all the four different annealing conditions.

The mechanical properties namely proof stress, tensile strength and elongation of the specimen after annealing was investigated in the Universal Testing Machine (UTM) having capacity 400 kN is shown in figure 4. The dial gauge readings obtained from the extensometer mounted on the specimen was used to find the actual elongation and the corresponding strain induced in the specimen under different loading conditions in the experiment.



Figure 4: Universal Testing Machine (UTM)

Yield point of the Aluminium alloys was found to be difficult to capture in the tensile test, hence corresponding proof stress was evaluated at 0.2% of the gauge length from the line of proportionality. The stress- strain graphs for the different annealed conditions were plotted, figure 5.

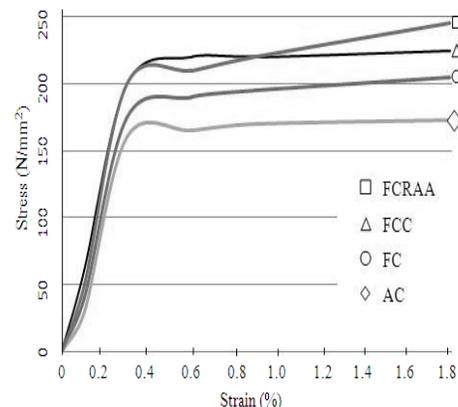


Figure 5: Stress - Strain graph at different annealed conditions

The hardness of all the four specimens was tested in the Brinell hardness tester. A steel ball indenter of diameter 10mm under 1000 kg force applied for 10 seconds. The diameter of the indentation 'd' was measured with the help of a 10X optical microscope. The corresponding Brinell hardness number was calculated using the following expression.

$$HBS = \frac{2P}{\pi D [D - \sqrt{D^2 - d^2}]}$$

Since Aluminium alloys are soft, the cutting has done at a distance of 3 mm from the plane to be polished and intervening distorted material was removed by wet grinding followed by fine polishing with the aid of 24 micron abrasive powder. Using optical microscope (200X), the grain structure of the 5xxx alloy at different annealed conditions were explored in the present work.

III. RESULTS AND DISCUSSIONS

The influence of different annealing processes on various mechanical properties was quantified in terms of tensile strength, elongation, proof stress and hardness of the 5xxx specimen. Their performance variations against the non-heat treated 5xxx alloy are shown in Fig. 6(a), 6(b), 6(c) and 6(d) respectively. The results obtained from 200X optical microscope exhibit the grain sizes for both furnaces cooled and air cooled annealed conditions found to be challenging and their grey scale grain images are shown in figure 7(a) and 7(b) respectively.

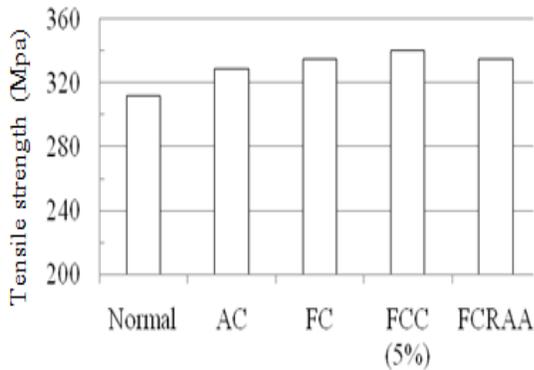


Figure 6(i)

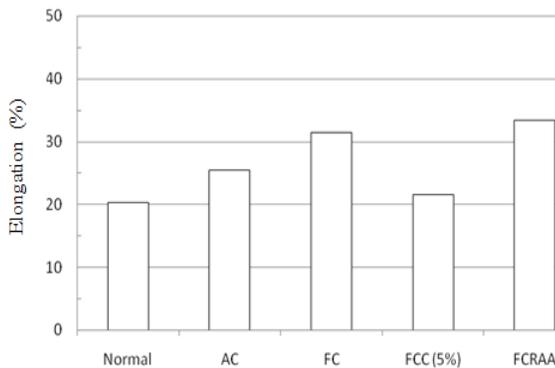


Figure 6(ii)

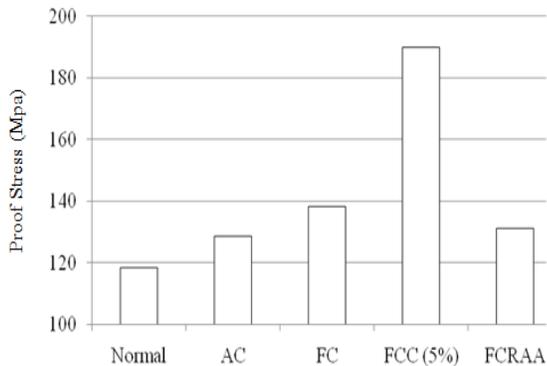


Figure 6(iii)

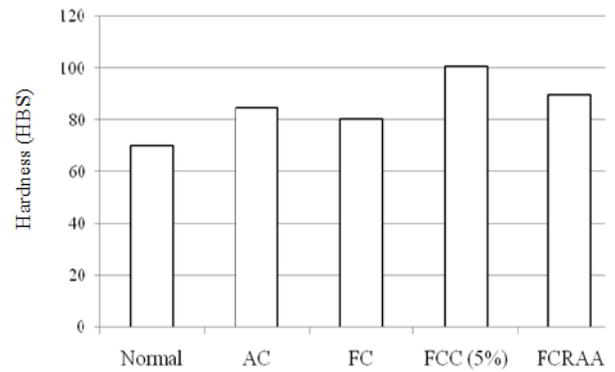


Figure 6(iv)

Figure 6: the variation of mechanical properties at different conditions



Figure 7 (i)

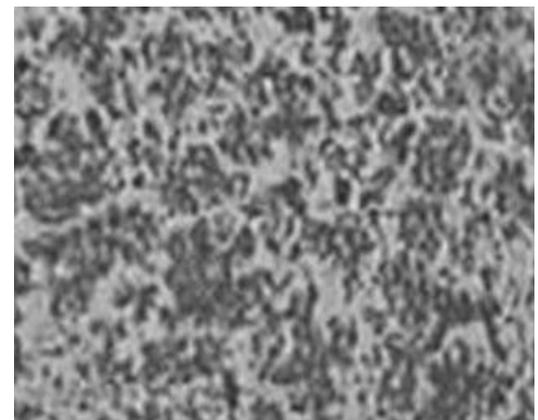


Figure 7(ii)

Figure 7(i) & 7(ii): the grain structure of air cooled and furnace cooled specimens at 200X magnification

IV. CONCLUSIONS

- ❖ The annealing carried out under furnace cool condition improve the hardness significantly.

- ❖ Furnace cooled annealing process provide 66% improvement of tensile strength in comparison with initial condition.
- ❖ Proof stress which is a direct measure of yield point shows found to be higher in furnace cooled annealing process.
- ❖ In furnace cooled annealing processes size of the grains found to be decreased from coarse to fine range due to the the formation of Mg_2Al_3 particles at the boundaries. This refinement of the grain size results in higher elongation property for the 5xxx alloys.

affiliated to Calicut University, Kerala, India. Email : cvbiju2009@gmail.com

Third Author – Sijo MT, Assistant Professor in Mechanical Engineering Department, in SCMS School of Engineering and Technology, Kerala, India., Email : sijomt@rediffmail.com

ACKNOWLEDGMENT

The authors would like to thank Mr. Deepu Kumar Engineer in-charge and Mr. A V Mohanan, Manager heat treatment lab, Steel & Industrial Forgings Ltd. (SIFL), Thrissur, Kerala, India for their technical support and experimental assistance throughout the work.

REFERENCES

- [1] Fuller. C.B, A. R. Krause, D.C. Dunand and D.N Seidman (2002). "Microstructure and mechanical properties of a 5754 aluminum alloy modified by Sc and Zr additions." *Materials Science and Engineering: A* 338(1-2): 8-16.
- [2] El-Amoush, A. S. (2011). "Intergranular corrosion behavior of the 7075-T6 aluminum alloy under different annealing conditions." *Materials Chemistry and Physics* 126(3): 607-613.
- [3] Hasegawa. K. T., Fujita, K. Araki, S. Mitao, K. Osawa, M. Nikura and Ohori .K. (1998). "Effects of intermediate annealing on the r-value of Al-Mg alloy sheets." *Materials Science and Engineering: A* 257(1): 204-214.
- [4] Yousef Y. M., R.J. Dashwood, P.D. Lee. (2005), "Effect of Clustering on Particle Pushing and Solidification Behaviour in TiB2 Reinforced Al PMMCs." *Composites* 36 (A): 747-763.
- [5] Morteson. A., Jin,(1992),"Solidification Processing of MMCs.", *International Material Rev.*,37(3): 101-28 20.
- [6] Cavaliere. P, Cerri E, LEO P. (2005). "Effect of heat treatments on mechanical properties and damage evolution of thixoformed aluminium alloys." *Materials Characterization* 55(1): 35-42.

NOMENCLATURE

- AC - Air cool
FC - Furnace cool
FCC - Furnace cooled cold compressed
FCRAA - Furnace cooled re-annealed and air cooled
ASTM - American Society for Testing and Materials
Rpm - Rotations per minute

AUTHORS

First Author – Nice Menachery, graduated in Mechanical Engineering from Calicut University, doing Post Graduate Student in Production & Industrial Engineering at SCMS School of Engineering and Technology, affiliated to Mahatma Gandhi University, Kerala, India., Email : nicemenachery@gmail.com
Second Author – Biju CV, Assistant Professor in Mechanical Engineering Department, in Jyothi Engineering College,

Change in global Climate and Prevalence of Visceral Leishmaniasis

Kumar Rajesh*, Kumar Sanjay**

* Associate Professor, Faculty of Advance Studies in the Life Sciences, Chhatrapati Shahu ji Maharaj University, Kanpur-208024, India

** PhD Scholar, Faculty of Advance Studies in the Life Sciences, Chhatrapati Shahu ji Maharaj University, Kanpur-208024, India

Abstract- *Leishmania donovani*, causes Visceral Leishmaniasis (VL), which is very serious disease and endemic in warmer part of the world covering almost 88 countries. It is most prevalent in India, Bangladesh, southern Sudan, Nepal and northeast Brazil. VL is transmitted by an insect vector i.e. Sand fly (*Phelobotomus argentipus*) that lives in warmer places (cervics, tree hole, dung and domestic wastes) where humidity and temperature both are present at regular intervals in a day (humidity during night and temperature at day time). These conditions are essential / necessary for the survival of vector, parasite development and for their distribution. But now a day, due to global climate changes and temperature increases, which support the high degree of sand fly growth, the transmission of disease has increased manifold. The flooding also increase the transmission of larvae from one place to another place thus also increases the distribution of disease.

Index Terms- *Leishmania donovani*, Visceral Leishmaniasis, Sand fly, Temperature, Humidity

I. INTRODUCTION

Visceral Leishmaniasis (VL) (Leash'ma NIGH a sis) is a vector-borne anthroozoonotic disease that is also known as Kala-Azar (Hindi: kala means black, azar means sickness), was first described by Leishman and Donovan in 1903. They separately demonstrated VL parasites in stained smears prepared from the spleen of patients suffering from a malaria-like illness.

It is caused by obligate intracellular macrophage protozoan *Leishmania donovani*, which belongs to the genera *Leishmania* within the family *Trypanosomatidae*, caused a group of diseases called **Leishmaniasis**. The causative organism of VL in the Indian subcontinent and Africa is *L. donovani*. The name *L. donovani* has been given by eminent scientist Sir Ronald Ross.

According to the findings of "impact of climate variability and change on Leishmaniasis", the distribution of Leishmaniasis is affected by the global climatic changes. It is endemic in warmer part of the world covering almost 88 countries (16 developed and 72 developing countries) around the globe with a total of 350 million people at risk and 12 million cases of infection. Out of 5 lakhs cases of VL, more than 90 percent are reported from India, Bangladesh, southern Sudan, Nepal and northeast Brazil.

II. CURRENT DISTRIBUTION AND RISKS

VL is considered to be an endemic disease, although its incidence increased significantly in the region during the 1990s. According to WHO (1994), about 25-70% of VL cases are infected with HIV and non-HIV VL incidence also present at a high rates. The worldwide distribution of Leishmaniasis is limited, in Europe, by the distribution of vector sand fly (*Phelobotomus argentipus*) and its cold climate, supports to internal development of specific species of *Leishmania*, and tendency to take blood from animals or humans only.

Since the mid-1990s, the worldwide geographical distribution of endemic Leishmaniasis has expanded. This spread of sand fly is probably due to a combination of various factors, which include, demographic change, land-use / land cover changes that create new habitats and / or changes in microclimate, and changes in seasonal climate.

Populations living in rural and peri-urban areas are at risk because here sand flies are prevalent. VL used to be found predominately in children but in recent years an increasing proportion of adult cases (non-HIV) also have been reported. This change in age distribution is probably caused by several factors, such as changes in human exposure patterns, environmental changes, and improvements in case diagnosis and notification. Improvements in nutritional and general health status in n children have probably played a roll in reducing the characteristic high susceptibility of children to this disease. The sand fly vector is mainly active during the night, and the highest risk for contracting the disease from sand fly bites is therefore between dusk and dawn.

III. INFLUENCE OF ENVIRONMENTAL AND CLIMATIC FACTORS ON DISEASE RISK

The distribution of VL is significantly less than the distribution of the sand fly vectors, because the transmission or distribution of disease is based on the vector abundance, its survival in environment, transmission and biting rate. It is also depend on the incubation period of the parasite and the length of transmission season. All of these parameters are based on the climate conditions. At the places where the temperature has been increases due to climatic changes, the prevalence of the disease have been increased many fold in those areas.

IV. EFFECT OF TEMPERATURE & HUMIDITY ON SURVIVAL OF SAND FLY

Temperature and humidity plays an important role in survival of sand fly, development and its activity. Sand fly (*Phlebotomus argentipus*) can survive cold temperatures in diapause (overwintering), which is initiated by a combination of low temperature and reduced daylight and can last 4 to 8 months depending on location. Temperature also affects the activity and growth of parasite. The worldwide distribution of sand flies is considered to be confined to areas that have at least one month with a mean temperature of 20°C.

Sand flies are sensitive to sudden temperature changes and usually prefer those regions where small differences maximum and minimum temperatures are slightly differ. Sand fly survival can be reduced if the climate gets too hot and dry, even though the flies may rest in cold, humid places during the daytime. Few species of sand fly live in tree holes and trunks. Peridomestic species rest on walls and, at hot times of the day, retreat into cracks and crevices. Poroton stone buildings provide favourable condition for sand fly growth because they store humidity during night and evaporate during day. These shows that climate directly affect the growth of sand fly and distribution of VL disease in addition to it, climate also has indirect impacts on disease transmission or sandfly by influencing

1. The distribution of hosts;
2. The local vegetation (important as resting sites and sugar sources);
3. Possible impact of future climate risks

With climate change, the distribution range of both the sandfly vector and the pathogen may extend northwards and into higher altitudes (WHO, 1999). In currently endemic areas, higher seasonal temperatures would lead to prolonged activity periods and shorter diapause periods. This could result in an increased number of sandfly generations per year. As climatic temperatures increases, it accelerates maturation of the leishmanian parasite, and also increasing the risk of infection. However, if the climate conditions are too hot and dry, vector survival rate is decreases and the disease may disappear from some localities.

V. CONCLUSION

The rises in temperature in day time and humidity level during night time have greatly influenced the growth of flies and the distribution of Leishmaniasis. But on the contrary to these, in the cold climatic countries the prevalence is limited because the growth of fly is limited and they are not able to suck the blood in night. High level of precipitation (rain) has also played very important role in the spared of disease, flooding may spread the vector of disease and the larvae of fly to distant and non infected areas also. Thus, climatic changes plays very important role in the distribution and spread of the disease.

REFERENCES

[1] Bogdan C, et al (2001) Visceral Leishmaniasis in a German child who had never entered a known endemic area: Case report and review of the literature. *Clin Infect Dis* 32: 302-306.

[2] Desjeux P, et al (2000) Leishmania / HIV co-infection in south-western Europe 1990-1998. *Retrospective analysis of 965 cases* Geneva:World Health Organization . (document WHO/LEISH/2000.42)

[3] Killick-Kendrick R, (1999) The biology and control of phlebotomine sandflies. *Clin Dermatol* 17: 279-289.

[4] Kuhn KG, (1999) Global warming and leishmaniasis in Italy. *Trop Med Int Health* 7: 1-2.

[5] Maier WA, et al (2003) Possible effects of climatic change on the distribution of arthropode (vector)-borne infectious diseases and human parasites in Germany. *Umweltbundesamt* 1-386.

[6] McCarthy JJ, et al (2001) *Climate change 2001. Impacts, adaptation, and vulnerability* Cambridge:Cambridge University Press .

[7] Meinecke CK, et al (19991) Congenital transmission of visceral leishmaniasis (Kala Azar) from an asymptomatic mother to her child. *Pediatrics* 104: 1-5.

[8] Naucke TJ, (1998) Investigation on vector control of phlebotomine sandflies in northeastern Greece Regensburg:S. Roderer Verlag .

[9] Naucke TJ, Schmitt C, (2004) Is leishmaniasis becoming endemic in Germany?. *International Journal of Medical Microbiology* 293: 179-181.

[10] Singh KV, (1999) Studies on the role of climatological factors in the distribution of Phlebotomine sandflies (Diptera: Psychodidae) in semi-arid areas of Rajasthan, India. *J Arid Environ* 42: 43-48.

[11] WHO, (1984) *The leishmaniasis: report of a WHO Expert Committee* Geneva:World Health Organization . (WHO Technical Report Series, No. 701)

[12] WHO, (1991) *Early human health effects of climate change and stratospheric ozone depletion in Europe* Copenhagen:WHO Regional Office for Europe . (document EUR/ICP/EHCO 02 02 05/15)

[13] WHO, (2002) *Report on the global HIV/AIDS epidemic.* (http://www.who.int/pub/epidemiology/hiv_aids_2001.xls)

[14] WHO, (1997) Leishmania/HIV co-infection. Epidemiological analysis of 692 retrospective cases. *Wkly Epidemiol Rec* 72: 49-54.

AUTHORS

First Author – Sanjay Kumar C/O Dr. Rajesh Kumar
Faculty of Advance Studies in Life Sciences
Chhatrapati Shahu Ji Maharaj University, Kanpur-208024
UP, India, Skumarbt88@gmail.com , +91-945-385-2292

Second Author – Kumar Rajesh, PhD Scholar, Faculty of Advance Studies in the Life Sciences, Chhatrapati Shahu ji Maharaj University, Kanpur-208024, India

Evaluation of Popular Rice (*Oryza sativa* L.) Hybrids for Quantitative, Qualitative and Nutritional Aspects

V. Ravindra Babu^{1*}, K.Shreya², Kuldeep Singh Dangi², G. Usharani² and P. Nagesh³

¹Crop Improvement Division, Directorate of Rice Research, Rajendranagar, Hyderabad, India.

²Department of Genetics and Plant Breeding, College of Agriculture, ANGRAU, Rajendranagar, Hyderabad, India.

³Grain Legume, Groundnut Breeding, ICRISAT, Patancheru, Hyderabad, India.

Abstract-Genotypic differences in grain quality including protein, micronutrient concentrations and few of the yield attributing parameters of twenty one popular rice hybrids were assessed. The data revealed huge variations in grain quality among the hybrids. All hybrids tested have statistically similar milling percentage (70.1- 72.9 per cent). Head rice recovery of PA 6444 being the highest (70.9 per cent) at par with 15 hybrids was significantly higher than Sahyadri-4, Indirasona, HSD-1 and CORH-3. Most of the grain types of the hybrids were classified as long slender types. Highest water uptake was exhibited with Pusa RH-10 and PSD-3. Protein content varied by 4.05 per cent among the hybrids ranging from 5.74 per cent in PSD 3 (lowest) to 9.79 per cent in DRRH-2 (highest). Mean micronutrient iron concentration of hybrids (68.4 ppm) was found to be 1.83 times that of zinc (37.3 ppm). Two hybrids with both high iron and zinc concentration (DRRH-2 with 125.8 ppm and 43.8 ppm; and Sahyadri-4 with 104.8 and 43.0 ppm) were identified.

Index Terms - Hybrid Rice, Nutrition, Quality and Yield

I. INTRODUCTION

Rice accounting for supply of twenty nine per cent of total calories is the principal food crop of India and breeding for higher yield is the prime focus of research. Rice is known as the grain of life and is synonymous with food for Asians as it supplies majority of starch, protein and micronutrient requirements [1], [2], [3]. The average percentage of protein in rice grains is 8 per cent, iron is 1.2 mg 100 g⁻¹ and zinc is 0.5 mg 100 g⁻¹. The amino acid profile shows that it is rich in glutamic acid and aspartic acid, highest quality cereal protein being rich in lysine (3.8 per cent), the first limiting amino acid. Recent studies have unraveled a number of unknown properties of rice, some of which have been reported in ancient Indian Ayurvedic literature. Positive qualities of high digestibility of starch, high biological value of amino acids, high content of essential fatty acids, selenium and anti-hypertension effect have been confirmed scientifically. Rice, therefore, is described as "Functional Food" [4].

The projected demand for rice can only be met by maintaining steady increase in production over the years. Several breeding strategies are being employed in increasing the yield potential of rice and those among the available strategies; hybrid rice offers an immediate opportunity to break the yield plateau set by the semi-dwarf rice varieties after the first green revolution. In the

recent years, much emphasis is given for the cultivation of hybrid varieties. Hybrid rice technology has proved to be one of the most feasible and readily adoptable approaches to break the yield barrier, as they yield about 15-20 per cent more than the best of the improved or high yielding varieties. Being convinced of the potential of hybrid rice technology in enhancing the production, India adopted this technique and has released nearly more than forty-three hybrids for commercial cultivation. Hybrid technology has been widely acclaimed and accepted. The extent of hybrid vigor for yield increase was the major concern when hybrid rice was first developed.

Attaining food self sufficiency in quantitative terms has been the aim of many countries of the world till late 20th century and accordingly the crop improvement programmes have been oriented in this direction that have successfully achieved this task. Many Asian countries are approaching self-sufficiency in rice production and are now looking for ways to improve the quality of their rice for either national consumption or as a revenue generating export. To achieve this goal and to compete in the international market, grain must be of high quality and conform to international standards. In recent decades, as living conditions are being steadily improved, human demand for high quality rice is continuously on increase, which entailed in incorporation of preferred grain quality features as the most important objective next to yield enhancement [5].

Grain quality in rice is very difficult to define with precision as preferences for quality vary from country to country. Grain quality has always been an important consideration in rice variety selection and development. Based on the survey of 11 major rice growing countries Juliano and Duff (1991) [6] concluded that grain quality is second only to yield as the major breeding objective. In the future, grain quality will be even more important as once the very poor, many of whom depend largely on rice for their staple food become better off and begin to demand higher quality rice [5].

Malnutrition has been a serious problem in the developing world mostly in South and South East Asia and Sub Saharan Africa [7]. Over three billion people suffer from micronutrient malnutrition [8]. In most of these countries, rice is the staple food. In order to enhance the micronutrient concentration in the grain, suitable breeding programmes should be followed. However, rice scientists have long recognized its micronutrient deficiencies, which are the basis of numerous human health problems worldwide. Mineral nutrient deficiencies have egregious societal costs including learning disabilities among children, increased morbidity and mortality rates, lower worker

productivity and added high health care costs, all of which diminish human potential, felicity and national economic development [9], [10]. In recent years, attention has turned towards strategies for improving human vitamin and mineral nutrition, especially iron, zinc, selenium and iodine [11], [12].

Rice is the only cereal crop cooked and consumed mainly as whole grains, and quality considerations are much more important than for any other food crop [13]. As a pivotal crop in cereals, rice provides the staple food for more than fifty percent of the world's people. However, as rice is consumed in the milled form, the physical attributes of the intact endosperm are of foremost importance in determining consumer preference. Therefore, the percentage of head grain, grain dimensions, weight, chalkiness, translucency of the grains, cooking and eating quality should be considered during the development of hybrid varieties. Most of the qualitative traits are genetically controlled. The inheritance of grain quality is more complicated than that of other agronomic traits in cereals due to epistasis, maternal, cytoplasmic effects, and the triploid nature of endosperm [14].

Since 1992, researchers at International Rice Research Institute have been evaluating the genetic variability of iron and zinc content in rice grain [15], [16]. There were obvious differences in iron and zinc contents among the genotypes tested, suggesting a genetic potential to increase content of these micronutrients in rice grain [17]. [18] Zeng *et al.* reported that mineral element contents of 653 Yunnan rice accessions were closely related to most quality traits, including significant correlations between amylose content and potassium, gel consistency and iron or zinc content, and gelatinization temperature and manganese content. [19] Zang *et al.* found that indirect selection of grain characteristics may be one of the breeding methods to select for iron, zinc and manganese content in black pericarp indica rice. Thus, it is important to improve the understanding of relationships between mineral nutrients and rice quality and select rice genotypes appropriate for breeding programme. Although, rice is not a major source of mineral in the diet, any increase in its mineral concentration could significantly help to reduce iron and zinc deficiency because of the high levels of rice consumption in Asia [16]. The estimation of iron and zinc concentration is normally achieved through Inductively Coupled Plasma Optical Emission Spectrophotometry or Atomic Absorption Spectroscopy [20]. [21] Jiang *et al.* reported that around 75 per cent of total grain zinc was present in the endosperm of brown rice, while [22] Takahashi *et al.* revealed that zinc is most abundant in the embryo and in the aleurone layer using X-ray fluorescence imaging.

Grain quality characters are reported to play important role in genetic divergence too [23]. Besides grain quality characters, agro-morphological characters like plant height, weight of panicle, 1000-grain weight, panicle length also contribute towards genetic divergence [24]. In the light of the above scenario, the present investigation is carried out with the objective of studying several quantitative, qualitative and nutritional parameters among popular rice hybrids of India.

II. MATERIALS AND METHODS

The present investigation is carried out at Directorate of Rice Research Farm, ICRISAT, Patancheru, Hyderabad, Andhra Pradesh, India, situated at 17.5°N latitude, 78.27°E longitude and at an altitude of 545 m above mean sea level. Twenty one popular rice hybrids released (Table 1) in India were analyzed in a Randomized Block Design with three replications in three blocks. Each block consisted of twenty one genotypes randomized and replicated within each block. Twenty seven days old seedlings raised in nursery were transplanted at 20 cm x 15 cm. The experimental sandy clay loam soil with pH 8.7 contained 0.9 per cent organic carbon, 11.8 kg ha⁻¹ of available P, 295 kg ha⁻¹ of available N and 439 kg ha⁻¹ of available K at the time of sowing. The crop was given a dosage of 100-26.4-33.3 kg N-P-K ha⁻¹ through urea (N), single superphosphate (P) and murate of potash (K). Entire P and K were applied as basal while N was applied in three equal splits (basal *i.e.* at transplanting, and top dressing at 25 and 50 days after transplanting). Two manual weedings were done prior to top dressing of nitrogen. Need based irrigations were given to supplement rainfall so as to maintain 2-3 cm standing water all through the crop till physiological maturity. All necessary precautions were taken to maintain uniform plant population in each treatment per replication. All the recommended package of practices was followed along with necessary prophylactic plant protection measures to raise a good crop.

Five representative plants for each hybrid in each replication were randomly selected to record observations on the quantitative characters under study. Days to 50 per cent flowering were computed on plot basis. Data was recorded on physico-chemical quality characters from the bulk samples. The samples have been analyzed for different quality traits which include kernel length (mm), kernel breadth (mm), length/breadth ratio, volume expansion ratio and amylose content (per cent) as per the standard procedures for each trait. Ten de-husked whole kernels were measured using a seed analyser and based on the kernel length and L/B ratio, grains were classified into long slender (LS), medium slender (MS), long bold (LB) and short bold (SB).

The milling characteristics were computed following the method given by Ghosh *et al.* in 1971 [25]. Dehusking was carried out in 'Satake' laboratory huller (type THU 35 A) and the dehusked brown rice was passed through Satake Grain Testing Mill (Type-TM 05) for 1 minute 30 seconds to obtain uniformly 5-6 per cent polish. Total polished kernels were weighed and the milling percentage was calculated (Weight of the polished kernel / Weight of the paddy x 100). The milled samples were passed through rice grader to separate whole kernels from the broken ones. Small proportions of whole kernels which passed along with the broken grains were separated by hand. Full rice and three fourth kernels were considered and weighed and head rice recovery in percentage was calculated (Weight of whole polished grain / Weight of paddy x 100).

As per the standard procedures, water uptake in ml [26], alkaline spreading value [27], amylose content [28] and gel consistency in mm [29] was estimated. Iron and zinc content (ppm) of seed samples was estimated by Atomic Absorption Spectrophotometer as suggested by Lindsay and Novell (1978)

[30]. Total nitrogen in rice flour was estimated by Micro-Kjeldahl method and the protein content was derived by multiplying total nitrogen content with 5.95 [3].

III. RESULTS AND DISCUSSION

a) Quantitative Parameters

The mean performance of quantitative characters of the popularly grown rice hybrids is presented in Table 2. Based on the mean performance it was observed that CORH-3 was found to be an early maturing hybrid (78 days), while Sahyadri-1 was a late maturing hybrid (108 days). The mean days to 50% flowering was observed to be around 96.7 days among the hybrids. Early maturing varieties tend to produce less head rice than late maturing varieties. Highest plant height was exhibited by CRHR-7 (116.89 cm) while lowest by Sahyadri-2 (83.66 cm). Mean plant height possessed by the hybrids was observed to be 97.3 cm. The length of the panicle was highest for CRHR-7 (29.56 cm) while it was lowest for PA 6129 (23.78 cm) with a mean value of 26.11 cm among the hybrids. Number of productive tillers per plant was observed to be more in DRRH-2 (11.7) and lowest (6.7) in CRHR-7. The mean value of productive tillers per plant was observed to be around 9.28.

Number of filled grains per panicle were lowest (67.2) in Sahyadri-4, whereas highest (159.3) in PA 6444. Mean number of filled grains per panicle possessed by the hybrids was observed to be 114 in count. Varieties that fill uniformly have higher grain density and less chalkiness. Number of chaffy grains per panicle were lowest in GK5003 (5.98), and were highest in Sahyadri-3(30.3) with a mean value of 20.2. Suruchi exhibited the lowest 1000-grain weight (19.1g), while HSD-1 recorded the highest values (28.4 g). The mean 1000-grain weight was observed to be around 24.1g among the hybrids. Mean grain yield per plant was observed to be around 22.98 t ha⁻¹. Highest mean grain yield per plant (24.35 g) was exhibited by Pusa RH-10, while lowest (20.99 g) in CRHR-7. Highest grain yield (t ha⁻¹) was produced by Pusa RH-10 (8.04) and the least by CRHR-7 (6.93).

b) Qualitative Parameters

The mean performance of qualitative characters of few of the selected hybrids grown popularly is presented in Table 3. Among the grain quality characters, the milling quality of rice may be defined as the ability of rice grain to stand milling and polishing without undue breakage so as to yield the greatest amount of total recovery and the highest proportion of head rice to brokens. The milling recovery was more in PA 6444 (73.5 per cent) and low in CORH-3 (70.1 per cent) with a general mean of 71.89 per cent among the hybrids. Head rice recovery is an inherited trait, although environmental factors such as temperature and humidity during ripening and post harvest stages are known to influence grain breakage during milling. Grain size and shape, hardness, presence or absence of abdominal white, moisture content, harvest precision, storage conditions, processing and type of mills employed have direct bearing on head rice recovery [31]. In general, varieties with long grains and those having white centers give lower head rice yields. The maximum mean value for head rice recovery percentage was

observed in PA 6444 (70.9 per cent) and low value in CORH-3 (54.9 per cent). Mean head rice recovery per cent possessed by the hybrids was observed to be around 66.16 per cent. Breeders have to pay special attention for improving this trait, as rice out turn is the most important index for fixation of procurement price of paddy [32]. The kernel length was found to be highest in Pusa RH-10 (7.91 mm) and lowest in Suruchi (5.43 mm) with a general mean value of 6.45 cm. The kernel breadth was highest for HSD-1(2.18 mm) and lowest for Pusa RH-10 (1.90 mm) with a mean of 2.08 cm. High expansion breadth wise is not a desirable quality attribute in high quality rice required to command premium in the market. Short and medium type grains which are more round, thick and hard than long grains produce higher head rice yields. The L/B ratio varied from 4.16 (Pusa RH-10) to 2.52 (Sahyadri-2) with the general mean of 3.11. A low value observed by Hossain *et al.* (2009) [13] indicates poor cooking quality.

The volume expansion ratio was highest in DRRH-2 (5.60) and lowest for HSD-1 (4.10). Mean volume expansion ratio possessed by the hybrids was observed to be around 4.62. The water uptake was highest for Pusa RH-10 (380 ml) while it was lowest for GK5003 (280 ml). The mean water uptake was observed to be around 309.52 ml among the hybrids. The extent of water absorbed by rice during cooking is considered an economic quality as it gives an estimate of the volume increase during cooking. Water uptake shows a positive significant influence on grain elongation [33]. Characters like alkali spreading value ranged from medium to high values with a general mean of 5.68. The alkali spreading value was found to be highest for Sahyadri-2 (7.01) while it was lowest for HSD-1(4.32). Rice grains with high amylose content possess high volume expansion, cook dry and flaky, are less tender and become harder upon cooling [34], while those with low amylose content cook moist and are sticky. The percentage of amylose content was found to be highest for CRHR 7 (25.66 per cent) while it was lowest for Sahyadri-3 (18.95 per cent). Mean amylose content per cent among the hybrids was observed to be around 22.13 per cent. Gel consistency measures the tendency of the cooked rice to harden on cooling. Rice grains with low gel consistency tend to be less sticky on cooking and are associated with harder cooked rices. This is particularly evident in high amylose rice. Grains with high gel consistency exhibit a higher degree of tenderness on cooking which is one of the most preferred characteristics among the grain quality parameters. Gel consistency (mm) was observed with a maximum value of 75 (KRH-2) to a minimum value of 37 (Suruchi) with a general mean of 55.38 mm.

c) Nutritional Parameters

The mean performance of nutritional characters of popular rice hybrids is presented in Table 4. Increasing the protein content of rice without losing the yield potential would increase the protein intake of people in Asia. Increasing the glutelin fraction mainly results in the enhancement of protein content. Donors with 16% protein are available in germplasm but studies have shown that inheritance of protein content is complex with low protein content being dominant. Heritability values are low in the early generation and a large proportion of the total variability in protein content is attributable to environment [32].

High amounts of protein content was found to be observed in the hybrids of DRRH-2 (9.79 per cent) and Sahyadri-2 (9.45 per cent) while lowest value was obtained for PSD-3 (5.74 per cent). The mean protein content among the hybrids was found to be 7.95 per cent. Plant breeders have had only limited success in improving the nutritional quality of seed proteins, primarily because genes encoding the seed storage proteins with high levels of essential amino acids do not normally exist in any given species. Modifying the genes that encode seed proteins by genetic engineering may therefore be an ideal solution to the problem of nutritional quality. High contents of iron (12.58 mg 100g⁻¹) and zinc (4.38 mg 100g⁻¹) were observed in DRRH-2 while lowest amount of iron was obtained in PHB-71(2.89 mg 100g⁻¹). The lowest content of zinc was observed in Sahyadri-3 (3.07 mg 100g⁻¹). The mean iron content was recorded to be around 6.84 mg 100g⁻¹ and zinc content at 3.73 mg 100g⁻¹ among the hybrids.

IV. CONCLUSION

The potential for improving quality through genetics is quite high. There should be no conflict between breeding for better appearance, milling and cooking qualities and breeding for yield. In the short term, the additional selection characters may slow breeding. However, most grain quality characters are apparently highly heritable and can be selected for at early generations. This study will guide the utilization of popular rice hybrids in plant improvement programmes and provides a basis for further studies into how the nutritional and grain quality parameters could be enhanced.

REFERENCES

- [1] L. C. Qiu, "Exploitation and utilization of better quality germplasm resources for increasing human health", In: Annual Report of Chinese Rice Science; Agricultural Science and Technology Press, Beijing, China, 1992, pp 1-4.
- [2] K. Donald, "The importance of Rice", *Science*, 2002, vol. 296, pp. 13.
- [3] B. O. Juliano, "Criteria and tests for rice grain qualities", In: Rice Chemistry and Technology, 2nd ed, American Association of Cereal Chemists, 1985, pp. 443 – 524.
- [4] U. Ahuja, S. C. Ahuja, R. Thakrar and R. K. Singh, "Rice – A Nutraceutical", *Asian Agri – History*, 2008, vol. 12 (2), pp. 93-108.
- [5] R. M. Welch and R. D. Graham, "Breeding crops for enhanced micronutrient content" *Plant and Soil*, 2002, vol. 245, pp. 205-214.
- [6] B. O. Juliano and B. Duff, "Rice grain quality as an emerging priority in national breeding programs", In Rice Grain Marketing and Quality Issues, International Rice Research Institute, Los Banos, Philippines, 1991, pp. 55-64.
- [7] Reddy, V. S. Belum, S. Ramesh and T. Longvah, "Prospects of breeding for micronutrients and β carotene dense sorghums", *ISMN*, 2005, vol. 46, pp.10-10.
- [8] Juliano and Villareal, "In: Grain quality evaluation of world quies IRRI, Los Banos , Philippines. 1993, pp. 389-405.
- [9] R. M. Welch, and R. D. Graham, " Breeding for micronutrients in staple food crops from a human nutrition perspective" *Journal of Experimental Botany*, 2004, vol. 55, pp. 353 -364.
- [10] R. A. Sperotto, T. Boffa, G. L. Duarte, L. S. Santos, M. A. Grusake and J. P. Fett, "Identification of putative target genes to manipulate Fe and Zn concentrations in rice grains", *Journal of Plant Physiology*, 2010, vol. 167, pp.1500-1506.
- [11] M. A. Grusak, "Enhancing mineral content in plant food products" *Journal of the American College of Nutrition*, 2002, vol. 21 (3), pp. 178s – 183s.
- [12] R. D. Graham, "Biofortification: a global challenge programme", *IRRN*, 2003, vol. 28 (1), pp. 4 – 8.
- [13] M. S. Hossain, A. K. Singh and Fasih-uz-Zaman, "Cooking and eating characteristics of some newly identified inter sub-specific *indica/japonica* rice hybrids", *ScienceAsia*, 2009, vol. 35, pp. 320-325.
- [14] P. He, S. G. Li, Q. Qian, Y. Q. Ma, J. Z. Li, W. M. Wang, Y. Chen and L. H. Zhu, "Genetic analysis of rice grain quality", *Theoretical and Applied Genetics*, 1998, vol. 98, pp. 502-508.
- [15] R. D. Graham, D. Senadhira, S. Beebe, C. Iglesias and I. Monasterio, "Breeding for micronutrient density in edible portions of staple food crops : Conventional approaches", *Field Crops Research*, 1999, vol. 60, pp. 57 – 80.
- [16] G. B. Gregorio, D. Senadhira, T. Htutt and R. D. Graham, "Breeding for trace mineral density in rice", *Food and Nutrition Bulletin*, 2000, vol. 21, pp. 382 – 386.
- [17] G. B. Gregorio, "Progress in breeding for trace minerals in staple crops", *Journal of Nutrition*, 2002, vol. 132, pp. 500s -502s.
- [18] Y. W. Zeng, S. Q. Shen, L. X. Wang, J. F. Liu, X.Y. Pu and J. Du, "Relationship between morphological and quality traits and mineral element content", *Chinese Journal of Rice Science*, 2005, vol.19 (2), pp. 127 – 131.
- [19] M. W. Zang, B. J. Guo and Z. M. Peng, "Genetic effects on Fe, Zn, Mn and P contents in indica black rice and their genetic correlations with grain characteristics", *Euphytica*, 2004, vol.135 (3), pp. 315 – 323.
- [20] E. Y. Choi , R. Graham and J. Stangoulis, "Semi-qualitative analysis for selecting Fe and Zn dense genotypes of staple food crops" *Journal of Food Composition and Analysis*, 2007, vol. 20, pp. 496-505.
- [21] W. Jiang, P. C. Struik, H. Van Keulen, M. Zhao, L. N. Jin and T. J. Stomph, "Does increased zinc uptake enhance grain zinc mass concentration in rice?", *Annals of Applied Biology*, 2008, vol.53, pp. 135-147.
- [22] M. Takahashi, T. Nozoye, N. Kitajima, N. Fukuda, A. Hokura and Y. Terada, "In vivo analysis of metal distribution and expression of metal transporters in rice seed during germination process by microarray and X-ray fluorescence imaging of Fe, Zn, Mn and Cu", *Plant and Soil* 2009, vol. 325, pp. 39-51.
- [23] Y. Singh, D. R. Pani, S.K. Pradhan, A. Bajpai, and U.S. Singh, "Divergence analysis for quality traits in some indigenous basmati rice genotypes", *Oryza*, 2008, vol. 45(4), pp. 263-267.
- [24] Y. Singh, and U. S. Singh, "Genetic diversity analysis in Aromatic Rice Germplasm using Agro- morphological Traits", *Journal of Plant Genetic Resources*, 2008, vol. 21 (1), pp. 32-37.
- [25] A. K. Ghosh, B. B. Nanda, S. G. Swami and B. B. Nayak, "Influence of nitrogen on the physico-chemical characteristics of rice grain", *Oryza*, 1971, vol. 891 pp. 87-97.
- [26] H. M. Beachell and J. W. Stansel, "Selecting rice for specific cooking characteristics in a breeding programme", *IRC Newsletter*, 1963, pp. 25-40.
- [27] R. R. Little, G. B. Hilder and E. H. Dawson, "Differential effect of dilute alkali on 25 varieties of milled white rice", *Cereal Chemistry*, 1958, vol. 35, pp.111 – 126.
- [28] B. O. Juliano, "Physicochemical properties of starch and protein and their relation to grain quality and nutritional value of rice", In: Rice Breeding, International Rice Research Institute, Los Banos, Philippines, 1972, pp.389 - 405.
- [29] C. B. Cagampang, C. M. Perez and B. O. Juliano, "A gel consistency test for eating quality of rice", *Journal of the Science of Food and Agriculture*, 1973, vol. 24, pp. 1589-1594.
- [30] W. L. Lindsay and W. A. Novell, "Development of a DTPA soil test for zinc, manganese and copper", *Soil Science Society of American Journal*, 1978, vol. 42, pp.421-428.
- [31] K. R. Bhattacharya, "Breakage of rice during milling: A Review", *Tropical Science*, 1980, vol. 22, pp. 255-276.
- [32] N. S. Rani, M. K. Pandey, G. S. V. Prasad and I. Sudharshan, "Historical significance, grain quality features and precision breeding for improvement of export quality basmati varieties in India", *Indian Journal of Crop Science*, 2006, vol. 1(1-2), pp. 29-41.
- [33] B. C. Sood and N. Saddiq, "Current status and future outlook for hybrid rice technology in India", In: Hybrid Rice Technology, Directorate of Rice Research, Hyderabad, 1986, pp. 1-26.
- [34] B.O. Juliano, C. M. Perez, A. B. Blakeney, C. Breckenridge, D. T. Castillo, N. Kongseree, B. Laignelet, E. T. Lapis, V. V. S. Murty, C. M. Paule, and B. D. Webb, "International cooperative testing on amylose content of milled rice" *Starch/Stärke*, 1981, vol. 33, pp. 157-162.

AUTHORS

First Author – Dr. V. Ravindra Babu, Principal Scientist, Plant Breeding, Crop Improvement Section, Directorate of Rice Research, Rajendranagar, Hyderabad - 500 030, Andhra Pradesh, India.

Email id : rbvemuri1955@gmail.com

Second Author – K. Shreya, M. Sc.(Ag.), Department of Genetics and Plant Breeding, College of Agriculture, Rajendranagar, Hyderabad - 500 030, Andhra Pradesh, India.

Email id : shreya834@gmail.com

Third Author – Dr. Kuldeep Singh Dangi, Associate Professor, Department of Genetics and Plant Breeding, College of

Agriculture, Rajendranagar, Hyderabad - 500030, Andhra Pradesh, India.

Email id : dangiks404@rediffmail.com

Fourth Author – G.Usharani, Ph.D Scholar, Department of Genetics and Plant Breeding, College of Agriculture, Rajendranagar, Hyderabad -500 030, Andhra Pradesh, India.

Email id : ushagenetics@gmail.com

Fifth Author – Dr. P. Nagesh, Research Associate, Grain Legume, Groundnut Breeding, ICRISAT, Patancheru, Hyderabad, Andhra Pradesh, India.

Email id : patnenagesh@gmail.com

***Correspondence Author** – Dr. V. Ravindra Babu
Email:rbvemuri1955@gmail.com

Table 1. Details of twenty one popular rice hybrids of India

S.No.	Name	Nominating Agency
1.	DRRH – 2	Directorate of Rice Research, Hyderabad
2.	PA 6129	Bayer Bio-Science
3.	Sahyadri – 2	Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli
4.	Sahyadri –4	Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli
5.	Pusa RH -10	Indian Agricultural Research Institute, New Delhi
6.	Indirasona	Indira Gandhi Krishi Vishwa Vidyalaya, Raipur
7.	GK 5003	Ganga Kaveri Seeds
8.	PSD-3	G. B. Pant University of Agriculture and Technology, Pantnagar
9.	Sahyadri – 3	Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli
10.	PA 6201	Bayer Bio-Science
11.	HSD-1(HKRH-1)	Chaudhary Charan Singh Haryana Agricultural University, Karnal
12.	PA 6444	Bayer Bio-Science
13.	Suruchi (MPH 5401)	Mahyco Seeds, Hyderabad
14.	JKRH- 2000	JK Agri. Genetics
15.	US - 312	US Agri Seeds
16.	CORH- 3	Tamil Nadu Agricultural University, Coimbatore
17.	KRH-2	University of Agricultural Sciences, Mandya
18.	Sahyadri -1	Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli
19.	PHB – 71	Pioneer Overseas Corporation
20.	CRHR - 5	Central Rice Research Institute, Cuttack
21.	CRHR - 7	Central Rice Research Institute, Cuttack

Table 2: Mean performance of popular rice hybrids for various quantitative characters

Character	Days to 50 per cent flowering	Plant height (cm)	Panicle length (cm)	No. of productive tillers/plant	No. of filled grains/panicle	No. of chaffy grains/panicle	1000-grain weight (g)	Grain yield(t/ha)
1. DRRH-2	82.9	85.0	25.22	11.67	134.0	24.4	23.89	7.92
2. PA 6129	80.3	92.2	23.78	9.44	120.2	12.9	23.59	7.45
3. Sahyadri-2	82.3	83.7	25.33	9.67	84.4	18.4	23.38	7.74
4. Sahyadri-4	89.8	89.5	26.11	9.67	67.2	15.5	24.90	7.69
5. Pusa RH-10	89.7	91.1	26.78	10.33	92.9	12.3	25.78	8.04
6. Indirasona	102.0	106.8	26.33	9.67	94.6	24.4	25.62	7.56
7. GK 5003	100.2	97.4	26.33	8.67	124.8	6.0	20.74	7.85
8. PSD-3	103.4	96.8	24.89	8.33	96.9	7.3	26.69	7.47
9. Sahyadri-3	96.0	92.7	27.78	9.00	80.5	30.3	26.32	7.63
10. PA 6201	95.1	100.8	25.89	9.33	113.9	25.0	21.84	7.59
11. HSD-1	102.4	92.6	27.11	9.22	121.2	25.6	28.35	7.37
12. PA 6444	103.2	103.3	26.33	8.44	159.3	30.2	23.75	7.29
13. Suruchi	102.2	98.7	25.56	7.44	92.2	20.0	19.14	7.25
14. JKRH-2000	100.4	86.5	25.78	10.67	136.2	27.8	23.25	7.66
15. US 312	102.9	101.6	27.22	10.00	133.4	9.1	21.39	7.70
16. CORH-3	77.4	98.0	24.67	8.11	85.9	11.8	22.31	7.64
17. KRH-2	100.7	98.9	25.89	11.33	123.9	30.0	22.89	7.90
18. Sahyadri-1	107.8	95.4	24.89	10.22	89.6	11.5	25.94	7.89
19. PHB-71	106.9	99.4	25.67	8.66	140.8	20.4	25.75	7.39
20. CRHR-5	103.4	115.3	27.11	8.33	152.5	21.7	24.27	7.15
21. CRHR-7	101.7	116.9	29.56	6.67	150.3	38.8	26.40	6.93
Mean	96.7	97.3	26.11	9.28	114.0	20.2	24.10	22.98
C. V.	1.84	5.68	3.00	13.04	5.37	9.74	2.32	4.40
S.E.	1.03	3.19	0.45	0.70	3.53	1.13	0.32	0.58
C.D. 5per cent	2.93	9.12	1.29	1.99	10.10	3.24	0.92	1.67

Table 3: Mean performance of popular rice hybrids for various qualitative characters

Character	Milling per cent	Head rice recovery per cent	Kernel Length (mm)	Kernel Breadth (mm)	L/B Ratio	Volume expansion ratio	Water uptake (ml)	Alkali spreading value	Amylose content (per cent)	Gel consistency (mm)
1. DRRH-2 (LS)	72.2	65.4	7.05	2.01	3.50	5.60	285.0	4.47	20.93	47.00
2. PA 6129 (LB)	72.3	67.5	6.00	2.21	2.72	4.70	320.0	6.94	20.43	49.00

3. Sahyadri-2 (SB)	70.2	64.9	5.47	2.17	2.52	4.10	315.0	7.01	22.34	50.00
4. Sahyadri-4 (LS)	71.6	63.3	7.01	2.09	3.36	4.10	325.0	7.00	23.48	41.00
5. Pusa RH-10 (LS)	72.4	68.4	7.91	1.90	4.16	4.60	380.0	6.07	20.05	51.00
6. Indirasona (LS)	70.4	61.5	6.85	2.01	3.41	4.40	295.0	5.06	24.54	71.00
7. GK 5003 (MS)	72.0	63.6	5.90	2.03	2.91	5.00	280.0	4.69	21.28	56.00
8. PSD-3 (LS)	72.4	67.9	7.04	2.07	3.41	4.10	345.0	7.00	20.82	60.00
9. Sahyadri-3 (LS)	72.2	65.2	7.41	2.07	3.58	4.40	290.0	5.61	18.95	63.00
10. PA 6201 (LS)	73.2	69.9	6.05	2.08	2.91	5.60	315.0	4.58	23.16	65.00
11. HSD-1 (LB)	71.9	60.7	6.45	2.18	2.95	4.10	305.0	4.32	21.42	54.00
12. PA 6444 (LB)	73.5	70.9	6.26	2.17	2.89	4.20	305.0	5.17	21.25	60.00
13. Suruchi (MS)	71.2	70.6	5.43	2.03	2.68	4.50	285.0	5.98	23.22	37.00
14. JKRH-2000 (SB)	72.8	69.9	6.29	2.11	2.99	4.20	310.0	5.44	22.86	60.00
15. US 312 (MS)	70.4	68.3	5.61	2.06	2.73	5.60	315.0	4.68	21.68	52.00
16. CORH-3 (LS)	70.1	56.9	6.37	2.05	3.10	4.60	310.0	5.86	24.83	44.00
17. KRH-2 (LB)	72.2	65.6	6.21	2.14	2.90	4.20	290.0	4.08	20.87	75.00
18. Sahyadri-1 (LS)	73.3	67.3	6.69	2.14	3.12	5.20	320.0	5.83	22.24	53.00
19. PHB-71 (LS)	72.6	68.0	6.44	2.00	3.21	4.60	300.0	5.66	22.45	51.00
20. CRHR-5 (LS)	71.7	67.5	6.57	2.07	3.19	5.00	310.0	5.90	22.34	60.00
21. CRHR-7 (LS)	72.0	68.0	6.55	2.08	3.16	4.20	300.0	6.92	25.66	64.00
Mean	71.9	66.2	6.45	2.08	3.11	4.62	309.5	5.68	22.13	55.38
C. V.	7.13	6.82	1.84	1.64	2.44	2.22	1.66	2.26	2.03	3.69
S.E.	2.96	2.60	0.07	0.02	0.04	0.06	2.96	0.07	0.26	1.18
C.D. 5%	-	7.45	0.20	0.06	0.12	0.17	8.45	0.21	0.74	3.37

Table 4: Mean performance of popular rice hybrids for various nutritional characters

Character	Protein content (per cent)	Iron (mg/100g)	Zinc (mg/100 g)
1. DRRH-2	9.79	12.58	4.38
2. PA 6129	8.86	8.95	4.26
3. Sahyadri-2	9.45	7.91	3.87
4. Sahyadri-4	8.80	10.48	4.30
5. Pusa RH-10	8.26	4.52	3.75
6. Indirasona	7.64	7.85	3.87
7. GK 5003	7.39	8.15	3.84
8. PSD-3	5.74	7.29	3.99
9. Sahyadri-3	7.67	4.13	3.07
10. PA 6201	7.86	7.76	4.59
11. HSD-1	7.84	6.76	3.17
12. PA 6444	7.15	6.11	3.72
13. Suruchi	7.93	6.87	3.35
14. JKRH-2000	7.42	7.15	3.55
15. US 312	7.47	6.62	3.76
16. CORH-3	8.10	7.37	3.53
17. KRH-2	6.49	4.39	3.43
18. Sahyadri-1	7.74	5.90	3.33
19. PHB-71	8.48	2.89	3.81
20. CRHR-5	8.59	2.96	3.15
21. CRHR-7	8.30	6.93	3.62
Mean	7.95	6.84	3.73
C. V.	12.92	28.62	4.42
S.E.	0.59	1.13	0.10

Naipaul's *India: A Million Mutinies Now*: A Political Perspective

Bhupinder Singh

G.T.B.K.Polytechnic Chhapianwali (Malout)

I. INTRODUCTION

V.S. Naipaul was born in Trinidad to parents of Indian descent. He is a postcolonial writer, who has focused much on the legacy of colonialism of the British Empire through his writings. His novels are situated both in the colonial as well as ex-colonial societies. The New York Review of Books celebrates him as "a master of modern English prose. The major themes of his novels are linked with the problems of the colonized people. The present article attempts to show the impact of the colonial rule on the politics of the rulers of independent India. The author compels irresistible aesthetic pull in his projection of the politics of the Indian rulers after the end of British colonial rule. In his book *India: A Million Mutinies Now*, Naipaul argues that the differences on the basis of class, caste, gender, religion lead to million mutinies i.e. fragmentation of Indian society. The political leadership is responsible for the infighting among Indians on various issues such as region, religion, caste or language. Castes dominate the political scenario in India. National issues are neglected often at the expense of the local ones. Politicians are more concerned about their own well being than the nation. There is loss of culture, tradition and religious identity. There is hardly any attempt made to preserve and propagate the Indian culture, language and religious beliefs. Contrary to this all out efforts are made to westernize the Indian society by promoting the language and culture of the colonizers. The satirical portrayal by Naipaul of Indian separatism, regionalism and its split into diverse groups depicts the divisive policies followed by the Indian rulers. In Lillian Feder's considered opinion, V.S. Naipaul

"... has been acclaimed for his penetration into the lasting impairment of postcolonial societies, especially the deprivations of individuals who inherited a history, and he has been excoriated as reactionary loyal to imperialist values" (Naipaul's Truth, 1)

Naipaul believes that India continues to naively believe in its unity and secularism despite the fact that it has never been one and that its unity has always been spurious. The talk of secularism by the politicians is just slogan to show their secular character. Perhaps Rushdie has aptly observed:

"Now it can be argued forcefully that the idea of secularism in India has never been much more than a slogan; that the very fact of religious block voting proves this to be so; that the divisions between the communities have by no means been subsumed in a common 'Indian' identity; and that it is strange to speak of nationalism when the main impetus in present-day India comes from regionalist, separatist political groups." (Imaginary Homelands, 385)

The ultimate goal of post-colonialism is to account for and combat the residual effects of colonialism on cultures. It is not simply concerned with salvaging the past worlds, but learning how the world can move beyond this period together, towards a place of mutual respect. The works of Naipaul has been interpreted by a number of critics from a variety of angles; he has been read as postcolonial and postmodern writer. Rob Nixon appreciates Naipaul's expertise on the issue of cross cultural relationships. Nixon reads the travel narratives of Naipaul as his commitment to the ... "idealized imperial England of his imaginings..." (*London Calling*, 37) Fawzia Mustafa is pained by Naipaul's "misperceptions and inappropriate inquiries" with regard to "Third-world issues." (Fawzia Mustafa, 1, 2) Colonialism is justified by Samuel Huntington for its idealization and universalization of European civilization. He describes the Diasporas as "intellectual migrants to the West." According to Fawzia Mustafa, Naipaul's link with language and resultant intellect is "partially responsible for his implication with in colonial discursive practice." (Fawzia Mustafa, 1, 2) SelwinCudjoe terms Naipaul's work as "imperialist" in its intent. According to Irving Howe, "Naipaul writes with a strict refusal of romantic moonshine about the moral charms of primitives or virtues of blood strained dictators... He is the scourge of our disenchanting age, as free colonialist bias as of infatuation with Third world delusions" (SelwinCudjoe, 265-266). Naipaul finds a strong defender of his works in shape of Brent Staples who comments, "Few writers of V.S. Naipaul's stature have been so consistently and aggressively misread on account of ethnic and racial literary politics..." (Brent Staples, 1)

In Naipaul's *India: A Million Mutinies Now*, Naipaul has made a scrutiny of non-fictional and anecdotal narration of his observations (about India) he makes during his sojourn in India. His presentation of India in ravages, in disappointing examples and depressive specificities as meted-out to her, by implication, during and in the wake of foreign-rule in its expected, usual and cruel dynamics inspire his tear-mingled sympathy and a sense of wrong for the harmless and guileless India and the Indian way of life. Nevertheless, he compensates his hurt by the consolation he feels by adverting to the economic growth in India which, he feels, has salvaged and emancipated millions of Indians which he thinks tantamount to the Mutiny of 1857 by analogy. Domination of the British during the colonial rule made the Indians work as slaves. Even after independence Indians have not developed their independent thought; they lack political awareness, determination and political will. Indian independence led to many subsequent upheavals within the country. Naipaul describes the affect of colonial rule which can be seen even after independence:

"...What was true of Bombay was true of other parts of India as well; of the state of Andhra, of Tamil Nadu, Assam,

the Punjabi All over India scores of particularities that had been frozen by foreign rule, or by poverty or lack of opportunity or abjectness, had begun to flow again”(6)

The Indians became weak because of centuries of subjection of them by colonial rule. The Indians had wrong notion that irrespective of who ruled the culture is to remain the same. “The country was run on principles that assumed that kings would change; the case would be fought, out that society would go on, pretty much undisturbed by those events.” (159)

Naipaul is of the view that even after the independence the Indian leaders and the people are yet to come out of the affect of their Ex-masters. The period after independence can be termed as ‘neo colonialism’. Indians continue to derive strength by imitating their ‘Ex – masters’. Their dress and working style was imitated. Dr Ambedkar the chairman of the draft committee of Indian constitution wore a European – style jacket and tie.

Colonialism had negative effect on Indian culture, there was loss of values, traditions and language domination has its effect on the ruled who think the rulers as superior people. Naipaul shows the political necessity of the rulers to work for the welfare of people. The Lords and Maharajas who are the rulers are wealthy people. They work for social and development causes, as such perform their duty towards society, so that they remain acceptable and tolerable to the masses.

“.... The royal family of Mysore had been known for the their great wealth, second only to fabulous but idle wealth of the Nizam of Hyderabad, but also for their responsibility as rulers, their pride in their state and their people. They had been known as builders of colleges and hospitals and irrigation systems, plantation of roadside trees and big public gardens...” (150)

The Colonizers also used to plan and execute new plans and projects for the Indians so that they could be looked upon by the masses as true rulers who work for their welfare.

The promotion of English language by Indians by running English schools after independence is a clear influence of west, which we can term as neo colonialism. Subramaniam describes to Naipaul:

“...I went to an English medium school. But it was a very Indian school. It was run by people who were orthodox Hindus, but convinced that we had to learn English, science and technology... (160)

Champa Rao Mohan in the book entitled ‘Postcolonial Situation in The Novels Of V.S Naipaul Writes that “...political independence has changed nothing and the imperialist states continue to retain their hold on the former colonies through newer, more camouflaged methods of neocolonialism... (9).

The story of Kala’s mother who went to British schools and was good in sports, academics and music, also she was bold and confident. This shows that with an interaction by an Indian with British one gets the qualities which the rulers possess. Ngugi Wa Thiango one of the prominent writers of Kenya has rightly pointed out that “language carries culture and culture carries ...the entire body of values by which we come to perceive ourselves and our place in the world.”(220, Ngugi Wa Thiango)

Naipaul shows how the colonial effect on Indians continued after independence. The celebration of win by D.M.K. in Madras woodland hotel depicted that Indians are still to relieve themselves from the influence of culture of the west. Colonialism had negative effect on Indian culture, there was loss of values,

traditions, religious beliefs and language domination has its effect on the ruled who think the rulers as superior people. Naipaul shows how Nikhil, who belongs to the Hindu family, talks of his belief in the Jesus Christ. He gives the logic of his belief in Christ. He is burdened by one legal problem and with his “devotion to the Image of Infant Jesus” (140) the legal problem disappeared. Naipaul describes the colonial affect on the Indians:

“...They had created in India something not of India, simplicity, something where the Indian past had been abolished. And after 450 years all they had left behind this emptiness and simplicity was their religion, their language...the image of infant Jesus. (142)

The influence of the west on the postcolonial societies is the issue of discussion and writings of the postcolonial writers. Carribean novelist while writing about Barbados of 1950’s writes that he is shaken by the thought that “how [Britain]...could have achieved the miracle of being called the Mother. It had made us pupils to its language and its institution, baptized in the same religion...” (George Lamming, 111)

The Indians are not self dependent people, they need some kind of support from outside to grow, and they lacked confidence in their own abilities. They are hardly bothered about who rule the country, only mattered was that state of affairs remaining the same.

The Maharajas lost their power after independence. Even they lost their titles. The loss of titles of the Maharajas further lowered their status. To regain the lost political and social status the sons of Ex-Maharajas started contesting elections to parliament, it is difficult to remain out of power when once you have remained powerful. The son of former Maharajas joined congress and became Member of Parliament. The issues of misrule and oppression are raised by parties to attain power but parties themselves become the symbol of oppression and suppression when they have taste of power.

The Zamindars exploits the laborers by not giving them minimum wages. The Zamindari system reflects the influence of the British who used Indians as slaves and exploited them. In the post-colonial period the Zamindars in India are following the legacy of the ex-colonizers, the British. The postcolonial politics of the rulers of independent India depict that Indians are still to liberate themselves from the negative aspects which pose serious threat to political and social system of the country. The denial of rights and exploitation of the laborers is painful. The Zamindars exploits the laborers by not giving them minimum wages. Naipaul shows how the Zamindari system of the colonial political system which exploited the landless labor before independence still persists and exploitation continues as Zamindars are needed by the politicians for the political support by the political players and the parties. The financially weak laborers are under the thumb of the Zamindars and to the extent that they cast their votes according to the wishes of their masters. Naipaul is critical of Zamindari system which exploits the laborers:

“...The Zamindars employed women for three rupees a day and men for five rupees a day. The minimum wage at that time was five rupees for women and nine for men...” (275)

Edward Said gives his views on the social, economic and political conditions of postcolonial countries. He says that “In

our time direct colonialism has largely ended; imperialism, lingers where it has always been, in a kind of general culture sphere as well as in specific political ideological, economic and social practices,” (Said, Edward, 8)

The Democrats (D.M.K.) of Tamil Nadu became imperialists. Power got to their heads and they hardly bothered about to look into the problems of public interest. They ignored real issues and following the imperialistic policy degraded the democratic institutions. It is the common trend of the political parties that after attaining power promises made during elections are forgotten and are remembered again during the next elections.

In the chapter entitled ‘After the Battle’ Naipaul shows how the effect of powerful west remained on the Indians even after independence. The Indians constructs their houses in accordance with European styles thought it proved ineffective in the in the Indian conditions.

Colonial language (English) helped Debu to rise in party as man knowing English was considered superior. The Indians considered their own language and culture to be inferior because of country’s subjection to century’s foreign rule. Naipaul describes:

“... and Debu found that being a foreign returned person and an English speaker was helping him up even in the communist party (Marxist)...” (335)

To conclude it can be said that the Indian polity is still very much under the influence of the policies and principles followed by the colonizers to rule the country. The society is still divided on the basis of caste, creed and religion. The ruling class considers themselves as superior and enjoys the political power at the expense of deprivation of basic amenities to the poor and needy. The politics is not aimed to create the bonds of unity in the masses belonging to different sections of society; rather they make all out efforts to create divisions in the society. This makes the task of their coming to power easier as the divided society does not pose threat to their continuation of remaining in power. The politicians hardly make efforts to save and propagate the Indian languages, culture and rich heritage; rather they have become promoters of English education and western culture. It is rather painful that even after the years of independence, the Indians are not having the independent thinking of their own and the political system still runs on the borrowed institutions and instead of making efforts to frame the policies for the betterment of the society, the politicians are indulged in the game of minting money through corrupt practices. The colonizers exploited the country and its masses, the present day rulers follow the legacy of their ex-masters.

REFERENCES

- [1] Cudjoe, Selwyn R. *V.S. Naipaul: a Materialist Reading*. Amherst, Mass: University of Massachusetts Press. 1988.
- [2] Fawzia, Mustafa. *V.S Naipaul*. New York. : Cambridge University Press, 1995
- [3] Edward Said, *Culture and imperialism*, London: Vintage, 1994, p.8)
- [4] Feder, Lillian. *Naipaul’s Truth: The making of a writer*. Oxford: Rowman& Littlefield Publishers, 2001
- [5] George Lamming, “Introduction” (1983)to *In the Castle of my Skin*(1970),introduced in Bruce King,ed., *New National and Postcolonial Literature-An Introduction*, Oxford: Clarendon Press, 1998,p111

- [6] Huntigton, Samuel. *The Clash of Civilization and the Remaking Of World Order*, New York: Simon and Schuster, 1996.
- [7] Naipaul V.S. *India: A Million Mutinies Now*. London: Heinemann, 1990.
- [8] Landeg, White. *V.S. Naipaul*. London: Manmillan Press, 1975
- [9] Mohan, Champa Rao *Postcolonial Situation In The Novels Of V.S Naipaul* New Delhi, 2004.
- [10] Ngugi Wa Thiango, “The Language of African Literature,” in Bill Achcroft et al., eds., *The Postcolonial Studies Reader*, London: Routledge, 1995,p.220
- [11] Nixon, Rob. *London Calling: V.S. Naipaul, Postcolonial Mandarin*. New York: Oxford Univ. Press, 1992.
- [12] Rohler, Gordon. *The Ironic Approach: The Novels of VS Naipaul, The Islands in Between*. London: Oxford University Press, 1968
- [13] Rushdie Salman. *Imaginary Homelands: Essays and Criticism 1981-1991* London: Granata Books, 1991
- [14] Staples, Brent. “Con Men and Conquerors, ‘a Review of A Way in the World,’ New York Times Book Review, 1994
- [15] Weiss, Timothy. *On the Margins: The Art of Exile in V.S. Naipaul*. Amherst: Univ. of Massachusetts Press, 1992.

AUTHORS

First Author – Bhupinder Singh G.T.B.K.Polytechnic
Chhapianwali (Malout)

Assessment of Surface Roughness and Material Removal Rate on Machining of TiB₂ Reinforced Aluminum 6063 Composites: A Taguchi's Approach

K.Krishnamurthy*, J.Venkatesh**

* Department of Mechanical Engineering, Adichunchangiri Institute of Technology, Chikmagalur-577102, INDIA

** Department of Automobile Engineering, PES College of Engineering, Mandya-571401, INDIA

Abstract- The utilization of TiB₂ particles reinforced aluminum (Al6063) metal matrix composite materials in many different engineering fields has undergone a tremendous increase. Accordingly, the need of accurate machining of composites has increased enormously; an attempt has been made to assess the factors influencing surface roughness and material removal rate on machining the composite. The orthogonal array, the signal-to-noise ratio, and analysis of variance were employed to study the performance characteristics in turning operations of 5 and 10 wt. % TiB₂ particles reinforced aluminum (Al6063) metal matrix composites. Taguchi method was used to find the optimal cutting factors for surface roughness (Ra) and material removal rate (MRR). Three cutting factors namely speed; feed and depth of cut were optimized with considerations of Ra and MRR. The experimental plan and analysis was based on the Taguchi L27 orthogonal array with three cutting factors using carbide tool (K20). The optimal parametric combination for K20 carbide insert was found to be feed, speed and depth of cut. The analysis of variance (ANOVA) result shows that feed the most significant process parameter on surface roughness followed by speed. The depth of cut was found to be insignificant from the study. For MRR result show that the speed and the feed are the most significant parameters followed by the composition of composite material.

Index Terms- TiB₂ reinforced 6063 aluminum composites, Taguchi Method, Analysis of variance, Surface Roughness, Material Removal Rate.

I. INTRODUCTION

Aluminium alloys are the most widely used non ferrous materials in engineering applications owing to their attractive properties such as high strength to weight ratio, good ductility, excellent corrosion resistance, availability and low cost [1]. However, their applications have often been restricted because conventional aluminium alloys are soft and notorious for their poor wear resistance. This problem is over by reinforcing hard ceramic particles in aluminium and its alloys to produce a discontinuous reinforced metal matrix composite which possesses nearly isotropic properties.

Aluminum based particulate reinforced metal matrix composites have emerged as an important class of high performance materials for use in aerospace, automobile, chemical and transportation industries because of their improved strength, high elastic modulus and increased wear resistance over conventional base alloys. Recently, In-situ techniques have been developed to fabricate aluminum-based metal matrix composites [3-4], which can lead to better

adhesion at the interface and hence better mechanical properties. In-situ composites are multiphase materials where the reinforcing phase is synthesized within the matrix during composite fabrication. There are different routes to Synthesize Al-TiB₂ composites, but in-situ approach is gaining importance due to simplicity of its fabrication. Among the reinforcements, TiB₂ has emerged as a promising candidate for Al-based composites. This is due to the fact that TiB₂ is stiff, hard and more importantly, does not react with aluminum to form reaction product at the interface of reinforcement and matrix. TiB₂ is a refractory compound that exhibits outstanding features such as high melting point (2790°C), high hardness (86 HRA or 960 HV) and high modulus characteristics. Its resistance to plastic deformation even at high temperatures portrays it to be a good potential reinforcing candidate in an aluminum matrix. 5 and 10 wt. % TiB₂ particles reinforced aluminum (Al6063) metal matrix composites produced by using master alloys of Al-Ti & B by stir casting process to obtain the material for the experiment [5-7].

Surface roughness has become the most significant technical requirement and it is an index of product quality. In order to improve the tribological properties, fatigue strength, corrosion resistance and aesthetic appeal of the product, a reasonably good surface finish is desired. Nowadays, the manufacturing industries specially are focusing their attention on dimensional accuracy and surface finish. In order to obtain optimal cutting parameters to achieve the best possible surface finish, manufacturing industries have resorted to the use of handbook based information and operators' experience. This traditional practice leads to improper surface finish and decrease in the productivity due to sub-optimal use of machining capability. This causes high manufacturing cost and low product quality [8-11]. In addition to the surface finish quality, the material removal rate (MRR) is also an important characteristic in turning operation and high MRR is always desirable [8, 12].

Hence, there is a need to optimize the process parameters in a systematic way to achieve the output characteristics/responses by using experimental methods and stastical models. Dr. Taguchi employed design of experiments (DOE), which is one of the most important and efficient tools of total quality management (TQM) for designing high quality systems at reduced cost. Taguchi emphasizes on the fact that Quality provides robustness and immune to the uncontrollable factors in the manufacturing state. This approach helps to reduce the large number of experimental trials when the number of process parameters increases. [14-16]

In the present investigation, optimization model based on Taguchi method and utility concept has been employed to determine the best combination of the machining parameters such as cutting speed, feed, and depth of cut to attain the minimum surface roughness and maximum MRR simultaneously. The predictive models obtained were used for performance measures.

II. DESIGN OF EXPERIMENTS

Experimental design is a statistical technique that enables an investigator to conduct realistic experiments, analyze data efficiently, and draw meaningful conclusions from the analysis. The aim of scientific research is usually to show the statistical significance of an effect that a particular factor (input parameter) exerts on the dependent variable (output/response) of interest. Specifically, the goal of DOE is to identify the optimum settings for the different factors that affect the production process. The primary reason for using statistically designed experiments is to obtain maximum information from minimum amount of resources being employed. An experiment (also called run) may be defined as a test in which purposeful changes are made to the input variables of a process so that the possible reasons for the changes in the output/response could be identified. The experimental strategy frequently practiced by the industries is **one factor at-a time approach** in which the experiments are carried out by varying one input factor and keeping the other input factors constant. This approach fails to analyze the combined effect, when all the input factors vary together which simultaneously govern the experimental response. A well designed experiment is important because the results and conclusions that can be drawn from the experimental response depend to a large extent on the manner in which data were collected.

A. Factorial designs

This is an experimental strategy, in which all the factors of study are varied together, instead of one at a time. If the factorial experiment has 2 factors at 2 levels (values) each, all possible combinations of the two factors across their levels are used in the design. As the number of factors of interest increases the number of experiments increases rapidly. Though this method is efficient, it is not feasible from the point of view of time and resources, when the number of factors and their levels are relatively large.

B. Taguchi designs

A Taguchi design, or an Orthogonal Array (OA), is a method of designing experiments that usually requires only a fraction of the full factorial combinations. Taguchi designs provide a powerful and efficient method for designing processes that operate consistently and optimally over a variety of conditions. Taguchi techniques have been used widely in engineering and scientific community because they are easy to adopt and apply for users with limited knowledge in statistics [13, 14]. An orthogonal array provides a set of well balanced experiments in which factor levels are weighted equally across the entire design. Because of this, each factor can be evaluated independently of all the other factors, so the effect of one factor does not influence the estimation of another factor.

C. Analysis of variance Analysis of Variance (ANOVA)

ANOVA is a statistical decision making tool, used to analyze the experimental data, for detecting any differences in the response means of the factors being tested. ANOVA is also needed for estimating the error variance for the factor effects and variance of the prediction error. In general, the purpose of analysis of variance is to determine the relative magnitude of the effect of each factor and to identify the factors significantly affecting the response under consideration (objective function).

D. Main effects

The change in average response produced by a change in the level of a factor is called "Main Effect" of that factor. The main effects plot displays the response means for each factor level in the sorted order. The points (response means) in the plot are located with respect to a reference line drawn at the overall mean of the response data and connected by a line.

- When the line is horizontal (parallel to x-axis), then there is no main effect present. Each level of the factor affects the response in the same way, and the response mean is the same across all factor levels.
- When the line is not horizontal, then there is a main effect present. Different levels of the factor affect the response differently. The steeper the slope of the line, the greater the magnitude of the main effect.

E. Interaction effects

If the effect of one factor is different at different levels of another factor, the two factors are said to interact or to have interaction. The interaction between two factors A and B is termed as "first order or two factor" interaction, denoted by AB ($A*B$ or AxB). Similarly, the interaction between three factors is referred as "second order or three factors" interaction. Minitab (Version 15) statistical software is used for designing experiments and for analyzing response data.

III. EXPERIMENTAL WORK

A Material

The material used is of 0, 5 and 10wt % TiB_2 reinforced with Al6063 composite material of size $\Phi 20 \times 60$ mm length shown in figure 1.



Figure 1: Composite Material 0, 5 & 10 wt% TiB_2 Reinforced with Al6063.

B. Experimental Procedure

The experiments were carried with four factors at three levels each as shown in the table 1.

Table 1: Factors (process parameters) and Levels Used in the Experiments

Process Factors	Levels		
	1	2	3
A-Cutting speed (m/min)	37.69	75.39	113.07
B-Feed rate (mm/min)	0.05	0.10	0.15
C- Depth of cut (mm)	0.25	0.50	0.75
D- Material (Al6063 -wt%TiB ₂)	0	5	10

The factorial design used is a standard L₂₇ (3¹³) orthogonal array. This orthogonal array is chosen due to its capability to check the interactions among factors. The turning trials were carried out on the CNC turning center (MITSUBISHI-EZ Motion NC E60) in dry machining condition as shown in figure2.



Figure 2.: CNC turning center. (MITSUBISHI-EZ Motion NC E60)

The insert used is of K₂₀ type carbide tool (SANDVIK: DNMG 3215 TOOL: K₅ – K₂₀) shown in Fig. 3.



Figure 3: SANDVIK: DNMG 3215 Tool (K₁₅ – K₃₅)

Table 2.: Factor settings, surface roughness data and MRR data

Exp No	Cutting Speed (m/min)	Feed (mm/min)	Depth of cut (mm)	wt% TiB ₂	Material Removal Rate (mm ³ /min)	Surface Roughness (R _a) μm
1	37.69	0.05	0.25	0	0.40	0.152
2	37.69	0.05	0.50	5	0.73	0.276
3	37.69	0.05	0.75	10	1.90	0.099
4	37.69	0.10	0.25	5	1.47	0.282
5	37.69	0.10	0.50	10	1.73	0.719
6	37.69	0.10	0.75	0	0.57	0.590
7	37.69	0.15	0.25	10	1.70	0.325
8	37.69	0.15	0.50	0	1.87	0.724
9	37.69	0.15	0.75	5	1.95	1.066
10	75.39	0.05	0.25	5	0.60	0.339
11	75.39	0.05	0.50	10	0.90	0.553
12	75.39	0.05	0.75	0	1.00	0.793
13	75.39	0.10	0.25	10	1.10	0.367
14	75.39	0.10	0.50	0	0.87	1.653
15	75.39	0.10	0.75	5	1.20	1.616
16	75.39	0.15	0.25	0	1.73	0.925
17	75.39	0.15	0.50	5	2.32	2.678
18	75.39	0.15	0.75	10	1.57	1.396
19	113.07	0.05	0.25	10	0.63	0.504
20	113.07	0.05	0.50	0	0.60	0.717
21	113.07	0.05	0.75	5	0.87	0.727
22	113.07	0.10	0.25	0	0.67	1.037
23	113.07	0.10	0.50	5	1.67	2.397
24	113.07	0.10	0.75	10	0.83	1.925
25	113.07	0.15	0.25	5	1.50	1.525
26	113.07	0.15	0.50	10	1.37	2.865
27	113.07	0.15	0.75	0	0.70	3.032

The surface roughness (R_a) of the machined surface was measured using HANDSURF E-35A instrument and the MRR is calculated using the following equation [9].

$$MRR = \frac{\{ \text{Initial weight of the work(gms)} - \text{Final Weight of the work(gms)} \}}{\text{Density (gms/mm}^3) \times \text{Machining time(min)}} \text{ (mm}^3/\text{min)}$$

VI. EXPERIMENTAL RESULTS AND ANALYSIS

A. Analysis of variance of Surface Roughness (R_a) and MRR

The response data recorded in table 2, for surface roughness and MRR are subjected to ANOVA for finding the significant factors, at above 95% confidence levels and the result of ANOVA for these response parameters are presented in the tables 3, 4 and 5, 6 respectively.

B. Surface Roughness

Average S/N ration for every level of experiment and the different values of S/N ration between maximum and minimum are shown in Table 3 for surface roughness. The feed rate, TiB₂ reinforced Al6063 composite work material;

cutting speed and depth of cut are the factors with different values of 6.12, 3.61, 2.34 and 2.02 respectively. Based on the Taguchi prediction that the bigger different values of S/N ratio will give more effect or more significant. Increase in the feed rate will increase the surface roughness significantly.

Table 3. Average for S/N ration and main effect of Surface Roughness.

Process Factors	Designation	Levels			Max-Min	Rank
		1	2	3		
Cutting Speed (m/min)	A	-1.55	-1.32	0.79	2.344	3
Feed rate	B	2.24	-0.42	-3.89	6.124	1
Depth of cut	C	0.31	-1.71	-0.67	2.025	4
Wt% TiB2	D	1.65	-1.96	-1.76	3.612	2

The results of analysis of variance for surface roughness are shown in table 4. DF (degree of freedom), SS (sum of squares), MS (mean of squares), F (variance ratio), P (Significant factor) and percentage contribution of each level [14, 15].

Table 4 shows that the feed rate and the TiB₂ reinforced Al6063 work material have more influence on the surface roughness value. Significant factor (P) values for both are 0.024 and 0.158 respectively. In statistical analysis of taguchi method, the smallest P value gives more significant effect on responded surface roughness parameters. The significant values for the feed rate and the TiB₂ reinforced Al6063 composite work material and their contributions are 38.52% and 13.22% respectively. The speed and TiB₂ reinforced Al6063 work material interaction contributes about 11.20%, where as the contribution of the cutting speed is about 9.53% and the other interactions and depth of cut are insignificant. The most significant factor, which affects the surface roughness measured in turning the 5 and 10wt % TiB₂ reinforced with Al6063 composite material, is the feed rate, therefore the surface roughness can be controlled with a suitable feed rate Value. Previous researchers suggest the similar results. They claimed that the surface roughness strongly depends on the feed rate. [15-17].

Table 4. ANOVA Analysis of S/N Ration for Surface finish

Process Parameters	Designation	DF	SS	MS	F	P	SS (%)
Cutting Speed (m/min)	A	2	0.71	0.36	1.84	0.238	09.53
Feed rate (mm/min)	B	2	2.87	1.43	7.43	0.024	38.52
Depth of cut (mm)	C	2	0.29	0.15	0.76	0.509	03.89

wt% TiB2 material	D	2	0.98	0.49	2.55	0.158	13.22
Speed* Feed	A*B	4	0.41	0.10	0.53	0.722	05.50
Speed * DOC	A*C	4	0.19	0.05	0.25	0.900	02.68
Speed * %TiB2	A* D	4	0.84	0.21	1.08	0.443	11.20
Error		6	1.16	0.19			15.55
Total		26	7.45				100.0

R-Sq = 84.45%

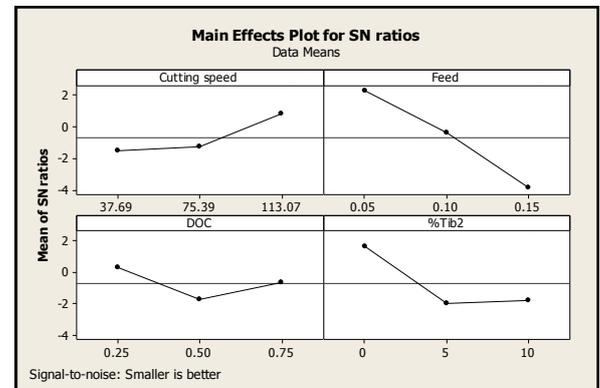


Figure 4. Main effect plots for SN ratios of process factors on Surface Roughness

The signal to noise ratio are shown in Figure 4 for the process factors on surface roughness. The B1 (low level of feed) is at the maximum value with 2.24 of S/N ratio, decrease dramatically to B2 (-0.42) and then to B3 (-3.89). S/N ratio for B2 and B3 decreased, due to increase in the feed rate. The parameter D1 (low level of material composition) is at the maximum value at 1.65 and it decreased to a value of -1.76 as the feed increases. The cutting speed is at the minimum value of -1.55 and increased to 0.79.

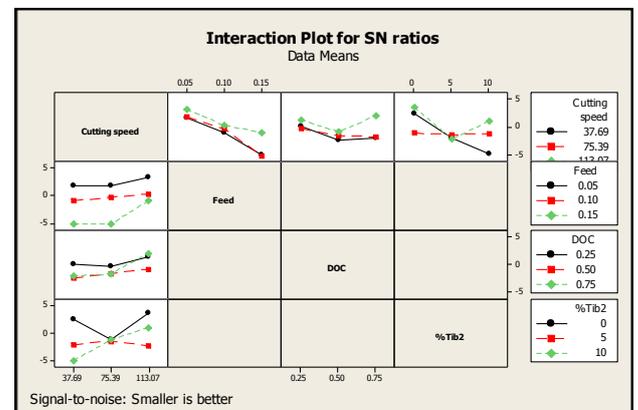


Figure 5. Interaction plot for SN ratios of process factors on Surface Roughness

The interactions among the factors are shown in Figure 5 for surface roughness. The cutting speed and the type of work material contribute the most of about 11.32% and become significant. The other interactions are insignificant.

C. Material Removal Rate (MRR)

In machining operation, maximizing the material removal rate (MRR) is an important criterion. Experimental results of the material removal rate for turning 5 and 10 wt% TiB2 reinforced with Al6063 composites material with various turning parameters are shown in table 5, which also gives the S/N ratio for the material removal rate. The cutting speed and the feed are the most significant factor that influences the MRR with the value of 11.39 and 10.78 respectively.

Table 5. Average for S/N ration and main effect of MRR

Process Factors	Designation	Levels			Max-Min	Rank
		1	2	3		
Cutting Speed (m/min)	A	-8.66	-0.66	2.71	11.391	1
Feed rate (mm/min)	B	-8.42	-0.56	2.36	10.778	2
Depth of cut (mm)	C	-6.43	0.53	-0.72	6.960	3
Wt% TiB2 material	D	1.67	-1.09	-3.87	2.776	4

Table 6. Provides the cutting speed and feed rate values are significant with the factor (P) value for both are 0.001 & 0.002 respectively. The contribution of the cutting speed and feed rate are 32.28% and 31.85% respectively. The depth of cut contributes about 16.64% and the other factor and interactions are insignificant.

Table 6. ANOVA Analysis of S/N Ratio for MRR

Process parameters	Designation	DF	SS	MS	F	P	SS (%)
Cutting Speed (m/min)	A	2	6.17	3.09	23.37	0.001	32.28
Feed rate (mm/min)	B	2	6.09	3.05	23.08	0.002	31.85
Depth of cut (mm)	C	2	3.19	1.59	12.07	0.008	16.64
Wt %TiB2 material	D	2	0.26	0.13	0.99	0.426	01.35
Speed* Feed	A*B	4	1.29	0.32	2.44	0.158	06.75
Speed *	A*C	4	0.57	0.14	1.08	0.444	02.98
Speed *	A*D	4	0.75	0.19	1.43	0.332	03.92
Error		6	0.79	0.13			04.13
Total		26	19.12				100.00

R-Sq = 95.86%

Figure 6 shows that the A1 (low cutting speed) is the minimum value with -8.68 of S/N ratio, and it increases dramatically to A2 (-0.66) and then to A3 (2.37). The main effect plot for the feed, and depth of cut have same trend lines but the TiB2 reinforced Al6063 composite work material shows inverse trend as wt% of TiB2 increases the MRR decreases.

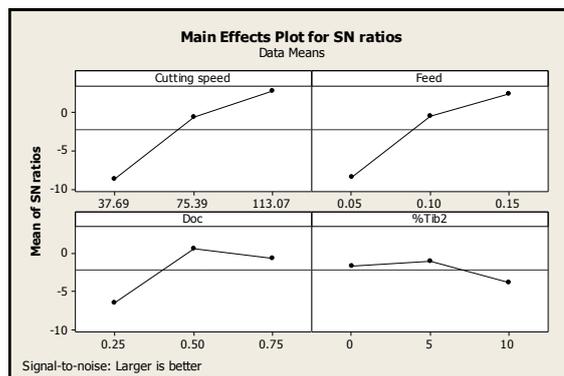


Figure 6. Main effect plots for SN ratios of Process factors on MRR.

The interactions among the factors are shown in figure 7 for the MRR. The cutting speed and the feed contribute the most of about 6.75% and become less significant. The other interactions are insignificant.

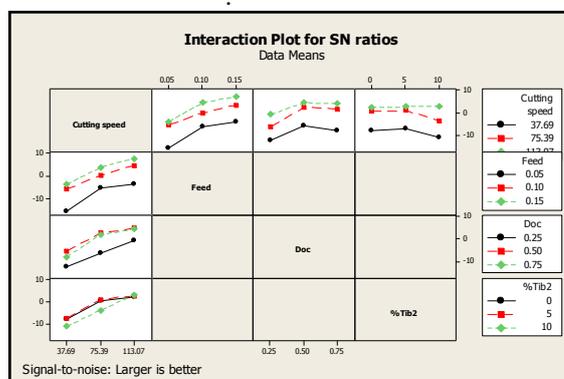


Figure 7. Interaction plot for SN ratios of Process Factors on MRR

Table 7. Factors with optimum levels for Surface Roughness and MRR

Process parameters	Optimum Level for Surface Finish	Optimum values for Surface Finish	Optimum Level for MRR	Optimum values for MRR
Cutting Speed (m/min)	A3	113.07	A3	113.07
Feed rate (mm/min)	B1	0.05	B3	0.15
Depth of cut (mm)	C1	0.25	C3	0.75
wt% TiB2 + Al60603 material	D1	0%	D1	0%

IV. CONCLUSIONS

- Taguchi robust design method is suitable to optimize the surface roughness and the material removal rate is adopted in the present work.
- The significant factors in turning 5 and 10 wt. % TiB₂ particles reinforced aluminum (Al6063) metal matrix composites material on surface roughness were feed rate and the type of work material, with contribution 38.52% and 13.22% respectively.
- For MRR the cutting speed and the feed rate are most significant factors, with contribution of 32.28% and 31.85% respectively. The depth of cut is contributed about 16.64%.
- The optimal conditions for surface roughness and the MRR are shown in Table 7.
- The optimal condition of cutting parameters for lesser surface roughness for the Al6063/TiB₂ composite material are the cutting speed of 113.07m/min; feed rate of 0.05 mm/min and the depth of cut of 0.25mm.
- The optimal condition of cutting parameters for higher material removal rate for the Al6063//TiB₂ composite material are the cutting speed 113.07m/min, feed rate of 0.15 mm/min and the depth of Cut of 0.75mm.

