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Trivariate Analysis of Organizational Culture, Leadership and Organizational Effectiveness: An Exploratory Study

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Abstract- In any organizations culture is subtle way which significantly helps in developing and maintaining leadership and organizational effectiveness. The present study demonstrated the empirical link between the organizational culture, leadership and organizational effectiveness. in present study data were gathered from selected manufacturing units of Gujarat from 440 samples. Descriptive and exploratory research design had been adopted. The finding of the study necessitated that the null hypotheses is rejected. In this survey it is found that there was non-spurious relationship found between organizational culture, leadership and organizational effectiveness. Present study contributes to the existing pool of knowledge on the relationship between culture, leadership and organizational effectiveness.

Index Terms- Leadership, Organizational Culture, and Organizational Effectiveness

I. INTRODUCTION

Organizational culture means two different but related things. First, it is the culture that exists in an organization. When the phrase is used in this sense, it means something similar to the culture is a society and consists of such things as shared values, beliefs, assumptions, perceptions, norms, artifacts and patterns of behavior. It is the unseen and unobservable force that is always behind organizational activities that can be observed. It is the work of Bass (1985) and Burns (1978) that defined most of the initial work in the field and laid the groundwork for Edgar Schein (1985) to focus on culture as the fundamental role of the leader in bringing about and solidifying the implementation of change in an organization. Schein's theories on culture seek to dispel several common myths about organizational culture. Taormina(2008) rightly point out in his study that by virtue of the authority of their positions, leaders have considerable freedom to decide how their organizations will be run, and can thus be expected to play a major role in influencing the culture of an organization . Further Hackman's theory (1976) can provide us a considerably strong framework to understand how an organization, particularly its norms as the basic blocks of organizational culture, influences individuals' work behavior and effectiveness. Since organizational culture influences all members, the increase in individual's effectiveness will result in an increase in organizational effectiveness.

Aim of this paper is to understand the effect of organizational culture on remain key variables by controlling

other variables. To draw the causal inference, one has to re-examine the bi-variate relations by controlling the effect of other variables into the analysis. In cross tabulation or bi-variate relationship may be observed just due to chance, or it may exist due to a third variable which is yet to be revealed. If the two variables are associated, it is not necessary that there is cause and effect relationship between the two variables. It is essentials that effects of other variables are ruled out as alternative explanation of the relationship. Hence tri-variate analysis that is re-examinations of the bi-variate relationship by controlling the effect of third variable serves the purpose of clarifying and elaborating the original relationship.

II. OBJECTIVES OF THE STUDY

1. To study the associations between organisational culture, leadership and organisational effectiveness.
2. To study and understand the effect of organisational culture on remains key variable such as leadership and organisational effectiveness.
3. To draw out causal inference between organisational culture, leadership and organisational effectiveness.

III. METHODOLOGY OF THE STUDY

Present study is descriptive and exploratory in nature. The required data was collected from primary sources through questionnaire. The primary data was collected from the 440 respondents had responded who are in managerial cadre positions from industries by applying simple random sampling method. Research instruments were pre-tested. Reliability test (Spilt-half) were applied on data collected in pre-testing. Coefficients of reliability of the above instruments are presented in the following:

Research instruments	No. Of items	Reliability
Organisational Culture	40	0.7414
Leadership	37	0.9254
Organisational Effectiveness	35	0.8570

Hypot
heses

H1: There is non-spurious relationship between organisational culture, leadership and organisational effectiveness.

H2: There are non significant associations between organisational culture, leadership and organisational effectiveness.

IV. DISCUSSION AND FINDINGS

Table 1: Showing Cross Tabulations between Organizational Culture and Leadership

Organizational Culture	Leadership			Total
	Low	Moderate	High	
Low	57(49.1)	58(50.0)	1(0.9)	116(100)
Moderate	44(20.1)	123(56.2)	52(23.7)	219(100)
High	10(9.5)	43(41.0)	52(49.5)	105(100)

Total	111(25.2)	224(50.9)	105(23.9)	440(100)
$\chi^2 = 96.785$	$d.f = 4$	$p = .000$	$C = .425$	

From above table it can be viewed that in case of organizational culture that those who perceived high also perceived high leadership say 49.5 percent (n = 52). Considerably it also found that those who perceived low leadership also perceived low organizational culture that is 49.1 percent (n=57). Further there is a significant association p.000 between organisational culture and leadership. Looking at contingency coefficient value 0.425 it can be inferred that associations are moderate. Taormena (2008) precisely demonstrate in his research study that there was correlations which revealed that leader behaviors to be more control-oriented in bureaucratic culture; and more flexible-oriented in innovative culture; but, contrary to expectations, more control-oriented in supportive culture

Table 2: Showing Cross Tabulations between Organisational Culture and Organisational Effectiveness

Organisational Culture	Organisational Effectiveness			Total
	Low	Moderate	High	
Low	61 (52.6)	47(40.5)	8(6.9)	116(100)
Moderate	49(22.4)	128(58.4)	42(19.2)	219(100)
High	12(11.4)	39(37.1)	54(51.4)	105(100)
Total	122(27.7)	214(48.6)	104(23.6)	440(100)

$\chi^2 = 96.841$ $d.f = 4$ $p = .000$ $C = .425$

From table 2 it can be seen that those who perceived high organisational culture and also perceived high on organisational effectiveness say 51.4 percent (n = 54). Similarly it can be also seen that those who perceived low organisational effectiveness also perceived low organisational culture say 52.6 percent (n = 61). Further there is a significant association p.000 between two. And such association found to be moderate as value of contingency coefficient is 0.425. Mehralizadeh & Atyabi (2006) significantly explained through his research that organizational culture significant influence to Organizational Effectiveness variability.

Further by looking to the Table no 3 is evident from the table no.3 that the original bi-variate associations that is organisational culture and leadership is unchanged by organisational effectiveness in its first two sub categories that is

low p.000 and moderate one p.000. In other words, it can be say that organisational culture and leadership is unchanged organisational effectiveness is either low or medium. However it is found that both variables are changed when organisational effectiveness is high p.071. Therefore it may be concluded that leadership is independent of organisational culture when organisational effectiveness is high. To be specific, it may be inferred that in case of high organisational effectiveness, the leadership played an influencing role irrespective of the level of organisational culture. Effect of third variables that is organisational effectiveness found to be partial. Hence organisational culture and leadership accounted by organisational effectiveness when it is high category

Table3: Showing Organizational Culture and Leadership Controlling Organisational Effectiveness

Organisational Effectiveness			Leadership			Total
			Low	Moderate	High	
Low	Organisational Culture	Low	36 (64.3)	25 (43.9)	0 (0)	6 (50.0)
		Moderate	16(28.6)	28(49.1)	5(55.6)	4 (40.2)
		High	4 (7.1)	4 (7.0)	4 (44.4)	12 (9.8)
	Total		56 (100)	57 (100)	9 (100)	122(100)
$\chi^2 = 22.592$			df = 4	p = .000	C = .395	
Moderate	Organisational Culture	Low	20 (40.8)	26 (22.2)	1(2.1)	47 (22.0)
		Moderate	27 (55.1)	75 (64.1)	26(54.2)	128 (59.8)
		High	2 (4.1)	16 (13.7)	21(43.8)	39 (18.2)
	Total		49(100)	117 (100)	48 (100)	214 (100)
$\chi^2 = 41.236$			df = 4	p = .000	C = .402	
High	Organisational Culture	Low	1 (16.7)	7 (14.0)	0 (0)	8 (7.7)
		Moderate	1 (16.7)	20 (40.0)	21(43.8)	42 (40.4)
		High	4 (66.7)	23 (46.0)	2 (56.3)	54 (51.9)
	Total		6 (100)	50 (100)	48 (100)	104 (100)
$\chi^2 = 8.641$			df = 4	p = .071	C = .277	

Table4 : Showing Organisational Culture and Organisational Effectiveness Controlling Leadership

Leadership			Organisational Effectiveness			Total
			Low	Moderate	High	
Low	Organisational Culture	Low	36 (64.3)	20 (40.8)	1 (16.7)	57 (51.4)
		Moderate	16 (28.6)	27 (55.1)	1 (16.7)	44 (39.6)
		High	4 (7.1)	2 (4.1)	4 (66.7)	10 (9.0)
	Total		56 (100)	49 (100)	6 (100)	111(100)
$\chi^2 = 33.452$ df = 4 p = .000 C = .481						
Moderate	Organisational Culture	Low	25 (43.9)	26 (22.2)	7 (14.0)	58 (25.9)
		Moderate	28 (49.1)	75 (64.1)	20 (40.0)	123 (54.9)
		High	4 (7.0)	16 (13.7)	23 (46.0)	43 (19.2)
	Total		57 (100)	117 (100)	50 (100)	224 ¹ (100)
$\chi^2 = 39.594$ df = 4 p = .000 C = .388						
High	Organisational Culture	Low	0 (0)	1 (2.1)	0 (0)	1 (1.0)

		Moderate	5 (55.6)	26 (54.2)	21 (43.8)	52 (49.5)
		High	4 (44.4)	21 (43.8)	27 (56.3)	52 (49.5)
	Total		9 (100)	48 (100)	48 (100)	105 (100)
$\chi^2 = 2.594$ df = 4 p = .628 C = .155						

It can be analysis from above table that organizational culture and organizational effectiveness is unchanged in its first two categories that is low p.000 and medium p.000. However it is found that it is changed when leadership is high that is p.628. Therefore it may be concluded that organizational culture and organizational effectiveness is independent when leadership is high. To be specific it may be inferred that culture do not play a role in organizational effectiveness, whereas it is found that leadership is accounted for organizational effectiveness. Over here leadership is termed as conditional variable.

V. CONCLUSION

Certain characteristics of this study help to increase its contribution to the research area in organizational culture, leadership and organizational effectiveness. The finding of the present study necessitated that the null hypotheses is rejected. In this survey it is found that there was non-spurious relationship found between organizational culture, leadership and organizational effectiveness. Organizational culture has been argued as one of the most powerful and stable forces operating in organizations and can influence a firm's leadership, decision making, performance, internal development, and, strategic development for the twenty- first century (Schein 1996). Further in the work Denison (1995) clearly mentioned the impact of organizational culture on organizational effectiveness can be examined from three interrelated aspects: direction, pervasiveness and strength. Given the current debate regarding the impact of organizational culture on leadership and organizational effectiveness the additional research in this area is required. The cause and effect relationship could be ascertained from various service sectors and manufacturing sectors as well.

Last but not least present study contributes to the existing pool of knowledge on the relationship between culture, leadership and organizational effectiveness.

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A Novel Ag/CS-PVC Nanomaterial with High Antimicrobial Properties: A Potential Self-Sterilizing Biomaterial

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Abstract- The field of manufacturing technology has totally been renovated with the emergence of nanotechnology; and the emergence of nanoscience with material science, biology, biotechnology and medicine has completely novelized various arrays of biomedical engineering. For the nanomedicine landscape we have designed and developed Ag/CS-PVC nanocomposite material having superb antimicrobial properties which can effectively be used as self-sterilizing catheter biomaterial especially for the cardiovascular system. Arjuna bark, one of the best cardio-protector agents, has been involved for the production of silver nanoparticles. Several techniques have been used for the characterization of nanoparticles and the nanomaterial developed. This biomaterial is cost effective and extremely biocompatible.

Index Terms- antimicrobial, biomaterial, nanocomposite, nanoparticles, self-sterilizing

I. INTRODUCTION

Advances in the field of nanomaterial manufacturing for biomedical engineering largely depend on the ability to synthesize nanoparticles in an eco-friendly manner without using any toxic chemicals in the protocol. In our present work, bioreduction and formation of silver nanoparticles has been achieved, by using the bark of the plant *Terminalia arjuna* which is commonly known as arjuna bark or arjun. Since time immemorial arjuna bark is considered to be an excellent astringent, hypolipidemic, anticoagulant, hypocholsteremic, antihypertensive, antiviral, antithrombotic, cardiac stimulant, hemostatic, rejuvenative tonic, lithontriptic, antifungal and antibacterial mean [1].

In our present investigation the silver nanoparticles produced involving the arjuna bark, has been incorporated into a chitosan (CS) – poly vinyl chloride (PVC) blended matrix, to develop a novel silver/chitosan-poly vinyl chloride (Ag/CS-PVC) antimicrobial self-sterilizing nanocomposite biomaterial, for the first time. The blending of PVC with CS was enabled through simultaneous casting of their separate solutions in 2:1 proportion of CS and PVC in suitable solvents, glutaraldehyde (GA) was used to ensure cross-linking between the two polymers. Chitosan, a natural biopolymer composed of poly (β -(1-4)-2-amino-2-deoxy-D-glucose), is one of the structural polysaccharide which is abundantly available in nature [2]. PVC is one of the most commonly used synthetic polymers in biomedical applications,

especially as a catheter material for the circulatory system [3]. Earlier studies shed an important light on the underappreciated and significant risks of biomaterials associated infection (BAI) through peripheral IVs as well as other cardiovascular catheters composed of PVC [4]. It indicates that it is immensely important to initiate interventions to combat the risk of BAI.

So in our study we have approached to design blending of PVC with CS, using GA as a cross-linker to enhance the CS/PVC compatibility and endow desired properties to the hybrid material for biomedical use. In addition, we have also dispersed the formed silver nanoparticles to this crosslinked copolymer matrix which renders the developed nanomaterial self-sterilizing [5], with superb antimicrobial response for effective use as a catheter material to splendidly subside biomaterials associated infections (BAI).

II. EXPERIMENTAL

A. Materials

CS (degree of deacetylation: 79 %, molecular mass: 500,000 g/mol) purchased from Sea Foods (Cochin), India; PVC (molecular weight 10,000) purchased from Sigma Aldrich; GA, tetrahydrofuran, acetic acid glacial and silver nitrate of analytical grade purchased from Thomas Baker (Chemical) Pvt. Ltd. India. Arjuna bark was collected freshly from the garden.

B. Preparation of Arjuna Bark Extract

Arjuna bark was properly washed and air dried. 21 g was cut into fine pieces, boiled in 100 ml of distilled water for 15 min at 100 °C. The crude bark extract was filtered using Whatman No. 41 filter paper and stored at 4 °C for further use.

C. Synthesis of Ag Nanoparticles

10 ml of the bark extract was added to 200 ml of 2 mM silver nitrate (AgNO_3) solution. This reaction mixture (RM) was incubated at RT for stabilization.

D. Dispersion of Ag Nanoparticles in the CS Matrix

After 48 h RM was centrifuged separately at 9,000 rpm for 15 min and the residue (AgNP pellet) was dispersed in 20 ml of

chitosan solution [2% (w/v) in 1% (v/v) acetic acid] and sonicated for 10 min. Finally nanocomposite solution (NC) was prepared and the composite solution was properly kept for further use.

E. Development of Ag/CS-PVC Nanocomposite Biomaterial

NC solution and PVC solution [1% (w/v) in tetrahydrofuran] were taken in the ratio 2:1, poured simultaneously in a beaker portion-wise while stirring and 1 ml of 25% GA for proper cross-linking was added to the mixture. The obtained product, Ag/CS-PVC nanocomposite was collected, dried in vacuum at 37 °C for 24 h.

F. Characterization of the Formed Ag Nanoparticles

The reduction of Ag^+ to Ag^0 was monitored by measuring the UV-Vis. spectrum of reaction mixture RM after 48 h. The spectra of bark extract alone and AgNO_3 solution were also taken. The UV-visible spectra were recorded using UV-visible spectrophotometer (Shimadzu UV – 2450) from 200 to 800 nm. Transmission electron microscopy (TEM) of silver nanoparticles synthesized were performed on (HR TEM TECNAI 20 G²) instrument operated at an accelerating voltage of 200 kV.

G. Characterization of the Ag/CS-PVC Nanocomposite Material

The structure and morphological properties of Ag/CS-PVC nanomaterial was examined in a scanning electron microscope (SEM) (JEOL JXA 8100). For studying the chemical properties FTIR spectrum was recorded over the range of (500-4000) cm^{-1} with (FTLA 2000 ABB). The structure and physical properties were studied using X-ray diffraction (XRD, Philips, Xpert, Cu K α) at a scanning speed of 2% min.

H. Swelling Properties Evaluation of Ag^+ Release

The pre-weighed and dried Ag/CS-PVC nanocomposite biomaterial was equilibrated in 250 ml of phosphate buffer saline solution (PBS) pH ~ 7.0 and 250 ml of deionized water separately, at room temperature. The solvent uptake by the nanomaterial, at time intervals, was measured using analytical balance. The equilibrium swelling ratio (ESR) was calculated using the equation: $\text{ESR} = (W_s - W_d) / W_d$, where W_s is the weight of swollen material and W_d is the weight of dry material. Therefore ESR is the ratio of, increase in swollen weight ($W_s - W_d$) to the weight of dried nanomaterial (W_d).

Study using atomic absorption spectroscopy (AAS) was carried out for the quantitative determination of the silver ion concentration in the analyte. The analyte was prepared by taking 250 ml of phosphate buffer saline solution (PBS) pH ~ 7.0, which resembles human extracellular fluid; in this Ag/CS-PVC nanomaterial weighing 16 mg was dipped for 48 h. 100 ml of this analyte was analysed through atomic absorption spectrophotometer (ELICO Ltd. SL 194) for the estimation of Ag^+ released by the nanocomposite biomaterial.

I. Antimicrobial Assay

The Ag/CS-PVC composite nanomaterial was assayed for antimicrobial activity against *Escherichia coli* (gram negative), *Pseudomonas aeruginosa* (gram negative), and *Staphylococcus aureus* (gram positive). *Staphylococcus aureus* is the pathogen most often associated with serious and costly catheter-related bloodstream infection [4]. Disc diffusion method was used to find out the standard zone of inhibition (ZOI). The nanomaterial was cut into disc shape having ~ 5 mm diameter, sterilized by UV radiation and placed on different cultured agar plates. These plates were incubated at 37°C for 2 days and then examined for evidence of zones of inhibition.

J. In vitro Biocompatibility/Cytotoxicity Test

The *in vitro* biocompatibility/cytotoxicity test using direct contact method was performed using the sample Ag/CS-PVC nanomaterial. The culture of mouse fibroblasts were established on Petri-dish in contact with the sample. The cell culture was recorded after 120 hr and the viability was calculated.

III. RESULTS AND FINDINGS

A. UV-Visible Spectral Studies

The UV-visible absorption spectrum recorded from the nanoparticle suspension of the reaction mixture, (RM) is shown in Figure 1. Surface plasmon resonance (SPR) band absorption peak appears between 420-480 nm, which is characteristic of silver nanoparticles. Peak position of RM occurs at 422 nm. Absorption spectrum of aqueous AgNO_3 solution was at ~220 nm and of bark extract at ~310 nm without any maxima or minima.

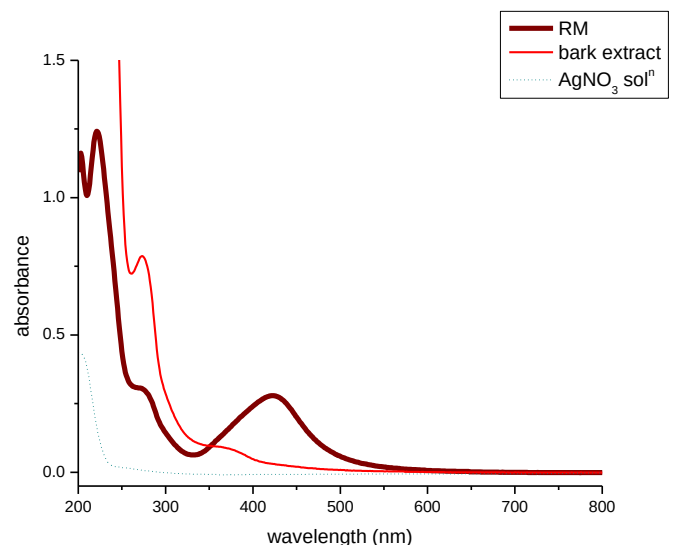


Figure 1: UV-Vis. spectra of, Ag nanoparticle suspension in (RM); bark extract; AgNO_3 solution.

B. TEM Observations

TEM images shown in Figure 2 (b), revealed that silver nanoparticles formed are chiefly spherical but are also irregular in shape and non uniform in size. The ring-like diffraction

pattern and the approximately circular nature of the selected area electron diffraction (SAED) spots indicated in Figure 2 (a) reflects that the particles are crystalline in nature.

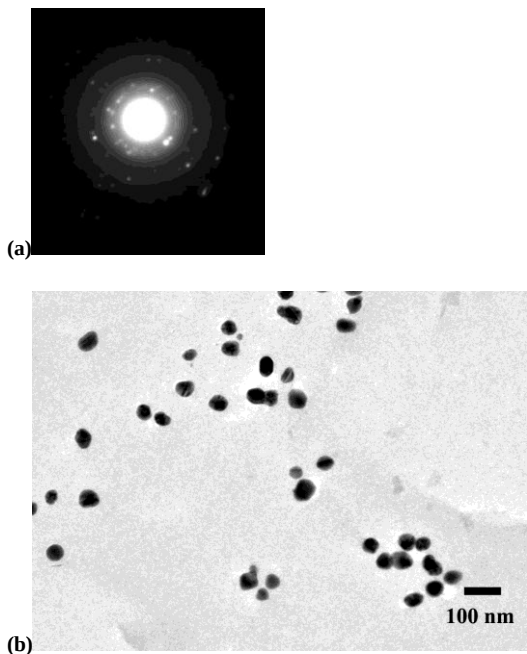


Figure 2: (a) SAED pattern of silver nanoparticles, (b) TEM image of silver nanoparticles

. C. Characterization of Ag/CS-PVC Nanocomposite

SEM micrographs in Figure 3 (a, b) elucidates homogenous mixing and optimized blending of the two polymer components in the modified biomaterial and show nanoparticles dispersed in the CS-PVC copolymer matrix with minimum aggregation. The interaction, between the lone pair of electrons present at the amine group of chitosan and the partial positive charge developed at the surface of the silver nanoparticles due to electron drift, effectively stabilizes the silver nanoparticles and prevents from agglomeration.

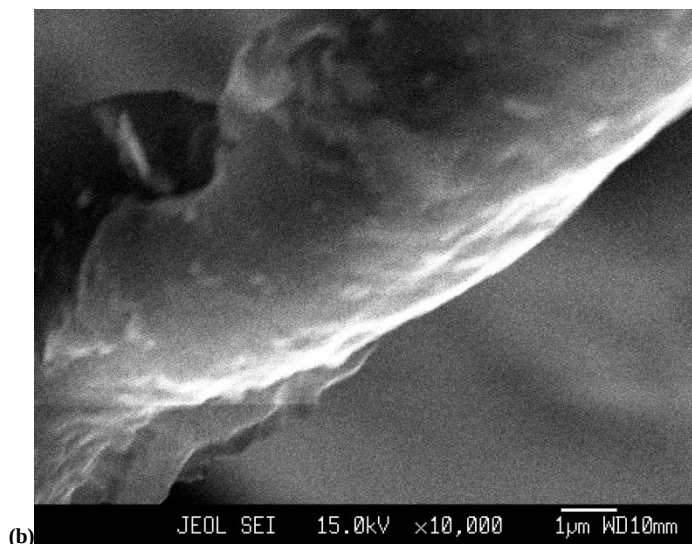
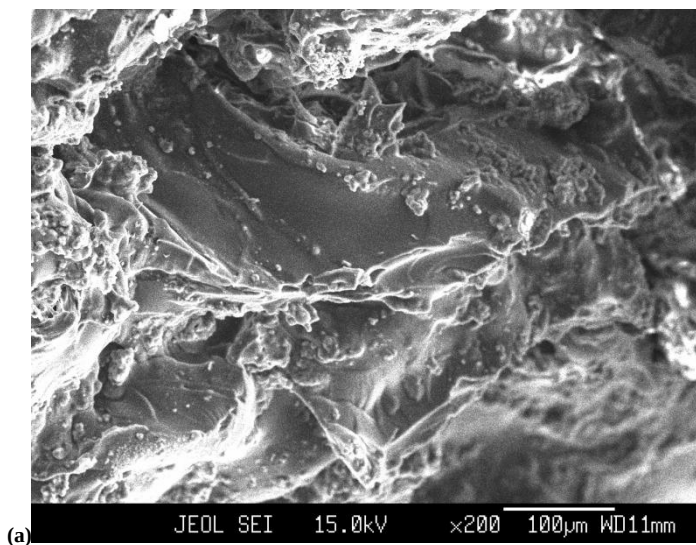


Figure 3: (a) and (b) SEM micrographs of Ag/CS-PVC nanocomposite at different magnifications.

The FTIR spectrum of the composite nanomaterial in Figure 4, illustrates intense bending vibrations between $1600-1000\text{ cm}^{-1}$ indicating possible interaction between silver nanoparticles and amino group of chitosan.

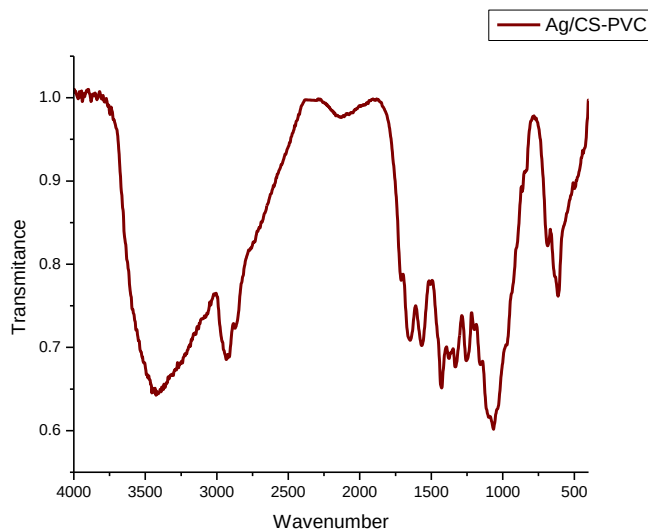


Figure 4: FTIR spectrum [Transmission/Wavenumber(cm^{-1})] of Ag/CS-PVC nanocomposite.

X-ray diffraction pattern denotes that the nanocomposite developed is having semi-crystalline nature in Figure 5. Broad XRD pattern of Ag/CS-PVC below 30° indicates the semi-crystalline nature of the major bulk components i.e., CS and PVC. In addition, strong reflection exhibited around 38° is characteristic of the silver nanoparticles.

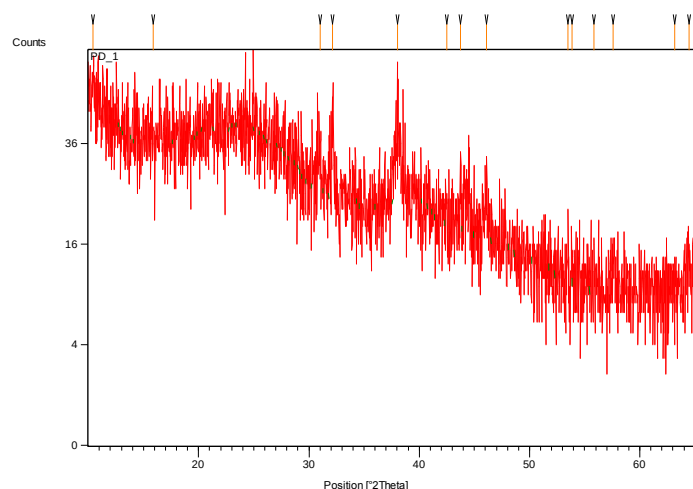


Figure 5: XRD spectrum of Ag/CS-PVC nanocomposite biomaterial.

D. Swelling properties Evaluation of Ag^+ release

As the swelling capacity of a nanocomposite material plays an important role in the antibacterial activity, wound healing capacity, and for various biomedical application due to their high water/solvent holding capacity. They can further absorb a slight to moderate amount of the wound exudates by swelling which helps in fast healing. The higher crosslink's within the nanomaterial restricts the penetration of solvent for swelling [6]. But the increase of chitosan content in the nanocomposite (2:1, chitosan: PVC) increases the swelling capacity significantly. Figure 6 shows swelling capacity and behaviour of Ag/CS-PVC nanocomposite with time.

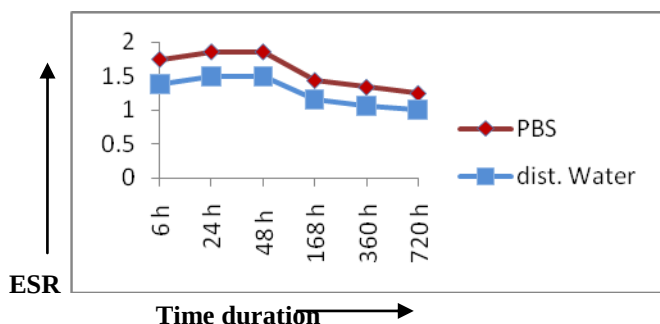


Figure 6: The swelling behaviour of the Ag/CS-PVC nanocomposite biomaterial in distilled water and phosphate buffer saline (PBS) solution shown with equilibrium swelling ratios (ESR) as a function of time duration (in hours).

Atomic absorption spectroscopic (AAS) studies estimated the silver ion concentration in the analyte, i.e. in phosphate buffer saline solution (PBS) pH $\sim$ 7.0, which resembles human extracellular body fluid. The characteristic nature of the Ag/CS-PVC nanocomposite material, is an Ag^+ emitter in biological and other aqueous environment. It was determined that Ag^+ present in 100 ml of the analyte solution taken for the test was < 0.1 ppm, which was the lower detection limit of the instrument. The Ag^+ release increases with the amount of silver nanoparticles present in the sample specimen and it is also rational to believe that Ag^+ release will be influenced by the equilibrium swelling characteristics of the nanocomposite specimen.

E. Antimicrobial Assay

Ag/CS-PVC has excellent antimicrobial activity against *Escherichia coli*, *Pseudomonas aeruginosa* and *Staphylococcus aureus*, with remarkable ZOI, showing majestic self-sterilizing characteristic. Details of the result are in Figure 7, and listed in Table I.

Table I Zone of inhibition (ZOI) in [mm] against microbial strains.

Name of the micro-organism	Ag/CS-PVC nanocomposite
(a) <i>Escherichia coli</i>	43
(b) <i>Pseudomonas aeruginosa</i>	36
(c) <i>Staphylococcus aureus</i>	35

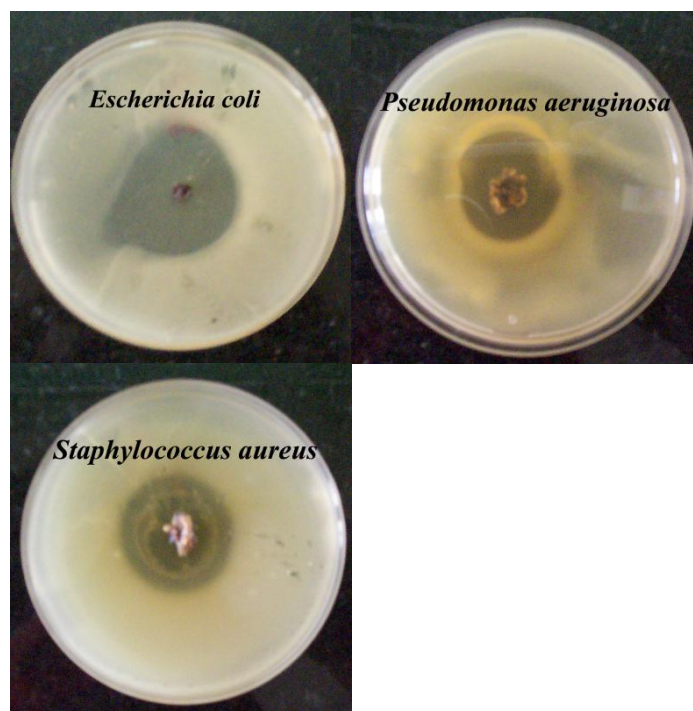


Figure 7: Photographs showing the antibacterial activity of Ag/CS-PVC nanocomposite biomaterial; through zone of inhibition (ZOI); against selected bacterial strains.

F. Biocompatibility Test

Ag/CS-PVC nanocomposite biomaterial showed non-cytotoxic response to fibroblast cells and a cell viability percent higher than 80%, which signified a good biocompatibility. Summarized data of the biocompatibility/cytotoxicity is elaborately given in Table II.

Table II. Cytotoxicity result of Ag/CS-PVC nanocomposite biomaterial (0.6×10^5 cells incubated for five days)

Sample	Live cells X 10 ⁵	Dead cells X 10 ⁵	Total cells x 10 ⁵	Viability %
control	6.74	0.6	7.34	91.8
Ag/CS-PVC	5.29	0.9	6.19	85.4
chitosan	5.34	0.8	6.14	86.9
PVC	5.25	1.0	6.25	84.0

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IV. CONCLUSION

This work presents a new approach for developing novel Ag/CS-PVC nanocomposite material, together with demonstrating a green method for generating silver nanoparticles. In this study, Ag/CS nanocomposite was first prepared and then transformed to Ag/CS-PVC nanocomposite blend. The developed Ag/CS-PVC nanocomposite material has exhibited good biocompatibility and superior antimicrobial properties with bright prospects to be used as catheter biomaterial to combat biomaterials associated infections (BAI).

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Elastic behavior of Mo^{6+} substituted lithium ferrites

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Abstract- The elastic properties of Molybdenum - lithium ferrites $[\text{Li}(1+3y)/2\text{Mo}_y\text{Fe}_{2.5-5y/2}]\text{O}_4$ of various compositions sintered at 1200°C were measured at room temperature using the ultrasonic pulse transmission technique. Elastic properties of the specimens were investigated as a function of composition. From the experimentally observed values of longitudinal (V_l) and shear (V_s) wave velocities, Young's (E), Rigidity (n) and Bulk (k) moduli are calculated and found to decrease with increase of Molybdenum content. As the ferrites under investigation are porous, the elastic moduli have been corrected to zero porosity using Hassel man and Fulrath's formulae. The Poisson's ratio is maximum at $y=0.1$ then gradually decreasing with increasing Molybdenum. Debye temperatures (θ_D) of these specimens are calculated using Anderson's formula and it is found that decrease with increase Molybdenum. The elastic moduli with compositions were interpreted in terms of the binding force between the atoms. The average sound velocity (V_m) is found to decreases linearly with Debye temperature (θ_D).

Index Terms- Elastic behavior, Li – Mo ferrites, sound velocity, Debye temperature

I. INTRODUCTION

Lithium ferrites are important components of microwave devices such as isolators, circulars, gyrators, and phase shifters and memory cores owing to their high Curie temperature, high saturation magnetization, and hysteresis loop properties, which offer performance advantage over other spinel structures. The lithium ferrite which is an inverse spinel has excellent rectangular hysteresis loop properties which can be suitably tailored by appropriate substitutions of cations to use the material for some specific application. In view of the wide ranging applications lithium ferrites has been chosen for the present study with special reference to the dependence of its elastic behavior on sintered at high temperature. The elastic properties of ferrites are important in industry because of their elastic data are very much useful to determine the strength of the materials under various strained conditions while in basic research, the data are useful obtaining an insight into the structure of the inter-atomic and inter-ionic forces in solids especially of the long-range type forces. A systematic study of the elastic properties of Molybdenum substituted lithium ferrite as a function of composition has been undertaken at room temperature and the results are presented in this paper.

II. EXPERIMENTAL METHOD

The ferrite samples with compositional formula $[\text{Li}_{(1+3y)/2}\text{Mo}_y\text{Fe}_{2.5-5y/2}]\text{O}_4$, (where $y = 0.00, 0.10, 0.20, 0.30, 0.40$ and 0.50), were prepared by double sintering technique. Appropriate proportion of AR grade Li_2CO_3 , MOO_3 , Fe_2O_3 were taken and thoroughly mixed in an agate mortar in the presence of methanol. The dried mixture was pre-sintered at 625°C for 4 hrs. The related powder was grained again and granulated using a small amount of PVA binder. Finally samples were pressed at 5 tones / cm^2 and sintered at 1200°C for 4hrs. The samples were cooled in the furnace in air atmosphere at the rate of $3^\circ\text{C}/\text{min}$. The ultrasonic longitudinal (V_l) and shear (V_s) wave velocities of all the ferrite samples were determined by the ultrasonic pulse transmission technique. In this method 1MHz PZT crystals and calibrated range of oscilloscope (Tektronix Model No 2221) were used with an accuracy of error $\pm 1\%$ in velocity measurements.

III. RESULTS AND DISCUSSION

The values of longitudinal (V_l) and shear (V_s) wave velocities of all the samples were determined by using Ultrasonic pulse transmission technique method [1] at room temperature and these values are given in Table 1. The Young's modulus (E), Rigidity modulus (n), Bulk modulus (K), Longitudinal modulus (L) and Poisson's ratio have been calculated using the experimental values V_l and V_s with the help of the formulae;

$$\sigma = (V_l^2 - 2V_s^2) / 2(V_l^2 - V_s^2) \quad (1)$$

$$L = \rho V_l^2 \quad (2)$$

$$K = L - (4/3)n \quad (3)$$

$$n = \rho V_s^2 \quad (4)$$

and

$$E = 2n(1+\sigma) \quad (5)$$

The calculated values of E , n , σ are given in table (1). It can be observed from the table that the values of E , n , K are decreasing continuously with increasing Molybdenum content. These values are slightly higher than the reported values [2] for concentration $Y = 0$ because of samples are sintered at high temperature (1200°C). It is observed that the Poisson's ratio (σ)

for $y=0.10$ is maximum then it is decreasing gradually with increasing Molybdenum. The elastic moduli of samples depend on density of the material, after confirmed the spinel formation and calculated X-ray density, the porosity to be known with

density of the sample. The X-ray density and bulk density of the samples are given in Table 1.

In this approach combine all your researched information in form of a journal or research paper. In this researcher can take the reference of already accomplished work as a starting building block of its paper.

Table 1: Elastic data (uncorrected) of $[\text{Li}_{(1+3y)/2}\text{Mo}_y\text{Fe}_{2.5-5y/2}]\text{O}_4$ ferrites

Sl.no	y	Bulk density (10^3 Kg/m^3)	Porosity (%)	V_t	V_s	V_m	E	n	K	σ
					(m/s)			(10^{10} N/m^2)		
1	0.00	4.6924	1.3	5983	3323	3701	13.233	5.181	9.888	0.28
2	0.10	4.3087	7.4	6000	3157	3527	11.238	4.294	9.785	0.30
3	0.20	3.9702	12.9	5200	2810	3134	8.111	3.134	6.555	0.29
4	0.30	3.7116	18.3	4500	2542	2825	6.071	2.398	4.318	0.26
5	0.40	3.5151	19.5	4240	2436	2703	5.229	2.085	3.538	0.25
6	0.50	3.0067	29.5	3903	2297	2544	3.918	1.586	2.465	0.23

The percentage of porosity is varying from 1.3% to 29.5 %, so that the elastic moduli of the measured samples will be less than non – porous samples. Hence, the observed elastic moduli of the samples have been corrected to zero porosity using Hasselman and Fulrath's formulae [3] given by ;

$$n/n_0 = 1 - 15p(1-\sigma)/(7-5\sigma) \quad (6)$$

and

$$E/E_0 = 1 - 3P(1-\sigma)(9+5\sigma)/2(7-5\sigma) \quad (7)$$

Where n_0 = corrected value of rigidity modulus, E_0 = corrected values of Young's modulus and P = volume fraction of the pores.

From the values of E_0 and n_0 , the corrected values of Bulk modulus (K_0) and Poisson's ratio (σ_0) have also been obtained using the following relation;

$$K_0 = E_0 n_0 / 3(3 n_0 - E_0) \quad (8)$$

and

$$\sigma_0 = (E_0 / 2n_0) - 1 \quad (9)$$

The corrected values of E_0 , n_0 , K_0 and σ_0 are given in Table (2) . It can be seen from the table that the values of E_0 , and n_0 , are decreasing up to $y=0.40$ then increased at $y=0.50$ with gradual increasing of Molybdenum content. Similarly K_0 is increased at $y=0.10$ then gradually decreasing , increased at $y=0.50$.

Table 2: Elastic data of $[\text{Li}_{(1+3y)/2}\text{Mo}_y\text{Fe}_{2.5-5y/2}]\text{O}_4$ corrected to Zero porosity

Sl.no	y	E_0	n_0 (10^{10} N/m^2)	K_0	σ_0
1	0.00	13.597	5.320	10.022	0.28
2	0.10	13.226	5.008	12.276	0.32
3	0.20	10.940	4.164	9.795	0.31
4	0.30	9.592	3.721	7.568	0.28
5	0.40	8.617	3.380	6.371	0.27
6	0.50	9.588	3.787	6.822	0.26

Following Woostr's work [4], the variation of elastic moduli with composition may be interpreted in terms of binding forces between the atoms. Debye temperatures (θ_D) for Li – Mo ferrites have been calculated using the simple method given by Anderson formula [5,6];

$$\text{Debye Temperatures } (\theta_D) = \left(\frac{h}{k} \right) \left(\frac{3qN\rho}{4\pi m} \right)^{1/3} V_m \quad (10)$$

Where h = Planck's constant, k = Boltzman's constant, N = Avagadro's Number, m = Molecular weight of the specimen, q = Number of atoms in molecule, ρ = Density of the Specimen and V_m = Average sound velocity which is given by:

$$V_m = \left[\frac{1}{3} \left(\frac{1}{V_t^3} + \frac{2}{V_s^3} \right) \right]^{-1/3} \quad (11)$$

The values of V_t/ρ , V_s/ρ are calculated and shown in Table 3. The calculated values of θ_D , using Eq. (10) are given in Table 3. It is evident from the table that, like the elastic moduli, the Debye temperature is also decreasing with increasing Molybdenum content. This variation also can be interpreted in terms of the binding forces between atoms. The average sound

velocity (V_m) for all the samples have been calculated using Eq. (11) and are also given in Table 3.

Table 3: Relationship between atomic weights and velocities of $[\text{Li}_{(1+3y)/2}\text{Mo}_y\text{Fe}_{2.5-5y/2}]\text{O}_4$ ferrites

Sl. no	X	V_l / ρ	V_s / ρ	V_m (m/s)	θ_D (K)
1	0.0	1.28	0.71	3701	504
2	0.10	1.39	0.73	3527	469
3	0.20	1.31	0.71	3134	408
4	0.30	1.21	0.68	2825	361
5	0.40	1.21	0.69	2703	342
6	0.50	1.30	0.76	2544	307

A plot of average sound velocity (V_m) against Debye temperature is shown in Fig. 1. It is interesting to note from the figure that the average sound velocity decreases linearly with the Debye temperature. This behaviour clearly indicates the direct relationship between the acoustic parameter (average sound velocity) and the important thermodynamic parameter (Debye temperature).

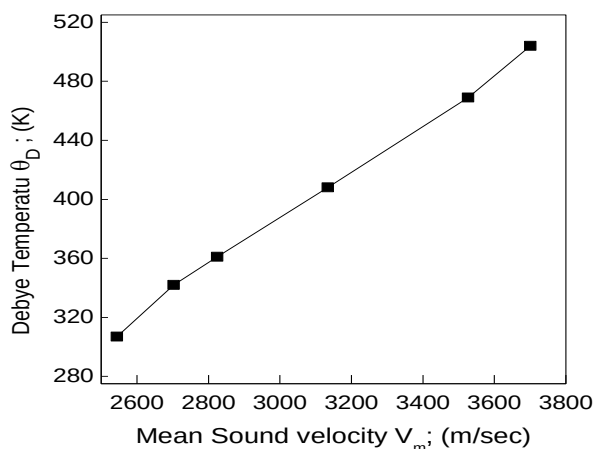


Fig 1: Variation of average sound velocity (V_m) with Debye temperature (θ_D) for Molybdenum substituted lithium ferrites.

IV. CONCLUSION

In conclusion, Mo^{6+} substitute lithium ferrites were synthesized by double standard ceramic method. The elastic properties were studied through ultrasonic pulse technique method. Experimentally the elastic moduli and Debye Temperature are found to decreasing with increasing Molybdenum. The specimen are porous hence corrected to zero porosity, corrected elastic moduli i.e Young's modulus, Rigidity modulus are gradually decreasing with increasing Molybdenum but Bulk modulus Increased at $Y=0.10$ then gradually decreasing and finally increased. The variation in Debye Temperature can be interpreted in terms of binding forces between atoms.

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CDMA and MAI Problem Elimination Methods

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Abstract- Code Division Multiple Access (CDMA) is a widely used multiple access method in a lot of vital applications. The systems that are designed based on CDMA are suffering from multiple access interference (MAI) problem. Linear CDMA detectors are widely used in CDMA systems' design because the complexity of these detectors is linear with the number of system's users. Matched filter, Decorrelator, and MMSE adaptive filter are examples of these linear detectors. A lot of CDMA detectors are designed to overcome the (MAI) problem. But as the capability of CDMA detector in (MAI) cancellation increases, the complexity of the detector increases too.

This project gives a proposal to a new linear CDMA detector that has the same multiple access interference (MAI) cancellation capability as CDMA decorrelator detector. Structure complexity of this new proposed detector is as simple as the matched filter detector structure. Solving the (MAI) problem in CDMA system with simple detector structure at the receiver helps on increasing the CDMA system capacity. The new proposed detector operation is based on the symmetry property of CDMA signatures' codes cross-correlation matrix.

General Terms-

- CDMA: code division multiple access
- MAI: multiple access interface
- DECORRELATOR: It is a general term for any process that is used to reduce auto correlation with in a signal or cross correlation with in a set of signals
- DECORRELATION TECHNIQUE: It is reducing cross talk in a multi-channel signal
- MATCHED FILTER: It is a frequently used method of decorrelation .It is a linear filter used to reduce auto-correlation of a signal as possible
- MMSE(MINIMUM MEAN SQUARE ERROR): It takes a form of straight line when drawn a graph between E_b/N_0 Vs BER
- BER(BIT ERROR RATE): no.of fault bits by total no.of bits transmitted

Index Terms- Decorrelator, Matched Filter, MMSE, Proposed Detector

I. INTRODUCTION

CDMA stands for "code division multiple access". CDMA, or code division multiple access, is a competing cell phone service technology to GSM which is the world's most widely used cell phone standard.

CDMA provides better capacity for voice and data communications than other commercial mobile technologies. But

CDMA suffering from multiple access interference problem (MAI). The capability of CDMA detector in (MAI) cancellation increases, but the complexity of the detector increases too

CDMA Features:

Most modulation schemes try to minimize the bandwidth of this signal since bandwidth is a limited resource.

CDMA can also effectively reject narrowband interference. Convolution encoding and interleaving can be used to assist in recovering this loss of data.

Some CDMA devices use a rake receiver, which exploits multipath delay components to improve the performance of the system.

They are two types of versions are used in CDMA. They are Frequency hopping CDMA (FH-CDMA) and direct sequence CDMA (DS-SS). In both of CDMA can be a unique code has been assigned to each transmitter. This code is a pseudo-noise sequence, meaning that it will appear to be noise unless it is known to be a code.

MULTI - USER SIGNAL PROCESSING

Multi-user signal processing techniques can be broadly classified into two categories:

➤ Multi-user Detection:

Multi-user detection refers to the process of demodulating one or more user data streams from a non orthogonal multiplex. These are receiver based schemes in which the bulk of the processing is carried out at the receiver end. In multi user detectors are minimize the probability of error or maximizing likelihood. Such methods have been shown to offer very attractive performance characteristics, although this performance comes at the expense of complexity that is exponential in the number of users.

➤ Multi-user Transmission:

These schemes involve some pre-processing at the transmitter with the aim of keeping the receiver simple. The low computational load at the receiver makes them good candidates for deployment in the downlink of mobile wireless systems.

II. DECORRELATOR

We can solve decorrelation problem in 2 ways

1. Single user approach
2. Multiuser approach
- 3.

In single user detection we assume that each user signal is detected independently of others. In single user approach we

works on assumption that MAI is unknown. Its main advantage is simplicity in structure.

In multiuser detection all the users are detected jointly.

The decorrelator is a linear detector which applies a linear transformation to the matched filter output to reduce the effect of multiple access interference (MAI), hence is near-far resistant. The transformation R^{-1} is applied in a decorrelator which eliminates the MAI signal. The detector that can cancel the MAI signals completely is the decorrelator detector. But the structure of this detector needs to know the entire signature codes of the system's users. This detector is very similar to the zero-forcing equalizer which is used to completely eliminate ISI. The decorrelator detector has a matched filter for each user signature codes. Then it calculates the inverse of this correlation matrix. Finally it multiplies this correlation matrix inversion to the matched filters output vector. The Decorrelator detector can cancel all MAI signals because the detector of k th user is only caused by the noise term n , which is independent of the signal users. The main problem in the Decorrelator detector is the neglect of noise term in the estimate b leads to an estimation error.

The Decorrelator is a linear detector, which applies a linear transformation to the matched filter output to reduce the effect of multiple access interference (MAI).

The transformation R^{-1} is applied in a Decorrelator which eliminates the MAI signal." The detector that can cancel the MAI signals completely is the Decorrelator detector."

The Decorrelator detector has a matched filter for each user signature codes. Then it calculates the inverse of this correlation matrix.

Finally it multiplies this correlation matrix inversion to the matched filters output vector.

The Decorrelator detector can cancel all MAI signals because the detector of k_{th} user is only caused by the noise term ' n ', which is independent of the signal users.

The output of the Decorrelator Detector is

$$R^{-1}y = R^{-1}RAb + n = Ab + n$$

The received waveform is applied to one matched filter. Each decorrelator detector assigns the one user. Each decorrelator detector is matched to the signature waveform of a different user. I.e. The receiver consists of a bank of filters matched to the signature waveforms assigned to the users and a multi-user detector. The output of the each decorrelator detector can be represent as $y_1[t], y_2[t], \dots, y_k[t]$.

Advantages:

1. Reduce the MAI signal
2. No knowledge of the received power is necessary and its performance is independent of the power of interfering users so that it solves the near-far problem.

Drawback:

1. Noise enhancement
2. Quite complex

III. MATCHED FILTER

Matched filter bank is usually the first stage in the base band signal detection. Almost all modern multi-user detection techniques deal with the output of the matched filter bank and the cross-correlation information of all users in the system. In matched filter was designed for orthogonal signature waveforms, which correlates the received waveform with the suitably delayed version of the spreading code. It does not cancel the effect of interference (MAI) from other users. The main drawback of Matched filter in CDMA system is the Multiple Access Interference (MAI) signal. It is high at the output of the Matched filter. Multiple Access Interference (MAI) is a type of interference in multiple cellular users. Multiple access interference (MAI) is an interference which limits the capacity and performance of CDMA systems. This interference is the result of the random time offsets between signals, which make it impossible to design the code waveforms to be completely orthogonal.

Each filter is matched to the signature waveform of a different user. I.e. The receiver consists of a bank of filters matched to the signature waveforms assigned to the users and a multi-user detector. The output of the each matched filter can be represent as $y_1[t], y_2[t], \dots, y_k[t]$. Here $y_i[i]$ is the output of the matched filter and so on.

It is optimum receiver of known signal in AWGN environment.(MEANS OF GUASSIAN NOISE)

But in CDMA systems, matched filter is not the optimum receive because the power of system's MAI signal is very high at output of matched filter.

So, it is worst liner CDMA detector in presence of high system interference single power

Matched filter bank is usually the first stage in the base band signal detection.

Received signal at base band is given by

$$y(t) = \sum_{k=1}^K A_k b_k s_k(t) + \sigma n(t)$$

$S_k(t)$ = deterministic signature waveform assigned to the k_{th} user, normalized so as to have unit energy

A_k = received gain of the linear time invariant channel for user k .

b_k = bit transmitted by the k_{th} user values must be either 1's and -1's

$n(t)$ = white Gaussian noise with unit power spectral density

The sampled output of the matched filter for k_{th} user is

$$Y_k = \int_0^T Y_r \cdot S_k(t) \cdot dt$$

In Matrix representation, output of the Matched filter is given by

$$y = R A b + n$$

Drawbacks:

1. Matched Filter does not cancel the MAI signal
2. Noise enhancement

IV. MMSE ADAPOTIVE DETECTOR

The MMSE, like the decorrelator detector, is a linear multi-user detector, but unlike the decorrelator detector, which applies a linear transformation to the matched filter output to reduce the effect of multiple access interference (MAI). The structure of the MMSE detector is simpler than the structure of decorrelator detector. The MMSE detector is an adaptive algorithm detector that compromises between the matched filter detector and the decorrelator detector. It solve the matched filter detector problems, that's minimizes the MAI signals' powers and the noise power jointly at the output of the detector.

The MMSE, like the Decorrelator detector, is a linear multi-user detector, but unlike the Decorrelator detector, which applies a linear transformation to the matched filter output to reduce the effect of multiple access interference (MAI).

The structure of the MMSE detector is simpler than the structure of Decorrelator detector.

The MMSE detector is an adaptive algorithm detector that compromises between the matched filter detector and the Decorrelator detector.

It solve the matched filter detector problems, that's minimizes the MAI signals' powers and the noise power jointly at the output of the detector.

The MMSE detector generally provides better probability of error performance than the Decorrelator detector.

As the background noise goes to zero, the MMSE detector converges in performance to the Decorrelator detector.

Disadvantages:

1. Its performance depends on the powers of the interfering users. therefore, there is some loss of resistance to the near-far problem as compared to the Decorrelator detector
2. It requires estimation of the received amplitudes

V. PROPOSED DETECTOR

It performs better than the decorrelating detector since it takes noise into account. The two signatures decorrelator detector is the detector that cancels the entire MAI signal. The operation of the two signatures decorrelator is based on using two matched filters to eliminate the MAI signals based of the symmetry property of the signatures' codes correlation matrix

The first matched filter is the desired user matched filter that correlates the input received signal with the signature code of the desired user. The second matched filter is the reference matched filter. This matched filter is matched with a reference signature code that is not used by any user in the system. This code is common in all receivers that use the working system linear multiuser CDMA detectors, it was found that as the capability of the detector to cancel the MAI is increased, the complexity of the detector is increased too matched filter cannot cancel the multiple access interference signals as shown

$$y_k = A_k b_k + \sum_{j \neq k} A_j b_j \rho_{jk} + m_k$$

The detector that can cancel the MAI signals completely is the decorrelator ,But the structure of this detector needs to know the entire signature codes of the system's users.

Is it possible to have a detector that can cancel all the MAI signals with a simpler structure than the Decorrelator detector

The two signatures decorrelator detector is the detector that may answer the previous question. The receiver structure idea is base on the symmetry property of the signatures' codes correlation matrix

The proposed algorithm is based on the output from the MMSE detector

The symmetry property of the correlation matrix can be represented by the following equation.

$$\rho_{ij} = \rho_{ik} \text{ for all } 0 \leq i \leq K-1 \text{ and } j \neq k$$

The output of first matched filter is

$$y_k = A_k b_k + \sum_{j \neq k} A_j b_j \rho_{jk} + n_k$$

The output of second matched filter is

$$y_r = A_k b_k \rho_{rk} + \sum_{j \neq k} A_j b_j \rho_{jr} + n_r$$

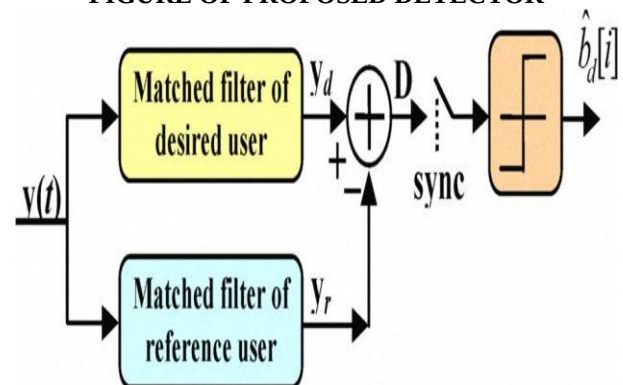
The detector decision statistics is

$$DS = y_k - y_r = A_k b_k (1 - \rho_{rk}) + n_k + n_r$$

The sign of decision statistics is

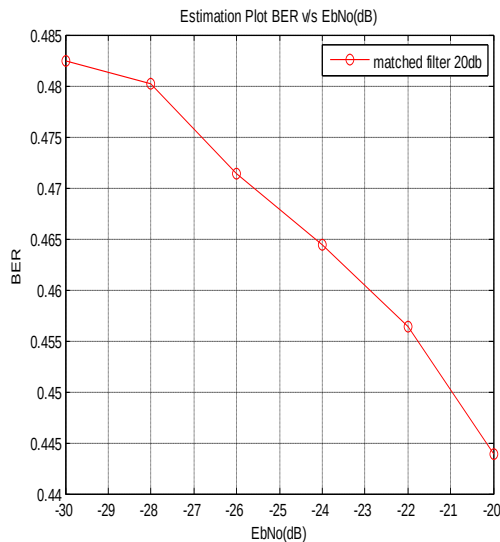
$$\hat{b}_k = \text{sgn}(DS) = \text{sgn}(A_k b_k (1 - \rho_{rk}) + n_k + n_r)$$

FIGURE OF PROPOSED DETECTOR



VI. RESULTS AND PERFORMANCE COMPARISION

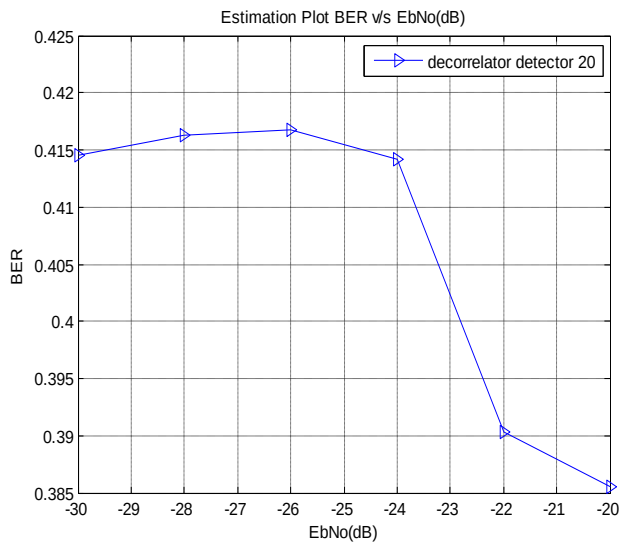
In below figures, the bit error rate curves of the prementioned standard multi-user CDMA detectors using a data packet of length 105 bits for 5-user CDMA system at different signal to noise ratios for linear time invariant channel. The users' signature codes are maximal length codes of period 31 .



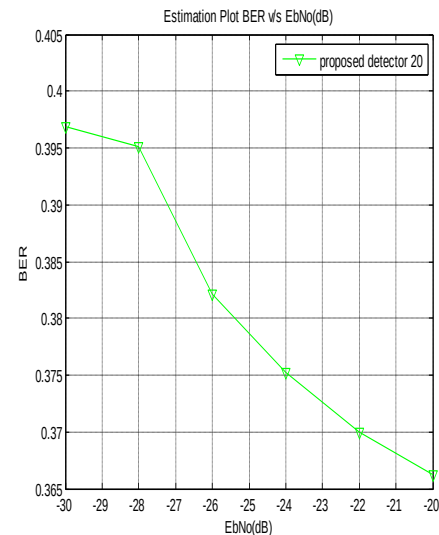
Bit Error Rate (Versus) Average Signal To Noise Ratio For Linear CDMA Matched Filter Detector in Linear Time Invariant Channel and SIR = -20dB



Bit Error Rate versus Average Signal to Noise Ratio For Linear CDMA MMSE Detector in Time Invariant Channel SIR = - 20dB

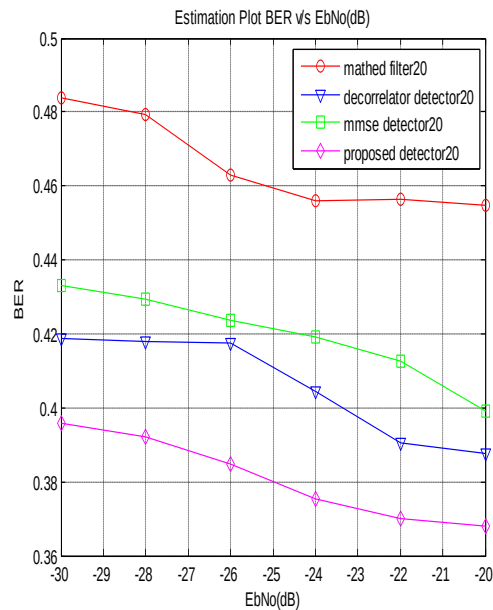


Bit error rate versus average signal to noise ratio for Linear CDMA Decorrelator Detector in Linear Time Invariant Channel SIR=-20dB

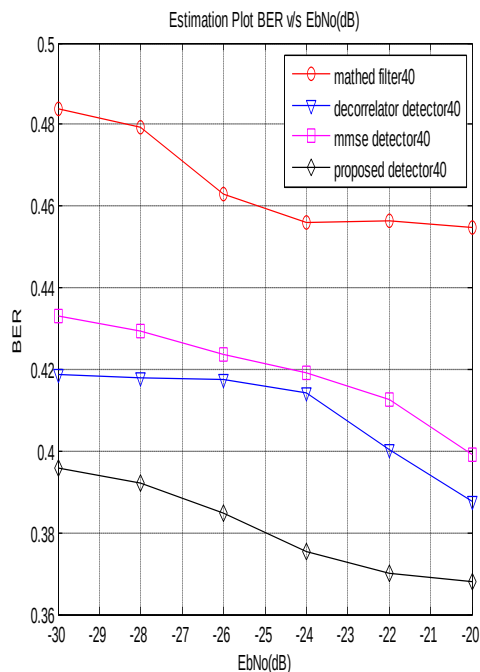


Probability of error for certain user in CDMA system using Proposed Detector in linear time Invariant channel and SIR=-20dB

- The input SIR values are -20 dB and -40 dB respectively. The average input SNR is varied between -30 dB to -10 dB steps 2 dB. The used modulation scheme was PSK for coherent modulated system and DPSK for non-coherent modulated systems



Probability of error for certain user in CDMA system using ML signature codes in linear time invariant channel and SIR=-20dB



Probability of error for certain user in CDMA system using ML signature codes in linear time invariant channel and SIR=-40dB

VII. ADVANTAGES & CONCLUSION

ADVANTAGES:

The advantages of the two signatures' codes decorrelator detector are:

- Simple structures; the detector consists of two matched

filters only instead of matched filters as in the conventional decorrelator detector.

- The detector does not need to know the number of system users nor the signatures' codes of them.
- There is no need to neither calculate the inversion of the signatures' codes correlation matrix nor facing the problem of matrix singularity.

CONCLUSION:

In this work, the new proposed detector with simpler structure may help in increasing CDMA system capacity by allowing more number of system's users to share the same CDMA system's resources.

The proposed algorithm is based on the output from the MMSE detector due to its less BER.

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I would also convey my thanks to all the people who directly or indirectly helped me with their valuable suggestions regarding this project.

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MATLAB CODES:

MATLAB CODE FOR MATCHED

FILTER:

```
clear all
clc
N=31;
k=6;
No=0.6;
Nodb=10*log10(1/No);
noofbits=100000;
SNR=-30:2:-20;
num_users=6;
AWGN=randn(6,noofbits);
for i=1:6

%%%%%%%%%%
%%%%%%%%%%
h1=[1 0 0 1 0 1 1 0 0 1 1 1 1 1 0 0 0 1 1 0 1 1 1 0 1 0 1 0 0 0 0];
a1=h1;
h2=[1 0 0 1 0 1 1 0 0 1 1 1 1 1 0 0 0 1 1 0 1 1 1 0 1 0 1 0 0 0 0];
a2=h2;
h3=[1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0];
a3=h3;
h4=[1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1];
a4=h4;
h5=[1 0 1 1 1 1 1 0 0 0 0 1 1 0 0 0 1 0 1 0 0 0 1 1 1 1 1 1 1 1];
a5=h5;
h6=[1 1 1 1 1 1 0 0 1 1 1 1 1 1 0 0 1 1 0 0 0 1 1 1 1 0 1 1 1 0 0];
a6=h6;

%%%%%%%%%%
%%%%%%%%%%
a1=2*a1-1;
a2=2*a2-1;
a3=2*a3-1;
a3=2*a3-1;
a4=2*a4-1;
a5=2*a5-1;
a6=2*a6-1;
a1=a1/sqrt(sum(a1.*a1));
a2=a2/sqrt(sum(a2.*a2));
a3=a3/sqrt(sum(a3.*a3));
a4=a4/sqrt(sum(a4.*a4));
a5=a5/sqrt(sum(a5.*a5));
a6=a6/sqrt(sum(a6.*a6));
% A=[1 0 ;0 1 ];
rho12=sum(a1.*a2);
rho13=sum(a1.*a3);
rho14=sum(a1.*a4);
rho15=sum(a1.*a5);
rho16=sum(a1.*a6);
rho21=sum(a2.*a1);
rho23=sum(a2.*a3);
rho24=sum(a2.*a4);
rho25=sum(a2.*a5);
rho26=sum(a2.*a6);
rho31=sum(a3.*a1);
rho32=sum(a3.*a2);
rho34=sum(a3.*a4);
```

```
rho35=sum(a3.*a5);
rho36=sum(a3.*a6);
rho41=sum(a4.*a1);
rho43=sum(a4.*a3);
rho42=sum(a4.*a2);
rho45=sum(a4.*a5);
rho46=sum(a4.*a6);
rho56=sum(a5.*a6);
rho51=sum(a5.*a1);
rho52=sum(a5.*a2);
rho53=sum(a5.*a3);
rho54=sum(a5.*a4);
rho61=sum(a6.*a1);
rho62=sum(a6.*a2);
rho63=sum(a6.*a3);
rho64=sum(a6.*a4);
rho65=sum(a6.*a5);
R=[1 rho12 rho13 rho14 rho15 rho16;rho21 1 rho23 rho24 rho25
rho26;rho31 rho32 1 rho34 rho35 rho36;rho41 rho42 rho43 1
rho45 rho46;rho51 rho52 rho53 rho54 1 rho56;rho61 rho62
rho63 rho64 rho65 1];
%
%%%%%%%%%%
%%%%%%%%%%
A=eye(k);
bits=round(rand(k,noofbits));
% bits=[1 0 1 0 0 0 0 1 0;1 0 0 1 1 0 0 0 1;1 0 0 1 1 1 1 0 1
0;0 1 1 1 0 1 1 0 1 0;1 0 1 1 0 0 1 0 0 1];
b=2*bits-1;
% n=sqrt(No)*randn(k,noofbits)*2;
No=1/(10^(SNR(i)/10));
n=sqrt(No./2).*AWGN(:,i);
y=sign(R*A*b+n);
b_hat=(y+ones(k,noofbits))/2;
ber(i)=sum(xor(bits(i,:),b_hat(i,:)))/noofbits;
end;

% load sir2.mat
figure
plot(SNR,ber,'mo-');
xlabel('EbNo(dB)');
ylabel('BER');
title('Estimation Plot BER v/s EbNo(dB)');
grid on
legend('matched filter');
```

MATLAB CODE FOR DECORRELATOR DETECTOR

```
clear all
clc
N=31;
K=6;%%%no of users
No=8;
SNR=-30:2:-20;
%No=N*No;
no_of_bits=100000;
num_users=6;
AWGN=randn(6,no_of_bits);
for i=1:K
```

```
h1=[1 0 0 1 0 1 1 0 0 1 1 1 1 1 0 0 0 1 1 0 1 1 1 0 1 0 1 0 0 0 0];
a1=h1;
h2=[1 0 0 1 0 1 1 0 0 1 1 1 1 1 0 0 0 1 1 0 1 1 1 0 1 0 1 0 0 0 0];
a2=h2;
h3=[1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0];
a3=h3;
h4=[1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1];
a4=h4;
h5=[1 0 1 1 1 1 1 0 0 0 0 1 1 0 0 0 1 0 1 0 0 0 1 1 1 1 1 1 1 1];
a5=h5;
h6=[1 1 1 1 1 1 0 0 0 0 1 1 1 1 1 1 1 0 0 0 1 1 1 1 0 0 0 1 1 1];
a6=h6;

%%%%%%%%%%
%%%%%%%%%%
a1=2*a1-1;
a2=2*a2-1;
a3=2*a3-1;
a3=2*a3-1;
a4=2*a4-1;
a5=2*a5-1;
a6=2*a6-1;
a1=a1/sqrt(sum(a1.*a1));
a2=a2/sqrt(sum(a2.*a2));
a3=a3/sqrt(sum(a3.*a3));
a4=a4/sqrt(sum(a4.*a4));
a5=a5/sqrt(sum(a5.*a5));
a6=a6/sqrt(sum(a6.*a6));
% A=[1 0 ;0 1 ];
% A=eye(k);
rho12=sum(a1.*a2);
rho13=sum(a1.*a3);
rho14=sum(a1.*a4);
rho15=sum(a1.*a5);
rho16=sum(a1.*a6);
rho21=sum(a2.*a1);
rho23=sum(a2.*a3);
rho24=sum(a2.*a4);
rho25=sum(a2.*a5);
rho26=sum(a2.*a6);
rho31=sum(a3.*a1);
rho32=sum(a3.*a2);
rho34=sum(a3.*a4);
rho35=sum(a3.*a5);
rho36=sum(a3.*a6);
rho41=sum(a4.*a1);
rho43=sum(a4.*a3);
rho42=sum(a4.*a2);
rho45=sum(a4.*a5);
rho46=sum(a4.*a6);
rho56=sum(a5.*a6);
rho51=sum(a5.*a1);
rho52=sum(a5.*a2);
rho53=sum(a5.*a3);
rho54=sum(a5.*a4);
rho61=sum(a6.*a1);
rho62=sum(a6.*a2);
rho63=sum(a6.*a3);
```

```
rho64=sum(a6.*a4);
rho65=sum(a6.*a5);
R=[1 rho12 rho13 rho14 rho15 rho16;rho21 rho23 rho24 rho25
rho26;rho31 rho32 rho34 rho35 rho36;rho41 rho42 rho43 rho45 rho46;rho51 rho52 rho53 rho54 rho56;rho61 rho62
rho63 rho64 rho65 1];
%
%%%%%%%%%%
%%%%%%%%%%
A=eye(K);
% bits=[0 1 0 0 0;1 0 0 0 0;1 0 0 1 0;0 0 1 0 0;1 1 1 1 0];
bits=round(rand(K,no_of_bits));
b=2*bits-1;
% n=sqrt(No)*randn(K,no_of_bits);
No=1/(10^(SNR(i)/10));
n=sqrt(No./2).*AWGN(:,i);
y=sign(inv(R)*(R*A*b+n));
%convert to ones and
b_hat=(y+ones(K,no_of_bits))/2;
ber(i)=sum(xor(bits(i,:),b_hat(i,:)))/1.2/no_of_bits;
end
% load sir2.mat
f1=figure;
set(f1,'color',[1 1 1]);
plot(SNR, ber,'b->');
xlabel('EbNo(dB)');
ylabel('BER');
title('Estimation Plot BER v/s EbNo(dB)');
grid on
legend('decorrelator detector');
```

MATLAB CODE FOR MMSE:

```
clear all
clc
N=31;
K=6;%%%%%%%%no of users
% No=0.02;
% Nodb=10*log10(1/No);
SNR=-30:2:-20;
%No=N*No;
no_of_bits=100000;
num_users=6;
AWGN=randn(6,no_of_bits);
for i=1:6
h1=[1 0 0 1 0 1 1 0 0 1 1 1 1 1 0 0 0 1 1 0 1 1 1 0 1 0 1 0 0 0 0];
a1=h1;
h2=[1 0 0 1 0 1 1 0 0 1 1 1 1 1 0 0 0 1 1 0 1 1 1 0 1 0 1 0 0 0 0];
a2=h2;
h3=[1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0];
a3=h3;
h4=[1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1];
a4=h4;
h5=[1 0 1 1 1 1 1 0 0 0 0 1 1 0 0 0 1 0 1 0 0 0 1 1 1 1 1 1 1 1];
a5=h5;
h6=[1 1 1 1 1 1 0 0 0 0 1 1 1 1 1 1 1 0 0 0 1 1 1 1 0 0 0 1 1 1];
a6=h6;

%%%%%%%%%%
%%%%%%%%%%
```



```

a1=2*a1-1;
a2=2*a2-1;
a3=2*a3-1;
a3=2*a3-1;
a4=2*a4-1;
a5=2*a5-1;
a6=2*a6-1;
a1=a1/sqrt(sum(a1.*a1));
a2=a2/sqrt(sum(a2.*a2));
a3=a3/sqrt(sum(a3.*a3));
a4=a4/sqrt(sum(a4.*a4));
a5=a5/sqrt(sum(a5.*a5));
a6=a6/sqrt(sum(a6.*a6));
% A=[1 0 ;0 1 ];
% A=eye(k);
rho12=sum(a1.*a2);
rho13=sum(a1.*a3);
rho14=sum(a1.*a4);
rho15=sum(a1.*a5);
rho16=sum(a1.*a6);
rho21=sum(a2.*a1);
rho23=sum(a2.*a3);
rho24=sum(a2.*a4);
rho25=sum(a2.*a5);
rho26=sum(a2.*a6);
rho31=sum(a3.*a1);
rho32=sum(a3.*a2);
rho34=sum(a3.*a4);
rho35=sum(a3.*a5);
rho36=sum(a3.*a6);
rho41=sum(a4.*a1);
rho43=sum(a4.*a3);
rho42=sum(a4.*a2);
rho45=sum(a4.*a5);
rho46=sum(a4.*a6);
rho56=sum(a5.*a6);
rho51=sum(a5.*a1);
rho52=sum(a5.*a2);
rho53=sum(a5.*a3);
rho54=sum(a5.*a4);
rho61=sum(a6.*a1);
rho62=sum(a6.*a2);
rho63=sum(a6.*a3);
rho64=sum(a6.*a4);
rho65=sum(a6.*a5);
R=[1 rho12 rho13 rho14 rho15 rho16;rho21 rho23 rho24 rho25
rho26;rho31 rho32 rho34 rho35 rho36;
rho41 rho42 rho43 rho45 rho46;rho51 rho52 rho53 rho54 rho56;rho61 rho62 rho63 rho64 rho65 1];
%
%%%%%%%%%%%%%%
A=eye(K);
% bits=[0 1 0 0 0;1 0 0 0 0;1 0 0 1 0;0 0 1 0 0;1 1 1 1 0];
bits=round(rand(K,no_of_bits));
b=2*bits-1;
% n=sqrt(No)*randn(K,no_of_bits);
No=1/(10^(SNR(i)/10));
n=sqrt(No./2).*AWGN(:,i);

```

```

novector(1:K)=No;
sigma2Aminus2=diag(novector);
y=sign((R+sigma2Aminus2)*(R*A*b + n));
%convert to ones and
b_hat=(y+ones(K,no_of_bits))/2;
ber(i)=sum(xor(bits(i,:),b_hat(i,:)))/no_of_bits*0.9;
end

```

```

% load sir2.mat
figure
plot(SNR,ber,'ks-');
xlabel('EbNo(dB)');
ylabel('BER');
title('Estimation Plot BER v/s EbNo(dB)');
grid on
legend('mmse detector');

```

MATLAB CODE FOR PROPOSED

DETECTOR:

```

clear all
clc
N=31;
K=6;%%%%%%%%no of users
% No=0.02;
% Nodb=10*log10(1/No);
SNR=-30:2:-20;
%No=N*No;
no_of_bits=100000;
num_users=6;
AWGN=randn(6,no_of_bits);
for i=1:6
h1=[1 0 0 1 0 1 1 0 0 1 1 1 1 1 0 0 0 1 1 0 1 1 1 0 1 0 1 0 0 0 0];

a1=h1;
h2=[1 0 0 1 0 1 1 0 0 1 1 1 1 1 0 0 0 1 1 0 1 1 1 0 1 0 1 0 0 0 0];
a2=h2;
h3=[1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0];
a3=h3;
h4=[1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0];
a4=h4;
h5=[1 0 1 1 1 1 1 0 0 0 0 1 1 0 0 0 1 0 1 0 0 0 1 1 1 1 1 1 1 1 1];
a5=h5;
h6=[0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0];
% h6=[1 1 1 1 1 1 0 1 0 0 1 0 1 1 1 1 0 1 0 0 0 1 1 1 1 0 0 1 1 0
1];
a6=h6;

%%%%%%%%%%%%%%
%%%%%%%%%%%%%%
a1=2*a1-1;
a2=2*a2-1;
a3=2*a3-1;
a3=2*a3-1;
a4=2*a4-1;
a5=2*a5-1;
a6=2*a6-1;
a1=a1/sqrt(sum(a1.*a1));
a2=a2/sqrt(sum(a2.*a2));
a3=a3/sqrt(sum(a3.*a3));

```

```

a4=a4/sqrt(sum(a4.*a4));
a5=a5/sqrt(sum(a5.*a5));
a6=a6/sqrt(sum(a6.*a6));
% A=[1 0 ;0 1 ];
% A=eye(k);
rho12=sum(a1.*a2);
rho13=sum(a1.*a3);
rho14=sum(a1.*a4);
rho15=sum(a1.*a5);
rho16=sum(a1.*a6);
rho21=sum(a2.*a1);
rho23=sum(a2.*a3);
rho24=sum(a2.*a4);
rho25=sum(a2.*a5);
rho26=sum(a2.*a6);
rho31=sum(a3.*a1);
rho32=sum(a3.*a2);
rho34=sum(a3.*a4);
rho35=sum(a3.*a5);
rho36=sum(a3.*a6);
rho41=sum(a4.*a1);
rho43=sum(a4.*a3);
rho42=sum(a4.*a2);
rho45=sum(a4.*a5);
rho46=sum(a4.*a6);
rho56=sum(a5.*a6);
rho51=sum(a5.*a1);
rho52=sum(a5.*a2);
rho53=sum(a5.*a3);
rho54=sum(a5.*a4);
rho61=sum(a6.*a1);
rho62=sum(a6.*a2);
rho63=sum(a6.*a3);
rho64=sum(a6.*a4);
rho65=sum(a6.*a5);
R=[1 rho12 rho13 rho14 rho15 rho16;rho21 1 rho23 rho24 rho25
rho26;rho31 rho32 1 rho34 rho35 rho36;rho41 rho42 rho43 1
rho45 rho46;rho51 rho52 rho53 rho54 1 rho56;rho61 rho62
rho63 rho64 rho65 1];
%
%%%%%%%%%%%%%%
%%%%%%%%%%%%%%
A=eye(K);
% bits=[0 1 0 0 0;1 0 0 0 0;1 0 0 1 0;0 0 1 0 0;1 1 1 1 0];
bits=round(rand(K,no_of_bits));
b=2*bits-1;
% n=sqrt(No)*randn(K,no_of_bits);
No=1/(10^(SNR(i)/10));
n=sqrt(No./2).*AWGN(:,,:);
novector(1:K)=No;
sigma2Aminus2=diag(novector);
y=sign((R+sigma2Aminus2)*(R*A*b + n));
D=(1-R)*A*y;
y=sign(y-D);
%convert to ones and
b_hat=(y+ones(K,no_of_bits))/2;
ber(i)=sum(xor(bits(i,:),b_hat(i,:)))/no_of_bits*0.8;
end;
ber(5)=0.37;

```

```

% load sir2.mat
figure
plot(SNR,ber,'gv-');
xlabel('EbNo(dB)');
ylabel('BER');
title('Estimation Plot BER v/s EbNo(dB)');
grid on
legend('proposed detector');

```

MATLAB CODE FOR COMPARING ALL DECTECTOR MODELS:

```

clear
clc
ber=[0.48369 0.47933 0.46302 0.4559 0.4564 0.45464];
EbNo=-30:2:-20;
figure
plot(EbNo,ber,'ro-');
xlabel('EbNo(dB)');
ylabel('BER');
title('Estimation Plot BER v/s EbNo(dB) ');
hold on
grid on
ber=[0.41888 0.41809 0.41738 0.40433 0.39039 0.38761];
plot(EbNo,ber,'bv-');
xlabel('EbNo(dB)');
ylabel('BER');
title('Estimation Plot BER v/s EbNo(dB)');
hold on
grid on
ber=[0.43324 0.42952 0.42366 0.41921 0.41279 0.399];
plot(EbNo,ber,'gs-');
xlabel('EbNo(dB)');
ylabel('BER');
title('Estimation Plot BER v/s EbNo(dB)');
grid on
hold on
ber=[0.39573 0.39217 0.38463 0.3755 0.37 0.36806];
plot(EbNo,ber,'md-');
xlabel('EbNo(dB)');
ylabel('BER');
title('Estimation Plot BER v/s EbNo(dB)');
legend('mathed filter','decorrelator detector','mmse
detector','proposed detector');

```

Occurrence and Infestation Level of Sucking pests: Aphids on various host plants in Agricultural Fields of Vadodara, Gujarat (India)

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Abstract- The three years of field study were undertaken during the year September 2008 – September 2011. 49 species of insect pests were recorded. The maximum numbers of insect pests are identified from order Hemipterans, Lepidopterans and Coleopterans. The major damage was seen from order Hemipterans, sucking pests mainly Aphids. There are around 6 species of aphids are prevalent; damaging approx. 30 host plants species from 16 different families were recorded. Host plant species belonging to family Malvaceae (16%), Fabaceae (15%), Solanaceae (12%) and Asclepiadaceae (10%) were found as preferred hosts of aphids in agro- ecosystem of Vadodara. Hence the present study provides the good information about the assessment of incidence and infestation rate of sucking pest, Aphids in the agro- ecosystem of Vadodara

Index Terms- Aphids, Sucking pests, Host plants, Hemipterans.

I. INTRODUCTION

Agriculture is the backbone of the Indian economy because 75% of India's population depends on agriculture or agro-industries for livelihood. However, it is disheartening to know that India's economic growth is not keeping up with the expectations because its agricultural growth is lagging behind (Bedi, 2008). The major crops of India are categorized into Cereals, Oilseeds, Pulses, Vegetables and Fruits. These crops are damaged by the insect pest's. Today the health of the crops is one of the major issues which farmers have to take into consideration and protecting these crops from insect pests is one of the most important subjects of present times. Dhaliwal *et al.* (2010) reported that the Indian agriculture is currently suffering an annual loss of about Rs. 8, 63, 884 million due to insect pests. The aphid infested 70.3% of US cotton, causing a 0.119% reduction in yield in 9,307,757 infested acres, resulting in a loss of 31,450 bales (Anwar *et al.*, 2007). In spite of various control measures against pests farmers are mainly depend on chemical control. The un-realistic and injudicious use of synthetic pesticides for the past several years led to outbreaks of many insect and non-insect pests. Overwhelmingly farmers in both developed and underdeveloped countries depend on synthetic insecticides, to control insect pest problems spending an enormous sum in the order of US \$ 9,000,000,000 per annum (Cork *et al.*, 2003). The rampant use of these chemicals, under the adage, "if little is good, a lot more will be better" has played havoc with human and other life forms. The extensive field

survey was done during 2008-2011 to record the insect pests mainly sucking pests, Aphids and their various host plant in agricultural fields of Vadodara. This study will be helpful in knowing the assessment of incidence and severity of damage caused by the Aphids so that proper control measures can be used in future to minimize the load of insecticides.

II. MATERIALS AND METHODS

Vadodara is in the eastern part of the state of Gujarat in western India. It is located at 22°11' N latitude and 73°07' E longitude. Vadodara District covers an area of 7,794 sq km. Agriculture fields were selected in all the four directions on the basis of accessibility and location of ecoregion. Economically important crops severely damaged by sucking pests (Aphids) were examined; to know about the assessment of incidence and extent of damage to the crop, as well as to collect insect stages from the crop. Insect's pests were then identified in the laboratory.

A. Study Sites

Agricultural fields Located within 80 kms from the city centre, all fields sampled were 5 ha or more in size. Soil type was sandy loam. The annual average day time soil temperature ranged from 28° C to 32°C, slightly lower than the air temperature.

Areas included were:

1. **A Site 1 – Channi** (15 Kms , North of the Vadodara): The field surveyed dominant crops and flora of Cotton , Castor , Pigeon pea, Sorghum , Bajra , Brinjal , Spinach , Cabbage Cauliflours , Beans , Mango , Banana, Hibiscus , Nerium, Marigold , Calotropis .
2. **A Site 2 - Ankleshwar** (80 Kms , South of the Vadodara) :- The field surveyed dominant crops and flora are Cotton , Chick pea , Pigeon pea , Maize , Ladies finger , Beans , Cabbage , Banana , Gauva , Nerium , Hibiscus , Marigold , Canna , Calotropis , Datura , Spiny amaranthus .
3. **A Site 3 - Dabhoi** (30 Kms , Southeast of the Vadodara):- The field surveyed dominant crops and flora are Wheat , Pigeon pea , Castor , Sorghum , Cabbage , Spinach , Nerium , Hibiscus , Marigold , Calotropis .

4. **A Site 4 – Wagodia** (25 Kms , East of Vadodara) :
- The field surveyed dominant crops and flora are Cotton , Castor , Sugarcane , Brinjal , Radish, Banana , Gauva , Nerium , Hibiscus , Vinca , Calotropis , Spiny amaranth .
5. **A Site 5 – Timbi** (15 Kms , West of Vadodara):
The field surveyed dominant crops and flora are Wheat , Castor , Pearly millet, Paddy , Jowar , Spinach , Mango , Gauva , Nerium .

B. Sampling techniques

Collection of insects was carried out depending upon the season in which crop was grown. During the sampling period of three years (2008-2011), each year was divided into two phases of four months: Phase 1 (January - April) and Phase 2 (September - December). Each phase had four sampling periods as field visits were conducted four times in every month. Each study site was visited twice a month. On each day the sampling was done twice once in morning hrs (7 am to 9 am) and second time in evening hrs(5pm to 7pm).

C. Collection Method

Collection was done by sweeping and hand picking method. In sweep net method each quadrat was swept several times. Every sweep was repeated after a gap of 10 minutes and 10 sweeps were performed each time. Large sized caterpillars, Adult females of Aphids and bugs were handpicked. Large insects were killed using killing jars with potassium cyanide powder. The tiny ones like Aphids were transferred in the vials having 70-90% ethyl alcohol, brought to the laboratory, mounted on slides and then observed and identified.

D. Identification

Identification and labeling was done using standard taxonomic literature. Collected insects were identified with the help of keys available in (Richards & Davies, 1997), (Borror et al., 1992), (Leffroy, 1909), (Ananthkrishnan & David, 2004) and standard manuals. Aphids were identified by using taxonomic key provided by (Blackman & Eastop, 2000) .A stereomicroscope; Leica MPS 60 Ø28/8x/MPS was used for identification and photographic record. The identified species were confirmed from Entomology Division, Anand Agricultural University, Anand, Gujarat. The identification of host plant species were done by Department of Botany of The Maharaja Sayajirao University of Baroda.

E. Host Plants and Assessment of Incidence and Infestation Rate of Sucking pests (Aphids)

The assessment of infestation by insect pests on various crops was done as per the scale given by Nagrare and his co-workers in the year 2011. (Central institute for Cotton research, Nagpur).

1-4 Scale infestation

I Grade: Scattered appearance of few aphids on the plant.

2 Grade: Severe infestation of aphids on any one branch of the plant.

3 Grade: Severe infestation of aphids on more than one branch or half portion of the plant.

4 Grade: Severe infestation of aphids on the whole plant.

The percentage of incidence was calculated by suitable formulae:

Percentage incidence (PI) = Number of infested plants / Total plant observed X 100.

Severity index (SI) = Sum of total grade points (1-4 infestation grade I to IV, respectively) of the infested plants / Total number of infested plants observed.

III. RESULTS AND DISCUSSION

Vadodara has a rich bio-diversity of insects. There are large numbers of agricultural fields of 2-5 hectares surrounding the city. An extensive survey of the agricultural fields in and around Vadodara was done for a period of three years from September 2008 to September 2011.

In the fields, Insect pests were identified for the purpose of **assessing the incidence and severity** of the insect pests. The infestation based on presence or absence of insect pests and the severity using one to four scale of infestation. Assessment showed that agricultural fields having economically important crops like Cotton, Maize, Castor, Wheat, Sorghum, Pigeon pea, Chick pea, Brinjal, Ladies Finger, Beans, Cauliflower, Cabbage etc., were being damaged by a wide range of insect pests. The present study identified 49 species of insects as pests. The number was reported from the collection and identification of insects from the severely damaged crops.

The result of insect pest percentage within the agro ecosystem of Vadodara reported the maximum insect pests, 33% from order hemiptera. Order lepidoptera was showing 27% of pest percentage followed by coleopteran i.e. 18%. However, the minimum pest percentage was recorded from order diptera (2%) in Vadodara agricultural fields (Fig. 1).The maximum severity of insect pests was observed in the order Hemiptera , Lepidoptera and Coleoptera. The occurrence of insect pests was observed in the month of September till April in all the three consecutive years in the agroecosystem of Vadodara.

In order hemiptera *Aphis gossypii*, *Aphis crassivora*, *A.nerii*, *A.fabae*, *A.brassicae* and *Myzus persicae* (Family: Aphididae) are considered as serious threat to the economically important crops of the agro ecosystem of the Vadodara. The species of Aphididae families attack various plants, infesting leaves, stems, fruits and roots (Blackman and Eastop, 2000). Aphids are considered to be a serious pest to almost all agricultural crops and alternative host plants because of their polyphagous feeding habits (Minks and Harrewijn, 1987).

They cause severe damage to many host plants. In Vadodara agro ecosystem, approx. 30 host plant species from 16 different families were recorded (Table 1). Similarly, Takaloozadeh in 2010 reported *Aphis gossypii* attacking more than 70 various host plants in Iran. Host plant species belonging to family Malvaceae (16%), Fabaceae (15%), Solanaceae (12%) and Asclepiadaceae (10%) were found as preferred hosts of aphids in Vadodara (**Error! Reference source not found.**). Vennila (2008) reported that the sap sucking pest like aphids, white flies and mealybug as emerging serious pest in India.

The peak population of aphids was observed from the month of December – February. The assessment of incidence and infestation rate was observed by 1-4 Scale of infestation . The maximum percentage of incidence and severity of damage caused by the *A.gossypii* on cotton crops, *A.crassivora* on Pigeon pea and Cow pea and *A.nerii* on Nerium plant. (Table 1).

Gujarat is in 5th Position in cotton production (Venilla *et al*, 2010).*A.gossypii* is major threat for cotton crop.Malik and Riazuddin (2006) reported the cotton aphids, *Aphis gossypii* Glov. (Homoptera: Aphididae) are significantly devastating pests of cotton in Pakistan. Gujarat is famous for the staple food. *A.crassivora* damaged the leguminous crops. Attle *et al*. (1987) reported as high as 100% yield reduction of different bean crops due to aphid infestation and during 2006. *A. nerii* and *A. fabae* damaged the beautiful ornamental plants whereas *A. brassicae* and *M.persicae* damaged the vegetables mainly cabbage (Francis *et al*, 2001)

To prevent yield loss farmers are mainly depend on chemical control method. Due to indiscriminate use of chemical caused pest resistance, resurgence of pests, residues in food, water, air and soil, elimination of natural enemies and disruption of ecosystem (Palikhe, 2002). Therefore the proper management of insect pests are needed as suggested by Gupta *et al*. (2004) integrating them with other proven methods of pest control against the target pests which replace insecticides to which the pest had developed resistance by reducing the number of spray and increases the yield (Ahuja, *et al.*, 2012).

Hence, the information provided by present study gives the important understanding of vast range of host plant which is helpful in survival of sucking pests throughout the year. To focus on the assessment of incidence and infestation rate .Therefore, in future the proper effective and significant eco friendly method were use for management of these polyphagous insect pests.

Table 1: Host plants of Aphids with its infestation level in agro systems of Vadodara

Host category	Aphids Species	Botanical Name	Common Name	Family	Infestation Scale
Field crops	<i>A.gossypii</i> , <i>M.persicae</i>	<i>Gossypiumhirsutum</i> (L.)	Cotton	Malvaceae	4 Grade
	<i>A.crassivora</i>	<i>Cajanuscajan</i> (L.Millsp.)	Pigeon pea	Fabaceae	4 Grade
	<i>A.crassivora</i>	<i>Vignaunguiculata</i> (L.)	Cow pea	Fabaceae	4 Grade
	<i>A.nerii</i>	<i>Zea mays</i> (L.)	Maize	Poaceae	2 Grade
	<i>A.nerii</i>	<i>Triticumaestivum</i> (L.)	Wheat	Gramineae	2 Grade
	<i>A.gossypii</i>	<i>Ricinuscommunis</i> (L.)	Castor	Euphorbiaceae	1 Grade
Vegetables	<i>A.gossypii</i>	<i>Abelmaschus esculentus</i> (L.)	Lady's finger	Malvaceae	4 Grade
	<i>A.gossypii</i> , <i>M.persicae</i>	<i>Solanummelongea</i> (L.)	Brinjal	Solanaceae	3 Grade
	<i>A.fabae</i>	<i>Solanumtuberosum</i> (L.)	Potato	Solanaceae	3 Grade
	<i>A.fabae</i>	<i>Lycopersiconesculentum</i> (L.)	Tomato	Solanaceae	4 Grade
	<i>A.gossypii</i>	<i>Cucumissativus</i> (L.)	Cucumber	Cucurbitaceae	2 Grade
	<i>M.persicae</i>	<i>Spinaciaoleracea</i> (L.)	Spinach	Amarathaceae	2 Grade
	<i>A.brassicae</i> , <i>M.persicae</i>	<i>Brassica oleracea</i> (Linn)	Cabbage	Brassicaceae	2 Grade
	<i>M.persicae</i>	<i>Raphanussativus</i> (L.)	Radish	Brassicaceae	2 Grade
	<i>A.fabae</i>	<i>Beta vulgaris</i> (L.)	Beet	Papaveraceae	0 Grade
Ornamental crops/ Fruit trees /trees and shrubs	<i>A.gossypii</i>	<i>Hibiscus mutubilis</i> (L.)	Cotton rose-mallow	Malvaceae	3 Grade
	<i>A.gossypii</i>	<i>Hibiscus rosa-sinensis</i> (L.)	China rose	Malvaceae	4 Grade
	<i>A.nerii</i>	<i>Neriumindicum</i> (Mill.)	Oleander	Apocynaceae	2 Grade

Host category	Aphids Species	Botanical Name	Common Name	Family	Infestation Scale
	<i>A.nerii</i>	<i>Nerium oleander</i> (L.)	Oleander	Apocynaceae	4 Grade
	<i>A.nerii</i>	<i>Vincarosea</i> (L.)	Periwinkle	Apocynaceae	1 Grade
	<i>A.fabae</i>	<i>Tagetes erecta</i> (L.)	Marigold	Asteraceae	1 Grade
	<i>A.fabae</i>	<i>Helianthus annuus</i> (L.)	Sunflower	Asteraceae	1 Grade
	<i>A.fabae</i>	<i>Atriplex rosea</i> (L.)	Red orach	Asteraceae	0 Grade
	<i>A.fabae</i>	<i>Matricaria recutita</i> (L.)	Chamomile	Asteraceae	0 Grade
	<i>A.fabae</i> , <i>A.gossypii</i>	<i>Chrysanthemum</i> sp. (L.)	Chrysanthus	Asteraceae	3 Grade
	<i>A.fabae</i>	<i>Papaver somniferum</i> (L.)	Opium poppy	Amaranthaceae	0 Grade
	<i>A.gossypii</i>	<i>Urtica dioica</i> (L.)	Stinging nettle	Urticaceae	0 Grade
	<i>A.crassivora</i>	<i>Ocimum sanctum</i> (L.)	Tulsi	Lamiaceae	1 Grade
	<i>A.nerii</i>	<i>Citrus limonium</i> (L.)	Lemon	Rutaceae	2 Grade
Weeds	<i>A.gossypii</i>	<i>Datura metel</i> (L.)	Angel's trumpet	Solanaceae	0 Grade
	<i>A.fabae</i>	<i>Chenopodium album</i> (L.)	Pigweed	Asteraceae	1 Grade
	<i>A.fabae</i>	<i>Cirsium arvense</i> (L.Scop)	Canada thistle	Asteraceae	1 Grade
	<i>A.nerii</i>	<i>Calotropis procera</i> (W.T.Aiton)	Apple of sodom	Asclepiadaceae	4 Grade
	<i>A.nerii</i>	<i>Gomphocarpus</i> sp. (E.mey.)	Cotton bushes, Balloon bushes	Asclepiadaceae	2 Grade
	<i>A.nerii</i>	<i>Asclepias</i> (E.mey.)	Butterfly weed	Asclepiadaceae	2 Grade

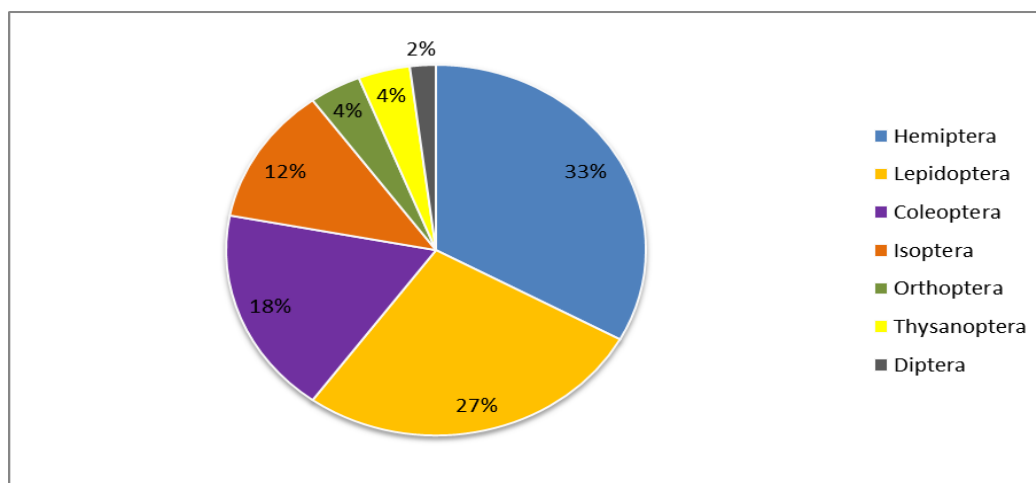


Fig.1: Insect Pest Percentage within the Agro ecosystem of Vadodara

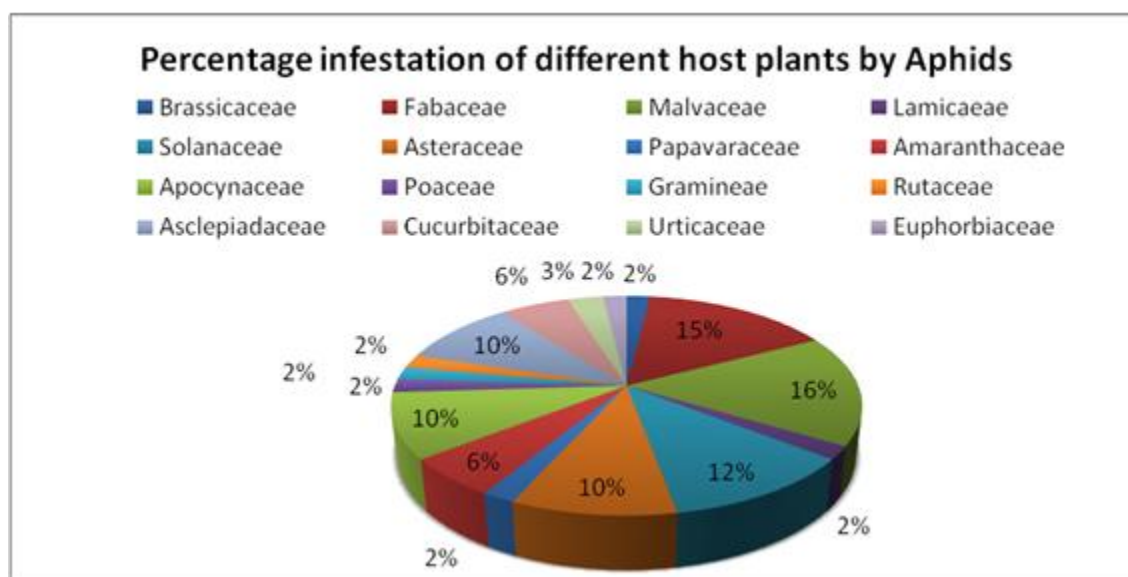


Fig.2: Percentage infestation of different host plants by aphids

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Various Slotted UWB Antenna for IEEE 802.15.3a Application

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Abstract- The basic circular monopole antenna exhibits a 10 dB return loss bandwidth over the entire frequency band, the paper proposed a modified version of simple circular monopole antenna for WPAN application. The antenna offers excellent performance in the range of 2-12 GHz. The antenna is designed on FR4 substrate and fed with 50 ohms micro strip feed line. The antenna is suitable for operating frequency of 7 GHz. It is shown that return loss of the antennas at 7 GHz is better than -10 dB and VSWR obtained is less than 2. Proposed geometry is design and simulated using HFSS11 Details of the proposed antenna design and measured results are presented.

Index Terms- Wireless communication, UWB, circular monopole, WPAN

I. INTRODUCTION

Ultra-Wideband (UWB) was approved by the Federal Communications Commission (FCC) in Mar. 2002 for unlicensed operation in the 3.1-10.6 GHz band subject to modified Part 15 rules. The rule limits the emitted *power spectral density* (*p.s.d*) from a UWB source measured in a 1 MHz bandwidth at the output of an isotropic transmit antenna at a reference distance to that shown in Figure1. Further, the transmitted signal must instantaneously occupy either i) a fractional bandwidth in excess of 20% of the center frequency or ii) in excess of 500 MHz of absolute bandwidth to be classified as a UWB signal. The maximum allowable *p.s.d* for UWB transmission of -41.3 dBm/MHz corresponds to approximately 0.5 mW of average transmit power when the entire 3.1-10.6 GHz band is used, effectively limiting UWB links to short ranges. Nevertheless, the potential for exploiting such low power UWB links for *high data rate* wireless PAN connectivity (in excess of 100 Mbps) at ranges up to 10 m particularly for in-home networking applications has led to considerable recent interest in this technology. Ultra-wideband (UWB) radio technologies draw big attentions considering the applications to the short range wireless communication, ultra-low power communication, ultra-high resolution radar etc., among them, the standardization of the UWB radio is ongoing under IEEE 802.15 WPAN

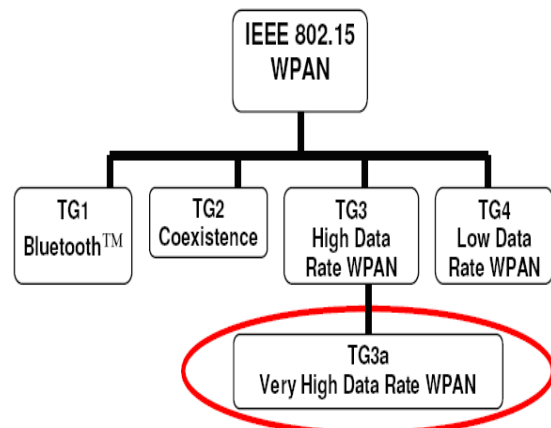


Figure 1: IEEE 802.15, standard group is responsible for WPAN Standard [4]

High Rate Alternative PHY Task Group 3a (IEEE802.15.3a) [1, 2] and wireless personal area network (WPAN) is originated by the Bluetooth (IEEE802.15.1). IEEE802.15.3a is trying to establish the new standard of WPAN to drastically increase the data rate, which is a weak point of Bluetooth. Now IEEE802.15.3a considers the use of UWB, following the tentative regulation of FCC (Federal Communications Commission, USA), to achieve the bit rate of 110 Mb/s at 10 m and 200 Mb/s at 4 m [3] Although the standardization has been at the final voting stage for more than half a year, the first candidate Multi-Band OFDM [4] has not been able to gain the required 75 % approval, and has been in competition with the second candidate DS-UWB [5].

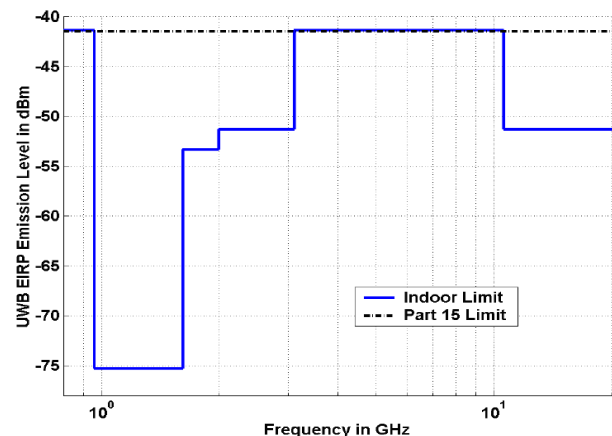


Figure2: UWB Spectral Mask Per FCC (Modified) Part 15 Rules [1]

Ultra wideband (UWB) is a leading candidate for short-range, wireless personal area networks, or WPANs. With this technology, people will be sharing photos, music, video, data and voice among networked consumer electronics, PCs and mobile devices throughout the home and even remotely. For example, users will be able to stream video content from a PC or consumer electronics (CE) device, such as a camcorder, DVD player or personal video recorder, to a flat screen HDTV (high-definition television) display without the use of any wires. In this application, a wireless universal series bus (W-USB) is required to replace cables and build up high speed wireless link between personal computers and other devices. The W-USB has strong demands for high performance UWB antennas which will be facing three most hallenging issues namely miniaturized size, reduced ground plane reliance, and enhanced diversity performance [1]. This paper proposes a miniaturized size of UWB antenna design to fit the existing USB dongles with a typical width of 18-22 mm. The design is based on a small printed UWB antenna [2] with dimension of 25 mm × 25 mm × 1.5 mm. A narrow strip is asymmetrically attached to the top side of the radiator to reduce the length of the radiator.

A rectangular notch is asymmetrically cut from the radiator. The ground-plane effect on impedance performance of the antenna has been significantly reduced due to the notch cut from the radiator. The notch extends the effective current path and concentrates majority of the current on the radiator instead of the system ground plane. This idea is an effective method to alleviate the problem of the ground plane reliance. This small printed antenna should be reduced further in order to fit within the W-USB dongle. The study of the UWB radio had started from the impulse radio which is advantageous in the hardware simplicity [1,20,21] but more complicated systems such as MB-OFDM and DS-UWB are considered now. In MB-OFDM system, a sub-band with 128 OFDM carriers occupies 528 MHz band, and different sub-bands are selected from time to time to achieve the frequency hopping (FH). Contrary, DS-UWB uses only two sub-bands to avoid IEEE802.11a band, i.e. the mandatory low band with 2.05 GHz bandwidth and the optional high band with 4.775 GHz bandwidth, which is more like the impulse radio. Recently, another task group IEEE802.15.4a has formed to standardize the low rate PHY using UWB [1,20,21]. It focuses on the high precision ranging, as well as the communications, with ultra low power, longer range, and lower cost. Properties and the antenna related issues.

A. IEEE 802.15 WPAN STANDARDS:

Originally, the IEEE 802.15 group was the Bluetooth™ group, but it has evolved to include other short-range Wireless Personal Area Network (WPAN) systems. The initial version, 802.15.1, was adapted from the Bluetooth specification and is fully compatible with Bluetooth 1.1. As it is now described by the IEEE, “The IEEE 802.15 Working Group proposes two general categories of 802.15, called TG4 (low rate) and TG3 (high rate). The TG4 version provides data speeds of 20 Kbps or 250 Kbps. The TG3 version supports data speeds ranging from 11 Mbps to 55 Mbps. Additional features include the use of up to 254 network devices, dynamic device addressing, support for devices in which latency is critical, full handshaking, security provisions, and power management. There will be 16 channels in

the 2.4-GHz band, 10 channels in the 915-MHz band, and one channel in the 868-MHz band.” The 802.15.3 Standard for high data rate services, which continues to be reviewed and enhanced, includes the following features and goals: • Data rates of 11, 22, 33, 44 and 55 Mbps.

- Quality of Service (QoS) isochronous protocol
- Ad hoc peer-to-peer networking
- Security
- Low power consumption
- Low cost

The higher data rate of this standard is designed to meet the requirements of portable consumer imaging and multimedia applications. The IEEE 802.15 Task Group 5 is studying mesh networking, determining the necessary mechanisms that must be present in the PHY and MAC layers of WPANs to enable mesh networking, in both full mesh and partial mesh topologies. Mesh networks are useful for intending network coverage without increasing transmit power or receive sensitivity, enhancing reliability with redundant routing, easy network configuration and, ultimately, longer device battery life due to fewer retransmissions. The IEEE 802.15.3 Study Group 3c, formed in March 2004, is developing a millimeter-wave-based alternative physical layer (PHY) for the existing 802.15.3 WPAN Standard 802.15.3-2003. This mm- Wave WPAN will operate in a band that includes the 57-64 GHz unlicensed band. The millimeter-wave WPAN will allow very high data rate applications such as high-speed internet access, streaming content download (video on demand, HDTV, home theater, etc.), real time streaming and wireless data bus for cable replacement. Optional data rates in excess of 2 Gbps are to be provided.

Table 1: lists a variety of wireless applications in the WPAN space and their estimated requirements for data rates.

Application	Min Data Rate	Max Data Rate
H.323 / T.120 Video Conferencing	188+ Mbps	1.4+ Gbps
Home Theater	43 Mbps	56.8 Mbps
Interactive Application (e.g. gaming)	76.8+ Mbps	unknown
Content Downloading (e.g. photos, MP3, CD, movies)	90+ Mbps	unknown

Table1: Estimated Data rates for various WPAN applications [21, 22, 23]

II. REVIEW OF THE STATE-OF-ART

The concept of ultra wideband communication originated in the early days of radio. In the 1900s, the Marconi spark gap transmitter (the beginning of radio) communicated by spreading a signal over a very wide bandwidth. This use of spectrum did not allow for sharing, so the communications world abandoned wideband communication in favor of narrowband or tuned communication in which the FCC governed spectrum allocation. The FCC provides guidelines for radiated power in the

bandwidths of these communications systems and for incidental out of band radiated power. This incidental radiated power limits were the motivation for various organizations to challenge the paradigm of narrowband communications, in an ongoing effort to squeeze capacity out of a highly regulated spectrum. The Shannon-Hartley theorem states that channel capacity grows linearly with increases in bandwidth and decreases logarithmically with decreases in the signal to noise ratio (SNR). Although this relation is only exact under a considerable caveat, it does suggest how capacity is an impetus for UWB communication. Many companies argued that they should be allowed to intentionally transmit at the incidental radiated power limits (where they could already transmit accidentally) over an ultra-wide bandwidth to take advantage of this capacity potential. This argument was the motivation for the FCC approval of UWB devices. In February of 2002, the FCC amended their Part 15 rules (concerning unlicensed radio devices) to include the operation of UWB devices without a license. The FCC defines UWB signals as having a fractional bandwidth of greater than 0.20 or a UWB bandwidth greater than 500 MHz. UWB bandwidth is defined as “the frequency band bounded by the points that are 10 dB below the highest radiated emission” [1,3,4,24]

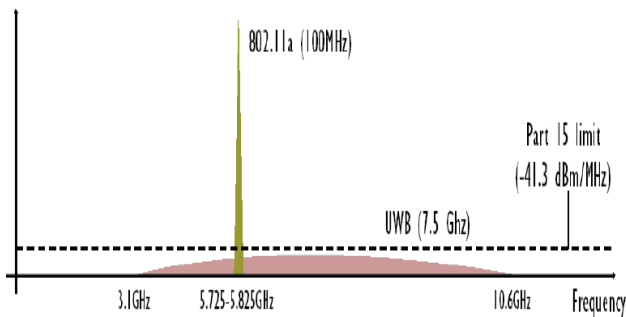


Figure3: Spectrum of UWB Signal Compared with Wi-Fi (802.11a) Signal [21, 22].

The FCC ruling allows UWB communication devices to operate at low power (an EIRP of -41.3 dBm/MHz) in an unlicensed spectrum from 3.1 to 10.6 GHz (see Figure 1). The low emission limits for UWB are to ensure that UWB devices do not cause harmful interference to (i.e. coexist with) “licensed services and other important radio operations” [1,20,21] (e.g. 802.11a devices).

A. IMPORTANT PARAMETERS IN THE DESIGN OF UWB ANTENNA FOR WPAN APPLICATION:

The following properties are required for the UWB antennas: *Linear phase and constant group delay in directivity*: If the group delay is not constant, the pulse waveform is spread out in the time domain. *Low return loss over ultra wide bandwidth*: If there are mismatches both at the antenna end and the circuitry end, the overall dispersion characteristic is much degraded due to the multipath within the feeding cable. *Constant directivity over ultra wide bandwidth*: The variation of the directivity according to the frequency results in the ripples of the frequency transfer function in some citation direction. The dispersion characteristic is then degraded. There are two

fundamental principles to achieve the broadband or UWB property of the antennas [9]:

1.1 SELF SIMILARITY ANTENNA: A self similarity antenna is with the constant electric shape over the wide frequency bandwidth. Here, the electric shape means the shape described in the dimension of the wavelength. A biconical antenna, a bow-tie antenna, a discone antenna, an equiangular spiral antenna are the examples of this class.

1.2 SELF COMPLEMENTARY ANTENNA: A self complementary antenna is usually composed of planar conductor(s), and its complementary structure is identical to the original structure. Here, complementary structure is obtained by replacing the conductor and the non-conductor parts in the plane. Among the self complementary antennas, the log-periodic antenna is well known. Note that both structures require the infinite size of the conductor. The shape is therefore truncated in reality, and it limits the lower bound of the bandwidth.

III. ANTENNA DESIGN AND CONFIGURATION

Figure 4 shows the evolution of the proposed printed monopole antenna. The structure is evolved from the circular monopole radiator to annular ring shaped radiator.