REFERENCES

- [1] Jiang Xu, Wenjin, and Liu, "Wear characteristic of in situ synthetic TiB₂ particulate reinforced Al matrix composite formed by laser cladding," *Wear* 260 (2006)486–492.
- [2] K.L. Tee, L. Lu and M.O. Lai, "In situ processing of Al–TiB₂ composite by the stir-casting technique," *Journal of Materials Processing Technology* : 89–90 (1999): 513–519.
- [3] L. Lu, M.O.Lai, Y.Su, H.L.Teo and C.F.Feng., In situ TiB₂ reinforced Al alloy composites. *Scripta materialia*: 45 (2001) 1017-1023.
- [4] A.Mandal, R. Maiti, M. Chakraborty and B.S. Murty, "Effect of TiB₂ particles on aging response of Al–4Cu alloy," *Materials Science and Engineering A*: 386 (2004) :296–300.
- [5] K.Sivaprasad, R.Narayanaswamy and S.P.Kumaresh Babu, "Study of abrasive and erosive wear behavior of Al 6063/TiB₂ in situ composites," *Materials science and Engineering A*: 498(2008):495-500.
- [6] C.S.Ramesh, Abrar Ahamed, B.H.Channabasappa, R.Keshavamurthy, Development of Al 6063-TiB₂ in situ composites, *Materials and Design* 31(2010): 2230-2236
- [7] C.S. Ramesh and Abrar Ahamed, "Friction and wear behaviour of cast Al 6063 based in situ metal matrix composites," *Wear* 271 (2011) 1928–1939.
- [8] Kamal Hassana, Anish Kumar, M.P.Garg, "Experimental investigation of Material removal rate in CNC turning using Taguchi method". *International Journal of Engineering Research and Applications (IJERA)* ISSN: 2248-9622 Vol. 2, Issue 2, Mar-Apr 2012, pp.1581-1590.
- [9] Hardeep Singh, Rajesh Khanna2, M.P.Garg. "Effect of Cutting Parameters on MRR and Surface Roughness in Turning EN-8." *Current Trends in Engineering Research* Vol.1, No.1 (Dec. 2011).
- [10] H. K. Davea, L. S. Patel and H. K. Raval, "Effect of machining conditions on MRR and surface roughness during CNC Turning of different Materials Using TiN Coated Cutting Tools – A Taguchi approach", *International Journal of Industrial Engineering Computations* 3,(2012)
- [11] M.Kaladhar, V.S. Subbaiah, Ch.S.Rao, and K.N.Rao., "Optimization of process parameters in turning of AISI 202 Austenitic Stainless Steel.", *ARPN Journal of Engineering and Applied Sciences*, 2010:5(9), 79-87.

- [12] Tian-syung Lan., Taguchi optimization of Multi objective CNC machining using TOPSIS. *International Technology journal*. 8(6): 2009:917-922.
- [13] A.I.Gusri, Che Hassan,C.H., A.G.Jaharah, B.Yanuar, A.Yasir, and A.Nagi, "Application of taguchi Method in optimizing turning parameters of Titanium Alloy",Seminar on Engineering mathematics @ 2008 engineering mathematics group.
- [14] Anjaiah Devnani and Avinash M Chincholkar, "AWSJ cutting of ceramics – An experimental study of the effect of process parameters on the surface roughness using DOE" a ©PRIC-WJT2009, 9th Pacific Rim International Conference on Water Jetting Technology.
- [15] J.A.Ghani, Choudhury and H.H. Hassan "Application of Taguchi method on the optimization of end milling parameters", *Journal of material processing and technology*,2004: 145, 84-92.
- [16] K.Palanikumar and R.Karthikeyan., " Assessment of factors influencing roughness on the machining of Al/SiC particulate composites", *Materials & Design* 28(2007): 1584-1591.
- [17] Syed Altaf Hussain, V.Pandurangadu, and K.Palanikumar," Surface roughness analysis in machining of GFRP composites by carbide tool (K20)", *European journal of scientific research*, Vol.41 No.1(2010),pp.84-98.

AUTHORS

First Author – K.Krishnamurthy: He earned his Undergraduate degree in Mechanical Engineering in 1990 from University of Mysore, Karnataka, post graduate degree in Advanced Manufacturing Engineering from KREC Surathkal, University of Mangalore in 1995. Presently he is working as Associate Professor in the department of Mechanical engineering, Adichunchangiri Institute of technology, Chikmagalur, Karnataka, India. He has published 5 papers in National/International conferences/journals. He is a life Member of Indian Society for technical education. E-mail: kkm.aitmech@gmail.com , kkm_aitmech@yahoo.co.in

Second Author – Dr.J.Venkatesh: He earned his Undergraduate degrees in Science and Automobile Engineering form University of Mysore in the year 1980 & 1984 respectively, post graduate degree from MIT, Madras-44, (Anna University) in 1989 and Doctoral degree in Mechanical Engineering (Composite materials) from University of Mysore in 1998. Presently working as a Professor and Head, Department of Automobile Engineering, PES College of Engineering, Mandya, Karnataka, India. He is a life Member of Indian Society for technical education and FIE. He has published 20 papers in National/International conferences/journals. E-mail: jvenkateshpesce@gmail.com

Correspondence Author – K.Krishnamurthy, E-mail: kkm.aitmech@gmail.com , kkm_aitmech@yahoo.co.in
Contact number: +91 9480736527.

Evaluation of Fiber Enriched Biscuits as a Healthy Snack

Shweta Sharma*, Seema Rana*, Charu Katare*, Tara Pendharkar*, GBKS Prasad**

* Department of Home Science, Govt. KRG PG Autonomous College, Gwalior.

** School of Studies in Biotechnology, Jiwaji University, Gwalior

Abstract- The increase in diabetic population of the world is among the top ten causes of death, with diabetes always high on the list of causes of death. The eating habits and patterns of the diabetic patients are the main causes for poor glycemic control. It is reported in epidemiological studies that high fiber dietary intake can significantly reduce the incidence of diabetes. The study was undertaken to evaluate acceptability and glycemic response of bottle gourd pulp powder (BGPP) enriched biscuits against standard wheat biscuits. Normal healthy subjects (n=7) and prediabetic subjects (n=7) were included in the study. Blood glucose values at 0, 30, 60, 90 & 120 minutes indicated significant difference in incremental area under the curve (IAUC) of glucose and two varieties of biscuits in prediabetic subjects as well as in normal healthy subjects. The mean IAUC of BGPP enriched Biscuits ($p < 0.001$) was significantly lower than that of glucose and Wheat flour Biscuits ($p < 0.001$) in normal as well as prediabetic subjects.

Index Terms- Fiber enrichment, diabetes, glycemic response, glycemic index

I. INTRODUCTION

Diabetes mellitus describes a metabolic disorder of multiple aetiology characterized by chronic hyperglycemia with disturbance of carbohydrate, fat and protein metabolism caused by defects in insulin secretion, insulin action or both. The effects of diabetes mellitus include long-term damage, dysfunction and failure of various organs (Liu S, 1999).

The incidence of diabetes has been increasing, and this epidemic may continue to escalate over the next decade, especially in minorities. For >30 years, researchers have been interested in potential beneficial effects of dietary fiber intake among individuals with diabetes. Many clinical studies have investigated the effect of high-fiber diets in persons with diabetes. More recently, the role of dietary fiber in the prevention of diabetes has received attention. (Montonen J 2003, Lairon D 2005, Petruzzello L 2006, Brown L 1999, Keenam 2002, Anderson JW 2004). Fiber, particularly soluble fiber, has repeatedly been shown to decrease postprandial glucose and insulin concentrations both in individuals with diabetes and in those without diabetes (Whelton SP 2005).

A generous intake of dietary fiber reduces risk for developing the following diseases: coronary heart disease, stroke, (Marangoni F 2008) hypertension, diabetes, (Meyer KA 2000) obesity, and certain gastrointestinal Disorders (Karhunen LJ 2010) Furthermore, increased consumption of dietary fiber improves serum lipid concentrations, lowers blood pressure, improves blood glucose control in diabetes, promotes regularity,

aids in weight loss, and appears to improve immune function. Dietary fiber, found in all plant-based foods, plays an essential role in human health.

Fiber has been studied in the treatment of diabetes for many years because increased fiber content decreases the glycemic index of foods. The glycemic index and glycemic load have been proposed as method of ranking of foods on the basis of the incremental blood glucose response they produce for a given amount of carbohydrate. The theory, then, is that the decreased glycemic index would lead to smaller increases in blood glucose, and thus reduced blood glucose (Ostman EM 2006) Although high fiber intake has been linked to a decreased risk of diabetes, the evidence on fiber intake and control of diabetes is mixed. Specifically, many of the studies focused on fiber intake and glycemic control are small and have conflicting results; some studies show an improvement in diabetes control and others show no improvement. The study was undertaken to evaluate acceptability and glycemic response of Biscuits supplemented with oven dry bottle gourd pulp powder (BGPP).

II. MATERIAL AND METHOD

In this study two products were subjected to organoleptic evaluation for various attributes like appearance, color, texture, taste and softness. Acceptability was determined by using 9 point hedonic scale for organoleptic qualities. The most acceptable combination which obtained maximum score for organoleptic quality was tested against glucose to evaluate post meal glycemic response. 14 subjects (7 normal and 7 prediabetic,) were selected for the study. The age group was 40-60 years. The subjects were explained the study protocol and a written consent regarding voluntary participation was obtained. The study evaluated blood glucose response after oral glucose tolerance test and administration of the test foods. In the phase I an oral glucose tolerance test (GTT) was performed with 25 gm glucose load on day 1 followed by administration of several equicarbohydrate (25gm, based on food composition tables ICMR) different test food combinations for subsequent 6 days to the selected 7 normal subjects and 7 IGT subjects.

Determination of Glycemic Index: Subjects were asked to attend the testing session after a 10-12 hour overnight fast. The subjects were instructed not to consume unusually large meals, drink alcohol or exercise vigorously on the previous day, and to avoid cycling or walking to the laboratory. On the first day subjects were given the standard or reference carbohydrate i.e. 25g glucose dissolved in 100 ml of water. Blood glucose level was measured in capillary whole blood obtained by finger prick (Accu-Chek Roche Diagnostics India Pvt Ltd, Mumbai) at 0, 30, 60, 90 and 120 minutes. Blood glucose curve and the

incremental area under the curve (IAUC) was calculated by the trapezoidal rule (**Gibaldi.M and D.Perrier, 1982**).

Equicarbohydrate quantity of varieties of food combinations (25gms carbohydrates) were used for testing against the reference carbohydrate (glucose) on the following two consecutive days. The food formulations chosen were wheat biscuits and wheat biscuits supplemented with BGPP. Similar procedure was repeated to calculate IAUC.

Calculation of Glycemic Index: The Glycemic Index (GI) values were calculated by the method of (**Wolever, 1990**). The glycemic index was calculated by dividing the IAUC for the test food by the IAUC for the reference food and multiplying by 100 for each individual. The following formula was used:

$$GI = \frac{IAUC \text{ for tested Food}}{IAUC \text{ for Reference Food}} \times 100$$

IAUC – Incremental Area Under the blood glucose response Curve.

The final glycemic index for each test food was calculated as the mean of the respective GI's of the ten individuals.

Glycemic Index range:

Foods with low GI (GI= 55% or less), foods with medium GI (GI= 69%) and foods with high GI (GI=70% or more) (**Foster-Powell, 2002**).

The GTT curve obtained for the test food combination showing significant reduction in mean peak rise was considered as dietary therapy/medical nutrition therapy.

Statistical Analysis: The data was analyzed using sigma stats package (3.5).

III. RESULTS (TABLE & GRAPHS)

Table 1 Blood glucose responses in normal subjects following glucose and products

Test & reference food	Time intervals						
	0	30	60	90	120	IAUC	GI
Glucose	99.3	167.0	187.1	144.1	105.1	338.6	-
BGPP enriched Biscuits (wh 80% + Bgpp20%)	100.3	112.7	120.7	110.1	103.6	73.75	21.7
Wheat Biscuits (wh 100%)	99.6	114.0	125.0	112.4	103.9	91.33	26.97

Note: - Values given mg/dl

Wh=Wheat Flour

Bgpp= Bottel Gourd pulp Fiber

Table 2 Blood glucose responses in prediabetic subjects following glucose or products

Test & reference food	Time intervals						
	0	30	60	90	120	IAUC	GI
Glucose	116.7	187.1	196.6	170.4	137.7	357.5	-
BGPP enriched Biscuits (wh 80%+ bgpp20%)	118.4	130.3	139.0	133.3	120.4	80.6	22.5
Wheat Biscuits (wh 100%)	118	133.6	143.6	135.3	128.6	106.3	29.7

Note: - Values given mg/dl

Wh=Wheat Flour

Bgpp= Bottel Gourd pulp Fiber

Table 3 Percent Reduction in baseline to peak

Test & reference foods	Normal healthy subjects		Prediabetic subjects	
	Baseline to peak	Peak to endpoint	Baseline to peak	Peak to endpoint
Glucose	46.9	43.8	40.6	29.9
BGPP enriched Biscuits (wh 80%+ bgpp20%)	16.9	14.2	14.8	13.4
Wheat biscuits (wh 100%)	20.3	16.9	17.8	10.4

Wh=Wheat Flour

Bgpp= Bottel Gourd pulp Fiber

IV. RESULT

The blood glucose curves of normal healthy subjects & prediabetic subjects after intake of 25 g glucose increased in the time period 0 to 60 minute and reached a peak value at 60 minute and then decreased progressively till the end of the observation period of 2 hours. Whereas the curve plotted for the products indicated the peak at 60 minutes there after gradually decreased in 2 hours period.

Products were observed for their peak value i.e. increment from baseline values, as well as decrement from peak value in normal and prediabetic subjects. In normal subjects increment of 46.9% at peak was seen and decrease of 43.8% was indicated from peak value in case of glucose. BGPP enriched Biscuits and Wheat Flour Biscuits indicated respective increment of 16.9%, and 20.3% at peak followed by decrement of 14.2% and 16.9%.

In pridiabetic subjects glucose was seen to have 40.6% increment and 29.9% decrement. Administration of , BGPP enriched Biscuits and Wheat Flour Biscuits exhibited 14.8% and 17.8% increment respectively from their baseline values and 13.4% and 10.4% decrease from their peak values.

The mean plasma glucose responses after the consumption of glucose and the test foods in normal subjects are shown in Table 1. The mean IAUC of glucose was found to be 338.6 mg/dl. Mean IAUC of BGPP enriched Biscuits was noted to be 73.75 mg/dl and Wheat Flour Biscuits 91.33 mg/dl respectively. The mean IAUC of BGPP enriched Biscuits ($p < 0.001$) was significantly lower then that of glucose and Wheat flour Biscuits ($p < 0.001$)

The mean plasma glucose responses after the consumption of glucose and the test foods in prediabetic subjects are shown in Table 2. The mean IAUC of glucose was 357.5 mg/dl. IAUC of BGPP enriched Biscuits was 80.6 mg/dl followed by 106.3 mg/dl of Wheat flour Biscuit. The mean IAUC of BGPP enriched Biscuits ($p < 0.001$) was significantly lower then that of glucose and Wheat flour Biscuits ($p < 0.001$).

V. DISCUSSION

The present study demonstrated that the highly BGPP added to biscuits had benefits to its consumers. It increased dietary fiber intake and reduced the glycemic index value of the snack to a similar extent in both healthy and diabetic participants. Soluble dietary fibers have been shown to alter food

texture, structure, and viscosity, and, therefore, the rate of starch degradation and digestion (**Brennan CS. 2005**), which is related to the regulation of postprandial glucose levels. BGPP is likely to be a mixture of soluble and insoluble fiber thus the effect on glycemic level could be attributed more to soluble fiber in it. Using the classification of Brand-Miller. Three types of the biscuits were found to have a low glycemic index but BGPP enriched biscuit indicating lowest glycemic index among all. BGPP enriched biscuits could be classified as a “low glycemic index” food (glycemic index ≤ 55), snack. The decreased glycemic index would lead to smaller increases in blood glucose, and thus reduced blood glucose and HbA1c levels. Although high fiber intake has been linked to a decreased risk of diabetes has been reported by (**Meyer KA, 2000, Wannamethee SG, 2009**) Results obtained from the present study indicate that BGPP supplemented biscuits may serve as health improving snack.

VI. CONCLUSION

BGPP is a very palatable fiber when added to a snack, which is able to reduce the glycemic response to a similar extent in both healthy participants and individuals with impaired glucose tolerance. Biscuits with low GI may potentially be a useful replacement of high GI snack foods in the diet.

REFERENCES

- [1] Liu S, Stampfer MJ, Hu FB, et al. Whole-grain consumption and risk of coronary heart disease: results from the Nurses' Health study. *Am J Clin Nutr.* 1999;70:412-419.
- [2] Whelton SP, Hyre AD, Pedersen B, Yi Y, Whelton PK, He J. Effect of dietary fiber intake on blood pressure: a metaanalysis of randomized, controlled clinical trials. *J Hypertens.* 2005;23:475-481.
- [3] Montonen J, Knekt P, Jarvinen R, Aromaa A, Reunanen A. Whole-grain and fiber intake and the incidence of type 2 diabetes. *Am J Clin Nutr.* 2003;77:622-629.
- [4] Lairon D, Arnault N, Bertrais S, et al. Dietary fiber intake and risk factors for cardiovascular disease in French adults. *Am J Clin Nutr.* 2005;82:1185-1194.
- [5] Petruzzello L, Iacopini F, Bulajic M, Shah S, Costamagna G. Review article: uncomplicated diverticular disease of the colon. *Aliment Pharmacol Ther.* 2006;23:1379-1391.
- [6] Brown L, Rosner B, Willett WW, Sacks FM. Cholesterol lowering effects of dietary fiber: a meta-analysis. *Am J Clin Nutr.* 1999;69:30-42.
- [7] Keenan JM, Pins JJ, Frazel C, Moran A, Turnquist L. Oat ingestion reduces systolic and diastolic blood pressure in patients with mild or borderline hypertension: a pilot trial. *J Fam Practice.* 2002;51:369-375.

- [8] Anderson JW, Randles KM, Kendall CWC, Jenkins DJA. Carbohydrate and fiber recommendations for individuals with diabetes: a quantitative assessment and meta-analysis of the evidence. *J Am Coll Nutr*. 2004;23:5–17.
- [9] Marangoni F, Poli A. The glycemic index of bread and biscuits is markedly reduced by the addition of a proprietary fiber mixture to the ingredients. *Nutr Metab Cardiovasc Dis* 2008; 18:* 602–5.
- [10] Meyer KA, Kushi LH, Jacobs DR Jr., Slavin J, Sellers TA, Folsom AR. Carbohydrates, dietary fiber, and incident type 2 diabetes in older women. *Am J Clin Nutr* 2000; 71: 921–30.
- [11] Karhunen LJ, Juvonen KR, Flander SM, et al. A psyllium fiber-enriched meal strongly attenuates postprandial gastrointestinal peptide release in healthy young adults. *J Nutr* 2010; 140: 737–44.
- [12] Ostman EM, Frid AH, Groop LC, Björck IM. A dietary exchange of common bread for tailored bread of low glycaemic index and rich in dietary fibre improved insulin economy in young women with impaired glucose tolerance. *Eur J Clin Nutr* 2006; 60: 334–41.
- [13] Brennan CS. Dietary fiber, glycaemic response, and diabetes. *Mol Nutr Food Res*. 2005;49:560–70. doi: 10.1002/mnfr.200500025. [PubMed]
- [14] Meyer KA, Kushi LH, Jacobs DR Jr., Slavin J, Sellers TA, Folsom AR. Carbohydrates, dietary fiber, and incident type 2 diabetes in older women. *Am J Clin Nutr* 2000; 71: 921–30.
- [15] Wannamethee SG, Whincup PH, Thomas MC, Sattar . Associations between dietary fiber and inflammation, hepatic function, and risk of type 2 diabetes in older men: potential mechanisms for the benefits of fiber on diabetes risk. *Diabetes Care* 2009; 32: 1823–5.
- [16] Foster-Powell K, Holt SH, Brand-Miller JC. International table of glycemic index and glycemic load values: 2002. *Am J Clin Nutr*. 2002; 76:5–56. [PubMed]
- [17] Gibaldi, M. and D. Perrier, 1982. Pharmacokinetics. 2nd Rev. Ed. Marcel Dekker, New York.
- [18] Wolever TMS, Boume GH (eds) (1990): The glycemic index. Aspects of some Vitamins, minerals and enzymes in health and diseases. *World Review Nutr Diet* 62, 120-185.
- [19] Gopalan C, Rama Sastri BV, Balasubramanian SC. nutritive Value of Indian Foods. Hyderabad: national Institute of nutrition, Indian Council of Medical Research; 2004.

AUTHORS

First Author – Shweta Sharma, Research Scholar, Department of Home Science, Govt. KRG PG Autonomous College, Gwalior, shweta.sharma138@gmail.com

Second Author – Seema Rana, Research Scholar, Department of Home Science, Govt. KRG PG Autonomous College, Gwalior, seemar02@gmail.com

Third Author – Charu Katare, Asst. Prof. of Home Science, Govt. KRG PG Autonomous College, Gwalior, katarecs@gmail.com

Correspondence Author – Shweta Sharma, shweta.sharma138@gmail.com, 08126915147, 09617670111

Performance Analysis of Diffraction Gain (G_d) Due to presence of Knife-Edge as Compared to Free Space E-Field and Identifying the Position of Obstacle in a Fresnel Zone

P.Sankara Rao

* Department of Electronics and Communication Engineering, Coastal Institute of technology and Management, kottavalasa

Abstract- This paper describes the concepts of diffraction, diffraction gain, diffraction loss, field strength at receiver due to knife-edge obstacles between the propagation path of the signal i.e. b/w transmitter and receiver. This paper also present the complete idea of identifying the position of obstacle in a Fresnel zone, diffraction loss, position of obstacle with varying distances b/w source and field and varying heights of obstacles in a Fresnel-zones represented by tabular forms and appropriate charts. The calculation, based on an approximate evaluation of the contribution of individual Fresnel zones to the total field, leads to the Fresnel theorem: the total field is just one-half that due to the first zone alone.

We show here that if the Fresnel zones are defined on a plane passing through the midpoint of the line joining the source point to the field point, the field due to each Fresnel zone may be calculated exactly. When the Fresnel zones are defined on a plane perpendicular to the line between the source and field points, the contribution of the first zone is equal to the total field multiplied by the factor $1 + (1 + \pi/nd')^{-2}$. Here, n is the wave number and d' is the distance separating source and field points. Thus, for this geometry, the Fresnel theorem holds only in the limit $nd' \gg 1$; for arbitrary nd' , the factor quoted must be used.

Index Terms- Diffraction gain(G_d), Knife-edge obstacle, Fresnel-zone geometry,, Fresnel-Kirchhoff's diffraction parameter(v), Diffraction loss, obstructing screen, Field strength(F), Shadowing effect LOS distance.

I. INTRODUCTION

In a mobile radio channel, Signal interference due to the earth and its atmosphere was not considered. Despite the fact that "free space analysis" may be adequate to provide a general understanding of radar systems, it is only an approximation. In order to accurately predict radar performance, we must modify free space analysis to include the effects of the earth and its atmosphere[2]. This modification should account for ground reflections from the surface of the earth, diffraction of electromagnetic waves, bending or refraction of radar waves due to the earth atmosphere, and attenuation or absorption of radar energy by the gases constituting the atmosphere.

The earth atmosphere is compromised of several layers. The first layer which extends in altitude to about 20 Km is known as the troposphere. Electromagnetic waves refract (bend

downward) as they travel in the troposphere[3]. The troposphere refractive effect is related to its dielectric constant which is a function of the pressure, temperature, water vapour, and gaseous content. Additionally, due to gases and water vapour in the atmosphere radar energy suffers a loss. This loss is known as the atmospheric attenuation[2]. Atmospheric attenuation increases significantly in the presence of rain, fog, dust, and clouds. The region above the troposphere (altitude from 20 to 50 Km) behaves like free space, and thus little refraction occurs in this region. This region is known as the interference zone. The ionosphere extends from about 50 Km to about 600 Km. It has very low gas density compared to the troposphere. It contains a significant amount of ionized free electrons. The ionization is primarily caused by the sun's ultraviolet and X-rays. This presence of free electrons in the ionosphere affects electromagnetic wave propagation in different ways. These effects include refraction, absorption, noise emission, and polarization rotation. Diffraction allows radio signals to propagate around the curved surface of the earth, beyond the horizon, and to propagate behind obstacles[8].

II. DIFFRACTION

Diffraction is the term used to describe the phenomenon of electromagnetic waves bending around the obstacles. In a radar system it is very important at very low altitudes[3]. Hills, mountains, buildings diffract radio energy and make possible to perform detection in regions that are physically shadowed. However, in these situations many assumptions made, here knife-edge obstacle is the very important and it is consider to be perfect conductor.

III. FRESNEL-ZONE GEOMETRY

The concept of diffraction loss as a function of the path difference around an obstacle is explained by Fresnel-zones. Fresnel zones represent successive regions secondary waves have a path length from the T_r to R_e which are $n\lambda/2$ which is greater than the total path length of a line-of-sight path[4].

Let we consider heights of antennas are h_{tr} and h_{re} of same heights, when a signal transmitted from source it encounters a knife-edge obstructing screen of effective h with infinite width height h_{keo} due to this obstacle signal is diffracted around it,

which causes some loss of signal strength when compared to free space transmission. The loss occurs due to this obstacle is known as "Diffraction loss"[7][2]. Assume $h_{keo} \ll d_{tkeo}$, d_{rkeo} (terminal distances from obstacle), $\lambda \ll h_{keo}$, then the difference b/w the direct path and diffracted path, called the excess path length or path difference(Δ) it can be obtained from the geometry and is given by

$$\Delta = h_o^2(d_{tkeo} + d_{rkeo}) / 2(d_{tkeo})(d_{rkeo}) \text{ -----(1)}$$

d_{tkeo} = distance b/w source to knife-edge
 d_{rkeo} = distance b/w receiver to knife-edge

The corresponding path difference is given by
 $\Phi = 2\sqrt{\Delta} / \lambda \text{ -----(2)}$

From figure -1 $\tan \alpha = x$, then

$$\alpha = \beta + \gamma \text{ from figure-1}$$

$$= h_o(d_{tkeo} + d_{rkeo}) / (d_{tkeo})(d_{rkeo}) \text{ -----(3)}$$

from equations 1&2 we can derive dimensionless Fresnel's - Kirchhoff diffraction parameter v which is given by

$$v = h\sqrt{2(d_{tkeo} + d_{rkeo})} / \lambda(d_{tkeo})(d_{rkeo}) \text{ -----(4)}$$

where α in radians and Φ can be expressed as

$$\Phi = \pi v^{2/2} \text{ -----(5)}$$

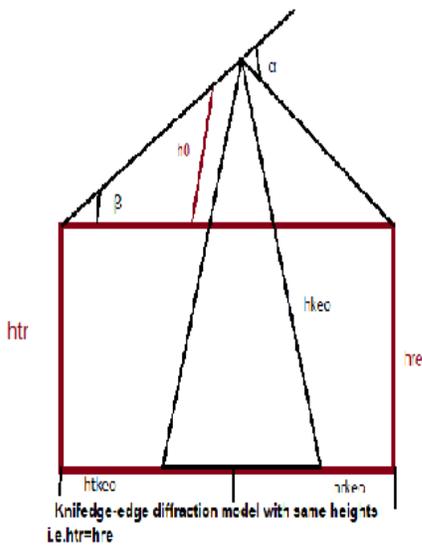
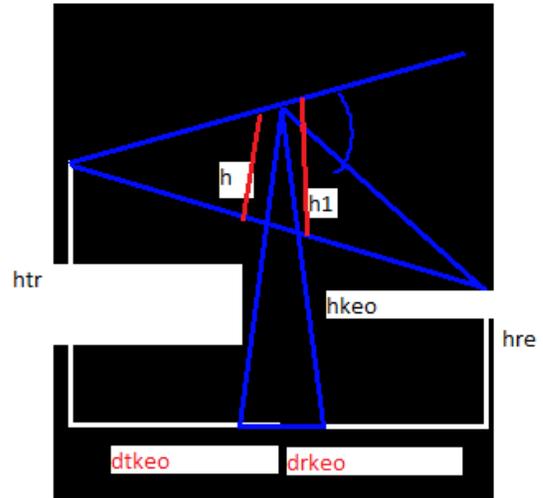


Figure-1

By using the above formulas we can estimate the diffraction parameter(v) with respect to obstructing screen of height(h). v changes accordingly with h as shown in table-1 and graph-1



Knife-edge diffraction model with different heights i.e. h_{tr} not equal to h_{re}
 figure-2

IV. VARIATION OF DIFFRACTION PARAMETER(v) WITH OBSTRUCTING SCREEN OF EFFECTIVE HEIGHT(h) $\lambda=1/3, D_1=1\text{KM}, D_2=1\text{KM}$

S.NO	Height(h)	Diffraction parameter(v)
1	0	0
2	5	0.547
3	10	1.095
4	15	1.6425
5	20	2.19
6	25	2.74
7	-5	-0.547
8	-10	-1.095
9	-15	-1.6425
10	-20	-2.19
11	-25	-2.74

TABLE-

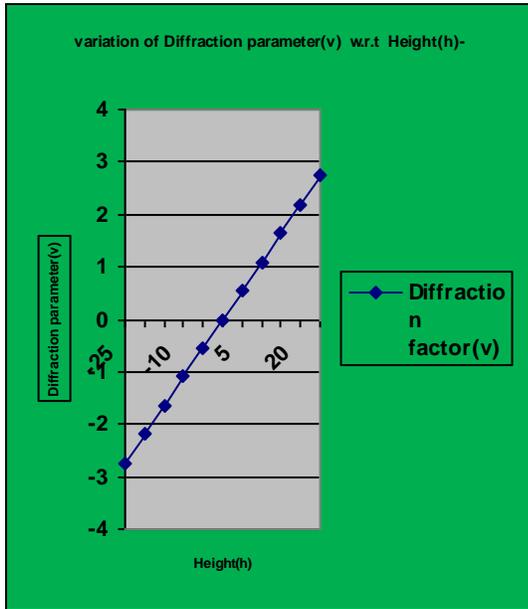


Figure-3

V. ANALYSIS ON RADIOUS OF FRESNEL ZONES WITH TERMINAL DISTANCES OF OBSTACLE

$$r_n = \sqrt{n\lambda (d_{tkeo})(d_{rkeo}) / (d_{tkeo} + d_{rkeo})} \quad (6) \text{ is only for } d_{tkeo}, d_{rkeo} \gg r_n$$

Radius of Fresnel zone with $d_{tkeo} = 2\text{km}$, $d_{rkeo} = 1\text{km}$, $\lambda = 1/3\text{m}$, $d_{tkeo}, d_{rkeo} \gg r$, $f = 3\text{Ghz}$.

n =number of Fresnel zones, r =radius of Fresnel zone

S. no	n	r	Path length	Path loss
1	1	13	$\lambda/2$	168.012dB
2	2	18	λ	
3	3	22	$3\lambda/2$	
4	4	26	2λ	
5	5	29	$5\lambda/2$	

Table-2

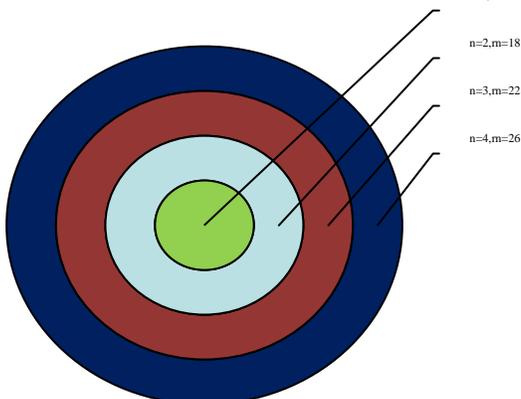


Figure-4 Circles which represents the boundaries of Fresnel zones.

From the tabular values it is observed that path travelling through the smallest circle corresponding to $n=1$. If n increases then path length increased by $\lambda/2$ (excess path length) as shown in figure. It is understood from the above analysis that shadowing is sensitive to frequency as well as the position of the obstacle with reference to Tr&Re[5].

VI. DIFFRACTIONLOSS

In mobile communication systems during the propagation of signal the direct line-of-sight is obstructed by a single object (of height h_{keo}), such as a mountain or building, the attenuation caused by diffraction over such an object can be estimated by treating the obstruction as a diffracting knife-edge. Diffraction loss takes place due to knife-edge diffraction it occurs from blockage of secondary waves such that only some portion of the energy is diffracted round an obstacle[6]. Due to this it allows some portion to the receiver. Depending on the Fresnel geometry energy will be a vector sum of the energy received from all unobstructed Fresnel zones, this loss will be clearly understood from the following numerical approximations.

Diffraction gain due to the presence of Knife-edge obstacle as compared to free space E-field i.e.

$$G_d (\text{Db}) = 20 \log |F(v)| \quad (7)$$

VII. VARIATION OF (G_d) WITH DIFFRACTION PARAMETER(v) DUE TO PRESENCE OF KNIFE-EDGE OBSTACLE.

VIII.

s.no	height(h)	diffraction parameter (v)	diffraction gain (G _d) in dB
1	0	0	-6.02 ≈ 6
2	5	0.54	-14.27 ≈ 14
3	10	1.09	-14.55 ≈ 15
4	15	1.642	-17.5 ≈ 18
5	20	2.19	-20 ≈ 20
6	25	2.74	-21.711 ≈ 22
7	-5	-0.54	-1.568 ≈ 2
8	-10	-1.09	0 ≈ 0
9	-15	-1.642	0 ≈ 0
10	-20	-2.19	0 ≈ 0
11	-25	-2.74	0 ≈ 0

Table-3

variation of diffraction gain(Gd) with diffraction parameter(v)

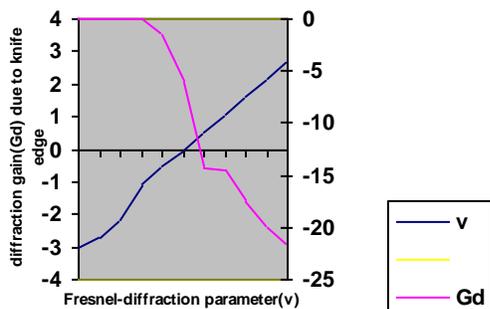


Figure-5

IX. IDENTIFYING THE POSITION OF OBSTACLE IN A FRESNEL ZONE

Number of zones $n=2 \Delta / \lambda$ ------(8) where

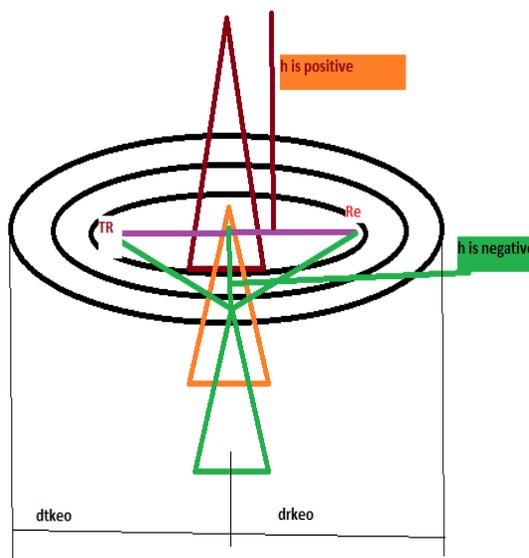
$$\Delta = \frac{h^2(dtkeo+drkeo)}{2(dtkeo)(drkeo)}-----(9)$$

$d1=2km, d2=1km$

S. no	h	Δ	(λ)	n	Comment on the position of the obstacle
1	0	0	1/3	1	Tip lies in the 1 st zone.
2	5	0.025	1/3	1	Tip lies in the 1 st zone.
3	10	0.1	1/3	1	Tip lies in the middle of 1 st zone.
4	15	0.225	1/3	2	Tip of the obstacle completely covers 1st Fresnel zone
5	20	0.4	1/3	3	Tip of the obstacle completely covers 2 ND Fresnel zone
6	25	0.625	1/3	4	Tip of the block completely covers 3 Fresnel zones
7	-25	0.625	1/3	4	Obstruction is below the LOS(since height is negative)

Table-4

Note:-If path difference increases number of zones increased.



Circles representing fresnel-zones for different knife-edge conditions.

Figure-6

X. VARIATION OF PATH DIFFERENCE(Δ) WITH OBSTRUCTING SCREEN OF HEIGHT(h_0) $D1=2KM, D2=1KM, \lambda= 1/3M$

s. no	ho	Δ
1	0	0
2	5	0.025
3	10	0.1
4	15	0.225
5	20	0.4
6	25	0.625
7	0	0
8	-5	0.025
9	-10	0.1
10	-15	0.225
11	-20	0.4
12	-25	0.625

Table-5

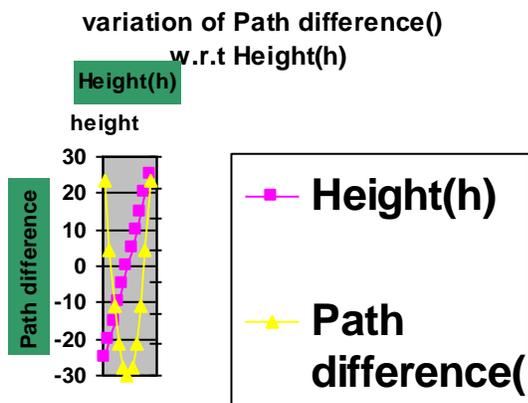


Figure-7

**XI. VARIATION OF FIELD STRENGTH(F) WITH
 TERMINAL DISTANCE(DTRRE)**

LOS Distance= $4.12(\sqrt{h_t} + \sqrt{h_r})$ -----(10)
 $=4.12(\sqrt{100} + \sqrt{16})=57.68\text{km}$

Field strength at 10km

$E_r = 88(\sqrt{P_t})ht \text{ hr} / d_{tr \text{ re}}^2 \lambda \text{ v/m}$ ----(11)

s.no	λ	ht	hr	P_t	d_{trre}	F
1	3	100	25	40kw	5km	58.6mv/m
2	3	100	25	40kw	10km	147mv/m
3	3	100	25	40kw	15km	65.1mv/m
4	3	100	25	40kw	20km	58.6mv/m
5	2	100	25	40kw	5km	880mv/m
6	2	100	25	40kw	10km	220mv/m
7	2	100	25	40kw	15km	97.7mvm
8	2	100	25	40kw	20km	55mv/m
9	1/3	100	25	40kw	5km	5.285v/m
10	1/3	100	25	40kw	10km	1.321v/m
11	1/3	100	25	40kw	15km	0.587v/m
12	1/3	100	25	40kw	20km	0.330v/m

Table-6

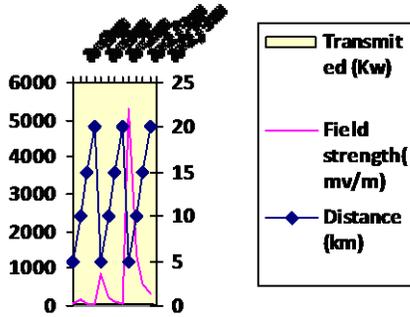


Figure-6 Field strength(F) w. r. t Distance(d_{trre}) b/w T_r & R_e

XII. VARIATION OF BASIC PATHLOSS(Δ) w. R. T DISTANCE B/W TERMINALS

Basic path loss= $32.45+20\log_{10}f\text{Mhz}+20\log_{10}d\text{km}$ ----(12)

Path loss calculations f=3Ghz

s.no	d trre	f=3Ghz	path loss in db
1	1000	3Ghz	161.992
2	5000	3Ghz	175.971
3	10000	3Ghz	181.99
4	15000	3Ghz	185.51
5	20000	3Ghz	188.01
6	25000	3Ghz	189.95
7	30000	3Ghz	191.534

Table-7

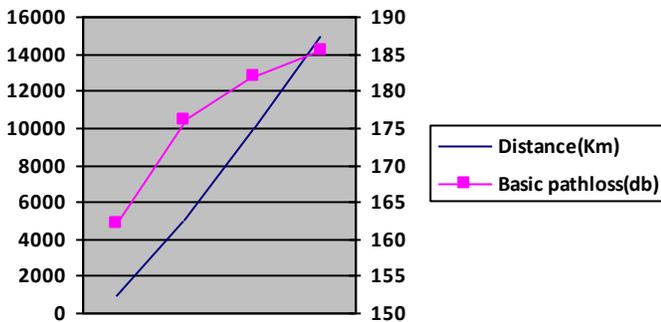


Figure-7 Basic path loss w. r. t Distance b/w T_r & R_e

This is the simplest of diffraction models, and the diffraction loss in this case can be readily estimated using the classical Fresnel solution for the field in the shadow behind a

half-plane[1]. Thus, the electric field strength, E_d, of a knife-edge diffracted wave is given by field strength in the shadowed region is given by

$E_d/E_0=F(v)=(1+J)/2 \int \exp((-j)[t^2]/2)dt$ -----(13)

where E₀ is the free space field strength in the absence of the knife-edge and F(v) is the complex Fresnel integral which is a tabulated function of the diffraction parameter[2].

$v=h\sqrt{2(dtkeo+ drkeo)/ \lambda(dtkeo)(drkeo)}$ ----- (14)

Where ‘dtkeo’ and ‘drkeo’ are the terminal distances from the knife edge. The diffraction loss, additional to free space loss and expressed in dB, can be closely approximated

XIII. CONCLUSION

Now a days, an increasing demand of mobile communications requires high quality of transmission with less price, it is possible only with high quality research .This paper may gives complete idea to minimize diffraction losses by adopting the above numerical approximations, graphical representations and tabular forms.

ACK NOWLEDGEMENT

The author would like to thank Dr.Varughese, Hon.Secretary, IETE,Visakhapatnam Centre and also to our Principal Dr. V.R.K.Narasimha Raju, Coastal Institute Of Technology and Management, Andhra Pradesh, INDIA, for giving their valuable suggestions& guide lines in preparing this Journal.

REFERENCES

- [1] John D Kraus, Ronald J Marheka, Ahmad S Khan, Antennas and Wave propagation, 4thEdition(2010), Tata McGraw Hill, New Delhi.
- [2] Theodore S. Rappaport, Wireless Communications, Principles and practice, second edition.
- [3] K.D. Prasad, Antenna and Wave propagation, 3rdEdition, New Delhi.
- [4] Fock, V.A Electromagnetic Diffraction and Propagation Problems, pp 254-275, Pergamon Press,New York, 1965.
- [5] Wait, J.R: “Electromagnetic surface waves”, Advances in Radio Research,1, New York, Academic press pp. 157-219,1964.Academic press
- [6] Walker, J., Halliday, D., & Resnick, R. (2011). Fundamentals of physics. Hoboken, NJ: Wiley.
- [7] Soundara Rajan. V.: Antenna Theory and and Wave propagation”, Scitech Publications(India) Pvt.Ltd,Chennai,2001. 3rdEdition, New Delhi. “ Anderson, Leland I. (2002).
- [8] Dhar,p.c.: “Electromagnetic Field Theory, “Antenna Theory and and Wave propagation”, Dhanpat Publishing Co. Pvt Ltd, New Delhi ,2001.
- [9] Gautam, A.K.: “Antenna and Wave propagation”, S.K. Kataria and Sons, Delhi, IIND Edition,2004.
- [10] C. Balannis, Antenna Theory-Analysis and Design. .New York: Wiley, 1982.

AUTHORS

First Author – P.Sankara Rao, Department of Electronics and Communication Engineering, Coastal Institute of technology and Management, kottavalasa, Email: Sankar.ecehod@gmail.com

Sex Pre-selection by Quantification of Y- Chromosome Bearing Spermatozoa in Goat Species

Sureka P*, Nilani K*, Eswaramohan T* and Balasubramaniam K**

* Department of Zoology, Faculty of Science, University of Jaffna, Jaffna, Sri Lanka

** Bio Tec, Thirunelvely, Jaffna, Sri Lanka

Abstract- Fractionation of female and male spermatozoa has been practiced for selection of preferred sex of offspring to increase the profit in livestock industries. Furthermore, female calves are desired by the farmers for enhancing milk production in dairy cows, whereas in goats farmers prefer male calves than female calves for beef production. Meanwhile sexed semen for AI purpose in SL has been importing from India with high cost. Thus the objective of the present study is to separate 'Y' chromosome bearing sperm through low cost method for sustaining the male goat requirement satisfying the demands of male sex goat. Sucrose stock solution (2g/ml) was prepared. It was diluted with sodium citrate buffer solution to obtain the following densities such as 1g/ml, 1.1g/ml, 1.12g/ml and 1.13g/ml. The density gradient was prepared by pipetting 0.5ml of each sucrose solution along the wall of the tube and layered without mixing one another and then 10 μ l of diluted semen was dropped on the top of the layer. Then it was centrifuged (at 500 x g for 12 minutes at 24°C) for sexing the semen by means of density gradient and then each layer was examined to get the percentage of Y-bearing chromosome after eluting each layers. Statistical analysis was performed by using Prism 5.04. One way ANOVA with Bonferroni test was performed to compare the percentage of 'Y' chromosome in each sucrose gradient layer. The percentage of 'Y' chromosomes decreased significantly ($P < 0.05$) for 1g/ml (59 ± 2.466 , $62.56 \pm 2.657\%$), 1.11g/ml (52.33 ± 0.8819 , $56.75 \pm 0.866 \%$), 1.12g/ml (41.00 ± 1.155 , $45.34 \pm 1.115 \%$) and 1.13g/ml (33.67 ± 0.8819 , 43.9 ± 1.617) in Sannan and Jamunapari respectively. The present study revealed that this technique can be considered to establish low cost semen sexing in developing countries.

Index Terms- Artificial insemination, Goat breed, Sexing, Y chromosome.

I. INTRODUCTION

Fractionation of female and male spermatozoa has been practiced for selection of preferred sex of offspring to increase the profit in livestock industries. Furthermore, female calves are desired by the farmers for enhancing milk production in dairy cows, whereas in goats farmers prefer male calves than female calves for beef production. Sperm sexing with density gradient has been performed using the physical characteristics of spermatozoa such as differences in size and shape, density, electrical surface charges, surface macromolecular protein, and different effect of atmospheric pressure to distinguish X- from Y-chromosome bearing sperms (Yan et al., 2006). There are several

methods for fractionation of male and female spermatozoa namely selection of pre-implantation embryos using H-Y antigen, sex-specific antibody binding, swim-up method, density gradient separation, electrophoresis, sexing through Sephadex gel filtration method, albumin centrifugation, sedimentation and flow fractionation. In these techniques, flow cytometry has been used as the most reliable method for separating X- and Y-bearing sperm, but there are some disadvantages in flow sorting, such as damages to sperm and possibility of alteration in mRNA expression of embryos, high equipment cost and maintenance etc. Garner, (2006) stated that flow cytometry separates X and Y-bearing sperms by DNA content with an accuracy of 90%.

Centrifugation using sucrose gradient has often been used to fractionate the cell organelles from crude cellular extracts. Sucrose has been utilized as a commercial medium, low cost and readily available reagent for the density-gradient separation of goat spermatozoa. Typically, a sucrose density gradient has been established by gently overlaying less density sucrose solution on densest solution in a centrifuge tube. The particles travel through the gradient until they reach the point in the gradient at which their density matches that of the surrounding sucrose. This fraction can then be removed and subjected to further analysis (Raposo, 1996). Meanwhile sexed semen for AI purpose in SL has been importing from India with high cost. Therefore farmers in the developing countries are unable to use flow cytometrically sexed semen to manipulate the sex of offspring in cattle farming. Thus the specific objective of the present study is to separate 'Y' chromosome bearing sperm through low cost method for sustaining the male goat requirement satisfying the demands of male sex goat.

II. MATERIAL AND METHODS

Semen collection

Semen of Sannan and Jamunapari were collected with the help of an artificial vagina twice a week since October 2010 from AI centre at Thirunelvely. Warm water (39-40°C) and air were injected into an artificial vagina to maintain the proper temperature and pressure for the ejaculation. The rubber part of the artificial vagina was lubricated by Vaseline. Then semen was collected into the graduated tube when the buck mounted a doe in heat.

Sucrose density gradient preparation

Stock solution preparation

20g sucrose was weighed by using electronic balance and it was dried in the oven. It was dissolved in 10 ml of sodium citrate

buffer. The stock solution (2g/ml) was diluted with sodium citrate buffer solution to obtain following densities such as 1g/ml, 1.11g/ml, 1.12g/ml and 1.13g/ml.

Separation of ‘Y’ bearing chromosome of goat semen

Progressively less dense sucrose solutions were layered upon one another (1g/ml, 1.11g/ml, 1.12g/ml and 1.13g/ml). 0.5ml of each sucrose solution was loaded into the eppendorf tube by using the micropipette without mixing. Then 10µl of diluted semen was layered at the top of sucrose solution. They were then centrifuged at 500 x g for 12 minutes at 36°C. Then the layers were carefully aspirated by using micropipette one by one to transfer into the four eppendorf tubes. They were then centrifuged 700x g for 5 minutes at 36°C. Pellet was separated from each eppendorf tube. After centrifugation pellet was treated with Orcein red (2%) and Giemsa (0.75%) stain to determine the percentage of X and Y chromosomes. One drop of stained sample was placed on the slide over which cover slip was placed by using needles. Cover slip was pressed by using thumb. Then each slide was examined under Olympus microscope (oil immersion objective). Sperm motility using hemocytometer (improved NEUBAUER) and stopwatch, acrosome integrity using Giemsa (0.75%) were determined before and after sperm sexing.

Statistical analysis

Statistical analysis was performed by using GraphPad Prism 5.04. One way ANOVA with Bonferroni multiple comparison test was performed to compare the percentage of ‘Y’ chromosome in each sucrose gradient layer.

III. RESULTS AND DISCUSSION

The results of present study indicated that average percentage of ‘Y’ chromosome was higher in less dense media (1g/ml, 1.11g/ml) than other layers. When compared with the theoretical sex ratio (50:50), higher numbers of female sperms were settled at the bottom fractions in our experiment. Sperm motility and acrosome integrity before separation were slightly higher than after the centrifugation. Sucrose was used to prepare density gradient, because sucrose does not affect the sperm cells. Before the preparation of stock solution, sucrose was placed in the oven at 55-60°C to remove the moisture content of sugar. Siméon, (2004) stated that Percoll gradient density has been used extensively for spermatozoa selection, due to Percoll's effectiveness and it's comparatively better selection compared with simple washing or swim-up preparation, but Percoll's reagents are highest cost than sucrose. During the preparation of stock solution, warmed sodium citrate buffer was used to increase the dissociation of sugar particles. Sodium citrate doesn't affect the sperm viability and maintain the pH. The addition of sodium citrate buffer helps to control the pH of the medium and regulation of the osmotic pressure. Before the dilution, stock solution was filtered with 0.2 µl filter to remove the microorganism and impurities.

Table 1: The percentage of ‘Y’ chromosomes decreased significantly (P<0.05) in Sannan and Jamunapari

Sucrose gradient	Goat species	
	Sannan	Jamunapari
1g/ml	59.25 ± 2.562	62.56 ± 2.657
1.11g/ml	52.00 ± 0.816	56.75 ± 0.866
1.12g/ml	41.00 ± 0.816	45.34 ± 1.115
1.13g/m	33.00 ± 0.912	43.9 ± 1.617

Table 2: Comparison of percentage of ‘Y’ chromosomes in different sucrose gradient layers in Jamunapari

Bonferroni's Test	P < 0.05
1g/ml vs 1.11g/ml	No
1g/ml vs 1.12g/ml	Yes
1g/ml vs 1.13g/ml	Yes
1.11g/ml vs 1.12g/ml	Yes
1.11g/ml vs 1.13g/ml	Yes
1.12g/ml vs 1.13g/ml	No

Table 3: Comparison of percentage of ‘Y’ chromosomes in different sucrose gradient layers in

Bonferroni's Test	P < 0.05
1g/ml vs 1.11g/ml	No
1g/ml vs 1.12g/ml	Yes
1g/ml vs 1.13g/ml	Yes
1.11g/ml vs 1.12g/ml	Yes
1.11g/ml vs 1.13g/ml	Yes
1.12g/ml vs 1.13g/ml	No

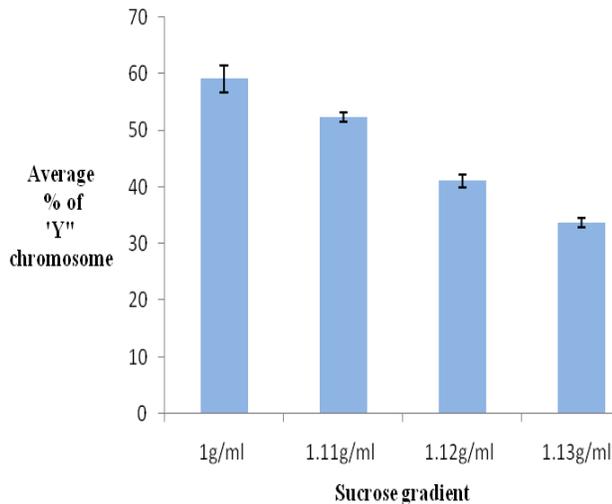


Figure 1: Average percentage of 'Y' chromosome in each density gradient layer of Sannan.

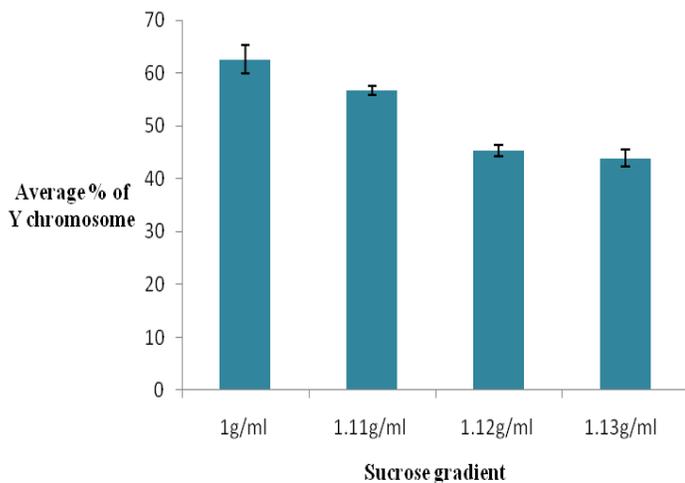


Figure 2: Average percentage of 'Y' chromosome in each density gradient layer of Jamunapari

In goat species Y-sperms are lighter than X-sperms due to the lower DNA content than female sperms. Heavier spermatozoa should settle down faster than lighter spermatozoa through sucrose gradient, therefore centrifugation time could positively influence X-bearing sperm moving down the gradient. Most of the methods for sexing were based on suggested physical differences between X and Y sperm, such as swimming velocity, density, surface charge, or presence of H-Y antigen (Amann, 1989; Johnson, 1992; Windsor *et al.*, 1993; Johnson, 1994; 1996). X chromosome was identified by its shape and thickness than Y chromosome. We considered the sperms as Y-chromosome bearing sperm in the absence of X chromosome, because identification of Y-chromosome was difficult as its shape and size was confused with the autosomes. During slide preparation some sperms head did not break, therefore it was unable to identify the X, Y chromosome in all sperms. Nail polish was used in order to prevent run off of the sample and oil intrusion into the cover slip.

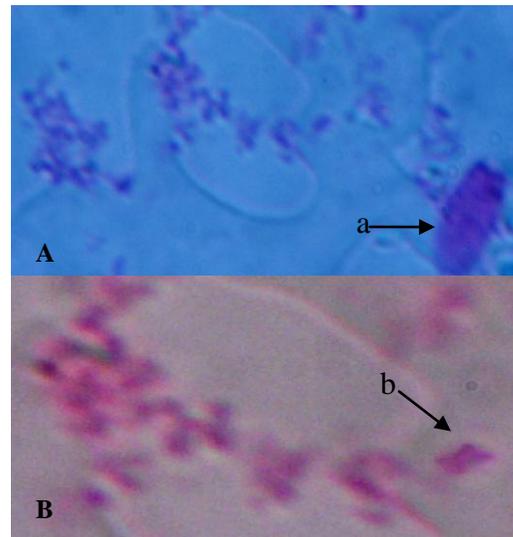


Figure 3: The assessment of 'X' chromosomes by using Giemsa (A) and Orcein red staining (B) in the goat semen, a- broken sperm head b- 'X' chromosome

Cattle have 60 chromosomes, 29 pair of autosomes and 1 pair of sex chromosomes. As in other mammals, males have an X and a Y chromosome and females have 2 X chromosomes. All of the autosomes are somewhat tear drop shaped, with the centromere at the end of the chromosome. Moruzzi, (1979) reported that sex chromosomes have the centromere in the middle of the chromosome, with the X being much larger than the Y. However Han *et al.*, (1993) and Lobel *et al.*, (1993) indicated that development of DNA technology is more precise methods to estimate the percentages of X and Y sperm in different fractions.

IV. CONCLUSION

Our present study suggested that the percentage of 'Y' chromosome was higher in 1g/ml solution than the other layers. Further study is needed for improvement of this gradient technique to enhance the higher meat production through male goat. There fore the present studies revealed that this technique can be considered to establish low cost semen sexing in developing countries.

ACKNOWLEDGEMENTS

We thank Dr.P. Mahadhevan (Artificial insemination centre, Thirunelvely) for providing the bull semen and Mr. P.J. Jude (reading for PhD degree in Dept of Zoology) for his help in identification of the X chromosome.

REFERENCES

- [1] J.F. Moruzzi, "Selecting a mammalian species for the separation of X- and Y- chromosome- bearing spermatozoa," *Journal of Reproduction and Fertility.*, 1979, 57: 319-323.
- [2] M.N. Simeon, "Comparison of Six Density Gradient Media for Selection of Cryopreserved Donor Spermatozoa," *Journal of Andrology.*, 2004, 25: 6.

- [3] G. Raposo, H.W. Nijman, W. Stoorvogel, "B lymphocytes secrete antigen-presenting vesicles," *Journal of Experimental Medicine.*, 1996, 183 (3): 1161.
- [4] R.P. Amann, "Treatment of sperm to predetermine sex," *Theriogenology* 1989, 31:49-60.
- [5] L.A. Johnson, "Gender preselection in domestic animals using flow cytometrically sorted sperm," *Journal of Animal Science.*, 1992, 70 (Suppl2):8-18.
- [6] L.A. Johnson, "Isolation of X- and Y-bearing sperm for sex preselection. In HM Charlton (ed): "Oxford reviews of reproductive biology," "Vol. 16. Oxford, UK: Oxford University Press, 1994, pp 303-326.
- [7] L.A. Johnson, Sex preselection by flow cytometric separation of X and Y chromosome-bearing sperm based on DNA difference: a review. *Reprod Int Dev* 7: 1996, in press.
- [8] D.P. Windsor, G. Evans, I.G. White, "Sex predetermination by separation of X and Y chromosome bearing sperm: a review," *Reproduction, Fertility and Development.*, 1993, 5:155-171.
- [9] T.L. Han, S.P. Flaherty, J.H. Ford, C.D. Matthews, "Detection of X- and Y-bearing human spermatozoa after motile sperm isolation by swim up," *Fertility and Sterility.*, 1993, 1160:1046-1051.
- [10] S.M. Lobel, R.J. Pomponio, G.L. Mutter, "The sex ratio of normal and manipulated human sperm quantitated by the polymerase chain reaction," *Fertility and Sterility.*, 1993, 59:387-392.
- [11] J. Yan, L. Huai, Z.J. Feng Chen, J.Hu, X. Gao, Y. Qin, "Influence of swim up time on the ratio of X- and Y- bearing spermatozoa," *European Journal of Obstetrics & Gynecology and Reproductive Biology.*, 2006, 129: 150-155.
- [12] D.L. Garner, "Flow cytometric sexing of mammalian sperm," *Theriogenology, Stoneham*, 2006, vol. 65, pp. 943-957.

AUTHORS

First Author – Ms. Sureka Paramsothy, Department of Zoology, Faculty of Science, University of Jaffna, Jaffna, Sri Lanka, Email: paramsothysureka@yahoo.com

Second Author – Ms. Nilani Kanesharatnam, Department of Zoology, Faculty of Science, University of Jaffna, Jaffna, Sri Lanka, Email: nilanik4@yahoo.com

Third Author – Dr. Thamboe Eswaramohan, Department of Zoology, Faculty of Science, University of Jaffna, Jaffna, Sri Lanka. Corresponding author

Fourth Author – Prof. Kandiah Balasubramaniam, Bio Tec, Thirunelvely, Jaffna, Sri Lanka.

Correspondence Author – Dr. T. Eswaramohan (Department of Zoology, Faculty of Science, University of Jaffna, Jaffna; email: eswaramohan@jfn.ac.lk, teswaramohan@gmail.com Mobile: 0713595778), Tel.: 0094(0)213737375; fax: 0094 (0) 212222685

Synthesis, Characterization and Thermal, Electrical study of CdS-Polyaniline Nanocomposite via Oxidation Polymerization

J. B. Bhaiswar^{*}, M. Y. Salunkhe^{**}, S. P. Dongre^{***}

^{*} Department of Physics, Institute of Science, Nagpur

^{**} Department of Physics, Institute of Science, Nagpur

^{***} Department of physics, Bhalerao Science College, Saoner

Abstract- Polyaniline/Cds nanocomposite has been prepared using chemical oxidation technique. The prepared products were characterized by FT-IR, XRD and Transmission electron Microscopy and TGA thermogram. FTIR absorption band at 414 cm⁻¹ indicated the presence CdS nanoparticles in the polymer matrix. The XRD study revealed the increased in crystalline nature of nanocomposite. TEM showed the CdS particles are in nanorange with the average diameter of 21 nm. Thermo gravimetric analysis clearly indicated the increased in thermal stability of nanocomposite than the pure PANI. The D.C electrical study of PANi/Cds nanocomposite clearly indicated that the CdS nanoparticles increased the electrical conductivity of polyaniline nanocomposite to 1.79x10⁻³ S/cm compared to the pure polyaniline (10⁻¹⁰ S/cm) and Silicon (10⁻⁴S/cm) semiconductors. Its electrical conductivity was found to be analogous with existing semiconducting metals [14].

Index Terms- polyaniline, electrical conductivity, thermal stability, cds nanoparticle

I. INTRODUCTION

Polymeric nanocomposites consisting of organic polymer and inorganic nanoparticles in a nanoscale regime represent a novel class of materials that have motivated considerable interest in recent years. These composites exhibit new advantageous properties and can be very different from those of their individual counterparts. It is therefore expected that this type of materials will play increasingly important roles in research and in numerous applications. They frequently have special properties and are significant for many technological applications, ranging from microelectronics to catalysis, optoelectronic devices, and synthesis of lubricant and preparation of electrolytes for rechargeable batteries [1–4]. Polyaniline (PANI) is one of the most interesting conducting polymers due to its low cost, good processability, environmental stability, unique active conduction mechanism [5] and reversible control of conductivity both by charge-transfer doping and protonation [6]. Inorganic semiconductors CdS, ZnS & PbS nanoparticles are the most promising materials used in various applications like sensors, optoelectronic devices and in solar cells. Studies on PANI-CdS nanocomposites have been reported by many researchers [7-10] and focused on electrical conductivity. This paper presents the d.c. electrical conductivity & thermal stability of PANI-CdS

nanocomposites in terms of TGA (Thermo-Gravimetric Analysis).

II. MATERIALS AND METHODS

All chemicals used in this investigation were of analytical reagent grade and used as received.

Only aniline was distilled prior to use.

2.1. Synthesis of Polyaniline via chemical oxidative polymerization:

Polymerization was carried out by the chemical oxidation of aniline in the presence of H₂SO₄ and APS (Ammonium persulphate) in 100ml distilled water both played the role as dopant and oxidant respectively. (0.4 mol) APS was dissolved in 100ml distilled water in a four-neck round bottom reaction flask and 0.4mol H₂SO₄ is also added under mechanical stirring for 2 hours. Aniline (0.4 mol) was stirred with 0.4mol of H₂SO₄ in 100ml distilled water. The solution of APS in H₂SO₄ was then added drop-wise in the solution of aniline with vigorous stirring on a magnetic stirrer for 3 hours to initiate the aniline polymerization. The reaction was later carried out at room temperature for 6-7 hours with stirring. A dark green colored PANi suspension was obtained with precipitation. The synthesized PANi was obtained as finely dispersed particles, which were recovered from the polymerization mixture by centrifugation and washed with deionized water repeatedly until the washing liquid was completely colorless. Finally, the mixture was filtered using filtered assembly. After keeping overnight, the dark gray color precipitate was obtained. A precipitate of polyaniline was dried under at 60 – 80°C for more than 8 hours.

2.2. Synthesis of PANi-Cds Nanocomposites:

The synthesis steps of PANi/Cds nanocomposite are similar to the synthesis method of PANi. Different amount of Cds were dispersed into the APS solution and stirred for 1 hour prior to the addition of aniline. Aniline (0.4 mol) stirred with 0.4mol H₂SO₄ in 100 ml of distilled water were added drop-wised using burette into the APS-Cds solution and stirred vigorously to form homogeneous dispersion. For convenience, PANi Composites were prepared with different weight percentages of Cds. Same synthesis conditions were maintained for all composites as that of pure PANi.

Characterizations

X-RD spectra of all samples were taken on Philips PW - 3071, Automatic X-ray diffractometer

Using Cu-K α radiation of wavelength 1.544 Å, continuous scan of 2° / min., with an accuracy of 0.01 at 45 KV and 40 mA. Fourier Transform Infra Red (FTIR) spectroscopy (Model: Perkin Elmer 100) of PANi: Cds nanocomposite was studied in the frequency range of 400–4000 cm⁻¹.

TGA thermograms of all samples were recorded on Perkin-Elmer Diamond TGA/DTA in argon atmosphere at a heating rate of 10°C/ min. TGA profile were taken over the temperature range of 30-800°C. The electrical conductivity measurement were made using four probe techniques.

III. RESULTS AND DISCUSSION

3.1. XRD Study

Fig.1. shows the XRD pattern of pure PANi in emeraldine base form, PANi/Cds Nanocomposite & cadmium sulphide powder. The XRD pattern of PANi shows the two broad peaks at 2 θ =20° and 25° with (111) & (110) plane and has an amorphous nature [11]. The degree of crystallinity increased in Pani/Cds nanocomposite than pure Pani and Cds, clearly indicated the homogeneous distribution of nanoparticles in the polymer matrix. The crystalline size of the crystalline particle can be

determined using Debye Scherer formula [$\frac{0.9\lambda}{\beta \cos \theta}$] and it is found that the grain size of PANi/Cds nanocomposite is (27.73nm).

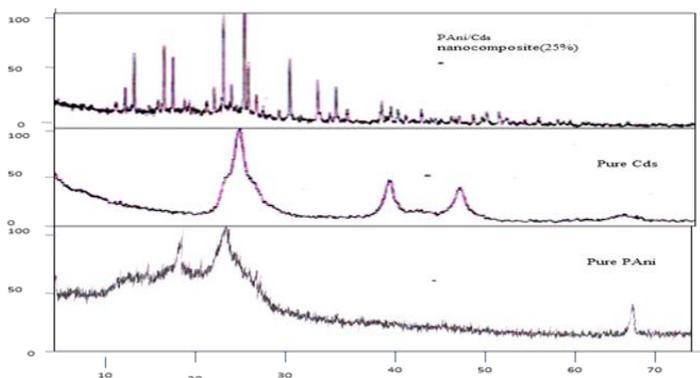


Fig.1.XRD pattern of Pure Pani, pure Cds and Pani/Cds nanocomposite.

3.2. FT-IR Spectroscopy:

Fig.2.shows the FT-IR spectra of pure PANi, Pani/Cds nanocomposite and pure Cds. The appearance of band at 1478 and 1559 cm⁻¹ are attributed to C=C stretching of the benzenoid and quinoid rings, respectively. The peak at 1240 cm⁻¹ corresponds to C-N stretching of secondary amine in polymer main chain and can be clearly seen in both the sample. The absorption band at 1144 cm⁻¹ has been originating from plane bending vibration of C-H. Absorption band near 2923 cm⁻¹ is assigned to aliphatic C-H stretching of the polymer. A weak vibration absorption peak at 414 cm⁻¹ for Cd-S bond was observed, shows the concentrations of CdS in the composites was low[14].

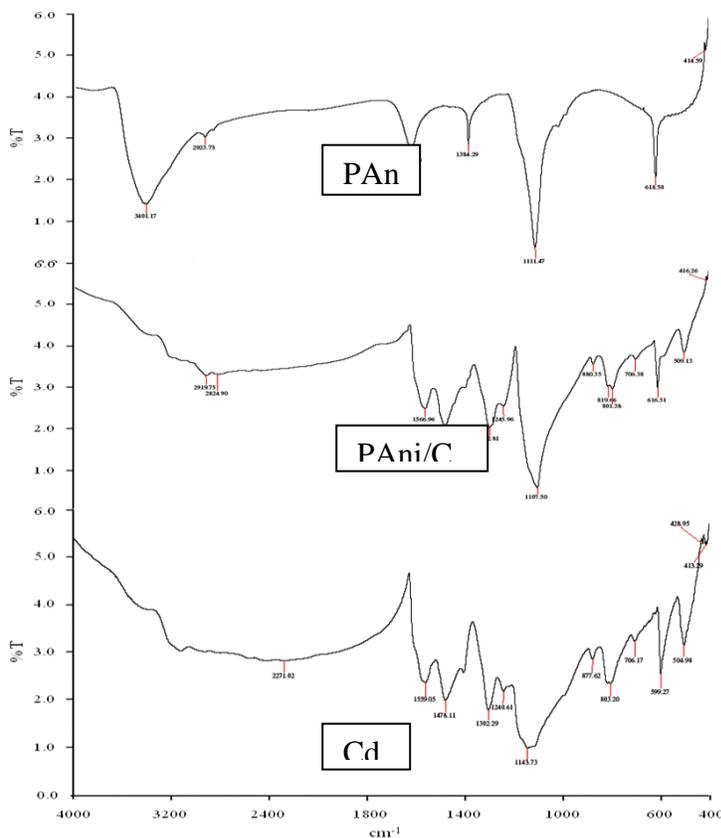


Fig.2.FT-IR spectra of Pure Pani, Pani/Cds nanocomposit, Pure Cds.

3.3. TEM of PANi/Cds Nacomposite:

Fig 3. Shows the micrograph of CdS nanoparticles. The average diameter of PANi/Cds nanoparticle which was synthesized using chemical oxidation technique is 21nm. The particle size of Cds nanoparticle is 60nm.

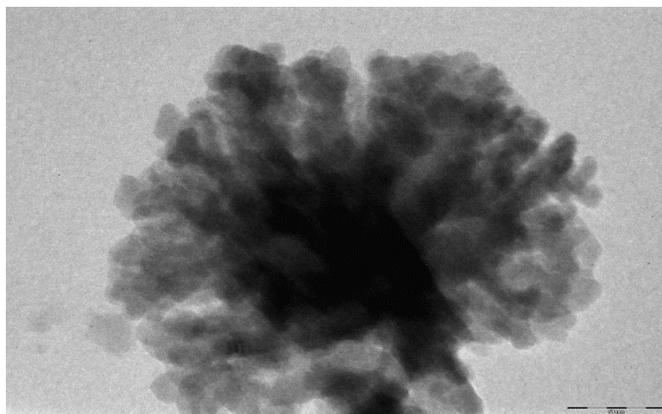


Fig.3.TEM image of Pani/Cds nanocomposite.

3.4. TGA Thermograph:

The results of TGA analysis for pure PANI and PANI/Cds nanocomposites are shown in Fig. 4. In the TGA thermograph of PANI/Cds, it can be observed that the losses of weight occurred around two temperature periods, ranging from 30 to 150 °C and around 400 to 600 °C. The first weight loss was mainly contributed by the elimination of impurities, residual water and

unreacted monomers. The second step weight loss which is attributed to the degradation of polymer main chain. The 50% weight loss of Pure Pani is attributed at temperature 320°C and in case of Pani/Cds nanocomposite it is at 600°C. This clearly indicated that the thermal stability for the nanocomposites has been improved significantly as higher decomposition temperature as compared to pure PANI in the TGA profile. It might be related to the combination of CdS nanocrystalline in the polymer matrix, which yielded stronger binding force due to the interaction between CdS nanoparticles and the lone pair electrons of N atom in the polymer backbone [12].

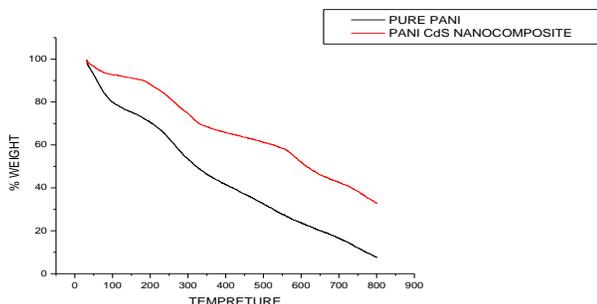


Fig: 4. TGA of pure PANI and PANI/CdS nanocomposite.

3.5. Electrical Conductivity:

The D.C electrical conductivity and the activation energy of the prepared sample of PANI/Cds nanocomposite with different wt % of CdS were calculated using Arrhenius equation (1) presented in given table.

$$\sigma(T) = \sigma_0 \exp\left(-\frac{E_0}{2kT}\right)$$

1.

Nanocomposite(wt % CdS)	Conductivity (S.cm ⁻¹)	Activation energy(e V)
5% Pani/Cds nanocomposite.	1.437×10^{-4}	0.24033
10% Pani/Cds nanocomposite	7.6201×10^{-5}	0.21233
15% Pani/Cds nanocomposite	3.747×10^{-4}	0.2137
20% Pani/Cds nanocomposite	9.5814×10^{-5}	0.12955
25% Pani/Cds nanocomposite	1.744×10^{-3}	0.0694

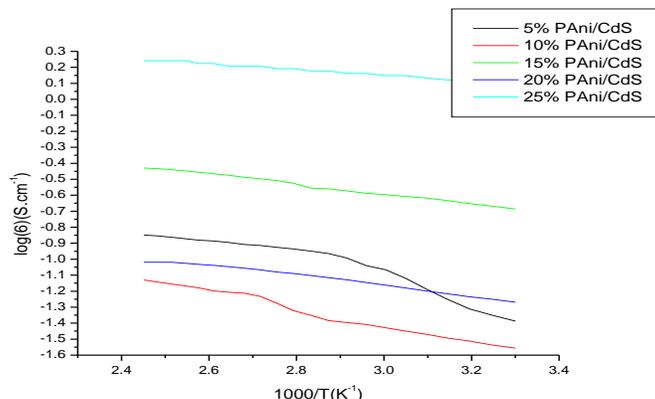


Fig.5. Electrical conductivity of PANI/Cds nanocomposite at different wt % of CdS.

The temperature dependence of electrical conductivity of CdS-polyaniline nanocomposite with different wt % of CdS shown in figure 5. XRD and FT-IR spectra demonstrated that CdS nanoparticles had been successfully incorporated into polymer chain. From this result it is believed that at suitable wt % of CdS in the polymer matrix were helped to increase the D.c electrical conductivity of the prepared nanocomposite due to increased in the degree of crystalline of CdS nanoparticles [14]. The conductivity of CdS-polyaniline (25%) (1.774×10^{-3} S/cm) nanocomposite were greater than pure polyaniline (10^{-10} S/cm) [13, 14], and other PANI/CdS nanocomposite.

IV. CONCLUSIONS

Polyaniline-coated cadmium supplied nanocomposites have been synthesized via chemical oxidation technique. The XRD study revealed the increased in the degree of crystallinity of nanocomposit. The concentration of the CdS in nanocomposites was low as a very weak vibration absorption peak of Cd-S bonding at 414 cm⁻¹ is observed in the FTIR spectrum. The average size of the nanocomposites is estimated to be 60 nm as observed in the TEM micrograph. The thermal stability for the nanocomposites has been improved as major mass losses occurred at higher decomposition temperature as compared to the pure polymer in the TGA profile.

REFERENCES

- [1] I. Honma, S. Hirakawa, K. Yamada, J.M. Bae, Solid State Ionics 118 (1999) 29.
- [2] T. Trindade, M.C. Neves, A.M.V. Barros, Scr. Mater. 43 (2000) 567.
- [3] S. Chen, W.M. Liu, L.G. Yu, Wear 218 (1998) 153.
- [4] W. Krawiec Jr., J.G. Scanlon, J.P. Fellner, R.A. Vaia, S. Vasudevan, E.P. Giannelis, J. Power Sources 54 (1995) 310.
- [5] A. J. Heeger, J. Phys. Chem. B 105, 8475 (2001).
- [6] A. G. MacDiarmid, Synth. Met. 84, 27 (1997).
- [7] Xiaofeng Lu, Youhai Yu, Liang Chen, Huaping Mao, , Wanjin Zhang & Yen Wei, Chem. Commun. 2004, 1522-1523 [DOI: 10.1039/b403105a]
- [8] X. Y. Ma, G. X. Lu, B. J. Yang, Applied Surface Science, 187, 2002, 235-238
- [9] Fan Jun, Ji Xin, Zhang Weiguang, Yan Yunhui, CJI, 6, 7, 2004, 45-49

- [10] D. Y. Godowsky, A. E. Varfolomeev, D. F. Zaretsky, J. Mater. Chem, 11, 2001, 2465-2469.
- [11] S. B. Kondawar, S. R. Thakare, V. Khati, S. Bompilwar, J. Modrn. Phys. B, 23, 15, 2009,
- [12] J.G. Deng, X.B. Ding, W.C. Zhang, Y.X. Peng, J.H.Wang, X.P. Long, P. Li, S.C. Chan, Polymer 43 (2002) 2179.
- [13] A G Mac Diarmid, "Synthetic metals: a novel role for organic polymers", Current Applied Physics vol. 1, no.4-5, pp., 269- 279, 2001 3297-3304.
- [14] Kose T.D, Ramteke S.P.international journal of composite materials: 2012, 2(4); 44-47.

AUTHORS

First Author – J. B. Bhaiswar, Department of Physics, Institute of Science, Nagpur, E-mail-jitendrabbhaiswar@yahoo.co.in

Second Author – M. Y. Salunkhe, Department of Physics, Institute of Science, R.T.road, civil line, Nagpur.

Third Author – S. P. Dongre, Bhalerao Science College, Saoner

An Effective Technique to Protecting Sensitive Information Using 2d Data Matrix

Mr.L.S.Khedekar*, Dr.A.S.Alvi**

* Information Technology, PRMIT & R,Badnera

** HOD,Information Technology, PRMIT & R,Badnera

Abstract- Today barcode system is very popular to protecting sensitive information. Many organizations are using this technique for protecting sensitive information. This paper presents an algorithm for hiding of data using 2D matrix code for high level of security.

The proposed algorithm uses some modified definition of support and confidence so that it would hide any desired sensitive association rule without any side effect. Actually the enhanced technique is using the same method (as previously used method) of getting association rules but modified definitions of support and confidence are used

Data Matrix is a matrix (2D or two-dimensional) bar code which may be printed as a square or rectangular symbol made up of individual dots or squares. This representation is an ordered grid of dark and light dots bordered by a finder pattern. The finder pattern is partly used to specify the orientation and structure of the symbol. The data is encoded using a series of dark or light dots based upon a pre-determined size. The minimum size of these dots is known as the X-dimension.

Index Terms- Barcode, Confidence, Data hiding, 2D Data Matrix and Support.

I. INTRODUCTION

This proposed paper is related with many government agencies, businesses and non-profit organizations in order to support their short and long term planning activities, they are searching for a way to collect, store, analyze and report data about individuals, households or businesses. Information systems, therefore, contain confidential information such as social security numbers, income, credit ratings, type of disease, customer purchases, etc. that must be properly protected.

Automatic identification systems provide a fast and efficient identification of products. Among the most frequent are certainly the barcodes, which we encounter daily on the majority of retail products. Even though they enable a quicker identification of products their drawback is that they can encode only small amounts of (usually numerical) data and their size is not suitable for labeling small items. The concept of 2D codes is based on coding the data in both horizontal and vertical directions. Its development enabled the encoding of much larger quantity of numeric or alphanumeric data, up to 70 times compared to conventional barcodes, on a smaller area. This enabled the labeling and identification of even the smallest products. In addition, 2D codes are more and more used in different types of advertising and information management. 2D codes can encode

the link to web pages and other types of information accessible by mobile phone capturing. 2D codes can be printed on different packaging and thus give to the customer additional information about the product or can be linked to the producer's web page or other content. The customer scans the code with a mobile phone camera, software in the mobile phone decodes the 2D code and the decoded message is visible on the mobile phone display

II. GENERAL STRUCTURE

2-D bar code consists of a certain white and black geometric modules that alternately arrange in the vertical and horizontal directions according to certain rules see Figure, and it is a symbol with large capacity for storing information. As the 2-D bar code with smallest size in the world, data matrix code is widely applied to electronic product components. 2-D bar code recognition technology shows great commercial value, and at present, most COTS (commercial of the shell) recognition algorithms are proprietary and protected by patents, so the 2-D bar code recognition technology is in a great demand for researching. Figure Datamatrix structure shows the principle of a Datamatrix barcode.

The image shows an annotated Datamatrix where the finder and synchronization patterns have been highlighted.

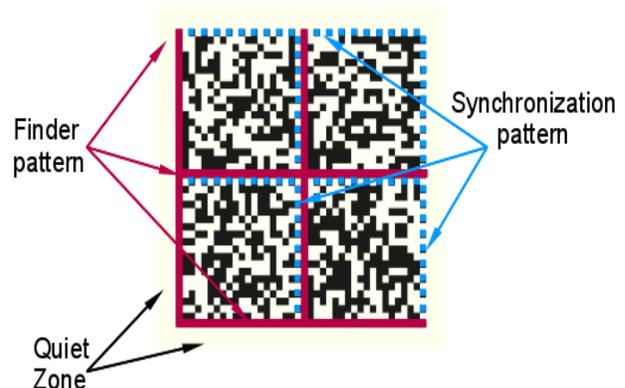


Figure Datamatrix structure.

III. ENCODING

Encoding is the process of converting data from one form to another. While "encoding" can be used as a verb, it is often

used as a noun, and refers to a specific type of encoded data. There are several types of encoding, including image encoding, audio and video encoding, and character encoding.

Media files are often encoded to save disk space. By encoding digital audio, video, and image files, they can be saved

in a more efficient, compressed format. Encoded media files are typically similar in quality to their original uncompressed counterparts, but have much smaller file sizes.

Figure shows the principle of Datamatrix encoding process.

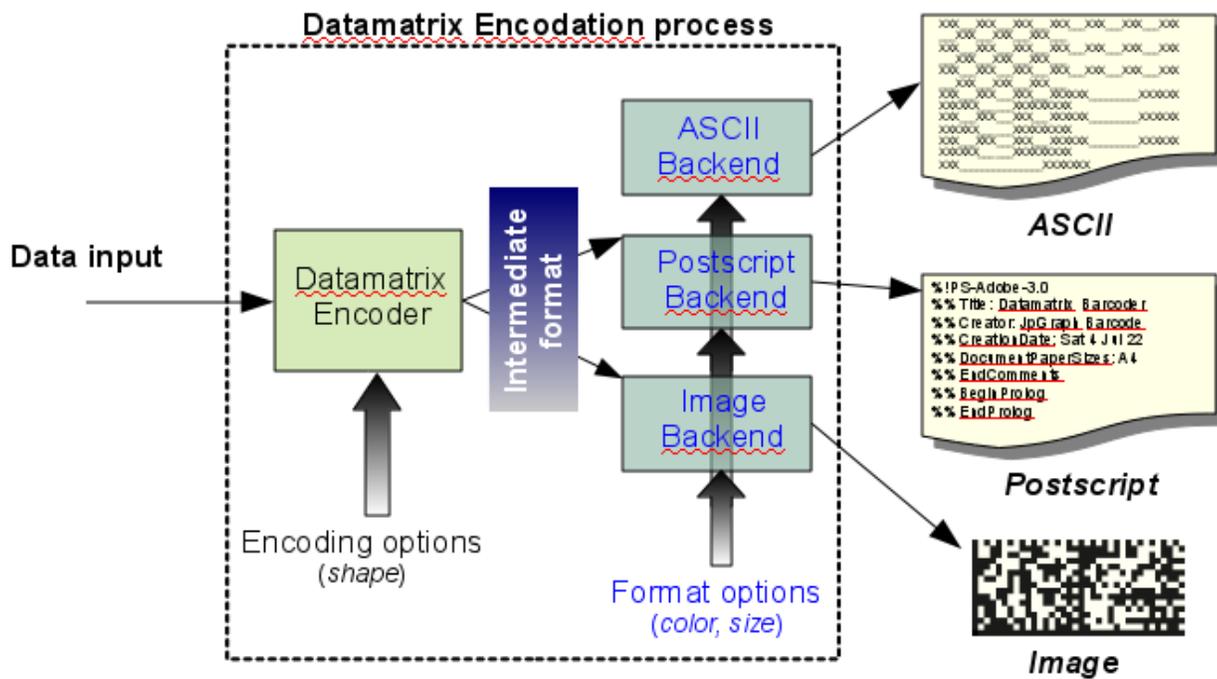


Figure Datamatrix encodation principle

IV. CODE READERS

Code readers operate on the principle of contrast between the code (printing ink) and the background (printing substrate). For code decoding various code readers are used and, in addition to readers, 2D codes can be decoded also with certain types of mobile phones.

Camera-Based readers

Camera-based readers are the newest type of code readers. This type of readers uses a small video camera to capture an image of the code. Sophisticated digital image processing techniques are then used to decode the code. Video cameras are equipped with the same CCD (Charge Coupled Device) technology as in a CCD code readers except that instead of having a single row of sensors, a video camera has hundreds of rows of sensors arranged in a two-dimensional array so that they can generate an image (Taltech, n.d.). Camera-based reader is the one used in capturing the codes with mobile phone camera.

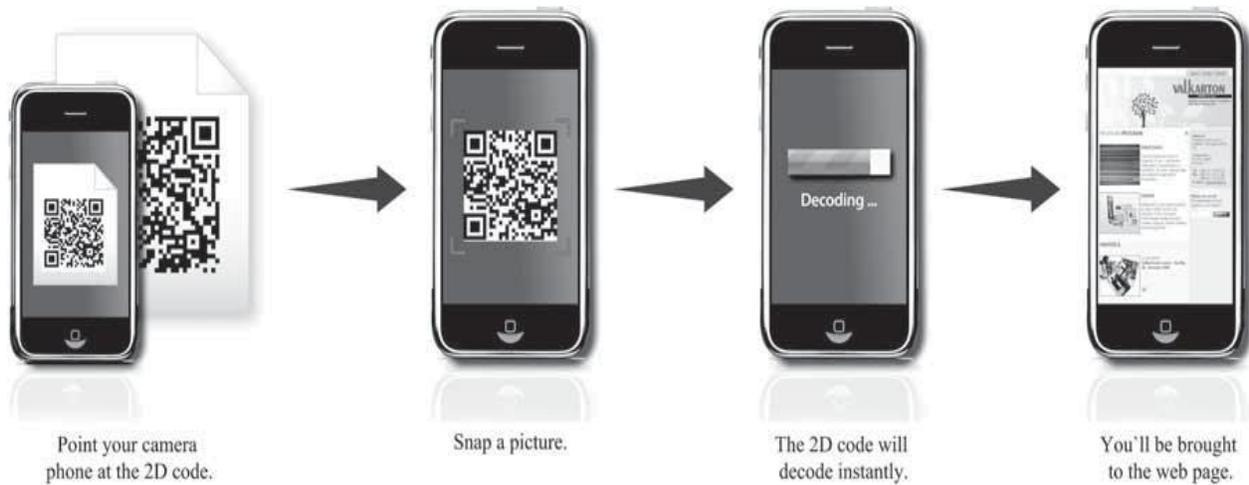


Figure. 2D Code reading using mobile phone.

V. PROBLEM DEFINITION

When user will store the sensitive information the unique ID will be generated. This Unique ID will be Tier 1 identification for the sensitive information. Entering this Unique ID as an Input to our Selective algorithm will generate a unique Image for that particular ID. This Unique image will act as Tier 2 identification for sensitive information. This image will be hash mapped to the User Unique ID and both will be used to identify sensitive information. When identifiers are used solely within a database, their generation should be left to the database itself.

VI. PROPOSED APPROACH

Internet communication technology has made this world very competitive. In their struggle to keep customers, to

approach new customers or even to enhance services and decision making, data owners need to share their data for a common good. Privacy concerns have been influencing data owners and preventing them from achieving the maximum benefit of data sharing. Data owners usually sanitize their data and try to block as many inference channels as possible to prevent other parties from finding what they consider sensitive. Data sanitization is defined as the process of making sensitive information in non-production databases safe for wider visibility. However, sanitized databases are presumed secure and useful for data mining, in particular, for extracting association rules.

Figure represents protecting sensitive information and accessible to authorized user. In this system consists of 11 stapes to get sensitive information to the authorized user.

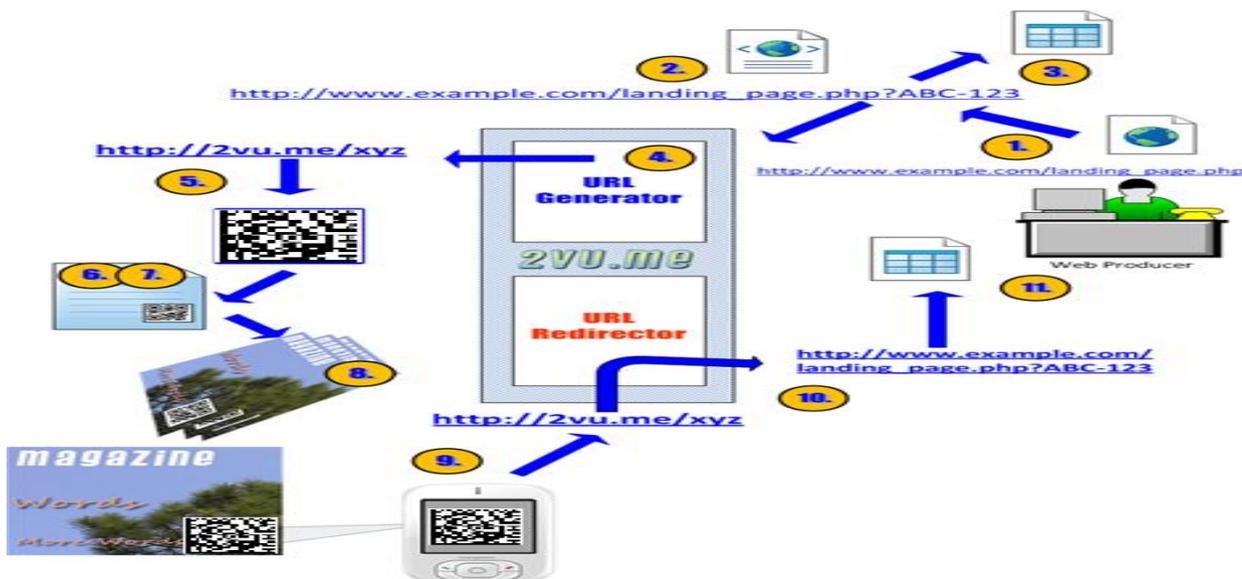


Figure. System

VII. RESULT ANALYSIS AND CONCLUSION

Example of data encoding

According to the ASCII encoding procedure, to encode numerical values of two digits, 130 should be added to the number. Encoding of numbers $\gg 1 \ll$, $\gg 2 \ll$, $\gg 3 \ll$, $\gg 4 \ll$, $\gg 5 \ll$ and $\gg 6 \ll$ is presented below.