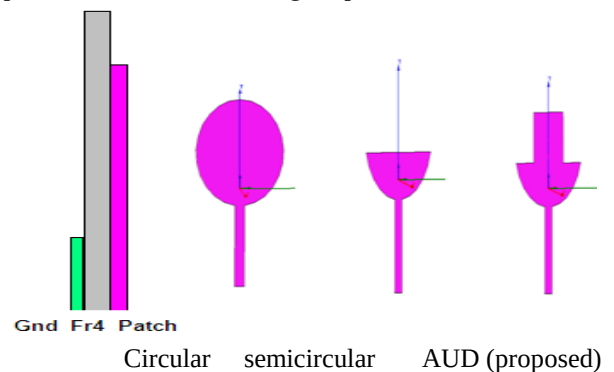


Figure 4: Evolution of the proposed dual band antenna.

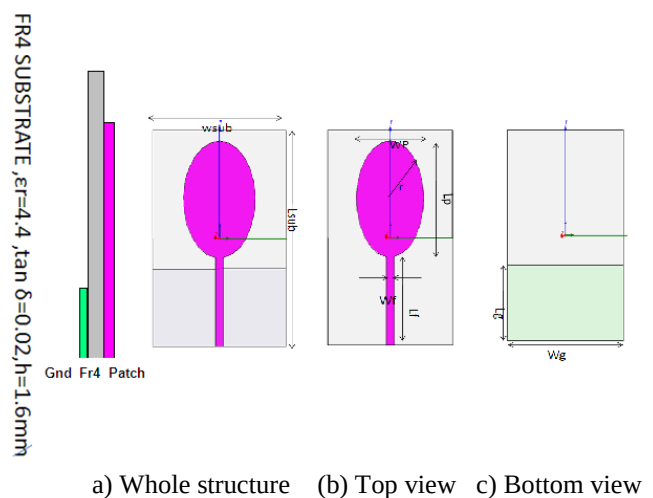


Figure5: Geometry of circular monopole antenna

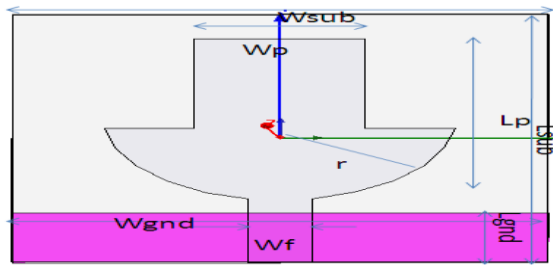


Figure 6: Geometry of Basic antenna

The geometry of the proposed antenna is shown in Fig. 4 is fed by a 50- microstrip line and fabricated on a 1.6-mm-thick FR4 substrate with 25× 25 mm surface area. The relative permittivity and loss tangent of the substrate is 4.4 and 0.02, respectively. The antenna structure is a variation of a circular monopole antenna. The radius (r) of the circular monopole [10] is obtained by using the equation no 1.

$$f_L = \frac{7.2}{2.25 \cdot r + g} \text{ GHz} \quad (1)$$

Where g is the gap between the radiating patch and ground plane, and fL is the lowest resonant frequency corresponding to VSWR=2 .

The resonant frequency of a TMnm mode is

$$f_{nm} = \frac{X_{nm}}{2\pi a \sqrt{\mu_0 \epsilon}} = \frac{X_{nm} c}{2\pi a \sqrt{\epsilon_r}} \quad (2)$$

The first five values of Xnm are:

(n, m)	(1,1)	(2,1)	(0,2)	(3,1)	(1,2)
X_{nm}	1.841	3.054	3.832	4.201	5.331

Equation 2, which is based on the perfect magnetic wall assumption, yields resonant frequencies which differ from measurements by about 20%. To take into account the effect of fringing field, an effective radius was introduced. This was obtained by considering the radius of an ideal circular parallel plate capacitor which would yield the same static capacitance after fringing is taken into account. A detailed calculation yields the formula.

$$a_e = a \left[1 + \frac{2t}{\pi a \epsilon_r} \ln \left(\frac{\pi a}{2t} + 1.7726 \right) \right]^{1/2} \quad (3)$$

Using ae , the resonant frequency formula becomes

$$f_{nm} = \frac{X_{nm} c}{2\pi a_e \sqrt{\epsilon_r}} \quad (4)$$

Equation 4 yields theoretical resonant frequencies which are within 2.5% of measured values.

Table 2. Optimum dimensions of the Basic design antenna (all dimensions are in mm).

SLOTS	Wr1	Lr1	Wr2	Lr2	Wr3	Lr3
L-slot	2.5	7	6.5	1.8	---	---
T-slot	4	2	1.5	6	---	---
U-slot	1.5	3	7	1.5	1.5	3

IV. PARAMETRIC STUDY

Parametric study has been conducted to optimize the design of the antenna. This study is crucial as it gives approximation measure before antenna fabrication can be done. The performance of annular shaped dual band antenna with WLAN band notched characteristic depends on number of parameters, such as gap (g) between radiating patch and ground plane, width (ws) and length (ls) of the substrate, length and width of the ground plane, width (w) and length (l) of the symmetrical step slot in radiating patch (rectangular strip inside circular annular ring and inner (r) and outer radius (R) annular ring. Beside these, antenna performance also depends on ground plane size and shape. The parameters which have significant effects on dual band with WLAN band notched characteristic are discussed and their parametric studies are reported in this section. The gap 'g' between the radiating patch and the ground plane affects the impedance bandwidth as it acts as a matching network. The impedance bandwidth of the proposed antenna at different Lg is shown in Figure7. The optimum impedance bandwidth is obtained at Lg=6mm, the capacitance that results from the spacing between edge of ground plane and radiating patch reasonably balances the inductance of the antenna. Figure 8 shows return loss S11 (dB)

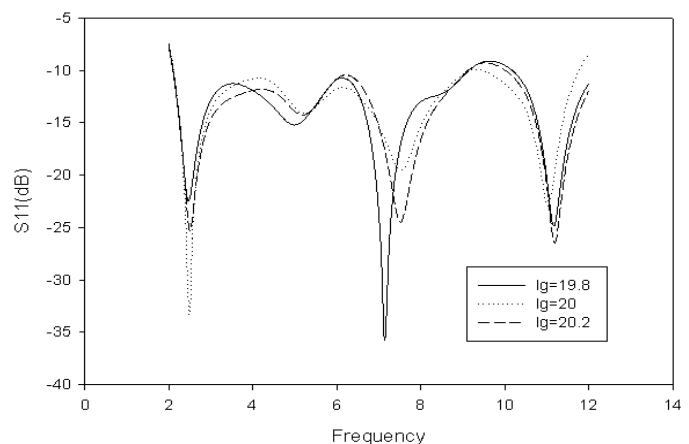


Figure7: Simulated return loss (S11) curves of Circular monopole antenna for different ground length

BAND NOTCH CHARACTERISTICS USING DIFFERENT SHAPE SLOTS:

To achieve the desired WLAN band notched characteristics, a T, U, L-shaped slots on the radiating patch is etched. The dimensions of quarter-wave resonating (mention-shaped) slot at central band-notched frequency can be postulated as

$$f_{notch} = \frac{c}{4(L + 2\Delta l)\sqrt{\epsilon_{eff}}} \text{ GHz} \quad (5)$$

$$\epsilon_{eff} = \frac{(\epsilon_r + 1)}{2} + \frac{(\epsilon_r - 1)}{2} \left(\sqrt{1 + \frac{12H}{w_g}} \right)^{-1} \quad (6)$$

$$\Delta l = \frac{0.412H(\epsilon_{eff} + 0.3) \left(\frac{w_g}{H} + 0.262 \right)}{(\epsilon_{eff} - 0.258) \left(\frac{w_g}{H} + 0.813 \right)} \text{ cm} \quad (7)$$

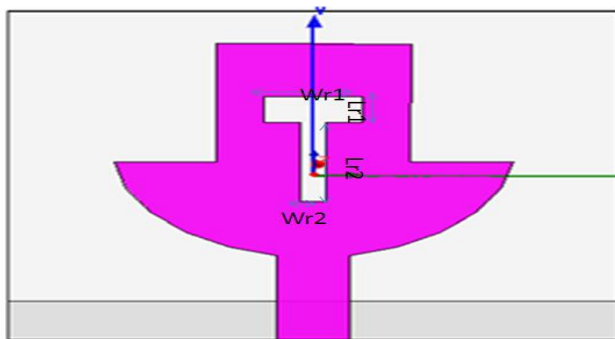


Figure8: Basic design with T slot

It is observed that for Lgnd of 6 mm, the antenna is able to operate as a narrowband antenna. However, the return loss of the antenna improves dramatically when the length ground patch reduces gradually and the best result is obtained at the height of ground plane, Lgnd of 5.4 mm.

The partial ground shows better return loss compared to full ground patch on the bottom because the antenna is transformed from patch-type to monopole-type by the partial ground. In order to further improve its overall bandwidth two steps of feed line can be used but that may be used for different application. The feed line is connected to SMA center pin with width of 3 mm

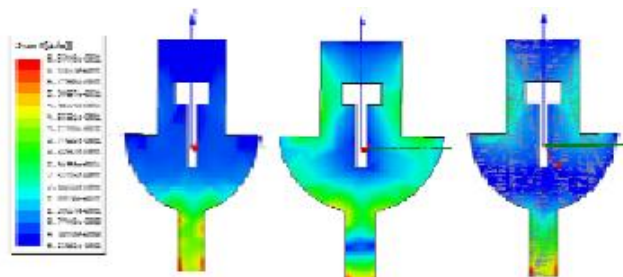


Figure 9: Surface current distributions of basic antenna at 3, 5 and 7 GHz

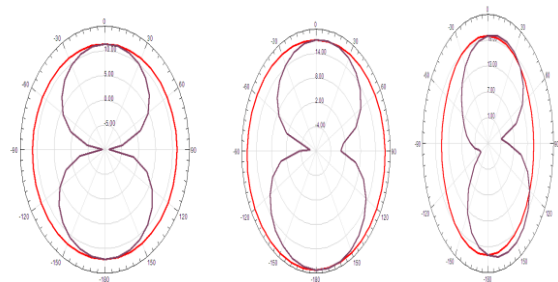


Figure10: radiation patterns in the $\phi = 0^\circ$ and $\phi = 90^\circ$ planes of a proposed patch with $\epsilon_r = 4.4$ at 3, 5, 7 GHz

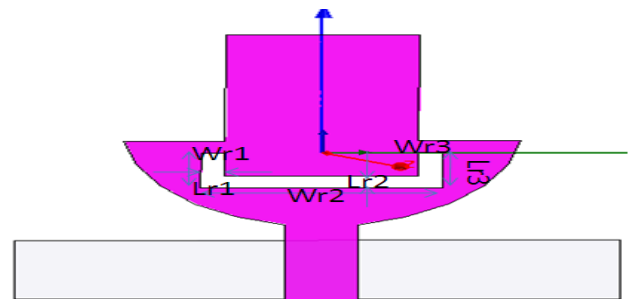


Figure11: Basic design with U slot

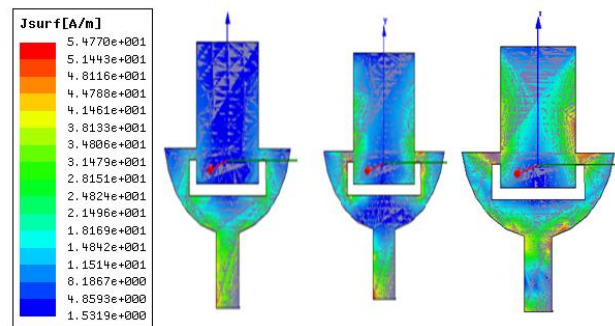


Figure12: Surface current distributions of basic shape antenna at 3, 5 and 7 GHz

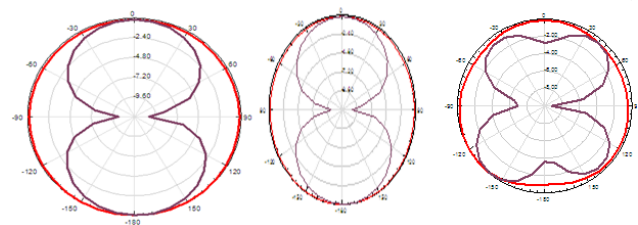


Figure13: radiation patterns in the $\phi = 0^\circ$ and $\phi = 90^\circ$ planes of a proposed patch with $\epsilon_r = 4.4$ at 3, 5, 7 GHz

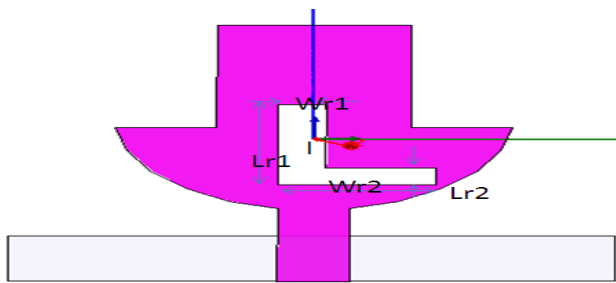


Figure14: Basic design with L slot

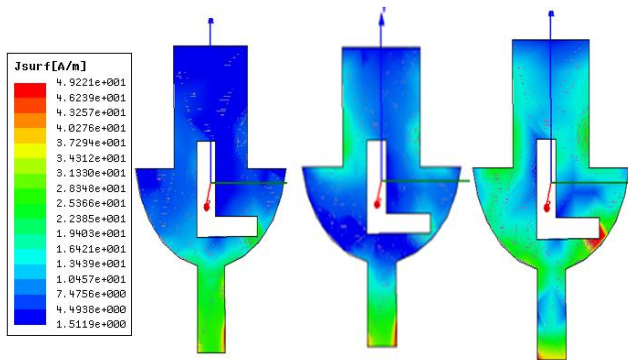


Figure15: Surface current distributions of basic antenna at 3, 5 and 7 GHz

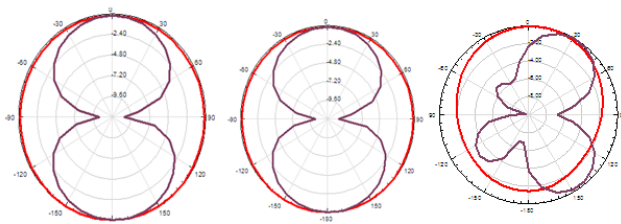


Figure16: radiation patterns in the $\phi = 0^\circ$ and $\phi = 90^\circ$ planes of a proposed patch with $\epsilon_r = 4.4$ at 3, 5, 7 GHz

Varies slotted antenna is reported and studied. The antenna is analyzed from their current distribution and radiation pattern behavior. The required band width which could be used for Bluetooth (2.4-2.484 GHz) and UWB (3.1-10.6 GHz) applications with WLAN (5.15-5.825 GHz) band-notched characteristics could not be achieved with above slots. The modification in the basic design is done to achieve the desired band.

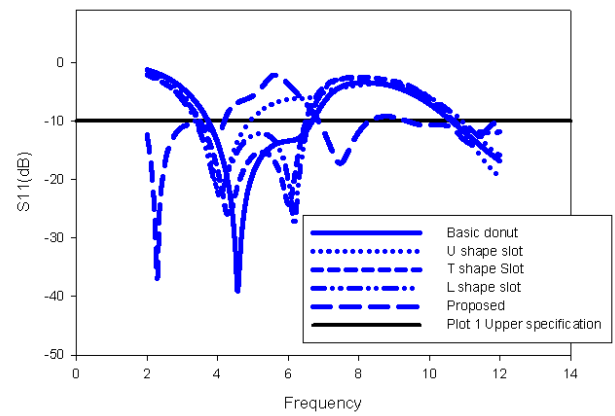


Figure17: Simulated return loss (S11) curves of all four antennas at $L_g = 5\text{mm}$.

V. MODIFICATION IN THE BASIC DESIGN TO ACHIEVE PROPOSED ANTENNA:

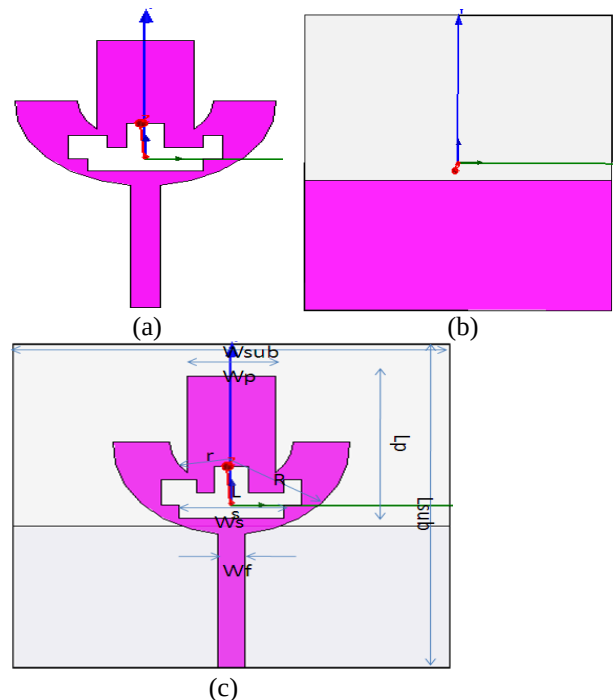


Figure18: Geometry of proposed antenna for UWB communication (a) Top View (b) bottom View (c) Design geometry

The antenna structure is fabricated on a printed circuit board (PCB) using Photolithography technique and tested. The fabricated antenna is shown in Figure 11. Below figure clearly shows the process for S11 (dB) measurement. The measured results reasonably agree with simulated results. The proposed antenna rejects the WLAN band and still performs good impedance matching over the UWB band.

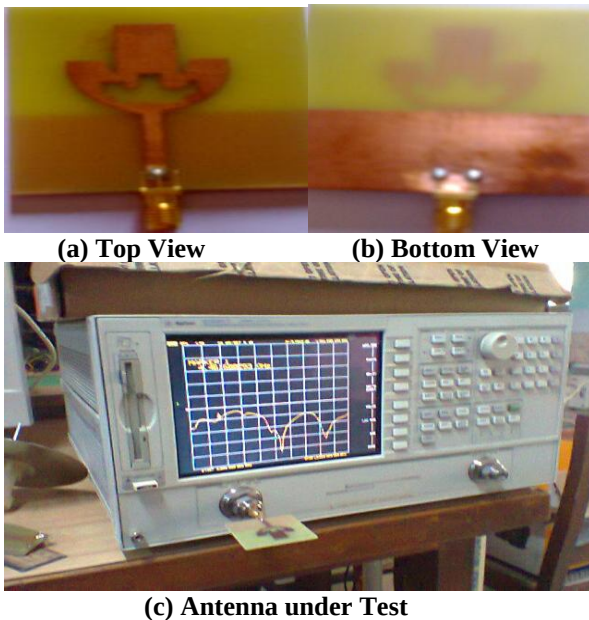


Figure19:..Photograph of the proposed antenna

Table3. Optimum dimensions of the proposed antenna (all dimensions are in mm).

Parameters	W_{sub}	L_{sub}	W_p	L_p	L_f	W_f	L_g	W_g	R	r
Basic ant	25	25	8	16	6.4	3	4.5	25	—	8.25
Proposed Design	50	50	8.5	24	19.5	3	19.5	50	13.5	7.5

V. CONCLUSION

A User centric concept in mobile communication has attracted increasing interest and attention recently. Future communication systems are driven by the concept of being connected anywhere anytime. These systems are powered by the emergence of small and lightweight wireless systems such as Bluetooth and UWB enabled devices. Since power required for small wireless devices is at very low level so the UWB antenna is a good candidature for WPAN applications. In this paper a simple, low-cost, and compact printed Trisul shaped dual-band antenna is proposed. This microstrip line fed antenna can be easily integrated within the printed circuit boards (PCBs) of various systems. Dimensions of the central arm govern the Bluetooth band, while dimensions of ground plane govern the UWB band. Hence, the proposed antenna provides effective control over two operating bands. The antenna provides more than 80% antenna efficiency, and its gain varies from 3–6 dB over two bands. The antenna has nearly omni directional radiation pattern, which indicates that the proposed antenna is suitable and a good candidate for Bluetooth and UWB applications.

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Influence of Drugs on the Formation of Struvite Urinary Calculi

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Abstract- Nephrolithiasis is a global problem affecting mankind for several centuries. Struvite stones may cause 'staghorn calculi' and if untreated could eventually damage kidneys. Recent findings showed that medication has caused an increase in the formation of urinary calculi. In view of this, an attempt is made to grow struvite crystals using gel method and to find the influence of drugs on the formation of urinary calculi. The chemical composition, thermal properties and morphology of the grown crystals with and without the addition of drugs were carried out using FTIR, thermogravimetric analysis and SEM-EDAX.

Index Terms- Gel method, struvite, urinary calculi, urolithiasis

I. INTRODUCTION

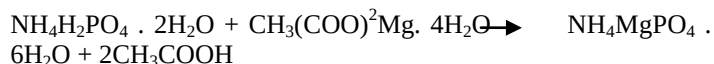
Urolithiasis has been documented since prehistoric period. Urinary calculi is the most painful and prevalent urological disorder affecting mankind for many centuries. Urinary calculi are more prevalent in men than in women (Suma Vupputuri *et al.*, 2003). Struvite stones composed of magnesium ammonium phosphate ($\text{MgNH}_4\text{PO}_4 \cdot 6\text{H}_2\text{O}$) accounts for 10-20% of all renal calculi (Steven J Scheinman 2003). Worldwide they make up to 30 % of all stones (C.K.Chauhan *et al.*, 2009). Struvite form in humans as a result of urinary tract infection. Struvite stones may form staghorn calculi which may damage the entire renal pelvis (Steven J Scheinman *et al.*, 2003). It has been already documented that medical conditions and certain drugs has been considered as one of the pathogenic factors for nephrolithiasis (John A. Sayer *et al.*, 2010). Hence it is essential to study the pathogenesis of struvite stone formation induced by drugs. Among the various drugs that are used for the treatment of stone disease, we have chosen calcyry and zyloric due to their antibiotic property. We have made an attempt to grow struvite crystals invitro and study the influence of drugs on their formation. We have chosen gel method to grow struvite crystals as it a suitable method owing to their viscous nature, which provide simulation of body fluid (T.K. Anee *et al.*, 2003) and also gels have proven to be the best method to mimic the growth of various biominerals in environments similar to natural biomineralization. The grown crystals were characterized using FT-IR, Thermogravimetry analysis and SEM-EDAX study.

II. MATERIALS AND METHODS

The single diffusion gel growth method was employed to study the growth and promoting or inhibiting behavior of struvite

crystals using different drugs. Reports suggest that gel method is the preferred technique to grow struvite crystals as it provides the simplified invitro model of the highly complex invivo growth of urinary calculi (C.K. Chauhan *et al.*, 2009). In this technique of gel growth, the gel acts as a three dimensional crucible which supports the crystals without exerting forces on the crystal, thus leading to high structural perfection in its formation. Sodium metasilicate (SMS) $\{\text{Na}_2\text{SiO}_3 \cdot 9\text{H}_2\text{O}\}$ solution of specific gravity 1.03 was used to prepare the gel. Silica gel has the advantage that it remains stable and does not react with the reacting solutions or with the product crystal formed. In this method one of the reagent is incorporated in the gelling mixture and later allowing another reagent to diffuse into the gel, leading to high supersaturation to initiate nucleation and crystal growth. All the chemicals used for this technique are AR grade.

Glass test tubes of 25 mm diameter and 140 mm length were used as the crystallization apparatus. Aqueous solution of ammonium dihydrogen phosphate (ADP)— $\{\text{NH}_4\text{H}_2\text{PO}_4 \cdot 2\text{H}_2\text{O}\}$ of 1M concentration was mixed with the SMS solution in appropriate amount so that the pH value 7.0 could be set for the mixture. 20 mL of the prepared gel solution was transferred into the test tubes. After gelation, 10 mL supernatant solution of pure 1.0 M magnesium acetate— $\{\text{C}_4\text{H}_6\text{MgO}_4 \cdot 4\text{H}_2\text{O}\}$ (without drug) and 1.0 M magnesium acetate prepared with 0.005g of the drug calcyry and 0.005 g of the drug zyloric were gently poured over the gel medium in test tube without disturbing the latter to study the influence of added drugs on the growth of struvite crystals. After pouring supernatant solution, the test tubes were capped with airtight stopples. Utmost care is taken to avoid microbial contaminations. The experiment was conducted at the room temperature. The following reaction is expected to occur in the gel between the two reactants.



Crystals started growing at the gel- solution interface and also inside the gel medium. The growth of the crystals without drugs and with drugs was monitored throughout the experiment. Struvite crystals of different morphologies such as rectangular platelet and prismatic type were obtained. The grown samples were harvested after 3 weeks by decanting the test tubes and the gel was removed and subsequently washed with distilled water and dried. The FTIR spectrum of the grown samples was recorded. SEM with Energy dispersive X-ray analysis and Thermogravimetric analysis were carried out.

III. RESULTS AND DISCUSSION

It was observed that presence of additives namely calcury and zyloric has caused a decrease in the number of grown struvite crystals and their average size.

FTIR studies: Fig 1 – shows the FTIR spectra of pure struvite and drugs namely calcury and zyloric substituted struvite samples. The FTIR spectra were recorded at room temperature using Perkin-Elmer Spectrophotometer using KBr pellet technique in the wave number range between 400 and 4000 cm^{-1} to analyze the sample qualitatively. The absorption bonds, absorption frequencies were recorded and compared with the reported values. The values are tabulated in Table 1. In pure Struvite the broad envelope occurring at 3270 cm^{-1} corresponds to the O-H and N-H stretching vibrations. The absorption band at 2935 cm^{-1} is due to NH_4^+ ion. The absorption band corresponding to 1666 cm^{-1} is assigned to N-H bending vibrations. The absorption band occurring at 1010 cm^{-1} is assigned to ionic phosphate. Absorption occurring at 564 cm^{-1} is assigned to metal-oxygen bond. The frequency value of functional groups confirms the Struvite crystal constituents. The small shift in the peak values of drug substituted samples is due to the incorporation of drug which has modified the vibrational absorptions.

Table 1: Assignments of functional groups

Functional group Assignments	Reported frequencies wavenumber(cm^{-1}) (Chetan K Chauhan <i>et al.</i> , 2008)	IR Observed frequencies wavenumber(cm^{-1}) for pure struvite
H-O-H and N/-H stretching vibrations	3280-3550	3270
Rocking of N/-H modes of vibration	808	893
N-H symmetric stretching vibrations in NH_4^+ units	2800-3000	2935
N-H asymmetric stretching vibration	3280-3550	3270
N-H symmetric stretching vibration in NH_4^+ units	2800-3000	2935
N-H bending vibration	1630-1750	1666
Ionic phosphate	1390-1640	1010
Metal-Oxygen bond	400-650	564

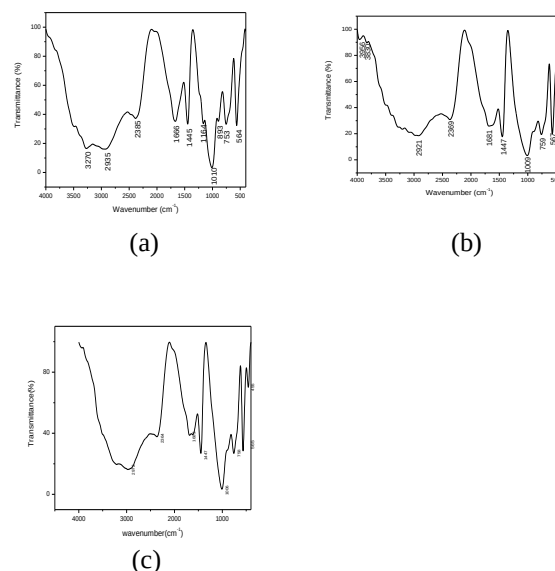


Figure.1: FTIR spectra of (a) pure struvite, (b) 0.005 g drug (calcury) added sample, (c) 0.005 g drug (zyloric) added sample.

SEM and EDS: Fig.2 shows the SEM images of pure struvite and drugs substituted samples. The SEM was taken at magnification values 1500 X, 5000X and 10000X. The micrographs show that the samples have granular structure. The average size of the pure struvite crystallite is 1.4 μm . However drug added struvite size ranges between 0.9 μm to 1.05 μm . The decrease in size is attributed to the substitution of drugs to the struvite sample, altering the growth of struvite crystals.

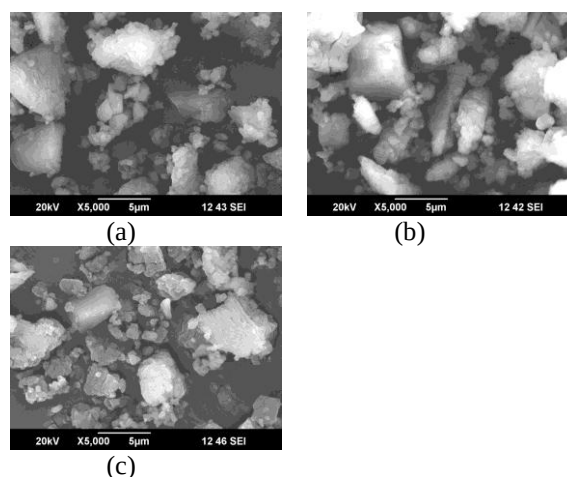


Figure.2. SEM image – magnification 5000X of (a) pure struvite, (b) 0.005 g of drug (calcury) added sample, (c) 0.005g of drug (zyloric) added sample

The elemental composition of the sample is identified using Energy dispersive X-ray analysis. The EDS spectrum of pure struvite and drug added sample is shown in fig.3. The higher peak of Mg, P and O shows that the more concentrated the

element is in the specimen. Table 2 shows the EDAX data of pure and drug added specimens.

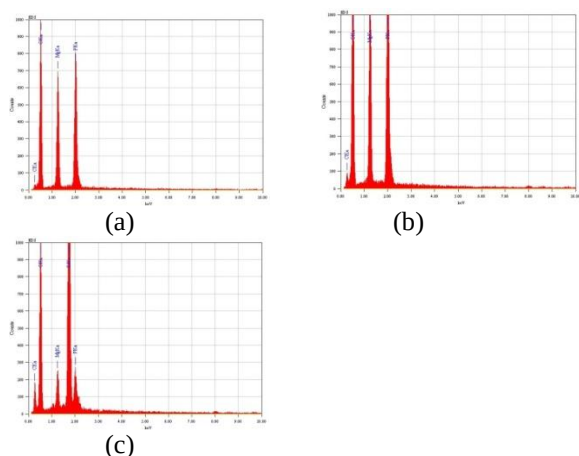


Figure.3: EDS spectrum of (a) pure struvite , (b) 0.005 g drug (calcury) added struvite, (c) 0.005 g drug (zyloric) added struvite

Table 2: EDAX data of pure and drug added struvite samples

Element	Pure Struvite (atm%)	Drug added struvite 0.005g of	
		Calcury	zyloric
C K	1.71	20.22	5.93
O K	53.26	39.22	48.49
Mg K	18.63	3.78	18.56
Si K	-	32.27	-
P K	26.39	4.51	27.02

TGA/DTA studies: The thermal property of the sample is understood by conducting TGA. Fig.4 shows the thermogram of pure struvite crystal and drug added samples. The thermal behavior of the pure struvite crystal were studied in the temperature range 30-820 °C at a heating rate of 10 °C/min in the nitrogen atmosphere. It was observed from the TGA curve that the decomposition of struvite crystal started just above the room temperature may be due to the loss of ammonia and water of crystallization, hence the struvite crystal is thermodynamically unstable. In the DTA analysis two sharp endothermic peaks were observed at 118.48 °C and 162.66 °C. The peak at 118.48 °C is assigned to the decomposition point. Before decomposition there are no characteristic exothermic or endothermic peaks. Sharpness of the endothermic peaks observed in DTA indicates good degree of crystallinity of the sample. An exothermic peak was also observed at 685.39 °C, which might be due to the high temperature phase transition. The TGA- DTA curve of drug added struvite crystals shows a small shift in the decomposition point.

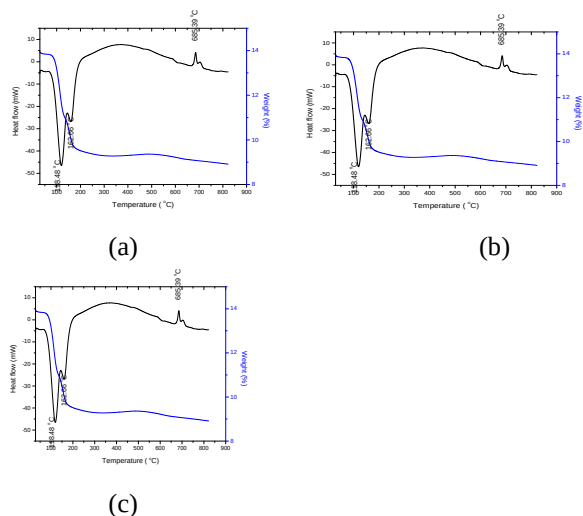


Figure.4: TGA-DTA curve of (a) pure Struvite, (b) 0.005 g of drug (calcury) added struvite, (c) 0.005 g of drug (zyloric) added struvite

IV. CONCLUSION

The struvite crystals with and without inclusion of drugs were grown gel media. The presence of water of crystallization, N-H bonds, PO₄ bonds, NH₄ and metal oxygen bond were confirmed using FT-IR analysis. The SEM-EDS microanalysis gives precise information about the samples and their compositions. The presence of Phosphorous, Magnesium, Oxygen and Carbon were detected. Thermal analysis confirms the decomposition point of the grown crystal. It was found that the pure struvite crystal decomposes at 118 °C. It also shows that the struvite crystals are thermally unstable. It was observed that the presence of drugs in the growth environment has caused a retarding effect on the formation of the struvite crystals. Further invivo studies are necessary to better evaluate the potential effect of drugs on struvite formation.

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Intra-Population Variation Studies in Laria - Wild Ecorace of Tropical Tasar Silkworm *Antheraea Mylitta* Drury

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Abstract- Laria is a wild ecorace of tropical tasar silkworm *Antheraea mylitta* Drury and the adaptability of this ecorace mainly on *Shorea robusta* (Sal). It has high economic importance is noteworthy for its small size, robust with variable cocoon colour and has low filament denier. In nature, the voltinism of this ecorace is uni-, bi-, and trivoltine. In the present study, variability in the cocoon characters and biochemical parameters was assessed to analyze the degree of heterogeneity with in the natural population of Laria in relation to the cocoon colour. Differential amount in the cocoon traits, such as cocoon weight and shell ratio were recorded with significant variability at $p < 0.05$ level. Protein and reducing sugar concentrations were recorded higher in whitish grey cocoons compared to the yellow colored cocoons. This would be highly warranted to study intra-population variability for the understanding of wild tasar silkworm ecoraces like Laria. The study also facilitates to harness the potentialities of Laria ecoraces to apply in breeding prospects.

Index Terms- Laria, cocoon color, protein, reducing sugar, cocoon trait

adjoining regions of Chhattisgarh. The ecorace is notable for spinning small size with long peduncle, varied color (Whitish grey-grey, dark & light yellow) cocoons, and robust with low filament denier. In nature the voltinism of this ecorace is not fully understood but presumed to exist as uni-, bi- and trivoltine (Suryanarana and Srivastava, 2005). In some limited areas farmers use Laria ecorace for 2nd crop (during September-October) that too in small scale. Third crop (November-February) is unstable and there is loss of biomass due to unseasonal moth emergence in unfavorable seasons. Adaptability of this ecorace is primarily on *Shorea robusta* (Sal) and this flora covers 86.9% of the total tasar flora in India as against 13.1% of *Terminalia arjuna* (Arjun) and *T. tomentosa* (Asan). The efforts for the utilization of Sal plantation are become thrust and need of the hour to enhance the total tasar silk production in India. Exploitation of Laria ecorace in this direction would pave the way to achieve the prime objectives. Thus, this would be highly warranted to study the intra-population variability for the understanding of wild tasar silkworm ecoraces its potentialities to harness for the higher tasar silk production and also to apply breeding strategies for better perpetuation and conservation.

I. INTRODUCTION

Tropical tasar silkworm *Antheraea mylitta* Drury is an ecological insect species producing the world famous tasar silk. The tropical tasar silkworm populations occupying different ecological and geographical regions show certain degree of phenotypic variability for which they are known as 'eco-races' (Srivastava *et al.*, 2003). About 44 ecoraces have been recognized out of which, eight ecoraces are being exploited for commercial tasar silk production in India (Suryanarana and Srivastava, 2005). Tasar silkworm *A. mylitta* a polyphagous insect feeds on wide range of host plants. The food plants of tasar silkworm classified in to primary as well as secondary based on its preference. Three important food plants such as *Terminalia arjuna* (Arjun), *Terminalia tomentosa* (Asan) and *Shorea robusta* (Sal) are widely utilizing for the rearing and production of commercial tasar silk. The implication of food plants on growth and development of the silkworms and subsequent productivity in terms of seed (fecundity) and silk recovery are prominent. Also it is apparent that the expression of phenotypic characters is largely depends on interaction with its host plants biochemical profile and the environment.

Laria is a *Shorea robusta* (Sal) based ecorace of economic importance distributed in various parts of Jharkhand and

II. MATERIALS & METHODS

Studies were undertaken at Silkworm Breeding and Genetics laboratories of Central Tasar Research & Training Institute, Ranchi, during October-2011 to February 2012. The cocoons of wild ecorace Laria collected from forest area of Peterbar, Jharkhand. The good cocoons were sorted based on the sex and the colour (whitish-grey and yellow). About 50 male and 50 female cocoons each of whitish-grey and yellow were used for the cocoon trait assessment and for the biochemical analysis.

a. Assessment of Cocoon Characters:

The important commercial cocoon characters such as individual cocoon weight and shell weight (for calculation of the shell ratio) were analyzed by random selection of 50 yellow colored cocoons and 50 whitish grey cocoons from the natural population of Laria which was collected from forest area of Peterbar, Jharkhand.

Preparation of Samples for biochemical studies:

Hemolymph of both whitish grey and yellow of both the sexes and male gonad were collected separately for the biochemical studies.

- i. Hemolymph was collected by cutting the anterior part of the pupa and pro leg of silkworm larvae in a pre-cooled micro-centrifuge tube containing a pinch of phenylthiourea as an anticoagulant and centrifuged at 5,000 rpm for 5 min at 4°C. The supernatant collected and stored at -20°C until further use.
- ii. Testes was collected in the male. Dissection was carried out in ice cold phosphate buffer. Homogenization of testis was done in a homogenizer using phosphate buffer pH 7. The homogenate was transferred to a clean centrifuge tube and centrifuged at 5000rpm for 5 min in cooling condition. The supernatant was collected in a clean test tube and were stored at -20°C until further use.

The total protein concentration and reducing sugars were estimated in both hemolymph and testes (Lowry *et al.*, 1951; Sinha *et al.*, 1998).

Statistical Analysis

One-way analysis of variance was used to test the significance of differences between the mean values of independent observations of proteins and reducing sugars in the haemolymph and testes of silkworm pupae. Comparisons were performed with Duncan's Multiple Range Test (DMRT) to find significance differences at $p < 0.05$ (Duncan, 1955).

III. RESULTS AND DISCUSSIONS

a. Cocoon Assessment

The study of commercially important cocoon traits such as cocoon weight and shell ratio showed variability among white and yellow color cocoons. Higher cocoon wt. and shell % was observed in the whitish-grey cocoons compared to yellow cocoons (Table. 1). Whitish grey is considered as predominant cocoon color spun by many ecoraces of the tasar silkworm and has commercially good cocoon qualities compared to other types of cocoon (Suryanarayana and Srivastava, 2005). With regard to quantitative characters, the cocoon and shell weight is variable from race to race. The *Shorea* based ecoraces shown higher shell weight and compactness compared to *Terminalia* based populations (Srivastava *et al* 2001).

b. Biochemical analysis:

The studies on the variability in the biochemical parameters of whitish-grey and yellow cocoons with in the natural population of Laria are recorded as follows;

i. Protein concentration:

A significant variation in the Protein concentration at $p < 0.05$ was observed in whitish-grey and yellow cocoons. Higher concentration of proteins (mean $\pm$ SD: 142 ± 5.00) observed in the hemolymph of female whitish-grey cocoons compared to other samples studied followed by male gonads (140 ± 5.29), hemolymph of yellow female (132 ± 5.00) and also significant difference in the protein concentration was observed between the different tissues studied (Table. 2).

The proteins play an important role in the haemolymph of insects not only in specific transport functions, but also in their enzyme action. Hurliman and Chen (1974) & Chen (1966) asserted that the synthesis and utilization of haemolymph proteins are conditioned by genetic and hormonal control. There is a general agreement that the fat body is a main source of haemolymph proteins and others may come from haemocytes. In silkworms the haemolymph protein fluctuates during its developmental stages and concentration was found to increase seven fold during last instar of larval life. The high protein concentration is an indication of a greater metabolic activity of the tissue. The haemolymph, the carrier of all nutrient substances distributes to each and every part of the body for cellular metabolism, wherein the micromolecules get converted into complex macromolecules like proteins and carbohydrates.

Higher concentration of the protein in the whitish-grey cocoons (pupal hemolymph) is attributed to the fact that these larvae have fed quality leaves and efficiently converted the dietary food during its feeding stage the corresponding level of proteins were maintained even in the non-feeding pupal stage (Babu *et al.* 2009). Also many authors have similarly recorded the higher proteins in the hemolymph of female cocoons earlier (Kumar *et al.*, 1998; Lokesh *et al.*, 2006; Lokesh *et al.*, 2006; Kumar *et al.*, 2011; Srivastava *et al.*, 2001). This is also corresponds with the cocoon weight recorded in the present study. The differential concentration of proteins in whitish-grey and yellow cocoons depicts the heterogeneity (Venugopala Pillai *et al.*, 1987) within the population of *A. mylitta* and better quantitative characters of the whitish-grey cocoons over the yellow cocoons (Srivastava *et al.*, 2002; Srivastava *et al.*, 2004).

ii. Reducing sugars:

The reducing sugars recorded significantly variable amounts in the tissues studied and between the yellow and whitish-grey cocoons. Higher reducing sugars were recorded with hemolymph of female white cocoons (32 ± 1.53) compared to yellow cocoons and the lowest was recorded in the hemolymph of Male yellow cocoon (28 ± 1.53) represented in the Table. 2.

Carbohydrates are essential components for the energy demand during non feeding stage. Trehaloses, glucose, fructose and mannitol, these compounds are highly essential during different developmental stages of an organism (Forcella *et al.*, 2007). Silkworms utilize carbohydrate in the production of some new proteins/ biomolecules to cope with the developmental changes. The concentration of reducing sugars in different tissues is in relation to the energy requirement for the metabolism. Higher amount of reducing sugars in the hemolymph is due the release of cellular carbohydrate in to the circulatory medium this subsequently channelize to different tissues/ organs of the body (Lakshmikumari *et al.*, 1997; Sarangi, 1985). Differential carbohydrate concentration between male and female also among different tissues in the present study is in correspondence with earlier works (Sinha *et al*, 1998; Srivastava *et al*, 2001; Srivastava *et al*, 2003; Kar *et al.*, 1994).

IV. CONCLUSION

From the present study, variability in the cocoon characters and biochemical parameters is apparent that, there is high degree

of heterogeneity within the natural population of Laria. Differential amount in the cocoon traits, protein and sugar concentration in whitish-grey and yellow cocoons can be considered as an indicator. Since, white cocoons recorded

quantitatively better this could be preferentially consider in the selection for better quantitative traits in conventional breeding.

Table 1: Study of variability in Cocoon characters in natural Laria population (Mean±SE)

	Cocoon Weight (g)	Shell Weight (g)	Shell ratio (%)
Whitish grey cocoon	11.137±0.476	1.914±0.040	17.26± 0.050
Yellow cocoon	10.241±0.702	1.668±0.078	16.373±0.114

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2287.227	5	457.445	368.642	.050
Within Groups	67.008	54	1.241		
Total	2354.236	59			

Table 2 : Biochemical variations in the white and yellow cocoon (Pupa) of Natural Laria Population (Mean±SE)

	White cocoon (Pupa)		Yellow cocoon (Pupa)	
	Proteins (mg/ml)	Reducing sugars (mg/ml)	Proteins (mg/ml)	Reducing sugars (mg/ml)
Male hemolymph	130±2.51	32 ±0.88	121±3.60	28 ±0.88
Female hemolymph	142±2.88	39 ±1.52	132±2.88	33±2.08
Male gonad	140 ±3.05	34 ±1.00	128 ±3.60	30 ±1.52

		Sum of Squares	df	Mean Square	F
Protein (Whitish-grey)	Between Groups	248.000	2	124.000	5.167
	Within Groups	144.000	6	24.000	
	Total	392.000	8		
Protein (Yellow)	Between Groups	186.000	2	93.000	2.709
	Within Groups	206.000	6	34.333	
	Total	392.000	8		
Reducing Sugar (Whitish-grey)	Between Groups	84.222	2	42.111	10.243
	Within Groups	24.667	6	4.111	

Reducing Sugar (Yellow)	Total	108.889	8		
	Between Groups	42.889	2	21.444	2.881
	Within Groups	44.667	6	7.444	
	Total	87.556	8		

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The etiological and demographic characteristics and health problems of the hospitalized adopted children in Bangladesh: Study on 54 cases

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Abstract- Objective: Worldwide, approximately 40,000 children per year are moved between more than 100 countries through adoption. By law, guardianship, not adoption, is permitted in Bangladesh. To the best of our knowledge, no scientific study on guardianship or adoption is ever reported from Bangladesh. Our study, for the first time, is reporting on some of the basic characteristics of adoption in Bangladesh.

Materials and methods: This cross sectional study was conducted on the hospitalized adopted children between September, 2009 and October, 2010 in the Institute of Child and Mother Health, Dhaka, Bangladesh. Total 54 adopted children, who were hospitalized due to different health problems, were included in the study.

Result: The mean ($\pm$ SD) age of the studied adopted children was 4.29 ± 3.47 months.

Among them, 42 (77.8%) were female and 12 (22.2%) were male child. All adoption happened among un-related Muslim families. Infertility was the commonest (72%) reason for adopting a child. No adoption took place according to the existing guardianship law in Bangladesh, and none was legally documented. Financial insolvency and the death of the biological mother reasoned for allowing adoption in 50% and 29.6% of cases respectively. In about one-third of the cases, the biological parents received money from the adopting parents.

Acute respiratory tract infection, gastroenteritis and undernutrition were the major health problems of the adopted children.

Since Islamic law does not allow inheritance of wealth to the adopted children, all the adopting parents left the inheritance issue to be solved “in future”.

Conclusion: The current guardianship law needs wide publicity, proper execution and strict monitoring. This law necessitates re-evaluation or possible adaptation into a full adoption law that can secure the future rights of the adopted children.

Index Terms- Adoption, Bangladesh, guardianship, infertility

I. INTRODUCTION

Every child deserves a home. Adoption is a process whereby a child is awarded to his adoptive parents and, in so doing, terminates the relationship between the biological parents and the child and permanently transfers all rights and responsibilities from the original parent(s) to nonbiological parents [1, 2, 3].

A guardianship, on the other hand, establishes a legal non-permanent relationship between a child and the guardian who isn't the child's parent, but it does not end the legal relationship between the child and the child's biological parents. A guardianship can be terminated or renewed at a later date [4, 5, 6]

Although the causes for adoption may vary in different society and country, the main causes include: infertility, untimely death of own children, single adults who like children, couples wanting a child of the opposite sex, death of parents, people who suffer from genetic diseases and choose not to have children of their own, and so on [7, 8, 9].

Adoption may be open or closed. A closed adoption prevents contact between the biological parents and the adopted person. On the other hand, open adoption allows varying degrees of contact; however they are not legally enforceable and may be closed at any time. [10]

So far, no published or unpublished data on the estimate of adoption in Bangladesh is retrievable from any government or non-government sources.

Guardianship law in Bangladesh:

Bangladesh is a Muslim country where there is no actual adoption law. Under the Guardianship and Wards Amendments Ordinances 1982, only guardianship of Bangladeshi children is permitted to its own citizens but not to non-Bangladeshi citizens. Since Bangladesh allows dual citizenship, Bangladeshi citizen who is also the citizen of another country, may become the guardian of a Bangladeshi children and can bring the child in the second country for adoption. The family court and the ministry of home affairs are the responsible authority for both intracountry and intercountry adoption in Bangladesh. [11, 12, 13, 14]

Procedure of guardianship in Bangladesh:

For a legal guardianship, the proposed ward must be below the age of 18 years; the biological parent must sign an irrevocable release of the child before a notary public, first class magistrate or the relevant family court in Bangladesh; and a ‘no objection certificate’ must be obtained from the home ministry [15].

Rational of the study:

To our knowledge, a systematic assessment of any aspect of adoption has not yet been reported in Bangladesh. Our study, for the first time, aimed at identification of etiological, procedural

and socio-demographic aspects of adoption and the health problems of hospitalized adopted children in Bangladesh.

II. MATERIALS AND METHODS

This hospital based, observational, descriptive, cross sectional study was conducted between September, 2009 and October, 2010 in the Institute of Child and Mother Health. This secondary-care level maternal and children hospital is located on the outskirts of Dhaka—the capital city of Bangladesh. Majority of the patients attending to this hospital belong to lower middle class and poor families residing in the sub-urban and rural areas. The studied patients were retrieved from the inpatient department of the hospital.

Eligibility requirements for enrollment included having the following: (1) an adopted child who had been placed permanently in the adoptive home and (2) voluntarily willing to participate in the study. Among 57 adopted children enrolled during the study period, 54 met the inclusion criteria. The excluded children were in fact abandoned children.

After obtaining verbal consent, detail information on demographic and health characteristics of adoptees and the adoptive parents and families, the etiological and procedural aspects of adoption and other relevant information were documented in a structured, pre tested questionnaire through in-depth interviews with the adopting parent(s). The core questions about adopting a child were asked to the adoptive mothers since, in all cases, they had been accompanying the adopted child in hospital. Information related to biological family was also extracted from the adopting parents; however, the obtained information could not be cross-checked since no biological parents were present in the hospital. Age of the children was calculated from the date of birth. Family income was defined as the interviewee's report of the total income in taka (currency of Bangladesh) received by all household members in previous year. Parental education was determined from the parent's response to the questions asking the last grade (class) in school.

Ethical clearance:

The study synopsis was ethically cleared by the Ethical Review Board of the Institute of Child and Mother Health. The ethical aspect of the study was in full compliance with the Helsinki declaration; all the obtained data were treated with highest possible confidentiality.

Statistical analysis:

Statistical analyses were performed with SPSS 15.0 for Windows (SPSS, Inc, Chicago, IL). As needed, descriptive and frequency analyses were done for selected variables.

III. RESULTS

By gender, 42 (77.8%) were female and 12 (22.2%) were male child; the male: female ratio was 1: 3.5. The mean ($\pm$ SD) age of the adopted children at the time of study was 4.29 ± 3.47 months (range—half month to 18 months). Forty five (83.3%) of the children were under the age of six months at the time of adoption; of whom 32 (71%) were adopted before one month of age.

The mean ($\pm$ SD) weight was 4.25 ± 1.66 kg (range 1.8 kg to 9.5 kg). Most (83.3%) of the adopted children had been suffering from various grades of malnutrition. Of them, 33.2% were moderately under weight, 20.4% were severely under weight, 20.4% were moderately wasted and 9.3% were severely wasted.

The mean ($\pm$ SD) monthly income of the adopting families was 7882 ± 5341 taka (US \$ 104.4 ± 70.75). Most (94.5%) of the foster mothers were house-wives; and 61% had only elementary-level education. Of the foster fathers, 25 (46.3%) were employed in different offices, 18 (33.3) were small traders, and the rest 11 (20.4%) had varying fleeting professions.

All adoptions took place among un-related Muslim families. None of the adopting parents knew about the existence of any adoption/guardianship law in Bangladesh, but all knew that wealth-inheritance to adopted children is not allowed in Islam.

In about one-third (17 out of 54; 31.5%) instances, the biological parents received money from the foster parents; although all denied to disclose the amount of money.

Table 1 looks at the social and procedural aspects of the adoptions:

Table-1:

Parameters	Numbers and Percentage
Procedural aspect of adoption:	n=54
Legal procedure followed	0 (0%)
Personal settlement between the families	44 (81.5%)
Societal settlement	10 (18.5%)
Documentation of adoption:	n=54
No documentation	31 (63.2%)

Written in plain paper	13 (24.07%)
Written in judicial stamp (only cases of adoption through societal settlement)	10 (18.5%)
Reasons of allowing adoption by the biological parent: (response obtained from the adopting parents):	n=54
Death of the mother	16 (29.6%)
Financial insolvency and many children (≥ 5)	27 (50%)
Separation of the parents/abandoned mother	5 (9.3%)
Unwilling to reply	6 (11.1%)
Reasons of adoption by the adopting parent(s):	n=54
Infertility	39 (72.2%)
Untimely death of own child	7 (13%)
Couples wanting a child of the opposite sex	8 (14.8%)
Treatment taken for infertility:	n=39
“Kabiraji” (locally available, popular herbal treatment)	19 (48.7%)
“Tabij”(a kind of religious treatment)	12 (30.8%)
Qualified gynecologist in hospital	6 (15%)
Homeopathy	2 (5)
Health problems of the adopted children diagnosed in hospital:	n=54
Respiratory tract infections	24 (44.4%)
Gastroenteritis	22 (40.7%)
Malnutrition	18 (33.3%)
Septicemia	6 (11.1%)
Mixed problems	9 (16.7%)
Food of the adopted children less than 6 months of age:	n=45
Diluted cow-milk	26 (57.8%)
Inappropriately diluted formula milk	7 (15.5%)
Appropriately diluted formula milk	7 (15.5%)
Goat-milk	5 (11.11%)

Of 39 infertile women, 28 (72%) tried to have own child for a minimum 10 years. Only a small (15%) portion of them consulted qualified gynecologist for treatment; and the choice of treatment modality was decided by the husband in 31 (79.5%) cases followed by the father-in-law in rest of the cases. None of the husband of the infertile women was tested for male infertility. In most of the instances (37/ 95%), it was the foster mother who desired first to adopt. Ten infertile mothers (25%) stated that their husbands had already married again.

In response to a question regarding feelings for the adopted children, all foster mothers and 17 (31.5%) foster father expressed genuine love and passionate emotion; the rest of the fathers refused to comment.

During the process of adoption by personal contract or societal settlement, all the biological parents committed, either verbally or in written, not to 'claim' for the child in future.

All the adopted babies were either re-named or named for the first time by the adopted parents. None of the foster parents had the plan to disclose the biological identity to the adopted children in future.

Regarding future inheritance of wealth, all adopting mothers referred to the adopting father to resolve the issues. All the fathers left this issue to be resolved in future.

IV. DISCUSSION

Although only guardianship is permitted by law, unofficial adoptions are happening in Bangladesh. None of the studied adoption was legally documented. The arrangers considered the documentation on judicial stamps (a common practice among Bangladeshi rural communities) as 'legal-bound'; which is in fact no. An unexpected but interesting finding of this report is to offer and to accept money during adoption—a practice that might deem 'unethical'; but since half of the adoptions originated from financial insolvency to rear up many children, this kind of 'unprincipled' practice is not unusual. Bangladesh is a densely-populated country where about 1045 people live in one square kilometer area and about half of the population lives below international poverty line [16, 17].

The girl predominance among the adoptees can be explained by the fact that most poor families in Bangladesh consider male child as an 'income-generating possession for future security'. Therefore the biological parents, unless compelled by unmanageable circumstances, rarely allow their male child for adoption.

Infertility was the commonest and self-explanatory cause for adopting a child; although no national statistics on the prevalence of infertility could be retrieved from any source. The attention-grabbing fact is that only the women were labeled infertile; no male was tested for infertility although the later can be an equally important cause of 'female infertility'. Majority of the women did not consult a specialist medical doctor, rather, being governed by the husband or father-in-law, received various kinds of 'traditional' treatment for infertility. This gender-discrimination is quiet evident across all levels of Bangladeshi patriarchal society where women are dependent on men

throughout their lives—from their fathers through to husbands, brothers or sons [18]. This is again reflected by further marriage of some husbands on the plea of wife's infertility since traditionally, women are recognized mainly for their reproductive role. The insecurity in conjugal life perhaps led to the foster mothers to desire and to initiate the process of adoption in most of the cases.

The Death of the biological mother reasoned for about 30% of adoption—the figure is attuned with the country's high maternal mortality rate (320 deaths per 100, 000 births) [19].

Acute respiratory tract infection (ARI) and gastroenteritis were the top ranked illness among the hospitalized adopted children; these figures parallel the national statistics of childhood illness in Bangladesh [20]. Over three-fourth of the adopted children already developed various grades of undernutrition, primarily due to feeding with diluted cow's and or faulty preparation of the formula milk. With a bad start in the beginning of lives, these children have already entered in the pool of alarming childhood malnutrition in Bangladesh, where 41% of under-five children are underweight [21, 22]. A comparable representation has been reported from a wealthy country (Canada), where half of the adopted children had weight or height deficiency, caused by illness, nutritional, emotional, or sensorial deprivation [23]

Studies have revealed that adopted children might have higher risk for maladjustment, behavioral problems and suicidal attempts in future [24, 25, 26, 27, 28, 29]. No data on the fates and later consequences of Bangladeshi adoption cases are available.

According to Islamic law of inheritance, adopted children are excluded from inheritance of the non-biological parents [30, 31, 32]. Since Bangladesh is a Muslim country, the concern of wealth inheritance was considered by most of the foster fathers as 'an issue to be solved in future'. However, the uncertainty remains. It is also interesting to note that no mother was empowered to answer to this question signifying the male dominance in vital decision-making issues in Bangladeshi families

V. COMMENTS AND RECOMMENDATIONS

It is important to interpret our findings in the context of several research limitations. An important limitation is small, probably un-representative sample size, so the results may not generalize to the broader population of adoptive families. By the current study, not much is known about the varied reasons for adoption in the whole country. However, our study deliberately focuses on several important aspects of adoption in Bangladesh; and results of this study are expected to be considered as a nucleus for further, nationwide cross-sectional and cohort studies to grasp multiple spheres of adoption and its future consequences.

The current guardianship law of Bangladesh needs wide publicity (through mass media), proper execution and strict legal monitoring. Its re-evaluation or possible conversion into a full adoption law seems to be a time-demanding issue for the policy makers. The issues of future rights and wealth-inheritance need

careful and logical consideration so that in one hand, it does not become contradictory to Islamic law, on the other hand it can protect the rights of the adopted children.

The political leaders, law-enforcing agencies, civil society and agencies working on human-rights can be integrated during adoption—this can, to some extent, help in guarding the rights of the adopted children.

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Design and FPGA Implementation of DAA Based FIR Filter

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Abstract- DSP functions such as FIR filters and transforms are used in a number of applications such as communication and multimedia. FIR Filter is an LTI system its output is a convolution function of input and impulse response of the system. It involves multiplication and addition operations. Application of DAA (Distributive Arithmetic Algorithm) in this implementation avoids the usage of multiplication to minimize the hardware complexity. In this paper a novel architecture for a 16 tap FIR filter is designed and implemented by using optimized DA algorithm. Xilinx Xc5vfx200T FPGA is targeted using Xilinx ISE 10.1i software. Performance of the implemented FIR filter in this paper is measured in terms of relative error in result by comparing the FPGA output with theoretical value calculated in MATLAB.

Index Terms- FIR, LTI, DA, FPGA, MATLAB, LUT, ASIC

I. INTRODUCTION

FIR filter is an LTI system, eq(1) represents the response of a 16 tap FIR filter, where $x(n)$ represents the input sequence and $h(n)$ represents the impulse response of the FIR filter.

$$y(n) = \sum_{k=0}^n h(k) * x(n-k) \quad \dots (1)$$

It is evident from eq(1) that, convolution involves multiplication and addition. But using multiplier is not economical in view of hardware complexity. Using Look Up Tables is one Solution to avoid the multipliers, which is described in DA algorithm.

$$\begin{aligned} y(n) &= \sum_{k=0}^n h(k) \bullet x_{k,0} + h(0) \bullet x_n + h(1) \bullet x_{n-1} \\ &\quad + \dots + h(n) \bullet x_{n-k} \quad \dots (2) \\ &= \sum_{k=0}^n h(k) \bullet x_{k,0} + \{h(0) \bullet x_{n,1} + h(1) \bullet x_{n-1,1} \\ &\quad + \dots + h(n) \bullet x_{n-k,1}\} \bullet 2^{-1} + \\ &\quad \{h(0) \bullet x_{n,2} + h(1) \bullet x_{n-1,2} + \dots \\ &\quad + h(n) \bullet x_{n-k,2}\} \bullet 2^{-2} + \\ &\quad \cdot \\ &\quad \cdot \\ &\quad \cdot \\ &\quad \{h(0) \bullet x_{n,7} + h(1) \bullet x_{n-1,7} + \dots \\ &\quad + h(n) \bullet x_{n-k,7}\} \bullet 2^{-7} \\ &\quad \dots (3) \end{aligned}$$

Input sample magnitudes in this implementation are taken as fractional. So, by using DA algorithm [2] the way eq (1) rearranged is described in eq(2) and eq(3):

So, In eq(3) each sum term can be stored in LUT, fetched appropriately and added to achieve $y(n)$.

II. OPTIMIZED DA ALGORITHM

In the convolution equation (3), maximum coefficient sum term may have 16 coefficients. So 2^M sum combinations are possible in M tap FIR filter implementation, it implies that ROM depth required is 2^M locations. It is a huge requirement. To minimize this, DA algorithm can be optimized [1] as in eq(4).

$$\begin{aligned} \sum_{k=1}^M A_k x_{kn} &= \sum_{k=1}^{M/2} A_k x_{kn} + \sum_{k=M/2}^M A_k x_{kn} \\ &= \sum_{k=1}^{M/4} A_k x_{kn} + \sum_{k=M/4+1}^{M/2} A_k x_{kn} \\ &\quad + \sum_{k=3M/4}^{3M/4+1} A_k x_{kn} + \sum_{k=3M/4+1}^M A_k x_{kn} \\ &\quad \dots (4) \end{aligned}$$

In equation (4), each floating point sample can be expressed as

$$x_m = -x_{m0} + \sum_{k=1}^{N-1} x_{mk} \cdot 2^{-n} \quad \dots(5)$$

In this implementation, value of N (number of bits) is 8. First bit represents sign and other bits represent the magnitude.

A typical term in eq(4) can be expanded as follows

$$\begin{aligned} \sum_{k=1}^{M/2} A_k x_{kn} &= \sum_{m=1}^{M/2} A_m (-x_{m0} + \sum_{k=1}^{N-1} x_{mn} \cdot 2^{-n}) \\ &= \sum_{m=1}^{M/2} \sum_{k=1}^{N-1} x_{mn} \cdot 2^{-n} + \sum_{k=1}^{M/2} A_m (-x_{m0}) \end{aligned} \quad \dots(6)$$

To implement the equation (4), required ROM dept is $2^{2+M/4}$.

Before optimization, required memory size is 2^M . So that it can save $2^{-2+3M/4}$ memory locations. This is 62.5% of ROM size in case of 16 tap FIR filter.

III.FPGA IMPLEMENTATION

Each input sample is represented in sign magnitude form with 8 bits. Controller module generates the address for lookup tables to fetch the appropriate coefficient sum terms in equation (4). Multiplication of sum terms with 2^{-k} is implemented using shift registers. Sum of the terms is achieved with accumulator.

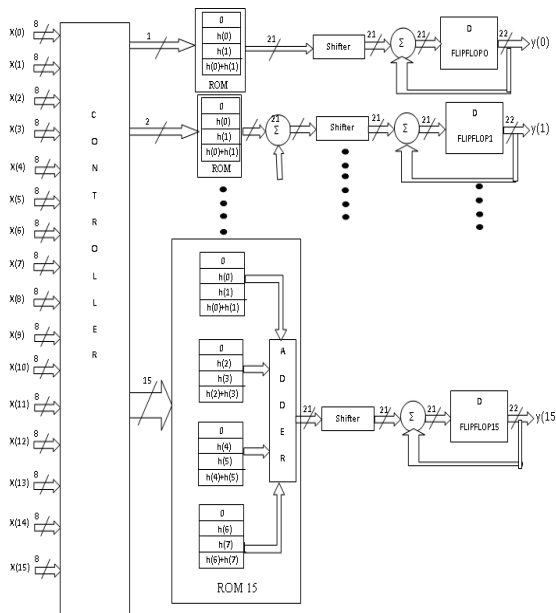


Fig. 3.1 FIR Filter Architecture

Processor takes eight clock cycles to result the output. In this implementation output is represented with 22 bits.

IV. RESULTS

A. Simulation Results

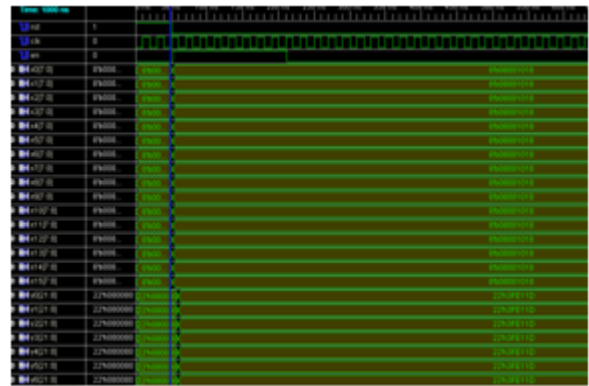


Fig 4.1 Input Output Waveforms from top module

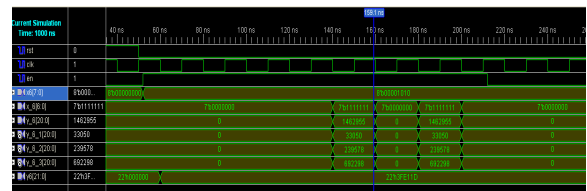


Fig 4.2 Typical waveforms of LUT6

B. Synthesis Results

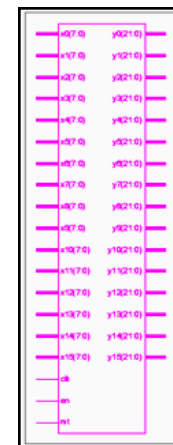


Fig 4.3 Top module's Port layout

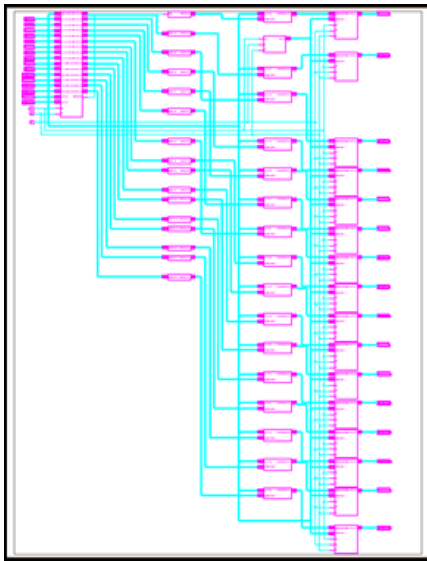


Fig 4.4 Top module

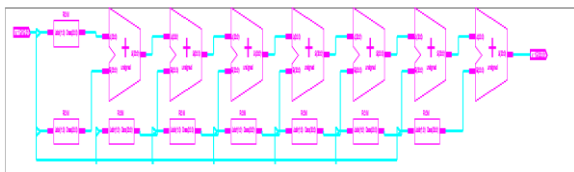


Fig 4.5 A typical LUT cum internal adder

C. Device utilization summary

Table 1. FPGA Resource Utilization

S. No.	FPGA Resource	Utilization
1	Slice registers	376
2	Slice LUTs	2364
3	LUT Flip Flop pairs	2381
4	IOs	483
5	Bonded IOBs	483

D. Relative Error

For a 16th-order FIR filter, the sampling frequency is 2.25 MHz; the pass band cutoff frequency is 100 kHz; The $h(k)$ is as follows:

$$\begin{aligned} h(0) &= h(15) = 298D & h(1) &= h(14) = 578D \\ h(2) &= h(13) = 1364D & h(3) &= h(12) = 2718D \\ h(4) &= h(11) = 4503D & h(5) &= h(10) = 6400D \\ h(6) &= h(9) = 7996D & h(7) &= h(8) = 8908D \end{aligned}$$

For a simple set of input points, i.e. $x(0)$

$$= x(1) = x(2) = x(3) = x(4) = x(5) = x(6)$$

$$= x(7) = x(8) = x(9) = x(10) = x(11) = x(12) = x(13) = x(14) = x(15) = (0.00001010)_2$$

7th output point values calculated using Mat lab is $(R1) = 114290$.

Respective FPGA simulation result $(R2) = 114256$

Percentage of relative error in FPGA calculation

$$= (R1 - R2) / R1 * 100\% = 0.0297\%$$

It is as typical relative error in the 7th output ($y(6)$) of the FIR filter circuit proposed in this paper. Relative error in all other output points also lies in the same order.

V. CONCLUSION

Architecture is implemented in Verilog and Xilinx Xc5vfx200T FPGA of Vertex5 family is targeted. FPGA simulation result obtained is very close to the theoretical result from MATLAB. Therefore it can be concluded that with improved DA algorithm, it is feasible to have a processor with performance almost closer to the theoretical expectation. And also this can be used as a reusable IP (Intellectual Property) in signal processing related ASICs.

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Efficacy of ventilatory muscle training in patients with Chronic Obstructive Pulmonary Diseases (COPD)

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Abstract- Study Design: Randomized controlled trial

Objective: To find out the effectiveness of ventilatory muscle training in COPD.

Background: COPD patients experiences increased resistance to air flow, Air trapping and hyperinflation of lungs. Hyperinflation places ventilatory muscles at mechanical disadvantage. Ventilatory muscle training may improve the muscle strength and endurance, pulmonary function and sensation of respiratory effort. Thus the purpose of our study is to focus on the management of patients with COPD for the improvement of respiratory muscle function, exercise performance and reduction of dyspnoea.

Methods and measures: The sample consisted of clinically diagnosed 63 subjects with COPD. Subjects were randomly divided in two groups that is experimental group treated with medications along with ventilatory muscle training (VMT) under supervision. Second control group treated with medications for eight weeks. Their baseline data includes dyspnoea scale (ATS), 6 min. walk test, Spirometer value (SVC, MVV, FEV1/FVC) and after VMT post measurements were taken for further analysis.

Results: Two groups were homogeneous regarding all parameters at baseline. Statistical analysis was done by using Graph Pad Instant software (Trial version 3.03) post exercise data shows highly significant difference between two groups i.e. ($p < 0.01$)

Conclusion: Ventilatory muscle training can be used as an adjunctive intervention in the treatment of in COPD

Index Terms- Incentive spirometer, COPD, Ventilatory muscle, strength and endurance, Dyspnoea

Implications- This Method can be used to treat the patients with COPD as a non-invasive method with improvement in comfort of patient.

I. INTRODUCTION

Approximately thirty million people of either sex suffer from chronic obstructive pulmonary disease with the fourth leading cause of death amongst the population in the age group of 65 to 84 years with a huge economic impact in relation to direct medical expenditure. Patients with Chronic obstructive pulmonary disease (COPD) experiences increased resistance to airflow, air trapping, and hyperinflation of the lung, which places the inspiratory muscles at a mechanical disadvantage. Exercise

and activity limitation are characteristic features of chronic obstructive pulmonary disease. Exercise intolerance may result from ventilator limitation, cardiovascular impairment, and/or skeletal muscle dysfunction. [1,2 3].

Presence of airflow obstruction caused by chronic bronchitis & emphysema is characteristic of chronic obstructive pulmonary disease. The airflow obstruction is generally progressive and may be accompanied by airway hyper reactivity & often partially reversible. Declining lung function is almost universally caused by the effects of exposure to tobacco smoke & develops insidiously so that patient often do not complain of exertion dyspnoea unless and until one second forced expiratory Volume (FEV1) is within 40% to 50% of its predicted value [4,9].

Dyspnoea frequently limits activity and reduces health-related quality of life, impaired lung function; peripheral muscle deconditioning and respiratory muscle dysfunction. The rationale for ventilatory muscle training in patients with chronic obstructive pulmonary disease is very strong. These patients not only have weakness of respiratory muscles, but also experience alterations in their chest wall mechanics that reduces the effectiveness of diaphragm with increase in the work for breathing[5,6]

Current state of the management of COPD consists of multidisciplinary approach to patient care. There are Significant advances in knowledge and use of pharmacological therapy for controlling the symptoms of COPD. The role of nutritional intervention, exercise training and pulmonary rehabilitation are established important therapeutic strategies for the improvement in exercise tolerance and reducing dyspnoea and leg fatigue. Respiratory rehabilitation is now days recognized as an important part of the management of patients with chronic obstructive pulmonary disease. The widespread application of such programmes should proceed by evidence of directly attributable improvements in function. [7, 8]

The aim of exercises in COPD is for improvement in regional ventilation and gas exchange by the ventilatory pump. Since dynamic hyperinflation improves respiratory muscle function, decrease in dyspnoea, improvement in exercise tolerance and quality of life in patients with COPD. Several studies of various authors had concluded that ventilatory muscle training may enhance respiratory muscle function and can reduce the dyspnoea in patients with moderate to severe COPD. According Smith et al, ventilatory muscle training (VMT) may

improve ventilatory muscle strength, to lower and probably diminish the sensation of respiratory effort [11].

Present study provides the physiotherapeutic management of chronic obstructive pulmonary disease. Pulmonary rehabilitation using whole body exercise training improves peripheral muscle function and reduces dyspnoea but does not improve respiratory muscle function. But providing adequate training intensities, specific loading of the inspiratory muscles with commercially available hand-held devices can improve ventilatory muscle strength and endurance. Several studies have investigated the effects of ventilatory muscle training on dyspnoea in COPD subjects. Present study was carried out by controlling respiratory cycle by using both an incentive target-flow device to facilitate and control through visual feedback [10, 16, 20].

II. MATERIALS AND METHODS

A randomized control trial was conducted at Department of Physiotherapy, Pravara Rural Hospital, Loni, Ahmednagar District Maharashtra state, India from 1 August 2010 to 31 Jan. 2011.

Subjects: A total of 110 subjects with a clinical diagnosis of COPD were screened to find out their suitability for the study. However, only 69 subjects were found suitable to participate in the study. When these subjects were requested to participate in the study only 60 subjects participated and completed the study. The inclusion criteria were both sexes, clinical diagnosis of COPD with the age between 40 to 70 years and willingness to participate in the study. COPD as defined under ATS with mild to severe air flow obstruction as per the score of ATS was 1 to 3. Base line values of PFT were with 50% to 65 % of their predicted values. Exclusion criteria were presence of any associated systemic disease or any clinical situations that are contraindicated.

Equipment: Spirometer- P.C.BASED RMS spirometer with Computer interface Machine for PFT measurement, Incentive spirometer for resistant training to ventilatory muscles, Stethoscope, Sphygmomanometer, Postural drainage table.

Procedure: All subjects selected under study diagnosed as COPD as per definition of the American Thoracic Society with mild to moderate airflow obstruction (FEV1 50% to < 65% of predicted). All subjects were stable in condition and free of any clinical evidence of cardiovascular, musculoskeletal, neuromuscular disease or any other disease that interferes with the study.

Subjects were informed about the procedure and were requested to sign an informed written consent following which each subject underwent a standardized history and physical examination as well as the data was collected for the baseline PFT values that includes (SVC, MVV, FEV1/FVC) dyspnoea scale (By American Thoracic Society) 6 min. walk test, After this all subjects were randomly allocated to control group (Group I) and study group (Group II.) Control group continued their medication as per the advice of physician and Breathing exercises. study group subjects received supervised ventilatory muscle training along with medication advised by their physician. There were two parts of the study for all subjects. A two week learning phase (pre training) was the first part in which

familiarization of subjects with the procedure. Since they regularly visited the laboratory and did procedure very correct manner. we assumed that they were compliant. We also tested control group, who were on medication and the breathing exercises for a period of two weeks, in a manner similar to the study group. Instructions were given to breathe comfortably and after two weeks all subjects were instructed to continue their training up to eight weeks. All tests were carried out in the beginning and end of training along with measurement of PFT values , Dyspnoea score, exercise capacity on the distance walked in 6 minute.



Patient performing exercise on incentive spirometer



(R.M.S. SPIROMETER) P.C based computer interface machine



Spirometer

Table No. 16 Comparison of and post exercise mean value of all parameters in(Group I) Control group and (group II) study group .

Parameters	Group I (Control Gr,n=30) Pre Mean $\pm$ SD	Group II Study Gr.,n=30) Post Mean $\pm$ SD	't' value	'p' value	Results
M V V	28.6 $\pm$ 5.69	97.05 $\pm$ 12.62	21.73	p<0.01	Highly significant
S V C	2.05 $\pm$ 0.50	3.36 $\pm$ 0.44	13.18	p<0.01	Highly significant
FEV ₁ / FVC	43.76 $\pm$ 3.94	54.50 $\pm$ 3.37	9.34	p<0.01	Highly significant
Dyspnoea	03 $\pm$ 0	1.3 $\pm$ 0.40	18.88	P<0.01	Highly significant
Walking Distance	93.95 $\pm$ 10.45	161.25 $\pm$ 21.34	13.06	P<0.01	Highly significant

III. RESULTS

Following results revealed the improvement in pulmonary function. Post exercise value of MVV in study group(Group II) observed was 97.05L/min as compared to control group (GroupI), which was 44.9L/minute (t = 51.777, p<0.01) showing high significance. Post exercise value of SVC in study group observed was 3.36L/min as compared to control group, which were 2.22.L/min (t =5.596, p<0.01) showing high significance. Post exercise value of FEV₁/ FVC in study group was 54.50 as compared to control group 46.00. (t =14.206, p <0.01) that is highly significant. By comparing the dyspnoea grades according to ATS (American thoracic society) it was observed that post exercise dyspnoea mean values in study group (1.3) and in control group (2.2) (t =4.466, p <0.01) is highly significant

Assessment of exercise performance was by maximum distance walked in 6 minutes. In study group, 93.95 meters walking distance was increased up to 161.25 metres but in

control group it was 95.15metres increasing up to 108 metres .This shows that there was increase in walked distance in study group, which is more than in control group. This can be because of combined training reduced dyspnoea and increased strength and endurance of the ventilatory muscles as well as peripheral muscles.

(MVV- Maximal voluntary ventilation , SVC- Sustained vital capacity,FEV₁- Forced expiratory volume in 1 min., FVC- Forced vital capacity.)

IV. DISCUSSION

The results of this study suggests that COPD subjects who participated in Ventilatory muscle training in additionto their regular medication had better reduction in dyspnoea and improvement in pulmonary function as compared to control group subjects who continued only with their medication and breathing exercises . This could be due to the effect of strength training by incentive spirometer. Which places the load on respiratory muscles that involves contraction of respiratory

muscles [7] Assessment of the efficacy of these programs typically has focused on reduction of dyspnoea, improve pulmonary function and psychological advantages of training program. Exercise is a critical component in the treatment care plan of the patients of impaired respiration that is COPD.

It was decided to use incentive spirometer as a training device. This device is useful in both i.e. controlling depth of inspired air (target flow) and encourages the patient (incentive) to perform them by the means of visual feedback. Moreover, this is less expensive where respiratory frequency needs to be controlled. SVC reflects the strength while MVV reflects the endurance of the ventilator muscles [11,12,18,19.] It is observed in most of the studies that breathing against load has increased maximum inspiratory pressure and endurance capacity of inspiratory muscles because of the significant hypertrophy of the predominantly of type I and type II fibres in the diaphragm.

There are many forms of exercise programs but in present study, training program mainly included the resistance training with incentive spirometry. It was an observation that in patients with chronic obstructive pulmonary disease that diaphragm was flattened, depressed with limited respiratory excursion and consequently making a minimal contribution to ventilation. Therefore these exercises are designed for increased contractions and pressure change with improvement of diaphragmatic excursion.

Three basic principles of skeletal muscle training are overload, specificity and reversibility. The training used in our study rested on this principle that is training on incentives spirometer of sufficient intensity to produce training effect (overload) and the training and testing device used the same training modality (specificity). The reversibility principle states that the effect of conditioning decline after training ceases. Therefore, whenever patients finished the training period we recommended them to continue performing breathing exercises regularly in order to maintain the obtained improvement [7, 8]. According to AACPR committee, we have concluded that VMT can be useful part of pulmonary rehabilitation for COPD patient. It is believed that this study can be a valuable help for exercise prescription in subjects with COPD without co-morbidity.

V. CONCLUSION

Ventilatory muscle training can be used as an adjunctive intervention in the treatment of in COPD as a non-invasive method with improvement in comfort of patient.

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Analysis of Heavy Vehicular Noise Pollution in Nagaon District of Assam, India

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Abstract- Sound which is undesirable for human hearing is called as noise. When there is a lot of noise from various sources, it constitutes what is called as noise pollution. Noise pollution can be caused due to various sources – there is street noise, traffic noise, and noise in public transport places, noise in playgrounds and parks, noise in the shopping malls, noise in workplaces..... One of the greatest sources of noise pollution is Heavy vehicles like Trucks and Buses. The Noise level in Nagaon District of Assam, India has been increasing rapidly due to rapid urbanization, uncontrolled movements of vehicles. Transport is the major contributor to noise in the town, especially from heavy vehicles like Trucks and Buses.

In this paper we are trying to present about the result of noise level in dB (A) on various points of Nagaon District. It has been found out that noise levels are more than permissible in all the investigated 27 spots (in each spot 15 no. of observations are taken) around the District. Result shows, the noise should be identified as the major environmental problem and should take necessary steps to minimize it.

Index Terms- Nagaon, Noise, Noise Pollution, Sound Level Meter.

I. INTRODUCTION

The environment today is polluted in terms of noise pollution. It has in the recent past, with the developments and the activities for comfort likewise have resulted in every spheres of life. Different countries have so far introduced various legislative measures to combat these problems. Various legislations have been imposed specially in developed countries but countries like India till date could reduce to some extent. In the recent days and days to come rapid urbanization and rapid industrialization with special reference to developing countries like India have reached its pick.

Rapid urbanization, motorization and industrialization become the primary cause of noise pollution. Countries like India are suffering a lot by this pollution in name of development. According to the Occupational Safety and Health Act (OSHA), exposure to high levels of noise for long durations may lead to hearing loss, create physical and psychological stress, reduce productivity and interfere with communication (OSHA, 2006). The main social consequence of hearing impairment is the incapability to understand speech in normal environment, which is considered as a social handicap (WHO, 2006). Sound that is classified as noise, such as the warning whistle from a train, is

actually beneficial for it acts as a warning for people during a potential dangerous situation.

Noise is defined as unpleasant, unexpected or undesired sounds. The word noise comes from the Latin word 'nausea' meaning seasickness and may considered as unpleasant or disturbing sound. The word Noise is unacceptable level of sound that creates annoyance to people and interferes with conversation, disturbs sleep, causing stress and challenge to public health. High level noise may cause severe stress on the auditory and nervous system of people, particularly the children.

Noise pollution can be divided into three groups — industrial noise, community noise and traffic noise. In the case of traffic noise, major portion of traffic noise is contributed by heavy vehicles (Commercial Trucks and Buses) only. An uncontrolled movement of these heavy vehicles in the town creates so called 'traffic jam' and finally creates noise. Vehicle noise mainly arises due to three parameters i.e. engine noise, tire noise and nature of roads. The overall vehicular noise is also dependent on the characteristics of the vehicle flow, speed of the vehicles, and condition of the road and traffic management system. The relative proportion also depends on the type of highway, P.W.D. way, subway and specially the time of the day i.e. office time, school time, festive time etc. Motorized traffic is the major sources of noise pollution especially in urban areas. The people of Nagaon district are being exposed to high level noise pollution due to the uncontrolled movement of heavy vehicles especially in Haiborgaon bus stand, Haiborgaon Railway station, Nutan bazar, Hojai bus stand, Lumding etc. In turn the noise pollution is very closely related to urbanization and motorization. With the increase of number of heavy vehicles in the district together with the need of people, the hazard of noise pollution has increased and now it has exceeded the tolerance level. Noise pollution is the condition where the noise has the characteristics to injure public health or which unreasonably interferes with comfortable enjoyment of life and property.

Literature Review

Many surveys addressing the problem of noise pollution in many cities throughout the world have been conducted (Li et al., 2002; Morillas JMB, 2002; Alberola, 2005; Lebedowska, 2005; Pucher, 2005; Tansatcha et al., 2005 Kura et al., 1999; Ali and Tamura, 2003; Marius A., 2005), and have shown the scale of discomfort that noise causes in people's lives. Primarily noise problem is the result of growing busy traffic. Few studies on traffic noise level have been carried out at the different cities in India [Chakraborty, D., Santra, S. C., Mukherjee, Kudesia, V.P. and Tiwari, T. N. (2002), Nigam, S.P. (2002)] and observed that

average noise levels in their study areas are more than the standard recommended value i.e. 55 dB (A).

Table1: The noise standards in India for different types of areas are given below (CPCB - 2000).

Area	Day time 6 AM - 10 PM dB(A)	Night time 10 PM - 6 AM dB(A)
Industrial Area	75	70
Commercial Area	65	55
Residential Area	55	45
Silence Zone	50	40

In Assam, due to rapid urbanization, motorization and population growth, the transportation sector is growing rapidly and number of vehicles on roads is increasing rapidly, which leads to overcrowded roads and pollution. It is also noticed that some outdated heavy vehicles (sand carrying trucks and goods carrying trucks) are moving freely in the district contributing a major portion of noise pollution. Therefore, an attempt has been made for comprehensive study of heavy vehicular noise pollution in Nagaon district of Assam. Nagaon district is one of the largest district of Assam. It is located at a distance of 123 kilometer by road from Guwahati. Nagaon district is located between 250 45/ to 260 45/ north latitudes and 920 33 / east and 930 20/ east longitude. Average altitude of Nagaon district is 60.6 meters above the sea level.

The objective of the study is that to identify the factors responsible for higher vehicular noise level in the district by measure vehicular noise by NOISE LEVEL METER in dB (A).

II. MATERIALS AND METHOD

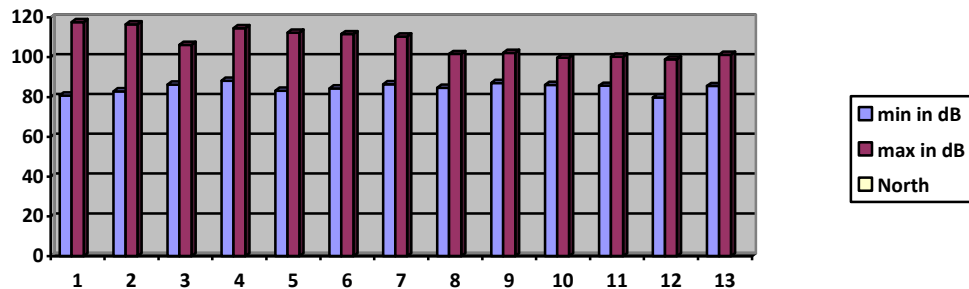
The vehicular noise levels are measured with the following standard procedure using calibrated sound pressure level (in dB) meter in decibel unit. The instrument consists of microphone, amplifier, network weighting (A, B, and C) and a digital display to read the noise level. Some observation and readings of vehicular noise level were taken on Nov., 2011 to Feb 2012 at some selected places of Nagaon district. In each selected sites, noise levels were measured in three different spots and on each spot, the measurement were taken at fifteen times during day time. The readings are taken by SLM from a distance of 5m. from the center of the road and placing it at a height of 1m.



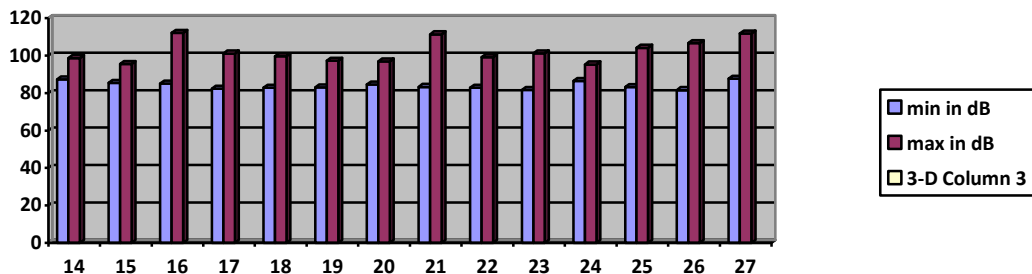
Table 2: Maximum and Minimum Readings Given By Slm in the Selected Places of the District

Sl No	places	Spots	No of obs.	Min.(dB)	Max.(dB)
1	Haiborgaon (Nagaon)	Haiborgaon (Morigaon bus stand)	15	80.8	117.6
2		Haiborgaon Traffic point	15	82.9	116.5
3		Haiborgaon old AT Road	15	86.3	106.2
4		Haibargaon Railway Crossing	15	88.2	114.6
5		Haiborgaon -Rupahi Bus Stand	15	83.2	112.3
6	Nagaon	Joyshree Cinema Point	15	84.3	111.6
7		Nowgong College Point	15	86.4	110.4
8		Panigaon Chariali	15	84.6	101.6
9		Natun Bazar Traffic Point	15	87	102.8
10	Nagaon	Nagaon Civil Hospital Point	15	86.1	99.8
11		Hojai-Lanka Bus Stand	15	85.7	100.2
12		Dhakaipatty(Hotel Bahagi)	15	79.8	98.9
13		SBI Main Branch Point	15	85.5	101.2

14	Raha	Raha Bus Sand	15	87.3	98.7
15		Raha Market	15	85.4	95.5
16		Near National Highway	15	85.1	112.2
17	Hojai	Main Bus Stand	15	82.3	101.1
18		Near Railway Station	15	82.9	99.6
19		Natun Bazar Point	15	83	97.2
20	Lumding	Bus Stand	15	84.6	96.9
21		Lanka-Lumding High Way	15	83.3	111.4
22		Lumding Bazar	15	82.9	99.1
23	Kalibor High Way	Kaliabor Tinali	15	81.7	101.2
24		Near Kaliabor College	15	86.4	95.3
25	Daboka	Daboka Bus Stand	15	83.2	104.2
26		Doboka-Nagaon High Way Point	15	81.6	106.7
27		Doboka-Hojai 4Lane Point	15	87.6	111.8



Bar diagram 1, shows comparative study of min. and max. Noise level in dB (A) in the spots of Nagaon and Haiborgaon of Nagaon district as measured by SLM.



Bar diagram 2, shows comparative study of min. and max. Noise level in dB (A) in Raha, Hojai, Lumding, Kaliabor and Daboka of Nagaon district as measured by SLM.

III. CONCLUSION

The aim of our study was to identify the specific places of the district which is not suitable for the human hearing or causes hearing impairment and problem in hearing. The study clearly indicates that noise pollution implies an unjustifiable interference and imposition upon human comfort, health and quality of modern life.

The recorded noise levels taken by Noise Level Meter in different places of Nagaon district of Assam in dB (A) is

assessed and analyzed. As there is no defined basic noise levels on the roads prescribed by CPCB, India, the detected noise levels of Nagaon district in day time are compared with the prescribed basic noise level (tolerance level) on roads traffic noise during day time at United Kingdom i.e. 70 dB(A) (Krishna Murthy et al., 2007). In all locations, the noise level has increased due to vehicular noise. It is found that in all places noise level exceed maximum value of minimum level of pollution and creating an environment with high level noise pollution and the study proves that Nagaon district is highly affected by noise pollution. This is because NH-37 is running through the middle of the town; the

breadth of the roads of the district is narrow compared to number of vehicles and rapid increase of number of vehicles. It is found that the loaded trucks, sand carrying trucks, Public Buses and other heavy vehicles are moving freely in the town causing high voltage noise. Same picture of noise pollution reflects in other places of the district. Therefore, Nagaon district administration, people and Govt. of Assam should take some imperative steps and regulatory measures to abate such vehicular noise pollution.

The study implies that natural vegetation, if high enough, wide enough, and dense enough, can decrease roadway traffic noise to some extents. The effectiveness in the screening of Vegetation plant noise barrier depends on the thicknesses of vegetation belts along the roadways and density and size of leaves (type of vegetation). Vegetation plant noise barrier are environmental friendly, having natural appearance and hence can be used as noise minimizer. This study was carried out to calculate the effectiveness of sound absorption from naturally grown vegetation under varying traffic conditions. Several places having naturally grown vegetation's on roadsides were selected for this study. Experiment proves that effective noise barriers can reduce noise levels by 4 to 6 decibels if is properly established and utilized. The measurements clearly show that noise absorption is linearly proportional to the width of the vegetation barrier.

General recommendation to reducing the noise pollution in these areas is:

- Restricting heavy vehicles movement within the urban and residential areas of the district.
- Banning of hydraulic horns, improvement and streamlining of roads and parking system, discouragement of high sound producing vehicles.
- Natural vegetation buffer zones and plantation of trees of high density must be created in these areas to minimize noise pollution.
- Public awareness would also helpful in reduction of the present noise level.
- Sustainable traffic management and proper town planning can also reduce noise pollution.
- Launching programs to monitor and control noisy vehicles on the roads.
- Older heavy vehicles should be replaced from the roads and District Transport Authority should be strict regarding this serious problem.

Together with these suggestions if the district administration takes bold steps to minimize noise pollution in the district then in practical we can control noise pollution to save our future generation.

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Analysis, Design and Control of Zero Current Switching DC To DC Buck Converter

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Abstract- A soft-switching buck converter is proposed for battery charging application. This converter can also be used with other low voltage miniature applications. Resonant inductor and capacitor helps to turn on-off the switch at zero current. This reduces switching losses in our conventional converter. In order to determine two (current) zero-cross points for switch-on and switch-off, the quasi-resonant state is employed. The quasi-resonant state is performed in full-waveform mode. This makes output voltage independent of output load variation. This leads to efficiency higher than conventional converter due to ZCS. Complete design-oriented mathematical calculations were done for zero current resonant switching converters. The performance of the proposed converter is evaluated on a 3.24-W (6 V/0.54 A) experimental prototype.

Index Terms- Soft switching, Zero current switching (ZCS)

I. INTRODUCTION

Advances in power electronics in the last few decades have led not only to improvements in power devices, but also to new concepts in converter topologies and control [1].

Electromagnetic interference (EMI) generally exists in all electrical and electronic equipment, especially in all DC/DC converters. Since the switching frequency applied in DC/DC converter is high it causes significant EMI if carelessly designed [2]. The high dv/dt and di/dt involved in the switching operation of traditional hard-switched power electronics devices are the major source of EMI emission. In order to improve the energy efficiency and reliability of power converters soft-switching techniques created in 1980s have been proposed to reduce [4].

- The switching power losses across the power devices,
- The switching stress of switched-mode power electronics circuits.

Zero current switch quasi-resonant-converters implement ZCS operation. Since switches turn-on and turn-off at the moment that the current is equal to zero, the power losses during switch-on and -off become zero. Consequently, these converters have high power density and transfer efficiency usually, the repeating frequency is not very high and the converter works in the resonance state, the components of higher order harmonics is very low. Therefore, the electromagnetic interference (EMI) is low, and electromagnetic susceptibility (EMS) and electromagnetic compatibility (EMC) are reasonable.

In this proposed soft switching converter output L-C filter is also designed to give constant output voltage with less than 0.01% ripple. Experimental results based on 3.24-W (6 V/0.54 A) prototype circuit are presented to verify the performance of the proposed converter.

II. CIRCUIT CONFIGURATION

Fig .a. shows the block diagram of proposed converter. From it it's clear that input DC voltage is changed to low voltage DC output. It is basically a DC- DC converter. Converter used here is off resonant type; particularly here zero current switching converters are used. Converter is controlled through 3524 PWM IC and totem pole driver circuit.

Fig.1. shows a circuit diagram of the proposed converter. Circuit consists of resonant capacitor (C_r) parallel with diode (D). Resonant inductor (L_r) is in series with switch (S) and supply DC voltage. Here MOSFET is used as switch. It contains parasitic diode inbuilt with it. This diode helps in full waveform mode operation of resonant converter. Filter inductor (L_f) and capacitor (C_f) is used for getting constant DC output voltage. L_f is made high to get approximately constant output current. Resistive load (R) is used to verify the result. Characteristic impedance is defined as :

$$Z = \sqrt{L_r/C_r}.$$

One need to ensure $V_{in}/Z > I_o$ to guarantee that current will return to zero. I_o is the output current and $I(L_r)$ is resonant inductor current. As soon as switch is turn on C_r and L_r forms series resonant circuit having capacitor parallel load (I_o). Switch is turn on till resonant current comes to zero again. This leads to zero current turn off the switch .This reduces switching losses and results in increase in efficiency of the converter.

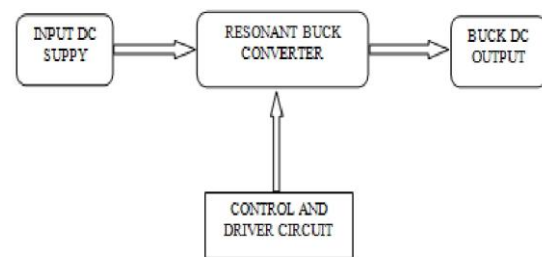


Fig.a: Block diagram of proposed converter

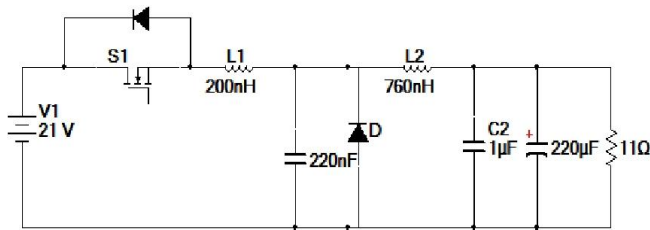


Fig.1: Circuit diagram of the proposed soft-switching converter

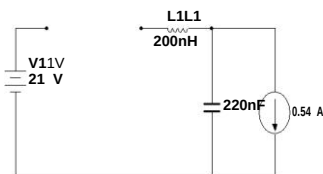
III. OPERATION PRINCIPLE

Various ZCS can work either in half wave mode (fig.7) or full wave mode (fig.6) as given in reference [4]. It can be seen that output voltage is sensitive to the load variation in half wave mode. At light load conditions, the unused energy is stored in C_r , leading to an increase in the output voltage. Thus, the switching frequency has to be controlled in order to regulate the output voltage. If an anti-parallel diode is connected across the switch, the converter will be operating in full-wave mode. The operation is similar to the one in half-wave mode. However, the inductor current is allowed to reverse through the anti-parallel diode and the duration for the resonant stage is lengthened. This permits excess energy in the resonant circuit at light loads to be transferred back to the voltage source V_i . This significantly reduces the dependence of V_o on the output load.

Various ZCS relationship in full wave mode has been derived by assuming various ideal conditions. But as this is not practical one, so later in this article non-ideality is also taken into account for getting the exact relations. But first start with ideal conditions

Followings is the assumptions:-

- Filter inductor is assumed to be very large so that output current I_o assumed to be off constant magnitude.



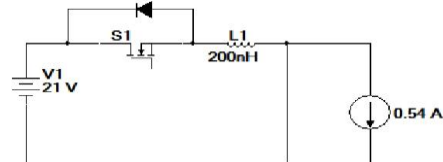
Mode c

- Diode D is assumed to be ideal, and so there is no voltage during ON state.
- MOSFET is also assumed to be ideal and so there is no resistive and switching loss.
- Voltage source is also assumed to be ideal voltage source means there is no inductance.
- Capacitor and inductor is also assumed to be ideal, assuming there is no resistance across it.

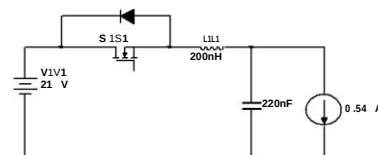
This ZCS configuration has been discussed in mainly four mode of operation namely mode a, b, c, d as shown in fig.5. Each configuration has been divided into four different time intervals as shown in fig.6.

Now various modes of operations are discussed as follows:

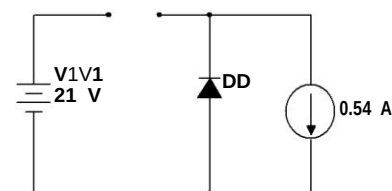
Mode a ($t_0 - t_1$): At time t_0 , the switch is turned on. Because of I_o flowing through the diode it appears as short circuit and the entire input voltage V_{in} appears across L_r . Therefore, the switch current builds up linearly until it becomes equal to I_{out} at time t_1 . Beyond this time, the diode turns off and the voltage clamp across C_r is removed. Switch S1 turns on at t_0 , the source current increases linearly with the slope V_{in} / L_r ; this is called current linear rising interval. This current is smaller than the constant loading current I_{out} . Therefore, current doesn't flow through the resonant capacitor C_r . The transistor turn on, causing current to ramp at $di/dt = V_{in}/L_r$ ----- (b)



Mode a



Mode b



Mode d

Mode b, mode c, mode d: Beyond t_1 , $i_t > I_{out}$ and their difference ($i_t - I_{out}$) flows through Cr. At t , it peaks and $V_c = V_d$. The circuit configuration give

$$V_{in} = Lr(di/dt) + V_d \quad - (1)$$

$$i_{cd} = C_d(dv/dt) = i_t - I_{out} \quad - (2)$$

Differentiating (1) and substitute it in (2). If the time when the diode turns off is used as the reference time $t=0$, the initial conditions are taken as $i_t(0) = I_{out}$. The solution is an undamped sinusoid,

$$i_t(t) = (V_{in}/Z_c)\sin(Wrt) + I_{out} \quad - (a)$$

Where:

W_r is the resonant frequency.

$$Z_c = \sqrt{Lr/Cr}$$

Notice that we need to ensure $V_{in}/Z_c > I_{out}$ to guarantee that the current will return to zero. This is an important detail: the characteristic impedance must be low enough to provide large variations in the inductor current when the resonant circuit is operating. In this case

$$I_1 = V_{in}/Z_c$$

Resonant converter action is generated as follows:

- Keep the MOSFET gate signal high until the current $i_t(t)$ reverses polarity. When the current reverses, the internal diode of the MOSFET will carry it.

- Turn the gate signal off at the current is negative (this will make the internal diode control the turn-off process).
- The MOSFET will turn off at the current zero crossing from negative to positive when its internal current reaches zero.

This action is illustrated in Fig.6. The turn on-time of MOSFET is the time from $t=0$ until the rising zero-crossing of the current occurs. This is just slightly less than one cycle of the resonant waveform. This point is the MOSFET turn-off is the solution of the set of equations:

$$0 = (V_{in}/Z_c)\sin(Wrt) + I_{out} \quad - (d)$$

- To find the output voltage, the voltage V_d (across the C_d) is needed. The configuration of interest is mode b and mode c, since V_d is zero otherwise. In mode b, the voltage equation can be derived from earlier relation (1) and (a) to give:

$$V_d(t) = V_{in}(1 - \cos(Wrt)) \quad - (3)$$

This equation is valid till t_{off2} . At time t_{off2} the mode c is valid and entire load current flows out of the capacitor. The capacitor voltage drops linearly according to $-I_{out} = C_d(dv/dt)$. When the voltage reaches zero, the diode turns on and the converter returns to **mode d**.

- Over a switching period T , average diode voltage will be required output voltage:

$$\langle V_d \rangle = \frac{1}{T} \left[\int_0^{t_{off2}} V_{in}(1 - \cos(Wrt)) dt + \int_{t_{off2}}^T V_d(t) dt \right]$$

Using above relation required output voltage can be found out just by changing the total time period T. We can get varied range of voltage using the above relation but meanwhile we have to insure that there is enough time for the operation of various modes without any fail, otherwise our objective of ZCS won't fulfill. To ensure ZCS operation of the output diodes, the half resonant period of inductor current should be finished before the power switches are turned off. So for proper operation gate pulse is given till little longer time than calculated to ensure zero switching operation. This is taken as safety precaution from designer point of view.

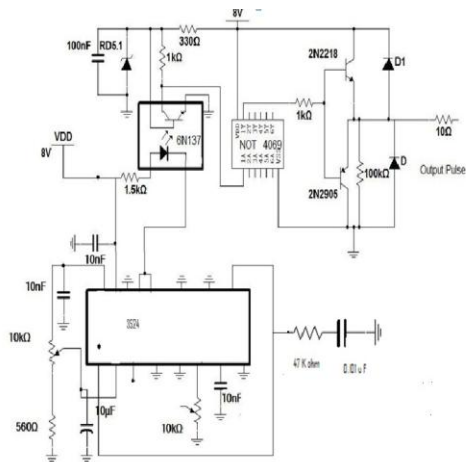


Fig.2: Driver and control circuit

Fig.2 shows a driver and control circuit diagram of the proposed converter. Control circuit consists of 3524 IC which is used for PWM. As from the datasheet of 6N137 Optocoupler pin 2 is connected to +12 V supply through a 1.5 kilo ohm resistor to limit the high current. Whenever 3524 output transistor turn on pulse at output goes to zero as diode in the optocoupler starts conducting and output gets shorted to ground. Output of optocoupler which is at pin 6 is connected to the 4069 IC. It inverts the input waveform. In addition to that it also rejects the noise present at the output of optocoupler. It results into perfect noise free PWM output at output pin. Output of 4069 is connected to the base of totem pole configuration through 1 kilo ohm resistor.

Totem pole configuration is used basically to drive the MOSFET in a healthy manner. MOSFET contains parasitic capacitances between Gate-Source (C_{gs}) and Gate-drain (C_{gd}). So as soon as gate pulse is given it (mosfet) draws initial current to charge its parasitic capacitors from the driver circuit. So for proper operation of MOSFET, driver should be in position to provide appropriate charging current. For charging purpose only 2N2218 is used. Gate pulse voltage applied between gate and source should be greater than threshold voltage (V_{th}) to turn on the device.

The gate drive must charge both C_{gd} and C_{gs} . The C_{gd} portion produces interesting effects in some converter arrangements: Since switch action causes the drain voltage to swing quickly between low and high voltage values, it is possible that a substantial current $I_{gd} = C_{gd} (dv/dt)$ will flow.

The gate drive must provide enough charge to account for this current as well as the current needed to charge C_{gs} [4].

To make the mosfet change state, the gate drive must charge the capacitor to sufficiently high voltage for turn-on, and then remove the charge for turn-off. The charge – discharge process is a time limiting step. It can also be reliability limiter. IRF 450 has got turn on time of about 90 s. so low –impedance gate drives are necessary, but create problems of their own. As the impedance drops lower and lower, the gate driver becomes a switching power converter in its own right the gate drive switches then require gate drives, which in turn require gate drives, and we are left with an unsolvable problem, real gate drives are limited to impedance on the order of five to ten ohms.

Gate drive resistance is calculated with the following relation:

$$R_g = t_r / (2.2 * C_{iss})$$

Where, $C_{iss} = C_{gs} + C_{gd}$

IV. DESIGN EXAMPLE

To verify the operation and performance of the proposed converter, a 3.24-W (6 V/0.54 A) experimental prototype circuit was built for battery charging application. A design procedure for the 3.24-W converter is presented. The specification are as follows:

$$V_{in} = 21V$$

$$V_{out} = 6V$$

$$I_{out} = 0.54 A$$

The selection of the resonant inductor and capacitor
Is determined by the need to satisfy the relation

$$V_{in}/Z_c > I_{out}$$

$$\text{Where, } Z_c = \sqrt{L_r/C_r}$$

So keeping these things in mind value chosen are:

$$C_r = C_d = 0.22 \text{ micro farad}$$

$$L_r = L_1 = 120 \text{ micro Henry}$$

According to the relation given in b, as the transistor turn on,
causing current to ramp at

$$di/dt = 21/120 = 0.175 \times 10^{-6} \text{ A/s}$$

so diode current will be zero in
 $0.6 \times 10^{-6} / 0.1782 = 3 \mu s$

so the diode current will drop to zero in 3 micro-second after
transistor turn on, then the circuit enters into mode 2.

$$Z_c = \sqrt{L_r/C_r} = \sqrt{120/0.22} = 23.386 \text{ (it is also called characteristic impedance)}$$

According to relation given in (c)

$$I_1 = V_{in}/Z_c = 21/23.3 = 0.899$$

This show:

$V_{in}/Z_c > I_{out}$. So resonant condition gets fulfilled.

However if load increases above 0.899, this LC combination
will no longer support soft switching.

$$W_r = 1/\sqrt{LC} = 0.01946 \times 10^6$$

$$f_r = W_r/2\pi = 30.97 \text{ kHz}$$

From the relation (d)

$$W_r t_{off} = 36.86$$

It (t) will be zero at 216.86(in degree) and 323.14(in degree).
Corresponding time can be calculated as

$$t_{off1} = 216.86 \times \pi / 180 \times 0.1988 = 19.03 \mu s$$

$$t_{off2} = 323.14 \times \pi / 180 \times 0.1988 = 28.36 \mu s$$

So MOSFET gate signal should be held high until $(3 + 19.03 = 22.03 \mu s)$. And it should be turn – off before t_{off2} is reached.
The gate signal of $22.5 \mu s$ will work nice in this case.

- The second integral is the area of a triangle. The triangle peak value is given (3):

$$V_d(t_{off2}) = 21 (1 - \cos(323.14)) = 4.19 \text{ V}$$

The time until V_d reaches zero is:

$$t = V_d(t_{off2}) / (I_{out}/C_d) = (4.19 \times 0.22) / 0.54 = 1.70 \mu s$$

From (ii)

$$\Delta \text{Area} = (0.22 \times 4.19) / (2 \times 0.54) = 3.57 \times 10^{-6} \text{ Vs}$$

From (i)

$$\begin{aligned} & [I_0 \int_{t_{off2}}^{t_{off1}} V_{in}(1 - \cos(W_r t)) dt] \\ & = 21 [28.36 + 3.49] \\ & 668 \times 10^{-6} \text{ Vs} \end{aligned}$$

So the average output voltage is

$$\langle V_d \rangle = (668 + 4.19) / T \quad \text{-----(F)}$$

Since the desired output is 6v then:

$$6 = (668 + 4.19) / T$$

$$T = 112 \mu s$$

So from above we get $f \cong 9 \text{ kHz}$ in **ideal** condition. But in **practical** case we have to take care the drop across the diode also over the period of time which is around 1.5 V during turn on time of diode.

$$6T = (668 + 4.19) - 1.5 (T - 33.53) \quad [33.53 \text{ is the off time of diode}]$$

Which gives $T \cong 96 \mu s$

And frequency = 10.37 kHz

By taking other non ideality in MOSFET, inductor, capacitor
practical switching frequency is coming around 13.4 kHz.

V. EXPERIMENTAL RESULTS

3.24-W (6 V/0.54 A) prototype of the ZCS converter, as shown in Fig. 1, is built to verify the theory. And the result is compared with simulation.

The specifications of the experimental prototype is as follows:

Input voltage = 21V, Output voltage = 6V, output current = 0.54 A.

Circuit parameters of the proposed converter are as follows.

- 1) Switch: MOSFET IRFP450.
- 2) Diode: PFR856.
- 3) Resonant capacitor: 0.22 uF/400 kV.
- 4) Filter capacitor: 220 uF/400 V.
- 5) Resonant inductor: 0.2mH (Pot core 26/11).
- 6) Output filter inductor: 0.67 uH (pot core).

Fig.13 shows the simulated waveforms for the above designed circuit.

Fig 8.Shows that as soon as we turn on the MOSFET current through the resonant inductor start increasing and it reaches maximum current (I_{max}) during resonance and again come back to zero .And that instant gate pulse has to be turned off. Then also current flow in small amount in negative direction due to the inherent diode connected inside the MOSFET. So MOSFET turns off at diode voltage drop.

Fig 8. Shows that maximum capacitor voltage reaches to around 38 V. But from the resonant theory it's clear that voltage should be twice the input voltage in ideal case. But in practical case due to drop in MOSFET and Inductor, voltage is less than ideal case. Voltage will start rising only when current has reached output current of 0.54, as you can appreciate these things in a better way from fig.12.

Fig 10.Shows that Output voltage is constant DC output voltage of magnitude 6 V for a particular frequency of 13.5 kHz. As from above relation (F) we can increase the output voltage by increasing the switching frequency but we have to also insure proper zero crossing of inductor current. Output voltage contains ripple of about 0.001%.

Fig 11.Shows that during turn on and during turn off there is no voltages shoot up as you can see these things in conventional buck converter. This results into less voltage stress of switches during switching times. During off state voltage waveform has got some short of oscillations due to parasitic capacitance and inductance of driver circuit.

Efficiency

From current waveform, average input current can be found out to be

$$I_{avg} = 0.192 \text{ A}$$

$$P_{out} = (6 * 0.54) = 3.24 \text{ watt}$$

$$P_{in} = V * I_{avg}$$

$$= 21 * 0.192$$

$$= 4.03 \text{ watt}$$

$$\text{Efficiency} = P_{out}/P_{in} = 3.24/4.03 = \mathbf{80.35\%}$$

Without resonance

$$I_{avg} = 0.198 \text{ A}$$

$$\text{Efficiency} = P_{out}/P_{in} = 3.24/4.15 = \mathbf{77.9\%}$$

And efficiency of this converter is coming around 81% mainly because of the on state drop of diode at freewheeling time. This drop is coming around 1.2 V with PFR 856. This reduces my efficiency. To overcome this problem, we can replace diode with MOSFET having on state drop of around 0.3 V. This will improve the efficiency of above converter above 90%.