ASCII encoding converts

6 characters to 3 bytes:

$$\gg 12 \ll = 12 + 130 = 142$$

$$\gg 34 \ll = 34 + 130 = 164$$

$$\gg 56 \ll = 56 + 130 = 186$$

After a short calculation each “result” is represented with followed decimal numbers: 142, 164 and 186. The binary values are then put into code words and inserted into the code matrix.

So it is clear that this approach is hiding all the given sensitive rules successfully without any side effect in small as well as large databases.

ACKNOWLEDGEMENT

First & foremost, I would like to express my sincere gratitude towards Dr.A.S.Alvi for his valuable guidance, encouragement, and optimism. I feel proud of his eminence and vast knowledge, which will guide me throughout my life. I wish to acknowledge with thanks to all the faculty members of Information Technology Department who has directly or indirectly helped me in the research paper work.

Last but not the least; I would like to express my sincere thanks to my institute Prof. Ram Meghe Institute of Technology & Research, Badnera. For providing me all the needful facilities during the research paper work.

REFERENCES

Journal paper

- [1] A new approach Data hiding in 2D data matrix and tilt correction algorithm
Kimmy ghanaiya1 gagandeep kaur2
- [2] An Efficient Technique for Protecting Sensitive Information Devlal Birla
#1, Mr. B L Pal #2
- [3] Multi-color 2D datamatrix codes with poorly readable colors Urška Bogataj
1, Tadeja Muck 2, Branka Lozo 3, Arjana Žitnik 4

Book

- [4] GS1 Data Matrix
Chapter in book
- [5] Chapter 26. Datamatrix (2D-Barcode) Part VI. Barcodes

AUTHORS

First Author – Mr.L.S.Khedekar, Information Technology
PRMIT&R,Badnera, lokeshkhedekar@gmail.com, 9850981749

Second Author – Dr.A.S.Alvi, HOD,Information Technology,
PRMIT&R,Badnera

A Study of the Impact of Laboratory Approach on Achievement and Process Skills in Science among Is Standard Students

Asst. Prof. Badri Yadav *, Prof. Shri Krishna Mishra **

* Asst. Professor, Shri Kanwartara Institute for Teacher's Training, Shri Nagar Colony, Mandleshwar, Tehsil-Maheshwar, Dist.Khargone (M.P.), India 451221

** Principa, Shri Kanwartara Institute for Teacher's Training, Shri Nagar Colony, Mandleshwar, Tehsil-Maheshwar, Dist.Khargone (M.P.), India 451221

Abstract- The purpose of this study was to compare the effects a laboratory based on the 7E learning cycle model with verification laboratory approach on university students' development of science process skills and conceptual achievement. In this study the sample consisted of 81 freshman university students who were taking the General Physics Laboratory-I- course at the university in DAVV Indore. In this study pretestposttest design with control group was used. B.Sc.class students (43) who took lower weighted standard points from university entrance exam (UEE) than BCA class students were selected as experimental group. BCA class students (38) were selected as control group. Thus, this study was quasi-experimental in design. In order to assess hypotheses of study was used "Science Process Skills Test-SPST" and "Force Concept Inventory -FCI" to compare skills and conceptual achievement of control and experimental groups students. Both tools were given to both groups as pretest and posttest.

Index Terms- A study of the impact, Laboratory approach on achievement.

I. INTRODUCTION

Science is one of the core components of the school curriculum. That is why, science as a separate subject has been incorporated in school curriculum. School curriculum includes following subjects:-

1. Language
2. Mathematics
3. Social Science
4. Natural Science

Introduction of science as a compulsory subject in school curriculum was done with the view to develop scientific attitude, scientific temperament, critical thinking active inquiry, independent work and understanding the physical world from different perspectives. 'Good science education is true to the child, true to life and true to science'. This simple observation leads to cognitive, content, process, historical, environmental and ethical validity of a science curriculum. So it is a powerful means of developing attitudes of critical inquiry, respect for truth, adaptability and systematic work which are a pre-requisite for

initiating the process of social change and of national development.

At the secondary school stage concepts that are beyond direct experience may come to occupy an important place in the science curriculum, since not all phenomena are directly observable. Science also relies on influence and interpretation, experimentation often involving quantitative measurement as a tool to discover theoretical principle should be an important part of science teaching.

1.1 Nature of science

Humans have, always, been curious about the world around them. The inquiring and imaginative human mind has responded to the wonder and awe of nature in different ways. One kind of response from the earliest time has been to observe the physical and biological environment carefully, look for any meaningful patterns and relations, make and use new tools to interact with nature and build conceptual models to understand the world.

1.2 This Human Endeavour is science.

Science is a dynamic, expanding body of knowledge covering ever new domains of experience. How is this knowledge generated ? What is the so called Scientific Method ? As with many complex things in life, the Scientific Method is perhaps more easily discerned than defined but broadly speaking, it involves several interconnected steps : observation, looking for regularities, making hypothesis, devising qualitative or mathematical models, deducing their consequences; verification or falsification of theories through observation and controlled experiments and thus arriving at the principles,

1.3 AIMS OF SCIENCE TEACHING IN SCHOOL

The general aims of science education follow directly from the six criteria of validity that are cognitive, content, process, historical, environmental and ethical. Science education should enable the learner to :-

- Know the facts and principles of science and its application, consistent with the stage of cognitive development.
- Acquire the skills and understand the methods and processes that lead to generation and validation of science knowledge.
- Relate to the environment (nature environment, artifacts and people) local as well as global, and appreciate the issues at the interface of science, technology and society.

- Acquire the requisite theoretical knowledge and practical technological skills to enter the world of work.
- Imbibe the values of honesty, integrity, cooperation, concern for life And preservation of environment.
- Cultivate 'scientific temer'- objectivity, critical thinking and freedom from fear and prejudice.

1.4 IMPORTANCE OF BIOLOGY LABORATORY

No course in biology can be considered as complete without including some practical work in it. Biology is a scientific topic, thus it should be learn through experimental method. The laboratory makes teaching of Biology more meaningful and interesting.

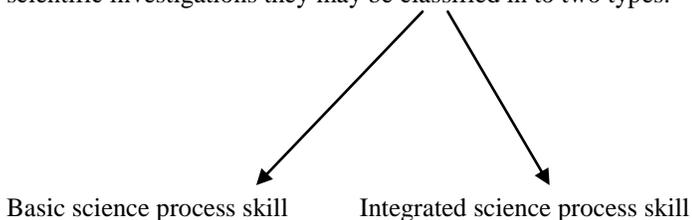
In the laboratories the learners learn about facts and laws of different branch of biology and check their truthfulness and learn to make practical use of them. In this method the learness become very active and learns himself. He himself notes down the figures of his observation and on the basis of calculation, draws conclusion so science laboratories are the places and means with the help which all these necessary activities can be performed smoothly and effectively. The practical work is to be carried out by individual in a science laboratory. Most of the achievement of modern science is due to the application of experimental method. At school stage, practical work is even more important because of the fact that we "learn by doing". Scientific principles and applications are thus rendered more meaningful. It is well known fact that an object handled impresses itself more firmly on the mind than an object merely seen from a distance or in illustrations. Centuries of purely deductive work did not produce the same utilitarian results as a dew decades of experimental work.

Practical classroom experiments help in broadening pupils experience and developing initiative resourcefulness and cooperation. Because of the reasons discussed above, practical work frames a prominent features in Biology. The active learning is that which uses the laboratory and traditional, which uses the teaching resources ordinarily available to the teacher. In laboratory students gain more content knowledge and knowledge of process skills compared to traditional instructions. The laboratory approach enhances knowledge and process learning for students.

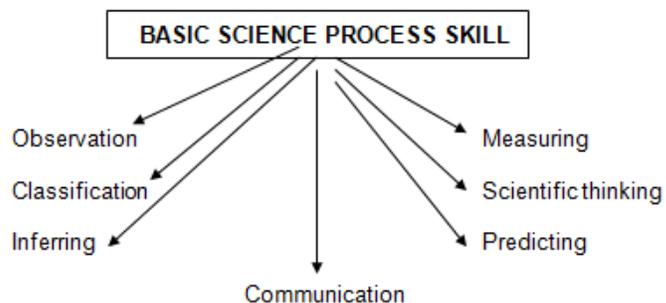
II. THE SCIENCE PROCESS SKILLS

Science process skills in science are very important to develop scientific ideas and to make learners independent thinkers.

SCREEN (1996) defined the process skills as the sequence of events that are engaged by researchers while taking part in scientific investigations they may be classified in to two types.



Brotherton And Preece (1995) Classified the basic science process Skills like :



They classified integrated science process skills as graphing hypothesizing, interpreting data, formulating models, experimenting and defining operationally.

Science series (2008) described that process skills in science are very important in the formal presentation of science to child. Process skill is a preparation to becoming a scientist. The work of science involves carrying out experiments, recording observations, making measurements and presenting data derived from the experiments. Process skills in science for children emphasizes the use of our five sense organs. The concept of doing science is very important for developing process skills among learners.

2.1 BRIEF DESCRIPTION OF THE SCIENCE PROCESS SKILLS

OBSERVATION :- The skill of observation is seen by miller and driver (1987) as an activity in which all the people young and old, engage in throughout their lives. It is said to be theory dependent in that what we see is dependent to some extent on the theories that we hold. They further aver that children's ability to observe involves the learning o a conceptual framework that identifies the elements of a complex situation that is scientifically worth observing.

Learners are curious by nature. They observe and compared the things. Observational skill developed among learners by designing such activities where learners are required to observe stages like:

- Use several senses while making observation.
- Use aids for observation such as microscope, thermometer.
- Make a number of observations.
- Identify similarities and differences.

2.2 HYPOTHESIZING:

The learners may provide some plausible explanation for observation. Each student may provide a different explanation, these plausible explanations become hypothesis. Thus hypothesis is a statement put forward or attempt to explain some happening or features.

- Hypothesis suggests an explanation which is consistent with evidences.
- Previous knowledge is used in attempting an explanation.
- Hypothesis is only provisional.

- Hypothesis should be testable.

2.3 PREDICTING :

Prediction proceeds investigation. It is an intelligent guess to what would happen type of questions.

- Prediction helps in planning the experiments.
- Prediction suggests what type of investigation is required to test hypothesis.
- Prediction is different from guess in that it makes use of scientific knowledge.

2.4 CONTROLLING VARIABLES:

Brotherton & Preece (1995) classify controlling variables as a basic science process skill. Controlling variables is the ability to recognize dependent and independent variables. In practical investigations, practical group is usually exposed to some treatment (the independent variable) while the control group is not exposed to the treatment.

2.5. GRAPHING :

Mckenzie and padilla (1986) defined graphs are an efficient and effective tool for making sense of the pile of information. Graphs are modes of representing quantitative data and are important means of communicating scientific data Graph presents concepts in a concise manner this displaying a wealth of information in a small space.

2.6 EXPERIMENTING:

Miller and Driver (1987) describe experimenting as an integrated process skill that include other process skills like observation, interpretation, planning and reporting. Integrated process skills are involved when learners conduct experiments. They formulate hypothesis, design experiments and makes a generalizations after collecting data. A central feature of experimentation is said to be the idea of control in order that possible alternate, interpretations of a situation may be eliminated.

2.7 INFERRING:

Inferring is also a kind of guess based on subjective explanation for observations.

- Inferring is based on a number of observation
- It explains the observations.
- Uses scientific principles.

2.8 COMMUNICATING:

Reporting the results of investigation and sharing with peers and others is important communication in science involves graph, chart, table, symbols.

- Discussing ideas among students orally and in written form.
- Recording observations while conducting experiments.
- Using graph, charts diagram, table to make communication meaningful.

2.9 LEARNING OF SCIENCE PROCESS SKILL AT SCHOOL:

The learning of Basic science process skills.

Padilla and pyle (1996) identified three steps that may be followed during the learning of basic science process skills namely brainstorming observation about an object or phenomenon, creating inferences based on observations and testing the inferences through simple experiments padilla and pyle (1996) found that for learners to observe more systematically, select some activities that will held their interest and let them perform on their own.

2.10 Dixon Adams and Hypes (2001)

Identified the following steps that might be followed during the learning of the skill of controlling variables.

- Have the learners brainstorm to determine the factor that are involved in the investigation.
- Ask the learners how they might determine the set up of the investigation that would result in the maximum solution of the problem.
- Before beginning the data collection have learners work in groups to identify the factors that they will keep constant and those that they will vary during their investigation.

III. THE LEARNING OF INTEGRATED SCIENCE PROCESS SKILL

Integrated process skill are graphing, experimenting etc. The same consideration in the learning of basic science process skills are needed for the learning of the integrated science process skills

Roth and Roychoudhary (1993)

Described as an integrated process skill that involves transforming results in to standard form, graphing data, determining the accuracy of experimental data, defining and discussing limitation and assumption and explaining the relationship.

According to Kamii and clark (1997)

Integrated process skills may be developed and enhanced by using every day activities. They hold that learners should be encouraged to struggle with a problem and to debate it among themselves.

3.1 ASSESSMENT OF SCIENCE PROCESS SKILLS :

Swain (1989) defines a process skill as a series of connected actions, experience or changes; which go on internally with in a learner and can usually be demonstrated externally.

Tamir, Doran and chye (1992:265) Identified the assessment of the outcome of practical work as follows:

- Continuous assessment by the science teacher based on systematic observations and records.
- Evaluation of laboratory reports made by the learners on the bases of their laboratory experiences.
- Individual learner projects based on practical skills.
- Paper pencil test items pertaining to laboratory experience and related issues.
- Practical examination.

Practical tests are administered individually or in groups. Individually administered tests involve a learner who performs the required tasks and an examiner who observes and assigns marks. Group practical tests involve learners. Written responses to questions which are based on observations, measurement inferences, Hypothesis, classification and reasoning by the learners during the performance.

IV. NEED AND IMPORTANCE OF THE STUDY

Science teaching does not mean passing on information only but is concerned with developing analytical, critical observation and problem solving abilities as well as the creativity of an individual. These abilities are less developed through traditional approach because in traditional approach practical and productive work does not find a prominent place.

Many research studies have been done concerning pupils achievement and performance. But very few researches have been made regarding process skill and achievement in the field of biology and this prompted the researcher to take up the present study of impact of laboratory approach on process skills and achievement.

V. STATEMENT OF THE PROBLEM

The present study is entitled as:- "A study of the impact of Laboratory Approach on Achievement and Process Skills in Science Among Standard Students."

VI. OPERATIONAL DEFINITION OF THE TERMS

Before proceeding further in any research the researcher should have a clear understanding of the problem. The problem selected for the study is impact of laboratory approach on process skills and achievement.

The terms such as achievement, process skill, laboratory approach, traditional approach needs special description, as these terms convey different meanings to different people. This may result in ambiguous understanding of the terms. Therefore, to overcome this problem, the researcher made an attempt to define the terms operationally so as to avoid confusion. In this study researcher has given the understanding of the terms.

VII. ACHIEVEMENT

Achievement is a general term for the successful attainment of some goal requiring –

1. A certain effect.
2. The degree of success attained in a test.
3. The result of a certain intellectual or physical activity defined according to individual and objective prerequisites.
4. Achievement is nothing but something accomplished successfully by means of exertion, skill, practice or perseverance.

7.1 PROCESS SKILLS:

Process skills are the sequence or events that are engaged by researcher while taking part in scientific investigations. Process skill as a series of connected actions, experiences or changes which go on internally within a learner and can usually be demonstrated externally. Process skills are important to formal presentation of science.

7.2 LABORATORY APPROACH

By this approach students make systematic use of science processes, develop concepts via questioning and require exercise of discretion.

7.3 TRADITIONAL APPROACH

Traditional approach is built on the assumption that there is a particular body of information that should be covered and mastered by the students. This approach in education is teacher and text book directed and designed for generic students. Traditional approach contained different methods like lecture, lecture cum demonstration etc.

VIII. OBJECTIVES OF THE STUDY

For the purpose of direction to the study the present researcher has formulated following objectives :

1. To study the effect of laboratory approach on developing process skills among IX std. students.
2. To study the effect of laboratory approach on the achievement of IX std. students.
3. To study the effect of traditional approach on developing process skills among IX std. students.
4. To study the effect of traditional approach on the achievement of IX std. students.
5. To study the differences in process skills achieved through traditional and laboratory approach.

IX. HYPOTHESIS OF THE STUDY

1. There will be variation in process skills among IX std. students studied through laboratory and traditional approach.
2. The development of process skills through laboratory approach will be better than the development of process skill through traditional approach.
3. There will be variations in achievement between IX std. students studied through laboratory and traditional approach.
4. The achievement of IX std. students studied through laboratory approach will be better than the achievement of students studied through traditional approach.

X. DELIMITATION OF THE STUDY

A. Spatiotemporal Limitation :

- The study has spatial limitation because it is confined to Khargone city only.
- The study has temporal limitation because it is completed in a duration of 10 days.

B. Procedural Limitation :

- The study has a procedural limitation because the activities carried out through a selected laboratory and traditional approach.

C. Disciplinary Limitation :

- The study has disciplinary limitation because it conducted only in the field of Biological science.

D. Sampling Limitation:

- The study has a sampling limitation that it carried out only on 40 students of a single school.

XI. SAMPLE

Most of the educational phenomena consists of a large number of units. It would be impractical to observe each unit of the population under controlled conditions in order to arrive at principle having universal validity. Some populations are so large that their study would be expensive in term of time, money effect and man power. Sampling is a process by which a relatively small number of individual objects of events are selected in order to find out something about entire population from which it was selected.

An appropriately chosen sample size enhances the reliability and validity of research findings commonly used sampling techniques are random sampling, stratified random, quota and purposive sampling.

For conducting the present study keeping in view the limitation and resources available with the researcher, the method of simple random sampling has been used.

Guilford Stated that :- The best definition of simple random sampling is that it is selection of cases from the population in such a manner that every individual in the population has an equal chance of being chosen. The selection of any one individual is also in no way tied to the selection of any other.

Sample of the study is drawn from one school that is -

Shri Kanwartara Public School Mandleshwar.

- A preliminary sample of 40 students were obtained to which tools were administered.

Details of sample

Group	Students
Experimental	20
Control	20
Total	40

11.1 VARIABLES:

A variable is something that varies. It is property that takes in different Values. Variables are the conditions or characterizes that the experimenter manipulates, control or observes. There are following type of variables.

Independent Variables :

The independent variables are the conditions or characterization that the experimenter manipulates controls or

observes. The independent variables in the present study are laboratory approach and traditional approaches both are teaching approaches. The experimental group was taught by the laboratory approach and control group was taught by the traditional approach.

Dependent variables :

The dependent variables are the conditions or characteristics that appear or change as the experimenter removes or changes independent variables. The effect studied was in relation to the process skills and achievement in Biological science hence, dependent variables of the study are process skills and achievement.

11.2 DATA GATHERING DEVICES:

To select or construct appropriate tools for the study is an important aspect of any research study. Sometimes the researcher uses tools which have been constructed by others which are standardized. Sometimes the researcher has to construct tools to fulfill his/her purpose.

In this present study the researcher has constructed two tools and a observation schedule keeping in view the objectives of the study, they are-

1. Achievement test.
2. Practical test.
3. Process skill assessment schedule. (Observation schedule)

All the three above mentioned tools were based on a particular topic of Biological science.

- The achievement test consisted of 25 multiple choice questions, each carrying 1 mark. The time provided for this exercise was 35 minutes.

- The practical test which was based on activities comprised of the following points.

- Drawing the diagram.
- Preparation of slide
- Spotting
- Viva-voce

25 marks were allotted for this test the time allotted was 1 hour 30 minutes.

- The third test which was applied by the teacher was an observation schedule. This schedule was based on process skills which could be assessed through activities imbedded in schedule.

11.3 TABULATION OF DATA:

With the completion of field work the next task was to score the test sheets and tabulate the obtained data for statistical processing and analysis. Obtained marks in achievement and practical test were tabulated in the data sheet.

XII. STATISTICAL TECHNIQUES

The tabulated data was then processed for obtained mean, standard deviation and t. value of the test wise score to analyse the difference as aimed in the objectives of the study.

12.1 SUGGESTIONS FOR FURTHER RESEARCH STUDIES:

The present study being exploratory in nature bring in to limelight several issues. In which further research can be

undertaken. Following are the few suggestions for further research:

1. In the present study the researcher had taken only four process skills that are classifying, observing, hypothesizing and inferring. Beside this, other process skills are also there which can be studied further.

2. The process skills evaluation procedure which was applied by the research based on observation schedule and practical test. This evaluation can be done by some other ways.

3. In this present study only biological science content was taken to study the development of process skills but there are other branches of science like physical science and chemical science. So a comparative study can be done in these three branches of science.

4. The development of process skills according to the mental age and class level can be studied and compared.

XIII. CONCLUSION

The researcher in the present study come to the conclusion that :

- The achievement of student studied through laboratory approach was significantly higher than traditional approach.

The development of process skill were higher in the student who were taught by laboratory approach. Therefore the laboratory approach should be used in teaching and learning in Biological sciences. The students studied through laboratory approach were better in process skills, achievement and in practical test also. So laboratory approach is beneficial for the students.

REFERENCES

- [1] Sharma santosh, (2008). Teaching science and technology self learning material for teachers (NCERT)
- [2] Best. J.W. (1986) Research Education, New Delhi, Prentice hall of India Pvt. Ltd.
- [3] Borg. M.B. and Goll, M.D. (1983) Educational Research- An Introduction New York : Longman Inc.
- [4] Kaul Lokesh (2004) Methodology of educational research Vikas Publishing House Pvt. Ltd. Delhi.
- [5] J.C. Agarwal (1996) Principles, Methods and Teachings techniques. Vikas Publishing House, Delhi.
- [6] J.L. Kumar (2003-04) Teaching of life science annual publication New Delhi.
- [7] Mangal S.K. (2004) Teaching of physical science (contents and pedagogy) capital offset Naveen Shahdara New Delhi.
- [8] Kulshrestha S.P. and Pasricha Harpal (2006) Teaching of biology Raj Printers Meerut.
- [9] Sharma H.L. (2004) School Science edu. In India commonweath publishers, New Delhi.
- [10] J. Randy Mcginnis and Anjelo Collins (2007) Journal of research in sciecne teaching volume-44 issue 7.
- [11] Journal of research in science teaching volume-44 issue-5 May 2007.
- [12] Buch M.M. (2006-07) Fourth survey of Educational Research, New Delhi, N.C.E.R.T.
- [13] Buch M.B. (2004-05) Fifth survey of Educational Research, Volume (I), New Delhi N.C.E.R.T.

- [14] Buch M.B. (2004-05) Fifth survey of Educational Research, Volume (II), New Delhi N.C.E.R.T.
- [15] Good, C.V. (2009) Dictionary of Educational, New, York MC Grow Hill Book Company.
- [16] National curriculum frame work (2005) N.C.E.R.T. New Delhi.
- [17] Arora, G.L, Child centered approach, (for learning without burden), oxford university press 2007.
- [18] Arora, O.P. Module on learners centered approach to curriculum, oxford university press, 2008.
- [19] Best J.W. Research Methodology, oxford university press, New Youk.
- [20] Billows, F.L., The technique of Language Teaching, oxford university press, New York.
- [21] Billy L. Turney and George P. Robb, Research in Education an introduction, the Dryden press Inc. Hinsdale, 2011
- [22] Boyd, Teaching communication skills in the elementary schools, Van nostrand Reinhold company, New York, 2010.
- [23] Bruce Joyce, Marsha weil with Beverly showers, Models of Teaching (Fourth Education), Prentice Hall of India Private Limited, New Delhi, 2011.

AUTHORS



First Author – Badri Yadav is working as an Assistant Professor in the Department of Education, Shrikanwartara Institute for Teachers Training Mandleshwar. Dist-khargone, Madhya Pradesh, India. His areas of interest are teaching of education He has an experience of 8 years of teaching and research experience.



Second Author – Shri Krishna Mishra is working as an Principal in the Department of Education, Shrikanwartara Institute for Teachers Training Mandleshwar. Dist-khargone, Madhya Pradesh, India. His areas of interest are teaching of education He has an experience of 15 years of teaching and research

experience.

Fuzzy A-Super Continuous Mappings

M. K. Mishra*, Manisha Shukla**

*Professor, Egs Pec Nagapattinam
**Asst. Prof. Agcw Karaikal

Abstract- In this paper we extend the concepts of a- super closed sets and a- super continuous mappings due to Baker [2] in fuzzy topological spaces and obtain several results concerning the preservation of fuzzy g- closed sets. Furthermore we characterize fuzzy a-super continuous and fuzzy a-super closed mappings and obtain some of the basic properties and characterization of these mappings.

Index Terms- Fuzzy super closure fuzzy super interior fuzzy super closed set, fuzzy super open set fuzzy g-super closed sets, fuzzy g-super open sets, fuzzy g- super continuous, fuzzy a-super closed, fuzzy a- super continuous and fuzzy gc-irresolute mappings.

I. INTRODUCTION

After the introduction of fuzzy sets by Zadeh [12] in 1965 and fuzzy topology by Chang [6] in 1968, several researches were conducted on the generalizations of the notions of fuzzy sets and fuzzy topology. Thakur and Malviya [7,10,11] introduced the concepts of fuzzy g- closed sets , fuzzy g-continuity and fuzzy gc-irresolute mappings in fuzzy topological spaces.

In this paper we introduce the concepts of fuzzy a-super closed and fuzzy a-super continuous mappings using fuzzy g-super closed sets .This definition enables us to obtain conditions under which maps and inverse maps preserve fuzzy g-super closed sets. We also characterize fuzzy $T_{1/2}$ -spaces in terms of fuzzy a-super continuous and fuzzy a-super closed mappings. Finally some of the basic properties of fuzzy a-super continuous and fuzzy a -super closed mappings are investigated.

II. PRELIMINARIES

Let X be a non empty set and $I = [0,1]$. A fuzzy set on X is a mapping from X in to I . The null fuzzy set 0 is the mapping from X in to I which assumes only the value is 0 and whole fuzzy sets 1 is a mapping from X on to I which takes the values 1 only. The union (resp. intersection) of a family $\{A_\alpha: \alpha \in \Lambda\}$ of fuzzy sets of X is defined by to be the mapping $\sup A_\alpha$ (resp. $\inf A_\alpha$) . A fuzzy set A of X is contained in a fuzzy set B of X if $A(x) \leq B(x)$ for each $x \in X$. A fuzzy point x_β in X is a fuzzy set defined by $x_\beta(y) = \beta$ for $y = x$ and $x_\beta(y) = 0$ for $y \neq x$, $\beta \in [0,1]$ and $y \in X$. A fuzzy point x_β is said to be quasi-coincident with the fuzzy set A denoted by $x_\beta qA$ if and only if $\beta + A(x) > 1$. A fuzzy set A is quasi-coincident with a fuzzy set B denoted by $A qB$ if and only if there exists a point $x \in X$ such that $A(x) + B(x) > 1$. For any two fuzzy sets A and B of X , $A \leq B$ if and only if $\overline{(A_q B^c)}$ [5]. A family τ of fuzzy sets of X is called a fuzzy topology [1] on X if

$0,1$ belongs to τ and τ is super closed with respect to arbitrary union and finite intersection .The members of τ are called fuzzy super open sets and their complement are fuzzy super closed sets. For any fuzzy set A of X the closure of A (denoted by $cl(A)$) is the intersection of all the fuzzy super closed super sets of A and the interior of A (denoted by $int(A)$) is the union of all fuzzy super open subsets of A .

Definition 2.1[4]: Let (X, τ) fuzzy topological space and $A \subseteq X$ then

1. Fuzzy Super closure $scl(A) = \{x \in X: cl(U) \cap A \neq \emptyset\}$
2. Fuzzy Super interior $sint(A) = \{x \in X: cl(U) \leq A \neq \emptyset\}$

Definition 2.2[4]: A fuzzy set A of a fuzzy topological space (X, τ) is called:

- (a) Fuzzy super closed if $scl(A) \leq A$.
- (b) Fuzzy super open if $1-A$ is fuzzy super closed $sint(A) = A$

Remark 2.1[4]: Every fuzzy closed set is fuzzy super closed but the converses may not be true.

Remark 2.2[4]: Let A and B are two fuzzy super closed sets in a fuzzy topological space (X, \mathfrak{S}) , then $A \cup B$ is fuzzy super closed.

Remark 2.3[4]: The intersection of two fuzzy super closed sets in a fuzzy topological space (X, \mathfrak{S}) may not be fuzzy super closed.

Definition 2.3 [6,10]: A fuzzy set A of a fuzzy topological space (X, \mathfrak{S}) is called:

- (a) Fuzzy g-super closed if $cl(A) \leq O$ whenever $A \leq O$ and O is fuzzy super open.
- (b) Fuzzy g super open if and only if A^c is fuzzy g-super closed.

Remark 2.4[10]: Every fuzzy super closed set is fuzzy g-super closed but its converse may not be true.

Remark 2.5[6,7,10]: A fuzzy set A of a fuzzy topological space is fuzzy g-super open if and only if $F \leq int(A)$ whenever F is fuzzy super closed and $F \leq A$.

Remark 2.6 [10]: Let (X, \mathfrak{S}) be a fuzzy topological space and R be the family of fuzzy super closed sets of X .Then $\mathfrak{S} = R$ if and only if every fuzzy subset of X is fuzzy g- super closed.

Definition 2.4 [10]: A fuzzy topological space (X, \mathfrak{T}) is called fuzzy $T_{1/2}$ -Space if every fuzzy g -super closed set in X is fuzzy super closed in X .

Definition 2.5[1,4,5,6,7,11] : Let (X, \mathfrak{T}) and (Y, σ) be two fuzzy topological spaces and let $f: X \rightarrow Y$ be a function. Then f is said to be:

- (a) fuzzy super continuous if the pre image of each fuzzy super open set in Y is fuzzy super open set in X .
- (b) fuzzy g -super continuous if the pre image of every fuzzy super closed set in Y is fuzzy g -super closed set in X .
- (c) fuzzy gc -irresolute if the pre image of every fuzzy g -super closed set in Y is an fuzzy g -super closed set in X .
- (d) Fuzzy super closed mapping if and only if the image of each fuzzy super closed set in X is fuzzy super closed set in Y .
- (e) fuzzy super open if the image of every fuzzy super open set in X is fuzzy super open set in Y .

Remark 2.7 [4,5,6] : Every fuzzy super continuous mapping is fuzzy g -super continuous, but the converse may not be true.

Remark 2.8 [4,5,6,11]: Every fuzzy gc -irresolute mapping is fuzzy g -super continuous, but the converse may not be true. The concepts of fuzzy gc -irresolute and fuzzy super continuous mapping are independent.

III. FUZZY A-SUPER CONTINUOUS AND FUZZY A-SUPER CLOSED MAPPINGS

Definition 3.1: A mapping $f: (X, \mathfrak{T}) \rightarrow (Y, \sigma)$ is said to be fuzzy approximately super continuous, (written as a -super continuous) provided that $cl(F) \leq f^{-1}(O)$ whenever F is fuzzy g -super closed set in X , O is an fuzzy super open set in Y and $F \leq f^{-1}(O)$.

Theorem 3.1: Every fuzzy super continuous mapping is fuzzy a -super continuous.

Proof: Let $f: (X, \mathfrak{T}) \rightarrow (Y, \sigma)$ be a fuzzy super continuous mapping. Let O be a fuzzy super open set of Y and F is a fuzzy g -super closed set of X such that $F \leq f^{-1}(O)$. Now since f is fuzzy super continuous, $f^{-1}(O)$ is fuzzy super open set in X . Since F is fuzzy g -super closed and $F \leq f^{-1}(O) \Rightarrow cl(F) \leq f^{-1}(O)$. Hence f is fuzzy a -super continuous.

Remark 3.1: The converse of theorem 3.1 may not be true. For,

Example 3.1: Let $X = \{ a, b \}$ and $\mathfrak{T} = \{0, U, 1\}$ be fuzzy topology on X , where U be a fuzzy set on X defined by $U(a) = 0.5$, and $U(b) = 0.4$. Then the mapping $f: (X, \mathfrak{T}) \rightarrow (X, \mathfrak{T})$ defined by $f(a) = b$ and $f(b) = a$ is fuzzy a -super continuous but it is not fuzzy super continuous.

Definition 3.2: A mapping $f: (X, \mathfrak{T}) \rightarrow (Y, \sigma)$ is said to be fuzzy approximately super closed (written as a -super closed) provided that $f(F) \leq int(A)$ whenever F is fuzzy super closed set in X , A is an fuzzy g -super open set in Y and $f(F) \leq A$.

Theorem 3.2: Every fuzzy super closed mapping is fuzzy a -super closed.

Proof: Let $f: (X, \mathfrak{T}) \rightarrow (Y, \sigma)$ be an fuzzy super closed mapping. Let F be fuzzy super closed set in X and A is an fuzzy g -super open set in Y such that $f(F) \leq A$. Since f is super closed $f(F)$ is fuzzy super closed set in Y . Now A is fuzzy g -super open and $f(F) \leq A \Rightarrow f(F) \leq int(A)$. Hence f is fuzzy a -super closed.

Remark 3.2: The converse of theorem 3.2 may not be true. For,

Example 3.2: Let $X = \{ a, b \}$ and $\mathfrak{T} = \{ 0, 1, U \}$ be fuzzy topology on X . Let U be a fuzzy set defined as follows $U(a) = 0.6$, $U(b) = 0.3$ be an fuzzy set on X . Then the mapping $f: (X, \mathfrak{T}) \rightarrow (X, \mathfrak{T})$ defined by $f(a) = b$ and $f(b) = a$ is fuzzy a -super closed but it is not fuzzy super closed.

IV. PRESERVING FUZZY G-SUPER CLOSED SETS

In this section the concepts of fuzzy a -super continuous and fuzzy a -super closed mappings are used to obtain some results on preservation of fuzzy g -super closed sets.

Theorem 4.1: If a mapping $f: (X, \mathfrak{T}) \rightarrow (Y, \sigma)$ is fuzzy g -super continuous and fuzzy a -super closed then $f^{-1}(A)$ is fuzzy g -super closed set in X whenever A is fuzzy g -super closed set in Y .

Proof: Suppose that $f: (X, \mathfrak{T}) \rightarrow (Y, \sigma)$ is fuzzy g -super continuous and fuzzy a -super closed. Let A be a fuzzy g -super closed set in Y such that $f^{-1}(A) \leq O$ where O be a fuzzy super open set in X . Then $1-O \leq f^{-1}(1-A)$ which implies that $f(1-O) \leq int(1-A) = 1-cl(A)$. Hence $f^{-1}(cl(A)) \leq O$. Since f is fuzzy g -super continuous and $f^{-1}(cl(A))$ is fuzzy g -super closed in X . Therefore $cl(f^{-1}(cl(A))) \leq O$ which implies that $cl(f^{-1}(A)) \leq O$. Hence $f^{-1}(A)$ is fuzzy g -super closed set in X .

Corollary 4.1: If a mapping $f: (X, \mathfrak{T}) \rightarrow (Y, \sigma)$ is fuzzy g -super continuous and fuzzy super closed then $f^{-1}(A)$ is fuzzy g -super closed set in X whenever A is fuzzy g -super closed set in Y .

Corollary 4.2: If a mapping $f: (X, \mathfrak{T}) \rightarrow (Y, \sigma)$ is fuzzy super continuous and fuzzy super closed then $f^{-1}(A)$ is fuzzy g -super closed set in X whenever A is fuzzy g -super closed set in Y .

Theorem 4.2: If a mapping $f: (X, \mathfrak{T}) \rightarrow (Y, \sigma)$ is fuzzy g -super continuous and fuzzy a -super closed then $f^{-1}(A)$ is

fuzzy g-super open in X whenever A is fuzzy g-super open in Y.

Proof: Suppose that $f : (X, \mathfrak{S}) \rightarrow (Y, \sigma)$ is fuzzy g- super continuous and fuzzy a-super closed mapping. Let A is fuzzy g- super open in Y. Then $1-A$ is fuzzy g-super closed in Y. Hence by theorem 4.1, $f^{-1}(1 - A)$ is fuzzy g- super closed in X. Since $f^{-1}(1 - A) = 1 - f^{-1}(A)$ for every fuzzy set A of Y . Hence $1 - (f^{-1}(A))$ is fuzzy g-super closed set in X. Therefore $f^{-1}(A)$ is fuzzy g-super open set in X.

Corollary 4.3 : If a mapping $f : (X, \mathfrak{S}) \rightarrow (Y, \sigma)$ is fuzzy g- super continuous and fuzzy super closed then $f^{-1}(A)$ is fuzzy g-super open in X whenever A is fuzzy g-super open in Y.

Corollary 4.4 : If a mapping $f : (X, \mathfrak{S}) \rightarrow (Y, \sigma)$ is fuzzy super continuous and fuzzy super closed then $f^{-1}(A)$ is fuzzy g-super open in X whenever A is fuzzy g-super open in Y.

Theorem 4.3:If $f : (X, \mathfrak{S}) \rightarrow (Y, \sigma)$ is fuzzy a- super continuous and fuzzy super closed mapping then the image of every fuzzy g- super closed set of X is fuzzy g- super closed in Y.

Proof: Let B be a fuzzy g super closed set of X, and $f(B) \leq O$. where O is fuzzy super open set in Y. Then $B \leq f^{-1}(O)$ and since f is fuzzy a- super continuous $cl(B) \leq f^{-1}(O)$ which implies that $f(cl(B)) \leq O$. Since f is fuzzy super closed mapping we have $cl(f(B)) \leq cl(f(cl(B))) = f(cl(B)) \leq O$. Hence $f(B)$ is fuzzy g- super closed in Y.

Corollary 4.5[7] :If $f : (X, \mathfrak{S}) \rightarrow (Y, \sigma)$ is fuzzy super continuous and fuzzy super closed mapping then the image of every fuzzy g- super closed set of X is fuzzy g- super closed in Y.

V. A CHARACTERIZATION OF FUZZY T_{1/2} - SPACES.

In the following theorems we give a characterization of a class of Fuzzy T_{1/2} -spaces by using the concepts of fuzzy a-super closed and fuzzy a-super continuous mapping.

Theorem 5.1 An fuzzy topological space (X, \mathfrak{S}) is fuzzy T_{1/2}- space if and only if every mapping $f : (X, \mathfrak{S}) \rightarrow (Y, \sigma)$ is fuzzy a- super continuous.

Proof: Necessity: Let $f : (X, \mathfrak{S}) \rightarrow (Y, \sigma)$ be a fuzzy mapping. Let A be a fuzzy g-super closed set of X and $A \leq f^{-1}(O)$ where O is a fuzzy super open set of Y. Since X is fuzzy T_{1/2} -space, A is fuzzy super closed set in X. Therefore $cl(A) = A \leq f^{-1}(O)$. Hence A is fuzzy a- super continuous .

Sufficiency: Let A be a non empty fuzzy g-super closed set in X and let Y be the set X with the fuzzy topology $\sigma = \{0, A, 1\}$ Finally let $f : (X, \mathfrak{S}) \rightarrow (Y, \sigma)$ be identity mapping. By assumption f is fuzzy a- super continuous. Since A is fuzzy g- super closed in X and fuzzy super open in Y and $A \leq f^{-1}(A)$

,it follows that $cl(A) \leq f^{-1}(A) = A$. Hence A is fuzzy super closed in X and therefore X is fuzzy T_{1/2} -space.

An analogous argument proves the following result for fuzzy a-super closed mapping.

Theorem 5.2: A fuzzy topological space (X, \mathfrak{S}) is fuzzy T_{1/2} -space if and only if every mapping $f : (X, \mathfrak{S}) \rightarrow (Y, \sigma)$ is fuzzy a-super closed.

VI. PROPERTIES OF FUZZY A- SUPER CONTINUOUS AND FUZZY A-SUPER CLOSED MAPPINGS

In this section we investigate some of the properties of fuzzy a-super closed and fuzzy a-super continuous mappings.

Theorem 6.1: Every fuzzy g- super continuous and fuzzy a-super closed mapping is fuzzy gc-irresolute.

Proof: Suppose that $f : (X, \mathfrak{S}) \rightarrow (Y, \sigma)$ is fuzzy g- super continuous and fuzzy a-super closed mapping and A is fuzzy g-super closed set in Y. Let $f^{-1}(A) \leq O$ where O is a fuzzy super open set in X. Then $1-O \leq f^{-1}(1-A)$ which implies that $f(1-O) \leq \text{int}(1-A) = 1 - (cl(A))$. Hence $f^{-1}(cl(A)) \leq O$. since f is fuzzy g- super continuous $f^{-1}(cl(A))$ is fuzzy g-super closed in X .Therefore $cl(f^{-1}(cl(A))) \leq O$ which implies that $cl(f^{-1}(A)) \leq O$. Hence $f^{-1}(A)$ is fuzzy g-super closed set in X. Therefore f is fuzzy gc-irresolute.

Theorem 6.2: If $f : (X, \mathfrak{S}) \rightarrow (Y, \sigma)$ is fuzzy super continuous and fuzzy a-super closed mapping then it is fuzzy gc-irresolute.

Proof: It follows from Remark 2.2 and theorem 6.1.

Theorem 6.3 : If $f : (X, \mathfrak{S}) \rightarrow (Y, \sigma)$ is a mapping for which $f(F)$ is fuzzy super open set in Y for every fuzzy super closed set F of X then f is fuzzy a-super closed mapping.

Proof: Let $f : (X, \mathfrak{S}) \rightarrow (Y, \sigma)$ is fuzzy mapping , F is fuzzy super closed in X , A is fuzzy g-super open in Y and $f(F) \leq A$. By hypothesis $f(F)$ is fuzzy super open in X. Therefore, $f(F) = \text{int} f(F) \leq \text{int}(A)$. Hence f is fuzzy a-super closed.

Theorem 6.4 : If $f : (X, \mathfrak{S}) \rightarrow (Y, \sigma)$ is fuzzy mapping for which $f^{-1}(V)$ is fuzzy super closed in X for every fuzzy super open set V of Y, then f is fuzzy a-super continuous mapping.

Proof: Let $f : (X, \mathfrak{S}) \rightarrow (Y, \sigma)$ is fuzzy mapping. Let F is fuzzy g-super closed set in X and V is fuzzy super open set of Y such that $F \leq f^{-1}(V)$. By hypothesis $f^{-1}(V)$ is fuzzy super closed in X. Hence $cl(f^{-1}(V)) = f^{-1}(V)$. Therefore $cl(F) \leq cl(f^{-1}(V)) = f^{-1}(V)$. Hence f is fuzzy a-super continuous.

Remark 6.1: Since the identity mapping on any fuzzy topological space is both fuzzy a- super continuous and fuzzy a- super closed, it is clear that the converse of theorems 6.3 and 6.4 does not hold.

Theorem 6.5 :If the families of fuzzy super open and fuzzy super closed sets of Y are coincide ,then the mapping $f : (X, \mathfrak{S}) \rightarrow (Y, \sigma)$ is fuzzy a-super closed if and only if $f(F)$ is fuzzy super open set in Y , for every fuzzy super closed set F of X .

Proof: Necessity: Let $f : (X, \mathfrak{S}) \rightarrow (Y, \sigma)$ is fuzzy a-super closed mapping. By Theorem 2.2, every fuzzy set of Y are fuzzy g-super closed and hence all are fuzzy g-super open. Thus for any fuzzy super closed set F of X , $f(F)$ is fuzzy g-super open in Y . Since f is fuzzy a-super closed, $f(F) \leq \text{int}(f(F))$ and then $f(F) = \text{int}(f(F))$. Hence $f(F)$ is fuzzy super open.

Sufficiency: Let F be an fuzzy super closed set of X and A be an g-super open set of Y and $f(F) \leq A$. By hypothesis $f(F)$ is fuzzy super open in Y and $f(F) = \text{int}(f(F)) \leq \text{int}(A)$. Hence f is fuzzy a-super closed.

Corollary 6.1: If the families of fuzzy super open and fuzzy super closed sets of Y are coincide, then the mapping $f : (X, \mathfrak{S}) \rightarrow (Y, \sigma)$ is fuzzy a-super closed if and only if it is fuzzy super closed.

Theorem 6.6: If $f : (X, \mathfrak{S}) \rightarrow (Y, \sigma)$ is fuzzy super closed and $g : (Y, \sigma) \rightarrow (Z, \Phi)$ is fuzzy a-super closed mapping, then $\text{gof} : (X, \mathfrak{S}) \rightarrow (Z, \Phi)$ is fuzzy a-super closed .

Proof : Let F be an fuzzy super closed set of X and A is fuzzy g-super open set of Z for which $\text{gof}(F) \leq A$ since $f : (X, \mathfrak{S}) \rightarrow (Y, \sigma)$ is fuzzy super closed mapping , $f(F)$ is fuzzy super closed set of Y . Now since $g : (Y, \sigma) \rightarrow (Z, \Phi)$ is fuzzy a-super closed mapping, then $g(f(F)) \leq \text{int}(A)$. Hence $\text{gof} : (X, \mathfrak{S}) \rightarrow (Z, \Phi)$ is fuzzy a-super closed mapping.

Theorem 6.7 : If $f : (X, \mathfrak{S}) \rightarrow (Y, \sigma)$ is fuzzy a-super closed and $g : (Y, \sigma) \rightarrow (Z, \Phi)$ is fuzzy super open and fuzzy gc-irresolute then $\text{gof} : (X, \mathfrak{S}) \rightarrow (Z, \Phi)$ is fuzzy a-super closed.

Proof: Let F be a fuzzy super closed set of X and A is fuzzy g-super open set of Z for which $\text{gof}(F) \leq A$. Then $f(F) \leq f^{-1}(A)$. Since g is gc-irresolute , $g^{-1}(A)$ is fuzzy g-super open in X and $f : (X, \mathfrak{S}) \rightarrow (Y, \sigma)$ is fuzzy a-super closed mapping .It follows that $f(F) \leq \text{int}(g^{-1}(A))$. Thus $(\text{gof})(F) = g(f(F)) \leq g(\text{int}(g^{-1}(A))) \leq \text{int}(g(g^{-1}(A))) \leq \text{int}(A)$. Hence $\text{gof} : (X, \mathfrak{S}) \rightarrow (Z, \Phi)$ is fuzzy a-super closed.

Theorem 6.9: If $f : (X, \mathfrak{S}) \rightarrow (Y, \sigma)$ is fuzzy a-super continuous and $g : (Y, \sigma) \rightarrow (Z, \Phi)$ is fuzzy super continuous mapping, then $\text{gof} : (X, \mathfrak{S}) \rightarrow (Z, \Phi)$ is fuzzy a-super continuous.

Proof: Let A be a fuzzy g- super closed set of X and V is fuzzy super open set of Z for which $A \leq (\text{gof})^{-1}(V)$. Now since $g : (Y, \sigma) \rightarrow (Z, \Phi)$ is fuzzy super continuous mapping, $g^{-1}(V)$ is fuzzy super open set of Y . Because $f : (X, \mathfrak{S}) \rightarrow (Y, \sigma)$ is fuzzy a-super continuous, $\text{cl}(A) \leq f^{-1}(g^{-1}(V)) = (\text{gof})^{-1}(V)$.

$^{-1}(V)$. Hence $\text{gof} : (X, \mathfrak{S}) \rightarrow (Z, \Phi)$ is fuzzy a-super continuous mapping.

REFERENCES

- [1] C.L. Chang Fuzzy Topological Spaces, J. Math. Anal. Appl. 24(1968), 182-190.
- [2] C.W. Baker on Preserving g-super closed sets Kyungpook Math. J. 36(1996), 195-199.
- [3] M.K. Mishra, et all on “ Fuzzy super closed set” International Journal of Mathematics and applied Statistics Accepted.
- [4] M.K. Mishra et all on “ Fuzzy super continuity” International Review in Fuzzy Mathematics ISSN : 0973-4392 July –December 2012.
- [5] M.K. Mishra M. Shukla M. Fuzzy Regular Generalized Super Closed Set” Accepted for publication in International Journal of Scientific and Research Publication ISSN2250-3153. July December 2012.(Accepted).
- [6] N. Levine Generalized super closed sets in topology Rend. Cerc. Mat. Palermo 19(2) (1970), 571-599.
- [7] R. Malviya on certain concepts in fuzzy topology. Ph.D. Dissertation, R.D.V.V. Jabalpur (1997).
- [8] P. M. Pu and Y. M. Liu Fuzzy topology I Neighbourhood structure of a fuzzy point and More-Smith Convergence. J. Math. Anal. Appl. 76(1980) 571-594.
- [9] P. M. Pu and Y. M. Liu Fuzzy topology II Product and quotient spaces J. Math. Anal. Appl. 77(1980) 20-37.
- [10] S. S. Thakur and R. Malviya Generalized super closed sets in fuzzy topology , Math Notae 38(1995) 137-140
- [11] S. S. Thakur and R. Malviya Fuzzy gc-Irresolute Mappings Proc. Math. Soc. BHU 11(1995),184-186 .
- [12] L. A. Zadeh, Fuzzy Sets, Information and Control, 18(1965),338-353

AUTHORS

First Author – M. K. Mishra , Professor, Egs Pec Nagapattinam
Second Author – Manisha Shukla , Asst. Prof. Agcw Karaikal
drmk1969@rediffmail.com

Comparative Analysis of Data Centric Routing Protocols for Wireless Sensor Networks

K. Karthikeyan, M.Kavitha

Department of IT, Dr. SNS Rajalakshmi College of Arts and Science
Department of CS, Dr. SNS Rajalakshmi College of Arts and Science

Abstract- Wireless sensor networks consists of small nodes with sensing, computation, and wireless communications capabilities. The life time of a sensor node depends on its energy consumption. Saving energy and increase network life time are main challenges of wireless sensor networks. The efficiency of the sensor node depends on the routing protocols used. Routing protocols provides a best data transmission route from sensor nodes to sink node to save energy for nodes in the network. This paper compares the three data centric routing protocols SPIN, SPIN-1, M-SPIN for energy efficiency. Based on this analysis M-SPIN performs better than other two. M-SPIN is a better approach for the application need quick and reliable response. The network simulator version 2 is used for performances analysis.

Index Terms- Energy, routing, SPIN, SPIN-1, M-SPIN, and WSN

I. INTRODUCTION

Wireless sensor network are highly distributed networks of small, lightweight wireless nodes deployed in a large numbers to monitor the environment. The main task of a wireless sensor node is to sense and collect data from a certain domain, process them and transmit it to the sink where the application lies.

A. Protocols for Wireless Sensor Network

The routing protocols[2][3] used in the sensor networks are unique from the protocols used in other fixed networks. Sensor networks are infrastructure-less and there is no guarantee for reliable delivery. The nodes in the sensor networks are very prone to failure and there are different categories of routing protocols designed for wireless sensor networks. Wireless sensor network routing protocols are classified as data-centric, node-centric, location aware and quality of service based routing protocols.

B. Data-Centric Protocols

Data-centric[6] protocols differ from traditional address-centric protocols in the manner that the data is sent from source sensors to the sink. In address-centric protocols, each source sensor that has the appropriate data responds by sending its data to the sink independently of all other sensors. However, in data-centric protocols, when the source sensors send their data to the sink, intermediate sensors can perform some form of aggregation on the data originating from multiple source sensors and send the aggregated[11]data toward the sink. This process

can result in energy savings because of less transmission required to send the data from the sources to the sink.

II.SPIN (Sensor Protocol for Information via Negotiation)

SPIN is a adaptive communication and data-centric routing protocol [7]. It is suitable to small or medium sized wireless sensor networks and to bridges other distribution environment. Therefore SPIN [4] protocol is more effective and higher energy than some other protocols in a particular environment. The performance of SPIN [7][8] is better than that flooding, gossiping and ideal protocol for energy and bandwidth consumption. Flooding, which broadcast the packet among all of its neighbors; Gossiping, a variant on flooding that sends messages to random sets of neighboring nodes; and ideal, an idealized routing protocol that assumes perfect knowledge and has the best possible performance. The traditional protocols which establish a path before transmit the data are also not suitable for the mobile sink. Because each time sink is changes its position. It needs to flood the data in order to reach at the sink node.

Negotiation [20]

Before transmitting data, nodes negotiate with each other to overcome implosion and overlap problems and only useful information will be transferred, observed data must be described by meta-data

Resource adaptation

Each sensor node has resource manager and applications probe manager before transmitting or processing data. Sensors may reduce certain activities when energy is low.

A .Meta data

Completely describe the data, and it must be smaller than the actual data for SPIN[4] to be beneficial and if you need to distinguish pieces of data, their meta-data should differ.

Meta-Data is application specific, and Sensors may use their geographic location or unique node ID and camera sensor may use coordinate and orientation

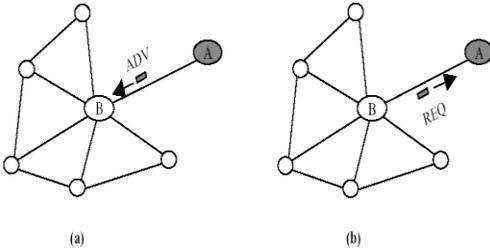
Application must be able to interpret and synthesize its own meta-data

Meta-data size is very small as compared to the size of the DATA. If a neighbor is interested in the data, it sends an REQ message for the DATA and the DATA is sent back to this neighbor node. The neighbor sensor node then repeats this process to its neighbors till reach at the sink node.

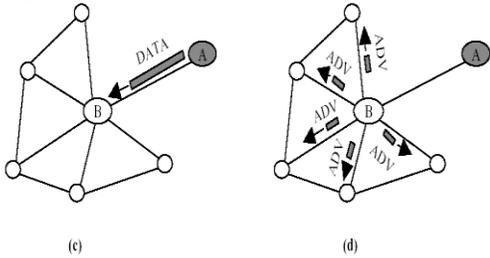
B.SPIN Messages[19]

Sensor nodes use three types of Messages ADV,REQ and DATA to communicate . ADV is used to advertise new data, REQ is also to request for data and DATA is the actual message. The protocol starts when a SPIN node gets new data that it is

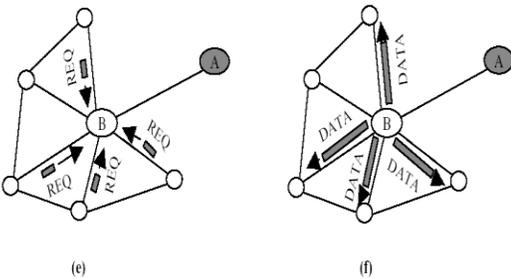
willing to share on on-demand basis. It does so by broadcasting an ADV message containing metadata.



Node B sends a REQ listing all of the data it would like to acquire



If node B had its own data, it could aggregate this with the data of node A and advertise



Nodes need not respond to every message

It starts by advertising its data to node B from Node A(a). Node B responds by sending a request to node A (b). After receiving the requested data (c), node B then sends out advertisements to its neighbors (d), who in turn send requests back to B (e, f). The strength of this protocol lies in its simplicity. Each node in the network performs little decision making when it receives new data, and therefore wastes little energy in computation. Furthermore, each node only needs to know about its single hop network neighbors.

SPIN [18] is designed based on two basic ideas; (1) to operate efficiently and to conserve energy by sending metadata (i.e., sending data about sensor data instead of sending the whole data that sensor nodes already have or need to obtain), and (2) nodes in a network must be aware of changes in their own energy resources and adapt to these changes to extend the operating lifetime of the system.

C. Advantages of SPIN

Topological changes are localized

It solves the implosion and overlap problem in the classic flooding protocol.

D. Drawbacks

Scalability: SPIN is not scalable,

If the sink is interested in too many events, this could make the sensor nodes around it deplete their energy, and SPIN's data advertisement technique can not guarantee the delivery of data if the interested nodes are far away from the source node and the nodes in between are not interested in that data.

E. The Problems of SPIN Protocol

SPIN[3][18] succeeds in avoiding the blind use of resources and solving implosion and overlap problem in the flooding protocol, but the problem of blind forward and data inaccessible still exists and other issues may be appear.

Blind Forward Problem[20]

Source node will send the DATA packet to all the neighbor nodes that respond. Nodes who have received data will broadcast ADV message to all of its neighbors in a similar way, and send DATA packets to its neighbor nodes that respond. This process is repeated until the packets reach the destination. If the network has a new data to be sent, it must repeat the process. So this method could lead to a "blind forward" problem. It is not only a waste of energy, but doesn't take into account the balance of energy consumption of the network nodes.

Data Unaccessible Issue

In the SPIN protocol, if sensor nodes collect new data that need to be forwarded, it will directly broadcast ADV message to its neighbor nodes. In some cases, due to energy of itself, some nodes are reluctant to forward the new data; furthermore, a node's neighbor nodes are not interested in the source of the data or they already have the data. In addition, there is an imbalance of energy consumption in the WSN. For the nodes around sink nodes, they locate on the only path of reaching the sink node, so they are bound to take more tasks and it is easy to run out of energy and fail. The problem above will result in data unaccessible in lossless network.

In SPIN[20], the "blind forward" problem will waste energy and shorten the life cycle of the network, and reduce network performance. The "data unaccessible" problem will lead to the network unable to collect information, and make the WSN lose the meaning of application.

III. SPIN-1 (Sensor Protocol for Information via Negotiation)

SPIN 1[5][20] will overcome the blind forward and data unaccessible problem. SPIN-1 is a data centric, flat routing, source initiated and data aggregation protocol. It establishes a connection based on three-way handshake. SPIN-1 has the same network model with SPIN protocol; the assumptions of network model are as follows:

- 1) The initial energy of each node is equal; nodes A and B can communicate with each other, the link is symmetrical;
- 2) Communication between two nodes is far away from the interference of other nodes, and power is without any constraints and nodes remain stationary;
- 3) Assuming all nodes want to achieve the data, and are located on the path to reach sink nodes;
- 4) Wireless signals in all directions consume the same energy.

A. The Working Mechanism of SPIN-1

The working mechanism of SPIN-1[21][9] is a negotiation process, which establishes a connection based on a three-way handshake.

Data broadcasting stage

When a sensor node (source node) has new data to send or forward, it first broadcasts ADV message to all its neighbors, and starts the timer. ADV message contains the metadata describing the data properties.

Data requesting stage[20]

After the neighbors have received ADV message, they first determine if they have enough energy to complete the task of the three stages. If its energy value is below the threshold, it will not make any response; otherwise, it checks whether it already has the data. If it already has the broadcast data, then it sets the flag of REQ message to 1, and back its energy value to the source node by REQ message. In SPIN[26][27] protocol, if the node has the data already, it won't make any response. This point is also the biggest difference between SPIN 1 and SPIN. If the neighbors do not have the data but their energy is enough, in order to request to send data, the flag of REQ message will be set to 0, and back to the source node together with its energy value using the REQ message.

Data transmission phase.

The source node updates its neighbor list according to the flag of REQ message it receives and energy values. In the threshold time, the source node judges nodes' flag in its neighbor list, if the flag in the neighbor list are both 1 or 0, then filters the nodes whose flags are 0 and forwards data to the node who has the largest energy value; if there are the same energy value, it will randomly select a node to forward; if all the flags of nodes are 0, chooses the node who has the largest energy value to forward the data. If the time is longer than threshold, and all the flags are 1, it is the point that "data inaccessible" problem appears, the source node selects a node who has the largest value from its neighbor list and forwards data mandatory, then removes nodes who do not send REQ message from the neighbor list.

B. Energy-Saving Analysis of SPIN-1 Protocol

Compares the total energy, which is consumed by the process in which one node transmits the m bytes of data it receives to the neighbor node through adopting SPIN protocol and SPIN-I protocol. Assuming that both of ADV and REQ messages are L bytes, it needs to consume E_m energy to sent a byte and E_r energy to receive a byte. The network is distributed, no packet losses or queuing delay, and the average number of node's neighbor is N. Any node in network will forward the m bytes of data it receives to the next hop node.

1) The steps of node B forwards the M byte of data in the SPIN protocol are:

- Send ADV messages, energy consumption is $(N-1)LE_m$;
- Receive the REQ message from N-1 nodes around it, the energy consumption is $L(N-1)E_r$;
- Send Data + L bytes of data, consume $(m+L)(N-1)E_m$ energy;

2) The steps of node B receives m bytes of data in the SPIN protocol are:

- Receive ADV message, consume LE_r energy;
- Send REQ message, the energy consumption is LE_m ;
- Receive m bytes of data, consume $(m+L)E_r$ energy;

According to the above description, in SPIN, the minimum energy consumption in process that node B receives the data and forwards the data to the next hop nodes is showed by the formal below:

$$E_{SPIN} = E_m(2NL + mN - m - L) + (NL + m + L)E_r \quad (1)$$

In accordance with the above assumptions of SPIN-1 protocol, calculate energy consumption of transmitting the same m bytes data. As the byte of energy's value and flag carried by REQ is very small, it can negligible.

3) The steps of node B forwards the M byte of data in the SPIN-1 are:

- Send ADV messages, energy consumption is $(N-1)LE_m$;
- Receive the REQ message from N-1 nodes around it, the energy consumption is $L(N-1)E_r$;
- Send Data+L bytes of data, consume $(m+L)E_m$ energy;

The steps and energy consumption values in the process that node B receives m bytes of data in the SPIN-I protocol are exactly the same with SPIN protocol's. According to the above description, the node B receives the data and forwards the data to the next hop nodes, the minimum energy consumption in SPIN-I routing protocols is:

$$E_{SPIN-I} = E_m(NL + L + m) + (L + NL + m)E_r \quad (2)$$

Compared formula 1 with formula 2 we can see that the coefficient of E_r is the same, so we only need to consider and compare the coefficients of E_m , and get formula 3 by formula 1 minus formula 2:

$$E_{SPIN-I} - E_{SPIN} = 2NL + mN - m - L - NL - L - m = (m+L)(N-2) \quad (3)$$

In Formula 3, the value of $m+L$ is greater than zero, so we need only consider the value of $N-2$. Only when N is equal to 2, the energy value of formula 1 is the same with formula 2. That is B node has two neighbors, a neighbor node sends data to B, B forwards data to the other neighbor node. But this situation is usually almost impossible, especially for newly created network. The average number of nodes in the network must be greater than 2, so the value of formula 3 must be greater than zero. Therefore, the larger N is, the energy consumption is lower significantly in SPIN-1 protocol than that of SPIN protocol. This is because it selects a neighbor node that has the largest energy value to forward message in SPIN-1 protocol, which can balance the energy of sensor nodes in the network. In addition, delete a node that does not respond over threshold time, thus saving the energy of the sensor. However, the time of the same data transfer to the sink node in SPIN-1 protocol is longer than the traditional SPIN protocol, so the SPIN-1 protocol is suitable for real-time low and small or medium scale networks.

IV. M-SPIN (Modified- SPIN)

M-SPIN[42] protocol to transmit information only to sink node instead of transmitting throughout the network. The protocol is based on SPIN family of protocol. In this protocol, total number of packet transmissions is less. Therefore a significant amount of total energy can be saved. Another interesting fact is that energy consumption not only depends on sensing the data but also on processing the sensed data and transmitting or receiving them to or from its neighbor nodes. So if it is possible to control number of transmission and receipt of messages, a significant amount of energy can be saved. In few applications such as alarm monitoring applications need quick and reliable responses. Suppose in forest fire warning system, quick response is needed

before any disaster occurs. In this case, it is desirable that data must be disseminated towards the sink node very quickly.

M-SPIN routing protocol is better approach for such type of applications than SPIN. Figure 2 shows an example of a WSN. An event that occurs in the WSN divides the entire network into two regions, A and B. Sensor nodes in region A are on the other side in the network in comparison with the sink node and sensor nodes in region B are on the same side and nearer to the sink node. Sensor nodes of region A can receive data from the event node, however, they will unnecessarily waste their energy in receiving or transmitting the data. In order to reach data to the sink node, data will have to travel more hops if they are sent via the nodes in region A. Thus, when an event occurs, it is always desirable that the data is sent through the nodes in region B. This would save the energy spent for transmission of a piece of data from an event node to the sink node. However, such selective transmission is not supported in the existing SPIN protocols.

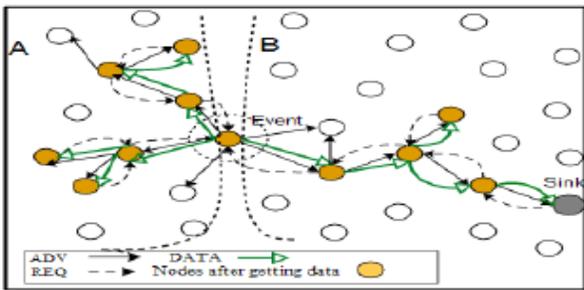


Figure 2. M-SPIN data transmission

A. M-SPIN working mechanism

M-SPIN[42] working mechanism consists of three phases:

Distance discovery phase:

During this phase, the hop distance is measured from sink node. Initially, the sink node broadcasts startup packet with the hop value set to 1. It is possible that a node might receive multiple startup packets from its neighbors. The node that receives multiple startup packets uses the minimum hop value received in the messages and stores the same. The node would re-broadcast the startup packet to its neighbor nodes with modified hop value. The process is continued till all the nodes receive the startup packets.

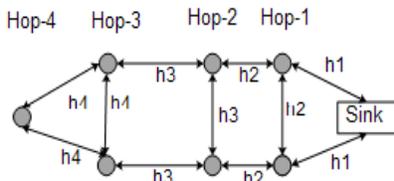


Figure 3. Distance Discovery Phase

Negotiation phase:

Negotiation process is almost the same as the first two phases of the SPIN-1 protocol. The main difference is that the receiver of the ADV message verifies whether it is nearer to the sink node or not in comparison with the node that has sent the ADV message. Only if the hop value of the receiver is lesser than the hop value of the sender of the ADV message then the receiving node sends the REQ message to the sending node for the current data.

Data Transmission phase:

The transmission phase is the same as the SPIN-1. After the reception of the REQ message, the data is sent by the source node to the node which requested the data.

V. COMPARATIVE ANALYSIS OF SPIN, SPIN-1 AND M-SPIN FOR ENERGY CONSUMPTION

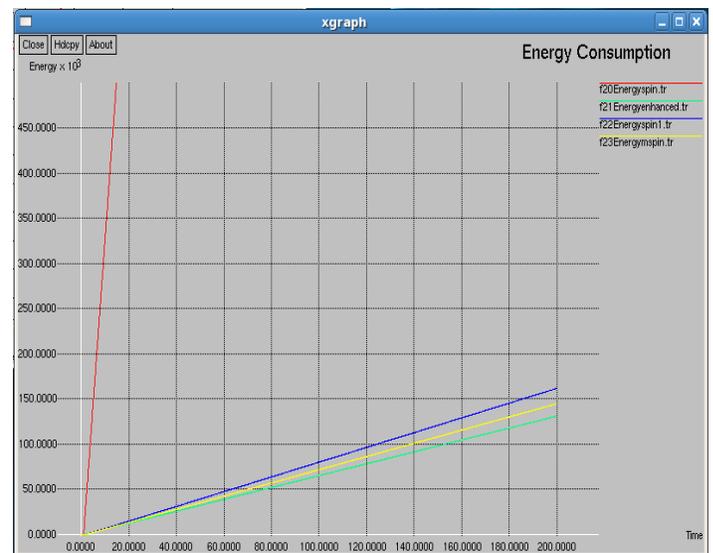
Both the SPIN-1 and the M-SPIN protocols consume lesser energy than SPIN. But the SPIN-1 consumes relatively higher power than M-SPIN. Simulations are performed to understand the energy consumption for the broadcast data transmission. In M-SPIN, only the nodes which are nearer to sink node send REQ packets in response to ADV packet from the source node. This helps the messages reach faster to the sink node using the hop value fixed in the distance discovery phase. In M-SPIN, total number of ADV, REQ and the data messages needed for the transmission of the data come down and this helps in the reduction of energy needed for the transmissions. Hence the energy needed for the transmission is reduced in M-SPIN compared to the SPIN-1. This is possible only because of the introduction of the distance discovery phase introduced in the M-SPIN protocol.

But one problem in M-SPIN is that few sensor nodes may be used several times and those nodes may dissipate energy and may be destroyed earlier than other nodes in the network.

The simulation for the energy consumption by a node for different protocols was performed for 200 seconds and the results are plotted as a graph. From the graphs, it can be concluded that

SPIN needs much higher energy than other protocols

SPIN-1 consumes lesser energy than SPIN but the energy consumption is higher than M-SPIN



Simulation Results Graph for different protocols (200sec – zoom view)

The figure above gives the zoomed view of the energy consumption for different protocols versus the time for which the network is simulation. From the above graph, it can be found that the M-SPIN needs least energy than other protocols

VI. CONCLUSION AND FUTURE WORK

In this paper we have compared three data-centric protocols for wireless sensor network. M-SPIN consumes lesser energy than other two protocols. M-SPIN protocol using hop-count values of sensor nodes for WSN. Here also negotiation is done before sending the actual data. M-SPIN only the nodes which are nearer to sink node send REQ packets in response to ADV packet from the source node. Therefore data is disseminated to the sink or neighbor nodes towards the sink node. M-SPIN achieves energy savings by discarding packet transmission to the opposite direction of sink node. But one major problem in M-SPIN is that few sensor nodes may be used several times and those nodes may dissipate energy and may be destroyed earlier than other nodes in the network. In future to overcome this problem faced in the M-SPIN protocol, uses cluster methodology and dynamic cluster head election to overcome the problem of using only few nodes for the forwarding of the data. Clustering algorithm is used for the formation of clusters and the election of cluster heads.

VII. REFERENCES

- [1] Akkaya, K., and Younis, M. (2005), "A Survey on Routing Protocols for Wireless Sensor Networks", Elsevier Journal of Ad Hoc Networks, Vol. 3, pp. 325-349.
- [2] Akyildiz, I.F., Vuran, M.C., Akan, O., and Su, W. (2004), "Wireless Sensor Networks: A Survey Revisited", Elsevier Journal of Computer Networks, Vol. 45, No. 3.
- [3] Akyildiz, I.F., Su, W., Sankarasubramanian, Y., and Cayirci, E., (2002), "Wireless sensor networks: a survey", Elsevier Journal of Computer Networks, Vol. 38, No. 4, pp. 393-422.
- [4] Al-Karaki, J.N., Kamal, A.E., (2004), "Routing Techniques in Wireless Sensor Networks: A Survey", IEEE transactions on Wireless Communications, Vol.11, No. 6, pp. 6-28.
- [5] Akyildiz, I.F., Su, W., Sankarasubramanian, Y., and Cayirci, E., (2002), "A survey on sensor networks", IEEE Communications Magazine, Vol. 40, No. 8, pp.102-114.
- [6] Azni, A.H., Madihah Mohd, S., Azreen, A., and Ariff Syah, J., (2009), "Performance Analysis of Routing Protocol for WSN Using Data Centric Approach", World Academy of Science, Engineering and Technology, Vol. 53.
- [7] Basagni, S., (1999), "Distributive and Mobility-Adaptive Clustering for Multimedia Support in Multi-hop Wireless Networks", Proceedings of Vehicular Technology Conference, VTC, Vol. 2, pp. 889-893.
- [8] Chee-Yee Chong, C., and Srikanta, P., (2005), "Sensor Networks: Evolution, Opportunities, and Challenges", IEEE Transactions on sensor networks, Vol. 28, pp.117-123.
- [9] Deepak, P., and Bibhudatta, S., (2010), "Adaptive Protocol for Critical Data Transmission of Mobile Sink Wireless Sensor Networks", International Journal of Computer Science, Vol.10.
- [10] Energy Harvesting Projects, (2005), "Collections of articles on IEEE Pervasive Computing", pp. 69-71.
- [11] Estrin, D., Girod, L., Pottie, G., and Srivastava, M., (2001), "Instrumenting the world with wireless sensor networks", Proc. Acoustics, Speech, and Signal Processing, Vol. 4, pp. 2033-2036.
- [12] Farhana, Z., (2007), "REEP : a data-centric, reliable and energy-efficient routing protocol for wireless sensor networks", Digital Commons @ Ryerson.
- [13] Garcia-Hernandez, C.F., Ibarguengoytia-González, P.H., Garcia-Hernandez, J., and Pérez-Díaz, J.A., (2007), "Wireless Sensor Networks and Applications: a Survey", International Journal of Computer Science and Network Security, Vol.7, No.3.
- [14] Herzelman, W., and Kulik, J., (1999), "Adaptive protocols for information dissemination in wireless sensor networks", ACM/IEEE Mobicom Conference, Seattle, WA, pp. 174-185.
- [15] Heinzelman, W., Chandrakasan, A., and Balakrishnan, H., (2000), "Energy-Efficient Communication Protocol for Wireless Sensor Networks", Proceeding of the Hawaii International Conference System Sciences, Hawaii, USA.
- [16] Heinzelman, W.R., Chandrakasan, A., and Balakrishnan, H., (2000), "Energy-efficient Communication Protocol for Wireless Microsensor Networks", IEEE Computer Society Proceedings of the Thirty Third Hawaii International Conference on System Sciences, Vol. 8, p. 8020.
- [17] 21 ideas for the 21st century, (1999), Business Week, pp. 78-167.
- [18] Jonna, K., Rabiner, W., and Hari Balakrishnan, (2002), "Negotiation -based protocols for Disseminating information in Wireless Sensor Networks", ACM Wireless Networks.
- [19] Kulik, J., Heinzelman, W.R., and Balakrishnan, (2002), "Negotiation-Based Protocols for Disseminating Information in Wireless Sensor Networks", Wireless Networks, Vol. 8, pp. 169-185.
- [20] Luis, J., Ana Lucila, S., Alicia, T., Cabrera, S., and Barenco Abbas, C.J., (2009), "Routing Protocols in Wireless Sensor Networks", Sensors 2009.
- [21] Luwei, J., Liu, F., and Li, Y., (2011), "Energy Saving Routing Algorithm Based on SPIN Protocol in WSN", IEEE Transactions on wireless sensor networks.
- [22] Li, L., and Wu, F., (2007), "Research on SPIN of wireless sensor network", Computer and Modernization, Vol. 3, pp. 93-96.
- [23] Munish, B., Kotary, D.K., and Soni, S., (2012), "Comparative analysis of energy efficient routing protocol for wireless sensor network", International journal of computer application on wireless communication and mobile networks, No. 14, pp.65-69.
- [24] Mudholkar, R.R., Sawant, S.R., and Patil, V.C., (2012), "Classification and comparison of routing protocols in wireless sensor networks", Ubic journal, Vol. 4, pp.704-711.
- [25] Obaisat, Y., and Braun, R., (2003), "On Wireless Sensor Networks: Architectures, Protocols, Applications, and Management".
- [26] Padmanabhan, K., and Kamalakkannan, P., (2011), "A Study on Energy Efficient Routing Protocols in Wireless Sensor Networks", European Journal of Scientific Research, Vol. 60, No. 4, pp. 499-511.
- [27] Rajashree, V., Biradar, V.C., Sawant S.R., and Mudholkar, R.R., (2012), "Classification and comparison of Routing Protocols in Wireless Sensor Networks", Ubiquitous Computing Security Systems Journal, Vol. 4, pp. 704-711.

- [28] Romer, K., and Mattern, F., (2004), "The design space of wireless sensor networks", IEEE transactions on Wireless Communications, Vol. 11, No. 6, pp. 54-61.
- [29] Schurgers, C., and Srivastava, M. B., (2001), "Energy Efficient Routing in Wireless Sensor Networks", MILCOM Proceedings on Communications for Network-Centric Operations: Creating the Information Force, McLean, VA.
- [30] Shi, Y. B., Ye, X. B., and Liu, P. L., (2005), "Research status on wireless sensor networks", Foreign Electronic Measurement Technology, Vol. 24, No. 1, pp. 19-23.
- [31] Singh, S.K., Singh, M.P., and Singh, D.K., (2010), "A survey of Energy-Efficient Hierarchical Cluster based Routing in Wireless Sensor Networks", International Journal of Advanced Networking and Application, Vol. 02, No. 02, pp. 570-580.
- [32] Singh, S.K., Singh, M.P., and Singh, D.K., (2010), "Routing Protocols in Wireless Sensor Networks – Survey", International Journal of Computer Science and Engineering Survey, Vol. 1, No. 2.
- [33] Shanmugam, A., and Chandrasekaran, V., (2012), "A review on hierarchical cluster based routing in wireless sensor networks", Journal of global research in computer science, Vol. 3, pp.12-16.
- [34] Singh, D., Choudhary, N., and Pandey, S., (2012), "Performance analysis of energy efficient clustering algorithms for wireless sensor networks", International journal of computer applications, Vol. 5, No. 12, pp.56-59.
- [35] Syah Johari, A., Madihah Mohd Saudi, M.M., and Azreen, A., (2009), "Performance analysis of routing protocols for WSN using data centric approach", World academy of Science, Engineering and Technology, Vol. 12.
- [36] Su, M., and Sankarasubramaniam, Y., (2002), "Wireless sensor network: a survey", Broadband and Wireless Networking Laboratory, School of Electrical and Computer Engineering, Atlanta, pp. 393-442.
- [37] Stankovic, A., (2006), "Wireless Sensor Networks", University of Virginia Charlottesville.
- [38] Vibhav, K.S., Imam, S.A., and Beg, M.T., (2012), "Energy efficient communication methods in wireless sensor networks-review", International journal of computer applications, Vol. 39, No. 17.
- [39] Wu, F., and L. Li., (2007), "Research on SPIN of wireless sensor network", Computer and Modernization, Vol. 3, pp. 93-96.
- [40] Younis, M., Youssef, M., and Arisha, K., (2002), "Energy-aware Routing in Cluster-Based Sensor Networks", Proceedings of the 10th IEEE/ACM International Symposium on Modeling, Analysis and Simulation of Computer and Telecommunication Systems.
- [41] Ying Miao, (2005), "Applications of sensor networks", Journal of Computer Networks and Communication Systems, pp. 27-34.
- [42] Zabin, F., Misra, S., Woungang, I., Rashvand, H.F., Ma, N.W., and Ali, M. A., (2007), "REEP: data-centric, energy-efficient and reliable routing protocol for wireless sensor networks". IET Communications on wireless sensor networks. Vol. 2, No. 8, pp. 995-1008.
- [43] Zeenat, R., Sarbani, R., and Nandini, M., (2011), "A Modified SPIN for Wireless Sensor Networks", IEEE transactions on wireless sensor networks Vol. 11, pp 978-982.

AUTHORS

First Author – . K.KARTHIKEYAN, M.Sc., M.Phil, Head,
Department of Information Technology,
Dr. SNS Rajalakshmi College of Arts and
Science, ithodsns@gmail.com

Second Author –M.KAVITHA, B.E., MSc, M.Phil,
Research Scholar, Dr.SNS Rajalakshmi College of Arts and
Science. Kaviblue_m@yahoo.co.in

Correspondence Author –M.KAVITHA
Kaviblue_m@yahoo.co.in.

Contact no:+91 9486708083

Depression among Fresh College Hostellers during Pre and Post Semester

Dr. K.Kajavinthan

Senior Lecturer in Psychology, Department of Philosophy, University of Jaffna

Abstract- This research work is an attempt to study the level of depression among fresh college Hostellers. The sample for this study comprises of 100 fresh college hostellers (50 male and 50 female). Data was collected by face-to-face interview method. Tools used for data collection were the personal information schedule and revised. Beck depression inventory (BDI) developed by Beck (1961). Mean, standard deviation and 't' test were the statistics calculated. The results indicated that depression among fresh college hostel inmates differ significantly in pre and post semester. Depression of fresh college hostel inmates found to be reduced in post semester when compared to pre semester. Depression of fresh college hostel inmates of female students also differs significantly in pre and post semester.

I. INTRODUCTION

Hostel is a place where the students are away from home. After the higher secondary school education, students are coming from various places to pursue their education by staying in hostel. Students before entering into the college hostel, they have positive ideas about the situation, place, room mates, education, etc. After entering the college hostel the students develop depression, fear, dissatisfaction, irritability, etc. In home they have freedom within certain limits; they are provided and protected from many problems by their parents. In the hostel they may face the problems within the hostel as well as in the college because of lack of adequate support. In the initial stage the students in hostel are all new to each other, even their roommates. So Students face difficulty in coping, adjusting, helping with others because there may be difference in language, lifestyle, belief, personality, etc. Within a short period however, a section of them cope with others, adjust with others and share with others immediately to the roommates. Then this sharing, adjusting extends to others. Some face however difficulty in this and it leads to depression among them. It interferes in their day to day activities and it gets expressed in their words, action, and thinking.

Depression is the common mood disorder found among all the age groups and races. Depression has been recorded since olden days and descriptions of what are now called mood disorders can be found in many ancient documents.

Depression in the normal individual include a state of sadness characterized by feeling of inadequacy, lowered activity, and hopelessness about the future, and in pathological cases, an extreme state of unresponsiveness to stimuli, together with self-depression, delusions of inadequacy and hopeless (Atkinson, Berne and Woodworth, 1988).

Beck and Beamesdefer (1974) suggest that characteristics of depression include hopelessness, sense of failure, self-dislike, social withdrawal, and somatic preoccupations.

The American Psychological Association (APA) DSM-IV-TR (2000) states that the essential features of depressive episodes are either depressed mood (or possibly in children and adolescents an irritable mood) or loss of interest or pleasure in almost all activities and the associated symptoms of the disorder include weight change, sleep disturbance, psychomotor agitation or retardation, decreased energy, feelings of worthlessness or excessive or inappropriate guilt, difficulties in thinking or concentrating or suicidal ideations or attempts.

In simplest terms, depressive states typically show a combination of three psychological symptoms (1) depressed mood (feelings of helplessness, hopelessness, guilt, worthlessness, psychic pain), (2) drive inhibition (loss of energy), and (3) anxiety. These symptoms are associated with disturbances of appetite, sleep and sexual libido. Behavioural symptoms such as social withdrawal, crying spells, and suicide attempts occur along with the typical depressive posture and faces with furrowed brow, turned-down corners of the mouth, and lack of animation.

II. OBJECTIVE OF THE STUDY

To assess depression among fresh college hostel inmates pre & post semester.

III. METHODOLOGY

Hypothesis:-

In view of the objective, the following null hypotheses were framed in the present study.

1. There is no significant difference in depression among fresh college hostel inmates pre and post semester.
2. There is no significant difference in depression among fresh college hostel inmates of female students pre and post semester.
3. There is no significant difference in depression among fresh college hostel inmates of male students pre and post semester.

Sample:-

The sample consisted of one hundred male and female fresh college Hostellers between ages of 17 and 20 served as subjects. The sample comprised of 50 males and 50 females, students belonging to various departments of a COLLEGE OF

ARTS AND SCIENCE HOSTEL in coimbatore, Tamilnadu, India.

Tools Used:

The tools used in the study by the researcher were selected after a thorough analysis of literature on depression. The following scales were employed to collect data:

- i. Personal information schedule
- ii. Beck depression inventory (BDI)

i) Personal information schedule

An information schedule was designed by the investigator to collect demographic and biographical information from the sample required for study .

ii) BECK DEPRESSION INVENTORY (BDI).

The Beck Depression Inventory was used to measure self-reported depression. This inventory consists of twenty one well known items and its reliability and validity has been established. Each item consists of a graded series of 4 Self-Evaluative statements. The statements are ranked to reflect the range of severity of the symptom from neutral to maximal severity. Numerical values from 0 – 3 are assigned each statement to indicate the degree of severity. Greater scores on the BDI reflect greater depression. The scores of 0 – 16 represents low depression, 16 – 32 mild depression, 32 – 48 moderate depression and 48 – 63 severe depression.

Procedure:

The inventories were distributed in the hostel. The students were given general instruction to complete the instrument in the order presented in personal information schedule followed by Beck Depression Inventory (BDI). The same questionnaires were given to the selected subjects in pre semester. After the first semester was over (six month later), the same inventories were given to the subjects as that of pre semester.

Statistical Analysis:

Beck Depression Inventory obtained from each subject was scored. Fresh college Hostellers were compared on the depression scores pre and post semester using a ‘t’ test. The values were analyzed at 0.05 level of significance.

IV. RESULTS AND DISCUSSION

Table I: Showing the values for depression among fresh college hostel inmates in pre and post semester.

S.No	Group	N	Mean	S.D	t
1.	Pre Semester	100	24.76	8.77	7.31*
2.	Post Semester	100	15.48	9.32	

Expected ‘t’ value < 1.96**. The ‘t’ value is significant.

From the above table it can be seen that the ‘t’ value (7.31) for depression among fresh college hostel inmates in pre and post semester is significant. This shows that there is difference in depression pre and post semester in the total sample. The null hypothesis is therefore rejected. The depression level was mild during pre semester and it was reduced to low depression at post semester. The time period of six months between pre and post semester influence the results of the depression. This may be due to the enhanced coping behavior and adjustment, sharing with roommates, hostel facilities and circumstances, etc., of the students of both sexes.

Table II: Showing the values for depression among fresh college hostel inmates of female students in pre and post semester.

S.No	Group	N	Mean	S.D	t
1.	Pre Semester	50	25.32	9.46	5.15*
2.	Post Semester	50	15.28	9.87	

Expected ‘t’ value < 1.96**. The ‘t’ value is significant.

From the above table it can be seen that the ‘t’ value (5.15) for depression among fresh college hostel inmates of female students in pre and post semester is significant. This shows that difference in depression exist. Hence the null hypothesis is rejected. The depression level was mild during pre semester and it got reduced to low depression at post semester. Perhaps the time period of six months between pre and post semester influenced the results of the depression. It may be also due to the improved coping behaviour, adjustments, sharing with roommates, hostel facilities and circumstances, etc.,

Table III: Showing the values for depression among fresh college hostel inmates of Male students in pre and post semester.

S.No	Group	N	Mean	S.D	t
1.	Pre Semester	50	24.20	8.08	4.98*
2.	Post Semester	50	15.68	8.83	

Expected ‘t’ value < 1.96**. The ‘t’ value is significant.

From the above table it can be seen that the ‘t’ value (4.98) for depression among fresh college hostel inmates of male students in pre and post semester is significant. This shows that the difference in depression exists. The depression level was mild during pre semester and it was reduced to low depression at post semester. The time period of six months between pre and post semester perhaps influenced the results of the depression. Depression is found to differ in pre & post semester among fresh college hostel inmates in pre and post semester. Thus the period of six months, several factors and circumstances may lead to reduce the level of depression in post semester when compared to the pre semester among college hostellers.

The result shows that depression had reduced. It may be due to several circumstances & facilities available in the hostel, the lifestyle, belief, etc. of the hostellers.

V. SUGGESTION AND CONCLUSION

Depression among fresh college hostel inmates may be due to their dissatisfaction, irritability, hopelessness, lifestyle, personality, beliefs, etc. However Hostel administration has taken appropriate action/planning to reduce the ill effects of the above problems through proper guidance & counseling, providing the needed facilities, creating a good rapport with hostel inmates, visiting regularly and meeting them to express their difficulties and grievances faced by them, and suggesting solutions to the problems, etc. Therefore, the hostel has become “a second home” for the inmates. Further studies are needed to clarify the role of hostel administration in alleviating depression among hostellers.

REFERENCES

- [1] Atkinson, J., Berne, E., & Woodworth, R.S. (1988):
- [2] Dictionary of psychology, Drysdale Publishers Inc. U.S.A
- [3] Beck, A.T. (1967). Depression: Clinical, experimental and theoretical aspects, Newyork: Hoeber.
- [4] Beck, A. T., & Beamesderfer, A. (1974), Assessment of depression: Depression Inventory. In P.Pichot (Ed.), Psychological measurements in psychopathology :Modern problems in pharma psychiatry. Basel: S.Karger. (PP.151-169).

AUTHORS

First Author – Dr.K.Kajavinthan, B.A(Hons)., MA.,M.Phil.,PhD, Senior Lecturer in Psychology, Department of Philosophy, University of Jaffna

Fourier Transform and Its Application in Cell Phones

Anupama Gupta

Senior Lecturer in Mathematics, Govt. College for Women, Parade Ground, Jammu

Abstract- Communication is all based on Mathematics, be it digital, wired or wireless. Signal transmission is done through modulation i.e. amplitude modulation (AM), frequency modulation (FM) or phase modulation (PM). At the receiving end the transmitted signal is demodulated to extract the information. All these techniques are based on pure mathematics. While modulating the information signal, a high frequency sinusoidal carrier signal is used to transmit the message signal through a medium (cable or air). It is then received and demodulated using Fourier Transform analysis. So for understanding the communication technology, the processes of modulation, demodulation and Fourier Transform need to be explored first. In this paper, I have discussed how Fourier Transform is used in cell phone networking.

Mathematics Subject Classification: Primary 94B12; Secondary 90B18

Index Terms- Signal processing, Base Transceiver Station (BTS), Nuclear Magnetic Resonance (NMR), Frequency Identifier Descriptor (FID).

I. INTRODUCTION

Mathematics is everywhere in every phenomenon, technology, observation, experiment etc. All we need to do is to understand the logic hidden behind. Since mathematical calculations give way to the ultimate results of every experiment, it becomes quite pertinent to analyze those calculations before making conclusions. The present era of communication technology has provided some major catalysts in developing the modern human society. Communication includes automatic transmission of data over wires and radio circuits through signals. In communication systems, signal processing, and electrical engineering, signal is a function that conveys information about the behavior or attributes of some phenomenon. Signal is basically a means of transmitting information in accordance with certain pre arranged system or code. It includes, among others, audio, video, speech, image, communication, geophysical, sonar, radar, medical and musical signals.

One of the most prominent communication devices, the Cell Phone is dramatically changing the way people interact and communicate with each other. Cell-phones emit small amount of electromagnetic signals via the radio waves through a low power transmitter. While talking over the cell-phone, the transmitter takes the sound of voice & changes it into a continuous sine wave. Sine wave is measured in terms of frequency. Transmitter sends the sine wave to antenna. Antenna transmits the sine wave in the form of electromagnetic signal to the BTS. Cell-phone works by communication between service network through BTS

or cell tower. Cell towers divide the city into small areas or cells. As the user moves from one cell to another, the signal along with the information is handed over from tower to tower. A lot of work is done on communication and signal process by Davis [1], Simon [4] and Taub [5]

Today cell phones are the best communication service which provide not only the basic functions of telephone and radio but also act as data sharing devices. Being cheap and reliable, cell phones are the fastest adopted technology in human history.

How mathematics is involved in making cell phones work and make calls?

The cell phones are designed by using a lot of math in just about every aspect of their design. Also cell phones operate by principles of electromagnetics, which are described mathematically.

- One has to dial a number that it is based in a protocol named Internet Protocol (IP). Protocol is basically a set of rules.
- The phone has to use coordinates to locate the Satellite to receive and transmitted to the other end.
- They have to convert from an electric system or wave system into a voice system that it is based in alphabetical words, and then translated between the 2 system based in a numerical system called binaries.
- This binary system it is integrated into satellites, transmitter and receivers by the motherboard integrated and each system, then incorporated into each one by programming and all it is traversed by mathematics. By the way the binary system it is multiples of 2's, and they go by 0's and 1's and also it is called machine language because those dome machines only work with electric impulses like On and Off.

When we place a cell phone call, the phone must send out an electronic signal which carries a digitalized version of your speech (mathematics comes into play here through the use of error correction and data compression). This signal must be sent at a frequency which will not interfere with the calls that are being placed by other nearby users of cell phones; otherwise there will degradation of the signal quality or in the worst case a "dropped call." This refers to a call which has been connected but during the course of the conversation there is a loss of signal which disconnects the call.

High sounds have higher frequencies and low sounds have a lower frequency. A higher frequency produces a higher pitch, and a lower frequency produces a lower pitch. For example, thunder has a frequency of only 50 hertz, while a whistle can have a frequency of 1,000 hertz, which means the high frequency wave has completed more cycles over the time whereas the low frequency wave has completed less cycles over the same time. If

we increase the amplitude of a sound, we are making it louder, just as we do when you turn up the volume on your radio. If you decrease the amplitude, you are making the sound softer (turning down the volume). The amplitude of a wave is related to the amount of energy it carries. A high amplitude wave carries a large amount of energy; a low amplitude wave carries a small amount of energy. The average amount of energy passing through a unit area per unit of time in a specified direction is called the intensity of the wave. As the amplitude of the sound wave increases, the intensity of the sound increases. Sounds with higher intensities are perceived to be louder.

The word that musicians use for frequency is pitch. The shorter the wavelength, the higher the frequency and the higher the pitch of the sound is. In other words, short waves sound high; long waves sound low. In fact cell phone works on same principle.

Role of Fourier Transform (FT) in Cell phone

Jean Baptiste Joseph Fourier, the French mathematician/physicist made an astonishing discovery in 1800. According to Fourier, every function could be represented by an infinite series of elementary trigonometric functions: sine and cosine. For example, consider decomposing the signal into its trigonometric constituents reveals the fundamental frequencies (tones, overtones, etc.) that combine to produce the instrument's distinctive timbre. Fourier analysis is an essential component of much of modern applied (and pure) mathematics. It forms an exceptionally powerful analytical tool for solving a broad range of partial differential equations. Fourier analysis lies at the heart of signal processing, including audio, speech, images, videos, seismic data, radio transmissions, and so on. Many modern technological advances, including television, music CD's and DVD's, cell phones, movies, computer graphics, image processing, and fingerprint analysis and storage, are, in one way or another, founded upon the many ramifications of Fourier theory.

The principle of the Fourier transform is that any signal, such as the sound produced by a musical instrument, e.g., piano, violin, trumpet, or drum, any sound recording can be represented as the sum of a collection of sine and cosine waves with different frequencies and amplitudes. This collection of waves can then be manipulated with relative ease—for example, allowing a recording to be compressed or noise to be suppressed. This Fourier decomposition lies at the heart of modern electronic music; a synthesizer combines pure sine and cosine tones to reproduce the diverse sounds of instruments, both natural and artificial, according to Fourier's general prescription. Anyone who's marveled at the tiny size of an MP3 file compared with the same recording in an uncompressed form has seen the power of the Fourier transform at work. The Fourier Transform is an algorithm used in many functions, including signal processing or statistical applications across a broad range of applications. Our mobile phone has devices performing Fourier Transform. Every mobile device--netbook, notebook, tablet, and phone have been built in high-speed cellular data connection, just like Fourier Transform. The Fourier Transform is a method for doing this process (signal processing) very efficiently. For more details about Fourier Transform, I refer to Bracewell [3], Howell [2].

The Fourier Transform is a mathematical procedure which transforms a function from the time domain to the frequency domain. Fourier Transform is a mathematical method using the trigonometric functions (sin and cos) to transform a time domain spectrum into a frequency domain spectrum. Sine and cosine are keys to the success of Fourier Transform because sound may be represented by a complex combination of their waves. Humans, very easily perform FT mechanically almost every day without having idea of it. For example, when you are in a room with a great deal of noise and you selectively hear your name above the noise, you have just performed FT. FT is the mathematical way of gathering unique frequencies from a broad spectrum of frequencies, like in the FID spectrum obtained in NMR. Fourier Transform can be used to convert from the series of numbers to sound.

A Fourier Transform works like a prism which splits white light into a spectrum of colors. The information on a CD has sounds of all frequencies mixed together and CD player splits apart the sound frequencies so they can be amplified and sent to the speakers. In our inner ears, the cochlea enables us to hear subtle differences in the sounds coming to our ears. The cochlea serves to transform the air pressure signal experienced by the ear drum into frequency information which can be interpreted by the brain as tonality and texture.

REFERENCES

- [1] Davis Kennedy, Electronic Communication Systems, (1999), Tata McGraw-Hill.
- [2] Kenneth B. Howell, Principles of Fourier Analysis, (2001), CRC Press.
- [3] R. Bracewell, The Fourier Transform and its Applications, (1999), Tata McGraw-Hill.
- [4] Simon S. Haykin and Van Veen Barry, Signals and Systems, 2nd ed., (2002), Wiley Press.
- [5] Taub and Schilling, Principles of Communication Systems, (1991), Tata McGraw-Hill.
- [6] <http://www.math4mobile.com>
- [7] <http://en.wikipedia.org>

AUTHORS

First Author – Anupama Gupta, Senior Lecturer in Mathematics Govt. College for Women, Parade Ground, Jammu, anu_ju08@yahoo.com

Cross Layer Transport Layer Approach for Multihop Wireless Sensor Network

Vaishali Rajput*, Tanaji Khadtare**, Atul Rohankar***

* Information Technology Department, Sinhgad Institute of Technology & Science, Pune
** Information Technology Department, Sinhgad Institute of Technology & Science, Pune
*** Information Technology Department, Sinhgad College of Engineering, Pune

Abstract- The traditional network is layered designed. Most network architectures of the radio network are also layered. In the layered design, each layer just is responsible for its own task. This can make the design more easily, and the network architecture adapted more application. But this also may make the design not efficient. Because each layer does its only job and does not know the other layer's status. For example, in many applications of wireless sensor networks, the MAC layer will shutdown the transceiver when the MAC layer thinks no data packet to send. But if when the node shutdown the transceiver, the routing layer thinks it is time to send a hello packet or something else, the node must reopen the transceiver. This does not save the energy. It is a waste of energy, the frequently open and shutdown operation will consume a lot of energy. But if the design is cross-layer, this situation could be avoided. When the MAC layer want shutdown the transceiver, it will check that whether it is time for the routing layer to send the hello message. Then the conflict is avoided. The radio network is application-dependent. So according to the actual application, the cross-layer design will make an efficient routing protocol for the wireless sensor networks.

Index Terms- Cross Layer, RTS-CTS, Autoack, Jennic

I. INTRODUCTION

The recent advances in micro-electro-mechanical system, wireless communication technology, and digital electronics have enabled the development of low-cost, low-power, small size distributed devices. Such small devices are called sensor nodes. Sensor nodes, which comprise sensing, data processing, and wireless communicating components, are capable of local processing and transmitting information wirelessly to base stations thus establishing a Radio Network. However the standardization has not been established yet. The 802.15.4 RFC is drafted for MAC/PHY layers. The Data link layer, Network layer and all rest of the layers are yet to be addressed. It is for sure that the upper layers cannot be as distinct as the OSI layer model but will have cross layer functionality due to the nature of desired small radio networks

Radio Network presents many new technical challenges for the research communities. This application addresses some important cross layer design of transport layer issues which are not handled yet.

Problem Definition

We have worked on following guidelines

- Real time study of the system overhead for bulk/file data transfer
- Devise solutions for addressing these problems.
- The protocol should have strict congestion control with little congestion control implementation overhead.
- The protocol should work with guaranteed QoS.
- The implementation code should be small (program and data memory efficient)
- Make use of the MAC/PHY layer support mechanism like AUTOACK (cross layer approach)
- The design should be generic enough to be used for other applications.

II. SYSTEM ARCHITECTURE

The system is divided into three components:

1. Master Device.
2. Network Processing Device.
3. End Node Device.

SETUP 1: End devices directly connected with Master



Figure 2.1 Mater-End device connectivity

SETUP 2: End devices connected with Master via NPDs.

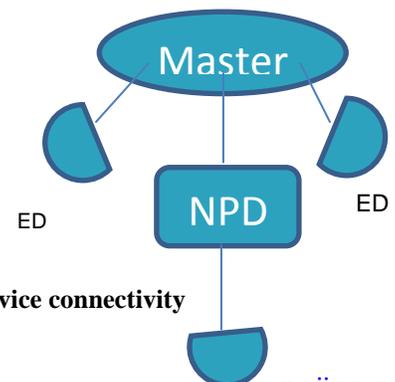


Figure 2.2 Mater-End device connectivity

III. HARDWARE ARCHITECTURE

The Controller board is supplied with Jennic evaluation kits, which provide a complete hardware environment for designers to develop IEEE 802.15.4 and ZigBee applications, and to accelerate time-to-market. The hardware provides a stable platform which allows designers to rapidly develop and test applications based around Jennic wireless microcontroller products.

3.1 Wireless Microcontroller

Applications that transfer data wirelessly tend to be more complex than wired ones. Wireless protocols make stringent demands on frequencies, data formats, and timing of data transfers, security and other issues. Application development must consider the requirements of the wireless network in addition to the product functionality and user interfaces. To minimize this complexity, Jennic provides a series of software libraries that control the transceiver and peripherals of the JN513x. These libraries, with functions called by an Application Programming Interface (API) remove the need for the developer to understand wireless protocols and greatly simplify the programming complexities of power modes, interrupts and hardware functionality.

3.2 Wireless Transceiver

The Wireless Transceiver is highly integrated and, together with the IEEE802.15.4 MAC library requires little knowledge of RF or wireless design. The Wireless Transceiver comprises a low-IF 2.45GHz radio, an O-QPSK modem, a baseband controller and a security coprocessor. The radio has a 200Ω resistive differential antenna port that includes all the required matching components on-chip, allowing a differential antenna to be connected directly to the port, minimizing the system BOM costs. The transceiver elements (radio, modem and baseband) work together to provide 802.15.4 Medium Access Control under the control of a protocol stack supplied with the device as a software library.

4.3 RISC CPU and Memory

A 32-bit RISC CPU allows software to be run on-chip, its processing power being shared between the IEEE802.15.4 MAC protocol, other higher layer protocols and the user application. The JN513x has a unified memory architecture, code memory, data memory, peripheral devices and I/O ports are organized within the same linear address space. The device contains 192kBytes of ROM, a choice of 8k, 16k, 32k or 96kBytes of RAM and a 48-byte OTP eFuse memory.

IV. IMPLEMENTATION AND CODING

4.1 System Implementation

To demonstrate the file transfer, transport layer protocol dynamics and our solutions on the same, serial communication is used.

4.2 Working of Uart

Two hardware flow control signals are provided: Clear-To-Send (CTS) and Request-To-Send (RTS). CTS is an indication sent by an external device to the UART that it is ready to receive data. RTS is an indication sent by the UART to the external device that it is ready to receive data. Monitoring and control of CTS and RTS is a software activity, performed as part of interrupt processing. The signals do not control parts of the UART hardware, but indicate to software the state of the UART external interface.

Characters are read one byte at a time from the Receive FIFO and are written to the Transmit FIFO using `vAHI_UartWriteData()`. The Transmit and Receive FIFO can be cleared and reset independently of each other using `vAHI_UartReset()`. The status of the transmitter can be checked using `u8AHI_UartReadLineStatus()`, which indicates if the transmit FIFO is empty, and if there is a character being transmitted. The status of the receiver is also checked using this call, which can indicate if conditions such as parity error, framing error or break indication have occurred. It also shows if an overrun error occurred (receive buffer full and another character arrives) and if there is data held in the receive FIFO.

4.3 File Transfer with different mechanisms

4.3.1 With RTS-CTS

Suppose Node A wants to send file to Node B.

1. Node A sends enquiry packet to Node B.
2. Node B checks for the free space in its transmit queue. If space is available it sends acknowledgement to Node A and sets itself into receive state.
3. After getting acknowledgement from Node B, Node A starts sending data packets.
4. Node B copies packet data to serial buffer for output to UART.
4. After receiving each packet, Node B sends acknowledgement to Node A.
5. Node A sends next packet.

4.3.2 Without RTS-CTS

In our application we are not using RTS-CTS instead; we are using AUTOACK mechanism at transport layer. We can achieve the quality of service by using hardware generated Autoack instead of software generated RTS-CTS.

4.3.3 AUTOACK mechanism

The JN513x baseband processor can automatically construct and send the acknowledgement packet without processor intervention and hence avoid the protocol software being involved in time-critical processing within the acknowledge sequence. The JN513x baseband processor can also request an acknowledgement for packets being transmitted and handle the reception of acknowledged packets without processor intervention.

4.4 Need For Cross Layer Design

The traditional network is layered designed. Most network architectures of the radio network are also layered. There are four layers for the radio networks, the physical layer, the link layer, the network layer and the application layer. In the layered design,

each layer just is responsible for its own task. This can make the design more easily, and the network architecture adapted more application. But this also may make the design not efficient. Because each layer does its only job and does not know the other layer's status. For example, in many applications of wireless sensor networks, the MAC layer will shutdown the transceiver when the MAC layer thinks no data packet to send. But if when the node shutdown the transceiver, the routing layer thinks it is time to send a hello packet or something else, the node must reopen the transceiver. This does not save the energy. It is a waste of energy, the frequently open and shutdown operation will consume a lot of energy. But if the design is cross-layer, this situation could be avoided. When the MAC layer want shutdown the transceiver, it will check that whether it is time for the routing layer to send the hello message. Then the conflict is avoided. The radio network is application-dependent. So according to the actual application, the cross-layer design will make an efficient routing protocol for the wireless sensor networks.

protocol with an explicit hop-by-hop Acknowledgment for loss recovery is employed. To ensure the end-to-end reliability, the maximum number of retransmissions are estimated and used at each hop. At the transport layer, an AUTOACK mechanism of MAC layer is used. By inspecting the sequence numbers on the packets, the sink can detect which packets were lost.

4.4.2 Experimental Setting

Jennic contains a controller board (featuring an LCD panel) and a number of sensor boards from the evaluation kit. The sensor boards measure temperature, humidity and light levels, and periodically send these measurements to the controller board. The controller board displays the received data on its built-in LCD panel. The interface is based on RS232. It acts as a gateway to connect the laptop and the radio wireless sensor network.

In this application, the setup was deployed within laboratory. Total 5 jennic nodes were used. One of the nodes acts as the Co-coordinator, two nodes act as Network Processing Devices and one node act as End Device. Separate code is provided for the Co-coordinator, Network Processing Devices and End Devices.

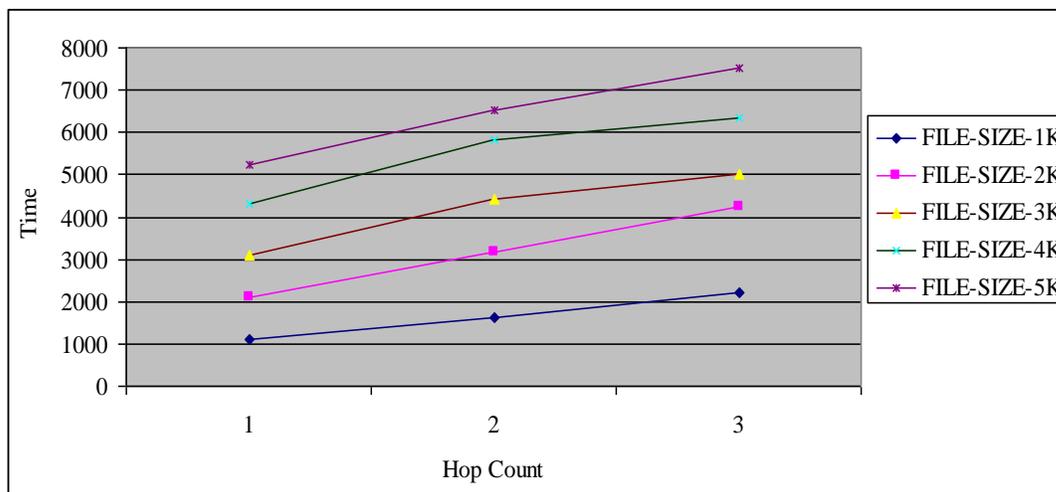
4.4.1 Cross Layer Design in this Application

We have employed reliable algorithms in each layer of the communication stack. At the MAC layer, a CSMA MAC

Time required for transmission of files of different sizes:

Table 4.1 Time required for transmission of files of different sizes

File size(In Kb)	Time required(In ms)		
	First Hop	Second Hop	Third Hop
1	1119	1605	2225
2	2106	3176	4240
3	3091	4421	4996
4	4302	5813	6354
5	5245	6538	7511

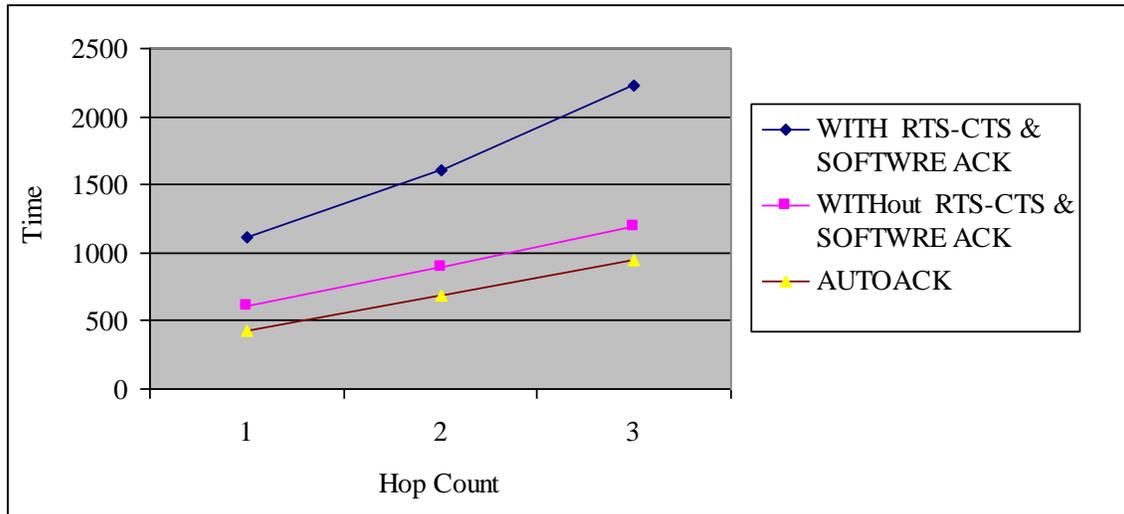


Time required for transmission of file with different mechanisms:

Table 4.2 Time required for transmission of file with different mechanisms

	Time required(In ms)		
File size (In Kb)	First Hop	Second Hop	Third Hop
1.01	1119	1605	2225
	606	899	1194
	421	689	945

With RTS-CTS & software ACK
 Without RTS-CTS & with software ACK
 Only Autoack



V. CONCLUSION AND FUTURE SCOPE

System overhead increases with RTS-CTS and software generated ACK mechanism. AUTOACK mechanism reduces time required for block/file transfer. It ensures data reliability by generating hardware acknowledgement for received packet. Cross layer design approach is achieved by using MAC/PHY support AUTOACK mechanism. For transfer of audio/video files the mechanisms like data compression, data fusion can be used.

ACKNOWLEDGMENT

I express my deep sense of gratitude to my guide Prof.A.W.Rohankar for his invaluable guidance and unflinching help during the research work. His esteemed suggestion and encouragement during the entire work have been inspiring source of motivation for me. I also wish to express my gratitude to Prof.G.R.Pathak for his invaluable moral support.

REFERENCES

- [1] A. Woo, T. Tong, and D. Culler, "Taming the underlying challenges of reliable multihop routing in sensor networks," in *SenSys '03: Proceedings of the 1st International Conference on Embedded Networked Sensor Systems*, (Los Angeles, CA, USA), pp. 14–27, ACM Press, 2003.
- [2] R. Stann and J. Heidemann, "Rmst: Reliable data transport in sensor networks," in *SNPA '03: Proceedings of the first IEEE International Workshop on Sensor Network Protocols and Applications*, (Anchorage, Alaska, USA), pp. 102–112, 2003.
- [3] C.-Y. Wan, A. Campbell, and L. Krishnamerthy, "Psfq: A reliable transport protocol for wireless sensor networks," in *Proceedings of the first ACM International Workshop on Wireless Sensor Networks and Applications*, (Atlanta, Georgia, USA), pp. 862–872, 2002.
- [4] S. Kim, R. Fonseca, P. Dutta, A. Tavakoli, D. E. Culler, P. Levis, S. Shenker, and I. Stoica, "Flush: A reliable bulk transport protocol for multihop wireless network," in *SenSys '07: Proceedings of the 5th ACM Conference on Embedded Networked Sensor Systems*, (Sydney, Australia), pp. 351–365, 2007.
- [5] "Ozg'ur B. Akan and I. F. Akyildiz, "Esrt: Event-to-sink reliable transport in wireless sensor networks," *IEEE/ACM Transactions on Networking*, vol. 13, no. 5, pp. 1003–1016, 2005.
- [6] Y. G. Iyer, S. Gandham, and S. Venkatesan, "Step: A generic transport layer protocol for wireless sensor networks," in *ICCCN '05: Proceedings of the 14th IEEE International Conference on Computer Communications and Networks*, (San Diego, CA, USA), 2005.

- [7] Y. Zhou and M. R. Lyu, "Port: A price-oriented reliable transport protocol for wireless sensor networks," in ISSRE '05: Proceedings of the 16th IEEE International Symposium on Software Reliability Engineering, (Washington, DC, USA), pp. 117–126, 2005.)

AUTHORS

First Author – Vaishali Rajput, ME(IT), Sinhgad Institute of Technology & Science, Pune, Kvaishu19@gmail.com

Second Author – Tanaji Khadtare, ME(IT), Sinhgad Institute of Technology & Science, Pune, tanajikhadtare@gmail.com

Third Author – Atul Rohankar, PHd (IT), Sinhgad College of Engineering, Pune, rohankar@gmail.com

An Optimization Model to Generate a Finite Sequence Subject to the Given Conditions

P.Paramadevan*, W.B.Daundasekera**

* Department of Mathematics, Eastern University, Sri Lanka
 ** Department of Mathematics, University of Peradeniya, Sri Lanka

Abstract- In this paper we develop an optimization model to generate a finite sequence, where i th term of the sequence is the number of occurrence of i in that sequence. This model is formulated as a 0-1 Integer Programming Problem and is solved using Branch-and- Bound algorithm.

Index Terms- Integer Programming problem.

I. INTRODUCTION

Our objective is to generate a finite sequence by placing the integers which are less than or equal to a given integer, say n ($n \neq 1, 2$ and 3), as a finite sequence, in which i th term, $i = 0, 1 \dots n-1$, of the sequence is the num of occurrence of i in that sequence. For an in-depth review of sequences refer [2],[3]and [4]. The optimization model presented here is used by Truls Flatberg [1] in his OPL tutorial.

The rest of the paper is organized as follows. The next section describes research elaborations and the subsequent sections present the results and appendix. Finally, we conclude the paper with our conclusion.

II. RESEARCH ELABORATIONS

Below we illustrate the formulation of the optimization model which is used to generate the sequence described above for an integer n :

Let a_{ij} be a 0-1 variable defined as below:

$$a_{ij} = \begin{cases} 1, & \text{if the } i^{\text{th}} \text{ term of thesequence has the value } j \\ 0, & \text{otherwise} \end{cases}$$

The constraints of the 0-1 integer linear programming model can be given as below:

Identify the constructs of a Journal – Essentially a journal consists of five major sections. The number of pages may vary depending upon the topic of research work but generally comprises up to 5 to 7 pages. These are:

$$\sum_{j=0}^{n-1} a_{ij} = 1 \quad , i = 0, 1, \dots, n-1 \dots \dots \dots 1$$

$$\sum_{i=0}^{n-1} a_{ii} - j \leq n(1 - a_{ij}) \quad , i, j = 0, 1, \dots, n-1 \dots \dots \dots 2$$

$$\sum_{i=0}^{n-1} a_{ii} - j \geq n(1 - a_{ij}) \quad , i, j = 0, 1, \dots, n-1 \dots \dots \dots 3$$

$$a_{ij} \in \{0, 1\} \dots \dots \dots 4$$

The second and the third constraints given above ensure

that $a_{ij} = 1$ implies that $\sum_{i=0}^{n-1} a_{ii} = j$.

Since we are interested in finding a feasible solution to the mathematical model, the objective function can be any arbitrary function. Therefore, in our study we take the objective function as:

Minimization 0.

A computer programme using C++ programming language is written to generate the constraints of the 0-1 Integer Linear Programming problem. This computer programme is capable of generating the constraints for any integer value of n . The C++ code can be found in the Appendix.

III. RESULT

The following tables exhibit some generated sequences obtained for certain values of n by solving the mathematical model developed above:

Table I: $n = 4$

Term	0	1	2	3
Value	2	0	2	0

Table II: $n = 5$

Term	0	1	2	3	4
Value	2	1	2	0	0

Table III: $n = 10$

Term	0	1	2	3	4	5	6	7	8	9
Value	6	2	1	0	0	0	1	0	0	0

Table IV: $n = 20$

Term	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Value	16	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0

IV. CONCLUSION

In this paper we presented a mathematical method to generate finite sequences subject to the conditions mentioned above. We conclude that the model failed to generate sequences when n takes the values 1,2 and 3. Also, we conclude that as n gets larger the computational time increases to generate the sequences.

APPENDIX

This appendix presents the C++ code that is used to generate the constraints of the 0-1 Integer Linear Programming problem.

```
#include<iostream.h>
#include <conio.h>
#include<fstream.h>
const int n=20;
void main()
{
clrscr();
ofstream testFile1("C:\\Param\\sequence.txt");
cout<<"model:"<<"\n";
testFile1<<"model:"<<"\n";

for (int i=0;i<n;i++)
{
for (int j=0;j<n;j++)
{
cout <<"x"<<i<<"_"<<j;
testFile1<<"x"<<i<<"_"<<j;
if (j!=n-1)
{
cout<<" ";
testFile1<<" ";
}
}
```

```

}
cout<<"=1;"<<"\n";
testFile1<<"=1;"<<"\n";
}
cout<<"\n";
testFile1<<"\n";

for (int p=0;p<n;p++)
{
for (int q=0;q<n;q++)
{
for (int k=0;k<n;k++)
{
cout <<"x"<<k<<"_"<<p;
testFile1<<"x"<<k<<"_"<<p;
if (k!=n-1)
{
cout<<" ";
testFile1<<" ";
}
}
}
}
cout<<"-"<<q<<"<="<<n<<"*(1-x"<<p<<"_"<<q<<");";
testFile1<<"-"<<q<<"<="<<n<<"*(1-x"<<p<<"_"<<q<<");";
cout<<"\n";
testFile1<<"\n";
}
}
cout<<"\n";
testFile1<<"\n";
}

for (int s=0;s<n;s++)
{
for (int t=0;t<n;t++)
{
for (int w=0;w<n;w++)
```

```
        {
        cout <<"x"<<w<<"_"<<s;
        testFile1<<"x"<<w<<"_"<<s;
            if (w!=n-1)
        {
        cout<<" ";
        testFile1<<" ";
        }
        }
        cout<<"-"<<t<<">="<<n<<"*(x"<<s<<"_"<<t<<"-1)";
        testFile1<<"-"<<t<<">="<<n<<"*(x"<<s<<"_"<<t<<"-
1)";
        cout<<"\n";
        testFile1<<"\n";
        }
        cout<<"\n";
        testFile1<<"\n";
        }

for (int e=0;e<n;e++)
{
for (int f=0;f<n;f++)
{
cout<<"@bin(x"<<e<<"_"<<f<<");" ;
testFile1<<"@bin(x"<<e<<"_"<<f<<");" ;
cout<<"\n";
testFile1<<"\n";
}
cout<<"\n";
testFile1<<"\n";
}
cout<<"end";
testFile1<<"end";
getch();
}
```

REFERENCES

- [1] Truls Flatberg, A short OPL tutorial by, January 17, 2009.
- [2] John B. Reade, An introduction to mathematical Analysis Oxford Science publications 1990 , pg 17-35.
- [3] Dipak Chatterjee , Real Analysis Prentice hall of India Private ltd, New Delhi-110001 2005, pp 52-122.
- [4] Prof.G.Rangan, Real Analysis (Part II), 1998, First edition, New Century book house Private ltd, pp 1-24.

AUTHORS

First Author – .Paramadevan, B.Sc,M.Sc, Department of Mathematics, Eastern University, Sri Lanka, param@esn.ac.lk
P

Second Author – W.B.Daundasekera,B.Sc,M.Sc,Ph.D, Associate Professor, Department of Mathematics, University of Peradeniya, Sri Lanka, wbd@pdn.ac.lk

Correspondence Author – W.B.Daundasekera,B.Sc,M.Sc,Ph.D, Associate Professor, Department of Mathematics, University of Peradeniya, Sri Lanka, wbd@pdn.ac.lk

Level of Customer Satisfaction and Usability Issues in Online Banking Websites

Gamage. M. P, Kodagoda. G. N

Sri Lanka Institute of Information Technology

Abstract- The internet has affected business in many ways. As a result banks have been under pressure to implement more advanced electronic delivery channels and payment methods. Most banks are now offering online services known as online banking or internet banking to their customers in order to remain in a competitive edge as well as to remain in business. In order to improve this facility it is needed to better understand customer attitude and the level of satisfaction and acceptance of this technology. The study considers web usability as a dominant factor effecting customer satisfaction of online banking. In several web usability researches done the usability issues of web sites in general were talked. The few specific web usability researches are focused mainly on Electronic commerce web sites. There is only limited literature available related to financial websites such as online banking websites. Bearing in mind that usability is still a major weakness in many websites and the importance of bank websites it would be valuable to extend the knowledge about usability in this sector.

Index Terms- Computer Science, Computer Interfaces, Human Computer Interaction, Internet

I. INTRODUCTION

Today most of the people use commercial websites to get done many of their day to day activities. Users most enjoy websites that provide clear information, easy navigation and an engaging customer experience. If a website is difficult to use, people leave. There's no such thing as a user reading a website manual or otherwise spending much time trying to figure out a Graphical User Interface (GUI) [1], [2]. Since there are plenty of other websites available leaving is the first line of defense when users encounter a difficulty. The first law of e-commerce is that if users cannot find the product, they cannot buy it either [1].

Online banking is a challenging endeavor for financial services companies such as banks since they must provide so much important as well as reliable information as well as services through their websites. However, to remain competitive they must be able to attract more and keep loyal users by enhancing their services convenience with an excellent online experience. Research shows that 50% of prospective customers registering for online banking bail out before signing up, mostly due to problems navigating the site, completing online forms, security fears, and understanding content and feedback [3], [4]. Therefore it could be argued that website usability becomes one of the most vital issues in online banking. Therefore conducting a research for banks with a try to solve this problem is considered essential. The main objectives of the study are;

- Find out usability related problems that require to be addressed when using the websites for online banking.
- Identify GUI features that lead to an enhanced user experience.

II. LITERATURE REVIEW

The major problem with the definition of usability is that it is very difficult to specify the characteristics and it's attributes that should be considered in particular [5], [6]. The nature of the characteristics and required attributes depend on the context in which the product is used. The broadest and most common definition of usability is simplified to ease-of-use. Web usability is about making the website in such a way that the site users can find what they're looking for quickly and efficiently. Research into users' interaction with websites and intranets has continued as the web has evolved through generations of technology. Despite many other definitions on usability, Jakob Nielsen's [5], [6] definition on web usability is widely accepted among usability experts. Jakob Nielsen founded the "discount usability engineering" movement for fast and cheap improvements of user interfaces and has invented several usability methods, including heuristic evaluation. He holds 79 United States patents, mainly on ways of making the Internet easier to use. He was named as "the reigning guru of web usability" by Fortune and as "perhaps the best-known design and usability guru on the Internet" by Financial Times and many more [5]. According to Nielsen's definition usability is a quality attribute that assesses how easy user interfaces are to use [5]. The word usability also refers to methods for improving ease-of-use during the design process. Usability is defined by five quality components by him as [1], [5].

- Learnability: How easy is it for users to accomplish basic tasks the first time they encounter the design?
- Efficiency: Once users have learned the design, how quickly can they perform tasks?
- Memorability: When users return to the design after a period of not using it, how easily can they reestablish proficiency?
- Errors: How many errors do users make, how severe are these errors, and how easily can they recover from the errors?
- Satisfaction: How pleasant is it to use the design?

According to a research done by Bahador Jamshidi [7] factors that shape B2B website usability were identified with a consideration of multiple sides of the usability of B2B websites. In a broader conclusion he claims that the meaning and definition

of usability in B2B environment is related with these four values: A secure and trusted website that saves cost and time and cares for the independency of its customers is called usable while talking in a B2B environment.

The goal of the usability test conducted by Janhavi Sheode [8] was to analyze the two websites against usability. Usability testing helps to find which features of a given design work well for the target audience, which features don't and determine the effectiveness of the design. Empirical technique for usability testing was applied to test the usability of the two websites by which participants were observed while they performed information seeking tasks using the websites and feedback was obtained to identify usability issues. The study indicated that overall both websites are user friendly although some information seeking tasks revealed problems in one website than the other due to lack of well presented information and inefficient website design.

In a research conducted by Michelle Bayles [9] results from a questionnaire designed to query online banking behavior are reported. The most frequent activities reported were checking account balances and viewing or paying bills. Purchasing insurance, CDs, and applying for a loan or credit card were the most infrequent online activities. Respondents indicated that convenience and saving time were the biggest incentives to bank online. Quick access to information, clear feedback, and simple terminology were identified as the most important features of an online banking site.

It is important to notice that these substantial technological advances have not caused radical changes in usability issues. Usability guidelines remain remarkably steady through generations of technology because usability is a matter of human behavior, and people don't change much from one decade to the next. Their characteristics are about the same, as are their behaviors [10]. Based on the principles of Human Computer Interaction (HCI), web usability has become a recognized success factor for all e-business, including online banking.

III. METHOD

The proposed research is an explorative study since although some factors are known more information is needed in identifying usability issues and features for potential improvements for an enhanced online banking experience. For this research the usability is assessed at individual bank level. The research considers data gathered from a group of individuals using the same bank's online facility as data corresponding to that particular bank. So the unit of analysis for the study is at the group level.

Questionnaire Technique and interviewing technique are used to gather information about usability issues, as well as to collect web surfer's interests and desires in online experiences, as well as to gather important feedback. When considering population for the questionnaire there are identifiable subgroups within the population that are expected to have different responses for the variable of interest (usability) to the researcher. The population for the research is online banking users in Sri Lanka and each sub group is the set of online banking users representing a particular bank. To trace the differences in the responses of the different sub groups within the population it is

necessary to use Stratified Random sampling method as the sampling method for the research. It is expected when using this sampling method each important segment of the population is better represented, and more valuable and differentiated information can be obtained with respect to each group. A sample of 100 subjects are considered for the survey from recognized IT companies and IT institutes under the assumption that they would be the most probable persons exposed to online activities such as online banking, and could provide representative replies relevant to this research. The subjects selected for each group will be disproportionate to the number of subjects in the group since for some groups it is expected that the number of subjects for some groups will be too small. A well constructed questionnaire is distributed among the selected sample of IT people. The questionnaire is created as an online survey questionnaire and is emailed to among the selected sample. The www.freeOnlineSurveys.com questionnaire tool is used for the purpose. The online survey is expected to increase the number of responses returned. For the interview sample consists of two individuals for each bank considered in the study, who is already using online banking facility of that bank. Judgment sampling method is used since people who possess the needed facts and are able to provide the information sought are required for the purpose.

As the usability measurement technique the web usability definition proposed by Jakob Nielsen is used. According to that the usability characteristics considered for evaluation are learnability, efficiency, memorability, errors and satisfaction [1], [5]. Further for the research the researcher considers two additional characteristics. These additional characteristics which would be essential for a bank website are identified using the secondary sources [11]-[13]. They are the level of perceived security and website content of the website. The questionnaire is designed incorporating well identified questions to measure the 7 characteristics (independent variables). A set of questions targets to address one of the characteristics. The results obtained from these 7 characteristics are used to get a measure on the level of usability (dependent variable). The 7 characteristics considered in the survey are; learnability, efficiency, memorability, errors, level of perceived security, website content, satisfaction.

IV. DISCUSSION

When conducting the research one of the assumptions the researcher made is when selecting IT people as the sample is that IT people are very much exposed to online transactions through internet. When considering the results obtained the number of online banking users is 39% as given in Fig. 1. So according to research results obtained it can be seen that in Sri Lanka online banking users within the IT industry is also very small.

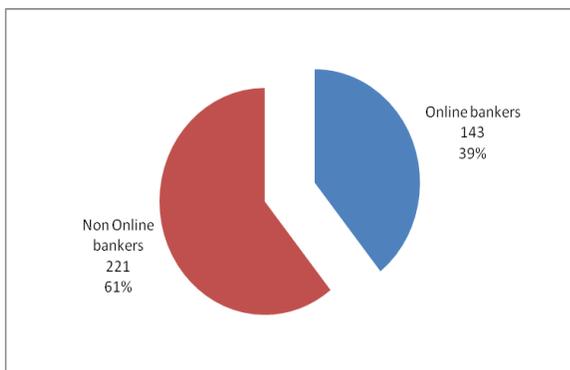


Fig. 1. Total number of valid respondents categorized in to 2 groups as online bankers and as non online bankers

When considering the age 62% are included into the 20 – 29 years age category as summarized in the Fig. 2. It can be assumed that this bias of age factor is introduced because IT related people are considered as the sample and still in Sri Lanka IT related job involvement is very less among older generation.

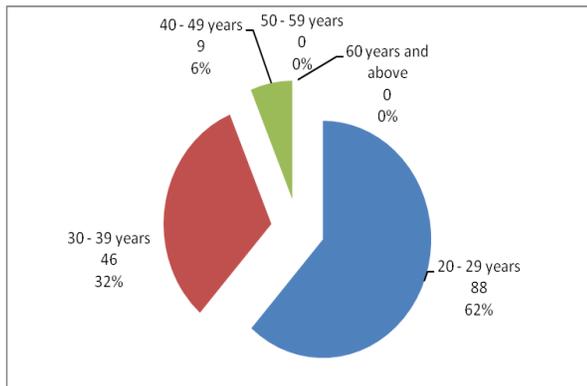


Fig. 2. Number of respondents who use online banking categorized by age

The number of online transactions done by the respondents using any website on internet is also considered in order to get an idea about how comfortable they are with transactions through internet. According to summary results given in Fig. 3 it can be seen that as a percentage 31% have done online transactions on internet at least more than 2 - 3 times. According to research results it can be concluded that people who use online banking are people who already feel comfortable with transactions over the internet.

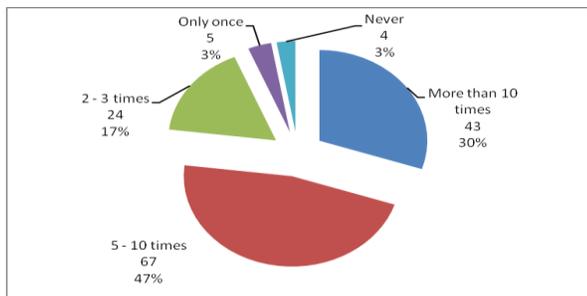


Fig. 3. The number of online transactions done by the respondents using any website on internet

The research tried to capture the factors as to why banking customers specially the ones in IT industry still have not moved towards online banking. As identified 41% as a percentage do not use online banking because of security fears. The summary results are given in Fig. 4. Even though all banks assure their customers of full protection for the online transactions done through their banks [15]-[18] according to research results it can be seen that people still do not feel secure about online transactions. So it is recommended that internet and online transaction security awareness programs are necessary in order to increase the number of online banking users in Sri Lanka.

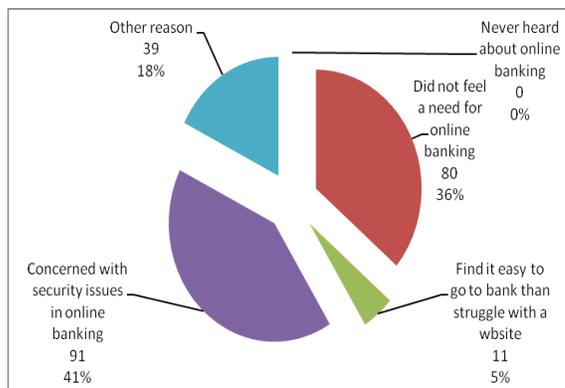


Fig. 4. Reason given by the non online banking respondents as to why they do not use online banking

According to results as given in Fig. 5 there is a considerable amount of users only for Bank A, Bank B, Bank C and Bank D. For Bank H and Bank I the number of users is very few and for other banks considered for the research the sample selected has 0 users. Even though the researcher has tried to capture the issues in most of the bank websites it can be seen for online banking users in Sri Lanka have clustered mainly around 3 banks for online banking.

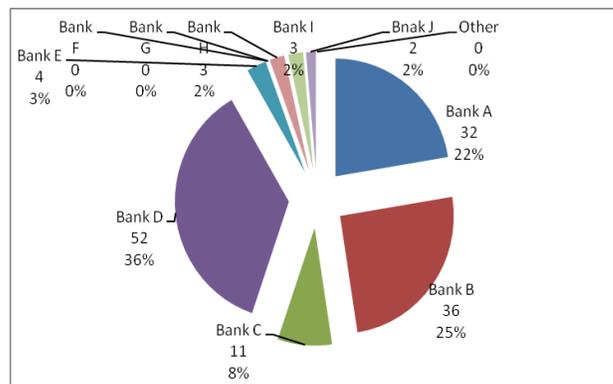


Fig. 5. Number of respondents identified for each bank from among the respondents who use online banking

Through the interview researcher identified the actions needed by the user to complete a particular task using the website and also the difficulties faced. Through the interview the researcher got a better understanding as to why the respondents have responded negatively for the survey questionnaire. The major problems captured in the research are listed as follows.

- Some icons are not viewable in some browsers

- The main menu is not clearly visible and also it does not seem like a menu bar that is clickable.
- Contact information, search facility, site map and information icons are hidden in the website.
- Since the search facility is not provided in the standard way users miss noticing it.
- Even though user can sign out it seems as no proper sign-out mechanism the way it is given.
- When the user go to do a transaction if he is not sure about the account balance he has to go back to the main menu and select the Check balance option to view the current balance, and again have to move back through the menu to perform the transaction.
- Also the user need to memorize the account balance (since it is not provided in the transaction performing page) until he settles all the payments if he plans to do many payments in the payments web page and also the balance deductions the user himself has to calculate.
- All available options are available only in the main page. Once you move in to an option all other available options are hidden.
- No proper way to increase the font size of a web page if needed. If the browsers functionality is used the page always gets upset in IE7.
- When checking the history information has to go inside the webpage of each transaction type and check for history information if needed to confirm about the security.
- Flash animations are widely used. Takes time to load a single page.
- No site map is provided to identify locations within the web page.
- No acknowledgement page is given before committing a transaction.
- Identifying error messages is difficult since they are not easily viewable. If an error occurs it seems like web page is not responding and the user is left confused.
- Information search is difficult. Have to go through the menu to search for different options.
- Wrong input information provided. Ex: To enter the payment date the date format is given as D/M/YY. But still if you enter it that way it is not accepted by the website. The accepted format is DD/MM/YY
- Has problem in remembering the username of the account. Username has no relationship with the account user's information.
- Display of history information in one go is limited.
- Although the home page is very informative most of the information are displayed as text links. So not much viewable as links with images.
- Tab menu available have problems with browser compatibility since in some browsers the tab menu cannot be viewed. Ex: In IE7 it looks like a normal line of text.

When analyzing the above issues it can be identified that some important considerations are ignored when developing the

bank websites. The proposed guidelines for bank websites are as follows.

- Always follow website standards and guidelines when developing a website.
- Make the website flexible at least to allow the user to change the username.
- Always make available the information and reports that are necessary for the users. Also make them easily accessible.
- Reduce what the user has to memorize. Provide all necessary information that is needed to perform transactions.
- Display the last 5 transactions that were performed on the account at the time of login along with the last login details. It ensures the feel of security for user.
- Reduce the amount of data the user has to key in, instead always allow the user to select his/ her input data whenever possible.
- Always make the website independent from the browser as much as possible
- Build the website compatible to a browser version that is most popular among the users but it should provide alternatives to the users who are using other browser versions too.
- Always address the needs of all types of users of a website. Include tool tips since it helps the visually disabled.

V. CONCLUSION

All websites of banks considered do not have major deficiencies regarding most of the usability features. So as a final conclusion it can be stated that the current online banking users are satisfied with the level of usability the website offers them. But the minimum, maximum and the variance values indicate that it is not the case for all. There may be different reasons for the variability of the responses. Since the sample consists of IT people the level of IT literacy and language problems cannot be considered as a major factor affecting the result. But still it cannot be ignored the fact that everyone might not have a good knowledge in IT. Rather physical factors such as bad eye sight, physical disabilities such as tremor in hands may have affected the result. But a good website must address the requirements of all types of users. So different problems that are present in the websites that affects the users were identified and guidelines were proposed.

ACKNOWLEDGEMENT

I warmly thank my staff for the valuable advice and help provided during the difficult times. My sincere thanks to my friends especially to Jude for the constructive criticism and advice provided during the preparation of this thesis. I add gratitude for all participants of the survey questionnaire and of the interview for spending their valuable time to help my research. I owe my loving thanks to all my family members. Without their encouragement and understanding it would have been impossible for me to finish this work.

REFERENCES

- [1] Jakob Nielsen, Hoa Loranger. New Riders. April 20, 2006. Prioritizing Web Usability. [E-book] Available: freebooksmedia.
- [2] Heidi Adkisson, 'Identifying de-facto standards for e-commerce websites', University of Washington, Master's Thesis, 2011.
- [3] Chris Nickson, "Why shouldn't you be banking online? ", 2002, [Online]. Available: <http://news.digitaltrends.com/feature/49/shouldn-t-you-be-banking-online>. [Accessed: Aug. 20, 2011].
- [4] "Investigating Factors effecting users and non-users of using internet banking in Saudi Arabia". Doctoral Symposium, Brunel Business School-London, May 21 & 22, 2008.
- [5] Jakob Nielsen, "Usability 101: Introduction to Usability", August 25, 2003. [Online]. Available: <http://www.useit.com/alertbox/20030825.html>. [Accessed: Oct. 5, 2011].
- [6] Jakob Nielsen, "Usability", 2004, [Online]. Available: <http://www.useit.com/jakob/>. [Accessed: Sep. 5, 2011].
- [7] Bahador Jamshidi, "Web usability in B2B Websites", Master's thesis, Lulea University of Technology, March 03, 2008.
- [8] Janhavi Sheode, "A usability study of Chapel Hill Transit and Triangle Transit Authority websites", Master's Thesis, November, 2007.
- [9] Michelle Bayles, "Online Banking: Why People Are Branching Out", Usability Views Article, 16 July 2004.
- [10] "International standards for HCI and usability", 2002, [Online]. Available: http://www.usabilitynet.org/tools/r_international.htm#9241-11. [Accessed: Aug. 20, 2011].
- [11] Andrej, "Usability of Online Internet Banking Applications of Slovak Banks - Pizza SEO Study", May 27, 2008. [Online]. Available: <http://blog.pizzaseo.com/usability-of-online-internet-banking-applications-of-slovak-banks-pizza-seo-study/>. [Accessed: Sep. 25, 2011].
- [12] "User Friendly e-Banking", 25th April 200, [Online]. Available: <http://www.uservision.co.uk/resources/articles/2004/user-friendly-e-banking/>. [Accessed: Oct. 14, 2011].
- [13] Francisco Javier Miranda, Rosa Cortes and Christina Barriuso; "Quantitative evaluation of e-banking web sites: an Empirical study of Spanish Banks", [Online], Available: http://www.ejise.com/volume-9/v9-iss-2/miranda_et_al.pdf. [Accessed: 05th June 2011].
- [14] Gloria Smith, "Internet Banking Security Now More Enhanced", 26 Sep 2008, [Online]. Available: <http://ezinearticles.com/?Internet-Banking-Security-Now-More-Enhanced&id=1524577>. [Accessed: Sep. 10, 2011].
- [15] Hatton National Bank, "Online Privacy Policy", [Online], Available: <https://www.hnb.lk/hnbvb/personal/privacy.jsp>. [Accessed: 25 August 2011].
- [16] HSBC, "Security Assurance", [Online], Available: <http://www.hsbc.lk/1/2/footer/privacy-and-security>, [Accessed: 20 August 2011].
- [17] Nations Trust Bank, "Online Security & Fraud Prevention ", [Online], Available: http://www.nationstrust.com/online_security.shtml. [Accessed: 20 August 2011]
- [18] Bank of Ceylon. "Internet Banking Security", [Online], Available: <http://www.boc.lk/bochome/online/sec-bank.jsp>, [Accessed: 25 September 2011].

AUTHORS

First Author – Gamage. M. P, Sri Lanka Institute of Information Technology

Second Author – Kodagoda. G. N, Sri Lanka Institute of Information Technology

Scaling Constant Estimation for Texture Segmentation using Level Sets

K M Sadyojatha *, Vinayadatt V Kohir **, Subhash Kulkarni ***

* Ballari Institute of Technology and Management, Bellary, Karnataka, India,

** PDA college of Engineering, Gulbarga, Karnataka, India,

*** PES institute of Technology, Bangalore, Karnataka, India,

Abstract- Proposed work is aimed at finding a method to estimate a scaling parameter λ because of which minor object irregularities in the target texture image are ignored by the level set function during the process of curve evolution. Here the texture segmentation is achieved by embedding the statistical moment features in to the Level set frame work implemented as per Chan – Vese approach. The scaling parameter estimated here is used for emphasizing the variances of intensities of inside or outside regions of the evolving curve, which is estimated from the histograms of the extracted moment features. Reasonably correct values of λ are estimated and are substantiated by the results presented in the further sections.

Index Terms- Level sets, Moments, Scaling parameter, Texture segmentation

I. INTRODUCTION

Segmentation techniques are normally either edge based or region based. The separation of different regions of an image is based on the dissimilarities between the regions in edge based techniques, were as the similarities within the region becomes the basis in case of region based techniques. The image containing texture regions has neither a well-defined edge nor a homogeneous distribution of intensities within the same class region. Hence the segmentation of such image is challenging for either of the two approaches mentioned above. If the distribution of intensities of an image is such that the regions are distinct as shown in fig 1(a), thresh holding can very conveniently separate the different regions. But such a situation is scantily seen as far as the textured images are concerned. Normally the distributions of intensities of different regions will be overlapping as shown in fig 1(b), where the pattern recognition techniques like thresh holding or clustering fail to partition the different regions of such image. In case of K-means, the Gaussian parameters are iteratively computed but the connectedness of the different partitions after segmentation is not ensured.[6] Under such circumstances a shift in the approach from pattern recognition techniques to some image processing techniques is required. Therefore, as an alternative, deformable models via level sets along with statistical moment features is used in this proposed work.[7].



Figure 1a and 1b: Distribution of intensities Vs frequency of occurrence

In this above context the present paper is poised on using of simple moment descriptors viz. mean, standard deviation and 3rd order moment of texture images over a predefined neighbourhood. This reduces the computational complexity and yet yielding irredundant texture features [7] when compared to more commonly used filter bank schemes like Gabor filters [4].

The features thus selected present a favourable ambience for segmenting an image. The conventional segmentation tool works well when the between class scatter is higher than a threshold level forcing the segmentation result to be erroneous. One solution to the problem is to include spatial neighbourhood information along with the feature selected. The inevitable option is to use deformable model as a tool. Level set frame work is implemented as per Chan – Vese approach [5][11].

In the simplest case, assume that an image I defined on Ω is composed of two regions separated by initialized model curve with homogeneous intensity values c_i and c_o . Given a curve C that corresponds to boundary descriptor of the image I , homogeneity – based functional is introduced as

$$E(C) = \int_{insideC} |I - c_i|^2 d\Omega + \int_{outsideC} |I - c_o|^2 d\Omega \tag{1}$$

where c_i and c_o are the average image intensities inside and outside of the model propagating curve C respectively. Assuming q to be the piece wise approximated model having intensity c_i inside C and c_o outside C , it is easy to observe that q can be represented as

$$q = c_i H(\phi) + c_o(1 - H(\phi)) \tag{2}$$

where the Heaviside function $H(\Phi)$ is defined as

$$H(\phi) = \begin{cases} 1, & \phi > 0 \\ 0, & \phi \leq 0 \end{cases}$$

II THE λ PARAMETER

With the functional in equation (1) the boundary between regions is defined by its extremum. To keep the curve functional continuously differentiable during evolution, regularizing terms based on the length and the area metrics of the curve are added.

$$E(c_i, c_o, C) = \lambda_i \int_{insideC} |I - c_i|^2 d\Omega + \lambda_o \int_{outsideC} |I - c_o|^2 d\Omega + \mu \text{length}(C) + \nu \text{area}(C) \tag{3}$$

Translating the energy functional in equation (3) to a higher dimensional level set function, one obtains

$$E(c_i, c_o, C) = \lambda_i \int_{\Omega} |I - c_i|^2 H(\phi) d\Omega + \lambda_o \int_{\Omega} |I - c_o|^2 (1 - H(\phi)) d\Omega + \mu \int_{\Omega} \delta(\phi) |\nabla \phi| d\Omega + \nu \int_{\Omega} H(\phi) d\Omega \tag{4}$$

This functional in equation (2) when subjected to minimization via Eulerian converts into motion PDE resulting into propagation of model curve.

$\mu, \nu, \lambda_i, \lambda_o$ are positive scaling constants for the length, inside area, inside and outside variances respectively.[8]. The values of λ_i and λ_o included in the proposed model decide the contribution of variances of inner and outer regions respectively to control the evolution of model curve.

In the present work the values of the λ_i and λ_o computed from the histograms of the feature images. As these parameters are used as scaling constants, they basically represent the variances of intensity distributions inside and outside of the evolving curve. Histograms of moment feature of an example texture combination are shown in figure (2).

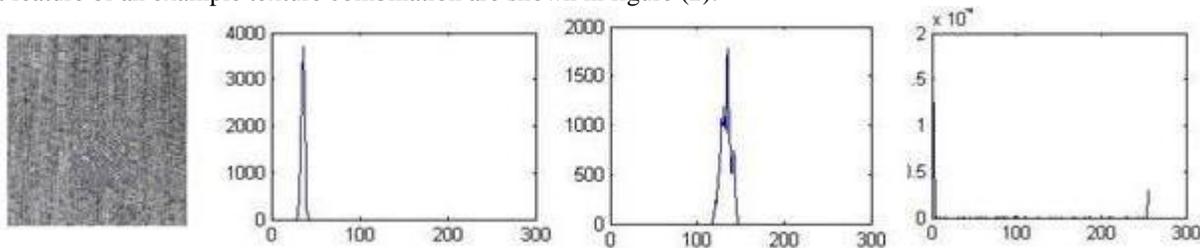


Figure2: from left-original image with combination of two textures, histogram of mean, variance and third moment of image.

It is difficult to identify the two texture regions distinctly from any of the histograms pertaining to mean or variance or the third moment as they are overlapping on one another. It can be read from the histograms that there are some dominant peaks and some of the peaks are comparatively small. These small peaks represent the object irregularities which are to be ignored by the evolving curve during the process of segmentation. One can logically decipher from the histograms that the width of the part of the histogram is the index of the variance within the respective region. i.e. more the width of the part of histogram pertaining to a region, more object irregularities within that region. Therefore higher the irregularities higher should be the tolerance so that the evolving curve shall not stop at the local minima. In a nut shell if some region is inside the evolving curve and the irregularities are more, a higher λ_i than λ_o value should be selected and vice versa.

It is found possible to compute the ratio of λ_i and λ_o based on the histograms of the feature sets. The histogram of the appropriate moment, which is used for segmentation is considered for estimation of λ_i and λ_o values. First the positions of the peaks are to be found for estimating the width of one part. This can be simply done by finding the zero crossings and computing the distance between two zero crossings in the differentiated version of the histogram which is shown in figure (3).

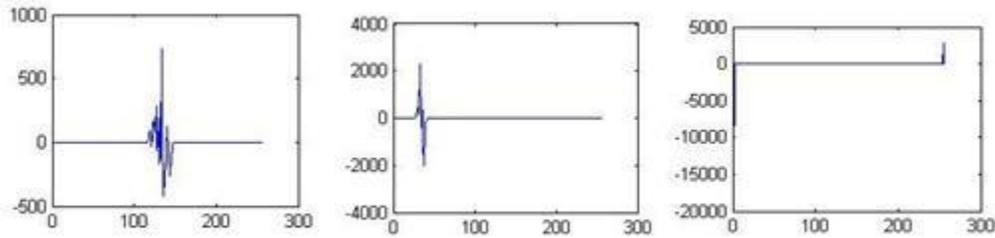


Figure3: Histograms' peaks represented as zero crossings for mean, variance and third moment

The ratio of widths between the dominant positive peak and the next negative peak to the width between the dominant negative peak and the next positive peak is taken as the ratio of λ_i and λ_o . The zero crossing positions of the above figure are presented below.

Zero crossings of positive peaks for the first histogram(mean): 120 127 130 134 141

Zero crossings of negative peaks for the first histogram(mean): 121 129 132 139

The ratio of λ_i and λ_o from the above values can be computed as 5/9 which is 0.55 and if λ_i is taken as 0.1 and λ_o can be calculated as 0.2.

III RESULTS AND DISCUSSIONS

The results are obtained using the motion PDE as mentioned above as in equation (5) and the λ values calculated as per the procedure explained in the previous section. Some of the results are presented below with the λ values used.

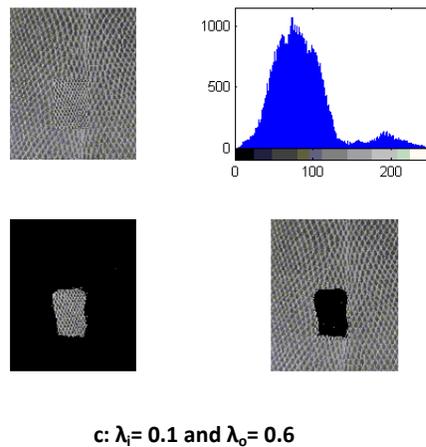
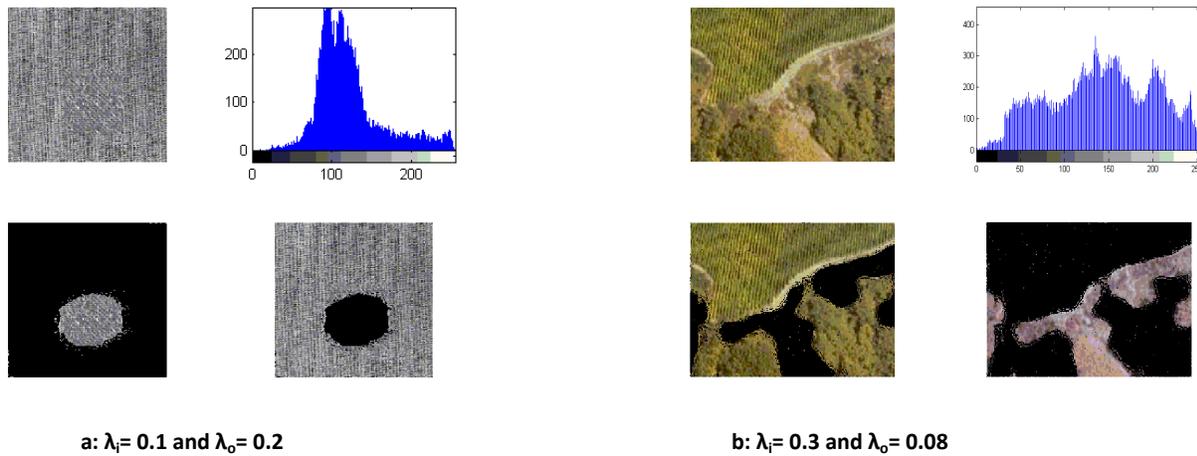


Figure4(a),(b),(c):Top of each result- original image , histogram and bottom two images- segmented portions.

The results presented in (a) and (c) for combination of two texture images extracted from Brodatz data base and (c) is a natural image containing textured regions. Results are also shown with texture regions having holes within and also with irregular boundaries.

IV .CONCLUSION

Intrinsic competence of the level set framework to segment the image in spite of overlapping features and computationally less intensive feature descriptors, when united result into efficient and robust segmentation framework which is evident from the results which are presented above. The main novelty of the work is finding a method for estimation of λ values helping the frame work to function totally unsupervised way and the unification of pattern recognition and image processing techniques as mentioned above. This proposed technique can be a better alternative to the computationally and time intensive conventional texture segmentation techniques such as Gabor filters or Wavelets [1][2][3][10].The present paper deals with segmentation of two layer textures. Further segmentation of multiple layer textures can be explored [9].

REFERENCES

- [1] A.C. Bovik, M.Clark, and W.S.Geisler, "Multi channel texture analysis using localized spatial filters", IEEE trans. Pattern Anal. Mach Intell., Vol.12, No.1, pp 55 – 73, Jan (1990).
- [2] A.Laine and J.Fan, "Texture classification by wave let packet signatures," IEEE trans, pattern Anal. Mach. Intell., Vol.15, No.11. pp.1186-1191, Nov.(1993).
- [3] A.Laine and J.Fan, "Texture classification by wave let packet signatures," IEEE trans, pattern Anal. Mach. Intell., Vol.15, No.11. pp.1186-1191, Nov.(1993).B. Smith, "An approach to graphs of linear forms (Unpublished work style)," unpublished.
- [4] D.Dunn and W.Higgins, "Optimal Gabor filters for texture segmentation," IEEE trans, image process., Vol.4, No.7. pp.947-964, July (1995).
- [5] Mumford D. and Shah J., "Optimal approximation by piece wise smooth function and associated variational problems". Commuⁿ.Pure Appl. Math,42, , 577-685 (1989).
- [6] R.Conners and C.Harlow, "A theoretical comparison of texture algorithms," IEEE trans. Pattern Anal. Mach. Intell, Vol.2, No.PAMI-3, pp.204-222, May (1980).
- [7] Sadyojatha K.M. and Subhash Kulkarni "Texture Segmentation Using Level Sets," ICCR 2008, Mysore, India, 168-174, 2008.
- [8] Sandeep V.M. and Subhash Kulkarni "Efficient Hierarchical approach for perceptual segmentation using Multi-phase Level Sets," IEEE's ICSIP2006, Hubli, India, 692-697, (2006).
- [9] Sandeep V.M., Subhash S.K., Natural histogram portioning based on invariantmulti-phase level set, IEEE's ADCOM2006, NITK, Surathkal, India, 314-317,2006
- [10] T.Chang and C.Kuo, "Texture analysis and classification with tree structured wave let transform", IEEE trans. image process Vol.11, No.2, pp 429 – 441, Oct. (1993).
- [11] T.F.Chan, L.A.Vese, Active contours without edges, IEEE trans. on image processing, 10, , 266-276, (2001).

Correspondence Author – Sadyojatha K M , saddukm@gmail.com, +91 9448020788

A Retrospective Analysis of Discordant CD4 and Viral Load Responses in HIV Patients on Anti-Retroviral Therapy

Revati Sharma*, Chitra Pai**, Harapriya Kar**

* MGM Institute of Research, MGM Medical College and Hospital, Navi Mumbai, Maharashtra, India

** Department of Microbiology, MGM Medical College and Hospital, Navi Mumbai, Maharashtra, India

Abstract- In industrialized countries 15%-30% of patients receiving long-term highly active antiretroviral therapy have discordant responses with a poor CD4 count response despite full suppression of HIV replication, 6 months to 2 years after starting therapy^(1, 2). There are few data representing the scenario of such discordant cases in developing countries like India.⁽¹⁾ The present study was aimed to find the rate of discordant responses among HIV patients attending a tertiary care centre in Navi Mumbai.

Methodology: The CD4 counts and viral loads of 142 treatment naïve HIV 1 patients who were put on anti retroviral treatment were carried out by Immunocount assay and Real Time PCR respectively. The counts obtained every three months during January 2009 to December 2011 were analysed and mean CD4 counts and viral load values calculated.

Results: On the basis of the mean values, the patients were categorized into four groups based on different permutations and combinations of the low or high CD4 counts and viral loads. Only 30.95 % of individuals showed an improvement in CD4 counts and reduction in viral load while 35.71% showed a discordant response. The paired 't' test was applied using SPSS 17 software; all the 4 categories gave a p value of < 0.05 showing statistical significance of the data.

Conclusion: HIV positive patients on ART may show discordance in the CD4 and viral load counts. This should be kept in mind by clinicians while monitoring the progression of HIV disease.

Index Terms- HIV naïve patients, Discordant CD4 and viral load count, anti retroviral treatment.

I. INTRODUCTION

Antiretroviral therapy (ART) is the recommended treatment for HIV infection. ART involves taking a combination (regimen) of three or more anti-HIV medications daily.

- Although anti-HIV medications can't cure HIV, people with HIV are enjoying healthy lives and living longer thanks to ART. The introduction of ART into clinical practice has led to dramatic reductions in morbidity and in mortality associated with infection with the human immunodeficiency virus (HIV).
- Viral load and CD4 counts are two important parameters used to monitor the progression of HIV

/AIDS and make critical decisions regarding antiretroviral therapy.

- The initiation of HAART generally leads to a rapid reduction in HIV-1 RNA plasma levels and to an increase in peripheral CD4+ cell counts.¹⁻³ However, some patients experience a 'discordant response', whereby the HIV-1 RNA plasma level is suppressed but the CD4+ cell count response is blunted. Other patients exhibit a different pattern of discordant response, characterized by a sustained CD4+ cell count response, despite persistent viraemia.
- In industrialized countries, discordant responses have been reported to occur in 20–30% of patients 6 months to 2 years after starting therapy. Studies have shown that 15%-30% of patients receiving long-term highly active antiretroviral therapy (HAART) have discordant responses with a poor CD4 count response despite full suppression of HIV replication.^(1,2) However there are few data representing the scenario of such discordant cases in developing countries like India.⁽¹⁾ The present study was aimed to find the rate of discordant responses among HIV patients attending a tertiary care centre in Navi Mumbai.

II. RESEARCH ELABORATIONS

Aims and objectives:

- To carry out a three years retrospective analysis of the CD 4 count and viral load in patients with HIV/AIDS.
- To detect the rate of discordant immunological and virological response among these patients.

III. METHODOLOGY

I. Selection of the Data and study participants:

- We included the data of one hundred and forty two treatment naïve patients who were above eighteen years of age with baseline CD4 cell counts of 200 cells/ml, who visited the tertiary care center from the year January 2009 to December 2011. Among the patients, twenty two were female and sixteen were male.

- Patients who failed to follow-up, died or if they had no plasma HIV RNA testing performed for 1 year were excluded from the study.
- Patients, put on anti retroviral drug therapy were asked to fill a drug request form that compiles information on applicant's address, past HIV specific drug history, previous CD4 and viral load counts, clinical history if any. The patients were counseled before and after collection of the blood for CD 4 counts and viral load test.
- HAART was defined as treatment with three antiretroviral drugs, including two nucleoside reverse-transcriptase inhibitors plus a non-nucleoside reverse-transcriptase inhibitor or a protease inhibitor.

- Fluorescence was detected after every 72°C extension incubation in FAM and JOE channel.
- For standard curves, real time PCR was performed on a 10-fold dilution series of kit specific positive controls ranging from 10^1 to 10^7 copies/mL.
- Quantitation of PCR products was performed using Roche Lightcycler 480 software. Color compensation was turned on in all assays to subtract bleed through between adjacent channels used to detect specific fluorescent tags.
- Analytic range of the assay is 48 - 10,000,000 HIV-1 RNA copies/mL.

d. **Statistical analysis**

The paired 't' test was applied on the data using SPSS 17 software.

IV. TEST PROCEDURES FOR CD4 AND VIRAL LOAD TESTS

The counts were obtained every three months during January 2009 to December 2011.

a. **CD 4 counts:**

The patient's blood samples were analysed for CD4/CD8 count by antigen-antibody slide reaction, a method which makes use of combination of antibodies such as monoclonal antibodies against CD4 & CD8, peroxidase anti peroxidase complex tagged rabbit anti mouse. In brief, the WBC's are obtained by histopaque (Sigma Aldrich) method and coated on a printed slide. Fixation is done by 25 % gluteraldehyde, followed by treatment with mixture of antibodies. Slides are then subjected to a mix of substrate and chromogen (1.25 ml: 1.5ml) and then counterstained with hematoxylin. Finally the cells are counted microscopically.

b. **RNA extraction:**

RNA was extracted according to the kit manufacturer's instructions (Qiagen, Hilden, Germany) using spin columns and a series of wash and elution buffers.

c. **Real time PCR:**

- Measurement of HIV 1 blood plasma level was performed by Real time Polymerase chain reaction using the Taqman principle.
- Real time PCR reactions were performed using, Roche Lightcycler master mix. Each reaction consisted of 1X Roche Lightcycler master mix, internal control HIV specific primer pairs and fluorescently-tagged hydrolysis probes (5'reporter dye and downstream quencher dye) in a total reaction volume of 25 μ l.
- Primers and probe target the gag gene of HIV 1
- Reactions were performed using a Roche Lightcycler 480 thermal cycler utilizing a 96 well plate.
- Thermal cycle conditions
 - Initial holding step of 50°C/15mins.
 - Second hold at 95°C/10 minutes.
 - Denaturation step at 95°C / 15seconds.
 - Annealing step at 55°C/20 seconds.
 - Extension step at 72°C/15 seconds
 - Followed by 45 cycles

V. RESULTS

- The mean CD 4 count and viral load of the patients were calculated.
- On the basis of the mean values, the patients were categorized into four groups based on different permutations and combinations of various immunological and virological responses.
- Only 30.95 % of individuals showed an improvement in CD4 counts and reduction in viral load while 35.71% showed a discordant response, while 28.57% patients did not show any improvement immunologically and virologically.
- Other studies on this subject have reported a range of results. Picketty et.al found equal rates (10.5%) of immunological only and virological only responses. Another study from Canada reported 11.7% and 15.4% out of 1547 subjects showed immunological and virological only responses respectively. In a study conducted in France, out of 2236 patients 19% and 17.3% patients exhibited immunological and virological only responses respectively. In all the above studies, the definition of discordant responses varied considerably.
- There was no association between the sex of the patient and the discordance observed. However the patients belonging to category 4 with suppression of viral load and a blunted CD4 response were of older age group (> 50). This can be attributed to the host characteristic (old age), as immune restoration depends upon the thymus activity which decreases with age.^(3,4)
- The paired 't' test was applied on the data using SPSS 17 software; all the 4 categories gave a p value of < 0.05 showing statistical significance of the data.

VI. CONCLUSION

- HIV positive patients on HAART may show discordance in the CD4 and viral load counts.
- Immunological and virological responses can be an important factor in determining the survival rate of the patients. This should be kept in mind by clinicians while monitoring the progression of HIV disease.
- Little is known about the pathogenesis of discordant responses, which seems to depend on the interaction of a multitude of viral, host and treatment-related factors.⁽¹⁾
- Further research is required to understand the risk factors and pathogenesis, prognosis and clinical management associated with the discordant treatment responses despite its relative frequency.
- There is a need to develop a standardised and universally accepted definition for discordant response which will help in defining the therapy responses having clinical significance for the patients and designing trials of possible therapeutic interventions.

REFERENCES

- [1] Mauro S and Suely HT (2006) Discordant immunological and virological responses to antiretroviral therapy. *Journal of Antimicrobial Chemotherapy* 58:506–510.
- [2] Gazzola L, Tincati C, Bellistri GM, Monforte A, Marchetti G (2009) The absence of CD4 T cell count recovery despite receipt of virologically suppressive highly active antiretroviral therapy: clinical risk, immunological gaps and therapeutic options. *Clin Infect Dis* 48:328-337
- [3] Nicastri E, Chiesi A, Angeletti C et al (2005) Clinical outcome after 4 years follow-up of HIV-seropositive subjects with incomplete virologic or immunologic response to HAART. *J Med Virol* 76: 153–60.
- [4] Moore DM, Hogg RS, Yip B et al (2005) Discordant immunologic and virologic responses to highly active antiretroviral therapy are associated with increased mortality and poor adherence to therapy. *J AcquirImmune Defic Syndr* 40: 288–93.

AUTHORS

First Author – Revati Sharma, Pursuing PhD, MGM Institute of Research, MGM Medical College and Hospital., Navi Mumbai, Maharashtra, India#, revupattani@gmail.com

Second Author – Chitra Pai, M.D. Microbiology, Dept of Microbiology, MGM Medical College and Hospital. chitrapai67@gmail.com

Third Author – Harapriya Kar, MD Microbiology, Dept of Microbiology, MGM Medical College and Hospital

Correspondence Author – Revati Sharma, Pursuing PhD
Dept of Microbiology, MGM Medical College and Hospital.
revupattani@gmail.com, Contact: 09833110502

Handling of Uncertainty – A Survey

Lakshmi.S.Dutt*, Mathew Kurian**

* Department of Computer Science and Engineering, Karunya University, India

** Department of Computer Science and Engineering, Karunya University, India

Abstract- Uncertainty is a state of lack of certainty, where having incomplete knowledge can make it impossible to describe the outcome. There are many challenges that occur due to uncertainty. Uncertainty in events can cause losses of data, providing inaccurate data, noisy output. Thus the need to handle uncertainty is essential. This paper represents an outline of various methods through which the uncertainty can be analyzed and handled.

Index Terms- Bayesian Network, fuzzy logic, probability, uncertainty

I. INTRODUCTION

Uncertainty the term covers a lot of concepts. Uncertainty can be due to lack of knowledge or insufficient information. This can be due to vagueness, no specificity and conflict in the information. It can be defined as a situation where the information available to the decision makers is imprecise to be summarized by a probabilistic measure. In truth scientific literature have lots of definitions for uncertainty. According to [2], [6] uncertainty can be classified into four classes namely: epistemic, linguistic, ambiguity and variability. Epistemic uncertainty is uncertainty due to lack of knowledge [14]. It is also referred to as state of subjective uncertainty, reducible uncertainty, Type B or knowledge uncertainty means that where uncertainty can be reduced through more relevant data. This epistemic uncertainty can be categorized as: the basis of the model that is the description of the system, completeness, systematic error, subjective uncertainty and measurement uncertainty. The epistemic uncertainty can be represented in many ways including probabilistic theory, fuzzy set, possibility theory, etc. But the major challenge in it is the selection of appropriate mathematical structure for the representation. Linguistic uncertainty produced by statements in natural language [3]. Linguistic uncertainty is important because it pervades in workshop, other face-to-face language based methods on which risk assessment relies on to measure and communicate risk. Linguistic uncertainty can be classified into five distinct types: vagueness, ambiguity, context dependence, under specificity and indeterminacy of theoretical terms. This may be accidental or deliberate which create problems for risk assessment. Ambiguity can be defined as uncertainty about the probability which is created by lack of information that is relevant and could be known. Ambiguity uncertainty is applied to the situation where the probabilities of the outcome are unknown. Ambiguity uncertainty arises from the concept that a word can have more than one meaning. The ambiguous events are having more uncertainty associated with it and are confused with vagueness. Variability as name specifies is due to variations or differences in a process or quantity. Assigning an exact value for a quantity is difficult because it depends on many parameters. The variability can be categorized as: natural variation which occurs naturally and inherent randomness are repeated processes and are irregular by nature [2]. Sometimes it can be reduced but cannot be eliminated completely.

Uncertainty analysis is a process that measures, recognizes, identifies and minimizes the all types of uncertainty in a risk estimates and separates this uncertainty among the risk factors that contributes to risk estimates. The uncertainty analysis includes many statistical problems [14] such as: uncertainty factor, decision making with uncertain information, estimation of uncertainty in complex models of risk, structural uncertainty and model specification and monitoring methods to reduce uncertainty. Quantitative approaches to measure uncertainty vary with complexity of the problem and the method to reduce risk.

II. UNCERTAINTY ANALYSIS TECHNIQUES

Various techniques are available for analyzing uncertainty. This section will discuss some of the uncertainty analysis techniques.

A. Probabilistic Analysis

Probability is the study of uncertain events or outcomes. Probability analysis is a method of uncertainty propagation for making qualitative and quantitative calculations in the face of uncertainties of various kinds. A probability distribution for the individual outcomes are defined, the probability of any event is defined on the sample space as the sum of the probabilities assigned to the outcomes in that event. Here the uncertainties are characterized by probabilities associated with the events. In probabilistic analysis the probability of the event is interrupted by the frequency of the occurrences of the event.

[13] Proposes a probabilistic approach to high-level event extraction from RFID data. Exploitation of RFID data presents significant challenges. RFID readers produce streams of low-level events; these must be transformed into high-level events. But these transformation is challenging due to two main issues i) reliability ii) ambiguity. These issues make deterministic event detection

unworkable and lead event recall near zero. A probabilistic model is enabled here complex event extraction to handle the uncertainty involved. Also includes techniques to extract events and to handle reliability and ambiguity.

[12] Proposes a frame work for knowledge representation and reasoning enabling the event interface i.e., the events to which the system must respond must be derived from other events that are based on complex temporal predicates, but are not generated by monitoring tools. Based on probability theory, the representation of the associated uncertainty is defined. In addition, the probability space also defined, and shows how the relevant probabilities can be calculated. Here defines the representation and semantics of event composition for probabilistic settings, and shows how to apply the extensions to the quantification of the occurrence probability of events. Thus these results enable any kind of active system to handle the uncertainty. Also defines a class of specification languages that make it possible to represent both types of uncertainty, using probability as the uncertainty representation mechanism. In addition, the general principles underlying a reasoning mechanism for inferring the occurrence probabilities of events also detailed. To illustrate these principles, a specific inference algorithm for a specific language is detailed.

B. Fuzzy Analysis

Fuzzy logic theory provides a very useful solution to understanding, quantifying and handling vague, ambiguous and uncertain data. Fuzzy sets are mainly used to handle and analyze uncertainty of data, environmental data and fuzzy logic to handle inaccurate reasoning in knowledge-based models of ecological processes. The fuzzy decision support systems aims at making imprecise reasoning to have rational decisions in an environment of uncertainty and imprecision. A decision support system consists of analytical tools and information management components for decision makers to solve relatively large and unstructured problems. This system can be termed as a multi-criteria analysis system which implies satisfying a set of criteria or constraints. A Fuzzy Logic System can deal with vagueness and uncertainty residing in the human knowledge base, and allows us to represent linguistic terms. Fuzzy rules with fuzzy sets have been used to express fuzzy knowledge. Moreover, the relative importance of criteria that may not equally influence a decision can also be considered by the Fuzzy Logic System.

[9] Proposes that the modeling of the real world complex systems has been always a challenging problem. Complexity and uncertainty are both features of the real world systems which are treated differently in different modeling approaches. A deterministic model of the system presents a deterministic mapping between inputs and outputs while probabilistic models are used for modeling of stochastic systems and can be characterized by the statistical properties of some random processes in the system. A probabilistic model in which probability is used as a way of representing statistical uncertainties in complex systems and Fuzzy logic is a way of representing non-statistical uncertainty. Fuzzy logic and probability theory are both powerful tools for handling uncertainty. However, they are complementary rather than competitive. The former represent non-statistical uncertainty while the later represent statistical uncertainty. This is while both of the above uncertainties can exist at the same time in real world systems. Consequently, probabilistic fuzzy logic [5] has been introduced as a general framework for combination of these theories and hence better handling such cases. A probabilistic fuzzy system is hence a generalized fuzzy system which utilizes the probabilistic fuzzy logic in presenting a new concept of probabilistic fuzzy rule. A general mathematical framework named DSU has been developed here for representing probabilistic fuzzy systems.

[11] Proposes a reliable human activity recognition methodology which handles the structural variations of an activity. When a new observation containing an execution of an activity is provided, the system measures how semantically similar a given observation is to the optimal structure of the activity. This similarity measure is not deterministic but is designed to consider uncertainties of the activities structures. A fuzzy interval describes the possible range of its starting time and that of its ending time as well as the confidence value associated with time frames within the ranges. Once fuzzy intervals are calculated, a dynamic programming algorithm that we have designed and presented here is applied to measure the similarity between the detected fuzzy intervals and the structure of the activity specified in the representation. The algorithm searches for the time points in ranges that satisfy the temporal structure specified in the activity representation while maximizing the fuzzy membership values.

C. Bayesian Analysis

In short Bayesian Networks, also known as belief networks or Bayes nets and it belong to the family of probabilistic Graphical Models. These models are used to represent knowledge about an uncertain domain. Bayesian Networks cross the divide between qualitative models, mechanistic models and statistical models, and are one of the few methods that can perform forward uncertainty propagation with little or no data, and statistical inference when data is available. Each node in the graph represents a variable and the edges represent the dependencies among the variables. These dependencies are evaluated using statistical and computational methods. Bayesian networks always forms acyclic graph. Bayesian Networks provide a transparent, mathematically a logic way to express one's belief in a conceptual model, and the conditional probability of events, in a manner that can be updated as data are gathered during the monitoring and validation stages of an evaluation. The technique can be used in case where data is missing to understand

various problem domains and to predict the future. Bayesian Networks have much to offer as a risk assessment tool and have been identified as a practical and scientific approach to modeling complex systems in the presence of “high uncertainty”.

[4] Proposes an industrial application of Bayesian Network for constructing an expert system for gas-liquid contacting device selection. Bayesian Networks support representation and reasoning under uncertainty. Bayesian Networks are useful in the study problem domain since they can accommodate the large number of contacting devices available and the uncertain nature of the attributes involved in the selection task. The directed acyclic graph component of Bayesian Networks is also useful since it shows the causal relationships between the attributes in the domain. Given data or a method to obtain the conditional probabilities of the attributes, Bayesian Networks are an effective uncertainty modeling technique. However one of the disadvantages of this technique is that, they are not always practical when the domain is large. To support more easy interaction with the user, an expert system using Bayesian functions is currently being implemented.

D. Soft Computing Technique

Soft computing techniques have become increasingly visible in finance applications. Soft computing is a pool of techniques that includes fuzzy logic, neural networks, and probabilistic reasoning. The basic aim of soft computing is to trade precision for a reduction in solution cost and tractability by exploiting the tolerance for imprecision and uncertainty.

[7] Proposes a system to focus on the issue of learning representations and adaptive learning algorithms through the combination of fuzzy, neural, and evolutionary algorithm techniques. To solve the structural problems, here propose the use of hybrid adaptive learning. Their flexible properties increase the range of their applicability and efficiency relative to simple learning algorithms. The system is based on neuro-fuzzy and genetic algorithm techniques. The structure of a fuzzy system lends itself to being able to capture expert knowledge. The fuzzy system representation allows re-mapping the knowledge contained in the system back into linguistic terms. Hence, the possibility of extracting knowledge from fuzzy systems remains high. Thus is more efficient in extracting knowledge. Here the representation parameters are rolled into the genetic coding and automatically tuning them along with the structure and other model parameters.

E. Rule Based Classification Technique

[10] Proposes a rule-based classification and prediction algorithm called uRule for classifying uncertain data. The algorithm introduces new measures for pruning, generating, and optimizing rules. These new measures are computed considering uncertain data interval and probability distribution function. The uRule algorithm uses the sequential covering approach to extract rules from the data. The algorithm extracts the rules one class at a time for a data set. A rule is desirable if it covers most of the positive examples and none of the negative examples. The algorithm is based on the RIPPER algorithm [1]. This algorithm follows the new paradigm of directly mining uncertain datasets and shows an excellent performance even when data is highly uncertain.

III. CONCLUSION

The need for handling uncertainty increases as uncertainty leads to incomplete information and unpredictability. There are many techniques available to analyze the uncertainty from the past decades. The main techniques discussed are Probabilistic analysis, fuzzy analysis, Bayesian Network analysis, Soft computing technique and Rule based classification technique. Among these the probability analysis, fuzzy analysis and Bayesian Network analysis are the most technically challenging techniques. The basic concepts behind these techniques are not so complex. The probabilistic analysis and fuzzy analysis helps to reduce linguistic uncertainty. The researches are going on this area to find an efficient mechanism to handle uncertainty thus will provide accurate result.

ACKNOWLEDGMENT

I express my thanks to my guide who have helped me to do this survey and ,all staffs and my friends who helped me with their knowledge and experiences to work on this paper “ Handling of Uncertainty – A Survey”.

REFERENCES

- [1] W. W. Cohen (1995), “*Fast effective rule induction*,” in Proc. of the 12th Intl.Conf. Machine Learning, pp. 115–123.
- [2] Daniel. P. Thunnissen. (2003) “*Uncertainty Classification for the Design and Development of Complex Systems*,” Proc. Third Annual Predictive Methods Conf. Veros Software.
- [3] Helen. M. Regan., Mark. Colyvan. and Mark. A. Burgman (2002) “*A Taxonomy And Treatment Of Uncertainty For Ecology And Conservation Biology*,” Proc. Ecological Applications.
- [4] E. Hui., Amornvadee Veawab. and Christine. W. Chan. (2004) “*Uncertainty Modeling in Selection of Gas/Liquid Contactors Using Bayesian Networks*,” Proc. 3rd IEEE Int’l Conf. Cognitive Informatics.

- [5] F. Jensen. , S. Lauritzen. and K. Olsen. (1990), “*Bayesian updating in recursive graphical models by local computations*,” Computational Statistics Quarterly, pp.269–282.
- [6] Keith. R. Hayes. (2011) “*Uncertainty and Uncertainty Analysis Methods*”.
- [7] M. A. Lee. and M. H. Smith. (1995), “*Handling Uncertainty in Finance Applications Using Soft Computing*,” Proc. 3rd Int’l Symp Uncertainty Modelling and Analysis.
- [8] Martin. Basil., Christos. Papadopoulos., Donald. Sutherland. and Hoi. Yeung. (2001) “ *Application Of Probabilistic Uncertainty Methods(Monte Carlo Simulation) In Flow Measurement Uncertainty Estimation.*” Int’l Conf.Flow Measurement.
- [9] Meghdadi. H. Amir., R. Mohammad. and T. Akbarzadeh. (2003) “*Uncertainty Modeling through Probabilistic Fuzzy Systems*,” Proc. 4th Int’l Conf.Uncertainty Modeling and Analysis, pp. 56 – 61.
- [10] B. Qin., Yuni Xia., S. Prabhakar and Yicheng Tu. (2009), “*A Rule-Based Classification Algorithm for Uncertain Data*,” Proc.IEEE Int’l.Conf on Data Engineering (ICDE), pp. 1633-1640.
- [11] M. S. Ryo. and J. K. Aggarwal. (2008) “*Human Activities: Handling Uncertainties Using Fuzzy Time Intervals*,” Proc.19th Int’l.Conf.Pattern Recognition(ICPR 2008)., pp.1-5.
- [12] S. Wasserkrug.,A. Gal. and O. Etzion. (2005) “*A Model for Reasoning with Uncertain Rules in Event Composition Systems*,” Proc. 21st Conf. Uncertainty in Artificial Intelligence (UAI ’05), pp. 599-606.
- [13] S. Wasserkrug.,A. Gal., O. Etzion and Y. Turchin. (2008), “*Complex Event Processing over Uncertain Data*,” Proc. Second Int’l Conf. Distributed Event-Based Systems (DEBS ’08), pp. 253-264.
- [14] Laura P. Swiler., Thomas L. Paez. and Randall L. Mayes (2009) “ *Uncertainty Analysis*,” Proc. IMAC.

AUTHORS

First Author – Lakshmi.S.Dutt, PG Scholar, Karunya University (Coimbatore, India) and lsdutt@gmail.com.

Second Author – Mathew Kurian, Assistant Professor, Karunya University (Coimbatore, India) and mathewk80@karunya.edu

Dialogue Initiative between Islam and West

Nazar Ul Islam Wani

Research Scholar at University of Kashmir, Department of Islamic Studies

Abstract- Historically Islam has been in conflict with the west since 8th century. The Arabs were in Spain for 700 years and Sicily for 500 years. Then there were about two hundred years of so-called crusades. Some centuries later Ottomans threatened to overrun Europe, making their way to Vienna. The colonial movements of the west in Muslim lands and the Muslim reaction to get political independence from France, Russia, Britain, and Holland etc also created the conflict between the West and Muslims. Hence, the animosity is deep rooted into the minds of both westerners and Muslims. The two communities are caught up in a whirlpool of violence. I consider the dialogue between Islam and West, a work of immense importance.

I. INTRODUCTION

Islam as is defined is a religion which demands and propagates peace and co-existence. It is true that there are so many questions posed by the non-Muslims to its credibility of being a peaceful religion. It is also true that Islam receives a very bad connotation to its name and teachings. Is this the fact that there are Muslims who practice Islam in a bad way, is not authentic. What needs to be explained is why the world does not seem to make a distinction between the minority who are not willing to live peacefully and the majority of law-abiding religious citizens.

Syed Farid Alatas speaks about the three major reasons of clash and impediments for dialogue between Islam and West:

1. Historically Islam had been in conflict with the west since 8th century. The Arabs were in Spain for 700 years and Sicily for 500 years. Then there were about two hundred years of so-called crusades. Some centuries later Ottomans threatened to overrun Europe, making their way to Vienna. The colonial movements of the west in Muslim lands and the Muslim reaction to get political independence from France, Russia, Britain, and Holland etc also created the conflict between the West and Muslims. Hence, the animosity is deep rooted into the minds of both westerners and Muslims.
2. The attack on twin towers on 9/11 and its repercussions.
3. The orientalist construction of Islam that has been constructed for centuries also maligned the spirit of dialogue between Islam and West¹.

These major issues need intense care and redressal from both political and other think tanks, if we have to approach for a dialogue. Moreover, syllabus and curriculum in the schools should be dialogue and cooperation oriented. Students must be taught the positive impacts of the relations between Christianity and Islam, like crusades resulted in a cultural exchange between Muslims and Christians. The bias of Orientalist's and Muslims for

one another in academic circles must go, because due to their wrong preconceived notions of past they are not able to add to knowledge in a positive way which could eventually lead to the development of civilisations.