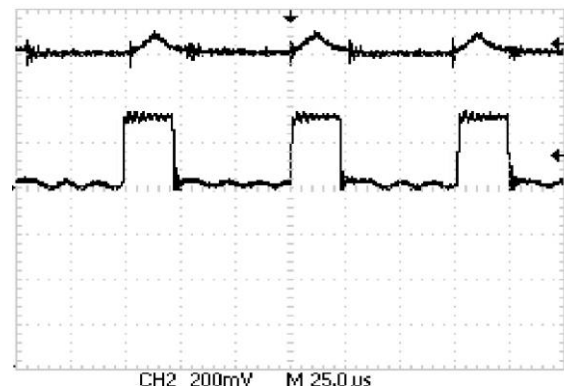


Fig 8: Current waveform with gate pulse

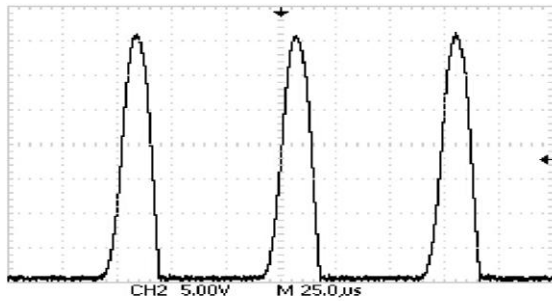


Fig 9 : Voltage waveform

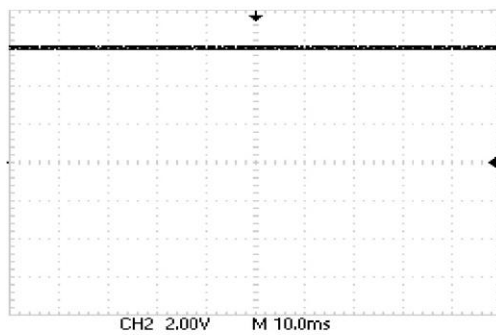


Fig 10: Output Voltage

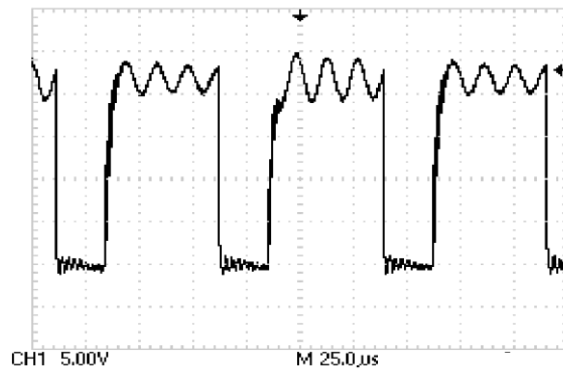


Fig 11: Voltage waveform across Switch

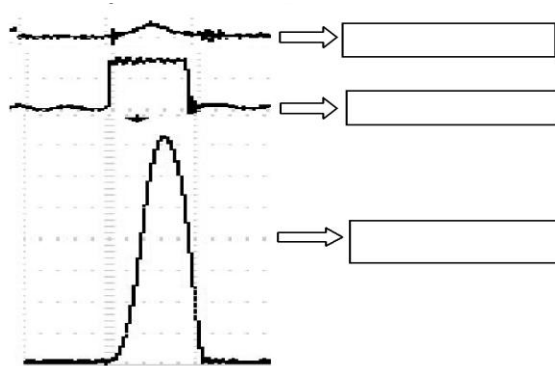


Fig 12: Waveform for combined inductor current and resonant capacitor voltage with gating pulse



Fig 13: Simulation waveform
(From top to bottom- resonant inductor current, resonant capacitor voltage, MOSFET voltage, Gate pulse, Output voltage)

VI. CONCLUSION

In this project zero current soft switching DC- DC has been designed and implemented using hardware. Switching losses has been reduced to a greater extent. Furthermore, power conversion efficiency can be improved by the soft-switching operation of switching devices. This operation requires a larger output filter. The resonant inductor current works here in DCM. The reverse-recovery loss of the output switch is reduced. Experimental results based on a 3.24-W (6 V/0.54 A) prototype have evaluated the performance of the proposed converter. The efficiency of the proposed converter is potentially better than the conventional buck converter.

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Performance Evaluation of SMT and CMP Processor Using Super Scalar Simulator

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Abstract- Multithreading and prefetching are the techniques used to increase the performance of the processor. Multithreading executes another concurrent thread when running thread encounters a cache miss. Prefetching increases the single thread performance by predicting the data address in advance. This paper presents the performance of standard benchmarks in simultaneous multithreading processor (SMT) and chip multiprocessor (CMP). SMT is a tightly coupled system where the processor and the cache are dependent on each other. CMP is a loosely coupled system with independent processor and cache. The processor is demonstrated by cyclic accurate execution driven simulator and the processor performance are evaluated based on execution speed and execution time.

Index Terms- SMT, CMP, Parallel Computing, Distributed Computing.

I. INTRODUCTION

As the speed gap between processor and memory system increases, a processor spends more time on memory stalls. To tolerate large memory latency, there have been a number of proposals for data prefetching [1]. Recently, a novel thread based prefetching technique called pre execution has received much attention in the research community.

Simultaneous multithreading (SMT) process program with multiple processors [6]. These processors share their common memory location. SMT processor balances the workload dynamically among the processors [2]. SMT processor resources are duplicated to handle more than one computational entity. Also there are large numbers of dependencies between instructions and multiple entities are executed to occupy unused resources.

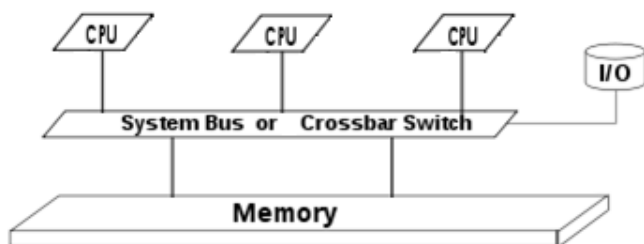


Fig. 1: The SMT Architecture.

The next performance increasing technique is chip multiprocessor (CMP). CMP duplicates the entire subsystem on a

single die [7]. Each core will have their primary and secondary cache. It is also possible to modify the processor with additional logic to behave as a dual core die.

These two processors are evaluated based on the performance of multi programmed environment [5]. Both the processors have limitations related to resources shared by multiple thread contents and are centered on data and instruction path connecting one processor with another.

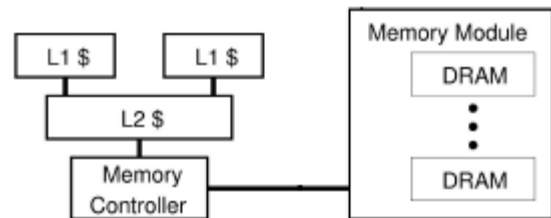


Fig. 2: The CMP Architecture.

This paper is based on performance of simultaneous multithreading processor (SMT) and chip multiprocessor (CMP). SMT is a tightly coupled system where the processor and the cache are dependent on each other. CMP is a loosely coupled system with independent processor and cache. The processor is demonstrated by cyclic accurate execution driven simulator and the outputs are evaluated.

II. RELATED LITERATURE

Pre-execution technique can be applied based on hardware and software configurations. Pre-execution techniques [7] for simultaneous multithreading (SMT) processor have been proposed and the performances are obtained by executing in simple scalar simulator. Optimizations can be made statically and dynamically to improve processor performance. Source-to-source compilation of pre-execution thread with program slicing, prefetch conversion and thread scheme selection algorithms are proposed [4].

Instruction traces are analyzed by speculative pre-computation [1] and data-drive multithreading [4] to pre-execute cache miss loads. Another technique used for pre-execution is execution-based prediction [8], which extracts the pre-execution code from binaries without instruction traces.

Dynamic speculative pre-computation [10] and dependence graph pre-computation [9] perform pre-execution which extract the code using trace processing hardware. Slip stream processor [15] identifies fault tolerance using speculative compute engine which runs on SMT and CMP processor. CMP processors

resources and caches are independent of each other so, whenever a change is made that does not reflect the entire processor system.

III. IMPLEMENTATION DETAILS

3.1 SESC Utilities

The performance of SMT and CMP processor is evaluated by super scalar simulator (SESC) [11]. Before building the super scalar source code it is necessary to build utility files. Super scalar utility is a group of building programs to run SESC. Super scalar utility is a cross-compiler tool chain which is used to compile programs on PC for running on MIPS. Before building utility file the compiler version is to be changed. SESC is built based on gcc 3.4 compiler version. Newer version of gcc is not compactable with older one.

To change the compiler version, files from deb packages are downloaded and installed in the system. The gcc versions are listed down and the needed version is selected based on the option. With utility tar file, original utility files are extracted and moved to the home directory. Build common file configuration is changed which is present in build-mipseb-linux. All the utility files are executed by installing bison, flex and lib.

3.2 SESC Environment

To build super scalar environment in the system, download the source code from cvs and place it in the home directory. Create a build folder and configure the super scalar simulator by installing bin utility which is necessary for building program running on super scalar simulator. If errors persist include limits and stdint header files. Install dev files and run make command. Successfully simulator is installed and test cases are checked.

3.3 Benchmarks

To test this experiment, benchmarks of SPEC CPU2000 and SPLASH2 are evaluated using super scalar (SESC) simulator. These benchmarks are given by standard performance evaluation corporation (SPEC) to identify and improve the processor performance. The simulation results are obtained by executing the benchmarks in SMT and CMP processor.

3.4 SMT Processor

There are number of configurations available within the super scalar simulator. To execute the benchmarks in SMT processor, enable the configuration file of simultaneous multithreading processor and create an environment by adopting the changes in library files. The benchmarks are executed and the results are tabulated in TABLE 1

TABLE 1
Applications Executed in SMP Processor

Applications	Execution Speed (KIPS)	Execution Time (sec)	Simulation Time (msec)
Crafty	949.830	21.750	7.787
Fft	958.939	0.330	0.078
Radix	923.964	41.640	32.809
Barnes	206.00	0.010	0.012
Smatrix	1073.764	2.080	0.383
Mcf	211.00	0.010	0.012

3.5 CMP Processor

To execute the benchmarks in CMP processor some changes are made by moving the configuration file to the executing environment. This change enables the chip multiprocessor and the benchmarks are executed. The results are tabulated in TABLE 2.

TABLE 2
Applications Executed in CMP Processor

Applications	Execution Speed (KIPS)	Execution Time (sec)	Simulation Time (msec)
Crafty	418.267	49.390	4.517
Fft	351.611	0.900	0.082
Radix	293.156	131.240	29.800
Barnes	206.00	0.010	0.014
Smatrix	271.377	8.230	0.33
Mcf	105.500	0.020	0.015

IV. CONCLUSION

The performance of SMT and CMP processor using super scalar simulator is presented in this paper. The future work will concentrate on improving the performance of processors by creating helper thread to reduce cache miss rate.

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Compression of Quasi-Group Encrypted Grayscale Images

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Abstract- When data is transmitted over insecure bandwidth-limited channels, data compression and encryption is always necessary. Slepian-Wolf coding can be applied to the lossless compression of encrypted sources. But for the images, image compression techniques present in the literature that make use of Markov properties in the Slepian-Wolf decoder do not offer significant result. This paper proposes compression of encrypted grayscale image. An encryption algorithm called Quasi-group is used to encrypt the grayscale image so as to protect the image during transmission. The encrypted image is compressed progressively in resolution by Resolution Progressive Compression (RPC) technique. The experimental result shows that the proposed approach provides significant security and high PSNR value.

Index Terms- Slepian-Wolf coding, RPC, Quasi-group, bandwidth-limited channel, PSNR

I. INTRODUCTION

Information explosion combined with the extensive development in software and hardware technology are changing industries, educational institutions, organizations, etc., towards 'paperless' environment. This transformation has a strong influence on the quantity of information digitized, thus raising the requirement for competent storage techniques. In association compact storage necessity, security is also regarded as an essential factor during image transmission and storage. Presently, digitized information generally comprises of compound images, which are a mixture of different data types like text, graphics, images, etc. traditional image compression techniques do not create quality compression and thus lot of research has been done in the area of image compression[1].

When data is broadcasted over insecure bandwidth-limited channels, data compression and encryption becomes very necessary. An encryption algorithm transforms the information from comprehensible to incomprehensible structure, thus causing the encrypted data hard to compress by means of any of the classical compression algorithms, which depends on intelligence embedded in the data [2].

Image compression schemes can be broadly classified into two types: Lossless compression and Lossy compression. In lossless compression, the image after compression and decompression is identical to the original image and every bit of information is preserved during the decompression process. The reconstructed image after compression is an exact replica of the original one. Lossless compression scheme is preferred in the case of medical image compression. In lossy compression, the reconstructed image contains degradations with respect to the original image. Here perfect reconstruction of the image is

sacrificed by the elimination of some amount of redundancies in the image to achieve a higher compression ratio. In lossy compression, a higher compression ratio can be achieved when compared to lossless compression [3].

II. LITERATURE SUPPORT

In order to compress the encrypted data stream, researchers have proposed several techniques based on Distributed Source Coding (DSC). DSC utilizes the correlation between the encryption key and the encrypted data, since the encryption key will be known at the decoder. The compression competence of DSC is based on this correlation, such as in this case the statistics of the information source (image) [4].

Kumar and Makur [5] proposed to apply encryption on the prediction error instead of the image. As the prediction errors utilize a Laplacian density function, significant compression can be attained. But, when the information owner applies encryption on the spatial domain of images, DSC based techniques cannot attain significant compression due to the uneven statistical distribution of pixels of the image.

An encrypted image is compressed progressively in resolution by Resolution Progressive Compression technique. The encoder initiates by transferring a downsampled version of the cipher text. At the decoder, the equivalent low resolution image is decoded from which a higher resolution image is obtained by intraframe prediction. The symmetric cryptographic technique called Quasi-group has good data scrambling property is used to encrypt the grayscale images[7] [8].

Slepian-Wolf codes are observed to produce fair results for binary images. But, certain drawbacks are associated with this approach. (i) Markov decoding in a Slepian-Wolf decoder is costly, particularly when handling with sources of nonbinary alphabets. (ii) Bit-plane based markov decoding indeed minimizes the complexity, however the source dependency that initially defined in the symbol domain is generally not fully utilized when translated to bit-planes. (iii) As image and video data are known to be extremely non-stationary, a global markov model cannot illustrate its local statistics accurately. Yang et al., [10] integrated Slepian-Wolf coding and trellis coded vector quantization for lossy compression of encrypted Gaussian sources.

Lossy image coding by Partitioned Iterated Function Systems (PIFS) commonly known as fractal image compression. In this approach, an image is encoded as a group of contractive transformations which denote the image compactly and generate an approximation to the original image. Fractal image compression has high compression ratio and resolution independence [12]. A novel secure image-coding is presented for still images based on encrypting certain parameters in the

contractive fractal transformation. Thus the end user gets only a partially readable image of poor quality. The clear image can be obtained upon request. In this scenario, the distributor will provide the client with a simple key to retrieve the clear image from the low quality image. This approach is highly secure and moreover, it offers relatively high compression.

The JPEG grayscale image compression is based on a data embedding technique that uses a secret key and secret mapping vector in the frequency domain. An encrypted feature vector obtained from the frequency domain is embedded redundantly and imperceptibly in the marked image. On the receiver side, the feature vector from the received image is obtained again and compared against the obtained watermark to authenticate the reliability and legitimacy [13].

III. METHODOLOGY

The proposed approach compresses the encrypted image progressively in resolution. This paper uses the quasi-group encryption and resolution progressive compression techniques.

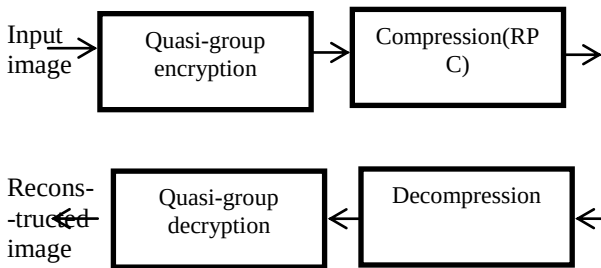


Figure 1: Proposed approach

The encryption technique used in this approach is the quasi-group, which has significant data-scrambling properties and thus it has effectively used in symmetric cryptography. The main aim of the scrambler is to enhance the entropy at the output even in scenario where the input is constant. The massive complexity associated with the assignment of discovering scrambling transformation assures the effectiveness of the encryption process. Quasi-group encryption is a development that has permutation based scrambling at its basis.

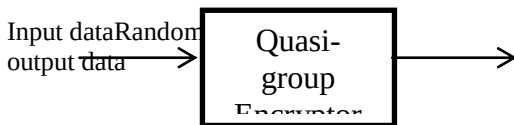


Figure 2: Quasi-group Encryptor

If Q is a quasi-group such that $a_1, a_2, a_3, \dots, a_n$ belong to it, then the encryption operation QE (Quasi-Encryptor) which is defined over the defined elements, maps those elements to another vector $b_1, b_2, b_3, \dots, b_n$ such that the elements of the resultant vector also belong to the same quasi-group.

The mathematical equation for encryption is defined by,

$$E(a_1, a_2, a_3, \dots, a_n) = b_1, b_2, b_3, \dots, b_n \quad (2)$$
 where $b_1 = a * a_1, b_i = b_{i-1} * a_i$, i increments from 2 to the number of elements that have to be encrypted and a is the hidden key. The Multi Level Indexed encryptor is denoted as,

$$QE_{h_1, h_2, \dots, h_n}^{I_r, I_s}(a_1, a_2, a_3, \dots, a_n) = e_1, e_2, e_3, \dots, e_n \quad (3)$$

where $a_1, a_2, a_3, \dots, a_n$ is the input data and $e_1, e_2, e_3, \dots, e_n$ is the output vector I_r and I_s are called indices that are arrays which have the indices of quasigroups having corresponding order. The vector $(h_1, h_2, \dots, h_n)$ is the hidden key or the secret key.

The decryption process is highly alike the process of encryption. The key point to be considered is the construction of the inverse matrix. The left inverse ' $\backslash$ ' is used for the quasi-group decryption. The mathematical equation for decryption is defined by,

$$D(a_1, a_2, a_3, \dots, a_n) = e_1, e_2, e_3, \dots, e_n \quad (4)$$

where $e_1 = a/a_1$ and $e_i = a_{i-1}/a_i$. The decryptor for a multilevel indexed based algorithm may be defined as follows,

$$QE_{h_1, h_2, \dots, h_n}^{I_r, I_s}(e_1, e_2, e_3, \dots, e_n) = a_1, a_2, a_3, \dots, a_n \quad (5)$$

where $e_1, e_2, e_3, \dots, e_n$ the input data and $a_1, a_2, a_3, \dots, a_n$ is the output vector I_r and I_s are called indices that are arrays which have the indices of quasigroups having corresponding order. The vector $(h_1, h_2, \dots, h_n)$ is the hidden key or the secret key.

3.1 ALGORITHM

3.1.1 Encryption Algorithm:

Input: Image, Encryption Key

Output: Encrypted Image

1. Get the size of the image and store in r and c respectively.
2. Convert image matrix into a vector.
3. Obtain all odd position values initially and then even position values.
4. Construct a new image matrix by filling the odd positions values followed by even position values.
5. Convert new image matrix into a vector.
6. Convert the decimal key into binary key data.
7. Binary key data is embedded in the vector.
8. Convert the vector into image matrix of size (r, c) .

3.1.2 Decryption Algorithm:

Input: Encrypted Image, Decryption Key

Output: Decrypted Image

1. Convert the encrypted image matrix into a vector.
2. Convert the decimal key into binary key.
3. The binary key $data1$ is initially used for decryption and stored as a vector.
4. The vector is converted to image matrix of size (r, c) .
5. Image matrix is divided into two vectors.
6. // if ' n ' is number of pixels in image, then ' $n/2$ ' is the size of the vectors.
7. The new image matrix is created by filling the, odd position pixels and even position pixels values from two vectors.
8. The resulted image is the decrypted image of size (r, c) .

The encrypted image is compressed using resolution progressive compression. The encoder gets the ciphertext Y and decomposes it into four subimages, namely, the 00, 01, 10 and 11 subimages. Each subimage is a downsampled –by-two version of the encrypted image. The name of a subimage denotes the horizontal and vertical offsets of the downsampling. The 00

subimage is further downsampled to create multiple resolution levels. We use 00_n to represent the 00 subimage in the n -th resolution level. The 00_n subimage can be losslessly synthesized from the 00_{n+1} , 01_{n+1} , 10_{n+1} and 11_{n+1} subimages. Decoding initiates from the 00 subimage of the lowest resolution N level. Then, other subimages of the identical resolution level are interpolated from 00_N subimage. Context adaptive interpolation technique is used to obtain the subimages of same resolution level.

IV. EXPERIMENTAL RESULTS

The performance of the proposed approach is evaluated based on MSE and PSNR. For this experimental observation, standard images like lena, cameraman and Barbarais taken. The software package (MATLAB) is used as the engine for image processing experiments. Mean Square error(MSE) is the error between the original and reconstructed image. A very small value of MSE means lower error. The formula for MSE (6) is,

$$MSE = \frac{1}{NM} \sum_{i=1}^N \sum_{j=1}^M [f(i,j) - f'(i,j)]^2 \quad (6)$$

where M and N are number of rows and columns, $f(i,j)$ is the original image and $f'(i,j)$ is the reconstructed image. The image quality is measured objectively by using Peak Signal to Noise Ratio (PSNR). The common use of the PSNR is to measure the quality of reconstructed images. PSNR is usually expressed in decibels, which is a logarithmic scale. The formula for PSNR (7) is,

$$PSNR = 20 * \log_{10} \frac{255}{\sqrt{MSE}} \quad (7)$$

where MSE is the Mean Square Error. The basic metric, Compression Ratio (CR) is used to evaluate the performance of compression algorithm. The formula for compression ratio (8) is,

$$CR = \frac{\text{Uncompressed image}}{\text{Compressed image}} \quad (8)$$

Table I shows the MSE and PSNR value for the images. Encrypted image is compressed using Resolution Progressive Compression.

Table I : MSE and PSNR value for proposed method

Images	MSE	PSNR(db)
Lena	0.9118	48.5316
Cameraman	2.3445	44.4303
Barbara	2.7744	44.7044
Goldhill	2.6222	43.9431

Table II shows the storage space used after and before compression. Figure 3 shows the comparison of storage space before and after compression.

Table II: Memory space used before and after compression

Standard Images	Before Compression (KiloBytes)	After Compression (KiloBytes)
Lena	65	8.35
Cameraman	64	7.34
Barbara	70.5	8.03
Goldhill	62	7.77

Figure 3 shows the comparison of storage space before and after compression.

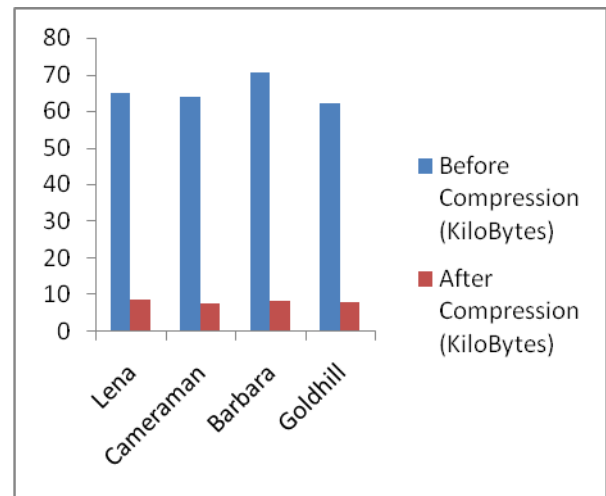


Figure 3: Comparison of original and compressed image

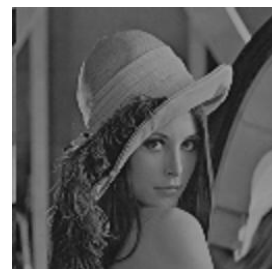


Figure 4: Original image



Figure 5: Encrypted image



Figure 6: Compressed image

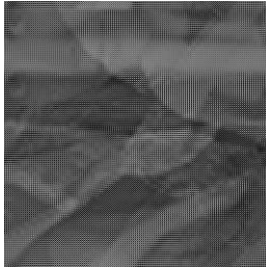


Figure 7: Reconstructed image

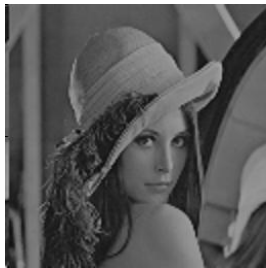


Figure 8: Decrypted image

V. CONCLUSION

This paper proposes a compression of encrypted grayscale images. The grayscale image is encrypted by using Quasi-group algorithm. It enhances the security of image during transmission. The encrypted grayscale image is compressed by Resolution Progressive Compression. The performance of the proposed approach is evaluated based on the PSNR and MSE. It is observed from the experimental results that PSNR approach is high when compared with traditional value.

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Sustainable Construction Management Practice- Site Waste Management

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Abstract- With the urge for development and to satisfy the needs and wants, working and growth of Construction Industry is unavoidable. However, the conventional approach and negligence towards future generation brought the concept of “Sustainability” which simply means the proper use of resources or to sustain resources for further generation to come. Using scarily and Eco- friendly material even though is a great compatible approach for achieving it but what about the construction already existing? brings a great question to one’s mind. Million tons of resources are utilized per year for construction purpose and million tons get waste both at construction and demolition time. This C & D waste needs to be given special attention .The aim of paper over here is to develop sound planning for such site waste material and the implementation of 3 R’s –Reduce , Reuse & Recycle for sustainable construction management practice.

Index Terms- C & D waste, sustainability , 3R’s –Reduce, Reuse and Recycle, sustainable, Site waste management plan.

I. INTRODUCTION

The construction industry has been found to be among the main consumers of resources and energy. Moreover, the construction sector is reported to be generating unacceptable levels of material waste. Millions of tons of waste is generated every year leading world towards depletion of resources. It is strange but still many of the country have no plans, rules and regulation for minimizing waste generation. Although “waste” is a familiar term in the industry world-wide, it is difficult to compare construction waste figures from different construction sites due to a number of reasons, including the use of varying definitions; and the use of different estimation approaches, by different groups.

From the earlier studies it can be stated that 30 to 40 % of wastage is done while the construction is under execution stage, similarly the sources reveals that in some of countries contribution of construction waste is about 70 to 75 % out of total waste generated annually. These construction waste needs to be minimized, reuse and recycle. But, for this it is must to undertake waste assessment study.

II. CLASSIFICATION AND SOURCES OF WASTE

A. Waste Classification:

Construction waste can be divided into three major categories: material, labor, and machinery waste. However, material wastage is of more concern because most of the raw materials from which construction inputs are derived come from non-renewable resources. These wastes can be called as

controlled waste as they are avoidable in nature and can be further reuse for commercial purpose.

B. Sources of waste:

Right from planning, designing, scheduling phase to execution and controlling phase the waste is generated at any construction project. As we have already said the waste term is just not used for material but any of the resources standing out of 5 M’s- Man, Machine, Money, Material and motivation. Finding of study reveals the sources as – Incorrect planning and Resource allocation, Improper use of efficiency of resource, negligence of management and control system, procurement, handling of materials , improper design , low market study, lacking in R and D , gap in communication etc.

C. Scope:

Even though it is the general approach for reducing, reusing and recycling C & D waste , the paper highlights some of the observation and aspects that can become essential element of Planning.

It’s the foremost preliminary step for proceeding with any research work writing. While doing this go through a complete thought process of your Journal subject and research for it’s viability by following means:

- 1) Read already published work in the same field.
- 2) Goggling on the topic of your research work.
- 3) Attend conferences, workshops and symposiums on the same fields or on related counterparts.
- 4) Understand the scientific terms and jargon related to your research work.

III. STUDIES AND FINDINGS

Site waste Management Plan:

Site Waste Management Plan (SWMP) is an important tool for Sustainable construction practice which Companies and their clients, of all sizes should follow to improve their environmental performance, meet regulatory controls and reduce rising costs of disposing of waste. It includes useful checklists and other guidance to help ensure the Plan is a practical tool.

There are eight important steps suggested for successful implementation of this Site Waste Management Plan:

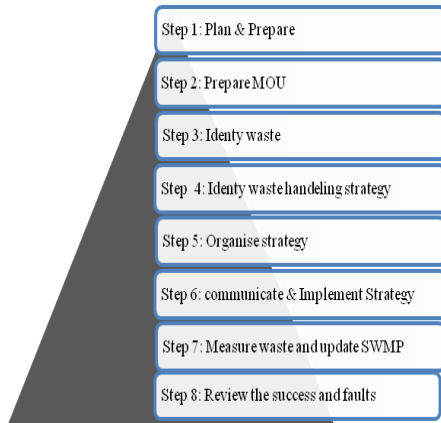


Figure no.1: Steps involved in SWMP

Step 1: Exact planning of construction including scheduling and resource allocation according to efficiency is of prime importance.

Step 2: Preparation and declaration of authority and responsibility of individual and duty as a whole towards common motive in favour of public and companies interest should be developed. This memorandum of understanding helps a lot for avoiding unnecessary conflict and misconduct.

Step 3: Identify waste and reasons for generation of such waste on basis of hierarchy, on- and off-site, Hazards, economical aspects etc.

Step 4: Plan out the strategy for handling various type of waste considering its reuse, economical aspects, social aspects etc. Input for reducing and reusing waste and output desired from planned strategy.

The strategy that can be applied under hierarchy is:-

- Avoid waste generation at first place.
- Minimise the amount of waste produce at project site.
- Reuse waste items as many time as one can provided desired specifications to be maintained.
- Recycle what only should be recycled after knowing its potential use and place to fit.
- Dispose of what's left in responsible way.

Step 5: Organising the flow of work for managing each and every elemental part of it. Carry out any necessary training of in-house and sub-contract staff so that everyone understands the requirements of project Site Waste Management Plan.

Step 6: Communication and implementation of planned strategy describing desired milestone. Designing and filling checklist and datasheets related to quantity and quality, type and future potential use of site generated waste.

Sample check list:

- Have you considered the construction methods and materials that you can use to reduce the amount of waste your project produces?
- Have you thought about ordering materials that have less or reusable/returnable packaging?

- Have you recorded all of your waste reduction decisions in your plan?
- Has someone with authority been assigned overall responsibility for the SWMP?
- Have you assessed the waste produced at each stage of the project - the types, how much and when, including the processes involved?
- Have you identified which workers will produce waste?
- Has an area of the site been set aside for storing new materials and waste, including
- Separate containers for different types of waste? You must store new materials separately from waste, and make sure storage areas are secure against vandalism.
- Have you set targets for the different types of waste likely to be produced by the project?
- Include targets for the amounts of each waste type to be reused, recycled and disposed of.
- Have measures been put in place to deal with expected and unexpected hazardous waste?
- Have you considered whether you can reuse materials either on site or off site?
- Have you considered on-site and off-site processing and reuse of materials?
- Have you assessed the quantities of materials you need to order to reduce over-ordering and site waste?
- Can you return unused materials to the supplier, sell them or use them on another job?
- Have you considered using recycled materials?
- Will you separate different types of waste to get the best value from good waste management practices?
- Are your storage areas secure and weatherproof to prevent wind and rain damaging your materials?
- Have you covered or netted any loose materials to prevent them being spread and possibly causing pollution?
- Is everyone who will handle waste aware of the SWMP requirements?
- Are contractors and subcontractors trained and aware of their responsibilities?
- Are SWMP requirements built into contracts?
- Are you carrying out spot checks and monitoring your staff regularly to make sure they are following procedures?
- Are you updating your plan every time waste is removed from your site?
- Are you checking the SWMP regularly and making sure targets are being reached?
- Have any issues or problems been taken into account for action in future projects?

Sample (Site waste management Data records):

- Name of Project;
- Cost of Project;
- Location of Project;
- Utility of Project;
- Stage or Phase at time of Recording;
- Total Resource demand;

- Classification of resources on basis of quantity and cost:(Percentage Participation)
- Type of waste generation, quantity :
 - 1) Inert
 - 2) Hazardous
 - 3) Nonhazardous
- Waste that can be Reduce:
- Waste that can be Reuse:
- Wastes that can be recycled maintaining specifications of work:
- Disposed waste, Location, treatment:
- Process for reusing and recycle adopted:
- Percentage success achieved:
- Failure for works:
- Risk associated:
- Review of earlier work:
- Post process measure:
- Next suggested date for recording data:

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Step 7: Measure how much waste is still generating at site so that to cope up with the baseline plan for handling it efficiently. To update the amount of waste treated and the quantity still reaming to be treated within desired duration.

Step 8: As the process is continuum process the time to time of review of success and faults achieved should be done so as to consider it while developing future plans and assigning weighted points to such risk and possibility of failure.

Limitation Of SWMP: Lack of responsibility and devotion of individual, missing role of Govt. Bodies and faults in rules and regulations related to construction waste. Lack of Training programme for concern people, awareness camps etc.

IV. CONCLUSION

The study for this research work highlights many aspects which are lacking for developing sustainable construction planning. Over here the approach for overcoming such waste mitigation strategy can only be successful by joint efforts of governing regulatory bodies as well as individual concern with it. Application of such sustainable waste management planning may increase the potential to reduce, reuse and recycle construction waste generation. Public - private awareness and participation on such alerting agendas will help to secure and sustain future generation to come.

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A Heuristic Approach for Two Stage Open Shop Scheduling with Transportation Time and Weightage of Jobs Including Job Block Criterion, the Processing Time Associated with Probabilities

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Abstract- This Paper provides a heuristic algorithm for two stage open shop scheduling problem to minimize the makespan in which processing times are associated with their respective probabilities including the concepts of job block criteria and transportation time. Further weights are attached with jobs to indicate their relative importance. A computer programme followed by a numerical illustration is given to justify the proposed algorithm.

Index Terms- Open Shop Scheduling, Processing time, Makespan, Equivalent job, Job block, Transportation time, Weightage.

I. INTRODUCTION

Now a day, Scheduling has a significant role in the field of manufacturing, management, computer Science, production concern etc. An appropriate scheduling provides useful results to the Decision maker and Industrial Supervisor for minimizing the manufacturing cost and time. In flow shop scheduling problem, each job is processed on all the machines in the same order with the objective to optimize some well defined criteria while in Open shop scheduling, the order of the machines, on which the jobs are processed, is not fixed and not known in advance. Hence the order of the machines can be selected arbitrarily. For instant, in a large aircraft garage with specialized work center, an airplane may be requiring repairs in engine and electrical circuit. These two tasks may be carried out in any order but it is not possible to do tasks on the same plane simultaneously.

The research work, in most of the literature has been done in the field of flow shop scheduling problem. The research work on two machine flow shop problem was first of all introduced by Johnson [11] with the objective to minimize the makespan (i.e. total elapsed time). The work was extended by many researchers like Ignall and Schrage[10], Bagga [2], Compbell[3], Maggu and Das[12], Yoshida and Hitomi[15], Singh T.P. [13], Harbans and Maggu [9], ChandraShekhara [4], V.A.Strusevich[14], Anup[1], Gupta and Singh[5], Gupta and Sharma[6,7] by considering various parameters. The basic concept of equivalent job for a job block was investigated by Maggu & Das [12], in which priority to one job over another was considered in order to create a balance between a cost of providing priority in service and cost of giving service with non priority.

Gupta & Singh et.al[8] have studied the optimal two stage **open shop scheduling** problem with the concept of job block criteria in which they associated processing time with their respective probabilities. Here we have extended their work by introducing the concepts transportation time (which involves loading time, moving time and unloading time etc.) and weightage of jobs in order to indicate their relative importance. Thus the problem in the present paper becomes wider and practically more applicable. An algorithm has been developed to minimize the maximum completion time (makespan). The algorithm is demonstrated through a numerical example.

II. PRACTICAL SITUATION

Many applied and experimental situations occur in day to day working in factories and industrial concern. Open shop scheduling problem has wide engineering applications in manufacturing. The practical situation of open shop scheduling may be taken in automobile repair, quality control centers, semiconductor manufacturing, Satellite Communications, Class assignment etc. For example in a automobile garage with specialized shops. A Car may require the following work: Replacement of exhaust and muffler and alignment of wheels. These two tasks will be performed on two machines and may be carried out in any order on the given machines. Similarly an airplane may be requiring repairs in engine and electrical circuit. These two tasks may be carried out in any order. In many manufacturing companies different jobs are planted at different places then the transportation time has a significant role in production concern. Sometimes, the priority of one job over the other is preferred. It may be because of urgency or demand of its relative importance. Hence the job block criteria becomes significant

III. NOTATIONS

- A_i : Processing time of i^{th} job on machine A.
- B_i : Processing time of i^{th} job on machine B.
- A'_i : Expected Processing time of i^{th} job on machine A.
- B'_i : Expected Processing time of i^{th} job on machine B.

- p_i : Probability associated to the processing time A_i of i^{th} job on machine A.
- q_i : Probability associated to the processing time B_i of i^{th} job on machine B.
- $T_{i,A \rightarrow B}$: Transportation time from machine A to B which is same as $T_{i,B \rightarrow A}$ Transportation time from machine B to A .
- w_i : Weight assigned to i^{th} job
- G_i : Processing time of i^{th} job on fictitious machine G
- H_i : Processing time of i^{th} job on fictitious machine H
- S_{AB} : Optimal/near optimal sequence for the machine order A to B
- S_{BA} : Optimal/near optimal sequence for the machine order B to A

IV. PROBLEM FORMULATION

Let n jobs $1, 2, 3, \dots, n$ be processed through two machines A and B. Let A_i and B_i be the processing time of i^{th} job ($i=1, 2, 3, \dots, n$) on machine A and B respectively. Let p_i and q_i be the probabilities associated with processing time A_i and B_i respectively such that $0 \leq p_i \leq 1$, $\sum p_i = 1$, $0 \leq q_i \leq 1$, $\sum q_i = 1$. Let w_i be the weights of i^{th} job ($i = 1, 2, 3, \dots, n$) and $T_{i,A \rightarrow B}$ be the transportation time of i^{th} job from machine A to B which is same as transportation time from machine B to A i.e. $T_{i,A \rightarrow B}$ is same as $T_{i,B \rightarrow A}$. Let α be an equivalent job for a job block (k, m) in which k is given priority over job m , where k and m are any jobs among the given n jobs.

The mathematical model of the problem can be stated in the matrix form as:

The mathematical model of the problem can be stated in the matrix form as:

Jobs i	Machine A		Transportation Time of i^{th} job from machine A to B or B to A	Machine B		w_i
	A_i	p_i		B_i	q_i	
1	A_1	p_1	$T_{1,A \rightarrow B}$ or $T_{1,B \rightarrow A}$	B_1	q_1	w_1
2	A_2	p_2	$T_{2,A \rightarrow B}$ or $T_{2,B \rightarrow A}$	B_2	q_2	w_2
3	A_3	p_3	$T_{3,A \rightarrow B}$ or $T_{3,B \rightarrow A}$	B_3	q_3	w_3
.	.	.	.	.	.	.
.	.	.	.	.	.	.
.	.	.	.	.	.	.
n	A_n	p_n	$T_{n,A \rightarrow B}$ or $T_{n,B \rightarrow A}$	B_n	q_n	w_n

Tableau-1

Our objective is to find the optimal or near optimal schedule of all the jobs which minimize the total elapsed time of each machine and weighted mean flow time whenever mean weighted production flow time is taken into consideration.

V. ASSUMPTIONS

1. Each job once started, must be processed to completion.
2. Two jobs can't be processed on a single machine at a time.
3. Jobs are independent to each other
4. In a job block $(i_1, i_2, \dots, i_k)$, priority is given to the i_1 job over $i_2, \dots, i_k$
5. Transportation times from machine A to B and B to A are same.
6. Transporting device is always available.
7. $\sum p_i = 1$, $\sum q_i = 1$, $0 \leq p_i \leq 1$, $0 \leq q_i \leq 1$.

VI. ALGORITHM

The heuristic algorithm for the open shop scheduling can be decomposed in the following steps:

Step1: Define expected processing time A'_i and B'_i on machine A and B respectively as follows:-

$$a) A'_i = A_i \times p_i$$

$$b) B'_i = B_i \times q_i$$

Step2: Define two fictitious machines G and H with processing times G_i and H_i as follows:-

$$(a) \text{ If } \min(A'_i, B'_i) = A'_i \quad \text{then} \quad \text{calculate} \quad G_i = A'_i + T_{i,A \rightarrow B} + w_i \quad \text{and} \quad H_i = B'_i + T_{i,A \rightarrow B}$$

$$(b) \text{ If } \min(A'_i, B'_i) = B'_i \quad \text{then} \quad \text{calculate}$$

$$G_i = A'_i + T_{i,A \rightarrow B} \text{ and } H_i = B'_i + T_{i,A \rightarrow B} + w_i$$

Step3: Calculate G'_i and H'_i as follows:-

$$(a) \quad G'_i = G_i / w_i$$

$$(b) \quad H'_i = H_i / w_i$$

Step4: Calculate the expected processing time for the equivalent job $\alpha = (k, m)$ on fictitious machines G and H using[12]:-

For the machine order $G \rightarrow H$

$$(a) \quad G'_\alpha = G'_k + G'_m - \min(G'_m, H'_k)$$

$$(b) \quad H'_\alpha = H'_k + H'_m - \min(G'_m, H'_k)$$

For the machine order $H \rightarrow G$

$$(a) \quad H'_\alpha = H'_k + H'_m - \min(G'_k, H'_m)$$

$$(b) \quad G'_\alpha = G'_k + G'_m - \min(G'_k, H'_m)$$

Step5: Define a new reduced problem with processing times G'_i and H'_i as define in step 3 & 4

Step6: For the machine order $G \rightarrow H$

Construct a set S_G of all the processing times G'_i where $G'_i \leq H'_i$ and S'_G of all the processing times G'_i where $G'_i \geq H'_i$.

Step7: Let S_1 denote a sub optimal sequence of jobs

corresponding to non decreasing times S_G and similarly a sequence S_2 corresponding to set S'_G .

Step8: The augmented ordered sequence $S_{AB} = (S_1, S_2)$ gives optimal or near optimal sequence of jobs for the machine order A to B

Step9: For the machine order $H \rightarrow G$

Construct the set S_H and S'_H of processing times H'_i Where $H'_i \leq G'_i$ and of processing times H'_i where $H'_i \geq G'_i$ respectively.

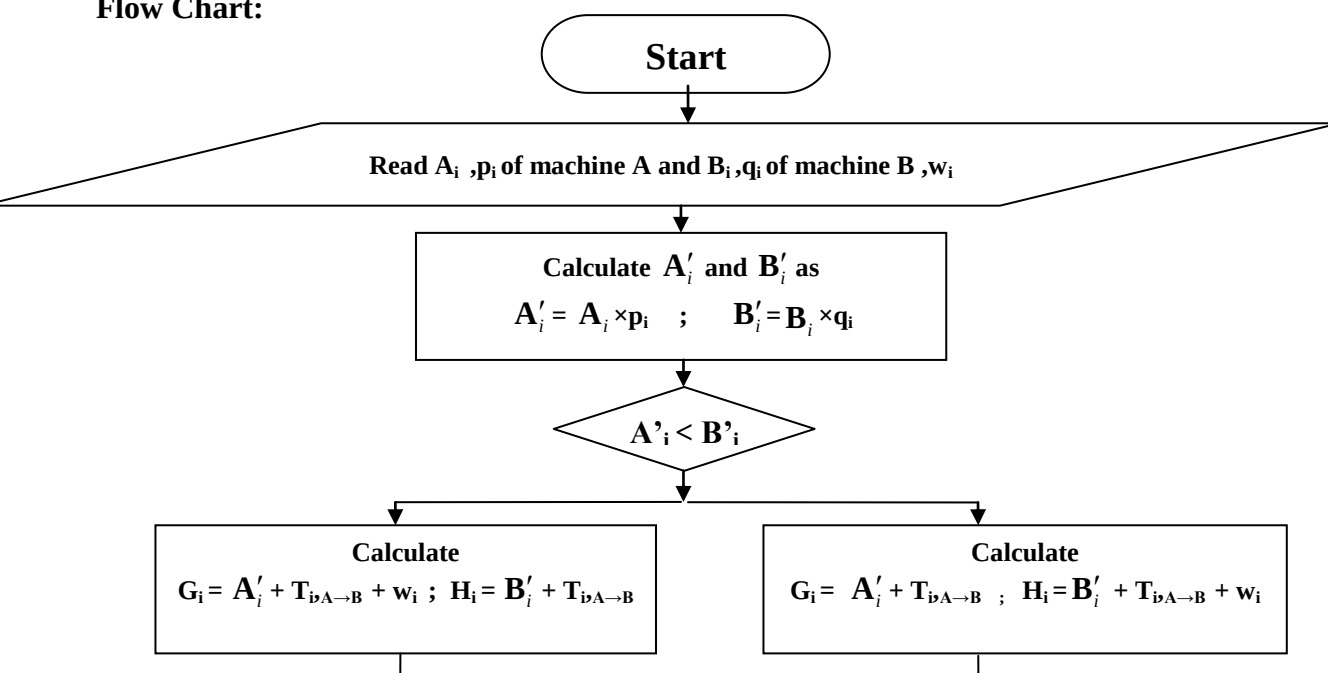
Step10: Let S_2 denote a sub optimal sequence of jobs corresponding to the non decreasing processing times in the set S_H . Similarly S'_2 corresponding to S'_H .

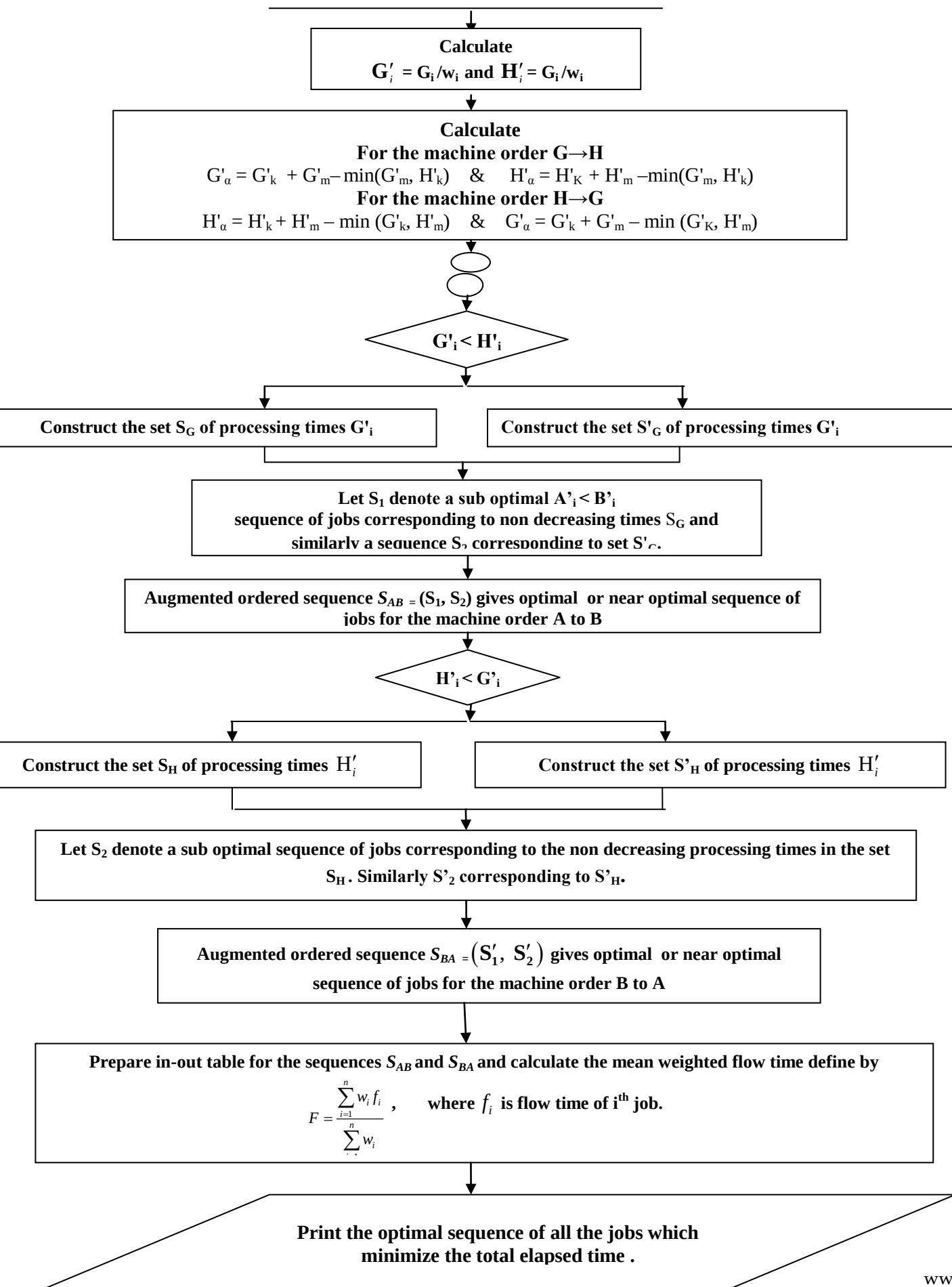
Step11: The augmented ordered sequence $S_{BA} = (S'_1, S'_2)$ gives the optimal or near optimal sequence of jobs for the machine order B to A.

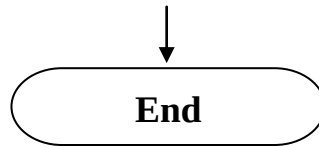
Step12: Prepare in-out table for the sequences S_{AB} and S_{BA} and calculate the mean weighted flow time F define by

$$F = \frac{\sum_{i=1}^n w_i f_i}{\sum_{i=1}^n w_i}, \text{ where } f_i \text{ is flow time of } i^{\text{th}} \text{ job.}$$

Flow Chart:







VII. COMPUTER PROGRAM

```
#include<stdio.h>
#include<fstream.h>
#include<iostream.h>
#include<conio.h>
#include<string.h>
#include<stdlib.h>
#include<iomanip.h>
int noj;
int ajs[100],bjs[100];
float asg[100][3];
float asdg[100][3];
float ash[100][3];
float asdh[100][3];
float atb5[100][3];
float atb8[100][3];
int a1,a2;
int r1,r2,nbr,n=0;
struct ob
{
float aai,api,ti,bbi,bqi,aadi,abdi,agi,ahi,agdi,ahdi,ain,aout,badi,bbdi,bgdi,bhi,bhdi,bin,bout,wi;
int job;
}obv[100];
struct vector
{
float aai,api,ti,bbi,bqi,aadi,abdi,agi,ahi,agdi,ahdi,ain,aout,badi,bbdi,bgdi,bhi,bhdi,bin,bout,wi;
int job;
}v;
class A
{
public:
struct vector tempv[100];
void showmenu()
{
float ain1,aout1,bin1,bout1,ain2,aout2,bin2,bout2;
int a;
re:
clrscr();
cout<<"Select your options:"<<endl<<endl;
cout<<"1. Read Data:"<<endl;
cout<<"2. Show Data:"<<endl;
cout<<"3. Delete All Data:"<<endl;
```

```
cout<<"4. Read the values of a:"<<endl;
cout<<"5. Generate Tables:"<<endl;
cout<<"6. Show the Final Result:"<<endl;
cout<<"7. Exit:"<<endl;
cin>>a;
switch(a)
{
case 1:
int jo;
float prot1=0,prot2=0;
clrscr();
cout<<"Enter the No of Jobs";
cin>>jo;
ofstream myf("data.txt",ios::app);
for(int u=1;u<=jo;u++)
{
v.job=u;
cout<<"Enter Ai for Machine A:";
cin>>v.aai;
cout<<"Enter Pi for Machine A:";
cin>>v.api;
cout<<"Enter Transportation Time Ti:";
cin>>v.ti;
prot1+=v.api;
cout<<"Enter Bi for Machine B:";
cin>>v.bbi;
cout<<"Enter Qi for Machine B:";
cin>>v.bqi;
cout<<"Enter wi ";
cin>>v.wi;

prot2+=v.bqi;
ofstream myf("data.txt",ios::app);
myf<<v.job<<endl;
myf<<v.aai<<endl;
myf<<v.api<<endl;
myf<<v.ti<<endl;
myf<<v.bbi<<endl;
myf<<v.bqi<<endl;
myf<<v.wi<<endl;

}
myf.close();
clrscr();
if(prot1!=1)
cout<<"Entered Pi is invalid\n\nDelete the data and Enter again..";
else if(prot2!=1)
cout<<"Entered Qi is invalid\n\nDelete the data and Enter again..";
else
cout<<"Data is stored";
getch();
```

```
goto re;
break;
case 2:
clrscr();
cout<<"The Data in the file is:\n\nJob\tAi\tPi\tTi\tBi\tQi\tWi\n-----\n";
ifstream myf1("data.txt");
while(!myf1.eof())
{
myf1>>v.job>>v.aai>>v.api>>v.ti>>v.bbi>>v.bqi>>v.wi;
if(myf1.eof())
break;
cout<<v.job<<"\t";
cout<<v.aai<<"\t";
cout<<v.api<<"\t";
cout<<v.ti<<"\t";
cout<<v.bbi<<"\t";
cout<<v.bqi<<"\t";
cout<<v.wi<<endl;
}
myf1.close();
getch();
goto re;
break;
case 3:
clrscr();
remove("data.txt");
cout<<"Data is Deleted\n\nRun the Program again to Fill new Data\n\n Press any key to EXIT";
getch();
exit(0);
case 4:
clrscr();
rup:
cout<<"Enter the value of à 1: ";
cin>>a1;
cout<<"Enter the value of à 2: ";
cin>>a2;
cout<<"\nData is stored";
goto re;
break;
case 5:

ain1=ain2=bin1=bin2=aout1=bout1=bout2=aout2=0;
float tgdk,tgdm,thdk,tgda,thda,tgik,thik,tgim,thim,thdm;
float btgdk,btgdm,bthdk,btgda,bthda,btgik,bthik,btgim,bthim,bthdm;
if(a1==0 || a2==0)
{
cout<<"Enter the valid values of à & á first\n\n";
goto rup;
}
else
{
```

```
n=0;
ifstream myf2("data.txt");
noj=0;
    clrscr();
    cout<<"The given values are:\n-----\n";
    cout<<"JOB\t Ai \t Pi \t Ti \t Bi \t Qi\n";

    while(!myf2.eof())
    {
        myf2>>v.job>>v.aai>>v.api>>v.ti>>v.bbi>>v.bqi>>v.wi;

        if(myf2.eof())
            break;
        tempv[n]=v;
        cout<<v.job<<"\t"<<v.aai<<"\t"<<v.api<<"\t"<<v.ti<<"\t"<<v.bbi<<"\t"<<v.bqi<<endl;
        n++;
        noj++;
    }
myf2.close();
cout<<"Table No: 3\n-----\n";
for(int a=0;a<n;a++)
{
    tempv[a].aadi=tempv[a].aai*tempv[a].api;
    tempv[a].badi=tempv[a].bbi*tempv[a].bqi;
    tempv[a].agi=tempv[a].aadi+tempv[a].ti;
    tempv[a].ahi=tempv[a].badi+tempv[a].ti;

    cout<<setprecision(2)<<tempv[a].aadi<<"\t"<<tempv[a].badi<<endl;

}
cout<<"Table No: 4\n-----\n";
for(a=0;a<n;a++)
{
    if(tempv[a].agi<tempv[a].ahi)
        tempv[a].agi+=tempv[a].wi;
    else
        tempv[a].ahi+=tempv[a].wi;
    if(tempv[a].job==a1)
    {
        tgdk=tempv[a].agi/tempv[a].wi;
        thdk=tempv[a].ahi/tempv[a].wi;
    }
    if(tempv[a].job==a2)
    {
        tgdm=tempv[a].agi/tempv[a].wi;
        thdm=tempv[a].ahi/tempv[a].wi;
    }

    cout<<setprecision(2)<<tempv[a].agi<<"\t"<<tempv[a].ahi<<endl;
}
// cout<<tgdk<<tgdm<<thdk<<thdm;
```

```
//Step 5;
    int i=0;
    float toa1,toa2;
    int nosg=0,nosdg=0;
    int nosh=0,nosdh=0;
    for(a=0;a<n;a++)
    {
        tempv[a].agi/=tempv[a].wi;
        tempv[a].ahi/=tempv[a].wi;

        if(a1==tempv[a].job || a2==tempv[a].job)
            cout<<"";
        else
        {
            atb5[i][0]=tempv[a].job;
            atb5[i][1]=tempv[a].agi;
            atb5[i][2]=tempv[a].ahi;

            atb8[i][0]=tempv[a].job;
            atb8[i][2]=tempv[a].agi;
            atb8[i][1]=tempv[a].ahi;

            if(tempv[a].agi>tempv[a].ahi)
            {
                asg[nosg][0]=tempv[a].agi;
                asg[nosg][1]=tempv[a].job;
                nosg++;
            }
            else
            {
                asdg[nosdg][0]=tempv[a].agi;
                asdg[nosdg][1]=tempv[a].job;
                nosdg++;
            }
        }
    }
//b->a
    if(tempv[a].agi<tempv[a].ahi)
    {
        ash[nosh][0]=tempv[a].agi;
        ash[nosh][1]=tempv[a].job;
        nosh++;
    }
    else
    {
        asdh[nosdh][0]=tempv[a].agi;
        asdh[nosdh][1]=tempv[a].job;
        nosdh++;
    }
}
```

```
i++;
}
}
atb5[i][0]=-1;
atb5[i][1]=tgda;
atb5[i][2]=thda;
atb8[i][0]=-2;
atb8[i][1]=bthda;
atb8[i][2]=btgda;
i++;
getch();
clrscr();
// cout<<"btgdk<<" + "<<btgdm<<" + "<<bthdk<<" + "<<bthdm<<" + "<<endl;

tgda=tgdk+tgdm-((thdk<tgdm)?thdk:tgdm);
thda=thdk+thdm-((thdk<tgdm)?thdk:tgdm);
bthda=thdk+thdm-((thdm<tgdk)?thdm:tgdk);
btgda=tgdk+tgdm-((thdm<tgdk)?thdm:tgdk);
// cout<<tgda<<" "<<thda<<" "<<bthda<<" "<<btgda<<" "<<endl;

// cout<<bthda<<" -*-"<<btgda<<endl;
cout<<"G'\à ="<<tgda<<"\tH'\à ="<<thda<<endl;
cout<<"G'\à ="<<btgda<<"\tH'\à ="<<bthda<<endl;

if(bthda<btgda)
{
    asdh[nosdh][0]=btgda;
    asdh[nosdh][1]=-2;
    nosdh++;
}
else
{
    ash[nosh][0]=bthda;
    ash[nosh][1]=-2;
    nosh++;
}
if(tgda<thda)
{
    asdg[nosdg][0]=thda;
    asdg[nosdg][1]=-1;
    nosdg++;
}
else
{
    asg[nosg][0]=tgda;
    asg[nosg][1]=-1;
    nosg++;
}

cout<<"\nTable no 5:\n-----\nJob\tG'\i\tH'\i\n";
for(a=0;a<i;a++)
```

```
{
if(atb5[a][0]==-1)
cout<<"à"<<"\t"<<setprecision(2)<<atb5[a][1]<<" \t "<<atb5[a][2]<<" \n";
else
cout<<atb5[a][0]<<" \t "<<atb5[a][1]<<" \t "<<atb5[a][2]<<" \n";
}
cout<<"\nTable no 10:\n-----\nJob\tH\ti\tG\ti\n";
for(a=0;a<i;a++)
{
if(atb8[a][0]==-2)
cout<<"à"<<"\t"<<setprecision(2)<<atb8[a][1]<<" \t "<<atb8[a][2]<<" \n";
else
cout<<atb8[a][0]<<" \t "<<atb8[a][1]<<" \t "<<atb8[a][2]<<" \n";
}
getch();
clrscr();
float tp1,tp2;
int b;
for(a=0;a<nosdg-1;a++)
    for(b=0;b<nosdg-1-a;b++)
        {
            if(asdg[b][0]>asdg[b+1][0])
            {
                tp1=asdg[b][0];
                tp2=asdg[b][1];
                asdg[b][0]=asdg[b+1][0];
                asdg[b][1]=asdg[b+1][1];
                asdg[b+1][0]=tp1;
                asdg[b+1][1]=tp2;
            }
        }
for(a=0;a<nosg-1;a++)
    for(b=0;b<nosg-1-a;b++)
        {
            if(asg[b][0]>asg[b+1][0])
            {
                tp1=asg[b][0];
                tp2=asg[b][1];
                asg[b][0]=asg[b+1][0];
                asg[b][1]=asg[b+1][1];
                asg[b+1][0]=tp1;
                asg[b+1][1]=tp2;
            }
        }
//sorting b->a
for(a=0;a<nosdh-1;a++)
    for(b=0;b<nosdh-1-a;b++)
        {
            if(asdh[b][0]>asdh[b+1][0])
            {
                tp1=asdh[b][0];
```

```
                tp2=asdh[b][1];
                asdh[b][0]=asdh[b+1][0];
                asdh[b][1]=asdh[b+1][1];
                asdh[b+1][0]=tp1;
                asdh[b+1][1]=tp2;
            }
        }
    for(a=0;a<nosh-1;a++)
        for(b=0;b<nosh-1-a;b++)
            {
                if(ash[b][0]>ash[b+1][0])
                {
                    tp1=ash[b][0];
                    tp2=ash[b][1];
                    ash[b][0]=ash[b+1][0];
                    ash[b][1]=ash[b+1][1];
                    ash[b+1][0]=tp1;
                    ash[b+1][1]=tp2;
                }
            }

    i=0;
    for(a=0;a<nosdg;a++)
    {
        if(asdg[a][1]==-1)
        {
            ajs[i]=a1;
            i++;
            ajs[i]=a2;
            i++;
        }
        else
        {
            ajs[i]=(int)asdg[a][1];
            i++;
        }
    }
    for(a=0;a<nosg;a++)
    {
        if(asg[a][1]==-1)
        {
            ajs[i]=a1;
            i++;
            ajs[i]=a2;
            i++;
        }
        else
        {
            ajs[i]=(int)asg[a][1];
            cout<<asg[a];
            i++;
        }
    }
}
```



```
    }
}
for(a=0;a<i;a++)
cout<<ajs[a]<<" ";

    ain1=0;
    aout1=0;
    bin1=0;
    bout1=0;
    cout<<endl;

float tti;
clrscr();
cout<<"In-Out table for the Order A->B\nJob\tA(in)\tA(out)\tB(in)\tB(out)\tWi\n-----\n";
float tbadi,fl;
float twi;
float timt=0,btimt=0;
float tottim=0,btottim=0;
    float temp=0;
    for(n=0;n<i;n++)
    {
        for(a=0;a<i;a++)
            if(tempv[a].job==ajs[n])
            {
                aout1=ain1+tempv[a].aadi;
                tti=tempv[a].ti;
                fl=tempv[a].badi;
                twi=tempv[a].wi;
            }
        bin1=aout1+tti;
        if(bin1<temp)
            bin1=temp;
        bout1=bin1+fl;
        timt+=(bout1-ain1)*twi;
    }
cout<<setprecision(2)<<ajs[n]<<" \t "<<ain1<<" \t "<<aout1<<" \t "<<bin1<<" \t "<<bout1<<" \t "<<twi<<endl;
    tottim+=twi;

    ain1=aout1;
    bin1=bout1;
    temp=bout1;
}

    cout<<"Total Weighted Flow Time is: "<<timt/tottim;
//B -> A
i=0;
for(a=0;a<nosdh;a++)
{
    if(asdh[a][1]==-2)
    {
        bjs[i]=a1;
        i++;
        bjs[i]=a2;
        i++;
    }
}
```

```
        }
        else
        {
            bjs[i]=(int)asdh[a][1];
            i++;
        }
    }
    for(a=0;a<nosh;a++)
    {
        if(ash[a][1]==-2)
        {
            bjs[i]=a1;
            i++;
            bjs[i]=a2;
            i++;
        }
        else
        {
            bjs[i]=(int)ash[a][1];
            i++;
        }
    }
    temp=0;
    //  cout<<"-----"<<endl;
    //  for(a=0;a<i;a++)
    //  cout<<bjs[a]<<" ";
    //  cout<<endl;
    ain2=0;
    aout2=0;
    bin2=0;
    bout2=0;
    cout<<"\n\nIn-Out table for the Order B->A \nJob\tB(in)\tB(out)\tA(in)\tA(out)\tWi\n-----\n\n";
    for(n=0;n<i;n++)
    {
        for(a=0;a<i;a++)
            if(tempv[a].job==bjs[n])
            {
                //          aout2=ain2+tempv[a].aadi;
                //          tti=tempv[a].ti;
                //          fl=tempv[a].badi;
                aout2=ain2+tempv[a].badi;
                tti=tempv[a].ti;
                fl=tempv[a].aadi;
                twi=tempv[a].wi;
            }
        bin2=aout2+tti;
        if(bin2<temp)
            bin2=temp;
        bout2=bin2+fl;
        btimt+=(bout2-ain2)*twi;
```

```
                btottim+=twi;
//                cout<<twi<<endl;
        cout<<setprecision(2)<<bjs[n]<<" \t "<<ain2<<"\t "<<aout2<<" \t "<<bin2<<"\t "<<bout2<<"\t"<<twi<<endl;
        ain2=aout2;
        bin2=bout2;
        temp=bout2;
    }
//    cout<<btimt<<" "<<btottim<<endl;
        cout<<"Total Weighted Flow Time is: "<<btimt/btottim;

    }
    getch();
    goto re1;
    break;
    case 6:
    re1:
        clrscr();
        cout<<"\n\n\nThe Total Elapsed time for the the sequence (";
            for(a=0;a<noj;a++)
                cout<<ajs[a]<<" ";
        cout<<") when the order is A-> B is: "<<bout1<<endl;

        cout<<"\n\nThe Total Elapsed time for the the sequence (";
            for(a=0;a<noj;a++)
                cout<<bjs[a]<<" ";
        cout<<") when the order is B-> A is: "<<bout2<<endl;
        cout<<"\nSo.....\n\n";
        if(bout1<bout2)
        {
            cout<<"\nHence the optimal sequence of all the job which minimise the total elapse time of each machine is (";
                for(a=0;a<noj;a++)
                    cout<<ajs[a]<<" ";
            cout<<") for the order  A -> B .";
        }
        else
        {
            cout<<"\nHence the optimal sequence of all the job which minimize the total elapse time of each machine is (";
                for(a=0;a<noj;a++)
                    cout<<bjs[a]<<" ";
            cout<<") for the order  B -> A .";
        }

        cout<<"\n\n\n Press Any key to exit..";
        getch();
        break;
    }//end switch
}

};
void main()
```

```
{
  clrscr();
  A ob;
  noj=0;
  ob.showmenu();
}
```

Numerical Illustration:

Consider 5 jobs, 2 machines open shop problem with processing time A_i and B_i associated with their respective probabilities p_i and q_i . Transportation time $T_{i,A \rightarrow B}$ or $T_{i,B \rightarrow A}$ and weights of each job are given in the following table. The jobs 3 and 5 are processed as a group job (3, 5).

Jobs	Machine A		$T_{i,A \rightarrow B}$ or $T_{i,B \rightarrow A}$	Machine B		w_i
	A_i	p_i		B_i	q_i	
1	24	0.2	4	22	0.3	5
2	20	0.2	2	16	0.2	4
3	30	0.3	6	13	0.2	3
4	15	0.1	5	10	0.1	2
5	25	0.2	3	12	0.2	3

Tableau-2

Our objective is to find the optimal or near optimal sequence which minimizes the total elapsed time and mean weighted flow time.

Solution:-

As per Step1: Define expected processing time A'_i and B'_i on machine A and B respectively by following formulae:-

- $A'_i = A_i \times p_i$
- $B'_i = B_i \times q_i$

Jobs	A'_i	$T_{i,A \rightarrow B}$ or $T_{i,B \rightarrow A}$	B'_i	w_i
1	4.8	4	6.6	5
2	4.0	2	3.2	4
3	9.0	6	2.6	3
4	1.5	5	1.0	2
5	5.0	3	2.4	3

Tableau-3

As per Step2: Define two fictitious machines G and H with their processing times G_i and H_i using:

- If $\min(A'_i, B'_i) = A'_i$ then calculate $G_i = A'_i + T_{i,A \rightarrow B} + w_i$ and $H_i = B'_i + T_{i,A \rightarrow B}$
- If $\min(A'_i, B'_i) = B'_i$ then calculate $G_i = A'_i + T_{i,A \rightarrow B}$ and $H_i = B'_i + T_{i,A \rightarrow B} + w_i$

J	G_i	H_i	w_i
1	13.8	10.6	5
2	6.0	9.2	4
3	15.0	11.6	3

4	6.5	8.0	2
5	8.0	8.4	3

Tableau-4

As per Step3: Calculate G'_i and H'_i where

(a) $G'_i = G_i / w_i$

(b) $H'_i = H_i / w_i$

Job s	G'_i	H'_i
1	2.76	2.12
2	1.5	2.3
3	5.0	3.86
4	3.25	4.0
5	2.66	2.8

Tableau-5

As per Step4: For the machine order $G \rightarrow H$

Calculate the expected processing time for the equivalent job $\alpha = (3, 5)$ on the fictitious machines G and H using:-

(a) $G'_\alpha = G'_k + G'_m - \min(H'_k, G'_m)$

$G'_\alpha = 5.0 + 2.66 - \min(3.86, 2.66)$
 $= 5.0 + 2.66 - 2.66 = 5.0$

(b) $H'_\alpha = H'_k + H'_m - \min(H'_k, G'_m)$

$H'_\alpha = 3.86 + 2.8 - \min(3.86, 2.66)$
 $= 6.66 - 2.66 = 4.0$

As per Step5: Define a new reduced problem with processing times G'_i and H'_i as define in step 3 & 4

Jo bs	G'_i	H'_i
1	2.76	2.12
2	1.5	2.3
α	5.0	4.0
4	3.25	4.0

Tableau-6

As per Step6: Construct a set S_G and S'_G

$S_G = \{1.5, 3.25\}$; $S'_G = \{2.76, 5.0\}$

As per Step7: $S_1 = \{2, 4\}$; $S_2 = \{1, \alpha\}$

As per Step8: Augmented ordered sequence $S_{AB} = \{S_1, S_2\}$ i.e. $\{2, 4, 1, 3, 5\}$ gives optimal/near optimal sequence for the machine order A to B

For the machine order $H \rightarrow G$; As per step1

Jobs	B'_i	$T_{i,A \rightarrow B}$ Or $T_{i,B \rightarrow A}$	A	w_i
1	6.6	4	4.8	5
2	3.2	2	4.0	4
3	2.6	6	9.0	3
4	1.0	5	1.5	2
5	2.4	3	5.0	3

Tableau-7

As per Step2: Define two fictitious machines H and G with processing times H_i and G_i for job i on machines H and G respectively.

Jobs	H_i	G_i	w_i
1	10.6	13.8	5
2	9.2	6.0	4
3	11.6	15.0	3
4	8.0	6.5	2
5	8.4	8.0	3

Tableau-8

As per Step3:

Jobs	H'_i	G'_i
1	2.1	2.76
2	2.3	1.5
3	3.8	5.0
4	4.0	3.25
5	2.8	2.66

Tableau-9

As per Step4: Calculate processing time for equivalent job $\alpha = (3,5)$ as define in step3&4

$$\begin{aligned}
 H'_\alpha &= H'_k + H'_m - \min(H'_m, G'_k) \\
 &= 3.86 + 2.8 - \min(5.0, 2.8) \\
 &= 3.86 + 2.8 - 2.8 = 3.86
 \end{aligned}$$

$$\begin{aligned}
 G'_\alpha &= G'_k + G'_m - \min(H'_m, G'_k) \\
 &= 5.0 + 2.66 - \min(5.0, 2.8) \\
 &= 5.0 + 2.66 - 2.8 = 4.86
 \end{aligned}$$

As per Step8: For the machine order $H \rightarrow G$

construct the set S_H and S'_H :

Jobs	H'_i	G'_i
1	2.1 2	2.7 6
2	2.3	1.5
α	3.8 6	4.8 6
4	4.0	3.2 5

Tableau-10

$$S_H = \{2.12, 3.86\} \quad ; \quad S'_H = \{2.3, 4.0\}$$

As per Step9: $S'_1 = \{1, \alpha\}$; $S'_2 = \{2, 4\}$

As per Step10: Augmented ordered sequence $S_{BA} = \{S'_1, S'_2\}$ i.e. $\{1, 3, 5, 2, 4\}$ gives the optimal / near optimal sequence for machine order B to A

Now calculate the total production time for the sequence S_{AB} and S_{BA}

As per Step11: In – Out table for the sequence S_{AB}

Jobs i	Machine A		Machine B	
	In	Out	In	Out
2	0.0	- 4.0	6.0	- 9.2
4	4.0	- 5.5	10.5	- 11.5
1	5.5	- 10.3	14.3	- 20.9
3	10.3	- 19.3	25.3	- 27.9
5	19.3	- 24.3	27.9	- 30.3

Tableau-11

The mean weighted flow time for the machine order A to B

$$= \frac{[9.2 \times 4 + (11.5 - 4.0) \times 2 + (20.9 - 5.5) \times 5 + (27.9 - 10.3) \times 3 + (30.3 - 19.3) \times 3]}{4 + 2 + 5 + 3 + 3}$$

$$= 12.62 \text{ hrs.}$$

In – Out table for the sequence S_{BA}

Jobs i	Machine B		Machine A	
	In	Out	In	Out
1	0.0	- 6.6	10.6	- 15.4
3	6.6	- 9.2	15.4	- 24.4
5	9.2	- 11.6	24.4	- 29.4
2	11.6	- 14.8	29.4	- 33.4
4	14.8	- 15.8	33.4	- 34.9

Tableau-12

The mean weighted flow time for the machine order B to A

$$= \frac{15.4 \times 5 + (24.4 - 6.6) \times 3 + (29.4 - 9.2) \times 3 + (33.4 - 11.6) \times 4 + (34.9 - 14.8) \times 2}{5 + 3 + 3 + 4 + 2}$$

=18.72 hrs

The total expected elapsed time when the order is from A to B for the sequence (2, 4, 1, 3, 5) is 30.3. units and for the sequence (1, 3, 5, 2, 4) is 34.9 units when order is B to A. Hence the optimal sequence of all the jobs which minimize the total elapsed time of each machine is (2, 4, 1, 3, 5) for the order A→B.

VIII. REMARKS

- [1] If the probabilities are not associated with processing time then the results tally with[9].
- [2] If probabilities are associate with processing time then the results tally with[8].
- [3] If both probabilities and transportation time are not included then results tally with[9].
- [4] Equivalent job formulation is associative and non commutative in nature.
- [5] The study on $n \times 2$ open shop scheduling may be further extended by including parameter such as break down interval, etc.
- [6] The study may further be extended for 3 machines, also by considering various parameters such as Transportation time, break down interval, weightage of jobs etc.

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Load Frequency Control Using Fuzzy Logic

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Abstract- In industry or any area increasing load is a vast problem for power generation plants due to increase in demand for power. So making balance between generation and demand is the operating principle of load frequency control (LFC). The reliable operation of a large interconnected power system necessarily requires an Automatic Generation Control (AGC). The objective of AGC is to regulate the power output of Generators within a specified area in response to change in the system frequency, tie line power or relation of the two to each other, so as to maintain the scheduled system frequency and power interchange in the other are within the prescribed limits. Several studies in LFC have led to the trend of applying the adaptive approach to the implementation on automatic generation control (AGC). However, the adaptive controller with self-tuning technique requires online acquisition of system parameters that was not clearly stated in the related literatures. Fuzzy controller and integral controller have been used to the models of single area power system and responses of area control error (ACE), tie line power and change in frequency are observed. The design of Fuzzy Logic Controller (FLC) involves the allocation of areas inputs and outputs, mapping of rules between inputs and outputs and defuzzification of outputs into a real value. There are some parameters (TP, M, β) which are used online for the adaptive tuning of fuzzy controller. We have solved for those parameters with model equations and used in the designing of the controller. Simulation results show that fuzzy control based estimate with an adaptive controller could enhance the performance of the LFC.

Index Terms- LFC, AGC, FLC, ACE, Tie line, acquisition, Defuzzification

I. INTRODUCTION

1.1 AUTOMATIC GENERATION CONTROL

When load in the system increases turbine speed drops before the governor can adjust the input. As the change in the value of speed decreases the error signal becomes smaller and the positions of governor valve get close to the required position, to maintain constant speed. However the constant speed will not be the set point and there will be an offset, to overcome this problem an integrator is added, which will automatically adjust the generation to restore the frequency to its nominal value. This scheme is called automatic generation control (AGC). The role of AGC is to divide the loads among the system, station and generator to achieve maximum economy and accurate control of

the scheduled interchanges of tie-line power while maintaining a reasonable uniform frequency. Automatic generation control (AGC) plays a very important role in power system as its main role is to maintain the system frequency and tie line flow at their scheduled values during normal period.

Automatic generation control with primary speed control action, a change in system load will result in a steady state frequency deviation, depending upon governor droop characteristics and frequency sensitivity of the load. Restoration of the system frequency to nominal value requires supplementary control action which adjusts the load reference set point. Therefore the primary objectives of the automatic generation control are to regulate frequency to the nominal value and to maintain the interchange power between control areas at the scheduled values by adjusting the output of selected generators. This function is commonly referred to as load frequency control. A secondary objective is to distribute the required change in generation among the units to minimize the operating costs.

A control signal made up of tie line flow deviation added to frequency deviation weighted by a bias factor would accomplish the desired objective. This control signal is known as area control error (ACE). ACE serves to indicate when total generation must be raised or lowered in a control area.

In an interconnection, there are many control areas, each of which performs its AGC with the objective of maintaining the magnitude of ACE (area Control Error) "sufficiently close to 0" using various criteria. In order to maintain the frequency sufficiently close to its synchronous value over the entire interconnection, the coordination of the control areas' actions is required. Any wide deviation from the nominal value of frequency or voltage will lead the system to total collapse. Hence AGC has gained importance with the growth of interconnected systems and with rise in size of interconnected system automation of the control system have aroused. A number of control strategies exist to achieve better performance. Due to non-linearity of power system, system parameters are linearized around an operating point. PI controller is generally used. The disadvantage of PI controller is that the mathematical model of the control process may not exist or may be too expensive in terms of computer processing powers and memory.

II. THEORY OF LOAD FREQUENCY CONTROL

2.1 FREQUENCY RESPONSE IN PRIMARY CONTROL

When the system frequency drifts from nominal value 50Hz, some frequency sensitive components react to this change, the

effective load for the power system changes. This process is called load damping and modeled with damping factor D. second, if the system frequency goes beyond the governor dead band (about 35 MHz); the governor will act to increase or decrease the output power of generating units. This can be done with the help of governed speed droop R, which is actually the feedback loop gain in the governor. The speed droop is defined as

$$R = \frac{\Delta w}{\Delta P} \text{ pu}$$

Where

Δw = speed deviation

ΔP = output power

Percent speed regulation or droop R

The value of R determines the steady state speed versus load characteristics of the generating unit as shown in figure 2.1 below.

The ratio of speed deviation (ΔW_r) or frequency deviation (Δf) to change in valve/gate position (ΔY) or output power (ΔP) is equal to R. the parameter R is referred to speed regulation or droop. It can be expressed in percent as

Percent R = percent speed or frequency change / percent power output change * 100

$$= [w(nl) - w(fl)] / w_0 * 100$$

Where

w(nl) = steady state speed at no load

w(fl) = steady state speed at full load

w₀ = nominal or rated speed

For example 5% speed droop or regulation means 5% frequency deviation causes 100% change in power output.

In figure 2.1 speed droop characteristics of governor is shown. A typical value of speed droops in the governor is 5%. These governors' responses from each unit in the control area collectively to stabilize the system frequency at a new equilibrium

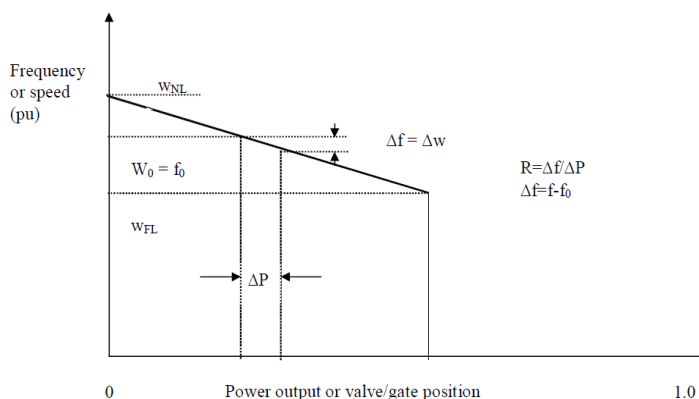


Figure 2.1: Ideal steady state characteristics of governor with speed droop

These two responses, load damping and governor response; help the system interconnection to be more stable. In short the

system frequency goes up when the generation output is relatively bigger than the loads and the vice versa. This can be understood as a strong natural inertia to stay on equilibrium. The governor speed droop characteristics intentionally put to help this natural process to be more effective.

These responses are mathematically modeled as D and R respectively and are combined into one frequency response characteristic.

$$\beta = \sum \left(\frac{1}{R} + D \right)$$

2.2 AGC (Automatic Generation and Control)

The objectives of AGC are as follows:

- To hold system frequency at or very close to a specified/nominal value.
- To maintain correct value of interchange power between control areas
- To maintain each units generation at the most economic value.

To accomplish these objectives, each control area has to continually determine and monitor system deviation in measured frequency, Δf and tie line flow, ΔT , to determine the Area Control Error (ACE) as a measure for the secondary control. The raw values of ACE is first processed through filters, and then pass through a PI regulator, distributed by regulation participation factors before being dispatched as the load reference signal to the governor of units. A demand signal may also be sent to coordinate boiler turbine controllers to initiate boiler action in advance for improved overall unit response. The response time of AGC is approximately, a minute or two, mainly limited by the delays associated with the response rate of the units.

2.4 Area Control Error

Area Control Error is defined by

$$ACE_i = \Delta P_{ij} + B_i * \Delta f$$

Where i control area for which ACE is being measured

ΔP_{ij} power interchange in areas i and j

B_i control area frequency bias coefficient

Δf deviation in frequency

ACE is an error signal consisting of two terms. First term represents the error in the scheduled tie flows. The second term is inter area assistance in generation from control area to prevent large deviation of interconnection frequency. ACE, as defined, represents the generation versus load mismatch for the control area. The ACE signal is used in conventional AGC which has PI control logic.

ACE serves to indicate when total generation must be raised or lowered in a control area. A general criterion can be given about which AGC is considered 'good'. The ACE signal should ideally be kept from becoming too large. Since ACE is directly influenced by random load variations, this criterion can be treated statically by saying that the standard deviation of ACE should be small ACE should not be allowed to 'drift'. This means that the integral of ACE over appropriate time should be small. A 'drift' in ACE has the cumulative effect of creating system time errors or inadvertent interchange errors. The amount

of control action called for by the AGC should be kept to a minimum.

2.5 Tie line bias control

Tie-line bias control is a control philosophy developed for load frequency control in a power system. It is widely used in AGC. It has been proved efficient in maintaining interconnection reliability and its simplicity in control implementation. The concept allows each control area to operate its generation and to fulfill areas control obligation, independently by monitoring and control the area's ACE. The frequency bias term in the ACE equation is important in that it assures that the objective of the AGC regulation is fulfilled while an area's responsibility to provide frequency response is not forfeited.

2.6 AGC in a single area system

In an isolated power system, maintenance of interchange power is not an issue. Therefore, the function of AGC is to restore frequency to the specified nominal value. This is accomplished by adding a reset or integral control which acts on the load reference settings of the governors of units on AGC. The integral control action ensures zero frequency error in the steady state.

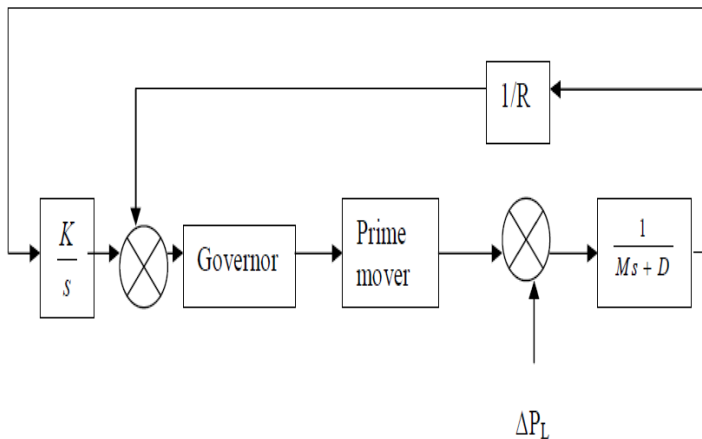


Figure 2.2: Addition of integral control on generating units selected for AGC

The supplementary generation control action is much slower than the primary speed control action. As such it takes effect after the primary speed control (which acts on all units on regulation) has stabilized the system frequency. Thus, AGC adjusts load reference settings of selected units, and hence their output power, to override then effects of composite frequency regulation characteristics of power system. In doing so, it restores the generation of all other units not on AGC to scheduled values.

2.7 AGC for a two area system

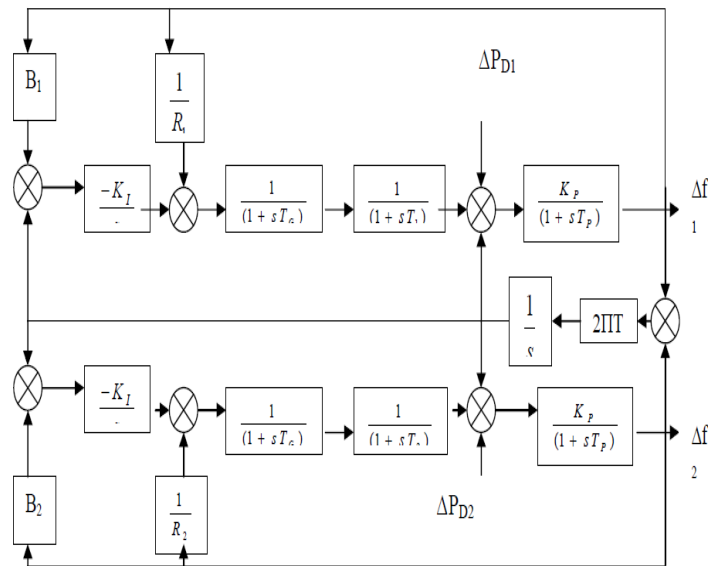


Figure 2.3: Transfer function model of a two area interconnected system

ΔP_{D1} Incremental load change in area 1.
 ΔP_{D2} Incremental load change in area 2
 R Governor speed regulation parameter.
 T_G Mechanical governor response time (second).
 T_T turbine time constant.
 B_1 Frequency bias constant for area 1.
 B_2 Frequency bias constant for area 2
 $TP = 2H/fD$
 $K_p = 1/D$
 D load damping constant
 K_I Integral gain
 Δf_1 Change in frequency for area 1
 Δf_2 Change in frequency for area 2

Figure 2.3 below shows block diagram representation of a two area interconnected system with each area represented by an equivalent inertia M , load damping constant D , turbine and governing system with a an effective speed droop R . The power flow on tie line from area 1 to area 2 is

$$P_{12} = \frac{E_1 E_2}{X_t} \sin(\delta_1 - \delta_2) \quad (2.1)$$

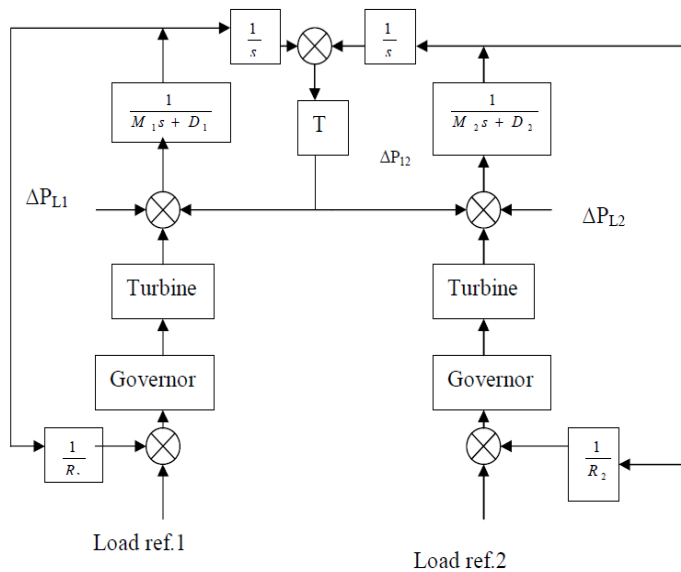


Figure 2.4: Two area system with primary speed control
Linearizing about an initial operating point represented by

$$\delta_1 = \delta_{10} \text{ and } \delta_2 = \delta_{20}$$

$$\text{And } \Delta P_{12} = T \Delta \delta_{12} \quad (2.2)$$

$$\text{Where } \delta_{12} = \delta_1 - \delta_2 \quad (2.3)$$

The tie line is represented by the synchronizing torque coefficient T. synchronizing coefficient T is given by

$$T = E_1 E_2 \cos(\delta_1 - \delta_2) / X_t \quad (2.4)$$

A positive ΔP_{12} represents an increase in power transfer from area 1 to area2. The steady state frequency deviation ($f-f_0$) will be same for two areas. For a total load change of ΔP_L

$$\Delta f = \Delta w_1 = \Delta w_2 = \frac{-\Delta P_L}{(1/R_1 + 1/R_2) + (D_1 + D_2)} \quad (2.5)$$

Consider the steady state values following an increase in area 1 load by ΔP_{L1} . for area 1

$$\Delta P_{m1} - \Delta P_{12} - \Delta P_{L1} = \Delta f D_1 \quad (2.6)$$

And for area 2

$$\Delta P_{m2} + \Delta P_{12} = \Delta f D_2 \quad (2.7)$$

The change in mechanical power depends upon regulation. Hence

$$\Delta P_{m1} = -\frac{\partial f}{\partial R_1} \quad (2.8)$$

$$\Delta P_{m2} = -\frac{\partial f}{\partial R_2} \quad (2.9)$$

Substitution of equation (2.8) in eq. (2.6) and eq. (2.9) in eq. (2.7) yields

$$\partial f \left(\frac{1}{R_1} + D_1 \right) = \Delta P_{12} - \Delta P_{L1} \quad (2.10)$$

And

$$\partial f \left(\frac{1}{R_2} + D_2 \right) = \Delta P_{12} \quad (2.11)$$

Solving equations (2.10) and (2.11)

$$\Delta f = \frac{-\partial P_L}{(1/R_1 + 1/R_2) + (D_1 + D_2)} = \frac{-\partial P_L}{(\beta_1 + \beta_2)} \quad (2.12)$$

Where β_1 and β_2 are the composite frequency response characteristics of area 1 and area 2 respectively. An increase in area 1 load by ΔP_{L1} results in a frequency reduction in both areas and a tie line flow of ΔP_{12} . a negative ΔP_{12} is indicative of flow from area 2 to area1. The tie line flow deviation reflects the contribution of the regulation characteristic $(1/R+D)$ of one area to another.

Similarly for a load change in area 2 by ΔP_{L2}

$$\Delta f = \frac{-\Delta P_{L2}}{\beta_1 + \beta_2} \quad (2.13)$$

And

$$\Delta P_{12} = -\Delta P_{21} = \frac{-\Delta P_{L2} \cdot \beta_1}{\beta_1 + \beta_2} \quad (2.14)$$

Examination of equations from (2.10) to (2.13) indicates a control signal made up of tie line flow deviation added to frequency deviation weighted by a bias factor would accomplish the desired objective. This control signal is known as area control error (ACE). From equation (2.10) and (2.11), it is apparent that a suitable bias factor for an area is its frequency response characteristic β .

Thus area control error for area 2

$$ACE_2 = \Delta P_{12} + B_2 \Delta f \quad (2.15)$$

Where

$$B_2 = \beta_2 = \frac{1}{R_2} + D_2 \quad (2.16)$$

Similarly for area 1

$$B_1 = \beta_1 = \frac{1}{R_1} + D_1 \quad (2.17)$$

The ACE represents the required change in area generation, and its unit is MW. The unit normally used for expressing the frequency bias factor B is MW/0.1Hz

III. FUZZY SYSTEM LOGIC

Logic is the science of reasoning. Symbolic or mathematical logic has turned out to be powerful computational paradigm. Not only symbolic logic help in the description of events in the real world but has also turn out to be an effective tool for inferring or deducing information from a given set of facts.

3.1 FUZZY LOGIC CONTROLLER

Fuzzy logic controller is used for automatic generation control in a two area system. Basic block diagram of fuzzy logic controller is as shown under.

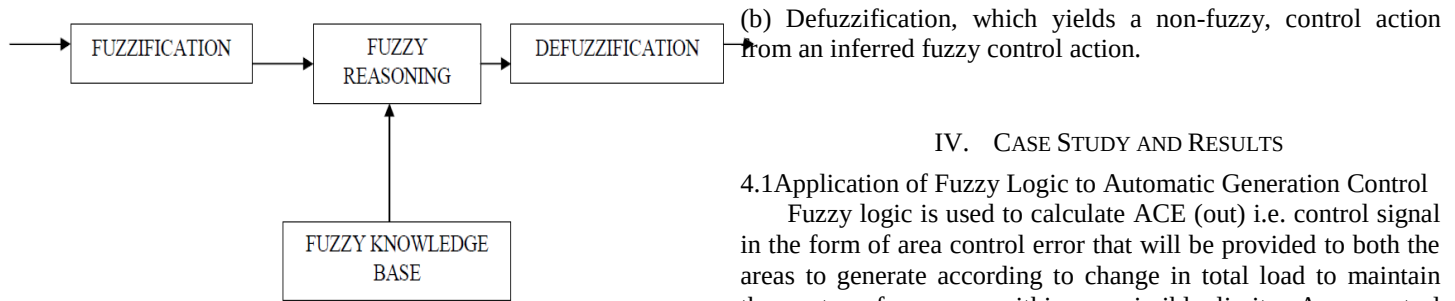


Figure 3.2: Basic structure of fuzzy logic controller.

The main building units of an FLC are a fuzzification unit, a fuzzy logic reasoning unit, a knowledge base, and a defuzzification unit. Defuzzification is the process of converting inferred fuzzy control actions into a crisp control action.

3.2 Design of FLC

In the design of an FLC system it is assumed that:

- The input and output variables can be observed and measured.
- An adequate solution (not necessarily an optimum one) is acceptable.
- A linguistic model can be created based on the knowledge of a human expert.

Fuzzy controllers are normally built with the use of fuzzy rules. The membership functions for the fuzzy sets will be derived from the information available from the domain experts and/or observed control actions.

The basic configuration of Fuzzy Logic Controller (FLC) consists of four main parts

- (i) Fuzzification
- (ii) Knowledge base
- (iii) Decision-making logic and
- (iv) Defuzzification

The functions of the above modules are described below.

(i) The Fuzzification:

- (a) Measure the values of input variables
- (b) Performs a scale mapping that transforms the range of values of input variables into corresponding universe of discourse.
- (c) Performs the function of fuzzification that converts input into suitable linguistic values, which may be, viewed labels of fuzzy sets.

(ii) The Knowledge Base:

It consists of data base and linguistic control rule base.

- (a) The database provides necessary definitions, which are used to define linguistic control rules and fuzzy data, manipulation in an, FLC.
- (b) The rule base characterizes the control goals and control policy of the domain experts by means of set of linguistic control rules.

(iii) The Decision Making Logic:

It is the kernel of an FLC; it has the capability of simulating human decision making based on fuzzy concepts and of inferring fuzzy control actions employing fuzzy implication and the rules of inference in fuzzy logic.

(iv) The Defuzzification:

- (a) A scale mapping which converts the range of values of input variables into corresponding universe of discourse.

IV. CASE STUDY AND RESULTS

4.1 Application of Fuzzy Logic to Automatic Generation Control

Fuzzy logic is used to calculate ACE (out) i.e. control signal in the form of area control error that will be provided to both the areas to generate according to change in total load to maintain the system frequency within permissible limits. Area control error and change in frequency of the system as input are used as inputs for FLC.

4.1.1 Algorithm for fuzzy logic application to AGC problem

The calculation of the control action in the fuzzy algorithm consists of following four steps.

1. Calculate area control error (ACE) and change of frequency (delF).
2. Convert the error and change of frequency into fuzzy variables i.e. linguistic variables such as Positive Big (PB), Positive Medium (PM) etc., as given below.
3. Evaluate the decision rules shown in rule base given below using the compositional rule of inference.
4. Calculate the deterministic input required to regulate the process. The control rules are formulated in linguistic terms using fuzzy sets to describe the magnitude of error, the frequency deviation and the magnitude of the appropriate control action.

NS = negative small

ZE = zero

PS = positive small

4.2 Online Estimation of T_p , M

The input and output relations could be approximated by Where P_{in} is unit's MW input commands. P_{out} is unit's actual MW output. Relocating the denominator and taking the inverse Laplace transform of , the

$$P_{in} \times \left(\frac{1}{T_{PS} + 1} \right) = P_{out} \quad (4.1)$$

equation becomes

$$P_{in} = P_{out} \times T_P + P_{out} \quad (4.2)$$

4.3 Online estimation of system's inertia constant M

The electromechanical power balance equation of an isolated power system is

$$(P_{out} - P_L) \times \frac{1}{Ms + D} = \Delta F \quad (4.3)$$

Where P_{out} is total MW generation, M is system's inertia constant in second, ΔF is frequency deviation in Hz, D is load damping in MW/Hz, and P_L is system MW load. Relocating the denominator term in (4.3) and taking the inverse Laplace transform, (4.3) becomes

$$P_{out} = M \times \Delta \dot{F} + D \times \Delta F + P_L \quad (4.4)$$

Once the system parameters are available, the integral gains in AGC could be scheduled corresponding to some nominal

operating conditions. In general, the operating states of LFC in a control area could be categorized into three load conditions, on peak, semi-on peak, and off peak. Each state may result in different T_p and M in the system. As a result, three parameters for three states would constitute 27 patterns of operating gains.

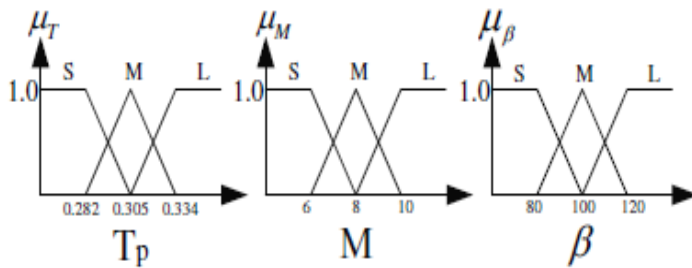


Figure 4.1: Membership functions for variables T_p , M , and β

In this case, a Sugeno Type Fuzzy Inference System (STFIS) was adopted to calculate the off nominal gains. Unlike Mamdani type fuzzy inference approach, STFIS does not use the complicated Defuzzification process to derive the off nominal gains. As a result, STFIS is simpler to design faster for AGC calculation. Table 4.1 is used as a reference to design and develop the fuzzy base rule where T_p , M are taken online.

1) Construct the membership functions: When T_p , M , and β are monitored, the estimated values are fuzzified by the membership functions depicted in Fig. 4.1. The membership functions are to be used for fuzzification process.

2) Setting the Fuzzification rule: The available T_p , M , and β are classified into three subsets (S, M, L).

3) We can take the value of Frequency bias factor β which is equal to

$$\beta = 1/R_{eq} + D \quad (4.5)$$

System investigated

Single area power system is investigated. Dynamic performance of system is observed for 1% step change. Simulation is carried on MATLAB.

Table 4.1: Integral gain corresponding to nominal system parameters

Pattern	T_p	M	β	K_I	Pattern	T_p	M	β	K_I
1	0.334	6	80	5.63	15	0.305	8	120	5.23
2	0.334	6	100	6.21	16	0.305	10	80	4.34
3	0.334	6	120	6.55	17	0.305	10	100	5.28
4	0.334	8	80	5.33	18	0.305	10	120	5.30
5	0.334	8	100	5.80	19	0.282	6	80	3.90
6	0.334	8	120	6.11	20	0.282	6	100	4.18
7	0.334	10	80	4.59	21	0.282	6	120	4.41
8	0.334	10	100	5.15	22	0.282	8	80	3.83
9	0.334	10	120	5.97	23	0.282	8	100	4.14
10	0.305	6	80	4.82	24	0.282	8	120	4.31
11	0.305	6	100	5.13	25	0.282	10	80	3.84
12	0.305	6	120	5.39	26	0.282	10	100	4.00
13	0.305	8	80	5.05	27	0.282	10	120	4.29
14	0.305	8	100	5.08					

4.4 Simulation Results of single area system with integral controller and fuzzy gain scheduling.

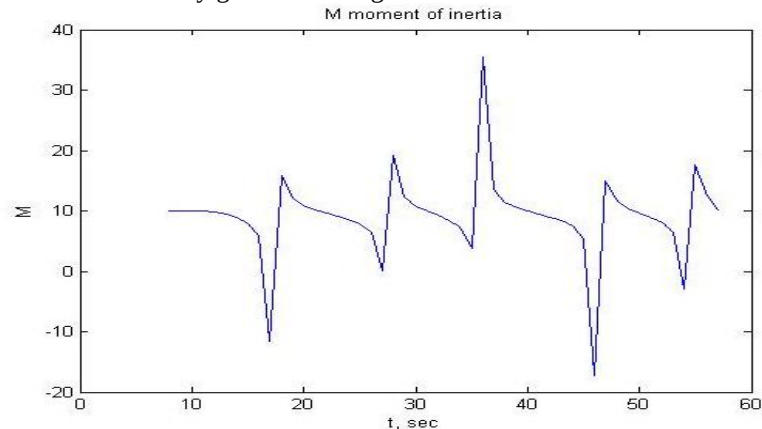


Figure 4.2: Online value of M (Moment of Inertia)

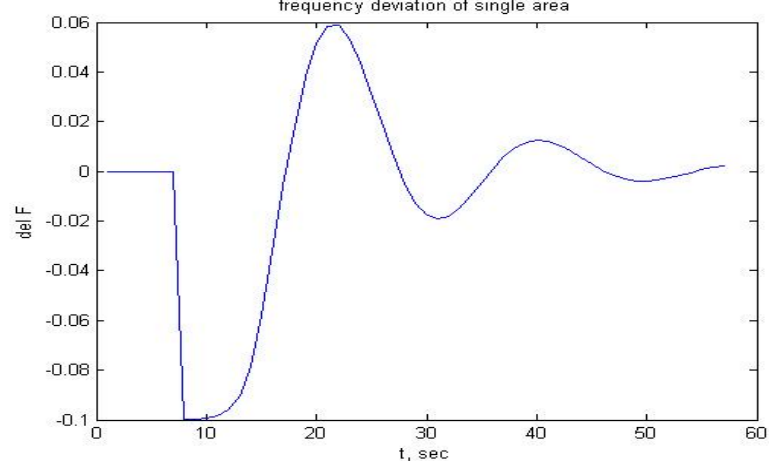


Figure 4.3: Frequency Deviation of Single area with integral controller

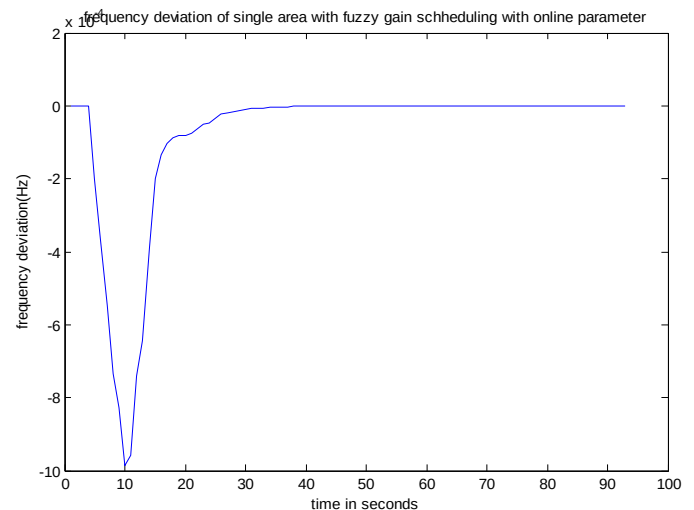


Figure 4.4: frequency deviation of single area with fuzzy gain scheduling (Blue for area one and Green for area 2)

4.5 Here this results shows changing of online parameter with load changes

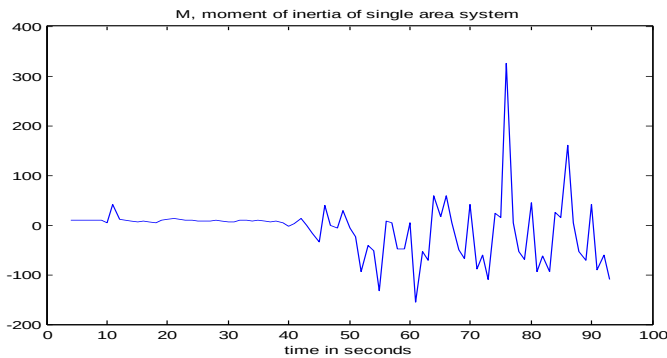


Figure 4.5: online value of M, moment of inertia of single area system fuzzy gain scheduling

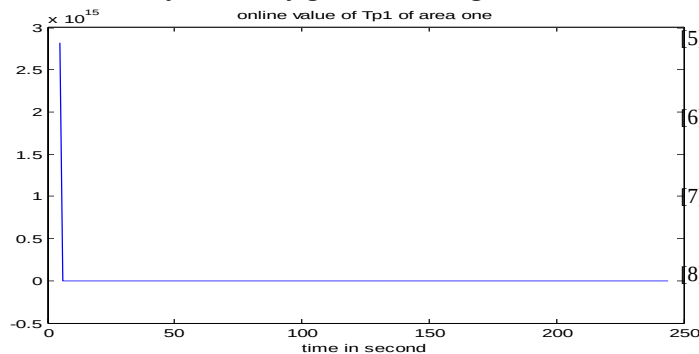


Figure 4.6: online value of Tp of single area diagram with fuzzy gain scheduling

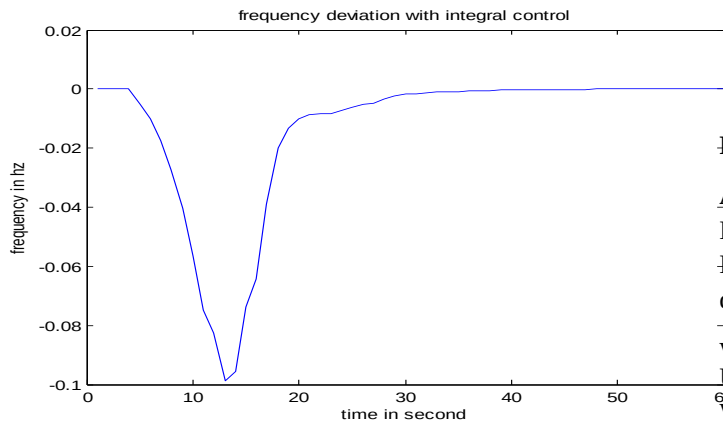


Figure 4.7: Frequency deviation in single area system with fuzzy controller

V. CONCLUSION

Firstly mathematical model of AGC in single area is presented & Integral controller is implemented, then estimate the online parameters of generation time constant (TP) and moment of inertia (M). Then Fuzzy Controller is implemented with generation time constant (TP) and moment of inertia (M) and freq bias coefficient β as inputs and integral gain (K) as output to fuzzy controller. Simulation is carried out on MATLAB and dynamic performance of system is observed.

We observed that adaptive fuzzy logic scheme to AGC problem enhanced the dynamic performance of single area

system. Dynamic performance (Δf) in a single area system is better when compared to conventional controller.

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In-Vitro Screening For Anti-Inflammatory Activity of Bulbophyllum Kaitense. Rechib. Pseudobulb Extract by HRBC Method. Eastern Peninsular Flora in South India

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Abstract- This work is of used on the evaluation of the anti-inflammatory activity various extracts of Bulbophyllum kaitense. Pseudobulb using experimental models. Four different extracts (Petroleum ether chloroform, Ethanol and aqueous) were tested. The anti-inflammatory activity of HRBC (Human Red Blood Cell Membrane Stabilization Method) was evaluated for the in vitro of anti-inflammatory property because the erythrocyte membrane is analogous to the lysosomal membrane and its stabilization implies that the various extracts may as well stabilize lysosomal membranes. Stabilization of lysosomal membrane is important in limiting the inflammatory response by preventing the release of lysosomal constituents of activated neutrophil such as bacterial enzymes and proteases. Which cause further tissue inflammation and damage upon extracellular release. The effects of the administration of reference standard (diclofenac) were evaluated. The plant extract showed significant activities in both of the anti-inflammatory assays as compared to diclofenac drug dependent manner. This investigation suggests that Ethanol extract has anti-inflammatory potential activity. The result obtained indicate the Bulbophyllum Kaitense Pseudobulb has anti-inflammatory activities that supports the folk medicinal use of the plant. The world first report in the plant.

Index Terms- Bulbophyllum kaitense, pseudobulb, Anti-inflammatory, Diclofenac, extracts

I. INTRODUCTION

The use of herbal extracts and nutritional supplements either as alternative or complementary medicine to the conventional chemotherapy for treatment of anti-inflammatory diseases is well documented in ayurveda. Which is an alternative medicinal system that has been practiced primarily in the Indian subcontinent for 5000 years (Dahankar et. Al.2000) inflammatory diseases, including different type of rheumatic disease are a major cause of inhibitory of the working force throughout the world. Many drugs produced a dramatic symptomatic improvement in rheumatic diseases but all of them shared the common effect called gastrointestinal irritation. The medicinal substances packaged in a plant can be safely assimilated by the body since the plants are its natural food. In India many ayurvedic practitioners are using various indigenous plants for the treatment of different types of inflammatory conditions. (K.Chandrasekaran 2011).

In the 17th century. The aesthetic appreciation was for tulips followed by the rose, gladiolus. Chrysanthemum and today virtually orchid has become the cynosure all over the world. This unusual aesthetic beauty is quite popular among the professional and amateur orchid lovers in many parts of the world. Contrary to the medicinal value of a vanguard taxon and of some other taxa including the present day eulalia (Dodonaea) Hochst., Plectranthus nodosa (Dall.) and Malaxis rheedii Sw. are discussed in Charaka Samhita; a classic ancient Indian medicinal treatise written by Charaka in Sanskrit a few thousand years ago. This forms first record of Indian orchids and their uses in Ayurvedic medicine (Manilal and Sathishkumar 1986) yet only in the later part of the 20th century, the medicinal value of orchid has been recognized. Lawler (1987) published an extensive account on ethnobotany of the family Orchidaceae and discussed the role and usage. Of many species is food, flavoring, confectionary industries, arts and crafts, animals and the veterinary medicines is several continents of the world. The use of several orchid taxa in medical practice was greatly appreciated by good in his work the family flora published in 1945 (Duggal 1971) in the ayurvedic system of medicine a group of eight drugs known as ashtavarga is employed in the preparation of a number of rejuvenating formulations and toxics the correct identification of these drugs has long been debated. The investigations have indicated that important constituents (drugs) of ashtavarga namely sivak (Microstylis wallichii), of ashtavarga (Habenaria acuminate) and ridhi varidhi (H. intermedia) are orchidaceous in nature (Handa 1986).

Bulbophyllum kaitense. Rechib, Pseudobulb this is an epiphytic family orchidaceous. Endemic to south it is native of India. Occurs in the forest of eastern ghats from Kolli hills above 1200m sympodial epiphytes with uninode pseudobulbs on the rhizome. Terminating the pseudobulbs. Inflorescence umbellate scape. Leaves 9-13 cm long flowers. Without mentum. Sepal unequal petals shorter than lateral sepals. The plants have been used in the indigenous medicine such as ayurveda and local traditional medicinal practices the pseudobulb is used for the treatment of certain antitumor, anticancer. Anti-inflammatory, antiseptic, antitumor and antimicrobial activity. The pseudobulb property is curing of different diseases. (A. Kalaiarasan) S. Ahmed John 2011) Analgesic, anesthetic, antiviral cancer preventive, fungicide, rodenticide emetic, vasodilator, COX-1 & COX-2 inhibitor, hypocholesterolemic, candidicide, diuretic, immunostimulant, chemopreventive, lipoxygenase inhibitor, pesticide, antidermatitic, Antileukemic, Hepatoprotective, hypocholesterolemic, antileukogenic,

vasodilator, antispasmodic, antibronchitic, anticoronary, antiarthritic. The plant is used a few years ago in Kolli hills agathiyammuniver. The plant has been used in indigenous medicine. This information was gathered by questioning local traditional healers and knowledgeable village people of Kolli hills. The aim of the present investigation was to evaluate the effect of *Bulbophyllum Kaitense*. Pseudobulb extract of anti-inflammatory experimental is human red Blood Cell membranes stabilization.

II. MATERIALS AND METHODS

Collection of plant material.

The healthy plant materials of *Bulbophyllum kaitense*. Rechits. Pseudobulb were collected from the eastern peninsula flora in south India. Kolli hills. India. September 2011 identified and authenticated by Ret, Dr.S. Hohn Britto. The director, the Rabinat Herbarium St, Joseph's College. Tiruchirappalli, Tamil Nadu. India, with the help of herbarium record. The plant voucher number RHT 827.

Preparation of Extract:

The plant material were cleaned, dried under shade and pulverized by using mixer, 500 g of the powder of plant was successively extracted with petroleum ether. Chloroform,

Calculation:

The percentage of HRBC membrane stabilization was calculated using the formula.

$$\text{Percentage protection} = \frac{100 - \text{Optical density of sample}}{\text{Optical density of control}} \times 100$$

III. RESULT

HRBC method was selected for the *in vitro* evaluation of anti-inflammatory property because the erythrocyte membrane is analogous lysosomal membrane and its stabilization implies that the extract may as well stabilize lysosomal membranes. Stabilization of lysosomal membrane is important in limiting the inflammatory response by preventing the release of lysosomal constituents of activated neutrophil. Which cause further tissue inflammation and damage upon extra cellular release.