II. INITIATIVES TOWARDS DIALOGUE

1. Media should be involved in dialogue.

Media must come in the process of dialogue, which has also maligned the Islam to a great degree. Media pays a very little attention on the positive aspects of Muslim world. There are equally strange and bizarre things that happen within other religions, like as Syed Farid says, "Jamestown mass suicide was not attributed to the Christianity", little attention paid on how Muslims suffer out of the transgressions of their own men like "Muslim victims of 9/11" and "in 1995 Oklahoma city bombing was carried by an American Anglo but at very first Muslims were blamed". There is need for a better media reporting which covers all the suffering in the world, co-operation between Muslims and non-Muslims and non-Muslims must understand the biased and stereotype scholarship concentrated on Islamic Studies².

Islam does not allow any misinformation to be carried out without proof. Quran says (2:111) "Produce the proof if you are truthful"

The proof of the news should be the priority to avoid the confusion of Islam. Media has bombarded a lot of misinformation regarding the Islam till now. There must be a dialogue between the Islamic Scholars and World Media.

2. Developing metaphysical commonalities between Christianity and Islam

In order to better understand the surrogate character and the ideological nature of many of the confrontations described above, we should briefly reflect on the undeniable similarities between Islam and Christianity that could be the basis for an enlightened dialogue between the two civilisations in the theological, cultural and political fields. It is commonplace that both civilisations are based on the belief in one god. Monotheism is the quintessence of their religious attitude towards the universe. The concept of 'oneness' of God is more precisely and with higher abstraction expressed in Islam while the Christian concept may be seen as containing relics of polytheism in its Trinitarian conception of God. The Islamic concept of God may help Christianity to clarify its own conception of monotheism and to critically evaluate any anthropomorphic elements in its dogma of the trinity of the one God. Furthermore, both religions are of a universal nature and therefore open to all mankind. Their concept of God is not one of a tribal god; it excludes any form of discrimination in regard to membership in the community of believers. This universality of their message may constitute a

rivalry between the two religions, reaching out to all mankind, but at the same time it underlines their open-mindedness towards all creeds of humanity. A special binding factor in the field of theology is the eminent role which Islam attributes to Jesus among all the prophets. The Christian beliefs in the 'Immaculate Conception' and in Jesus being without sin are equally upheld by Islam. (The main difference, however, remains as to Jesus being regarded as the son of God or merely as a prophet, albeit the most noble among them all.) Similar conceptions exist in both religions in regard to the Resurrection and the Final Judgment.

These "structural" similarities of the metaphysical dogma, however, have not become the basis for a genuine dialogue between the two religions. For Christianity in particular, dogmatic differences have been more important and the Prophet's labeling as "heretic" has poisoned the relations between the communities over the centuries. A lack of confidence, even deep mistrust has prevailed between the two communities, which may partly be seen as a result of hundreds of years of armed confrontation in Europe and the Near East. A hostile prejudice against Islam still characterizes many European approaches to questions of the Muslim world, its religious dogma, its social rules, lifestyle, etc. As the Austrian-born Pakistani thinker Muhammad Asad rightly stated, Europe identified the political and military threats posed by the Muslim powers of the time -- particularly the threat of the Ottoman Empire -- with Islam as such, i.e. with the religious message of the Prophet³.

3. Orientalist must shun the bias towards Islam.

Another obstacle to genuine understanding and dialogue was constituted by the fact that for a very long time research on Islam was in the hands of Christian missionaries who dealt with the subject in an apologetic and highly polemical manner. This created a strangely distorted image of Islam in its religious, moral and social aspects as well. Such a doctrinal position, in turn, has had a profoundly negative impact on the popular European perception of Islam up to the present day. What today is known as "orientalism" has its roots in this apologetic Christian approach which put the Christian doctrine in a position of superiority over the pretended Islamic "heresy". As aptly stated by Edward Said,

Orientalism depends for its strategy on a positional superiority, which puts the Westerner in a whole series of possible relationships with the Orient without ever losing him the relative upper hand⁴.

This kind of approach is one of the major obstacles to an understanding between Muslims and Christians at present.

This approach completely fails to critically analyze the existing stereotypes as a legacy of earlier confrontations; on the contrary: it strengthens those stereotypes in the new set-up of a "clash of civilisations" according to which Islam is portrayed as a threat to the security of Europe and to the preservation of its cherished "liberal" lifestyle and value system. Orientalism, the profession of "Islamic Studies", is in many respects part of a new "crusade" under the Eurocentric conditions of the 20th century.

One of those stereotypes affecting Islamic-Christian relations since the times of the crusades and the wars with the Ottoman Empire has been that of the hostile nature of Islam in both its religious and political message. This stereotype revolves around the Christian interpretation of the Quranic term *jihād* and

may serve as an example of the work still to be done to prepare for a fair and balanced interpretation and representation of the Islamic message in Europe. Christian scholars used to teach that Islam generally and unreservedly justifies war against non-believers, i.e. Christians themselves. Certain sentences of the Qur'an were and still are deliberately taken out of context so as to "prove" an aggressive nature of Islam. Interpretation of Quran and other scriptures according to the context and background. The misinterpretation of the use of force in the teachings of the Qur'an is one basic example of an Islamic-Christian misunderstanding that has created an atmosphere of deep mistrust prolonging the wrongful perception of Islam as being a threat to Christian civilisation in Europe and negating its very right of existence.

4. Developed Countries should first approach for dialogue
The dialogue against the clash is of dire need because the way we find ourselves, as human beings, is violent and globally insecure. Our current approach to dialogue is dysfunctional. Clash is actually the interest of very few among the needs of many. Many want dialogue and peace and co-existence. Clash can never help us to reach the Just ends. The developed nations of the world should play an upper hand in acquiring that kind of atmosphere. It is very well said by the Dianna Francis, a member of IFOR (International Fellowship on Reconciliation):

If the rich nations put half of the effort into justice that they currently put into defending vested interests; if they stopped talking about the 'debts' of others and started to seek forgiveness and make reparation for their own indebtedness...if they began behaving democratically in world forums rather than trying to force other countries to line up with them through bribing and bullying, relationships would be transformed and the world would rapidly become more secure...⁵

She further says that if the big powers applied the approaches and procedures of conflict and resolution for the maintenance of the relationship, the face of international politics would be transformed to the extent that people would be more talking about the peace rather the clash. The mentality and ideology of the people must go through debates and discussions. This can be done from the beginning, at the very inception of the child. The debates in schools should be the priority of the teachers and the authorities who frame the syllabus of schools. The government should frame policies for the inter-religious debates.

5. Conferences on Dialogue among religions should be held

On 24, November 1919 an All India Khilafat Conference was held in Delhi to discuss the 'peace celebrations' of the British at the end of the Great War. The conference became a display of hind-Muslim fraternity. Gandhi presided and spoke in Urdu. His first sentences translated by MJ Akbar as;

It ought not to appear strange for the Hindus to be on the same platform as the Muslims in a matter that specifically and solely affects the Muslims. After all the test of true friendship is true assistance in adversity and whatever we are, Hindus, Parsis, Christians, Jews, if we wish to live as one nation, surely the interest of any of us must be the interest of all...We talk of Hindu-Muslim unity. It would be an empty phrase if the Hindus

hold aloof from the Muslims when their vital interest were at stake⁶.

However, such initiatives could not stop the millions of killings in the name of religion in 1947 partition. We must say that Gandhi was right in saying that 'true friendship is true assistance in diversity'

So many conferences are held every year and many days are celebrated. We have Environmental Day, Teachers Day and Days in the memory of important people; their importance is explored. Why don't we have a World Cooperation Day? This idea can be a utopia because the world and the people living in it are becoming extremely intolerant to face each other and listen to each other.

Very strong academic measures are to be taken to approve the dialogue among the religions of the World. One such effort took place in Japan in 2005

In March 2005, as reported elsewhere in this Bulletin, the XIX World Congress of the International Association for the History of Religions was held in Tokyo. Taking advantage of what was to prove the largest gathering of scholars of religion from around the world in the history of Japan, the Nanzan Institute invited several participants to join for a day's workshop on "The Dialogue among Religions around the World". The Scholars were from the all around the world". The scholars from Romania, Hungary, Ukraine, Belgium, Cuba, Brazil, Philippines, Korea and Japan participated in the dialogue⁷.

Such conferences must be held again and again. The very nature of religion demands a dialogue between all the major world religions. This dialogue has particular urgency for the three Abrahamic religions, Judaism, Islam, and Christianity. There are as many reasons for Muslims and Jews to engage in interfaith dialogue as there are for Jews and Christians to come closer together. Historically speaking, the Muslim world has a solid record of dealing with the Jewish people. Jews have always been welcomed in times of troubled water, e.g., when the Ottoman Empire embraced Jews after their expulsion from Andalusia.

6. Face to face interaction of the members of different faiths.

Face to face interaction among the members of different faiths will prove healthy for the dialogue and co-existence. Once we start doing things out of textual books which are virtually biased, the reality and the behavior of people would come through direct experience. Hanna Shefskey, a music teacher narrates a direct experience of two children from different faiths:

As I sat and talked with Ala Khatib, the co-principal of a Jerusalem elementary school, two young girls, one Jewish and one Arab, ran into his office. The Jewish girl, her bright red hair and freckles a great contrast to the olive coloring of her friend, went right up to Ala and began pleading with him to let his daughter sleepover at her house that night. When Ala finally said he would speak to his wife to see if it was possible, the girls exchanged a high-five, giddy with excitement, and ran off together down the hall. Although two girls begging their parents for a sleepover is not out of the ordinary, the friendship I witnessed between a young Jewish girl and a young Arab girl is far from normal in Israeli society. In terms of typical, everyday encounters, Israeli Jews and Arabs are often very segregated....⁸

This is what the face to face interaction can do. But due to the lack of self-confidence, particularly in the last few centuries, Muslim have become almost anxious to demonstrate their 'separateness' from the rest of mankind. They progressively tend to emphasize their differences from them instead of trying to, what they so brilliantly did in their heyday, bring out the 'commonality' in human beings, their common ends, and to bridge the different paths by which they seek to reach them. This reversal of attitude seems to be contrary against the spirit of Islam, its traditions and above all glorious example set by the Prophet Muhammad⁹.

7. Youth must involve in promoting cultural peace and dialogue among civilisations.

The youth is the future and tomorrow's leaders are today's youth. It is very essential to promote a culture of peace among the youth through education and cultural programme. The participation of youth plays a key role in the future of the world. We know that majority of the population in the world are youth but their expression has very few channels.

In September 2006, a joint work was done by the students of a youth organization named as "Youth For Alliance Among Civilisations" in which they did a survey which addresses to the decision makers of the generation now in power; government and United Nations officials and diplomats, business leaders, donors, leaders of civil society organizations, teachers and university officials, community leaders, etc. In their survey the team contacted thousands of organizations and received feedback from 475 organizations in 125 countries. The report was submitted to the chair of 'Alliance Among Civilisations' and one of the paragraphs read:

Most youth suggest training and workshops to be conducted for youth on issues such as the culture of peace, conflict resolution and mediation, values and human rights. Vocational training and employment programmes are also seen as vital for youth in promoting a culture of peace.... Intercultural and international exchanges, where youth get to know others, are also popular proposals in building a culture of peace, and many youth have also mentioned the need to meet internationally, to promote networks and to publish and document their work, distributing the information widely, both online and on paper and by radio in local communities¹⁰.

8. We should learn to forgive others

The God forgives the one who asks! But human beings are locked in a 'tit for tat' situation. We must create an environment where people who commit mistakes are forgiven but at the same time taught with wisdom.

M Fethullah Gulen directs attention to the fact that if we do not forgive others, we in return have no right to expect forgiveness. All human beings are part of the same human family in the sense that we are fellow passengers on the ship called planet Earth. Gulen exhorts all of us to pull together to construct a better world built on tolerance. His optimistic and hopeful view of the future leads him to say that the twenty-first century will be called the age of tolerance. And he wants this tolerance to become permanent, that is, to last for all ages. His views about the future stand diametrically opposed to those of Mr. Huntington¹¹.

III. CONCLUSION

In the end I would like to say that the decisions made by the powerful people may prove a gospel truth. They may mussel the ordinary people, intellectually by giving conflict prone theories and politically by exploiting your weakness. The people challenge the politics of the super power countries-at whatever stage and level of violence. There are ordinary people working to address it, to end violence, injustice, conflict or clash. The people around the world defend Human Rights, build understanding and exorcise the past: from Gujarat to Bradford, from Georgia to the Philippines, from Burma to Columbia and from Bosnia to Rawand. Civil Society is on the move. This movement needs a lot of impetus. The decision of peace making is not an easy task. It needs a lot of training from visionaries of peace-the prophets and strategists, philosophers and politicians, and act to transform relationships and build peace in our own communities¹².

We must encourage a new form of history, writing about the past and present from the point of view of those which have seemed to have no power, so that we recognize that we are all part of history and its making. We must create some unbiased theories which appeal to ever one relatively.

To create the sense of hope that there should be no clash or conflict can be a utopia because the terms and conditions to establish it are long and complex. This is also because human beings have accepted the conflict in their lives and to de-condition them from this needs intense psychological training. No one of us can work everything but every one of us can. We cannot end the clash neither I am here to end it because there needs a shift in political thinking from war to peace. I think due the hard work of ordinary people at micro level this shift has begun to take place.

AUTHORS

First Author – Nazar Ul Islam Wani, Research Scholar at University of Kashmir., Department of Islamic Studies

REFERENCES

- [1] Syed Farid Atlas "Islam and dialogue among civilisations:-Prerequisites and Preparations. www.nursistudies.org.
- [2] Ibid.
- [3] Dr, Hans Koechler, Muslim- Christain Ties in Europe: Past, Present and Future, International Seminar on Civilisational Dialogue: "Japan, Islam and the West"(Kuala Lumpur, 2-3 September 1996)
- [4] Edward. W. Said, penguin books, New Delhi, 1995, p.7
- [5] Dianna Francis, Rethinking War and Peace, Pluto Press, London, 2004, p.152.
- [6] M J Akbar, The Shade of Swords- Jihad and conflict between Islam and Christianity, Lotus collection, 2003, India, p.215.
- [7] James. W. Heisig, "The Dialogue among Religions around the World"
- [8] "Face to Face" Working Toward Peace Through Arab-Jewish Encounters in Israel by Hanna Shefskey.
- [9] www.tuftsgloballeadership.org/files/shefskey.pdf
- [10] Islam in the Modern World- Problems And Prospects, Ed. Prof. A.A. Suroor, Iqbal Institute University of Kashmir, Srinagar, 2001,p.23-24
- [11] Youth Cooperation for Culture of Peace and Dialogue, Survey Results and Proposal, Global Youth Solidarity Fund and Programme, September 2006. Available at, www.decade-culture-of-peace.org/report/YouthReport.pdf.
- [12] M Fethullah Gulen's Response to the Clash of Civilisations Thesis" by Richard Penaskovic. Available at www.gulenconference.org.uk.
- [13] Dianna Francis, Rethinking War and Peace, Pluto Press, London, 2004, p.158.

Interactive Electronic Board Using ARM Processor

Mrs. Mayuri Joshi*, Prof. Sunil .S. Morade**

* E&TC Department, K.K.Wagh Institute of Engineering Education & Research, Nashik, India

** Associate Professor, E&TC Department, K.K. Wagh Institute of Engineering Education & Research, Nashik, India.

Abstract- At present, multimedia is widely used in classroom for teaching, using chalk is not only laborious, but it also produces a lot of chalk dust, polluting the air and adversely affecting the health of the students and teachers, also the use of multimedia helps in better teaching learning process. At present the traditional black board is replaced by smart electric boards produced by companies like Hitachi, Panasonic, which are very costly. This design uses ARM 9 processor for hand-held terminal hardware and Embedded Linux operating system for hand-held terminal software. When teacher writes on a book-size touch screen with an electrical pen, handwriting signal will be transferred to the PC terminal by wireless transmission module. Thus it makes classroom teaching be more efficient.

Index Terms- ARM 9, LINUX, Qt, VNC, Kernel, Uboot

I. INTRODUCTION

Different multimedia equipments are widely used in classroom for better teaching learning process. At present the traditional black board is replaced by smart white electric boards produced by companies like Hitachi, Panasonic [16], [17] which are very costly around 50,000 to 80,000 INR.

In this design, Wireless Electric Board is designed which costs just one-fifth of the ordinary electric board. This design uses ARM processor as a heart of this hand-held terminal hardware and Linux operating system for hand-held terminal software. Handwriting signal written touch screen will be transferred to the PC terminal by wireless transmission module to PC and will be display by projector.

In many embedded operating systems, Linux, with its unique advantages, takes a large share of the embedded field. Linux owns open source and rich software resources, supports multi-thread, multi-user, multi-process, and has good portability, powerful functions and stability. It supports a large number of microprocessor architecture, hardware devices, and graphics support and communication protocols.

Virtual Network Computing (VNC) is a simple remote display protocol. VNC protocol is totally independent of operating system, windowing system, and applications. VNC requires only a reliable transport medium and the simplest of display capabilities. The virtual network computing (VNC) system, server machines supply not only applications and data but also an entire desktop environment that can be accessed from any Internet-connected machine using simple software. VNC allows a single desktop to be accessed from several places simultaneously, thus supporting application sharing [6].

Qt is a framework to create cross-platform applications. Qt is used to create amazing GUI applications. Qt helps to design and code an application, but the real advantage of Qt lies in the

fact that an application can be made to run on a variety of operating systems without changing the code [18].

II. SYSTEM OVERVIEW

This design uses ARM processor board for hand-held terminal hardware with has been interfaced to different memories like SRAM and Flash memory and varies input output interface like Touch screen, Keyboard, USB. It uses Linux operating system for hand-held terminal software. The data written on the book size touch screen by a stylus touch screen will be transferred to the PC terminal by wireless transceiver module and display it in a larger form by projector [1]. The structure diagram of this system is shown in Figure 2.1.

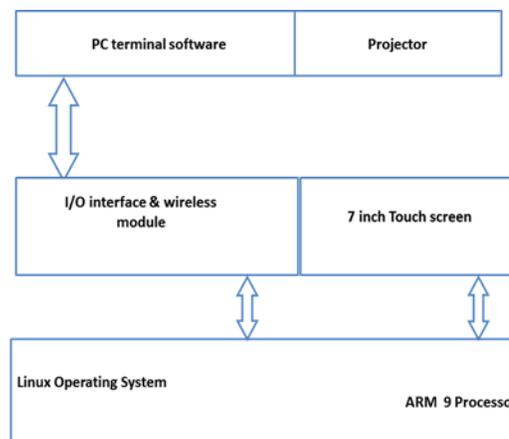


Figure 2.1: Block Diagram of the system.

2.1 Hand Handled terminal Hardware Structure

Hardware design includes hand-held terminal hardware and PC terminal. Hand-held terminal hardware consists of ARM 9 Processor, on board. NANAD and NOR Flash memory. The processor is interfaced to 7 inch Touch Screen, memories, and various input output modules along with the wireless transceiver. The hand-held terminal hardware structure for the system is shown in Figure2.2.

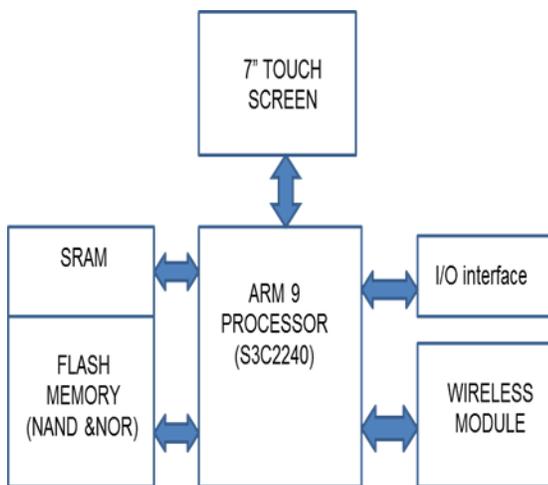


Figure 2.2: Hand Handled Terminal Hardware Structure

2.2 Hand-held terminal software architecture

Hand-held terminal software architecture Hand-held terminal software is divided into four parts: Boot Loader, Drivers, Kernel, and Applications. Primarily, Boot Loader is used for initializing necessary peripherals and interrupt vector table in processor. Secondly, Drivers, which refer to LCD driver, touch screen driver, NAND Flash driver and wireless module driver are used for supporting communication with Kernel. Thirdly, Kernel chooses real time multitasking kernel for Linux. Finally, Application can be available based on these above mentioned three dispensable parts: Boot Loader, Kernel and Drivers. Software architecture is shown in Figure 2.3

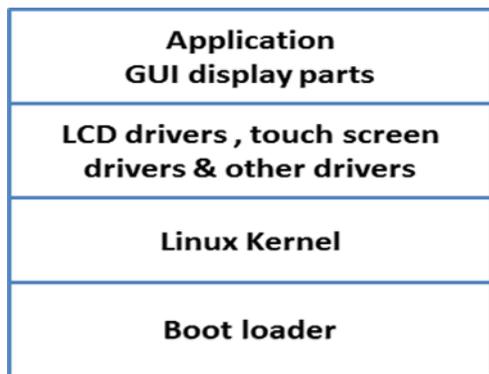


Figure: 2.3: Hand –held Software architecture

2.2.1 Boot Loader design

After connecting the power supply, the NAND Flash controller of SOC will automatically copy the primary 4KB of data to Stepping Stone, while the Boot Loader will be preserved in the beginning 4KB of NAND Flash. Here as Boot Loader will realize these functions: shutting off watchdog, setting system timer, initializing MMU, defining stack and modifying NAND Flash controller.

2.2.2 Transplantation of Linux Kernel

Linux is a real-time multitasking kernel, responsible for process' creating, scheduling and communication. The porting of

Embedded Linux is divided into the following steps: obtaining source codes; building cross compiler environment; porting Linux boot loader (Uboot or VIVI), then configure and compile the kernel, porting and loading the embedded file system, developing and debugging of application program, program downloading. In this paper, we mainly introduce the porting technology of Linux kernel. [5]

2.2.3 Drives design

Drivers provide the interfaces of hardware operating modules for Kernel and Application, including LCD driver, touch screen driver, USB drivers, NAND Flash driver, and wireless transmission module driver.

2.2.4 Application Design

Application is composed of four parts: Qt GUI display, touch information gathering, processing program and wireless sending.

III. PORTING OF LINUX KERNEL TO ARM PROCESSOR

Algorithm for updating the boot loader

- i. Update boot loader, kernel or file system images with our customized images by using commands of uboot: install boot loader, install-kernel and install-file system
- ii. Update boot loader , Kernel and File system
- iii. Make file system image by, Assume rootfs is the directory of your root file system on host PC
- iv. Load the boot loader image into NAND flash

3.1 Algorithm for porting the Linux kernel and device delivers

The porting of Embedded Linux is divided into the following steps: obtaining source codes; building cross compiler environment; porting Linux boot loader (Uboot) , then configure and compile the kernel, porting and loading the embedded file system, developing and debugging of application program, program downloading. In this paper, we mainly introduce the porting technology of Linux kernel. [5]

- i. Modify Make file
- ii. Set Flash Partition
- iii. Prohibit Flash ECC check
- iv. Configuring Kernel
- v. Kernel Compilation
- vi. Kernel downloads

3.2 Installation of tool chain

Most ARM systems programming occurs on non-ARM workstations using tools that cross-compile, targeting the ARM platform. The GNU ARM tool chain is such a programming environment, allowing you to use your favorite workstation environments and tools for designing, developing, and even testing on ARM simulators. Included in the GNU tool chain are the binary utilities (binutils), the GNU Compiler Collection (GCC), the GNU Remote Debugger (GDB), GNU make, and the GNU core utilities.

- i. To download the GNU tool chain, from the Code Source download and choose the IA32 GNU/Linux TAR file.
- ii. Extracting the downloaded GNU tool chain.
- iii. Modify The PATH environment variable to access the bin directory of the tool chain, and the tools are ready to use.
- iv. Set up symbolic links to ARM tools.

IV. APPLICATION SOFTWARE

4.1 Basics of GUI

A Graphical user interface (GUI) is a pictorial interface to a program. A good GUI can make program easier to use by providing them with a consistent appearance, and with intuitive controls such as pushbuttons, edit boxes, text boxes sliders and menus. The GUI should behave in an understandable and predictable manner, so that user knows what to expect when he or she performs an action. The Graphical User Interface, or GUI, refers to the now universal idea of icons, buttons, etc., that are visually presented to a user as a “front-end” of a software application.

4.2 Introduction to Qt

Qt is a cross platform development framework written in C++, but makes extensive use of a special code generator (called the *Meta Object Compiler*, or *moc*) together with several macros to enrich the language. It runs on the major desktop platforms and some of the mobile platforms. All modules have a common scheme and are built from the same API design ideas. Qt extends C++ with macros and introspection, all code is still plain C++. Qt has Cross platform applications built from one source. It builds native applications with native look and feel. Easy to (re)use API, high developer productivity, openness,. Qt is open source software, but the development is led by Qt Development Frameworks Embedded target platforms: Windows CE, Symbian, Maemo, Embedded Linux (Direct frame buffer access) [18].

4.2.1 User Interface Design Flow

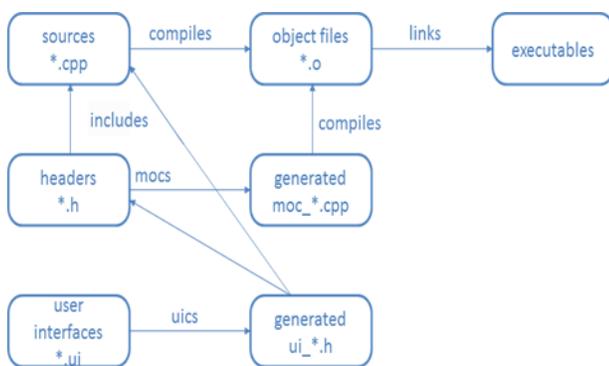


Figure 4.1: Flow graph for design

4.3 Creating Scrabble in QT

The Scribble example shows how to re-implement some of [QWidget](#)'s event handlers to receive the events generated for the application's widgets. We re-implement the mouse event handlers to implement drawing, the paint event handler to update the application and the resize event handler to optimize the application's appearance. In addition we re-implement the close event handler to intercept the close events before terminating the application. We also use [QPainter](#) to draw an image in real time, as well as to repaint widgets. With the Scribble application the users can draw an image. The **File** menu gives the users the possibility to open and edit an existing image file, save an image and exit the application. While drawing, the **Options** menu allows the users to to choose the pen color and pen width, as well as clear the screen. In addition the **Help** menu provides the users with information about the Scribble example in particular, and about Qt in general. It has two main parts:

- a. ScribbleArea is a custom widget that displays a [QImage](#) and allows to the user to draw on it.
- b. MainWindow provides a menu above the Scribble Area.

4.4 Algorithm for scrabble pad

4.4.1 Main Window

- i. Initialize the required header files for main window and scrabble area.
- ii. Set the area size for scrabble pad and name for the window as “Finger Paint”
- iii. Add the various tools for the file menu that is file open, save print, exit by using the various QAction .
- iv. Implement the various event handlers form Qwidgets like mouse event handler, close event handler
- v. Create various actions to open file, save file in various image formats, print, exit, clear screen and help.
- vi. Add the menus for these various events in the tool bar.
- vii. We use close event to save the written data on the scrabble pad in the various image formats. By default the image will be saved in “png” format.
- viii. Save the file to the desired path or directory.

4.4.2 Scrabble Area

- i. Initialize the required header files for scrabble area, Widgets and PrintDialog.
- ii. Accept the touch event and set the colour for the pen for the new image which is open and save the image with the specified size.
- iii. Foe new image clear the screen using the given option in tool bar to ckear screen
- iv. Define the height, width for the image size by using resize event of QWidget.
- v. Set the Printer option using QPrint and QPrintDialog for printing the image.
- vi. For every new image detect the event of Touch Begin, Touch Update & Touch End.

4.5 Virtual Network Computing (VNC)

The technology underlying Virtual Network Computing (VNC) is a simple remote display protocol. VNC protocol is totally independent of operating system, windowing system, and applications. The VNC system is freely available for download. Host and client computers must be connected to the same TCP/IP network. This can be a private network such as a LAN or VPN, or a public network such as the Internet. Note that firewalls and routers must typically be configured before an Internet connection can be established.

To start a remote control session, run VNC Viewer and identify VNC Server on the host computer you want to control. Once authenticated, VNC Viewer displays the host computer's desktop in a new window, and you can take control using the client computer's keyboard and mouse. You can run applications, change settings, and access data on the host computer exactly as you would be permitted to do were you sitting in front of it. By default, VNC Server permits other users to connect to the host computer at the same time as we may be sharing control.

- xiii. The PC is connected to projector and the written data is projected.

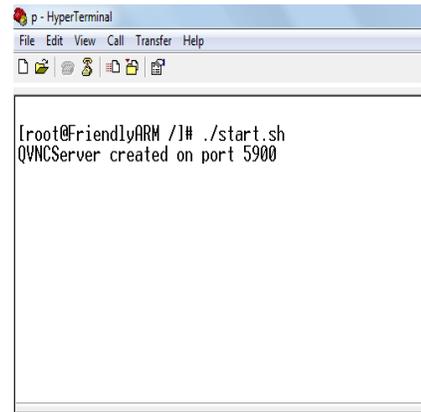


Figure 5.1: Hyper Terminal Command Prompt

V. SYSTEM OPERATION AND RESULTS

5.1 System Operation

- i. We have to download the uboot, kernel and the file system of so that the entire operating system is present and ready to use.
- ii. The device drivers for various interfaces are configured in kernel.
- iii. We compile these using tool chain and the download it through the serial port step wise by configuring the HyperTerminal for 115200 baud rate and at com1 port.
- iv. Once the HyperTerminal is configured we give the various commands on the command prompt (#) of the serial port and thus entire Operating system is downloaded.
- v. We compile the Code for Qt and then download the application through the USB ports on the PC and the board.
- vi. The board is power on and first configures the board for the Wireless communication.
- vii. We turn of the board Ethernet connection and connect it to Wi-Fi network through the wireless dongle which connects to Wi-Fi router
- viii. The Wi-Fi router is connected to PC wirelessly by setting the wireless network. Thus a network is formed between PC, router and the board.
- ix. Once the connection is established we turn on the serial for and give the command on the root # prompt as #./start.sh to start the application on the board by terminating the server.
- x. Then we use the VNC Viewer on the client PC to see the data written on the VNC server that is our Application.
- xi. For VNC Viewer we have to give the IP address of the board and connect it to port 5900 which is open when we start our application.
- xii. After the connection has been established between the server and client we can seen what is written on the scrabble pad of the application on the PC.

VI. RESULTS

The hardware is build around the ARM 9 Processor by interfacing the Touch screen, memories, wireless module and other input output devices. The Linux operating system is downloaded on the ARM processor and then the application is downloaded in the OS whose program is written in Qt and the VNC server is initialized in the application. The VNC client setup is installed in PC. Here we are using ultra VNC on the client side.

The data is written on the 7 inch touch screen and is the transferred to PC wirelessly which is seen on PC terminal using Ultra VNC viewer. For transferring the data the wireless network is setup between boards, PC by a Wi-Fi router. The board has a wireless dongle attached to USB port and the wireless connection of PC is turned on thus data can be transferred from board to PC wirelessly.



Figure 5.2: Scrabble pad on board

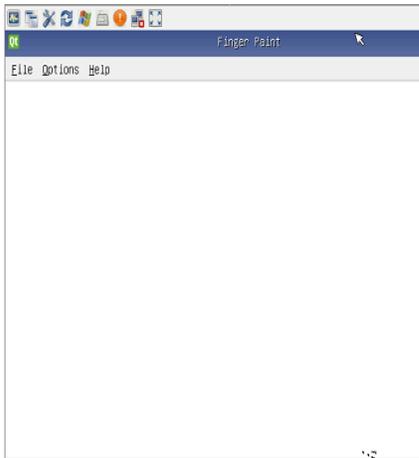


Figure 5.3: Scrabble pad on PC

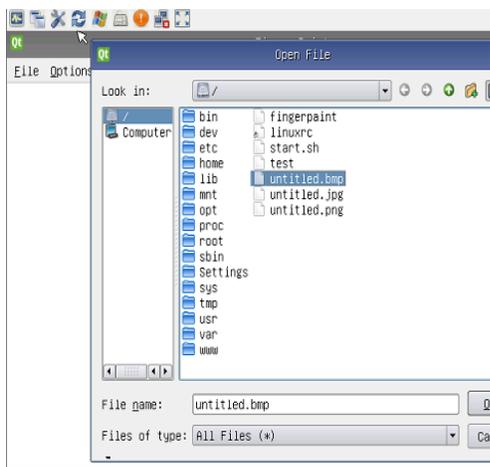


Figure 5.4: Data transferred from Board to PC

VII. CONCLUSION

This design of hand held equipment is build using ARM 9 processor S3C2240 which can interface to wireless module and 7 inch touch screen. The data written on the screen is transferred to PC through wireless medium (Wi-Fi). The use of Linux operating system helps in specification for multitasking and also for writing the application software on the kernel. The application software is written in Qt which is ported to the operating system. The programming in 'Qt' is similar to C++ which can be easily compiled. VNC server is also implemented in the application and VNC viewer is used for the PC through which data written on the hand held equipment is transferred to PC which is displayed on projector.

Moreover this technology helps in avoiding use of traditional chalk & board thus eliminating health issues caused by chalk dust. This hand-held equipment is cost effective compared to present interactive white boards and is portable many features.

REFERENCES

[1] Di WU, Yang Zhang, Baoding Zhou "Wireless Electric Board Based on an ARM-based Embedded System", IEEE International conference computer

science and information technology (ICCSIT) Volume 5, pp 268-270, September 2010.

- [2] Ian McLoughlin, Anton Aendenroomer "Linux as a Teaching Aid for Embedded Systems", IEEE, 978-1-4244-1890- July 2007.
- [3] Shao Guojin, Shen Yunqin "Embedded Linux Core Transplantation and Development of Handheld Terminals System" IEEE, Volume 5, pp 583- 586 978-1-4244-5586-October 2010.
- [4] Christof Ebert, "Using Linux for Real-Time Applications", Published by the IEEE Computer Society, 0740 -7459 April 2004.
- [5] Chun-yue Bi, Yun-peng Liu, Ren-fang Wang, "Research of Key Technologies for Embedded Linux Based on ARM", International Conference on Computer Application and System Modeling (ICCSM), Volume 8, pp 373 -378, June 2010.
- [6] Tristan Richardson, Quentin Stafford-Fraser, Kenneth R. Wood and Andy Hopper "Virtual Network Computing", IEEE Internet Computing, Volume 2, January/February 1998
- [7] IEEE. Information technology "Portable Operating System Interface (POSIX)-Part1: System Application: Program Interface (API) [C Language]", ANSI/IEEE Std 1003.1,1996 Edition.
- [8] Seongsoo Hong "Embedded Linux Outlook in the PostPC Industry", Proceedings of the Sixth IEEE International Symposium, on Object-Oriented Real-Time Distributed Computing (ISORC'03) 0-7695-1928-8/03 \$17.00 © 2003 IEEE
- [9] A White Paper "Survey of Real-time operating system"
- [10] A White Paper by Bob Japenga "Why Use Linux for Real-Time Embedded Systems"
- [11] A White Paper by Catherine Lingxia Wang, Bo Yao, Yang Yang, Zhengyong Zhu "A Survey of Embedded Operating System".
- [12] ARM9 Processor S3C2240 datasheet <http://www.samsungsemi.com>
- [13] Single computer board specifications <http://www.embedinfo.com>
- [14] Installation Manual for S3C2240 using Linux
- [15] U-Boot: <http://www.denx.de/wiki/UBoot>
- [16] Interactive white board <http://panasonic.com/panaboard>
- [17] Interactive white board www.hitachi-soft.com
- [18] QT GUI <http://www.qt-project.org>

AUTHORS

First Author – Mrs. Mayuri Joshi, E&TC Department, K.K.Wagh Institute of Engineering Education & Research Nashik, India, mayuriujoshi@gmail.com

Second Author – Prof, Sunil .S. Morade, Associate Professor, E&TC Department, K.K. Wagh Institute of Engineering Education & Research, Nashik, India., ssm.eltx@gmail.com

Intelligent Contract Management

Manju Pillai*, Pramila Adavi**

* Department of Civil Engineering, Maharashtra Institute of Technology, Kothrud, Pune-38, India.

** Department of Civil Engineering, Maharashtra Institute of Technology, Kothrud, Pune-38, India.

Abstract- Contracting is an integral part of construction projects. Managing the contracts therefore is equally important for the success of any business process due to rapid increase in multiple contracts. The conventional method of managing contract involves risks and chaos which include inadequate information in contracts, inadequate delegation of authority and responsibility, fraud, theft, corruption, other unethical activities, communication gap, delayed financial decisions thus dampening the progress of the project, all due to manual intervention in managing contracts. This calls for a need of systematic and an effective method of contract management. This paper speaks about Intelligent Contract Management (automated contract management) which is an efficient, transparent and flawless concept of managing contracts. This technique will streamline the business process by reducing the time taken to create, review, execute and approve contracts, thus easing activities like tracking, central storage of contract documents, and reduction in disputes, minimize risks associated with manual data entry.

Contract management is an issue of strategic importance to both organization and to projects and through automated contract management technique; organizations can increase control, increase effectiveness, reduce cost and also provide strategic and competitive advantage. Key objective of automated contract management system is to ensure easy access to contract information to form flexible support for the contract workflow.

Index Terms- Automated Contract Management, Documentation, Change Management

I. INTRODUCTION

The construction industry in this competitive world is undergoing number of changes. As a part of these changes the construction process is enhanced with the help of modern electronic systems to enable strong partners/stakeholders relationship. Due to these electronic advances appropriate systems are necessary to ensure proper management control of contracts, thus enabling automated contract management. It would be useful in managing the administrative aspects of contracting, meet contract obligations and avoid the risk of missed deadlines and other penalties. Contract management is an important factor which directly affects the following factors of the project: 1) Scope. 2) Quality 3) Time 4) Cost & 5) Resource.

The traditional method of managing contracts is all done manually. Some of the limitations in manual methods are:

- The process is slow and does not favour a life cycle cost approach to projects
- Requires large staff to conduct the whole process
- Communication gap between the partners/stakeholders
- Poorly drafted contracts

- Delayed financial decisions and so on...

Time demands for an Automated Contract Management to overcome most of the limitations of manual method and to gain maximum benefits from Contract Management process. The Workflow would be automated; the alerts and other regular reporting would be generated by pre-determined parameters. Visual effects often add to our understanding. Let me with the help of the below flowchart illustrate the basic concept of Automated Contract Management.

II. OBSERVATIONS

1. Contract creation

Automated systems help to reduce the amount of time it takes to create, negotiate, review, execute and approve contracts with an electronic approach that automates workflow, automatically notifies partners/stakeholders, retain document version, history, provides electronic/digital signatures and keep track of all activities. For example, predefined format of Letter of Acceptance can be used to create a Letter of acceptance against quotation.

2. Contract Id/Code/No

A unique identification would be assigned to each Contract and general information recorded. This will allow reports to be sorted by partners and other stakeholders to gain a view of their overall performance across multiple contracts.

3. Document control

Document control in construction projects is the management of contract documents. It is the incoming and outgoing correspondence and their attachments, and their flow to the members of the management team for action or information. The easy availability of information encourages better decision making and improved management of contracts. It is essential that an accurate record of the project be maintained from the onset of the project until its completion. Parties involved are commonly: Architect, Consultants, Contractors, Sub contractors, Suppliers/Vendors etc. These parties involved in the organization can be notified when commitments and milestones are coming due, as well as when contracts are expiring and are due for renewal. Document control system covers all contract documents, such as minutes of meeting, daily progress report, drawing logs, submittals. It provides real time information stored in a central repository, so that parties can see where each submittal is in the approval process and know who is responsible for what and by when.

Details included in contract documents can vary in accordance with type of the contract, but items such as contract amount, contract date and contracting parties are included in all contract documents, which do not change. This can be summarized as below:

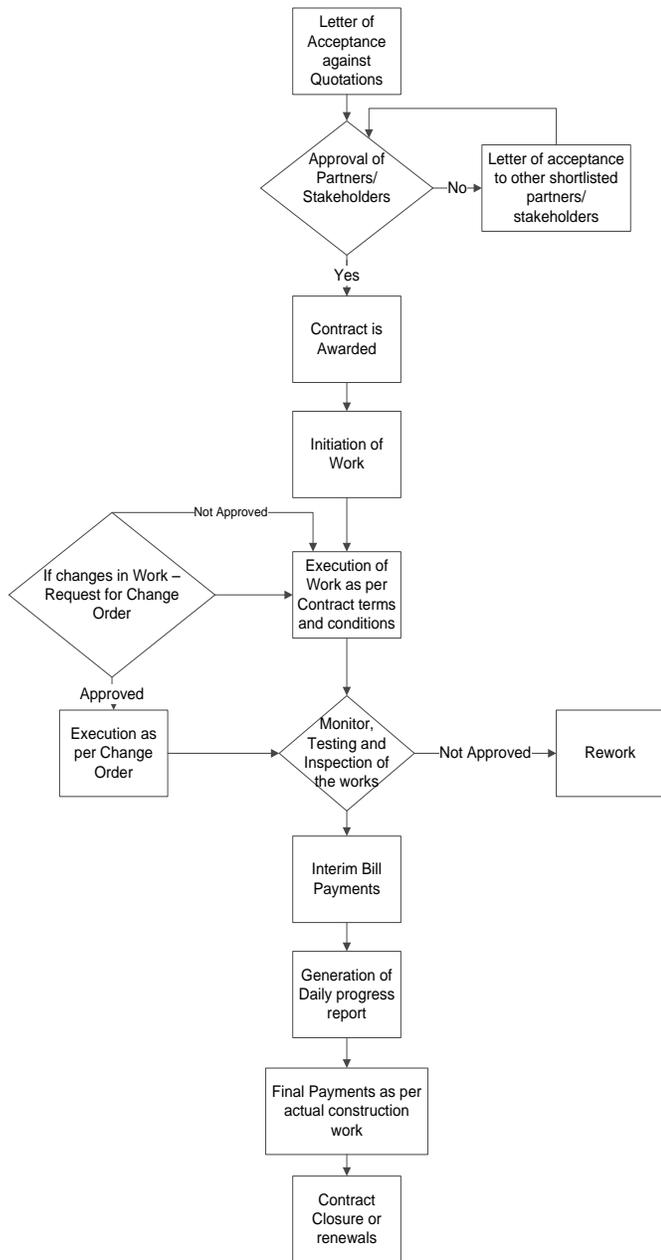


Fig. 1. Automated Contract Management Process workflow

Each stage indicates who would be involved, the processes to be followed, what data needs to be collected and where it would be re-directed. With a process map in hand the team would be in a position to assess opportunities for optimization through automation. In order to get the documents in an electronic repository with some amount of useful database fields, a unique key point/data will have to be captured as and when the documents are created. Points of integration with other systems are to be identified to work in line with functions and disciplines of other systems. For example, for bill payments the integration would be with the organizations accounting system (payables and receivables). Such simplified process workflows would also eliminate any occurrence of disputes and baising.

Category	General Information
Essential Information	Contract Name, Type, Method, Date, Start Date, End Date and so on
Detailed Information	Depending on the type of contracts
Continuous action	Management of Contract history, Management of execution history
Others	Contract type grouping, Contract information document

Table 1. Details and categories of Contract Document

Document management also enables version control, access restriction and locked down as individuals tend to deviate from the protocols.

4. Contract Change Management

A change is typically understood as the difference between the contract requirements as set forth in the original agreement between the parties and the requirements imposed subsequent to this agreement. Changes that arise during construction can originate with the owner, contractor, or even third party of the contract.

The change management process is divided into 4 parts: Identification> Evaluation> Approval> Notification. This process can be viewed in the below flowchart.

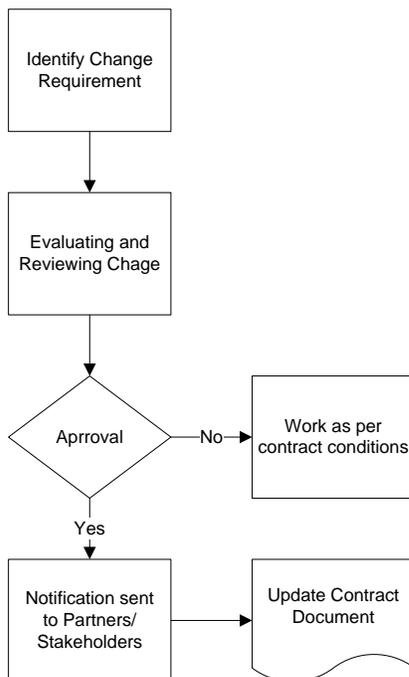


Fig. 2. Contract Change Management workflow

Above workflow stages can be elaborated as below:

Identify Change Requirement: In this stage of change management changes are pursued and requested. A change requestor designates a reviewer and approver. The requestor should attach relevant documents to help change reviewer/approver in next processes

Evaluation and Reviewing Change: This stage contains a significant amount of information as it is the most important stage in the change management process. Once review request on changes are received from the identification stage the change manager(s) conduct the assessment based on the evaluation criteria.

Approval: When an assessment is completed the evaluation scores are calculated automatically and then approval on changes is requested along with the evaluation results. However if the reviewers reject the changes the progress is returned to initial stage

Notification: An alert/ notification of approved changes with the final approval will be sent to each partner or stake

holders. Once the information is reviewed the contact document can then be updated.

All the information generated in the earlier process will be stored in the change database.

5. Payments

Payments and collections depend largely on policies, procedures and systems to ensure:

- Good record keeping
- Financial billing and payment systems
- Streamlined and well documented procedures and
- Staff performance in carrying out routine tasks and timely escalations

Once the deliverables are complete the contractors will create an invoice receipt in the system this will in turn be verified by the accounts payable. Once verified, the payment then would be made to the contractors based on the payment terms maintained in the system.

6. Reports

Daily work reports forms and visualized photos or videos can be uploaded for recording actual work completed, conditions at the project site, information on equipment and materials used, the results of field tests and other information. Information of these reports can be used to generate progressive payments. Visualized information will help the whole project team to know the status. The reports can be created in the corporate design in standard output formats and diagram type if desired. All reports would be automatically generated and sent on a regular basis via e-mail.

III. BENEFITS

- Significant reduction in time and effort required to track and administer contracts.
- Improvement in business process efficiency throughout the contract management lifecycle with automated workflow.
- Reduction in manual processes and contract administration workload through process optimisation and automation.
- Consolidation of contract database
- Improved contract consistency and user- friendliness by leveraging contract template functionality
- Elimination of duplicate effort through integration with ERP, document management, and other legacy systems.
- Extensive reporting capabilities.
- Improved stakeholder participation
- Improved contract visibility & access to review and edit.
- Increased collaboration through online interaction which streamlines the creation, negotiation and management of contracts field and other non-contracting staff.
- Automated workflow allow users

IV. CONCLUSION

Contract management is an issue of strategic importance to both organisations and projects. Successful implementation of contract management may help the organisation upsurge its control over the contracts. It may increase effectiveness in managing the contracts and thereby reduce the costs and also provide strategic and competitive advantages. A smart contract management may facilitate the exchange of information in planning, designing, and other phases of construction. Intelligent contract management aids in maintaining quicker and better decisions, and has the potential to facilitate relationship contracting.

Remote access to the system via Internet enables speedy output. The contractors would not have to wait until the paperwork is processed. The automated workflow comes handy in timely decision making and thus eradicating the manual effort involved. It may also help in tracking the changes in the contracts and the owner of the contract changes. Progressive payments can be made based on the business conducted as per the terms of contract. The organization can keep an eye on the revenue leaks due to manual intervention and reduce the same on implementation of intelligent contract management. A history of contacts can be maintained which may prove useful in evaluation of partners in future. There might be some unseen issues in contract management, which can be taken care of while we progress towards the successful execution of the intelligent contract management.

REFERENCES

- [1] The Chartered institute of Purchasing and Supply 'Contract Management Guide'
- [2] International Association of Contract and Commercial Managers (IACCM)
- [3] FIDIC Website
- [4] Australian Government 'Public Private Contract Management'

AUTHORS

First Author – Manju Pillai, M.E. Civil Construction Management student, Maharashtra Institute of Technology, Kothrud, Pune-38, India.

Second Author – Pramila Adavi, Associate Professor, Maharashtra Institute of Technology, Kothrud, Pune-38, India.

Law of Intellectual Property and Bioinformatics

Jagadish.A.T

Faculty of Law, JSS Law College, Autonomous, Kuvempunagar, Mysore.

Abstract- In this paper there is attempt to portray the law of intellectual property, its statutory framework, rights and liabilities of intellectual property holder with special reference to patentee and protection afforded by intellectual property to bioinformatics. There is also focus on nature of bioinformatics, scope and significance of bioinformatics and how the various components of bioinformatics relate to intellectual property protection, India's position on patent protection to bioinformatics and other branches of intellectual property rights. Whether intellectual property protection should be extended for bioinformatics.

I. INTRODUCTION

Intellectual property (IP) is an intangible right exercisable and asserted in respect of a material or tangible work³. The term 'intellectual property' was used as a specific legal term in mid-nineteenth century. Random House Webster's Unabridged Dictionary contains this defined entry under 'Intellectual property' Law. Property that results from original creative thought, as patents, copyright material and trademarks (1840-45 Amer)⁴. In the importance of intellectual property has increased because of international trading relations that emphasised during the negotiations that led to the successful conclusion of the GATT⁵ Uruguay Round on the world trading system⁶. The GATT TRIPS initiative that led eventually to the agreement on Trade Related Aspects of Intellectual Property Rights 1994 that was signed in Marrakesh⁷ was sparked off by a strong desire to eradicate international counterfeiting and piracy, but it became clear at very early stage that the cure against the fake Gucci or Cartier watch, Lactose shirts or even counterfeited fire extinguishing systems in jet engines, for passenger planes, or against what is often described as a plague threatening the worldwide exploitation of intellectual property, required also a harmonisation of national intellectual property laws. Intellectual property is a creative work of the human intellect, human creativity and innovation⁸. The main idea of protecting IP is to encourage and reward creativity.

The law of intellectual property consists of following distinct branches and governed by the mentioned laws in India:-

Patents	Patents Act, 1970
Trademarks	Trade Marks Act, 1999
Copyright	Copyright Act, 1957
Geographical indications	Geographical Indications of Goods (Registration and Protection) Act, 1999
Industrial designs	Designs Act, 2000
Semi-Conductor chips and integrated circuits	Semiconductor Integrated Circuits Layout-Design Act, 2000
Plant Varieties	Protection of Plant Varieties and Farmers' Rights Act, 2001
Trade secrets	National Innovation Bill, 2008
Biotechnology	Biological Diversity Act, 2000
Bioinformatics	Patents, Copyrights, Trademarks, Trade secrets

There is special reference to Patent which is a monopoly right conferred to the inventor who invented a new product or process through his intellectual efforts which is capable of industrial application.⁹ Novelty, utility (industrial application), non-obviousness, inventive step, are the requirements to be satisfied to get a patent. On demonstration of inventive step and commercial significance patents are granted for twenty years to the inventor to use and exploit the patent.

Rights of Patentees¹⁰

The owner of the "Patent", i.e. patentee is entitled to deal with such property in the same manner as owner of any other moveable property.

- Patentee has exclusive right to prevent third parties from using his patented article.
- The patentee can sell the whole or part of his Patent.
- He can also grant license to other(s) to use the patented property.
- He can also assign such property to any other(s).

Such sale, license or assignment of such patented property naturally has to be for valuable consideration, acceptable mutually.

³ V.J.Taraporevala, Senior Advocate, Law of Intellectual Property, Mumbai, December, 2005

⁴ Second edition Page no.990

⁵ The General Agreements on Tariffs and Trade, basically the world free trading system which as a structure and organisation was succeeded by the WTO as a result of Uruguay round of trade negotiations.

⁶ Holyoak & Torremans, Intellectual Property Law, Oxford University Press, Fourth edition, 2005.

⁷ The final text of TRIPS was published in 1994 and administered by WTO, which succeeded to GATT.

⁸ Catherine Colstan, Principles of intellectual Property Law, Cavendish Publishing Limited, London, 1991, p.1

⁹ Sahil. K.Roy Chowdary and H.K.Shang, Law of trademarks, copyrights, patents and designs, Kamal Law House, Calcutta, 1999, Second edition, volume II, P.26

¹⁰ Article 48 of Patents Act, 1970.

II. PATENT SPECIFICATION

A patent specification is a document describing the technical details of the invention culminating with one or more sets of claims defining the monopoly sought by the patentee out of the invention. It is the heart and soul of a patent. The validity and monopoly conferred by the patent to the patentee depend on the specification which was filed and successfully prosecuted by the patentee and granted by the Patent Office. Specification is a technical as well as legal document (techno-legal document). It is technical in the sense that the complete specification of a patent provides a scientific explanation and technical workout of a particular invention. It also describes known arts in the field of invention and points out the drawbacks involved in such prior art technology. The specification is a legal document since the rights of patentee are specified in the claim part of the document and many terms incorporated in the document are subjected to legal interpretation¹¹.

Every patent application shall be accompanied by a provisional or complete specification¹². There are two kinds of specification:

- Provisional specification
- Complete specification.

The provisional specification describes the nature of invention or the process of involved in the proposed invention. The title of the invention in the provisional specification should give a fair indication of the art or subject to which the invention relates. The complete specification filed after filing provisional specification should substantially the same as that which is described in the provisional specification and it should be written in greater details and with clarity. If adequate drawings have been furnished to clearly illustrate the invention and as per rules 16 to 19 of the Indian Patents Rules, 1972 with the provisional specification, there is no need to repeat the same in complete specification. Parts of the complete specification include¹³:

- Title of the invention
- Opening description of the invention
- Prior art description
- Objects of the invention
- Statement of the invention(optional)
- Detailed description of the invention
- Claims

Use of Patented invention by the Central Government¹⁴

The grant of patent confers the exclusive right of use on the patentee for commercial gain but the Act recognises that the Central Government may use any invention even without the payment of royalty to the inventor. The idea is that the invention

can be put to use for general public benefit by the government in certain circumstances when the patentee would have to forego his commercial gain in the general public interest.

Some restricted use of patented invention permissible under the law

The essence of a patent is conferring of the exclusive right on the patentee. Yet some restricted use of a patented invention by a person other than the patentee is permissible under the law. For such instance, use of a patented invention is permissible for research or experimental purposes or for imparting knowledge or instructions to pupils¹⁵.

Infringement of the patent¹⁶

The right conferred by the Patent is the exclusive right to make, use, exercise, sell or distribute the invention in India. Infringement consists in the violation of any of these rights. The act expressly provides that use by a person other than the patentee, patentee's assignee or licensee would be an infringement of the patent and as such illegal. The recent case on the issue of patent is *Apple Inc. v. Samsung Electronics Co., Ltd*¹⁷ was the first of a series of ongoing [lawsuits](#) between [Apple Inc.](#) and [Samsung Electronics](#) regarding the design of [smart phones](#) and [tablet computers](#); between them, the companies made more than half of [smart phones](#) sold worldwide as of July 2012. In 2011, Apple began litigating against Samsung in [patent infringement](#) suits, while Apple and [Motorola Mobility](#) were already engaged in a [patent war](#) on several fronts. Apple's multinational litigation over technology [patents](#) became known as part of the [mobile device](#) patent wars: extensive litigation in fierce competition in the global market for consumer mobile communications. By August 2011, Apple and Samsung were litigating 19 ongoing cases in nine countries; by October, the legal disputes expanded to ten countries. By July 2012, the two companies were still embroiled in more than 50 lawsuits around the globe, with billions of dollars in damages claimed between them. While Apple won a ruling in its favour in the U.S., Samsung won rulings in South Korea and Japan, and the UK. Apple sued its component supplier Samsung, alleging in a 38-page federal complaint on April 15, 2011 in the United States District Court for the Northern District of California that several of Samsung's Android phones and tablets, including the Nexus S, Epic 4G, Galaxy S 4G, and the Samsung Galaxy Tab, infringed on Apple's intellectual property: its patents, trademarks, user interface and style. Apple's complaint included specific federal claims for patent infringement, false designation of origin, unfair competition, and trademark infringement, as well as state-level claims for unfair competition, common law trademark infringement, and unjust enrichment. Apple's evidence submitted to the court included side-by-side image comparisons of iPhone 3GS and i9000 Galaxy S to illustrate the alleged similarities in packaging and icons for apps. However, the images were later found to have been tampered

¹¹ Basic Principles and Acquisition of Intellectual Property Rights, Paper-I, Material for Post Graduate Diploma in Intellectual Property Rights Law, National Law School of India University, Bangalore, at p.44

¹² Section 7(4) of Patents Act, 1970

¹³ Supra note 9 at p.45

¹⁴ Chapter XVII (section 99-103)of Patents Act, 1970

¹⁵ Meenu Paul, Intellectual Property Law, Allahabad Law Agency, Faridabad (Harayana),Fourth Edition 2012, p.272-277.

¹⁶ Chapter XVIII (section 104-115)of Patents Act, 1970

¹⁷ *C 11-1846 & C 12-0630*

with in order to make the dimensions and features of the two different products seem more similar, and counsel for Samsung accused Apple of submitting misleading evidence to the court. Samsung [counter-sued](#) Apple on April 22, 2011, filing federal complaints in courts in [Seoul](#), [Tokyo](#) and [Mannheim](#), Germany, alleging Apple infringed Samsung's patents for mobile-communications technologies. Samsung also filed suits against Apple in the British [High Court of Justice](#), in the [United States District Court for the District of Delaware](#), and with the [United States International Trade Commission](#) (ITC) in Washington D.C., all in June 2011.

The ruling in the landmark patent case raised controversies over the impact on the consumers and the [Smartphone](#) industry. The jury's decision was criticized for being Apple-friendly possibly leading to increased costs for [Android](#) Smartphone users because of licensing fees to Apple. Some raised the question about lay juries in the U.S. patent system. i.e., how qualified the jury members were to determine who was at fault in a complex patent case. It later turned out that the jury foreman, Velvin Hogan, was an electrical engineer and a patent holder himself. His post-verdict interviews with numerous media outlets raised a great deal of controversies over his role as the jury foreman. He told the Bloomberg TV that his experience with patents had helped to guide the jurors' decisions in the trial. A juror Manuel Ilagan said in the interview with CNET a day after the verdict that "Hogan was jury foreman. He had experience. He owned patents himself...so he took us through his experience. After that it was easier." The jury instructions stated that jurors can make decisions based solely on the law as instructed and "not based on your understanding of the law based on your own cases." Hogan also told the Reuters that the jury wanted to make sure the message it sent was not just a slap on the wrist and wanted to make sure it was sufficiently high to be painful, but not unreasonable. His remark does not agree with the jury instructions, which state that "the damages award should put the patent holder in approximately the financial position it would have been in had the infringement not occurred" and "it is meant to compensate the patent holder and not to punish an infringer." Samsung has appealed claiming jury misconduct. If the appeal court finds the juror misconduct, Samsung can be given a new trial. Other questions were raised about the jury's quick decision. The jury had been given more than 700 questions including highly technical matters to reach the verdict and awarded Apple more than \$1 billion in damages after less than three days of deliberations. It was claimed that the nine jurors did not have a chance to read the jury instructions. A juror told in an interview with the CNET that the jury decided after the first day of deliberations that it believed Samsung was in the wrong

Remedy for infringement of patent: An action for infringement must be instituted by way of a suit in any District Court or a High Court having jurisdiction to entertain the suit. The plaintiff on satisfying the court about infringement of his patent would be entitled to the following relief:

Interlocutory injunction:-The Plaintiff may at the commencement of the action move for an interim injunction to restrain the defendant from committing the acts complained of until the hearing of the action or further orders. The plaintiff should make out a prima facie case and also show that the balance of convenience lies in his favour.

Damages:-In assessing the damages the important question is what is the loss sustained by the patentee. The loss must be the natural and direct consequence of the defendant's acts. The object of damages is to compensate for loss or injury.

Accounts of profits:-Where a patentee claims the profits made by the unauthorised use of his patent, it is important to ascertain how much of his invention was appropriated, in order to determine what proportion of the net profits realised by the infringer was attributable to its use.

III. NATURE OF BIOINFORMATICS

Bioinformatics is the convergence of analytical and computational tools with the discipline of biological research. This has vast influence in biological research as numerous data that are collected through laboratory experiments can be organized, analyzed, or prediction made to reduce the time spent in finding cures to diseases or causes of diseases, biological or other healthcare-related applications¹⁸.

Bioinformatics is the application of computer technology to the management of biological information. Computers are used to gather, store, analyze and integrate biological and genetic information which can then be applied to gene-based drug discovery and development. The need for Bioinformatics capabilities has been precipitated by the explosion of publicly available genomic information resulting from the Human Genome Project. The goal of this project is to determine the sequence of the entire human genome (approximately three billion base pairs). The science of Bioinformatics, which is the melding of molecular biology with computer science, is essential to the use of genomic information in understanding human diseases and in the identification of new molecular targets for drug discovery. In recognition of this, many universities, government institutions and pharmaceutical firms have formed bioinformatics groups, consisting of computational biologists and bioinformatics computer scientists. Such groups will be key to unravelling the mass of information generated by large scale sequencing efforts underway in laboratories around the world¹⁹.

IV. SCOPE AND SIGNIFICANCE OF BIOINFORMATICS

Bioinformatics involve the design and implementation of programs and systems for the storage, management and analysis of vast amounts of DNA sequence data. Such positions require in-depth programming and relational database skills, which very few biologists possess, and so it is largely the computational specialists who are filling these roles. As the bioinformatics field matures there will be a huge demand for outreach to the biological community to separate through gigabases of genomic sequence in search of novel targets. It will be in these areas that biologists with the necessary computational skills will find their

¹⁸ Dennis Fernandez & Mary Chow, Fernandez & Associates LLP, www.iploft.com Intellectual Property Strategy in Bioinformatics and Biochips.

¹⁹ <http://www.bioplanet.com/whatis.html> last visited on 30-10-2012.

position²⁰. The worldwide bioinformatics value has touched \$ 3.0 billion in 2010, at an average annual growth rate (AAGR) of 15.8%. The application of bioinformatics in drug development is expected to reduce the annual cost of developing new drugs by 33% and time for drug discovery by 30%²¹. The pharmaceutical companies are expected to increase their R&D expenditures in the future and a major portion of this is expected to go into Bioinformatics²². Though the IPR laws enforced strictly on territorial basis of countries which offers protection through patents, copyrights, trademarks and trade secrets to invention or creative work, the information technology makes it available throughout the world. As a result, cross-country differences in patent, copyright and other IP laws can result in inadequate protection.

V. BIOINFORMATIC COMPONENTS

Before one can understand intellectual property protection for bioinformatics, it is necessary to understand the nature of the various components that comprise the field of bioinformatics. Bioinformatics involves the acquisition, organization, storage, analysis, and visualization of information contained within biological molecules²³. To be a patentable subject matter an invention should be a process, machine, manufacture, or composition of matter or any improvement²⁴. Bioinformatics is analyzed according to the following categories:

(A) Biological sequences such as DNA, RNA, and protein sequences,

(B) Databases in which these sequences are organized, and

(C) Software and hardware designed to create, access, organize, and analyze information contained within these sequences and databases.

²⁰ <http://biinoida.blogspot.in/2007/12/scope-and-needs-of-bioinformatics.html>
last visited on 07-11-2012.

²¹ Edited by Dr. Sreenivasulu, Chapter by Mr. Sriramamurthy Boppana, Intellectual Property Rights, Regal publications, New Delhi, Second revised and enlarged edition, 2011, p. 268

²² Business Communication Company, Inc. Report.

²³ M. Scott McBride, Bioinformatics and Intellectual Property Protection

²⁴ Dr. Kalyan C Kankanala, Gentic Patent Law and Strategy, Manupatra, Noida, U.P., First Publication 2007.

Patentability of gene-related subject matter in India, USA, and Europe²⁵

Subject Matter	India	USA	Country EPC
Genes	Patentable	Patentable	Patentable
Genetically modified Unicellular Organism	patentable	Patentable	Patentable
Genetically modified Multicellular Organism	Not Patentable	Patentable	Patentable
Genetically modified Animals(Excluding Humans)	Not Patentable	Patentable	Patentable (Expect mammals)
Genetically modified Plants			
Genetically modified Humans			Patentable
Gene Therapy	Not Patentable	Patentable	Not Patentable
	Not Patentable	Not Patentable	Not Patentable but enforceable
	Not Patentable	Patentable	

²⁵ Ibid at p.27

VI. INTELLECTUAL PROPERTY PROTECTION FOR BIOINFORMATICS

Patents: Companies and entrepreneurs can obtain a legal monopoly to protect their technology from being manufactured and sold by competitors, thus making patents an important incentive for technology development and innovation. In U.S the following types of patent exist: utility patent, plant patent, and design patent. Of those the utility patent is commonly associated with bioinformatics inventions and can be obtained for new and useful, non-obvious process, machine, manufacture, composition of matter, or new and useful improvement of any of the aforementioned.

Trademarks: It can be used to protect trade names, product names, domain names, and service marks/slogans for bioinformatics companies.

Copyrights: It can be used to protect bioinformatics related materials such as scientific articles, books, software code, manuals, web pages, graphic artwork, multimedia works, and compilations of facts/databases.

Trade secrets: It is used to protect bioinformatics related materials such as software code, manuals, and compilations of facts/databases, formulas and processes²⁶.

VII. INTELLECTUAL PROPERTY AND BIOINFORMATICS-INTERFACE

Intellectual property protection is the key factor for economic growth and advancement in the bioinformatics and biotech sectors. The patents add value to the laboratory discoveries, computer coding and in doing so provide incentives for private sector investment into bioinformatics and biotech sectors and for their development.²⁷ Intellectual property laws are the driving force for innovation and progress in the contemporary society. Different forms of IP such as patents, copyrights, trademarks, trade secrets, can be used to protect the products of invention and innovation. Patents provides for development of new products, improvement over the existing product, employment opportunity for people around the world. There was no application of IP in biotechnology until the landmark decision in *Diamond v/s Chakrabarty*²⁸ by the United States Supreme Court where the court held that anything made by hand of man as eligible for patenting.

In 1972, respondent Chakrabarty, a microbiologist, filed a patent application, assigned to the General Electric Company. The application asserted 36 claims related to Chakrabarty's invention of "a bacterium from the genus *Pseudomonas* containing therein at least two stable energy-generating plasmids, each of said plasmids providing a separate hydrocarbon degradative pathway. This human-made, genetically engineered bacterium is capable of breaking down multiple components of crude oil. Because of this property, which is possessed by no

naturally occurring bacteria, Chakrabarty's invention is believed to have significant value for the treatment of oil spills.

Chakrabarty's patent claims were of three types: first, process claims for the method of producing the bacteria; second, claims for an inoculum comprised of a carrier material floating on water, such as straw, and the new bacteria; and third, claims to the bacteria themselves. The patent examiner allowed the claims falling into the first two categories, but rejected claims for the bacteria. His decision rested on two grounds: (1) that microorganisms are "products of nature," and (2) that as living things they are not patentable subject matter under 35 U. S. C. §101. Chakrabarty appealed the rejection of these claims to the Patent Office Board of Appeals, and the Board affirmed the Examiner on the second ground. Relying on the legislative history of the 1930 Plant Patent Act, in which Congress extended patent protection to certain asexually reproduced plants, the Board concluded that §101 was not intended to cover living things such as these laboratory created microorganisms.

Bioinformatics is the science of storing, managing and analyzing biological data using computational tools. It uses multiple and diverse disciplines of Mathematics, Statistics, Biology, Chemistry, Computer Mathematics and Physical Sciences, etc. Bioinformatics within a short time by means of computational tools has us to understand the function and structure of genes and proteins. The recent technologies includes Genomics, Proteomics, Antisense Technology, RNA Inference, Stem and Progenitor Cells, Cell and Gene Therapy, Phramacogenomics²⁹

VIII. CONCLUSION

Bioinformatics comprises a wide array of components, and it follows that a wide array of protection might be available, depending on the particular nature of the bioinformatics component and its intended use such as from patent, copyright, trademark, trade secret protection. Because of the tremendous growth and investment in the field of bioinformatics, it is important to consider whether IP protection is available to offset the cost of development and create new efficiencies.

With regard to bioinformatics software, the inventor can obtain patent protection on the method within the program, provided the method produces tangible results; and the author can obtain copyright protection, but only for the literal elements of the bioinformatics software code. Although trade secret protection is available for bioinformatics software, again, like many bioinformatics components, the owner runs the risk that the code will be reverse engineered and the trade secret will be lost to the public domain. With regard to biological sequences, trade secret protection may be the only practical protection. This holds best where the owner effectively maintains confidentiality agreements or does not intend to commercialize the corresponding biological composition, because sequences can be easily determined or "reverse engineered" where compositions are available. Likewise, trade secret protection may provide the best protection for biological databases, but only if adequate

²⁶ Supra note.19 at p.270

²⁷ Supra note 19 at p. 263

²⁸ 443 U.S.303 (1980)

²⁹ Philip W. Grubb, Patents for Chemicals, Pharmaceuticals and Biotechnology, Oxford University Press, Fourth Edition 2004, First Indian Edition 2006 p.265-268.

security measures can reliably limit access and the owner effectively maintains confidentiality agreements. Copyright protection for databases is minimal and is unlikely to extend to the information contained within the database.

AUTHORS

First Author – Jagadish.A.T, Faculty of Law, JSS Law College, Autonomous, Kuvempunagar, Mysore.

Improving Efficiency of Apriori Algorithm Using Transaction Reduction

Jaishree Singh*, Hari Ram**, Dr. J.S. Sodhi***

Department of Computer Science & Engineering, Amity School of Engineering and Technology, Amity University, Sec-125 NOIDA, (U.P.),India

Abstract- Association rules are the main technique to determine the frequent itemset in data mining. Apriori algorithm is a classical algorithm of association rule mining. This classical algorithm is inefficient due to so many scans of database. And if the database is large, it takes too much time to scan the database. In this paper, we proposed an Improved Apriori algorithm which reduces the scanning time by cutting down unnecessary transaction records as well as reduce the redundant generation of sub-items during pruning the candidate itemsets, which can form directly the set of frequent itemsets and eliminate candidate having a subset that is not frequent.

Index Terms- apriori algorithm, association rules, candidate-itemsets, data mining

I. INTRODUCTION

Data mining also known as Knowledge Discovery in Database(KDD). The purpose of data mining is to abstract interesting knowledge from the large database. From the analysis of abstracted patterns, decision-making process can be done very easily.

Association rule is based mainly on discovering frequent itemsets. Association rules are frequently used by retail stores to assist in marketing, advertising, inventory control, predicting faults in telecommunication network.

Apriori algorithm represents the candidate generation approach. It generates candidate (k+1) itemsets based on frequent k-itemsets. Apriori is a Breadth First Search Algorithm (BFS).

II. BASIC CONCEPTION

A. Association Rules [3]

The concept of the association rules was first proposed by R.Agrawal.It is used to describe the patterns of customers' purchase in the supermarket. The association rules can be formally defined as

Definition 1: Let $I=\{i_1,i_2,i_3,\dots,i_n\}$ be finite itemsets. D is a transactional database. Where $i_k(k\in\{1,2,\dots, \dots, m\})$ is an item, and Tid is the exclusive identifier of transaction T in transactional database.

Definition 2: Let $X\subset I, Y\subset I$, and $X\cap Y =\emptyset$.The implication of the form $X\Rightarrow Y$ is called an association rules.

Definition 3:Let D is a transactional database. If the percentage of transactions in D that contain $X \cup Y$ is s%, the rule $X\Rightarrow Y$ holds in D with Support s. If the percentage of transactions in D containing X that also contain Y is c%, the rule $X\Rightarrow Y$ has Confidence c.The definitions of probability are,

$$\text{Support}(X \Rightarrow Y) = P(X \cup Y) \quad (1)$$

$$\text{Confidence}(X \Rightarrow Y) = P(Y|X) \quad (2)$$

Rules that satisfy both minimum support threshold (minsup) and minimum confidence threshold (minconf) are called strong rules.

Definition 4: If the support of itemsets X is greater than or equal to minimum support threshold, X is called frequent itemsets. If the support of itemsets X is smaller than the minimum support threshold, X is called infrequent itemsets.

III. TYPICAL APRIORI ALGORITHM

A. Description of the Typical Apriori Algorithm

1) Typical Apriori algorithm[7]

Apriori employs an iterative approach known as a levelwise search, where k-itemsets are used to explore (k+1)-itemsets. First, the set of frequent 1-itemsets is found by scanning the database to accumulate the count for each item,and collecting those items that satisfy minimum support. The resulting set is denoted L1. Next, L1 is used to find L2,the set of frequent 2-itemsets, which is used to find L3, and so on, until no more frequent k-itemsets can be found. The finding of each Lk requires one full scan of the database.To improve the efficiency of the level-wise generation of frequent itemsets, an important property called the Apriori property, presented is used to reduce the search space. Apriori property: All nonempty subsets of a frequent itemset must also be frequent. A two-step process is used to find the frequent itemsets: join and prune actions.

a) The join step

To find Lk a set of candidate k-itemsets is generated by joining Lk-1 with itself. This set of candidates is denoted Ck.

b) The prune step

The members of Ck may or may not be frequent, but all of the frequent k-itemsets are included in Ck. A scan of the database to determine the count of each candidate in Ck would result in the determination of Lk (i.e., all candidates having a count no less than the minimum support count are frequent by definition, and therefore belong to Lk). To reduce the size of Ck, the Apriori property is used as follows. Any (K-1)-itemset that is not frequent cannot be a subset of a frequent k-itemset. Hence, if any (K-1)-subset of a candidate k-itemset is not in Lk-1, then the candidate cannot be frequent either and so can be removed from Ck.

2) Description of the algorithm

Input: D, Database of transactions; min_sup , minimum support threshold

Output: L, frequent itemsets in D

Method:

```

(1) L1=find_frequent_1-itemsets(D);
(2) for(k=2; Lk-1≠∅; k++){
(3) Ck=apriori_gen(Lk-1, min_sup);
(4) for each transaction t∈D{
(5) Ct=subset(Ck,t);
(6) for each candidate c∈Ct
(7) c.count++ ;
(8) }
(9) Lk={ c∈Ck |c.count≥min_sup }
(10) }
(11) return L=UkLk ;

```

Procedure apriori_gen(Lk-1:frequent(k-1)-itemsets)

```

(1) for each itemset l1∈ Lk-1 {
(2) for each itemset l2∈ Lk-1 {
(3) if(l1 [1]= l2 [1])∧ (l1 [2]= l2 [2]) ∧...∧(l1 [k-2]=
l2 [k-2]) ∧(l1 [k-1]< l2 [k-1]) then {
(4) c=l1∞l2;
(5) if has_infrequent_subset(c, Lk-1) then
(6) delete c;
(7) else add c to Ck ;
(8) }}}
(9) return Ck;

```

Procedure has_infrequent_subset(c: candidate k-itemset;

Lk-1:frequent(k-1)-itemsets)

```

(1) for each(k-1)-subset s of c {
(2) if s ∉ Lk-1 then
(3) return true; }
(4) return false;

```

IV. PRINCIPLE OF IMPROVED ALGORITHM

Classical Apriori algorithm generates large number of candidate sets if database is large. And due to large number of records in database results in much more I/O cost. In this project, we proposed an optimized method for Apriori algorithm which reduces the size of database. In our proposed method, we introduced an attribute Size_Of_Transaction (SOT), containing number of items in individual transaction in database. The deletion process of transaction in database will be made according to the value of K. Whatever the value of K, algorithm searches the same value for SOT in database. If value of K matches with value of SOT then delete only those transaction from database. Table 1 is generating frequent itemsets by using proposed algorithm very efficiently.

Description of the algorithm

Input: D: Database of transactions; min_sup : minimum support threshold

Output: L: frequent itemsets in D

Method:

```

1) L1=find_frequent_1-itemsets(D);

```

```

2) For(k=2;Lk-1≠∅; k++){
3) Ck=apriori_gen(Lk-1, min_sup);
4) for each transaction t∈D{
5) Ct=subset(Ck,t);
6) for each candidate c∈Ct
7) c.count++;
8) }
9) Lk={ c∈Ck |c.count≥min_sup };
10) if(k≥2){
11) delete_datavalue(D, Lk, Lk-1);
12) delete_datarow (D, Lk); }
13) }
14) return L=UkLk ;

```

Procedure apriori_gen(Lk-1:frequent(k-1)-itemsets)

```

1) for each itemset l1∈ Lk-1 {
2) for each itemset l2∈ Lk-1 {
3) if(l1 [1]= l2 [1])∧ (l1 [2]= l2 [2]) ∧...∧(l1 [k-2]= l2
[k-2]) ∧(l1 [k-1]< l2 [k-1]) then {
4) c=l1 ∞l2;
5) for each itemset l1∈Lk-1 {
6) for each candidate c ∈Ck {
7) if l1 is the subset of c then
8) c.num++; } } } }
9) C'k={ c∈Ck |c.num=k};
10) return C'k;

```

Procedure delete_datavalue (D:Database; Lk: frequent (k)-itemsets; Lk-1: frequent(k-1) - itemsets)

```

1) for each itemset i ∈Lk-1 and i ∉ Lk{
2) for each transaction t∈D{
3) for each datavalue∈t{
4) if (datavalue=i)
5) update datavalue=null;
6) }}

```

Procedure delete_datarow (D: Database; Lk:frequent(k) - itemsets)

```

1) for each transaction t∈D{
2) for each datavalue∈t{
3) if(datavalue!=null and datavalue!=0 ){
4) datarow.count++; } }
5) if(datarow.count<k){
6) delete datarow;}
7)}

```

Example of Algorithm

Transaction database D is shown in Table 1. Suppose the minimum support count $min_sup=3$. The algorithm is as follows:
Step 1: First we have to convert database into the desired database that is with SOT column.

Step 2: In the first iteration of the algorithm, each item is a member of the set of candidate 1-itemsets, C1. The algorithm simply scans all of the transactions in order to count the number of occurrences of each item.

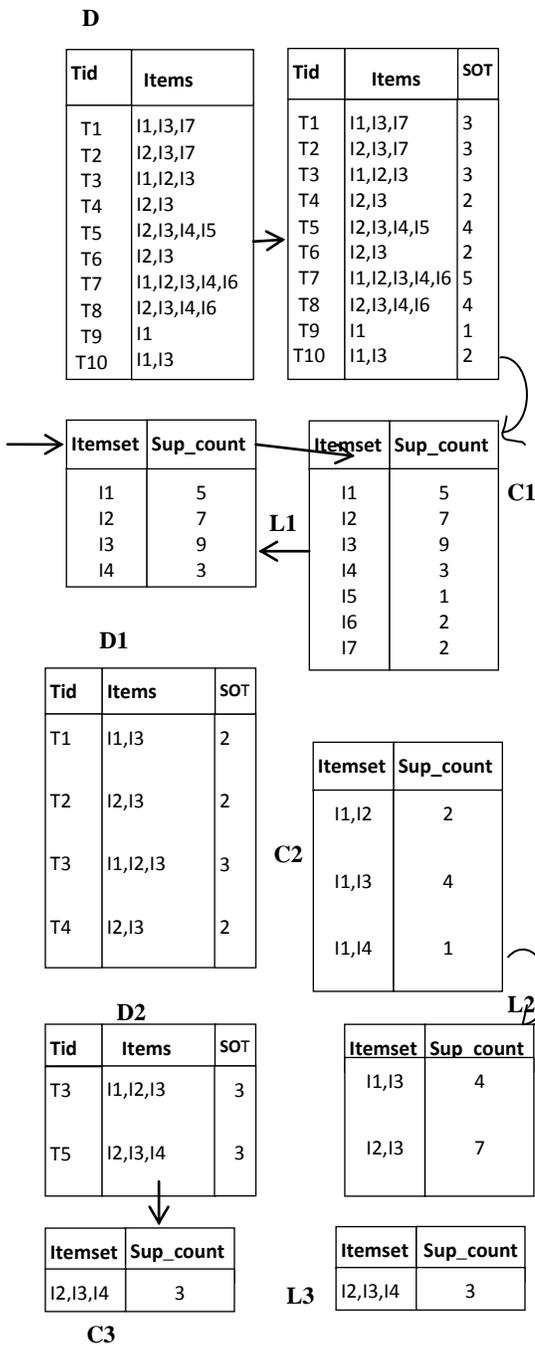


Table 1: Example of algorithm

Step 3: This algorithm will then generate number of items in each transaction. We called this Size_Of_Transaction (SOT).

Step 4: Because of min_sup=3, the set of frequent 1-itemset, L1 can be determined. It consists of the candidate 1-itemset, C1, satisfying minimum support.

Step 5: Since the support count of I5,I6,I7 are less than 3, they won't appear in L1. Delete these data from D. In addition, when L1 is generated, now, the value of k is 2, delete those records of transaction having SOT=1 in D. And there won't exist any elements of C2 in the records we find there is only one

data in the T9. We delete the data and obtain transaction database D1.

Step 6: To discover the set of frequent 2-itemsets, L2, the algorithm uses the join $L1 \bowtie L1$ to generate a candidate set of 2-itemsets, C2.

Step 7: The transactions in D1 are scanned and the support count and SOT of each candidate itemset in C2 is accumulated.

Step 8: The set of frequent 2-itemsets, L2, is then determined, consisting of those candidate 2-itemsets in C2 having minimum support.

Step 9: After L2 is generated, we can find the transaction record of T1, T2,T4, T6, T10 are only two in D1. Now, the value of k is 2, delete those records of transaction having SOT=2. And there won't exist any elements of C3 in the records. Therefore, these records can be deleted and we obtain transaction database D2.

Step 10: To discover the set of frequent 3-itemsets, L3, the algorithm uses the join $L2 \bowtie L2$ to generate a candidate set of 3-itemsets C3, where $C3 = L2 \bowtie L2 = \{I1, I2, I3\}, \{I2, I3, I4\}$. There are a number of elements in C3. According to the property of Apriori algorithm, C3 needs to prune. Because {I1, I2} not belongs to L2, we remove it from C3. Because the 2-subsets {I2, I3}, {I2, I4} and {I3, I4} all belong to L2, they should remain in C3.

Step 11: The transactions in D2 are scanned and the support count of each candidate itemset in C3 is accumulated. Use C3 to generate L3.

Step 12: L3 has only one 3-itemsets so that $C4 = \Phi$. The algorithm will stop and give out all the frequent itemsets.

Step 13: Algorithm will be generated for Ck until Ck+1 becomes empty.

V. CONCLUSION AND FUTURE SCOPE

In this paper, Apriori algorithm is improved based on the properties of cutting database. The typical Apriori algorithm has performance bottleneck in the massive data processing so that we need to optimize the algorithm with variety of methods. The improved algorithm we proposed in this paper not only optimizes the algorithm of reducing the size of the candidate set of k-itemsets, Ck, but also reduce the I/O spending by cutting down transaction records in the database. The performance of Apriori algorithm is optimized so that we can mine association information from massive data faster and better.

Although this improved algorithm has optimized and efficient but it has overhead to manage the new database after every generation of Lk. So, there should be some approach which has very less number of scans of database. Another solution might be division of large database among processors.

REFERENCES

- [1] Lu, Lin; Pei-qi, "Study on improved apriori algorithm and its application in supermarket," Information Sciences and Interaction Sciences (ICSI), 20103rd International Conference on, vol., no., pp.441-443, 23-25 June 2010.
- [2] Sheng Chai; Jia Yang; Yang Cheng, "The Research of Improved Apriori Algorithm for Mining Association Rules," Service System and Service Management, 2007 International Conference on, vol., no., pp.1-4, 9-11 June 2007

- [3] Wanjun Yu; Xiaochun Wang; Erkang Wang; Bowen Chen; , "The research of improved apriori algorithm for mining association rules," Communication Technology, 2008. ICCT 2008 11th IEEE International Conference on, vol., no.,pp.513-516, 10-12 Nov. 2008.
- [4] Yiwu Xie; Yutong Li; Chunli Wang; Mingyu Lu; , "The Optimization and Improvement of the Apriori Algorithm," Education Tecnology and Training, 2008. And 2008 International Workshop on Geoscience and Remote Sensing. ETT and GRS 20008.
- [5] Sixue Bai, Xinxi Dai, "An Efficiency apriori Algorithm: P_Matrix Algorithm," isdpe, pp.101-103, The First International Symposium on Data, Privacy, and E-Commerce (ISDPE 2007), 2007
- [6] Yan-hua Wang; Xia Feng; , "The Optimization of Apriori Algorithm Based on Directed Network," Intelligent Information Technology Application, 2009. IITA 2009. Third International Symposium on, vol.3, no., pp.504-507, 21-22 Nov. 2009.
- [7] Zhang Changsheng; Li Zhongyue; Zheng Dongsong; , "An Improved Algorithm for Apriori," Education Technology and Computer Science, 2009. ETCS '09. First International Workshop on , vol.1, no., pp.995-998, 7-8 March 2009
- [8] Rui Chang; Zhiyi Liu; , "An improved apriori algorithm," Electronics and Optoelectronics (ICEOE), 2011 International Conference on , vol.1, no., pp.V1-476-V1-478, 29-31 July 2011
- [9] Du Ping; Gao Yongping; , "A new improvement of Apriori Algorithm for mining association rules," Computer Application and System Modeling (ICCSM), 2010 International Conference on , vol.2, no., pp.V2-529- V2-532, 22-24 Oct. 2010.
- [10] Agrawal, Rakesh, "Fast Algorithms for Mining Association Rules in Large Databases", Proceedings of the ACM SIGMOD International Conference Management of Data, Washington, 1993, pp.207-216.
- [11] Sheng Chai, Jia Yang, and Yang Cheng, "The Research of Improved Apriori Algorithm for Mining Association Rules" Proceedings of the Service Systems and Service Management, 2007.
- [12] Peng Gong, Chi Yang, and Hui Li, "The Application of Improved Association Rules Data Mining Algorithm Apriori in CRM", Proceedings of 2nd International Conference on Pervasive Computing and Applications, 2007.
- [13] A. Savasere, E. Omiecinski, and S. Navathe, "An Efficient Algorithm for Mining Association Rules in Large Databases", In VLDB'95, pp.432-443, Zurich, Switzerland.
- [14] H. Jiawei and M. Kamber, Data Mining Concepts and Techniques, Beijing Higher Education, 2001.
- [15] Y. Tang, Y. Wang and H. Yang, "Optimized Method for Mining Maximum Frequent Itemsets," Comput. Eng. Appl., Beijing, vol. 42(31), pp. 171-173, 2006.
- [16] L. Cheng and B. B. Wang, "An Improved Apriori Algorithm for Mining Association Rules, " Comput. Eng., Shanghai, vol. 28(7), pp. 104-105, 2002.
- [17] Z. Y. Xu and C. Zhang, "An Optimized Apriori Algorithm for Mining Association Rules," Comput. Eng., Shanghai, vol. 29(19), pp. 83-84, 2003.
- [18] Luo Ke, Wu Jie. Apriori algorithm based on the improved [J]. Computer Engineering and application, 2001, 20: 20-22.
- [19] Li Xiaohong, Shang Jin. An improvement of the new Apriori algorithm [J]. Computer science, 2007, 34 (4) : 196-198. 2007

Security Compliance Specialist (CSCS). His research area includes Network security. He has published number of research papers in reputed National & International Journals.

AUTHORS

First Author – Jaishree Singh is pursuing M. Tech (CS&E) from Amity University, Uttar Pradesh, India. Her research areas include Data Mining and Software Engineering.

Second Author – Hari Ram is a Senior Solution Integrator in Ericsson, Uttar Pradesh, India. He has done MCA. His research areas include Telecommunication and Data Mining.

Third Author – Dr. J.S. Sodhi is a Head-IT & CIO (Assistant Vice President) with AKC Data Systems (An Amity Group and AKC Group Company), Amity University, Uttar Pradesh, India. He is Ph. D. in Information Security Management and Certified

Ways of Transacting Online

Mukta Sharma*, Dr. R.B. Garg**

* Research Scholar, TMU

** HOD CS/MCA, Tecnia, IP University, Ex-Prof., Delhi University

Abstract- There is no doubt the Internet is a wondrous creation. The entire world is rapidly becoming obsessed with it. With the advancement of technology, there was a long felt need to give recognition to the electronic means as an alternative to paper based banking. The internet has made banking and other business transactions a lot easier because money is easily transferred from bank to bank, employer to employee, employee to bank, shopper to department store, and almost any scenario in which money has to be transacted, all because of the internet and other electronic technologies.

The worldwide proliferation of the Internet has led to the recent birth of electronic payment system: a payment service solution-software that enables monetary value to be transferred digitally. Parties conducting electronic businesses and transactions have usually never seen each other face-to-face, nor exchanged currency or hard copies of documents hand-to-hand. The society prefers transactions that involve physical contact of people, cash and cheques to that, which is done via a telecommunication network such as the Internet. However, security, trust and convenience are among the major contending factors affecting the adoption of e-payment systems. In this paper, we considered some critical examinations on the existing payment system.

Purpose: The objective of the paper is to understand the various mediums of paying online and variant issues affecting the same, along with few standards of security like-SET, SSL, HTTPS etc.

Design/methodology/approach: To understand the existing medium of paying online and accessing the benefits and limitations for the same.

Findings: The banking sector occupies a pivotal position in the global economy. E-banking is one of the most challenging tasks as it is changing the banking industry and is having the major effects on banking relationships. We are moving from brick & mortar model to click & mortar model. E-banking involves use of Internet for delivery of banking products & services. There are various medium involved to make a secure payment.

Research limitations/implications: Research design is exploratory in nature hence; the results of the study are not very conclusive.

Index Terms- E-Banking, E-Payment System (EPS), Automated Clearing House (ACH), point of sale (POS)

Paper Type - Conceptual Paper

I. INTRODUCTION

Buyers and sellers increasingly want to use the Internet to conduct their business electronically. Consumers will want to use the Internet as a means for multiple phases of the purchase process: searching for suppliers, price negotiation, ordering, and payment for goods. Technology developments and innovations are having a significant impact on the banking industry. Banks face the challenge of adapting, innovating and responding to the opportunities provided by the technological advancements. The growth of e-banking has benefited enormously to banks and their customers. It has allowed banks to expand outreach, reduce transaction costs, improve efficiency, and provide virtual banking services. On the other hand, customers have benefited from efficient banking services at relatively lower costs and having the option to choose from alternate delivery channels. The e-banking has also facilitated swift movement of funds domestically and across borders.