The results of the present investigation suggest that the ethanolic extract of *Bulbophyllum kaitense*. Pseudobulbs. Exert anti-inflammatory activity possibly. The petroleum ether, Chloroform, and aqueous extract more or less anti-inflammatory activity. Result of anti-inflammatory activities are presented in (table-1)

IV. CONCLUSION

The present investigation it is concluded that extracts of *Bulbophyllum kaitense*. Pseudobulbs are capable of inhibiting inflammatory reactions as well as pain. The results provided experimental evidence for its traditional use in treating various diseases associated with inflammation and pain.

Ethanol and Aqueous in order of their increasing polarity using Soxhlet apparatus.

A) Studies on anti-inflammatory activity:

The anti-inflammatory activity using HRBC (Human Red Blood Cell Membrane stabilization) Method was carried out as described by Muruges. N. (1981) Anti-inflammatory activity was evaluated using the HEB method was used for the estimation of anti-inflammatory activity *in vitro*. Blood was collected from healthy volunteers and was mixed with equal volume of sterilized saline solution. This blood solution was centrifuged at 3000 rpm and the packed cells are separated. The packed cells were packed washed with saline solution and a 10% v/v suspension is made with saline. This HRBC suspension was used for the estimation of anti-inflammatory property. The plant pseudobulb various extract. Reference sample mixed with 1 ml of phosphate buffer. 2ml of hyposaline and 0.5ml of HRBC suspension. The reference used for this investigation is diclofenac sodium, all the assay mixtures were incubated at 37°C for 30 minutes and centrifuged at 3000 rpm. The supernatant liquid was decanted and the hemoglobin content was estimated by spectrophotometer at 560nm. The percentage hemolysis was produced is the control as 100%

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TABLE 1: SHOWS *IN-VITRO* ANTI-INFLAMMATORY ACTIVITY OF PSEUDOBULB

Sample	Percentage protection for Pet ether extract in blood			Percentage protection for Chloroform extract in blood			Percentage protection for aqueous extract in blood			Percentage protection for Ethanolic extract in blood		
	0.5	1.0	1.5	0.5	1.0	1.5	0.5	1.0	1.5	0.5	1.0	1.5
Pseudobulb	7.8	10.8	13.4	3	11.5	12.4	16.9	30	37	28.8	11.5	12.4

TABLE 2: *IN-VITRO* ANTI-INFLAMMATORY ACTIVITY OF PSEUDOBULB

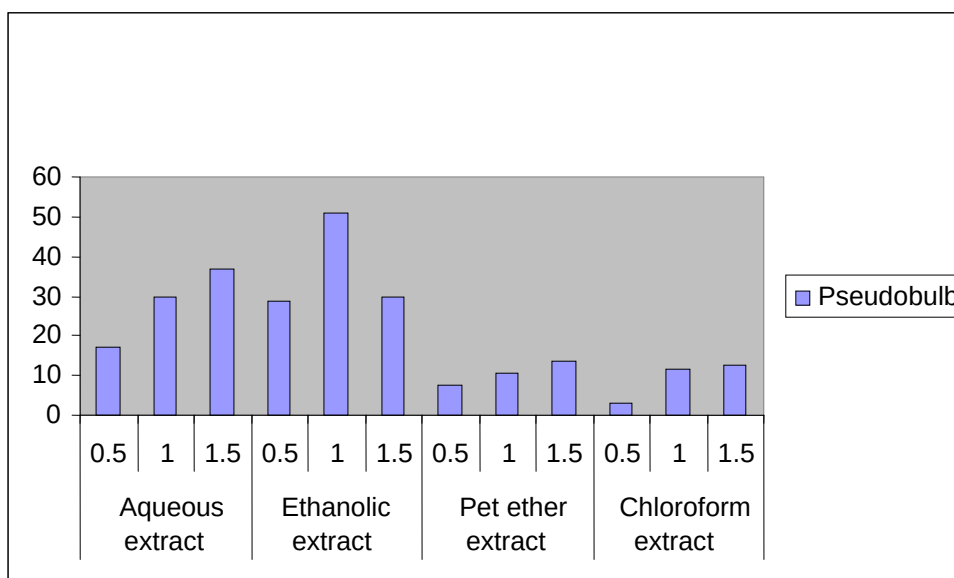


Figure 1: In vitro Analysis of Anti Inflammatory Activity by HRBC Method (Control)

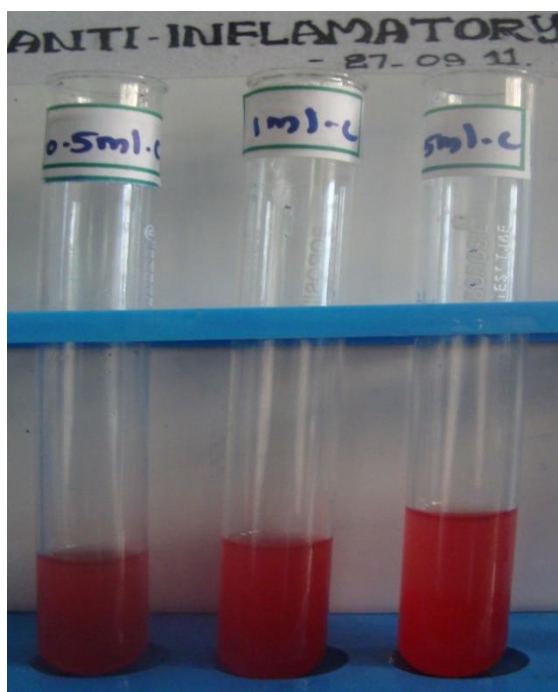


Figure 2: In vitro Analysis of Anti Inflammatory Activity by HRBC Method (Aqueous and Ethanolic Extract)

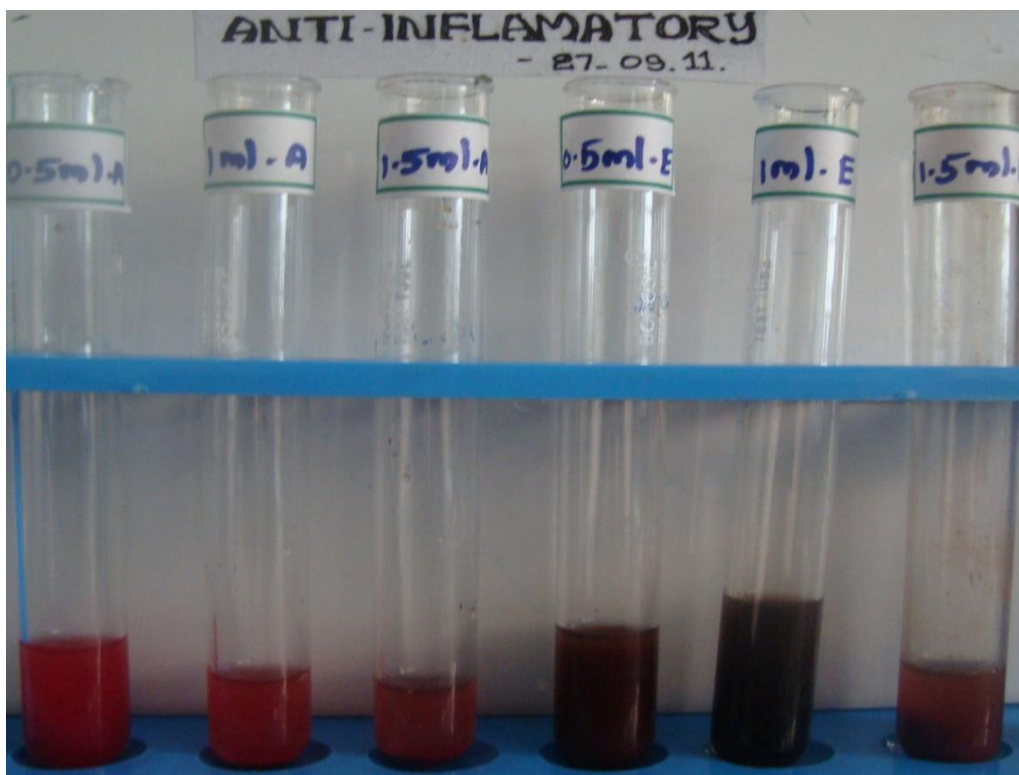


Figure 3: *In vitro* Analysis of Anti Inflammatory Activity by HRBC Method (Chloroform) Pet ether Extract

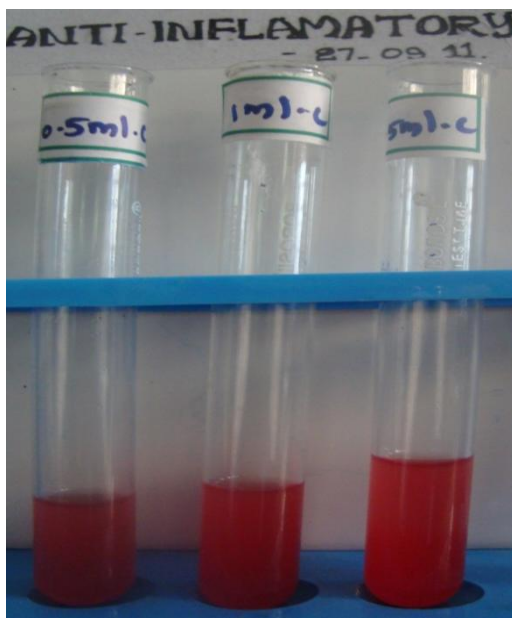


Figure 4: *In vitro* Analysis of Anti Inflammatory Activity by HRBC Method (Chloroform) Pet ether Extract



Rapid and Efficient Procedure for Isolation of High Yielding DNA from Castor (*Ricinus communis* L.)

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Abstract - The ability to perform high-throughput seed DNA extractions is highly desirable and essential for plant breeding and other molecular screening techniques. DNA extraction methods for PCR-quality DNA from calluses and plants are not time efficient, since they require that the tissues be ground in liquid nitrogen, followed by precipitation of the DNA pellet in ethanol, washing and drying the pellet, etc. Secondly, it gets more difficult to isolate the DNA from seed containing oil. The need for a rapid and simple procedure is urgent, especially when hundreds of samples need to be analyzed. Hence, for this purpose, a simple and efficient method of isolating high-quality genomic DNA for PCR amplification and enzyme digestion from seed is developed.

Index Terms – Castor, DNA extraction, DNA purification, Genomic DNA, PCR amplification.

I. INTRODUCTION

The castor bean plant (*Ricinus communis* L.) is a member of the family Euphorbiaceae. In spite of its common name, the castor plant is not a true bean (i.e. leguminous plants belonging to the family, Fabaceae). The Euphorbiaceae family occurs mainly in the tropics, expresses mixed relationship with several other groups, and includes plants producing the most important economic products such as Para rubber (*Hevea brasiliensis*), Castor oil (*Ricinus communis* L.), Tung oil (*Aleurites fordii*) and Cassava meal (*Manihot esculenta*). According to Hutchinson (1964) Castor and Jatrophas are commercially important non-edible oilseed crops in the Euphorbiaceae, very large genera with sparges and croton forming. The seeds of *R. communis* consist of 40-60% by weight of one of the world's most useful natural plant oils (Shamns, 2005). The seed of castor bean contains more than 48% oil and its oil is rich (80 to 90%) in an unusual hydroxyl fatty acid and ricinoleic acid (Jeong and Park, 2009). Castor oil is widely used for its lubricating properties and for medicinal purposes. In industry, castor oil is used for the manufacturing of soaps, lubricants, hydraulic and brake fluids, paints, dyes, coatings, inks, cold resistant plastics, waxes and polishes, nylon, pharmaceuticals and perfumes (Morris, 1996-2003; Franz and Jaax, 1997; Duke, 1998). Castor oil contains ricinoleic acid, which has been effective at inhibiting the growth of many viruses, bacteria, yeasts, and molds, which lends credence to the medicinal use of castor oil as a topical treatment for a variety of skin infections and ailments (Williams, 1995). Castor oil is also

used as a laxative, as an emetic, and to induce labor in close to full-term pregnant women (Duke, 1998).

Castor is a plant that is commercially very important to the world. Castor is produced in about 30 countries lying in the tropical belt of the world (Milani *et al.*, 2009). The world production of castor seed hovers around at an average of 12.5 lakh tons and of castor oil is 5.5 lakh tons. The major producer countries of castor are India, China, Brazil, Paraguay, Ethiopia, Philippines, Russia, Thailand etc. The top most country in the list is India with around 65% of the share in production followed by China with 23% and Brazil with 7% of share. The world production levels observed a sharp rise in the year 2001 which took the level to 17.5 lakh tons but it again fell down due to crop failure (Hegde *et al.*, 2003). Due to high production and utilization of such crop, it gets essential to differentiate the varieties for benefit of mankind. In order to achieve that, the basic requirement is DNA isolation which becomes difficult due to its oil content. Hence, the below mentioned method is described to isolate the genomic DNA which can be further utilized for molecular based studies.

II. MATERIALS AND METHOD

Seed germination:

The seeds of castor were germinated for isolation of the genomic DNA as the castor seed contains approximate 48% of oil. Due to such higher oil content, isolation of genomic DNA from it becomes much difficult procedure so there is a need to germinate seed before isolation procedure. The seed is allowed to germinate *in vitro* for 5-7 days and the apical region of the hypocotyls is utilized for the purpose (Fig-1).



Figure 1: *In vitro* seed germinated of castor seeds.

Genomic DNA extraction:

Isolation of DNA from seed sample is very tedious as seed was hard and dry. There are very few protocols available for isolating DNA from seed (Anonymous, 2006). According to Doyle and Doyle (1990) generally for molecular studies, leaf and other soft tissues are being used for DNA extraction, therefore it requires costly column. In this study, DNA from the seed was isolated by the method of Patel and Jasrai (2010), which requires very less time and is cost effective.

Seed material:

Germinated Castor seeds were taken for DNA isolation. The apex region of the sprout of the germinated castor seed was taken and crushed with mortar and pestle in presence of extraction buffer. This extract was transferred to the 1.5 ml micro centrifuge tube.

Chemicals required:

- NaCl (AR, Ranbaxy Fine Chemicals Ltd. India)
- Hexadecyltrimethyl-Ammonium Bromide (CTAB) (AR, Ranbaxy Fine Chemicals Ltd. India)
- Tris HCl (AR, Ranbaxy Fine Chemicals Ltd. India)
- Na₂-EDTA (AR, Ranbaxy Fine Chemicals Ltd. India)
- Proteinase K (Banglore Genie, Bangalore, India)
- RNase A (Banglore Genie, Bangalore, India)
- β -mercaptoethanol (AR, Ranbaxy Fine Chemicals Ltd. India)
- Phenol (Banglore Genie, Bangalore, India)
- Chloroform (AR, Ranbaxy Fine Chemicals Ltd. India)
- Iso-amyl alcohol (AR, Ranbaxy Fine Chemicals Ltd. India)
- Iso-propyl Alcohol (AR, Ranbaxy Fine Chemicals Ltd. India)
- Sodium Acetate (AR, Ranbaxy Fine Chemicals Ltd. India)
- Poly vinyl pyrrolidone (Loba cheme)
- Ethidium bromide (Sigma)

Chemical preparation:

- 1) Extraction Buffer: (1M Tris, pH 8.0, 5M NaCl, 0.5M EDTA)
For 1 liter extraction buffer take 100 ml 1M Tris (pH8.0), 280 ml 5M NaCl, 40 ml 0.5M EDTA, 20g CTAB in an appropriate beaker. Stir it and heat up to 60-65°C till CTAB dissolve completely. Adjust pH with HCl to pH 8.0, Adjust volume to 1 liter with de-ionized H₂O. Store it at room temperature up to 1 year. (NOTE: Add 1% w/v polyvinyl pyrrolidone (PVP) to the extraction buffer)
- 2) Proteinase-K: (20 mg/ml)

Dissolve 200 mg Proteinase-K in 10 ml de-ionized H₂O. Store it at -20°C up to 2 years.

- 3) RNase-A: (100 mg/ml)
Dissolve 100 mg RNase-A in 1 ml de-ionized H₂O. Store at -20°C up to 2 years.
- 4) 1X TE buffer: (1M Tris, pH 8.0, 0.5M sodium EDTA)
Mix 10 ml of 1M Tris, pH 8.0 with 2 ml of 0.5M sodium EDTA and bring the final volume up to 1 liter with de-ionized H₂O.
- 5) Phenol:Chloroform:Iso-amyl alcohol (24:24:1):
For 100 ml phenol:chloroform:iso-amyl alcohol (24:24:1), combine 49 ml phenol, 49 ml chloroform and 2 ml iso-amyl alcohol. Mix thoroughly and store it at room temperature under the fume hood for up to 6 months.

Isolation of genomic DNA:

DNA was extracted from 0.3-0.5g of germinated seed. 500 μ l of extraction buffer was added to the mortar and was crushed. Then the extract was transferred to 1.5 ml micro-centrifuge tube. 25 μ l of β -mercaptoethanol was also added to the above mixture. After that it was kept in the water bath for 1 hour at 55- 60°C. (The contents were mixed by inverting the micro-centrifuge tubes at an interval of 15 min.) The micro-centrifuge tubes were removed after 1 hour, and to that 500 μ l of phenol:chloroform: iso-amyl alcohol in the ratio of 24:24:1 was added, so as to precipitate the cell debris and protein present in the crude extract. The micro-centrifuge tubes were mixed gently by inverting for 5 minutes and were kept for centrifugation at 9800 rpm for 13 minutes.

After centrifugation, 250 μ l of the upper phase was pipetted out, and transferred to new micro-centrifuge tube. To this, 25 μ l of 3M sodium acetate and 360 μ l of iso-propyl alcohol/ethanol were added. The mixture was swirled gently and carefully. In this step, the DNA gets precipitated and appears like a white coil in the solution that is stored at -20°C for 30-40 min.

These tubes were centrifuged at 12,000 rpm for 12 minutes at low temperature. Then the supernatant was discarded by inverting the tubes. A translucent pellet appears on the wall of the tube that is pure DNA. The tubes were kept upside down on tissue paper to dry the sample for 2-3 hour. Removing the residual iso-propyl alcohol was critical especially if the DNA is to be used directly for PCR. The dried samples were stable at RT overnight. If air drying is used, the drying time advised is minimum of 1-h, but an overnight drying at RT was done.

TE buffer in the volume of 200 μ l was added to the DNA pellet and incubated for another 10 min at 50°C. The DNA was solubilized by tapping gently and stored at -20°C until further use. Samples in TE can be stored at 4 or -20°C.

Purification of DNA:

The dissolved DNA being crude requires further purification. 1 μ l of proteinase-K was added to dissolve the protein constituent and 1 μ l RNase-A was added for getting rid of RNA from the DNA extract. This was kept in the water bath for 1 hour at 55- 60°C. (The contents were mixed by inverting the micro-centrifuge tubes at an interval of 15min.)

The micro-centrifuge tubes were removed after 1 hour, and to that 200 μ l of chloroform:iso-amyl alcohol in the ratio of 24:1 was added, so as to precipitate the cell debris and protein present in the crude DNA. The micro-centrifuge tubes were mixed gently by inverting for 5 minutes and were kept for centrifugation at 9800 rpm for 13 minute. .

After centrifugation, 150 μ l of the upper phase was pipetted out, and was transferred to new micro-centrifuge tube. To this, 25 μ l of 3M sodium acetate and 360 μ l of iso-propyl alcohol/ethanol were added. The mixture was swirled gently and carefully. In this step, the DNA gets precipitated and appears like a white coil in the solution, then it was stored at -20°C for 30-40 min. These tubes were centrifuge at 12,000 rpm for 12 minutes at -20°C. The supernatant was discarded by inverting the tubes. A translucent pellet appears on the wall of the tube, is the pure DNA. The tubes were kept upside down on tissue paper for 2-3 hour to dry and to remove the residual iso-propyl alcohol. If air drying is used, the drying time advised is minimum of 1-h. but an overnight drying at RT was done and was far better than air drying. 200 μ l of TE buffer was added to the DNA pellet and incubated for another 10 min at 50°C. The DNA was solubilized by tapping gently and was stored at -20°C until further use. Samples in TE can also be stored for more period of time at -20°C.

III. RESULTS AND DISCUSSION

Genomic DNA isolation and quantification:

In plants, genomic DNA extraction was carried out by CTAB protocol. CTAB is a cationic detergent that is compatible with the high salt concentrations often used to dissociate DNA from chromosomal proteins, and can also be used to selectively precipitate nucleic acids. CTAB-isolated plant DNA is now routinely used.

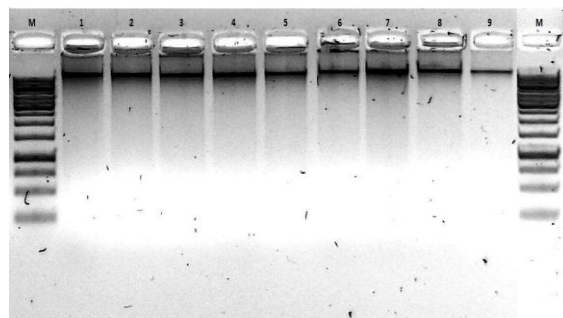


Figure 2: Ethidium bromide stained Genomic DNA of *Ricinus communis* (Castor) electrophoresed in 0.8% agarose gel. M- indicates the 1Kb DNA ladder.

The quality of total DNA isolated was checked by using agarose gel electrophoresis, in which 2 μ l of 6X loading dye (Fermentas, USA) to 10 μ l of isolated DNA samples. 10 μ l of this was loaded in a well of 1.2% agarose gel (Merck, India) containing 10mg/ml of ethidium bromide (EtBr). 1Kb DNA ladder (Fermentas, USA) was used as a marker. The intact DNA form a thick single band of good quality of DNA. The quality and quantity of DNA was further checked with the help of UV Spectrophotometer (at wavelengths 260 and 280 nm). Quality of extracted DNA was also confirmed by the agarose gel electrophoresis. The bands (Fig. 2) shows that the genomic DNA isolated from 9 different cultivars of castor plant was pure and lacks the other impurities like RNA and proteins. M (Fig. 2) indicates the DNA ladder which was used to measure the size of genomic DNA obtained. The data reported confirm that the extraction method is capable of isolating DNA from any kind of seed material and a suitable quality and quantity for subsequent PCR based detection applications is obtained.

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Some approximation results on Basakakov type special class of positive linear operators

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Abstract- Recently S. P. Singh et. al. (Proceeding of The Mathematical Society BHU Vol. 24 (2008) 1-9) introduced special class of positive linear operators and studied some approximation results on it. Which are modified operators given by Deo N. et. al. (Appl. Maths. Compt., 201 (2008),604-612.). We shall study some approximation results on it.

I. INTRODUCTION

Recently S. P. Singh et. al. (Proceeding of The Mathematical Society BHU Vol. 24 (2008) 1-9) introduced a sequence of positive linear operators $\{A_n f\}$ which are defined as,

$$(A_n f)(x) = n \left(1 + \frac{1}{n}\right)^2 \sum_{k=0}^{\infty} \binom{k + \frac{n}{c} - 1}{k} \frac{(cx)^k}{(1+cx)^{\frac{n}{c}+k}} \dots \int_0^{\frac{n}{n+1}} p_{n,k}(t) f(t) dt \dots (1.1)$$

$$\text{where } p_{n,k}(t) = \left(1 + \frac{1}{n}\right)^n \binom{n}{k} t^k \left(\frac{n}{n+1} - t\right)^{n-k};$$

$$c > 0 \text{ and for } t \in \left[0, \frac{n}{n+1}\right].$$

we studied some approximation results on it.

Again S. P. Singh et. al. [5] introduced a sequence of positive linear operators $\{A_{n,x} f\}$ which are defined as,

$$(A_{n,x} f)(x) = n \left(1 + \frac{1}{n}\right)^2 \sum_{k=0}^{\infty} \binom{k + \frac{n}{c} - 1}{k} \frac{(ct)^k}{(1+ct)^{\frac{n}{c}+k}} \dots \int_0^{\frac{n}{n+1}} p_{n,k}(y) f(x+y) dy \dots (1.2)$$

$$\text{where } t, x \in \left[0, \frac{n}{n+1}\right] \text{ and } x \text{ is fixed.}$$

and studied some approximation results on it.

Deo N.et.al. [1] introduced a new Bernstein type special operators $\{V_n f\}$ defined as,

$$(V_n f)(x) = \sum_{k=0}^n p_{n,k}(x) f\left(\frac{k}{n}\right) \dots (1.3)$$

$$\text{where } p_{n,k}(x) = \left(1 + \frac{1}{n}\right)^n \binom{n}{k} x^k \left(\frac{n}{n+1} - x\right)^{n-k};$$

$$\text{for } 0 \leq x \leq \frac{n}{n+1}$$

Again Deo N.et.al.[1] gave the integral modification of the operators (1.3) which are defined as ,

$$(L_n f)(x) = n \left(1 + \frac{1}{n}\right)^2 \sum_{k=0}^n p_{n,k}(x) \int_0^{\frac{n}{n+1}} p_{n,k}(t) f(t) dt \dots (1.4)$$

and prove some approximation results on the operators (1.4).

Singh S.P. [4] studied some approximation results on a sequence of Szász type operators defined as,

$$(S_{n,x} f)(t) = \sum_{k=0}^{\infty} b_{n,k}(t) f\left(x + \frac{k}{n}\right); \dots (1.5)$$

$$\text{where } b_{n,k}(t) = e^{-nt} \frac{(nt)^k}{k!}; \quad x \in [0, \infty) \text{ is fixed.}$$

which map the space of bounded continuous functions $C_B[0, \infty)$ into itself following [3].

Kasana H.S. et. el. [2] obtained a sequence of modified Szász operators for integrable function on $[0, \infty)$ defined as,

$$(M_{n,x} f)(t) \equiv M_{n,x}(f(y); t)$$

$$= n \sum_{k=0}^{\infty} b_{n,k}(t) \int_0^{\infty} b_{n,k}(y) f(x+y) dy \dots (1.6)$$

where $t, x \in [0, \infty)$ and x is fixed.

In this paper if we put $c = 1$ in the operators (1.1) and (1.2), it gives the new modified operators $\{A_n^* f\}$ and $\{A_{n,x}^* f\}$ as follows:

$$(A_n^* f)(x) = n \left(1 + \frac{1}{n}\right)^2 \sum_{k=0}^{\infty} \binom{n+k-1}{k} \frac{x^k}{(1+x)^{n+k}} \dots \int_0^{\frac{n}{n+1}} p_{n,k}(t) f(t) dt \dots (1.7)$$

and

$$(A_{n,x}^* f)(x) = n \left(1 + \frac{1}{n}\right)^2 \sum_{k=0}^{\infty} \binom{n+k-1}{k} \frac{t^k}{(1+t)^{n+k}} \dots \int_0^{\frac{n}{n+1}} p_{n,k}(y) f(x+y) dy \dots (1.8)$$

$$\text{where } t, x \in \left[0, \frac{n}{n+1}\right] \text{ and } x \text{ is fixed.}$$

We shall study some approximation results on the operators (1.7) and (1.8).

II. BASIC RESULTS-I

In order to prove our main result, the following basic results are needed.

$$1. \sum_{k=0}^{\infty} \binom{n+k-1}{k} \frac{x^k}{(1+x)^{n+k}} k = nx \dots (2.1)$$

$$2. \sum_{k=0}^{\infty} \binom{n+k-1}{k} \frac{x^k}{(1+x)^{n+k}} k^2 = n^2 x^2 + nx(1+x) \dots (2.2)$$

$$3. \sum_{k=0}^{\infty} \binom{n+k-1}{k} \frac{x^k}{(1+x)^{n+k}} k^3$$

$$= n^3 x^3 + 3n^2 x^2(1+x) + nx(1+2x)(1+x)$$

.....(2.3)

$$4. \sum_{k=0}^{\infty} \binom{n+k-1}{k} \frac{x^k}{(1+x)^{n+k}} k^4$$

$$= n^4 x^4 + 6n^3 x^3(1+x) + 4n^2 x^2(2+5x+2x^2)$$

$$+ nx(1+6x+6x^2) \dots \dots \dots (2.4)$$

III. PROOF OF BASIC RESULTS-I

We know that

$$(1+x)^n = \sum_{k=0}^{\infty} \binom{n+k-1}{k} \left(\frac{x}{1+x}\right)^k \dots (2.5)$$

Differentiating with respect to x , we get

$$n(1+x)^{n-1} = \sum_{k=0}^{\infty} \binom{n+k-1}{k} k x^{k-1} (1+x)^{-k} + \sum_{k=0}^{\infty} \binom{n+k-1}{k} \frac{(A_n^* t^4)(x)}{x^k} \frac{(-k)}{nx(96+71x+26x^2)+24} \frac{(n+2)(n+3)(n+4)(n+5)}{(n+1)^4} \dots (2.12)$$

Multiplying x both sides, we get

$$nx(1+x)^{n-1} = \sum_{k=0}^{\infty} \binom{n+k-1}{k} \left(\frac{x}{1+x}\right)^k k \left[1 - \frac{x}{1+x}\right]$$

$$nx(1+x)^{n-1} = \sum_{k=0}^{\infty} \binom{n+k-1}{k} \left(\frac{x}{1+x}\right)^k k \left(\frac{1}{1+x}\right)$$

$$nx(1+x)^n = \sum_{k=0}^{\infty} \binom{n+k-1}{k} \left(\frac{x}{1+x}\right)^k k \dots (2.6)$$

$$nx = \sum_{k=0}^{\infty} \binom{n+k-1}{k} \frac{x^k}{(1+x)^{n+k}} k$$

This completes the proof of (2.1).

Again differentiating (2.6) with respect to x , we get

$$n^2 x(1+x)^{n-1} + n(1+x)^n = \sum_{k=0}^{\infty} \binom{n+k-1}{k} k^2 x^{k-1} (1+x)^{-k} \dots (2.7)$$

Multiplying x both sides, we get

$$n^2 x^2(1+x)^{n-1} + nx(1+x)^n = \sum_{k=0}^{\infty} \binom{n+k-1}{k} k^2 x^k (1+x)^{-k} \dots \dots \dots \int_0^{\frac{n}{n+1}} \left(\frac{n+1}{n}\right)^n \binom{n}{k} t^k \left(\frac{n}{n+1} - t\right)^{n-k} 1 dt$$

$$[n^2 x^2 + nx(1+x)](1+x)^{n-1}$$

$$= \sum_{k=0}^{\infty} \binom{n+k-1}{k} k^2 x^k (1+x)^{-k} \left[1 - \frac{x}{1+x}\right]$$

$$[n^2 x^2 + nx(1+x)](1+x)^n$$

$$= \sum_{k=0}^{\infty} \binom{n+k-1}{k} k^2 x^k (1+x)^{-k} \dots \dots \dots (2.7)$$

$$n^2 x^2 + nx(1+x) = \sum_{k=0}^{\infty} \binom{n+k-1}{k} \frac{x^k}{(1+x)^{n+k}} k^2$$

This completes the proof of (2.2).

In the same way after differentiations and calculations, we get required result s (2.3) and (2.4).

IV. BASIC RESULTS-II

$$1. (A_n^* 1)(x) = 1 \dots \dots \dots (2.8)$$

$$2. (A_n^* t)(x) \rightarrow x \text{ as } n \rightarrow \infty. \dots (2.9)$$

$$3. (A_n^* t^2)(x) \rightarrow x^2 \text{ as } n \rightarrow \infty. \dots (2.10)$$

$$4. (A_n^* t^3)(x) = \frac{n^3[n^3 x^3 + 3n^2 x^2(1+x) + nx(18+9x+2x^2) + 6]}{(n+1)^3 (n+2) (n+3) (n+4)} \dots \dots \dots (2.11)$$

$$5. (A_n^* t^4)(x) = \frac{n^4[n^4 x^4 + 2n^3 x^3(8+3x) + n^2 x^2(73+50x+3x^2)]}{(n+1)^4 (n+2) (n+3) (n+4) (n+5)} \dots \dots \dots (2.12)$$

$$6. (A_n^* (t-x))(x) = \frac{n[1-3x] - 2x}{(n+1) (n+2)} \dots \dots \dots (2.13)$$

$$7. (A_n^* (t-x)^2)(x) = \frac{2xn^3 + n^2[11x^2 - 8x + 2] + n[17x^2 - 6x] + 6x^2}{(n+1)^2 (n+2) (n+3)} \dots \dots \dots (2.14)$$

$$8. (A_n^* (t-x)^3)(x) = o\left(\frac{1}{n}\right). \dots \dots \dots (2.15)$$

$$9. (A_n^* (t-x)^4)(x) = o\left(\frac{1}{n^2}\right). \dots \dots \dots (2.16)$$

V. PROOF OF BASIC RESULTS-II.

By putting $f(t) = 1$ in equation (1.7), we get

$$(A_n^* 1)(x) = n \left(1 + \frac{1}{n}\right)^2 \sum_{k=0}^{\infty} \binom{n+k-1}{k} \frac{x^k}{(1+x)^{n+k}}$$

$$= n \left(1 + \frac{1}{n}\right)^2 \sum_{k=0}^{\infty} \binom{n+k-1}{k} \frac{x^k}{(1+x)^{n+k}} \frac{1}{n} \left(\frac{n}{n+1}\right)^2$$

$$= \sum_{k=0}^{\infty} \binom{n+k-1}{k} \frac{x^k}{(1+x)^{n+k}} = 1.$$

This completes the proof of (2.8).

By putting $f(t) = t$ in equation (1.7), we get

$$(A_n^* t)(x) = n \left(1 + \frac{1}{n}\right)^2 \sum_{k=0}^{\infty} \binom{n+k-1}{k} \frac{x^k}{(1+x)^{n+k}}$$

$$\dots \dots \dots \int_0^{\frac{n}{n+1}} \left(\frac{n+1}{n}\right)^n \binom{n}{k} t^k \left(\frac{n}{n+1} - t\right)^{n-k} t dt$$

$$\begin{aligned}
 &= n \left(1 + \frac{1}{n}\right)^2 \sum_{k=0}^{\infty} \binom{n+k-1}{k} \frac{x^k}{(1+x)^{n+k}} \dots \\
 &= \frac{n}{(n+1)(n+2)} \left\{ \sum_{k=0}^{\infty} \binom{n+k-1}{k} \frac{x^k}{(1+x)^{n+k}} k + \sum_{k=0}^{\infty} \binom{n+k-1}{k} \frac{x^k}{(1+x)^{n+k}} 1 \right\} \\
 &= \frac{n}{(n+1)(n+2)} [nx + 1] \\
 &= \frac{n^2 x + n}{(n+1)(n+2)} \\
 (A_n^* t)(x) &\rightarrow x \text{ as } n \rightarrow \infty.
 \end{aligned}$$

This completes the proof of (2.9).

By putting $f(t) = t^2$ in equation (1.7), we get

$$\begin{aligned}
 (A_n^* t^2)(x) &= n \left(1 + \frac{1}{n}\right)^2 \sum_{k=0}^{\infty} \binom{n+k-1}{k} \frac{x^k}{(1+x)^{n+k}} \\
 &\dots \int_0^{\frac{n}{n+1}} \left(\frac{n+1}{n}\right)^n \binom{n}{k} t^k \left(\frac{n}{n+1} - t\right)^{n-k} t^2 dt \\
 &= n \left(1 + \frac{1}{n}\right)^2 \sum_{k=0}^{\infty} \binom{n+k-1}{k} \frac{x^k}{(1+x)^{n+k}} \dots \\
 &\dots \frac{(k+1)(k+2)}{n(n+2)(n+3)} \left(\frac{n}{n+1}\right)^4 \\
 &= \frac{n^2}{(n+1)^2(n+2)(n+3)} \left\{ \sum_{k=0}^{\infty} \binom{n+k-1}{k} \frac{x^k}{(1+x)^{n+k}} k^2 \right. \\
 &\quad \left. + \sum_{k=0}^{\infty} \binom{n+k-1}{k} \frac{x^k}{(1+x)^{n+k}} 3k + \sum_{k=0}^{\infty} \binom{n+k-1}{k} \frac{x^k}{(1+x)^{n+k}} 2 \right\} \\
 &= \frac{n^2 [n^2 x^2 + nx(4+x) + 2]}{(n+1)^2(n+2)(n+3)} \\
 (A_n^* t^2)(x) &\rightarrow x^2 \text{ as } n \rightarrow \infty.
 \end{aligned}$$

This completes the proof of (2.10).

In the same way by taking $f(t) = t^3$ & $f(t) = t^4$ respectively in (1.7) and after little calculations we get required results (2.11) to (2.16).

VI. MAIN RESULTS

In this section we shall give our main results.

LEMMA: Let $f \in C\left[0, \frac{n}{n+1}\right]$ then the sequence of positive linear operator defined by $\{A_n^* f\}$ is converges uniformly to f as $n \rightarrow \infty$.

Proof: Since from basic results (2.8), (2.9) and (2.10), we get

$$\begin{aligned}
 (A_n^* 1)(x) &\xrightarrow{\text{uniformly}} 1 \text{ as } n \rightarrow \infty \\
 (A_n^* t)(x) &\xrightarrow{\text{uniformly}} x \text{ as } n \rightarrow \infty \\
 (A_n^* t^2)(x) &\xrightarrow{\text{uniformly}} x^2 \text{ as } n \rightarrow \infty
 \end{aligned}$$

Then using Korokin theorem we can conclude that

$$(A_n^* f)(x) \xrightarrow{\text{uniformly}} f \text{ as } n \rightarrow \infty.$$

This completes the proof.

Theorem : Let f be the integrable and bounded in the interval $\left[0, \frac{n}{n+1}\right]$ and let if f'' exists at a point x in $\left[0, \frac{n}{n+1}\right]$, then one gets that

$$\lim_{n \rightarrow \infty} n[(A_n^* f)(x) - f(x)] = (1 - 3x)f'(x) + x f''(x),$$

where $\{A_n^* f\}$ are defined in (1.7).

Proof : Since f'' exists at a point x in $\left[0, \frac{n}{n+1}\right]$, then by using Taylor's expansion, we write

$$f(t) = f(x) + (t-x)f'(x) + \frac{(t-x)^2}{2} f''(x) + (t-x)^2 \lambda(t-x) \dots \dots \dots (3.1)$$

where $\lambda(t-x) \rightarrow 0$ as $t \rightarrow x$.

Now for each $\varepsilon > 0$, there corresponds $\delta > 0$ such that $|\lambda(t-x)| \leq \varepsilon$ whenever $|t-x| \leq \delta$.

Again for $|t-x| > \delta$, then there exist a positive number M such that

$$|\lambda(t-x)| \leq M \leq M \frac{(t-x)^2}{\delta^2}.$$

Thus for all t and $x \in \left[0, \frac{n}{n+1}\right]$, we get

$$|\lambda(t-x)| \leq \varepsilon + M \frac{(t-x)^2}{\delta^2} \dots \dots \dots (3.2)$$

Applying $\{A_n^*\}$ on (3.1), we get

$$\begin{aligned}
 (A_n^* f)(x) &= f(x)(A_n^* 1)(x) + f'(x)(A_n^* (t-x))(x) + \frac{f''(x)}{2} (A_n^* (t-x)^2)(x) + (A_n^* (t-x)^2 \lambda(t-x))(x) \\
 &= f(x) + f'(x) \left[\frac{n[1-3x]-2x}{(n+1)(n+2)} \right] + \frac{f''(x)}{2} \left[\frac{2xn^2 + n^2[11x^2-8x+2] + n[17x^2-6x]+6x^2}{(n+1)^2(n+2)(n+3)} \right] \\
 &\quad + n \left(1 + \frac{1}{n}\right)^2 \sum_{k=0}^{\infty} \binom{n+k-1}{k} \frac{x^k}{(1+x)^{n+k}} \dots \\
 &\dots \int_0^{\frac{n}{n+1}} p_{n,k}(t) (t-x)^2 \lambda(t-x) dt
 \end{aligned}$$

Multiplying n both side, we get

$$\begin{aligned}
 n[(A_n^* f)(x) - f(x)] &= \\
 f'(x) \left[\frac{n[1-3x]-2x}{(n+1)(n+2)} \right] n + \\
 \frac{f''(x)}{2} \left[\frac{2xn^2 + n^2[11x^2-8x+2] + n[17x^2-6x]+6x^2}{(n+1)^2(n+2)(n+3)} \right] n + nR_n(t, x)
 \end{aligned}$$

(say) $\dots \dots \dots (3.3)$

Here we write,

$$\begin{aligned}
 nR_n(t, x) &= n \left(1 + \frac{1}{n}\right)^2 \sum_{k=0}^{\infty} \binom{n+k-1}{k} \frac{x^k}{(1+x)^{n+k}} \dots \\
 &\dots \int_0^{\frac{n}{n+1}} p_{n,k}(t) (t-x)^2 \lambda(t-x) dt
 \end{aligned}$$

$$\begin{aligned}
 |nR_n(t, x)| &= \left| n \left(1 + \frac{1}{n}\right)^2 \sum_{k=0}^{\infty} \binom{n+k-1}{k} \frac{x^k}{(1+x)^{n+k}} \dots \dots \dots \right. \\
 &\quad \left. \dots \int_0^{\frac{n}{n+1}} p_{n,k}(t) (t-x)^2 \lambda(t-x) dt \right|
 \end{aligned}$$

$$\leq nn \left(1 + \frac{1}{n}\right)^2 \sum_{k=0}^{\infty} \binom{n+k-1}{k} \frac{x^k}{(1+x)^{n+k}} \dots$$

$$\int_0^{\frac{n}{n+1}} p_{n,k}(t) |(t-x)^2 \lambda(t-x)| dt \dots (3.4)$$

Using (3.2) in equation (3.4), we get

$$|nR_n(t, x)| \leq n\varepsilon (A_n^*(t-x)^2)(x) + \frac{nM}{\delta^2} (A_n^*(y-t)^4)(x)$$

$$\leq n\varepsilon o\left(\frac{1}{n}\right) + \frac{nM}{\delta^2} o\left(\frac{1}{n^2}\right)$$

$$\leq \varepsilon + \frac{M}{\delta^2} o\left(\frac{1}{n}\right)$$

By choosing $\delta = n^{-1/4}$, we get that

$$|nR_n(t, x)| \leq \varepsilon + \frac{M}{n^{-1/2}} o\left(\frac{1}{n}\right)$$

$$\leq \varepsilon + M o\left(\frac{1}{\sqrt{n}}\right).$$

Since ε is arbitrary and small, we get

$$|nR_n(t, x)| \rightarrow 0 \text{ as } n \rightarrow \infty, \dots \dots \dots (3.5)$$

Using (3.5) in equation (3.3), we get

$$\lim_{n \rightarrow \infty} n[(A_n^* f)(x) - f(x)] = (1-3x)f'(x) + xf''(x).$$

This completes the proof.

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Analysis of Turbo codes in Frequency Selective Fading Channel

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Abstract- In this paper, we discuss the bit error performance of turbo codes in Rayleigh fading channel. Turbo encoded signal is transmitted over a Rayleigh fading channel with additive white Gaussian noise. Training sequence is sent prior to data transmission in order to calculate the channel coefficients. After computing channel coefficients, it is assumed that channel characteristics are constant over a small interval of time. Data signal is determined using these coefficients and then turbo decoded. It reduces the bit error probability and a more reliable output is obtained.

Index Terms- Turbo codes, turbo encoder, Rayleigh fading channel, turbo decoder, MAP algorithm, likelihood ratio.

I. INTRODUCTION

Key system parameters for a communication system are transmitted power and channel bandwidth. These parameters determine the bit energy to noise ratio E_b/N_0 . Practical considerations place a limit on the value that can be assigned to E_b/N_0 . For a fixed E_b/N_0 , only practical option for changing data quality from problematic to acceptable is by error control coding. Shannon's work promised the existence of theoretical performance improvement of 11.2 dB over the performance of uncoded systems. Although Shannon proved the theoretical limit at which error-free communications could take place using error-correcting codes, all previous coding schemes have fallen far short of this limit. Turbo codes are one of the most powerful types of channel codes that were introduced in 1993, along with error correction capability and a practical decoding algorithm. The importance of turbo codes is that they enable reliable communications with power efficiency close to the theoretical limit predicted by Claude Shannon [1].

Wireless communication systems have to overcome the problems of data transmission over fading channels. In the proposed method, the input data bits are encoded by a rate R turbo encoder. The resulting bits are binary phase shift keying modulated and transmitted over a Rayleigh fading channel with additive white Gaussian noise. Training sequence is used to find the time-varying properties of the channel prior to data transmission. A synchronised version of the training sequence is generated at the receiver, where it is applied to the equaliser as the desired response. The adaptation is achieved by observing the error between the desired response and actual response at the filter output and using this error to estimate the tap weights of the filter. By using these coefficients, the data signal is determined

assuming channel characteristics are constant over a period of time. Then it is turbo decoded to obtain more accurate results.

II. SYSTEM MODEL

The system analysed in this paper consists of following blocks: Turbo encoder, Rayleigh fading channel, channel estimator, turbo decoder.

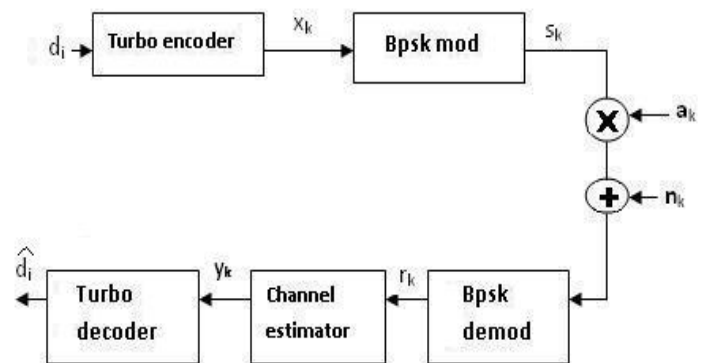


Figure 1: System Model

III. METHODOLOGY

A. Turbo encoding

The input data bits d_i , $d_i \in \{0, 1\}$ $1 \leq i \leq L$ are encoded by a rate R turbo encoder with an interleaver of size L . A turbo encoder consists of two identical recursive systematic convolutional encoders connected in parallel by an interleaver. Message bits are applied directly to encoder1 and reordered version of the same message bits is applied to encoder2. The more scrambled the information sequence for the second encoder, the more uncorrelated the information exchange between the decoders. The output of encoder consists of systematic bits (that is the original message bits) and two sets of parity-check bits (generated by the two encoders). The input data stream and the parity outputs of the two parallel encoders are then serialised into a single turbo codeword [2].

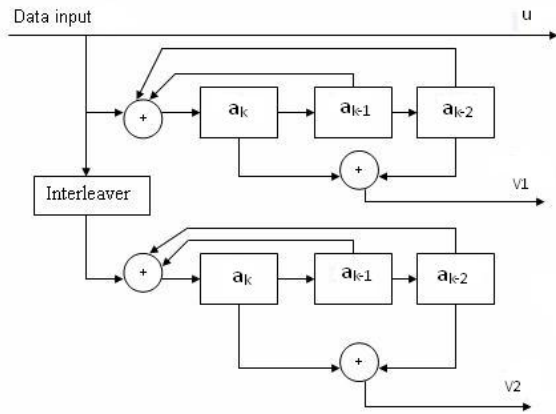


Fig. 2: Turbo Encoder

B. Interleaving

Interleaving is a process of rearranging the ordering of a data sequence in a one to one deterministic format. The inverse of this process is called de-interleaving which restores the received sequence to its original order. Interleaving is a practical technique to enhance the error correcting capability of coding. In turbo coding, interleaving is used before the information data is encoded by the second component encoder. The basic role of an interleaver is to construct a long block code from small memory convolutional codes, as long codes can approach the Shannon capacity limit. Secondly, it spreads out burst errors.

C. Fading channel

The encoded bits x_k , $1 \leq k \leq (L/R)$ are binary phase shift keying modulated, by doing discrete time base conversion to obtain s_k , $s_k \in \{-1, 1\}$.. Then it is transmitted over a Rayleigh fading channel with additive white Gaussian noise. Rayleigh fading is a reasonable model when there are many objects in the environment that scatter the radio signal before it arrives at the receiver. In Rayleigh fading model, the magnitude of a signal that passes through the transmission medium fades according to Rayleigh distribution. In this paper, multipath propagation of the signal is considered and applies different channel path delays. Then the signal is extremely faded. In Rayleigh distribution, the random variable S has a probability density function.

$$p_S(r) = \frac{2r}{\sigma^2} \exp\left(-\frac{r^2}{\sigma^2}\right), r \geq 0 \quad (1)$$

$$\text{where } \sigma^2 = E(S^2)$$

D. Channel estimator

After BPSK demodulation, the received signal can be represented as

$$r_k = a_k s_k + n_k \quad (2)$$

where a_k are Rayleigh distributed fading amplitudes and n_k are samples of AWGN process.

A training sequence is transmitted through the Rayleigh

fading channel. A synchronised version of the training sequence is generated at the receiver, where it is applied to the equaliser as the desired response. When the training process is completed, the adaptive equaliser is ready for normal data transmission. For a few consecutive frames, same channel coefficients are used by considering that channel characteristics are same for particular interval of time. Training sequence is repeated after a fixed time interval. Initially weight vector is computed as follows:

Received signal $r(n)$ is fed to a Wiener filter of order N and with coefficients w_i , $i = 0; 1; \dots; N$.

The output of the filter is denoted by $y(n)$.

$$y(n) = \sum_{i=0}^N w_i r(n-i) \quad (3)$$

The Wiener filter is designed to minimise the mean square error

$$w_i = \underset{w_i}{\operatorname{argmin}} E \{ e_1^2[n] \} \quad (4)$$

where $e_1(n)$ is the difference between filter output $y(n)$ and reference input $s(n)$. Filter coefficients are computed by solving Wiener Hopf equations, which has compact matrix formulation

$$\mathbf{T} \mathbf{w}_0 = \mathbf{P} \quad (5)$$

where $\mathbf{T}$ is the autocorrelation matrix of $r(n)$, $\mathbf{P}$ is the cross correlation vector of $r(n)$ and $s(n)$ and $\mathbf{w}_0$ is the coefficient vector.

$$\mathbf{w}_0 = \mathbf{T}^{-1} \mathbf{P} \quad (6)$$

Then the coefficient vector $\mathbf{w}_0$ is taken as the initial weight vector $\mathbf{W}(1)$. In Least Mean Square algorithm for adaptive equalisation, the error signal $e(n)$ actuates the adjustments applied to individual tap weights of the equaliser as the signal proceeds from one iteration to the next. The $(N+1)$ tap-weight vector,

$$\mathbf{W}(n) = [w_0(n), w_1(n), \dots, w_N(n)]^T \quad (7)$$

Firstly received training sequence is taken as the signal input

$$\mathbf{X}(n) = [x(n), x(n-1), \dots, x(n-N)]^T \quad (8)$$

for $n=1, 2, \dots$ compute filter output

$$y(n) = \mathbf{X}^T(n) \mathbf{W}(n) \quad (9)$$

$\mathbf{W}(n+1)$ is updated value of k th tap weight

$$\mathbf{W}(n+1) = \mathbf{W}(n) + \mu e(n) \mathbf{X}(n) \quad (10)$$

$\mathbf{W}(n)$ is old value of k th tap weight, μ is step size parameter,

$X(n)$ is input signal applied to k th tap weight, $e(n)$ is error signal.

error signal

$$e(n) = d(n) - y(n) \quad (11)$$

where $d(n)$ is the desired response obtained from training sequence and $y(n)$ is the actual response.

Take N as the filter order. Firstly, N samples of the input is taken. Using the filter coefficients obtained from Wiener Hopf equations, output $y(n)$ is calculated. As the received sequence is complex valued, real part of $y(n)$ is taken. Error between desired response and actual response is calculated. Updating of weight vector is continued until the error becomes 0.1. For the first $N/2$ samples, the step size μ is taken as 0.5 for faster convergence and for the remaining samples, μ is taken 0.02 to obtain correct weights. The same procedure is repeated for the remaining samples. The step size μ in the LMS algorithm governs the convergence rate, accuracy and stability of the adaptive filter.

For the few consequent received frames, the same weight vector is used to obtain the response. On comparing the received frames before and after equalisation, the number of errors is considerably reduced.

E. Turbo decoder

The process of turbo code decoding starts with the formation of a posteriori probabilities (APPs) for each data bit, which is followed by choosing the data bit value that corresponds to the maximum a posteriori (MAP) probability for that data bit [2]. Upon reception of a corrupted code bit sequence, the process of decision-making with APPs allows the MAP algorithm to determine the most likely information bit to have been transmitted at each bit time. There are two main algorithms to decode the data. One of the algorithms is called Soft Output Viterbi Algorithm (SOVA) and the other is Maximum A posteriori Algorithm (MAP) [6].

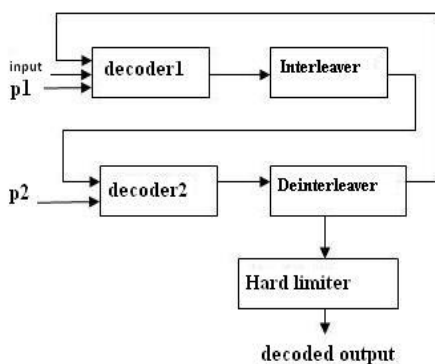


Fig. 3: Turbo decoder

The difference in MAP algorithm from the other algorithm is that while the former produces hard outputs, this one produces soft outputs. The MAP algorithm calculates the APPs for each code symbol produced by a Markov process given a noisy channel observation y . The APPs are $P[d_k = 1/y]$, the probability that the information bit is a 1 given the received vector y , an $P[d_k = 0/y]$, the probability that the information bit is a 0 given the

received vector y . Once these probabilities are found, they are put into log-likelihood ratio (LLR) form in order to make a decision on a particular symbol. If the LLR $L(d_k)$ is greater than zero, a binary 1 is chosen as the most likely transmitted symbol; conversely, if the LLR $L(d_k)$ is less than zero, a binary 0 is chosen.

The iterative MAP turbo decoder consist of two component decoders serially concatenated via an interleaver. The first MAP decoder takes as input the received information sequence and the received parity sequence ($p1$) generated by the first encoder. The decoder then produces a soft output, which is interleaved and used to produce an improved estimate of the a priori probabilities of the information sequence for the second decoder. The inputs to the second MAP decoder are the interleaved received information sequence and the received parity sequence ($p2$) produced by the second encoder. The second MAP decoder also produces a soft output, which is used to improve the estimate of the a priori probabilities for the information sequence at the input of the first MAP decoder. The feedback loop is a distinguishing feature of this decoder. After a certain number of iterations, the soft outputs of both MAP decoders stop to produce further performance improvements. Then the last stage of decoding makes a hard decision after de-interleaving.

F. Bit error probability

$$P_b = B_d \text{erfc} \left(\sqrt{R d_k (E_b/N_0)} \right) \quad (12)$$

where B_d is bit errors/data bits, d_k is the weight of the k th codeword, R is the code rate, E_b/N_0 is the bit energy to noise ratio.

IV. SIMULATION RESULTS

The performance of turbo coding system with channel estimation technique is evaluated through MATLAB simulations. The following results show the performance of turbo codes for different block sizes, channel path delays, constraint lengths and different frame sizes. The performance graph is plotted between bit energy to noise ratio and bit error rate.

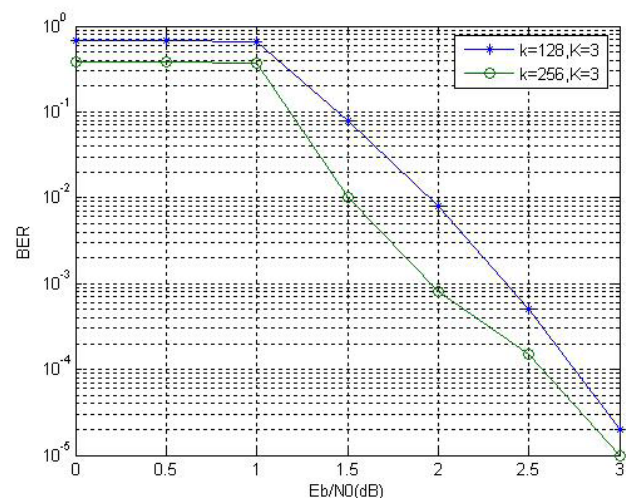


Fig. 4: Simulation results for different block sizes and constraint length $K=3$

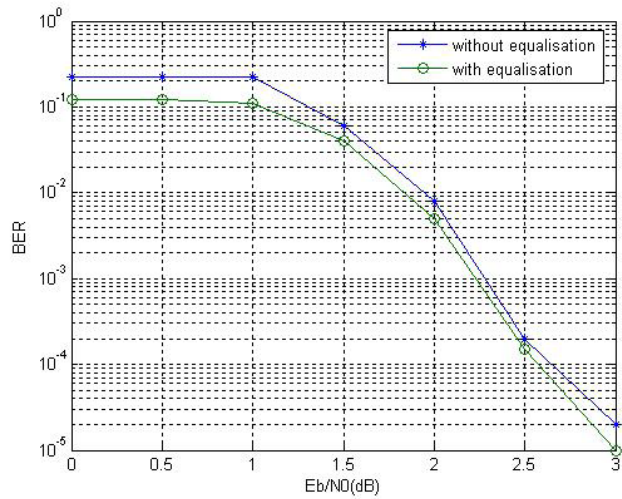


Fig. 5. Simulation results of turbo codes with and without equalisation

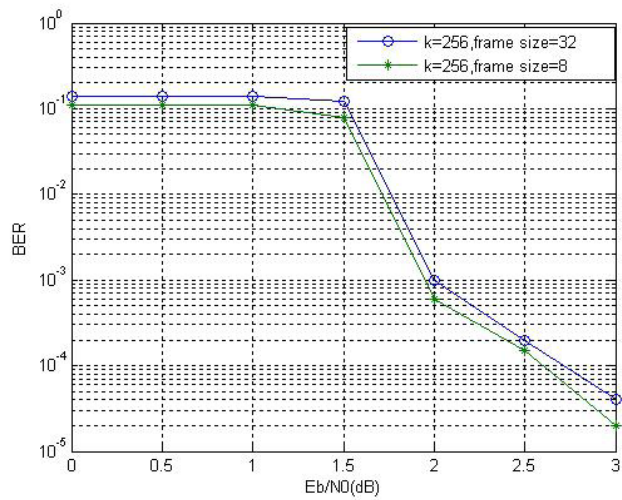


Fig. 7. Simulation results for same block size and different frame sizes

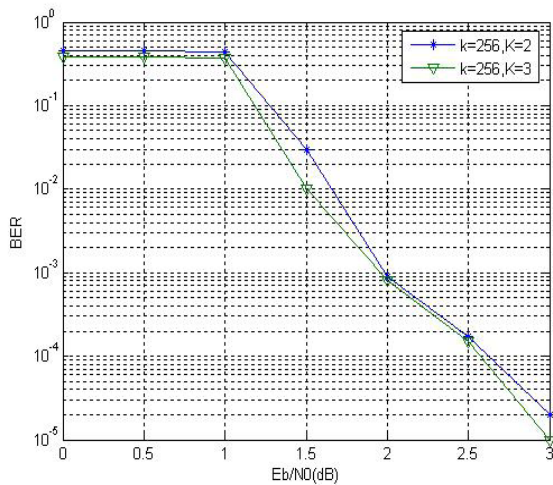


Fig. 6. Simulation results for same block size and different constraint lengths

V. CONCLUSION

This paper investigates the performance of turbo codes in Rayleigh fading channel. Turbo coding with channel estimation scheme improves the bit error performance. From simulation results, it is found that equalisation provides better results. Performance of turbo codes is better for large block sizes compared to small ones. Bit error rate of turbo codes with different path delays is compared. Future work can include channel estimation schemes for other channel models.

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Enhanced BER Analysis of Mitigation of ICI through SC, ML and EKF Methods in OFDM Systems

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Abstract- OFDM is a multicarrier modulation technique in which a high rate bitstream is split into N parallel bit-streams of lower rate and each of these are modulated using one of N orthogonal sub-carriers. Orthogonal Frequency Division Multiplexing (OFDM) is an emerging multi-carrier modulation scheme, which has been adopted for several wireless standards such as IEEE 802.11a and HiperLAN2. In a basic communication system, the data is modulated onto a single carrier frequency. The available bandwidth is then totally occupied by each symbol. This kind of system can lead to inter-symbol-interference (ISI) in case of frequency selective channel. The basic idea of OFDM is to divide the available spectrum into several orthogonal sub channels so that each narrowband subchannels experiences almost flat fading. Orthogonal frequency division multiplexing (OFDM) is becoming the chosen modulation technique for wireless communications. A well known problem of OFDM is its sensitivity to frequency offset between the transmitted and received signals, which may be caused by Doppler shift in the channel, or by the difference between the transmitter and receiver local oscillator frequencies[2]. This carrier frequency offset causes loss of orthogonality between sub-carriers and the signals transmitted on each carrier are not independent of each other. The orthogonality of the carriers is no longer maintained, which results in inter-carrier interference (ICI).The undesired ICI degrades the performance of the system[6]. This paper investigates three methods for combating the effects of ICI: ICI self-cancellation (SC), maximum likelihood (ML) estimation, and extended Kalman filter (EKF) method. These three methods are compared in terms of bit error rate performance, bandwidth efficiency, and computational complexity. Through simulations, it is shown that the three techniques are effective in mitigating the effects of ICI. For high values of the frequency offset and for higher order modulation schemes, the ML and EKF methods perform better than the SC method.

Index Terms- Inter symbol interference, Inter carrier interference, orthogonality, Doppler shift, Self cancellation, CIR, BER etc.

I. INTRODUCTION

Orthogonal Frequency Division Multiplexing (OFDM) is a technique in which the total transmission bandwidth is split into a number of orthogonal subcarriers so that a wideband signal

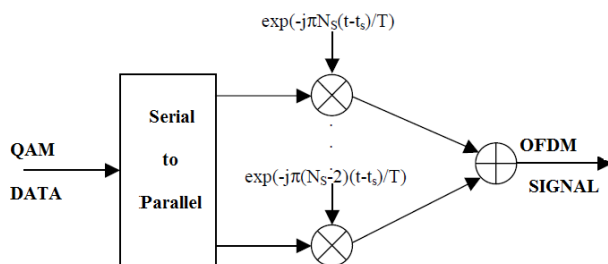
is transformed in a parallel arrangement of narrowband 'orthogonal' signals. In this way, a high data rate stream that would otherwise require a channel bandwidth far beyond the actual coherence bandwidth can be divided into a number of lower rate streams. Increasing the number of subcarriers increases the symbol period so that, ideally, a frequency selective fading channel is turned into a flat fading one. In other words, OFDM handles frequency selective fading resulting from time dispersion of multipath channels by expanding the symbol duration [1]. Very high data rates are consequently possible and for this reason it has been chosen as the transmission method for many standards from cable-based Asymmetric Digital Subscriber Line (ADSL), to wireless systems such as the IEEE 802.11a/g local area network, the IEEE 802.16 for broadband metropolitan area network and digital video and audio broadcasting. The fact that the OFDM symbol period is longer than in single carrier modulation, assures a greater robustness against Inter-Symbol Interference (ISI) caused by delay spread. On the other hand, this makes the system more sensitive to time variations that may cause the loss of orthogonality among subcarriers thus introducing cross interference among subcarriers. Other possible causes of this loss may be due to frequency or sampling offsets emerging at the local oscillator, phase noise and synchronization errors: the combination of all these factors forms the frequency domain OFDM channel response that can be summarized in an ICI matrix. Estimation of this channel matrix is crucial to maximize performance, but in real world OFDM systems this task can be very tough, since the size of the ICI matrix depends on the number of OFDM subcarriers which can be in the order of hundreds or thousands. Several channel estimation algorithms and methods to obtain ICI cancellation have been reported in the literature in both frequency and time domain: although blind techniques are possible without reduction of Spectrum efficiency, commercial systems include pilot patterns to improve the estimation process. These are exploited for example in [2] where a pilot-symbol-aided estimation in the time domain is proposed. Other approaches tend to exploit some other redundancy in the signal structure. In [3][4], training symbols are used to estimate the frequency offset, in [5] the authors propose to use the cyclic-prefix and then Independent Component Analysis (ICA) is applied to the received subcarriers. In [6] frequency offset estimation is obtained by repeated information symbols.

In this paper, the effects of ICI have been analyzed and three solutions to combat ICI have been presented. The first method is a self-cancellation scheme[1], in which redundant data is transmitted onto adjacent sub-carriers such that the ICI between adjacent sub-carriers cancels out at the receiver. The other two techniques, maximum likelihood (ML) estimation and the

extended Kalman filter (EKF) method, statistically estimate the frequency offset and correct the offset [7], using the estimated value at the receiver. The works presented in this paper concentrate on a quantitative ICI power analysis of the ICI cancellation scheme, which has not been studied previously. The average carrier-to interference power ratio (CIR) is used as the ICI level indicator, and a theoretical CIR expression is derived for the proposed scheme.

The paper is organized as follows. In Section 2 the formulation of the OFDM channel in frequency domain is introduced together with the ICI matrix approximation. In Section 3 the problem due to inter carrier interference is analyzed and In Section 4-6 the proposed methods are described and in Section 7 the simulations results are analyzed. Finally conclusions and some perspectives are given.

II. SYSTEM MODEL



In an OFDM system, the input bit stream is multiplexed into N symbol streams, each with symbol period T , and each symbol stream is used to modulate parallel, synchronous sub-carriers [1]. The sub-carriers are spaced by 1 in frequency, thus they are orthogonal over the interval $(0, T)$.

A typical discrete-time baseband OFDM transceiver system is shown in Figure 2.1. First, a serial-to-parallel (S/P) converter groups the stream of input bits from the source encoder into groups of $\log_2 M$ bits, where M is the alphabet of size of the digital modulation scheme employed on each sub-carrier. A total of N such symbols, X_m , are created. Then, the N symbols are mapped to bins of an inverse fast Fourier transform (IFFT). These IFFT bins correspond to the orthogonal sub-carriers in the OFDM symbol. Therefore, the OFDM symbol can be expressed as

$$X(n) = \frac{1}{N} \sum_{m=0}^{N-1} X(m) \exp\left(\frac{j2\pi nm}{N}\right) \quad \text{-----(2.1)}$$

where the $X(m)$'s are the baseband symbols on each sub-carrier. The digital-to-analog (D/A) converter then creates an analog time-domain signal which is transmitted through the channel.

At the receiver, the signal is converted back to a discrete N point sequence $y(n)$, corresponding to each sub-carrier. This discrete signal is demodulated using an N -point fast Fourier transform (FFT) operation at the receiver. The demodulated symbol stream is given by:

$$Y(m) = \sum_{n=0}^{N-1} y(n) \exp\left(\frac{-j2\pi nm}{N}\right) + W(m) \quad \text{---(2.2)}$$

where, $W(m)$ corresponds to the FFT of the samples of $w(n)$, which is the Additive White Gaussian Noise (AWGN) introduced in the channel.

The high speed data rates for OFDM are accomplished by the simultaneous transmission of data at a lower rate on each of the orthogonal sub-carriers. Because of the low data rate transmission, distortion in the received signal induced by multipath delay in the channel is not as significant as compared to single-carrier high-data rate systems. For example, a narrowband signal sent at a high data rate through a multipath channel will experience greater negative effects of the multipath delay spread, because the symbols are much closer together [3]. Multipath distortion can also cause inter-symbol interference (ISI) where adjacent symbols overlap with each other. This is prevented in OFDM by the insertion of a cyclic prefix between successive OFDM symbols. This cyclic prefix is discarded at the receiver to cancel out ISI. It is due to the robustness of OFDM to ISI and multipath distortion that it has been considered for various wireless applications and standards[3].

2.1 DERIVATIONS OF ICI COEFFICIENTS:

say Y_k is the Discrete Fourier Transform of $y(n)$. Then we get,

$$\begin{aligned} Y(k) &= \sum_{n=0}^{N-1} x(n) \exp\left(\frac{j2\pi n\epsilon}{N}\right) \exp\left(\frac{-j2\pi nk}{N}\right) \\ &= \sum_{n=0}^{N-1} \left(\frac{1}{N}\right) \left(\sum_{m=0}^{N-1} X(m) \exp\left(\frac{j2\pi nm}{N}\right) \exp\left(\frac{j2\pi n(\epsilon-k)}{N}\right)\right) \\ &= \frac{1}{N} \sum_{m=0}^{N-1} X(m) \sum_{n=0}^{N-1} \exp\left(\frac{j2\pi n(m+\epsilon-k)}{N}\right) \\ &= \frac{1}{N} \sum_{m=0}^{N-1} X(m) \sum_{n=0}^{N-1} \exp\left(\frac{j2\pi n(m+\epsilon-k)}{N}\right) \end{aligned}$$

We can expand $\frac{1}{N} \sum_{n=0}^{N-1} \exp\left(\frac{j2\pi n(m+\epsilon-k)}{N}\right)$ using the geometric series as,

$$\begin{aligned} \frac{1}{N} \sum_{n=0}^{N-1} \exp\left(\frac{j2\pi n(m+\epsilon-k)}{N}\right) &= \frac{1}{N} \frac{1 - \exp(j2\pi(m+\epsilon-k))}{1 - \exp(j2\pi(m+\epsilon-k)/N)} \\ &= \frac{1}{N} \frac{\exp\left(\frac{j2\pi(m+\epsilon-k)}{2}\right) \left(\exp\left(-\frac{j2\pi(m+\epsilon-k)}{2}\right) - \exp\left(\frac{j2\pi(m+\epsilon-k)}{2}\right)\right)}{\exp\left(\frac{j2\pi(m+\epsilon-k)}{2N}\right) \left(\exp\left(-\frac{j2\pi(m+\epsilon-k)}{2N}\right) - \exp\left(\frac{j2\pi(m+\epsilon-k)}{2N}\right)\right)} \\ &= \frac{1}{N} \exp(j2\pi(m+\epsilon-k)(1-\frac{1}{N})) \frac{1}{\sin\left(\frac{\pi(m+\epsilon-k)}{N}\right)} \end{aligned}$$

Substituting (B.2) in (B.1), we get,

$$Y(k) = \sum_{m=0}^{N-1} X(m) S(m-k) \quad \text{Where,}$$

$$S(m-k) = \exp(j2\pi(m+\epsilon-k)(1-\frac{1}{N})) \frac{1}{N} \frac{\sin\left(\frac{\pi(m+\epsilon-k)}{N}\right)}{\sin\left(\frac{\pi(m+\epsilon-k)}{N}\right)}$$

Which are the required ICI coefficients.

III. ANALYSIS OF INTER CARRIER INTERFERENCE

The main disadvantage of OFDM, however, is its susceptibility to small differences in frequency at the transmitter and receiver, normally referred to as frequency offset. This frequency offset can be caused by Doppler shift due to relative motion between the transmitter and receiver, or by differences between the frequencies of the local oscillators at the transmitter and receiver. In this project, the frequency offset is modeled as a multiplicative factor introduced in the channel[10].

The received signal is given by

$$Y(n)=x(n) \exp\left(\frac{j2\pi n \varepsilon}{N}\right) + W(n) \quad \text{---(3.1)}$$

where ε is the normalized frequency offset, and is given by $\Delta f N T_s$. Δf is the frequency difference between the transmitted and received carrier frequencies and T_s is the subcarrier symbol period. $w(n)$ is the AWGN introduced in the channel.

The effect of this frequency offset on the received symbol stream can be understood by considering the received symbol $Y(k)$ on the k^{th} sub-carrier.

$$Y(k)=x(k)S(0) + \sum_{l=0, l \neq k}^{N-1} X(l)S(l-k) + n_k \quad \text{---(3.2)}$$

$$K=0,1, \dots, N-1$$

where N is the total number of subcarriers, $X(k)$ is the transmitted symbol (M-ary phase-shift keying (M-PSK), for example) for the k^{th} subcarrier, is the FFT of $w(n)$, and $S(l-k)$ are the complex coefficients for the ICI components in the received signal. The ICI components are the interfering signals transmitted on sub-carriers other than the k^{th} sub-carrier. The complex coefficients are given by

$$S(l-k) = \frac{\sin(\pi(l+\varepsilon-k))}{N \sin(\frac{\pi(l+\varepsilon-k)}{N})} \exp(j\pi(1-1/N)(l+\varepsilon-k)) \quad \text{---(3.3)}$$

The carrier-to-interference ratio (CIR) is the ratio of the signal power to the power in the interference components. It serves as a good indication of signal quality. It has been derived from (3.2) in [7] and is given below. The derivation assumes that the standard transmitted data has zero mean and the symbols transmitted on the different sub-carriers are statistically independent.

$$\text{CIR} = \frac{|S(k)|^2}{\sum_{l=0, l \neq k}^{N-1} |S(l-k)|^2} = \frac{|S(0)|^2}{\sum_{l=0}^{N-1} |S(l)|^2} \quad \text{---(3.4)}$$

IV. ICI SELF-CANCELLATION SCHEME

ICI self-cancellation is a scheme that was introduced by Yuping Zhao and Sven-Gustav Häggman in 2001 in [8] to combat and suppress ICI in OFDM. Succinctly, the main idea is to modulate the input data symbol onto a group of subcarriers with predefined coefficients such that the generated ICI signals within that group cancel each other, hence the name self-cancellation[6].

4.1 ICI Canceling Modulation

The ICI self-cancellation scheme shown in figure 4.1.1 requires that the transmitted signals be constrained such that $X(1) = -X(0)$, $X(3) = -X(2)$, ..., $X(N-1) = -X(N-2)$. Using (3.3), this assignment of transmitted symbols allows the received signal on subcarriers k and $k+1$ to be written as

$$Y'(K) = \sum_{l=0, l=\text{even}}^{N-2} x(l) [S(l-k) - S(l+1-k)] + n_k$$

$$Y'(K+1) = \sum_{l=0, l=\text{even}}^{N-2} x(l) [S(l-k-1) - S(l-k)] + n_{k+1} \quad \text{---(4.1)}$$

and the ICI coefficient $S'(l-k)$ is denoted as

$$S'(l-k) = S(l-k) - S(l+1-k) \quad \text{---(4.2)}$$

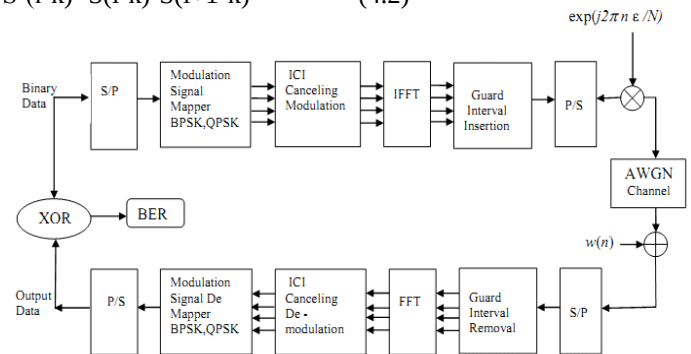


Fig.4.1.1 : OFDM Model with Self cancellation

ICI coefficients $S(l-k)$ Vs subcarrier k is plotted in figure 4.1.2

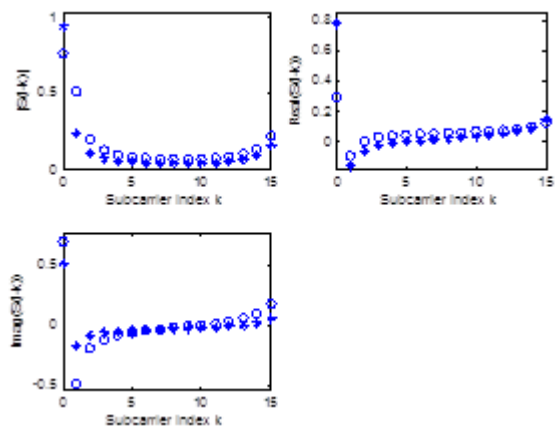


Figure 4.1.2: ICI coefficients $S(l-k)$ Vs subcarrier k

Figure (4.1.3) shows a comparison between $|S'(l-k)|$ and $|S(l-k)|$ on a logarithmic scale. It is seen that $|S'(l-k)| \ll |S(l-k)|$ for most of the $l-k$ values. Hence, the ICI components are much smaller in (4.2) than they are in (3.3). Also, the total number of interference signals is halved in (4.2) as opposed to (3.3) since only the even subcarriers are involved in the summation.

comparison of $|S(l-k)|$, $|S'(l-k)|$, and $|S''(l-k)|$ for $\epsilon=0.2$ and $N=64$

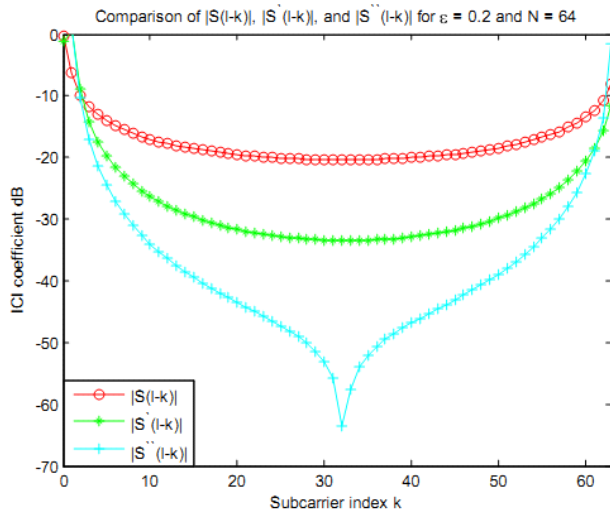


Figure (4.1.3): Comparison of $S(l-k)$, $S'(l-k)$ and $S''(l-k)$ Vs subcarrier k

4.2 ICI Canceling Demodulation

ICI modulation introduces redundancy in the received signal since each pair of subcarriers transmit only one data symbol. This redundancy can be exploited to improve the system power performance, while it surely decreases the bandwidth efficiency. To take advantage of this redundancy, the received signal at the $(k+1)^{th}$ subcarrier, where k is even, is subtracted from the k^{th} subcarrier. This is expressed mathematically as $Y''(k) = Y'(k) - Y'(k+1)$

$$= \sum_{l=0, l=\text{even}}^{N-2} x(l) [-S(l-k-1) + 2S(l-k) - S(l-k+1)] + n_k - n_{k+1}$$

Subsequently, the ICI coefficients for this received signal becomes

$$S''(l-k) = -S(l-k-1) + 2S(l-k) - S(l-k+1) \quad \text{---(4.4)}$$

When compared to the two previous ICI coefficients $|S(l-k)|$ for the standard OFDM system and $|S'(l-k)|$ for the ICI canceling modulation, $|S''(l-k)|$ has the smallest ICI coefficients, for the majority of $l-k$ values, followed by $|S'(l-k)|$ and $|S(l-k)|$. This is shown in Figure 4.1.3 for $N = 64$ and $\epsilon = 0.2$. The combined modulation and demodulation method is called the ICI self-cancellation scheme. The reduction of the ICI signal levels in the ICI self-cancellation scheme leads to a higher CIR.

From (4.4), the theoretical CIR can be derived as

$$\text{CIR} = \frac{|-S(-1) + 2S(0) - S(1)|^2}{\sum_{l=2, l=\text{even}}^{N-2} |-S(l-1) + 2S(l) - S(l+1)|^2} \quad \text{---(4.5)}$$

Figure (4.2.1) shows the comparison of the theoretical CIR curve of the ICI self-cancellation scheme, calculated by (4.5), and the CIR of a standard OFDM system calculated by (3.3). As expected, the CIR is greatly improved using the ICI self-cancellation scheme[9]. The improvement can be greater than 15 dB for $0 < \epsilon < 0.5$.

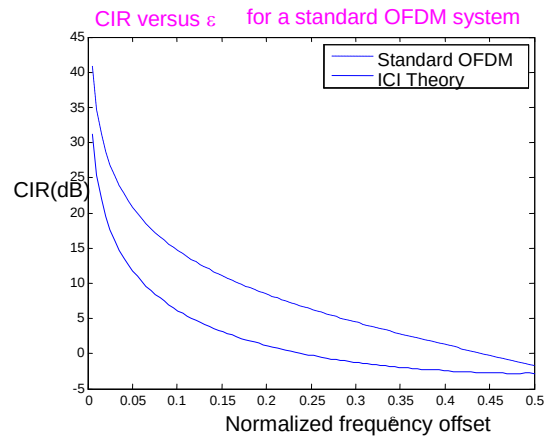


Figure (4.2.1): CIR Vs Normalized frequency offset

As mentioned above, the redundancy in this scheme reduces the bandwidth efficiency by half. This could be compensated by transmitting signals of larger alphabet size. Using the theoretical results for the improvement of the CIR should increase the power efficiency in the system and gives better results for the BER shown in figure (4.2.2).

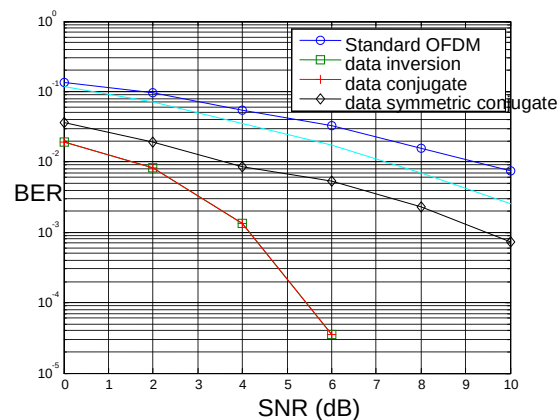


Figure 4.2.2: BER Vs SNR for an OFDM system

Hence, there is a tradeoff between bandwidth and power tradeoff in the ICI self-cancellation scheme.

V. MAXIMUM LIKELIHOOD ESTIMATION

The second method for frequency offset correction in OFDM systems was suggested by Moose in [2]. In this approach, the frequency offset is first statistically estimated using a maximum likelihood algorithm and then cancelled at the receiver. This technique involves the replication of an OFDM symbol before transmission and comparison of the phases of each of the subcarriers between the successive symbols.

When an OFDM symbol of sequence length N is replicated, the receiver receives, in the absence of noise, the $2N$ point sequence $\{r(n)\}$ given by

$$r(n) = \frac{1}{N} \left[\sum_{k=-K}^K X(k) H(k) e^{j \frac{2\pi n (k+2)}{N}} \right] \quad k=0,1,\dots,N-1, N \geq 2K+1$$

where $\{X(k)\}$ are the $2k+1$ complex modulation values used to modulate $2k+1$ subcarriers, $H(k)$ is the channel transfer function for the k^{th} carrier and ϵ is the normalized frequency offset of the channel.

The first set of N symbols is demodulated using an N -point FFT to yield the sequence $R_1(K)$, and the second set is demodulated using another N -point FFT to yield the sequence $R_2(K)$. The frequency offset is the phase difference between

$R_1(k)$ and $R_2(k)$, that is $R_2(k) = R_1(k)e^{j2\pi\epsilon}$

Adding the AWGN yields

$Y_1(k) = R_1(k) + W_1(k)$

$Y_2(k) = R_1(k)e^{j2\pi\epsilon} + W_2(k)$

$k=0,1,\dots,N-1$

The maximum likelihood estimate of the normalized frequency offset is given by:

$$\hat{\epsilon} = \left(\frac{1}{2\pi} \right) \tan^{-1} \left\{ \frac{\left(\sum_{k=-K}^K \text{Im}[Y_2(k)Y_1^*(k)] \right)}{\left(\sum_{k=-K}^K \text{Re}[Y_2(k)Y_1^*(k)] \right)} \right\}$$

This maximum likelihood estimate is a conditionally unbiased estimate of the frequency offset and was computed using the received data [7]. Once the frequency offset is known, the ICI distortion in the data symbols is reduced by multiplying the received symbols with a complex conjugate of the frequency shift and applying the FFT,

$$\hat{x}(n) = \text{FFT}\{y(n)e^{-j\frac{2\pi\epsilon n}{N}}\}$$

From Figure 5.1, it can be seen that the results of the maximum likelihood estimation of the frequency offset are quite accurate over a varying range of SNR values.

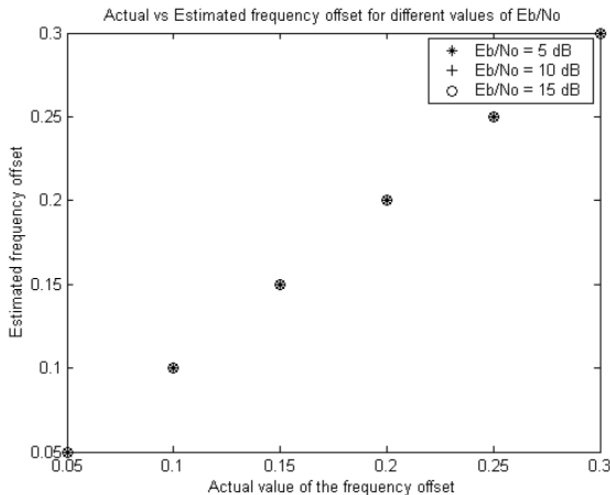


Figure 5.1: Actual vs ML estimation of frequency offset for various values of Eb/No

5.1 MLE SCHEME

Another way of canceling the effect of ICI in OFDM systems is statistically estimating the frequency offset and canceling this offset at the receiver. In this technique, an OFDM symbol stream of N symbols is replicated such that the duplicate symbols are N positions apart in the symbol stream. These

symbols are then modulated using a $2N$ -point inverse discrete Fourier transform (IDFT). At the receiver, the first set of N symbols are demodulated using an N -point discrete Fourier transform (DFT) to yield the sequence Y_{1k} , and the second set is demodulated with another N -point DFT to yield the sequence Y_{2k} . The frequency offset is the phase difference between Y_{1k} and Y_{2k} , that is, $Y_{2k} = Y_{1k}e^{j2\pi\epsilon}$.

The maximum likelihood estimate of the normalized frequency offset is given by:

$$\hat{\epsilon} = (1/2\pi) \tan^{-1} \left\{ \left(\sum_{k=-K}^K \text{Im}[Y_{2k}Y_{1k}^*] \right) / \left(\sum_{k=-K}^K \text{Re}[Y_{2k}Y_{1k}^*] \right) \right\} \quad (3)$$

This maximum likelihood estimate is a conditionally unbiased estimate of the frequency offset and will be computed using the received data [7]. Once the frequency offset is known, the ICI distortion in the data symbols can be reduced by multiplying received symbols with a complex conjugate of the frequency shift. To test the accuracy of the estimate, a mean squared error (MSE) metric, calculated between the estimated offset and the actual offset for different values of the frequency offset, will be used.

VI. EXTENDED KALMAN FILTERING

Kalman filters are common in communications and signal processing literature. The Kalman filter is a remarkably versatile and powerful recursive estimation algorithm that has found various applications in communications, such as adaptive equalization of telephone channels, adaptive equalization of fading dispersive channels, and adaptive antenna arrays. As a recursive filter, it is particularly applicable to non-stationary processes such as signals transmitted in a time-variant radio channel. In estimating non-stationary processes, the Kalman filter computes estimates of its own performance as part of the recursion and use this information to update the estimate at each step. Therefore, the estimation procedure is adjusted to the time-variant statistical characteristics of the random process.

6.1 Problem Formulation

A state-space model of the discrete Kalman filter is defined as

$$z(n) = a(n)d(n) + v(n)$$

In this model, the observation $z(n)$ has a linear relationship with the desired value $d(n)$. By using the discrete Kalman filter, $d(n)$ can be recursively estimated based on the observation of $z(n)$ and the updated estimation in each recursion is optimum in the minimum mean square sense.

As illustrated in Figure 3.1, the received symbols are

$$y(n) = x(n)e^{j\frac{2\pi\epsilon n}{N}} + w(n)$$

It is obvious that the observation $y(n)$ is in a nonlinear relationship with the desired value $\epsilon(n)$,

$$y(n) = f(\varepsilon(n)) + w(n)$$

where

$$f(\varepsilon(n)) = x(n) e^{j \frac{2\pi n \varepsilon(n)}{N}}$$

In order to estimate $\varepsilon(n)$ efficiently in computation, we build an approximate linear relationship using the first-order Taylor's expansion:

$$y(n) = f(\hat{\varepsilon}(n-1)) + f'(\hat{\varepsilon}(n-1))[\varepsilon(n) - (\hat{\varepsilon}(n-1))] + w(n)$$

where $\hat{\varepsilon}(n-1)$ is the estimation of $\varepsilon(n-1)$

$$f'(\hat{\varepsilon}(n-1)) = \left. \frac{\partial f(\varepsilon(n))}{\partial \varepsilon(n)} \right|_{\varepsilon(n) = \hat{\varepsilon}(n-1)}$$

Define

$$z(n) = y(n) - f(\hat{\varepsilon}(n-1))$$

$$d(n) = \varepsilon(n) - \hat{\varepsilon}(n-1)$$

and the following relationship:

$$z(n) = f'(\hat{\varepsilon}(n-1))d(n) + w(n)$$

which has the same form as (6.1), i.e., $z(n)$ is linearly related to $d(n)$. Hence the normalized frequency offset $\varepsilon(n)$ can be estimated in a recursive procedure similar to the discrete Kalman filter. As linear approximation is involved in the derivation, the filter is called the extended Kalman filter (EKF). The derivation of the EKF is omitted in this report for the sake of brevity.)n

The EKF provides a trajectory of estimation for $\varepsilon(n)$. The error in each update decreases and the estimate becomes closer to the ideal value during iterations. It is noted that the actual error in each recursion between $\varepsilon(n)$ and $\hat{\varepsilon}(n)$ does not strictly obey (6.8). Thus there is no guarantee of optimal MMSE estimates in the EKF scheme. However it has been proven that EKF is a very useful method of obtaining good estimates of the system state. Hence this has motivated us to explore the performance of EKF in ICI cancellation in an OFDM system.

6.2 EKF SCHEME

The Extended Kalman Filtering (EKF) technique is another method to estimate the frequency offset in the received signal. It is assumed that the channel is slowly time varying so that the time-variant channel impulse response can be approximated to be quasi-static during the transmission of one OFDM frame. Hence the frequency offset is considered to be constant during a frame. The preamble preceding each frame can thus be utilized as a training sequence for estimation of the frequency offset imposed on the symbols in this frame.

Let $s(n)$ be the training sequence in the time domain, which is generated at baseband by taking the IDFT of the M-QAM modulated preamble. In the case of frequency offset, the signal

$s(n)$ will be distorted by a frequency shift $e^{j2\pi n \varepsilon / N}$ where ε is the same normalized frequency offset as defined in the SC method. Without cyclic prefix, the received training sequence is expressed as

$$y(n) = s(n) e^{j2\pi n' \varepsilon / N} + w(n),$$

where n' denotes the modulation of the index n by N and $w(n)$ the complex white Gaussian additive noise.

To estimate the quantity ε using an EKF, a state-space model is built as

$$\hat{\varepsilon}(n) = \hat{\varepsilon}(n-1)$$

$$y(n) = e^{j2\pi n' / N \cdot \hat{\varepsilon}(n)} s(n) + w(n)$$

Through a recursive iteration procedure, an estimate of the frequency offset can be obtained. Fig. 2 shows the estimates for various normalized frequency offsets. It is observed that the EKF technique offers fast convergence. The ICI distortion in the following data symbols can be mitigated by multiplying the received signal with a complex conjugate of the estimated frequency offset

6.3 ASSUMPTIONS

In the following estimation using the EKF, it is assumed that the channel is slowly time varying so that the time-variant channel impulse response can be approximated to be quasi-static during the transmission of one OFDM frame. Hence the frequency offset is considered to be constant during a frame. The preamble preceding each frame can thus be utilized as a training sequence for estimation of the frequency offset imposed on the symbols in this frame. Furthermore, in our estimation, the channel is assumed to be flat-fading and ideal channel estimation is available at the receiver. Therefore in our derivation and simulation, the one-tap equalization is temporarily suppressed.

6.4 ICI CANCELLATION

There are two stages in the EKF scheme to mitigate the ICI effect: the offset estimation scheme and the offset correction scheme.

6.4.1. Offset Estimation Scheme

To estimate the quantity $\varepsilon(n)$ using an EKF in each OFDM frame, the state equation is built as

$$\varepsilon(n) = \varepsilon(n-1)$$

i.e., in this case we are estimating an unknown constant ε . This constant is distorted by a non-stationary process $x(n)$, an observation of which is the preamble symbols preceding the data symbols in the frame. The observation equation is

$$y(n) = x(n) e^{j \frac{2\pi n \varepsilon}{N}} + w(n)$$

where $y(n)$ denotes the received preamble symbols distorted in the channel, $w(n)$ the AWGN, and $x(n)$ the IFFT of the preambles $X(k)$ that are transmitted, which are known at the receiver. Assume there are N_p preambles preceding the data symbols in each frame are used as a training sequence and the variance σ^2 of the AWGN $w(n)$ is stationary. The computation procedure is described as follows.

1. Initialize $\hat{\varepsilon}(0)$ the estimate and corresponding state error $P(0)$.

2. Compute the $H(n)$, the derivative of $y(n)$ with respect to $\varepsilon(n)$ at $\hat{\varepsilon}(n-1)$, the estimate obtained in the previous iteration.
3. Compute the time-varying Kalman gain $K(n)$ using the error variance $P(n-1)$, $H(n)$, and σ^2 .
4. Compute the estimate $\hat{y}(n)$ using $x(n)$ and $\hat{\varepsilon}(n-1)$, i.e. based on the observations up to time $n-1$, compute the error between the true observation $y(n)$ and $\hat{y}(n)$.
5. Update the estimate by adding the $K(n)$ -weighted error between the observation $y(n)$ and $\hat{y}(n)$ to the previous estimation $\hat{\varepsilon}(n-1)$.
6. Compute the state error $P(n)$ with the Kalman gain $K(n)$, $H(n)$, and the previous error $P(n-1)$.
7. If n is less than N_p , increment n by 1 and go to step 2; otherwise stop.

It is observed that the actual errors of the estimation $\hat{\varepsilon}(n)$ from the ideal value $\varepsilon(n)$ are computed in each step and are used for adjustment of estimation in the next step.

Through the recursive iteration procedure described above, an estimate of the frequency offset $\hat{\varepsilon}$ can be obtained. It is observed that the EKF technique offers fast convergence.

6.4.2. Offset Correction Scheme

The ICI distortion in the data symbols $x(n)$ that follow the training sequence can then be mitigated by multiplying the received data symbols $y(n)$ with a complex conjugate of the estimated frequency offset and applying FFT, i.e.

$$\hat{x}(n) = \text{FFT}\{y(n)e^{-j\frac{2\pi\hat{\varepsilon}n}{N}}\}$$

As the estimation of the frequency offset by the EKF scheme is pretty efficient and accurate, it is expected that the performance will be mainly influenced by the variation of the AWGN.

VII. SIMULATION RESULTS AND DISCUSSION

Figure 4.1.1 shows the Fast Fourier transform (FFT) based N-subcarrier OFDM system model used for simulation[1]. The simulation parameters used for the model shown in Figure 4.1 is as given below Table 7.1

Parameter	Specifications
IFFT Size	64
Number of Carriers in one OFDM symbol	52
Channel	AWGN
Frequency Offset	0, 0.15, 0.3
Guard Interval	12
Modulation	BPSK, QPSK
OFDM symbols for one loop	10000

Table 7.1 : Simulation Parameters

7.1 BER performance of BPSK OFDM system:

- (a) BER performance of a BPSK OFDM system with & without self cancellation:

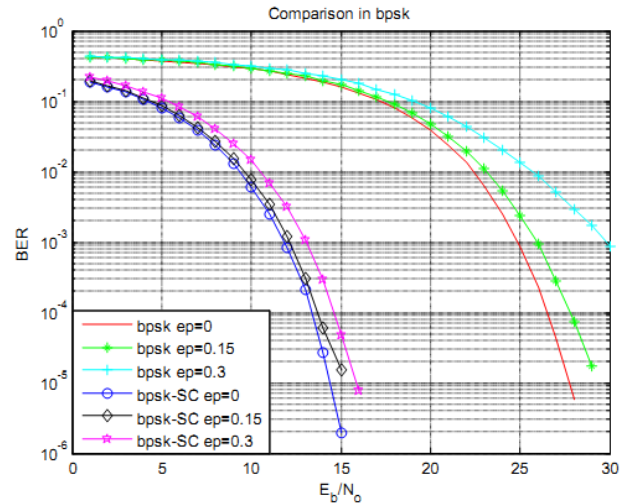


Figure. 7.1.1: BER performance of a BPSK OFDM system with & without Self Cancellation

BER performance of a BPSK OFDM system with & without Self Cancellation shown in Fig. 7.1.1. This is the plot which shows the comparison between standard OFDM and OFDM with self cancellation technique for different values of frequency offset for the modulation BPSK. From the figure we observe that as the value of carrier frequency offset ε increases, the BER increases. We can infer that self cancellation technique in OFDM has less BER compared to without self cancellation.

5.2 BER performance of QPSK OFDM system

- (a) BER performance of a QPSK OFDM system with & without Self Cancellation:

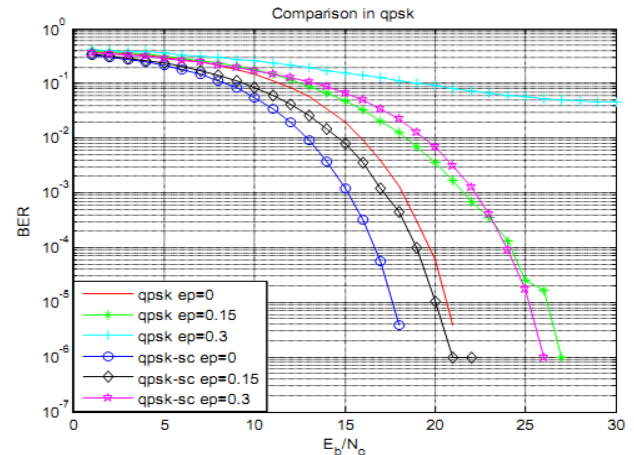


Figure.7.2.1: BER performance of a QPSK OFDM system with & without Self Cancellation

From the figure 7.2.1 we observe that as the value of carrier frequency offset ε increases, the BER increases. As SNR increases QPSK BER curve leans downward which indicates reduction in bit error rate. This is the plot which shows the comparison between standard OFDM and OFDM with self

cancellation technique for different values of frequency offset for the modulation QPSK.

We can infer that self cancellation technique in OFDM has low BER compared to standard OFDM.

(b) BER performances of QPSK, BPSK OFDM systems with constant frequency offsets is simulated in figure(7.2.2).

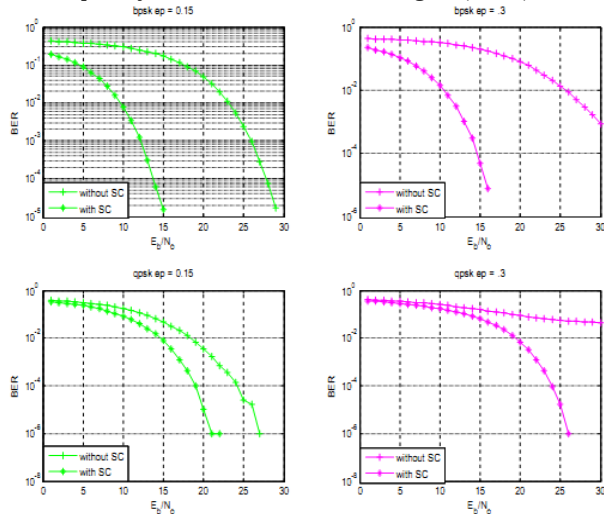


Figure 7.2.2: BER performances of QPSK, BPSK OFDM systems with constant frequency offsets

7.3 Comparison of BER performances of BPSK, QPSK OFDM systems

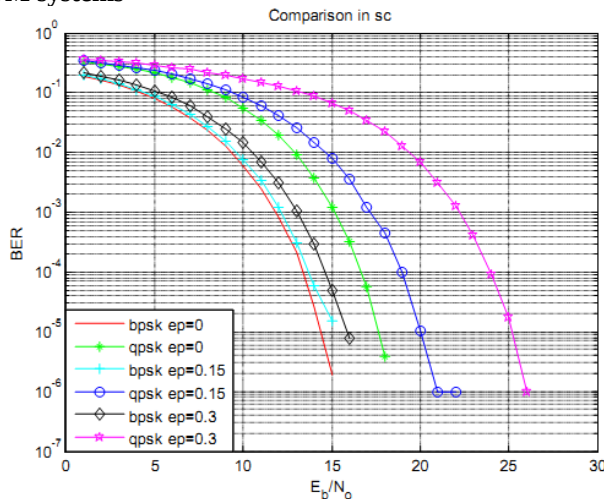


Figure 7.3.1: BER performance of a BPSK, QPSK OFDM systems with Self Cancellation.

This plot shown in figure (7.3.1) is the comparison between two modulation techniques for different values of frequency offset. Here only self cancellation technique is considered. We notice that as the value of carrier frequency offset ϵ increases, the BER increases. For low frequency offset value BER is less. For constant ϵ value, BER of BPSK is less than BER of QPSK.

VIII. COMPARISON

In order to compare the three different cancellation schemes, BER curves were used to evaluate the performance of each scheme. For the simulations in this paper, MATLAB was employed with its Communications Toolbox for all data runs. The OFDM transceiver system was implemented as specified by Figure 2.1. Frequency offset was introduced as the phase rotation as given by (3.1). Modulation schemes of binary phase shift keying (BPSK) and 4-ary quadrature amplitude modulation (QAM) were chosen as they are used in many standards such as 802.11a. Simulations for cases of normalized frequency offsets equal to 0.05, 0.15, and 0.30 are given in Figure 8.1.

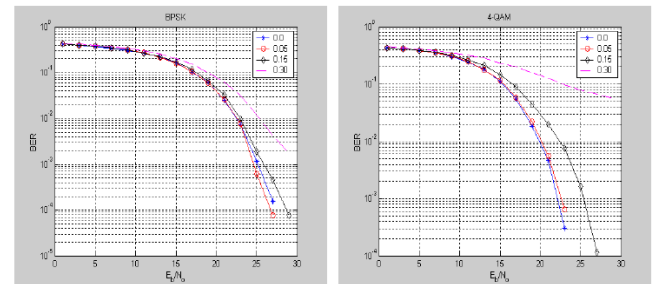


Figure 8.1: Simulations for normalized frequency offsets equal to 0.05, 0.15, and 0.30

These results show that degradation of performance increases with frequency offset. For the case of BPSK, even severe frequency offset of 0.30 does not deteriorate the performance too greatly. However, for QAM with an alphabet of size 2, performance degrades more quickly. When frequency offset is small, the 4-QAM system has a lower BER than the BPSK system. But the BER of 4-QAM varies more dramatically with the increase the frequency offset than that of BPSK. Therefore it is concluded that larger alphabet sizes are more sensitive to ICI.

Figures 8.2-8.4 provide comparisons of the performance of the SC, ML and EKF schemes for different alphabet sizes and different values of the frequency offset.

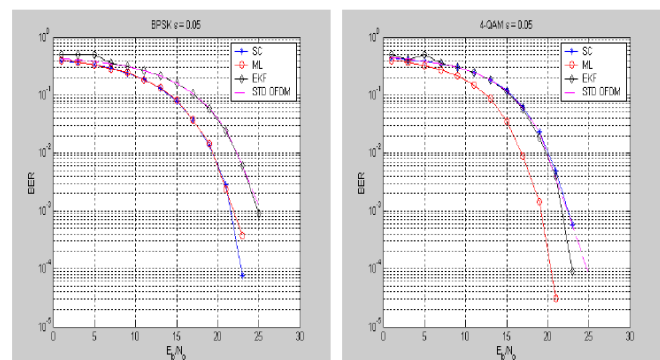


Figure 8.2: Performance of the SC, ML and EKF schemes FOR $\epsilon = 0.05$

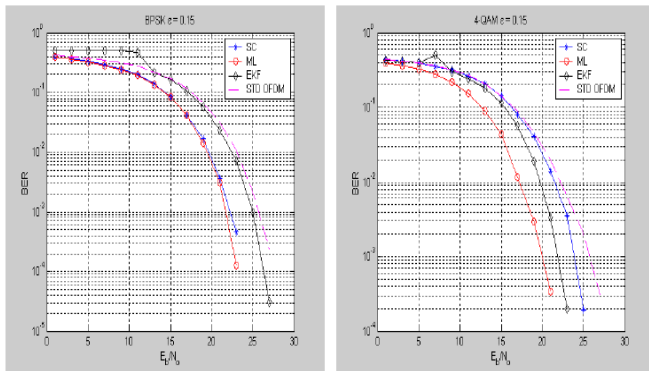


Figure 8.3: Performance of the SC, ML and EKF schemes $\varepsilon = 0.15$

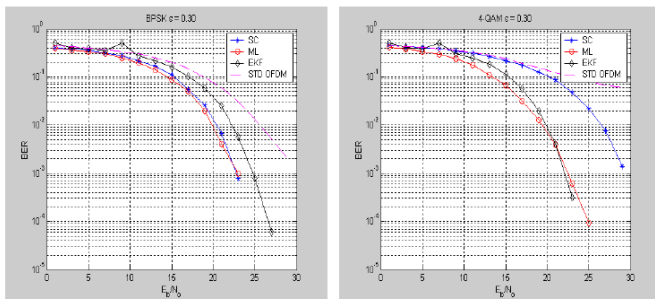


Figure 8.4: Performance of the SC, ML and EKF schemes $\varepsilon = 0.30$

It is observed in the figures that each method has its own advantages. In the presence of small frequency offset and binary alphabet size, self cancellation gives the best results. However, for larger alphabet sizes and larger frequency offset such as 4-QAM and frequency offset of 0.30, self cancellation does not offer much increase in performance. The maximum likelihood method gives the best overall results. The Kalman filter method indicates that for very small frequency offset, it does not perform very well, as it hardly improves BER. However, for high frequency offset the Kalman filter does perform extremely well. It gives a significant boost to performance. Tables 8.1 and 8.2 summarize required values of SNR for BER specified at 10^{-2} . Significant gains in performance can be achieved using the ML and EKF methods for a large frequency offset.

Method	$\varepsilon = 0.05$	Gain	$\varepsilon = 0.15$	Gain	$\varepsilon = 0.30$	Gain
None	23 dB		23 dB		26 dB	
SC	18 dB	5dB	18 dB	5 dB	20.5 dB	5.5 dB
ML	18 dB	5dB	18 dB	5dB	20 dB	6dB
EKF	22.5dB	0.5dB	22dB	1dB	23dB	3dB

Table 8.1: Required SNR and improvement for BER of 10^{-2} for BPSK

Method	$\varepsilon = 0.05$	Gain	$\varepsilon = 0.15$	Gain	$\varepsilon = 0.30$	Gain
None	20 dB		23 dB		40 dB	
SC	20 dB	0dB	22 dB	1 dB	27dB	13 dB
ML	17 dB	3dB	17dB	6dB	19.5 dB	20.5dB
EKF	20dB	0dB	20dB	3dB	20dB	20dB

Table 8.2: Required SNR and improvement for BER of 10^{-2} for 4-QAM

For small alphabet sizes (BPSK) and for low frequency offset values, the SC and ML techniques have good performance in terms of BER. However, for higher order modulation schemes, the EKF and ML techniques perform better. This is attributed to the fact that the ML and EKF methods estimate the frequency offset very accurately and cancel the offset using this estimated value. However, the self-cancellation technique does not completely cancel the ICI from adjacent sub-carriers, and the effect of this residual ICI increases for larger alphabet sizes and offset values.

8.1. EXPECTED OUTCOME

Numerical simulations of the three ICI mitigation schemes will be performed and their performance will be evaluated and compared in terms of various parameters such as CIR, BER, bandwidth efficiency, and computational complexity. These simulations will be implemented in MATLAB. The normalized frequency offset for these simulations will be in the range of $|\varepsilon| < 0.5$. The EKF technique is expected to be more computationally efficient as compared to the SC and MLE techniques.

ICI mitigation techniques are essential in improving the performance of an OFDM system in an environment which induces frequency offset error in the transmitted signal. The comparisons of the three schemes in terms of various parameters will be useful in determining the choice of ICI mitigation techniques for different applications and mobile environments.

IX. CONCLUSION

In this paper, the performance of OFDM systems in the presence of frequency offset between the transmitter and the receiver has been studied in terms of the Carrier-to-Interference ratio (CIR) and the bit error rate (BER) performance. Inter-carrier interference (ICI) which results from the frequency offset degrades the performance of the OFDM system.

One of the main disadvantages of OFDM is its sensitivity against carrier frequency offset which causes attenuation and rotation of subcarriers, and inter carrier interference (ICI). Orthogonality of the sub-carriers in OFDM helps to extract the symbols at the receiver without interference with each other.

Three methods were explored in this paper for mitigation of the ICI. The ICI self-cancellation (SC) and the maximum

likelihood (ML) estimation techniques were proposed in previous publications [8]-[9]. The extended Kalman filtering (EKF) method for estimation and cancellation of the frequency offset has been investigated in this project, and compared with these two existing techniques.

The choice of which method to employ depends on the specific application. For example, self cancellation does not require very complex hardware or software for implementation. However, it is not bandwidth efficient as there is a redundancy of 2 for each carrier. The ML method also introduces the same level of redundancy but provides better BER performance, since it accurately estimates the frequency offset. Its implementation is more complex than the SC method. On the other hand, the EKF method does not reduce bandwidth efficiency as the frequency offset can be estimated from the preamble of the data sequence in each OFDM frame. However, it has the most complex implementation of the three methods. In addition, this method requires a training sequence to be sent before the data symbols for estimation of the frequency offset. It can be adopted for the receiver design for IEEE 802.11a because this standard specifies preambles for every OFDM frame. The preambles are used as the training sequence for estimation of the frequency offset.

In this paper, the simulations were performed in an AWGN channel. This model can be easily adapted to a flat-fading channel with perfect channel estimation.

9.1 SCOPE OF FUTURE WORK:

Following are the areas of future study which can be considered for further research work.

1. Coding associated with frequency (among carriers) and time interleaving make the system very robust in frequency selective fading. Hence Channel coding is very important in OFDM systems. COFDM (Coded OFDM) Systems can be used for ICI reduction using self cancellation technique.
2. This self cancellation technique can also be applied under different multipath propagation mobile conditions such as Rayleigh fading channel, urban, rural area channels etc.
3. This self cancellation scheme can be extended to Multiple input and Multiple output (MIMO) OFDM systems.
4. Further work can be done by performing simulations to investigate the performance of these ICI cancellation schemes in multipath fading channels without perfect channel information at the receiver. In this case, the multipath fading may hamper the performance of these ICI cancellation schemes.

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Keyframe Based Video Summarization Using Automatic Threshold & Edge Matching Rate

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Abstract- Shot boundary detection and Keyframe Extraction is a fundamental step for organization of large video data. Key frame extraction has been recognized as one of the important research issues in video information retrieval. Video shot boundary detection, which segments a video by detecting boundaries between camera shots, is usually the first and important step for content-based video retrieval and video summarization. This paper discusses the importance of key frame extraction; briefly review and evaluate the existing approaches, to overcome the shortcomings of the existing approaches.

This paper also proposes a new approach for key frame extraction based on the block based Histogram difference and edge matching rate. Firstly, the Histogram difference of every frame is calculated, and then the edges of the candidate key frames are extracted by Prewitt operator. At last, the edges of adjacent frames are matched. If the edge matching rate is above average edge matching rate, the current frame is deemed to the redundant key frame and should be discarded. Histogram-based algorithms are very applicable to SBD; They provide global information about the video content and are faster without any performance degradations.

Index Terms- key frame extraction; Histogram Difference; Prewitt operator; edge matching rate

I. INTRODUCTION

The availability of cheap digital storage has led to a rapid expansion of digital video archives, and with such enormous video data resources, sophisticated video database systems are highly demanded to enable efficient browsing, searching and retrieval. Initial attempts to meet this need involved the use of textual data obtained from subtitles and speech recognition transcripts. However, while these methods are effective for some needs, such as broadcast news retrieval, they take no account of the visual content of the video.

The traditional video indexing method, which uses human beings to manually annotate or tag videos with text keywords, is time-consuming, lacks the speed of automation and is hindered by too much human subjectivity. Therefore, more advanced approaches such as content-based video retrieval are needed to support automatic indexing and retrieval directly based on videos content, which provide efficient search with satisfactory responses to the scenes and objects that the user seeks.

Video shot boundary detection, which segments a video by detecting boundaries between camera shots, is usually the first and important step for content-based video retrieval [1]. A video

consists of a sequence of images (often being called frames), which can be played consecutively at the speed of around 20 to 30 frames per second in order to view smooth motion. To index and retrieval a video, shot boundary detection is usually conducted to segments the video into shots by detecting boundaries between camera shots.

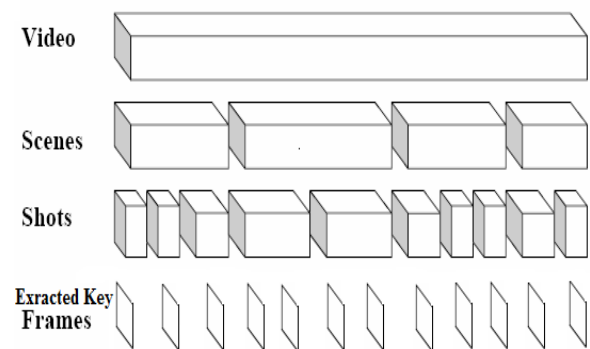


Figure.1.1: Overview of Shot boundary detection.

A shot is defined as the consecutive frames from the start to the end of recording in a camera. It shows a continuous action in an image sequence. There are two different types of transitions that can occur between shots, abrupt (discontinuous) also referred as cut, or gradual (continuous) such as fades, dissolves and wipes [1]. The cut boundaries show an abrupt change in image intensity or colour, while those of fades or dissolves show gradual changes between frames.

- A cut is an instantaneous transition from one scene to the next and it occurs over two frames.
- Fade is a gradual transition between a scene and a constant image (fade out) or between a constant image and a scene (fade in).
- A dissolve is a gradual transition from one scene to another, in which the first scene fades out and the second fades in.
- A wipe occurs as a line moves across the screen, with the new scene appearing behind the line.