We have known money as a medium of exchange to simplify transactions & to decide the worth of goods. E-money is an electronic medium for making payments and is the trend today. People are moving from paper-based money to plastic money. This changing financial landscape has posed new challenges for banks and policymakers/supervisors. Banks now have increased reliance on technology to compete in an increasingly competitive business environment and thus need to effectively manage the IT security and other related risks. Banks have to focus on the various e-payment System. E-payment scheme allows two users to securely exchange e-cash and digital product over an open network. Today, electronic payment system is flourishing due to the openness, speed, anonymity, digitization, and global accessibility characteristics of the Internet, which has facilitated real-time payment transactions and other business activities.

II. TRADITIONAL BANKING

Traditional payment methods include cash, cheque, credit and debit cards. These methods have several shortcomings.

- Cheque and cash cannot be exchanged in real time
- Credit and debit card info exchanged over the phone or by email entails security risks
- Some individuals do not have access to credit cards or checking accounts because of credit history.
- The overhead of all but cash do not support low value transactions (micropayments)

There are many problems with the traditional payment systems enumerated below:

(a) Inconvenience:

Traditional payment systems require the consumers to either send paper cheques by snail-mail/ via some one to handover the cheques or require him/her to physically come over and sign papers before performing a transaction. This may lead to annoying circumstances sometimes.

(b) Lack of Security:

This is because the consumer has to send all confidential data on a paper (which is not encrypted), that too by post where it may be read/ modified by anyone.

(c) Lack of Coverage:

When we talk in terms of current businesses, they span many countries or states. These business houses need faster transactions everywhere. This is not possible without the bank having branch near all of the companies' offices.

(d) Lack of Eligibility:

Not all potential buyers may have a bank account.

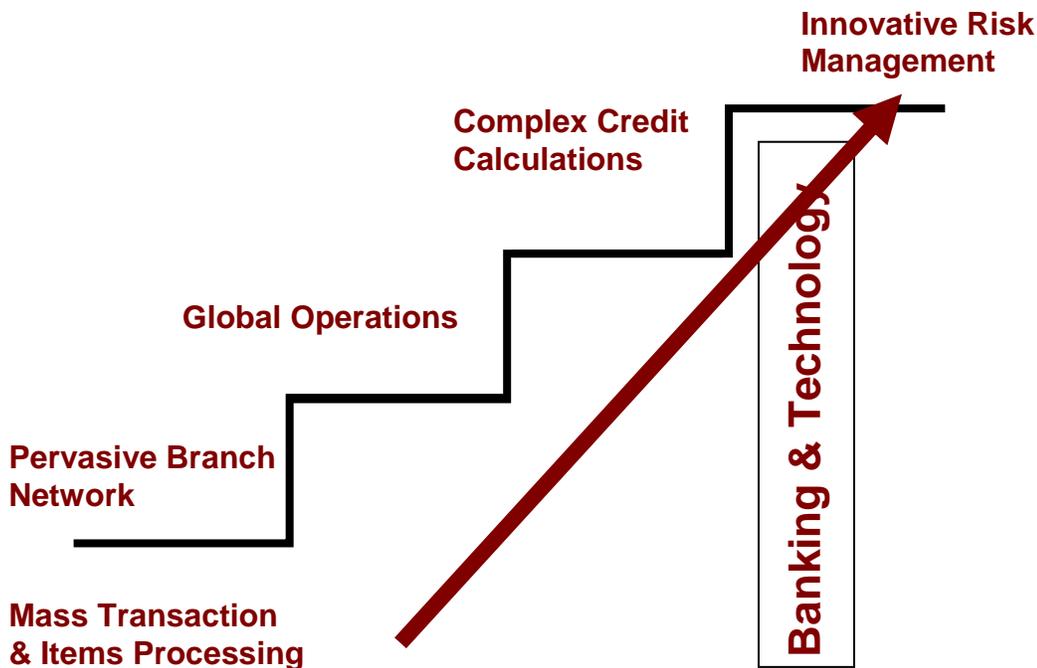
(e) Lack of support for micro-transactions:

Many transactions done on the Internet are of very low cost though they involve data flow between two entities in two countries. The same if done on paper may not be feasible at all.

III. E-BANKING

“Electronic Banking” or “e-banking” is an umbrella term for the process by which a customer may perform banking transactions electronically without visiting a branch and includes the systems that enable customers of banks, individuals or businesses, to access accounts, transact business, or obtain information on financial products and services through a public or private network, including the Internet.

E-banking is defined as the automated delivery of new and traditional banking products and services directly to customers through electronic, interactive communication channels. E-banking includes the systems that enable financial institution customers, individuals or businesses, to access accounts, transact business, or obtain information on financial products and services through a public or private network, including the Internet. Customers access e-banking services using an intelligent electronic device, such as a personal computer (PC), personal digital assistant (PDA), automated teller machine (ATM), kiosk, or Touch Tone telephone.



Advantages of Using E-banking

(i) Convenient

E-banking is convenient because we can use e-banking for tracking money in bank without going to bank. It saves time and is lot more easier.

(ii) Protection of Environment

E-banking, protects environment and is much cheaper.

Suppose, customer have to withdraw money from a bank and deposit it to another bank. He/ She has to commute via some vehicle. By using vehicle, you are increasing the pollution in the

environment. You can also use e-bill facility of your Internet bill.

Earlier customer use to maintain passbook to see every transactions, which customer have made in recent past. This leads to cutting of trees (as paper is made from tress). Now you do not have to get it printed or manually updated. You can see it online by log in to your account or you can get a message on your cell communicating you about the immediate transaction & available balance. It is a paperless environment. we can call this as green environment.

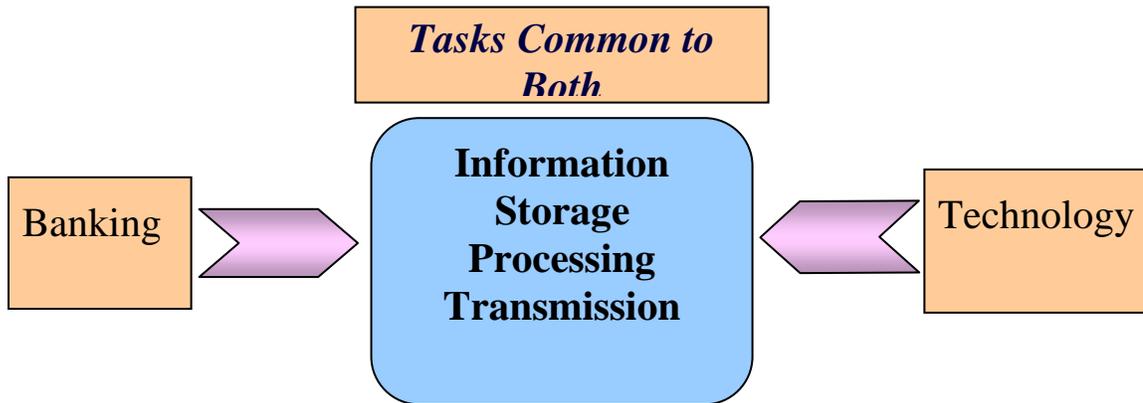
Disadvantages of Using E-banking

Hacking, Phishing, spyware program, computer virus and breaking online password are the weakness of e-banking or online banking. Online big hackers are using computer virus and after spreading it, they compromise your computer. After this, they know all detail of your computer and banking password and

illegally transfer all your money. Even you can stop this crime by writing strong password but you cannot remove it totally.

IV. TECHNOLOGY AND BANKING

The Quintessence Nature of Banking harmonizes closely with Technology –



Many Benefits of Technology

- Increased operational efficiency, profitability & productivity
- Superior customer service
- Multi-channel, real-time transaction processing
- Better cross-selling ability
- Improved management and accountability
- Efficient risk management
- Minimal transaction costs
- Improved financial analyses capabilities

Not only employees, there are problems for customers too when a new technology arrives.

Issues with Customers

- Comfort levels
- Security and trust issues
- Convenience factor
- Getting rid of myths
- Migration from existing to new systems
- Changing the habits
- Electronic Payments system

An Electronic Payments system means ensuring payment security, transaction privacy, system integrity, customer **authentication**, and the purchaser's promise to pay [3]. Electronic payment system is a mechanism of transferring money over the Internet and technology used in this transfer is called as EFT. The main objectives of EPS are to increase efficiency, improve security, and enhance customer convenience an ease of use. Although these systems are in their adolescence age, some significant development has been made. There are several methods of electronic payments system such as Electronic cash, software wallets, smart cards, and credit/debit cards.

Advantages of E-Payment

- **Increase payment efficiency**
 - Reduce transaction costs
 - Enable trade in goods and services of very low value
- **Increase convenience of making payments**
 - Payment can be made swiftly and remotely using various devices
- **Can be used for**
 - e-commerce / e-Trade
 - For other purposes like paying bills, taxes, etc

Categories of EFT

- **Banking and financial payments**
 - Large-scale or wholesale payment
 - Small scale or retail payment
 - Home banking
- **Retailing payments**
 - Credit cards
 - Debit cards
- **On-line electronic commerce payments**
 - Token-based payment system
 - Electronic cash
 - Electronic checks
 - Smart cards or debit cards
 - Credit card-based payment systems
 - Encrypted credit cards
 - Third-party authorization numbers

An ecommerce environment, a bank, or any financial institution with a payment system needs a complex design. A payment system means ensuring payment security, transaction privacy, system integrity, customer authentication & the purchaser's promise to pay. There are distinct set of properties, which we need to consider during money transfer.

ACID Test

Atomicity states that modifications must follow an “all or nothing” rule. Each transaction is said to be “atomic.” If one part of the transaction fails, the entire transaction fails. A transaction must occur completely or not at all.

Consistency states that all parties involved in transaction must agree to exchange. In a customer-retailer relationship involving a purchase, the customer must agree to purchase the goods for a specific price & merchant must agree to sell it at that price; otherwise, there is no basis for exchange.

Isolation means each transaction must be independent of any other transaction and be treated as a stand-alone episode.

Durability ensures the last committed state or reverses the facts of the exchange. This means reversing charges in the event that customers change their mind.

ICES TEST

Interoperability- Must be interoperable or exchangeable for other digital cash, paper cash, goods or services.

Conservation- Must be storable and retrievable

Economy- Must have a monetary value. Per transaction, cost must be small enough that is insignificant.

Scalability- Ability of the system to handle multiple users at the same time.

In addition to ACID & ICES test, other properties important for an EPS are-

Security- The infrastructure supporting electronic commerce must be usable and resistant to attack.

Reliable- The infrastructure must be highly available and should not present a single point of failure.

Flexible- Different models (credit, cash, cheque etc) for different situations, Need for a common framework.

Computational efficiency- Micropayments, frequent payments for small amounts must be supported. Merchants & payment servers must be able to handle the load.

Unobtrusiveness- Users must be able to monitor their spending and they also should be controlling when, to whom and how much is paid. They should not be interrupted to provide payment information.

V. TYPES OF EPS

The electronic payment systems are proliferating in air ticketing, insurance, banking, retail, health care, online markets and even government. Organizations are motivated by the need to deliver various kinds of products and services. More cost effectively and to provide a higher quality of service to customers.

Internet based Payment System Models- As compensation for information, goods and services provided through the internet are Access to copyrighted materials, Database search, Consumption of system resources etc. Online buyers may use one of the following EPSs to pay for products/services purchased online [12]:

- **Electronic funds transfer (EFT):** EFT involves electronic transfer of money by financial institutions. It is one of the oldest electronic payment systems. EFT is the groundwork of the cash-less and check-less culture

where and paper bills, cheques, envelopes, stamps are eliminated. EFT is used for transferring money from one bank account directly to another without any paper money changing hands. The most popular application of EFT is that instead of getting a paycheck and putting it into a bank account, the money is deposited to an account electronically. EFT is considered to be a safe, reliable, and convenient way to conduct business. The advantages of EFT contain the following:

- Simplified accounting
- Improved efficiency
- Reduced administrative costs
- Improved security
-
- **Payment cards:** They contain stored financial value that can be transferred from the customer's computer to the businessman's computer.
- **Credit cards:** They are the most popular method used in EPSs and are used by charging against the customer credit.
- **Smart cards:** They include stored financial value and other important personal and financial information used for online payments.
- **Electronic money (e-money/e-cash):** This is standard money converted into an electronic format to pay for online purchases.
- **Online payment:** This can be used for monthly payment for Internet, phone bills, etc.
- **Electronic wallets (e-wallets):** They are similar to smart cards as they include stored financial value for online payments.
- **Micro-payment systems:** They are similar to e-wallets in that they include stored financial value for online payments; on the other hand, they are used for small payments, such as kurus in Turkey.
- **Electronic gifts:** They are one way of sending electronic currency or gift certificates from one individual to another. The receiver can spend these gifts in their favorite online stores provided they accept this type of currency.

Above-mentioned EPS have some overlap among them. Since the e-banking is a growing and maturing segment. We have four main models to illustrate internet based systems are electronic currency, credit cards, debit cards, and smart cards.

Cyber Cash- This concept was given by Bill Melton & Dan Lynch in year 1994. They formed Cyber cash Inc. (www.cybercash.com). This was acquired by VeriSign. VeriSign was later acquired by PayPal and recently PayPal has been acquired by eBay. Cyber cash model makes safe passage over the Internet for credit card transaction data. They take the data sent to them from the merchant, and pass it to the merchant's acquiring bank for processing. Except for dealing with merchant through Cyber Cash's server, the acquiring bank processes the credit card transaction as they would process transactions received through a point of sale (POS) terminal in a retail store. Cyber cash servers act as a gateway between the merchant on the

internet and the bank's secure financial networks. The company offers a range of e-commerce solutions, from credit card based payment to secure micropayment system.

- Cyber cash offers services for businesses
- Cyber cash also offers a wallet for users
- Everything is authenticated
- Supports major credit cards as well as debit and purchase cards
- Flexibility to process offline orders
- Automatically logs every transaction including sales, credits, and voids
- Fast transaction processing speed for large volumes
- All transactions are encrypted and digitally signed
- Customers are notified in "real time" of rejection/approval of transactions

Net Bill- This method uses internet for purchasing goods and services and is a secure and economical payment method used mainly for Micropayments. The Net Bill server maintains accounts for both consumers and merchants, which allows customer to pay merchants for goods to be delivered. The goods are delivered in encrypted form to the consumer's machine. The Money Tool software verifies receipt and the goods are automatically displayed for the consumer. The Net Bill protocols enable communication between Money Tool, the merchant server and the Net Bill Server.

Credit Card- A credit card is a small plastic card issued to users dealing in e-commerce. Most credit cards are the same shape and size, as specified by the ISO 7810 standard. A credit card is different to a debit card in that it does not remove money from the user's account after every transaction. In the case of credit cards, the issuer lends money to the consumer (or the user) to be paid to the merchant.

Customers who purchase any goods send their credit card details to the service provider involved and the credit card organization will handle this payment. Online credit card payment has following categories:

- Payment using plain credit card details
- Payments using encrypted credit card details
- Payment using third-party verification

Entities involved in Credit card Transaction

- Consumer (Buyer or Card holder)
- Merchant (Seller)
- Card Issuer (Consumers' Bank)
- Acquirer or Principal (Merchant's Bank)
- Card Association (Visa, Master Card etc)
- Third party processor

Debit Card- The difference between credit cards and debit cards is that in order to pay with a debit card you need to know your personal identification number (PIN) and need a hardware device that is able to read the information that is stored in the magnetic strip on the back [3].

Debit cards task similar to checks in that the charges will be taken from the customer's checking account. The benefit for the customer is the easiness of use and convenience. These cards also keep the customer under his or her budget because they do not allow the customer to go beyond his or her resources. The advantage to the merchant is the speed at which the merchant collects these charges.

Smart Card- It was first introduced by Motorola, 1977. A smart card is a plastic card with an embedded microchip containing information about you. A smart card can store about 100 times the amount of information that a magnetic strip plastic card can store. A smart card contains private user information, such as financial facts, private encryption keys, account information, credit card numbers, health insurance information, etc. Popular in Europe, Germany, Singapore and Japan to pay for public phone call, transportation. Smart cards can accommodate a variety of applications that allow the customer to make purchases from a credit account, debit account, or stored value on the card.

These cards can even have multiple applications operating at the same time. The customer, for example, could have a frequent flyer program working on the same card as the customer debit or credit account. This enables the customer to earn points in his or her favorite program

Smart cards are of two types:

1. Relationship-based Smart Cards also called as Contact: It is the enhancement of existing card services that offer customers far better options like:

- Access to multiple accounts (debit, credit, e-cash) on one card.
- Offer various functions (cash access, bill payment, balance inquiry, fund transfer)
- Multiple access options at multiple location using multiple access device (ATM,

PC, PDA or screenphone etc)

2. Electronic Purses and Debit Cards also called as Contact-Less: Electronic Purses or E- wallet are the smart cards embedded with programmable microchip that store sum of money instead of cash. Once a purse is loaded with money it require card reader vending machine which verifies its authenticity .Then after amount is deducted from balance. It shows the remaining balance on the card hence eliminate the small bill in busy stores. E-wallets when depleted can be recharged with money.

E-Wallet- To facilitate the credit-card order process, many companies are introducing electronic wallet services. E-wallets allow you to keep track of your billing and shipping information so that it can be entered with one click at participating merchants' sites. E-wallets can also store echeques, e-cash and your credit-card information for multiple cards. A popular example of an e-wallet in the market is Microsoft Wallet. It can be used for micro-payments. They also eliminate

reentering personal information on the forms, resulting in higher speed and efficiency for online shoppers.

Micro payments-Micro-payments are used for small payments on the Web. The process is similar to e-wallet technology where the customer transfers some money into the wallet on his or her desktop and then pays for digital products by using this wallet. Using micro-payment one will be able to pay for one article from a professional journal, a chapter from a scientific book, or one song from a CD on the Web. There are many vendors involved in micro-payment systems. IBM offers micropayment wallets and servers. IBM micro-payment systems allow vendors and merchants to sell content, information, and services over the Web.

Automated Clearing House (ACH) routes bank transactions among financial institutions so that accounts held by respective financial institutions can be debited and credited.

VI. MAIN CONCERNS IN E-BANKING

In a survey conducted by the Online Banking Association, member institutions rated security as the most important issue of online banking. Unauthorized access or Phishing is one of the main risks in Internet Banking. If a customer provides his internet banking credentials in a website, that is not a legit bank website, his details can be used by the fake website to access his bank account and make transactions.

To control this - customers should be educated about phishing and asked to validate the authenticity of the website before they enter their credentials. In addition, customers must keep their credentials memorized and if they have written it down, they must keep it in a safe place that can be accessed only by them.

There is a dual requirement to protect customers' privacy and protect against fraud. Banking Securely: Online Banking via the World Wide Web provides an overview of Internet commerce and how one company handles secure banking for its financial institution clients and their customers. Some basic information on the transmission of confidential data is presented in Security and Encryption on the Web. PC Magazine Online also offers a primer: How Encryption Works. A multi-layered security architecture comprising firewalls, filtering routers, encryption and digital certification ensures that your account information is protected from unauthorized access:

- Firewalls and filtering routers ensure that only the legitimate Internet users are allowed to access the system.
- Encryption techniques used by the bank (including the sophisticated public key encryption) would ensure that privacy of data flowing between the browser and the Infinity system is protected.
- Digital certification procedures provide the assurance that the data you receive is from the Infinity system.

Security Solution

- A multi-layered security architecture comprising firewalls, filtering routers, encryption and digital

certification ensures that your account information is protected from unauthorized access

- Firewalls and filtering routers ensure that only the legitimate Internet users are allowed to access the system.
- Encryption techniques used by the bank (including the sophisticated public key encryption) would ensure that privacy of data flowing between the browser and the Infinity system is protected.
- Digital certification procedures provide the assurance that the data you receive is from the Infinity system.

Disadvantage

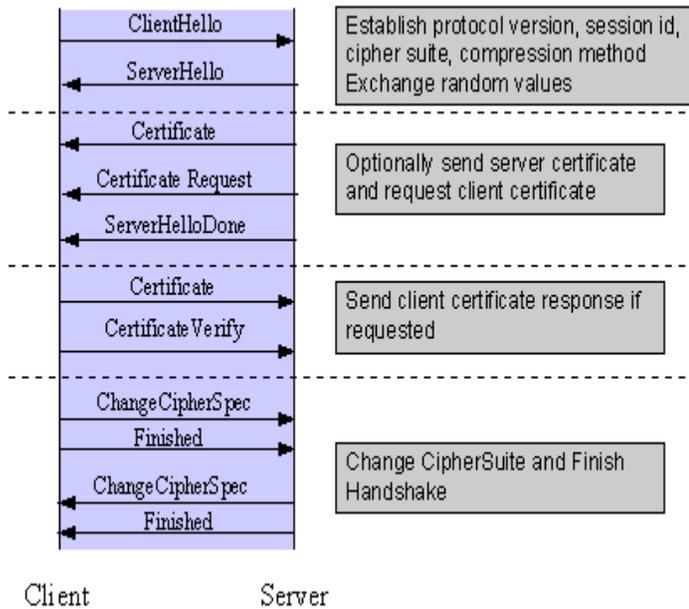
- Distorted facts are possible with such a plethora of information. Investors looking for information may find the wrong information or information that has been cooked, changed, or distorted in the corporations' favor.
- Also, the more information there is out there, the harder it is to find the information you need because you have to trudge through all the excessive information

Secure Sockets Layer (SSL) is a protocol developed by Netscape Communications Corporation. It provides secure communications over an open communication network, like the Internet. SSL provides data privacy and integrity as well as server and client authentication.

Once the server has a digital certificate, SSL-enabled browsers like Microsoft Internet Explorer can communicate securely with the server using SSL. With SSL, one can easily establish a security-enabled Web site on the private intranet or on the Internet.

SSL uses a security handshake to initiate a secure connection between the client and the server. During the handshake, the client and server agree on the security keys they will use for the session and the algorithms they will use for encryption. The client authenticates the server; optionally, the server can request the client's certificate.

Establishing a Session:



After the handshake, SSL is used to encrypt and decrypt all of the information in both the https request and the server response, including:

- The URL the client is requesting.
- The contents of any form being submitted.
- Access authorization information like user names and passwords.
- All data sent between the client and the server.

SSL defines methods for data encryption, server authentication, message integrity, and client authentication for a TCP/IP connection. SSL uses public key and symmetric techniques to protect information.

HTTPS is a unique protocol that combines SSL and HTTP. A client user can open a URL by specifying https:// to request an SSL-protected documents. HTTPS (HTTP + SSL) and HTTP are different protocols and use different ports (443 and 80, respectively), you can run both SSL and non-SSL requests at the same time. As a result, you can choose to provide information to all users using no security, and specific information only to browsers who make secure requests.

On the internet, **HTTPS** provides authentication of the web site and associated web server that one is communicating with, which protects against Man-in-the-middle attacks. Additionally, it provides bidirectional encryption of communications between a client and server, which protects against eavesdropping and tampering with and/or forging the contents of the communication. In practice, this provides a reasonable guarantee that one is communicating with precisely the web site that one intended to communicate with (as opposed to an impostor), as well as ensuring that the contents of communications between the user and site cannot be read or forged by any third party.

Because HTTPS piggybacks HTTP entirely on top of TLS, the entirety of the underlying HTTP protocol can be encrypted. This includes the request URL (which particular web page was requested), query parameters, headers, and cookies

(which often contain identity information about the user). However, because host (web site) addresses and port numbers are necessarily part of the underlying TCP/IP protocols, HTTPS cannot protect their disclosure. In practice this means that even on a correctly configured web server eavesdroppers can still infer the IP address and port number of the web server (sometimes even the domain name e.g. www.example.org, but not the rest of the URL) that one is communicating with as well as the amount (data transferred) and duration (length of session) of the communication, though not the content of the communication.

Historically, HTTPS connections were primarily used for payment transactions on the World Wide Web, e-mail and for sensitive transactions in corporate information systems. In the late 2000s and early 2010s, HTTPS began to see widespread use for protecting page authenticity on all types of websites, securing accounts and keeping user communications, identity and web browsing private.

The SET (Secure Electronic Transaction) standard is a global industry specification that was developed jointly by Visa International, MasterCard, and other companies. The SET protocol uses digital certificates to protect credit card transactions that are conducted over the Internet. The SET standard is a major step toward securing Internet transactions, paving the way for more merchants, financial institutions, and consumers to participate in electronic commerce. ICSF provides callable services that support the development of SET applications that run at the merchant and acquirer payment gateway.

SET addresses seven major business requirements:¹

1. Provide confidentiality of payment information and enable confidentiality of order information that is transmitted along with the payment information.
2. Ensure the integrity of all transmitted data.
3. Provide authentication that a cardholder is a legitimate user of a branded payment card account.
4. Provide authentication that a merchant can accept branded payment card transactions through its relationship with an acquiring financial institution.
5. Ensure the use of the best security practices and system design techniques to protect all legitimate parties in an electronic commerce transaction.
6. Create a protocol that neither depends on transport security mechanisms nor prevents their use.
7. Facilitate and encourage interoperability among software and network providers.

Point 1 ensures that card information cannot be viewed by unauthorized parties. Point 2 ensures that the information cannot be changed or tampered. Points 3 and 4 ensure that the cardholder and merchant are really who they claim they are. Hence, in essence, this framework, if implemented effectively, will allow both buyers and sellers to transact in total confidence in an open network.

VII. E-BANKING CASE STUDY

Intuit: Intuit is a leading provider of financial software it pioneered the concept of e-banking by making a personal finance software called Quicken in 1984. It launched online bill payment services in the year 1990, IntelliCharge credit card service in 1993 and Quicken Quotes a portfolio price update service in 1994.

At the forefront was the company's software Quicken; it allows users to organize, understand and manage their personal finance. Quicken looks and works like a chequebook, it allows users to enter their financial transactions and then generate meaningful reports and graphs. It allows users to reconcile their bank accounts and also track their credit card purchases. It also enables users to print cheques from the computer and allows them to make online payments.

The company also offers to its customer's online banking, bill payment and credit management.

How It Works:

Customers will have to sign up with a local bank and then use Quicken software to get the desired information. Quicken users then dial a local number and all transactions between Quicken and the banks are done through an Intuit subsidiary National Payment Clearing House, which changed its name to Intuit Service Corporation. ISC is an intermediary between the Quicken software and the banks. ISC's network design is based on "burst and disconnect" i.e. the user connects to ISC gets his desired information and disconnects. This strategy allows full utilization of the network and allows maximum number of users. The network applies the RSA security method. Intuit is banking partners download all bank related information like bank balances and statements into ISC's servers. So that all information is available to the user from his computer and modem. In case of credit card payments, the request is passed to the credit card company, which feeds the details about the latest transactions to ISC, which then gets back to the user.

In case of Bill Payment, the user just logs into the ISC server and feeds the details of the bills he has to pay. ISC then sees the most appropriate method of payment of the bill. There may be many possible ways, as some companies may have tied up with ISC itself, some may have tied up with other networks etc. If the bill cannot be paid over the network then Intuit prints a physical cheque and sends it to the party.

VIII. CONCLUSION

The online payment system facilitates the acceptance of electronic payment for online transactions, in other words, enables monetary value to be transferred digitally. The e-commerce payment systems have become increasingly popular due to the widespread use of the internet-based shopping and banking.

Traditional payment methods include cash, cheque, credit and debit cards. The problems with the traditional ways are inconvenience, lack of security, coverage & the time involved in the process etc. Over which the e-banking offers facilities at lower costs, convenience to the customers in varied domains like

paying utility bills, taxes etc and overall reducing the time involved in process.

The paper discusses the internet based payment models like EFT, payment cards, credit cards, smart cards, e-money, micro-payment systems, electronic wallets etc.

The risks to the use of e-commerce are identity theft & theft of payment data, & fraudulent rejection of the part of consumers. Security is considered to be most important issue of online banking. To control unauthorized access & phishing the customers should be educated about these threats and ways to prevent these.

With respect to the payment methods that have been discussed here, it is impossible to say that any one of them is perfect, although each one of them has advantages opposed to the others. A multi-layered security architecture comprising firewalls, filtering routers, encryption and digital certification ensures that users' information is protected. Therefore and until the use of electronic signature is wide spread, we must use the technology available for the moment to guarantee a reasonable minimum level of security on the network.

REFERENCES

- [1] Akudo C. Anyanwu, Absalom E. Ezugwu, Sale E. Abdullahi , "Electronic Payment System (EPS):Facilitating the Development and Adoption in Nigeria", IJCSI International Journal of Computer Science Issues, Vol. 9, Issue 2, No 1, March 2012
- [2] Awad, E.M. Electronic Commerce from vision to Fulfillment. Pearson Education. 2007
- [3] Chhabra, T.N. Suri, R.K. & Verma, S. e-commerce new vistas for Business.Dhanpat Rai & Co. 2007-2008
- [4] Kalakota & Winston. Frontiers of Electronic Commerce. Pearson Education, LPE. 2003
- [5] Jaiswal, S. Doing business on the Internet E-Commerce. Galgotia publication Pvt. Ltd. 2003
- [6] http://httpd.apache.org/docs/2.2/ssl/ssl_intro.html
- [7] <https://www.cibc.com/ca/student-life/banking-101/intro-to-banking/benefit-online-bnkg.html>
- [8] http://en.wikipedia.org/wiki/HTTP_Secure
- [9] <http://www.informedia.cs.cmu.edu/documents/netbill.pdf>
- [10] <http://www.isaca.org/Journal/Past-Issues/2000/Volume-6/Pages/Secure-Electronic-Transaction-SET-Protocol.aspx>
- [11] <http://www.moneymatters101.com/banking/onbk.asp>
- [12] http://ocw.metu.edu.tr/pluginfile.php/354/mod_resource/content/0/Lecture_4.pdf
- [13] <http://online-only-banks-review.toptenreviews.com/online-banking-vs.-traditional-banking.html>
- [14] <http://publib.boulder.ibm.com/infocenter/zos/v1r11/index.jsp?topic=/com.ibm.zos.r11.halz002/encalg.htm>
- [15] <http://rbidocs.rbi.org.in/rdocs/Publications/PDFs/4456.pdf>
- [16] <http://www.sis.pitt.edu/~spring/E-Business/example/pdf/FinancialSupport.PDF>
- [17] <http://webserver.ignou.ac.in/virtualcampus/adit/course/cst304/ecom2.htm>

AUTHORS

First Author – Mukta Sharma, Research Scholar, TMU, m.mukta19@gmail.com

Second Author – Dr. R.B. Garg , HOD CS/MCA, Tecnia, IP University, Ex-Prof., Delhi University, garg1943@gmail.com

A Study of Comparative Purification Efficiency of Two Species of *Potamogeton* (Submerged Macrophyte) In Wastewater Treatment

Parvaiz Ahmad Lone^{*}, Ajay Kumar Bhardwaj^{**}, Fayaz Ahmad Bahar^{***}

^{*} Department of Environmental Sciences and Limnology, Barkatullah University, Bhopal, Madhya Pradesh, India.

^{**} Department of Botany, Government Narmada Post Graduate College Hoshanagbad, Madhya Pradesh, India.

^{***} Faculty of Agriculture (FOA) Wadura Sopore, SKUAST-Kashmir, India.

Abstract- In the balancing of lake ecosystem macrophytes play a very important role. They have capacity to improve the water quality by absorbing nutrients with their effective root system and hence as Biofilters. Attempt was made in which samples of two *Potamogeton* species viz. *Potamogeton crispus* and *Potamogeton pectinatus* were collected during December 2008 to April 2009 from three different sites of Upper Lake of Bhopal. The nutrients including the phosphorus, potassium and sodium in the plants were analysed and found to be high. Significant correlations in phosphorus, potassium and sodium levels were apparent between the tissues of two *Potamogeton* species which were related to their life forms and to the limnological characteristics of the lake. The objective of the study was to know the comparative purification efficiency of two species of *Potamogeton* in wastewater treatment i.e. in reducing the nutrient content of the water. Purification of water through macrophytes is a good example of purification of water with natural means. Results indicated that both species were capable of improving water quality by reducing nutrient concentrations. But *Potamogeton crispus* rather than *Potamogeton pectinatus* was found more potent in improving the quality of lake water.

Index Terms- Macronutrients, *Potamogeton crispus*, *Potamogeton pectinatus*, Upper Lake, Wastewater, Water quality.

I. INTRODUCTION

Freshwater aquatic macrophytes grow naturally in water bodies polluted by nutrient loading from urban and agricultural activities. Accumulation of nutrients in an aquatic ecosystem leads to eutrophication resulting into massive growth of the macrophytes and weeds. Main cause of nutrient accumulation is rapid urbanization and anthropogenic pressure. Storm water runoff and discharge of sewage into the lakes are two common ways through which various nutrients enter the aquatic eco-system, resulting into the death of those systems [1]. The washing of large amount of clothes by dhobis and laundry workers, continued entry of domestic sewage and death and decay of macrophytes are posing pollution problems and hence an imbalance in the dynamics of water quality. The water quality issues regarding lakes everywhere is of great concern. Eutrophication of a water body signifies the aging of a lake. It is caused by the accumulation of nutrients, sediments, silt and

organic matter in the lake from the catchment area. Macrophytic vegetation plays an important role in maintaining the ecosystem of a lake. Various types of macrophytes viz. emergent, free floating, submerged are generally observed in an aquatic ecosystem where they play a very important role in improving the quality of water since later is a prime natural resource, a basic human need and a precious natural asset.

Among the principal characteristics of macrophytes is their ability to accumulate nutrients and accelerate nutrient loading in the environment. Many aquatic plants utilize these nutrients and produce large amount of biomass which can be used for some beneficial purposes. The concept of using aquatic plants for treating wastewater is giving the attention of local and state agencies in various parts of the U.S.A. Submerged macrophytes especially *Potamogeton* species play a key role in aquatic food webs by providing substrate for epiphytes [2] and invertebrate colonization [3], as well as providing a forage source and refugia for fish. Nutrient compositions of four submerged macrophytes were analyzed and it was concluded that variation in nutrient content was a function of the age of the species tested [4, 5].

Increasing efforts have been made in the study of chemical composition of aquatic macrophytes with emphasis on different aspects including the possibility of commercial exploitation of the plants [6], their seasonal changes in chemical composition [7], their role in nutrient accumulation, balance cycling within the ecosystem [8], and the effects of nutrient enrichments on these plants [9]. These results demonstrated, amongst other things that the chemical compositions of the plants varied according to species, the time of the year, and the site in which they are found. It has been, for example, reported that the distribution of two *Potamogeton* species was differentially affected by changes in the lake stage over a 20 year period in six interconnected shallow water lakes in the Netherlands [10].

Macrophytes absorb a wide range of macronutrients in the ambient environment including phosphorus, sodium and potassium etc and subsequently accumulate them in their tissues. They serve as tools for lake management [11]. A number of studies have demonstrated that a large reservoir of nutrients can accumulate in aquatic macrophytes in lake ecosystems [12, 13, 14]. Phosphorous compounds generally constitute the most important limiting nutrients in freshwater lakes [15, 16]. By determining the concentration of macronutrients (Na, P and K) in the tissues of two *Potamogeton* species originating from sites undergoing human impact, the aim of our study was to compare

the nutrient removal efficiency of the two species and to establish the role of these plants in improving the water quality.

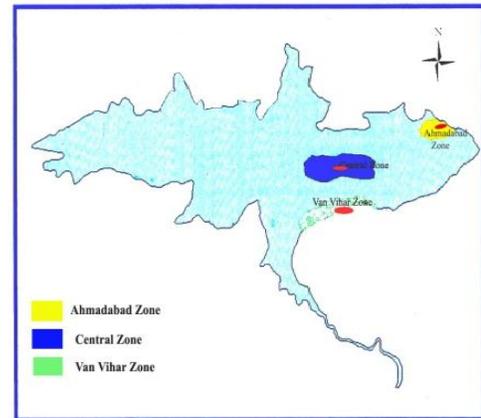
II. MATERIAL AND METHODS

Upper Lake, locally known as “Bada Talab”, is the oldest man-made lake of India ($77^{\circ} 18' - 77^{\circ} 24' E$, $23^{\circ} 13' - 23^{\circ} 16' N$) and is surrounded by Vanvihaar National Park on the south, human settlements on the east-north and agricultural fields on the west. It was constructed by Raja Bhoj in 11th century by constructing an earthen dam across the river Kolans. It is a source of drinking water to urban populations and miscellaneous purposes viz., aesthetic, recreational, industrial purposes etc.

Submerged plant biomass samples of the two *Potamogeton* species were collected from the three sites of the lake viz, Ahmadabad site, (Longitude $77^{\circ} 22' 51. 2''$ and Latitude $23^{\circ} 15' 31.0''$), Central site (Longitude $77^{\circ} 22' 07. 9''$ and Latitude $23^{\circ} 15' 05. 4''$) and Vanvihaar site (Longitude $77^{\circ} 21' 45. 01''$ and Latitude $23^{\circ} 14' 27. 05''$) after a duration of every two months from December 2008 to April 2009. For the identification of plants important works like Water plants of world [17], Marsh plants of India & Burma [18] and other relevant literature were consulted.

Potamogeton crispus commonly known as curly pondweed is an aquatic herb with branched compressed somewhat dichotomous stem. It is found in sub- littoral and sometimes in pelagic zone of the lake and is one of the most dominant species. It was frequently found at all sampling stations at almost all the occasions. Its highest density was recorded at Ahmadabad site. On the other hand, *Potamogeton pectinatus* commonly called as Sago pondweed has filiform rather profusely branched stems. It is commonly found in sub-littoral zones of lake. It prefers to grow in waters with moderately rich nutrient content. During study it was reported at Vanvihaar and Central sites, which are relatively low in nutrient content. However, its maximum density was noticed at Vanvihaar site.

After collections, the samples were brought to the laboratory in polythene bags and ice boxes, where they were washed with water several times and then with 0.2% detergent solution to remove any waxy coating and adhering soil particles. Subsequently, they were washed with 0.1N HCL to remove metallic contamination and lastly with deionised water to wash the previous two solutions. The two species of *Potamogeton* were then dried separately in an oven at $60^{\circ}C$ for 48 hours. Dried samples were homogenized and ground to yield fine powder. A standard procedure for water and aquatic plants was used to prepare plant material for chemical analysis [19, 20]. The grinded samples were digested by following tri-acid and di-acid digestion procedure. Lastly, processed samples were analysed for the contents of sodium, potassium and phosphorous. The total phosphorous was assayed spectro-photometrically by Ammonium- Vavnadate- Molybdatye method while as the sodium and potassium was determined flame-photometrically.



Map of Upper Lake showing three sampling sites.



Site-I (Ahmadabad site)



Site-II (Central site)



Site-III (Vanvihaar site)



Potamogeton crispus



Potamogeton pectinatus

III. RESULTS

Plants absorb nutrients from the soil/sediments and lake water. Different plants have affinity with particular nutrients and such nutrient elements are absorbed by the plant and retained in the particular part of the body. The results of the investigation show that in the biomass of *Potamogeton crispus* (which occupies the shallowest regions of the lake [21]) there are

differences between particular investigated main nutrients. In order to see the role and participation of *Potamogeton crispus* in the cycling of nutrients in the Upper Lake we calculated the quantity of investigated main nutrients in the course of December 2008 to April 2009.

The maximum sodium values of *Potamogeton crispus* (0.64%) was reported at Ahmadabad site as compared to other two sites. In *Potamogeton pectinatus* the maximum sodium value was reported both at Ahmadabad site (0.59% -man made pollution) and at the Vanvihaar site (0.60%-natural pollution) with little variations, as compared to the Central site (0.35% -no pollution). Potassium belongs to the group of major macronutrients and is responsible for plant growth, namely primary production. According to the results, the concentration of potassium in *Potamogeton crispus* (1.90%) was higher than in *Potamogeton pectinatus* (1.83%). It was also found that the concentration of potassium in both the plant species was higher at Ahmadabad site. Similarly the average stock values of phosphorus in the biomass of *Potamogeton crispus* was higher (0.42%) than that of the *Potamogeton pectinatus* (0.36%). Moreover, the minimum concentration of phosphorous in both the plants was recorded at the Central site (0.35%- 0.38%). Results also indicated that the concentration of phosphorous was at minimum in the late winter (December) and increased towards the end of growing season (April). The content of Na, K and P in two macrophytes of Upper Lake is given in the Tables 1&2 below:

Table 1: Variation in % Na, K and P values in *Potamogeton crispus*

Macronutrients\ Site	Ahmadabad site	Central site	Vanvihaar site
% Sodium (Na)	0.64	0.44	0.44
% Potassium (K)	1.9	1.43	1.5
% Phosphorus (P)	0.42	0.38	0.41

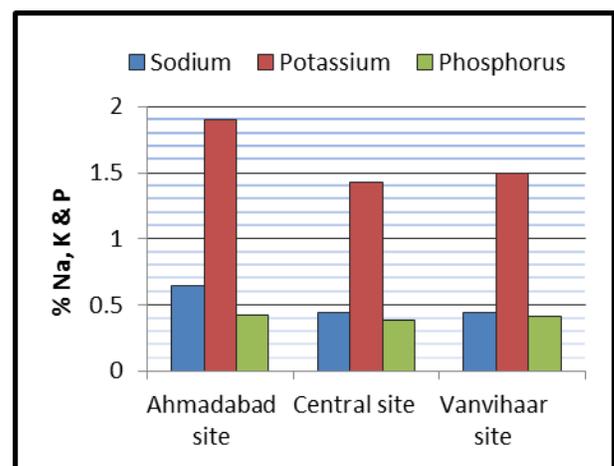


Fig. 1: Variation in % Na, K and P values in *Potamogeton crispus*

Table 2: Variation in % Na, K and P values in *Potamogeton pectinatus*

Macronutrients\ Site	Ahmadabad site	Central site	Vanvihaar site
% Sodium (Na)	0.59	0.35	0.6
% Potassium (K)	1.83	1.5	1.26
% Phosphorus (P)	0.36	0.35	0.36

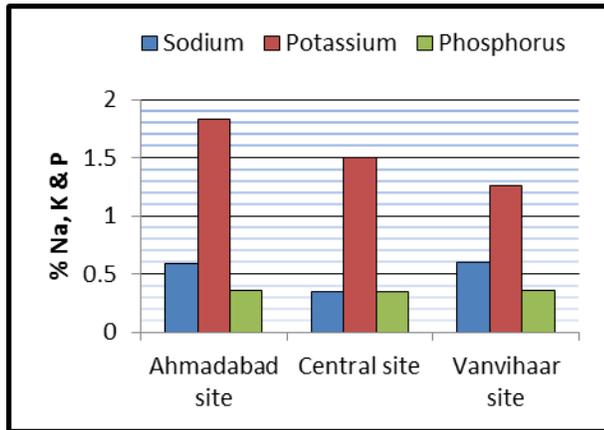


Fig.2: Variation in % Na, K and P values in *Potamogeton pectinatus*

IV. DISCUSSION

Differences in the chemical composition of the two species of *Potamogeton* were probably related to their life forms & to the limnological characteristics of the lake. Submerged and floating macrophytes are rich in phosphorous [22]. The results showed that *Potamogeton crispus* and *Potamogeton pectinatus* which are both submerged plants have the highest concentration of phosphorous and many other nutrients such as sodium and potassium in their biomass. The maximum sodium value (0.64%) in *Potamogeton crispus* at Ahmadabad site was due to the fact that at this site there was man-made pollution on account of the entry of sewage into the lake from the catchment area that brought a lot of nutrients such as Na, K, and P along [23]. In *Potamogeton pectinatus* the high concentration of sodium was not only reported at Ahmadabad site but also at the Vanvihaar site. Vanvihaar site was naturally polluted firstly because of surface runoff and secondly there was dense growth of macrophytes, which upon natural death and decomposition added a great concentration of nutrients to the lake water and sediments. In general, submerged and floating leaved macrophytes are more quickly decomposed while floating and emergent species have slower decomposition rates [24, 25]. Macrophytic plants can directly recycle phosphorous from the sediments via, root uptake, incorporation into tissues and subsequent senescence [26, 27, 28]. They can indirectly recycle phosphorous from sediment via, increasing pH of water column through photosynthetic activities. The concentration of both phosphorous and potassium were also reported to be very high in *Potamogeton crispus* than in the *Potamogeton pectinatus* at Ahmadabad site on account of the above mentioned facts. The minimum value of phosphorous in the month of December (Late winter) and the maximum value of phosphorous in the month of

April (end of growing season) were also reported [15]. Occurrence of dense growth of macrophytes at Ahmadabad and Vanvihaar sites than at the Central site was probably due to the availability of more nutrients. A phosphorous content of 3.5 to 5.6 mg g⁻¹ (mean 4.9) in *Potamogeton maackianus* was reported earlier [29] which also supports our results. Sediments have a far larger reserve of nutrients than the lake water, and during the growing season more phosphorous is taken up by *Potamogeton* species than enters lake water from the inflows, certainly indicates that the sediments are the principle source for the plants. The very large biomass of this plant (*Potamogeton*) means next to the sediments the macrophytes have the largest reserve of nutrients. Results indicated that both species were capable of improving water quality by reducing nutrient concentration. Since, the level of estimated nutrients was comparatively found high in *Potamogeton crispus*, it became evident from our results that *Potamogeton crispus* has comparatively more nutrient accumulation capacity and hence purification efficiency than *Potamogeton pectinatus* [30].

V. CONCLUSION

A comprehensive research work, that included both field and laboratory components, was done with the view to know the comparative purification efficiency of two species of *Potamogeton* in wastewater treatment *i.e.* in reducing the nutrient content of the water. The two plants were collected thrice from three different sites of Upper Lake of Bhopal. The results of the investigation showed that Upper Lake was receiving enough nutrients particularly sodium, potassium and phosphorous etc. at the Ahmadabad site from the catchment area. It also showed a significant variation of element concentrations in two *Potamogeton* species. *Potamogeton crispus* rather than *Potamogeton pectinatus* was found more potent in improving the quality of lake water.

ACKNOWLEDGEMENTS

We are highly indebted to the Head of the Department of Environmental Sciences and Limnology, Barkatullah University, Bhopal for providing us best laboratory facilities and encouragement.

REFERENCES

- [1] Sudhira, H.S. and Kumar, V.S. Monitoring of lake water quality in Mysore City. In T.V. Ramchandra, M.C. Rajasekara and N. Ahalya (Eds.), Int. symp. on restoration of lakes and wetland: Proceeding of lake 2000; pp 1-10. Bangalore, India. Centre for Ecological Sciences, Indian Institute of Sciences, 2000.
- [2] Cattaneo, A. and Kalff, J. The relative contribution of macrophytes and their epiphytes to the production of macrophytic beds. *Limnol. Oceanogr.*, 1980; 25: 280-289.
- [3] Soszka, G.J. Ecological relationships between invertebrates and submerged macrophytes in the lake littoral. *Ekol. Polska*, 1975; 23:3 93-415.
- [4] Lubbers, L., Boynton, W.R. and Kemp, W.M. Variations in the structure of estuarine fish communities in relation to abundance of submerged plants. *Mar. Ecol. Prog. Ser.*, 1990; 65: 1-14.

- [5] Shardenu and Ambasht RS. Relationship of nutrients in water with biomass and nutrient accumulation of submerged macrophytes of a tropical wetland. *New Phytol.*, 1991; 117:493-500.
- [6] Riemer, D.N. and Toth, S.J. A survey of chemical composition of aquatic plants in New Jersey. *New Jersey Agr. Exp. Stat. Bul.*, 1968; 820: 1-14.
- [7] Boyd, C.E. Vascular aquatic plants for mineral nutrient removal from polluted waters. *Economic Botany*, 1970a; 24: 95-103.
- [8] Dhote, S. and Dixit, S. Water Quality Improvement through Macrophytes: A Case Study. *Asian J. Exp. Sci.*, 2007; 21(2): 427-430.
- [9] Neundorfer, J.V. and Kemp, W.M. Nitrogen versus Phosphorus enrichment of brackish waters: responses of the submerged plant *Potamogeton perfoliatus* and its associated algal community. *Marine Ecology Progress Series*, 1993; 94: 71-82.
- [10] Scheffer, M., Redelijkheid, M.R. and Noppert, F. Distribution and dynamics of submerged vegetation in a chain of Eutrophic lakes. *Aquatic Bot.*, 1992; 42: 199-216.
- [11] Melzer, A. Aquatic macrophytes as tools for lake management. *Hydrobiologia*, 1999; 395/396: 181-190.
- [12] Howard-Williams, C. and Lenton, G.M. The role of littoral zone in the functioning of a shallow tropical lake ecosystem. *Freshwater Water Biology*, 1975; 5: 445-449.
- [13] Howard-Williams, C. and Junk, W.J. The chemical composition of Central Amazonian aquatic macrophytes with special reference to their role in the ecosystem. *Arch. Hydrobiol.*, 1977; 79: 446-464.
- [14] Carpenter, S.R. and Adams, M. The macrophytic tissue nutrient pool of a hardwater eutrophic lake: implications for macrophyte harvesting. *Aquatic Botany*, 1977; 3: 339-355.
- [15] Howard-Williams, C. and Allanson, B.R. Phosphorus cycling in a dense *Potamogeton pectinatus* L. *Bed. Oecologia (Berl)*, 1981; 49: 56-66.
- [16] Boyd, C.E. Chemical analysis of some vascular aquatic plants. *Arch. Hydrobiol.*, 1970b; 67: 78-85.
- [17] Cook, C.D.K., Gut, B.J., Rix, E.M. and Schneller, J. Water plants of the world. A Manual for the Identification of the Genera of Freshwater Macrophytes. Dr. W. Junk. Bv. (Publ.), 1974. The Hague, 33.
- [18] Biswas, K. and Calder, C.C. Hand-book of common water and marsh plants of India and Burma, 1936. Bishen Singh Mahendra Pal Singh, Nature, 1984; pp. 216.
- [19] APHA. Standard methods for examination of water and waste water, In: M. H. Franson (Ed.), 19th Edition. American Public Health Association, Washington, DC.
- [20] Tandon, H.L.S. Methods of analysis of Soils, Plants, Water and Fertilizers (ed). Fertilizer Development and Consultation Organization, New Delhi, India, 1993; pp. 143.
- [21] James, W.F., Barko, J.W. and Eakin, H.L. Direct and indirect impacts of submerged aquatic vegetation on the nutrient budget of urban Oxbow lake. Vicksburg, MS, U.S. Army Engineer Research and Development Center. Vicksburg, MS., 2001.
- [22] Gopal, B. Nutrient dynamics of aquatic plant communities in: Gopal, B. (ed.). Ecology and management of aquatic vegetation in the Indian subcontinent. Kluwer Academic Publisher. Dordrecht, 1991; 177-197.
- [23] Talevska, M. and Ohridski, N. Quantity of main nutrients in biomass of reed head grass (*Potamogeton perfoliatus* L.) from Lake Ohrid. *Hydrobiological Institute Ohrid, R.Macedonia*.
- [24] Kulshreshtha, M. and Gopal, B. Decomposition of freshwater wetland vegetation. II. Aboveground organs of emergent macrophytes. *Wetlands: Ecology and management*. Jaipur: National Int. Ecology., 1982; 282-296.
- [25] Sharma, K.P and Goel, P.K. Decomposition of water hyacinth. *Eichhornia crassipes* (Mart.) Solms. *Int. J. Ecol. Environ. Sci.*, 1987; 13: 13-18.
- [26] Barko, J.W. and Smart, R.M. Comparative influences of light and temperature on the growth and metabolism of selected submerged freshwater macrophytes. *Ecol. Monogra.*, 1981; 51: 219-235.
- [27] Carpenter, S.R. Enrichment of lake Wingra, Wisconsin by submerged macrophyte decay. *Ecology*, 1980; 61: 1145-1155.
- [28] Barko, J.W. and James, W.F. Effects of submerged aquatic macrophytes on nutrient dynamics, sedimentation, resuspension. In: Jeppesen, E., Sondergaard, Ma, Sondergaard, Mo, Christofferson, K. The structuring role of submerged macrophytes in Lakes. Springer, New York, *Ecological Studies*, 1998; 131: 197-214.
- [29] NI L. Effects of water column nutrient enrichment on the growth of *Potamogeton maackianus*. *J. Aquat. Plant Manage.*, 2001; 39:83-87.
- [30] HO, Y.B. Inorganic mineral nutrient level studies on *Potamogeton pectinatus* L. and *Euteromorpha prolifera* in forfar loch, Scotland. *Hydrobiologia*, 1979; 62(1): 7-15.

AUTHORS

First Author – Parvaiz Ahmad Lone, M.Sc., M.Phil., PGDCA, Department of Environmental Sciences and Limnology, Barkatullah University, Bhopal, Madhya Pradesh-462026. parvaizphd@gmail.com

Second Author – Ajay Kumar Bhardwaj, M.Sc., Ph.D., FMA, PGDCA, Professor, Department of Botany, Government Narmada Post Graduate College Hoshanagbad, Madhya Pradesh-461001. akbkranti@yahoo.com

Third Author – Fayaz Ahmad Bahar, M.Sc., Ph.D., Scientist Agronomy, Faculty of Agriculture (FOA) Wadura Sopore, SKUAST-Kashmir-193201. baharfayaz@rediffmail.com

Correspondence Author – Parvaiz Ahmad Lone, parvaizphd@gmail.com.

Feasibility of training Female Health Workers to diagnose and treat reproductive tract infections of females at the community level – a study done at Christian Medical College, Vellore

Dr.Maneesha Godbole*, Dr.Sulochana Abraham**, Dr.Jasmine Prasad***

* Dr.Maneesha Godbole Asst.Professor, Dept. of Community Medicine, Karnataka Institute of Medical Sciences, Hubli, Karnataka

** Dr.Sulochana Abraham, Professor (Retired), Dept. of Community Medicine, Christian Medical College, Vellore

*** Dr.Jasmine P Associate Professor, Dept. of Community Medicine, Christian Medical College Vellore

Abstract- Background: Infections of the reproductive tract in females is a major public health concern because of the associated morbidity. Women often delay seeking care for problems pertaining to the reproductive tract, as they feel shy to take these problems to a doctor, especially a male doctor. Moreover, health services are usually not accessible to the rural people and the urban poor. The nurses and paramedical workers are not trained to deal with gynaecologic diseases, and the availability of doctors in rural areas is very limited. **Objectives:** This study aims to assess the validity of diagnosis of the reproductive tract infections by the Female Health Worker, after a period of training. **Material and Methods:** 10 female health workers (known as Health Aides) of the Community Health Department of the Christian Medical College Vellore, were provided training in diagnosing the reproductive tract infections from visual examination of the vaginal discharge using a speculum. Training was also provided in counselling the patient and the partner.

Results: The validity of diagnosis by the Health Aides showed a sensitivity of 87 %, a specificity of 91%, Likelihood Ratio of 8.7, Positive Predictive value of 85.95. Kappa for agreement between the trainer and the Health Aide was 74.3%.

Conclusions: Utilising the skills of the Female Health Workers would overcome the problem of accessibility and lack of availability of a female doctor, and contribute positively to the reproductive health of the community, especially the rural poor who have poor access to services, and thus ensure an optimum level of health for all.

Index Terms- reproductive tract infections, India, Female Health workers, training

I. INTRODUCTION

World Health Organization defines reproductive health as a condition in which reproduction is accomplished in a state of complete physical, mental and social well being, and not merely the absence of disease or disorders of the reproductive process.¹ Control of reproductive tract infections, especially sexually transmitted infections contributes positively to reproductive health. This is especially important because reproductive tract infections play an important role in the

transmission of Human Immunodeficiency Virus (HIV).² A study conducted by the Department of Medicine and Epidemiology of the University of Washington among HIV positive women showed that vaginal HIV transmission decreased by 3.2 fold and 4.2 fold after treating candida and trichomonal infections respectively.³ Reproductive tract infections (RTIs) are associated with adverse health outcomes such as infertility, intrauterine growth retardation, premature labour, and increased vulnerability to HIV/AIDS.⁴

The WHO estimates that each year, there are over 333 million new cases of curable sexually transmitted infections.⁵ Though these infections affect both men and women, the brunt is borne mostly by the women, because of various factors like shyness, lack of a female health care provider, lack of accessibility of health care.⁶ A study conducted in Tamil Nadu showed that 15% of women in the reproductive age group had sexually transmitted infections and 28% had endogenous infections.

Two-thirds of the symptomatic women had not sought any treatment - the reasons cited were absence of a female health care provider in the nearby health care centre, lack of privacy, distance from home, cost and a perception that their symptoms were normal.⁷ In another study in rural Tamil Nadu, a total of 452 women were interviewed and 235 of them were found to be suffering from RTIs giving a prevalence of 51.9%.⁸ Bang et al reported 62% women suffering from vaginitis clinically in Gadchiroli, rural Maharashtra.⁹

Symptoms like white discharge are accepted as normal and women do not seek care for this due to a feeling of shame or guilt, owing to its perceived link with promiscuity.¹⁰ Moreover, health services are not accessible to the rural people and the urban poor. The availability of doctors in rural areas is very limited, and the nurses and paramedical workers are not trained to deal with gynaecologic diseases. In response to these problems, the WHO came up with the Syndromic approach, which helps in making a diagnosis based on the presence of groups of symptoms and signs. Treatment is given for all possible organisms that would cause the particular syndrome. However, this tends to be nonspecific, and leads to overtreatment. Incorporating the use of a speculum for examination was found to overcome this problem, however only doctors are trained to do a speculum examination.

Various studies have shown that training health workers to contribute to the general health care in diagnosis and management has been quite successful.^{11,12} Moreover, in the presence of clear guidelines, prompt treatment of patients on the spot is more effective, as referral to higher centres may result in drop-out of a significant number of patients.¹³ The female health worker, because of her proximity and good rapport with the women in the community, can be trained to provide these services. Training of nurses, health workers, dais, anganwadi workers regarding RTI identification and referral using syndromic approach and promotion of menstrual hygiene, genital hygiene and health care seeking behaviour have been shown to help in reducing the burden of RTI in the community.¹⁴ Going one step further, if the health workers are trained to do a speculum examination to identify the probable infection from the nature of the discharge, and provide the appropriate treatment, it would overcome the problem of drop-out of referrals. If successful, this could later be replicated in the wider government system with the aid of the Village Health Nurse, who already possesses the skill for speculum examination, having been trained for Cu-T insertion.

II. MATERIALS AND METHODS

The study was conducted in Kaniyambadi, a rural block of Vellore district, in the state of Tamil Nadu in South India, where the Community Health Department of the Christian Medical College, Vellore provides the primary health care services. The Female Health Worker (known as Health Aide), is an important link in the system providing the primary health care. The Health Aides are women with a basic education of up to the tenth standard, who undergo training for one and a half years, during which period they are taught the basics of female anatomy, physiology, reproduction and conduction of normal deliveries. They are expected to register and report pregnancies, births and deaths, provide health education, report any unusual occurrence of morbidity and assist in the investigation of epidemics. They are similar in training and hierarchy to the Village Health Nurse of the Government system.

The study consisted of two components

1. Training of the Health Aides in diagnosing reproductive tract infections in women - history taking, speculum examination, diagnosis and counselling.
2. Assessing the validity of diagnosis of the Health Aides.

Since after a search it was found that a training manual was not available, a training module was prepared by the principal investigator and this was used to impart training to the health workers.

Training was conducted over a period of 6 months, in the local language and was carried out in an informal manner, keeping in mind the educational level and age of the health workers. A judicious mix of different teaching methods and aids was used – lectures, demonstrations, anatomical models, role play and examination of patients. Pre-test and post-test evaluation was done to assess if the objectives of the training

were met. After it was ascertained that the Health Aides were able to confidently perform a speculum examination, they were taken into the community to assess the reliability of the diagnosis.

Assessing reliability

After all the Health Aides had gained adequate competence in examining women using a speculum and were able to identify the clinical findings satisfactorily, the reliability of their diagnosis was assessed. A sensitivity and specificity each of 90% was considered acceptable. The sample size was calculated for a sensitivity of 90%, and precision of 10%, using the formula $4pq/d^2$.

P , sensitivity = .9, $q = 1-p$, i.e. 0.1 and $d=10\%$
The sample size worked out to 36.

An earlier study done in the same rural block had shown that 50% of women with a complaint of vaginal discharge would actually have a reproductive tract infection and that the prevalence of reproductive tract infections among women in the age group of 15-45 years was 50%.¹⁶

Therefore, it was inferred that each Health Aide would have to interview 144 women to obtain 72 women with a history of vaginal discharge, expecting 38 out of these to have positive findings.

Selection of the sample

Women were selected from one of the villages covered by the particular Health Aide. The village was selected at random, and a street from the village was randomly selected. The Health Aide asked every woman in the age group of 16-45 years living in that street for complaint of white discharge, until 76 women were found. If enough number of women with a positive history were not found, the next street was included and so on till the required number of women was reached.

A form was required to be filled for each patient, it consisted of 2 sections:

Section A – was for recording the history and consisted of details of duration and nature of the discharge, presence of other symptoms of reproductive tract infections, presence of related complaints in the sexual partner. At the end the Health Aide was required to conclude if the discharge could be normal or pathological.

Section B- this consisted of the findings of the examination of the external genitalia followed by speculum examination where they were required to note the condition of the vagina, details of the discharge, condition of the cervix, the vaginal pH checked by using a litmus paper and the diagnosis.

The investigator accompanied the Health Aide to the house of each woman and observed the following:

1. History taking
2. Convincing the woman for a speculum examination in case of a positive history
3. Arranging for speculum examination
4. Speculum examination and the findings
5. Advice to the woman in case of a positive finding on speculum examination

The investigator also examined the nature of the discharge at the same time as the Health Aide was doing the speculum examination and the findings were put down on separate forms, for analysis later. This gave an opportunity to the investigator to observe the knowledge, attitude and skills of the Health Aide. The data was analysed using Epi Info6.04b and SPSS 9.0 for Windows.

III. RESULTS

Seventeen Health Aides underwent training. All seventeen were evaluated for knowledge, attitude and skills. However, the assessment of reliability of diagnosis was done for only the ten Health Aides who were going to be a part of the intervention project.

Table 1 Age distribution of the Health Aides

Age	Frequency	Percent
35-39	6	35.3
40-44	3	17.6
45-49	6	35.3
>49	2	11.8
Total	17	100

Table 2 Performance of the Health Aides in the pre-test

Test	Mean (%)	Median (%)	Range
Theory	62	62	48-78
Practical	34.2	34.3	21-56
Total	51.8	52	38-63

Table 3 Performance of the Health Aides in the post-test

Test	Mean (%)	Median (%)	Range
Theory	73.9	75	60-89.2

Table 6 Agreement between the diagnosis of the Health Aide and the Trainer

HA/Trainer	Normal	Candidiasis	Trichomonas Vaginalis	Bacterial Vaginosis	Mixed Infection	Total
Normal	181	5	8	2	1	197
Candidiasis	6	35	2	0	3	46
Trichomonas Vaginalis	5	1	44	1	4	55
Bacterial Vaginosis	6	1	1	12	0	20
Mixed Infection	1	0	1	0	5	7
Total	199	42	56	15	13	325

The percentage agreement was 74.3%, CI 74.25-74.32

Practical	58.1	57	43-73
Total	68.7	70	61-83

There was a significant difference in the pre-test and post-test mean scores.

Table 4 The validity of the diagnosis made by the Health Aides

Diagnosis by the Trainer

Diagnosis by Health Aide	Infection +	Infection -	
Infection +	110	18	128
Infection -	16	181	197
Total	126	199	325

Sensitivity – 87% (95% CI 86.78-87.22)

Specificity – 91% (95% CI 90.96-91.03)

Likelihood Ratio – 8.7

Positive Predictive value – 85.9%

Table 5 Distribution of sensitivity, specificity and likelihood ratio of the diagnosis by the health workers

Health worker	Sensitivity (%)	Specificity (%)	Likelihood Ratio
1	85.7	93.3	12.8
2	77.7	95.8	18.5
3	93.3	90	9.3
4	83.3	100	8.3
5	100	81.8	5.5
6	100	90	10
7	86.6	72	3.1
8	100	94.4	17.9
9	72.7	94.7	13.7
10	81.8	100	8.2

The lowest sensitivity was 72.2% and the highest 100%.

The lowest specificity was 72% and the highest 100%

Correlation between the pre-training and post-training performance showed a positive correlation. The 'r' value was 0.5384, significant at $p=0.026$.

Correlation between the age of the Health Aide and the % post-training score was negative. The 'r' value was -0.599, significant at $p=0.011$, which means that the performance is poorer among Health Aides who are older.

There was no correlation between post-training score and the Likelihood Ratio. The 'r' value was 0.268 which was not significant.

IV. DISCUSSION

The training of Health Aides was conducted for a total of 48 hours spread over 20-24 weeks, so as to allow them to carry on with their routine work.

The situation analysis, through needs assessment and task analysis done at the outset through discussion with the Health Aides helped to identify the areas requiring training. It also ensured participation of the trainees in the training program from an early stage.

The written test was in the form of multiple choice questions, and the practical test was in the form of Objective Structured Practical Examination and consisted of 3 stations – one on counselling, one on demonstration of use of condom, one on speculum examination. In the pre-test the speculum examination was on the model of the pelvis whereas in the post-test it was on a patient.

There was a significant difference in the performance in the pre-test and post-test, in both the theory and practical. The overall sensitivity of diagnosis was 87% and the overall specificity of diagnosis was 91%, which are good.

It is difficult to compare ten subjects across the board in terms of sensitivity and specificity. Some tend to have a higher sensitivity and others higher specificity. Likelihood Ratio helps to overcome this problem. By and large, a good diagnostic test with a sensitivity of 90% and a specificity of 90% should yield a Likelihood Ratio of 9, which means that a woman who is diagnosed to have a reproductive tract infection by the Health Aide, has 9 times greater odds of having the disease as compared to the pre-test odds. In this case the Likelihood Ratio is 8.7.

The Kappa, calculated for agreement between the diagnosis of the doctor and the Health Aides is 74.3%, with a narrow Confidence Interval of 74.25-74.32, which is a good degree of agreement.

The tests for correlation show that those Health Aides who had done well in the pre-training evaluation also did well in the post-training evaluation.

The test for correlation between the age of the Health Aides and their post-training performance shows that the older Health Aides have not performed so well. It is probably difficult to learn new skills at an older age.

There is no correlation between the post-training performance in the written and practical examination, and the Likelihood Ratio of their diagnosis from a speculum examination. Therefore, the diagnostic reliability of a Health Aide cannot be assessed with the help of written and practical examination alone.

Evaluation of the technique of speculum examination was carried out with the help of a checklist in the field setting. The skills checked were – explanation to the patient about the examination, the ability to select the appropriate place for examination, the sterile precautions and the explanation to the patient after the examination. The overall performance was found to be satisfactory, with an average score of 75%.

A study conducted in the same department, where the Balwadi teachers were trained to identify ear problems through an examination of the children's ears using a head mirror showed a sensitivity and specificity of more than 80%, as against 87% and 91% respectively in our study.¹⁵

In a study undertaken in Tamil Nadu to examine if the Village Health Nurse (VHN) could be trained to identify a cervical abnormality by visual inspection, the agreement between the gynaecologist and the VHN was 95%. However, the present study did not show such a high degree of agreement. The number of cases of specific infections was not adequate. This was similar to the problem faced by the WHO and UNICEF during the training of health workers in the Integrated Management of Childhood Illnesses.¹⁶

V. CONCLUSION

Search of the literature showed that training health workers to provide health care services has been quite successful in improving the quality of services. The Department has a similar experience, where the Traditional Birth Attendants have been trained to conduct deliveries under hygienic conditions and have made a great contribution to improvement in the maternal health status in the block. Anganwadi workers have been successfully trained to recognise and manage common ear problems.¹⁷ Therefore it can be presumed that the Health Aides or the female multipurpose health workers can be used to provide diagnostic and curative services at the periphery.

Preparation of the training module based on the needs assessment and performance in the pre-test made the lessons relevant and focused. Employment of various aids of teaching helped to sustain the enthusiasm of the Health Aides.

From this study it is seen that utilising the skills of the Health Aides would definitely contribute positively to the reproductive health of the community, especially the rural poor who have poor access to services, and ensure an optimum level of health for all.

VI. RECOMMENDATIONS

Upgrading the skill set of the health workers will help to improve the availability and accessibility of health services to the rural poor and the remote areas. This will also make the health workers more empowered in improving the health of the community, and give them a better status in the community, thus improving their acceptance by the people.

ACKNOWLEDGEMENTS

This project was done as a part of the larger project funded by the International Council for Research on Women. Without

their financial assistance this would not have been possible. I would like to thank them for this and also for the opportunity given to me to present the preliminary findings at the conference in

I would like to express my gratitude to Dr. Abraham Joseph, Head of the Department of Community Medicine, Christian Medical College Vellore, whose boundless energy motivated us and kept us on our toes.

My sincere thanks to my guide Dr. Sulochana Abraham, Professor, Department of Community Medicine, Christian Medical College, Vellore, and Dr. Jasmine Prasad, Assistant Professor for helping me throughout the project.

My heartfelt gratitude to Dr. J.P. Muliylil without whose help the analysis would have been impossible, Dr. Vinohar Balraj for kindly lending me the use of his office and computer, my colleagues and the faculty of the department of Community Medicine, Christian Medical College, Vellore.

REFERENCES

- [1] Khanna P, Van Look PFA, Griffin PD, editors. Special programme of research, development and research training in human reproduction. Reproductive Health: a key to bright future. Biennial Report 190-91 Geneva World Health Organization, 1992. p.4
- [2] Helfgott A, Eriksen N, Bundrick CM, Lorimor R, Ban Eckhout B. Vaginal infections in human immunodeficiency virus infected women. *Am J Obstet Gynecol* 2000;183:347-55
- [3] Wang CC, McClelland RS, Reilly M, Overbaugh J, Emery SR, Mandaliya K, et al. The effect of treatment of vaginal infections on shedding of human immunodeficiency virus type 1. *J Infect Dis* 2001;183:1017-22.
- [4] Wasserheit J, Holmes K J. Reproductive tract infections: challenges for international health, policy, programs & research. In: Germain A, Holmes K, Piot P, Wasserheit J, eds. *Reproductive tract infections: global impact and priorities for women's reproductive health*. New York: Plenum Press, 1992. 7-33.33.
- [5] Population Council. Reproductive Tract Infections: An Introductory Overview. A Set of Fact sheets. Thailand: Population Council; 1999.
- [6] Khanna P, Van Look PFA, Griffin PD, editors. Special programme of research, development and research training in human reproduction. Reproductive Health: a key to bright future. Biennial Report 1990-91 Geneva World Health Organization, 1992. p.4
- [7] Prasad JH, Abraham S, Kurz KM, George V, Lalitha MK, John R, Jayapaul MN, Shetty N, Joseph A. Reproductive tract infections among young married women in Tamil Nadu, India. *Int Fam Plan Perspect*; 2005 Jun;31(2):73-82
- [8] Savita Sharma, BP Gupta. The Prevalence of Reproductive Tract Infections and Sexually Transmitted Diseases Among Married Women in the Reproductive Age Group in a Rural Area. *Indian J Community Med.* 2009 January;34(1):62-64
- [9] Bang R, Bang A, Baitule M, Chaudhury Y, Sarmukaddam S, tale O. high prevalence of gynaecological diseases in rural Indian women. *Lancet* 1989;8629:85-88.
- [10] Mamdani M. Management of Reproductive Tract Infections in Women: Lessons from the field. In: Pachauri S. editor. *Implementing a reproductive health in India: a beginning*. New Delhi: Population Council; 1999. p.426
- [11] Gajalakshmi CK, Krishnamurthy S, Ananth R, Shantha V. Cervical cancer screening in Tamil Nadu, India: a feasibility study of training the village health nurse [Abstract]. *Cancer Causes Control* 1996;7:520-4
- [12] Bang AT, Bang RA, Sontakke PG and the Search team. Management of childhood pneumonia by traditional birth attendants. *Bulletin of the World Health Organization* 1994;72:897-905.
- [13] Grosskurth H, Mwijarubi E, Todd J, Rwakatare M. Operational performance of an STD control programme in Mwanza Region, Tanzania. *Sex Transm Infect* 2000;76:426-36.

- [14] Singh MM, Devi R, Garg S, Mehra M. Effectiveness of syndromic approach in management of reproductive tract infections in women. *Indian J Med Sci.* 2001 Apr;55(4):209-14.
- [15] Abraham V. Training Anganwadi workers to identify early ear morbidity. [Dissertation]. Chennai: The Tamil Nadu Dr.MGR Medical University.
- [16] Lambrechts T, Bryce J, Orinda V. Integrated Management of Childhood Illness: a summary of my first experiences. *Bulletin of the WHO* 1999;77:537-616
- [17] Prasad JH, Abraham S, Kurz KM, George V, Lalitha MK, John R, Jayapaul MN, Shetty N, Joseph A. Reproductive tract infections among young married women in Tamil Nadu, India. *Int Fam Plan Perspect*; 2005 Jun;31(2):73-82

AUTHORS

First Author – Dr. Maneesha Godbole, Dr. Maneesha Godbole Asst. Professor, Dept. of Community Medicine, Karnataka Institute of Medical Sciences, Hubli, Karnataka
Second Author – Dr. Sulochana Abraham, Dr. Sulochana Abraham, Professor (Retired), Dept. of Community Medicine, Christian Medical College, Vellore
Third Author – Dr. Jasmine Prasad, Dr. Jasmine P Associate Professor, Dept. of Community Medicine, Christian Medical College Vellore

Modeling and Architectural Simulations of the Statistical Static Timing Analysis of the Non-Gaussian Variation Sources for VLSI Circuits

Abu M. Baker* and Yingtao Jiang*

* Department of the Electrical and Computer Engineering
University of Nevada, Las Vegas
Las Vegas, NV 89154

Abstract- As CMOS technology scales down, process variation introduces significant uncertainty in power and performance to VLSI circuits and significantly affects their reliability. Although Static-Timing Analysis (STA) it is an excellent tool, but current trends in process scaling have imposed significant difficulties to STA. As one of the promising solutions, Statistical static timing analysis (SSTA) has become the frontier research topic in recent years in combating such variation effects. This paper will be focusing on two aspects of SSTA and its applications in VLSI designs: (1) Statistical timing modeling and analysis; and (2) Architectural implementations of the atomic operations (max and add). Experimental results have shown that our approach can provide 282 times speedup when compared to a conventional CPU implementation.

Index Terms- Statistical static timing analysis, CMOS, VLSI, non-Gaussian, process variations

I. INTRODUCTION

Static-timing analysis (STA) has been one of the most ubiquitous and popular analysis engines in the design of digital circuits for the last 30 years. However, in recent years, the increased loss of predictability in semiconductor devices has raised concern over the ability of STA to effectively model statistical variations. This has resulted in all-encompassing research [1], [2] in the so-called statistical STA (SSTA), which marks a significant departure from the traditional STA framework. The fundamental paleness of STA is that while global shifts in the process (referred to as die-to-die variations) can be approximated by creating multiple corner files, there is no statistically rigorous method for modeling variations across a die (referred to as within-die variations). However, with process scaling progressing well into the nanometer regime, process variations have become significantly more pronounced and within-die variations have become a non-negligible component of the total variation. It is shown that the incapability of STA to model within-die variation can result in either an over- or underestimate of the circuit delay, depending on the circuit topology [3]. Hence, STA's desirable property of being conservative may no longer hold for certain circuit topologies while, at the same time, STA may be overly pessimistic for other circuit topologies. This accuracy problem of STA can be even more pronounced in advanced processes. Consequently, the need for an effective modeling of process variations in timing analysis has led to extensive research in statistical STA.

SSTA algorithms can be broadly categorized into path-based and block-based. The path based SSTA seeks to estimate timing statistically on selected critical paths. However, the task of selecting a subset of paths whose time constraints are statistically critical has a worst-case computation complexity that grows exponentially with respect to the circuit size. Hence the path based SSTA is not easily scalable to handle realistic circuits. On the other hand, the block based SSTA champions the notion of progressive computation. Specifically, by treating every gate/wire as a timing block, the SSTA is performed block by block in the forward direction in the circuit timing graph without looking back to the path history. As such, the computation complexity of block based SSTA would grow linearly with respect to the circuit size. However, to realize the full benefit of block based SSTA, we have to address a challenging issue that timing variables in a circuit could be correlated due to either global variations([4], [5], [6]) or path reconvergence ([7], [8]). Global correlation refers to the statistical correlation among timing variables in the circuit due to global variations such as inter or intra-die spatial correlations, same gate type correlations, temperature or supply voltage fluctuations, etc. Path correlation, on the other hand, is caused by the phenomenon of path reconvergence, that is, timing variables in the circuit can share a common subset of gate/wire blocks along their path histories. Several solutions have been proposed to deal with either of these two types of correlations. In [4], [5], [6], the dependence on global variations is explicitly represented using a canonical timing model. However, these approaches did not take into account the path correlations. In [8], a method based on common block detection is introduced to deal with the path correlations. However, this method does not address the issue of dependence on global variations. To the best of our knowledge, there is no existing method that has dealt with both types of correlations simultaneously. We present a novel block based SSTA modeling in this paper that is designed to consider both global correlations and path correlations:

- We develop a model encompassed with numerical computations and tightness probabilities to conditionally approximate the MAX/MIN operator by a linear mixing operator.

- We extend the commonly used canonical timing model to be able to represent all possible correlations, including the path correlations, between timing variables in the circuit.

The remainder of this paper is organized as follows. SSTA problem formulation has been described in Section II. Section III details the solution approaches. Section IV details our architectural simulation and also present results from experiments which were conducted in order to benchmark our approach. We conclude in Section V.

II. SSTA PROBLEM FORMULATION

In this section, we will formally define the problem to be solved.

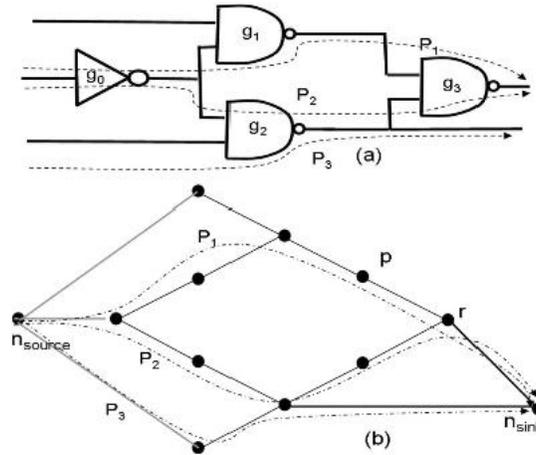


Fig. 1. Combinatorial circuit and its corresponding DAG [9].

Definition: A combinational circuit can be described using a Directed Acyclic Graph (DAG) G given as $G = \{N, E, n_s, n_f\}$, where N is the set of nodes corresponding to the input/output pins of the devices in the circuit, E is the set of edges connecting these nodes, each with weight d_i , and n_s, n_f are respectively source and sink of the graph. Figure 1(a) shows a digital circuit and its corresponding DAG is shown in Figure 1(b).

Problem Formulation:

Let p_i be a path of ordered edges from a source to a sink in G . Let $D_i = \sum d_{ij}$ be the path length of p_i . Then $D_{max} = \max(D_1, \dots, D_i, \dots, D_n)$ is referred as the SSTA problem of the circuit.

There are two main challenges in SSTA. The Topological Correlation which emerges from reconvergent paths, these are the ones which originate from a common node and then converge again at another node (reconvergent node). Such correlation complicates the maximum operation as it now has to be computed over correlated RVs. In a circuit example shown in Figure 2, one can see that the two red paths reconverge at the rightmost gate (g_3).

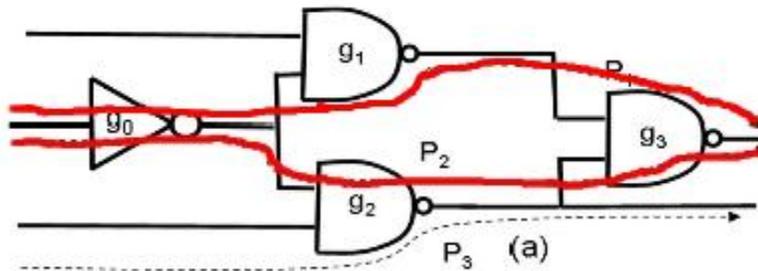


Fig. 2. Topological Correlation [9].

The second challenge is the Spatial Correlation. It arises due to device proximity on the die and gives raise to the problems of modeling delay and arrival time so that correlations are included, as well as preserving and propagating these correlations. Figure 3 shows such two paths correlated by two closely placed gates (g_1 and g_2).

III. SOLUTION APPROACHES

The most general and brute force method of solving the above mentioned problem is to use numerical integration [7]. Although exact and applicable, this method is highly computationally expensive and thus, undesired. This leads to another approach, namely, the use of Monte Carlo methods [8]. The exact structure of these methods varies with the problem at hand. However, in general they all follow a common pattern: perform a statistical sampling of the sample space, perform deterministic computation for each sample, and aggregate the results into one final. In order to decrease the error, a lot of samples need to be taken, which, on the other hand, increases the computation effort. Therefore, probabilistic analysis methods are highly desired. Two such exist, one is the *Path-based* approach and the other is the *Block-based* approach.

The Path-based approach constructs a set of nodes that are likely to form the critical paths. The delay for each of these paths is then computed and a statistical maximum is performed over these results to yield the worst case delay.

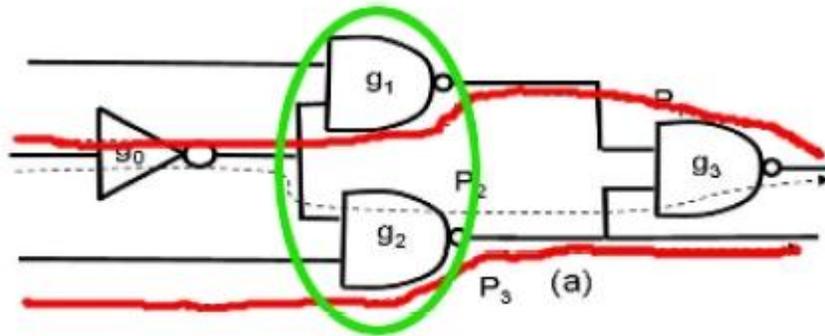


Fig. 3: Spatial Correlation [9]

However, there are several problems associated with this approach. Sometimes it is hard to construct a set of likely critical paths. Therefore, the worst case scenario can be unintentionally omitted. This significantly increases the number of computations needed. Therefore, it is desired to use the Block-based approach. There instead of constructing critical paths the whole graph is traversed node by node. For all fan-in edges to a node the associated delay is added to the arrival time at the source node (the node upstream of the current one). The final arrival time at the node is computed using a maximum operation over the previous results. This approach has the advantage of propagating only two times, the rise and the fall time.

A. Distribution Propagation Approaches

Analytical handling of distributions would be a good and computationally inexpensive approach. However, due to the nonlinearities and nonnormalities that are to occur in the dependencies and distributions used, it becomes a task close to impossible. There exist ways of handling this problem analytically, but assumptions are inevitable part of them. Therefore, another way is to discretize the distributions and normalize them so that the discrete values sum up to 1. In this way new set of probability mass functions is constructed, which closely approximates the real densities.

Now summation is an easy task to do. The result of such an operation is just a sum of shifted and scaled values of the delay. The shifts and the magnitude of the scaling is determined by the distribution of the arrival time.

$$z = x + y \tag{1}$$

$$f_z(t) = f_x(1)f_y(t-1) + f_x(2)f_y(t-2) + \dots + f_x(n)f_y(t-n) \tag{2}$$

$$f_z(t) = \sum_{i=-\infty}^{\infty} f_x(i)f_y(t-i) = f_x(t) * f_y(t) \tag{3}$$

Where x, y are the delays of two devices which are connected in series. z is the resulting delay. f_x, f_y, f_z are the delay functions of the device x, y and convolution of x & y function respectively.

Performing discrete time convolution is enough to compute the resulting delay from two devices in series. In order to compute the maximum delay between two paths (x and y) two cases have to be considered. Either one of the path y has a particular delay and path x has a delay less than or equal to the one of x or vice versa (equation 5). In order to obtain a density function this must be computed for all possible values of the delay t .

$$z = \max(x, y) \tag{4}$$

$$f_z(t) = F_x(\tau < t)f_y(t) + F_y(\tau < t)f_x(t) \tag{5}$$

B. Propagation of Delay Dependences

Expressing the delay of each device by a linear combination of independent random variables leads to the creation of the canonical form.

$$d_a = \mu_a + \sum_i^n a_i z_i + a_{n+1} R \tag{6}$$

where μ_a is the mean delay, z_i represents the n independent RVs used to express the spatially correlated device-parameter variations, R represents the residual independent variation, and coefficients a_i 's represent the sensitivity of delay to each of the RVs.

It will be convenient to express both the sum and the maximum of such canonical forms in a canonical form. This will preserve the same approach throughout the computation of the delay for the whole circuit. Expressing the sum (C) of two canonical delays (A and B) is almost a straightforward task. The only unintuitive part is the coefficient of residual independent variation c_{n+1} . As the two coefficients, of which it is composed, correspond to independent (orthogonal) RVs, the new coefficient must be equal to the combined magnitude of the two.

$$C = A + B \tag{7}$$

$$\mu_c = \mu_a + \mu_b \tag{8}$$

$$c_i = a_i + b_i \text{ for } 1 \leq i \leq n \tag{9}$$

$$c_{n+1} = \sqrt{a_{n+1}^2 + b_{n+1}^2} \tag{10}$$

Computation of the maximum is a significantly more involved. As the maximum operation is nonlinear, but the canonical form is, only an approximation of the maximum can be computed. The following is an algorithm proposed for solving this problem [10].

1) *Compute variances and covariance of A and B*

First of all the variance and covariance of the canonical forms A and B need to be calculated.

$$\sigma_a^2 = \sum_i^n a_i^2 \quad \sigma_b^2 = \sum_i^n b_i^2 \quad r = \sum_i^n a_i b_i \tag{11}$$

2) *Compute tightness probability $T_A = P(A > B)$ (the probability that arrival time A is larger than B) as presented in [11]*

$$T_A = \Phi\left(\frac{\mu_a - \mu_b}{\theta}\right) \tag{12}$$

$$\Phi(x) = \int_{-\infty}^x \phi(x) dx \tag{13}$$

$$\phi(x) = \frac{1}{\sqrt{2\pi}} \exp\left(-\frac{x^2}{2}\right) \tag{14}$$

$$\theta = \sqrt{\sigma_a^2 + \sigma_b^2 - 2r} \tag{15}$$

3) *Compute mean and variance of $C = \text{maximum}(A, B)$*

The new mean and variance of the new canonical form $C = \text{max}(A, B)$ have to be expressed.

$$\mu_c = \mu_a T_A + \mu_b (1 - T_A) + \theta \phi\left(\frac{\mu_a - \mu_b}{\theta}\right) \tag{16}$$

$$\sigma_c^2 = (\mu_a + \sigma_a^2) T_A + (\mu_b + \sigma_b^2) (1 - T_A) + (\mu_a + \mu_b) \theta \phi\left(\frac{\mu_a - \mu_b}{\theta}\right) - \mu_c^2 \tag{17}$$

4) *Compute sensitivity coefficient c_i using the tightness probability*

Then the weighting coefficients for the maximum.

$$c_i = a_i T_A + b_i (1 - T_A) \text{ for } 1 \leq i \leq n \tag{18}$$

5) *Compute sensitivity coefficient c_{n+1} of canonical form c_{approx} to make the variance of c_{approx} equal to the variance of $C = \text{maximum}(A, B)$.*

It was shown in [12] that a valid coefficient c_{n+1} always exists as the residue $(\sigma_c^2 - \sum_i^n c_i^2)$ is always greater than or equal to zero.

Unfortunately, this approach only computes an estimate, which by no means guarantees conservative results. Therefore, it is not suitable as it might underestimate the delay on some occasions. Another way of coping with the problem is the use of the following relation.

$$\max(\sum_i^n a_i, \sum_i^n b_i) \leq \sum_i^n \max(a_i, b_i) \tag{19}$$

Consider the very simple canonical form for two delays $d_a = \mu_a + a\Delta$ and $d_b = \mu_b + b\Delta X$, where μ_a and μ_b are the mean delays of d_a and d_b respectively, and a and b are their sensitivities to the common RV ΔX . In [13] an example of d_a and d_b is shown as a function of ΔX . The maximum of d_a and d_b is the upper envelope of these two intersecting lines, which is a nonlinear function and cannot be expressed exactly by the canonical form. Hence, to represent this maximum, a linear function of ΔX must be constructed that approximates this nonlinear function.

Note that c_{approx} will at times underestimate and at times overestimate the actual result. On the other hand, the method proposed in [5] constructs a bound $d_{c_{bound}} = \mu_{c_{bound}} + c_{bound}\Delta X$, where $\mu_{c_{bound}} = \max(\mu_a + \mu_b)$ and $c_{bound} = \max(a, b)$. As can be seen, the error of c_{approx} will be smaller than that of c_{bound} , where as c_{bound} , will be guaranteed conservative.

This result guarantees that if the higher of the coefficients corresponding to a particular independent RV is selected, then the result will be conservative. Therefore, a bounding canonical C_{bound} form of the delay can be constructed by selecting the higher mean and the largest coefficients.

$$\mu_c = \max(\mu_a, \mu_b) \tag{20}$$

$$C_{bound_i} = \max(a_i, b_i) \tag{21}$$

C. Nonlinear and Nonnormal Approaches

Because of the existence of nonnormal distributions and nonlinear dependencies, special canonical forms have been developed to cope with these challenges [11]. All of these are handled by numerical computations and tightness probabilities. In order to include the effect of nonlinear dependencies additional term is included in the form.

$$d_a = \mu_a + \sum_i^n a_i z_i + \sum_{i=1}^n \sum_{j=1}^n b_{ij} z_i z_j + a_{n+1} R \tag{22}$$

Where z_1 to z_n represent sources of normal variations, and z_{n+1} to z_{n+m} are RVs with nonnormal variations.

For the nonnormal distributions the same approach is used. The delay terms for both the normally distributed contributions and the nonnormal ones.

$$d_a = \mu_a + \sum_i^n a_i z_i + \sum_j^m a_{n+j} z_{n+j} + a_{n+m+1} R \tag{23}$$

Equations 22 and 23 can be aggregated in the following common form.

$$d_a = \mu_a + \sum_i^n a_i z_i + f(z_{n+1}, \dots, z_{n+m}) + a_{n+1} R \tag{24}$$

Where f represents the nonlinear function and is described as a table for computational purposes, and RVs z_{n+1} to z_{n+m} represent sources of normal variations with nonlinear dependences or nonnormal variations.

IV. ARCHITECTURAL SIMULATIONS

The vector-thread (VT) architectural paradigm describes a class of architectures that unify the vector and multithreaded execution models. In other words, VT architectures compactly encode large amounts of structured parallelism in a form that lets simple microarchitectures attain high-performance at low power by avoiding complex control and datapath structures, and by reducing activity on large wires. Moreover, VT exploits fine-grained parallelism locality more effectively than traditional superscalar, VLIW, or multithreaded architectures. In this paper, we feed our statistical model to the specified Scaled Vector Thread Architecture as well as Graphic Processing Unit (GPU) GeForce 8800 GTX architecture with some parameters shown in Table 1 which includes a MIPS-RISC control processor or *Single instruction, multiple data* (SIMD) processor, 32 Kbytes of cache, and a four-lane vector-thread unit or multiprocessor that can execute 16 operations per cycle and support up to 128 simultaneously active virtual processor threads.

Table 1. Processor parameters

Clock Rate	Vector Thread Units/ # of Multiprocessors	# of Clusters/# of Processors	# of Registers (per cluster)/# of Registers (per processor)
400 MHz	4	16	8192

Our SSTA delay model has been implemented in C/C++ and tested by benchmark circuits. It is noted that before testing all benchmark circuits are re-mapped into a library which has gates of *not*, *nand2*, *nand3*, *nor2*, *nor3* and *xor/xnor*. Table 2 summarizes the performance comparison and runtime estimations. We ran 60 large IWLS, ITC and ISCAS benchmark designs to compute the per-circuit speed of our tightness probability based SSTA engine implemented on vector thread architecture. This tightness probability based analysis was performed with 4 vector thread units. Columns 1 list the name of the circuit. Columns 2, 3 and 4 list the number of primary inputs, primary outputs and gates in the circuit. Columns 5 and 7 list the GPU and CPU runtime, respectively. The time taken to transfer data between the CPU and GPU was accounted for in the GPU runtimes listed. In particular, the data transferred from the CPU to the GPU is the arrival times at each primary input, and the μ and σ information for all pin-to-output delays of all gates. Column 8 reports the speedup obtained by using a single GPU card. Our results indicate that our approach can obtain an average speed up of about 282 times as compared to a serial CPU implementation and is faster than GeForce 8800 GTX.

Table 2: SSTA results using tightness probability

Circuit	# Inputs	#Outputs	#Gates	Single GPU runtimes (s)	Scaled VT Processor runtimes (s)	CPU runtimes	Speedup For Single GPU	Speedup For Scaled VT
b14	276	299	9496	4.734	4.201	1303.63	275.394x	310.314x
b15_1	483	518	13781	6.952	6.521	1891.884	272.116	290.121x
b17	1450	1511	41174	20.736	19.311	5652.45	272.589x	292.706x
b18	3305	3293	6599	6.326	5.977	905.924	143.197	151.568x
b21	521	512	20977	10.311	10.101	2879.765	279.298x	285.097x
b22_1	734	725	25253	12.519	12.210	3466.783	276.913x	283.929x
s832	23	24	587	0.298	0.248	80.585	270.376x	324.939x
s8381	66	33	562	0.295	0.278	77.153	261.341x	277.528x
s1238	32	32	857	0.432	0.419	117.651	272.248x	280.789x
s1196	32	32	762	0.388	0.359	104.609	269.796x	291.389x
s1423	91	79	949	0.521	0.497	130.281	249.858x	262.134x
s1494	14	25	1033	0.508	0.489	141.812	279.414x	290.004x
s1488	14	25	1016	0.5	0.481	139.479	279.187x	289.977x
s5378	199	213	2033	1.16	0.979	279.094	240.58x	285.080x
s92341	247	250	3642	1.949	1.766	499.981	256.57x	283.114x
s13207	700	790	5849	3.512	3.271	802.963	228.633x	245.479x
s15850	611	684	6421	3.675	3.347	881.488	239.855x	263.366x
s35932	1763	2048	19898	11.318	11.008	2731.638	241.349x	248.150x
s38584	1464	1730	21051	11.544	11.104	2889.924	250.335x	260.259x
s38417	1664	1742	18451	10.341	9.97	2532.991	244.958x	254.061x
C1355	41	32	715	0.366	0.309	98.157	268.363x	317.660x
C1908	33	25	902	0.446	0.393	123.828	277.46x	315.083x
C2670	233	140	1411	0.797	0.689	193.705	242.906x	281.139x
C3540	50	22	1755	0.842	0.803	240.93	286.1x	300.037x
C432	36	7	317	0.155	0.139	43.518	280.605x	313.079x
C499	41	32	675	0.347	0.317	92.665	267x	292.318x
C5315	178	123	2867	1.461	1.379	393.588	269.323x	285.415x
C6288	32	32	2494	1.197	1.139	342.381	285.927x	300.597x
C7552	207	108	3835	1.899	1.810	526.477	277.214x	290.871x
C880	60	26	486	0.253	0.224	66.719	263.923x	297.852x
Avg							258.994x	282.1352x

V. CONCLUSION

In this paper, we have presented the implementation of tightness probability based SSTA on Vector Thread Architecture as well as a GPU GeForce 8800 GTX architecture. Tightness probability based SSTA is computationally expensive, but crucial in design timing closure since it enables an accurate analysis of the delay variations. Our implementation computes multiple timing analysis evaluations for a single gate in parallel. Threads which execute in parallel do not have data or control dependencies on each other. All

threads execute identical instructions, but on different data. Our results indicate that our approach can provide 282 times speedup when compared to a conventional CPU implementation.

REFERENCES

- [1] T. Kirkpatrick and N. Clark, "PERT as an aid to logic design," *IBM J.Res. Develop.*, vol. 10, no. 2, pp. 135–141, Mar. 1966.
- [2] H. Jyu, S. Malik, S. Devdas, and K. Keutzer, "Statistical timing analysis of combinational logic circuits," *IEEE Trans. Very Large Scale Integr.(VLSI) Syst.*, vol. 1, no. 2, pp. 126–137, Jun. 1993.
- [3] R. Brashear, N. Menezes, C. Oh, L. Pillage, and M. Mercer, "Predicting circuit performance using circuit-level statistical timing analysis," in *Proc. DATE*, Mar. 1994, pp. 332–337.
- [4] C. Visweswariah, K. Ravindran, and K. Kalafala, "First-order parameterized block-based statistical timing analysis," *TAU'04*, Feb 2004.
- [5] A. Agarwal, D. Blaauw, and V. Zolotov, "Statistical timing analysis for intra-die process variations with spatial correlations," *ComputerAided Design, 2003 International Conference on. ICCAD-2003*, pp. 900 – 907, Nov 2003.
- [6] H. Chang and S. S. Sapatnekar, "Statistical timing analysis considering spatial correlations using a single pert-like traversal," *ICCAD '03*, pp. 621–625, Nov 2003.
- [7] A. Agarwal, V. Zolotov, and D. Blaauw, "Statistical timing analysis using bounds and selective enumeration," *IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems*, vol. 22, no. 9, pp. 1243 –1260, Sept 2003.
- [8] A. Devgan and C. Kashyap, "Block-based static timing analysis with uncertainty," *ICCAD '03*, pp. 607–614, Nov 2003.
- [9] D. Blaauw, K. Chopra, A. Srivastava, and L. Scheffer, "Statistical timing analysis: From basic principles to state of the art.," *IEEE Transactions on ComputerAided Design of Integrated Circuits and Systems*, vol. 27, no. 4, pp. 589-607, April 2008.
- [10] H. Chang and S. Sapatnekar, "Statistical timing analysis considering spatial correlations using a single pert-like traversal," in *Proc. ICCADO3*, 2003.
- [11] Charles E. Clark. The greatest of a finite set of random variables. *Operations Research*, 1961.
- [12] D. Sinha, N. Shenoy, and H. Zhou, "Statistical gate sizing for timing yield optimization," in *Proc. ICCAD*, 2005, pp. 1037–1041.
- [13] H. Chang, V. Zolotov, S. Narayan, C. Visweswariah, Parameterized block-based statistical timing analysis with non-Gaussian parameters, nonlinear delay functions, in: Proceedings of the Design Automation Conference, June 2005, pp. 71–76.

AUTHORS

First Author – Abu M Baker, Ph.D. Candidate at the University of Nevada, Currently working at Microsoft Corporation and bakera2@unlv.nevada.edu.

Second Author – Dr. Yingtao Jiang, Associate Professor in the Department of Electrical and Computer Engineering at the University of Nevada, Las Vegas, yingtao.jiang@unlv.edu

Correspondence Author – Abu M Baker, bakera2@unlv.nevada.edu, 15975 NE 84th Way, Redmond, WA-98052, +1-281-222-8936.

Changes of Serum Lipids and Proteins during Probiotics Feeding and Its Exposure

JGS Ranasinghe*, SSP Silva**, N. Herath**

*Department of Biochemistry, Faculty of Medicine, University of Peradeniya, Sri Lanka.

** Veterinary Research Institute, Gannoruwa, Peradeniya, Sri Lanka

** Postgraduate Institute of Science, University of Peradeniya, Sri Lanka

Abstract- The aim of this study was to investigate the effect of *L. bulgaricus* and *S. thermophilus* genera on serum cholesterol and triglyceride lowering potential of probiotic in guinea pigs and the changing pattern of above serum parameters after termination of the treatment. The effects of oral supplementation of probiotics to animals have been carried out in many occasions but their outcome after the termination of treatment is lacking. Twenty four eight weeks old guinea pigs were selected randomly divided into two groups (n=12) the test and the control, were reared in six cages (four per cage). Both groups received control mash diet (based on corn and soybean) during the experiment, to meet the nutrient requirements. A 5 ml of aqueous medium culture of *L. bulgaricus* and *S. thermophilus* with 1.76×10^9 and 1.5×10^8 colony forming units/ml, respectively were given to test animals for fourteen days and the control animals were given the same volume of distilled water. Blood samples were withdrawn by heart puncture at 14 and 21 days after the initiation of probiotic supplementation and serum total cholesterol, triglycerides, HDL cholesterol and total protein levels were assayed in both groups. The total cholesterol level of the test group was significantly lower ($p < 0.01$) than the control group after 2 weeks and it increased slightly after the termination of probiotic supplementation. HDL cholesterol level was significantly higher in test animals after 3 weeks ($p < 0.05$). There were no significant differences ($p > 0.05$) in serum triglycerides, total protein, weight gain, body temperature, food and water intakes and body temperature between the control and treated groups. It was concluded that live probiotics significantly reduced the serum total cholesterol during the treatment period and increased the HDL cholesterol significantly following termination of the treatment.

It is suggested that the feeding of probiotic does not affect food intake and bring up the metabolic changes during the treatment period and the changes reversibly return normal following termination of treatment but there is significant persisting effect for serum HDL cholesterol. However further studies are required to gain insights into the understanding the treatment of probiotics with time interval in order to economize the beneficial effects.

Index Terms- Probiotics, Serum cholesterol, Serum HDL, Serum triglycerides *L. bulgaricus* and *S. thermophilus*

I. INTRODUCTION

Probiotics are live microbial supplements when administered in adequate amounts, confer a beneficial effect on the health

of the host by improving its intestinal microbial balance (FAO/WHO, 2001; Fuller, 1989). The control of serum cholesterol and triglyceride levels by using probiotics has been well recognized (Lin et al. 1989; Taranto et al. 1998; Kalavathy et al., 2006). The use of probiotics has only acquired scientific recognition in recent years although their applications as functional foods have been well-established throughout generations. Among the numerous intestinal microbes, selected as probiotics, include species of the genera *Lactobacillus*, *Bifidobacterium*, and *S. thermophilus* with many health beneficial effects (Harish and Varghese, 2006). In the interest of their promising effects on health and well being, probiotics has become increasingly recognized as supplements for human consumption.

It is known that elevated levels of total blood cholesterol or other blood lipids such as triglycerides are the main component could be considered as risk factors for developing many health problems of human including coronary heart diseases (Lim et al., 2004). People affected with hypercholesterolemia may avert the use of cholesterol-lowering drugs, because of the expense of drug therapy and the unwanted side effects.

Studies examining the efficacy of hypocholesteremic effect of probiotics often do not sufficiently address the optimum dose, frequency, duration of treatment and the effect of post exposure. Many studies have used hamsters (Lin et al., 2004), guinea pigs (Madsen et al., 2007) and pigs (Patterson et al., 2008) as models due to their similarities with humans in terms of cholesterol and bile acid metabolism, plasma lipoprotein distribution, and regulation of hepatic cholesterol enzymes (Fernandez et al., 2000). Although probiotics have been delivered in the range of 10^7 to 10^{11} CFU/day in humans (Naruszewicz et al., 2002) and 10^7 to 10^9 CFU/day in animals (Lubbadeh et al., 1999), some probiotics have been shown to be efficacious at lower levels, while some require a substantially higher amount to exert a hypocholesteremic effect.

Higher dosage may not necessarily translate to better effects on cholesterol, as compared to lower dosage. Strains of probiotics have also been found to exhibit antibiotic resistance and have raised concerns about horizontal resistant gene transfer to the host and the pool of gastrointestinal pathogenic microflora (Huys et al., 2006). Considering these facts, the safety verification of probiotics with respect to the effect of post exposure has to be studied extensively.

Although the hypocholesteremic potential of probiotics has been widely studied, an accurate dosage of administration and efficacy after termination of the treatment yet to be established. The objectives of this study were to determine the effect of probiotic containing *L. bulgaricus* and *S. thermophilus*

bacteria on serum lipid profiles, total protein concentration, weight gain of guinea pigs and their changing pattern of above parameters after termination the treatment.

II. MATERIALS AND METHODS

The experiment was conducted at the Faculty of Medicine, University of Peradeniya, during February to June 2011.

2.1 Subjects

A total of twenty four, eight weeks old female guinea pigs (*Cavia porcellus*) (350 g±10), were obtained from Medical Research Institute, Colombo with a good reputation of producing disease free laboratory animals. They were randomly divided into two groups (Test and control n=12). Each group had six replicate pens were randomized with respect to the treatment. They were reared under sanitary conditions and fed for two weeks on rations based on corn and soybean formulated to meet the nutrient requirement of guinea pigs (National Research council,1994). Feed and water were provided *ad libitum*. Ethical approval for the study was obtained from the local authority and the animal experiment was carried out according to the International Guiding Principles for Biomedical Research Involving Animals (Council for the International Organizations of Medical Sciences 1985).

2.2 Probiotic culture for colony counting

L. bulgaricus and *S. thermophilus*, the two probiotic bacteria used in this study were obtained from MILCO Private Ltd (YO-MIXTM621 bulk freeze dried yoghurt culture manufactured in Germany. "Pour plate method" was used to measure the number of colony forming units in the initial highly concentrated culture, Pour plates were prepared using MRS (de Man, Rogosa, Sharpe) and NRC (Neutral Red Chalk) agar and serial dilutions of organisms from 10^{-1} to 10^{-9} were used. Plates were incubated at 42°C for 24 hours. *Lactobacillus* colonies appeared as white patches in MRS agar and *Streptococcus* colonies appeared as reddish pink patches in NRC agar. The number of colonies in each plate was counted and the number of colony forming units in the initial probiotic culture was calculated.

2.3 Treatment

Following an adaptation period of one month, 5 ml of probiotic solution contained *L.bulgaricus* and *S.thermophilus* with 1.76×10^9 and 1.5×10^8 colony forming units / ml respectively was given to each test animal orally for two weeks. Animals in the control group were given the same volume of distilled water. The body weights and body temperatures were recorded daily throughout the experimental period.

2.4 Biochemical parameters

After termination of probiotic supplementation at 14 days, three milliliters of blood was collected from each animal through heart puncture following anesthetizing animals with chloroform. They were kept fasting for 12 hours before the collection of blood. Samples were centrifuged for 10 min at 2000 rpm, sera was separated and were stored at -20°C until assayed. Second

bleeding was carried out one week after termination of the treatment as described above and serum was stored.

2.5 Chemical analysis

Serum total cholesterol, triglyceride and HDL cholesterol levels were measured using commercial diagnostic kits (Randox Laboratories Ltd, Ardmore, Diamond Road, Crumin, co. Antrim, United Kingdom). The total protein in serum was estimated with commercial kits from Biolabo Reagents, Maizy, France.

2.6 Data Analysis

Data were analyzed using the statistical package GenStat Discovery Edition 5 (VSN International Ltd., Hemel Hempstead, U.K.). Statistically significant differences between group means were determined by analysis of variance (ANOVA). Mean values were considered significantly different at $P < 0.05$.

III. RESULTS

3.1 Total cholesterol concentration

Table 1 gives the mean total cholesterol concentration in serum samples at 2 weeks and 3 weeks after probiotic feeding were T₁,T₂ and C₁ and C₂ for control respectively. T₁ group had a significantly lower serum total cholesterol level (about 30%) than the control group (C₁) ($p < 0.05$). However, in T₂ there wasn't a significant difference between the control and the test. However, one week after termination of probiotic supplementation, the level of total cholesterol in control (C₂) guinea pigs was quite close to that of treatment group (T₂).

3.2 Serum triglyceride concentration

The mean triglyceride concentration in both T₁ and T₂ were lower than the control groups although the changes were not statistically significant ($p > 0.05$) (Table 1). Eventhough, there is a tendency to increase the mean triglyceride levels with aging, there was a non- significant decline ($p > 0.05$) with probiotic feeding. At 2 weeks (T₁) it was a significantly lower than the control group (C₁), whereas there was no significant difference ($p > 0.05$) among C₂ and T₂.

3.3 DL Cholesterol concentration in serum

The mean HDL cholesterol levels in test group (T₁) and control group (C₁) were quite closer to each other two weeks after initial probiotic introduction. However, HDL cholesterol level of T₂ test group animals one week after termination of probiotic supplementation (T₂) was significantly higher than the control group C₂ ($p < 0.05$).

3.4 Total protein concentration in serum

The total protein concentrations in serum after two weeks of probiotic feeding and one week after termination of probiotic feeding are shown in Table 1. Probiotics feeding had not altered the serum concentration of protein to a significant level at two weeks after probiotic treatment. However after termination of live micro organisms feeding, total protein level of test group (T₂) was appreciably higher than control group (C₂) even though the changes were not statistically significant.

3.5 Feed and water intake, body temperature and body weight gain Probiotics did not have a significant influence on either the weight gain or the body temperatures of guinea pigs. Food intake, water intake were also not significantly affected by probiotic supplementation.

IV. DISCUSSION

The test group (T₁) had a significantly low level of serum total cholesterol compared to the control group (C₁) at 2 weeks of probiotic supplementation. However, one week after termination of probiotic supplementation, there wasn't a significant difference between the control (C₂) and the test (T₂). Cholesterol lowering effect of probiotic bacteria is in agreement with the studies conducted on bottle fed babies (Harrison and Peat, 1975), (Grunewald, 1982), in pigs (Gilliland, *et al*, 1985), rats (Pulusani and Rao, 1983) and hens (Tortuero and Brenes, 1975). However reason for the cholesterol lowering action of these bacteria still remains to be clarified. Mechanisms for the cholesterol lowering effect of *L.acidophilus* group (Gilliland, *et al*, 1985, Rašić *et al* 1992, Noh *et al*, 1997) and *Bifidobacteria* (Tahri *et al*, 1992) had been discussed. The co-precipitation with deconjugated bile salts in an acidic environment by interfering absorption from the intestinal lumen (Klaver and Van-der-Meer, 1993, De-Rodas *et al*, 1996) is also considered. Thus, increased excretion of bile acids should result in lowered serum concentrations, which in turn would decrease the enterohepatic circulation.

According to the results of this study, decrease in serum cholesterol was limited to the time of probiotic bacteria feeding. The increase level of total cholesterol after termination of the treatment could be explained as increased *de novo* synthesis of cholesterol in liver in order to replace the excreted bile acids. This could be due to inability of the particular strain of probiotic bacteria to attach permanently to the gut wall and hence continuous supply might be necessary to exert the effects.

There was no significant difference in serum triglyceride concentrations between test and control groups. But the probiotic feeding has an influence on lipid metabolism of animals to decrease serum triglyceride. The feeding period of two weeks may not be sufficient to give a significant change of serum triglyceride concentration. Sometimes *L. bulgaricus* and *S. thermophilus* may not have a direct influence on serum triglyceride, but effect may be indirectly through cholesterol metabolism.

HDL cholesterol concentration of treatment (T₁) and control groups (C₁) were not significantly different. But, 3 weeks after initial probiotic feeding (T₂) HDL cholesterol concentration was significantly higher than the control group (C₂). This is one of the key findings of this study. This result is in agreement with certain studies conducted on rats and humans (Usman and Hosono, 2000; Keim, *et al.*, 1981). HDL is also known as friendly cholesterol, which has been increased considerably and hence, will be an important contributor for reducing the risk of heart disease. These animals also share an almost similar digestive anatomy and physiology, nutrient requirements, bioavailability and absorption, and metabolic processes with humans, making them useful experimental models for research applications (Patterson *et al.*, 2008). Hence, the positive

hypocholesterolemic effects shown in animal studies suggest a similar potential in humans.

Since the probiotic feeding did not influence the feed intake of the subjects, there had no effect on serum protein and this finding is in agreement with work reported earlier (Fernandez, 2001).

Probiotic supplementation had no influence on feed and water intake, body temperature and body weight gain of the guinea pigs. This indicates that for changes of serum cholesterol levels are not related to their feed intake and it is exclusively for the probiotic supplementation. This fact can be further confirmed by normal weight gain of the animals in the treated group.

V. CONCLUSION

Live probiotics significantly reduced the serum total cholesterol and increased the HDL cholesterol of guinea pigs during the treatment period. But there was no influence on serum protein, body weight gain, feed and water intake with two weeks treatment period. To the best of our knowledge, this is the first study which the effects of probiotic feeding is compared after termination of treatment. The results of this study suggest that the effect of probiotic is independent from the food intake and the live organisms bring up the metabolic changes only during the treatment period and all the changes reversibly return normal following termination of treatment. However further studies are required to gain insights into the understanding the treatment of probiotics with time interval in order to achieve the maximum beneficial effect with minimum cumbersome.

ACKNOWLEDGMENT

The authors wish to express their appreciation to the Chairman, (MILCO Private Ltd) for providing probiotics for this study. Authors gratefully acknowledge the support of Mr. Wijeratena Banda YM & Nawaratena JMNS of Department of Biochemistry, Faculty of Medicine, Peradeniya.

REFERENCES

- [1] B.Z., De-Rodas, S.E. Gilliland and C. Maxwell, 1996. Hypocholesterolemic action of *Lactobacillus acidophilus* ATCC 43121 and calcium in swine with hypocholesterolemia induced by diet. *J Dairy. Sci.*, 79: 2121–2128.
- [2] FAO/WHO, 2001. Evaluation of health and nutritional properties of powder milk and live lactic acid bacteria. Food and Agriculture Organization of the United Nations and World Health Organization Expert Consultation Report, Cordoba, Argentina, pp. 1-34.
- [3] M.L. Fernandez, 2001. Guinea pigs as models for cholesterol and lipoprotein metabolism. *J. of Nutr.*, 131(1):10-20.
- [4] R. Fuller, 1989. Probiotics in man and animals. *J. Appl. Microbiol.* 66:365-78.
- [5] S.E. Gilliland, C.R. Nelson, C. Maxwell, 1985. Assimilation of cholesterol by *Lactobacillus acidophilus*. *Appl. Environ. Microbiol.*, 49(2):377-381.
- [6] P.H.E. Groot, W.A.H.J. Van Stiphout, X.H. Krauss, H. Jansen, A. Van Tol., E. Van Ramshort, 1991. Postprandial lipoprotein metabolism in normolipidemic men with and without coronary artery disease. *Arterioscl. Throm. Vas.*, 11: 653-662.
- [7] K.K. Grunewald, 1982. Serum cholesterol levels in rats fed skim milk fermented by *Lactobacillus acidophilus*. *J. of Food. Sci.*, 47:2078–2079.

- [8] K. Harish, T.Varghese, 2006. Probiotics in humans evidence based review. 4(4):3 – 1Harrison, V.C., G. Peat, 1975. Serum cholesterol and bowel flora in the newborn. *Am. J.Clin. Nutr.*, 28:1351–1355.
- [9] J.E. Hokanson, M.A.Austin, 1996. Plasma triglyceride level is a risk factor for cardiovascular disease independent of high-density lipoprotein cholesterol level: a meta-analysis of population-based prospective studies. *J. Cardiovasc. Risk.*, 3(2): 213-219.
- [10] G D. Huys, Haene K, J.Swings, 2006. Genetic Basis of Tetracycline and Minocycline Resistance in Potentially Probiotic *Lactobacillus plantarum* Strain CCUG 43738. *Antimicrob. Agents Chemother.* 50:1550–1551.
- [11] Kalavathy, Abdullah, S. Jalaludin, M.Wong, Y.W. Ho, 2006. Effects of *Lactobacillus* feed supplementation on cholesterol, fat content and fatty acid composition of the liver, muscle and carcass of broiler chickens. *Animal Research* 55: 77-82.
- [12] N. L.Keim, J.A.Marlett, C.H.Amundsopn, 1981. The cholesterolemic effect of skim milk in young men consuming controlled diets. *Nut Res.*,1:429–442.
- [13] F.A.M.Klaver, R.Van-der-Meer, 1993. The assumed assimilation of cholesterol by *Lactobacilli* and *Bifidobacterium bifidum* is due to their bile salt-deconjugating activity. *Appl. Environ. Microbiol.*, 59: 1120–1124.
- [14] G.N. Levine, J.F. Keaney, M.D.Vita, 1995. Cholesterol reduction in cardiovascular disease-clinical benefits and possible mechanisms. *New. Engl. J. Med.*, 332: 512-521.
- [15] H.J.Lim, S.Kim, W. Lee, 2004. Isolation of cholesterol-lowering lactic acid bacteria from human intestine for probiotic use. *J. of Vet. Sci.*, 5: 391-395.
- [16] Lin, S.Y, J.W.Ayres, W. Winkler, W.E. Sandine, 1989. *Lactobacillus* effects on cholesterol: in vitro and in vivo results. *The Journal of dairy research* 72: 2885-2889.
- [17] Lin Y-G, G.W.Meijer, .M.A.Vermeer, E.A.Trautwein, 2004. Soy Protein Enhances the Cholesterol-Lowering Effect of Plant Sterol Esters in Cholesterol-Fed Hamsters. *J. Nutr.* 134:143–148.
- [18] W.Lubbadeh , M.S.Y.Haddadin, M.A. Al-Tamimi, R.K.Robinson, 1999. Effect on the Cholesterol Content of Fresh Lamb of supplementing the Feed of Awassi Ewes and Lambs with *Lactobacillus acidophilus*. *Meat Sci.* 52:381–385.
- [19] C.S. Madsen, E. Janovitz , R. Zhang , V.Nguyen-Tran, C.S Ryan , Yin X-H, H. Monshizadegan , M.Chang , C. D’Arienzo , S. Scheer , R. Setters , D.Search, X.Chen , Zhuang S-B, L.Kunselman , A.Peters , T.Harrity , A. Apedo , C.Huang , C.A.Cuff , M.C.Kowala , M.A.Blanar , Sun C-Q, J.A.Robl, P.D.Stein 2007. The Guinea Pig as a Preclinical Model for Demonstrating the Efficacy and Safety of Statins. *J. Pharmacol. Exp. Ther.* 324:576–586.
- [20] K.K. Namboodiri, P.P.Green, E.B. Kaplan, J.A. Morrison, G.A.Chase., R.C.Elston, A.R. Owen, B.M.Rifkind, C.J.Glueck, H.A.Tyroler, 1984. The collaborative lipid research clinics program family study. iv. Familial associations of plasma lipids and lipoproteins. *Am. J. Epidemiol.* 119 (6) : 975-96.
- [21] M. Naruszewicz, M-L. Johansson, D. Zapolska-Downar, H. Bukowska, 2002. Effect of *Lactobacillus plantarum* 299v on Cardiovascular Disease Risk Factors in Smokers. *Am. J. Clin. Nutr.* 76:1249–1255.
- [22] NATIONAL RESEARCH COUNCIL,1994. Nutrient Requirements of guinea pig. 9th. Ed., National Academy Press, Washington DC.
- [23] D.O. Noh, S.H. Kim, S.E. Gilliland, 1997. Incorporation of cholesterol into the cell membrane of *Lactobacillus acidophilus* ATCC 43121. *J Dairy Sci.* 80: 3107–3113.
- [24] J.K. Patterson, X.G. Lei, D.D. Miller, 2008. The Pig as an Experimental Model for Elucidating the Mechanisms Governing Dietary Influence on Mineral Absorption. *Exp. Biol. Med.* 233:651–664.
- [25] G. Patsch, T. Miesenbock, V. Hopferwieser, E. Muhlberger, J.K. Knapp, A.M.Dunn, 1992. Relation of triglyceride metabolism and coronary artery disease. *Arteriosclerosis Thrombosis Vascular Biology* 12: 1336–1345.
- [26] S.R. Pulusani, D.R. Rao, 1983. Whole body, liver and plasma cholesterol levels in rats fed thermophilus, bulgaricus and acidophilus milks. *J. Food. Sci.* 48:280–281.
- [27] D.I.A. Pereira, G.R. Gibson, 2002. Effects of Consumption of Probiotics and Prebiotics on Serum Lipid Levels in Humans. *Crit.Rev. Biochem.* 37(4):259-81.
- [28] J.L.Ra’si’c , Vuj’ci’c IF, ~ Skrinjar M, Vuli’c M, 1992. Assimilation of cholesterol some cultures of lactic acid bacteria and bifidobacteria. *Biotechnol. Lett.* 1992;14: 39–44.
- [29] J.E. Rossouw, E. Burger, P.Van der Vyver, J.J.Ferreira, 1981.The effect of skim milk, yogurt and full cream on human serum lipids. *Am. J. Clin. Nutr.* 34:351–356.
- [30] M.P. St-Onge, E.R. Farnworth, P.J.H.Jones, 2000. Consumption of fermented and non fermented dairy products, effects on cholesterol concentrations and metabolism .*Am. J. Clin. Nut.r.* 71: 674–81.
- [31] K. Tahri, J.P. Grill, F.Schneider, 1996. *Bifidobacteria* strain behaviour toward cholesterol, coprecipitation with bile salts and assimilation. *Curr Microbiol* 33: 187– 189.
- [32] M.P. Taranto, M. Medici, G. G.R. Perdigon, Ruiz Holgado, Ap And G.F.Valdez, 1998. Evidence for hypocholesterolemic effect of *Lactobacillus reuteri* in hypercholesterolemic mice. *J Dairy Sci.* 81: 2336- 2340.
- [33] G.R.J.Taylor, C.M.Williams, 1998. Effects of probiotics and prebiotics on blood lipids. *Brit. J. Nutr.* 80(4): 225–230.
- [34] F. Tortuero, A. Brenes, 1975.The influence of intestinal (ceca) flora on serum and egg yolk cholesterol levels in laying hens. *Poult. Sci.* 54:1935–1938.
- [35] I. Usman, A. Hosono, 2000. Effect of Administration of *Lactobacillus gasseri* on Serum Lipids and Fecal Steroids in Hypercholesterolemic Rats. *J. of Dairy Sci.* 83 (8) : 1705-1711.

Table 1- Effects of feeding probiotics on serum cholesterol ,triglyceride, HDL cholesterol, protein (mg/dl) in guinea pigs

	Cholesterol		Triglyceride		HDL cholesterol		Protein	
	2wk	3 wk	2 wk	3 wk	2 wk	3 wk	2 wk	3 wk
Control	52.4	51.2	57.6	77.1	5.05	5.09	5.38	5.52
Test	36.8	50.8	34.2	49.9	7.96	8.85	5.43	6.01
Standard error	4.12	8.85	14.65	14.06	1.44	1.31	0.32	0.27
F value	0.004	0.486	0.146	0.256	0.547	0.002	0.874	0.12

AUTHORS

First Author – JGS Ranasinghe (BVSC, Ph.D., Professor in Biochemistry), Department of Biochemistry, Faculty of Medicine, University of Peradeniya, Sri Lanka., JGS Ranasinghe
Email addresses: shirani05@yahoo.com, Tel- 94 81 2240240,
Fax 94 81 2389106

Second Author – SSP Silva (BVSc, PhD), Veterinary Research Institute, Gannoruwa, Peradeniya, Sri Lanka,
E mail address- susil_vri@yahoo.com

Third Author – N. Herath (BSc, MSc), E Mail address
(Naddeka@yahoo.com), Postgraduate Institute of Science,
University of Peradeniya, Sri Lanka

Correspondence Author – JGS Ranasinghe (BVSC, Ph.D., Professor in Biochemistry), Department of Biochemistry, Faculty of Medicine, University of Peradeniya, Sri Lanka.
Veterinary Research Institute, Gannoruwa, Peradeniya, Sri Lanka

Exploring Potentials of Marine Microbiology and Biotechnology in Developing Countries

Olumide Adedokun Odeyemi

Marine Science program (Marine microbiology and biotechnology), School of Environmental and Natural Resources, Faculty of Science and Technology, National University of Malaysia, UKM Bangi, Malaysia

Abstract- Ocean occupies 70 % of the earth's land mass. Forty percent of the world inhabitants are living along the coastline of the oceans. Marine ecosystems provide more potential biodiversity for novel products and services than any other ecosystem in the world. Marine lives ranging from bacteria to higher forms of lives are sources of micro and macro molecules required for advancement of biotechnology. Despite the vast socio economic potentials of oceans, yet developing countries are yet to fully tap the potentials. Hence, marine microbiology which is the study of microorganisms from marine environment and marine biotechnology defined as application of marine micro and macro organisms either in whole or part for production of various industrial, medical, environmental and agricultural products and services for human utilization serve as key tools in exploring oceanic potentials. This paper aim to highlights potentials of marine microbiology and biotechnology as key tools in tapping vast marine biodiversity and challenging factors to utilize the tools like other developed countries of the world.

Index Terms- marine microbial diversity, marine microbiology, biotechnology.

I. INTRODUCTION

Seventy percent of the earth is occupied by oceans and thereby makes the earth "blue planet" (Bowler et al., 2009; Glöckner and Joint 2010). Moreso, the ocean as been considered as the mother of all forms of lives (Bhatnagar and Kim, 2010). Forty percent of the world inhabitants are living along the coastline of the oceans. Marine microorganisms have been associated with various processes in the ocean with 50% of global primary production occurring in the ocean and carried out by marine bacterial metabolisms of chemical elements. One millilitre of sea water contains more than 10^5 bacterial cells hence the global oceans invariably contains 3.6×10^{29} cells making a vast bio resource centre (Sogin et al., 2006). Marine microbes are drivers of most biogeochemical cycles occurring in the sea. A significant question to ask is that with marine biodiversity, is there any possibility of exploring both the social and economic potentials of these oceanic forms of life for the benefits of mankind?. Absolutely yes as marine microbiology and biotechnology proffer answers to the question. The last few decades have been experiencing global explosion by various researchers of the world in understanding isolations, functions and utilization of bacteria, fungi, protozoans and viruses from the ocean. Microbiology is the study of microorganisms that are too small to be seen with naked eyes. Although developed over few centuries ago, yet more and more aspect of this field of scientific

endeavor keeps emerging. Among these newly emerging aspects of microbiology are marine microbiology and marine biotechnology. The former is defined as the study of microorganisms which could be bacteria, viruses, fungi and from ocean, marine sediment, hydrothermal vents, surface of marine macro-organisms like sponges, sea foods and other higher forms of life (Aristides Yahanas 2003). Marine biotechnology is also an emerging field of biotechnology. Biotechnology defined as either the application of living organism (whole or part) or a process with the sole aim of developing products and services for the benefit of mankind (Thakur and Thakur 2005, Odeyemi 2012). Biotechnology and its applications have existed before now. Although not known as biotechnology then but its applications in fermentation of foods in China, brewing of beer and baking of bread in Egypt has been in practice ever before civilization that revolutionalized technology globally. However, a major breakthrough occurred as a result of production of the first recombinant DNA (deoxyribonucleic acid) aside deciphering the structure of DNA in the early 1960s. Application of biotechnology cuts across pharmaceuticals drugs (pharmaceutical biotechnology), agriculture (agricultural biotechnology), medical (medical or health biotechnology), industry (industrial biotechnology) and environment (environmental biotechnology) to conservation of food and related organic wastes. Global revolution in biotechnology occurs due to various scientific discoveries in biological sciences with its huge basic and applied research impacts. Biotechnology itself is a multidisciplinary science involving fields such as molecular biology, microbiology, genetics, immunology, chemistry, biochemistry, tissue and cell culture (Tonukari, 2004). Developing nations of the world have been said to be significantly benefiting from biotechnological advancement (Tonukari, 2004) with the advent of various collaboration with developed countries both in capacity development and resources for research and development. Inclusive of these huge benefits by developing countries is patenting and introduction of biotechnology education into higher education curriculum although some countries are still lagging behind in this. Marine biotechnology could be defined as application of marine micro and macro organisms either in whole or part for production of various industrial, medical, environmental and agricultural products and services for human utilization serve as key tools in exploring oceanic potentials. Historically, it started in the United States of America and Australia in the late 1970's and 1980's. However, in 1989, Japan joined this wagon as a result of interest and investment from the public sector. The Japanese government therefore initiated and created over 15 companies and two Marine Biotechnology Institutes. This led to, organization of an

International Marine Biotechnology Conference (IMBC'89). Japanese Biotechnology Society was founded while and Journal of Marine Biotechnology was established. Early 1990's, Journal of Molecular Marine Biology and Biotechnology was formed in the United States with the mandate of to handling increasing number of manuscripts on molecular techniques applied to marine animals. Further conferences on marine biotechnology were organized in the following countries: Baltimore, US, 1991; Tromsø, Norway, 1994; and Sorrento, Italy, 1997 and Australia, 2000. European Society for Marine Biotechnology (ESMB) came into existence in 1994 at Tromsø, Norway while in 1995; Asian-Pacific Marine Biotechnology Society was founded (Halvorson et al., 2001). The Asian society in collaboration with Japanese Society for Marine Biotechnology held a conference in July, 2012 at Kochi, Japan. It is noteworthy that up till date no such scientific organization focusing on advancement of marine biotechnology research and development is formed in Africa. Ever since then, more of such conferences, workshops, research and training institutes are springing forth in the developed world. However, developing countries are yet to tap into these vast opportunities.

Potentials of marine microbiology and Biotechnology

The potentials of marine microbiology and biotechnology will be highlighted with the following area of benefits.

Health – novel drug discovery

Global occurrences of emerging and re emerging resistance of pathogenic organisms to available and once potent drugs have called for research into other sources of drugs. Initially, when antibiotics was discovered, there was sigh of relief from scientists that deadly human and animal pathogens with their attendant diseases and infections are soon to be past history. However, this was never so as some of these pathogens began to develop resistance to most available chemotherapeutics which

eventually has led to global search for new and novel drugs capable of combating these antibiotics resistant microorganisms. Despite the fact that divers natural products have been discovered and recovered from both higher forms of life such as plants and animals and microorganisms with a total estimate of more than 1 million products discovered and averagely 50 % of these products were derived from terrestrial plants with more than 22% of these natural products showing antibacterial, anti fungal, anti protozoal, anti cancer, anti malarial, anti inflammatory and anti nematode activities either in vivo or in vitro (Berdy, 2005; Penesyan et al., 2010), yet the search continues because use of antibiotics indiscriminately coupled with horizontal transfer of genes among these pathogens have increase antibiotics resistance worldwide. The search therefore as shifted from plants and other terrestrial forms of life to marine biodiversity with main focus on marine microbes which only began in 20th century (Monaghan and Tkacz 1990). One tenth of all known bioactive compounds originated from microbial sources however, 10⁷ antibiotics are yet to be discovered from actinomycetes alone. Scientific focus on marine sources (microorganisms and macroorganisms) for discovery of novel bioactive products has received attention in recent time. Most of the recent and ongoing discoveries regarding marine bioactive compounds are traceable to developed countries. Developing countries especially Africa need to take giant step of tapping into these unlimited marine bio resources as the continent is the most disease ravaged in the world from Malaria to cholera. Researchers in this part of the world need to take of the challenge of proffering solution to the endemic occurrence of deadly diseases in the region. Less dependence should be on foreign companies coming up with drugs to cure diseases in developing nations.

Table 1: Identified marine microbial bioactive compounds

Marine source	bioactive compound	antimicrobial activity
Actinomycetes	Resistoflavine	Antibacterial and anticancer
	Marinomycin A	Antitumor and antibiotic
	Daryamide C	Antitumor
	Violacein	Antiprotozoal
Algae	Norharman	Enzyme inhibitor
	Calothrixin-A	Antimalarial and anticancer
Eicosapentanoic acid (EPA)	Anti inflammatory agent	
Bacteria	Macrolactin S	Antibacterial
	Pyrone I and II	Antibacterial
	MC21-B	Antibacterial
Cyanobacteria	Dolastatin 10, 15	Antimicrotubule;
	Curacin A	Antimicrotubule
	Toyocamycin	Antifungal
Fungi	Meleagrins	Antitumor
	Oxaline	Antitumor
	Alternaramide	Antibacterial
Symbiotic microbes	Macrolactin V	Antibacterial and antilarval
	DAPG	Antibacterial
	BE-43472B	Antibacterial

Source: **Bhatnagar and Kim (2010)**

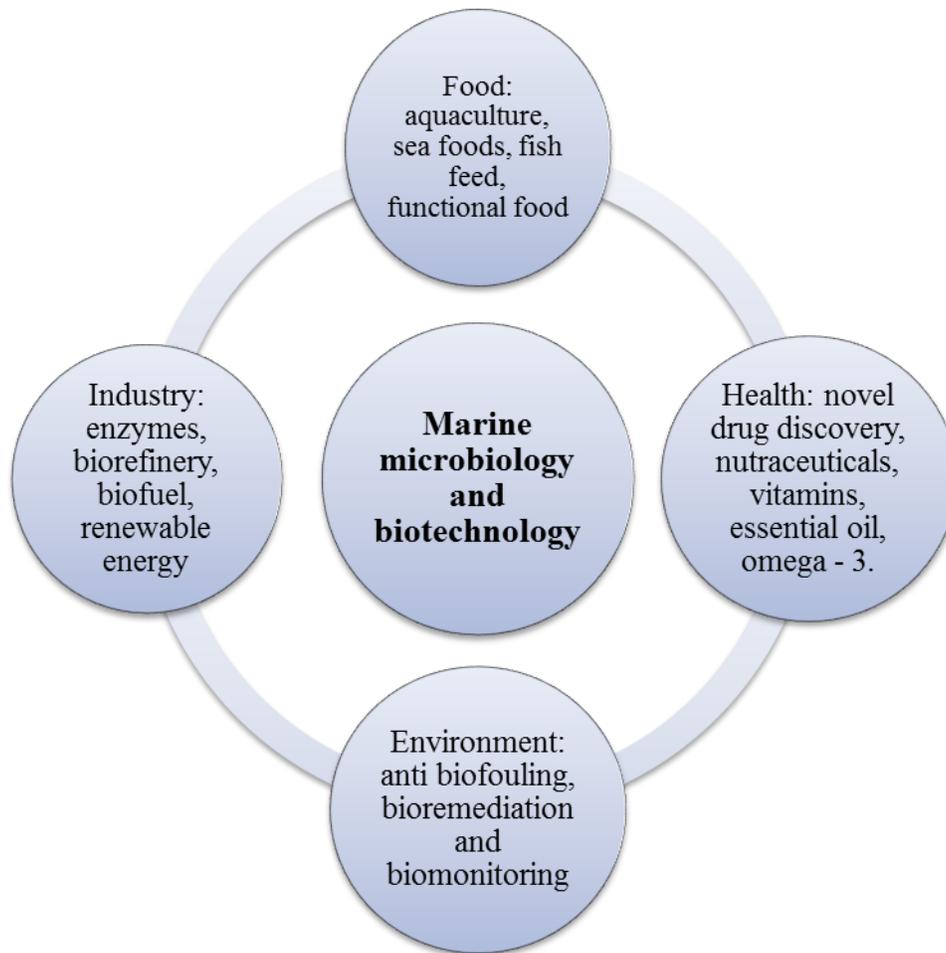


Figure 1: Potentials of marine microbiology and biotechnology (Odeyemi, 2012)

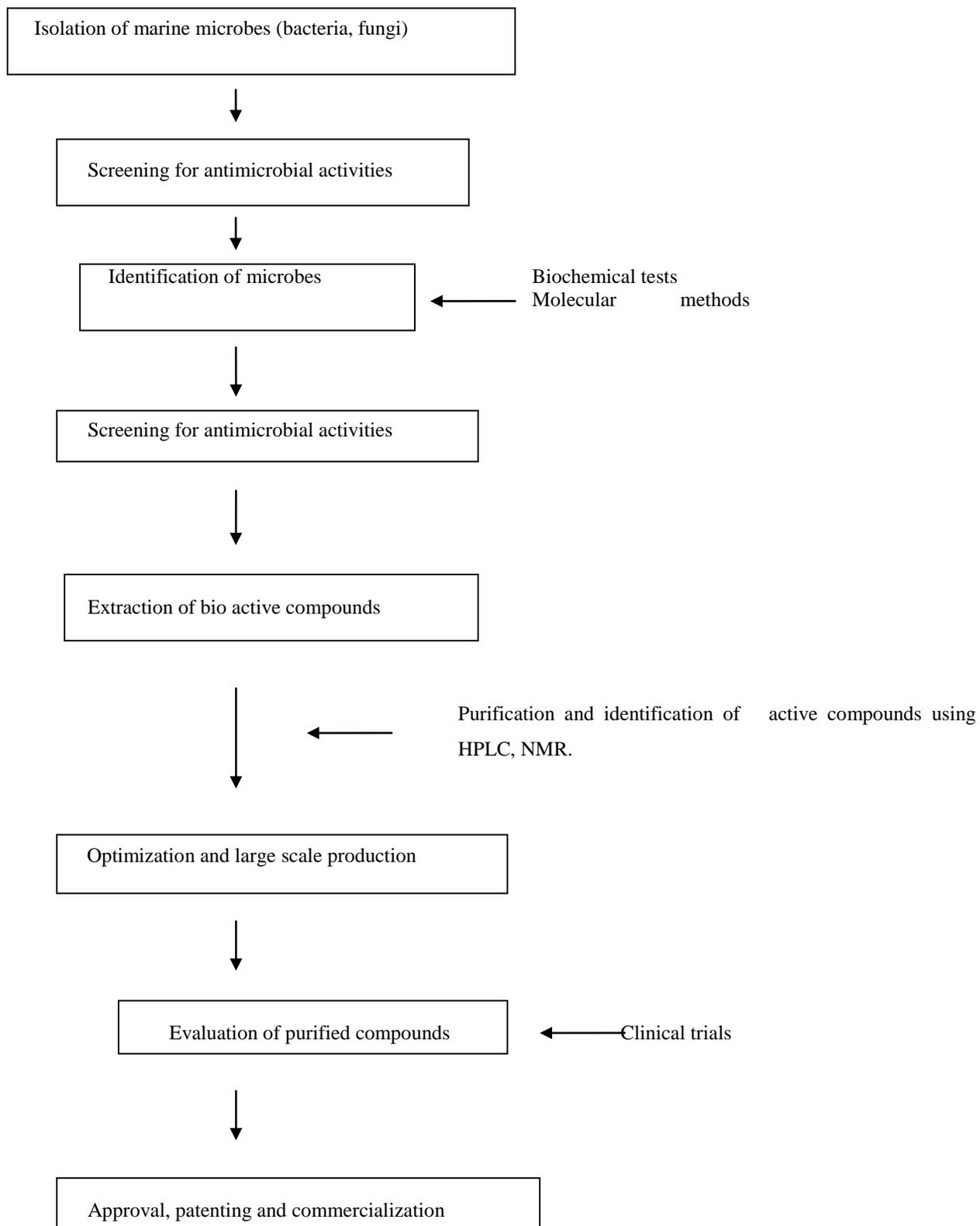


Figure 2: Schematic sketch of marine natural products discovery

II. MARINE MICROBIAL ENZYMES

Divers enzymes have been isolated, identified and purified from different sources such as plants, animals and microorganisms. However, due to diversity of microbes in nature, large scale fermentation process and genetic engineering, more enzymes have been isolated in microorganisms than any other source (Bragger et al., 1989, Annison, 1992 and Niehaus et al, 1999). As earlier stated, over 70 % of this planet earth is been covered ocean. Microbes inhabit different part of the ocean from shallow shell sea to deep and ocean and hydrothermal vents. Due to this, marine microbes require different substrates for metabolic processes thereby producing various enzymes required to metabolize these substrates. Exploring these marine microorganisms can help understand various biochemical pathways through which these enzymes are produced. Additionally, microorganisms from the marine environment has received much research attention from scientists because enzymes produced by these organisms are found to be more potent biochemically and stable than those derived from plants and animals (Bull and Ward 2000; Kin 2006). Advancement in biotechnology globally has led to increased interest and search for enzymes with unique properties. It is however, from marine environment that such enzymes could be obtained as a result of the complex nature of the marine ecosystem due to low temperature, high salinity and pressure because these microorganisms require enzymes different from those obtained from other forms of live to be able to survive in these type of environment. So far, enzymes obtained from marine microbial sources have been used in food additives, pharmaceuticals and other chemicals substances. More recently, enzymes with unique attributes from marine microbes such as bacteria, actinomycetes and fungi are been used for industrial purposes most especially marine microbial enzymes with considerable amount of bioactive properties. (Haefner, 2003; Ghosh et al, 2005). Protease is the most commercially available enzyme with over 60% of world enzymes. These enzymes are used in leather and detergent industries respectively. Moreso, it is applicable in pharmaceutical industries for production of anti inflammatory and easily digestible drugs. Lipases enzymes are present in different environments and they are responsible for the catalytic degradation of fats and oils releasing free fatty acids, glycerol di - acylglycerols, and monoglycerols as by products. These enzymes are also used in various chemical processes like esterification, aminolysis, and trans esterification (Babu et al., 2008). Microbial lipases are found useful in production of detergents, cosmetics, paper and food flavours respectively. Other polysaccharide degrading enzymes such chitinase, agarase, alginate lyases, xylase, cellulose and hydrolases have all been isolated from marine organisms.

Marine derived functional foods

Different definitions have been given to functional foods. However, it could be defined as foods having resemblance to “normal” conventional foods in terms of appearance which are therefore consumed like other foods although with inherent health enhancement and reduction of risk of diseases potentials. Both functional foods and nutraceuticals are been used

interchangeably in some countries of the world while they are been considered different in other countries (Freitas et al., 2012, Shirwaikar et al., 2011, Shahidi, 2009). In 2010, Kadam and Prabhasankar stated that marine ecosystems are good sources of high valued functional foods because they are naturally rich in functional ingredients like algal constituents, carotenoids, omega-3 oils, fish protein hydrolysates chitin, chitosan, collagen and taurine. These functional ingredients can be extracted from the marine sources and incorporated into conventional foods to achieve the purpose of health enhancement. Marine bacteria, fungi, algae, macro and microalgae are excellent sources of functional ingredients. Algae also known as seaweeds are naturally rich in calori free fat (Ganesan et al., 2008; Je et al., 2009). *Sargassum*, a macroalgae is also said to be rich in dietary carotenoids and fibers coupled with antioxidant properties. It can be used to prevent neuron related diseases (Chandini et al., 2008). Minerals, vitamins, amino acids like taurine, omega 3, calcium, proteins and antioxidants can all be obtained from fish and fish wastes ((Dragnes et al., 2009). Marine fungi especially yeast have been reported to yield level of γ -amino-butyric acid making it a promising functional food ingredient (Masuda et al., 2008). Likewise, some marine bacteria have been reported to be producers of different kinds of Polyunsaturated fatty acids – *PUFAs like* docosahexaenoic acid (DHA) and eicosapentaenoic acid – EPA (Bozarth et al., 2009).

Marine algae derived biofuel

The discovery of crude oil was a fundamental scientific breakthrough due to products like petroleum, diesel, lubricating oil, gasoline and others that were derivable from its raw form. Various countries of the world have relied solely on crude oil as major economy booster. However, some of these products are deleterious to human environment as a result of the green house gases that serve as by products which in turn affects the climate and causing global warming. Ever increasing climate change has therefore necessitated search for alternative energy sources can be renewed and that poses less danger to the environment. Aside causing climate change, some of these products especially petrol is becoming more expensive and unaffordable to citizens of developing countries. Marine microalgae or phytoplankton have been targeted as good renewable energy source (Walker et al., 2005). They are aquatic photosynthetic microorganisms that are able to convert carbon dioxide other biochemicals which can eventually be converted to bio fuel (Demirbas 2010; Wilffels and barbosa 2010; Pienkos and Darzins 2009; Oltra 2011). Production of biodiesel from marine microalgae is still at the early stage of development and affected by factors such as production cost and public acceptance. Some developed countries have carried out various research on microalgae derived biofuel and are even using it as alternative source of energy although still expensive than normal petrol.

Marine sustainable aquaculture

Aquaculture could be defined as farming of fish (cat fish, tilapia), mollusks (shrimps, prawn), crustaceans (bivalve) or aquatic plants in which there is an intentional intervention in the process of rearing these organisms with the sole aim of enhancing production yield, high nutritional values. It is the

world food economy growing and increasing yearly by 10 % contributing 30% of total fish consumed in the world. Aquaculture has its origin in Asia with China responsible for over 65% of production in the region unlike Africa and Latin America that are just tapping the potentials (White et al., 2004). Among the 40% of the world inhabitants living along the coastline of the oceans, fishing serves source of income to most of them. Most developing countries only practice small scale fisheries out of over 40 million people globally earning income from aquaculture. Globally, there is an increased need for food due to increase in overall population. Moreso, marine organisms are going into extinction. One of the ways to reduce much demands on fisheries stock and yet still meet worldwide demand for seafood, is through sustainable aquaculture as world demands could lead to complete fall of the fishery industry (Worm et al., 2006). Efficiency in production process, cost effectiveness, high yield and reduction in environmental pollution serve as focus of sustainable aquaculture. These can be achieved through the use of latest marine microbiology and biotechnology tools for identification of molecular markers needed to identify high yielding species, molecular diagnosis of pathogens and feed production.

III. CONCLUSION

Exploring potentials of marine microbiology and biotechnology in developing countries could help solve problems of food shortage, unemployment, disease outbreak by discovering novel bioactive compounds needed to combat resistant pathogens. However, factors such as lack of adequate man power in this field, poor infrastructures, state of the art equipment, research funding from government agencies, adequate awareness and policy. Developing countries need to consciously empower its citizens through inclusion of marine science related courses into their post secondary and higher education curricula. More scientists needs to be sponsored either through private or public scholarships and trained in developed countries that well advanced in exploring marine microbial world on the use of various molecular marine microbiology and biotechnology tools that are needed to further their knowledge in this field. Having adequate man power will help solving food shortage and unemployment. Regional and international collaboration is also required. Conferences, seminars and workshops on benefits of marine related researches should be organized nationwide. More marine research stations or institutes to be located in all states of these countries will also help to foster marine research. Marine ecosystems undoubtedly serve as bio economy sources globally. Developed countries have been able to identify these potentials and exploring them. This is no so in many developing countries due to some or all of the challenges highlighted above. Conscious efforts from individual, government and private agencies are all required if the potentials of marine microbiology and biotechnology is to be completely tapped.

REFERENCES

- [1] Niehaus, F.; Bertoldo, C.; Kähler, M.; Antranikian, G. Extremophiles as a source of novel enzymes for industrial application. *Appl. Microbiol. Biotechnol.* 1999, 51, 711–729.
- [2] Annon, G. Commercial enzyme supplementation of wheatbased diets raises ileal glycanaseactivities and improves apparent metabolisable energy starch and pentosan digestibilities in broiler chickens. *Anim. Feed Sci. Technol.* 1992, 38, 105–121.
- [3] Bragger, J.M.; Daniel, R.M.; Coolbear, T.; Morgan, H.W. Very stable enzyme from extremely thermophilic archaeobacteria and eubacteria. *Appl. Microbiol. Biotechnol.* 1989, 31, 556–561.
- [4] Kin, S.L. Discovery of novel metabolites from marine actinomycetes. *Curr. Opin. Microbiol.* 2006, 9, 245–251.
- [5] Bull, A.T.; Ward, A.C.; Goodfellow, M. Search and discovery strategies for biotechnology: The paradigm shift. *Microbiol. Mol. Biol. Rev.* 2000, 64, 573–606.
- [6] Bernan, V.S.; Greenstein, M.; Maiese, W.M. Marine micro-organisms as a source of new natural products. *Adv. Appl. Microbiol.* 1997, 43, 57–89.
- [7] David, W.; Michel, J. Extremozymes. *Curr. Opin. Chem. Biol.* 1999, 3, 39–46.
- [8] Harmsen, H.J.M.; Prieur, D.; Jeanthon, C. Distribution of microorganisms in deep sea hydrothermal vent chimneys investigated by whole-cell hybridization and enrichment culture of the thermophilic subpopulations. *Appl. Environ. Microbiol.* 1997, 63, 2876–2883.
- [9] HALVORSON, Harlyn O.; CHAVEZ-CROOKER, Pamela; DIAZ, Paula y QUEZADA, Fernando. Marine Biotechnology Opportunities for Latin America. *Electron. J. Biotechnol.* [online]. 2001, vol.4, n.2, pp. 19-20. ISSN 0717-3458.
- [10] Shahidi F. Nutraceuticals and functional foods: whole versus processed foods. *Trends Food Sci Technol* 2009;20:376–87.
- [11] Shirwaikar A, Parmar V, Khan S. The changing face of nutraceuticals—an overview. *Int J Pharm Life Sci* 2011;2:925–32.
- [12] Walker TL, Purton S, Becker DK, Collet C: Microalgae as bioreactors. *Plant Cell Rep* 2005, 24:629-641.
- [13] Demirbas A: Use of algae as biofuel sources. *Energ Convers Manage* 2010, 51:2738-2749.
- [14] Pienkos P, Darzins A: The promise and challenges of microalgal-derived biofuels. *Biofuel Bioprod Bior* 2009, 3:431-440.
- [15] Oltra C: Stakeholder perceptions of biofuels from microalgae. *Energ Policy* 2011, 39:1774-1781.
- [16] Wijffels RH, Barbosa MJ: An outlook on microalgal biofuels. *Science* 2010, 329:796-799.
- [17] Worm, B., Barbier, E.B., Beaumont, N., Duffy, J.E., Folke, C., Halpern, B.S., Jackson, J.B.C., Lotze, H.K., Micheli, F., Palumbi, S.R., Sala, E., Selkoe, K.A., Stachowicz, J.J., Watson, R., 2006. Impacts of biodiversity loss on ocean ecosystem services. *Science* 314, 787–790.
- [18] Cambria Finegold (2012). The importance of fisheries and aquaculture to development. *Fisheries, Sustainability and Development.* 353 -363.
- [19] Chandini SK, Ganesan P, Suresh PV, Bhaskar N. In vitro antioxidant activities of three selected brown seaweeds of India. *Food Chem* 2008;107:707–13.
- [20] Dragnes BT, Stormo SK, Larsen R, Ernsten H, Elvevoll EO. Utilization of fish industry residuals: screening the taurine concentration and angiotensin converting enzyme inhibition potential in cod and salmon. *J Food Compos Anal* 2009;22:714–7.
- [21] Ganesan P, Chandini SK, Bhaskar N. Antioxidant properties of methanol extract and its solvent fractions obtained from selected Indian red seaweeds. *Bioresour Technol* 2008;99:2717–23.
- [22] Masuda K, Guo X, Uryy N, Hagiwara T, Watabe S. Isolation of marine yeasts collected from the Pacific Ocean showing a high production of γ -Aminobutyric acid. *Biosci Biotechnol Biochem* 2008;72:3265–72
- [23] Kadam SU, Prabhasankar P. Marine foods as functional ingredients in bakery and pasta products. *Food Res Int* 2010;43:1975–80.
- [24] Bozarth A, Maier UG, Zauren S. Diatoms in biotechnology: modern tools and applications. *Appl Microbiol Biotechnol* 2009;82:195–201.
- [25] Ana C. Freitas, Dina Rodrigues, Teresa A.P. Rocha-Santos, Ana M.P. Gomes, Armando C. Duarte (2012). Marine biotechnology advances

towards applications in new functional foods. *Biotechnology Advances* 30 (2012) 1506–1515.

- [26] Bowler, C., Karl, D.M., and Colwell, R.R. (2009) Microbial oceanography in a sea of opportunity. *Nature* 459: 180– 184.
- [27] Frank Oliver Glöckner and Ian Joint (2010). Marine microbial genomics in Europe: current status and perspectives. *Microbial Biotechnology* (2010) 3(5), 523–530.
- [28] Bhatnagar, Ira; Kim, Se-Kwon. 2010. "Immense Essence of Excellence: Marine Microbial Bioactive Compounds." *Mar. Drugs* 8, no. 10: 2673-2701.
- [29] Sogin ML, Morrison HG, Huber JA, Mark WD, Huse SM, et al. (2006) Microbial diversity in the deep sea and the underexplored "rare biosphere". *Proc Natl Acad Sci USA* 103: 12115-12120.
- [30] A. Aristides Yayanias (2003). Marine microbiology at Scripps. *Oceanography*. Vol. 16 (3):67 -75.
- [31] Narsinh L. Thakur and Archana N. Thakur (2006). Marine microbiology: An overview. *Indian Journal of Biotechnology*. Vol 5. 263-268.
- [32] Nyerhovwo J. Tonukari (2004). Fostering biotechnology entrepreneurship in developing countries *African Journal of Biotechnology* Vol. 3 (6), pp. 299-301.
- [33] Odeyemi OA. Harnessing potentials of medical biotechnology in delivery of quality health service in Nigeria. *Int J Stud Res* 2011;1(4):105-7.
- [34] Glöckner FO, Joint I (2010) Marine microbial genomics in Europe: current status and perspectives. *Microbial Biotechnology* 3:523-530.
- [35] Berdy, J., 2005. Bioactive microbial metabolites, a personal view. *J. Antibiot.*, 58: 1-26.
- [36] Anahit Penesyan, Staffan Kjelleberg, and Suhelen Egan 2010. Development of Novel Drugs from Marine Surface Associated Microorganisms. *Mar Drugs*. 2010; 8(3): 438–459.
- [37] Monaghan, R.L., and Tkacz, J.S. (1990). Bioactive microbial products: Focus upon mechanism of action. *Annu. Rev. Microbiol.* 44, 271–301.
- [38] Ghosh, D.; Saha, M.; Sana, B.; Mukherjee, J. *Marine Enzymes. Adv. Biochem. Eng. Biot.* 2005, 96, 189–218.
- [39] Haefner, B. Drugs from the deep: marine natural products as drug candidates. *Drug Discov. Today* 2003, 8, 536–544.
- [40] Kumar, C.; Joo, H.S.; Koo, Y.M.; Paik, S.; Chang, C.S. Thermostable Alkaline Protease from a Novel Marine Haloalkalophilic *Bacillus Clausii* Isolate. *World J. Microbiol. Biotechnol.* 2004, 20, 351–357.
- [41] Ilona, K.; Zdzislaw, E.S. Neutral and alkaline muscle proteases of marine fish and invertebrates a review. *J. Food Biochem.* 2007, 20, 349–364.
- [42] Zhang, L.X.; An, R.; Wang, J.P.; Sun, N.; Zhang, S.; Hu, J.C.; Kuai, J. Exploring novel bioactive compounds from marine microbes. *Curr. Opin. Microbiol.* 2005, 8, 276–281.
- [43] Guerard, F.; Guimas, L.; Binet, A. Production of tuna waste hydrolysates by a commercial neutral protease preparation. *J. Mol. Catal. B-Enzym.* 2002, 19, 489–498.
- [44] Franz, S.; Rosa, M.; Thomas, P. Extracellular Protease-Producing Psychrotrophic Bacteria from High Alpine Habitats. *Arct. Antarct. Alp. Res.* 1992, 24, 88–92.
- [45] Rajesh, P.; Mital, D.; Satya, P.S. Extracellular alkaline protease from a newly isolated haloalkaliphilic *Bacillus* sp.: Production and optimization. *Process Biochem.* 2005, 40, 3569–3575.
- [46] Babu, J.; Pramod, W.R.; George, T. Cold active microbial lipases: Some hot issues and recent developments. *Biotechnol. Adv.* 2008, 26, 457–470.
- [47] Kobayashi, T.; Koide, O.; Mori, K.; Shimamura, S.; Matsuura, T.; Miura, T.; Takaki, Y.; Morono, Y.; Nunoura, T.; Imachi, H.; Inagaki, F.; Takai, K.; Horikoshi, K. Phylogenetic and enzymatic diversity of deep subseafloor aerobic microorganisms in organics- and methane-rich sediments off Shimokita Peninsula. *Extremophiles* 2008, 12, 519–527.
- [48] Seiichi, A.; Akihiko, Y.; Mutsuo, H. Occurrence of Marine Bacterial Lipase Hydrolyzing Fish Oil. *Agric. Biol. Chem.* 1991, 55, 2657–2659.
- [49] Chi, Z.; Chi, Z.; Zhang, T.; Liu, G.; Li, J.; Wang, X. Production, characterization and gene cloning of the extracellular enzymes from the marine-derived yeasts and their potential applications. *Biotechnol. Adv.* 2009, 27, 236–255.
- [50] Bragger JM, Daniel RM, Coolbear T, Morgan HW (1989) Very stable enzyme from extremely thermophilic archaeobacteria and eubacteria. *Appl Microbiol Biotechnol* 31: 556±561

AUTHORS

First Author – Olumide Adedokun Odeyemi, Marine Science program (Marine microbiology and biotechnology), School of Environmental and Natural Resources, Faculty of Science and Technology, National University of Malaysia, UKM Bangi, Malaysia, oluodeyemi@gmail.com

Campus placements in Kerala-An empirical study at the selected Engineering Colleges in Kerala

Suresh Kumar N^{*}, Prasanth MK^{**}, Ajith Sundaram^{***}

^{*} Associate Professor and Head of the Department, College of Engineering and Management Punnapra, Alappuzha, Kerala.

^{**} Assistant Professor, Institute of Management and Technology Punnapra, Alappuzha, Kerala

^{***} Asst Professor, RVS Institute of Management Studies, Kannampalayam, Coimbatore.

Abstract- The fundamental skills that are acquired by the students at the school level have an overall impact in shaping the career of students. In the later stages the extracurricular activities such as technical events, arts, sports and games, has an impact on the overall personality development and hence increases the employability of the students. Apart from that the quality of teaching and medium of instruction are important component at various stages of selection process. The percentage of drop outs in the first and second stage (Screening test and Group Discussion) is the highest in the selection process. The level of interest of students in campus placements whose guardian is in various professions such as business, salaried and professional differ. More over there is association between number of placement drives attended by the students and the percentage marks obtained by the students, the number of times the candidate have cleared the group discussion and the percentage mark obtained by the candidate.

I. INTRODUCTION

The Engineering education in Kerala is flourishing at a rapid rate with 140 Engineering colleges containing 39000 Engineering seats in various disciplines. Out of these 39000 Engineering seats only 3000 seats comes under Government of Kerala and the remaining 36000 Engineering seats are owned by Government controlled self financing colleges and privately owned self financing colleges But the real fact is that apart from tier1 Engineering colleges which includes various Government colleges under Department of Technical Education and very few private owned self financing colleges which have a good placement records the number of students who got industry offers through campus placements comes around 25%. In this paper we are focusing on what are the various parameters that affect the students in tackling campus placements and how these parameters affect the employability of the students.. Because there are lot of Government Engineering colleges, Management Engineering Colleges (aided) and self financing Engineering colleges in every district of Kerala. It is very hard to differentiate or rank the top 10 engineering colleges among them, we should judge many criteria, like Academic Record and history, Placement history, Lab and Library Facilities, Faculties, Campus culture, Management, Arts & Sports performances in competitions etc. The important factors that make a student to be successful in tackling campus placements is to identify the opportunities, practices in tackling interview ,GD and Aptitude Test, review curriculum an to search the profile of the company

where the applicant is papering for interview and to equip yourself in tackling it.

II. OBJECTIVES

To find out the impact of the extracurricular activities on students and its relation with campus placement.

To find out the impact of educational qualification of parents (family background) with respect to campus placement.

To find out various parameters of teaching that plays a pivotal role in modeling the students at various stages of selection process.

III. HYPOTHESIS

H1: There is a significant difference between Educational Qualification with respect to level of interest in campus placement.

H2: There is a significant difference between number of placement drives attended and the percentage marks obtained by the students.

H3: There is a significant difference between number of times the student cleared the aptitude test and the percentage marks obtained by the students.

H4: There is a significant between number of times the student cleared the Group Discussion and the percentage marks obtained by the students.

H5: There is a significant difference between mean ranks various factors affecting the students to convert campus placements to industry offers.

IV. SCOPE OF THE STUDY

Before the opening Kerala's Higher education sector to government controlled and Private self financing colleges, there were limited number of colleges(below 10) and limited number of engineering seats(in between 1500-2000). It was a golden time where almost all the students were placed in respected institutions. But the opening of the sector opened a new window of opportunity to the student's community to pursue engineering education but posed a big challenge to the system. The present pass rate is in between 40-45 percent and campus placement is nearly 25%.The study analyses the important factors affecting campus placements and put forward suggestions to improve it. The study having wide impact as it can be used as a tool by the academicians, corporate and students for improving in the future.

Research Methodology:

The study was conducted at the leading engineering colleges in Kerala. The various elements of research design are;

a) Database Design-The primary data was collected from students of engineering colleges in Kerala. The secondary data was collected from government records, other official records journals, text books and internet portals.

b) Measurement Design- The data was collected by using questionnaire. Nominal, ordinal; interval and ratio scales were used depending upon the data collected.

c) Sampling Design- The simple random sampling is used for the study. The total sample size is 114 and the samples were collected from the student’s community of selected engineering colleges in Kerala. The period of the study was from January 02, 2012 to May 25, 2012.

d) Statistical design: Appropriate mathematical and statistical tool were used for analysis.

Analysis Procedure

The data was analyzed using statistical package for social science (SPSS V 12.0). Descriptive statistics such as mean and standard deviation were generated to provide an overview of the data. ANOVA was used for finding significant difference between Educational Qualification with respect to level of interest in campus placement. Chi-square test were used to find out association between number of placement drives attended and the percentage marks obtained by the students, number of times the student cleared the aptitude test and the percentage marks obtained by the students, number of times the student cleared the Group Discussion and the percentage marks obtained by the students. The Friedman test was used for finding out the various parameters of teaching and extracurricular activities on campus placements.

Limitations of the study:

- There are certain limitations of these project report which are listed below;
- The major constraint of the study was the study was limited to last academic year 2011-2012.
- Some of the students did not co-operate with the survey.
- Sample size for the study is low.
- There are chances that the respondent’s bias may also reduce the effectiveness of the data collected.
- The result of the study cannot be generalized.

HYPOTHESIS 1

Null Hypothesis: There is no significant difference between occupation of guardian of students with respect to the level of interest in campus placements

Table 1: ANOVA for significant difference between Educational Qualification with respect to level of interest in campus placement

Occupation of guardian	Mean	Std. Deviation	F value	P value
Business	34.73 _c	1.973	22.531	0.000**
Salaried	33.14 _b	1.002		
Professional	31.00 _a	0.000		

Note ** Denotes significance at 1% level Duncan Multiple Range test

Since P value is less than 0.01, the null hypothesis is rejected at 1 percent level of significance. Hence concluded that there is significant difference between occupation of the guardian with respect to the level of interest in campus placement. Based on Duncan Multiple Range test the level of interest of students in campus placements whose guardian is doing business , salaried and professional differ.

HYPOTHESIS 2

Null Hypothesis: There is no association between number of placement drives attended and percentage marks obtained by the student

Table 2: Chi-square test for association between number of placement drives attended and the percentage marks obtained by the students

No. of times campus placements attended	Percentage of marks		Total	Chi Square Value	P value
	60-65	66-75			
1	12 (100.0%) [20.0%]	0 (0.0%) [0.0%]	12 (100.0%) [10.5%]	48.619	0.000**
2	6 (25.0%) [10.0%]	18 (75.0%) [33.3%]	24 (100.0%) [21.1%]		

3	6 (20.0%) [10.0%]	24 (80.0%) [44.4%]	30 (100.0%) [26.3%]
5	12 (100.0%) [20.0%]	0 (0.0%) [0.0%]	12 (100.0%) [10.5%]
7	12 (66.7%) [20.0%]	6 (33.3%) [11.1%]	18 (100.0%) [15.8%]
9	6 (50.0%) [10.0%]	6 (50.0%) [11.1%]	12 (100.0%) [10.5%]
10	6 (100.0%) [10.0%]	0 (0.0%) [0.0%]	6 (100.0%) [5.3%]
Total	60	54	114

Note: 1. The value within () refers to Row Percentage
 2. The value within [] refers to Column Percentage
 3. ** denotes significant at 1% level

Since P value is less than 0.01, the null hypothesis is rejected at 1 percent level of significance. Hence we can infer that there is association between number of placement drives attended by the students and the percentage marks obtained by the students. The students who is securing 60 to 65% marks at the B.Tech level have attended more number of placement drives compared to students who is securing 66 to 75% marks. This may be due to the fact that the students who is securing percentage marks between 66 to 75 will get absorbed in campus placements in the initial campus recruitment drives .So they will not attend further recruitment drives and hence the number of drives attended by the students who is securing aggregate marks in the range 66 to 75 % will be less as compared to those securing the marks in the range 60- 65%.Moreover the majority

of the students with aggregate marks in the range 66 to 75 will get offers within three recruitment drives.

HYPOTHESIS 3

Null Hypothesis: There is no association between number of times the student had cleared the aptitude test and percentage marks obtained by the student

Table 3: Chi-square test for association between number of times the student cleared the aptitude test and the percentage marks obtained by the students

No of times cleared aptitude test	Percentage of marks		Total	Chi Square Value	P value
	60-65	66-75			
0	12 (100.0%) [20.0%]	0 (0.0%) [0.0%]	12 (100.0%) [10.5%]	43.519	0.000*
1	12 (28.6%) [20.0%]	30 (71.4%) [55.6%]	42 (100.0%) [36.8%]		
2	12 (50.0%) [20.0%]	12 (50.0%) [22.2%]	24 (100.0%) [21.1%]		
3	6 (50.0%) [10.0%]	6 (50.0%) [11.1%]	12 (100.0%) [10.5%]		
4	0 (0.0%) [0.0%]	6 (100.0%) [11.1%]	6 (100.0%) [5.3%]		
6	18 (100.0%) [30.0%]	0 (0.0%) [0.0%]	18 (100.0%) [15.8%]		
Total	60	54	114		

Note: 1. The value within () refers to Row Percentage
2. The value within [] refers to Column Percentage
3. ** denotes significant at 1% level

Since P value is less than 0.01, the null hypothesis is rejected at 1 percent level of significance.

Hence we can infer that there is association between number of times the candidate have cleared the aptitude test and the percentage marks obtained by the students .We can infer that the majority of students who secure an aggregate mark between 66 to 75% will clear at least one aptitude test. This may be due to the fact that the intelligence quotient level of students who secure 66 to 75% marks are more than that of those students who got 60 to 65% marks in the examination

HYPOTHESIS 4

Null Hypothesis: There is no association between number of times the student had cleared the group discussion and percentage marks obtained by the student

Table 4: Chi-square test for association between number of times the student cleared the Group Discussion and the percentage marks obtained by the students

No of times cleared Group discussion	Percentage of marks		Total	Chi Square Value	P value
	60-65	66-75			
0	18 (60.0%) [30.0%]	12 (40.0%) [22.2%]	30 (100.0%) [26.3%]	30.970	0.000*
1	12 (25.0%) [20.0%]	36 (75.0%) [66.7%]	48 (100.0%) [42.1%]		
2	18 (75.0%) [30.0%]	6 (25.0%) [11.1%]	24 (100.0%) [21.1%]		
4	6 (100.0%) [10.0%]	0 (0.0%) [0.0%]	6 (100.0%) [5.3%]		

6	6 (100.0%) [10.0%]	0 (0.0%) [0.0%]	6 (100.0%) [5.3%]		
Total	60	54	114		

Note: 1. The value within () refers to Row Percentage
2. The value within [] refers to Column Percentage
3. ** denotes significant at 1% level

Since P value is less than 0.01, the null hypothesis is rejected at 1 percent level of significance.

Hence we can infer that there is association between the number of times the candidate have cleared the group discussion and the percentage mark obtained by the candidate. We can infer that the majority of students who secure an aggregate mark between 66 to 75% will clear at least one group discussion. This may be due to the fact that the students with good academic track record have a tendency to dedicate more time in equipping itself for clearing group discussion

HYPOTHESIS 5

Null Hypothesis: There is no significant difference between mean ranks towards various factors affecting the students to convert campus placements to industry offers

Table 6 Friedman test for significant difference between mean ranks various factors affecting the students to convert campus placements to industry offers

Factors affecting students to convert campus placements to industry offers	Mean Rank	Chi-square Value	P value
The quality of teaching is an important component at various stages of selection	5.13	210.832	0.000*
Medium of instruction by teachers has an impact on the ability of students in expressing their ideas when it comes to soft skill development	4.53		
The consistent academic track record has an impact in the overall employability of the students	3.92		
The fundamental skills that are acquired by the students at the school level has an overall impact in shaping the career of students in the later stages	5.84		
Spoon feeding by parents adversely affect the ability of the student to act on his own	4.24		

which in turn affects the employability in the later stages			
The percentage of drop outs in the first and second stage(Screening test and Group Discussion) is the highest in the selection process	5.03		
The one of the outcome of nuclear family is over attachment by parents towards children and vice versa adversely affect the career prospect of the student.	2.11		
The extra curricular activities such as technical events, arts ,sports and games, has an impact on the overall personality development and hence increases the employability of the students	5.21		

Since P value is less than 0.01, the null hypothesis is rejected at 1 percent level of significance. Based on relative importance the various factors that plays pivotal role for students in converting campus placements to industry offers includes the fundamental skills that are acquired by the students at the school level has an overall impact in shaping the career of students in the later stages, the extracurricular activities such as technical events, arts ,sports and games, has an impact on the overall personality development and hence increases the employability of the students, the quality of teaching is an important component at various stages of selection, the percentage of drop outs in the first and second stage(Screening test and Group Discussion) is the highest in the selection process and medium of instruction by teachers has an impact on the ability of students in expressing their ideas when it comes to soft skill development

V. CONCLUSION

It is certainly possible that one’s personality and emotional temperament would influence one’s academic abilities, and, regardless of the variations in language and classification, there is some evidence of an association between affective characteristics and academic performance.

There is certainly a need for more research on the effectiveness of using multiple measures for academic placement, as well as guidance on the potential uses of the non cognitive assessments.

REFERENCES

[1] Armstrong, W. B. (2000). The association among student success in courses, placement test scores, student background data, and instructor grading practices. *Community College Journal of Research & Practice*, 24(8), 681–695.

[2] Bailey, T. (2009). Challenge and opportunity: Rethinking the role and function of developmental education in community college. *New Directions for Community Colleges*, 145, 11–30.

[3] Bailey, T., Jeong, D. W., & Cho, S.-W. (2010). Referral, enrollment, and completion in developmental education sequences in community colleges. *Economics of Education Review*, 29(2), 255–270.

[4] Behringer, L. B. (2008). Remedial education at the community college: A study of student sensemaking (Doctoral dissertation). New York, NY: New York University Steinhardt School of Culture, Education, and Human Development.

[5] Berger, D. M. (1997). Mandatory assessment and placement: The view from an English department. *New Directions for Community Colleges*, 100, 33–41.

[6] Bettinger, E. P., & Long, B. T. (2005). Remediation at the community college: Student participation and outcomes. *New Directions for Community Colleges*, 129, 17–26.

[7] Bettinger, E. P., & Long, B. T. (2009). Addressing the needs of underprepared students in higher education: Does college remediation work? *Journal of Human Resources*, 44(3), 736–771.

[8] Boylan, H. R. (2002). What works: Research-based best practices in developmental education. Boone, NC: Continuous Quality Improvement Network with the National Center for Developmental Education, Appalachian State University.

[9] Boylan, H. R. (2009). Targeted Intervention for Developmental Education Students (T.I.D.E.S). *Journal of Developmental Education*, 32(3), 14–23.

[10] Brennan, R. L. (Ed.). (2006). *Educational measurement* (4th ed.). Westport, CT: ACE/Praeger Publishers.

[11] Calcagno, J. C., & Long, B. T. (2008). The impact of postsecondary remediation using a regression discontinuity approach: Addressing endogenous sorting and noncompliance (NBER Working Paper 14194). Cambridge, MA: National Bureau of Economic Research.

[12] Cohen, A. M., & Brawer, F. B. (2008). *The American Community College* (5th ed.). San Francisco, CA: Jossey-Bass.

[13] College Board. (2003). *ACCUPLACER OnLine: Technical manual*. New York, NY: College Board.

[14] College Board. (2007). *ACCUPLACER coordinator's guide*. New York, NY: College Board.

[15] Collins, M. L. (2008). *It's not about the cut score: Redesigning placement assessment policy to improve student success*. Boston, MA: Jobs for the Future.

[16] Conley, D. (2005). *College knowledge: What it really takes for students to succeed and what we can do to get them ready*. San Francisco, CA: Jossey-Bass.

[17] CPT Cut Score Committee. (2006). *CPT cut score committee final report*. Retrieved from Florida Department of Education website: http://www.fldoe.org/articulation/pdf/acc_102506ada.pdf

[18] Cronbach, L. J., & Snow, R. E. (1977). *Aptitudes and instructional methods: A handbook for research on interactions*. New York, NY: Irvington Publishers.

[19] Ewell, P., Boeke, M., & Zis, S. (2008). *State policies on student transitions: Results of a fifty-state inventory*. Boulder, CO: National Center for Higher Education Management Systems.

[20] Fonte, R. (1997). Structured versus laissez-faire open access: Implementation of a proactive strategy. *New Directions for Community Colleges*, 100, 43–52.

[21] Gerlaugh, K., Thompson, L., Boylan, H., & Davis, H. (2007). National Study of Developmental Education II: Baseline data for community colleges. *Research in Developmental Education*, 20(4), 1–4.

[22] Achilles, C. M., Reynolds, J.S., & Achilles, S.H. (1997). Problem analysis: Responding to school complexity. Larchmont, NY: Eye On Education.

[23] Airasian, P.W., Kellaghan, T., Madaus, G.F., & Pedulla, J.J. (1977). Proportion and direction of teacher rating changes of pupils’ progress attributable to standardized test information. *Journal of educational Psychology*, 69(9), 702 – 709.

[24] Akst, G., & Hirsch (1991). Selected studies on math placement. *Review of Research in Developmental Education*, 8(4), 3-9.

[25] Aldeman, C. (1999). Why can't we stop talking about the SAT? *The Chronicle of Higher Education*, 46(11), B4-B5.

- [26] Aleamoni, L. & Oboler, L. (1978). ACT versus SAT in predicting first semester GPA. *Educational and Psychological Measurement*, 38, 393-399
- [27] Allen, J., & Sconing, J. (2005). Using ACT assessment scores to set benchmarks for college readiness (ACT Research Rep. No. 2005-3). Iowa City, IA: American College Testing Program.
- [28] American College Testing Program (1994). ACT Assessment course placement service interpretive guide. Iowa City, I: author.

AUTHORS

First Author – Suresh Kumar N. B.Tech, M.Tech
Associate Professor and Head of the Department, College of
Engineering and Management Punnapra, Alappuzha, Kerala

Second Author – Prasanth MK. MBA, PGDCM
Assistant Professor, Institute of Management and Technology
Punnapra, Alappuzha, Kerala

Third Author – Ajith Sundaram. B.Tech, MBA, MS (UK),
(MSc Psychology), (PhD)
Asst Professor, RVS Institute of Management Studies
Kannampalayam, Coimbatore.

Minimized Routing Protocol in Ad-Hoc Network with Quality Maintenance Based on Genetic Algorithm: A Survey

Upasna*, Jyoti Chauhan**, Manisha***

* Student M.tech, Deptt. Computer science Banasthali Vidyapith University, Rajasthan, India

** Student M.tech Deptt. Computer science Banasthali Vidyapith University, Rajasthan, India

*** Student M.tech Deptt. Computer science Banasthali Vidyapith University, Rajasthan, India

Abstract- Mobile ad-hoc network networks are self-organizing network having a concise radio range and limited bandwidth without having the any specified infrastructure. The topology of the ad hoc network may change suddenly. At this type of situation, is finding the shortest path (SP) between source and destination nodes within a specified time so as to satisfy the Quality of Service (QoS) with security. For finding the shortest path between the sources to destination, we will use the genetic algorithm (GA) with backups of routes and authentication with having, minimum power consumption and congestion. This type of routing technique will reduce the reroute discovery if failure occurred in the path. It will take the less time in resending the packet to the destination and the throughput will be high in the Mobile Ad-Hoc Network (MANET). In this paper, we will also discuss the routing protocols, its classifications, advantage and disadvantages of the routing protocols in Mobile Ad-hoc network (MANET).

Index Terms- MANET, Routing protocols, Genetic Algorithm (GA), Backups, Bandwidth, Power consumption.

I. INTRODUCTION

MANET has the dynamic nature caused by the mobility of nodes. Mobile Ad-Hoc Network is having the properties of that type of network which are not physically connected. It leads to poor route discovery because there is not any specified topology or infrastructure. Wireless Network is based on the particular topologies. But in the wireless network, there is nit any physical connection and topologies are used only in the wired network. In these networks there is no fixed topology due to the mobility of nodes, interference, multiple path and path loss [16]. Genetic algorithm facilitates the good characteristics for finding the shortest path. Every node in the MANET should have backups if they will have the backup, power consumption and time consumption will be less backup give facility for storing the route. It will avoid the reroute discovery and traffic jamming or congestion in the network. MANET is consisting the dynamic nature so we follow the many dynamic routing protocols for searching the shortest path in the network. MANET is totally differing from the wired network. In wired network, there is exist any topology but Wireless communication medium has variable and unpredictable characteristics. Due to the unpredictable characteristics, the signal strength and propagation delay may

vary with respect to time and environment where the mobile nodes are [1].

In the paper section-A explain the routing protocol family and section-B explain the Genetic Algorithm, Range and Bandwidth and Section-C explain the Back up and authentication.

II. SECTION-A

CLASSIFICATION OF THE MOBILE AD-HOC NETWORK PROTOCOLS:

1) FLAT ROUTING:-

PROACTIVE (TABLE-DRIVEN):-

- ✓ FSR
- ✓ FSLs
- ✓ OLSR
- ✓ TBRPF

REACTIVE (ON-DEMAND):-

- ✓ AODV
- ✓ DSR

2) HIERARCHICAL ROUTING:-

- ✓ HSR
- ✓ CGSR
- ✓ ZRP
- ✓ LANMAR

3) GEOGRAPHIC POSITION ROUTING:-

- ✓ GEOCAST
- ✓ LAR
- ✓ DREAM
- ✓ GPSR

1) FLAT ROUTING PROTOCOL:-

Flat routing, each node perform the routing functions. All nodes are on the same level in the network. Every node in the network maintains the global routing information rather than its neighbour's information [24].

✓ PROACTIVE:-

A proactive routing protocol is table driven protocols. Using a proactive routing protocol, nodes in a MANET continuously evaluate routes to all reachable nodes and attempt to maintain consistent up to date routing information [2].

- **FSR (FISHEYE STATE ROUTING IN MOBILE AD-HOC NETWORK):-**

FSR is based on the multilevel (not hierarchical) fisheye scope to reduce routing update overhead in large networks. It maintains the neighbour's information [30].

- **FSLs (FUZZY SIGHTED LINK STATE ROUTING PROTOCOL):-**

This routing protocol achieves lower routing overhead and delay, without affecting other metrics, such as packet delivery ratio. An FSLs protocol is that distant nodes do not need to be informed about link state changes as frequent as nearby nodes [38].

- **OLSR (OPTIMIZED LINK STATE ROUTING):-**

This type of protocol is proactive protocol (table-driven). It concise the size of the information. It is reducing the retransmission jam or congestion because it spread the packets in whole network [31, 32].

- **TBRPF (TOPOLOGY-BASED RESERVE PATH FORWARDING):-**

It is also a link state routing and proactive routing protocol. Each node, using a Dijkstra's alike algorithm, computes a source tree that is based on partial topology information stored in a topology table. The source tree provides the shortest paths to all reachable nodes. LSP dissemination are sent over 'source trees'. A combination of periodic and differential updates is used to keep all neighbour informed [32].

- ✓ **REACTIVE :-**

Reactive routing protocol is also called the on-demand routing protocol. In a reactive routing protocol routing paths are searched only when needed. A route discovery operation invokes a route determination procedure. The discovery procedure terminates when either a route has been found or no route is available after examination for all route permutation.

- **DSR (DYNAMIC SOURCE ROUTING):-**

It is discover the route by sending the request (RREQ) to neighbour and neighbour send the reply (RREP) to the source and update own route cache memory because it is not table driven protocol.

- **AODV (AD-HOC ON DEMAND DISTANCE VECTOR):-**

An Ad-Hoc network is the co-operative engagement of a collection of mobile nodes without the required intervention of any centralized access point. Route finding is based on a route discovery cycle involving a broadcast network search and a unicast reply containing discovered paths. It maintains the route if a route is not use in lifetime than it will be expire and save the route cache space. If the route is already existing it send the packets otherwise source discovers the routes [2, 3].

- ✓ **HIERARCHICAL ROUTING:-**

Hierarchical Routing protocol is used for scalability purpose. The scalability, with respect to increasing node count, of hierarchical routing in MANETs. The performance metric

under consideration is the control overhead per node required by hierarchical routing. This assessment considers only the overhead due to the maintenance of routing tables and hierarchical clustering. The overhead due to location (or address) management is considered elsewhere [39].

- **(HSR) HIERARCHICALLY SEGMENTED ROUTING:-**

This routing is very good routing protocol. It provides many facilities. It provides a good scalability. If network is vast. In this situation it gives a low overhead facility. It also gives the low end to end delays, seamless connectivity and quality of service.

- **CGSR (CLUSTER GATEWAY SWITCH ROUTING PROTOCOL):-**

It is multichannel operations in the network. It facilitates the code separation among the clusters. There is some algorithm are used for electing the cluster head. When two cluster head come in contact or cluster is out of range from all other cluster heads, by using LCC (Least cluster change) can cluster heads only heads changed. If source is sending a packet to the destination then it will send the packet to first cluster head that come in route and it will send to the another cluster head until the destination node's cluster head is reached [35].