1.1 Motivation

Recent developments in video compression technology, the widespread use of digital cameras, high capacity digital systems, coupled with the significant increase in computer performance and the growth of Internet and broadband communication, have increased the usage and availability of digital video. Applications such as multimedia information systems, distance learning, video on-demand produce and use huge amount of video data. This

situation created a need for tools that can effectively categorize, search and retrieve the relevant video material.

In general, management of such activities over large collections of video requires knowledge of the “content” of the video. In particular, digital video data can be processed with the objective of extracting the information about the content conveyed with this data. The algorithms developed for this purpose, referred as “video content analysis” algorithms and serve as the basis for developing tools that would enable us to understand the events and objects within the scene of a video, or generate summary of large video material or even to derive semantically meaningful information from the video [2].

The definition of “content” is highly application dependent but there are a number of commonalities in the applications of content analysis. Among others, *shot boundary detection* (SBD), also known as *temporal video segmentation* is one of the important aspects.

Parsing a video into its basic temporal units -shots- is considered as the initial step in the process of video content analysis. A shot is a series of video frames taken by a single camera, such as, for instance, by zooming into a person or an object, or simply by panning along a landscape [2]. The content is similar in shot regions. The regions where the significant content change occurs are, therefore, called shot boundaries. Since the SBD is a prerequisite step for most of the video applications involving the understanding, parsing, indexing, characterization, or categorization of video, temporal video segmentation has been an active topic of research in the area of content based video analysis.

1.2 THRESHOLDING

Shot boundaries are identified based on the visual content change. Therefore, the most critical activity in the SBD process is the selection of the thresholds in any shot boundary detection step. The performance of the algorithm mainly remains in the thresholding phase. However, using a single threshold cannot perform equally well for all video sequences. Using a dynamic global threshold by extracting the overall sequence characteristic cannot solve this problem. Dynamic local thresholds are considered as a better alternative but thresholding still remains as a major problem in this area.

II. FUNDAMENTAL PROBLEMS OF SBD

Shot boundary detection (SBD) is not a new problem anymore. It has been studied more than a decade and resulting algorithms have reached some maturity. However, challenges still exist and are summarized in the upcoming sections:

2.1 DETECTION OF GRADUAL TRANSITION

During the video production process, first step is capturing the shots by using a single camera. Two consecutive shots are then attached together by a shot boundary that can either be abrupt or gradual. Abrupt shot boundaries are created by simply attaching a shot to another. While there is no modification in the consequent shots in an abrupt shot boundary, gradual transitions result from editing effects applied to the shots during attachment operation. According to the editing effect gradual transitions can be further divided into different subtypes. The number of

possible transitions due to editing effect is quite high but most of the transitions fall into the three main categories: dissolve, fades (fade in, fade out), and wipes. Different types of transitions are demonstrated in the following figures:



Figure 2.1: Dissolve Effect I



Figure 2.2: Dissolve Effect II



Figure 2.3: Wipe Effect



Figure 2.4: Fade In/Fade Out Effect

Detection of abrupt changes has been studied for a long time. On the other hand, gradual transitions pose a much more difficult problem. This situation is mainly due to the amount of available video editing effects. The problem gets harder when multiple effects are composed in the case of a lot of object or camera motion. Another reason is that the gradual transitions spread over time. Each editing effect has a different temporal

pattern than the others and the temporal duration changes from three frames to hundred frames. Finally, the temporal patterns, as a result of editing effects to create a gradual transition, are very similar to the patterns due to camera/object motion. Therefore, gradual transitions remain to be one of the most challenging problems in SBD.

2.2 FLASHLIGHTS

Color is the primary element of video content. Most of the video content representations employ color as a feature. Continuity signals based on color feature exhibit significant changes under abrupt illumination changes, such as flashlights. Such a significant change might be identified as a content change (i.e. a shot boundary) by most of the shot boundary detection tools. Several algorithms propose using illumination invariant features, but these algorithms always face with a tradeoff between using an illumination invariant feature and losing the most significant feature in characterizing the variation of the visual content. Therefore, flashlight detection is one of the major challenges in SBD algorithms.

2.3 OBJECT/CAMERA MOTION

Visual content of the video changes significantly with the extreme object/camera motion and screenplay effects (e.g. one turns on the light in a dark room) very similar to the typical shot changes. Sometimes, slow motion cause content change similar to gradual transitions, whereas extremely fast camera/object movements cause content change similar to cuts. Therefore, it is difficult to differentiate shot changes from the object/camera motion based on the visual content change. Therefore, the most critical activity in the SBD process is the selection of the thresholds in any shot boundary detection step. The performance of the algorithm mainly remains in the thresholding phase. However, using a single threshold cannot perform equally well for all video sequences. Using a dynamic global threshold by extracting the overall sequence characteristic cannot solve this problem. Dynamic local thresholds are considered as a better alternative but thresholding still remains as a major problem in this area.

III. LITERATURE REVIEW & RELATED WORK

SBD is a popular area in the video content analysis and has been studied for a long time. Research has resulted in a variety of algorithms. In this section, briefly the SBD work in the literature is reviewed.

Many approaches used different kinds of features to detect shot boundary, including histogram, shape information, motion activity. Among these approaches, histogram is the popular approach. However, in these histogram-based approaches, pixels' space distribution was neglected. Different frames may have the same histogram.

In view of this, Cheng *et al* [13] divided each frame into r blocks, and the difference of the corresponding blocks of consecutive frames was computed by color histogram; the difference $D(i, i+1)$ of the two frames was obtained by adding up all the blocks' difference; in the meanwhile, the difference $V(i, i+1)$ between two frames i and $i+1$ was measured again without

using blocks. Based on $D(i, i+1)$ and $V(i, i+1)$, shot boundary was determined[1].

Zhuang *et al.* [14] proposed an unsupervised clustering method. A video sequence is segmented into video shots by clustering based on color histogram features in the HSV color space. For each video shot, the frame closest to the cluster centroid is chosen as the key frame for the video shot. Notice that only one frame per shot is selected into the video summary, regardless of the duration or activity of the video shot.

Zuzana Cernekova [15] proposed a new approach for shot boundary detection in the uncompressed image domain based on the MI and the joint entropy (JE) between consecutive video frames. Mutual information is a measure of information transported from one frame to another one. It is used for detecting abrupt cuts, where the image intensity or color is abruptly changed. A large video content difference between two frames, showing weak inter-frame dependency leads to a low MI. The entropy measure provides with better results, because it exploits the inter-frame information flow in a more compact way than a frame subtraction.

Ali Amiri [16] proposed a novel video summarization algorithm which is based on QR-decomposition. Some efficient measures to compute the dynamicity of video shots using QR-decomposition was utilized in detecting the number of key frames selected for each shot. Also, a corollary that illustrates a new property of QR-decomposition. This property was utilized in order to summarize video shots with low redundancy.

Hanjalic *et al.* [17] developed a similar approach by dividing the sequence into a number of clusters, and finding the optimal clustering by cluster-validity analysis. Each cluster is then represented in the video summary by a key frame. The main idea in this paper is to remove the visual redundancy among frames.

DeMenthon *et al.* [18] proposed an interesting alternative based on curve simplification. A video sequence is viewed as a curve in a high dimensional space, and a video summary is represented by the set of control points on that curve that meets certain constraints and best represent the curve.

Doulamis *et al.* [19] also developed a two step approach according to which the sequence is first segmented into shots, or scenes, and within each shot, frames are selected to minimize the cross correlation among frames' features.

3.1 STATE OF ART SHOT BOUNDARY DETECTION

SBD algorithms from the literature are studied and analyzed. A brief summary of the algorithms is presented in the remainder of this chapter. Following are the algorithms.

3.1.1 Pixel-wise Difference with Adaptive Thresholding

In this algorithm individual pixels from frames are compared to find out difference. Pair-wise comparison evaluates the differences in intensity or color values of corresponding pixels in two successive frames. In this algorithm the pixel-wise difference algorithm gives quite acceptable results with adaptive thresholding. By considering difference between the difference signal values of adjacent frames is a worthwhile approach. In practice, it is observed that it is useful to reduce the effects of scenes containing a lot of movement by comparing the

difference signal with a threshold derived from the maximum and minimum difference signals over a small aperture.

Even with the adaptive thresholding, the algorithm produces false alarms, if the shot before/after the shot boundary includes high motion activity. The reason can be explained as follows: The weakness of the pixel based features is the high sensitivity to the video content. It is difficult for this algorithm to understand whether the change in the continuity signal is due to shot boundary or due to disturbances/motion. In order to enhance the algorithm, adaptive thresholding can be used. However, the high level of activity in the images around shot boundary produces a larger difference signal than expected. As a result adaptively obtained threshold is larger. A threshold that is larger than expected results in missed shot boundary.

The main disadvantage of this method is its inability to distinguish between a large change in a small area and a small change in a large area. It is observed that cuts are falsely detected when a small part of the frame undergoes a large, rapid change. For the same reason, the algorithm is not able to detect most of the flashlights.

3.1.2 Histogram Difference with Adaptive Thresholding

While the pixel-wise approach focuses on local intensity (color) comparison between individual pixels, this method is interested with the global percentage of colors that an image contains. The method works by calculating percentages from the bin totals and comparing them with those of the adjacent frame giving a difference value. A difference above the threshold value will be classed as a shot change [2].

Histogram method is not sensitive to local motion and local illumination changes. In the case of slight illumination changes or small camera/object motion, histogram difference method provides robust performance and better results compared to pixel-wise difference algorithm.

On the other hand, It is observed that global changes in the video frames, such as large brightness change, zooming or fading effects (especially fast zooming), result in false alarms. This is an expected result, since histogram feature is sensitive to the overall (or global) content of the video. Therefore, any effect resulting in a global change in the video content (e.g. fast zooming, large object movement) can be erroneously interpreted by the histogram algorithm.

Another conclusion observation of the algorithm is that it cannot detect shot boundaries if there is a video-in-video effect. Since the outer frame, which remains constant, decreases the change ratio of the histogram bins significantly, amount of histogram difference is small. Consequently the transition is missed.

3.1.3 Edge Change Ratio

During a cut or a dissolve, new edges appear far from the locations of old edges. In addition, old edges disappear far from the location of new edges. This observation was applied to digital video segmentation by Zabih et. al. [4] who identified two new types of edge pixels:

- Entering pixel: One that appears far from an existing edge pixel.
- Exiting pixel: One that disappears far from an existing edge pixel.

According to Zabih et. al. it is possible to detect CUTs and GTs by counting the entering and exiting pixels.

The main drawback for this algorithm is its execution time. Calculating the edges and the dilation operation consumes significant computing power and in parallel takes more time to process the frames. Cut detection results can be considered acceptable, if the algorithm could be faster. However, gradual transition results are not promising.

3.1.4 Petersohn's Algorithm with 2-Means Clustering

This system which uses pixel, edge and histogram difference statistics for detecting CUTs and GTs. The system uses the luminance information only and down-samples all the frames by a factor of 8 in x and y directions before processing.

This algorithm is quite fast. Main reason behind this improvement in the speed of the shot boundary detection is that the system uses the luminance information only and down samples all the frames by a factor of 8 in x and y directions. Algorithm senses only significant changes in the video content. In addition to using DC images, the algorithm employs pixel and histogram features together.

3.1.5 Segmentation Method

Although many methods have been proposed for this task, finding a general and robust shot boundary method that is able to handle the various transition types caused by photo flashes, rapid camera movement and object movement is still challenging. In this method the problem of shot boundary detection is casted into the problem of text segmentation in natural language processing. This is possible by assuming that each frame is a word and then the shot boundaries are treated as text segment boundaries (e.g. topics).

The text segmentation based approaches in natural language processing can be used. The shot boundary detection process for a given video is carried out through two main stages. In the first stage, frames are extracted and labeled with predefined labels. In the second stage, the shot boundaries are identified by grouping the labeled frames into segments. Following six labels to label frames in a video can be used: NORM FRM (frame of a normal shot), PRE CUT (pre-frame of a CUT transition), POST CUT (post-frame of a CUT transition), PRE GRAD (pre-frame of a GRADUAL transition), IN GRAD (frame inside a GRADUAL transition), and POST GRAD (post-frame of a GRADUAL transition).

Given a sequence of labeled frames, the shot boundaries and transition types are identified by looking up and processing the frames marked with a non NORM FRM label. It uses a support vector machine (SVM) for the purpose of shot boundary detection.

3.1.6 Motion-Based Algorithm

Similar to Petersohn's Algorithm frames are first down-sampled by a factor of 2 in both x- and y-directions. The algorithm further performs a preprocessing step for filtering out the obvious non-boundary frames. With this achievement, it is allowed to spend more processing power on the areas that are likely to be shot boundaries.

In this early processing step, sum of absolute differences between the R, G and B values are calculated for candidate shot

boundary frames. Generally, motion-based algorithms are not preferred in the uncompressed domain, since estimation of motion vectors consumes significant computational power and time. In contrary, Algorithm is faster mainly due to the preprocessing step for skipping the frames which have very low probability of being a shot boundary. Secondly, utilizing down-sampled images together with the fastest block matching algorithm (i.e. Dual Cross Search) increases the speed of the algorithm significantly.

3.1.7 Motion Activity Descriptor Based Algorithm

The motion activity is one of the motion features included in the visual part of the MPEG-7 standard. It also used to describe the level or intensity of activity, action, or motion in that video sequence. The main idea underlying the methods of segmentation schemes is that images in the vicinity of a transition are highly dissimilar. It then seeks to identify discontinuities in the video stream. The general principle is to extract a comment on each image, and then define a distance [5] (or similarity measure) between observations.

The application of the distance between two successive images, the entire video stream, reduces a one-dimensional signal, in which we seek then the peaks (resp. hollow if similarity measure), which correspond to moments of high dissimilarity. In this work [19], the extraction of key frames method based on detecting a significant change in the activity of motion is used. To jump 2 images which do not distort the calculations but we can minimize the execution time. First the motion vectors between image i and image $i+2$ is extracted then calculates the intensity of motion, we repeat this process until reaching the last frame of the video and comparing the difference between the intensities of successive motion to a specified threshold. The idea can be visualized in figure below.

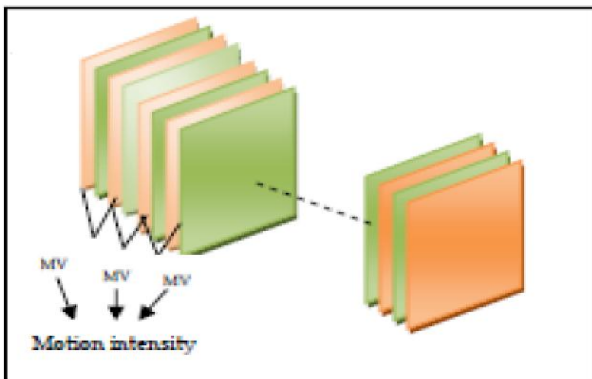


Figure 3.1: the Idea of Video Segmentation Using Motion Intensity

IV. IMPLEMENTATION STRATEGY

The method for key frame extraction consists of three steps: Input a video and calculate the block based histogram difference of each consecutive frame. Choose the current frame as a candidate key frame whose histogram difference is above the threshold point. Extract the edges of the candidate key frames and calculate the edge matching rate of adjacent frames. If the edge matching rate is above average edge matching rate, the

current frame is considered as a redundant frame and should be eliminated from the candidate key frames.

Project will consist of following three modules.

- Shot boundary detection
- Key frame extraction
- Eliminate Redundant Frames

Following is the explanation of each module with their algorithm.

4.1 SHOT BOUNDARY DETECTION:

Let $F(k)$ be the k^{th} frame in video sequence, $k = 1, 2, \dots, F_v$ (F_v denotes the total number of video). The algorithm of shot boundary detection is described as follows.

Algorithm : Shot boundary detection

Step 1: Partitioning a frame into blocks with m rows and n columns, and $B(i, j, k)$ stands for the block at (i, j) in the k^{th} frame;

Step 2: Computing x^2 histogram [8] matching difference between the corresponding blocks between consecutive frames in video sequence. $H(i, j, k)$ and $H(i, j, k+1)$ stand for the histogram of blocks at (i, j) in the k^{th} and $(k+1)^{\text{th}}$ frame respectively. Block's difference is measured by the following equation:

$$D_B(k, k+1, i, j) = \sum_{l=0}^{L-1} \frac{[H(i, j, k) - H(i, j, k+1)]^2}{H(i, j, k)} \quad (4.1)$$

Where L is the number of gray in an image;

Step 3: Computing x^2 histogram difference between two consecutive frames:

$$D(k, k+1) = \sum_{i=1}^m \sum_{j=1}^n w_{ij} D_B(k, K+1, i, j) \quad (4.2)$$

where w_{ij} stands for the weight of block at (i, j) ;

Step 4: Computing threshold automatically: Computing the mean and standard variance of x^2 histogram difference over the whole video sequence [2]. Mean and standard variance are defined as follows :

$$MD = \frac{\sum_{k=1}^{F_v-1} D(k, k+1)}{F_v - 1} \quad (4.3)$$

$$STD = \sqrt{\frac{\sum_{k=1}^{F_v-1} (D(k, k+1) - MD)^2}{F_v - 1}} \quad (4.4)$$

Step 5: Shot boundary detection

Let threshold $T = MD + a \times STD$. Shot candidate detection: if $D(i, i+1) \geq T$, the i^{th} frame is the end frame of previous shot, and the $(i+1)^{\text{th}}$ frame is the end frame of next shot.

Final shot detection: shots may be very long but not much short, because those shots with only several frames cannot be captured by people and they cannot convey a whole message. Usually, a shortest shot should last for 1 to 2.5 s. For the reason

of fluency, frame rate is at least 25 fps, (it is 30 fps in most cases), or flash will appear. So, a shot contains at least a minimum number of 30 to 45 frames. In our experiment, video sequences are down sampled at 10 fps to improve simulation speed. On this condition, the shortest shot should contain 10 to 15 frames. 13 is selected for our experiment. We formulate a “shots merging principle”: if a detected shot contain fewer frames than 13 frames, it will be merged into previous shot, or it will be thought as an independent one.

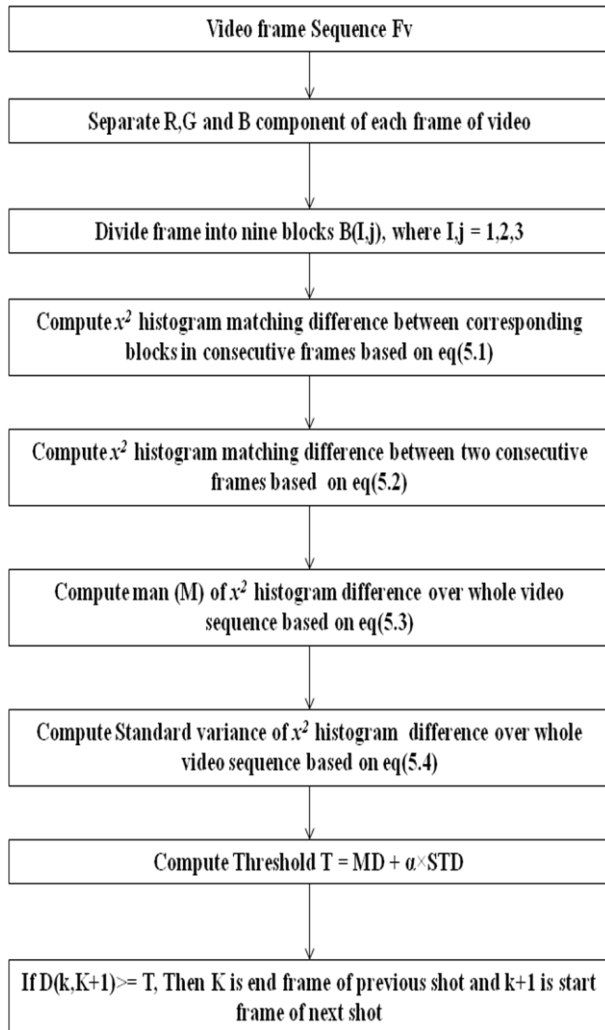


Figure 4.1 Flowchart of shot boundary detection algorithm.

Definition 1: Reference Frame: it is the first frame of each shot; **General Frames:** all the frames except for reference frame; “Shot Dynamic Factor” $\max(i)$: the maximum x^2 histogram within shot i ;

Definition 2: Dynamic Shot and Static Shot: a shot will be declared as dynamic shot, if its $\max(i)$ is bigger than MD; otherwise it is static shot; $F_C(K)$: the k^{th} frame within the current shot, $k=1,2,3 \dots F_{CN}$ ($F_{CN}(k)$ is the total number of the current shot).

4.2 KEYFRAME EXTRACTION

The algorithm of key frame extraction is described as follows.

Algorithm: Key frame extraction

Step 1: Computing the difference between all the general frames and reference frame with the above algorithm:

$$D_C(1, k) = \sum_{i=1}^m \sum_{j=1}^n w_{ij} D_{CB}(1, k, i, j), k = 2, 3, 4, \dots, F_{CN} \quad (4.5)$$

Step 2: Searching for the maximum difference within a shot:

$$\max(i) = \{D_C(1, k)\}_{\max}, k = 2, 3, 4, \dots, F_{CN} \quad (4.6)$$

Step 3: Determining “ShotType” according to the relationship between $\max(i)$ and MD: StaticShot(0) or DynamicShot:

$$\text{ShotType}_C = \begin{cases} 1 & \text{if } \max(i) \geq MD \\ 0 & \text{Others} \end{cases} \quad (4.7)$$

Step 4: Determining the position of key frame: if $\text{ShotType}_C = 0$, with respect to the odd number of a shot’s frames, the frame in the middle of shot is chose as key frame; in the case of the even number, any one frame between the two frames in the middle of shot can be choose as key frame. If $\text{ShotType}_C = 1$, the frame with the maximum difference is declared as key frame.

4.3 ELIMINATE REDUNDANT FRAMES

4.3.1 Extract Edges of the Candidate Key Frames

The candidate key frames obtained from the above treatment do well in reflecting the main content of the given video, but exist a small amount of redundancy, which need further processing to eliminate redundancy.

As the candidate key frames are mainly based on the Histogram difference which depends on the distribution of the pixel gray value in the image space, there may cause redundancy in the event that two images whose content are the same exist great difference from the distribution of the pixel gray value. For example, the substance content of images A and B in Fig.5.2. don’t change, but the two images are both identified as key frames as a result of the different gray value distribution, resulting in redundancy.



Figure 4.2: Redundant Frames A and B

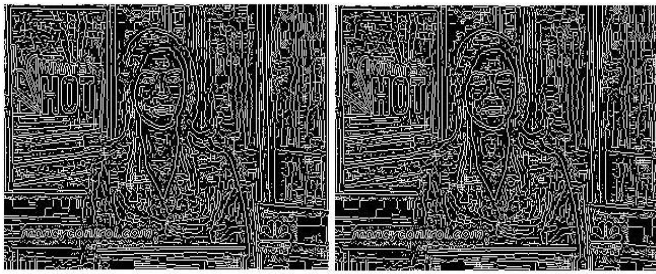


Figure 4.3: Edge Images of A and B.

As edge detection can remove the irrelevant information and retain important structural properties of the image, we can extract the edges of objects in the image to eliminate redundancy. At present, there are many edge detection algorithms, which are mainly based on the differentiation and combined with the template to extract edges of images.

Edge detection operators that are commonly used are: Roberts [20] operator, Sobel operator, Prewitt operator and the Laplace operator etc. Here we extract edges of frames by Prewitt operator.

4.3.2 Eliminate Redundant Frames Based on the Edge Matching Rate

The edge images have no difference in the distribution of the gray value. For example, the images shown in Fig.4.3 are the edge images of the images shown in Fig.4.2. with Prewitt operator and both of them are remarkably similar. So we use the edge matching rate to match the edges of adjacent frames to eliminate redundant frames. The formula for calculating the edge matching rate is as follows:

$$p(f_i, f_{i+1}) = s / n \quad (4.8)$$

In the formula,

$$n = \max(n_{f_i}, n_{f_{i+1}}) \quad (4.9)$$

$$s = \sum_i^m \sum_j^n h(i, j) \quad (4.10)$$

$$h(i, j) = \begin{cases} 1, & v_{fk}(i, j) = v_{fk+1}(i, j) \\ 0, & \text{Otherwise} \end{cases} \quad (4.11)$$

Where $v_{fk}(i, j)$ and $v_{fk+1}(i, j)$ are the pixel values of the position (i, j) in the frame fk and the frame $fk+1$, respectively. m and n indicate the height and the width of the image, n_{fi} and

n_{fi+1} represent the number of the pixels on the edge of the frame fi and the frame f_{i+1} respectively. Assume the keyframe sequence as $\{f_1, f_2, f_3, \dots, f_k\}$ (the total number of the candidate key frames is k), we make use of the following steps to eliminate redundant frames:

- Use the Prewitt operator to extract edges of the candidate key frames and obtain their corresponding edge images.
- Set $j=2$.
- Calculate the edge matching rate $p(f_{j-1}, f_j)$ between the current frame f_j and the previous frame f_{j-1} with the formula (5.8). If $p(f_{j-1}, f_j)$ is above average edge matching rate, the current frame f_j will be marked as a redundant frame.
- $j = j+1$, if $j > k$, go to (e). Otherwise, return to (c) and continue processing the remaining frames.
- Remove the frames which have been marked as
- Redundant frames from the candidate key frames.
- The remaining candidate key frames are the ultimate key frames. With the edge detection and edge matching, we eliminate redundant key frames, improve the accuracy rate of the key frame extraction and reduce the redundancy.

V. EXPERIMENTAL RESULTS AND DISCUSSION

Proposed Keyframe Extraction Algorithm is implemented with GUI based approach which provides easy user interaction. The GUI of the proposed system is shown in Figure 5.1.

Algorithm work on Avi Video files. Implemented project first loads Avi video file after loading video file it initializes ShotBoundary Algorithm to extract key frames depending input parameters set by user. These Frames will be called as Candidate Keyframes and will be extracted in "Candidate frames" folder. Shot Boundaries will be stored in "SBD" folder. Project then removes redundant Candidate frames by using edge detection Algorithm which will be called as actual keyframes, and will be stored in "Keyframes" folder. Project also provides facility to view extracted Keyframes on GUI itself.

The algorithm Shotboundary used in this project is evaluated and tested by using three different videos CNBC_News.avi, Football_Match.avi, Shrek_3.avi. Video clips are obtained from Internet and various television channels. Ies are selected since every video provides different pattern to extract Keyframes. Videos are of AVI (Audio Video Interleaved) format.

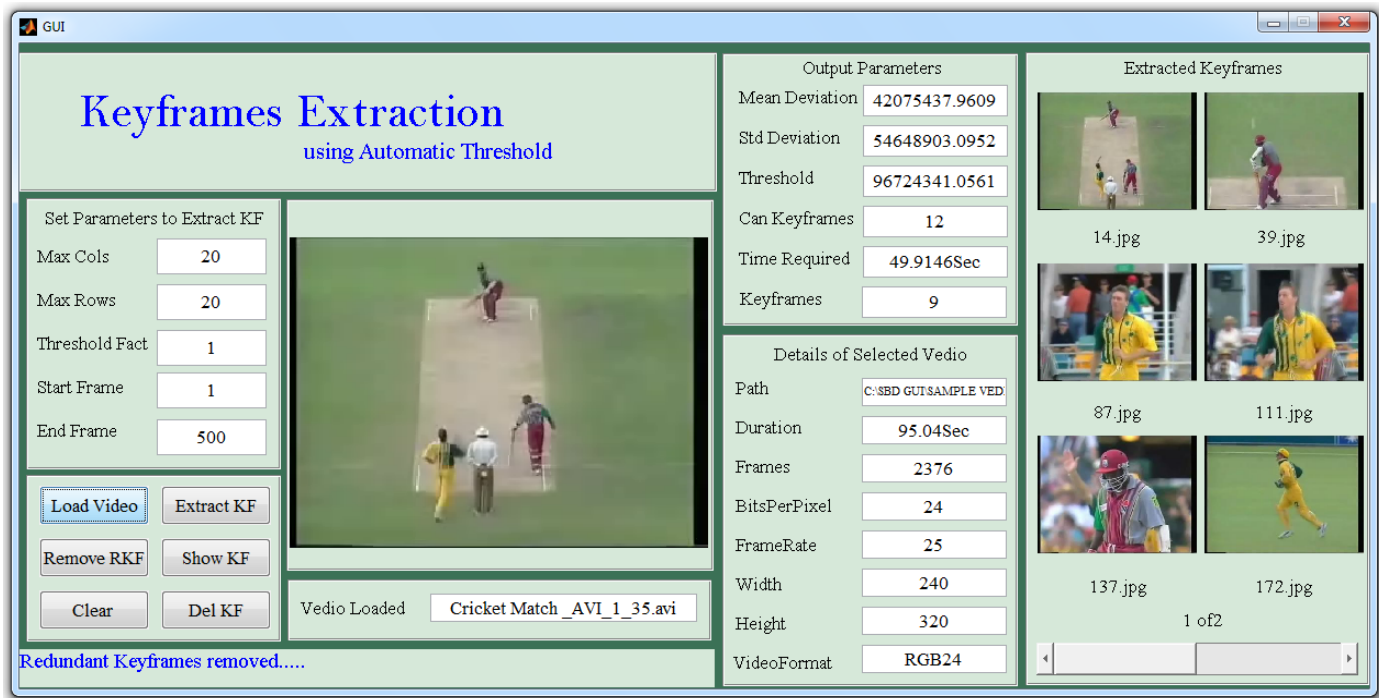


Figure 5.1: Keyframe Extraction GUI

Following is the example of Keyframes extracted by our proposed algorithm.



Figure 5.2 Example of Keyframes extracted

5.1 CONSTANT PARAMETERS SELECTED FOR EVALUATION

Evaluation is done by keeping total number of frames constant from each video. Threshold Factor is selected as 1. Figure 5.3 shows relation in between Number of frames extracted and Threshold Factor selected. Max Columns and Max Rows is selected as constant as 20. Weight Matrix for assigning weight to different blocks in frame is calculated using rand() function. "prewitt" operator[20] is selected when removing redundant Candidate keyframes in Edgedetection algorithm.

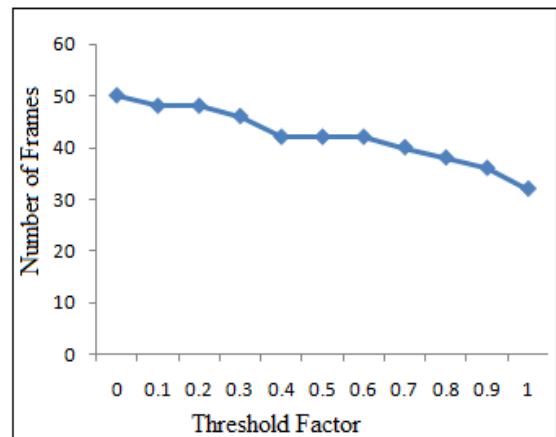


Figure 5.3: Number of Frames vs. Threshold Factor

5.2 SHOT BOUNDARY DETECTION FROM UNCOMPRESSED VIDEO

Following simulation results are plot of frame number versus χ^2 histogram matching difference between consecutive frames. Plots represent variation in χ^2 histogram matching difference for various effects like cut, fade, dissolve etc.

Case 1: Video:: Shrek_3.avi

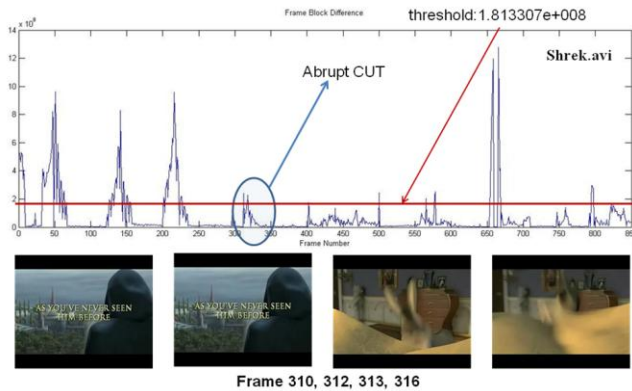


Figure 5.4: Abrupt Cut detection

Case 2: Video:: Shrek_3.avi

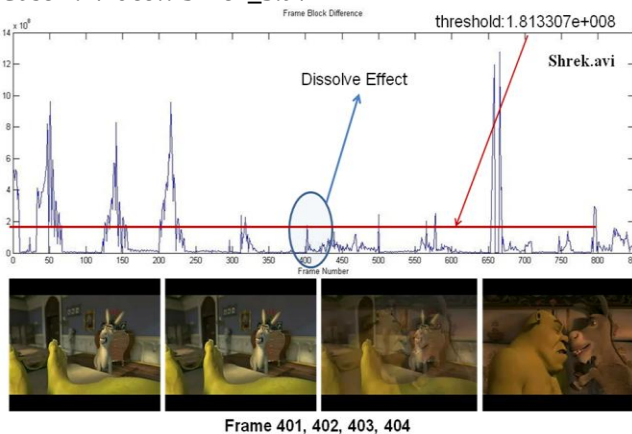


Figure 5.5: Dissolve Effect Detection

Case 3: Video:: Shrek_3.avi

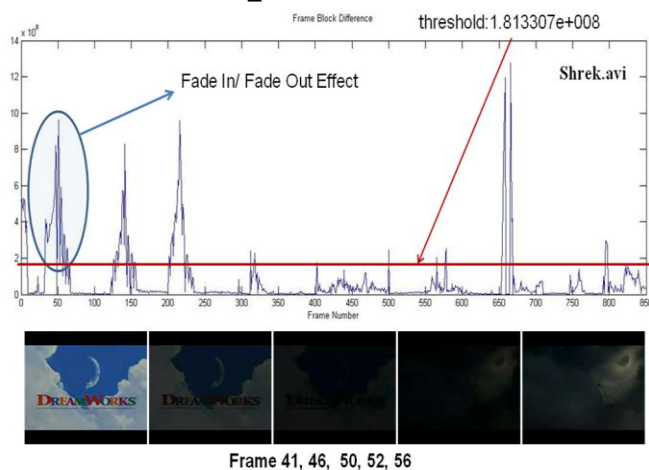


Figure 5.6: Fade In /Fade Out Effect Detection

Case 4: Vi6deo:: Shrek_3.avi

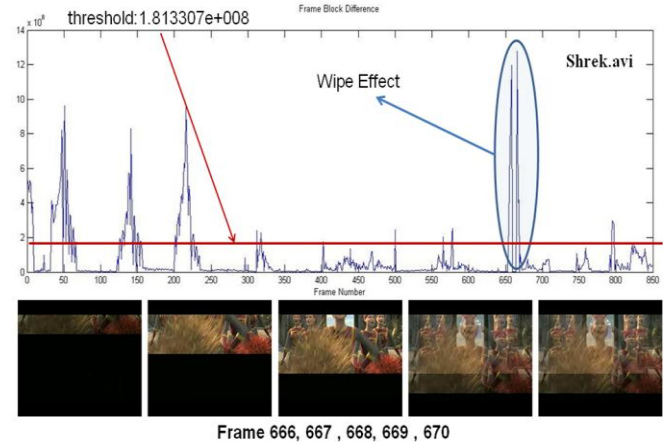


Figure 5.7: Wipe Effect Detection

From the above four cases we can see how χ^2 histogram can be used to detect shot boundaries, It also shows Automatic Threshold calculated by Shotboundary algorithm. Frames above Threshold are extracted as Candidate keyframes.

5.3 PERFORMANCE EVALUATION

In order to evaluate the performance of the shot cut detection method presented in Chapter 5, following measures were used.

Definition 1: Recall: the Recall measure, also known as the true positive function or sensitivity that corresponds to the ratio of correct experimental detections over the number of all true detections:

$$\text{Precision Rate} = \frac{\text{Correctly Detected}}{(\text{Correctly Detected} + \text{Missed Detected})} \quad (5.1)$$

Definition 2: Precision: the Precision measure defined as the ratio of correct experimental detections over the number of all experimental detections:

$$\text{Recall Rate} = \frac{\text{Correctly Detected}}{(\text{Correctly Detected} + \text{Errorly Detected})} \quad (5.2)$$

In order compare the overall performance of the algorithms, F measure, which combines recall and precision results with equal weight.

$$F(\text{recall}, \text{precision}) = \frac{(2 \times \text{recall} \times \text{precision})}{(\text{recall} + \text{precision})} \quad (5.3) \text{ Where,}$$

Correctly Detected are the Keyframes correctly detected by Shotboundary algorithm.

Missed Detected are the Keyframes which are missed in while detecting Shot Boundary detection.

Errorly Detected are the Keyframes detected as Boundaries but actually they are not the boundaries of shots.

In further tables 2000 frames of six different video are analyzed and Recall & Precision are calculated and compared.

Following are the notations used in further table.

CT : CUT

DS : Dissolve

FD: Fade

WP: WIPE

AP: Actual present effects in video

DT: Effects detected by proposed algorithm

MS: Effects missed in detection by proposed algorithm
ED: Errorly detected effects by proposed algorithm
RR: Recall Rate
PR: Precision Rate

Results for : Shrek 3_AVI_1_35

	AP	DT	MS	ED	RR	PR
CT	12	9	3	1	90	75
DS	8	6	2	2	75	75
FD	4	4	0	0	100	100
WP	2	1	1	0	100	50

Table 5.1: Recall Rate and Precision Rate for Shrek 3 Video

Following is the example of cut in Shrek3 movie detected by proposed algorithm.



Frame 351, 352

Figure 5.8: Example of cut in Shrek3 Movie

Following is the example of fade in Shrek3 movie detected by proposed algorithm.



Frame 705, 706

Figure 5.9: Example of Wipe in Shrek3 Movie

Results for :Football Match_AVI_1_35

	AP	DT	MS	ED	RR	PR
CT	10	10	0	3	77	100
DS	9	7	1	1	88	88
FD	NIL	NIL	NIL	NIL	NIL	NIL
WP	NIL	NIL	NIL	NIL	NIL	NIL

Table 5.2: Recall Rate and Precision Rate for Football Match Video

Following is the example of Cut detected in Football Match



Frame 714, 715

Figure 5.10: Example of Cut in football Match

Following is the Example of Dissolve in Football Match



Frame 413

Figure 5.11: Example of Dissolve in Football Match

Results for :CNBC News_AVI_51

	AP	DT	MS	ED	RR	PR
CT	1	1	0	0	100	100
DS	NIL	NIL	NIL	NIL	NIL	NIL
FD	NIL	NIL	NIL	NIL	NIL	NIL
WP	3	3	0	1	75	100

Table 5.3: Recall Rate and Precision Rate for CNBC News Video

Following is the Cut detected in CNBC News by proposed algorithm.



Frame 296, 297

Figure 5.12: Example of Detected Cut in CNBC News

Following is the Errorly detected Wipe in CNBC News by proposed algorithm



Figure 5.13: Example of Errorly detected wipe in CNBC News

Video Name	Shrek 3 Trailer		Football Match		CNBC News		Average	
	RR	PR	RR	PR	RR	PR	RR	PR
CT	90	75	77	100	100	100	92	90
DS	75	75	88	88	NIL	NIL	85	88
FD	100	100	NIL	NIL	NIL	NIL	100	100
WP	100	50	NIL	NIL	75	100	94	88
TOTAL AVERAGE							93	92

Table 5.4: Summary of Experimental Results

Above table shows some of the video which do not have either of the effect like cut, Dissolve Fade or Wipe there NIL is entered. The values of precision Rate and Recall Rate may vary depending on sample video selected for experiments. From above tables we can see that proposed algorithm is better in detecting cuts and wipe effect, it also detect Dissolve effect and Fade effect.

	Our Algorithm	Approch in [1]	Approch in [2]
Recall Rate in %	93	90	88
Precision Rate in %	92	92	75

Table 5.5: Comparison of Recall Rate and Precision Rate

The video sequences are of various shots. Generally speaking, there are two kinds of shots: abrupt shot and gradual shot. The temporal and spatial down sample is performed to 25 fps and 320×240 pixels to improve simulation speed. Table 5.5 shows that our algorithm can detect all the abrupt shots and most gradual shots, and, recall and precision are 93% and 92%, respectively. The performance is better than many current algorithms.

VI. CONCLUSION

In this project, we proposed Block based χ^2 Histogram algorithm for shot boundary detection. Shot boundary detection and key frame extraction system using image segmentation is a novel approach for video summarization. First video is segmented in frame, then employed different weights to compute the matching difference and threshold. By using the automatic threshold, boundaries are detected. We detect various shot boundaries like Cut, Fade and Dissolve with the help of χ^2 histogram matching difference between consecutive frames and automatic threshold. Experimental results show that the proposed algorithm gives satisfactory performance for shot boundary detection. The contributions and characteristics of the proposed approach are summarized below:

- **Efficiency:** Easy to implement and fast to compute. Only the χ^2 Histogram is o be found out in order to extract keyframes.
- **No Redundant Keyframes:** As Redundant Key Frames are removed use Edgedetection algorithm Information per Keyframe has improved and time to summarize video will also increase.
- **Detection of Zoom:** Proposed algorithm is also efficient in detecting Keyframes with Zoom and Object in front of camera effect.
- **Higher Recall & Precision:** Algorithm provides higher Recall Rate and Precision Rate as compared to the algorithm proposed in [1,2].

In order to further improve accuracy, Graph Partition Model with Support Vector Machine can be used. Graph Partition Model will be the further direction.

VII. FUTURE WORK

χ^2 Histogram and Automatic Threshold approach is very efficient for detecting. We can further improve the performance of algorithm by using Graph Partition Model.

Graph Partition Model with Support Vector Machine is new research area in Shot boundary detection. Graph theoretic segmentation algorithms are widely used in the fields of computer vision and pattern recognition. Segmentation with graph partition model is one of the graph theoretic segmentation algorithms, which offers data clustering by using a graph model. Pair-wise similarities between all data objects are used to construct a weighted graph as an *adjacency matrix* (*weight matrix* or *similarity matrix*) that contains all necessary information for clustering. Representing the data set in the form of an edge-weighted graph converts the data clustering problem into a graph partitioning problem.

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Solar Cell

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Abstract- The world's fossil fuel resources are unable to sustain our current energy requirements beyond the next few decades and so the need for inexpensive alternatives is now urgent. Organic devices are well placed to meet the needs of both the electronics and energy industries because their manufacture does not require expensive processing steps and they can be adapted to a range of applications. Consequently there has been significant interest in this field over recent years and there are now many research groups world-wide investigating the semiconducting properties of conjugated materials and their use in LEDs, photovoltaic and transistors. This activity of creating electricity through the use of organic solar cells is an example of one way scientists are trying to alleviate some of the dependence on non-renewable resources. It is the purpose of my research proposal to explore that with a little human ingenuity, other ways to create energy can be attained.

I. INTRODUCTION TO ENERGY

Energy are broadly classifies into two main groups: Renewable and Non-renewable.

1.1 Non-Renewable Energy: Non-Renewable energy is energy which is taken from the sources that are available on the earth in limited quantity and will vanish fifty-sixty years from now. Non-renewable sources are not environmental friendly and can have serious affect on our health. They are called non-renewable because they cannot be re-generated within a short span of time. Non-renewable sources exist in the form of fossil fuels, natural gas, oil and coal.

According to recent predictions [1-2], the inevitable permanent de-cline in the global oil production rate is expected to start within the next 10-20 years. However, the combustion of fossil fuels in the past has *already* harmful effects on the delicate balance of nature on our planet. Today, about 20×10^{12} kg of carbon dioxide are put into the atmosphere every year, mainly by burning fossil fuel [3-5]. Today's plants are unable to absorb this huge amount of extra CO₂. As a result the CO₂ concentration in the atmosphere continues to mount adding considerably to the greenhouse effect which will increase the global mean surface temperature - depending on future emission scenarios and the actual climate sensitivity - by another 0.6-7.0°C by the year 2100 [4].

Global mean surface temperature has increased by 0.3-0.6 °C since the late 19th century and the global sea level has risen by 10-25cm, most likely due to human activities [4]. The consequences of this temperature change have already increased the frequency and severity of natural disasters [5] and are likely to have more devastating effects for humans and other life forms in all parts of Earth within the next decades.

1.2 Renewable Energy: Renewable energy is energy which is generated from natural sources i.e. sun, wind, rain, tides and can be generated again and again as and when required. They are available in plenty and by far most the cleanest sources of energy available on this planet. For eg: Energy that we receive from the sun can be used to generate electricity. Similarly, energy from wind, geothermal, biomass from plants, tides can be used this form of energy to another form. Worldwide, oil prices will then rise considerably favoring the introduction of various *renewable* energy sources such as the direct conversion of solar energy (solar cells), but also others like for example, hydroelectric- and wind-power systems. *Renewable* energy sources neither run out nor have any significant harmful effects on our environment.

II. WHAT IS SOLAR CELL?

Solar cells are devices which convert solar energy directly into electricity, either directly via the photovoltaic effect, or indirectly by first converting the solar energy to heat or chemical energy. Assemblies of cells used to make solar modules which are used to capture energy from sunlight, are known as solar panels. The energy generated from these solar modules, referred to as solar power. Cells are described as photovoltaic cells when the light source is not necessarily sunlight (lamplight, artificial light etc). The amount of power available from a PV device is determined by -the type and area of the material, the intensity of the sunlight, the wavelength of the sunlight.

III. THE NEED OF SOLAR CELLS

- the need for low maintenance, long lasting sources of electricity suitable for places remote from both the main electricity grid and from people; eg satellites, remote site water pumping, outback telecommunications stations and lighthouses;
- the need for cost effective power supplies for people remote from the main electricity grid; eg Aboriginal settlements, outback sheep and cattle stations, and some home sites in grid connected areas.
- the need for non polluting and silent sources of electricity; eg tourist sites, caravans and campers
- the need for a convenient and flexible source of small amounts of power; eg calculators, watches, light meters and cameras;
- the need for renewable and sustainable power, as a means of reducing global warming.

IV. WORKING OF SOLAR CELL

The solar cell works in following steps:

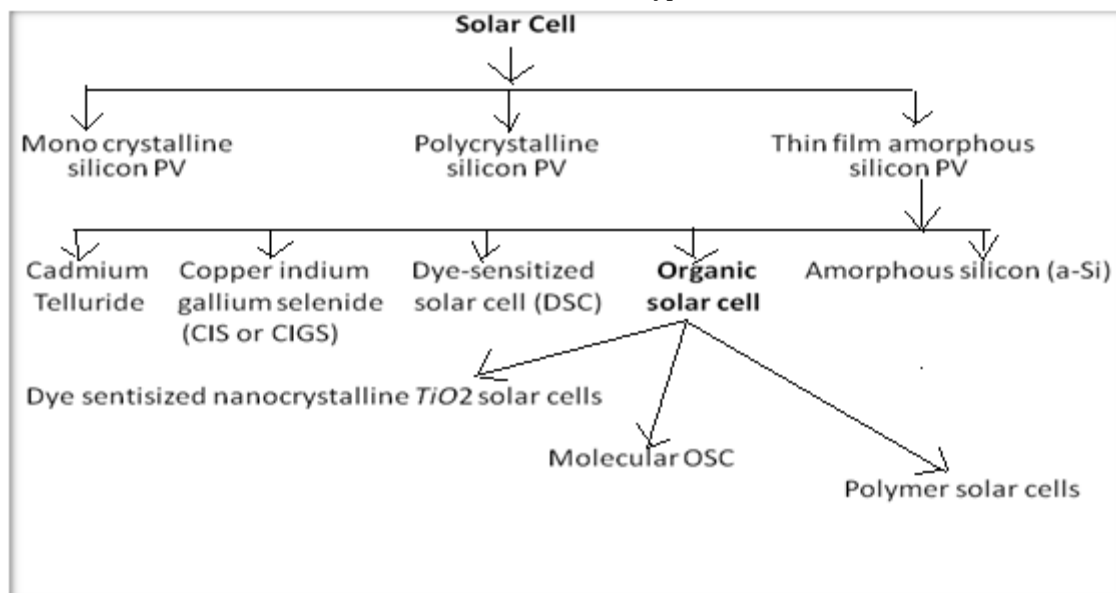
1. Photons in sunlight hit the solar panel and are absorbed by semiconducting materials, such as silicon. Photons with energy equal to the band gap energy are absorbed to create free electrons. Photons with less energy than the band gap energy pass through the material.
2. Formation of electron-hole pair (exciton)
3. Exciton diffusion to Junction
4. Charge separation- Electrons (negatively charged) are knocked loose from their atoms, causing an electric potential difference. Current starts flowing through the

material to cancel the potential and this electricity is captured i.e. Electrons that are created on the n-type side may travel through the wire, power the load, and continue through the wire until they reach the p-type semiconductor-metal contact. Here, they recombine with a hole that was either created as an electron-hole pair on the p-type side of the solar cell. Due to the special composition of solar cells, the electrons are only allowed to move in a single direction.

5. An array of solar cells converts solar energy into a usable amount of direct current (DC) electricity.

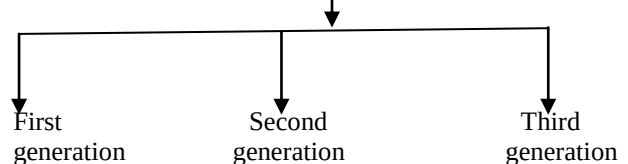
V. TYPES OF SOLAR CELL

Based on the material used different types of solar cell are-



Materials presently used for photovoltaic solar cells include monocrystalline silicon[6], polycrystalline silicon[6], amorphous silicon[6], cadmium telluride[6,7], and copper indium gallium selenide [6,7]. Many currently available solar cells are made from bulk materials that are cut into wafers between 180 to 240 micrometers thick that are then processed like other semiconductors. Other materials are made as thin-films layers, organic dyes, and organic polymers[8] that are deposited on supporting substrates. A third group are made from nanocrystals and used as quantum dots (electron-confined nanoparticles)[9]. Silicon remains the only material that is well-researched in both *bulk* and *thin-film* forms.

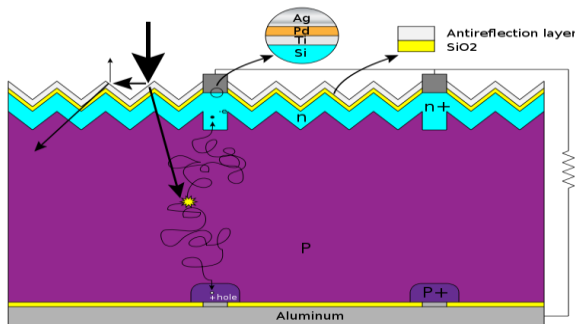
VI. GENERATIONS OF SOLAR CELL



6.1 First generation: This term refers to the classic p-n junction photovoltaic. Typically, this is made from silicon (multicrystalline and single crystalline) doped with other elements to make them preferentially positive (p) or negative (n) with respect to electronic charge carriers as shown in fig(1). However in the past these devices were made from other materials like Germanium as well. First generation photovoltaic cells (also known as silicon wafer-based solar cells) are the dominant technology in the commercial production of solar cells, accounting for more than 86% of the solar cell market. They are dominant due to their high efficiency. This despite their high

manufacturing costs, a problem that second generation cells hope to remedy.

Monocrystalline silicon (c-Si) often made using the Czochralski process. Single-crystal wafer cells tend to be expensive, and because they are cut from cylindrical ingots, do not completely cover a square solar cell module without a substantial waste of refined silicon. Hence most c-Si panels have uncovered gaps at the four corners of the cells. Monocrystalline solar cells can achieve 17% efficiency [10]. **Polycrystalline silicon**, or **multicrystalline silicon**, (poly-Si or mc-Si) made from cast square ingots—large blocks of molten silicon carefully cooled and solidified. Poly-Si cells are less expensive to produce than single crystal silicon cells, but are less efficient. Polycrystalline are only capable of achieving around 10% efficiency.



Fig(1): Silicon_Solar_cell_structure

6.2 Second generation: Thin films of photon-absorbers and layered stacks of thin films. It can combine multiple light absorbing materials in a “stack” of films, with each absorbing a slightly different range of light wavelengths than the one below it. The advantage of using a thin-film of material was reducing the mass of material required for cell design. Typically, the efficiencies of thin-film solar cells are lower compared with silicon (wafer-based) solar cells, but manufacturing costs are also lower. The most successful second generation materials have been cadmium telluride (CdTe), copper indium gallium selenide, amorphous silicon and micromorphous silicon.

A cadmium telluride solar cell uses a cadmium telluride (CdTe) thin film, a semiconductor layer to absorb and convert sunlight into electricity. The cadmium present in the cells would be toxic if released. CdTe technology costs about 30% less than CIGS technology and 40% less than A-Si technology.

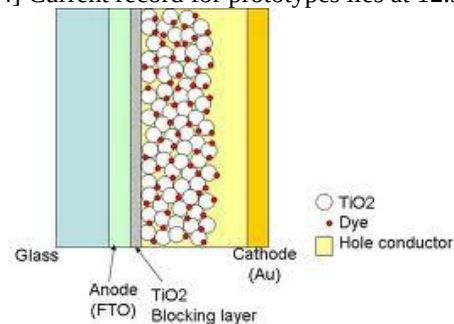
Copper indium gallium selenide (CIGS) is a direct band gap material. It has the highest efficiency (~20%) among thin film materials (see CIGS solar cell).

An amorphous silicon (a-Si) solar cell is made of amorphous or microcrystalline silicon and its basic electronic structure is the p-i-n junction. a-Si is attractive as a solar cell material because it is abundant and non-toxic (unlike its CdTe counterpart) and requires a low processing temperature, enabling production of devices to occur on flexible and low-cost substrates. As the amorphous structure has a higher absorption rate of light than crystalline cells, the complete light spectrum can be absorbed with a very thin layer of photo-electrically active material. However, because it is amorphous, it has high inherent disorder and dangling bonds, making it a bad conductor for charge carriers. Amorphous silicon has a higher bandgap

(1.7 eV) than crystalline silicon (c-Si) (1.1 eV), which means it absorbs the visible part of the solar spectrum more strongly than the infrared portion of the spectrum.

6.3 Third generation: Third generation technologies aim to enhance poor electrical performance of second generation (thin-film technologies) while maintaining very low production costs. Generally, third generation cells include solar cells that do not need the p-n junction necessary in traditional semiconductor, silicon-based cells. Third generation contains a wide range of potential solar innovations including polymer solar cells, nanocrystalline cells, and dye-sensitized solar cells.

A dye-sensitized solar cell (DSSC, DSC or DYSC [11]) is a low-cost solar cell belonging to the group of thin film solar cells[12]. It is based on a semiconductor formed between a photo-sensitized anode and an electrolyte, a **photoelectrochemical** system. A modern DSSC shown in fig(2) is composed of a porous layer of titanium dioxide nanoparticles, covered with a molecular dye that absorbs sunlight. The titanium dioxide is immersed under an electrolyte solution, above which is a platinum-based catalyst. As in a conventional alkaline battery, an anode (the titanium dioxide) and a cathode (the platinum) are placed on either side of a liquid conductor (the electrolyte). Sunlight passes through the transparent electrode into the dye layer where it can excite electrons that then flow into the titanium dioxide. The electrons flow toward the transparent electrode where they are collected for powering a load. After flowing through the external circuit, they are re-introduced into the cell on a metal electrode on the back, flowing into the electrolyte. The electrolyte then transports the electrons back to the dye molecules. In the DSSC, the bulk of the semiconductor is used solely for charge transport, the photoelectrons are provided from a separate photosensitive dye. Charge separation occurs at the surfaces between the dye, semiconductor and electrolyte. The dye molecules are quite small (nanometer sized), so in order to capture a reasonable amount of the incoming light the layer of dye molecules needs to be made fairly thick, much thicker than the molecules themselves. To address this problem, a nanomaterial is used as a scaffold to hold large numbers of the dye molecules in a 3-D matrix, increasing the number of molecules for any given surface area of cell. Overall peak power conversion efficiency for current DSSCs is about 11%[13][14] Current record for prototypes lies at 12.3%[15].



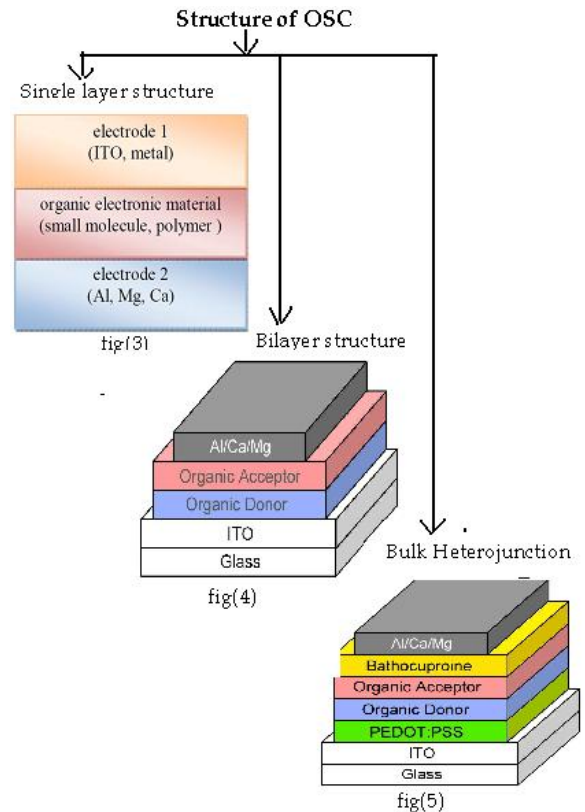
Fig(2): dye-sensitized solar cell

Quantum dot solar cells (QDSCs) are based off of the Gratzel cell, or dye-sensitized solar cell, architecture but employ low band gap semiconductor nanoparticles, also called quantum dots (such as CdS, CdSe, Sb₂S₃, PbS, etc.), instead of organic or organometallic dyes as light absorbers.

(nc-Si) has about the same bandgap as c-Si, the nc-Si and a-Si can advantageously be combined in thin layers, creating a layered cell called a tandem cell. The top cell in a-Si absorbs the visible light and leaves the infrared part of the spectrum for the bottom cell in nc-Si.

Organic solar cells and polymer solar cells are built from thin films (typically 100 nm) of organic semiconductors including polymers, such as polyphenylene vinylene and small-molecule compounds like copper phthalocyanine (a blue or green organic pigment) and carbon fullerenes and fullerene derivatives such as PCBM. Energy conversion efficiencies achieved to date using conductive polymers are low compared to inorganic materials. However, it has improved quickly in the last few years and the highest NREL (National Renewable Energy Laboratory) certified efficiency has reached 8.3% for the Konarka Power Plastic[16]. In addition, these cells could be beneficial for some applications where mechanical flexibility and disposability are important.

These devices differ from inorganic semiconductor solar cells in that they do not rely on the large built-in electric field of a PN junction to separate the electrons and holes created when photons are absorbed. The active region of an organic device consists of two materials, one which acts as an electron donor and the other as an acceptor. When a photon is converted into an electron hole pair, typically in the donor material, the charges tend to remain bound in the form of an exciton, and are separated when the exciton diffuses to the donor-acceptor interface. excitons are broken up into free electrons-hole pairs by effective fields. The effective field are set up by creating a heterojunction between two dissimilar materials. Effective fields break up excitons by causing the electron to fall from the conduction band of the absorber to the conduction band of the acceptor molecule. It is necessary that the acceptor material has a conduction band edge that is lower than that of the absorber material[17][18][19][20]. The short exciton diffusion lengths of most polymer systems tend to limit the efficiency of such devices. Nanostructured interfaces, sometimes in the form of bulk heterojunctions, can improve performance[21].



As shown in fig (3) single layer structure of OSC[20] consists of - Organic material is sandwiched between two electrodes, One electrode is transparent, Organic material absorbs/emits light (OPV/OLED). As shown in fig (4) bilayer OSC structure[22] consists of - Two different organic materials, Exciton dissociation at the interface, Power conversion efficiency > 1% is possible.

Structure of bulk heterojunction OSC[22] shown in fig (5) consists of -

Bathocuproine:

- Exciton blocking layer
- Hole blocking layer
- Prevents metal diffusion into acceptor

PEDOT:PSS:

- Smoothes rough ITO surface
- Exciton blocking layer

OSC Advantages

- Low temperature, low energy processing
- Low material requirement
- Relatively cheap in production and purification.
- Can be used on flexible substrate.
- Materials can be tailored for the demand
- Can be shaped or tinted to suit architectural applications.
- Low manufacturing cost
- Utilization of eco friendly materials
- Scalable manufacturing processes for large area Organic solar cells (OSC) are flexible, semi-transparent and relatively inexpensive to produce.

OSC Disadvantages

- Low efficiency
- Unproven technology
- Limited lifetime/ stability issue

VII. CONCLUSION

In the past year the price of fossil fuels has increased more than anytime in recent memory. Because of this fact, the race for alternate energy sources to replace or lessen the use of fossil fuels has risen. This activity of creating electricity through the use of organic solar cells is an example of one way scientists are trying to alleviate some of the dependence on non-renewable resources. It is the purpose of my research proposal to explore that with a little human ingenuity, other ways to create energy can be attained. It is therefore plan to develop a simulator for Organic Solar Cell which can reproduce the behaviour of a real device as close as possible

At present, solar cells comprising an inorganic semiconductor such as mono- and multi-crystalline silicon have found markets for small scale devices such as solar panels on roofs, pocket calculators and water pumps. These conventional solar cells can harvest up to as much as 24% [23] of the incoming solar energy which is already close to the theoretically predicted upper limit of 30% [24]. This illustrates that technologies which allow low fabrication costs - rather than somewhat higher conversion efficiencies - are now desired. One approach here would be to reduce the amount of silicon by using thinner films on (cheap) glass substrates. Today, the production of these solar cells still requires many energy intensive processes at high temperatures (400-1400°C) and high vacuum conditions with numerous lithographic steps leading to relatively high manufacturing costs [25].

Considerably less effort and production energy is necessary if organic semiconductors are used because of simpler

processing at much lower temperatures (20-200 °C) than the above mentioned inorganic cells. For example, electro-chemical solar cells using titanium dioxide in conjunction with an organic dye and a liquid electrolyte [26] already exceeded 6% power conversion efficiencies [23] and are about to enter the commercial market thanks to their relatively low production costs. Possible applications may range from small disposable solar cells to power smart plastic (credit, debit, phone or other) cards which can display for example, the remaining amount, to photo-detectors in large area scanners or medical imaging and solar power applications on uneven surfaces.

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Extending Google Android's Application as a Social Matchmaking Tool

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Abstract- This paper introduces how to extend Google's Android Platform as a social matchmaking tool by using the latest embedded software features, sensors and integration with social (Application Programming Interface) API's such as Facebook and Twitter. It starts with the importance of social networks in the context of matchmaking and then proposes a sample framework by using Android's (Software Development Kit) SDK and framework to build apps that intelligently match personalities and suggest potential matches.

Index Terms- Android, Android platform, Social Networks, Matchmaking, Android SDK

I. INTRODUCTION

The importance of social networks and their integration with mobile phones in our lives is becoming more and more recognized. The advent of Google's Android Platform and Social Platforms such as Facebook and Twitter opening up their APIs for mobile platforms provides new exciting avenues for building intelligent socially aware apps for mobile platforms and devices. This research was inspired by teaching college students to experiment with the new Facebook APIs and harness the social functionality into their applications.

Admittedly there is some stigma associated with meeting people online – especially through dating sites. One may seek relationships online because the variety of people around may be limited and one may not find an attractive person to date. Since the beginning of fourth century^[1] India has a rich tradition of arranged marriages that have been practiced mainly to establish a sacred bond between two families. Online dating websites such as shaadi.com have had enormous success by reaching 20 million users. This shows that in countries like India matchmaking services have immense potential. However one cannot simply marry someone by looking at their photograph or background. It is necessary to assess various traits and common things between the two people to make them click.

This is where Android and Social Services like Facebook come in. Facebook has over 800 million users^[2]. The social media giant has 425 million mobile users. Facebook stores a variety of user data right from what their birthday is to what they like to eat, where they studied and so on.

This information can be useful in matching individuals. Smartphones such as Android are location aware, which allows your places of interest to be shared and matched with similar individuals. We look into these various aspects in our paper.

II. THE IMPORTANCE OF SOCIAL NETWORKS IN MATCHMAKING

A social networking service is an online service, platform, or site that focuses on facilitating the building of social networks or social relations among people who share interests, activities, backgrounds, or real-life connections. A social network service consists of a representation of each user (often a profile), his/her social links, and a variety of additional services. Most social network services are web-based and provide means for users to interact over the Internet, such as e-mail and instant messaging. Social Networks store user data and may make them available to other users. Social networks may store a variety of information such as:

- 1) Name
- 2) Birth day, Date, Year
- 3) Current Location, Hometown
- 4) Past visits to geographical locations and the duration of the stay
- 5) Interests – music, movies etc
- 6) Sexual Orientation
- 7) Photographs

We can harness this information for matching details of individuals based on specific criteria

III. THE IMPORTANCE OF SMARTPHONES IN MATCHMAKING

Smartphones are used everywhere in the world and are capable of various data aggregation and connectivity functions. Smartphones can be programmed to run specific software or in simple terms “apps”. Google Android is one such open source platform that allows development in a Java based environment. It also allows you to harness the power of all the native phone functions and also allows any third party API's to integrate with one's product. Smartphones are capable of but not limited to:

- 1) Storing Location data – Where one has been, How much time one spends, What one does there, etc
- 2) Face recognition, detection and tracking
- 3) Recording data such as which songs one plays, what kind of apps one downloads or buys, what kind of games one plays etc
- 4) Communicating over 3G and EDGE providing real time location data and instant messaging

IV. THE BASIC FRAMEWORK

We propose a sample framework where you can harness the power of social API's and smartphone functionality. Let us propose a basic app which has

- 1) Connectivity to Facebook via GPRS
- 2) Facebook API integrated into the application
- 3) Location Aware integration

The application will first log you into to Facebook with your credentials validated. Once logged in the app will connect to Facebook via their Android API for Facebook. The app will retrieve the details of your friends with the Facebook graph API. The details of each friend will be matched with the aggregated data from your Facebook profile. Whatever details are common to both parties will be listed and a percentage of common interests will be calculated. The application will then find out the users locations and inform the user if the users live close by or are in your area, in case you want to meet them. It will periodically use the location data from one's phone to find out details based on user location. For example if you eat three times a week at a Chinese restaurant, the app will record that data and assume you like Chinese food. It will then match all the friends in your Facebook list and find out which friends go to the same restaurant or have a predilection for Chinese food. The app may also contain a feature that allows you to short list any potential matches you like. If two people list each other, the cloud based system will automatically recognize and send them a message indicating they are interested in each other.

V. IMPROVEMENTS AND FUTURE WORK

The app will be able to match pictures taken of someone not in their friends list and match them up with their Facebook profiles with face recognition technologies. It will automatically inform the user of mutual friends and suggest methods of contacting them. It may also analyze any patterns such as how often one listens to a particular type of music and if any of their friends are listening to that particular song at that time. The app will also analyze patterns of behavior such as high frequency texting, social content sharing frequency and will upload that data on cloud hosting for further analysis.

VI. CONCLUSION

We can see from this paper that there is immense potential in harnessing the power of social networks and mobile technologies for matchmaking.

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Review on Process, Application and Performance of Rotating Biological Contactor (RBC)

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Abstract- The rotating biological contactor is an attached growth biological treatment used in removal of biodegradable matter present in wastewater is popular due to its simplicity low energy requirement, low land requirement, stable in various shock loading and recirculation not required and low hydraulic retention time. This review paper focuses on various controlling parameter of RBC like organic loading, hydraulic retention time, speed of rotation, dissolve oxygen, staging, temperature, submergence etc. The paper also highlights on the performance studies of RBC for different types of wastewater.

Index Terms- Rotating biological contactor, organic loading, speed of rotation, dissolves oxygen, staging and submergence.

I. INTRODUCTION

A rotating biological contactor is an aerobic and anaerobic fixed film biological treatment. This treatment is widely used as secondary treatment of industrial and domestic wastewater. In this system the disc portion is partly submerged in wastewater and partly exposed in atmosphere. The rotation of the system leads to continuous growth of microorganisms and the formation of biological slime layer on the surface of the discs known as biofilm is developed on the rotating disc. The constant rotation of the disc causes mixing of the liquid. During submergence organic matter is removed while during emersion aeration of the culture is accomplished. Oxygen is transferred to the thin film of liquid that remains attached to the discs when they rise above the liquid surface increasing its dissolved oxygen content. The Rotating Biological Contactor (RBC) was introduced, on the basis that the Dissolved Oxygen (DO) in the reactor did not have significance on treatment efficiency because adequate amount of oxygen could be supplied during the air exposure cycle required for metabolism of microorganism. (Kubsad et al, 2004).

In rotating disc shaft assembly is mounted into a tank with the shaft slightly above the surface of the liquid. Approximately 34-60 % of the disc surface is submerged in the waste and the remaining disc surface is exposed to the atmosphere. (Ahmady, 2005). The rotation of the discs also mixes the liquid keeping the detached biomass in suspension and maintaining a uniform dissolved oxygen concentration. Although the exact composition of the microbial population on a disc depends upon the type of wastewater being treated and the relative position of the disc in the reactor. A continuous sloughing off from the discs when the innermost microorganisms lose their ability to adhere to the rotating surface and sloughed biofilm have good settling characteristics. Sloughed biofilm and suspended solids are washed out of the contactor as the wastewater flows through the

unit. They are later removed from the effluent during secondary clarification. (Kinner et al ,1983)

Rotating biological contactor requires low power because the only power required for rotation is needed in overcoming the drag friction of discs in the liquid. RBC has a better shock load, because of the short residence time and the shock does not kill the whole biomass and recovery is fairly rapid. RBC have more process stability with load variations since the microorganisms in a fixed film system are attached to a media, they cannot wash out with increasing flow rate. Also fixed film systems generally have a greater mass of microorganisms, making them better able to handle increasing organic load. Recycling of solids is not required as the microorganisms are not washed off. (Borghi et al, 1985). RBC requires low energy, short hydraulic retention time and low operating cost. It has excellent process control and is capable of handling a wide range of flows and organic concentration. (Pathan et al, 2011)

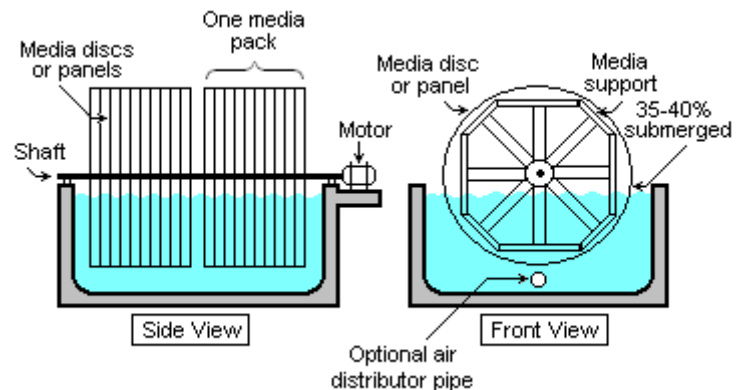


Fig 1: graphical representation rotating biological contactor
(http://en.wikipedia.org/wiki/Rotating_biological_contactor)

The RBC is used because of its advantages such as high specific surface area, high activated sludge concentration, better sludge settling, process stability, and low maintenance and power consumption.(Ghawi et al,2009). RBC is widely used for its simplicity of construction and operation, low energy consumption in comparison with other aerobic treatment processes, reliability in terms of stability to sudden hydraulic surges. The sludge from RBC has good settling ability. (Hansford et al,1978)

II. RBC CONTROLLING PARAMETERS

The major factors controlling rotating biological contactor systems design and their performance are organic loading, hydraulic loading, Biomass, rotational speed wastewater temperature, staging and others. The performance and the

operational problems of each stage of an RBC system needs to evaluate and the design criteria should be effectively judged. The rotating biological contactor performance and design parameters are given in table 1.

A. Organic Loading and Hydraulic Loading Rate

Organic loading rate is very important and major element in designing RBC. The efficiency of RBC depends mainly on organic loading rate rather than on the organic concentration or flow rate. Substrate utilization rate (organic removal rate) increases with increasing the Organic Loading Rate (OLR) to such limit which after it, increasing the load has no or very limited impact on the removal rate. There is a strong correlation between the organic loading at influent and the concentration of the Total Suspended Solids (TSS) present in the rotating biological contactor. (Ahmady, 2005). Effect of organic loading rate was studied and was evaluated, firstly organic loading was kept constant of Chemical Oxygen Demand (COD) 6.2 g/l and Hydraulic Retention Time (HRT) was reduced from 48 to 24 hours, which showed that removal efficiency decreased as HRT reduced. Secondly they varied from 18.44 to 36.89 g/m²day the COD removal efficiency decreased from 97.4 to 85.4 %. Reduction of COD removal capacity was due to limitation in oxygen mass transfer and disc surface area for attached microorganism. (Najafpour et al, 2006). The attached-growth process like in RBC seems to be more stable than the suspended-growth process like Activated sludge, when the wastewater has considerable fluctuations in flow rate and organic loading. (Najafpour et al, 2005). Increasing hydraulic loading decreases organic concentration removal efficiency in wastewater. Hydraulic loading rate, flow rate and organic loading altogether act in the substrate removal rate and efficiency. (Ghawi et al, 2009)

B. Biomass

Biomass present on disc media plays important role in removing the organic and inorganic substrate present in wastewater, which they used it for their metabolism and treating wastewater. Microorganisms present in the wastewater adhere to the disc surfaces within 1 to 4 weeks and form a slime layer biofilm ranging from 1 to 4 mm in thickness. The biofilm after reaching a critical thickness, microorganisms in deep are unable to receive nutrient and oxygen, they are no longer able to stick to disc and slough off. (Yargholi et al, 2011). Large surface area allows a large, continuous and stable biomass population to develop on disc. (Schultz, 2005). The thickness of biofilm is not uniform since sloughing process occurs randomly. Sloughed biofilm and suspended solids are washed out of the contactor as the wastewater which is later removed in settling tank or at secondary clarification. (Kinner et al, 1983). The Biomass contains different types of microorganisms, initially brown colour organism is considered as healthy biomass whereas white and grey biofilm are regarded as unhealthy ones. (Pathan et al, 2011). This newly developed RBC treatment can retain large amount of biomass, therefore it has the capacity to treat high strength of organic loading and hydraulic shocks. (Najafpour et al, 2006). When OLR of COD 11g/m²day was loaded to RBC the biofilm thickness was measured in first and second stage which was found to be 2.4 and 1.7 respectively. Also there was average

thickness increased from 2.8 to 3.5mm when OLR was increased from COD 23 to 47 g/m²day (Twafik et al, 2006)

C. Speed

The speed of rotation helps in transfer of oxygen and nutrient required for growth of microorganism present in the biofilm. The film thickness and the dissolved oxygen can be controlled by adjusting the rotational speed of the discs. (Borghi et al, 1985). For any specific loading, increases the disc rotational speed improved the removal efficiency but eventually, the removal efficiency remained constant even though rotational speed was increased. (Brazil, 2005). The Soluble Chemical Oxygen Demand (SCOD) removal was increased from 62.7 to 93.7% when rotation speed was increased from 3 to 11 rpm due to increase in dissolve oxygen (Najafpour et al, 2006). In study of colour removal revealed that efficiency increased with increasing rotational speed. At low rotational speeds of 10 and 20 rpm, colour removal efficiencies were around 33% and 35%, respectively. TOC removal efficiencies for 10 rpm and 20 rpm were 65% and 72% respectively. These results indicated that aeration was not sufficient for decolourization and TOC removal, at low rotational speeds such as 10 rpm and 20 rpm. At higher rotational speeds of 30 and 40 rpm, decolourization and TOC removal efficiencies were approximately 75% and 80%, respectively. (Kapdan et al, 2001). A change in the disc rotational speed does not always result in a major change in its treating capacity but, affects the power requirement. Thus to obtain high power economy the RBC should be operated at minimum rotating speed. (Fujie et al, 1982)

D. Dissolved Oxygen (DO)

In partly submerged RBC the biomass on disc receives oxygen air-liquid interface during rotation of disc. The oxygen transfer rate is known to limit the performance of RBC's in aerobic wastewater treatment. An increase in the rotational speed from 18 to 42 rpm resulted in an increase in the dissolved oxygen concentration in the bulk liquid such that oxygen saturation increased from 37 to 99%. The rate of decolouration tended to be higher at higher rotational speeds when the dissolved oxygen concentration was at saturation. (Ramsay et al, 2006). In initial stage dissolved oxygen level generally reduces and slowly recovered in successive stages. There is direct correlation between DO and organic loading, higher the loading there is sharp decrease in DO. (Ahmady, 2005). During treatment of food canning wastewater the BOD reduction was observed to be 96.4% at the end of 5th days. Initial DO level was 8.0 mg/l, then on 5th days the DO dropped to 4.3mg/l and remained constant for 5 days. If dissolved oxygen in reactor is not sufficient which affects treatment efficiency, after few days bad odour and detachment of biomass is observed (Najafpour et al, 2006). At high disc rotation speed, oxygen absorption by the liquid film was more and at low speed this insufficient aeration occurred. Aeration through the liquid film is the main mechanism for biochemical oxygen transfer at rotational speeds investigated to be 3–25 rpm. (Kubsad et al, 2004)

Table 1: Showing details of various experimental data and their performance

Type of reactor	Type of Disc material	Media dimension	Disc Submergence	RPM	Type of Wastewater	HRT	Inlet organic loading /substrate concentration	Mode of Working	Other data/ staging	Performance	Reference
Lab scale	Polymethyl acrylate with polyester colth mounted	diameter 18 cm	30 ,35 and 45 %	50 ,75 and 100	Phenolic Wastewater	36,28 and 24 hours for respective RPM	Phenol 40 to 220 mg/L	Batch	Single	Phenol removal efficiency was 99% for phenol loading of up to 40 to 180 mg/L . At higher rotational speed, the dissolved oxygen concentration in the fluid was increased from 4 to 6.9 mg/L also the increasing rotational speed decreased HRT.As submergence increased it HRT reduces	(Pradeep et al, 2011)
Lab scale	textured plastic sheet	-	40%	1.7	Grey water	1/2 ,1 and 1 1/2 hour.	COD 146 mg/L	Batch	Single	Percentage removal of BOD ₅ and COD being 53 and 60% respectively at 1 1/2 hour HRT. Removal efficiency increases with increasing HRT.	(Pathan,2011)
Lab scale	polystyrene wedge attached to disc	diameter 35 cm	40%	10	Heavy Metal prepared in Laboratory	84 days	Heavy metal concentration of 5 to 83 mg/L	Batch	Single	The high metal sorption capacities recorded, particularly for copper, indicate that the biofilm of a RBC could be used as a tool to remove and recover metals from wastewaters.	(Costley et al,2001)
Pilot Plant	-	-	40%	-	Domestic Grey water	12 Hours	Three BOD Concentration of 72 mg/L,119 mg/L and 182 mg/L	Continuous	Single	The treatment efficiency of the RBC system based on BOD removal is ranged between about 93.0 to 96.0 %, and based on TSS removal is ranged between about 84.0 to 95.0 % for all concentrations of influent grey water	(Kader et al,2011)
Pilot Plant	polyurethane	diameter 23 cm	40%	6	Winery effluent	1Hour	COD 3828 mg/L	Continuous	Two	On average, the RBC reduced the influent COD of the winery effluent by 23% (from 3 828 mg/l to 2 910 mg/l) and increased the pH by 0.95 units (from 5.77 to 6.13) at an average retention time of 1h.	(Coetzee et al,2004)

Type of reactor	Type of Disc material	Media dimension	Disc Submergence	RPM	Type of Wastewater	HRT	Inlet organic loading /substrate concentration	Mode of Working	Other data/ staging	Performance	Reference
Lab scale	Plexiglas	diameter 7 cm	35%	8	Municipal wastewater	22.5 hour	COD 32 to 182 mg/L	Continuous	Single	The removal efficiency achieved in terms of COD, BOD Total suspended solids and total nitrogen was 82%,86%,63% and 54% and efficiency increased when it is followed by settling which was for COD and TSS up to 94% and 97%.respectively	(Hiras et al,2003)
Lab scale	Polyurethane foam pasted on plastic disc	diameter 18 cm	40%	4	Sugar refinery	3 days	-	Continuous	Single	The result showed that RBC can treat sugar refinery effluent .It not only treat and remove colour by 55%,but also reduce total phenol and COD by 63% and 48 % respectively	(Guimaraes et al,2005)
Lab scale	plastic Disc	diameter 35 cm		10	Palm Oil mill effluent	5 day	COD 16000 mg/L	Batch	Single	The untreated POME was fed with the volumetric flow rates of 1.1, 2.3, 3.6, 4.8 and 6 l/h. About 88% COD was removed with the lowest flow rate of 1.1 l/h of POME. When the flow rate was increased to 3.6 l/h the reduction of COD decreased to 57%.	(Najafpour et al ,2005)
Lab scale	polyurethane foam attached to disc	diameter 25 cm	42.50%	10	Petroleum refinery	7.6, 3.8, 2.53 and 1.89 h, respectively, in each successive stage.	2.3 -5.3,4.7-10.7,9.5-18.8 and 12.7-25.1 g/m ² .d for respective hydraulic loading 0.01, 0.02, 0.03 and 0.04 m ³ /m ² .d	Batch	Four	COD removal rate was 87.5% , 84.9% , 81.5% and 80.2% for respective loading of inlet COD 2.3 -5.3,4.7-10.7,9.5-18.8 and 12.7-25.1 g/m ² .d	(Tyagi et al ,1992)
Lab scale	Acrylic	diameter 32 cm	33	4	Dairy Wastewater	16 ,24 & 36 hour	COD (45 -72 g/L)	Continuous	Three	COD removal rate was 80% , 83% and 92% was achieved at 16 ,24 and 36 HRT	(Ebrahimi et al ,2008)
Lab scale	Lightweight clear plastic sheet	diameter 35 cm	36,31.4 and 23.7%	3 to 11	Food canning	24 ,32,40 and 48 hour	55.33,66.39,89.99 and 110.66 g/m ²	Batch	Three	COD removal was increased 85.3 to 97.4% when HRT was increased from 24 to 48 hour. Also the COD removal at first stage was 88% of organic compound which indicates that single stage RBC may be sufficient in practical application.	(Najafpour et al ,2006)

E. Staging

Various studies on staging of RBC till now have revealed that it has improved the treatment efficiency. During experimentation of smaller multiple stages RBC in series achieve greater constituent reduction than a single stage of the same total media and hydraulic volume. This series configuration facilitates microorganism population to segregate as they acclimate to the different conditions within the treatment basin. This results in better carbon reduction and nitrification (Brazil, 2005). When microorganisms are grown in stages then different types will flourish in varying degree to remove various substrate concentration from stage to stage. (Borghi et al, 1985). Difference of biomass thickness and colour indicated that there is high removal efficiency was achieved in first stage. The biofilm in first stage was thick and creamy colour and in second and third compartment were brownish and thin which only support 15% of removal efficiency. (Najafpour et al, 2006). Decrease in the amount of attached biomass on the successive stages was found in the control RBC during studies. (Janczukowicz et al, 1992)

F. Temperature

The temperature is the main factor which directly affects and controls the rate of biological process. (Borghi et al, 1985). Temperature is another important factor affecting the limiting viscosity of RBC sludge and limiting viscosity decreased by increasing the temperature. (Jdayil et al, 2009). During experimentation the author observed that in the range of 15–36 °C, the bioreactor was more active in comparison with the responses at lower temperature than 15 °C and higher than 36 °C. (Alemzadeh et al, 2002)

G. Disc Submergence

Disc submergence along with other factor affects the biological process. Generally, partially submerged RBC's are used for nitrification and fully submerged for denitrification. (Teixeira et al, 2001). The experiment was carried out with three submergence level from 23.7, 31.4 and 36%. As disc submergence was increased from 31.4 to 36 % the removal efficiency of Total Chemical Oxygen Demand (TCOD) and Soluble Chemical Oxygen Demand (SCOD) improved and result obtained were 74.9 to 87.5 % and 89.5% to and 93.75% respectively. (Najafpour et al, 2006). For aerobic RBC Submergence more than 50% is not practically possible as the bearings holding the shaft will be immersed in wastewater and can get deteriorated affecting the working of shaft. (Pradeep et al, 2010). Various performance of disc submergence are shown in table 1.

III. CONCLUSION

Rotating biological contactor is very effectively used for treatment of wastewater of very high organic loading. Mostly now a days the RBC is used for aerobic treatment process for removal of organic concentration, also anaerobic RBC are used for Denitrification process. As various controlling parameters like organic loading, hydraulic retention time, speed of rotation, dissolve oxygen, staging, temperature, submergence etc pose limitation on performance of reactor. Nevertheless improvement and studies should also be done on biofilm characteristic, cost of

actual treatment unit on site and its structure during operation, various operational problems, supporting disc media etc. Several modification in structure of RBC are still needed concern regarding changing rotational speed to acquire desired dissolve oxygen for maximum removal efficiency of varying organic loading, disc submergence, step feeding during multiple staging to improve RBC's performance.

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Judicial Ombudsmen, Politics and Legitimacy of Judgments

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Abstract- The Indian Judiciary has seen a state of catastrophe primarily because of the presence of inefficient and dishonest judges. This research not only tries to catch on the issues that have been related to a judge's performance and standards, departure from standards and corrective measures that can be taken *et cetera*, but also an in-depth study of impeachment cases of Justice Soumitra Sen, Justice P.D. Dinakaran and Justice Ramaswami. Also, Articles 124(2), 124(4) and 217(1) of the Indian Constitution which relate to the Appointment and Impeachment processes have been discussed. Studies done in Latin America and Singapore have been covered which talk about the introduction of digital technology which, apparently, would help in reducing both, delay and corruption. It would also help in keeping a better and comprehensive record, making it difficult for judges to lose case files and extract bribes. The three schools of thought about judicial reform, view problems of the legal system as one of funding, one of indiscriminate access and one of incentive. Yet another group is of the belief that the problem lies in the judiciary following ineffective and rigid. Methods that are being followed in nations like Argentina, Ecuador, Paraguay and Uganda have been compared with the Indian methods while dealing with the judges and the judiciary. The significance of fast track courts and speedy trials have been taken into account for making better judicial proficiency and fund allocation by the government. The gist of the article lies in deliberating about The Judicial Accountability Bill, 2010 and its role in preventing the miscarriage of justice by handling complaints against corrupt judges. It suggests, employing "Crash Programs" as a corrective measure to reduce backlogs, through substantial infusion of resources in the Indian Judicial System. The individual calendar system wherein judges are bound to follow the cases allocated to them from the beginning to the end and case management technique which has been recently introduced recently by the Hon'ble Supreme Court of India includes reforms ranging from pre-trial conferences, strict scheduling to shortened discovery time cut-offs. The paper also throws light on accurate statistics and time limits being other corrective measures, as they appear to work because they sustain a legal culture antagonistic to delay in the judicial arrangement.

Index Terms- Accountability, Backlog, Corruption, Efficiency, Impeachment, Incentive, Judge, Judiciary, Workload

I. INTRODUCTION

"Morality cannot be legislated but behavior can be regulated. Judicial decrees may not change the heart, but they can restrain the heartless," said Martin Luther King, Jr.

quotes. Judiciary serves to be the *sin qua non* of the democracy, holding colossal power in its hands. It has been discharging its function with least amount of disputes in comparison to the other estates of democracy. But nevertheless it is perceived to be in crisis around the world.

This crisis finds its origin from various reasons like government's small-scale expenditure for its reform, inefficiency of judges, dishonesty amongst the players of democracy and many others. "Something is rotten in Allahabad High Court," said Hon'ble Mr. Justice MarkandeyKatju, hinting towards the present condition in the mentioned high court.¹ Another instance was when the Chief Justice of Gujarat High Court openly conceded to the fact that "In our judiciary, anybody can be bought".² These remarks by such authorities indicate the dire straits of our judiciary and shake the foundation of the relationship between a common man and the judiciary.

Its efficiency relies on the interpretation and application of law and if this pillar works effectively, it brings a direct proportional impact on the economic development of the nation. This is achieved by keeping a check on the government's abuses and facilitating fruitful exchanges amongst individuals.³

Respect for law has been observed as one of the constitutive ingredients for mankind's equitable and effective instrumentality. The concept of accountability is more voluminous than the principles of responsibility and liability. There exists a notion that the lawful application of power imports accountability for its exercise. This, in turn, creates a regulatory and behavioral cage. There should be particular attention paid to the benchmarks concerning good administration, transparent conduct and monitoring; the principle of good faith; the principle of constitutionality and institutional balance, including acting within the scope of functions; the principle of supervision and control.⁴

It is the courts and not the legislature that imbibes in the citizens, the keen, and cutting edge created by law. The procedural and substantive aspects in law are essentially made and administered by persons, whose views and interpretations are buffeted by the winds of change throughout the years, so that it has become a "truism that the quality of justice depends more on the quality of the persons who administer the law than on the content of the law they administer."

¹ <http://www.thehindu.com/news/national/article915161.ece>

² http://articles.timesofindia.indiatimes.com/2010-03-06/india/28137253_1_court-judges-judicial-officers-judiciary

³ See 18 The World Bank Research Observer, No. 1, 61 (Spring, 2003).

⁴ See International Law Association Berlin Conference, Final Report, ACCOUNTABILITY OF INTERNATIONAL ORGANISATIONS (2004).

The practice of iniquitous behavior of judges in today's judiciary manifests the crisis of this part of the legal system. It owes reason to the dishonesty and inefficiency of the judges in both civil and criminal cases. There is evidence that such inefficiency affects most, the poor strata of the society.⁵ Inefficiency shown in deciding a case leads to various shortcomings like backlogs and increase in cost of civil and criminal cases. Such shortcomings affect most the general public of our adversarial system.

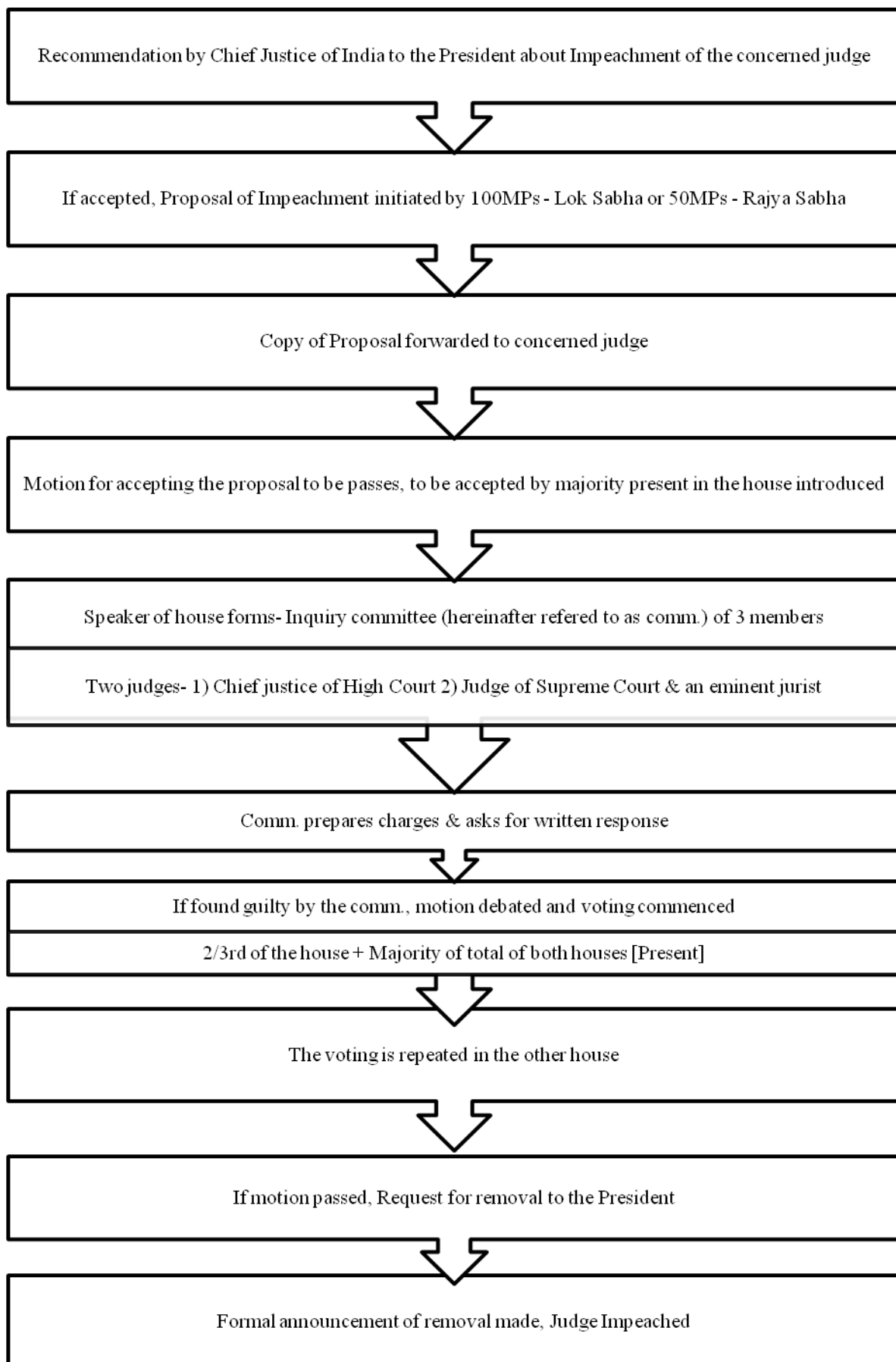
One hypothesis regarding reforms in the judiciary, describes the link between good judiciaries and economic development⁶. It is of the opinion that when courts operate in an efficient manner then the potential misuse of the rule of law by the government is investigated, which in a way aids the economic development of the country. It also carries that- contracts between individuals, when facilitated for productive achievement of it by the courts, enriches the economic development.

Evidence to such scandalous and dishonest conduct can be seen, not only in developing countries like India but also in developed countries like in United States of America, where more than 11 federal judges have been impeached.⁷ In India, the process to evict corrupt judges is interminable enough to make it work effectively. Although the view is not that a concise process may always lead to efficiency but lengthy processes bring down, to a great extent, its orderliness as the possibility of it getting plagued by politics or resignations increases and later on creates escape opportunities which is the reason why, till date, no judge has been impeached in the country. It was only once that the Parliament came close to impeaching a Judge in the case of former Chief Justice V Ramaswami of Punjab and Haryana High Court for corruption in 1991. The process can be comprehended by the following flowchart.

⁵See African Governance Report, p. 206 (2009); The AGR reveals that most judicial officers are poorly remunerated and the overall consequences of these deficiencies restrict the access to justice for many poor and marginalized people as shown in the expert survey carried out in Lesotho, Cameroon, South Africa, and Ethiopia who said that the first instance or lower courts are rarely or never accessed by citizens within three days and delays impede the maintenance of the rule of law and access to justice for all.

⁶See The World Bank Report, *Supra* note 3, pp. 61

⁷See Office of Democracy and Governance, *Guidance for promoting judicial independence and impartiality*, 143 (January 2002).



A member of the higher judiciary can be removed from service only through the process of impeachment on grounds of proven misbehavior or incapacity.⁸ There is no other process in India by which a Judge can be removed from office before his term comes to an end though the process is very cumbersome.⁹

Hon'ble Mr. Justice V. Ramaswami was the first judge in independent India against whom impeachment proceedings were initiated. He was a practicing judge in both, civil and criminal law at the Madras High Court. Later, he was appointed as the permanent judge of the same. The scandal regarding the ostentatious expenditure of his official residence, accusing Ramaswami of abuse of financial and administrative powers while he was serving his tenure as the Chief Justice of Punjab and Haryana. Any further legal work was withdrawn when the Supreme Court Bar Association passed a resolution calling for his impeachment. The committee was constituted by Speaker Rabi Ray, which found Justice V. Ramaswami guilty of 11 out of 14 charges.

The main difficulty with this impeachment case was that out of 411 members present in the Assembly, there were 196 votes for impeachment since he failed "to do complete justice". Out of those who did not vote, 205 were of ruling Congress and its allies. The motion thus failed to pass, as it required not less than two-third majority of total number of members present in both the houses of Parliament and an absolute majority of its total membership.

The main issues regarding the impeachment procedure which were raised are:

- Politics involved

Even after 11 pellucid charges against Justice Ramaswami, only 196 being in favor out of 411 for impeachment revealed something suspicious in the system, especially when out of these, 205 belonged to Congress and its allies. This system, as tagged and criticized by the media and other politicians was 'entirely on political lines'.¹⁰ This criticism indubitably contained some element of truth as heavy politics was involved in such a case.

A very fundamental question which will be dealt with, in any future impeachment proceedings is that-any case which involves such an important decision to be taken by the system be let gone and be lost just because of involvement of dirty politics? Should the just decisions be lost at the cost of politics that prevails, a decision, which could be, a new turnover and a precedent for future cases regarding impeachments?

Although much cannot be done to fight back such a problem but certainly steps can be taken to revamp some provisions in The Judges (Inquiry) Act, 1968 so that there is re-search done at the discretion of some non-political members of the system.

- How effective the impeachment process is, in sweeping out the dirt from the Indian Judiciary

If 2/3rd of the majority of the House does not think that certain charges are correct, are these to be left even though the other charges, which are *prima facie*, ascertained by the committee to be correct? If a committee of such a high proficiency finds out charges, the charges must be having some basis or an origin. It is often said –'for a stereotypical notion to exist, there is least but some evidence of the notion in the past because of which it is a stereotype.' If charges are framed and are proved by such a committee constituting members like Vice President, there must be some or little truth however less substantial but such little evidence to a wrong committed cannot be let gone just because of lack of majority. "*Fial Justitia Ruat Caelumi*"

After a period of time, Ramaswami voluntarily resigned from his post as the trick played by the Congress in Motion-1 had been successfully carried out.

The only other Indian judge to have faced impeachment proceedings was Justice Soumitra Sen. In a report, the charges framed against him were: -

1. Misappropriation of large sums of money, which he had received in his capacity as Receiver appointed by the High Court of Calcutta;¹¹ and
2. Misrepresented facts with regard to the misappropriation of money before the High Court of Calcutta.¹²

This was a very strong case, which was foreseen then, to lead towards justness because of its congruency in the charges framed. After the charges had been framed and the Inquiry Committee found him guilty of the charges, the Rajya Sabha passed the motion following which, Sen resigned 4 days before the matter was to be taken to the Lok Sabha for further voting. The Attorney General had even advised that the impeachment proceedings be carried on, as it was too late to lapse the motion but after a while it was decided that the Lok Sabha shall not go ahead with the impeachment as President Pratibha Patil approved the notification on Sen's resignation. The amount of disgrace he faced as he escaped the impeachment could be evidenced by newspaper reports where it was severely stated that 'In a bid to avoid the ignominy of becoming the first judge to be impeached by the Parliament, Justice Soumitra Sen of Calcutta High Court tendered his resignation'.¹³

Another judge, Justice Paul Daniel Dinakaran, was charged with land grabbing, escaped the impeachment process even before the impeachment proceedings could be initiated by resigning. It is blatantly noticeable that escaping impeachment could be easily facilitated by the powerful so called 'defence' of resignation which can become a trend in future cases for to-be-impeached judges. The important issue raised is – is resignation a mean of escaping liability? If this is the case then, the judiciary in which the people, after such cases, will undoubtedly lose faith does gross injustice.

⁸See INDIA CONST., art. 124, § 4.

⁹Available

<http://www.expressindia.com/latest-news/The-law-on-impeachment-of-judges/555056/> (last visited Jan. 14, 2012).

¹⁰Available at: www.financialexpress.com/news (last visited Jan. 14, 2012).

at:

¹¹ REPORT OF THE INQUIRY COMMITTEE [Constituted by the Chairman, Rajya Sabha], *In regard to investigation and proof of the misbehavior alleged against Mr. Justice Soumitra Sen of Calcutta High Court*, (September 10, 2010).

¹²*Ibid.*

¹³Available at: www.post.jagran.com/calcutta-high-court-judge-justice-soumitra-sen (last visited Jan. 14, 2012).

II. OBJECTIVES

Simply stating reasons such as corruption, inefficiency and dishonesty does not do the job until unless methods are devised to identify specific solutions, which can be molded to become yardsticks for future. Going in depth and in detail and finding out what caused such deficiency in the system is the need of the hour. In this manner, one can gather the problem's origin and it will be much more easier for the law makers to put into the statutes and rules, some provisions which can put an end to the justice providing system's state of laxity. By realizing the filtered causes, we will try to find solutions, which can act as standards for the Judiciary.

There are various schools of thought, which try to identify the problem in their own course. While one suggests that inefficiency is because of excessive and indiscriminate access by opening the floodgates and bogging courts down with mostly frivolous cases and slowing the meritorious ones, the argument given, may at first, sound very promising but later we shall see that ignoring frivolous cases may not always seem to be the best selection.¹⁴ The other school leads to the belief that the problem is one of funding while another school is of the view that incentives are the problem. Yet another school thinks that the main problem is of inflexible and futile procedures. We will see that this problem has the widest dimensions clubbing with the problem of improper motivation.

Questions like-If certain corrective measures are formulated, how will they help in reducing corruption in the judiciary, are some of the most fundamental questions which are being asked. By studying how some measures have functioned in some countries and inspecting and comparing the situation and state of judiciary of India with them, it helps in deducing whether the measure is beneficial for our society or not. The Judicial Accountability & Standards Bill, 2010 is an apt example of a set of corrective measures assembled from different areas according to different situations for regulating corruption amongst judges.

The Judicial Standards and Accountability Bill, 2010

In India, studies have shown the rot in the judicial system, which is, indeed, disturbing. In view of increasing cases of corruption involving many judges, a drastic overhaul of the judiciary has become imperative, but this process has to be expedited. Corrupt judges in the higher judiciary can be removed only by impeachment. At present, there is no mechanism that can deal with complaints against judges.

The bill is a result of the efforts of the Law Minister, Verappa Moily, who, amidst the din and noise in the Lok Sabha, introduced it on 1st December 2010. The menace of corruption has nipped every possible institution, eating the very core of our polity.

The bill replaces The Judges (Inquiry) Act, 1968 but preserves its basic features. The act, by judicial inquiry, prefaces impeachment as in case of Justice V. Ramaswami's case, where the inquiry inculpated him but the motion fell through, in the Parliament, in 1992. The bill contemplates setting up of a national oversight committee through which the public can lodge

complaints against erring judges, which includes the Chief Justice of India and the Chief Justices of the High Courts.

A mechanism is furnished under The Judicial Standards and Accountability Bill that deals with complaints against judges of High Courts and the Supreme Court by making judges answerable for their lapses and also sets judicial standards under which, they must act. The bill mandates to declare their assets and liabilities, including those of their spouses and dependents and to file an annual return for the same. The Bill does not allow any member of the immediate family of judges to appear before them in courts. Also, it mandates that they should not have any close associations with individual members of the Bar. Moreover, there should not be any bias in their work or the judgments they deliver, on the basis of religion, caste, sex, race, or place of birth.

III. METHODOLOGY

Creswell said that - "Research is a process of steps used to collect and analyze information to increase our understanding of a topic or issue". It consists of three steps: Pose a question, collect data to answer the question, and present an answer to the question. The question in hand is such that an ex post facto research methodology is adopted. Study of what and how things exist and function has been the focal point of the research. Such an extensive research methodology also helps find the causes behind the existing loopholes in the system. Qualitative research techniques have also been incorporated as the question involved is regarding the flaws in the system and the study puts forth various reasons behind such an existing system. Empirical analysis of the existing examples also helped to formulate the yardsticks for betterment of the work by the judiciary.

While writing the paper, we communicated with an Additional District Judge (*identity concealed*) of Uttar Pradesh District. The judge had a good impression of the judiciary. The judge knew the ambit in which he should have functioned and thereby performed his duties by not providing any official views or comments on the judiciary or any authoritative report because of provisional and security reasons and the internal laws that govern them. This also gives us an insight into the reality in form of transparency, wherein, ultimately, help was provided in a manner, which was not official but had substance in it.

The problem of incentives has been questioned in the paper. It has been seen that incentives have not been a reason, especially in a country like India, for the inefficiency of judges or for indulgence in any type of malpractice.

One of the members of the Soumitra Sen impeachment committee was also communicated with. The person (*unofficially*) conveyed about the flaws in the judiciary are, the problems faced by the judges, reasons for injustice, delay and other crucial factors elaborated in the paper. He also remarked 'all that glitters is not gold', a strong and thought provoking line. The problem of backlogs has been studied thoroughly and an attempt to provide solutions has been made for the same.

There is no definite answer to the data that has been gathered since it has been based on a country's understanding. Therefore, terms like cases filed, cases resolved and cases pending are subjective. In a similar manner, there are statistical records that sometimes, cannot be held reliable and are not well maintained.

¹⁴See The World Bank Report, *Supra* note 3, pp. 62.

It should therefore be taken into consideration that some change in numbers, during the course of the paper, might be possible and cannot be clarified.

An insight has also been given in the following areas:

- 1) Number of cases filed and disposed off per year;
- 2) The total number of pending cases;
- 3) Average duration of a case;
- 4) Number of people per judge in different countries;

IV. CORRECTIVE MEASURES

The Three Schools Of Thought & Their Relevance In India

There are three schools of thought which apprise us about the pertinence between the problems of the Judiciary like – backlogs, problems associated to performance of judges with the corrective measures, which we seek for betterment in the whole process of administering justice.

❖ First School of Thought - Excessive and Indiscriminate Access

The first view is of excessive and indiscriminate access. What this means is that there is a huge inflation in the number of cases filed, which include not only the worthy ones, but unfortunately, the frivolous ones too. According to the aforementioned school, the legal system has opened the floodgates, extirpating courts down with frivolous cases, mostly.

¹⁵ This is because there is excessive access to file cases even if the case is a trivial one. This maybe because of the fact that people are getting aware of their rights regarding filing of suits. The corrective measures suggest that there should be “procedural hurdles” for lawsuits. This confines the number and quality of cases that are filed, concentrating and shifting the focus towards the ones that are laudable. Limiting access for the sake of efficiency, however, raises social concerns because justice may become a luxury that only the wealthy can afford.¹⁶

➤ Relevance in India

There should be provisions in the Indian Judiciary, to screen cases, so that the number is narrowed and the judges can shift their focus on the important ones. Their workload can be tapered to a stage at which the productivity in their performance significantly increases. The reason for there being excessive burden on the judges is evidenced by statistical analysis of reports, some of which have been mentioned below.

➤ Why is there excessive work load on Indian judges?

According to statistical reports as on 31st March 2010, the total number of judges sanctioned in courts for the year, 2010 was 16,880 in the lower courts, 895 in the High Courts and 31 in The Supreme Court of India.¹⁷ Also, vacancies of posts in the

number of judges are 2,785 in the lower courts, 267 in the High Courts and 2 in the Supreme Court of India.¹⁸

The total population of India as per the census report 2011¹⁹ is 1,21,01,93,422.²⁰ If the work load per judge is to be calculated, we reach a figure of approximately 82,000 people falling under one judge, which is an astonishing number; analysis of which, *prima facie* tells that the burden on each judge is exorbitant enough, to excessively lower the productivity of the judge as a consequence of which, efficiency shown in each and every case is a little extra to expect. According to the National Litigation Policy Report, 2010²¹, the total numbers of cases pending in all the courts are 3,21,27,796 out of which, the lower courts have the highest share (2,78,89,465). Newspaper reports tell us that India would need 124 years for clearing pending cases in its courts.²² The reason why lower courts hold such a big number has been explained later, in the article. As compared to the United Kingdom, where a single judge²³, handles cases of just about 2,000 people. According to another report,²⁴ the motions per active judge in the United States in 2011 were 937 and the total number of cases pending were just 4,479. This indicates the efficiency and the apt amount of workload, which is levied on a judge of the U.S. courts.

A solution for such a problem, as suggested by experts and judges approached is Alternative Dispute Resolutions, hereinafter ADRs, like arbitration or small-claim courts. They seem to be a more suitable option to reduce the pressure faced by judges in functioning in the judicial system. ADRs will automatically help to decrease the number of pending cases and help in shifting both, the judge’s mind free from the burden of frivolous cases and his mind’s main focus on the meritorious ones.

Therefore, ADRs, though not directly affect or better the performance of judges but indirectly do so, thereby acting as a useful measure.

❖ Second School of Thought – Incentives

The second school of thought comes across with the problem of incentives. In general, if the judges are not provided with the proper incentives they deserve, the judges will slow down in their performance. The rationale behind this is that if there is dearth of proper motivational techniques, it would be difficult for the system to sustain the judges as they might feel demotivated because of the amount of work they do, as a result of which the whole judicial system seems to be crumbling. It is

¹⁸ *Ibid*

¹⁹ See Census Report 2011, (Government of India) Available at: <http://censusindia.gov.in/2011-prov-results/indiaatglance.html> (last visited Jan. 14, 2012).

²⁰ The figures for India and Manipur, include by sex, the estimated population, 0-6 population and literates of Paomata, Mao Maram and Purul sub-divisions of Senapati District of Manipur for Census 2001 and 2011.

²¹ Available at: www.pib.nic.in (last visited Jan. 14, 2012).

²² See Dr. V. Prasad, *Condition of Indian Judiciary*, The Tribune, May 20th, 2007, p.14.

²³ Available at: www.Judiciary.gov.uk (last visited Jan. 14, 2012).

²⁴ See United States courts of appeals 5th circuit, clerks annual report, JUDICIAL WORKLOAD STATISTICS (July 2010-June 2011)

¹⁵ See The World Bank Report, *Supra note 3*, pp. 62.

¹⁶ *Ibid*

¹⁷ Available at: http://supremecourtindia.nic.in/courtnews/2010_issue_1.pdf (last visited Jan. 14, 2012).

seen in many countries that incentives may not always prove to be the main constituent of a better performance.

Another problem discussed further is of complicated procedures, which, when clubbed with the problem of incentives is seen to be the most crucial area of the inefficiency of judges. It also seems that being just incentive-oriented for the Judiciary is not always perfectly effective. Here, the aspect of quality comes into picture where only efficiency is regarded to be the prime motive. Thus, incentives cannot amend ceaseless judicial inefficiency alone.

• Relevance in India

This problem might not seem to be a big problem faced by the Indian judges as after the 6th pay commission²⁵ the salary structure has increased to three-folds. The CJI who received Rs.33,000 is now getting Rs.1,00,000 a month while the salary of the Apex Court inflated to Rs.90,000 from Rs.30,000. Chief Justices of High Courts got a boost from Rs. 30,000 to Rs.90,000 while the other judges of High Courts were paid Rs. 80,000 from the earlier Rs. 26,000.

As per studied conducted, it was seen that most judges in India are satisfied with such an increase and it is nowhere to be seen that the inefficiency in their performance is now related to that of incentives. Such an increase in salary and provision of other moral incentives the Judiciary provides, is helping the system in sustaining judges with better productivity.

Thus, we can infer that incentives might seem to be a yardstick in the judicial systems where the incentives are exceedingly low but as per current situation of India, the need for further improvement in incentives is not called for, as there is sufficiency of the same. The main focus of reforms should therefore not be on incentives to a great extent.

❖ Third School of Thought – Funding

The third school of thought is of the view that the problem is of funding. There are four dimensions identified to this problem:

- A. Resources
- B. Training
- C. Systems
- D. Staff and Infrastructure

It suggests that if there is improvement shown in developing the adequate amount of the mentioned four, there can be efficiency reached. According to case studies done in Paraguay, there was introduction to two patterns i.e. increase in the number of judges and oral proceedings.²⁶ The result of this type of an experiment was that there were savings in terms of time and cost. Oral proceedings helped in saving time and less paper work resulted in reducing cost. In a unique study in Uganda, it was seen that the minor issue of deficiency of stationery caused the backlogs.

• Relevance in India

As mentioned before that there is inadequacy in judges and staff, it is a point of concern for the Judiciary to see that over the years, as the population of the country has increased, the number of cases filed have also increased but there has been no proportional and adequate increase in the number of judges handling the plethora of cases of the enormous population. For instance, the Allahabad High Court's sanctioned number of judges is 160 but at present the working strength of judges is 82.²⁷ There were two reasons viewed by a judge in our research (*identity concealed*); one, lengthy procedures; and two, lack of courtrooms. The latter hints towards the lack of infrastructure provided by the government, which makes it hard for the judges to accommodate proceedings. In another study conducted, it was found out that in more than twenty-five districts of the State of Uttar Pradesh, there seems to be an absence or deficit of the least infrastructure required to set up district courts' court rooms. The district court of Gautam Budh Nagar did not have proper court rooms for twelve years' proceedings because of which, had to be carried out in a rented place in a market. This indicates the plight of the Indian Judiciary where there are no courtrooms available for proper jurisdictions in a State of the country, which has the highest number of Legislative members.

The spending that the government does on the Judiciary is somewhere between 0.0077% of the GDP.²⁸ It is suggested by experts that if this spending is increased to a decent figure of 1%, then conditions pertaining to funding may improve, as the infrastructural administration and other expenses will be met without much hindrance. Another insight of the Indian courts was found in a research that there are not only vacancies in the posts of judges but also for the posts of supporting staff. This supporting staff is needed for all the administrative work, which, by the lack of personnel, creates inefficiency as there is no specialization in one job but one person has to do several jobs for which he is not officially appointed. For instance, in the District court of Gautam Budh Nagar, the post for accountant in the district court is vacant. This, although being a very small issue, raises concern as it goes on a higher level. There, a person who is appointed to do some other work is handling the accounts, which may result in discrepancies in the outcome of the job's expected function. The District Magistrate, although, is empowered with assigning additional charges to the judges of a district court but overdoing of the same and overburdening the judges with work may lead to the same work load theory as seen in the first school of thought.