- **ZRP (ZONE ROUTING PROTOCOL):-**

It is a hybrid routing protocol for MANET. It is able to proactively maintain routes within a local region of the network called as routing zone. It can improve the efficiency of a reactive route query/reply mechanism. The ZRP can be configured for a particular network through adjustment of a single parameter, the routing zone radius [36].

- **LANMAR (LAND MARK ROUTING PROTOCOL):-**

Each node knows the routes to various "landmarks" at different hierarchical levels. LANMAR combines the features of fisheye state routing (FSR) and landmark routing. Main facility of this routing protocol it nodes that can move as a group and by land marking is reduce the routing update overhead [37].

- ✓ **GEOGRAPHIC POSITION ROUTING:-**

The local topology is updated in a timely manner according to network dynamics and traffic demands. Our route optimization scheme adapts the routing path according to both topology changes and actual data traffic requirements. Each node can determine and adjust the protocol parameter values independently according to different network environments, data traffic conditions and node's own requirements.

- **GEOCAST ROUTING PROTOCOL:-**

The goal of a geocasting protocol is to deliver data packets to a group of nodes that are with a specified geographical area, i.e., the geocast region. In an ad hoc environment, there are numerous scenarios which would benefit from geocast communication (e.g., to Broadcast emergency information within

a mile radius of a fire or to broadcast a coupon for coffee within a block of a Starbucks) [40].

- **LAR (LOCATION AIDED ROUTING):-**

LAR is a flood based routing algorithm, like DSR, that uses location information in order to reduce route search space and thereby minimises route control traffic. It assumes that each node obtains its location information using a GPS (global positioning system). In LAR a node forwards route request packets only to the nodes that reside inside the route search space (also referred to as the request zone). Any node outside the request zone ignores such packets. If route is not discovered within a suitable timeout period, the request zone is expanded. Two schemes have been considered in LAR to determine a request zone.

- **DREAM (DISTANCE ROUTING EFFECT ALGORITHM FOR MOBILITY):-**

Dream uses location information using GPS (Global positioning system) to provide loop-free Multi-path routing for mobile ad-hoc networks. Each node in DREAM maintains a location table that records location information of all Nodes. DREAM minimises routing overhead, that is, location update overhead, by employing two principles referred to as the "distance effect" and the "mobility rate". The "distance effect" states that the greater the distance between two nodes the slower they appear to move with respect to each other. Thus nodes that are far apart need to update their location information less frequently than the nodes closer together. This is realised in DREAM by associating an age with each location update message that corresponds to how far from the sender the message can travel. The "mobility rate" states another interesting observation that the faster a node moves, the more frequently it needs to advertise its new location information to other nodes.

- **GPSR (GREEDY PERIMETER STATELESS ROUTING):-**

This routing protocol is energy efficient protocol. The greedy forwarding mode as follows: a forwarding node first determines a candidate set of neighbour nodes – the nodes that lie closer to the destination than itself. The weight of each such candidate neighbour node is then computed to be the sum of the fraction of the initial energy currently available at the neighbour node and the progress (i.e., the fraction of the distance covered between the forwarding node and the destination) obtained with the selection of the neighbour node. The candidate neighbour node that has the largest weight value is the chosen next hop node to receive the data packet. This procedure is repeated at every hop where greedy forwarding is possible. In case, greedy forwarding is not possible, similar to GPSR, energy efficient GPSR switches to perimeter forwarding [29].

III. SECTION-B

RANGE OR BANDWIDTH IN MANET

Mobile Ad Hoc network is a self configuring and self organizing multihop wireless network, where the structure of the network changes dynamically [15]. Dynamically change creates problem in the network. Mobile Ad hoc Networks are consisting of mobile nodes having limited radio range and bandwidth without having any fixed infrastructure. Geometric routing or position based routing is beneficial for searching the shortest path in limited radio range and bandwidth between sources to destination. Geometric routing each mobile node knows its position and the positions of their neighbour nodes using location service of the GPS modems by satellite attached with each mobile node [10 and 11]. By using the position based routing can reduce the packet delay in lower bandwidth in MANET.

GENETIC ALGORITHM IN MANET

Genetic Algorithm is proposed by the John Holland in 1970 [10, 13, 19, 20 and 21]. Genetic Algorithm is used in MANET for searching the shortest path or minimized path from source to destination. Genetic Algorithm is based on the biological neural network. It works on the survival of fitness rule.

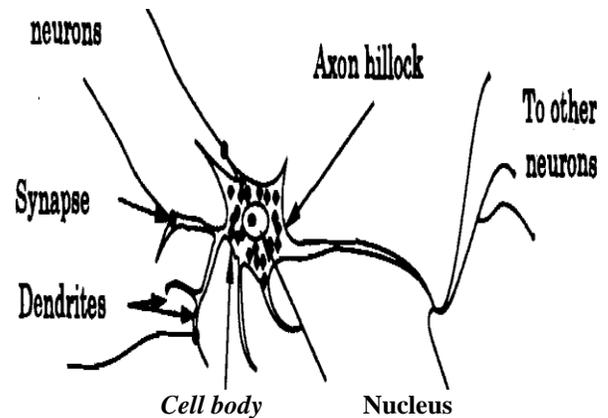


Figure. [19]

NEURONS:-

The basic unit of the unit is called the neuron or nerve cell. **Neurons** are pathways for electrical messages to pass through. They usually transmit these messages between a receptor (something that picks up a stimulus. A stimulus includes things such as temperature, pressure, pain etc.), the brain and an effector.

NUCELUS:-

Nucleus is the part of the cell body. The nucleus is found inside each cell within a double membrane called the nuclear envelope, and is the 'organelle' (little organ) that controls all functions of that cell. The nucleus contains the DNA, which are the instructions which tell the cell what kinds of enzymes and hormones to create and how to function.

CELL BODY:-

Cell body is consisting in the Neuron. The cell body is apart of a cell nerve that contains the nucleus but it does not contain the dendrites or the axon. It produces all proteins and contains organelles.

DENDRITES:-

Dendrites are connected with the cell body. Dendrites are consisting the synapse which is used for signal transferring to another neuron.

SYNAPSE:-

Synapse send the signal to another as a transmitter and another will receive the signal as a receiver.

AXON HILLOCK:-

An axon hillock is the region of the axon closest to the cell body where the action potential often originates. An axon hillock is the prominence on a nerve-cell body from which an axon arises. There is also a person Axon Hillock on Lindedln.

OPERATIONS OF THE GENETIC ALGORITHM

- 1) INITIAL POPULATION.
- 2) SELECTION.
- 3) CROSSCOVER.
- 4) EVALUATION OF THE FITNESS.
- 5) MUTATION.

INITIAL POPULATION:-

The GA starts with a group of chromosomes known as the population. The population has N_{pop} chromosomes and is an $N_{pop} \times N_{bits}$ matrix filled with random ones and zeros generated using

Pop=round (rand (N_{pop} , N_{bits}));

Where the function (N_{pop} , N_{bits}) generates an N_{pop} , N_{bits} matrix of uniform random numbers between zero and one [22]. Genetic Algorithms (GAs) work best when building short, low-order Population containing the optimum or desired near optimum are expected to grow, hereby permitting crossover to generate the desired solution or solutions [17].

SELECTION:-

By Selection process, offspring are generated. Offspring are generated by the parent. Parent can be that chromosomes that have the best fitness in all population.

CROSSOVER:-

In the crossover process, one or more than bit of chromosomes changed and generate a new population.

EVALUATION OF THE FITNESS:-

Fitness function is used for neglecting of that type of population which are not long time survival. It separates the relevant and irrelevant population [13]. Many formulas are used for finding the fitness value of the chromosomes in the population. The fitness function plays a very important role in

guiding GA/P to obtain the best solutions within a large search space [12]. Bad fitness functions, on the other hand, can easily make GA/P get trapped in a local optimum solution and lose the discovery power.

MUTATION:-

Finally, the mutation operator alters randomly some bits of the new strings [5]. GA can converge too quickly into one region of the cost surface. If this area is in the region of the global minimum, that is good. However, some functions, such as the one we are modelling, have many local minima. If we do nothing to solve this tendency to converge quickly, we could end up in a local rather than a global minimum. To avoid this problem of overly fast convergence, we force the routine to explore other areas of the cost surface by randomly introducing changes, or mutations, in some of the variables. For the binary GA, this amounted to just changing a bit from a 0 to a 1, and vice versa. The basic method of mutation is not much more complicated for the continuous GA [22].

IV. SECTION-C

BACKUP AND AUTHENTICATION

If each node in the network has the route history or backup then the overhead can be removed. Because if the failure will occur, from node creating a failure by which that node from backup another route can find and solve the overhead problem and time [10, 9]. ZRP (Zone Routing Protocol) facilitates the authentication facilities [36].

V. CONCLUSION

Ad Hoc network have a dynamic nature. It have the lot problems like mobility nature of nodes, power consumption, delay in information, authentication etc. at the time of communication. By using many routing protocols can resolve these types of problems. Backups can solve the many problems like power consumption, energy efficiency, delay in messages, network overheads. And ZRP protocol gives the authentication protocol. By Genetic algorithm can find the shortest path in a less time. Genetic algorithm is work faster than the routing protocols [9, 10].

REFERENCES

- [1] Azzedine Boukerche, "Algorithms and Protocols for Wireless and Mobile Ad-Hocnetworks.
- [2] Subir Kumar, Sarkar T G Basavaraju, C Puttamadappa, "Ad Hoc Mobile Wireless Networks Principles, Protocols, and Applications".
- [3] Stefano Basagni, Marco Conti, Silvia Giordano, Anstojmenovic.
- [4] Md. Mahbulul Alam, Tanmoon Taz Shetu,"Congestion control in Mobile Ad-Hoc Networks (MANETs)".
- [5] Anjum A. Mohammed, Gihan Nagib, "Optimal Routing In Ad-Hoc Network Using Genetic Algorithm".
- [6] Vidya Shree.P, Sophia Reena.G., "A survey of various routing protocols in mobile ad-hoc networks (MANET)".
- [7] M.Sravan Kumar, J.Damodhar," Qos improvement in MANETS using reactive routing protocols".

- [8] Ajay Shah, Hitesh Gupta, Mukesh Baghel, "Energy-Efficient Routing Protocol for Mobile Ad Hoc Networks".
- [9] D.Suresh Kumar, K.Manikandan, M.A.Saleem Durai, "Secure On-Demand Routing Protocol for MANET using Genetic Algorithm".
- [10] Sonam Jain, Sandeep Sahu, "Geometric Routing Protocol based on Genetic Algorithm for Minimized Delay in MANETS".
- [11] Holger Füller, Angelika Leibscher, Jörg Widmer, Matthias Transier, and Wolfgang Effelsberg, "Contention-Based Distance-Vector Routing (CBDV) For Mobile Ad-Hoc Networks".
- [12] Weiguo Fan, Edward A. Fox, "The Effects of Fitness Functions on Genetic Programming-Based Ranking Discovery for Web Search".
- [13] Cristina Lopez-Pujalte, Vicente P. Guerrero-Bote, Félix de Moya-Anejo, "Order-Based Fitness Functions for Genetic Algorithms Applied to Relevance feedback".
- [14] Vassilios Petridis, Spyros Kazarlis, and Anastasios Bakirtzis, "Varying Fitness Functions in Genetic Algorithm Constrained Optimization: The Cutting Stock and Unit Commitment problems".
- [15] Vivek Kumar, Sumit Miglani, "simulation and comparison of AODV and DSR routing protocols".
- [16] Krishna Gorantala, "Routing Protocols in Mobile Ad-hoc Networks".
- [17] David E. Goldberg, Mike R. Udlick, "Genetic Algorithms and the Variance of Fitness".
- [18] K.V.Pradeep, Matam Veeresh Kumar, "An Efficient Routing Technique for Mobile Adhoc Wireless Networks".
- [19] B. Yegnanarayana, "Artificial Neural Networks".
- [20] Melanie Mitchell, "An introduction to genetic algorithm".
- [21] David E. Goldberg, "Genetic Algorithms in search, Optimization & Machine Learning".
- [22] Randy L. Haupt, Sue Ellen Haupt, "Practical Genetic Algorithms".
- [23] Talooki, V., "Energy Efficient Flat Routing Protocol for Wireless Ad Hoc Networks".
- [24] Youngjun Park, "Comparison study on flat routing and hierarchical Routing".
- [25] Adam Carmine, "Hierarchical routing in MANETs using simple Clustering".
- [26] Young-Bae KO and Nitin H. Vaidya, "Geocasting in Mobile Ad Hoc Networks: Location-Based Multicast Algorithms".
- [27] Mohammad A. Mikki, Gaza, Palestine, "Energy Efficient Location Aided Routing Protocol for Wireless MANETS".
- [28] Stefano B-Agni, Irnich Chlmtac, Violet R. Syrotiuk, Barry A. Woodward "A Distance Routing Effect Algorithm for Mobility (DREAM)".
- [29] Natarajan Meghanathan, "An Energy-aware Greedy Perimeter Stateless Routing Protocol for Mobile Ad hoc Networks".
- [30] Guangyu Pei, Mario Gerla, Tsu-Wei Chen, "Fisheye State Routing in Mobile Ad Hoc Networks".
- [31] P. Jacquet, P.Muhlethaler, T.Clausen, A. Laouiti, "Optimization Link State Routing Protocol for Ad Hoc Networks".
- [32] "http://www.cs.wmich.edu/wsn/cs603/advNtwkSumII03/lec14b%20routing%20protocols%20for%20adhoc%20080603.pdf".
- [33] Technion, "Mobile Ad-Hoc Networks TBRPF".
- [34] Sarosh Patel, Syed Rizvi and Khaled Elleithy, "Hierarchically Segmented Routing (HSR) Protocol for MANET".
- [35] Petteri Kuosmanen, "Classification of Ad Hoc Routing Protocols".
- [36] Mr. Kamaljit I. Lakhtaria, Mr. Paresh Patel, "Analyzing Zone Routing Protocol in MANET Applying Authentic Parameter".
- [37] Guangyu Pei, Mario Gerla and Xiaoyan Hong, "LANMAR: Landmark Routing for Large Scale Wireless Ad Hoc Networks with Group Mobility".
- [38] Georgios Koltidas and Fotini-Niovi Pavlidou, "Single-path and Multipath Routing Algorithms for Mobile Ad Hoc Networks".
- [39] John Sucec and Ivan Marsic, "Clustering Overhead for Hierarchical Routing in Mobile Ad hoc Networks".
- [40] Xia Jiang, Tracy Camp, "A Review of Geocasting Protocols for a Mobile Ad Hoc Network".

AUTHORS

First Author – Upasna, Student M.tech, Deptt. Computer science Banasthali Vidyapith University, Rajasthan, India, Email: Chaudhary_upasna@yahoo.com

Second Author – Jyoti Chauhan, Student M.tech Deptt. Computer science Banasthali Vidyapith University, Rajasthan, India, Email: Jyotichauhan191989@gmail.com

Third Author – Manisha, Student M.tech Deptt. Computer science Banasthali Vidyapith University, Rajasthan, India, Email: manishamalik2011@gmail.com

Mobile Banking Services as Adoption and Challenges: A Case of M-Banking in India (Positive and Negative impacts, Mobile Growth in India, Adoption Models and Mobile Technology)

Dr. Vinod Kumar Gupta^{*}, Renu Bagoria^{**}, Neha Bagoria^{***}

^{*}Jagan Nath University, Chakshu, Jaipur, India

^{**}Jagan Nath University, Chakshu, Jaipur, India

^{***}JIET Jodhpur, Jodhpur, Rajasthan, India

Abstract- This paper identifies and investigates the factors which influence customers decision to use a specific form of mobile banking, and specifically focuses on the evaluation of SMS-based mobile banking in India. Other my study plans to connect the gap of research in the acceptance of mobile banking among the customers. Main challenges are what are the Positive and Negative factors which influence the adoption of SMS-based mobile banking? Second is Focus on the adoption of mobile banking services by customers and usage of mobile banking in India. Third is Different Technologies behind Mobile Banking. Although the study has its limitations, the implications of the results allow providing practical recommendations to the banking areas, banking industries and directions for further work.

Index Terms- SMS, Mobile Banking, IVR, WAP

I. INTRODUCTION

Mobile banking is an application of mobile computing which provides customers with the support needed to be able to bank anywhere, anytime using a mobile handheld device and a mobile service such as Short Message Service (SMS). Mobile banking facility removes the space and time limitations from banking activities such as checking account balances or transferring money from one account to another and time saving when we go to bank and doing some banking activities.

Internet Banking helps give the customer's anytime access to their banks. Customer's could check out their account details, get their bank statements, perform transactions like transferring money to other accounts and pay their bills sitting in the comfort of their homes and offices. But the biggest limitation of Internet banking is the requirement of a Personal Computer with an Internet connection, but definitely a big barrier if we consider most of the developing countries of Asia like India. Mobile banking addresses this fundamental limitation of Internet Banking, as it reduces the customer requirement to just a mobile phone. Mobile usage has seen an explosive growth in most of the Asian economies like India. The main purpose of Mobile Banking scores over Internet Banking is that it enables 'Anywhere Anytime Banking is Available'. Customers don't need access to a computer terminal to access their bank accounts.

II. MOBILE BANKING ADOPTION AND CHALLENGES IN INDIA: POSITIVE AND NEGATIVE, IMPACTS, MOBILE BANKING SERVICES, MOBILE GROWTH, ADOPTION MODELS AND MOBILE TECHNOLOGIES

Financial Services are generally complex and need a lot of trust for the consumer to use technology. Banks have changed from paper-based banking solutions provider to the latest of the technologies like online-banking, mobile-banking, etc. Customers across the world, even technologically optimists, have refrained from using technology aided solutions. There are many reasons why technology has not been able to ride the acceptance wave and cross the hurdle and become an acceptable feature in banking. As today's banking has redefined itself as customer centric, it becomes more important that the customer is happy with the services being provided. Unfortunately, the acceptance and adoption rates are very low even in the case of educated customers. The paper looks at various factors which explain why consumers are not using mobile banking and other technologies in banking. It would also try to suggest why people are not currently using mobile banking and try to suggest how to overcome this problem and increase the acceptance levels.

Mobile Banking where banks provide these following services:

Account Details: - define the information related to accounts and following are the main services of accounts.

- a) Mini-statements and checking of account history
- b) Alerts on account activity
- c) Monitoring of term deposits
- d) Access to loan statements/card statements
- e) Mutual funds / equity statements
- f) Insurance policy management
- g) Pension plan management

Payments and Transfers: define the information about the payments and transfers activities like bill payment process.

- a) Domestic and international fund transfers
- b) Micro-payment handling
- c) Mobile recharging
- d) Commercial payment processing
- e) Bill payment processing

Investments Details: define the information related to investments services.

- a) Portfolio management services
- b) Real-time stock quotes
- c) Personalized alerts and notifications on security prices Support
- d) Status of requests for credit, including mortgage approval, and insurance coverage
- e) Check (cheque) book and card requests
- f) Exchange of data messages and email, including complaint submission and tracking

Content Services: define the information related to Location based and weather like updates.

- a) Loyalty-related offers
- b) Location-based services
- c) General information such as weather updates, news

Technologies behind Mobile Banking

Mobile Banking is being deployed using mobile applications developed on one of the following these emerging technologies.

IVR – Interactive Voice Response

IVR Technology used in Banks: - Interactive Voice Response service operates through pre-specified numbers that banks advertise to their customers. Customer's make a call at the IVR number and are usually greeted by a stored electronic message followed by a menu of different and multiple options. Customers can choose any options by pressing the corresponding number in their keypads, and then read the regarding information, mostly using a text to speech program. Mobile banking based on IVR has some main limitations that they can be used only for Enquiry based services. Also, IVR is more costly as compared to other channels as it involves making a voice call which is generally more costly than sending a text message or making data transfer .One way to enable IVR is by deploying a PBX system that can host IVR dial plans.

Banks looking to go the low cost way should consider evaluating Asterisk, which is an open source Linux PBX system SMS uses the popular text-messaging standard to enable mobile application based banking. The way this works is that the customer requests for information by sending an SMS containing a service command to a pre-specified number. The bank responds with a reply SMS containing the specific information. For instance, if any customer wants to gets any information regarding his/her account balance. Customer can use a handheld mobile and customers of the AXIS Bank in India can get their account balance details by sending the keyword 'AXISBAL' and receive their balance information again by SMS.

There are other services of IVR-

- a) Bank and stock account balances and transfers
- b) Surveys and polls
- c) Office call routing
- d) Call center forwarding
- e) Simple order entry transactions
- f) Selective information lookup (movie schedules, etc.)

- g) Mobile — Pay-As-You-Go account funding; registration; mobile purchases
 - h) Banking — balance, payments, transfers, transaction history
 - i) Retail & Entertainment — orders, bookings, credit & debit card payments
 - j) Utilities — meter readings
- Travel — ticket booking, flight information, check-in
Weather forecasts, water, road and ice conditions

SMS (Short Messaging Service)

SMS Banking initiatives permit you to access your Bank accounts and carry out various banking transactions and Services. If you have a mobile phone, you can use the SMS facility and conduct the following operations using the messaging services of your service provider.

- a) Balance Enquiry
- b) Last Few Transactions
- c) Cheque Paid Status
- d) Suspend ATM / Debit Card
- e) Loan Balance Enquiry
- f) Deposit Service

Here, we are introducing SMS Banking to all our customers. Presently SMS Alert facility is free to the customers. There are two types of services available namely SMS PUSH Alerts and SMS PULL Alerts. There are different types of PUSH Alert services. SMS Banking sends many alert facilities to customers. if any customer facing some following situation than SMS provide following Services.

- a) To send an alert when the account balance goes above the maximum balance specified by the customers.
- b) To send an alert when the transaction amount credited is Rs. 5,000 and above or the amount specified by the customer, whichever is higher.
- c) To send an alert when the transaction amount is debited.
- d) To send an alert when a cheque is bounced.
- e) The send an alert when the outstation cheque is realized.
- f) To send an alert when a cheque deposited by the customer gets returned un paid.
- g) To send the end of day balance of the specified account given by the customer (CA / OD / CC).
- h) To send reminding alert seven days before the maturity of the term deposit accounts (Amount may not be mentioned).
- i) To send reminding alert seven days before the installment due date for the loan accounts (Amount may not be mentioned).

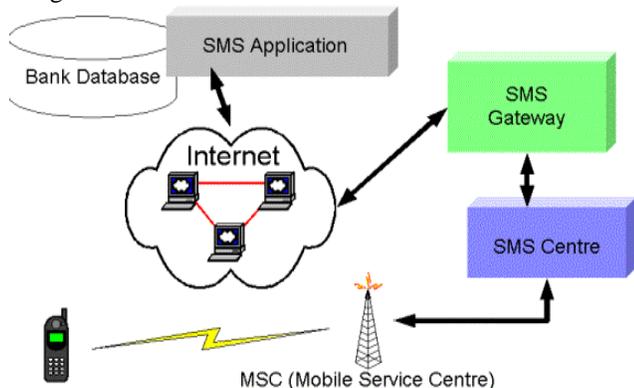
Pull Alert Services are:

- a) Account balance enquiry
- b) Mini statement request
- c) [Electronic bill payment](#)
- d) Transfers between customer's own accounts, like moving money from a savings account to a current account to fund a cheque
- e) Stop payment instruction on a cheque
- f) Requesting for an [ATM card](#) or [credit card](#) to be suspended

- g) De-activating a credit or debit card when it is lost or the PIN is known to be compromised
- h) Foreign currency exchange rates enquiry
- i) Fixed deposit interest rates enquiry.

If any customer wants to registration process then Customers have to submit the application form by giving their mobile number, account number and alert details. The customer has the option to choose or not to choose the different alerts available.

An SMS based service is hosted on a SMS gateway that further connects to the Mobile service providers SMS Centre. This Figure shows:

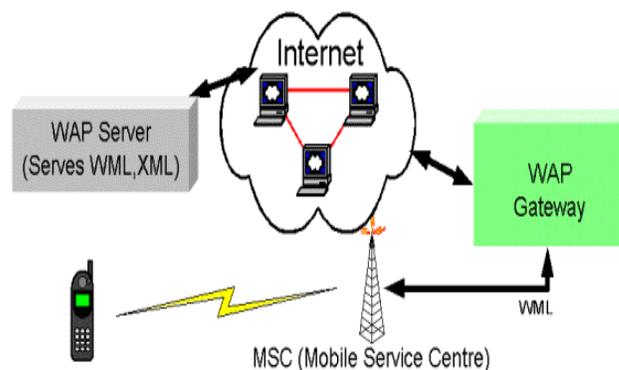


WAP – Wireless Access Protocol

To bridge the gap between the mobile network and Internet.WAP is a global standard produced by WAP forum founded in 1997 with the help of Nokia, Ericsson, Motorola and Unwired Planet. There are two different editions: WAP 1.x and WAP 2.x Banks maintain a WAP site which is similar is internet banking. Which customer's access using a WAP compatible browser on their mobile phones. WAP sites provide the familiar form based interface and can also implement security quite effectively.

The banks customers can now have an anytime, anywhere access to a secure reliable service that allows them to access all enquiry and transaction based services and also more complex transaction like trade in securities through their phone A WAP based service requires hosting a WAP gateway. Mobile Application users access the bank's site through the WAP gateway to carry out transactions, much like internet users access a web portal for accessing the banks services.

The following figure demonstrates the framework for enabling mobile applications over WAP. The actually forms that go into a mobile application are stored on a WAP server, and served on demand. The WAP Gateway forms an access point to the internet from the mobile network.



Standalone Mobile Application Clients

Standalone mobile applications are the ones that hold out the most promise as they are most suitable to implement complex banking transactions like trading in securities. They can be easily customized according to the user interface complexity supported by the mobile. In addition, mobile applications enable the implementation of a very secure and reliable channel of communication.

One requirement of mobile applications clients is that they require to be downloaded on the client device before they can be used, which further requires the mobile device to support one of the many development environments like J2ME . J2ME is fast becoming an industry standard to deploy mobile applications and requires the mobile phone to support Java. The major disadvantage of mobile application clients is that the applications needs to be customized to each mobile phone on which it might finally run. J2ME ties together the API for mobile phones which have the similar functionality in what it calls 'profiles'. Out of J2ME and BREW, J2ME seems to have an edge right now as Nokia has made the development tools open to developers which has further fostered a huge online community focused in developing applications based on J2ME. Nokia has gone an additional mile by providing an open online market place for developers where they can sell their applications to major cellular operators around the world. Quite a few mobile software product companies have rolled out solutions, which enable J2ME mobile applications, based banking. One such product is Wireless Ibanco. The mobile user downloads and installs the wireless I-banco application on their J2ME pone. The J2ME client connects to the wireless I-banco server through the service providers GSM network to enable users to access information about their accounts and perform transactions. One of the other big advantages of using a mobile application client is that it can implement a very secure channel with end-to-end encryption.

Positive impact of Mobile Banking Cost Reduction

The biggest advantage of mobile banking offers to banks is that it drastically cuts down the costs of providing service to the customers. For service providers, Mobile banking offers the next surest way to achieve growth. Countries like India where mobile penetration is nearing saturation, mobile banking is helping service providers increase revenues from the now static subscriber base. Service providers are increasingly using the

complexity of their supported mobile banking services to attract new customers and retain old ones.

To Control Fraud

A very effective way of improving customer service could be to inform customers better. Credit card fraud is one such area. A bank could, through the use of mobile technology, inform owners each time purchases above a certain value have been made on their card. This way the owner is always informed when their card is used, and how much money was taken for each transaction.

Reminder Facility

Similarly, the bank could remind customers of outstanding loan repayment dates, dates for the payment of monthly installments or simply tell them that a bill has been presented and is up for payment. The customers can then check their balance on the phone and authorize the required amounts for payment. The customers can also request for additional information. They can automatically view deposits and withdrawals as they occur and also pre-schedule payments to be made or cheques to be issued. Similarly, one could also request for services like stop cheque or issue of a cheque book over one's mobile phone.

Easy to avail Mobile Services

A mobile is almost always with the customer. As such it can be used over a vast geographical area. The customer does not have to visit the bank ATM or a branch to avail of the bank's services. Research indicates that the number of footfalls at a bank's branch has fallen down drastically after the installation of ATMs. As such with mobile services, a bank will need to hire even less employees as people will no longer need to visit bank branches apart from certain occasions. With Indian telecom operators working on offering services like money transaction over a mobile, it may soon be possible for a bank to offer phone based credit systems. This will make credit cards redundant and also aid in checking credit card fraud apart from offering enhanced customer convenience. The use of mobile technologies is thus a win-win proposition for both the banks and the bank's customers.

The banks add to this personalized communication through the process of automation. For instance, if the customer asks for his account or card balance after conducting a transaction, the installed software can send him an automated reply informing of the same. These automated replies thus save the bank the need to hire additional employees for servicing customer needs

Security features

Customer will receive the alerts only in the mobile number, which he has registered with bank. Moreover the sensitive information such as account number is not sent as a whole. But only the last six digits and account type will be sent to the customer. The customer can receive his account balance and transactions only when the request is received from the mobile phone number registered with us and duly authenticated by the 4 digit Code Number, which will be provided when PULL Alert services are introduced. The mobile phone number and the Code number from which the service is accessed will serve as a User

ID and password for authentication. The Code number has therefore to be kept confidential

Negative impact of Mobile Banking Security

Security experts generally agree that mobile banking is safer than computer banking because very few viruses and Trojans exist for phones. That does not mean mobile banking is immune to security threats, however Mobile users are especially susceptible to a phishing-like scam called "smishing." It happens when a mobile banking user receives a fake text message asking for bank account details from a hacker posing as a financial institution. Many people have fallen for this trick and had money stolen through this scam.

Online banking is usually done through an encrypted connection so that hackers cannot read transmitted data, but consider the consequences if your mobile device is stolen. While all banking applications require you to enter a password or PIN, many people configure their mobile devices to save passwords, or use insecure passwords and PINs that are easy to guess.

Compatibility

Mobile banking is not available on every device. Some banks do not provide mobile banking at all. Others require you to use a custom mobile banking application only available on the most popular smart phones, such as the Apple iPhone and RIM Blackberry. Third-party mobile banking software is not always supported.

If you do not own a smart phone, the types of mobile banking you can do are usually limited. Checking bank account balances via text message is not a problem, but more advanced features such as account transfers are generally not available to users of "dumb phones."

Cost

Network service charges quickly add up. The cost of mobile banking might not appear significant if you already have a compatible device, but you still need to pay data and text messaging fees. Some financial institutions charge an extra fee for mobile banking service, and you may need to pay a fee for software. These extra charges quickly add up, especially if you access mobile banking often.

Mobile Banking Growth 2009 to 2012

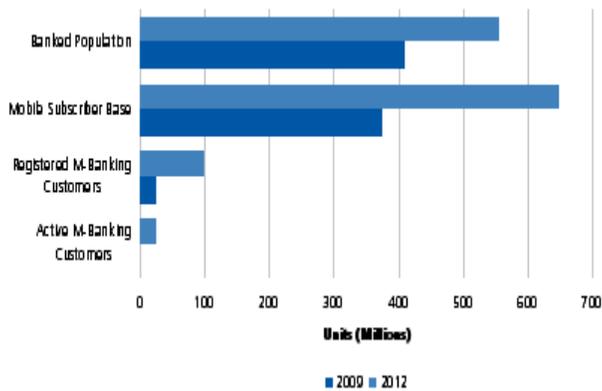
Mobile banking in India is in a budding stage, with the high penetration of mobile phones acting as a growth driver. India's existing mobile phone user base consists of 347 million users, including 73 million rural users. The Growth of mobile banking active users base to reach 2% by 2012, up from the current 0.2%.

In a new report, examines the potential for mobile banking growth in India's urban and rural markets. Mobile banking is currently free of cost to encourage customers to adopt this new channel. Despite this, the registered user base is only 25 million people, and the active user base is just 10% or 2.5 million of registered user base.

One major reason for the current low adoption of mobile banking, especially among the urban population, is the availability of alternative modes of banking, such as accessibility

to ATMs, online banking, etc. Mobile payments have evidenced better usage among youth. The young, banked, urban working populations are tech-savvy and present short-term potential for the growth of mobile banking in India.

Growth in Mobile Banking Subscribers, 2009 to 2012



III. CONCLUSION

The aim of my paper is to review of research paper on mobile banking to analyze the different factors as Negative and Positive that impact adoption of mobile banking, and to introduce the mobile banking emerging technologies and services.

It is well recognized that mobile phones have immense potential of conducting financial transactions thus leading the financial growth with lot of convenience and much reduced cost. and there are many positive factors are introduced such like Cost Reduction, To Control Fraud, Easy to avail Mobile Services and Reminder Facilities and have some Negative Factors are also introduced like Security ,Compatibility and Costly Network Service Charges.

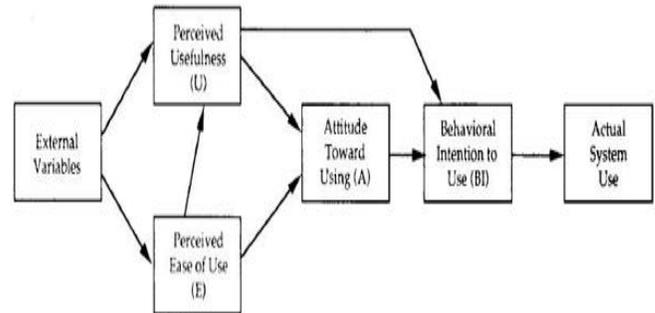
For inclusive growth, the benefits of mobile banking should reach to the common man at the remotest locations in the country. For this all stakeholders like Regulators, Govt, telecom service providers and mobile device manufactures need to make efforts so that penetration of mobile banking reaches from high-end to low-end users and from metros to the middle towns and rural areas. Inclusion of non-banking population in financial main stream will benefit all. There is also need to generate awareness about the mobile banking so that more and more people use it for their benefit..

Adoption models: TAM, DIT, TBP

TAM is an adaptation of the Theory of Reasoned Action (TRA) to the field of IS. TAM posits that perceived usefulness and perceived ease of use determine an individual's intention to use a system with intention to use serving as a mediator of actual system use. Perceived usefulness is also seen as being directly impacted by perceived ease of use. Researchers have simplified TAM by removing the attitude construct found in TRA from the current specification (Venkatesh et. al., 2003). Attempts to extend TAM have generally taken one of three approaches: by introducing factors from related models, by introducing additional or alternative belief factors, and by examining

antecedents and moderators of perceived usefulness and perceived ease of use (Wixom and Todd, 2005).

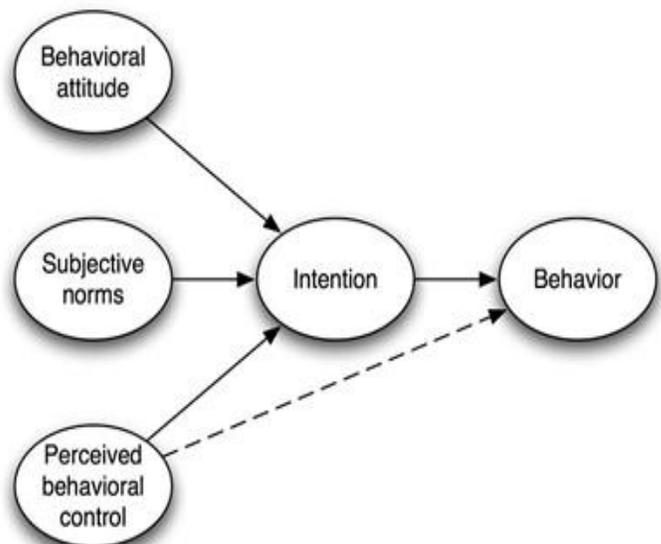
TRA and TAM, both of which have strong behavioural elements, assume that when someone forms an intention to act, that they will be free to act without limitation. In practice constraints such as limited ability, time, environmental or organisational limits, and unconscious habits will limit the freedom to act



DIT "Diffusion of Innovations Theory"

Another well established theory for user adoption is IDT (Rogers, 1962, 1983, 1995). Innovation diffusion is achieved through users' acceptance and use of new ideas or things (Zaltman and Stiff, 1973). The theory explains, among many things, the process of the innovation decision process, the determinants of rate of adoption, and various categories of adopters, and it helps predict the likelihood and the rate of an innovation being adopted. Rogers, (1995) stated that an innovation's relative advantage, compatibility, complexity, trialability and observability were found to explain 49 to 87 per cent of the variance in the rate of its adoption. Other research projects including the meta-analysis of seventy-five diffusion articles conducted by Tornatzky and Klein, (1982)16 found that only relative advantage, compatibility and complexity were consistently related to the rate of innovation adoption

TBP(Theory of Behaviour Planning) Model



REFERENCES

- [1] Adoption of Mobile Banking Services in Jordan, Scientific Journal of King Faisal University(Humanities and Management Sciences), Vol9 No2, 1429H(2008)
- [2] Shi Yu, Factors influencing the use of Mobile Banking:The case of SMS-based Mobile Banking, 2009
- [3] Supathanish Termsnguanwong, CUSTOMERS' DISCERNMENT OF MOBILE BANKING BUSINESS : NORTHERN REGION OF THAILAND, International Trade & Academic Research Conference (ITARC) - London 2010.
- [4] Ching Mun Cheah¹, Aik Chuan Teo², Jia Jia Sim³, Kam Hoe Oon⁴ and Boon In Tan⁵, Factors Affecting Malaysian Mobile Banking Adoption: An Empirical Analysis, International Journal of Network and Mobile Technologies,ISSN 2229-9114 Electronic Version,VOL 2 / ISSUE 3 / SEPTEMBER 2011.
- [5] Central Bureau of Statistics. National Micro and Small Enterprise Baseline Survey. Government printer, Nairobi. 1999.

AUTHORS

First Author – Dr. Vinod Kumar Gupta, Jagan Nath University, Chakshu, Jaipur,India, e-mail: vinodgupta602@gmail.com

Second Author – Renu Bagoria Jagan Nath University, Chakshu, Jaipur, Indiae-mail: renubagoria@gmail.com.

Third Author – Neha Bagoria, JIET Jodhpur, Jodhpur, Rajasthan, India, Nehabagoria06@gmail.com

Anti - Microbial Plasma Membrane Activity of Daptomycin and Pantoyl Lactone against *Streptococcus equi*

Zidan A. Bashir^{1 2}

¹ School of Biosciences and Biotechnology, Faculty of Science and Technology, National University of Malaysia, Malaysia

² Department of Zoology, Faculty of Science, Sebha University, Lybia

Abstract- In this study, the ability of two antibiotics daptomycin and pantoyl lactone to inhibit growth of horse originated pathogen *Streptococcus equi* by disrupting plasma membrane of the bacterium was investigated using agar diffusion and micro tube dilution methods. The results obtained from this study indicated that daptomycin was more effective in inhibiting the growth of the pathogen in vitro than the second antibiotics. The 3 tested strains were susceptible to daptomycin but completely resistant to pantoyl lactone. Hence, daptomycin therefore tends to be potent for treating horse infections caused by this pathogen.

Index Terms- plasma membrane, agar diffusion, antimicrobial

I. INTRODUCTION

The membrane of *Streptococcus equi*, like other microorganisms contains lipids and proteins which are the major components of all membranes (Kakizaki et al., 2002). Below is an overview of some of the major components of the *S. equi* membrane. Gram - positive bacteria such as *S. equi* have developed mechanisms for anchoring of proteins to their membranes via covalent N-terminal lipidation (Sutcliffe & Russell, 1995). The lipidation process occurs during the export to the cell surface. Lpp form significant proportion of bacterial membrane; hence they may participate in a wide variety of functions including metabolic regulation, nutrient acquisition and signal transduction. They may also contribute to the virulence of some bacterial pathogens (Harrington et al., 2002). Lactone compounds are widely distributed in the nature and play important roles in microorganisms. Lactone-hydrolyzing enzymes may be involved in the synthesis and degradation of such lactone compounds (Rose, 1976). Pantoyl lactone is an antimicrobial compound that has been found to bring about changes in the cell membrane lipids of microorganisms such as *Micrococcus lysodeikticus* (Johnson et al., 1980). Significant amounts of the two major phospholipids (phosphatidylglycerol and diphosphatidylglycerol) were converted to lyso-forms, which are compounds resulting from the hydrolysis of one of the fatty acids (usually the β) present in phosphodiacylglycerol (Devlin, 1997). Pantoyl lactone has also been shown to inhibit the uptake of glycerol, pyruvate, malate, 2-deoxy-D-glucose, uracil and several amino acids (Grula and King, 1971). Johnson et al., (1980) reported that the hydroxyl and carbonyl functional groups of Pantoyl lactone interact with lipids of the cell membrane, most likely through hydrogen bonding, whereas the methyl group is

hydrophobic. This interaction led to the damage of cell membrane, as revealed by scanning calorimetry, thereby inhibiting cell division (Johnson et al., 1980). Hence this compound has been shown to affect bacterial membranes. However, its effects on *S. equi* have never been reported. It is one of the aims of this project to investigate the effect this antimicrobial agent will have on the membrane lipids of *S. equi*. Daptomycin is a cyclic lipopeptide, which is used as antibactericidal agent against a wide range of gram-positive bacterial pathogens, including the antibiotic resistant pneumococci, enterococci, and staphylococci that are currently presenting a challenge for the development of empirical chemotherapy (Barry et al., 2001). Tally et al., (1999) reported that daptomycin is currently being evaluated for possible applications in cases in which there may be a high prevalence of antibiotic-resistant gram-positive bacteria such as *Streptococci* and *Staphylococci*. The bacterial activity of daptomycin requires the presence of calcium cations. Jones et al., (1987) recommend that when testing for daptomycin, the broth media should contain additional calcium approaching the concentration of ionized calcium that is normally found in human serum (e.g. 50mg/l). Barry et al., (2001) reported that *Staphylococci* and *Streptococci* were inhibited by daptomycin at 2 μ g/ml when tested in calcium supplemented with Cation-adjusted Mueller-Hinton broth (CAMHB). In recent years, attention has been focused on minimum inhibitory concentrations of daptomycin ranging from 2.0 to 4.0 μ g/ml have been determined when assessing the effect of additional calcium to the broth medium (Barry et al., 2001). Thus, several studies indicated that daptomycin might be useful for treating serious enterococcal infections (Kennedy & Chambers, 1989; Ramas et al., 1992). Despite the potent antibacterial ability of daptomycin, its mechanism of action has not been clearly understood. However, two different mechanisms of action have been proposed for its bacterial activity, involving either the inhibition of LTA synthesis (Boaretti & Canepari, 1995) or the dissipation of the membrane potential across the cytoplasmic membrane, leading to the disruption of several different cellular processes (Alborn et al., 1991). Recently, Silverman et al. (2003) proposed a multi-step model for the mechanism of action of daptomycin that involves the depolarisation of the cytoplasmic membrane. Jung et al., (2004) have also attempted to elucidate the mechanism of action of daptomycin by significantly modifying the model of Silverman et al., (2003) by demonstrating that Ca^{2+} is required for two distinct

conformational changes, each of which separately impacted how daptomycin interacted with membranes.

In this study we are aiming to bring to an end the suffering of horses by identifying antibiotics that might inhibit growth of *S. equi* by focusing on selected compounds (chemicals/antibiotics) that may interact with *S. equi* membrane component resulting in the rupture and killing of the bacterium or inhibition of its growth. The compounds investigated in this study are chosen for their likely ability to interact, dissolve into and affect membranes.

II. MATERIALS AND METHODS

Source of bacteria

The following three strains of *S. equi* 4047, K3 and NCTC 9682 strains were used in this study and obtained from Dr. I. Sutcliffe, Northumbria University, United Kingdom). The strains were firstly cultured in Brain Heart Infusion (BHI) broth overnight and incubated at 37 °C. Incubation was until the broth became turbid. Biochemical tests and Gram staining were also used to ascertain that the bacteria are gram-positive cocci in chains. Pure culture of each bacterial strain obtained by aseptically streaking a loopful inoculum on to solidified (BHI agar). The plates were incubated for 18 – 24 hours at 37 °C overnight. Stock culture were then prepared from the pure cultures and kept at 4 °C in the refrigerator for further study.

Media preparation

Brain Heart Infusion (BHI) broth

This was prepared according to manufacturer's instruction. Briefly, 7.4 g of granulated BHI was weighed before adding it to 200 ml of distilled water. This was mixed thoroughly for the solute to dissolve before distributing 20 ml into 10 universal bottles. All the bottles were autoclaved at 121 °C for 15 minutes.

Preparation of calcium supplemented BHI agar

This was prepared as described by Zidan (2012).

Preparation of antimicrobial compounds:

Preparation of pantoyl lactone (PL) stocks.

Two methods for preparing PL stocks were carried out. In first method, 0.36 mg of pantoyl lactone (PL) powder was weighed into sterile tubes before adding 200 ml of distilled water. The tubes were shaken thoroughly so as to enable the solute to dissolve. Prepared stock was then refrigerated for further use. However, the second method was as follows: 200 mg/ml stock of PL was prepared by weighing out 600 mg of PL and dissolving this into 3 ml of sterilized BHI broth which was

well mixed in a bijoux tube and filtered by use of membrane filter (for sterilization) and kept in the freezer as a stock.

Preparation of 20 mg/ml daptomycin stock.

This was prepared by weighing 36mg of daptomycin into a sterile eppendorf and dissolving in 20mg/ml of sterile distilled water. The prepared stock solution was clearly labelled and stored in the freezer.

Broth (tube) assay for MICs of antibiotics.

Starter culture was prepared by inoculating two McCartney tubes containing 20ml of BHI broth by a single colony of *Strep. equi* 4047 and then kept in the incubator at 37°C for 24 hours. Duplicate inocula consisting of 20 ml broth were necessary to avoid failure of growth in one of the McCartney tubes. The tubes and plates were then placed in a closed jar containing a lit candle to create an anaerobic condition then incubated at 37°C overnight. The jar containing the tubes and plates was taken out of the incubator to be examined. The tubes were arranged in an ascending order in a rack (i.e. tube 1 to tube 12) for observation. The tubes with bacteria growth were scored as positive (+) while the tubes without bacteria growth were scored as negative (-). Scoring the results starts from the control tube, which was 12th in which bacterial growth is expected because no antibiotic was added into it. Next is the scoring of 11th tube with the lowest antibiotic concentration, and so on. MIC is taken as the lowest concentration at which no growth. The agar plates were examined by counting the number of colonies, particularly on the plate marked with 10⁻⁴ dilution. The result was used to calculate the viable counts (c.f.u/ml) in the starting inocula.

Broth assay for other antibiotics

In the case of the revised method for pantoyl lactone from the stock previously prepared (the second method) as mentioned earlier, 1ml was transferred into the first test-tube that contained 1ml BHI broth and labelled as tube 1 with 100 mg/ml concentration of pantoyl lactone. Then from tube 1, two fold serial dilutions were carried out up to tube 11 from which 1ml was discarded. Tube 12 was kept as a control. The final concentrations of pantoyl lactone in the various tubes were recorded.

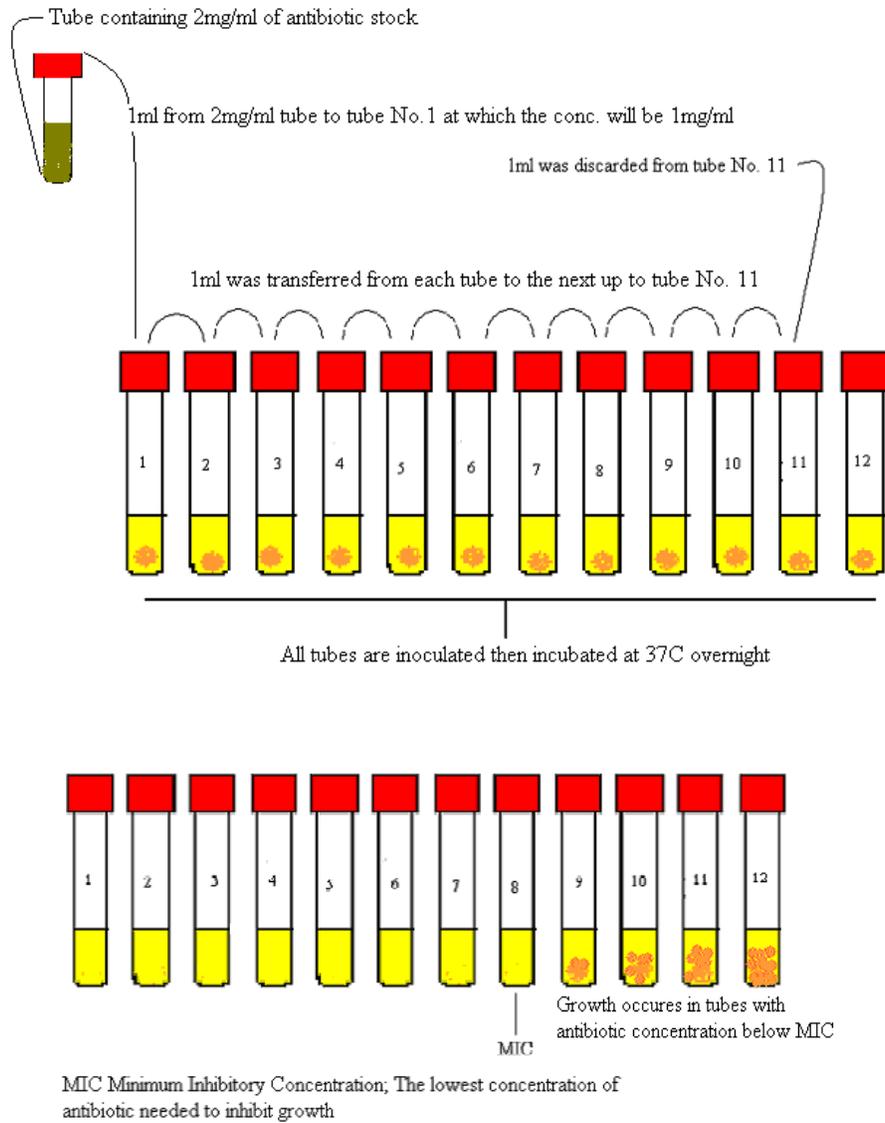


Figure1: Shows MIC determination by two-fold serial dilution

Table 1: Shows the final concentrations of pantoyl lactone in the various tubes.

Tube number	Pantoyl lactone addition (mL)	Broth addition (mL)	Final pantoyl lactone concentration (mg/mL)
1	1 (from 200 mg/1 stock)	1	100
2	1 (from tube 1)	1	50
3	1 (from tube 2)	1	25
4	1 (from tube 3)	1	12.5
5	1(from tube 4)	1	6.3
6	1(from tube 5)	1	3.1
7	1(from tube 6)	1	1.6
8	1(from tube 7)	1	0.8
9	1(from tube 8)	1	0.4
10	1from tube 9)	1	0.2
11**	1(from tube 10)	1	0.1
12	0	1	0

In the case of daptomycin, to prepare 40 mg/L, by transferring 8µl of the stock into 4ml BHI+Ca broth in a sterile tube. Two fold serial dilutions were carried out up to tube 11,

from which 1ml was discarded. Tube 12 was kept as a control. The final concentrations of daptomycin in the various tubes also recorded.

Table 2: Shows the final concentrations of daptomycin in the various tubes.

Tube number	Daptomycin addition (mL)	BHI+Ca Broth addition (mL)	Final antibiotic concentration (mg/L)
1	1 (from 40mg/L (stock))	1	20
2	1 (from tube 1)	1	10
3	1 (from tube 2)	1	5
4	1 (from tube 3)	1	2.5
5	1(from tube 4)	1	1.25
6	1(from tube 5)	1	0.625
7	1(from tube 6)	1	0.312
8	1(from tube 7)	1	0.156
9	1(from tube 8)	1	0.078
0	1from tube 9)	1	0.039
11**	1(from tube 10)	1	0.020
12	0	1	0

Plate assay

Disc diffusion assay of daptomycin.

Both starter culture and inoculum for each strain was prepared as earlier described Each strain was inoculated onto calcium supplemented BHI plate by adding 25µl from the inoculum onto each plate, which was spread using a sterile glass spreader while sterile forceps were used to place daptomycin sensitivity disc into each of the inoculated plates. All plates were then incubated under anaerobic conditions for 24 hours at 37°C.

III. RESULTS & DISCUSSION

Pantoyl lactone

Various concentrations of pantoyl lactone were tested for inhibitory ability by observing visible growth shown as turbid in all the tubes (Table 1). Results obtained indicated that the MIC

was > 1 mg/ml. Thus the concentration of pantoyl lactone was revised; the concentration range was increased to 100 mg/ml in subsequent experiments as shown in Table 3. Using these revised concentrations, there was no growth in tubes 1-4 in the first two experiments, while growth occurred in tubes 5-12; this means the MIC in this case was ≥ 12.5 mg/ml. Four more experiments were conducted (Table 3) to confirm the MIC ≥ 12.5 mg/ml obtained in the first two experiments. However, growth was observed in all the tubes, including tube No.1, with a concentration of 100 mg/ml. Therefore, the MIC ≥ 100 mg/ml indicates that *S. equi* 4047 is resistant to pantoyl lactone with this concentrations range 0.1mg/ml-100mg/ml. Pantoyl lactone assay with other strains. Pantoyl lactone assay was performed on the three strains of *Strep. equi* 4047, K3 and NCTC 9682 within the concentration range of 0.1mg/ml-100mg/ml. Growth was observed in all the tubes of the three strains as illustrated in Table 4, thus confirming that the three strains are resistant to pantoyl lactone within this concentration range. In contrast, media containing a

concentration of 0.15M (0.0195g/ml) pantoyl lactone has been reported to significantly inhibit growth and transport activities in *Micrococcus lysodeikticus* (Johnson et al., 1980). This inhibition was brought about by the modification of membrane phospholipids to lyso forms. Despite the alteration of the cell

membrane composition of *Micrococcus lysodeikticus* when grown in pantoyl lactone, normal cell growth and transport activities resume when the cells are washed free of pantoyl lactone (Johnson et al., 1980).

Table 3. Shows action of Pantoyl Lactone for *S. equi* strain 4047 (Revised method)

Expt NO.	Inoc c.f.u/ml	Tube number, Antibiotic final concentration & Growth state +/-											
		1	2	3	4	5	6	7	8	9	10	11	12
1	1 x10 ⁷	1mg /mL	500 g/ml	250g/ ml	125 g/ml	62.5 g/ml	31 g/ml	15.6 g/ml	7.8 g/ml	3.9 g/ml	2.0 g/ml	1.0 g/ml	Zero
2	4.2 x10 ⁶	100 mg/mL	50m g/ml	25mg /ml	12.5 mg/ml	6.3mg/ml	3.1mg/ml	1.6mg/ml	0.8mg/ml	0.4mg/ml	0.2mg/ml	0.1m g/ml	zero
		-	-	-	-	+	+	+	+	+	+	+	+
3	5.5 x10 ⁶	100 mg/mL	50m g/l	25mg /l	12.5 mg/l	6.3mg/ml	3.1mg/ml	1.6mg/ml	0.8mg/ml	0.4mg/ml	0.2mg/ml	0.1m g/ml	zero
		-	-	-	-	+	+	+	+	+	+	+	+
4	4.5 x10 ⁶	100 mg/L	50m g/l	25mg /l	12.5 mg/l	6.3mg/ml	3.1mg/ml	1.6mg/ml	0.8mg/ml	0.4mg/ml	0.2mg/ml	0.1m g/ml	zero
		+	+	+	+	+	+	+	+	+	+	+	+
5	2.5 x10 ⁶	100 mg/L	50m g/l	25mg /l	12.5 mg/l	6.3mg/ml	3.1mg/ml	1.6mg/ml	0.8mg/ml	0.4mg/ml	0.2mg/ml	0.1m g/ml	zero
		+	+	+	+	+	+	+	+	+	+	+	+
6	7.5 x10 ⁶	100 mg/L	50m g/l	25mg /l	12.5 mg/l	6.3mg/ml	3.1mg/ml	1.6mg/ml	0.8mg/ml	0.4mg/ml	0.2mg/ml	0.1m g/ml	zero
		+	+	+	+	+	+	+	+	+	+	+	+
7	3.4 x10 ⁶	100 mg/L	50m g/l	25mg /l	12.5 mg/l	6.3mg/ml	3.1mg/ml	1.6mg/ml	0.8mg/ml	0.4mg/ml	0.2mg/ml	0.1m g/ml	zero
		+	+	+	+	+	+	+	+	+	+	+	+

Table 4. Shows action of Pantoyl Lactone for *Strep. equi* strains 4047, K3, NCTC 9682.

Tube NO.	1	2	3	4	5	6	7	8	9	10	11	12
Pantoyl lactone concentration	100m g/mL	50mg /ml	25mg /ml	12.5 mg/ml	6.3m g/ml	3.1m g/ml	1.6m g/ml	0.8m g/ml	0.4m g/ml	0.2m g/ml	0.1m g/ml	0
<i>S. equi</i> 4047 Growth	+	+	+	+	+	+	+	+	+	+	+	+
<i>S. equi</i> K3 Growth	+	+	+	+	+	+	+	+	+	+	+	+
<i>S. equi</i> NCTL 9682 Growth	+	+	+	+	+	+	+	+	+	+	+	+

Daptomycin assay.

The daptomycin results are shown in Table 5, which indicates that the MICs of daptomycin for the three strains is $\geq 1.25\mu\text{g/ml}$.

Table 5. Shows action of Daptomycin for *Strep. equi* strains 4047, K3 and NCTC 9682.

Tube NO.	1	2	3	4	5	6	7	8	9	10	11	12
Daptomycin concentration	20 mg/L	10μg/l	5μg/l	2.5 μg/l	1.2 5μg/l	0.6 25μg/l	0.3 12μg/l	0.1 56μg/l	0.078 μg/l	0.039 μg/l	0.20μg/l	0
<i>S. equi</i> 4047 ¹ Growth	-	-	-	-	-	+	+	+	+	+	+	+
<i>S. equi</i> K3 ² Growth	-	-	-	-	-	+	+	+	+	+	+	+
<i>S. equi</i> NCTL 9682 ³ Growth	-	-	-	-	-	+	+	+	+	+	+	+

- 1- Strain 4047 3.7×10^5 c.f.u /ml
- 2- Strain K3 4.35×10^5 c.f.u /ml
- 3- Strain NCTC 9682 3.10×10^6 c.f.u /ml

The experiment was repeated twice as shown in Tables 19 and 20, in order to confirm the MICs for the different strains. The MIC of daptomycin on strain 9682 was confirmed to be \geq

$1.25\mu\text{g/ml}$. However, there were slight variation of the MICs on the other two strains which was confirmed to be $\geq 0.625\mu\text{g/ml}$ (see Tables 18 and 19).

Table 6. Shows action of Daptomycin for *Strep. equi* strains 4047, K3 and NCTC 9682.

Tube NO.	1	2	3	4	5	6	7	8	9	10	11	12
Daptomycin concentration	20 mg/L	10μg/l	5μg/l	2.5 μg/l	1.2 5μg/l	0.6 25μg/l	0.3 12μg/l	0.1 56μg/l	0.078 μg/l	0.039 μg/l	0.2 μg/l	0
<i>S. equi</i> 4047 ¹ Growth	-	-	-	-	-	-	+	+	+	+	+	+
<i>S. equi</i> K3 ² Growth	-	-	-	-	-	-	+	+	+	+	+	+
<i>S. equi</i> NCTL 9682 ³ Growth	-	-	-	-	-	+	+	+	+	+	+	+

- 1- Strain 4047 5.2×10^5 c.f.u /ml
- 2- Strain K3 3.28×10^5 c.f.u /ml
- 3- Strain NCTC 9682 2.12×10^6 c.f.u /ml

Table 7. Shows action of Daptomycin for *Strep. equi* strains 4047, K3 and NCTC 9682.

Tube NO.	1	2	3	4	5	6	7	8	9	10	11	12
Daptomycin concentration	20 mg/L	10μg/l	5μg/l	2.5 μg/l	1.2 5μg/l	0.6 25μg/l	0.3 12μg/l	0.1 56μg/l	0.078 μg/l	0.039μg/l	0.20μg/l	0
<i>S. equi</i> 4047 ¹ Growth	-	-	-	-	-	-	+	+	+	+	+	+
<i>S. equi</i> K3 ² Growth	-	-	-	-	-	-	+	+	+	+	+	+
<i>S. equi</i> NCTL 9682 ³ Growth	-	-	-	-	-	+	+	+	+	+	+	+

- 1- Strain 4047 6.7×10^5 c.f.u /ml
- 2- Strain K3 9.8×10^5 c.f.u /ml
- 3- Strain NCTC 9682 2.10×10^6 c.f.u /ml

Daptomycin disc diffusion assay

Four experiments were conducted for daptomycin disc diffusion assay for the three strains of *S. equi*, and the results

were as shown in Figure 7. Discs led to the appearance of a clear zone for all the strains. The diameters of the clear zones were measured and presented in Table 8.

Table 8. Shows diameters of the clear zones of daptomycin disk.

<i>Strep. equi</i> strains		diameters in mm for different experiments				mean \pm sd
4047	27	31	26	28	28 \pm 1.87	
K3	22	25	22	23	23 \pm 1.22	
9682	25	29	25	26	26.2 \pm 1.64	

The mean diameter of each of the strains was > 16. Therefore, according to daptomycin Kirby-Bauer interpretive criteria all the three strains of *Strep. equi* are sensitive to daptomycin.

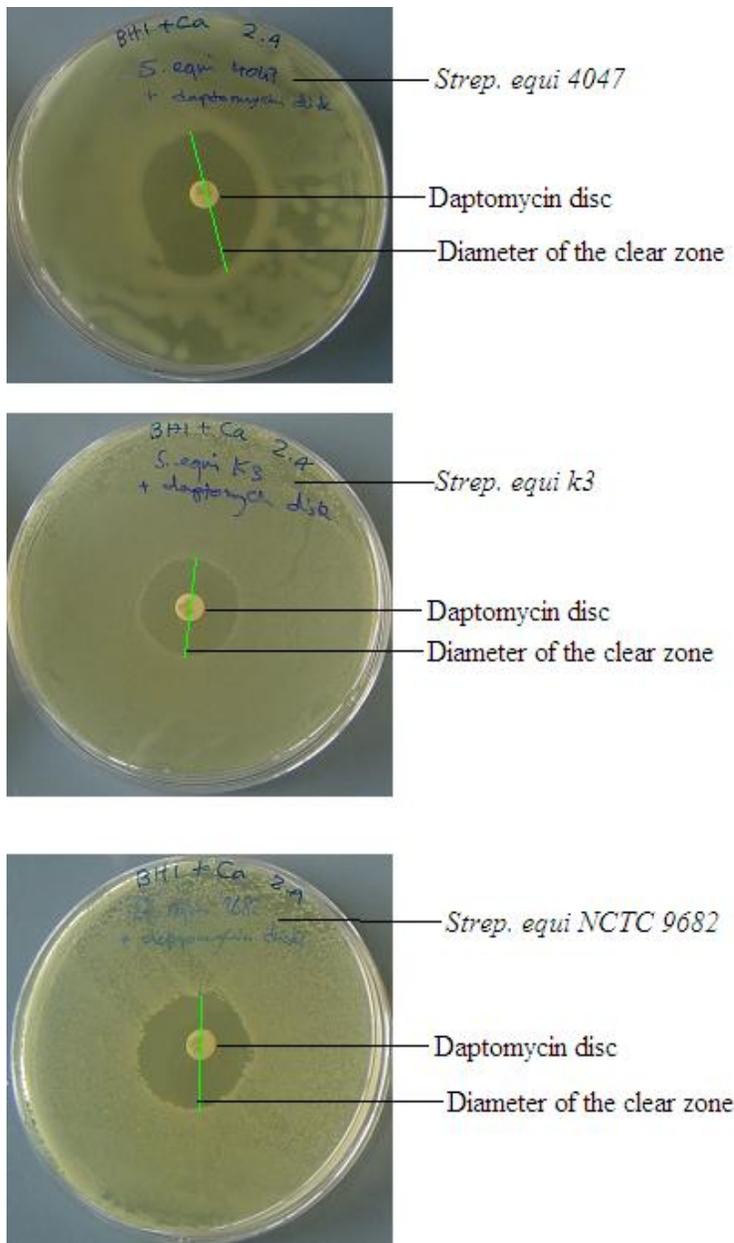


Fig 2. Daptomycin disk assay for *Strep. equi* 4047, K3 and NCTC 9682.

IV. CONCLUSION

Daptomycin has been reported to have a potent antibacterial action on a wide range of micro-organisms including against vancomycin-susceptible and vancomycin-resistant enterococci (Barry et al., 2001). The highly sensitive response of the three strains of *S. equi* obtained in this work is in agreement with that represented by Barry et al., (2001), in which almost all *Staphylococci* and *Streptococci* strains were inhibited at 2 mg/ml when tested in calcium-supplemented. Hence, daptomycin therefore tends to be potent for treating horse infections caused by this pathogen

REFERENCES

- [1] Alborn, W.E., Allen, N.E., and Preston, D.A.(1991). Daptomycin disrupts membrane potential in growing *Staphylococcus aureus*. *Antimicrob. Agents Chemother.* **35**, 2282-2287.
- [2] Barry, A. L., P. C. Fuchs, and S. D. Brown. 2001. In vitro activities of daptomycin against 2,789 clinical isolates from 11 North American medical centers. *Antimicrob. Agents Chemother.* **45**:1919-1922.
- [3] Boaretti, M., and Canepari, P.(1995). Identification of daptomycin-binding proteins in the membrane of *Enterococcus hirae*. *Antimicrob. Agents Chemother.* **39**, 2068-2072.
- [4] Devlin T, M. 1997. Textbook of biochemistry with clinical correlations. Fourth edition, wiley-liss,.Inc. New York.
- [5] Grula, E.A., and King, R.D. (1971). Changes in cell membrane of dividing and nondividing cells of *Micrococcus lysodeikticus* disIIP'. *Biochem. Biophys. Res. Commun.* **44**,1356.
- [6] Harrington D. J., Sutcliffe I. C., Chanter N. (2002). The molecular basis of *Streptococcus equi* infection and disease. *Microbes and Infection*, **4**, 501-510.
- [7] Kakizaki I, Keiichi Takagaki, Yasufumi Endo, Daisyke Kydo, Hitoshi Ikeya, Taruzo Miuoshi, Bruce A. Baggenstoss, Valarie L. Tlapak-Simmons, Kshama Kumari, Akio Nakane, Paul H. Weigel and Masahiko Endo. (2002). Inhibition of hyaluronan synthesis in *Streptococcus equi* FM100 by 4-methylumbelliferone. *Eur. J. Biochem.* **269**, 5066-5075.
- [8] Johnson J.H., Grula E.A, Richard Staerke, Fung B.M, and Mangum B.L.(1980) Modification of cell membrane lipids in *Micrococcus lysodeikticus* induced by Pantoyl lactone. *J. Membrane Biol.* **56**, 49-53.
- [9] Jones R. N., and Barry A. L (1987). Antimicrobial activity and spectrum of LY 146032, a lipopeptide antibiotic, including susceptibility test recommendations. *Antimicrob. Agents Chemother.* **31**: 625-629.
- [10] Kennedy S and Chambers H. F (1989). Daptomycin (LY146032) for prevention and treatment of experimental aortic valve endocarditis in rabbits. *Antimicrob. Agents Chemother.* **33**: 1522-1525.
- [11] Ramas G. M., Grayson M. L., Eliopoulos G. M and Bayer A. S (1992). Comparison of daptomycin, vancomycin, and ampicillin-gentamicin for treatment of experimental endocarditis caused by penicillin-resistant enterococci. *Antimicrob. Agents Chemother.* **36**: 1864-1869.
- [12] Rose A. H., (1976). *Chemical Microbiology an introduction to microbial physiology*. Third edition,. Butterworth & co. Ltd. Norwich.
- [13] Silverman, J.A., Perlmutter, N.G, and Shapiro, H.M, (2003). Correlation of daptomycin bactericidal activity and membrane depolarization in *Staphylococcus aureus*. *Antimicrobial Agents And Chemotherapy.* **47**, pp. 2538-2544
- [14] Sutcliffe I. C & Russell R. R. B (1995). Lipoproteins of Gram-positive bacteria. *J bacterial* **175**, 1123-1128.

- [15] Tally, F.P., Zeckel, M., Waselewski, M.M., Carini, C., Berman, C.L., Drusano, G.L., and Oleson, F.B (1999). Daptomycin: a novel agent for Gram-positive infections. *Exp. Opin. Investig. Drugs* **8**: 1223-1238.
- [16] Zidan A. Bashir. In Vitro Antimicrobial Activity of Membrane - Acting Antibiotics Action Against *Streptococci*. *J App Pharm Sci*. 2012; 2 (12): 042-047.

AUTHORS

First Author – Zidan A. Bashir, School of Biosciences and Biotechnology, Faculty of Science and Technology, National University of Malaysia, Malaysia.
Department of Zoology, Faculty of Science, Sebha University, Lybia

A Research Survey on Sanskrit Offline Handwritten Character Recognition

R. Dineshkumar¹, Prof. Dr.J.Suganthi²

¹ HOD Incharge - CSE, KTVR Knowledge Park for Engineering and Technology, Coimbatore, Tamilnadu, India
me.dineshkumar@gmail.com

² Vice Principal and Head – CSE, Hindusthan College of Engineering and Technology, Coimbatore, Tamilnadu, India.
sugi_jeyan@hotmail.com

Abstract: Sanskrit (Devanagari), an alphabetic script, is used by over 500 million people all over the world. Recognition of Sanskrit (Devanagari) handwritten scripts is complicated compared to other language scripts. However, many researchers have provided real-time solutions for offline Sanskrit character recognition also. Offline Sanskrit handwritten documents recognition still offers many motivating challenges to researchers. Current research offers many solutions on Sanskrit (Devanagari) handwritten documents recognition even then reasonable accuracy and performance has not been achieved. This paper analyses the various approaches and challenges concerning offline Sanskrit (Devanagari) handwritten character recognition.

Index Terms – Binarization, Segmentation, SVM

I. INTRODUCTION

The handwritten text written in palm leaves decayed over a period of time. It is very difficult to preserve them in the same form. This paper analyses the various approaches and challenges concerning offline Sanskrit handwritten character recognition.

Recognition of characters can be done either from printed documents or from handwritten documents. Handwritten document recognition can be done offline or online. Offline character recognition is more complicated than online. In particular, Sanskrit (Devanagari) handwritten OCR is more complicated than other related works. This is because Sanskrit (Devanagari) letters have more angles and modifiers.

Challenges that researches face during recognition process are due to the curves in the characters, number of strokes and holes, sliding characters, differing writing styles so on.

The steps involved in character recognition comprise pre-processing, segmentation, feature extraction and classification.

1.1 Sanskrit (Devanagari) Language

Although, Sanskrit is an ancient language and no longer spoken, written material still exists. Hindi is world's third most commonly used language after English and Chinese and there are approximately 500 million people all over the world that speak and write in Hindi. Devanagari has about 14 vowels and 34

consonants. It is used as the writing system for over 28 languages including Sanskrit, Hindi, Kashmiri, Marathi and Nepali. The corpus of Sanskrit literature encompasses a rich tradition of poetry and drama as well as scientific, technical, philosophical and dharma texts. Sanskrit continues to be widely used as a ceremonial language in Hindu religious rituals and Buddhist practice in the forms of hymns and mantras.

Sanskrit Alphabet in modern Devanagari Script Vowels

अ आ इ ई उ ऊ ऋ ॠ ए ऐ ओ औ अं अः

Consonants

Gutturals	- क ख ग घ ङ
Palatal s	- च छ ज झ ञ
Cerebrals	- ट ठ ड ढ ण
Dentals	- त थ द ध न
Labials	- प फ ब भ म
Semivowels	- य र ल व
Sibilants	- श ष स
Sonant	- ह

Figure 1: vowels and consonants

II. BLOCK DIAGRAM OF RECOGNITION SYSTEM

The schematic block diagram of handwritten Sanskrit (Devanagari) Character Recognition system consists of various stages as shown in figure. They are Preprocessing, Segmentation, Feature Extraction, and Classification.

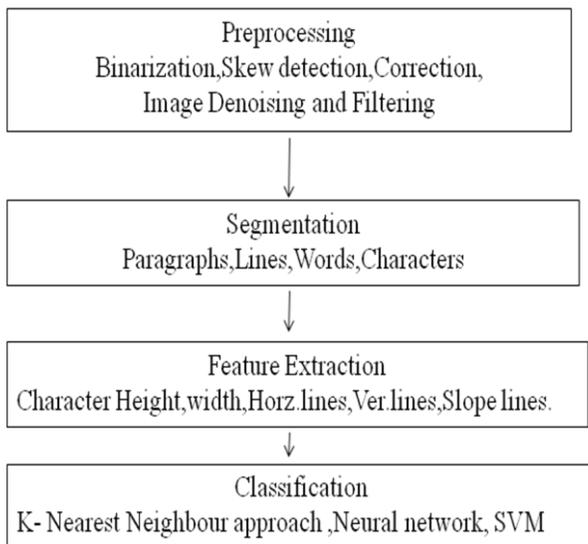


Figure 2. Block diagram of Recognition system

2.1 Preprocessing

This is the first step in the processing of scanned image. The scanned image is pre processed for noise removal. The resultant image is checked for skewing. There are possibilities of image getting skewed with either left or right orientation. Here the image is first brightened and binarized.

The processes which get involved in pre-processing are illustrated below:

1. Binarization
2. Noise reduction
3. Normalization
4. Skew correction, thinning

2.1.1 Binarization

Binarization is a method of transforming a gray scale image into a black and white image through Thresholding. Normally, most researchers use thresholding concepts to extract the foreground image from background image.

2.1.2 Noise Removal

Digital images are prone to many types of noises. Noise in a document image is due to poorly photocopied pages. Median Filtering, Wiener Filtering method and morphological operations can be performed to remove noise. Median filters are used to replace the intensity of the character image, where as Gaussian filters can be used to smoothing the image.

2.1.3 Normalization

Normalization is the process of converting a random sized image into a standard size. The Roi-Extraction [19] method is used to get the single structural element from the image.

2.1.4 Skew correction, Thinning

Thinning is a pre-process which results in single pixel width image to recognize the handwritten character easily. It is applied repeatedly leaving only pixel-wide linear representations of the image characters.

2.2 Segmentation

After pre-processing, the noise free image is passed to the segmentation phase, where the image is decomposed into individual characters. The various steps in segmentation.

Algorithm for segmentation:

- (1) The binarized image is checked for Inter line space.
- (2) If inter line spaces are detected then the image is segmented into sets of paragraphs across the interline gap.
- (3) The lines in the paragraphs are scanned for horizontal space intersection with respect to the background. Histogram of the image is used to detect the width of the horizontal lines. Then the lines are scanned vertically for vertical space intersection. Here histograms are used to detect the width of the words. Then the words are decomposed into characters using character width computation

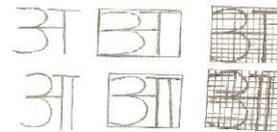


Figure 3. Character Segmentation

2.3 Feature extraction

The feature extraction techniques can be broadly grouped into three classes namely statistical features, structural features and the hybrid features. A statistical technique uses quantitative measurements for feature extraction, whereas structural techniques use qualitative measurements for feature extraction. In hybrid approach, these two techniques are combined and used for recognition.

In feature extraction where individual image glyph is considered and extracted for features. Each character glyph is defined by the following attributes: (1) Height of the character. (2) Width of the character. (3) Numbers of horizontal lines present—short and long. (4) Numbers of vertical lines present—short and long. (5) Numbers of circles present. (6) Numbers of horizontally oriented arcs. (7) Numbers of vertically oriented arcs. (8) Centroid of the image. (9) Position of the various features. (10) Pixels in the various regions

2.4 Classification

The Extracted features are given as the input to the Classification process. A bag-of-key point extracted from the feature extraction approaches are used for classification. There are some approaches are used for classify the character features in the existing systems such as K- Nearest Neighbour approach, Neural network, SVM classifier and so on.

2.4.1 SVM Classifiers

Support vector machines (SVM), when applied to text classification provide excellent precision, but poor recall. One means of customizing SVMs to improve recall, is to adjust the threshold associated with an SVM. Shanahan and Roma described an automatic process for adjusting the thresholds of generic SVM [20] with better results.

SVMs have achieved excellent recognition results in various pattern recognition applications. Some more properties are commonly seen as reasons for the success of SVMs in real-world problems. [20]. Empty area around the decision boundary defined

by the distance to the nearest training patterns. These patterns, called support vectors, finally define the classification function.

perceptron (MLP) of the feed forward networks and the Kohonen's Self Organizing Map (SOM) of the feedback networks.

2.4.2 Neural network Technique

Neural network architectures can be classified as, feed forward and feedback (recurrent) networks. The most common neural networks used in the OCR systems are the multilayer

III. COMPREHENSIVE STUDY

The table 1 shows the comprehensive study of which has been made on the different OCR's available for offline character recognition:

Ref. Paper No	Preprocessing	Segmentation	Feature Extraction	Classification
[1]	Binarization (two-level thresholding), using a global or a locally adaptive method conversion to another character representation (e.g. skeleton or contour curve)	Line (imaginary) segment and word and characters segment	Template matching Deformable templates Graph description Discrete features Zoning Fourier descriptors	Graph descriptions or Grammar based descriptions of the characters are well suited for structural or synthetic classifiers. Real-valued feature vectors are ideal for statistical classifiers.
[2]	Image Binarisation Thinning of binarised image Windowing	Character recognition by neural network (Feed Forward Algorithm).	Replacing the recognized characters by standard fonts.(Back Propagation Algorithm)	Assembling all the separated characters in the same order as they appeared in the input image to give final output.
[3]	Convert the character image to bitmap and scale	Chain code histogram(for each segment)	Shadow features are extracted from scaled binarized character image. Chain code Histogram features are extracted by chain coding.	Combined MLP Combined MLP and Minimum Edit distance classifier
[4]	Binary level images, pseudo color and true color images. (preprocessing required is minimal) The next category of images is the pseudo color images.	Line Segmentation Word Segmentation Character Segmentation Maintain the data structure to feed the line, word and character boundaries	-	Normalized feature vector used to identify characters using fuzzy logic
[5]	Median and wiener		Zone based approach is	SVM for

	filtering used for noise removal	Conjunct segmentation algorithm process Structural segmentation algorithm.	used for Feature extraction	Classification Process
[6]	Preprocessing is done to normalize the position and size of the sample and to remove local noise so that the extracted features from the sample become robust.	Horizontal projection file method is used for segmentation(upper line and lower line)	Images scaled into height and width using bilinear interpolation technique Unwanted portion corrected using sobel edge.	well known feed forward algorithm
[7]	Morphological operation are used to noise removal Thinning algorithm is used to remove the distortions Bicubic interpolation are used for standard sized image	Differential distance based technique used for identifying the shirorekha and spine	Top, bottom, left, right or on a combination technique. A single or double vertical line called a Danda (Spine) was traditionally used to indicate the end of phrase or sentence	Preliminary classification is performed for better results. Devnagari hand-printed numeral recognition system based on binary decision tree classifier
[8]	Thresholding method used for Binarization	Lines are segmented by noting the valleys of projection profile	Upper Zones denotes portion above head line, middle Zone denotes portion of basic, lower Zone in the portion below base line. Special feature called hill-valley-distance extracted to estimate the orientation of text block	Statistical analysis, insensibility of machine printed and hand written text classification
[9]	The digitized images are in gray tone uses histogram based thresholding approach to convert them in two-tone images.	Line segmentation uses a horizontal projection profile based technique	Head-line feature horizontal projection profile Robustness, accuracy and speed of computation are the features used in feature extraction	Optical Character Recognition (OCR) used to separate different scripts before feeding them to their individual OCR system.
[10]	Morphological operations are used to achieve Noise removal.	Histogram profile and connected component analysis for line character segmentation	Any interesting character points Scale Invariant Feature Transform(SIFT) method for Feature Extraction K-Means clustering to	Bag-of-key points to count the number of patches K-Nearest Neighbor to recognition Scale.

	<p>Bicubic interpolation is used for standard sized image.</p> <p>Morphological gradient to find character boundaries</p>		<p>create a code book for each characters (two features condition)</p> <p>Nearest Neighbour,centroid condition)</p> <p>CB obtained from LBG algorithm</p>	<p>Invariant Feature Transform(SIFE) transfer character image to set of local frame</p>
[11]	<p>Scanned data encapsulated in Glyphs</p>	-	<p>Character height, width</p>	<p>Multilayer perception (MLP) learning algorithm for two hidden layers with back propagation used for final character identification.</p> <p>Hyperbolic tangent function used for activation purpose.</p>
[12]	<p>Median filter used to replace the intensity filter (noise).</p> <p>Thresholding method used for Binarization</p>	<p>Line segmentation used to segment the characters.</p>	<p>Cover vertical projection profile, word profile, background to-link transitions</p> <p>Profile features (vertical features and word profile) approach used for feature extraction.</p>	<p>Hidden Markov model (HMM) method used to recognize character.</p> <p>Recognize the word using Baum-Welch or forward and backward algorithm</p>
[13]	<p>Thinning algorithm used to thin the characters</p> <p>Hilditch's algorithm is used for skeletonization.</p> <p>Thresholding method used for Binarization</p>	<p>Spatial space detection technique.</p> <p>Histogram method used to convert the image to glyph</p>	<p>Character height, width, no. of horizontal and vertical lines (long and short).</p> <p>Horizontal and vertical curves, circles, slope lines image centroid and dots</p> <p>Output of the segmentation part(image glyph) is subjected to feature extraction procedure</p>	<p>Support Vector Machine(SVM) used for classification (vapnik's structural). Type 1 SVM.</p> <p>Self organizing map used to minimize the errors.</p> <p>Neural classification algorithm and Radial-Basis-Function networks, Hybrid Neuro fuzzy systems used for reduce the recognition problems.</p> <p>RCS Algorithm used for better recognition results.</p>
[14]	<p>Gabor Thresholding and Otsu Thresholding methods(global) are used for Binarization</p>	<p>Horizontal and vertical profile method is used for segmentation (line and characters).</p> <p>Bilinear interpolation</p>	<p>Zone will capture pixel variation</p> <p>Zone based approach is used for Feature</p>	<p>Support vector machine (SVM) method is used for classification.</p> <p>Redial basic</p>

		technique used for normalization	extraction	function(RDF) kernel used for support to SVM to divide the line
[15]	<p>Threshold technique used for preprocessing color image to gray scale.</p> <p>Normalization done using Java Image Class</p>		<p>Row wise, column wise and diagonal wise selection</p> <p>Encoding binary variation method used for extract the features. Then comparing trained text and tested image for recognize the characters</p>	SVM Comparison technique
[16]	<p>Converted to grey image.</p> <p>Noise reduction is done through Nonlinear Algorithm.</p> <p>Grey image is then converted to Black and White image called Binarization</p>	<p>Line segmentation is done through ROWS having black pixel frequency.</p> <p>Word segmentation is done through COLUMN having black pixel frequency.</p> <p>In Letter segmentation MATRA is preserved</p>	<p>Tree Data Structure is used in features.</p> <p>Separate algorithm is used for Line tracing and making Feature tree.</p> <p>Connected components are extracted. For each char component we make Feature tree and finally prefix notation is applied to HMM.</p>	<p>Post processing is done through 2 steps</p> <ol style="list-style-type: none"> 1. Constructing letter from component. 2. Rearranging the letter
[17]	<p>Scanned document is Filtered and Binarized for both Hindi and Telugu.</p> <p>Projection files in range of + or - 20 degree for Skew correction.</p>	<p>Line and Word segmentation is done through projection files For both Hindi and Telugu.</p> <p>In Telugu characters are split to constituent components.</p>	<ol style="list-style-type: none"> 1. Extraction considers entire image. 2. Considers some selected moment and shape as its dimensionality is reduced by principal components. 	<p>SVM-ability to identify decision boundary with minimal margin</p> <p>K-nearest neighbor and neural network classifiers are popular for characters rearrange application.</p>
[18]	<p>Approach that computes the length of input stroke and if it is smaller than set of priority we ignore those words.</p> <p>Operations of pre-processing such as Shift of origin, smoothing, resampling of points.</p>	<p>Analytic approach segmentation is made into smaller components and is identified during recognition stage.</p> <p>No segmentation is done in holistic approach.</p> <p>Recursive contour following approach and certain water reservoir technique was used in segmentation</p>	<p>Preprocessed stroke is divided in to 7 sub strokes. Then its center of gravity (C.G), Histogram is calculated for number of feature components are generated and feature vector for strokes.</p>	<p>QDF classifier used for recognition of offline Hand writing.</p> <p>MQDF is used by considering the principle of Eigen vectors.</p>

IV. CONCLUSION

A lot of research work exists in the survey for Sanskrit (Devanagari) Handwritten recognition. However, there is no standard solution to identify all Sanskrit characters with reasonable accuracy. In this paper, we have projected various aspects of each phase of the offline Sanskrit character recognition process. Researchers have used minimal character set. The following key challenges to be carried out by researchers cursive character, increased number of holes and strokes, mixed words.

REFERENCES

- [1] Oivind Due Trier, Anil K Jain, Torfinn Taxt "Feature Extraction Methods For Character Recognition A Survey" ,(1995) Pattern Recognition Vol 29, No. 4 pp. 641-662, 1996.
- [2] K. Y. Rajput and Sangeeta Mishra "Recognition and Editing of Devnagari Handwriting Using Neural Network", Proceedings of SPIT-IEEE Colloquium and International Conference, Mumbai, India Vol. 1, 66.
- [3] S. Arora, D. Bhattacharjee, M. Nasipuri, D. K. Basu & M. Kundu "Recognition of Non-Compound Handwritten Devnagari Characters using a Combination of MLP and Minimum Edit Distance", International Journal of Computer Science and Security (IJCSS), Vol 29, No. 4 pp. 641-662, 1997.
- [4] Script Vijay Kumar, Pankaj K. Sengar "Segmentation of Printed Text in Devanagari Script and Gurmukhi" International Journal of Computer Applications (0975 – 8887) Volume 3 – No.8, June 2010.
- [5] Bansal, Veena and R.M.K. Sinha "Segmentation of touching and fused Devanagari characters", Pattern Recognition, volume 35 (2002), number 4 pp. 875-893.
- [6] Chandan Biswas, Ujjwal Bhattacharya, Swapan Kumar Parui "HMM Based Online Handwritten Bangla Character Recognition using Dirichlet Distributions", International Conference on Frontiers in Handwriting Recognition 2012.
- [7] Sandhya Arora, Debotosh Bhattacharjee, Mita Nasipuri, Latesh Malik "A Two Stage Classification Approach for Handwritten Devanagari Characters" Proceedings of the Fifth International Conference on Document Analysis and Recognition, 1999, pp.653-656.
- [8] Veena Bansal and R. M. K. Sinha "Integrating Knowledge Sources in Devanagari Text Recognition" IEEE Transactions on Systems, Man, and Cybernetics, Systems and Humans, VOL. 30, NO. 4, JULY 2000
- [9] M C Padma and P A Vijaya "Identification of Telugu, Devanagari and English Scripts Using Discriminating Features", International Journal of Computer science & Information Technology (IJCSIT), Vol 1, No 2, November 2009
- [10] S. Palit and B.B. Chaudhuri "A feature-based scheme for the machine recognition of printed Devanagari script", In Pattern Recognition, Image processing and Computer Vision, Ed. P. P. Das and B. N. Chatterjee, Narosa Publishing House, 1995, pp. 163-168.
- [11] Stuti Asthana, Farha Haneef and Rakesh K Bhujade, "Handwritten Multiscript Numeral Recognition using Artificial Neural Networks", Int. J. of Soft Computing and Engineering ISSN: 2231-2307, Volume-1, Issue-1, March 2011
- [12] Sigappi A.N, Palanivel S and Ramalingam V, "Handwritten Document Retrieval System for Tamil Language", Int. J of Computer Application, Vol-31, 2011
- [13] Suresh Kumar C and Ravichandran T, "Handwritten Tamil Character Recognition using RCS algorithms", Int. J. of Computer Applications, (0975 – 8887) Volume 8– No.8, October 2010
- [14] Shanthi N and Duraiswami K, "A Novel SVM -based Handwritten Tamil character recognition system", springer, Pattern Analysis & Applications, Vol-13, No. 2, 173-180, 2010
- [15] U. Garain, B.B. Chaudhuri "Segmentation of Touching Characters in Printed Devnagari and Bangla Scripts Using Fuzzy Multifactorial Analysis", Proceedings of the 6th International Conference on Document Analysis and Recognition. (ICDAR '01).
- [16] Md. Sheemam Monjel and Mumit Khan "Optical Character Recognition For Bangla Documents Using HMM" Proceedings of Int. Conf. on Document Analysis and Recognition, Bangalore, India, September 20-22, 1999.
- [17] C. V. Jawahar, M. N. S. S. K. Pavan Kumar, S. S. Ravi Kiran "A Bilingual OCR for Hindi-Telugu Documents and its Applications", Proc. of the 11th ICPR, vol. II, pp. 200-203, 1992.
- [18] U. Bhattacharya A. Nigam Y. S. Rawat S. K. Parui "An Analytic Scheme for Online Handwritten Bangla Cursive Word Recognition", Pattern Recognition, vol. 26, no. 3, pp. 451-460, 1993
- [19] Xiaoguang Shao, Kun Gao, Guoqiang Ni "A new method for the extraction of Region-Of-Interest based on visual Attention", Proc. of SPIE Vol. 7513 75132X
- [20] Sandhya Arora et al., "Performance Comparison of SVM and ANN for Handwritten Devnagari Character Recognition", IJCSI International Journal of Computer Science Issues, Vol. 7, Issue 3, May 2010.

AUTHORS BIOGRAPHY

Mr. R.DINESHKUMAR obtained his B.E degree in CSE from Bharathiar University. He received M.E degree in Computer Science in 2008, from the Anna University, Tamilnadu, India. He is a part-time PhD research scholar in the Department of Information Technology, Anna University, Chennai. His main interests in research are Hand written Character recognition of Sanskrit language. Email address: me.dineshkumar@gmail.com

Prof.Dr.J.SUGANTHI obtained her B.E degree in CSE from Madurai Kamaraj University. PG degree in M.E CSE from Bharathiar University, Coimbatore & further did her PhD in Anna University, Chennai. She is with Hindusthan college of Engineering and Technology as Vice Principal and Head, CSE since Aug. 2008. Her main interests in research are Image processing and Data mining. Email address: sugi_jeyan@hotmail.com