View of the government officials is that the politicians handling the finance of the government want this part of the system to remain weak. That is why this sector is defined as "unplanned sector", though not officially, but in real terms.

²⁵Available at: www.finmin.nic.in/6cpc (last visited Jan. 14, 2012).

²⁶ Maria Dakolias, *Court Performance around the World A Comparative Perspective*, pp. 3 (World Bank Technical Paper no. 430).

²⁷Available at: www.allahabadhighcourt.in (last visited Jan. 14, 2012).

²⁸Available at: <http://indiabudget.nic.in/> (last visited Jan. 14, 2012); Expenditure on Ministry of Law being ` 687.19 cr. and Total GDP being \$1.73 Trillion (USD).

Allocation of Budget for expenditure on Judiciary – 0.0077% of the GDP

Lack of Infrastructure, Staff & Resources

Delay in Cases + Increased Chances of taking benefit of Loopholes

Backlogs + Indulgence in immoral activities

Inefficiency + Dishonesty of Judges

Miscarriage of Justice

Non-availability of justice to majority classes of society

Call for Judicial Reform

Thus, in view of the predicament of the Indian Judiciary, this problem has great significance as explained by the studies. The measure, which is to be taken as per the need by the government i.e. proper, funding, may act as an effective tool to reform the Judiciary and diametrically affect the performance of Indian judges. This will also help reduce backlogs, which have been considered as a worm plaguing the Judiciary for a long time.

❖ Lengthy and Rigid Procedures

Apart from the three schools of thought, which regard the problems as those of funding, incentives, and indiscriminate access, there is another problem regarding the malfunctioning of the Judiciary. This problem is well known, as it is pervasive throughout the government- the problem of rigid, ineffective and lengthy procedures.

There are several yardsticks, which can be derived when the corrective measures of this problem are reached: -

1. Crash Programs: These are programs which were introduced in the U.S. District Court of Colorado to reduce the trouble of backlogs. This is an effective measure which was taken and which was successful in the courts which basically dealt the cases even before they went for a trial. It was defined by a newspaper of the United States of America when a six-week program was undergoing as a “massive assault on the backlog”. There were three categories of cases in this program, namely-

- The cases disposed off prior to the crash programs;
- The cases disposed off during the crash programs;
- The cases not disposed off at the end of the crash programs.²⁹

It was seen that this district court had 111 cases pending out of which 100 cases were cleared off after the use of this program. This shows that there was efficiency level of around 90%, which is very useful to cull out backlogs of the courts. Under these 100 cases, 36 were of category (a)) and 64 belonged to category (b))

Crash programs, although, were seen to be highly effective in disposing off cases in the backlog in the short-run but somewhere lacked the long-term impact aspect which could be evidenced in Queens and Brook land.³⁰ In India, crash settlement programs are still to be implemented in the provisions of the Judiciary but it is suggested that this type of a program can help reduce the enormous backlog here. In a superior court of Santa Monica, the crash settlement programs were mandatory for the court. Such a compulsion in India can do great wonders.

Thus, crash programs seem to be an option to reduce backlogs effectively in the short term, but in the long term it may fail to perform such a function.

2. Usage of Information Technology (IT): These are important and helpful tools in obtaining accurate statistics which replace the age old paper based procedure. What this does is that it makes the judge accountable by making it simply difficult for him to state excuses like loss of case file or it can be evidently checked if there is any bribe taken from the litigants.

The state of use of information technology as a part of decision making is seldom used in India although there has been a change in the trend which can be seen as Supreme Court Cases and other High Court decisions are available online which includes the pending case status which is an indicator of progressing transparency in the administration.

There is lack of computer facilities and defective typewriters are likewise, not sufficient reasons for not deciding cases on time. They merely ease the courts work load but their lack should not be used to justify delay.³¹ It is also to be realised that in a place like India where well functioning court rooms are a distinct dream, providing courts with the proper information technology is a secondary step towards reform.

In a case study done in Latin America and Singapore, computer systems helped reduce delay. It also appeared that it reduced corruption because of the accountability factor.³²

3. Time Limits: This concept focuses to make the judges accountable, thereby increasing their efficiency by assigning a specific period of time per case in which it has to be cleared. In

²⁹See 44 Denv. L.J. 380 – Court congestion and crash programs, a case study, Sykes, Gresham M.; Isbell, Michael.

³⁰See 74 Judicature 76 (1990-1991); Limits of Crash programs, the church, Thomas Space W.; Space Heumann, Milton.

³¹Available at: http://sc.judiciary.gov.ph/jurisprudence/2005/dec2005/am_05_10_299_mctc.htm (last visited Jan. 14, 2012).

³²See 2, Calvoet. al, *Journal of Latin America and Caribbean Economic Association*, pp. 120 (Spring 2002).

countries where there are mandatory time limits, there is eradication of slow trials and this popular response helps in improving the poor track records of the courts. The countries in which these type of time limits are enforced are Argentina, Bolivia and United States of America.

There can be 2 yardsticks related to this concept:

a. Individual Calendars: This yardstick concentrates on increasing the accountability and creating an impact on judicial performance. This type of system was propounded by the Gesell Committee.³³ This was first used by a U.S. Metropolitan Court where the judges were assigned a specific number of cases which they had to strictly follow from beginning to end. In the U.S. court, cases or matters are assigned to specific judges by a method of random allocation as determined from time to time by order of courts.³⁴ One alternative to this yardstick is a master calendar where many judges work on different parts of a case at different times.³⁵ The individual calendar systems are found to be more effective than the master calendars as there is a sense of hard work in cases where the judge in charge of a case becomes more familiar with their cases and feels accountable.

Although the individual calendar system may be *prima facie* a safe option as found out by other countries in Latin America but the fact cannot be ignored that the result of a process like this is not always uniform.

b. Case Management: It identifies that there are four players in a judicial system which are:

1. Judges
2. Lawyers
3. Litigants
4. Court Staff and the Registry

The Law Commission of India has assigned specific duties and roles to play for ensuring better management of a case. This regards judges more than their actual position and sees them as managers while lawyers and litigants are expected to play the role to be updated with the information, documents, and the time of the case as no one would spend time more than what is required on daily matters. It also regards court registry as the backbone of the system because of the administrative work they perform. They need to show efficiency related to all papers pertaining to a case from beginning to the end.³⁶

In an experiment conducted in the Delhi High Court, the cases were categorized and accumulated in which cases of similar nature were grouped under one head and were dealt similarly. This helped in mass litigation. Not only is it a tool of increasing accountability of judges but is also intended towards increasing public confidence in the justice system.³⁷

4. Statutes involving action against Corruption amongst Judges in India: The need for an institutional mechanism has long been felt that could deal with cases of judges of various High Courts and the Supreme Court charged with misconduct or any similar malpractice. Another question that has to be dealt with is whether or not, judges on whom investigation is pending be assigned work by the Judiciary. The duty lies with the government to fast-track all cases related to corruption, nepotism and moral turpitude. The impeachment process of a judge needs to be speeded up so that the President's sanction is obtained sooner and the judge is thereby impeached.

There is a debate whether the executive should have the power to retire judges but in order to maintain the independence of the Judiciary; this power should remain in the hands of the Judiciary itself, which is the cornerstone of the Constitution. The Supreme Court has the power to quash down any amendment relating to impeachment of judges if it does not pass the test of judicial scrutiny as otherwise, it would be violative of the basic structure of the Indian Constitution.

V. CONCLUSION

Inefficiency and dishonesty of the keepers of law has been a behavior, rife around the globe. It is because of these reasons that the Judiciary weakens by carrying the burden of backlogs and costing it in terms of both civil and criminal cases. There is an indirect relationship between good judiciaries and economic development of a country. It does so by facilitating fruitful contracts between individuals and by keeping a check on abuse of power by the government.

An effective way to put an end to such occurrences of inefficiency is getting the judge impeached by a process contained in the constitution of the country, or otherwise. The impeachment process in India is lengthy enough to be evidenced in the impeachment processes of judges like Hon'ble Mr. Justice V. Ramaswami and Justice Soumitra Sen. Both the impeachments ended in a fiasco. Involvement of politics and resignation-these were two foremost ways because of which, neither both of them nor other judges in independent India, impeached. The Judicial Standards and Accountability Bill, 2010 was seen as a new beginning in the issue of corruption prevalent in the judiciary. It came out as a modification of The Judges (Inquiry) Act, 1968, preserving the basic features.

To find out the reasons why the Judges are inefficient in their work, identification of three schools of thought was done. The first talks about indiscriminate access of the common people to file cases. According to this school, people now are more aware of their right hence they tend to file more and more trivial cases which ultimately increase backlog. Because of this, the cases, which need to be at the top priority, lose their time and importance. A solution, which can be derived out is Alternative Dispute Resolution systems (ADRs) like arbitration and small-claim court. There is a proper workload analysis done, by which the workload on a judge in India and other countries is determined. The second school observes the problem to be one of incentives. It believes that efficiency of judges is dependent (like in management) on the incentives the judge receives. These

³³Available at: www.dccs.org/GerhardAGesell/App1-individual%20c.pdf (last visited Jan. 14, 2012).

³⁴Available at: www.mnd.uscourts.gov/local_rules/LR-40-1.html (last visited Jan. 14, 2012).

³⁵See The World Bank Report, *Supra* note 3, p.65.

³⁶Available at: www.lawcommissionofindia.nic.in/adr_conf/Justice_Lokur.pdf (last visited Jan. 14, 2012).

³⁷Available at: www.albertacourts.ab.ca/provincialcourt/courtcasemanagement/tabid/331/default.aspx (last visited Jan. 14, 2012).

incentives not only include monetary motivational techniques but also non-financial incentives. Another school correlates the problem of inefficiency of the courts with funding, which includes resources, training, systems and staff and infrastructure. In studies in India and other countries it is evident that such a problem is of great concern as it aids in creation of backlogs. Other than the three schools of thought, there is yet another group which blames lengthy and rigid procedures to be a major flaw. To help avoid getting plagued by such procedures, yardsticks such as crash programs, which is dealing of cases before trials, usage of IT, which fastens decisions and eliminates the age old paper work methods, time limits which, fixes time for a judge to solve a case with techniques like individual calendars and case management and lastly statutes which involve action against corruption amongst judges, which has in its purview, The Judicial Standards and Accountability Bill, 2010.

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Performance Analysis of Four Wave Mixing Based Wavelength Conversion in Commercial Optical Fibers

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Abstract- In this paper, we discussed on Four-wave-mixing (FWM) based wavelength conversion at 1.55 μm and 1.552 μm using six different types of commercial optical fibers. For a pump peak power of 6.2W, a numerical simulation is used to predict the performance of each type of fibers for different experimental conditions and to address the potential of each fiber type in wavelength conversion applications utilizing four-wave-mixing. It is shown that wavelength conversion, covering the entire C-band, can be achieved with different performance for each type of optical fiber at reasonable optical pump power.

The simultaneous wavelength conversion of two different formats or bit-rate optical signals, with low input power, is demonstrated in a highly nonlinear optical fiber with a single strong continuous-wave pump. The effect of four-wave-mixing at highly nonlinear optical fiber is analyzed at 1 km distances with its power. The Four Wave Mixing is analyzed in non-degenerate mode for wavelength conversion.

Index Terms- Four wave mixing (FWM), MZI modulator, SMF-28 single mode fiber, Positive dispersion non-zero dispersion-shifted fiber (LEAF), Negative dispersion non-zero dispersion-shifted fiber (METRO), Dispersion compensating fiber (DCF), Vascade Optical fiber (Sea Cable).

I. INTRODUCTION

The field of nonlinear optics has continued to grow at a tremendous rate since its inception in 1961 and has proven to be a nearly inexhaustible source of new phenomena and optical techniques. In optical communication systems the term nonlinearity refers to the dependency of the system on power of the optical beam being launched into the fiber cable. Nonlinear effects in optical fibers have become an area of academic research and of great importance in the optical fiber based systems. Several experiments in the past have shown that the deployment of high-bit-rate multi-wavelength systems together with optical amplifiers creates major nonlinear effects such as stimulated Raman scattering (SRS), stimulated Brillouin scattering (SBS), self-phase modulation (SPM), cross-phase modulation (XPM) and four-wave-mixing (FWM). These effects have proven to be of utility in a great number of applications including pulse compression, solitons, optical tunable delays, optical switching, and pulse retiming and wavelength conversion.

In a wavelength-routed optical network, wavelength conversion plays a major role to reduce wavelength blocking, provide high flexibility and utilization of wavelength allocation in network management, which has been investigated extensively

in the past several years. An all-optical approach of wavelength conversion is favorable to avoid bit-rate bottleneck and costly signal conversion between optical and electrical domains since current electronic processing speeds are approaching fundamental limits near 40Gb/s. Ultra-high data rate all-optical wavelength conversion is an enabling technology for providing wavelength flexibility, increasing the capacity of photonics networks and enhancing optimized all-optical routing and switching. Several all-optical wavelength conversion approaches have been demonstrated, which are based on nonlinearities in semiconductor optical amplifiers, in optical fibers, in crystals and so on. Among these approaches, wavelength conversion based on the nonlinearity of optical fibers is inherently featured of femto-second response time, low insertion loss, non-degraded extinction ratio of the signal and low-noise characteristics, which shows the promising potential of achieving terabit-per-second performance. Nonlinear effects mainly applied in fiber-based wavelength conversion are XPM, FWM and SPM, all of which originate from the Kerr effect. Among the various nonlinear phenomena exploited for fiber-based wavelength conversion, FWM is regarded as advantageous due to its transparency both in terms of modulation format and bit rate. However to make use of this nonlinear phenomenon in optical signal processing requires that a suitable fiber be available.

In this paper, six commercial optical fibers to achieve a wavelength conversion covering the entire C-band have been analyzed and comparison is made in their performance using a simulator software Optisystem 9.0 from Optiwave Inc. The mathematical review presented is based on the theory and a numerical analysis of the wavelength conversion process is carried out. All optical wavelength conversion is considered as key components due to their main advantages which comprises increase in the flexibility, the capacity of networks besides facilitating WDM network management. Therefore the optical wavelength conversion based on FWM, one of the phenomena's on fiber nonlinearities have been proposed and discussed and then its framework of application in optical communication networks based on complex meshes.

The objectives are discussed in this paper:

- A. To study the Four Wave Mixing (FWM) phenomenon based wavelength conversion.
- B. To investigate the performance of different commercial fibers for FWM based wavelength conversion in WDM system.

II. MATHEMATICAL REVIEW

The total polarization P is nonlinear with respect to the electric field E , however, it can be written as:

$$P = \epsilon_0 (\chi^{(1)} \cdot E + \chi^{(2)} \cdot E \cdot E + \chi^{(3)} \cdot E \cdot E \cdot E + \dots)$$

Where, ϵ_0 is the vacuum permittivity and $\chi(j)$ ($j = 1, 2, \dots$) is j th order susceptibility.

When light propagates in a transparent medium, its electric field causes some amount of polarization in the medium. While at low light intensities the polarization is linear with the electric field, nonlinear contributions become important at high optical intensities, so the polarization equation consists linear terms as well as nonlinear terms. The first order susceptibility $\chi^{(1)}$ represents the linear term, and nonlinearities can have strong effects in fibers at the third order susceptibility $\chi^{(3)}$. So, only the nonlinear effects in the optical fibers, which originate from the third-order susceptibility $\chi^{(3)}$, will be considered and the other terms will be neglected. The programming will start from the third-order susceptibility $\chi^{(3)}$. Thus the electric field of the signal can be written as:

$$E(r, t) = \epsilon_0 E_t \cos(\omega t - \beta z)$$

Where, β is the propagation constant, and ω is angular frequencies.

Substituting Equation 4.2 into Equation 4.1, and if only the term of the third order susceptibility is taken into account, the nonlinear dielectric polarization is given as

$$\begin{aligned} P &= \epsilon_0 \chi^{(3)} \sum_{i=1}^N (E_i \cos(\omega_i t - \beta_i z) \cdot E_j \cos(\omega_j t - \beta_j z) \cdot E_k \cos(\omega_k t - \beta_k z)) \\ &= \frac{3 \epsilon_0 \chi^{(3)}}{4} \sum_{i=1}^N (E_i^2 + 2 \sum_{j=1}^N (E_i E_j)) E_i \cos(\omega_i t - \beta_i z) \\ &\quad + \frac{\epsilon_0 \chi^{(3)}}{4} \sum_{i=1}^N (E_i^3 \cos(3\omega_i t - 3\beta_i z)) \\ &\quad + \frac{3 \epsilon_0 \chi^{(3)}}{4} \sum_{i=1}^N \sum_{j=1}^N (E_i^2 E_j \cos((2\omega_i - \beta_j) t - (2\beta_i - \beta_j) z)) \\ &\quad + \frac{3 \epsilon_0 \chi^{(3)}}{4} \sum_{i=1}^N \sum_{j=1}^N (E_i^2 E_j \cos((2\omega_i + \beta_j) t - (2\beta_i + \beta_j) z)) \\ &\quad + \frac{3 \epsilon_0 \chi^{(3)}}{4} \sum_{i=1}^N \sum_{j=1}^N \sum_{k=1}^N (E_i^2 E_j E_k) \\ &\quad \cos(\omega_i + \omega_j + \omega_k) t - (\beta_i + \beta_j + \beta_k) z \\ &\quad + \cos(\omega_i + \omega_j - \omega_k) t - (\beta_i + \beta_j - \beta_k) z \\ &\quad + \cos(\omega_i - \omega_j + \omega_k) t - (\beta_i - \beta_j + \beta_k) z \\ &\quad + \cos(\omega_i - \omega_j - \omega_k) t - (\beta_i - \beta_j - \beta_k) z \end{aligned}$$

The nonlinear susceptibility of the optical fiber generates new waves at the angular frequencies $\omega_r \pm \omega_s \pm \omega_t$ ($r, s, t = 1, 2, \dots$). Equation 4.3 represents the effects of SPM and XPM. Terms in equation 4.3 can be neglected, due to lack of phase matching. The remaining terms can satisfy the phase matching condition.

FWM is a phenomenon that occurs in the case of DWDM systems in which the wavelength channel spacing are very close to each other. This effect is generated by the third order distortion that creates third order harmonics. As shown in

Figure 1, these cross products interfere with the original wavelength and cause the mixing. In fact, these spurious signals fall right on the original wavelength which results in difficulty in filtering them out. In case of 3 channel system, there will be 9 cross products, where 3 of them will be on the original wavelength. This is caused by the channel spacing and fiber dispersion. If the channel spacing is too close, then FWM occurs. If the dispersion is lesser, then FWM is higher since dispersion is inversely proportional to mixing efficiency.

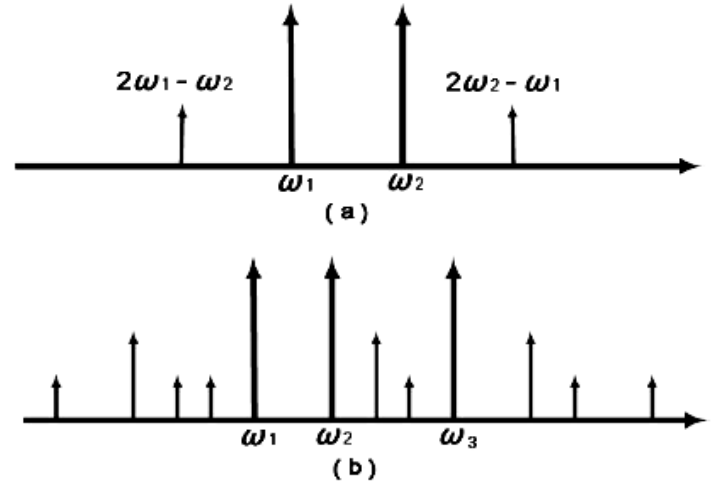


Figure 1: (a) two input signals ω_1 and ω_2 (b) three input signals ω_1 , ω_2 and ω_3 and the arising new frequency components due to FWM

It can be seen that three of the interfering products fall right on top of the original three signals and the remaining six products fall outside of the original three signals. These six wavelengths can be optically filtered out. The three interfering products that fall on top of the original signals are mixed together and cannot be removed by any means. Figure 1 shows results graphically. The three tall solid bars are the three original signals. The shorter cross-hatched bars represent the nine interfering products. The number of the interfering products increases as $(N^3 - N^2)/2$ where N is the number of signals.

III. RESULT AND DISCUSSION

We have simulated an experimental setup for analysis of FWM phenomenon. The peak power is launched into the fiber is approx 6W, while the power of the signal was 2.4 mW as shown in Figure 2. In order to compare the performance of the optical fibers numerical experiment setup has proposed, we applied the same parameters and conditions for the six types of fibers including the influence of the gain and received power of the induced fiber. At the output of the system, the FWM process between the pump and the signal in any specific optical fiber gave gain and its performance at received signal power for a particular length of fiber.

The block diagram of commercial optical fibers with spectral analyzer has shown in Figure 2. All commercial fibers have different parameters gives FWM based wavelength conversion

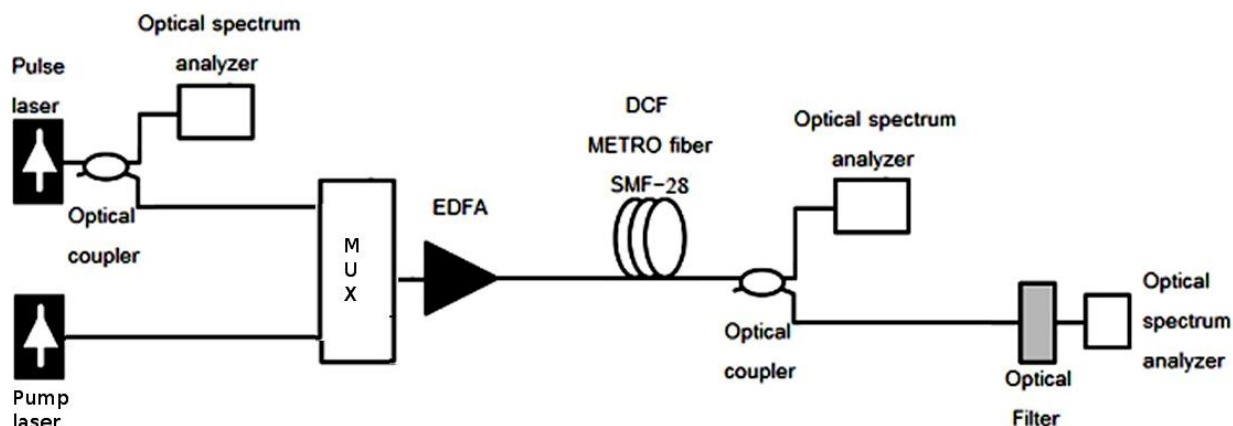


Figure 2: Block Diagram of FWM analysis in commercial optical fibers

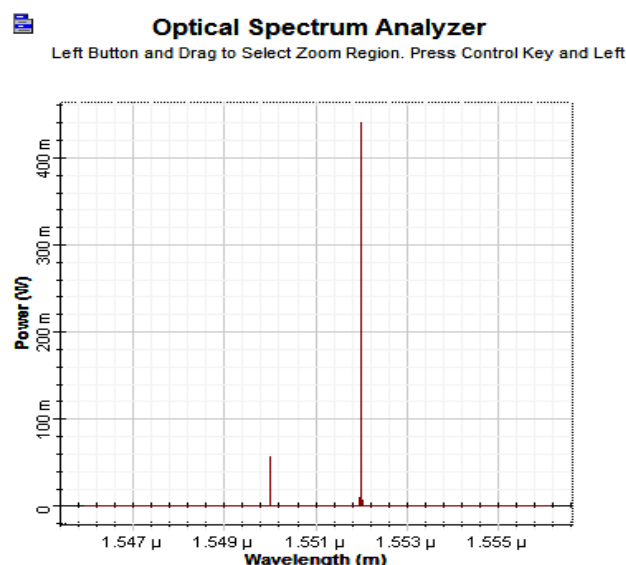


Figure 3(a): Spectral analysis obtained at the input (W) of the SMF-28 fiber

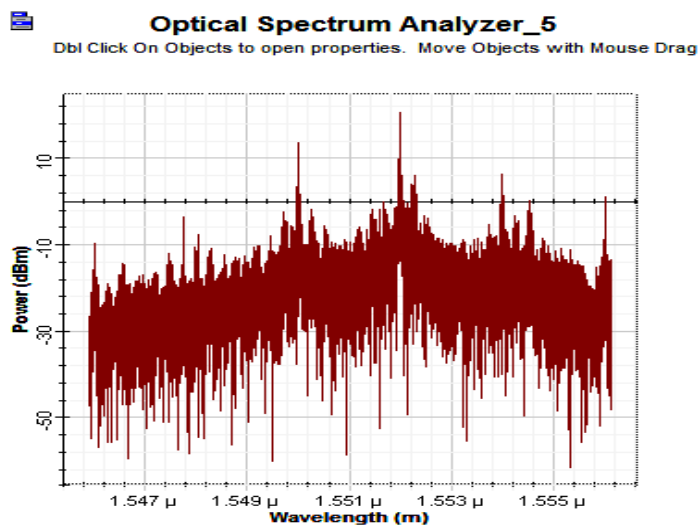


Figure 3(c): Spectral analysis obtained at the output (W) of the SMF-28 optical fiber

Spectral analyses at output of METRO fiber has shown below in fig.4 and compare it with fig.3(c).

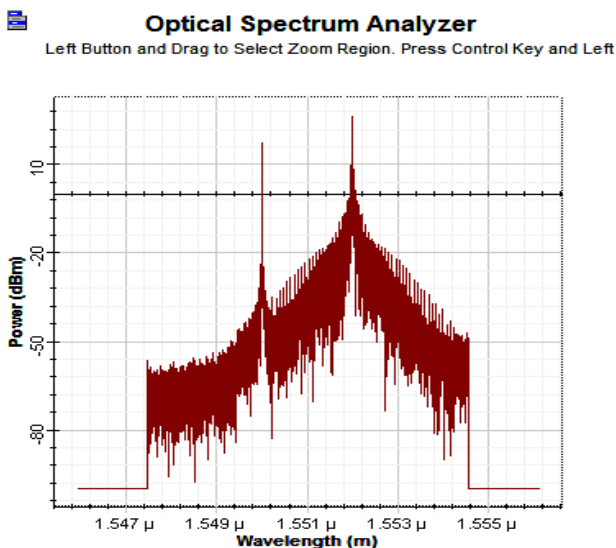


Figure 3(b): Spectral analysis obtained at the output of the SMF-28 optical fiber

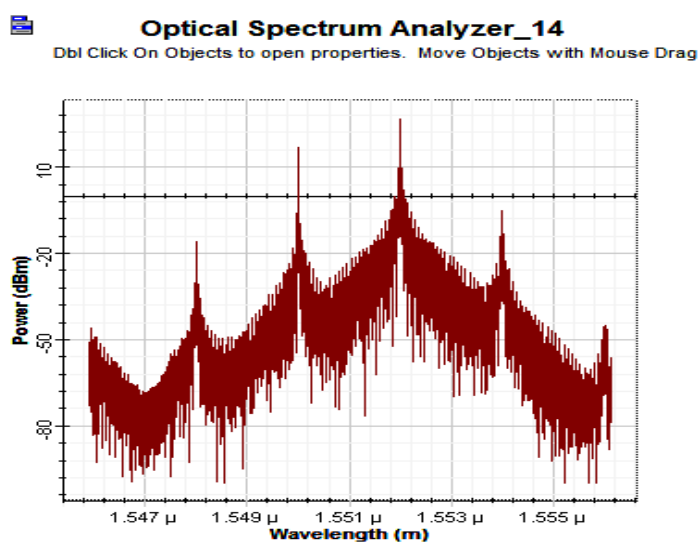


Figure 4: Spectral analysis obtained at the METRO optical fiber.

BER and eye diagram of single mode fiber at receiving end has shown in figure 5.

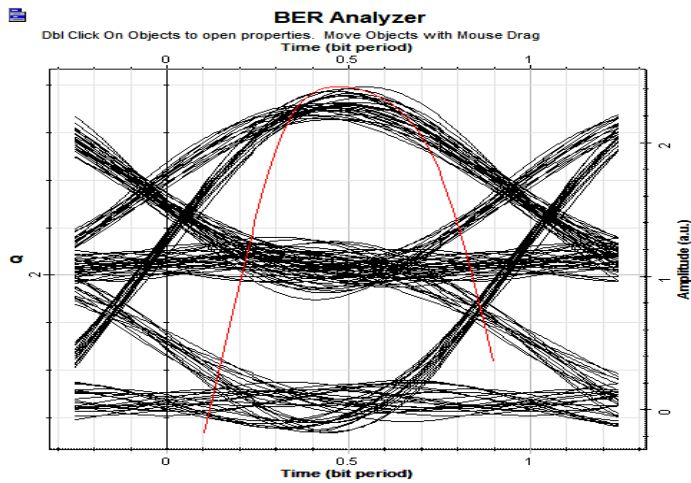


Figure 5: BER and Eye diagram obtained at the output SMF-28 optical fiber

Table 1: Comparison of Gain obtained in various applied commercial fibers

Types of Fiber	Received power At 1 km		
	Wavelength(nm)	Gain(db)	Output signal(dbm)
SMF	1552	-14.53	15.1963
	1550	-4.3276	13.3846
DCF	1552	-0.748	29.0451
	1550	-1.88	15.8215
LEAF	1552	-0.4813	29.2477
	1550	-0.6496	17.0626
PMD	1552	-0.7504	28.9787
	1550	-1.0841	16.6281
VASCAD E	1552	-0.5100	29.2091
	1550	-0.8170	16.8952
METRO	1552	-0.2535	29.4755
	1550	-0.6794	17.0328

Received Signal Power

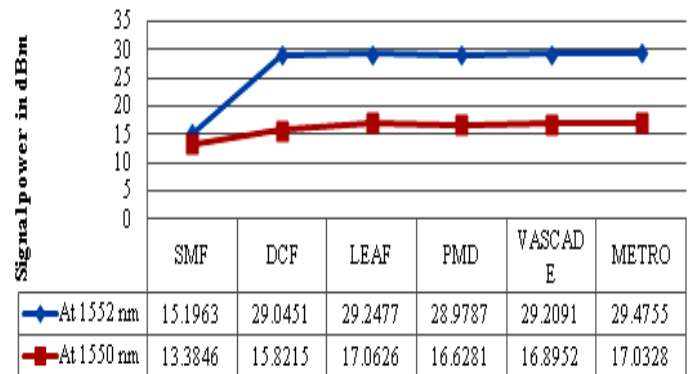


Figure 7 Received signal power for commercial optical fibers

It is observed in figure 6 that gain in SMF is lower than METRO optical fiber, but increasing the effective area that reduces the Four Wave Mixing effect and brings improvement in gain and received signal power in all commercial optical fibers as indicated in Table 1.

All results obtained indicate that, the FWM effects depend on dispersion and effective area of optical fiber. This is because the longer optical fiber, the more light interacts with the fiber material and the greater the nonlinear effects. We also have noticed that, the behavior of the DCF fiber has the highest peak power compared to the SMF-28 optical fiber. This was due to the relative advantage of the DCF fiber characteristics compared to SMF optical fibers.

In other types of fibers, when changing the effective area, it is observed that gain of signal is improved and output power is also improved.

IV. CONCLUSION

In the paper, it is shown as to how the nonlinearity in the commercial optical fiber has been utilized for wavelength conversion. The performance of the commercial optical fiber in FWM based wavelength conversion covering the entire C-band has been analyzed.

In the simulated WDM system, high pump power transmitted signals were used. It was observed that as high power transmission of WDM signal, maximum nonlinear effect is occurred within the various commercial optical fibers. Bit Error Rate was measured by Eye Diagram for the performance measurement besides gain and received signal power. Performance evaluation of the simulated system revealed that the METRO fiber has better performance for the transmission of WDM signals in comparison with SMF, DCF, LEAF and VASCAD E and found to be more useful for FWM based wavelength conversions.

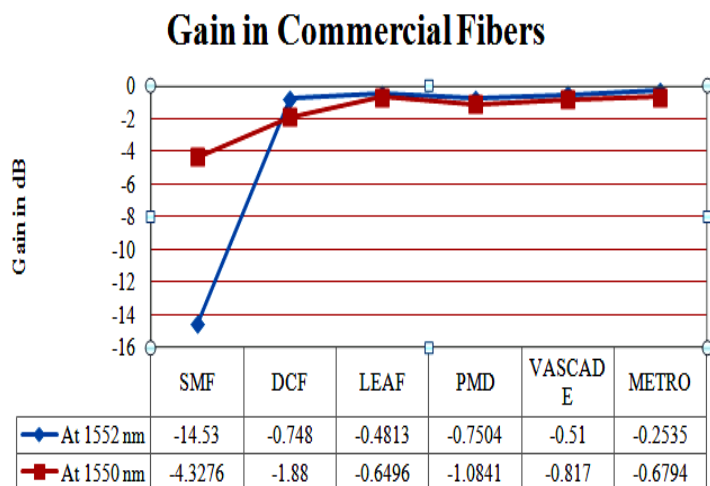


Figure 6: Comparison of gain in commercial optical fibers

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A Survey on Image Contrast Enhancement Using Genetic Algorithm

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Abstract- This paper reviews an introduction to various approaches to image contrast enhancement in the spatial domain using genetic algorithm and its extension based on population based incremental learning (PBIL). GA performs efficient search in global spaces to get an optimal solution. The algorithm does not require any prior knowledge about image in Order to select the appropriate enhancement function. GA is more effective in the contrast enhancement and produce image with natural contrast. Histogram equalization and similar methods for image contrast enhancement produce unnatural brightness. This paper introduces various approaches based on genetic algorithm to get image with good and natural contrast.

Index Terms- GA, PBIL, Contrast Enhancement.

I. INTRODUCTION

A genetic algorithm is a type of search algorithm that takes input and computes an output where multiple solutions might be taken. It is a mechanism based on natural selection and natural genetic. It works well in global search space. Genetic algorithm uses the principle of selection and evolution to produce solutions at each generation. In simple genetic algorithm the size of whole population is same [2]. It uses strings to represent a chromosome. Genetic algorithm works as – The initial population of solutions is created by a group of individuals randomly. These candidate solutions are called chromosomes. The individuals in the population are evaluated using a fitness function to measure the work of chromosome towards solving the problem. Two individuals are selected based on their fitness, the higher fitness, and the higher chance of being selected. Only fittest individuals are allowed to survive for next generation [1]. These individuals perform crossover to reproduce one or more offspring using crossover function. Some individuals are mutated randomly.

Basically genetic algorithm used in any study are characterised by parameters- population size, selection, crossover, type, crossover rate and mutation rate. The population size shows the number of chromosomes that are present in every generation. Selection is used to select the individuals for next generation. The crossover type is used to get a way to recombine information. Crossover is used to recombine two strings to get better string. The two strings that are involved in the crossover operation are known as parent string and resulting strings are known as child strings. Crossover operation is done by randomly selecting two strings for crossover operation. Many crossover operators exist in genetic algorithm. Single point crossover, a point of exchange is selected randomly in the two individual's

genomes and swaps the content of chromosomes to produce an offspring's. Two point crossover, two crossover points are selected randomly and swaps the contents of chromosomes to produce an offspring's. Uniform crossover, the value at any given location in the offspring's is either the value of genome of one parent at that position or the value of genomes of the other parent at that position. Following exemplify the crossover process.

One point	Parent A	0010010010000
Crossover	Parent B	1101101101111
	Child A	0010010011111
	Child B	1101101100000

Two point	Parent A	0010010010000
Crossover	Parent B	1101101101111
	Child A	0000010000000
	Child B	1111101111111

Uniform	Parent A	0010010010000
Crossover	Parent B	1101101101111
	Child A	0101101101111
	Child B	1010010010000

The percentage of the time that crossover occurs when two chromosomes are selected to combine is known as crossover rate. Mutation rate is the probability of adding new information randomly. Mutation may be the chromosomes of individuals to be different from their parent individuals.

This paper is introducing various approaches for image contrast enhancement based on genetic algorithm. Contrast enhancement improves the quality of images for human viewer by increasing the dynamic range of input gray level. It has an important role in image processing. Various contrast enhancements techniques exist in literature like linear transformation in which the end points of the data distribution are pulled to the end points of the palette and all values in between are re-scaled accordingly. Histogram equalization attempts to assign the same number of pixels to each gray level in the output image. It produces unnatural image with extreme contrast. Local histogram equalization (LHE) method is the extension of HE that uses the transformation function of HE for the block and processes the image on block-by-block basis to modify its centre pixel. But it produces unacceptable and Unnatural image modification due to noise amplification.

Adaptive histogram equalization (AHE) works on small regions in the image known as sub images. The contrast of each sub image is enhanced by performing histogram equalization. Then they are combined by bilinear interpolation. Gray level

grouping (GLG) [5], in the given input image the histogram components are categorized into some groups according to a certain parameter, then these groups are redistributed uniformly over the gray scales. Adaptive GLG (AGLG) is an extension of GLG, in that the input image is divided into sub images and then applied GLG method to each of these sub images.

The histogram matching (HM) [7] is another method for contrast enhancement. In this method, the contrast of the original image is enhanced by specifying the histogram of the desired image. This method requires user involvement to define desired histogram.

II. CONCEPT1- CHROMOSOME STRUCTURE BASED ON LUT TECHNIQUE

This approach was introduced for gray images with low contrast that are captured by a camera and image capturing system. In this approach a relation between input and output gray level is determined to convert an original gray image into an enhanced images with good contrast [3]. This relation is represented by a look up table (LUT). Here the number of gray levels is 256. Therefore the range of minimum input gray level is 0 and the maximum input gray level is 255 and the range of output gray level is the same.

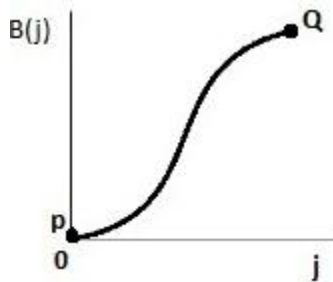


Figure 1: mapping Curve for enhanced image

In this method, a relation between input gray level and output gray level is determined using a genetic algorithm. The minimum gray level is converted to 0 and maximum gray level is converted to 255 to enhance the contrast of an image. In this case, each chromosome k is represented by a byte string that represents a relation between input gray level and output gray level. Where each byte represented the difference $b(j-1)$ between values of transformed curve $B(j)$ and $B(j-1)$. Here j is a bit position from left edge of a chromosome [3].

$$\begin{aligned} B(j) &= 0 & (j=0) \\ B(j) &= B(j-1) + b(j-1) & (1 \leq j \leq I_{max} - I_{min}) \end{aligned} \quad (1)$$

Evaluate the fitness of an individual by the sum of intensities of edges $E(k)$ in an enhance image. The intensity of an edge is calculated by Prewitt operator [4].

$$E(I) = \sum_x \sum_y \sqrt{\delta h_1(x, y)^2 + \delta V_1(x, y)^2}$$

$$\begin{aligned} \delta h_1(x, y) &= g_k(x+1, y-1) + g_k(x+1, y) + g_k(x+1, y+1) - g_k(x-1, y-1) - g_k(x-1, y) - g_k(x-1, y+1) \\ \delta V_1(x, y) &= g_k(x-1, y+1) + g_k(x, y+1) + g_k(x+1, y+1) - g_k(x-1, y-1) - g_k(x, y-1) - g_k(x+1, y-1) \end{aligned}$$

$C(k)$ is calculated using the sum of intensities of edge $E(k)$.

$$C(k) = E(k) + \eta L(k) \quad (2)$$

Here η is a positive efficient. $L(k)$ means difference between $I_2(k) - I_1(k)$ [3]. The fitness of the individual k is calculated by the following expression.

$$F(k) = C(k) / C_0 \quad (3)$$

G is the number of individuals in the population. Only those individuals are selected that have higher fitness in the population and survived to the next generation. The individuals that have low fitness are discarded in the population because they do not have abilities to survive to next generation. Number of child individuals that are survived in next generation is same as the number of discarded individuals to keep the number of individuals constant in all generation. At the survived rate $S\%$ only $G \cdot S / 100$ individuals in all individuals are selected to survive to next generation. The number of discarded individuals are $G(100-S)/100$ [3]. Two parent individuals are selected randomly to generate the child individuals. The number of generated child individuals is $G(100-S)$.

III. CONCEPT2- CHROMOSOME STRUCTURE BASED ON RANDOM SELECTION OF INTEGER'S

This concept [5] was introduced for those images that are suitable to use in application like consumer electronic products. In this concept a simple chromosome is a sorted array of random integer number. The size of chromosome is equal to the number of gray levels in the image.

To enhance the contrast of image, the first gray level is replaced with the value of first gray level of the enhanced chromosome and so on.

$$T(G(k)) = C_i(k) \quad K=1, 2, 3, \dots, n \quad (4)$$

Where T is the function. G is the sorted array of input gray level, k is the number of gray levels in the input image and C_i is the i th chromosome in the population. In this method the number of input gray level is calculated to generate initial population. After constructing initial population the fitness for all individuals is evaluated. If the number Of individuals is P_s then only $P_s - P_s \cdot P_c$ number of individuals are passed to next generation at crossover rate P_c . So the number of new generated individuals in each generation is $P_s \cdot P_c$ [5]. The number of edges and their overall intensities are used as fitness value as fitness value for each chromosome [3],

$$\text{fitness}(x) = \log(\log(E(I(X)))) \cdot n_{\text{edge}}(I(X)) \quad (5)$$

where X is the chromosome and $\text{fitness}(x)$ is the fitness value of X and $I(X)$ is the enhanced image $n_{\text{edge}}(I(X))$ is the number of detected edges in the enhanced image [5]. The intensity of an edge is calculated by Sobel edge detector [6]. $E(I(X))$ is calculated by the following expression [5],

$$E(I) = \sum_x \sum_y \sqrt{\delta h_1(x, y)^2 + \delta V_1(x, y)^2}$$

$$\begin{aligned} \delta h_1(x, y) &= g_i(x+1, y-1) + 2g_i(x+1, y) + g_i(x+1, y+1) - g_i(x-1, y-1) - 2g_i(x-1, y) - g_i(x-1, y+1) \\ \delta V_1(x, y) &= g_i(x-1, y+1) + 2g_i(x, y+1) + g_i(x+1, y+1) - g_i(x-1, y-1) - 2g_i(x, y-1) - g_i(x+1, y-1) \end{aligned}$$

Here, log-log is used to prevent producing un-natural images [7]. Roulette wheel selection is used for the selection of the individuals. Only $P_s * P_c$ individuals are selected for generating the same number of individuals. Two point crossovers is used for generating the child individuals for the next generation. To perform crossover operation parent individuals are selected randomly if it is lower than some mutation constant then mutation operation will be performed.

IV. CONCEPT3- IMAGE ENHANCEMENT USING REAL CODED GENETIC ALGORITHM

This concept [7] was introduced for a new automatic image enhancement technique based on real coded genetic algorithm. Automatic enhancement is a method that enhanced image without human interaction. This method is based on local enhancement technique. Local enhancement methods apply transformation function that is based on the gray level distribution [7]. This method was applied on each pixel at location (x,y).

$$g(x, y) = \left(k \cdot \frac{M}{\sigma(x, y) + b} \right) \cdot [F(x, y) - c \cdot m(x, y)] + m(x, y) \quad (6)$$

0.5 < k < 1.5;
 $a \in \Psi_1, b \in \Psi_2, c \in \Psi_3$ with $\Psi_1, \Psi_2, \Psi_3 \subset R_+$

Where M is the global mean of image and f(x,y) is the gray level intensity of input image pixel at location (x,y). g(x,y) is the pixel's output gray level intensity value at the same location. $\sigma(x,y)$ and m(x,y) are standard deviation computed in a neighbourhood centred at (x,y) having n*n pixels [7]. In this method $b \neq 0$ that allows for zero standard deviation in the neighbourhood and $c \neq 0$ allows for original pixel gray level [7]. a,b,c and k are four parameters that is a string of four real genes are same for the entire image [8].

$$g(x, y) = T(f(x, y); a, b, c, k) \quad (7)$$

Where T is the operation given in equation (6). A enhanced image with good contrast has a high number of edges and also has a high intensity of the edges. The number of edges and their intensity are not enough to define a valid fitness criteria. So they have found following fitness.

$$F(x) = \log \left(\log \left(E(I(x)) \right) \right) \cdot \frac{n_{edges}(I(x))}{H_{size} * V_{size}} \cdot H(I(x)) \quad (8)$$

In the above equation F(x) is the fitness function and x is the chromosome. I(x) is the original image I with the transformation T applied according to equation (1). H_size and V_size are the number of pixels presented in both direction of the image. H(I(x)) is a measure of the entropy in the image [7]. E(I(x)) is the intensity of edges detected by Sobel edge detector.

$$E(I) = \sum_x \sum_y \sqrt{\delta h_1(x, y)^2 + \delta V_1(x, y)^2}$$

$$\delta h_1(x, y) = g(x+1, y-1) + 2g(x+1, y) + g(x+1, y+1) - g(x-1, y-1) - 2g(x+1, y) - g(x-1, y+1)$$

$$\delta V_1(x, y) = g(x-1, y+1) + 2g(x, y+1) + g(x+1, y+1) - g(x-1, y-1) - 2g(x, y-1) - g(x+1, y-1)$$

A combination between binary tournament that has a constant and high selection pressure with a K elitist scheme is used for selection. Arithmetic crossover is used to produce the children. Arithmetic crossover is defined as

$$x_1^0 = ax_1^p + (1-a)x_2^p \quad (9)$$

$$x_2^0 = (1-a)x_1^p + ax_2^p \quad (10)$$

Where $x_{[1,2]}^p$ are parents and $x_{[1,2]}^0$ are offspring. a is a random number that is generated from a uniform distribution. PCA mutation is used as the mutation operator that has very good capabilities in maintaining higher levels of diversity in the population [7].

V. CONCEPT4- IMAGE-CONTRAST ENHANCEMENT BASED ON A COMPREHENSIVE APPROACH

This Concept [9] was introduced for a novel comprehensive approach to image contrast enhancement. This method has a general functional form that is able to map different transformation function and uses a learning technique to select the parameter values that are used in image processing- a) each pixel of the image has assigned local measures of spatial activity. b) Human visual response based function is used to determine local contrast value for each pixel. c) On the basis of spatial activity of the image obtained from the transformation, parameters of a comprehensive contrast enhancement function are selected using a GA.

There are N numbers of individuals in GA population $f_i(x, y)$ is a contrast transformation function with k_i parameter that is represented by a string of length p processing then $k_n * p$ is sufficient to represent the parameter set of contrast transformation function. So $c + (k_n * p) * 3$ string length is used for the processing alternatives where C is the length of the function's code number [9]. The spatial activity classification is a primary task that is defined as the value of the sum of the differences of gray level intensities between adjacent pixels over a neighborhood. The measure of spatial activity SA_{xy} can be described by a masking function defined as [10].

$$SA_{xy} = \sum_{i=x-m}^{x+m} \sum_{j=y-n}^{y+n} w_{ij} \Delta B_{ij} \quad (11)$$

Where m and n are the dimensions of neighborhoods and ΔB_{ij} is the result of the edge operator on the location (i,j) and w_{ij} is the weight [9]. The constant value that is based on the Weber function [11] associated to the pixel(x,y) is defined as

$$C_{xy} = \frac{f(x, y) - I(x, y)}{I(x, y)} = \Delta I(x, y) / I(x, y)$$

$$I(x, y) = \sum_{i=x-p}^{x+p} \sum_{j=y-q}^{y+q} w_{ij} f(x-i, y-j) \quad (12)$$

Where p and q are the dimensions of the neighborhoods. I(x,y) is the average intensity of the neighborhoods and w_{ij} is the weight, four different function of the perceived constant curve for each region are observed- Constant, De Varies- Rose, Weber and Saturation [9].

To measure the fitness of each solution GA uses objective function that determined an optimal solution having the fitness values higher than a given threshold and representations condition for the iteration of the GA.

To analyze the local variations of the spatial activity in the image the original image is divided into small blocks [9]. The change of the average SA values are relative to same blocks can be calculated as

$$\Delta SA(i) = |\overline{SA(i)^a} - \overline{SA(i)^b}| \quad (13)$$

that represents the absolute variation of the average spatial activity in the i th range before $(SA(i)^b)$ and after $(SA(i)^a)$ the processing [9].

The ideal spatial activity $IASA$ is defined as

$$F = w_1 F_1 + w_2 F_2 + w_3 F_3 \quad (14)$$

Where w_1, w_2 and w_3 are the number of pixels belonging to each spatial activity domain and

$$F_j = \sum_i (\Delta(SA(i) - IASA(i))) \quad (15)$$

for $i \in SA$ class j , where $j=1,2,3$.

If F is less than 0, then the contribution of the second term of the sum, $w_2 F_2$ is low. So that the transformation function will heavily change the low and/or the high SA regions, that provides a large enhancement of the background. Higher value for F represents a greater enhancement of the image.

The GA fitness function is based on F so that the GA fitness function is represented by the weight product of the above term.

VI. CONCEPT 5 - POPULATION BASED INCREMENTAL LEARNING

As a GA works randomly. So it can be possible to lose the best solution due to random search. It also can be possible that the solutions are selected from the current population for recombination is best and if it is selected then the crossover and mutation operation will not lose some information of it. Its speed is very slow as compare to other search algorithm because it works globally. To avoid such problem of GA PBIL algorithm was introduced. It is the extension of GA. It is a combination of evolutionary optimization, the probabilistic incremental evolution algorithm and Bayesian optimization algorithm [12].

In PBIL algorithm population is generated from a single prototype vector of attributes to generate candidate solutions. Mutation and updates operation are performed using prototype vector. PBIL works in three phase- First is the number of samples that are generated using each probability vector before an update. Second is the number of steps for good solution. Third is the number of vectors to update.

A structure of prototype vector [12] is based on competitive learning in that activation of output unit is calculated by

$$output_i = \sum_j w_{ij} * input_j \quad (16)$$

Where w is the weight of connection between node i and j . Weight of the winning output is calculated by

$$\Delta w_{ij} = LR * (input_j - w_{ij}) \quad (17)$$

Replacement of the population of generation G from generation $G-1$ is computed by following formula

$$P(i, j) = P(x_i = j) = \frac{\sum_{V \in Population_{G-1}} Evaluate Vector(V)}{\sum_{V \in Population_{G-1}} Evaluate Vector(V)} \quad (18)$$

Probability update operation can be performed using the update rule of competitive learning.

$$probability_j = (probability_j * (1.0 - LR)) + (LR * vector \eta_j) \quad (19)$$

VII. CONCLUSION

In this paper we discussed about genetic algorithm based methods that measures the fitness of an individual by evaluating the intensity of spatial edges included in the image for image contrast enhancement. Chromosome structure based on LUT technique was introduced for those images contrast that are captured by a camera and image capturing system. Chromosome structure based on random selection of integer's technique is well suitable for those images that are used in area like consumer electronic products and other optical system. Automatic image enhancement using genetic algorithm method enhanced image automatically without human interaction. Comprehensive approach to image contrast enhancement does not require any prior knowledge of image to select the enhancement function. PBIL algorithm is the extension of GA. It was used to avoid the drawbacks of GA. It gives the result better than the above methods of contrast enhancement. If time is not constraint then PBIL gives better response as compare to GA.

In comparison to linear transformation and histogram equalization, genetic algorithm treats the image globally and produces image with natural contrast.

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Heart Disease Prediction from Horoscope of a Person Using Data Mining

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Abstract- This paper deals with finding out the possibilities of suffering a person from heart disease i.e. predicting heart disease from horoscope of a person using data mining techniques. Horoscope has 12 regions each occupying 30° . Each region is called an “house” that deals with different significations. There are total 12 planets that can occupy any house in a horoscope. According to position of the planets different angular combinations can be formed and these combinations are termed as “Yoga’s” that are used in predicting features of horoscope. Each house deals with different significations and the same set of combinations obtaining in a particular house might influence the different significations comprehended by the house, in different ways. To be more specific, let us consider the 4th house of a horoscope. It is supposed to signify mother, education, land and house properties. An illiterate person may possess many houses and a long-lived mother while a highly educated person may not possess any properties. This apparent inconsistency has been reconciled to some extent by the introduction of an important factor, viz., the Karaka (indicator). This paper aims at testing new horoscopes & finding out different possible angular combinations present in that horoscope and to predict the possibility of heart disease. This is also an approach to find out whether Astrology is a scientific study and application of language of the heavenly bodies or not.

Index Terms- Data Mining, Horoscope reading, Horoscope classification, heart disease prediction etc.

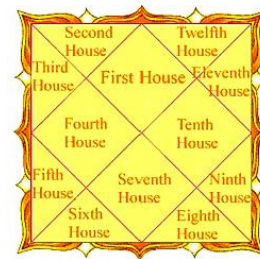
I. INTRODUCTION

Planets are constantly in motion with respect to earth in the skies. There is a strong belief that the positions of Sun, Moon and some planets close to earth can give important clues about the fortunes of individual human beings and groups of human beings. And that is the basic premise of astrology. There are many theories and philosophies in vogue and they are significantly different from each other. This astrological approach is known in the world by many names. Early pioneers of modern Indian astrology, like Dr. B.V. Raman, called it “Hindu astrology”, because this system was first taught by ancient Hindu sages.

This is an approach to find out whether Astrology is a scientific study and application of language of the heavenly bodies or not. Astrology is based on the fact that when the environment can effect our feelings, the moon can effect so far placed non-living (according to science) sea thus much bigger

planets like Sun, Venus etc. do effect the human behavior and it is left to us to predict what changes will they bring to our lives.

Sample Horoscope:



Every house in a horoscope indicates different significances. Viz.

House	Significance
First	physical appearance of the person, his basic instincts, health, longevity, nature, and the basic vitality with which the person will live his life
Second	house influences throat and eyesight. Speech is also one of the gifts of the second house.
Third	This house rules courage, stamina, intelligence, self-esteem, and also younger siblings in a person's life and his relationship with them, writing skills, aspects of jewellery and clothes, along with prospects of short journeys.
Fourth	As sukhashtan, it denotes prosperity, domestic surroundings and happiness in general. Old age, private and public affairs and inheritance can also be determined from this house
Fifth	The fifth house defines prospects in education (Vidyasthan) and children (Putrasthan). Other than that, it governs intellect and luck.
Sixth	Sixth house tells the stories of enemies, health and service life.
Seventh	Seventh house is an important house defining spouse and conjugal happiness. This bhava includes prospects in business partnerships as

	well.
Eighth	This house indicates diseases, Death and obstacles. It also determines sources of illegal income, mental pains, the mode by which person will die, and chances of imprisonment.
Ninth	Wisdom, wealth, reputation and higher learning are all the gifts of this house.
Tenth	This house defines Father, professional life and overall status person will achieve in his/her lifetime. Honor, power and authority are defined by occupation and other worldly activities.
Eleventh	Eleventh house talks about income, monetary gains and accumulated wealth. Honor and social success also succeeds the above-mentioned qualities, hence these are also defined here.
Twelfth	Private enemies, charity, pleasures of bed, sorrow, expenditures, losses and debts are defined by the twelfth house in horoscope.

Some astronomical facts about planets:

The following is a very brief description of the planets which are of relevance in Vedic astrology.

SUN:

This is the most important of the nine grahas. In fact the sun is our nearest star in the space with planets revolving around it. It is the source of all the natural light and the heat of the earth. It provides the centripetal force to balance the centrifugal force generated by the planets going around it. Its diameter is 1.392 million kilometers, which is almost 109 times the diameter of the earth. The mass of the sun is some 323,000 times the mass of the earth. It has extremely high surface and core temperatures, and goes on producing immense amount of energy. At one time the sun was considered as the center of the universe (this was never the view of Vedic astrology), but now we know it lies near the edge of the spiral arm of the milky way galaxy, lying some 30,000 light years from the galactic center, and sharing the rotation of the galaxy.

MOON:

It is a satellite of the earth. In Vedic astrology it is of great importance. It is the fastest moving planet and has the usual west to east movement along the zodiac. It has relatively small size, its diameter being only about 3476 kilometers. Its average distance from the earth is about 384,400 kilometers. It always presents the same face towards earth because it takes the same time to rotate once on its axis as it does to revolve once around the earth i.e. 27.32 days. Since the rotation is a uniform motion, while the motion in orbit is not, we may sometimes see an extra strip of the moon's surface on one or the other side. Some 59% of the total

surface of the moon may thus be visible to us on the earth at one time or the other. This phenomenon is called as liberation. The luminosity of the moon is caused by the light from the sun. It is the varying relative positions of the sun and the moon that produce the phases of the moon. These lunar phases, earlier discussed as tithis, are extremely important in Vedic astrology

MARS

Mars is the first of the outer planets and fourth in order of distance from the sun. Its orbit is highly elliptical as compared to that of earth, due to which its closest position may be only 56 million kms. Whereas at its farthest it may reach up to 100 kms. The brilliance of the mars depends upon its location. Mars is only twice as large than earth's moon. Its diameter being 6786 kms. It is at a mean distance of 227.8 million kms from the sun. The synodic period of the mars is 780 days, which is the interval between martian oppositions to the sun, with the earth lying in between. Mars rotates on its own axis in 1.026 days and has an orbital period of 687 days. Mars has two small satellites called phobo and deimos.

MERCURY

Mercury is the planet nearest to the sun and hence is extremely hot. It has a very eccentric orbit so its minimum distance (perihelion) from the sun is much less than its maximum distance (aphelion). Its mean distance from the sun is about 58 kms. and its diameter is 4870 kms, and its maximum inclination of about 7 degrees on either side of the ecliptic. Mercury rotates once round its axis in 58.65 days which is 2/3rd of its orbital period of about 88 earth days. (planet has maximum speed at perihelion and minimum at aphelion).

JUPITER

Jupiter is the largest planet of the solar system, its mass exceeding that of all the other planets combined together. Its rapid spin (once in 9 hours 50 minutes) has caused it to bulge at equator (diameter at equator 143,000 kms.) and to flatten at the poles (diameter 133,000 kms.). It is 318 times as massive as the earth and less than the 1000th part of the sun. Its mean distance from the earth is 778 million kms. And has an orbital period of 11.86 earth years. Being far away from the sun, it is a cold planet with its gaseous cloud having a temperature of 140 deg. below freezing point. There are perhaps 16 satellites which circle around Jupiter

VENUS

Venus is the second nearest planet to the sun. Its dense cloudy atmosphere reflects light extremely efficiently and accounts for the brilliance of this planet in the sky. The maximum inclination of this orbit is about 3.24 deg. on either side of the ecliptic. It is located at a mean distance of 108 million kms. and has a diameter of about 12,000 kms. The rotation period of venus is 242.6 days. An important fact about the rotation of venus is that it is retrograde, that is opposite to the general direction of rotations in the solar system. The orbital period of venus is about 224.7 days.

SATURN

It is the last of the naked eye planets. Its mean distance from the sun is 1426 million kms. Its rotation period is

approximately 10 hours 14 minutes, and its orbital period is 29.46 years. Saturn has a diameter of over 142 thousand miles at the equator. Being further away from the sun, Saturn is a cold planet. It is larger than the rest of the planets (except Jupiter) and is about 95 times as massive as the earth. Its characteristic feature is the presence of rings around it. At least twenty satellites are known to revolve around the planet. The extra-saturnine planets (Uranus, Neptune and Pluto) need the help of a telescope for their identification. They do not form a part of predictive Vedic astrology and are, therefore, not treated of here.

Astrologers designate the 12 signs as follows:

Aries, the first sign of the zodiac, is a cardinal fire sign. It is a positive, masculine sign, ruled by the planet Mars. Its symbol is the ram, and its glyph (symbol) is said to represent a ram's horns. It takes its name from the Greek god of war. Aries is associated with the head, and people with an Aries sun sign (the Sun is in the sign Aries in their natal chart) are prone to headaches and injuries to the head and face. The association of the head with Aries is the source of the expression "head-strong," which characterizes people with a strong Aries nature. Aries is dry, vernal and equinoctial (it begins on the vernal equinox), diurnal, movable, commanding, eastern, choleric, and aggressive. The native, that is, the person born under its influence, is tall of stature, of a strong but spare make, long face and neck, thick shoulders, piercing eyes, sandy or red hair, and brown complexion. The native's disposition is warm, hasty, and passionate. The aspects of the planets however, may materially alter these traits. (Aspects are the angular relationships between various points in a horoscope; in a natal chart the planets represent the various facets of one's psyche, and aspects between them indicate how these facets conflict or work together.) This sign rules the head and face. As the first sign, the key phrase for Aries is "I am," representing the birth of awareness.

Taurus, the second sign of the zodiac, is a fixed earth sign. It is a negative, feminine sign, ruled by the planet Venus. Its symbol is the bull, and its glyph is said to represent a bull's head and horns. It takes its name from the Greek word for "bull." A sign known for its stubbornness, it is the source of our expressions "bullheaded" and "stubborn as a bull." Taurus is associated with the throat and neck. People with a Taurus sun sign, although they often have beautiful voices, are also prone to sore throats, thyroid irregularities, and other neck problems. Taurus is cold and dry, melancholy, nocturnal, and southern. When influential in a nativity, it usually produces a person with a broad forehead, thick lips, dark curling hair, and melancholy, slow to anger, but when once enraged, violent, furious, and difficult to appease. Places ruled by Taurus are stables, cow houses, cellars and low rooms, and all places used for or by cattle. The key phrase for Taurus is "I have."

Gemini, the third sign of the zodiac, is a mutable air sign. It is a positive, masculine sign, ruled by the planet Mercury. Its symbol is the twins, and its glyph is said to represent a set of twins. It takes its name from the Latin word for "twins." Gemini is associated with the shoulders, arms, hands, and lungs. The native is tall and straight with long arms and well-formed hands and feet, rather dark complexion, brown hair, and hazel eyes. The native is strong and active in person, sound and acute in judgment, lively, playful, and generally skillful in business.

Places ruled by Gemini are hilly and high grounds, the tops of houses, wainscoted rooms, halls and theaters, barns, storehouses, and stairs. The key phrase for Gemini is "I think."

Cancer, the fourth sign of the zodiac, is a cardinal water sign. It is a negative, feminine sign, ruled by the Moon. Its symbol is the crab, and its glyph is said to represent the two claws of a crab. It takes its name from the Latin word for "crab." A moody sign, it is the source of the expression "crabby." Cancer is associated with the breasts and the stomach. It is a cold, moist, nocturnal, and exceedingly fruitful sign, more so than any other. The native is fair and pale, short and small, with the upper part of the body larger in proportion to the lower, a round face, light hair, and blue or gray eyes. The native is phlegmatic and heavy in disposition; weak in constitution, and of a small voice. Places associated with Cancer are the sea and all rivers, swamps, ponds, lakes, wells, ditches, and watery places. The key phrase for Cancer is "I feel."

Leo, the fifth sign of the zodiac, is a fixed fire sign. It is a positive, masculine sign, ruled by the Sun. Its symbol is the lion, and its glyph is said to be a modified version of the initial letter of its Greek name. It takes its name from the Latin word for "lion." Leo is associated with the back and, especially, the heart. The association of Leo with the heart is the astrological basis for the common expression "lion hearted." Leo is hot, dry, commanding, and very barren. When this sign ascends in a nativity, the individual has a tall and powerful frame and is well shaped, with an austere countenance, light, yellowish hair, large piercing eyes, commanding aspect, and ruddy complexion. The character is fierce and aggressive, yet open, generous, and courteous. This sign is more modified by planetary influences than any other. Leo governs woods, forests, deserts and hunting grounds, and fireplaces and furnaces. The key phrase for Leo is "I will."

Virgo, the sixth sign of the zodiac, is a mutable earth sign. It is a negative, feminine sign, ruled by the planet Mercury. Its symbol is a young woman, and its glyph is said to represent a serpent. Virgo takes its name from the Latin word for "virgin." Virgo is associated with the nervous system and, especially, with the bowels. Virgo is cold, dry, barren, and melancholy. The native is handsome and well shaped, slender, of average stature, with a clear, ruddy or brown complexion, dark hair and eyes, a rather round face, and a voice sweet and clear but not strong. The character is amiable and benevolent, witty and studious, but not persevering; and if not opposed by planetary aspects, apt to oratory. Virgo is associated with cornfields and granaries, studies and libraries. The key phrase for Virgo is "I analyze."

Libra, the seventh sign of the zodiac, is a cardinal air sign. It is a positive, masculine sign, ruled by the planet Venus. Its symbol is the scales, which its glyph is said to represent. It takes its name from the Latin word for "pound weight," or "scales." Libra is associated with the lower back, buttocks, and kidneys. Libra is sanguine, hot, moist, and diurnal. The native is tall and well made, very handsome, of a fine, ruddy complexion in youth, which changes to a deep red with advancing years. The native has long, flaxen hair, gray eyes, a courteous disposition, and a just and upright character. The places Libra rules are mountains, sawpits, and newly felled woods. The key phrase for Libra is "I balance."

Scorpio, the eighth sign of the zodiac, is a fixed water sign. It is a negative, feminine sign, ruled by the planet Pluto (in traditional astrology it was ruled by Mars). Its symbology is complex, being the only sign with three symbols—the scorpion, the snake, and the eagle. Its glyph is said to represent a serpent. It takes its name from the Latin word for "scorpion." Scorpio is associated with the sexual organs and the kidneys. Scorpio is a cold, nocturnal sign. The native has a strong, robust, corpulent body, is of average stature, and has a broad visage, dark but not clear complexion, dark gray or light brown eyes, black or very dark brown hair, short, thick legs, and a thick neck. Scorpio governs swampy grounds and stagnant waters, orchards and ruinous houses, especially near water. The key phrase for Scorpio is "I desire."

Sagittarius, the ninth sign of the zodiac, is a mutable fire sign. It is a positive, masculine sign, ruled by the planet Jupiter. Its symbol is the centaur (sometimes, alternately, the archer) and its glyph is an arrow, which refers to the arrow in the bow that the centaur is holding. It takes its name from the Latin word sagitta, "arrow." Sagittarius is associated with the hips, the thighs, and the liver. Sagittarius is hot, dry, and diurnal. The native is well formed and of slightly above-average stature, with fine chestnut hair, but inclined to baldness, a visage somewhat long but ruddy and handsome. The body is strong, stout, and hardy. The native is inclined to horsemanship and field sports, careless of danger, generous and intrepid, but hasty and careless. Sagittarius rules the hips and is the cause of gout, rheumatism, and disorders that affect the muscles. Accidents and disorders occasioned by intemperance come under the government of this sign. Sagittarius is associated with stables and parks. The key phrase for Sagittarius is "I see."

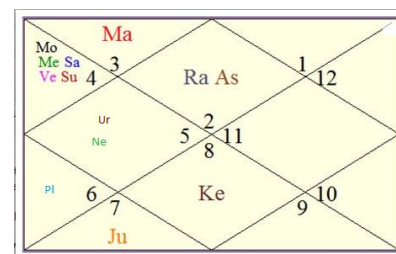
Capricorn, the tenth sign of the zodiac, is a cardinal earth sign. It is a negative, feminine sign, ruled by the planet Saturn. Its symbol is a goat with a fishtail, and its glyph is said to reflect this symbol. It takes its name from the Latin capricornus, "goat horn." Capricorn is associated with the bones and, especially, with the knees. It is a cold, dry, nocturnal, domestic sign. The native usually is tall, of slender stature and long, thin countenance, with a small beard, dark hair and eyes, long neck, and narrow chest and chin. The native is cheerful and collected, talented and upright. Ruling the knees and hips, Capricorn governs all diseases that afflict them, and also melancholy diseases such as hypochondriasis and hysteria. The places over which it has power are workshops and fallow grounds. The key phrase for Capricorn is "I use."

Aquarius, the eleventh sign of the zodiac, is a fixed air sign. It is a positive, masculine sign, ruled by the planet Uranus (before the outer planets were discovered, it was said to be ruled by Saturn). Its symbol is the water bearer, and its glyph is a pair of wavy lines representing water. Aquarius is associated with the shins, ankles, and the circulatory system. Aquarius is a hot, moist, rational, sanguine sign. The native is a well-made and robust person, of above-average stature, long face, but with a pleasing and delicate countenance, clear, bright complexion, and flaxen hair. The native is fair, open, and honest. Aquarius rules the legs and ankles and causes all diseases that affect them: lameness, swelling, cramping, and gout. It governs mines and quarries, flying machines, roofs of houses, wells, and conduits. The key phrase for Aquarius is "I know."

Pisces, the twelfth sign of the zodiac, is a mutable water sign. It is a negative, feminine sign, ruled by the planet Neptune (in traditional astrology it was ruled by Jupiter). Its symbol is two fish moving in opposite directions, tied together by a rope. Its glyph is said to be a stylized representation of this symbol. It takes its name from the plural of the Latin word for "fish." Pisces is associated with the feet. It is a cold, moist, nocturnal, and extremely fruitful sign, second only to Cancer. The native is short and ill shaped, fleshy, if not corpulent, with thick, round shoulders, light hair and eyes, pale complexion, and a large head and face. The native has a weak and vacillating disposition and is well-meaning but devoid of energy. Pisces rules the feet and causes lameness and every kind of disorder occasioned by watery humors. Pisces governs the same places as Cancer, except for the sea and rivers. The key phrase for Pisces is "I believe."

II. HOROSCOPE CHART

Is the one in which the order of the houses is fixed. It consists of four central rhomboidal houses (which are numbered 1, 4, 7 and 10, starting from the upper central rhomboid) and eight triangular houses. The sign rising at the time of birth is marked in the first house or the upper central rhomboid, and the remaining signs marked in regular order in an anti-clockwise direction.



III. CREATING A DATABASE FROM ABOVE HOROSCOPE

Every horoscope contains 12 planets, 12 different signs & 12 different houses. Depending on the placement of all these different angular combinations are formed. A horoscope can be identified by 13 attributes viz. Ascendant sign & signs of 12 Planets. A 14th attribute may be added to represent whether the person will suffer from heart disease or not.

IV. TABLE STRUCTURE

Attribute	Constraints	Datatype
Ascendent	Not Null	Varchar
Sun	Not Null	Number
Moon	Not Null	Number
Mars	Not Null	Number
Mercury	Not Null	Number
Jupiter	Not Null	Number
Venus	Not Null	Number
Saturn	Not Null	Number
Rahu	Not Null	Number
Ketu	Not Null	Number
Uranus	Not Null	Number
Neptune	Not Null	Number

Pluto	Not Null	Number
HeartDisease	Not Null	YES/NO

The values are inserted in the database as,

Ascendent	2
Sun	4
Moon	4
Mars	3
Mercury	4
Jupiter	7
Venus	4
Saturn	4
Rahu	2
Ketu	8
Uranus	5
Neptune	5
Pluto	6
HeartDisease	NO

The database can be created for many such horoscopes. This database will serve as the training set in predicting the newer dataset. The training set will contain many horoscopes (For testing, I used 2000 sample horoscope that definitely suffer from Heart Disease & 2000 sample horoscopes that do not suffer from Heart Disease) & is given as input to the classifying algorithm in WEKA.

V. INTERFACING WEKA WITH HOROSCOPE

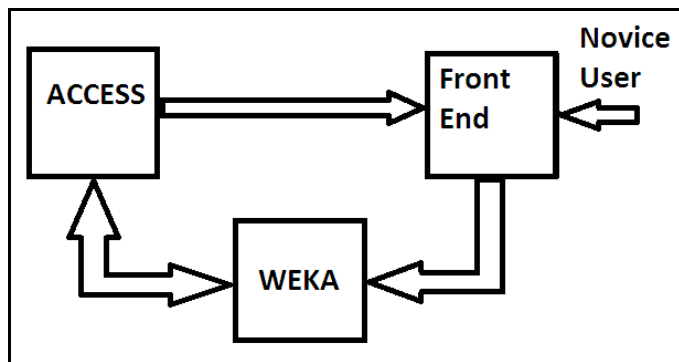


Fig: Applying Horoscope to the WEKA

VI. WEKA (WAIKATO ENVIRONMENT FOR KNOWLEDGE ANALYSIS)

WEKA is a collection of machine learning algorithms for data mining tasks. The algorithms can either be applied directly to a dataset or called from your own Java code. WEKA contains tools for data pre-processing, classification, regression, clustering, association rules, and visualization. It is also well-suited for developing new machine learning schemes.

A database created above can be given as input to the WEKA algorithm such as Neural Networks, Lazy, Decision

Table etc. & a model can be built up from this input. This model is then used in predicting the nature of new horoscope.

VII. RESULTS

Sr. No	Training Set Size	Algorithm	Accuracy (%)
1	4000	Decision Table	82
2	4000	MultilayerPerceptron	76
3	4000	J48	52
4	4000	LWL	91

VIII. CONCLUSION

Predicting heart disease from horoscope of a person is successfully find out using data mining techniques.

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Optimization of Video Streaming Quality in 802.16

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Abstract- 802.16 also called WiMax is the latest wireless technology that is being used. Video streaming which is one among the multimedia applications is being tremendously used with the increased use of internet. In centralized networks such as WiMax the base station takes care of allocating the appropriate time or frequency slot for all the subscriber stations that are competing for the medium depending on the type of traffic that each subscriber station holds thereby providing quality of service support by differentiating among the traffic types. The traffic in WiMax is prioritized by the scheduling service that is employed at the MAC layer. However encoding video with efficient encoding codec's is necessary for optimizing the video quality thereby minimizing the distortion at the receiver end. There may be several reasons for distortion in the video quality at the receiving end like transmission errors, loss of important video frames etc, However we concentrate only on the second one i.e. distortion due to loss of any important frames which would obviously result in deteriorating of the video quality at the receiver end. The system uses MPEG-4 for encoding the video.

Index Terms- WiMax, QOS, IEEE 802.16 and MPEG-4

I. INTRODUCTION

IEEE 802.16 is a set of standards for building up a wireless network similar to that of Wireless Local area networks. WiMax stands for worldwide interoperability for micro wave access technology. The name "WiMax" was created by **WiMax Forum**, which formed in June 2001. The basic intention was to promote conformity and interoperability of the standard. However what differs WiMax from WLANs is that WiMax supports high data rates and more coverage range (i.e. more number of subscriber stations can be served by a base station). It is said that Wi-Fi is capable to cover up to a range of just 30 meters where as WiMax can cover a radius of 50 km. WiMax supports TDMA or FDMA duplexing techniques at the mac layer. These techniques are responsible for performing the Quality of service differentiation i.e., base station may serve the subscriber stations either by employing TDMA or FDMA. With TDMA each subscriber station is given a different time slot (slots are of variable lengths depending on the type of traffic the station

has to transmit) with same frequency. In case of FDMA all subscriber stations can transmit at same time but at different frequencies. Unlike 802.11, 802.16 are centralized, which means any subscriber station if wants to transmit needs to get its appropriate slot from the base station. However when considering TDMA mechanism the wireless medium is divided into frames of time slots. Each frame is then divided into two sub frames. One is the uplink sub frame and the second downlink sub frame. Uplink sub frame is used for transmission from subscriber stations to the base station and the downlink sub frames are used by the base station for transmitting to the subscriber stations [8]. However what is required is that at the MAC layer both base station and subscriber stations be synchronized at all times there by transmitting in their appropriate time slots.

Different types of traffic can be streamed in network. When streaming video in any network what is important is that it needs to be sent fast and in order. In order to reach this constraint we opt for differentiated services, which means differentiating the service depending on the type of traffic. In general, WiMax at the mac layer supports five scheduling services. Through these WiMax is allowed to allocate different bandwidths to different stations depending on the priority of the application that each station holds. The five scheduling services are 1) Unsolicited Grants Service (UGS) 2) Real-Time Polling Service (rtps) 3) Extended Real-Time Polling Service (ertps) 4) Non-Real-Time Polling Service (nrtps) 5) Best Effort Service. Both UGS and rtPS scheduling services are designed for applications that do have any specific delay requirement. We concentrate only on rtPS which supports real time multimedia applications that generates variable size data packets like for example MPEG (moving pictures expert group) and VOIP (voice over IP).

II. IDENTIFY, RESEARCH AND COLLECT IDEA

In this section, we describe how video is encoded in an efficient manner. With this efficient encoding the distortion at the destination is reduced to a maximum. When a video needs to be streamed in the network it first has to be encoded. There are several encoding techniques available which include H.264, MPEG2, etc., we have chosen MPEG-4 standard for compressing the video. However what is important before streaming video is to exploit video data characteristics by considering the most significant information from the application layer. This will lead to improve the quality of the streamed video at the receiver end.

The MPEG-4 standard defines three types of video frames for the compressed video stream, which include I (Intra-coded) frame, P (Predictive-coded) frame, and B (Bi-directionally predictive-coded) frame. The MPEG I frame is an independent frame which means both its encoding and decoding is said to be independent which means that it can be coded as a still image, with no relationship to any of its previous or successive frames. The P frame is however said to be dependent on its preceding I or P frame. Encoding P frame uses prediction from the preceding I or P frames in the video sequence. Therefore the P frame requires the information of the most recent I frame or P frame for encoding and decoding. The B frame is dependent on the preceding and succeeding I or P frames. It is encoded using predictions from the preceding and succeeding I or P frames. According to the coding relation, in MPEG-4 video stream the most significant video type is the I frame, with the P frame being more important than B frame [3].

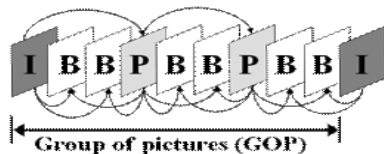


Figure 1: Prediction encoding of MPEG-4, GOP (N=9, M=3)
(from CH-Lin et al [3])

In general video sequence can be decomposed into smaller units, which we call GOP (Group of Picture), similar to a deterministic periodic sequence of frames (shown in figure 1). A GOP pattern is characterized by two parameters, G (N, M): N is the I-to-I frame distance and M is the I-to-P frame distance. For example, G (9, 3) means that the GOP includes one I frame, two P frames, and six B frames (as shown in figure 1). The next I frame successive to the 9 frames marks the beginning of the next GOP. B frames and P frames decoded are dependent on the preceding or succeeding I or P frames and are indicated by the arrows in the above figure. For MPEG-4 video stream, loss of any important frames would obviously result in deteriorating of the video quality at the receiver end. For example, the loss of one I frame would make all frames in the same GOP to be undecodable; while at the same time, one B frame loss just affects itself. However based on the importance of video frames at the MAC layer they are prioritized with the I frame as the highest; the P frame below I but above B's priority, and the B frame given the lowest priority.

Generally compressed video data is said to be highly sensitive to errors. There may be several reasons that cause the decoding failed at the receiver end and shall result in distortion of the pictures. Two of such reasons include transmission errors or dropping of some important video frames due to network congestion etc. What is important is to take care of the encoded video by properly setting up the priority to the encoded video frames in such a way that the most important frames say like I frames are not lost. Loss of such frames will result in the entire GOP to be undecodable by the receiving station. This results in minimizing/avoiding loss of the most important frames thereby avoiding the distortion at the receiver end. Therefore before directly streaming the encoded video we set priorities to the frames depending on their type to inform the network about their

prioritization. WiMax takes care of setting up the priorities to the different traffic types that the different subscriber station holds. The Mac layer takes care of QOS management in WiMax. However multiple traffic streams by a single subscriber station is a total different concept. Also a PRD model is used to relate the available power with the rate of encoding so as to minimize the distortion [Cheng et al. 2006]:

$$D(p_s, r_s, \sigma_s, \mu_s) = \sigma_s^2 2^{-\mu_s r_s g(p_s)}$$

Where σ_s^2 is the video sequence variance, μ_s is the encoder efficiency, and the function $g(p_s)$ represents the mapping between the video coder complexity and the microprocessor power consumption which is given by: $g(p_s) = p_s^{1/\gamma}$, where $1 \leq \gamma \leq 3$ is a system parameter [8].

III. SIMULATION SETUP

To evaluate the performance of the proposed solution we have used network simulator NS-2. The video used in the simulation is YUV QCIF (176 x 144), Foreman. Each video frame was fragmented into packets before transmission, while the maximum transmission packet size over the simulated network is 1000 bytes. A total of 15 nodes were used in the simulation setup. Apart from video there exist other flows like voice, constant bit rate and TCP traffic flows, for which voice is given the highest priority, video the second, CBR the third and finally TCP. Among these nodes one is a video sender and the other a video receiver. Where in a sender sends to the receiver via the base station. Higher priority video frames (I frames) are given higher priority during the transmission. However different traffics are started at different simulation times. Incase if the nodes move far away from the coverage range of the base station then the packets are said to be dropped.

IV. PERFORMANCE EVALUATION

In this section, we report our evaluation results that illustrate the effectiveness of our encoding based quality optimization in 802.16 against the optimization in 802.11e Wireless LAN. Fig.1 shows a resultant graph that reads the X and Y axis values from two trace files resulting in a comparison for distortion with 802.11e versus 802.16.

The x-axis indicates the time and Y-axis the distortion. The distortion in case of 802.11e for optimizing the video quality is said to slowly increase as time passes when compared to that of the 802.16 optimization of video quality with an efficient encoding technique. Also it is clear that after certain time in the simulation the distortion is said to be stable in case of the proposed solution but it is not so in case with 802.11e WLANs.

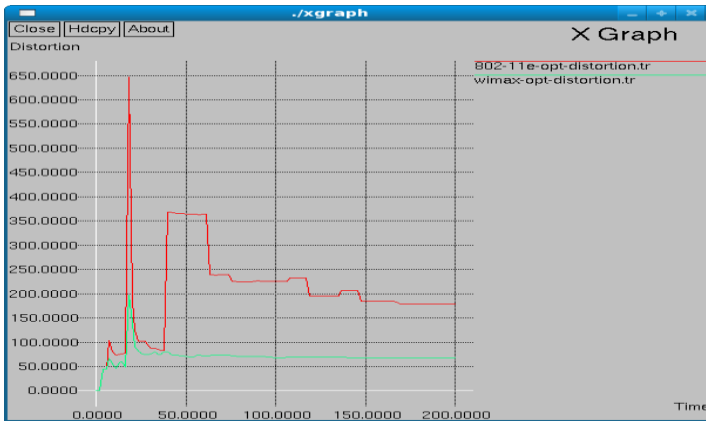


Fig. 1. X-Graph comparison for distortion in case of 802.11e with 802.16

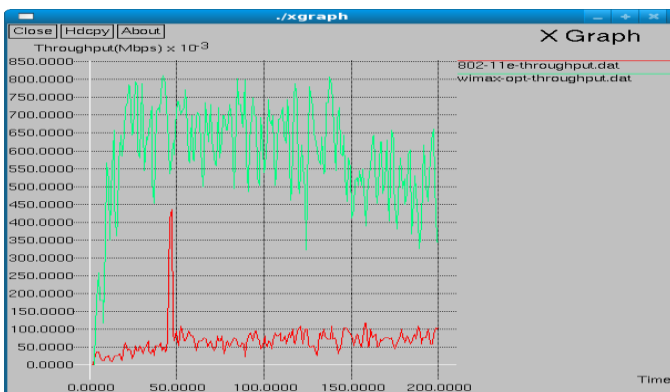


Fig. 2. X-Graph comparison for distortion in case of 802.11e with 802.16

Fig. 2 shows a resultant graph that reads both the X and Y axis values from two trace files resulting in a comparison for throughput with 802.11e versus 802.16.

The x-axis indicates the time and Y-axis the throughput. The throughput in case of 802.16 optimization of the video quality is very much high when compared to the throughput of 802.11e optimization of video quality.

V. CONCLUSION

We present the optimization of video streaming quality in WiMax networks with an efficient encoding mechanism that actually prevents the loss of the most important encoded video frames during their transmission in the network. Thereby reducing the distortion of the streamed video at the receiving end. Our investigation showed that this solution achieved good performance when compared against the cross-layer framework for optimization of video quality in WLANs.

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Histogram Equalization by Cumulative Frequency Distribution

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Abstract- Image enhancement is one of the most important issues in image processing. Various enhancement schemes are used for enhancing an image which includes gray scale manipulation, filtering and Histogram Equalization (HE). In This Paper I use a new method for image quality Enhancement by Histogram equalization. It will become a popular technique for contrast enhancement because this method is simple and effective. To perform histogram equalization of an image, we have to derive the cumulative density function and intensity mapping that will as best as possible of each pixel to equalize the image histogram. For each intensity in the original image, an intensity is calculated for the transformed image that has as close as possible, the same amount of Cumulative frequency.

Index Terms- Histogram Equalization, Cumulative density function, Intensity mapping, contrast enhancement.

I. INTRODUCTION

In general literature survey [1-7] we came to know that a histogram is the estimation of the probability distribution of a particular type of data. An image histogram is a type of histogram which offers a graphical representation of the tonal distribution of the gray values in a digital image. By viewing the image's histogram, we can analyze the frequency of appearance of the different gray levels contained in the image. If there are 256 gray levels and the image only has values between approximately 50– 100. Therefore this image has low contrast.

Contrast enhancement is an important area in image processing for both human and computer vision. It is widely used for medical image processing and as a preprocessing step in speech recognition, texture synthesis, and many other image/video processing applications [5], [7], [8], [9]. Different methods have already been developed for this purpose [3],[4], [6], [11],[12]. Some of these methods make use of simple linear/nonlinear gray level transformation functions [6] while some of the others use complex analysis of different image features.[12]

The main purpose of image enhancement is to bring out detail that is hidden in an image or to increase contrast in a low contrast image. Whenever an image is converted from one form to other such as digitizing the image some form of degradation occurs at output. Comparative analysis of different enhancement techniques will not be carried out here. An original image is normalized and the range of its intensities is [0, to 7], and $F(x)$ is the density function of intensity distribution of the original image, where $F(I)$ denotes the intensity value of the normalized image .and CuF denotes the cumulative density function of each

pixel. The desired density function of intensity distribution of the output image is equal to 1 after equalization

II. SOME EXISTING METHOD OF HISTOGRAM EQUALIZATION

A. Adaptive Histogram Equalization method:

The major objective of the Adaptive histogram Equalization method [11] is twofold; locally adaptive histogram equalization and reduction of undesired artifacts such as noise and blocking artifact. Move specifically, local adaptivity is incorporated by block-based processing, blocking artifact is reduced by overlapping adjacent blocks, and noise is suppressed by spatio-temporally adaptive filtering. The detail of block-overlapped histogram equalization algorithm is summarized as following without considering image boundary.

B. Recursive mean square histogram equalization method :

In this paper[4], a new contrast enhancement algorithm referred as the Recursive Mean-Separate Histogram Equalization (RMSHE) with scalable brightness preservation is proposed. The main idea lies on recursively separating the input histogram based on the mean.

The ultimate goal behind the RMSHE is to allows higher level of brightness preservation to avoid unpleasant artifacts and unnatural enhancement due to excessive equalization while enhancing the contrast of a given image as much as possible.

C. Global Histogram equalization method

Some enhancement algorithms have been developed for yielding better visual contrast such as global histogram equalization (GHE)[1]

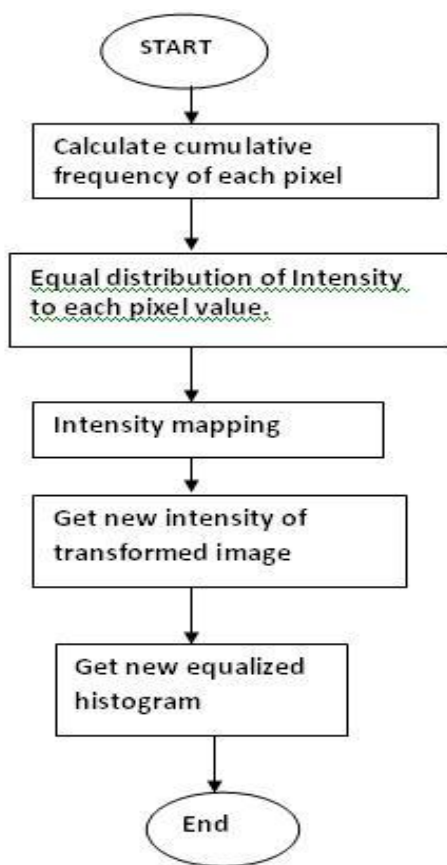
For GHE, the histogram is constructed using all pixels of the image. Next, using the histogram equalization technique, the enhanced image can be obtained by the new transformation function. GHE is fast and simple but can lead to an increase in noise

III. DESCRIPTION OF ALGORITHM

1. Create the histogram for the image.
2. Take eight possible gray scale level, i.e 0 to 7
3. Calculate the cumulative frequency distribution function

4. Maximum intensity value is divided into equal pixel value and only integer value is taken.
5. Assign new values for each gray value in the image.
6. Compare with the cumulative frequency of an equalized histogram.
7. Find intensity in the transformed image, that has close as possible the same amount of cumulative frequency.
8. Design the mapping

IV. THE BLOCK DIAGRAM FOR ALGORITHM IMPLEMENTATION



V. PROPOSED APPROACH FOR GETTING EQUALISED HISTOGRAM

Given an image as below, derive the intensity mapping that will as best as possible equalize the image histogram. The image histogram is as shown on the right. There are 8 possible grey scale levels from 0 to 7.

6	6	6	6	6
5	6	4	6	5
5	4	4	4	5
5	6	4	6	5
6	6	6	6	6

I	0	1	2	3	4	5	6	7
f(I)	0	0	0	0	5	6	14	0

calculate the cumulative frequency distribution (Cuf).

I	0	1	2	3	4	5	6	7
f(I)	0	0	0	0	5	6	14	0
Cuf	0	0	0	0	5	11	25	25

Idea is to derive an intensity mapping that will make the CuF turn into a straight slope

Compare with the CuF of an equalized histogram

In this case the Equalized (ideal) histogram needs to have $25/8$ pels in each bin = 3.125 but only integer numbers of pels are possible (its frequency after all). So I've added in one to make it ok

I	0	1	2	3	4	5	6	7
F(I)	0	0	0	0	5	6	14	0
Cuf	0	0	0	0	5	11	25	25
Feq	3	3	3	3	3	4	3	3

Design the mapping

I	0	1	2	3	4	5	6	7
F(I)	0	0	0	0	5	6	14	0
Cuf	0	0	0	0	5	11	25	25
Feq	3	3	3	3	3	4	3	3
CuFeq	3	6	9	12	15	19	22	25

For each intensity in the original image, find an intensity in the transformed image that has as close as possible, the same amount of Cumulative frequency

So for intensity 0, this has Cuf 0, and 0 is close to 3. CuFeq 3 generated for I=0. So Intensity 0 in the input image maps to intensity 0 in output image.

I	0	1	2	3	4	5	6	7
F(I)	0	0	0	0	5	6	14	0
Cuf	0	0	0	0	5	11	25	25
Feq	3	3	3	3	3	4	3	3
CuFeq	3	6	9	12	15	19	22	25

Intensity 1 in input maps to Intensity 0 in output Same
Intensity 2 and 3 in input maps Intensity 0 in output

I	0	1	2	3	4	5	6	7
F(I)	0	0	0	0	5	6	14	0
Cuf	0	0	0	0	5	11	25	25
Feq	3	3	3	3	3	4	3	3
CuFeq	3	6	9	12	15	19	22	25

But intensity 4 maps Cuf value 5 and 5 is the closest of CuFeq Value 6 which maps the intensity value 1. So input 4 maps 1 in output.

Input I	Output I
0	0
1	0
2	0
3	0
4	1

4 -> 1

Intensity 5 maps Cuf value 11. Which is close to CuFeq Value 12. which maps the intensity 3. So for input image 5 output image pixel value will be 3.

I	0	1	2	3	4	5	6	7
F(I)	0	0	0	0	5	6	14	0
Cuf	0	0	0	0	5	11	25	25
Feq	3	3	3	3	3	4	3	3
CuFeq	3	6	9	12	15	19	22	25

Input I	Output I
0	0
1	0
2	0
3	0
4	1
5	3
6	7
7	7

5 -> 3

6 -> 7

7 -> 7

And so on ... The new equalized histogram result is shown in the next part.

VI. THE EXPERIMENT AND RESULT

6	6	6	6	6
5	6	4	6	5
5	4	4	4	5
5	6	4	6	5
6	6	6	6	6

Original

Input I	Output I
0	0
1	0
2	0
3	0
4	1
5	3
6	7
7	7

7	7	7	7	7
3	7	1	7	3
3	1	1	1	3
3	7	1	7	3
7	7	7	7	7

Equalized

VII. CONCLUSION

The Proposed algorithm has been implemented using Cumulative frequency distribution without help of any probability density function. In order to evaluate the proposed method previous some method result are compared with this new approach. GHE[1] is fast and simple but cannot lead to an increase in noise. Resulting image is getting poor as inner region was darker and outer region was brighter. In Adaptive histogram[11] method over equalization is not prevented perfectly. In RMSHE method[4] blocking effect appears. The proposed method can prevent over equalization and remove noise. Contrast is enhanced 72% compared to other method and intensity become lower.

VIII. FUTURE ENHANCEMENT

This histogram equalization algorithm is executing for gray image basically. In future, for the enhancement purpose color images can be taken from the different application fields so that it becomes clearer that for which application which particular technique is better both for Gray Scale Images and color Images. Particularly, for color images there are not many performances measurement parameter considered. So, new parameters can be considered for the evaluation of enhancement techniques. New color models can also be chosen for better comparison purpose. Optimization of various enhancement techniques can be done to reduce computational complexity as much as possible.

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Numerical Solution of Multidimensional Integral by Using Newton Kote's Formula

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Abstract- In many different fields such as Physics, Geostatistics, Psychometrics, & finance among others the estimation process of parameters of a model involve the calculation of an integral. Although in principle, unfortunately the resulting (multidimensional) integrals usually does not have an analytic solution and therefore it is necessary to use numerical methods to approximate it. In this paper we mainly focus on the numerical solution of Weddle's rule by using Newton Kote's formula.

Index Terms- Numerical Integration, Multidimensional integral, Weddle's rule, Newton Kote's formula

I. INTRODUCTION

Numerical integration is the process of computing the value of definite integral from a set of numerical values of the integrand. The process is sometimes referred as mechanical quadrature. The approximate values of the definite integral which are either impossible to be computed analytically or for which anti derivative is too complex to be used. The inverse process to differentiation in calculus is represented by

$$I = \int_a^b f(x)dx \quad \dots\dots 1.1.1$$

1.3] Newton Kote's formula

Suppose $f(x)$ is given for equidistant values of x say $a = x_0, x_0+h, x_0+2h, \dots, x_0+nh = b$. Let the range of integration (a,b) is divided into n equal parts each of width h so that $b-a = nh$

By using fundamental theorem of numerical analysis it has been proved the Newton Kote's formula which is as follows.

$$I = nh \left[f(x_0) + \frac{n}{2} \Delta f(x_0) + \frac{(2n^2-3n)}{12} \Delta^2 f(x_0) + \frac{(n^3-4n^2+4n)}{24} \Delta^3 f(x_0) + \left(\frac{n^4}{5} - \frac{3}{2}n^3 + \frac{11}{3}n^2 - 3n \right) \frac{\Delta^4 f(x_0)}{4!} + \left(\frac{n^5}{6} - 2n^4 + \frac{35}{4}n^3 - \frac{50}{3}n^2 + 12n \right) \frac{\Delta^5 f(x_0)}{5!} + \left(\frac{n^6}{7} - \frac{15}{6}n^5 + 17n^4 - \frac{225}{4}n^3 + \frac{274}{3}n^2 - 60n \right) \frac{\Delta^6 f(x_0)}{6!} + \dots + \text{upto } (n+1) \text{ terms} \right]$$

This can be written in simplified form as follows

$$I = nh \left[f(x_0) + \frac{n}{2} \Delta f(x_0) + \frac{n(2n-3)}{12} \Delta^2 f(x_0) + \frac{n(n-2)^2}{24} \Delta^3 f(x_0) + \left(\frac{n^4}{5} - \frac{3}{2}n^3 + \frac{11}{3}n^2 - 3n \right) \frac{\Delta^4 f(x_0)}{4!} + \left(\frac{n^5}{6} - 2n^4 + \frac{35}{4}n^3 - \frac{50}{3}n^2 + 12n \right) \frac{\Delta^5 f(x_0)}{5!} + \left(\frac{n^6}{7} - \frac{15}{6}n^5 + 17n^4 - \frac{225}{4}n^3 + \frac{274}{3}n^2 - 60n \right) \frac{\Delta^6 f(x_0)}{6!} + \dots + \text{upto } (n+1) \text{ terms} \right] \quad \dots\dots 1.3.1$$

Which means that the integral of a function $f(x)$ with respect to the independent variable x evaluated between the limits $x = a$ to $x = b$. Equation 1.1.1 also corresponds to the area under the curve of $f(x)$ between $x = a$ and $x = b$.

1.2] Need for numerical integration

There are several reasons for carrying out numerical integration. The integrand $f(x)$ may be known only at certain points such as obtained by sampling. Some embedded system and other computer application may need numerical integration.

A formula for the integrand may be known but it may be difficult or impossible to find out an anti derivative which is elementary function. An example of such an integrand is $f(x) = e^{-x^2}$ the anti derivative of which can not be written in elementary form.

It may be possible to find an anti derivative symbolically but it may be easier to compute a numerical approximation than to compute the anti derivative. That may be the case if the anti derivative is given as an infinite series or product or if its evaluation requires a special function which is not available.

The equation 1.3.1 is referred as Newton Kote's formula.

1.4] Weddle's rule

Let the values of a function $f(x)$ be tabulated at points x_i equally spaced by $h = x_{i+1} - x_i$ so that $f_1 = f(x_1), f_2 = f(x_2), \dots$. Then Weddle's rule approximating the integral of $f(x)$ is given by

putting $n = 6$ in the Newton Kote's formula. For Weddle's rule the number of subinterval should be taken as multiple of 6.

Since we take $n = 6$ means $f(x)$ can be approximated by a polynomial of 6th degree so that seventh and higher order differences are vanishes in the Newton Kote's formula. This is illustrated in the following figure

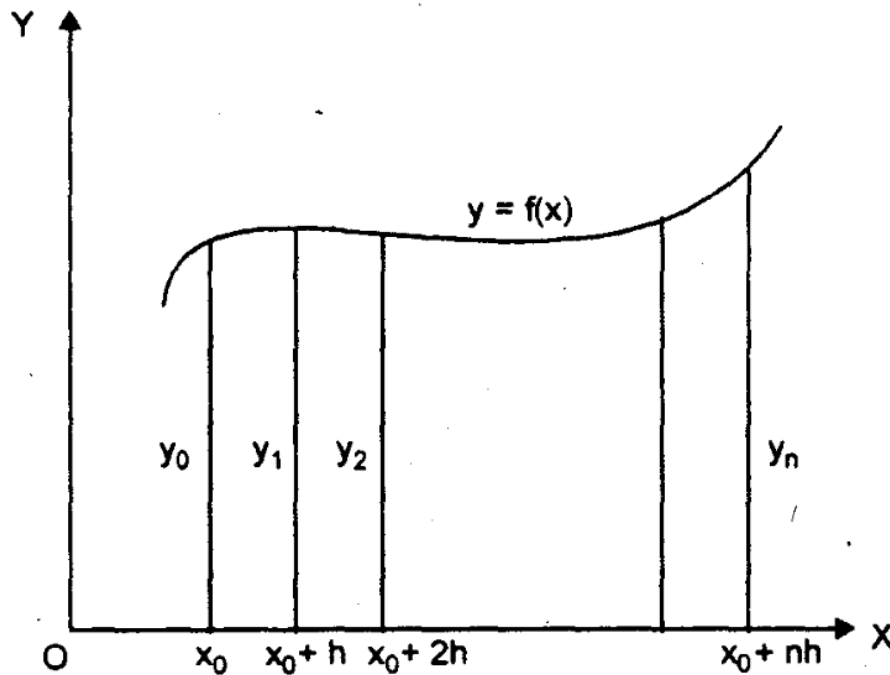


Fig 1.4.1: Illustration of Weddle's rule

To find the area we consider the integral as follows

$$I = \int_a^b f(x) dx = \int_{x_0}^{x_6} f(x) dx = \int_a^{a+6h} f(x) dx \quad \text{where } x_i = a + ih \text{ and } h = \frac{(b-a)}{6}$$

Substituting $n = 6$ in the above equation we get

$$I = 6h \left[f(a) + 3\Delta f(a) + \frac{9}{2}\Delta^2 f(a) + 4\Delta^3 f(a) + \frac{1}{24} \times \frac{246}{5} \Delta^4 f(a) + \frac{1}{120} \times 66 \Delta^5 f(a) + \frac{1}{720} \times \frac{246}{7} \Delta^6 f(a) \right]$$

$$I = \frac{6h}{20} \left[20 f(a) + 60 \{f(a+h) - f(a)\} + 90 \{f(a+2h) - 2f(a+h) + f(a)\} + 80 \{f(a+3h) - 3f(a+2h) + 3f(a+h) - f(a)\} \right. \\ \left. + 41 \{f(a+4h) - 4f(a+3h) + 6f(a+2h) - 4f(a+h) + f(a)\} + 11 \{f(a+5h) - 5f(a+4h) + 10f(a+3h) - 10f(a+2h) + 5f(a+h) - f(a)\} + \{f(a+6h) - 6f(a+5h) + 15f(a+4h) - 20f(a+3h) + 15f(a+2h) - 6f(a+h) + f(a)\} \right]$$

After simplifying we get Weddle's rule as follows

$$I = \frac{3h}{10} \left[f(a) + 5f(a+h) + f(a+2h) + 6f(a+3h) + f(a+4h) + 5f(a+5h) + f(a+6h) \right]$$

1.5] Composite Weddle's rule

$$\begin{aligned}
 I &= \int_{x_0}^{x_0+nh} f(x) dx = \int_{x_0}^{x_0+6h} f(x) dx + \int_{x_0+6h}^{x_0+12h} f(x) dx + \int_{x_0+12h}^{x_0+18h} f(x) dx + \dots + \int_{x_0+(n-6)h}^{x_0+nh} f(x) dx \\
 &= \int_a^{a+6h} f(x) dx + \int_{a+6h}^{a+12h} f(x) dx + \int_{a+12h}^{a+18h} f(x) dx + \dots + \int_{a+(n-6)h}^{a+nh} f(x) dx \\
 &= \frac{3h}{10} [f_a + 5f_{a+h} + f_{a+2h} + 6f_{a+3h} + f_{a+4h} + 5f_{a+5h} + f_{a+6h}] \\
 &\quad + \frac{3h}{10} [f_{a+6h} + 5f_{a+7h} + f_{a+8h} + 6f_{a+9h} + f_{a+10h} + 5f_{a+11h} + f_{a+12h}] \\
 &\quad + \frac{3h}{10} [f_{a+12h} + 5f_{a+13h} + f_{a+14h} + 6f_{a+15h} + f_{a+16h} + 5f_{a+17h} + f_{a+18h}] \\
 &\quad + \dots + \frac{3h}{10} [f_{a+(n-6)h} + 5f_{a+(n-5)h} + f_{a+(n-4)h} + 6f_{a+(n-3)h} + f_{a+(n-2)h} + 5f_{a+(n-1)h} + f_{a+nh}] \\
 &= \frac{3h}{10} [f_a + f_n + 5\{f_{a+h} + f_{a+5h} + f_{a+7h} + f_{a+11h} + \dots + f_{a+(n-5)h} + f_{a+(n-1)h}\} \\
 &\quad + \{f_{a+2h} + f_{a+4h} + f_{a+8h} + f_{a+10h} + \dots + f_{a+(n-4)h} + f_{a+(n-2)h}\} \\
 &\quad + 6\{f_{a+3h} + f_{a+9h} + f_{a+15h} + \dots + f_{a+(n-3)h}\} \\
 &\quad + 2\{f_{a+6h} + f_{a+12h} + f_{a+18h} + \dots + f_{a+(n-6)h}\}] \dots 1.5.1
 \end{aligned}$$

Equation 1.5.1 yields to give composite Weddle's rule. Weddle's rule is known to yield the most accurate results for hand calculators and those computers without preprogrammed routines.

1.6] Application of Numerical Integration

Numerical integration has always been useful in biostatistics to evaluate distribution function and other quantities. Emphasis in recent years on Bayesian and Empirical Bayesian method and on mixture models has greatly increased the importance of numerical integration for computing likelihood and posterior distributions and associated moments and derivatives. Many recent statistical methods are dependant especially on multiple integration possibly in very high dimension.

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DHBA Increases Solubility of Iron With Surface Reductase And Enhances Algal Growth of Marine *S. obliquus*/*Nostoc*

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Abstract- DHBA (2,3-Dihydroxybenzoic acid) increases the solubility of iron and this phenomenon helps out for enhancing the growth of marine algae for CO₂ sequestration to minimize the atmospheric global warming. Stability constant of DHBA by mole ratio method at pH 7.8 is that 15 days. The growth of *S. obliquus* and *Nostoc* is analyzed by analyzing chlorophyll-a content in this medium. Chlorophyll-a in DHBA-Fe sufficient is high as compared with DHBA, Fe deficient medium. DHBA-Fe (4:1) shows maximum growth as compared to (2:1) and (1:1). Finally this growth was reduced due to lack of nutrients in the medium. The solubility of iron with DHBA is due to surface reductases enzyme present on algae.

Index Terms- *Nostoc*, *S. obliquus*, Siderophore, Stability constant, XRD

I. INTRODUCTION

Siderophore is an iron chelating compound secreted by all microorganisms. The importance of siderophores extends beyond their immediate role in microbial physiology and their applications in biotechnology (Messenger and Ratledge, 1985) as well as in antimicrobial activity (Duffy and Defago, 1999). Global warming is a predominant problem in front of world. To minimize this problem carbon capture and storage within plant and algae by photosynthesis can be done. For increase growth of algae in ocean, siderophore is important enhancer (Balley and Taub, 1980). Particulate and colloidal iron is believed to be unavailable to phytoplankton (Wells et al., 1995; Finden et al., 1984; Rich and Morel, 1990) and the solubility of iron in open ocean waters is extremely low, log [Fe(III)]_{b_9} (Liu and Millero, 2002). Regarding dissolved iron, it has been proposed that eukaryotic phytoplankton species utilize only inorganic iron species (Anderson and Morel, 1982). However, more recent studies have shown that some eukaryotic algae are able to utilize iron bound to organic chelators via a cell surface reductase mechanism (Jones et al., 1987; Soria-Dengg and Horstmann, 1995; Hutchins et al., 1999; Maldonado and Price, 1999; Weger, 1999). Unlike eukaryotic algae, marine bacteria acquire iron through a siderophore-mediated uptake system (Winkelmann, 1991). The stability constants of Fe (III)-siderophore complexes are in the range of log K=25–50 (Albrecht-Gary and Crumbliss, 1998). Besides increasing the solubility of iron, siderophores also accelerate iron oxide dissolution (Hersman et al., 1995; Yoshida

et al., 2002; Cheah et al., 2003; Kraemer, 2004). Siderophores are biologically important and therefore in this study we used 2,3-Dihydroxybenzoic acid (DHBA).

II. MATERIALS AND METHODS

2.1 Materials

2,3-Dihydroxy benzoic acid (DHBA) catecholate type and ferric oxide (red) were obtained from Across and Fine-Chem Limited respectively. All other chemicals used in this study were of Analytical grade from E-Merck, India Ltd., Mumbai, India.

2.1.1 Algal Cultures

Axenic culture of *Scenedesmus obliquus* and *Nostoc* were obtained from the Botany Department of the Nagpur University and grown in a BG-11 (Rippka et al., 1979) medium in batch culture in 250ml flasks. Cultures were incubated at 25° C under an intensity of 40 $\mu\text{Em}^{-2}\text{s}^{-1}$ provided by cool white lamps, with 14h/10h/light/ dark cycles. Cultures were shaken manually once every day.

2.2 Methods

2.2.1 XRD Pattern

XRD (X-ray diffraction) analysis was done by the Rigaku miniflex II X-ray diffractometer. The crystal structure of ferric oxide was observed.

2.2.2 Estimation of iron

Iron was estimated by 1,10-phenanthroline method (APHA, 1995). In which DHBA was added in reference for detection of solely iron. Then the absorbance was measured at wavelength 510 nm and the concentration of samples was calculated by plotting standard graph using ferrous sulphate.

2.2.3 Stability constant

The stability constant was performed by mole-ratio method in which the series of the solution was prepared containing constant amount of Fe but increasing the concentration of DHBA and OD was measured.

2.2.4 Incubation and cultivation

The *Scenedesmus obliquus* and *Nostoc* were incubated in both standard and modified material BG-11 medium (Rippka et

al., 1979). In the latter, iron in the form of ferrous sulphate along with chelating agent DHBA were excluded from the original medium having pH 7.8.

Scenedesmus obliquus and *Nostoc* cells were cultivated on Fe and chelating agent deficient as well as Fe and chelating agent (DHBA) sufficient growth media. Five different experiments were carried out for study of DHBA and Fe complexation on growth of *S. obliquus* and *Nostoc* which included DHBA and Fe deficient, DHBA (0.005 M) and Fe (0.005 M) i.e. in 1:1 ratio, DHBA (0.01 M) and Fe (0.005 M) i.e. in 2:1 ratio, DHBA (0.02 M) and Fe (0.005 M) i.e. in 4:1 ratio. The culture were incubated for 21 days at 25°C.

2.2.5 Measurement of chlorophyll-a concentration

The chlorophyll-a concentration was used to track algal growth. Chlorophyll-a were measured by standard methods (APHA, 1995) extraction with acetone, and absorbance measurements at 664 nm and 750 nm (Jeffrey and Humphrey, 1975; Lorenzen, 1967; Strickland and Parsons, 1968).

III. RESULTS AND DISCUSSION

3.1 XRD Analysis

X-ray diffraction spectra are observed that shows ferric oxide has been recorded using Rigaku miniflex II X-ray diffractometer (Fig. 1). It is observed that the ferric oxide shows rhombohedral symmetry. The major XRD peaks were observed at 2θ values 33.260° , 24.200° , 35.700° , 43.620° , 49.580° , etc. compared with (JCPDS-85-0987).

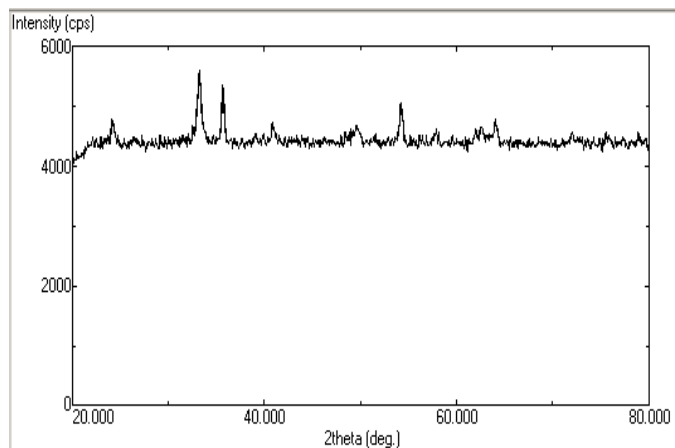


Figure 1: The XRD spectrum of Ferric Oxide

3.2 Stability Analysis

The stability constant of Fe-DHBA for a pH range of 2.51 and 7.8 as calculated by mole-ratio method is shown in (Fig. 2). An absorption maxima of Fe-DHBA complex is showed 310 nm and 547 nm at pH 2.51 and 7.8 respectively. On the basis of assumption the Fe^{3+} in the Fe^{3+} -DHBA complex is more stable at pH 2.51 than 7.8. The stability constant of Fe-DHBA is 19d and 15d at pH 2.51 and 7.8 respectively.

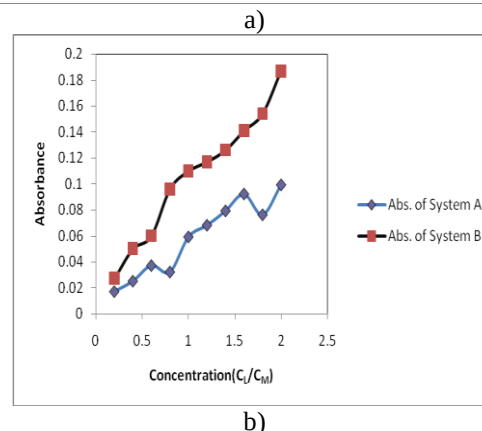
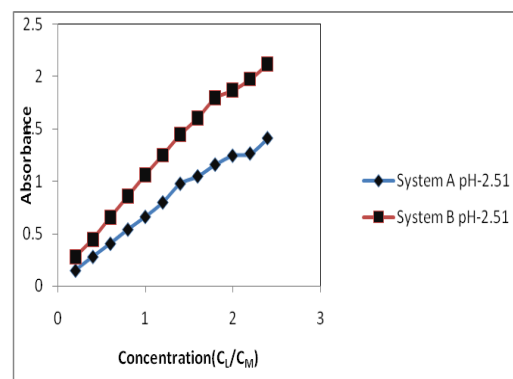
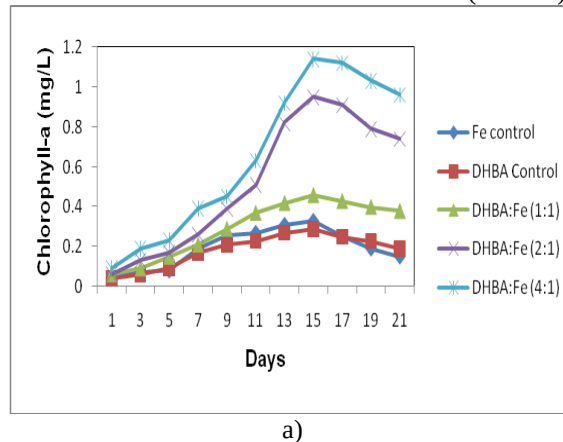
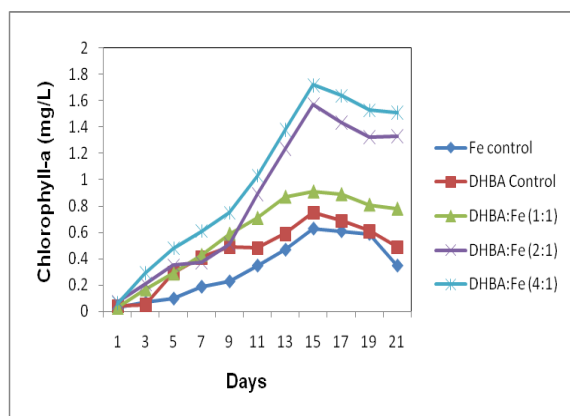


Figure 2: Graphical representation of stability constant a) at pH-2.51b) at pH-7.8

3.3 Effect of DHBA on Growth of *S. Obliquus* and *Nostoc*

The effect of DHBA and Fe complexation on growth of algae; DHBA-Fe 1:1 ratio, DHBA-Fe in 2:1 ratio, DHBA-Fe in 4:1 ratio, DHBA deficient and Fe deficient shows in figure (3). The population of *S.obliquus* and *Nostoc* are tended to increase gradually with the addition of DHBA complex with Fe. DHBA was added in media having pH 7.8 and at this pH; Fe (III) solubility was observed (Liu and Millero, 1999). The complexation between iron and DHBA allowed potentially bio-available iron and contributed to the growth of algae (Boyer & Groffman, 1996). As compare with Fe and DHBA deficient the growth of algae increases 3.45 times and 3.93 times in *S. obliquus* and 2.29 times and 2.73 times in *Nostoc* (Table 1).





b)

Figure 3 : Effect of DHBA on growth of a) *S. obliquus* b) *Nostoc*

Table : 1 Effect of DHBA-Fe complex on times of growth of algae.

a) On growth of <i>S. obliquus</i>			
<i>S. obliquus</i>	Times of growth	Increases in <i>S. obliquus</i>	
	DHBA-Fe(1:1)	DHBA-Fe(2:1)	DHBA-Fe(4:1)
Compare with Fe	1.39	2.87	3.45
Compare with DHBA	1.58	3.27	3.93

b) On growth of <i>Nostoc</i>			
<i>Nostoc</i>	Times of growth	Increases in <i>Nostoc</i>	
	DHBA-Fe(1:1)	DHBA-Fe(2:1)	DHBA-Fe(4:1)
Compare with Fe	1.21	2.09	2.29
Compare with DHBA	1.44	2.49	2.73

DHBA= 2,3-dihydroxy benzoic acid; Fe=iron

IV. CONCLUSION

Ferric-oxide shows absorptinon maxima at 475.61 nm indicating the formation of complex with DHBA is in vissible range. The stability of DHBA at pH 2.51 and 7.8 is upto 19 and 15 days respectively. This is due to conformational changes in DHBA by increasing the pH upto 7.8. The growth of *S. obliquus* and *Nostoc* showed pronounced effect in presence of DHBA (1:1), DHBA (2:1) and DHBA (4:1). The chrrophyll-a content at 15th day were 1.14 mg/L and 1.72 mg/L for *S. obliquus* and *Nostoc* at DHBA-Fe (4:1) which is indictive that potentially bioaviability of soluble iron. The iron can be solublised with the help of DHBA due to presence of specific reductases on plasmamembrane of algae (Cristoph Volker and Wolf-Gladrow, 1999). In DHBA-Fe (4:1) the growth increases but not consistence. This is due to more concentration of DHBA itself inhibit the complexation process therefore low solubility of iron. After 15 day the growth of algae decreases, this is due to the deficiency of micronutrient and macronutrient in the medium.

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“Reduction in Test Cases using Regression testing approach and cost effective test prioritization testing techniques” - APFD measure

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Abstract- Testing of software is an important means of assessing the software to determine its quality. Software testing has proven that testing, analysis, and debugging cost usually consume over 50% of the costs associated with the development of large software systems. Software testing and retesting occurs continuously during the software development lifecycle to detect errors as early as possible. The sizes of test suites grow as software evolves. Regression testing is an expensive testing process used to validate modified software and detect whether new faults have been introduced into previously tested code. To reduce the cost of regression testing, software testers may prioritize their test cases such that those which are more important, by some measure, are run earlier in the regression testing process. Test case prioritization techniques schedule test cases for regression testing in an order that increases their ability to meet some performance goal. One potential goal of such prioritization is to increase a test suite's rate of fault detection. An improved rate of fault detection during testing can provide faster feedback on the system under test and let software engineers begin correcting faults earlier than might otherwise be possible. Test case prioritization techniques schedule test cases for execution in an order that attempts to increase their effectiveness at meeting some performance goal. Sometimes it is difficult to choose appropriate prioritization technique for a given testing scenario. Thus we analyse the fault detection rates. This paper presents several strategies for selecting a smaller number of test suites by reordering the test cases. We have used a metric --- APFD for measuring rate of fault detection. Here we have

reordered the test cases, applied APFD metric to various test suites and reported the results of experiments using those techniques. The rate of fault detection is measured for different reordered test cases, comparing the rates achieved by randomly ordered and optimally ordered test cases.

Index Terms- software testing, test case, test prioritization, tests case reordering, test suits, regression testing

I. INTRODUCTION

Testing of software is an important means of assessing the software to determine its quality. Software Testing is an important process that is performed to support quality assurance or we can say testing of software is an important means of assessing the software to determine its quality. Testing activities support quality assurance by gathering information about the nature of the software being studied. Software testing has been proven that testing, analysis, and debugging costs usually consume over 50% of the costs associated with the development of large software systems. These activities consist of designing test cases, executing the software with those test cases, and examining the results produced by those executions. Studies shows that testing consumes 40~50% of development efforts, and consumes more effort for systems that require higher levels of reliability. So it is a significant part of the software engineering.

Software testing is a very broad area, which involves many other technical and non-technical areas, such as specification, design and implementation, maintenance, process and management issues in software engineering.

The definition of testing varies according to the purpose, process, and level of testing described. While discussing about software testing, let give an overview of software development life cycle (or SDLC) and a general software testing process. In general, the SDLC process contains the following phases: requirement gathering, design & analysis, development, testing, and Maintenance [1]. These phases can be represented as follows:

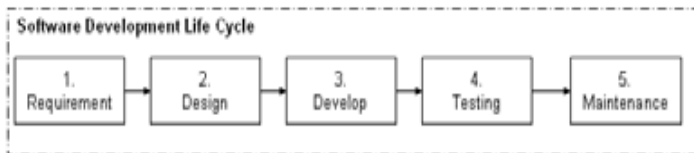


Figure-1: A General SDLC Process

One of the phases of SDLC is the testing phase [5] which contains the following processes:

- Test planning,
- Test development,
- Test execution
- Evaluation of result

These processes can be represented as follows:

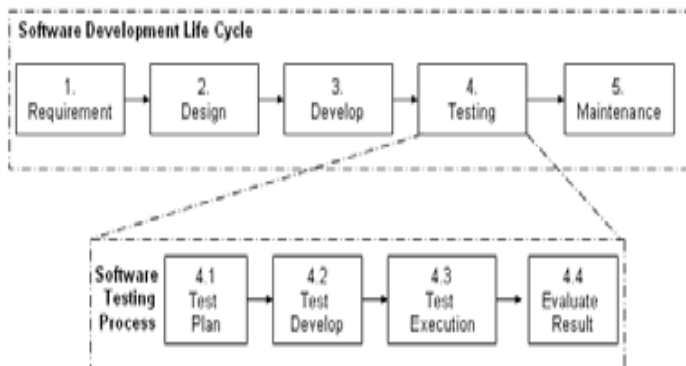


Figure-2: A General Software Testing Process

Miller gives a good description of testing in [2]:

“The general aim of testing is to affirm the quality of software systems by systematically exercising the software in carefully controlled circumstances”.

Software Testing is the process of executing a program or system with the intent of finding errors [3]. Software testing is a comprehensive set of activities which is conducted with the intent of finding the errors in software. In the software development process, software testing is the one activity which aimed at evaluating a software item such as system, subsystem and features (e.g. functionality, performance and security) against a given set of system requirements. Also we can say that a software testing is the process of validating and verifying that a program functions properly.

The researchers in the field of software testing have proven that software testing is one of the most critically important phases of

the software development life cycle, and it consumes significant resources in terms of effort, time and cost.

Arden [35] said that “The impact of software errors is enormous because virtually every business in the United States now depends on software for the development, production, distribution, and after sales support of products and services. Innovations in fields ranging from robotic manufacturing to nanotechnology and human genetics research have been enabled by low-cost computational and control capabilities supplied by computers and software.”

In a study conducted by NIST in 2002, reports that software bugs costs the economy the most. More than one-third of this cost could be avoided if better software testing was performed [35]. According to Boris [36], software testing takes around 40-70% of the time and cost of the software development process. Numerous approaches have been proposed to reduce time and cost during software testing process. These approaches include test case prioritization techniques and test case reduction techniques. Various Test case prioritization techniques and Test case reduction techniques are explained in [37], [38], [39], [40], [41], [16], [17] and [19]. Many empirical studies for prioritizing test cases have also been conducted and explained in [10], [11], [12], [13], [14] and [15].

Gregg Rothermel [39] has proven that prioritizing and scheduling test cases are one of the most critical tasks during the software testing process. In an industrial collaborators report, Gregg Rothermel referred that if there are approximately 20,000 lines of code then running the entire test cases requires seven weeks. In such a situation, test engineers may want to prioritize and schedule test cases in order such that test cases with higher priority are executed first. In the research of Gregg Rothermel [37] [9], he stated that test case prioritization methods and process are very much required because of the following:

- (a) The regression testing phase consumes a lot of time and cost to run
- (b) There is not enough time or resources to run the entire test suite
- (c) There is a need to decide which test cases to run first.

There are various goals to increase the effectiveness: one such goal involves rate of fault detection. Fault detection is a measure of how quickly faults are detected within the testing process. During testing an improved rate of fault detection can provide faster feedback on the system under test and help the software engineers to begin correcting faults as earlier as possible. One of the application of prioritization techniques is regression testing. It is defined as the retesting of software following some modifications. So here prioritization techniques can take advantage of information gathered about the previous execution of test cases to obtain test case orderings. In order to reduce the cost of regression testing, software testers may prioritize their test cases so that those test cases which are more important are run earlier in the regression testing process. One of the potential goals of such type prioritization is to increase a test suite's rate of fault detection.

Test case prioritization techniques prioritize and schedule test cases in an order that attempts to maximize some objective function. For example, software test engineers might wish to schedule test cases in an order that achieves code coverage at the fastest rate possible, exercises features in order of expected frequency of use, or exercises subsystems in an order that reflects their historical propensity to fail [4]. When the time required to execute all test cases in a test suite is short, test case prioritization may not be cost effective rather it will be most expedient simply to schedule test cases in any order [37], [9]. When the time required to run all test cases in the test suite is sufficiently long, the benefits offered by test case prioritization methods become more significant. As we know test case prioritization methods have great benefits for software test engineers but still outstanding major research issues that should be addressed [4]. The major areas of research issues are related to (a) existing test case prioritization methods ignore the practical weight factors in their ranking algorithm (b) existing techniques have an inefficient weight algorithm and (c) those techniques are lack of the automation during the prioritization process [30].

Section 2 discusses a literature review of existing test case prioritization techniques and prioritization processes. Section 3 proposes research challenges measuring the effectiveness. Section 3 also proposes test case prioritization techniques schedule test cases for execution in an order that attempts to increase their effectiveness to meet some performance goal. Section 4 provides the comparison related to APFD metric and calculating the rate of fault detection. Section 5 discusses conclusion and future work for test case prioritization area. The last section represents all source references used in this paper.

II. LITERATURE SURVEY

Software testing has been widely used as a way to help software engineers to develop high-quality systems. It is one of the important process that is performed to support quality assurance by gathering information about the nature of the software being studied M. J. Harrold [34]. These activities consist of designing test cases, executing the software with those test cases, and then examining the results produced by those executions. Boris [36] indicates that more than fifty percent of the cost of software development is devoted to testing with the percentage for testing critical software being even higher. As more as the software becomes pervasive, is used more often to perform critical tasks and the importance of its quality will remain high. When the engineers are unable to find efficient ways to perform effective testing, the percentage of development costs devoted to testing may increase significantly.

Test techniques include the process of executing a program or application with the intent of finding software bugs. It can also be stated as the process of validating and verifying that software meets the business and technical requirements that guided its design and development, so that it works as expected [30]. Software testing can be implemented at any time in the development process. Software engineers generally save test suites that they develop so that they can easily reuse those suites later as the software evolves. Reusing test cases in regression

testing process is pervasive in the software industry [34] and can save as much as one-half of the cost of software maintenance [36].

Arup Abhinna Acharya et. al., in their paper proposes a method to prioritize the test cases for testing component dependency in a Component Based Software Development (CBSD) environment using Greedy Approach [6]. According to Arup Abhinna Acharya et. al., the cost and time required for regression testing can be minimized by using the prioritization technique discussed in their paper. Here they have proposed a model based prioritization method by considering the number of Object Interactions per unit time as the objective function. Here more importance is given to number of inter component object interactions present because maximum faults are expected to be present when components interact with each other [6]. James A Jones et al. [7] have presented an algorithm for test suite prioritization that incorporates the complexities of modified condition or decision coverage.

Boris [8], claimed software testing should take around 40-70% of the time and cost of the software development process. Many approaches have been proposed to reduce time and cost during software testing process, including test case Prioritization techniques and test case reduction techniques. According to Elbaum et.al. , Test case prioritization techniques help engineers execute regression tests in an order that achieves testing objectives earlier in the testing process. In their paper they discussed that one testing objective involves *rate of fault detection* {a measure of how quickly a test order detects faults}. An improved rate of fault detection can provide earlier feedback on the system under test, enable earlier debugging, and increase the likelihood that, if testing is prematurely halted, those test cases that offer the greatest fault detection ability in the available testing time will have been executed [18].

Elbaum et. al. [22][23], Rothermel et. al. [20][21] chosen four heuristics for the target prioritization technique in their literature and investigation. Their literature and investigations in empirical studies that could or have been easily implemented by practitioners, allow them to examine two of the key dimensions of differences among techniques. These dimensions are the uses of feedback and information on modifications. For simplicity and to facilitate comparison, Elbaum et.al., Rothermel et al., restricted their attention to function-coverage-based techniques. Zheng Li et al. have tested experimentally that genetic algorithms perform well for test case prioritization [24].

In [32], Rothermel et al. pointed that the potential goal of prioritization is to increase a test suite's rate of fault detection earlier in the software process. It has been tested experimentally in [33] that some of the biggest causes for project failures are lack of user input and changing or incomplete requirements. Software engineers save the test cases and re-run the test cases as regression test in later versions.

Kim and Porter [25] also presented a technique, which they refer to as a "history-based prioritization" that utilizes information from previous testing cycles to select the test cases that must be

executed for a new version of the program. But this technique is not sometimes considered as a “prioritization technique” in the sense done in the literature because it imposes no ordering on test cases. Ordering of tests is the essential characteristic for the definition of prioritization. This approach selects a subset of a test suite, using history information to determine which test cases should be selected, and is more accurately described as a “regression test selection technique” by Rothermel and Harrold in 1996 [26].

Gregg Rothermel [27] has proven that prioritizing and scheduling test cases are one of the most critical tasks during the software testing process. They referred the industrial collaborators reports, which show approx 20,000 lines of code, running the entire test cases and require seven weeks. In this situation, test engineers may want to prioritize and schedule those test cases in order that those test cases with higher priority are executed first. Additionally, he [28], [29] stated that test case prioritization methods and process are required, because: (a) the regression testing phase consumes a lot of time and cost to run, And (b) there is not enough time or resources to run the entire test suite (c) there is a need to decide which test cases to run first [30].

According to A. G. Malishevsky et al., Test case prioritization has been primarily applied to improve regression testing effects as mentioned in their paper [31].

As we have seen above, Rothermel [38], [39] gave an interesting example of industrial collaborators. In such cases, testers may want to order their test cases so that those test cases with the highest priority, according to some criterion, are run first. Test case prioritization techniques prioritize and schedule test cases in an order that attempts to maximize some objective function. For example, software test engineers wish to schedule test cases in an order that achieves the code coverage at the fastest possible rate, exercises features in order of expected frequency of use, or exercises subsystems in an order that reflects their historical propensity to fail [4]. One of the interesting feature in Test case prioritization is: When the time required to execute all test cases in a test suite is short, test case prioritization may not be cost effective - it may be most expedient simply to schedule test cases in any order [38], [9]. When the time required to run all test cases in the test suite is sufficiently long, the benefits offered by test case prioritization methods become more significant. Test case prioritization techniques provide a way to schedule and run test cases, which have the highest priority in order to provide earlier detected faults. This study presents numerous techniques developed, between 2002 and 2008, that can improve a test suite’s rate of fault detection. With existing test case prioritization techniques researched, there is “4C” classification of those existing techniques, based on their prioritization algorithm’s characteristics. This classification is given as follows:

1. Customer Requirement-based techniques.
2. Coverage-based techniques.
3. Cost Effective-based techniques.
4. Chronographic history-based techniques [30].

III. TEST CASE PRIORITIZATION PROBLEM

Rothermel et al. (2001) define the test case prioritization problem and describe several issues relevant to its solution. Now to understand testing techniques properly, we will study the test case prioritization techniques and its problem in detail. The test case prioritization problem is defined as follows:

In Test Case Prioritization Problem, we have been given:

$T \rightarrow$ a test suite;

$PT \rightarrow$ the set of permutations of T ;

$f \rightarrow$ a function from PT to the real numbers.

The Problem of Test Case Prioritization is:

Find $T0 \in PT$ such that $(\delta T00) (T00 \in PT) (T00 \neq T0) [f(T0), f(T00)]$.

Here, PT represents the set of all possible prioritizations (orderings) of T , and f is a function that is applied to any such ordering and yields an *award value* for that ordering [18].

There are many of the possible goals for prioritization. Our main focus is on increasing the likelihood of revealing faults as earlier as possible in the testing process. By this goal one can informally improve the test suite's *rate of fault detection*. And to quantify this goal, we will use a metric APFD (Average of the Percentage of Faults Detected), introduced by Rothermel et al.

APFD helps to measures the weighted average of the percentage of faults detected over the life of the suite. The APFD values range from 0 to 100; the higher the number, the faster (better) is the fault detection rates.

Let T be a test suite containing n test cases, and let F be a set of m faults revealed by T .

Let TF_i be the first test case in ordering $T0$ of T which reveals fault i .

The APFD for test suite $T0$ is given by the equation:

$$APFD = 1 + \frac{TF_1 + TF_2 + ... + TF_m}{nm} + \frac{1}{2n} \quad (1)$$

We will consider a program with a test suite of five test cases. These test cases are from V to Z. The program contains ten faults detected by those test cases, as shown by the table in Table-1.

Table-1: Test suite and faults exposed

Tests	Faults									
	1	2	3	4	5	6	7	8	9	10
V	X				X					
W						X	X			
X	X	X	X	X	X	X	X			
Y					X					
Z								X	X	X

IV. MEASURING EFFECTIVENESS

Test case prioritization techniques schedule test cases for execution in an order that attempts to increase their effectiveness to meet some performance goal. In measuring the effectiveness,

we measure how rapidly a prioritized test suite detects faults. In other words, for finding the rate of fault detection of the test suite, we require an appropriate objective function. Here we are using APFD (Average of the Percentage of Faults Detected) metric. APFD helps to measure the weighted average of the percentage of faults detected over the life of the suite. The APFD values range from 0 to 100; the higher the number, the faster (better) is the fault detection rates. As an example we have taken a program with test suite of 5 test cases. These test cases are named V to Z. The program contains 10 faults detected by those test cases. Table-1 shows test suite and faults exposed. The APFD values represent the area under the curve by plotting percentage of faults detected on the y-axis of a graph, and Test Suite Fraction on the x-axis of a graph. The area inside the inscribed rectangles represents the weighted percentage of faults detected over the corresponding fraction of the test suite. In other words, the area under the curve thus represents the weighted average of the percentage of faults detected over the life of the test suite, since our aim is to measure how quickly the percentage of faults detected over the life of the suite.

Now we will illustrate the APFD measure for different test case orders using graphs. Consider the following orders of test cases: Order T1: V-W-X-Y-Z; Order T2: W-V-X-Y-Z; Order T3: X-Z-W-V-Y; Order T4: Z-Y-X-W-V; Order T5: Z-X-W-V-Y.

Suppose we place the test cases in order V-W-X-Y-Z to form prioritized test suite. The graph for order T1: V-W-X-Y-Z is shown as:

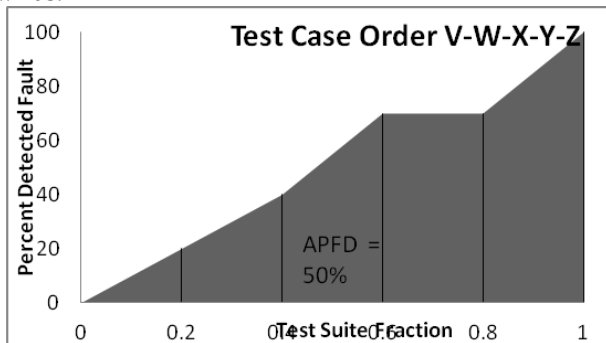


Figure 3A: APFD for prioritized test suite T1

Figure 3A shows the percentage of detected faults versus the fraction of test suites according to order T1. After running test case V, 2 of the 10 faults are detected; thus 20% of the faults have been detected. After running test case W, 2 more faults are detected and thus 40% of the faults have been detected. The area under the curve represents the weighted average of the percentage of faults detected over the life of the test suite. This area is the prioritized test suite's average percentage faults detected metric (APFD); the APFD is 50% in this example.

Suppose now we swap V with W and then place the test cases in order W-V-X-Y-Z to form prioritized test suite. The order T2: W-V-X-Y-Z received after swapping V and W alters the rate at which *particular* faults are detected, but not the overall rates of fault detection. Thus the orders V-W-X-Y-Z and W-V-X-Y-Z are equivalent in terms of rate of fault detection. This equivalence is reflected in equivalent APFDs (50%).

When the test case order is Order T3: X-Z-W-V-Y to form prioritized test suite. The graph for Order T3: X-Z-W-V-Y is shown as:

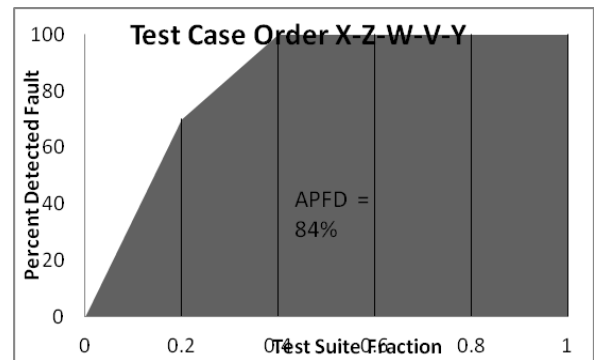


Figure 3B: APFD for prioritized test suite T3

Figure 3B also shows the percentage of detected faults versus the fraction of test suites according to order T3: X-Z-W-V-Y. Under the APFD metric this order is assigned an APFD value of 84%. This test order T3 (Figure 3B) is much faster detecting test order than T1 and order T2, (and in fact, an optimal order) with an APFD of 84.0%.

Now we consider the test cases in order Z-Y-X-W-V to form prioritized test suite. The graph for order T4: Z-Y-X-W-V (Figure 3C) is shown as:

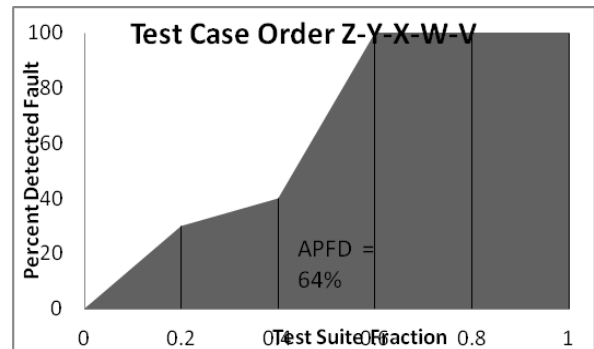


Figure 3C: APFD for prioritized test suite T4

Figure 3C also shows the percentage of detected faults versus the fraction of test suites according to order T4: Z-Y-X-W-V. Under the APFD metric this order is assigned an APFD value of 64%. This test order T4 (Figure 3C) is slower in detecting test order than T3 and much faster detecting test order than T1 and order T2 with an APFD of 64.0%.

Consider the test cases in order Z-X-W-V-Y to form prioritized test suite. The graph for order T5: Z-X-W-V-Y (Figure 3D) is shown as:

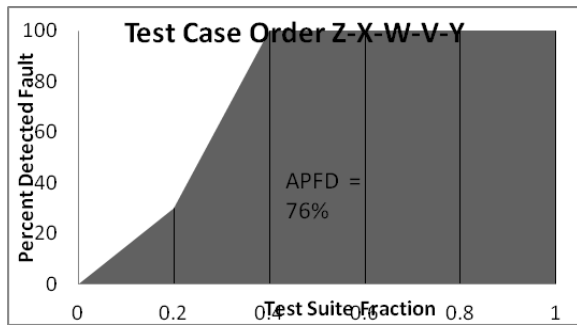


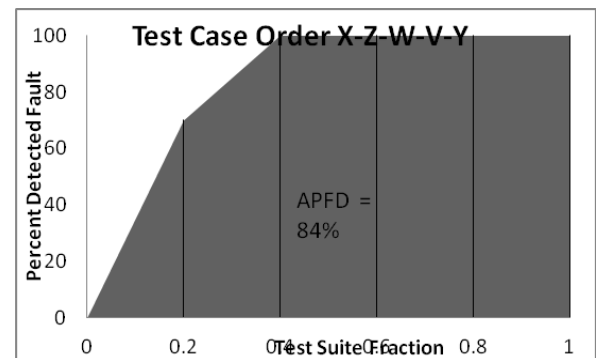
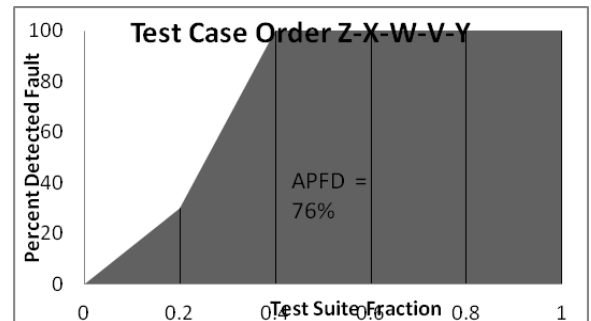
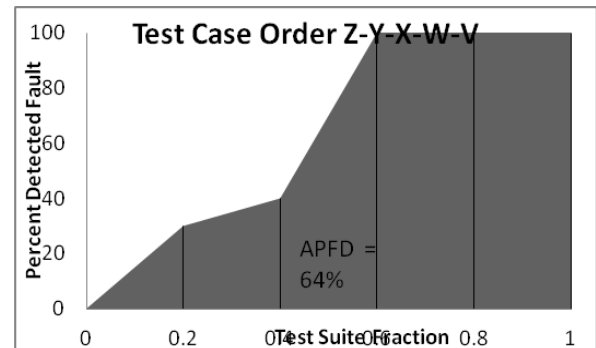
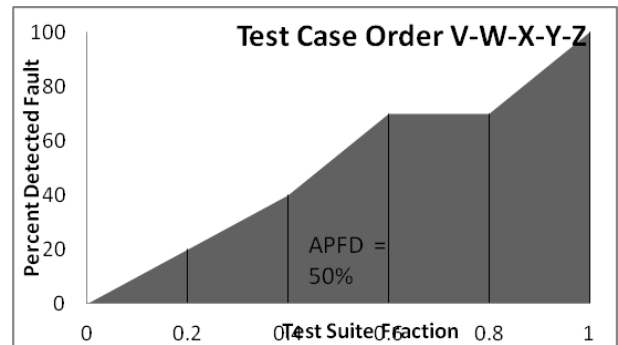
Figure 3D: APFD for prioritized test suite T5

Figure 3D also shows the percentage of detected faults versus the fraction of test suites according to order T_5 : Z-X-W-V-Y. Under the APFD metric this order is assigned an APFD value of 76%.

V. COMPARISON

Software maintenance is an important and costly activity of the software development lifecycle. To ensure proper maintenance the software undergoes regression testing. As we know, it is very inefficient to re execute every test case in regression testing for small changes. Hence test case prioritization is a technique to schedule the test case in an order that maximizes some objective function. One such objective function involves rate of fault detection. The Rate of fault detection is defined as a measure of how quickly faults are detected within the testing process. Early fault detection can provide a faster feedback generating a scope for debuggers to carry out their task at an early stage. Test case prioritization techniques schedule test cases for execution in an order that attempts to increase their effectiveness to meet some performance goal. In our experiments while measuring the effectiveness, we measure how rapidly a prioritized test suite detects faults. Thus, for finding the rate of fault detection of the test suite, we require APFD (Average of the Percentage of Faults Detected) metric. APFD helps to measures the weighted average of the percentage of faults detected over the life of the suite. The APFD values range from 0 to 100; the higher the number, the faster (better) is the fault detection rates. As explained above we have taken a program with test suite of 5 test cases named V to Z and contain 10 faults detected by those test cases. Table-1 shows test suite and faults exposed. The percentage of fault detected is plotted on y-axis and test suite fraction on x-axis of graph. The APFD values represent the area under the curve. The area under the curve thus represents the weighted average of the percentage of faults detected over the life of the test suite, since our aim is to measure how quickly the percentage of faults detected over the life of the suite.

As a summery, the following graphs illustrate the APFD measure for different test case orders we considered above.



From the above graph we can make a table of comparison showing the test case orders and Average of the Percentage of Faults Detected. The comparison table is shown as:

S.No.	Test Case Order	APFD Measure (%)
1	T1: V-W-X-Y-Z	50%
2	T2: W-V-X-Y-Z	50%

3	T3: X-Z-W-V-Y	84%
4	T4: Z-Y-X-W-V	64%
5	T5: Z-X-W-V-Y	76%

Table-2: Calculation of % fault detection

From table-2 we can conclude that when we consider the test case order T3: X-Z-W-V-Y, the APFD is 84%. This means that area is the prioritized test suite's average percentage faults detected metric (APFD) is 84%. Thus Test Prioritization Testing Techniques are found to be very effective in early fault detection as compared to non-prioritize approach.

The APFD metric presented above relies on two assumptions: (1) all faults have equal severity, and (2) all test cases have equal costs. These assumptions simply plots the percentage of faults detected against the fraction of the test suite run. In general when these assumptions hold, the metric operates well but in practice there are cases in which this APFD metric do not hold and can give the unsatisfactory results.

VI. CONCLUSION

We have presented techniques for prioritizing test cases that attempt to account for the effects of varying test case fault severity. Our focus in this work has been the APFD metric. If we select the similar types of test cases which give the same expected results then we can find the percentage of fault detection very easily. The higher APFD value the more number of faults are detected at early stages of software development. So now the main emphasis should be given on the techniques which can reduce the cost of testing. Since cost is the factor which affect the software development the most. If we can predict the set of test suites or test cases at the early stages of the software development, then cost of the software testing can be reduced. Time is also another factor. When the time required to execute all test cases in a test suite is short, test case prioritization may not be cost effective - it may be most expedient simply to schedule test cases in any order. When the time required to run all test cases in the test suite is sufficiently long, the benefits offered by test case prioritization methods become more significant. Suppose all ten faults are equally severe. Test cases V, W, Y, and Z each require one hour executing, but test case X requires ten hours. Consider test case order X-Z-W-V-Y. Under the APFD metric this order is assigned an APFD value of 84% (Figure 3B). The alternative to this test case is order Z-X-W-V-Y. This order is assigned an APFD value of 76% (Figure 3D). This metric does not differentiate test cases in terms of relative costs. Here all vertical bars in the graph have the same width. The APFD for this order is 76% – lower than the score for test case order X-Z-W-V-Y. In terms of faults-detected-per-hour, the second order (Z-X-W-V-Y) is preferable since it detects 3 faults in the first hour, and remains better in terms of faults-detected-per-hour than the first order up through the end of execution of the second test

case. We have kept the cost uniform while varying fault severities. So a new model should be generated in which cost must also be considered along with the rate of fault detection. The cost and time required for regression testing can be minimized by using the prioritization technique.

VII. CONTINUING WORK

We have presented APFD, for assessing the rate of fault detection of prioritized test cases that incorporates varying test case and fault costs. The proposed method can further be extended to prioritize test cases to perform regression testing for real time systems and distributed systems. We have presented a few prioritization techniques intended to improve prioritization under this metric, but there may be other techniques better suited to maximizing the objective function represented by APFD. Further we will try to construct an infrastructure to support experiments in which factors such as test cost and fault severity can be controlled and varied, and test cost and fault severity data drawn directly.

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New Antigenic Approach to Diagnose Visceral Leishmaniasis in India

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Abstract- Visceral Leishmaniasis (VL) is a vector borne anthroozoonotic disease caused by a protozoan, *Leishmania donovani*, of *Trypanosomatidae* family. The most precise methods used for its diagnosis includes the analysis of spleen & liver smears (90%), Bone Marrow smear (80%), sternal or iliac crest puncture, and referred as gold standard for diagnosis. Various serological tests like Aldehyde test, antimony test, Leishmania skin test, Direct agglutination Test(DAT), Indirect fluorescent antibody test (IFAT), ELISA etc. are also used to diagnose VL, but in the case of immunocomprised patient, diagnosis of VL is difficult due to low titer of antibody. Several molecular diagnostic techniques are also available but they need from more sophisticated laboratory and expertise person. The current article is devoted to the detection of specific antigen which are useful in diagnosis of VL in VL patients as well as in immunocomprised patients.

Index Terms- Visceral Leishmaniasis, LD bodies, Antibody detection, Antigens

I. INTRODUCTION

Visceral Leishmaniasis (VL) also known as Kala-azar (Hindi: kala means black, azar means sickness, also known as Assam fever, Dumdum fever, Sikari disease, Burdwan fever, Shahib's disease and tropical splenomegaly) was first described in 1824, in Jessore District of Bengal, what is now Bangladesh. Leishmaniasis, because of its importance, was selected by WHO out of six most precarious diseases under its special programme for research and training in tropical diseases. It ranks next to malaria among the human diseases caused by protozoan. The disease is endemic, covering almost the five continents, in 88 countries (16 developed and 72 developing or 66 countries are in the Old World while 22 countries located in the New World) with a total of 350 million people at risk and 12 million cases of infection. Out of 500, 000 cases of visceral Leishmaniasis, more than 90 percent are reported from India, Bangladesh, southern Sudan, Nepal and northeast Brazil. At the turn of the 20th Century VL was observed in many parts of India. In India, kala-azar (Visceral leishmaniasis; VL) affects millions of people, and the state of Bihar accounts for nearly 90% cases, followed by West Bengal and Eastern Uttar Pradesh. In Uttar Pradesh recently few active cases have been seen from eastern districts e.g. Varanasi, Gorakhpur, Gonda, Faizabad etc. where there is under reporting of kala-azar and post kala-azar dermal leishmaniasis in women and children 0-9 years of age. Untreated cases of kala-azar are associated with up to 90% mortality. Although disease is to

widely prevalent, the accurate data on the incidence and prevalence of Leishmaniasis is lacking especially from this part of the country.

II. MATERIALS AND METHOD

The standard strain of *Leishmania donovani* (Strain HOM/1N/80/Dd8: WHO reference strain originally isolated from human Kala-azar patients from Muzaffarpur, Bihar, India), is taken for the preparation of various antigens. NNN' Media is used to culture promastigotes. The polyacrylamide gel electrophoresis is carried out by Davis, B. J., 1964.

Pathological methods are mainly based on demonstrate of parasites in biopsies or aspirated from infected spleen, bone marrow and lymphnodes (Zijlstra et al., 1992). Their sensitivities are in the range of 90-95% (Manson Bahr 1987; Zijlstra et al., 1992). Parasitological diagnosis remains the gold standard in Leishmaniasis diagnosis, because of its high specificity.

Detection of LD bodies in smear of Spleen, bone marrow Painful, cumbersome and some times. Leishmanian test or Intradermal skin reaction or Montenegro reaction (Singh S, 2003) was also used. This is a test for Delayed type hypersensitivity. In this test an injection of 0.5 ml (5×10^7 phenol killed promastigotes) in volar aspect of the forearm of the patient leads to the formation of an induration measureable after 48 / 72 hours. Comparing the size of the induration with a control injection with phenol-saline in the other forearm it is possible to determine either an individual is infected or not. But this test not gives satisfactory result, because of large number of false positive and negative cases

Serological Diagnosis: Various serological tests are being used for the diagnosis of the disease but their demerits are that they cross react with other chronic diseases (Chatterjee, 1957; Evans, 1973). Other serological tests which have been used for the diagnosis are as:-

Napier Test. In Napier Test, About 1-2 ml of serum from a case of kala azar will be taken in a small glass tube and to it will add a drop or two of 40 % formalin. The aldehyde test procedure is simple. Five cubic millimeters venous blood is drawn from the patient and left for clotting. Serum is separated by removing supernatant after centrifugation. To one ml of serum, 2-3 drops of commercial formalin (40% formaldehyde) is added. Opaque jellification like white of a boiled egg indicates a positive reaction. Jellification time indicates intensify of infection as indicated in the table below.

Antimony Test (Chopra et al): This also depends upon a rise of serum gamma globulin. In Antimony test, 4% of urea stibamine solution in distilled water will add to whole serum from kala-azar patients in a small tube. A positive test will be indicated by the formation of a profuse flocculent precipitate. A negative result is indicated when the two fluids mix without precipitation. As a diagnostic aid antimony test is less reliable than the aldehyde test.

Complement Fixation Test with W.K.K. Antigen: This test depends upon the presence of certain immune bodies in blood sera of kala-azar patients, the antigen used in the test is prepared from either human tubercle bacilli (Witebsky, Kligenstein & Kuhn: WKK antigen) or from Kedrowsky's acid-fast bacillus. The test is essentially an antigen-antibody reaction in which the antibodies present in the serum are bound to an antigen.

Direct Agglutination Test: The Direct agglutination test (DAT) is a highly specific and sensitive test. It is inexpensive and simple to perform making it ideal for both field and laboratory use. The test is based on antigen-antibody reaction.

Indirect Immuno fluorescent Assay Test (IFAT): This is a commonly used technique for Kala azar. This is a specific and sensitive test requiring fewer amounts of antigens and detects the low titer of antibodies present in patient serum, which are demonstrated in the very early stage of infection and are undetectable six to ninth months after cure. If the antibodies persist in low titers, it is good indication of a probable relapse. The sensitivity and specificity of this test is 96 % and 98 % respectively.

Enzyme linked Immunosorbant Assay: ELISA has been used as a potential serodiagnostic tool for almost all infectious disease. Enzyme linked immunosorbent assay (ELISA) is also equally sensitive and specific but specificity depends upon the antigen used, requiring less amount of antigen. This is rapid inexpensive and simple to perform and can be used for diagnosis of Kala-azar for epidemiological work.

Rapid Immunochromatographic assay (dipstick or strip test): A promising ready-to-use immunochromatographic strip test based on rK39 antigen has been developed as a rapid test for use in difficult field conditions. The recombinant antigen is immobilized on a small rectangular piece of nitrocellulose membrane in a band form, and goat anti-protein A is attached to the membrane above the antigen band. After the finger is pricked, half a drop of blood is smeared at the tip of the strip, and the lower end of the strip is allowed to soak in 4 to 5 drops of phosphate-buffered saline, placed on a clean glass slide or tube. If the antibody is present, it will react with the conjugate (protein A colloidal gold) that is pre dried on the assay strip. The mixture moves along the strip by capillary action and reacts with rK39 antigen on the strip, yielding a pink band. In the strip of patients who are infected, two pinkish lines appear in the middle of the nitrocellulose membrane (the upper pinkish band serves as a procedural control). Several studies from the Indian subcontinent reported the test to be 100% sensitive).

Western Blot: A new method, the Western blot for detection of anti-leishmania antibodies in the sera is developed which allows specific serodiagnosis of Visceral Leishmaniasis in patients living in non-endemic areas (Salotra P, 1999). In non-endemic areas,

Molecular Diagnosis: A variety of nucleic acid detection methods have also been developed. PCR assay can detect presence of parasite DNA or RNA in blood sample of any clinical sign or symptoms. Different DNA-based methods have been used for characterization of isolates of Leishmania at (Bernhard Ronacher 2002)

- (a) **Genus level:** by performing PCR using Leishmania common primers depending on direct identification of the parasite in clinical
- (b) **Species level:** different methods could be applied, such as PCR which depends on species specific primers (Ibrahim et al., 1994), analysis of restriction fragment length polymorphism (RFLP), where the substrate can be whole genomic DNA, kDNA or PCR amplification products, analysis of kinetoplast and nuclear DNA including Southern blot hybridisation with specific DNA probes (Jackson et al., 1984; Beverley et al., 1987; Barker, 1989; Van Eys et al., 1989&1991)
- (c) **Strain level:** These methods are capable to detect variation among isolates of Leishmania belonging to the same species such as sequencing.

Antigen Detection: Antigen detection is more specific than antibody-based immunodiagnostic tests (De Colmenares et al., 1995). This method is also useful in the diagnosis of disease in cases where there is deficient antibody production (as in AIDS patients) (Riera et al., 2004). Because of the conditions prevailing in endemic area, any sophisticated method cannot be employed on a wider scale. There is a need for a simple rapid and accurate test with good sensitivity and specificity, which can be used without any specific expertise. A promising ready to use Latex test (KAtex) based on detection of antigen in urine has been developed as a rapid test for use in difficult field conditions (Attar et al., 2001).

III. RESULT & DISCUSSION

All above parasitological as well as serological techniques which are used to diagnose VL in India have some limitations and not is useful in field conditions. As we know that parasitological diagnosis is gold standard due to its specificity. Detection of LD bodies in smear of Spleen, bone marrow are invasive Painful, cumbersome and are not conveniently applicable under field conditions (Osman, 1998), but according to Neva & Sacks, 1990; Weiss, 1995, there is no possibility to distinguish between leishmania amastigotes belonging to the different species. *François Chappuis et al, 2007 demonstrated that*, The accuracy of microscopic examination is influenced by the ability of the laboratory technician and the quality of the reagents used. Leishmanian Skin Test not gives satisfactory result, because of large number of false positive and negative cases. LST requires culture facility to produce LST antigens. The different antigen preparation impact test sensitivity and the test

did not recognize present or past infections. In the case of gammaglobulin detection (serological diagnosis) in serum of the patients, the serum globulins also increase in a variety of infections and thus this test is considered to be rather non-specific. A positive reaction may also be seen in diseases like tuberculosis, cirrhosis of liver, malaria, etc. Further, in kala-azar, the test becomes positive only when infection is at least three months old and may remain so even after six months of cure. (Napier & Antimony) are non-specific, and show cross reaction with other pathological conditions, hence are unsuitable for diagnosis. Complement fixation tests by W.K.K. antigen gives better results. However, cross reactions are observed in cases of pulmonary tuberculosis, leprosy and Mycobacterium infections. Most serological tests are non-specific, permitting detection of antigen shared by related organisms. They do not distinguish antigens confined to a single species as group reactions mask specific ones. The major disadvantage of DAT is the relative long incubation time of 18 h and the need for serial dilutions of serum. Also, DAT has no prognostic value. DAT remains positive for a longtime after the disease is cured, and thus cannot be used as a test of cure or for diagnosis of relapses. Immunochromatographic dip stick test rK 39 has a drawback that an individual with a positive rK39 strip test result may suffer from an illness (malaria, typhoid fever, or tuberculosis) with clinical features similar to those of VL yet be misdiagnosed as suffering from VL. Using western blotting, one can find even minor antigenic differences among various organisms and thus detect cross reactive antigens. This process is time consuming, technically cumbersome, and expensive. Two urinary antigens of 72-75 and 123 kDa have been reported to be very useful in diagnosis and prognosis of Kala-azar with sensitivity of 96% and specificity of 100%.

Cruz *et al.* 2006 demonstrated that the detection of antigens in serum is complicated by the presence of high levels of antibodies, circulating immune complex, serum amyloid, rheumatoid factors, and autoantibodies,

Total 7 bands were obtained with Dd8 strain which were 35Kda, 27Kda, 19 Kda, 15Kda, 10Kda, 9.5Kda and 8 Kda. Of these 7 bands, 8.0 Kda protein fractions were shown to react with all kala-azar sera.

However, sera from cured cases of kala-azar and other disease sera did not show any reaction with this 8.0 Kda protein fraction. This 8.0Kda protein fraction was observed in all 14 isolates tested including DD8. Antigenic fractions of 8 of these isolates were electro-transferred on to the surface of NCP and subsequently immunoblotted.

IV. CONCLUSION

Many of the diagnostic methods / procedures are reported with due course of time but none of them was found completely reliable for the diagnosis of the VL. Review of several diagnostic approaches revealed that antigen detection is most sensitive and better technique to diagnose VL patients including immunocompromised ones. This review article will provide definitely the insight to the readers about the various methods and be helpful for the development of new specific antigens for the diagnosis of VL

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Performance Comparison between GA and PSO for Optimization of PI and PID controller of Direct FOC Induction Motor Drive

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Abstract- This Paper presents a comparative study of Genetic Algorithm method (GA) and Particle swarm optimization (PSO) method to determine the optimal proportional-integral (PI) and proportional-integral-derivative (PID) controller parameters, for speed control of a Field Oriented Control (FOC) induction motor. The FOC induction motor has been modeled in MATLAB (SIMULINK); the GA and PSO algorithm has been programmed and implemented in MATLAB. Comparing with traditional Ziegler-Nicholson method and the evolutionary algorithms (EA), it has been observed that during optimizing the controller parameters of a FOC IM drive with PSO the performance of the controller is improved for the step input in speed control as well as for speed tracking problem more efficiently, than Ziegler – Nicholson method and EAs.

Index Terms- FOC (IM), fitness function, GA, PSO, PI Control, PID control

I. INTRODUCTION

Induction motors has been widely used in various industries due to its robustness maintenance free operation, better efficiency and lower cost. In different industries, wide range of speed control with fast torque response regardless of load variation is required. This can be achieved very efficiently for induction motor using Field Oriented Control (FOC) [1, 2]. For speed control of induction motor, PI (proportional-integral) and PID (Proportional-integral-derivative) controllers are generally used. To find out the optimum parameters of the controller to obtain a good closed loop response at different operating conditions is a trivial task and these parameters can be optimized by conventional tuning methods, such as Ziegler-Nicholson (Z-N) method [6]. Other tuning methods like pole placement optimization technique are also done [4]. Now a day, Evolutionary methods like Genetic Algorithm (GA), Particle Swarm Optimization (PSO) are used for tuning the parameters. These new tuning techniques can very efficiently solve complex problems like speed tracking problems, where demand speed is a complex function of time, where the conventional methods may not optimize the controller parameter so easily. Genetic Algorithm is a heuristics search method based on Charles Darwin principle of Natural Selection which narrates ‘the survival of the fittest’ of each and every individual on earth. At each step, the GA selects individuals from the current population as parents and uses them to produce the offspring’s for the next generations. The fitness of all the individual of the population is calculated and the convergence of the generation is based on this fitness criterion. It is well suited for its solving complex design

optimization problem as it can handle discrete and continuous variables, nonlinearity and different constrain functions of a system, without requiring gradient information [9].

PSO is inspired by the ability of flock of birds or herd of animals to adapt to their environment. It was developed in 1995 by James Kennedy and Russ Eberhart while attempting to simulate the choreographed, graceful motion of the swarm of birds as a part of socio-cognitive study investigating the motion of collective intelligence in biological population. In PSO, a set of randomly generated solutions propagates in the designed space towards the optimal solution over a number of iteration based on large amount of information about the designed space [10,].

Both GA and PSO are similar in the sense that these two techniques are population based heuristic search methods and they approach for the optimal solution by updating generations. Since the two approaches are supposed to find a solution to a given objective function but employ different strategies and computation effort, it is appropriate to compare their performance. Many researchers have applied both GA and PSO in different fields of engineering e.g. In [17], the authors have compared GA with PSO for designing a TCSC based controller for power system stability improvement.

The major objective of this work is to compare efficiency of both PSO and GA optimization technique applied to a direct field oriented Control Induction motor drive for a simple speed demand problem as well as for a complex speed problem. Here both PSO and GA have been applied to search for the optimal PI and PID controller parameters of FOC IM drive. The error criteria for both the methods are set to improve transient error and steady state error. Hence the fitness function is taken here are Integral Square Error (ISE), Integral Absolute Error (IAE) and Integral Time Square Error (ITSE) [6,8,14]. The performance of both optimization techniques in terms of convergence rate, error minimization and time complexity are compared. The initial parameters are chosen in the neighborhood of the parameters obtained by tuning through Z-N methods.

II. BASIC PLAN OF THE WORK

In this work, optimization of the parameters of PI/PID controller for speed control of a FOC IM has been done using GA and PSO and a comparative study between these two methods has been carried out for a speed tracking problem where the demand speed is a time varying function. The design has been considered for an induction motor (3- Φ , 1.5 HP, 415V, 50Hz) in MATLAB SIMULINK environment. The gain parameters for a step input are initially calculated by Ziegler-Nicholson’s optimization technique which serves as the parent

for the first generation for both the algorithms, so as to optimize the system much earlier and faster than what it is supposed to be. The algorithms have been developed in matlab 'm-file' and have been interfaced with SIMULINK model as shown in Fig 1.

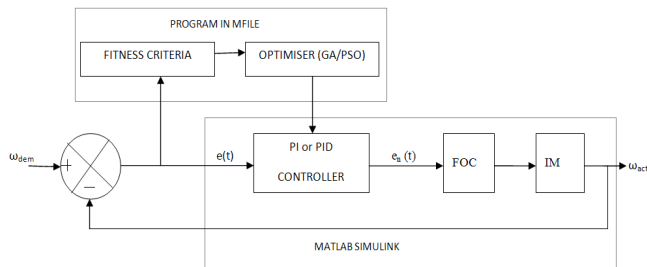


Fig.1: Schematic diagram of GA or PSO based optimizer for PI and PID controller of FOC IM

The PI and PID controller's gain parameters viz. K_p , K_i and K_d are optimized, by either GA or PSO, to have the optimum output of the controllers are given by Eqn.4 and Eqn.5 [6,7,8]. Here $e(t)$ is the difference between the demand speed and the actual speed of the system is denoted by ω_{dem} and ω_{act} respectively. For optimization, three different, criterion namely IAE, ISE and ITSE are chosen which served as the fitness function of the algorithms shown in Eq.6. For the speed tracking problem, the parameters are optimized obeying the same procedure as stated above.

III. THEORITICAL BASICS

A. Field Oriented Control:

By Field Oriented Control (FOC) the transient response of IM improves since IM can be controlled like dc machine where its torque component and field flux component are separated virtually and independent control of each component is possible [1,3,8]. FOC is based on phase transformation, where a three phase time and space variant system is transformed to a synchronously rotating, time invariant system, leading to a structure similar to that of a dc machine [1, 2, 3, 4, 5,14]. Thus by this transformation, the three phase time varying system is transformed into two phase time-invariant system, where i_{qe} corresponds to the Armature component and i_{de} corresponds to the flux component like a dc machine. Hence the torque (T_e) of an IM can be computed as shown in Eq. 1

$$\begin{cases} T_e = K' \times \psi_r \times i_{qe} \\ T_e = K' \times i_{de} \times i_{qe} \end{cases} \dots (1)$$

where ψ_r is the peak value of the field flux space vector. In FOC control here i_{ds} is analogous to the field current, i_f and i_{qe} is analogous to armature current of the dc machine [1]. This means that when i_{qe} is controlled it affects the torque directly, ψ_r remaining unaffected. Similarly when i_{ds} is controlled it affects the flux only and does not affect the i_{qs} component of current. Thus an induction motor can be treated as a dc machine [1,8,14]. Independent direct torque control can be possible by only controlling the q-axis current control [1,3,4,8].

B. Genetic Algorithm:

Evolutionary Algorithm (EA) has been employed for solving optimization problems quite successfully. Instead of minimizing or maximizing the object function, it starts with an initial set of parameter values selected randomly. The objective function is evaluated with these parameters and those sets for which the value of the objective function is lower (or higher, as the need may be) are retained and other sets are manipulated. Thus a new set of parameters is evolved from the initial ones and the process is repeated until a "best" choice of parameters is obtained for which the objective function is minimum (or maximum)[8,15].

Among the various evolutionary approaches, Genetic Algorithm can effectively tackle the optimization problem. It is characterized by the chromosome representation, population size, crossover and mutation, their probability rate settings, selection mechanism and fitness function [8, 9,15].

GA requires encoding the solution of an optimization problem in the form of binary strings. The coded parameter in a string represents the chromosome of a particular individual in a population. A large population size incorporates more variation, i.e diversity into the population, but the convergence becomes slower [8, 9,15].

This ensures the possibility of producing individuals with better fitness. Two randomized methods are incorporated in the algorithm for producing future generations, crossover and mutation. In crossover a partial exchange of genes occur between two parent chromosomes [8,9,15]. The simplest way to achieve this is single point crossover where, a random location of chromosome is selected. If probability of a particular bit in a chromosome exceeds of a pre specified probability i.e., $p > p_{cross}$ (defined), the portion of the chromosome of one of the parent, preceding the selected point is combined with the portion of other parent, following the selected bit. In mutation, the parental characteristics are transferred with a slight change in gene[8,9,15]. A selected cell at random is toggled if the probability exceeds the probability of mutation, i.e. if $p > p_{mut}$. The choice of the probability rate for crossover and mutation is very much dependent on the population size[8,9,15].

The fitness function provides information regarding the goodness of a particular individual of a generation. Fitness functions generally consist of physical equations representing the objective function that is subject to optimization. In a GA, the fitter chromosomes are allowed to reproduce with higher probability and thus propagate into future generations [8,9,15]. According to their fitness, individuals are selected for next generation. This is called selection, which ensures that the latter generations contain fitter individuals. This selection mechanism may be deterministic or stochastic. Tournament selection involves running several "tournaments" among a few individuals chosen at random from the population. The winner of each tournament (the one with the best fitness) is selected for crossover. The performance of any selection procedure is guided by the biasing and it affects the time complexity [8, 9,15].

C. Particle swarm optimization:

Particle swarm optimization (PSO) is a population based stochastic optimization technique. It shares many similarities with evolutionary computation techniques such as genetic

algorithm but the features of PSO, like easy way of implementation, stable convergence characteristics and computational efficiency has made it much superior than others [10, 11, 12, 13,14].

PSO is initialized with a group of random particles (solutions) and then searches for optima by updating generations. In every iteration, each particle is updated by following two "best" values. The first one is the best solution (fitness) it has achieved so far. (The fitness value is also stored.) This value is called p_{best} . Another "best" value that is tracked by the particle swarm optimizer is the best value, obtained so far by any particle in the population. This best value is a global best and called g_{best} [10, 11, 17, 18]. When a particle takes part of the population as its topological neighbors, the best value is a local best and is called l_{best} . After finding the two best values, the particle updates its velocity and positions with following equation for d^{th} generation [10, 11, 13, 14], i^{th} particle as shown in Eq. 4.

$$\left\{ \begin{array}{l} v_{id}[n+1] = v_{id}[n] + \\ \quad c_1 \times \text{rand}() \times (p_{best_{id}}[n] - \text{present}_{id}[n]) + \\ \quad c_2 \times \text{rand}() \times (g_{best_{id}}[n] - \text{present}_{id}[n]) \\ \text{present}_{id}[n+1] = \text{present}_{id}[n] + v_{id}[n+1] \end{array} \right\} \dots (2)$$

Where $v[n]$ is the particle velocity, $\text{present}[n]$ is the current particle (solution). $p_{best}[n]$ and $g_{best}[n]$ are defined as stated before. $\text{Rand}(n)$ is a random number between (0, 1). C_1 , C_2 are learning factors. The value of c_1 and c_2 has been calculated as shown in eqn. 5

$$\left\{ \begin{array}{l} C_1 = (C_{1f} - C_{1i}) \times \left(\frac{i_{ter}}{m_{axiter}} \right) + C_{1i} \\ C_2 = (C_{2f} - C_{2i}) \times \left(\frac{i_{ter}}{m_{axiter}} \right) + C_{2i} \end{array} \right\} \dots (3)$$

where C_{1i} , C_{1f} , C_{2i} , and C_{2f} are constants, i_{ter} is the current iteration number and m_{axiter} is the number of maximum allowable iterations. The objective of this modification was to boost the global search over the entire search space during the early part of the optimization and to encourage the particles to converge to global optima at the end of the search. Actually C_1 was decreased from 2.5 to 0.5 whereas C_2 was increased from 0.5 to 2.5 [10, 11, 12, 13, 14].

D. PI/PID controller:

The PID controller is a generic control loop feedback mechanism (controller) widely used in industrial control systems [6, 8, 15]. A PID controller calculates an "error" value as the difference between a measured process variable and a desired set point. The controller attempts to minimize the error by adjusting the process control inputs (6, 7, 8, 15). The PID controller calculation involves three separate parameters; the proportional, the integral and derivative values, and is given by

$$r(t) = K_p e(t) + K_i \int e(t) dt + K_d \frac{de(t)}{dt} \dots (4)$$

Where K_p , K_i , K_d are the proportional, integral and derivative gain of the system. $u(t)$ is the input signal and $e(t)$ is the error signal. For PI controller calculation involves two parameters, proportional and integral values and is given by

$$r(t) = K_p e(t) + K_i \int e(t) dt \dots (5)$$

E. PI/PID performance criteria:

In PID controller design methods, the most common performance criteria are integrated absolute error (IAE), the integrated of time weight square error (ITSE) and integrated of squared error (ISE) that can be evaluated analytically in the frequency domain [6,8,14,15]. The IAE, ISE, and ITSE performance criterion formulas has been given below

$$\left. \begin{array}{l} IAE = \int_0^t |e(t)| dt \\ ISE = \int_0^t |e^2(t)| dt \\ ITSE = \int_0^t t \times |e^2(t)| dt \end{array} \right\} \dots (6)$$

3.6 Optimization of PI/PID controller using Ziegler-Nichol's method:

From all the methods designed to optimize PID controller, Ziegler and Nichols' method is mostly used [8,14,15]. The methods are based on characterization of process dynamics by a few parameters and simple equations for the controller parameters. The first method is applied to plants with step responses [8,14,15]. This type of response is typical of a first order system with transportation delays. The second method targets plants that can be rendered unstable under proportional control. The technique is designed to result in a closed loop system with 25% overshoot [8,14,15]. This is rarely achieved as Ziegler and Nichols determined the adjustments based on a specific plant model. Here the second methods have been used, K_{cr} is the gain at critical oscillation and P_{cr} is the time period [8,14,15]. The controller gains are specified in the table no:1.

Table1:PID Controller Gain calculation by z-n method

PID type	K_p	K_i	K_d
P	$0.5 K_{cr}$	∞	0
PI	$0.45 K_{cr}$	$P_{cr}/1.2$	0
PID	$0.6 K_{cr}$	$P_{cr}/2$	$P_{cr}/8$

IV. FLOWCHART

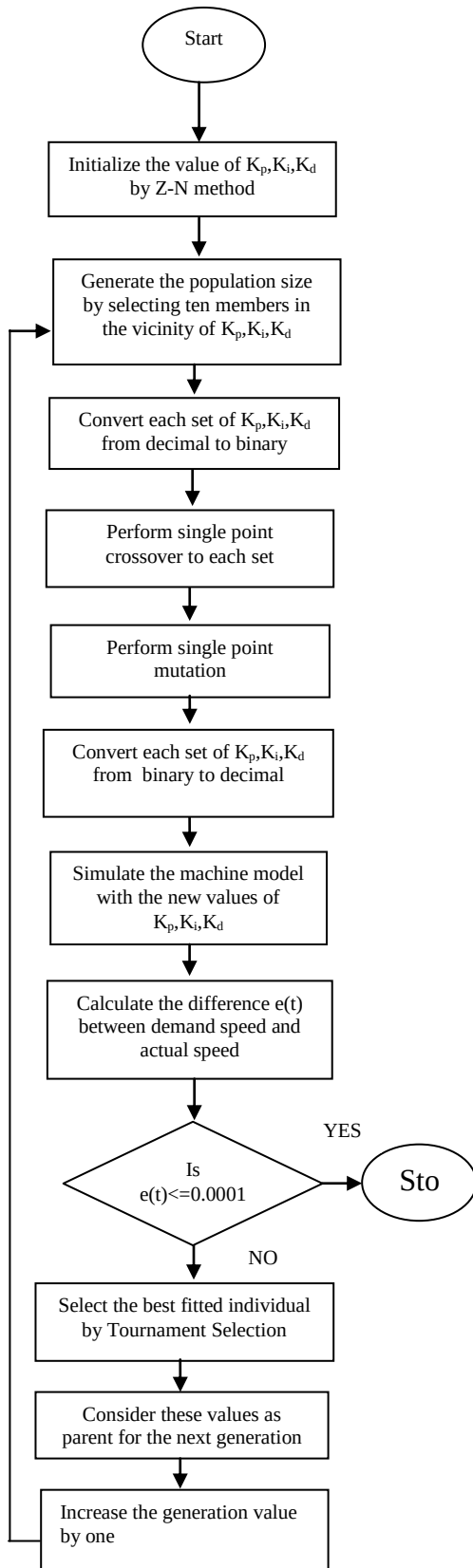


Fig2: Flow chart for optimizing PI/PID controller parameters using GA

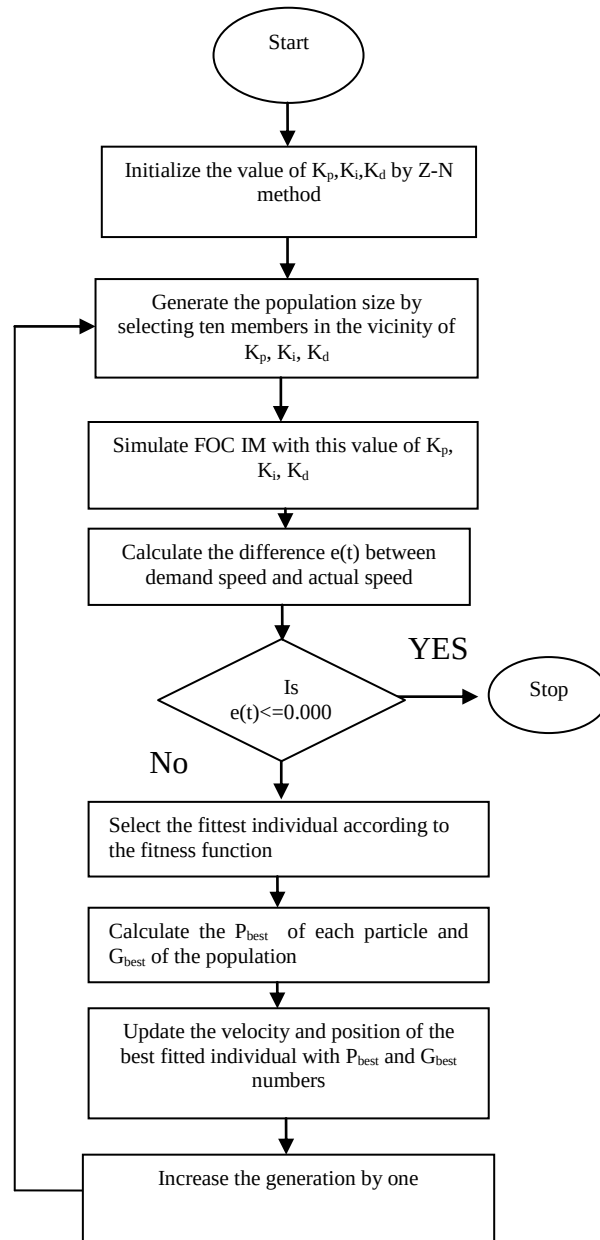


Fig3: Flow chart for optimizing PI/PID controller parameters using PSO

V. RESULTS

Initially a step input to the PI and PID controller has been given. As mentioned, initially the values of proportional, integral gain has been calculated using Z-N method and the system has been simulated and Fig 4 shows the result with this initial parameters settings. Then GA and PSO have been implemented, and the optimized result with GA and PSO has been shown in Fig 5 and Fig 6, respectively. Similarly with Z-N method the parameters of a PID controller for FOC controlled IM has been designed (Fig 7). With this initial values GA and PSO has been evaluated and the result of optimization (Fig 8, Fig 9) gives

almost same results but computational time by PSO was found much less than by GA.

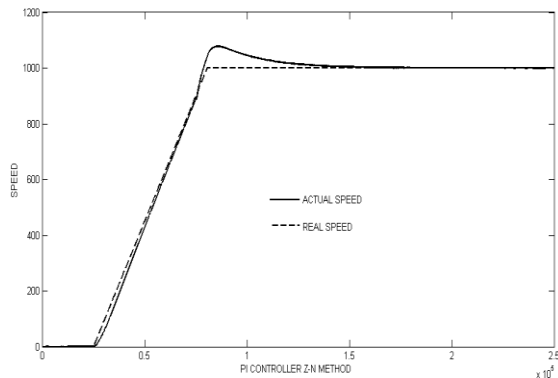


Fig 4: Step (speed) response of PI controlled FOC IM drive using Z-N method.

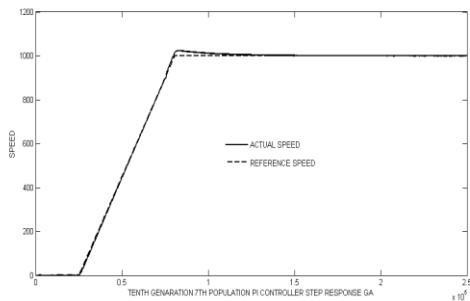


Fig 5: Step (speed) response of PI controlled FOC IM drive of tenth generation using GA.

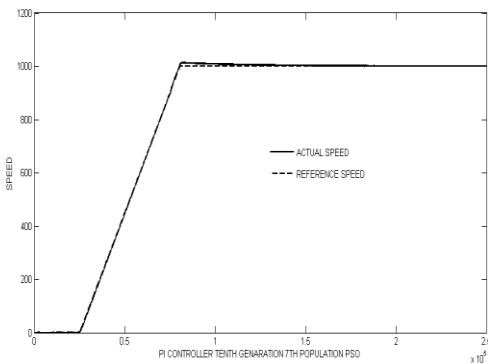


Fig 6: Step (speed) response of PI controlled FOC IM drive of tenth generation using PSO.

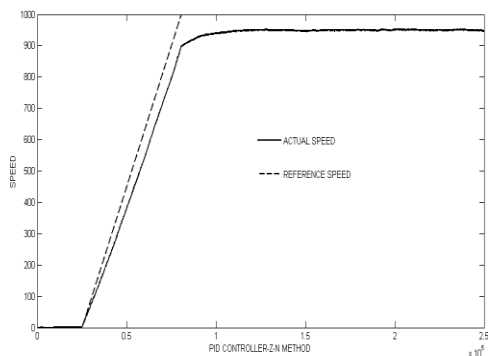


Fig 7: Step (speed) response of PID controlled FOC IM drive using Z-N method.

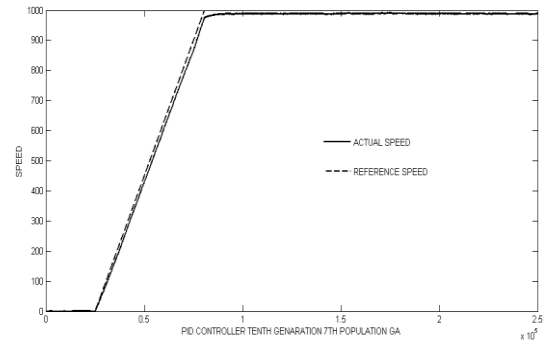


Fig 8: Step (speed) response of PID controlled FOC IM drive of tenth generation using GA.

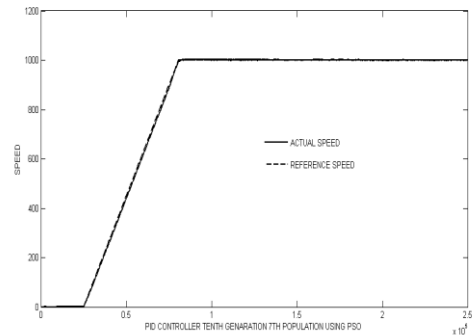


Fig 9: Step (speed) response of PID controlled FOC IM drive of tenth generation using PSO.

The convergence characteristics of GA and PSO has been shown below in the Fig 10, which shows that as the system progresses towards its optimum condition all the values of proportional, integral gain converges to one point. The first graph shows the convergence characteristics of PI controller using Z-N, initially the first generation populations has been plotted and the points were scattered but the optimized population tried to converge to one point. The second graph shows the convergence characteristics of the PI controller using GA, where the optimum condition was found at the tenth generation, and the third shows convergence characteristics using PSO, where the system almost converged at the eighth generation but as the error speed was not less than 0.0001 so it took two more generation to converge. The first generation populations were almost linearly scattered but he optimized parameters converged to a point using PSO.

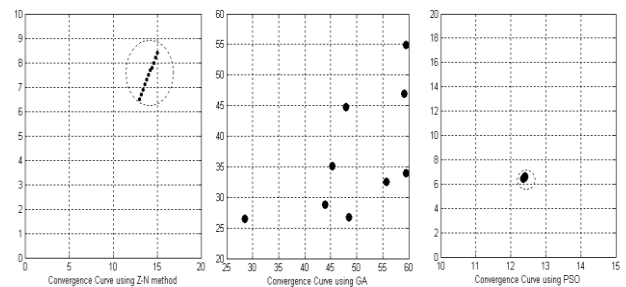


Fig.10: Convergence characteristics of GA and PSO used algorithm to optimize the PI controller

The following Table 1 and Table 2 shows the variation of maximum overshoot (M_p), peak time (T_p) and settling time (T_s)

over five generations of PI and PID controllers, first by using GA and then by PSO. It shows that the transient response of PSO is better than that of GA. And the convergence characteristics of the gain parameters i.e. proportional gain parameter K_p and Integral gain parameter K_i is better in PSO than GA. It has been observed that PSO gave better result than GA.

Table 1: Variation of settling time, maximum overshoot and peak time of ten populations over Ten generations of PI controller

Using GA						Using PSO					
Gen	Kp	Ki	Mp	Tp	Ts	Gen	Kp	Ki	Mp	Tp	Ts
1 st	10.23	10.21	17	1.63	2.9	1 st	7.08	14.5	3.2	1.75	2.8
2 nd	52.4	52.47	12	1.6	2.83	2 nd	6.56	12.34	3.1	1.75	2.7
3 rd	69.29	69.2	9	1.6	2.72	3 rd	7.1089	12.36	3.1	1.75	2.6
4 th	28.08	28.08	5	1.6	2.6	4 th	7.2	12.37	3.05	1.75	2.4
5 th	30.38	30.37	4	1.6	2.3	5 th	7.1147	12.53	3	1.75	2.2
6 th	54.9800	59.4300	3.7	1.6	2.28	6 th	7.1197	14.5951	2.9	1.75	2.16
7 th	28.8500	43.9400	3.32	1.6	2.28	7 th	7.1240	14.6051	2.9	1.74	2.10
8 th	26.7700	48.4500	3.1	1.59	2.25	8 th	7.1277	12.4594	2.7	1.72	2
9 th	46.9100	59.1300	2.8	1.59	2.2	9 th	6.6105	10.6212	2.64	1.72	1.9
10 th	44.8100	47.9400	2.7	1.59	2.1	10 th	6.1302	10.6017	2.5	1.70	1.8

Table 2: Variation of settling time, maximum overshoot and peak time of ten populations over Ten generations of PID controller

Using GA							Using PSO						
Gen	Ki	Kp	Kd	Mp	Tp	Ts	Gen	Kp	Ki	Kd	Mp	Tp	Ts
1 st	10.23	10.21	0.25	17.3	1.77	3.7	1 st	7.08	14.5	1.59	6	2.5	3.2
2 nd	52.4	52.47	0.27	13.2	1.75	3.6	2 nd	6.56	12.34	1.48	5.7	2.5	3.2
3 rd	69.29	69.2	0.51	12	1.8	3.5	3 rd	7.1089	12.36	1.37	3	2.5	3.15
4 th	28.08	28.08	0.25	8.0	1.8	3.3	4 th	7.2	12.37	1.27	2.8	2.4	3.1
5 th	30.38	30.37	0.51	6.7	1.8	3.2	5 th	7.1147	12.53	1.1	2.6	2.3	3
6 th	54.9800	59.4300	0.7600	6.2	1.77	3.17	6 th	7.1197	14.5951	1.0709	2.4	2.3	2.8
7 th	28.8500	43.9400	1.020	6	1.77	3.14	7 th	7.1240	14.6051	1.0713	2.1	2.3	2.76
8 th	26.7700	48.4500	1.0200	5.8	1.76	3.1	8 th	7.1277	12.4594	1.0716	2	2.28	2.7
9 th	46.9100	59.1300	0.7600	5.5	1.76	2.9	9 th	6.6105	10.6212	1.0710	1.8	2.28	2.7
10 th	44.8100	47.9400	0.7600	4	1.76	2.8	10 th	6.1302	10.6017	1.0602	1.8		2.7

The complexity curve for PI and PID controllers has been shown in the Fig 11, which shows that time complexity of PSO is lesser than GA.

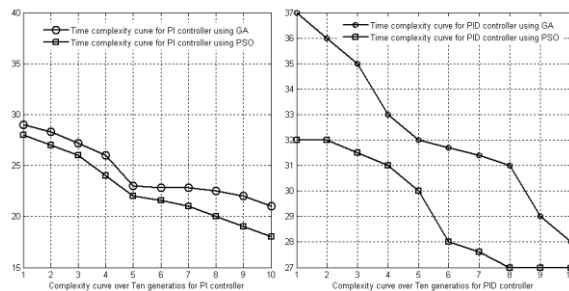


Fig 11: Complexity curve for PI and PID controllers speed Response over ten generations

Now the Table 3 shows the error between the demand speed and the actual speed of the FOC IM system that has been calculated by using various performance indices IAE, ISE, ITSE at different value of demand speed amongst which ITSE gave better result when used with PSO algorithm for PI controller.

Table 3: Comparison table showing different performance indices at different speed for PI Controller of tenth generation tenth population

Speed	Using GA			Using PSO		
	IAE	ISE	ITSE	IAE	ISE	ITSE
100	0.000031	0.000030	0.000031	0.00037	0.00027	0.00022
400	0.000313	0.00029	0.00028	0.00033	0.00026	0.00028
800	0.000303	0.000267	0.000259	0.00012	0.000211	0.00017
1000	0.000301	0.000251	0.00025	0.00017	0.0000162	0.00015
1500	0.000021	0.000020	0.000019	0.00011	0.000015	0.000134
1800	0.000019	0.0000181	0.000012	0.000011	0.0000189	0.00001
2000	0.000009	0.0000081	0.000006	0.000002	0.000017	0.000001

The Table 4 shows the error between the demand speed and the actual speed of the FOC IM system that has been calculated by using various performance indices IAE, ISE, ITSE at different value of demand speed amongst which ITSE gave better result when used with PSO algorithm for PID controller.

Table 4: Comparison table showing different performance indices at different speed for PID Controller for tenth population of the tenth generation

speed	Using GA			Using PSO		
	IAE	ISE	ITSE	IAE	ISE	ITSE
100	0.003643	0.003107	0.004341	0.004843	0.004210	0.003527
400	0.00493	0.004636	0.001936	0.003774	0.003192	0.000344
800	0.003082	0.003065	0.00613	0.003143	0.003123	0.0002817
1000	0.002701	0.002471	0.00215	0.003400	0.002800	0.02053
1500	0.000197	0.00146	0.00066	0.0003595	0.0000812	0.000061
1800	0.000169	0.000051	0.000050	0.0000150	0.0000135	0.0000137
2000	0.000009	0.0000032	0.0000021	0.0000053	0.0000039	0.0000015

From the above tables and figures it can be said that higher generation, integral, proportional and derivative gain parameters were much better evolved than the first generation one. The settling time (T_s), Maximum Overshoot (M_p), peak time (T_p) has reduced considerably generation wise as shown in table 1 and in table 2 for PI and PID Controller respectively. The steady state error at tenth generation is observed by setting different performance criteria (ASE, ISE, ITSE) as fitness function and tabulated for PI and PID Controller Table 3 and Table 4 respectively for GA and PSO. All the results for GA were better than Z-N method but PSO is even better than GA. The result shows very little difference for different fitness function. ITSE is better than the other in both type of evolutionary algorithms.

After this a speed tracking problem has been considered where the speed demand consists of two step input with 1.5s delay time and it has been applied to FOC controlled IM as shown in Fig 12. Just like the previous one, the PI and PID controllers has been optimized by using Z-N method first, and then the Evolutionary algorithms has been used to optimize the same. Here also it has been seen that PSO gave better result that optimization with GA as shown in the following figures.

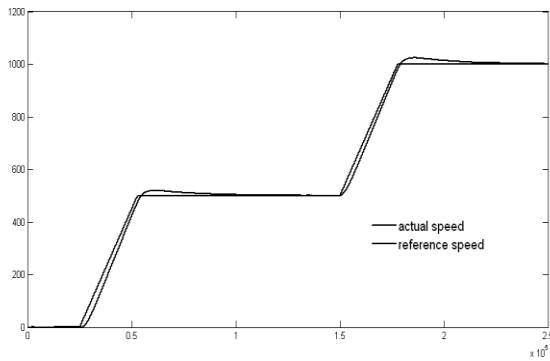


Fig12: Step (speed) response of PI controlled FOC IM drive of tenth generation using Z-N Method for the speed tracking problem

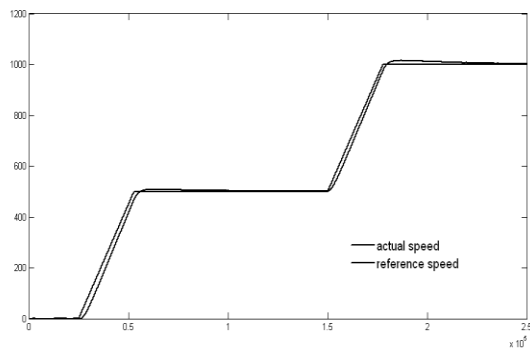


Fig 13: Step (speed) response of PI controlled FOC IM drive of tenth generation using GA for the speed tracking problem

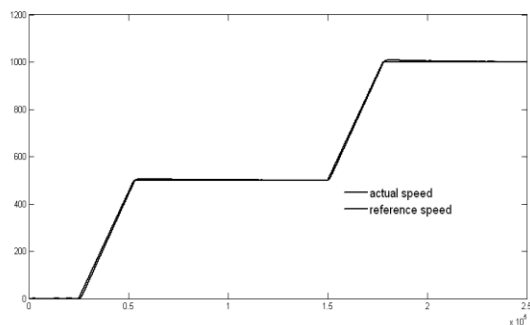


Fig 14: Step (speed) response of PI controlled FOC IM drive of tenth generation using PSO for the speed tracking problem

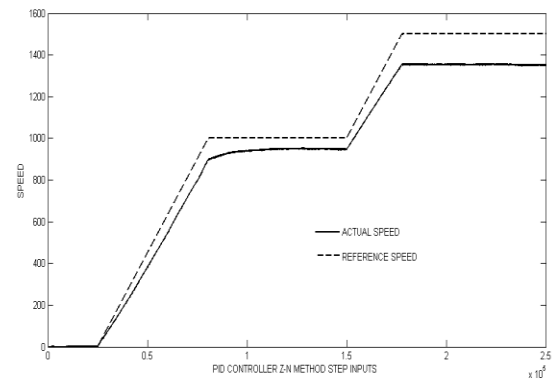


Fig.15: Step (speed) response of PID controlled FOC IM drive using Z-N method for speed tracking problem

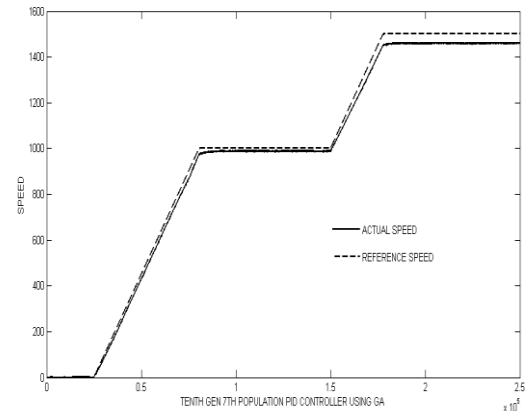


Fig 16: Step (speed) response of PID controlled FOC IM drive of tenth generation tenth population using GA for speed tracking problem.

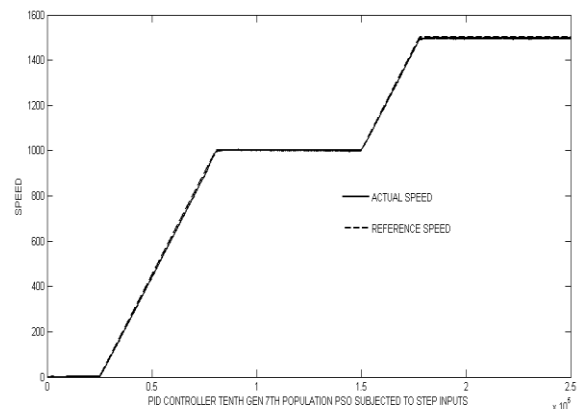


Fig 17: Step (speed) response of PID controlled FOC IM drive of fifth generation tenth population using PSO for speed tracking problem

Thus from Fig 12 the response has become much better in Fig 13 and Fig 14 for the PI controller and Fig 17 and Fig 18 was better than Fig 15 for the PID controllers. But Fig 14 and Fig 17 was even better than Fig 13 and Fig 16 i.e the response due to PSO algorithm was much better than both GA and Z-N method.

VI. CONCLUSION

Thus it can be concluded that, the evolutionary algorithms provide much better speed response than that of conventional Z-N method but among them PSO works with much better efficiency as computational time minimizes, simple, and has stable convergence characteristics than GA

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DOE based investigation for C40 and C90 material to improve the surface attributes using EDM

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Abstract- The manufacturing sector has undergone a sea of change in the recent years. Several applications demanding modern machinery, technology, materials etc have been developed. This ever-changing radical scenario has led to the demand of materials for applications involving high temperatures, corrosion and oxidation resistance, better strength to weight ratio, hardness etc. These exotic materials possess properties that result in superior product performance; nevertheless, it becomes difficult to machine these materials by conventional methods. Hence Unconventional processes like EDM, ECM etc have been found suitable for machining of such materials. In EDM the Sink-EDM process has been the most preferred machining process for die making as surface attributes of dies such as surface finish, dimensional accuracy etc. are of great significance with respect to the products manufactured. The most important performance measure in EDM is the surface finish; among other measures material removal and tool wear rates could be listed. In the present work, experiments have been conducted to determine the parameters affecting Surface finish. The data obtained for performance measures have been analyzed using the proven Design of Experiments (DOE).

Index Terms- : EDM, MRR, RaT, RaW.

I. INTRODUCTION

The current manufacturing scenario has led to the demand of materials for applications involving high temperatures, corrosion and oxidation resistance, better strength to weight ratio etc. These newly developed materials have high strength and stiffness at elevated temperatures, extreme hardness, high brittleness and strength to weight ratio, high corrosion and oxidation resistance along with chemical inertness. Although such properties result in superior product performance; nevertheless, it is difficult to machine these materials by conventional methods. This situation has given a new impetus to the development of non-traditional machining processes since early 1940's, where in material have been removed by mechanical means (USM, AJM, WJM), thermal erosion (EDM, LBM, EBM), anodic dissolution (ECM), chemical reaction or combination of two or more than two processes called hybrid machining (EDAG, ECSM).

The Electro Discharge Machining (EDM) process can be compared with the conventional cutting process, except for the fact that, in this case a suitably shaped tool electrode with a precision controlled feed movement is employed in place of the

cutting tool & cutting energy is provided by means of short duration electrical impulses.

The EDM process works on the principle of controlled erosion of the material by repetitive electric sparks between the work piece and the tool submerged in a bath of the dielectric medium. The work piece and electrode are separated by a spark gap across which the dielectric fluid flows. A servo system maintains the working gap for continuous operation. During the EDM process, a series of non-stationary, timed electrical pulses remove material from the work piece. The electrode and the workpiece are held by the machine tool, both of which remain submerged in the dielectric medium. A power supply controls the timing and intensity of the electrical charges of the electrode in relation to the workpiece.

In EDM, a power supply delivers high-frequency electric pulses to the tool and the workpiece. The gap between the tool and workpiece is flushed with a stream of dielectric liquid. When an electric pulse is delivered from the power supply, the insulating property of the dielectric fluid is momentarily broken down. This allows a small spark (discharge) to jump the shortest distance between the tool and workpiece. A small pool of molten metal is formed on the workpiece and the tool at the point of discharge. A gas bubble forms around the discharge and the molten pools. As the electric pulse ceases and the discharge disappears, the gas bubble collapses. The onrush of cool dielectric causes the molten metal to be ejected from the workpiece and the tool, leaving small craters. This action is repeated hundreds of thousands of times each second during EDM processing. This removes material from the workpiece in a shape complementary to that of the tool.

EDM has found its application in the machining of hard metals or alloys which cannot be machined easily by conventional methods. It thus plays a major role in the machining of dies, tools, etc. made of tungsten carbides, satellites or hard steels. Alloys used in the aeronautics industry for example hastalloy, nimonics, etc. could also be machined conveniently by this process. This process has the added advantage of being capable of machining complicated components.

The products produced from die casting using excellent quality dies will be a replica of the dies used for the process. Hence the dies should possess high dimensional accuracy and superior surface finish.

EDM process has been used in the present work to machine die casting dies used for producing superior product having high dimensional accuracy and superior surface finish. The reason for using EDM for machining die casting dies is because of the superior process control over surface finish and dimensional accuracy parameters [1-5].

II. RESEARCH METHODOLOGY

The present research work has been carried out by following the steps given below:

- 1) Identification of the important process parameters
- 2) Development of the design matrix and finding upper and lower limits of process parameters
- 3) Conduction of the experiments as per the design matrix and recording the responses
- 4) Evaluation of the regression coefficients and developing the mathematical models for MRR, TWR, Raw
- 5) Checking the adequacy of the mathematical models
- 6) Conformation of the experiments w.r.t the mathematical model.

The methodology followed has been clearly depicted in the form of a flowchart in the Fig 3.

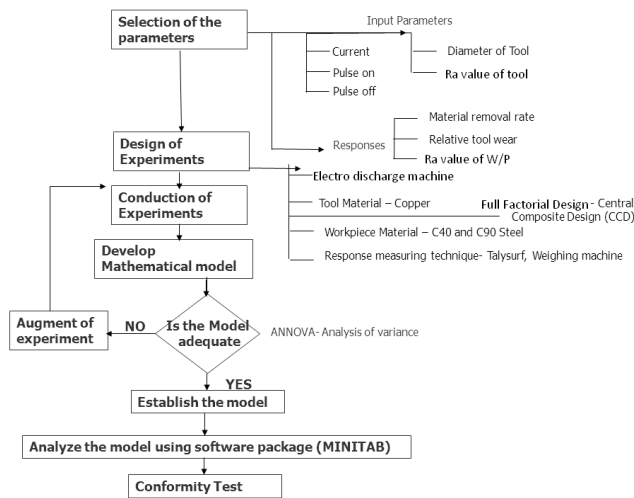


Fig.3 Methodology of Research work

III. EXPERIMENTAL SETUP

Experiments have been designed to develop empirical response models for MRR, RTW and RaW by investigating the effects of diameter of tool (Cross-sectional area) and Surface Roughness of the tool along with different Current, Pulse-On and Pulse-off levels and correlating the interactive and higher order influences of various sink-EDM process parameters using RSM.

The schematic diagram of the EDM setup has been depicted in Fig 1. The EDM machine used for the experimental work in this research has been shown in Fig 2.

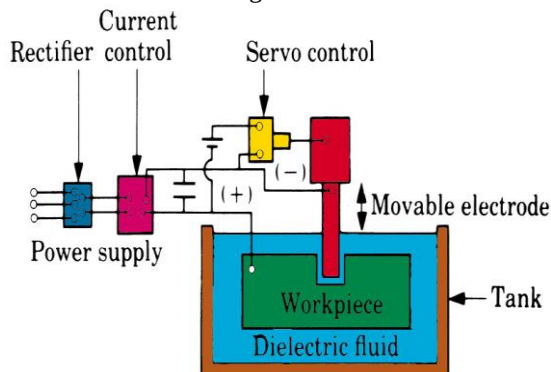


Fig.1 Schematic Diagram of EDM setup



Fig.2 EDM Machine

Workpiece materials used in the research work are C40 and C90 steels. C40 steel with a density of 7.859 gm/cc and hardness of 28 HRC obtained after water quenching has been used for the experiments. C-90 steel with a density of 7.84 gm/cc and hardness of 35 HRC obtained after water quenching has also been used.

IV. EXPERIMENTATION PROCEDURE

The following steps have been followed during the experimentation phase of the research work.

- 1) A simple experimental procedure has been used to understand the impact of controlled input parameters for an EDM process.
- 2) The workpiece(C-40 and C-90 steel) are ground on top and bottom face to a good level of surface finish.
- 3) Using CNC the bottom surface of the tool (99.7% Cu) is finished to a desired level of surface finish.
- 4) The workpiece and the tool both are held in requisite positions on EDM setup.
- 5) The workpiece and tool have been connected to the positive and negative terminals of power supply, respectively.
- 6) The process is executed in the presence of dielectric fluid
- 7) The experiments have been conducted in a random order to remove the effects of any unaccounted factors.
- 8) At the end of each experiment, the work piece and tool has been removed, washed and dried.
- 9) An electronic balance is used to measure weights of tool and workpiece before and after machining.
- 10) The instrument Taly-Surf has been used to determine the surface finish of the work piece after conducting each experiment.

V. THE MATHEMATICAL MODEL

Forty-five experimental runs were conducted as per the design matrix at random to avoid any systematic error creeping into the

system. The observed and calculated values of MRR, RTW and RaW for C40 steel have been indicated with symbols in design

matrix as shown in Table 1. Similar design matrix has been created and analyzed for C-90 material also.

Std Order i	Run Order xi	Coded values					Natural values					Responses		
		A	B	C	D	E	A	B	C	D	E	MRR(gm/min)	TWR(gm/in)	SF(μm)
1	6	-1	-1	-1	-1	-1	10	25	3	20	1.6	48.31047	7.6884	5.419
2	33	1	-1	-1	-1	-1	20	25	3	20	1.6	286.407	35.0448	5.842
3	20	-1	1	-1	-1	-1	10	75	3	20	1.6	292.33239	16.6284	6.705
4	17	1	1	-1	-1	-1	20	75	3	20	1.6	822.927	17.5224	6.905
5	10	-1	-1	1	-1	-1	10	25	7	20	1.6	150.9357	16.3966	6.194
6	44	1	-1	1	-1	-1	20	25	7	20	1.6	286.5648	33.4612	6.504
7	5	-1	1	1	-1	-1	10	75	7	20	1.6	74.955	10.9962	7.563
8	3	1	1	1	-1	-1	20	75	7	20	1.6	427.7958	27.8084	7.649
9	39	-1	-1	-1	1	-1	10	25	3	30	1.6	148.332	35.0448	5.689
10	34	1	-1	-1	1	-1	20	25	3	30	1.6	303.765	44.3424	6.218
11	37	-1	1	-1	1	-1	10	75	3	30	1.6	336.903	43.4484	5.889
12	28	1	1	-1	1	-1	20	75	3	30	1.6	695.1879	25.5684	6.194
13	13	-1	-1	1	1	-1	10	25	7	30	1.6	421.8783	44.4318	6.013
14	31	1	-1	1	1	-1	20	25	7	30	1.6	404.737	61.9542	6.429
15	19	-1	1	1	1	-1	10	75	7	30	1.6	198.2757	35.4918	6.473
16	23	1	1	1	1	-1	20	75	7	30	1.6	403.968	25.5684	6.488
17	8	-1	-1	-1	-1	1	10	25	3	20	4.8	22.881	7.6884	5.826
18	18	1	-1	-1	-1	1	20	25	3	20	4.8	82.6872	28.7868	6.686
19	15	-1	1	-1	-1	1	10	75	3	20	4.8	206.9547	25.8366	5.804
20	9	1	1	-1	-1	1	20	75	3	20	4.8	494.9397	16.6284	6.337
21	35	-1	-1	1	-1	1	10	25	7	20	4.8	344.004	16.8966	5.361
22	1	1	-1	1	-1	1	20	25	7	20	4.8	224.5494	42.1968	6.005
23	2	-1	1	1	-1	1	10	75	7	20	4.8	119.64396	16.6284	5.318
24	24	1	1	1	-1	1	20	75	7	20	4.8	225.5751	25.6578	5.813
25	38	-1	-1	-1	1	1	10	25	3	30	4.8	148.4898	25.5684	7.17
26	26	1	-1	-1	1	1	20	25	3	30	4.8	55.32468	25.5684	7.937
27	14	-1	1	-1	1	1	10	75	3	30	4.8	190.149	46.36284	5.862
28	11	1	1	-1	1	1	20	75	3	30	4.8	324.279	15.3768	6.54
29	42	-1	-1	1	1	1	10	25	7	30	4.8	565.78401	34.5084	6.054
30	43	1	-1	1	1	1	20	25	7	30	4.8	299.031	43.5378	6.804
31	36	-1	1	1	1	1	10	75	7	30	4.8	206.9547	33.2568	4.925
32	12	1	1	1	1	1	20	75	7	30	4.8	167.91498	16.6284	5.452
33	25	-1	0	0	0	0	10	50	5	25	3.2	151.7247	16.0026	5.78
34	29	1	0	0	0	0	20	50	5	25	3.2	283.251	16.7178	6.255
35	40	0	-1	0	0	0	15	25	5	25	3.2	163.9542	35.4918	6.154
36	45	0	1	0	0	0	15	75	5	25	3.2	251.7699	33.29256	5.98
37	27	0	0	-1	0	0	15	50	5	25	3.2	323.5689	16.6284	6.721
38	22	0	0	1	0	0	15	50	7	25	3.2	328.1451	16.8966	6.584
39	21	0	0	0	-1	0	15	50	5	20	3.2	202.2996	33.2568	5.955
40	30	0	0	0	1	0	15	50	5	30	3.2	263.9994	51.4944	5.76
41	41	0	0	0	0	-1	15	50	5	25	1.6	319.545	52.3884	6.042
42	32	0	0	0	0	1	15	50	5	25	4.8	269.6802	45.98736	5.779
43	7	0	0	0	0	0	15	50	5	25	3.2	219.1842	32.0052	6.106
44	16	0	0	0	0	0	15	50	5	25	3.2	247.4304	33.2568	6.106
45	4	0	0	0	0	0	15	50	5	25	3.2	247.4304	33.2568	6.106

Table 1: Experimental layout plan as per CCD and responses

The following models have been developed for MRR, RTW and RaW for C40 steel.

Material removal rate (MRR)

$$YMRR = -1593.70 + 107.43X_1 + 20.22X_2 - 137.21X_3 + 60.767X_4 - 25.53X_5 - 1.25X_{12} - 0.07X_{22} + 19.27X_{32} - 0.63X_{42} + 17.90X_{52} + 0.46X_1X_2 - 4.10X_1X_3 + -1.44X_1X_4 - 7.38X_1X_5 - 1.96X_2X_3 - 0.26X_2X_4 - 0.79X_2X_5 + 2.72X_3X_4 - 11.65X_3X_5 - 1.12X_4X_5.$$

Relative Tool Wear (RTW)

$$YTWR = -85.0865 + 27.3177X_1 + 0.6703X_2 + 42.5399X_3 - 13.7633X_4 - 34.0414X_5 - 0.6487X_{12} + 0.0029X_{22} - 3.9537X_{32} + 0.3919X_{42} + 6.4884X_{52} - 0.0510X_1X_2 + 0.2723X_1X_3 - 0.2093X_1X_4 - 0.2852X_1X_5 - 0.0747X_2X_3 -$$

$$0.0056X_2X_4 + 0.0527X_2X_5 - 0.0644X_3X_5 - 0.1350X_3X_5 - 0.2708X_5$$

Ra Value of Workpiece (RaW)

$$YRaw = -1.6234 + 0.094403X_1 + 0.086689X_2 - 0.84233X_3 + 0.489682X_4 + 0.424358X_5 - 0.001944X_{12} + 1.00E-06X_{22} + 0.146598X_{32} - 0.008344X_{42} - 0.060785X_{52} - 4.65E-04X_1X_2 - 0.003288X_1X_3 + 0.000545X_1X_4 + 0.011602X_1X_5 + 0.000543X_2X_3 - 0.002187X_2X_4 - 0.008867X_2X_5 - 0.0117X_3X_4 - 0.10627X_3X_5 + 0.027273X_4X_5.$$

VI. RESULTS AND DISCUSSIONS

Comparison of the Interaction effect of various parameters (current, pulse on, pulse off, diameter of tool and surface roughness of tool) on the responses like Surface Finish of Workpiece (RaW), Material Removal Rate (MRR), Relative Tool Wear (RTW) and Tool Wear Ratio (TWR = MRR / RTW) have been carried out & their interpretations provided w.r.t. C-40 & C-90 material. Some of the important observations have been taken and discussed here on.

A. Interaction effect of current, Ra value on tool with reference to MRR and Surface Finish of the work for C40 material

The current varies from 10amps to 20amps and Ra value of tool from 1.6 μ m to 4.8 μ m, keeping pulse-on time, pulse-off time, and diameter of tool, at mid level (5 μ s, 50 μ s and 25mm respectively) as shown in Fig 3.

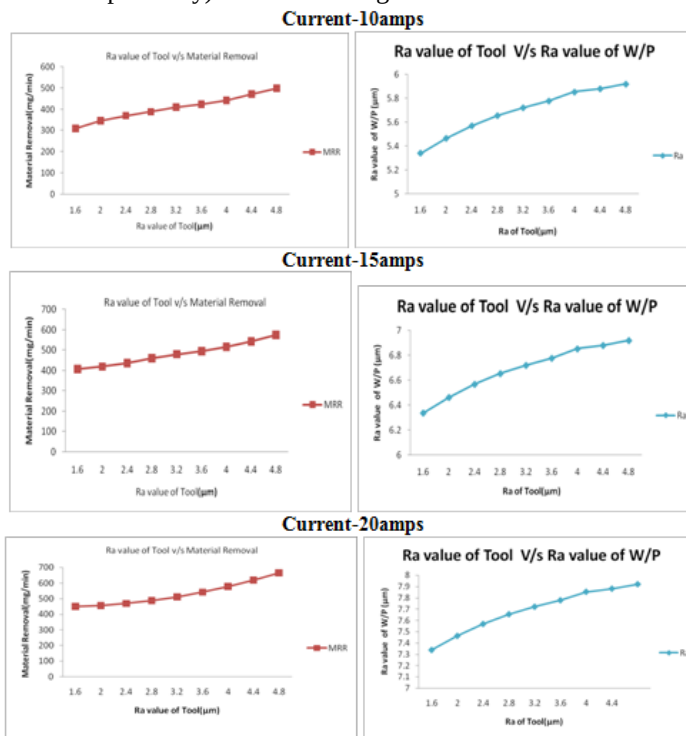


Fig 3: Variation of RaT w.r.t MRR, RaW at different current levels

It has been inferred that the maximum MRR at various values of current can be obtained with the tool having the rougher surface i.e higher Ra value. However it has been observed that the better quality work surface can be obtained with the tool having lower Ra value i.e. with a relatively lower MRR.

B. Interaction effect of Pulse-on and Ra value of the tool with reference to MRR and Surface Finish of the work for C40 material

The Pulse-on time varies from 25 μ s to 75 μ s and surface roughness of tool from 1.6 μ m to 4.8 μ m. keeping pulse-off, diameter of tool, and current of tool at mid level (5 μ s, 25mm, and 15 amps respectively) as shown in Fig 4.

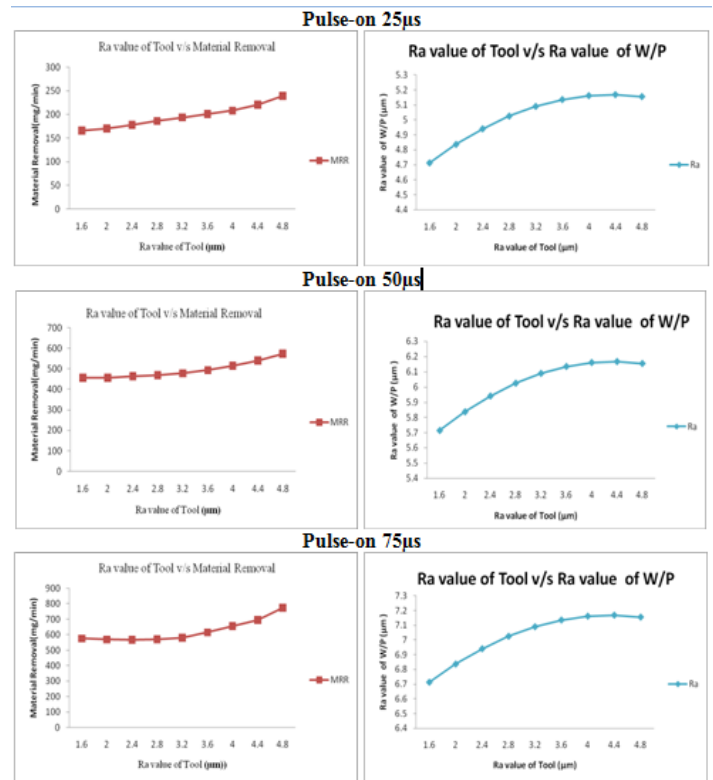


Fig 4: Variation of RaT w.r.t MRR, RaW at different Pulse-on levels

At a lower value of Pulse-on time i.e 25 μ s and lower RaT value of 1.6 μ m of the tool, good surface finish on the workpiece can be achieved. Thus Ra value of tool is directly proportional to Ra value of workpiece.

C. Interaction effect of current, Pulse-on with reference to MRR and surface Finish of the work for C90 material

The current varies from 10amps to 20amps and Pulse-on from 25 μ s to 75 μ s, keeping pulse-off, diameter of tool and surface roughness, at mid level (5 μ s, 25mm and 3.2 μ m respectively) as shown in Fig 5.

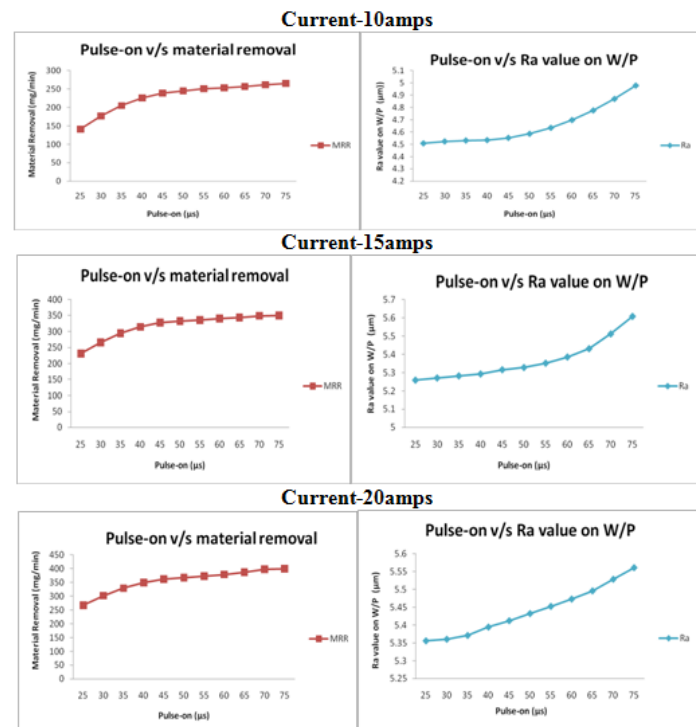


Fig 5: Variation of Pulse-on w.r.t MRR, RaW at different current levels

For finishing operation it is recommended to use lower current with lower pulse-on time thereby improving in Surface finish and compromising with MRR.

D. Interaction effect of current, surface roughness of tool with reference to MRR and SF for C90 material

The current varies from 10amps to 20amps and surface roughness of tool from 1.6 μ m to 4.8 μ m, pulse-off, diameter of tool, and pulse-on at mid level (5 μ s, 25mm, and 50 μ s respectively) as shown in Fig 6.

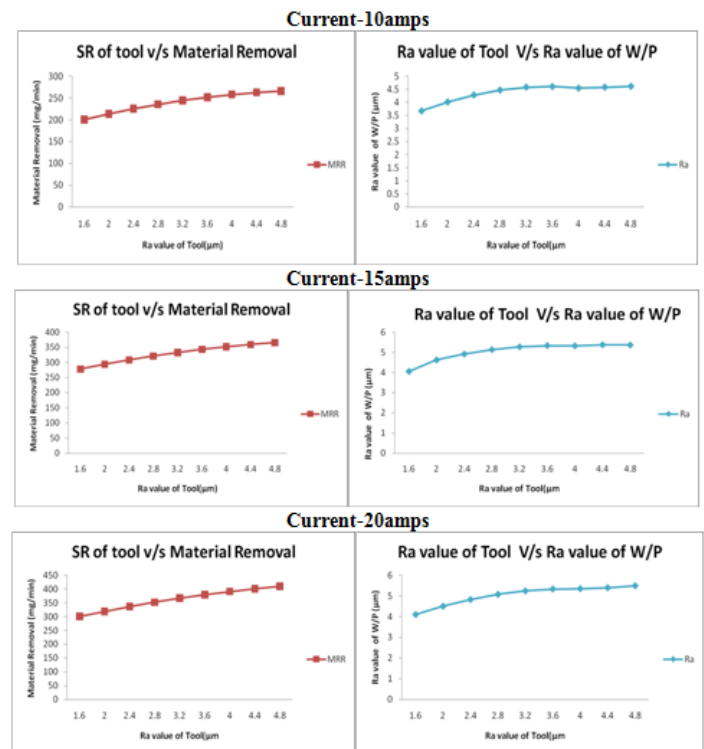


Fig 6: Variation of Pulse-on w.r.t MRR, TWR at different current levels

It has been inferred that the maximum MRR at various values of current can be obtained when the tool has the rougher surface i.e higher Ra value. However it has been observed that the better quality work surface can be obtained with the tool having lower Ra value with a relatively lower MRR.

VII. CONFORMITY EXPERIMENTS

In order to determine the accuracy of developed empirical models for C40 steel, the conformity experiments have been conducted using the same experimental setup. The process parameters have been assigned the intermediate values other than that used in the design matrix and the validation test runs have been carried out. The responses have been computed and compared with the predicted values for MRR, RTW, and Surface finish models respectively.

The percentage error of the developed RSM based empirical models is found to be within $\pm 5\%$, which clearly indicate the accuracy of the developed mathematical models. The experimental and the predicted values of MRR, RTW, and RaW for validation data set are illustrated in Graphs shown in Fig 7. Similar tests have been conducted for C-90 material also. The results obtained have been found satisfactory.

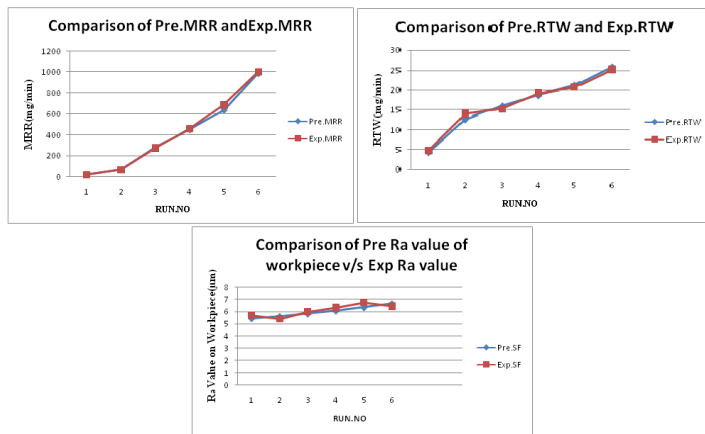


Fig 7: Conformity tests

VIII. CONCLUSION

The following general observations have been made with reference to the interaction effects of input parameters on the responses for C40 material.

- 1) Higher discharge current, pulse-on time and higher surface roughness of tool in combination with one another give good MRR and also better TWR which is more desirable. Higher material Removal can be achieved using higher discharge Current followed by Pulse-on time, Diameter of tool and surface roughness of tool.
- 2) The trend indicates that the interaction of moderate current and larger diameter of the tool does have a significant effect on Material Removal Rate (MRR) and Tool Wear Ratio (TWR).
- 3) A tool with lower Ra value (RaT) in combination with other Medium/ Low levels of input parameters yield good surface finish on the product.

To achieve good Surface Finish (SF) on the work component following combination of input parameters have to be used with reference to responses for C40 material.

- 1) Lower discharge current in combination with Lower pulse-on time, smaller diameter tool are preferred.
- 2) Lower discharge current in combination with lower surface roughness yield better Surface quality on the workpiece.
- 3) Smaller tool diameter with lower surface roughness of tool yields better Surface Finish.

The following are the observations made w.r.t. the interaction effects of input parameters on the responses for C90 material.

- 1) Higher discharge current, pulse-on time, and higher surface roughness of tool in combination with one another give good MRR and also better TWR which is more desirable. Higher material Removal can be achieved using higher discharge Current followed by Pulse-on time, Diameter of tool and surface roughness of tool.
- 2) The trend indicates that the interaction of higher current and larger diameter of the tool does have a significant effect on Material Removal Rate (MRR) and Tool Wear Ratio (TWR).

To achieve good Surface Finish (SF) on the work component following combination of input parameters have to be used with respect to responses for C40 material.

- 1) Lower discharge current in combination with Lower pulse-on time, smaller diameter tool are preferred.

- 2) Lower discharge current in combination with lower surface roughness yield better Surface quality on the workpiece.
- 3) Smaller tool diameter with lower surface roughness of tool yields better Surface Finish.

As C-90 material contains more percentage of carbon and also harder compared to C-40 material. From the above experimentation and analysis it is observed that with the same set and combination of input parameters higher MRR, TWR can be achieved on C-40 material. Higher surface Finish can be obtained on C-90 material with the same combination of input parameters.

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Impact of Socio-Emotional School Environment on Academic Achievement of Teenager-boys

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Abstract- The aim of this research is to study the effect of socio-emotional school environment on academic achievement of teenager-boys. Sample of 250 teenager-boys of higher secondary level were taken at Kanpur city. The data was collected on the basis of standardised inventory S.E.S.C.I. by Dr. (Smt.) Renuka Kumari Sinha & Smt. Rajni Bhargava (1994) and for academic achievement, percentage of class 10th marks was taken into consideration. The testing of hypothesis is done by relation the sources of two groups using the 'r' test and comparing the scores of the two groups using the 't' test. The result reveals that there is a significant difference in academic achievement of aided and private higher secondary teenager-boys. The result also reveals that there is a significant relation between socio-emotional school environment and academic achievement of teenager-boys. This shows that the socio-emotional school environment determinates the academic achievement of teenager-boys.

I. INTRODUCTION

Education is the organisation of acquired habits of such action as will fit the individual to his physical and social environment. Social environment has different agencies; school environment is one of them. School environment means the school setting relating to the physical set-up, the fairness and adequacy of disciplinary procedures, the academic environment and students health including the available physical and mental health support and services.

School environment has also various domains. Socio-emotional environment is one of the most important domain of school. **Gabriel, Bonnie & Sidney** (2001); results were consistent with the idea that careful attention needs to be given to the socio-emotional environment of middle schools. Particularly for young adolescents preoccupied with issues of self identity.

Socio-emotional environment is a factor which is responsible for variation in adolescents' personality, emotions and relationship with others. Socio-emotional factor selective theory developed by Stanford psychologist, Laura Carstensen-is a life span theory of motivation. The theory maintains that as time horizons shrink as they typically do with age, people become increasingly selective, investing greater resources in emotionally meaningful goal and activities. Accordingly to the theory, motivational shifts also influence cognitive processing and cognitive processing is also related to academic achievement of adolescents.

Through observation the point emerged that learners placed in an identical set of academic situations in their scholastic achievement. It is convincingly demonstrated that the academic achievement is a product of a number of factors

operating within the individual and school environment. **Ferreira & Chainho** (2011); results revealed that school satisfaction had a positive effect on the special needs of adolescents.

Adolescents from satisfactory school environment are rated as above the average in social adjustment, personality traits, achievement, information and versatility of interest but adolescents behaviour in case of unsatisfactory school environment is something seriously abnormal. **Bajpai** (2006); results indicate that aggressive behaviour of adolescents is significantly related to unsatisfactory school environment. Thus school environment plays a significant role in development of adolescents' behaviour and education.

Socio-emotional school environment may have an impact on academic achievement of teenager-boys and can also form the basis of their education and vocational success. The present study focuses on the role of socio-emotional environment in different types of higher secondary schools (Government Aided & Private). The present study concentrates on the impact of socio-emotional school environment on academic achievement of teenager-boys.

II. VARIABLE OF STUDY

Variable of Study: The variable in the present study are:-

1. Independent Variable:

1.1- Socio-Emotional School Environment – Socio-emotional school environment is studied with the help of interaction, love, compassion, respect, honor, courtesy and sympathy.

1.2- Different types of school – Researcher selected two types of schools.

1.2.1- Government Aided School – A higher secondary school aided and supported by government.

1.2.2- Private School – A higher secondary school run and supported by private individuals or co-operation rather than a government or public agency.

2. Dependent Variable:

2.1- Academic Achievement – Academic Achievement is a term used in school evaluation. Here the academic achievements in terms of marks or grades of the students are taken into consideration.

2.2- Teenager – A young person between 13 and 19 years old. The time of life between childhood and maturity. A young person who has undergone puberty but who has not reached full maturity. It is also called a no-man's land.

Coding Words:

a_1b_1 = Means that the teenager-boys of aided higher secondary schools.

a_2b_1 = Means that the teenager-boys of private higher secondary schools.

ab_1 = Means that the total teenager-boys of higher secondary schools.

Objectives: The present study was conducted with the following objectives:-

- 1- To study the difference in academic achievement of teenager-boys studying in aided and private higher secondary schools.
- 2- To study the relation between academic achievement and socio-emotional school environment of aided higher secondary teenager-boys (a_1b_1).
- 3- To study the relation between academic achievement and socio-emotional school environment of Private Higher Secondary teenager-boys (a_2b_1).
- 4- To study the relation between academic achievement and socio-emotional school environment of total higher secondary teenager-boys (ab_1).

Hypothesis: The following null hypotheses (H_0 ;) were formulated :-

- H_0 :1- There is no difference in academic achievement of teenager-boys studying in aided and private higher secondary schools.
- H_0 :2- There is no relation between academic achievement and socio-emotional school environment of aided higher secondary teenager-boys (with regard to a_1b_1).
- H_0 :3- There is no relation between academic achievement and socio-emotional school environment of Private Higher Secondary teenager-boys (with regard to a_2b_1).
- H_0 :4- There is no relation between academic achievement and socio-emotional school environment of total Higher Secondary teenager-boys (with regard to ab_1).

III. RESEARCH DESIGN

1. Research Method- Survey method was used in this present descriptive research.

2. Population- The teenager-boys of higher secondary schools of Kanpur city (India – U.P. State) form the population of present study.

3. Sample- The researcher selected **250 teenager-boys** from different **aided** and **private** higher secondary schools of Kanpur city (situated in India – U.P. State) by lottery random sampling method. In the present study Kanpur city was divided into five zones – North, South, East, West and Central. One aided and one private school was randomly selected in each zone. Total **125 teenager-boys** from **aided higher secondary school** and **125 teenager-boys** from **private higher secondary school** were taken. But the investigation was delimited to U.P. Board School. These teenager-boys are the students of class 11th & 12th.

4. Tools-

4.1- Academic Achievement: Academic achievement in term of percentage of mark obtained in class 10th by teenager-boys.

4.2 Socio-emotional School Environment: Socio-emotional School climate inventory constructed by Dr. (Mrs.) Renuka Kumari Sinha and Mrs. Rajni Bhargava (1994). It is a standardized test. S.E.S.C.I. has 70 items. 35 items belong to social school climate and 35 items belong to emotional school climate and total items belong to socio-emotional school climate. This is a two point scale. Marking for negative statements 0,1 for 'Yes' and 'No'. For positive statements 1,0 for 'Yes' and 'No'.

5. Procedure: The tool was administered on the above said population personally before administering the questionnaires. A rapport was established with the subjects and they were assured confidentiality of their responses. The filled up questionnaires were then scored in the prescribed manner given in the respective manuals obtained data was tabulated for statistical analysis.

6. Statistical Technique: The data was analysed with the help of - 6.1 Mean, 6.2 – Standard Deviation, 6.3 – 't' test & 6.4 – Co-relation.

Table-1
Academic Achievement of teenager-boys in Aided and Private Higher Secondary Schools

Teenager-boys	N	Mean	Div.	S.D.	' t' Value	Level of Significance
Aided School	125	52.95	II	6.64	11.11	significance at 0.05 level (> 1.96)
Private School	125	63.07	I	7.65		

From the perusal of Table-1, it is observed that the mean of academic achievement of aided and private higher secondary teenager-boys is 52.95, they have second division. But the mean of academic achievement of private higher secondary teenager boys is 63.07, they have first division. 't' – value is 11.11. This value is more than 1.96, there fore the difference is significant, which shows that null hypothesis ($H_0:1$) is rejected.

Discussion: Result shows that different types of schools have different socio-emotional environment. So this might affect their academic achievement.

Table-2
Co-relation between academic achievement and socio-emotional School
environment of Aided higher secondary teenager-boys (with regard to a_1b_1)
(N = 125)

School Environment	Academic Achievement	
	Co-efficient of Co-relation	Level of Significance
Social	0.250	Significance at 0.05 Level (> 0.176)
Emotional	0.219	Significance at 0.05 Level (> 0.176)
Socio-Emotional	0.271	Significance at 0.05 Level (> 0.176)

From the perusal of Table-2, it is observed that Co-relation between academic achievement and social, emotional and socio-emotional of aided higher secondary teenager-boys are: – 0.250, 0.219 & 0.271. The value is more than 0.176 (0.05 level). Therefore the relationship is significant, which shows the null hypothesis ($H_0:2$) is rejected. Thus there is positive and significant Co-relation between academic achievement and socio-emotional school environment of aided higher secondary teenager-boys.

Table-3
Co-relation between academic achievement and socio-emotional School
environment of Private higher secondary teenager-boys (with regard to a_2b_1)
(N = 125)

School Environment	Academic Achievement	
	Co-efficient of Co-relation	Level of Significance
Social	0.207	Significance at 0.05 Level (> 0.176)
Emotional	0.178	Significance at 0.05 Level (> 0.176)
Socio-Emotional	0.222	Significance at 0.05 Level (> 0.176)

From the perusal of Table-3, it is observed that co-relation between academic achievement and social, emotional and socio-emotional school environment of private higher secondary teenager-boys are: – 0.207, 0.178 & 0.222. The value is more than 0.176 (0.05 level). Therefore the relationship is significant, which shows the null hypothesis ($H_0:3$) is rejected. Thus there is positive and significant co-relation between academic achievement and Socio-emotional school environment of private higher secondary teenager-boys.

Table-4
Co-relation between academic achievement and socio-emotional school
environment of higher secondary teenager-boys (with regard to ab_1)
(N = 250)

School Environment	Academic Achievement	
	Co-efficient of Co-relation	Level of Significance
Social	0.230	Significance at 0.05 Level (> 0.126)
Emotional	0.199	Significance at 0.05 Level (> 0.126)
Socio-Emotional	0.247	Significance at 0.05 Level (> 0.125)

From the perusal of Table-4, it is observed that co-relation between academic achievement and social, emotional and socio-emotional of aided higher secondary teenager-boys are: – 0.230, 0.199 & 0.247. The value is more than 0.126 (0.05 level). Therefore the relationship is significant, which shows the null hypothesis ($H_0:4$) is rejected. Thus there is positive and significant co-relation between academic achievement and socio-emotional school environment of higher secondary teenager-boys.

Discussion – Results (Table – 2, 3 & 4) disclose that a significant co-relation exists between academic achievement and socio-emotional school environment of teenager-boys in different types of schools (aided & Private). This shows that the socio-emotional school environment affects academic achievement of teenager-boys. Socio-emotional school environment can either impede or support learning. It also provides information on assessment instruments for measuring school environment. Ming & Rebecca (2010), have similar results that school environment of adolescents influenced academic achievement directly and indirectly. It can be said that the socio-emotional school environment is a deciding factor in the academic achievement of higher secondary teenager-boys.

IV. CONCLUSIONS

The conclusions of the study are as follows:

1. There is a significant difference between academic achievement of teenager-boys studying in aided and private higher secondary schools.
2. There is a significant relation between academic achievement and socio-emotional school environment of aided higher secondary teenager-boys (with regard to a1b1).
3. There is a significant relation between academic achievement and socio-emotional school environment of private higher secondary teenager-boys (with regard to a2b1).
4. There is a significant relation between academic achievement and socio-emotional school environment of higher secondary teenager-boys (with regard to ab1).

Educational Implications: - Competition has been used as a motivating influence during the entire history of pedagogy, so socio-emotional school environment can play a crucial role in developing academic achievement in the following ways:-

- Create a warm, orderly environment in the classroom and in school. The conducive environment develops academic achievement among adolescents and avoids higher stress and disorganisation.
- Focus attention on desired educational goals and make clear understanding of academic achievement in life.
- Teachers encourage the development of positive motive and make it clear to the adolescents that new motives will improve their self image.
- Emphasize upon the fact that new motive is an improvement of prevailing educational value.

- Help adolescents to set and attain realistic educational goals and provide incentives and motivate them if necessary.
- Make an effort to develop conducive socio-emotional environment in the classroom so that every adolescents should feel elevated and feel a sense of belongingness to high groups of adolescents.

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Comparative Study of Dual-Tree Complex Wavelet Transform and Double Density Complex Wavelet Transform for Image Denoising Using Wavelet-Domain

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Abstract- There has been a lot of research work dedicated towards image denoising. However, with the wide spread of image usage in many fields of our lives, it becomes very important to develop new techniques for image denoising. The previous research in image denoising was based on two of the famous techniques in the image denoising named 2-D Dual-tree Complex Wavelet Transform (2D DTCWT) and 2-D Double Density Complex Wavelet Transform (2D DDCWT). In this paper, we introduce a comparative study of applying both Dual-tree Complex Wavelet Transform and Double Density Complex Wavelet Transform techniques to the image denoising. The main goal of this study is to exploit the advantages and disadvantages of using these techniques so as to determine the proper application of both.

Index Terms- Image denoising, Dual-tree complex wavelet transform, and Double Density complex wavelet transform.

I. INTRODUCTION

Generally, noise reduction is an essential part of image processing systems. An image is always affected by noise in its capture, acquisition and processing. This denoising is used to improve the quality of corrupted by a lot of noise due to the undesired conditions for image acquisition. Generally, the image quality is measured by the peak signal-to-noise ratio (PSNR) or signal-to noise ratio (SNR).

Traditionally, this is achieved by linear processing such as Wiener filtering. A variety of methods has emerged recently on signal denoising using nonlinear techniques in the case of additive Gaussian noise. To denoise the image we study the Dual Tree Complex Wavelet Transform method first then we study the Double Density Complex Wavelet Transform and compare advantages & disadvantages of the both the methods. Comparison gives a new hybrid model which has the characteristics of both the methods Dual Tree Complex Wavelet Transform & Double Density Complex Wavelet Transform.

II. DUAL-TREE WAVELET TRANSFORM

We introduce the Dual-Tree Complex Wavelet Transform (DT CWT), which uses two trees of real filters to generate the

real and imaginary parts of the wavelet coefficients separately with the following properties:

- (1) Approximate shift invariance;
- (2) Good selectivity and directionality in 2-dimensions (2-D) with Gabor-like filters (also for higher dimensionality).
- (3) Phase Information: - Local phase extraction is possible through analytic interpretation of two parallel trees of DT-DWT.
- (4) Perfect reconstruction (PR) using short linear phase filters.
- (5) Limited Redundancy.

Recently complex-valued wavelet transforms CWT have been proposed to improve upon these DWT deficiencies, with the Dual-Tree CWT (DT-CWT) becoming a preferred approach due to the ease of its implementation. In the DT-CWT, real valued wavelet filters produce the real and imaginary parts of the transform in parallel decomposition trees, permitting exploitation of well established real-valued wavelet implementations and methodologies. A primary advantage of the DT-CWT lies in that it results in decomposition with a much higher degree of directionality than that possessed by the traditional DWT. The real-valued filter coefficients are replaced by Complex-valued coefficients by proper design methodology that satisfies the required conditions for convergence. Then the complex filter can again be decomposed into two real-valued filters. Thus, two real-valued filters that give their respective impulse responses in quadrature will form the Hilbert transform pair. The combined pair of two such filters is termed as an analytic filter. The formulation and interpretation of the analytic filter is figure1.

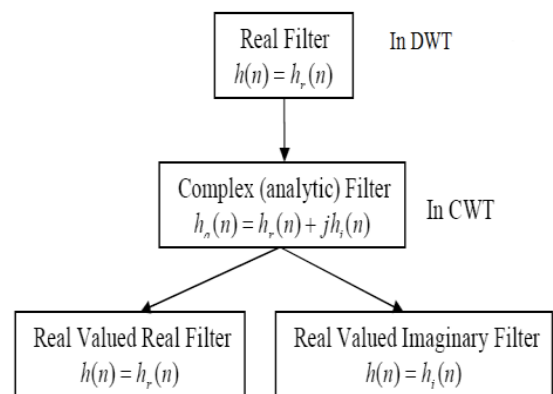


Figure 1: Analytic Filter

The implementation of 2-D DTCWT consists of two steps. Firstly, an input image is decomposed up to a desired level by two separable 2D DWT branches, branch *a* and branch *b*, whose filters are specifically designed to meet the Hilbert pair requirement. Then six high-pass sub bands are generated at each level. HL*a*, LH*a*, HH*a*, HL*b*, LH*b* and HH*b*. **Secondly**, every two corresponding sub bands which have the same pass-bands are linearly combined by either averaging or differencing. As a result, sub bands of 2D DT-CWT at each level are obtained as

$$\begin{aligned} & (LH_a + LH_b) / \sqrt{2}, (LH_a - LH_b) / \sqrt{2}, \\ & (HL_a + HL_b) / \sqrt{2}, (HL_a - HL_b) / \sqrt{2}, \\ & (HH_a + HH_b) / \sqrt{2}, (HH_a - HH_b) / \sqrt{2} \end{aligned}$$

The six wavelets defined by oriented shown above have the sum/difference operation is orthonormal, which constitutes a perfect reconstruction wavelet transform. The imaginary part of 2D DT-CWT has similar basis function as the real part. The 2D DT-CWT structure has an extension of conjugate filtering in 2D case. The filter bank structure of 2D dual-tree is shown in figure 2.

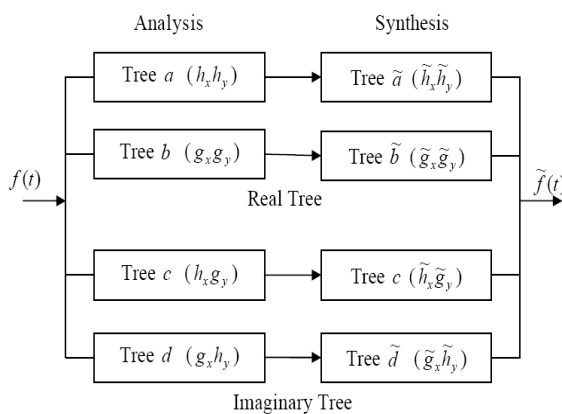


Figure 2: Filter bank structure for 2D DT-CWT

2D structure needs four trees for analysis as well as for synthesis. The pairs of conjugate Filters are applied to two dimensions (x and y) directions, which can be expressed as:

$$(h_x + jg_x)(h_y + jg_y) = (h_x h_y - g_x g_y) + j(h_x g_y + g_x h_y)$$

The filter bank structure of *tree a*, similar to standard 2D DWT spanned over 3 level, is shown in figure 3.

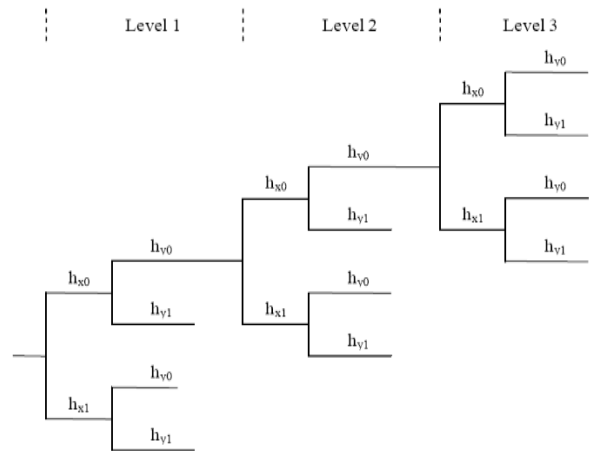


Figure 3: Filter bank structure of tree-a of figure 2

All other *trees-(b, c & d)* have similar structures with the appropriate combinations of filters for row- and column-filtering. The overall 2D dual-tree structure is 4-times redundant (expensive) than the standard 2D DWT. The *tree-a* and *tree-b* form the real pair, while the *tree-c* and *tree-d* form the imaginary pair of the analysis filter bank. Trees-(*a*~, *b*~) and trees- (*c*~, *d*~) are the real and imaginary pairs respectively in the synthesis filter bank similar to their corresponding analysis pairs.

Using the same principle for the design of shift invariant filter decomposition, Kingsbury suggested to apply a 'dual-tree' of two parallel filter banks are constructed and their band-pass outputs are combined. The structure of a resulting analysis filter bank is shown in Figure: 4, where index *a* stands for the original filter bank and the index *b* is for the additional one. The dual-tree complex DWT of a signal *x*(*n*) is implemented using two critically-sampled DWTs in parallel on the same data.

In one dimension, the so-called dual-tree complex wavelet transform provides a representation of a signal *x*(*n*) in terms of complex wavelets, composed of real and imaginary parts which are in turn wavelets themselves. In fact, these real and imaginary parts essentially form a quadrature pair.

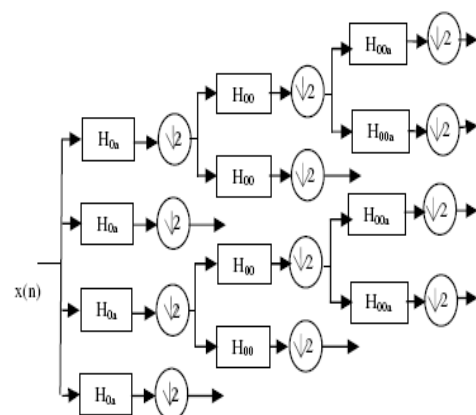


Figure 4: Three level Complex dual tree

Table 1: First Level DWT Coefficients

H_{00}	H_{10}	H_{20}	H_{30}
0	0	0.01122679	0
-0.08838834	-0.01122679	0.01122679	0
0.08838834	0.01122679	-0.08838834	-0.08838834
0.69587998	0.08838834	0.08838834	-0.08838834
0.69587998	0.08838834	0.69587998	0.69587998
0.08838834	-0.69587998	0.69587998	-0.69587998
-0.08838834	0.69587998	0.08838834	0.08838834
0.01122679	-0.08838834	-0.08838834	0.08838834
0.01122679	-0.08838834	0	0.01122679
0	0	0	-0.01122679

The dual-tree CDWT uses length-10 filters, the table of coefficients of the analyzing filters in the first stage is shown in Table 1 and the remaining levels are shown in Table 2. The reconstruction filters are obtained by simply reversing the alternate coefficients of the analysis filters.

To extend the transform to higher-dimensional signals, a filter bank is usually applied separably in all dimensions. To compute the 2D CWT of images these two trees are applied to the rows and then the columns of the image as in the basic DWT.

Table2: Remaining Level DWT Coefficients

Tree a		Tree b	
H_{00a}	H_{01a}	H_{00b}	H_{01b}
0.03516384	0	0	-0.03516384
0	0	0	0
-0.08832942	-0.11430184	-0.11430184	0.08832942
0.23389032	0	0	0.23389032
0.76027237	0.58751830	0.58751830	-0.76027237
0.58751830	-0.76027237	0.76027237	0.58751830
0	0.23389032	0.23389032	0
-0.11430184	0.08832942	-0.08832942	-0.11430184
0	0	0	0
0	-0.03516384	0.03516384	0

This operation results in six complex high-pass sub-bands at each level and two complex low-pass sub-bands on which subsequent stages iterate in contrast to three real high-pass and one real low-pass sub-band for the real 2D transform. This shows that the complex transform has a coefficient redundancy of 4:1 or 2m:1 in m dimensions. In case of real 2D filter banks the three high-pass filters have orientations of 0° , 45° and 90° for the complex filters the six sub-band filters are oriented at angles $\pm 15^\circ, \pm 45^\circ, \pm 75^\circ$.

The CDWT decomposes an image into a pyramid of complex sub images, with each level containing six oriented sub images resulting from evenly spaced directional filtering and subsampling, such directional filters are not obtainable by a separable DWT using a real filter pair but complex coefficients makes this selectivity possible.

The Dual-Tree Complex Discrete Wavelet Transform has been developed to incorporate the good properties of the Fourier transform in the wavelet transform. As the name implies, two wavelet trees are used, one generating the real part of the complex wavelet coefficients tree and the other generating the imaginary part tree.

The shift invariance and directionality of the CWT may be applied in many areas of image processing like denoising, feature extraction, object segmentation and image classification. Here we shall consider the denoising example. The Complex Discrete Wavelet Transform is used for denoising as an important signal/image processing application. Complex Discrete Wavelet Transform technique is a powerful tool in removing signal/image noise. For denoising a soft thresholding method is used rather than hard-thresholding in terms of MSE and SNR.

III. DOUBLE DENSITY DISCRETE WAVELET TRANSFORM

The new version of DWT, known as Double Density DWT (DDDWT) is recently developed. It has the following important additional proprieties: -

- (1) It employs one scaling function and two distinct wavelets which are designed to be offset from one another by one half.
- (2) The double density DWT is over complete by a factor of two.
- (3) It is nearly shift-invariant where complex wavelets with real and imaginary parts approximating Hilbert pairs are proposed for denoising signal.

The double density Discrete Wavelet Transform is constructed with analysis and synthesis filter bank and it is shown in the Figure 5.

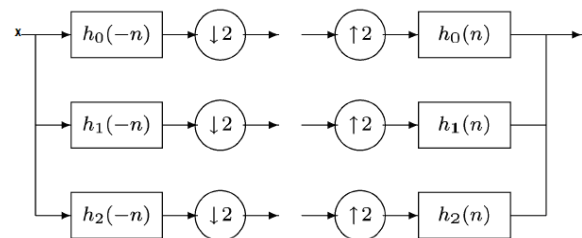


Figure 5: Oversampled analysis and synthesis filter bank

In two dimensions, this transform outperforms the standard DWT in terms of enhancement; however, there is need of improvement because not all of the wavelets are directional. That is, although the double-density DWT utilizes more wavelets, some lack a dominant spatial orientation, which prevents them from being able to isolate those directions.

A solution to this problem is provided by the double-density complex DWT, which combines the characteristics of the double-density DWT and the dual-tree DWT. The double-density complex DWT is based on two scaling functions and four distinct wavelets, each of which is specifically designed such that the two wavelets of the first pair are offset from one other by one half, and the other pair of wavelets form an approximate Hilbert transform pair.

By ensuring these two properties, the double-density complex DWT possesses improved directional selectivity and can be used to implement complex and directional wavelet transforms in multiple dimensions. We construct the filter bank structures for both the double-density DWT and the double-density complex DWT using finite impulse response (FIR)

perfect reconstruction filter banks. These filter banks are then applied recursively to the low pass subband, using the analysis filters for the forward transform and the synthesis filters for the inverse transform. By doing this, it is then possible to evaluate each transforms performance in several applications including signal and image enhancement.

A. 1-D Double-Density DWT

The double-density DWT is implemented by recursively applying the 3-channel analysis filter bank to the low pass subband. This process is illustrated in Figure 6.

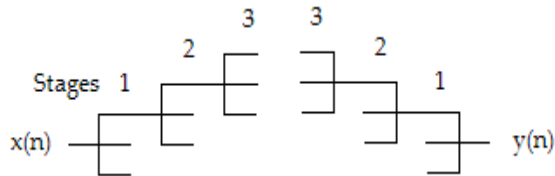


Figure 6: Three stage recursion of the 1-D double-density DWT

Conversely, the inverse double-density DWT is obtained by iteratively applying the synthesis filter bank.

B. 2-D Double-Density DWT

To use the double-density discrete wavelet transform for 2-D signal and image processing, we must implement a two-dimensional analysis and synthesis filter bank structure. This can simply be done by alternatively applying the transform first to the rows, then to the columns of an image. This gives rise to nine 2-D subbands, one of which is the 2-D low pass scaling filter, and the other eight of which make up the eight 2-D wavelet filters, as shown in Figure 7.

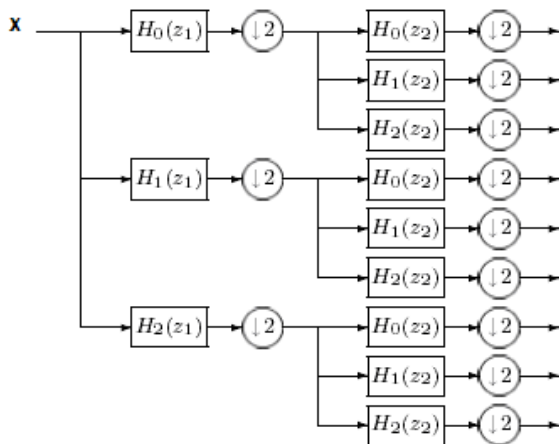


Figure 7: An Oversampled Filter Bank for 2-D Images

The differences between the double-density DWT and the dual-tree DWT can be clarified with the following comparisons.

- 1) In the dual-tree DWT, the two wavelets form an approximate Hilbert transform pair, whereas in the double-density DWT, the two wavelets are offset by one half.
- 2) For the dual-tree DWT, there are fewer degrees of freedom for design (achieving the Hilbert pair property adds constraints), whereas for the double-density DWT, there are more degrees of freedom for design.
- 3) Different filter bank structures are used to implement the dual-tree and double-density DWTs.
- 4) The dual-tree DWT can be interpreted as a complex-valued wavelet transform, which is useful for signal modeling and denoising (the double-density DWT cannot be interpreted as such).
- 5) The dual-tree DWT can be used to implement 2-D transforms with directional Gabor-like wavelets, which is highly desirable for image processing (the double-density DWT cannot be, although it can be used in conjunction with specialized post-filters to implement a complex wavelet transform with low-redundancy, as developed).

IV. EXPERIMENTAL RESULTS

Experiments are carried out on grey scale image to compare the performances of DT-CWT and DD-CWT methods. To evaluate the performance of the Dual-Tree and Double-Density DWT are performed. The performance of denoising method (indexed by the PSNR) is confirmed by the visual quality as shown in Figure 8.



Figure 8: (a) Input Image, (b) Gaussian noisy image for $\sigma=10$, (c) Denoised with Dual Tree CWT (d) Denoised images with Double Density DWT

V. CONCLUSIONS

This paper highlighted wavelet based enhancement of gray scale digital images corrupted by additive Gaussian noise. In this study we have evaluated and compared the performances of complex wavelet transforms.

The DT CWT is shift invariant and forms directionally selective diagonal filters. These properties are important for many applications in image processing including denoising, deblurring, segmentation and classification. In this paper we have illustrated the example of the application of complex wavelets for the denoising of Lena images. To obtain further improvements, it is also necessary to develop principled statistical models for the behavior of features under addition of noise, and their relationship to the uncorrupted wavelet coefficients.

In terms of image enhancement, the double-density complex wavelet transform performed much better at suppressing noise over the double-density wavelet transform. However, to improve the performance further it is necessary to use a different threshold for each subband because for this transform the wavelets associated with different subbands have different norms. The simulation results indicate that the complex double density dual tree discrete wavelet transform performances better than others wavelet transform.

The proposed one is a hybrid model of Complex Dual-Tree DWT and Complex Double-Density DWT. The complex double density dual tree discrete wavelet transform (CDDTDWT) outperforms in comparison with others wavelet transform in the highly corrupted images.

The double-density dual-tree DWT, which is an overcomplete discrete wavelet transform (DWT) designed to simultaneously possess the properties of the double-density DWT and the dual-tree complex DWT. The double-density DWT and the dual-tree complex DWT are similar in several respects (they are both overcomplete by a factor of two, they are both nearly shift-invariant, and they are both based on FIR perfect reconstruction filter banks), but they are quite different from one another in other important respects. Both wavelet transforms can outperform the critically sampled DWT for several signal processing applications, but they do so for different reasons. It is therefore natural to investigate the possibility of a single wavelet transform that has the characteristics of both the double-density DWT and dual-tree complex DWT.

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Performance Comparison of Routing Protocols Based on Different Models in Mobile Adhoc Network

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Abstract- The main characteristics of Mobile Adhoc NETWORK (MANET) are no infrastructure, no centralized administration and self-configuring networks. The primary motivation of MANET deployment is to increase portability, flexibility and mobility but, mobility causes an unpredictable change in topology and makes routing more difficult. Efficient dynamic routing is a research challenge in such networks. In this paper we have evaluated the performance of three protocols namely AODV (Adhoc On demand Distance Vector routing), DSR (Dynamic Source Routing) reactive routing protocol and DSDV (Destination Sequenced Distance Vector) routing which is a proactive routing protocol on the basis of packet delivery ratio and normalized routing overhead using NS-2 simulator. Four different models are created by changing few parameters of traffic generator file and scenario file like pause time, speed of mobile nodes, network size and number of maximum connections and the results demonstrate that the difference in the mechanism of routing protocols lead to specific performance variation. The selection of an efficient routing protocol thus depends on different parameters of the MANET.

Index Terms- AODV; DSDV; DSR; MANET; ns2

I. INTRODUCTION

Mobile Adhoc Networks is an autonomous system of mobile nodes connected by multi-hop wireless links without centralized infrastructure support. A central challenge in such networks is the development of dynamic routing protocol that can efficiently find routes between two communicating nodes and is able to keep up with the high degree of node mobility that often changes the network topology drastically and unpredictably. The routing protocols can be broadly classified into on-demand routing protocols (reactive) and table-driven routing protocols (proactive). The most popular on demand routing algorithms are Adhoc On-Demand Distance Vector routing [1] and Dynamic Source Routing [3]. Destination Sequenced Distance Vector [2] routing is a table-driven routing algorithm. To determine the advantage of these protocols many researchers have made investigations comparing the performance of these protocols under various conditions and constraints [4][5][7][10].

The rest of the paper is organized as follows. In Section II related works on the research already done in the field of protocol comparison is discussed. In Section III, we present brief overview of routing protocols used. Section IV gives a

description of simulation environment and the performance metrics evaluated. The simulation results obtained are discussed in Section V. Finally, Section VI concludes this paper.

II. RELATED WORK

A number of protocols are implemented and tested for MANETS in order to fulfill the major requirements of routing including, enhancement of the bandwidth utilization, loop-free routing, minimum route acquisition delay, higher packet delivery ratio, lesser overheads per packet, minimum consumption of energy and others.

In the beginning, protocol comparison of DSDV, AODV and DSR was carried out by Per Johansson et.al. [7]. The simulations were made on random scenarios including varied mobility and varied load. Results were presented as a function of a novel mobility metric designed to reflect the relative speeds of the nodes in a scenario. In most simulations the reactive protocols (AODV and DSR) performed significantly better than DSDV. The performance comparison of two reactive routing protocols AODV and DSR was presented by S.R Das et.al. [5] using varying network load, mobility and network size. The simulation results show that DSR outperforms AODV when there are less number of nodes and low mobility but AODV outperforms DSR in more stressful situation.

The various types of mobility models were identified and evaluated by Tracy Camp et al. [6] and it is seen that the mobility of a node will also affect the overall performance of the routing protocols. The performance of the routing protocols OLSR, AODV and DSR was examined by considering the metrics of packet delivery ratio, control traffic overhead and route length by using NS-2 simulator [11] [12]. Mobile Adhoc protocols possess qualitative properties (distributed operation, loop freedom, demand based routing & security) and quantitative properties (end-to end delay, route discovery time, throughput, control packet overhead and packet delivery ratio). Most of the routing protocols are qualitatively enabled but lot of simulation studies were carried out in the paper by B. Mohammed [9] to review the quantitative properties of routing protocols. In our study we have compared two quantitative properties (packet delivery ratio and normalized routing overhead) of AODV, DSR and DSDV routing protocols when run over different models constructed by taking four different scenarios including varied mobility in terms of pause time and speed of nodes, varied traffic connection and varied network size.

III. ROUTING PROTOCOLS

Adhoc On-demand Distance Vector (AODV) routing protocol

AODV [1] works on an on-demand basis that is, route is found from source node to destination only when there is a demand to transmit a data packet. It uses table driven routing framework and destination sequence numbers. AODV supports only one route for each destination and it deals with route table management. The path discovery and route maintenance process can be explained as follows:

Path Discovery Process in AODV: A RREQ packet is broadcasted to initiate path discovery. The RREQ contains the following fields:

<source_addr,source_sequence_#,broadcast_id,dest_addr,destination_sequence_#,hop_cnt>.

Each neighbor re-broadcasts it to its own neighbor after increasing the hop_cnt. An intermediate node can receive multiple copies of same RREQ broadcast from various neighbors. The pair <source_addr,broadcast_id > uniquely identifies a RREQ. An RREQ with same source address and broadcast_id is discarded. The intermediate node records the address of the neighbor from which it receives the first copy of the RREQ to automatically build the reverse path. Source_seq_# is used to maintain “freshness” information about the reverse route to the source. The destination_seq_# is the latest sequence number received in the past by the source for any route towards the destination. RREP contains the following information:

<source_addr, dest_addr, dest_sequence_#, hop_cnt, lifetime>

If an intermediate node has route entry for desired destination in its routing table, it compares its destination sequence number to the destination sequence number in the RREQ. If RREQ's sequence number is greater than intermediate node must not use its recorded route and re-broadcast the RREQ. If it has a route with sequence number greater or equal to that contained in RREQ it uncast a RREP back to its neighbor from which it received the RREQ. In the event that there is no corresponding entry for that destination, an entry is created. Lifetime is the time in milliseconds for which nodes receiving the RREP consider the route to be valid.

Route Maintenance in AODV: If a source node moves during an active session, it can reinitiate route discovery procedure to the destination. If an intermediate node moves, its upstream neighbor notices the move and sends RERR (route error) packet giving link failure notification message. Optionally a mobile node may perform local connectivity maintenance by periodically broadcasting HELLO messages.

Dynamic Source Routing (DSR)

DSR [3] is an on-demand routing protocol based on source routing. In source routing the sender knows complete hop-by-hop route to the destination. Each packet carries list of all nodes in the path in its header which makes packet routing trivially loop-free. The routes are stored in a route cache. DSR is composed of two processes: *Route Discovery and Route Maintenance*.

Route Discovery in DSR: If a node in an adhoc network wishes to send a data packet to a destination for which it does not already know the route, it initiates a route discovery by flooding the network with RREQ packets. Each node receiving a RREQ, rebroadcasts it, until it is the destination node or it has a route to

the destination in its route cache. The sending node even saves a copy of the original packet in a local buffer called Send Buffer where each packet is stamped with time and discarded after this timeout period. While the packet remains in the Send Buffer, the node should occasionally initiate a new Route Discovery for the destination. A RREQ packet is replied by a RREP packet which routes itself back to the source by traversing the RREQ path backwards. The propagation of RREQ and RREP in DSR is shown in Fig. 1 and Fig. 2 respectively. In response to single route discovery, a node may learn and cache multiple routes to any destination. So, if the currently used route fails or breaks, there is no need to perform a new Route Discovery.

Route Maintenance in DSR: The mechanism by which a node sending a packet along a specified route to some destination detects if that route is broken is called Route Maintenance. Route Maintenance is used to handle route breaks. When a node encounters a fatal transmission problem at its data link layer, it removes the route from its route cache and generates a route error message. The route error message is sent to each node that has sent a packet routed over the broken link. When a node receives a route error message, it removes the hop in error from its route cache.

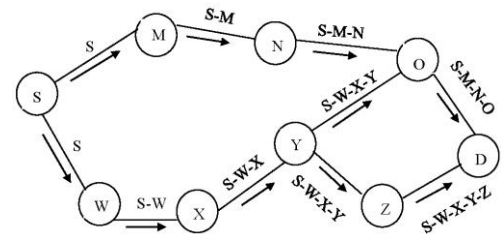


Figure 1: Propagation of Route Request

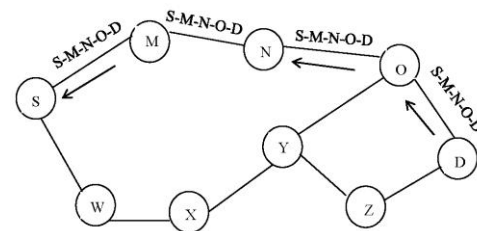


Figure 2: Propagation of Route Reply

Destination Sequenced Distance Vector (DSDV) Routing Protocol

DSDV [2] is a Proactive (table-driven) routing protocol based on the idea of the classical Bellman-Ford Routing Algorithm with certain improvements. Packets are transmitted between the stations of the network by using routing tables which are stored at each station of the network. Each routing table, at each of the stations, lists all available destinations, and the number of hops to each. Each route table entry is tagged with a sequence number which is originated by the destination station. Each station periodically transmits updates, and transmits updates immediately when significant new information is available. The DSDV protocol requires each mobile station to advertise, to each of its current neighbors, its own routing table. The data broadcast by each mobile computer will contain its new sequence number and the following information for each new route: destination's address, number of hops required to reach the destination and

sequence number of the information received regarding that destination, as originally stamped by the destination.

Routes with more recent sequence numbers are always preferred as the basis for making forwarding decisions. Of the paths with the same sequence number, those with the smallest metric will be used. Mobile Hosts cause broken links as they move from place to place, the broken link may be detected by the layer-2 protocol, or it may instead be inferred if no broadcasts have been received for a while from a former neighbor. A broken link is described by a metric of ∞ (i.e., any value greater than the maximum allowed metric). When a link to a next hop has broken, any route through that next hop is immediately assigned an infinite metric and assigned an updated sequence number.

IV. SIMULATION AND PERFORMANCE METRICS

A. Simulation Environment

The simulations were performed using the Network Simulator 2 (ns-2) [8], which allows node mobility, thereby providing for simulation of mobile ad hoc networks. In ns-2 protocols used in ad hoc networks have been supported. Node movement is modeled by the random waypoint mobility model [13] in which the nodes move from one waypoint to another randomly. A specific speed and duration is chosen for every transition. After the stipulated transition duration ends the node may pause for a specific duration of time (pause time) before starting its transition towards the next waypoint. We have compared the routing protocols by generating different network scenarios modeled as Pause-time model (pause time is varied in the scenario generator file), Nodes model (number of nodes in the network are varied both in the scenario and traffic generator file), Speed model (speed of mobile nodes is varied in scenario file) and Flow model (number of maximum connections in the network are varied in the traffic generator file). The Simulation Environment for different models is given in Table I

B. Performance Metrics

The performance metrics considered for comparisons and evaluations are

Packet Delivery Ratio: The Packet Delivery Ratio (PDR) is defined as the ratio between payload packets delivered to the destination and those generated by the source nodes. This number presents the effectiveness of the protocol and it is generally denoted as percentage. It measures the loss rate and characterizes both the correctness and efficiency of ad hoc routing protocols. A high packet delivery ratio is desired in any network.

$$\text{Packet Delivery Ratio (\%)} = \frac{P_r}{P_s} * 100$$

P_r = total packets received

P_s = total packets sent

Normalized Routing Overhead: The number of routing packets “transmitted” per data packet “delivered” at the destination is known as normalized routing overhead. This metric provides an indication of the extra bandwidth consumed by overhead to deliver data traffic.

$$\text{Normalized Routing Overhead} = \frac{\text{number of routing packets}}{\text{number of transmitted data packets}}$$

Table 1: Simulation Environment for Different Models

Simulation Parameters	Models			
	Pause Time Model	Nodes Model	Speed Model	Flow Model
Simulation time(s)	300	300	300	300
Simulation area	1000m x 600m	1000m x 600m	1000m x 600m	1000m x 600m
Channel BW (Mb/s)	2	2	2	2
MAC Layer	IEEE 802.11	IEEE 802.11	IEEE 802.11	IEEE 802.11
No. of nodes	25	Varied (5,10,15, 20,25)	10	25
Node transmission range (m)	250	250	250	250
Pause time(s)	Varied(5, 0,100,15, 0,200,25, 0)	100s	100s	100s
Node speed(m/s)	10	10	Varied(5, 10,15,20, 25)	10m/s
Traffic type	CBR	CBR	CBR	CBR
Data packet size (byte)	512	512	512	512
Data rate (pkts/s)	4	4	4	4
Max connections	25	equal to no. of nodes (5,10,15, 20,25)	10	Varied(5, 10,15,20, 25 nodes)

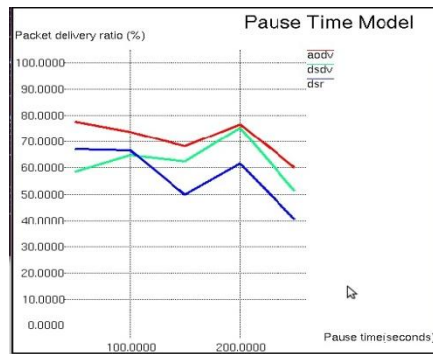
V. RESULTS AND DISCUSSIONS

In this section results are evaluated by comparing three protocols AODV, DSR and DSDV using four different models by varying the pause time (pause time model), number of nodes(nodes model), number of connections (flow model) and speed of node movement(speed model). The performance parameters compared include Packet Delivery Ratio (PDR) and Normalized Routing Overhead.

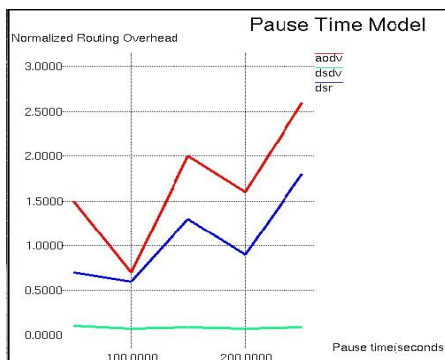
Pause Time Model

In this model the pause time governing mobility of nodes in the network is varied from 50s to 250s in slots of 50s. Lower

pause time means high node's random movement. If pause time is increased then movement of nodes is decreased. Fig. 3(a) shows the result for Packet Delivery Ratio for pause time model. PDR value of AODV is higher than all other protocols because of its on demand nature. Only when nodes want to send data connection is established therefore always selecting fresh and active route made it possible to deliver large number of data packets even in a situation of high mobility when routes break frequently. DSDV has lowest PDR value for low pause time, because of lack of alternate routes and presence of stale routes in routing table that leads to packet drop when nodes are moving at higher rate. In higher mobility scenario DSR has poor PDR than the other reactive routing protocol, AODV.



(a) Packet Delivery Ratio vs. Pause Time



(b) Normalized Routing Overhead vs. Pause Time

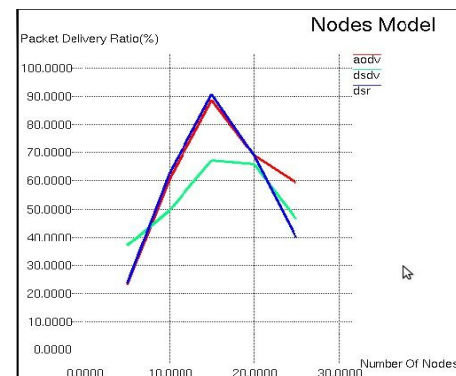
Figure 3: Packet Delivery Ratio (PDR) and Normalized routing overhead in Pause Time Model

Fig. 3(b) shows the normalized routing overhead for AODV, DSR and DSDV for this model. Although fast routes discovery of AODV leads to better delivery fraction it increases routing overhead. As compared to DSDV, routing overhead of AODV is higher in high mobility. Routing overhead of proactive protocol (DSDV) is comparatively low or stable than AODV, because of periodic updates of DSDV. DSR almost always has a lower routing load than AODV because of the aggressive caching strategy used by DSR so that it is more likely to find a route in the cache, and hence resorts to route discovery less frequently than AODV. The major contribution to AODV's routing overhead is from RREQ's, while RREP's constitute a large fraction of DSR's routing overhead.

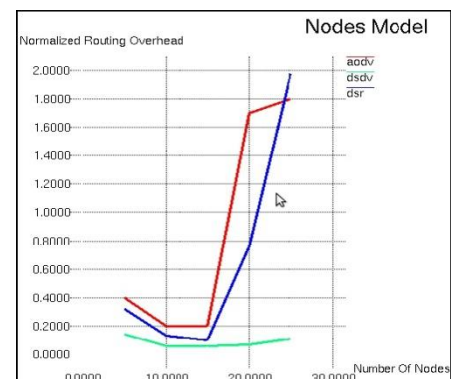
Nodes Model

In this model, the number of nodes in the network varies from 5 nodes to 25 nodes and traffic flow is between all the nodes in the network. Fig. 4(a) shows the result of packet delivery ratio and Fig. 4(b) shows Normalized routing overheads for this model. If number of nodes is low in case of PDR the performance of DSR and AODV is similar but as the number of nodes increase AODV starts outperforming DSR. DSDV being proactive routing protocol is suitable for limited number of nodes with low mobility due to the storage of routing information in the routing table at each node.

The routing overhead of AODV and DSR rise steeply if number of nodes are increased because they are reactive routing protocols and find routes only when desired, so as the number of sources increase, the overhead increases. DSDV, shows consistent overhead over the increasing number of sources. DSR has less overhead as compared to AODV because it uses source routing mechanism



(a) Packet Delivery Ratio vs. Number of Nodes



(b) Normalized Routing Overhead vs. Number of Nodes

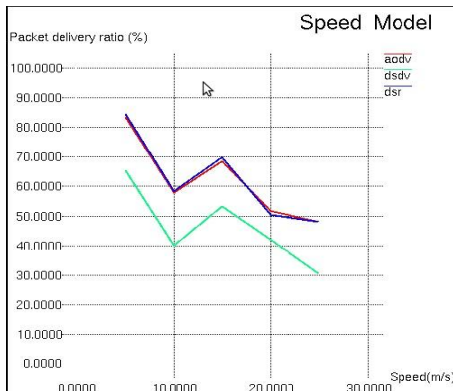
Figure 4: Packet Delivery Ratio (PDR) and Normalized routing overhead in Nodes Model

Speed Model

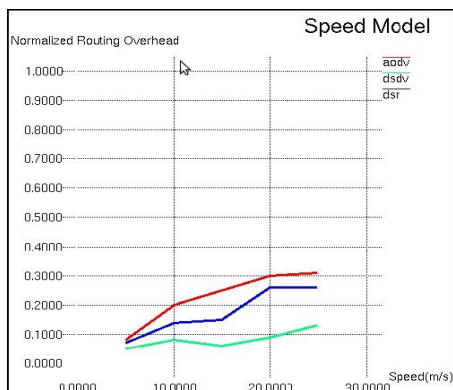
In this model the speed of node movement is varied between 5m/s to 25 m/s in a network of 10 nodes. Fig. 5(a) shows the packet delivery ratio as the speed of nodes is increased. AODV and DSR show equivalent performance but the PDR decreases with increase in speed of node movement. On the other hand, packets delivery fraction of DSDV is found lower than AODV

and DSR, when nodes are moving at high speed. This is because the chance to select stale route (in high mobility) increases which causes packets to be dropped.

The Normalized Routing Overhead of the three protocols is compared in Fig. 5(b). As compared to DSDV routing overhead of AODV is higher and increased as speed is increased. In the presence of high mobility, link failures can happen very frequently which trigger new route discoveries in AODV since it has at most one route per destination in its routing table. The reaction of DSR to link failures in comparison is mild and causes route discovery less often. The reason is the abundance of cached routes at each node. But with high mobility, the chance of the caches being stale is quite high in DSR. Eventually when a route discovery is initiated, the large number of replies received in response which adds to overheads in DSR. Routing overhead of DSDV is comparatively low or stable than AODV. DSDV is showing lowest routing overheads as it is proactive routing protocol.



(a) Packet Delivery Ratio vs. Node Speed



(b) Normalized Routing Overhead vs. Node Speed

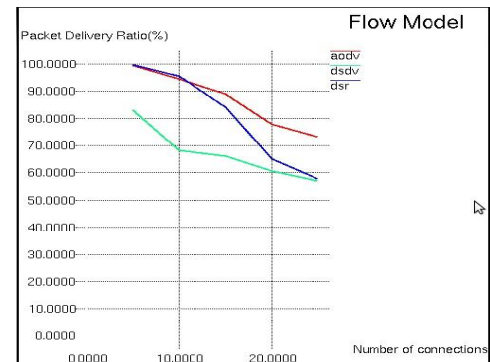
Figure 5: Packet Delivery Ratio (PDR) and Normalized routing overhead in Speed Model

Flow Model

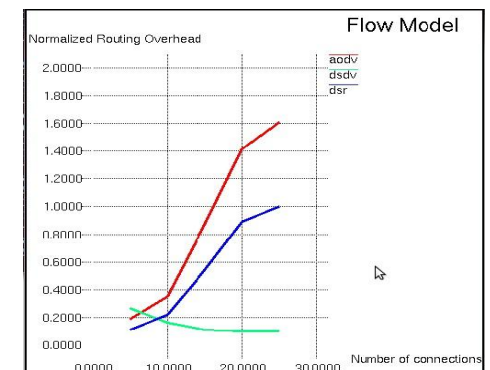
In this model the number of connection in the network is varied from 5 nodes to 25 nodes in slots of 5. The comparison of Packet delivery ratio of AODV, DSR and DSDV for variable traffic connections is shown in Fig. 6(a). The PDR for DSR and AODV are similar with 5 and 10 sources. However, with increasing number of connections, AODV outperforms DSR. As

number of CBR sources increase DSDV maintained its packets delivery (an average of 65%) continuously till the end of simulation while DSR started dropping packets rapidly. So in the Flow model AODV shows the best delivery ratio and DSDV shows the worst performance.

The Normalized Routing Overhead of AODV, DSR and DSDV are shown in Fig. 6(b). Always choosing active routes requires AODV to initiate route discovery process most frequently therefore routing overhead of AODV is higher than DSDV. The low routing load of DSDV is because of local periodic messages which keep routing table update. As the number of connections are increased the routing overheads of AODV and DSR are increased because of its reactive nature.



(a) Packet Delivery Ratio vs. number of connections



(b) Normalized Routing Overhead vs. number of connections

Figure 6: Packet Delivery Ratio (PDR) and Normalized routing overhead in Flow Model

VI. CONCLUSION AND FUTURE OUTLOOK

In this paper, the performance of three MANET Routing protocols such as DSDV, AODV and DSR was analyzed using NS-2 Simulator. The comprehensive simulation results of packet delivery ratio and normalized routing overhead are evaluated by varying pause time, network size, speed of mobile nodes and number of connections. DSDV is a proactive routing protocol and suitable for limited number of nodes with low mobility due to the storage of routing information in the routing table at each node. Comparing DSR with AODV protocol, overheads in DSR is less since DSR protocol uses source routing and route cache.

Hence, DSR is preferable for moderate traffic with moderate mobility. AODV has better packet delivery ratio in more stressful situations where there is high mobility and large network size but it performs badly in terms of normalized routing overhead. If the results are compared in terms of Packet Delivery Ratio then AODV is the best protocol but, if routing overheads are considered DSDV shows minimum overheads. Overall DSR presents a good tradeoff and can be considered a good selection. It is also true that any of the single protocol does not supersede the other one. Their performance depends upon the different network scenarios. In future the performance comparison of the routing protocols will be done over different MAC Protocols like CSMA and ETDMA that would impact the relative performance of routing protocols considered in different network scenarios.

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Bancassurance: Tapping of Insurance into Banking Pursuit

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Abstract- The Indian banking customer now a day are getting more sophisticated in his financial needs and lays greater emphasis on convenience and a single provider for all financial products. Banks providing multiple services at one place to the customers' means enhanced customer satisfaction. It is therefore imperative for the Indian banks to include insurance in the product offering, for customer retention. With Insurance Regulatory and Development Authority's approval a number of public and private sector banks in India have tied up with insurance companies for selling insurance products. Public sector banks, co-operative, newly established private and foreign banks offer various types of insurance products to their customers. The customers look for any particular bank which provides integrated financial solutions with stable returns, total perfection and enlightened service. Banks which places highest priority on customer service and satisfaction has a competitive edge over its competitors.

This paper which examines the bancassurance business of India banks suggests that with the increasing usage of information technology and enhanced customer sophistication, bancassurance is expected to play an important role in future growth of life insurance.

Index Terms- Bancassurance, Insurance, State bank of India

I. INTRODUCTION

In this competitive and liberalised environment everyone is trying to do better than others and consequently survival of the fittest has come into effect. Financial service industries is of no exception to this, has given rise to new form of business wherein two big financial institutions have come together and integrated all their strengths and efforts and created new means of marketing and promoting their products and services. On one hand, it is the banking sector which is highly competitive and on the other hand the insurance sector which has a lot of potential for growth. The combination of these two sectors results in an innovative concept of "BANCASSURANCE".

The term bancassurance is a combination of two words 'banc' and 'assurance' which refers to banks selling insurance products. Bancassurance as a term first appeared in France in 1980, to define the sale of insurance products through banks' distribution channels. It is the arrangement whereby branches of a bank distribute insurance products by an insurance company owned wholly or partially by the bank, or the branches distribute products developed by other insurance companies with which the banks have entered into selling arrangement.

II. BANCASSURANCE: TAPPING OF INSURANCE IN TO BANKING PURSUIT

The business of banking in India has undergone a sea change due to the integration of the global financial market, development of new technologies, universalisation of banking operation, and diversification of non banking activities. The Narasimham Committee and the Khan Committee Reports have also facilitated this transformation in the banks to become universal service providers. The public sector banks, which are the mainstay of the Indian banking system have moved away from the classical model of deposit acceptance and credit disbursal through their branch networks and have begun to offer a wide range of products and services to their customers.

Banks, world over have realised that offering value added services facilitate to meet client expectation. With the entry of new generation private sector and foreign banks with advanced base of automation and multiple channels, customers have become more discerning in the products and services offered to them. This makes it imperative that public sector banks provide wide variety and best possible products and services to ensure customer satisfaction. To address the challenge of retention of customers, banks have started to switch over to customer-centric business models. Banks seek to retain loyal customers by offering them a vastly expanded and more sophisticated range of products. When these products are offered to the customer from the same bank branch, it automatically makes the branch a one stop financial provider or a super market of financial services to its customers. This is the phenomenon of 'Universal Banking' that builds on the principle of leveraging existing networks to broaden its portfolio offerings. This diversification of banking services has been driven by a number of factors, all of which have threatened bank profitability.

As far as the present scenario is concerned the public sector banks are unfortunately burdened with excessive non performing assets and massive manpower. Furthermore, after the deregulation of interest rates on deposits and advances, there is a very thin margin available to these banks. The cut throat competition among the banks has also resulted in southward movement of profitability. The net interest margin of the public sector banks considerably declines through the years. As it could be seen from Table1.1 that the spread ratio has reasonably come down cutting across the total banking system.

TABLE 2.1: Interest Spread for Bank Groups in India
(Net interest margin as per cent to total assets)

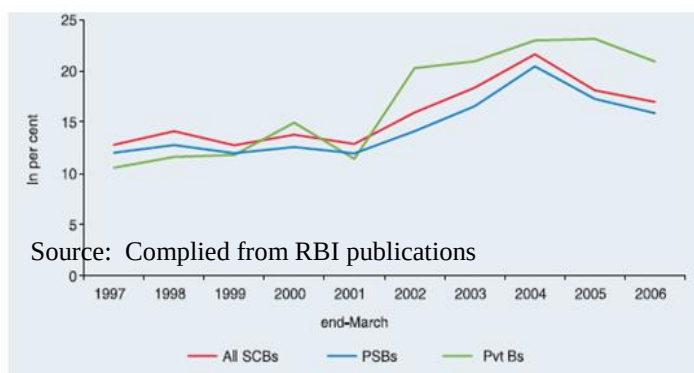
Year Bank group	1990- 91	2003- 04	2004- 05	2005- 06	2006- 07	2007- 08	2008- 09
Public sector banks	3.2	3.0	2.9	2.8	2.6	2.1	2.1
Private sector banks	4.0	2.2	2.3	2.4	2.2	2.4	2.7
Foreign banks	3.9	3.6	3.3	3.8	3.8	3.8	3.9
Total banking system	3.3	2.9	2.8	2.8	2.6	2.3	2.4

Source: Compiled from RBI publications.

The spread ratio of public sector banks decelerated from 3.2 per cent at end of March 1991 to 2.1 per cent at end of March 2009. Therefore, the public sector banks were compelled to be constantly on the look out for a stable alternate source of earnings in the form of non traditional and fee based sources of income. New and innovative products like merchant banking, lease and term finance, capital market/equity market related activities ,hire purchase, real estate and the like ,come in handy for the banks to substantially enhance their profitability and staff productivity. This is reflected in the sharp proportion of non-interest income to total income of public sector banks in recent years as depicted in Chart 1.1.

CHART 2.1

Non- Interest Income of Public Sector Banks to its Total Assets



The Reserve Bank of India, being the regulatory authority of the banking system has recognised the need for banks to diversify their activities at the right time permitted them to enter into insurance sector as well. Banks with their brand image and existing customer relationship offer a natural market for selling insurance products. Insurance is an ideal option as banks feel that they can fulfill the three major requirements for a successful insurance business viz., asset management and investment skills, distribution and capital adequacy. A bank, which is able to

market insurance products has a competitive edge over its competitors and furthermore can impart complete financial planning service to its customers under one roof. To sum up, for banks, insurance offers opportunities like sophisticated product offerings, greater life cycle management, diversification and growth of revenue base from existing relationships, diversifying risk by tapping another area of profitability, and the realisation that insurance is a necessary customer need. Therefore, public sector banks entering into insurance business is only a natural corollary and is fully justified too as 'insurance' is another financial product bestowed to the bank customer.

III. INSURANCE MARKET IN INDIA

Insurance industry in India for a fairly longer period relied heavily on traditional agency distribution network. As the insurance sector had been completely monopolised by the public sector organisations for decades, there was slow and rugged growth in the insurance business due to lack of competitive pressure. The Government of India, in 1994 appointed a Committee under the Chairmanship of R. N. Malhotra, former Governor of RBI to study the need for private participation in the insurance industry. The committee reported that only 22 per cent of the Indian population was insured. Based on the committee report, the Government of India took necessary initiatives to improve the operational efficiency of insurance companies and insurance penetration as well. The year 1999 brought a remarkable change in the Indian insurance sector, as a result of major structural changes like ending of Government monopoly and passing of the Insurance Regulatory and Development Authority (IRDA) bill, relaxing all entry restrictions for private and foreign players to enter into the market. Innovative products, smart marketing and aggressive distribution have enabled fledgling private insurance companies to sign up Indian customers faster than any one expected.

The Insurance industry in India experienced substantial growth in terms of numbers, life insurance premium, and the number of policies after the opening up of the industry to the private sector. Today, there are totally 44 registered players penetrated into insurance business with 22 in life and 21 in general insurance businesses and one national re-insurer⁵. Table 1.2 shows the penetration of insurance companies in life and non-life in the Indian insurance market.

TABLE.3.3: Penetration of Insurance Companies

Insurer	Year	1999- 00	2000- 01	2001- 02	2003- 04	2004- 05	2006- 07	2007- 08	2008- 09
Public	Life	1	-	-	-	-	-	-	-
	Non life	4	-	-	1	-	-	-	-
Private	Life	-	10	2	1	1	1	2	4
	Non life	-	6	3	-	-	1	3	3
Total	Life	1	11	13	14	15	16	18	22
	Non life	4	10	13	14	14	15	18	21

Source: Compiled from annual reports of IRDA

The number of insurance companies in India accelerated from 1 in life insurance to 22 in the year 2008-09. General insurance business has also showed an upward direction from four to 21 at the end of December 2008-09. This had eventually resulted in the tremendous increase in the number of policies issued by the public and private sector insurance companies which is depicted in the Table 1.3.

Table 3.2: Number of Policies issued by Insurance Companies (in Life)

<i>Insurer</i>	LIC	Private Sector
<i>Year</i>		
2002-03	24545580 (96.75)	825094 (3.25)
2003-04	26968069 (9.87)	1658847 (101.05)
2004-05	23978123 (-11.09)	2233075 (34.62)
2005-06	31590707(31.75)	3871410(73.37)
2006-07	38229292(21.01)	7922274(104.64)
2007-08	37612599 (-1.61)	13261558 (67.40)
2008-09	35912667 (-4.52)	15010710(13.19)

(Note: Figures in parentheses indicate the growth over the previous year)

Source: Compiled from annual reports of IRDA

The number of lives insured by these companies has increased from 25370674 to 50874157 at the end of December 2007-08. With aggressive marketing strategies, wide variety of products and by identifying multiple channels of distribution, the private sector companies are experiencing remarkable growth in the industry. The total number of policies issued by LIC has fallen steadily from 2003-04, compared to the previous year, whereas the number of policies from private insurance companies has more or less doubled during these years. The decreasing number of policies issued by LIC and increased number by private sector shows the growth and potentiality of private companies in the insurance market.

In spite of the significant growth of the insurance companies and policies, as regarding the present size of the insurance market in India, it is stated that India accounts a very low percentage to the global market. Though insurance market in India is over 30.00 billion US Dollars and growing at healthy 25 per cent rate per annum, the per capital penetration is still way below the mark.

In terms of insurance penetration ratio, a key indicator of the spread of insurance coverage and insurance culture, India compares poorly by international standards. The penetration ratio of India was less than 3 per cent in 2001 and improved to 4.6 per cent by the year 2007 as against UK and Taiwan at 15.70 per cent and world penetration ratio of 7.50 per cent.

TABLE 3.4: Insurance Penetration in India
[As ratio (in per cent) of premium (in US Dollars) to GDP (in US Dollars)]

<i>Year</i> <i>Insurance segment</i>	2002	2003	2004	2005	2006	2007	2008
Life	2.59	2.26	2.53	2.53	4.10	4.00	4.00
Non-life	0.67	0.62	0.64	0.61	0.60	0.60	0.6
Total	3.26	2.88	3.17	3.14	4.80	4.70	4.6

Source: Compiled from reports of Swiss Re

With largest number of life insurance policies in force in the world, insurance happens to be a mega opportunity in India. With about 200 million middle class households, India shows a better potential for insurance industry. Simple products designed according to the needs and wants of the people may be the answer for better penetration of insurance products in India. Apparently, the challenge is not on the product but the closer observation reveals that the challenge is on the distribution and services. With the increased pressure in combating competition, companies are forced to come up with innovative techniques to market their products and services to stand apart and ahead in the market. It therefore makes sense to look at well balanced, alternate channels of distribution like corporate agents, brokers, bancassurance and the like. Another factor leading for the multiple channel distribution and marketing is that nationalised insurers are already well- established and have an extensive reach and presence while the new players find it difficult, expensive and time consuming to bring up a distribution network to such standard. The use of multiple distribution avenues becomes a must for the private insurance companies to tap the India's population base and to reach out the worthwhile number of customers.

Of the various distribution channels, bancassurance offers the insurance companies a basket full of benefits. Bancassurance as a distribution channel facilitates insurance companies in developing networks and customer database faster than any other channel. Insurers can find bancassurance as a profitable venture due to lower customer acquisition cost, quicker reach to untapped market, introduction of new hybrid products, and economies of scale in administrative cost. Bancassurance is gaining more and more popularity and expected to become a major channel of sale of insurance product in the country as well. The tremendous increase in the new business premium underwritten by insurance companies through banks as showed in Table 1.5 has made bancassurance even more attractive and as a profitable venture.

TABLE 3.5: Share of New Business Premium underwritten through Banks in Life (in per cent)

<i>Year</i> <i>Insurer</i>	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09
Private sector	10.57	15.42	16.87	16.58	18.20	19.19
LIC	0.11	0.87	1.25	1.24	1.15	1.56

Source: compiled from annual reports of IRDA

As it can be observed from the Table 1.5 the share of new business premium underwritten by private life insurance companies through bancassurance business accelerated from 10.57 per cent to 19.19 per cent which is almost doubled. Still, there is enormous scope for bancassurance business to play a significant role in the Indian insurance industry. The success of bancassurance has been limited to life insurance mostly, primarily because of the matching of banking products with the personal financial needs of individuals and families. By realising the potentiality of bancassurance many banks including the State Bank of India have taken equity stakes in the insurance companies.

IV. BANCASSURANCE- WHAT IS IN STORE FOR CUSTOMERS?

Today, convenience is a major issue in managing a person's day to day activities. Customers prefer to have a consolidation and delivery of all financial services at his doorstep. He lays greater emphasis on convenience and single provider for his financial needs. Towards that end, bancassurance offers the customer by providing comprehensive financial advisory services under one roof, (i.e. insurance services along with other financial services such as banking, personal loans, mutual funds, and the like). It relieves him from the painstaking efforts of searching for separate persons for each and every service or product. Through bancassurance, the customer can enjoy the benefits of choosing multiple products at one place. Along with the traditional whole life insurance, the customer also has the choice of term, group, child, endowment and pension products along with riders. Further more, the customer can utilise the distribution channels of banks to pay his insurance premiums which in turn reduces the number of policy lapse. The customer also has the satisfaction of the brand strength of the bank, his existing relationship and trust on the banks. In addition, the products sold through bancassurance can give better value and offer cheaper premiums due to lower distribution costs. So, bancassurance for the customer is a bonanza in terms of reduced premium charges, a high quality product and delivery at doorstep.

V. CONCLUSION

With largest number of life insurance policies in force in the world, insurance happens to be a mega opportunity in India. With about 200 million middle class households, India shows a better potential for insurance industry. Saturation of markets in many developed economies has made the Indian market even more attractive for global insurance majors. Last estimate suggests that out of 30.00 billion, only 9 per cent of the Indian population is covered under various insurance schemes, which mean both rural as well as urban areas, are not fully covered. In such a situation, Bancassurance as a distribution channel facilitates insurance companies in developing networks and customer database faster than any other channel. Insurers can find bancassurance as a profitable venture due to lower customer acquisition cost, quicker reach to untapped market, introduction of new hybrid products, and economies of scale in administrative cost. The bancassurance channel has already contributed around 20 to 25 percent of the new business amongst the private sector life insurance companies and it is expected to increase further. Bancassurance has the potential to be an effective distribution channel in India due to its extensive network of 80,369 bank branches comprising 31,796 rural branches, 19,119 semi-urban branches and 15,612 urban and 13,842 metropolitan branches² which offers the bank a huge opportunity to sell insurance products. Finally, the combination of bank and insurance will result in win-win-win situation for its stake holder's viz., banks, insurers and customers, the ultimate winner.

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Marketing Efficiency of Kashmir Apple

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I. INTRODUCTION

An efficient marketing system is a prerequisite for sustaining the tempo of increased agricultural production. This ensures fair returns to the farmers for their efforts. The economic efficiency of the marketing system is generally measured in terms of the price-spread of an agricultural commodity. The smaller the price-spread, the greater the efficiency of the marketing system.

The term "Price-spread" generally refers to the difference between the two prices, i.e. the price paid by the consumer and the price received by the producer. A study of the price spread involves not only the ascertainment of the actual price at various stages of the marketing channel, but also the costs incurred in the process of the movement of the produce from farm to the consumer, as well as the margin of various intermediaries. Therefore, the price-spread plays an important role in determining the efficiency of a marketing system. Thus, establishes a unique relationship between the returns to growers and price-spread effect, which shows that as the price-spread effect reduces it will increase the returns to growers.

Moreover, price-spread effect is the principle tool in determining the viability of a marketing channel. In a marketing channel the frequency of intermediaries will affect the magnitude of price-spread.

However, for an analytical study of price-spread in Kashmir apple, three marketing channels viz.

- Producer----Pre-harvest-Contractor---Wholesaler---Retailer---Consumer.
 - Producer--- Commission-agent ---wholesaler --Retailer--Consumer.
 - Grower--Consumer.
- Were selected and are presently in practice. The price-spread for the Kashmir apple has been calculated by taking following figures into consideration.
- Grower.
 - Gross Returns.
 - Expenses incurred.
 - Packing cost.
 - Labour cost.
 - Fare to terminal market.
 - Wholesaler.
 - Wholesaler's price-per box.
 - Expenses incurred.
 - Marketing margin.
 - Retailers.
 - Retailer.
 - Expenses incurred by Retailer.
 - Retailer's percentage loss.
 - Retailers Margin.
 - Consumers price per box.

The Table 1.1 shows the price-spread of different kinds of apple through marketing Channel i.e. producer...commission agent...wholesaler...Retailer...consumer. Three popular varieties of apple like, delicious apple, Maharaji apple and American apple were taken in to account.

Table: 1.1: shows the price-spread of different kinds of apple

S. No.	Particulars	Delicious Apple	Maharaji Apple	American Apple
01.	Net Price Received by grower	257.80 (51.38)	103.22 (35.41)	227.17 (50.64)
02.	Marketing cost incurred by grower	89.82 (17.90)	86.78 (29.77)	84.03 (18.73)
03.	Commission agent	54.64 (10.89)	34.9 (11.97)	49.39 (11.01)
04	Growers sale price/ wholesaler purchase price	402.26	224.98	360.59
05	Marketing cost incurred by wholesaler	8.03 (1.60)	7.76 (2.66)	6.87 (1.53)
06	Wholesalers net margin	19.87 (3.96)	13.44 (4.61)	17.59 (3.92)
07	Wholesaler price/ retailers purchase price	430.16	246.1	385.05
08	Expenses incurred by retailer	20.93	15.22	18.44

		(4.17)	(5.22)	(4.11)
09	Retailers Margin	50.53 (10.07)	27.46 (9.42)	44.94 (10.02)
	Retailers selling price	501.62	288.78	448.59

Source: Compiled from the information collected from apple growers/traders through interview method & market investigation.

Table 1.1 shows the price-spread of Kashmir apple. Net returns were Rs 257.80 (51.38% of consumer's price Rs 501.62) for delicious apple, Rs 103.22 (35.41% of consumer's Price Rs 288.78) for Maharaji Apple Rs 227.17 (50.64% of consumer's Price Rs 448.59) for American apple. Marketing cost incurred by the grower is Rs 89.82 (17.90% of consumer's price Rs 501.62) for delicious apple, Rs 86.73(29.77% of consumer's prices Rs 288.78) for Maharaji apple Rs 84.03 (18.73% of consumer's Price Rs 448.59) for American apple. Average commission taken by the commission agent is Rs 54.64 (10.89% of consumer's price Rs 501.74) for delicious apple, Rs 34.9 (11.97% of consumers price Rs. 288.78) for Maharaji apple, Rs 49.39 (11.01% of consumer's price Rs 448.59) for American apple. An average cost incurred by the wholesaler is Rs 8.03 (1.60% of consumer's price Rs. 501.74) for delicious apple, Rs. 7.76 (2.66% of consumer's price Rs 288.78) for Maharaji apple and

Rs 6.87 (1.53% of consumer's price) Rs 448.59) for American apple.

Moreover, the table 1.1 shows the passage of intermediaries by which the produce reaches to the final consumer. It is evident that grower receives only 51.38% of consumer's price while 48.62% of consumer's price is distributed among the intermediaries as a remunerative share of crop grower in case of delicious apple, 35.41% of consumer's price is received by the grower as a net price while 64.59% of consumer's price by intermediaries in case of Maharaji apple and 50.64% of consumer's price is received by the grower and 49.36% of consumer's price by intermediaries in case of American apple respectively.

Table: 1.2 Showing the price-spread of different kinds of apple through marketing channel (Producer Pre-harvest contractor Wholesaler Retailer Consumer)

S. No.	Particulars	Delicious Apple	Maharaji Apple	American Apple
01.	Net Price Received by grower /Producers share	210.03 (48.73)	102.31 (48.03)	124.54 (51.06)
02.	Deduction by Pre-harvest contractor	52.5 (12.18)	37.19 (17.46)	31.13 (12.76)
03.	Growers price sale / Pre-harvest contractor purchase price	262.53	139.5	155.67
04	Marketing cost incurred by Pre-harvest contractor	10.48 (2.43)	6.97 (3.27)	6.61 (2.71)
05	Marketing margin by pre-harvest contractor	59 (13.70)	23.24 (10.91)	23.35 (9.57)
06	Wholesalers purchase price	332.01	169.71	185.63
07	Marketing cost incurred by wholesaler	5.7 (1.30)	3.24 (1.52)	3.02 (1.24)
08	Marketing margin by wholesaler	19.66 (4.56)	9.29 (4.36)	13.21 (5.42)
09	Wholesaler price / retailers purchase price	357.37	182.24	201.86
10	Cost-incurred by retailer	20.99 (4.87)	12.08 (5.67)	13.14 (5.39)
11	Retailers Margin	52.5 (12.18)	18.59 (8.73)	28.79 (11.80)
12	Consumer's price	430.86	212.91	243.79

Source: Compiled from the information collected from apple growers/traders through interview method & market investigation.

Table 1.2 shows the price-spread of Kashmir Apple through marketing channel (producer pre-harvest – contractor wholesaler Retailer Consumer).

The above table shows that the net returns were Rs 210.03 (48.73% of consumer's price Rs 430.86) for delicious apple, Rs

102.31 (48.03% of consumer's price Rs 212.91) for Maharaji apple and Rs 124.54 (51.06% of consumer's price Rs 243.79) for American apple. The marketing cost incurred by the pre-harvesting contractor was Rs 52.5 (12.18% of consumer's price Rs 430.86 of consumer's price) Rs 37.19 (17.46% of consumer's price Rs 212.91) for Maharaji apple and Rs 31.13 (12.76% of

consumer's price Rs 243.79) for American apple. The marketing cost incurred on the marketing was Rs 10.48 (2.43% of consumer's price Rs 430.86) for delicious apple, Rs 6.97 (3.27% of consumer's price Rs 212.91) for Maharaji apple and Rs 6.61 (2.71% of consumer's price Rs 243.79) for American apple. Marketing margin by pre-harvesting contractor was Rs 59 (13.70% of consumer's price Rs 430.86) for delicious apple, Rs 23.24 (10.91% of consumer's price Rs 212.91) for Maharaji apple and Rs 23.35 (9.57% of consumer's price Rs 243.79) for American apple. Marketing cost incurred by wholesaler was Rs 5.7 (1.30% of consumer's price Rs 430.86) for delicious apple, Rs 3.24 (1.52% of consumer's price Rs 212.91) for Maharaji

apple and Rs 3.02 (1.24% of consumer's price Rs 243.79) for American apple. Marketing Margin charged by wholesaler was Rs 19.66 (4.56% of consumer price Rs 430.86) for Delicious apple, Rs 9.29 (2.36% consumers price Rs 212.91) for Maharaji apple and Rs 13.21 (5.42% of consumers price Rs 243.79) for American apple. Cost incurred by Retailer was Rs 20.99 (4.87% of consumer's price Rs 430) for delicious apple, Rs 12.08 (5.67% of consumer's price Rs 212.91) for Maharaji apple and Rs 28.79 (11.80% of consumer's price Rs 243) for American apple.

Table: 1.3: Showing the price-spread of different kinds of apple through marketing channel (Grower Consumer)

S. No.	Particulars	Delicious Apple	Maharaji Apple	American Apple
01.	Net Price Received by grower	372.66 (87.41)	144.50 (61.86)	288.13 (76.69)
02	Marketing cost incurred by grower	53.70 (12.59)	89.07 (38.13)	69.31 (23.30)
03	Growers sale Price/consumer purchase price	426.36	233.57	297.46

Source: Compiled from the information collected from apple growers/traders through interview method & market investigation.

The above table 1.3 showing the price-spread of different kinds of Apple through marketing channels (Grower consumer). Table shows that net returns received by the grower are Rs 372.66 (87.41% of consumer's price) for delicious apple, Rs 144.50 (61.86% of consumer's price) for Maharaji apple and Rs 288.13 (76.69% of consumer's price) for American apple. The marketing cost of grower is Rs 53.70 (12.59% of consumer's price) for delicious apple, Rs 89.07 (38.13 of consumer's price) for Maharaji apple and Rs 69.31 (23.30% of consumer's price) for American apple.

This is now clear from the above presentation that price-spread in the three selected marketing channels has provided a diversified picture. In marketing channel first; Producer...commissionagent...wholesaler...Retailer...Consumer, the net returns received by the grower was 51.38%, 35.41% and 50.64% for Delicious apple, Maharaji apple and American apple respectively. In the selected marketing channel second; Producer Pre-harvest contractor wholesaler Retailer Consumer, the net returns received by the grower were 48.73%, 48.03% and 51.06% of consumer's price for delicious apple, Maharaji apple and American apple respectively. Comparing with the selected Marketing channel third; Grower Consumer, the net returns received by the grower were 87.41% 61.86% and 76.69% for Delicious apple, Maharaji apple, and American apple respectively. This implies that the channel third i.e. Grower...Consumer shows the less price-spread compared with selected marketing channel first and second which means that the marketing channel Grower...Consumer is much more efficient comparatively. But, it is found in the research area that the said channel is rare in practice due to many problems faced by the growers. Some problems are mentioned as:

- Lack of marketing knowledge.
- Difficulty in contacting the consumers directly.

- Lack of marketing credit within the growers.
- Small farm size and small production.
- Lack of institutional measures in this regard.

Otherwise, this channel is the most appropriate and much remunerative as depicted by the price-spread effect. Therefore, in light of the above discussion, there is utmost need to design a suitable marketing strategy based on private-public partnership. So that the price-spread effect will be reduced and returns will be maximized by the Apple growers.

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Performance Evaluation of Costas codes using Fusion Techniques

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Abstract- The resolution is the important parameter of the radar. Here waveform design plays an important role in the radar applications. These waveform designs can be achieved by using signal processing tools like auto correlation and ambiguity function. In this project signal processing techniques have been developed by using above functions. These techniques are most useful in the multi target scenario of the radar. In this project the signals like burst signal, linear frequency modulated (LFM) and Non Linear Frequency Modulated (NLFM) signals are used for the determination of radar resolution and also these waveforms are implemented in popular codes like "COSTAS". The three dimensional plots are generated to evaluate both range and Doppler resolution by using ambiguity functions. The results are being presented for the COSTAS code by using LFM and COSTAS code by using NLFM signals. The performance of these waveforms is compared with the conventional waveforms.

Index Terms- COSTAS, Ambiguity function, LFM, NLFM.

I. INTRODUCTION

The word radar is an abbreviation for Radio Detection and Ranging. In general, radar systems we use modulated waveforms and directive antennas to transmit electromagnetic energy into a specific volume in space to search for targets. In this radar the target reflects back is the echo of the object [1, 2]. One fundamental issue in designing a good radar system is its capability to resolve two small targets that are located at long range with very small separation between them. This requires a radar system to transmit along pulse which will have enough energy to detect a small target at long range. However, a long pulse degrades range resolution. Hence, frequency or phase modulation of the signal is used to achieve a high range resolution when a long pulse is required.

A commonly used radar or sonar pulse is the linear frequency modulated (LFM) pulse (or "chirp"). It has the advantage of greater bandwidth while keeping the pulse duration short and envelope constant. A chirp is a signal in which the frequency increases ('up-chirp') or decreases ('down-chirp') with time. In some sources, the term chirp is used interchangeably with sweep signal. The linear-FM, or chirp, waveform is the easiest to generate. If a signal is Costas can be performed easily with the help of the difference matrix. The coding sequence, the order of frequencies used, is a concise way to describe the coding matrix. With regard to the difference matrix, note that the top row and the left most column are headings and not part of the matrix.

The element of the difference matrix in row i and column j , is

$$D_{i,j} = a_{i+j} - a_j, \quad i+j \leq M$$

Costas sequences are optimum discrete signals with good correlation characteristic. Coding with Costas is combined with LFM signal to generate LFM-Costas radar signal. The ambiguity function is analyzed. By using ambiguity function only we can plot the signals like LFM, COSTAS, and COSTAS WITH LFM. In the 3, 4, 5 sections we will discuss the above techniques.

II. AMBIGUITY FUNCTION

An ambiguity function is a two-dimensional function of time delay and Doppler frequency $\chi(\tau, f)$ showing the distortion of a returned pulse due to the receiver matched filter (commonly, but not exclusively, used in pulse compression radar) due to the Doppler shift of the return from a moving target. The ambiguity function is determined by the properties of the pulse and the matched filter, and not any particular target scenario. Many definitions of the ambiguity function exist; some are restricted to narrowband signals and others are suitable to describe the propagation delay and Doppler relationship of wideband signals. Often the definition of the ambiguity function is given as the magnitude squared of other definitions.

The radar ambiguity function is defined as the response of the matched-filter radar receiver to a target displaced in range delay T and Doppler frequency u from a reference target. The response is measured at the instant in time when the reference target is at its maximum value. The ambiguity function is therefore closely related to the matched filtered output waveform. In fact it is simply the squared magnitude of the time-reversed matched-filter response.

For a given complex baseband pulse $s(t)$, the narrowband ambiguity function is given by

$$\chi(\tau, f) = \int_{-\infty}^{\infty} s(t) s^*(t - \tau) e^{-i2\pi f t} dt$$

Range Resolution: Is the ability of a radar system distinguished between two or more targets on the same bearing but at different ranges. The degree of range resolution depends on the width of the transmitted pulse, the types and sizes of targets, and the efficiency of the receiver and indicator. Pulse width is the primary factor in range resolution.

The theoretical range resolution of a radar system can be calculated from the following formula:-

$$s_r \geq c_0 \tau / 2$$

Doppler Resolution: Is the minimum separation in targets radial velocities that can be distinguished by the radar receiver. This resolution is fundamentally related to coherent integration time of radar

$$\Delta f_d = 2\Delta v_r / \lambda$$

Where Δv_r is the radial velocities, λ is the radar wavelength;

III. LFM

A **chirp** is a signal in which the frequency increases ('up-chirp') or decreases ('down-chirp') with time. In some sources, the term **chirp** is used interchangeably with **sweep signal**. It is commonly used in sonar and radar, but has other applications, such as in spread spectrum communications. In spread spectrum usage, SAW devices such as RACs are often used to generate and demodulate the chirped signals. In optics, ultra short laser pulses also exhibit chirp, which, in optical transmission systems interacts with the dispersion properties of the materials, increasing or decreasing total pulse dispersion as the signal propagates.

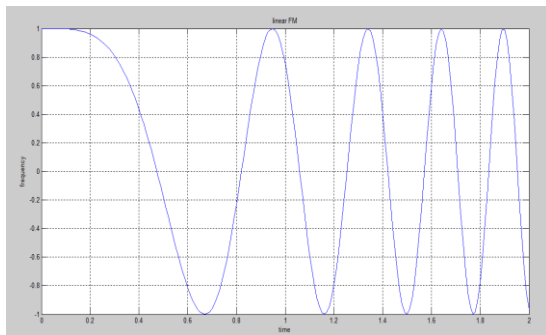


Fig 1: Linear Frequency Modulation

The complex envelope of a linear-FM pulse is given by

$$u(t) = \frac{1}{\sqrt{T}} \text{rect}\left(\frac{t}{T}\right) \exp(j\pi k t^2) \quad k = \pm \frac{B}{T}$$

A complete description of a linear FM requires that at least three parameters be known: the duration and the FM's start and end frequencies. The change in over time ("t" in ms) defines the slope of a linear FM, such that slope = $f(t_2) - f(t_1) / (t_2 - t_1)$, i.e., frequency bandwidth/duration. In speech sounds, slope of the formant transition is equivalent to slope of an FM and may be measured in Hz/ms.

In this pulse compression technique the LFM signal are one of the techniques are used in the radar signals.

Pulse compression is a signal processing technique mainly used in radar, sonar and echography to increase the range resolution as well as the signal to noise ratio. This is achieved by modulating the transmitted pulse and then correlating the received signal with the transmitted pulse. In this LFM the ambiguity plot is important because from the plot we can determine the range resolution, Doppler resolution and peak side lobe ratio.

The ambiguity plot is as shown in fig.

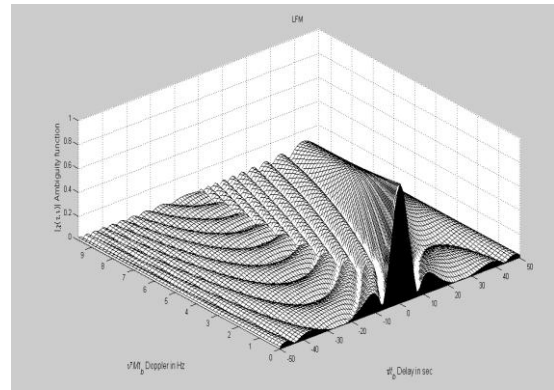


Fig 2: Ambiguity plot of LFM signal

IV. COSTAS

John P. Costas (1984) suggested a discrete frequency coding that is practically the opposite of the linear law used in LFM[4]. In this Costas we are having the binary matrix representation of both LFM and the Costas, for LFM it is linear in the matrix representation and for the Costas is represented in the frequency that we are taking.

If a signal is Costas can be performed easily with the help of the **difference matrix**. The **coding sequence**, the order of frequencies used, is a concise way to describe the **coding matrix**. With regard to the difference matrix, note that the top row and the leftmost column are headings and not part of the matrix.

The element of the difference matrix in row i and column j , is

$$D_{i,j} = a_{i+j} - a_j, \quad i+j \leq M$$

Where a_i is the i th element of the coding sequence, the blanks at the remaining locations. Thus the first row is formed by taking differences between adjacent terms in the sequence, the second row by taking differences between next adjacent terms, and so on. The corresponding values in the difference matrix and side lobe matrix were marked with different colour circles.[5]

The difference matrix not only determines whether a sequence is Costas or not, but it also identifies the major side lobe locations in the positive delay slots of the ambiguity function. The side lobes in the negative delay slots are obtained by applying the rule of symmetry with respect with the origin. [5].

Difference matrix

a_j	4	7	1	6	5	2	3
$i=1$	3	-6	5	-1	3	1	
$i=2$	-3	-1	4	-4	-2		
$i=3$	2	-2	1	-3			
$i=4$	1	-5	2				
$i=5$	-2	-4					
$i=6$	-1						

The ambiguity function of the Costas signal

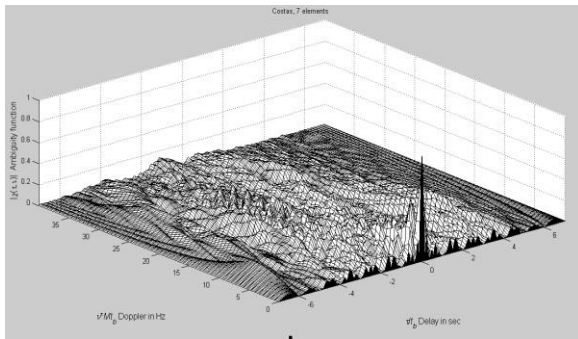


Fig 3: Ambiguity plot of COSTAS signal

By using this plot we can calculate the range, Doppler resolution and peak side lobe ratio

V. COSTAS WITH LFM

Costas sequences are optimum discrete signals with good correlation characteristic. Coding with Costas is combined with LFM signal to generate LFM-Costas radar signal. The ambiguity function is analyzed.

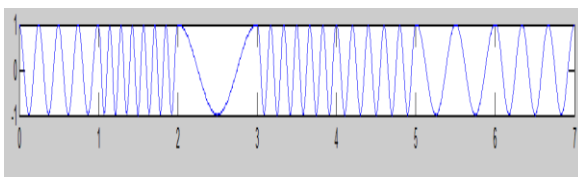


Fig 4: Costas with LFM signal

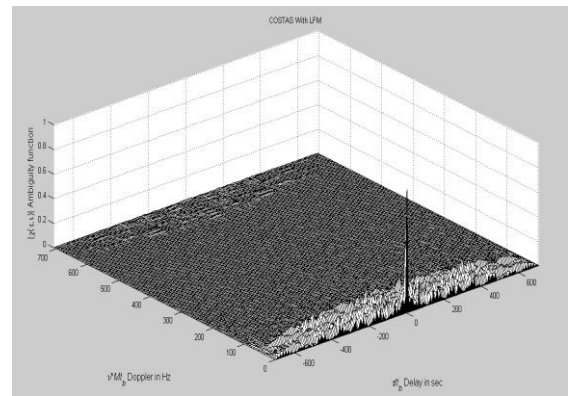


Fig 5: Ambiguity plot of COSTAS with LFM signal.

Costas code with LFM is having the 2 different sweep rates, their ambiguity plot are

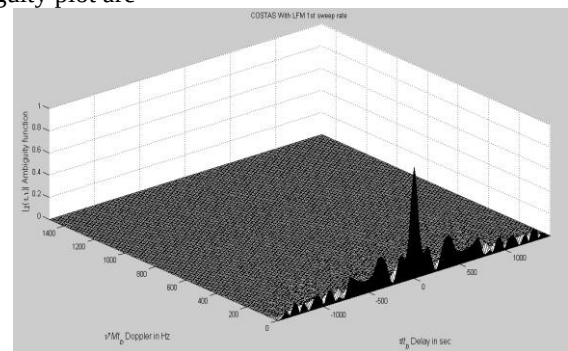


Fig 6: Ambiguity plot of Costas with LFM signal with 1st sweep rate

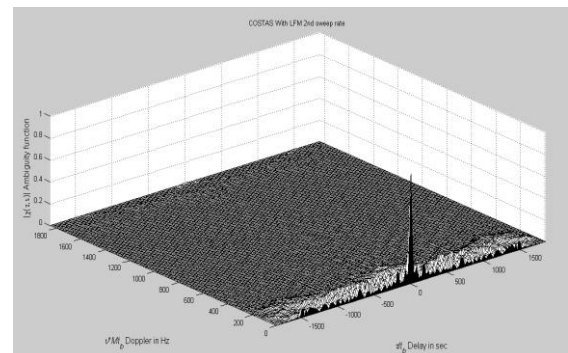


Fig 7: Ambiguity plot of Costas with LFM signal with 2nd sweep rate

NLFM

Another method for shaping the spectrum is to deviate from the constant rate of frequency change and to spend more time at frequencies that need to be enhanced. This approach was termed nonlinear FM (NLFM).

COSTAS WITH NLFM

Coding with Costas is combined with NLFM (Non Linear Frequency Modulation) signal to generate NLFM-Costas radar signal. The ambiguity function is analyzed.

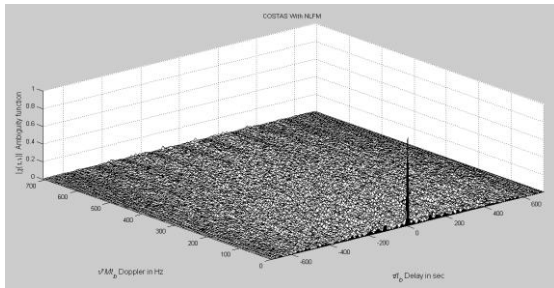


Fig 8: Ambiguity plot of Costas with NLFM

VI. CONCLUSION

In this work the waveform design of radar by using different signal processing techniques like burst signal, LFM signal, and Costas signal, Costas with LFM and Costas with NLFM. Costas is a frequency coding technique multiple frequency signals are transmitted according to the code that we are using. LFM signal is a Linear Frequency Modulation signal even it has the great resolution but power is lost due to the ridges.

Presently Costas code and Costas with LFM is being implemented using un-modulated sine wave with different sweep rates.

By calculating the above parameters, Costas with NLFM signal is having the low range resolution, low Doppler resolution and high peak side lobe ratio. Hence it is concluded the Costas with NLFM is preferable signal for low range resolution and Doppler resolution when compared to Costas with LFM.

parameter Waveform	RR in cm	DR in m/s	PSLR
SINE	0	0.182	undefined
LFM	300	0.48	6.02
COSTAS	211.5	0.2115	10.7
COSTAS WITH LFM	105.75	0.0423	19.09
COSTAS WITH LFM 1 ST SWEEP RATE	898.2	0.4991	3.424
COSTAS WITH LFM 2 ND SWEEP RATE	1105.2	0.5526	7.35
COSTAS WITH NLFM	72.03	0.0216	50

Table 1: Performances of different signal in range resolution, Doppler resolution and peak side lobe ratio.

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Modified Design of Experimental Setup and Measurement of Permeability of the Sand by Using Darcy's Law

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Abstract- This paper deals with the action of amendment in Darcy's apparatus by suitable changes. During fabrication there is a use of different materials which are assembled to make the experimental setup to measure the permeability of sand (except coarse grained soils) by falling head method at different length of samples used. Graphs and Experimental analysis shows that compactness of the sand verses moisture content first increases at certain higher value than decreases a moisture content increase. Results obtained are almost accurate within typical permeability range which is used in petroleum geology, casting industries for making mould etc. This setup is too simple to operate with low skilled workers.

Index Terms- Darcy's law, Hydraulic conductivity or Permeability, Porosity.

I. INTRODUCTION

IN 1855, Henry Darcy supervised a succession of experiments with the objective to determine the relation between the volumetric flow of water through sand beds and the hydraulic head loss [1]. Darcy used, long column permeameter were the filling of sand and sand removal was difficult task, liquid having Reynolds number less than unity, filter changing was difficult, used constant head method where it was difficult to always maintain constant pressure head. This setup is used to calculate the permeability by falling head method.

Permeability: The passage of gaseous materials, water and steam vapour through the sand is related to permeability. It is the property of the sand. It is define as the ability of transmit water [2].



Fig.1 Ability to transmit water

Porosity: It is defined as the ability to hold water [2].

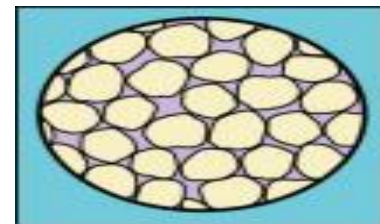


Fig.2 Ability to hold water

Darcy's Law: In fluid dynamics, Darcy's law is a phenomenologically derived constitutive equation that describes the flow of a fluid through a porous medium. The law was formulated by Henry Darcy based on the result of experiments [3] on the flow of water through beds of sand [4]. Darcy's law is a simple proportional relationship between the instantaneous discharge rates through a porous medium. The viscosity of a fluid and the pressure drop over a given distance. The total discharge, Q (units of volume per time) is equal to the product of the permeability (k units of area) of the medium, the cross-sectional area (A) to flow, and the pressure drop ($P_b - P_a$), all divided by the dynamic viscosity μ (in SI units), and the length L the pressure drop is taking place over. The negative sign is needed because fluid flows from high pressure to low pressure. So if the change in pressure is negative (in the x -direction) then the flow will be positive (in x -direction) [5].

Where q is the flux (discharge per unit area, with the units of length per time, m/s) and is the pressure gradient factor. Thos value of flux, often referred to as the Darcy flux, is not the velocity which the water travelling through the pores is experiencing [5].

$$q = -k/\mu \Delta p$$

The pore velocity (V) is related to the Darcy's flux (q) by the porosity (Φ). The flux is divided by porosity to account for the fact that only a fraction of the total formation volume is available for flow. The pore velocity would be the velocity a conservative tracer would experience if carried by the fluid through the formation [5].

$$V = q/\Phi$$

Assumptions

Darcy law is a simple mathematical statement which neatly summarizes several familiar properties that groundwater flowing in aquifers exhibits, including.

- If there is no pressure gradient over a distance, no flow occurs (this is hydrostatic condition).
- If there is no gradient, flow will occur from high pressure towards low pressure (opposite the direction of increasing gradient – hence the negative sign in Darcy's law).
- The greater the pressure gradient (through the same formation material), the greater the discharge rate, and
- The discharge rate of fluid will often be different direction) – even if the same pressure gradient exists in both cases.

Hydraulic Conductivity: Hydraulic conductivity is a property of vascular plants, soil or rocks that describe the ease with which water can move through pore spaces or fractures [6]. Hydraulic conductivity is the proportionality constant in Darcy's law, which relates the amount of water which will flow through a unit cross-sectional area of aquifer under a unit gradient of hydraulic head [7]. It is analogous to the thermal conductivity of materials in heat conduction. The hydraulic conductivity (K) is specific to the flow of a certain fluid (typically water, sometimes air or oil); intrinsic permeability k is a parameter of a porous medium which is independent of fluid. Where

$$K = k \gamma / \mu$$

K is the hydraulic conductivity [LT^{-1} or ms^{-1}];
k is the intrinsic permeability of the material [L^2 or m^2];
 γ is the specific weight of water [$ML^{-2}T^{-2}$ or $N m^{-3}$], and;
 μ is the dynamic viscosity of water [$ML^{-1}T^{-1}$ or $kg m^{-1}s^{-1}$].

II. OBJECTIVE

To modify a setup to calculate permeability of a medium by Darcy's law. Testing of samples and determine the relation between the flow rate, head difference, and length of flow path.

THEORY OF DARCY'S LAW

Derivation: A one- dimensional flow column is shown in figure:

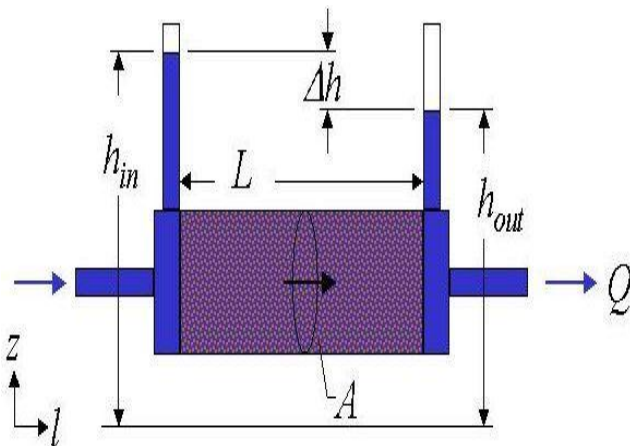


Fig.3: Simple column

$$Q = AK (\Delta h/L) \dots \dots \dots (1)$$

Q=volumetric flow rate (m^3/s),
A=flow area perpendicular to L (m^2)
K=hydraulic conductivity (m/s),
L=flow path length (m),
 Δh =hydraulic head (m), and
 Δ =denotes the change in h over the path L.

The hydraulic head at a specific point is the sum of pressure head and the elevation [8], or

$$h = (p/\rho g + z) \dots \dots \dots (2a)$$

$$h = (p/\rho g + z) \dots \dots \dots (2b)$$

Where,
p=water pressure (N/m^2)
 ρ =water density (kg/m^3)
 ρg =water specific weight (N/m^3)
g=acceleration of gravity (m/s^2)
z=elevation (m)

The hydraulic head at a specific point. H is the sum of the pressure head and the elevation, or

$$h = (p/\rho g + z) \dots \dots \dots (2)$$

Where,
P = water pressure
ρ = water density
g = acceleration of gravity
z = elevation

Equation (2) is the normal SI form of the equation. The hydraulic head is the height that water would raise in a piezometer. Thus; Δh is simply the difference in height of water in piezometer placed at the inlet and the outlet. Substituting (2(a)) into 1

$$q = -KA [(p/\rho g) + z]/L \dots \dots \dots (3)$$

Equation (3) is approximately the form Darcy used to analyse his experimental data.

Note that the flow is not a function of the absolute pressure or the elevation. It is only a function of the change in hydraulic head.

Differential Form

A more general form of equation results when the limit of Δh with respect to the flow direction L, as the flow path L goes to zero.

Applying that step to equations (1) and (3) yields,

$$Q = -AK dh/dl = -AK d\{(p/\rho g) + z\}/dl \dots \dots \dots (4)$$

The minus sign on the right hand terms reflects that the hydraulic head always decreases in the direction of flow.

Flow Variables

(i) Darcy Flux

The Darcy's flux is defined as,

$$q = Q/A \dots \dots \dots (5)$$

Where q = Darcy flux (m/s)

The Darcy's flux is the volumetric flow per unit area. Substitution of equation (5) into (4) yields,

$$q = -K \frac{dh}{dl} = -Kd \left\{ \left(\frac{p}{\rho g} \right) + z \right\} / dl \dots \dots \dots (6)$$

(ii) Seepage Velocity

While the Darcy's flux has the unit of velocity, it is not the velocity of the water in the pores. The solid matrix takes up some of the flow area. The average pore water velocity is termed as the seepage velocity, and is given by

$$v = Q/Af = q/f \dots \dots \dots (7)$$

Where f is the porosity of the porous media. The maximum pore velocity is the function of the pore geometry and cannot be easily predicted except of simple shaped. In circular tubes the maximum velocity is twice of seepage velocity (v) [9].

Application and Scope

Subsurface Pavement Drainage System Installation

Excessive and uncontrolled subsurface water has been responsible for large numbers of pavement failures, slope failures, and unsatisfactory projects. Groundwater can have a considerable impact on the success of a highway construction project. If groundwater and seepage are not identified and adequately addressed it can significantly impair the following:

- Constructability;
- Pavement performance; and
- Slope stability.

Surface water infiltrating through porous or cracked pavements and unsealed joints, capillary water rising from the underlying water table, accumulated water vapour from temperature fluctuations and other atmospheric conditions and high groundwater table [10].

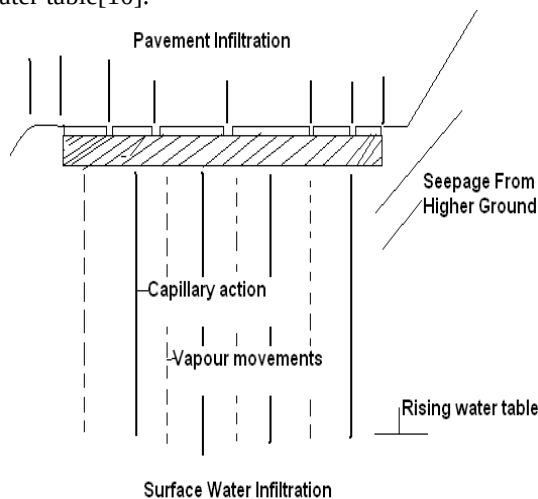


Fig.5

Pavement Subsurface Drainage System Installation

A drainable pavement contains the following integral components: the asphalt or concrete surface pavement, a permeable base, a separator/filter layer, the sub grade, and edge drains. To construct a subsurface pavement drainage system we need to determine permeability of a soil and its properties such as seepage velocity and flow rate by using Darcy's setup [11].

- Petroleum geology: In extraction and filtration of crude oil by passing the oil through the layers with different permeability.
- Wastage dumping: To prevent soil pollution release from the wastage.
- Water harvesting: To prevent loss of water a comparatively less permeable base layer is used.

Terminology

Hydraulic Conductivity: Hydraulic Conductivity is a property of vascular plants, soil or rock that describes the ease with which water can move through a pore spaces or features. It is the proportionality constant in Darcy's Law, which relates the amount of water which will flow through a unit cross-section area of aquifer under a unit gradient of hydraulic head.

Permeability: Permeability is a measure of the ability of material (typically, a rock or unconsolidated material) to transmit fluids.

Porosity: Porosity is a measure of the void spaces in a material, and is measured as a fraction, between 0-1, and percentage between 0-100 percent.

Seepage velocity: While the Darcy flux has the unit of velocity, it is not the velocity of water in the pores. The solid matrix takes up some of the flow area. The average pore water velocity is termed as the seepage velocity, and is given by

$$v = Q/Af = q/f$$

Where f is the porosity of the porous media. The maximum pore velocity is the function of the pore geometry and cannot be easily predicted except of simple shaped. In circular tubes the maximum velocity is twice of seepage velocity.

Darcy flux: The Darcy flux is the volumetric flow per unit area. The Darcy flux is defined as

$$q = Q/A$$

Where,

q = Darcy flux (m/s or ft/s)

Q = volumetric flow rate (m³/s or ft³/s),

A = Flow area perpendicular to L .

III. MODIFICATION IN DESIGN OF APPARATUS

Material Required

- Circular cross-section tube of plastic
- Sand filter
- Metal box with one open face
- Clamp
- Gate valve, T-joint
- Stop watch
- Hollow iron rod

- Flexible pipe
- Hard adhesive
- Measuring Flask
- Rolling wheel

Description of parts

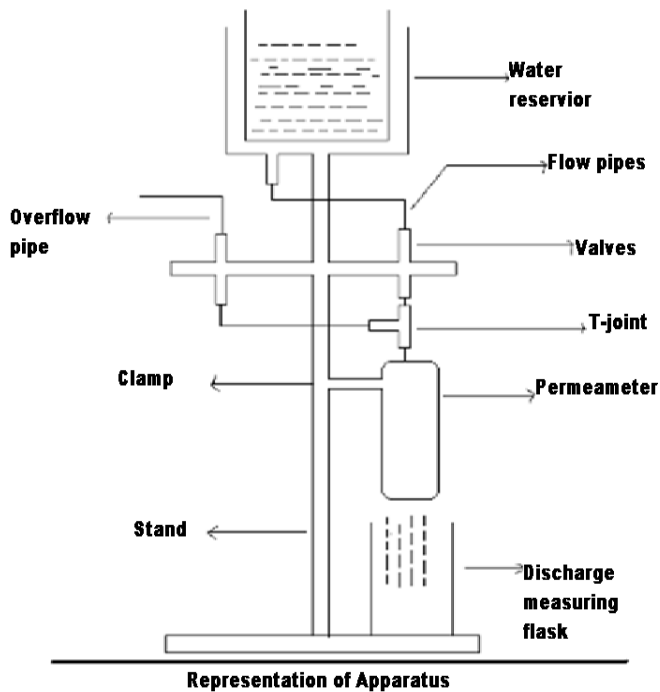


Fig.6

Permeameter: Circular cross-section tube of plastic of 10.2 cm diameter and 1-2 mm thickness to hold sand sample. Plastic material is selected to prevent rusting and corrosion.

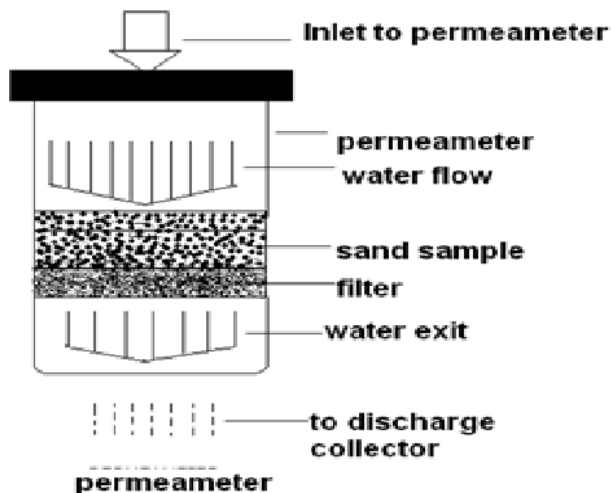


Fig.7

Sand filter: It consists of two layers of thin plastic strainers or cloth strainer sandwiched between perforated metal plates. This is one of major parts of apparatus and should be able to prevent

the flow out of sand particle in sample with proper passage of water. Its mesh size is 60 μ m.

Water Reservoir: Metal box of width 47.5 cm, length 47.5 cm and height 17 cm. It has one open face to fill water into it.

Clamp: Welded with stand to hold permeameter in vertical position.

Gate Valve: To regulate water flow through pipes.

Stop Watch: To record time for discharge.

Hollow Iron Rod: To make stand to hold above mentioned parts.

Flexible Pipe: To make connections.

Hard Adhesive: To stop leakage at pipe joints.

T joint: To connect air flow pipe and water flow pipes.

Measuring flask: To collect the definite discharge through permeameter.

Difficulties Faced While Fabrication of Apparatus

Difficulty 1: Leakage of pipe joints at reservoir, gate valve, T-joint.

Remedy: Putting hard adhesive at pipe joints.

Difficulty 2: Flow out of fine sand particles through filter.

Remedy: Make filter multilayered and use filter materials with very fine pores.

LIMITATIONS

Medium in Darcy's tube should not solidify as it can result in blockage of flow path.

Medium should not chemically react with water.

No bubble formation in Darcy's tube and flow pipe.

Properly compress the medium to avoid loose packing of medium particles and reduce the inter particle space.

Water flow through the medium should be laminar.

Water should flow through whole cross-section of medium.

Apparatus can be used only for one dimensional vertical flow.

IV. WORK DONE

Experiments

By using Darcy's Law we are going to perform experiments on samples of different permeability by using either the constant head method or falling head method depending on the type of sample being tested.

Gravels	Fine sand Homogeneous	Silts		
	Weathered Clay	Clay		

Falling Head Test

The falling head test is different in that it does not fix the total head difference across the specimen. Instead, a stand pipe is connected to the inflow, and the water is then allowed to flow through the soil without maintaining a constant pressure head [12]. This will also well for coarse-grained soils, because they are so permeable that the head drops too rapidly to be accurately measured.

Samples

We will test two samples of varying permeability. The samples are:

SAMPLE 1: Sandy Gravel (From River Betwa, Hamirpur (U.P)

Permeability range of sample: 10^{-1} - 10^{-3}

Porosity range: 23% to 35%

SAMPLE 2: Fine Sand (From River Yamuna, Agra)

Permeability range of sample: 10^{-3} - 10^{-5}

Porosity range: 44% to 50%

Experiment Number 1

Objective: To test following sample to determine hydraulic conductivity, Darcy's velocity and seepage velocity by falling head test.

Sample 1: Sandy Gravel

Apparatus: Darcy's setup, sand sample, timer clock

Theory

Darcy's Law: Darcy's Law is a generalized relationship for flow of porous media. It shows that the volumetric flow rate is a function of a flow area, elevation, fluid pressure and proportionality constant.

$$K = (Q/t) (L/Ah)$$

K = hydraulic conductivity or coefficient of permeability (cm/sec)

Q = volume (ml) of water flowing through the sand in time t

t = time period (sec) for the volume Q to flow

h = change of head in water surfaces (cm)

A = horizontal cross-section area (cm²) of sand sample

L = length (cm) of a sand sample

Darcy's Flux: The Darcy's flux is the volumetric flow per unit area

$$q = Q/A$$

Where q = Darcy's flux

Seepage velocity: While the Darcy flux has the unit of velocity, it is not the velocity of the water in the pores. The solid matrix takes up the some of the flow area. The average pore water velocity is termed the seepage velocity, v, and is given by

$$V = Q/A f = q/f$$

Where f is the porosity of the pores media. The maximum pore velocity is a function of the pore geometry and cannot be easily predicted except for simple shaped.

Typical permeability ranges [13]

Soils exhibit a very wide range of permeability and while particle size may vary by about 3-4 orders of magnitude, permeability may vary by about 10 orders of magnitude.

10^{-1} 10^{-2} 10^{-3} 10^{-4} 10^{-5} 10^{-6} 10^{-7} 10^{-8} 10^{-9} 10^{-10} 10^{-11}

PROCEDURE [14]

- Close all gate valves and fill the water in reservoir.
- Insert filter in permeameter.
- Fill permeameter with 6 cm height of sample.
- Close permeameter opening and connect inlet pipe to permeameter.
- Place discharge collecting plastic containers below permeameter.
- Open permeameter inlet gate valve and allow water to flow and collect in the discharge tube.
- Allow water to flow for sometime so that sand adjust in the permeameter and steady state condition is obtained.
- Start timer and measure the time taken for 100 ml and 200 ml discharge of water.
- Repeat above step for two more readings (for same volume of discharge) and take average of three values as final time for calculations.
- Repeat above steps for sample length of 8 cm height of sand sample.
- Record results in observation table.

Discharge (Q) cc	Pressure Head (H) cm	Time Taken for Discharge Q (t ₁) sec	Time Taken for Discharge Q (t ₂) sec	Time Taken for Discharge Q (t ₃) sec	Average Time Taken for Discharge Q (t _{avg}) sec
100	101.5	26	28	33	29
200	101.5	41	47	49	45.67

OBSERVATION TABLES:

Sample: sandy Gravel

Length of sample (L) =6 cm

Diameter (D) =10.2 cm

Area of cross-section (A) =81.713 cm²

Porosity for sample (f) =35%

Table1: observations for sandy gravel (L=6 cm)

Calculations

For discharge (Q) =100 ml

Coefficient of permeability $K_1 = (Q \times L) / (A \times H \times t_{avg})$

$$K_1 = (100 \times 6) / (81.713 \times 101.5 \times 29)$$

$$K_1 = 0.249 \times 10^{-2} \text{ cm/sec, i.e.}$$

$$K_1 = 0.00249 \text{ cm/sec}$$

Darcy velocity, $V_1 = Q / (A \times t_{avg})$
 $V_1 = 100 / (81.713 \times 29)$
 $V_1 = 0.0421 \text{ cm/s}$

Seepage velocity, $V_{s1} = Q / (A \times f \times t_{avg})$
 $V_{s1} = 100 / (81.713 \times 0.35 \times 29)$
 $V_{s1} = 0.120 \text{ cm/s}$

Discharge (Q) cc	Pressure Head (H) cm	Time Taken for Discharge Q (t ₁) sec	Time Taken for Discharge Q (t ₂) sec	Time Taken for Discharge Q (t ₃) sec	Average Time Taken for Discharge Q (t _{avg}) sec
100	101.5	26	29	30	28.33
200	101.5	41	44	46	43.67

For discharge (Q) = 200 ml

Coefficient of permeability $K_2 = (Q \times L) / (A \times H \times t_{avg})$

Sample: sandy Gravel

Length of sample (L) = 8 cm
 Diameter (D) = 10.2 cm
 Area of cross-section (A) = 81.713 cm²
 Porosity for sample (f) = 35%

Table 2: observations for sandy gravel (L=8 cm)

$K_2 = (200 \times 8) / (81.713 \times 101.5 \times 43.67)$
 $K_2 = 0.316 \times 10^{-2} \text{ cm/s}$
 $K_2 = 0.00316 \text{ cm/s}$

Darcy velocity $V_2 = Q / (A \times t_{avg})$
 $V_2 = 200 / (81.713 \times 43.67)$
 $V_2 = 0.053 \text{ cm/s}$

Seepage velocity, $V_{s2} = Q / (A \times f \times t_{avg})$
 $V_{s2} = 200 / (81.713 \times 0.35 \times 43.67)$
 $V_{s2} = 0.153 \text{ cm/s}$

Calculations

For discharge (Q) = 100 ml

Coefficient of permeability $K_1 = (Q \times L) / (A \times H \times t_{avg})$

$K_1 = (100 \times 8) / (81.713 \times 101.5 \times 28.33)$

$K_1 = 0.340 \times 10^{-2} \text{ cm/sec}$, i.e.
 $K_1 = 0.00340 \text{ cm/sec}$

Darcy velocity, $V_1 = Q / (A \times t_{avg})$
 $V_1 = 100 / (81.713 \times 28.33)$
 $V_1 = 0.0432 \text{ cm/s}$

Seepage velocity, $V_{s1} = Q / (A \times f \times t_{avg})$
 $V_{s1} = 100 / (81.713 \times 0.35 \times 28.33)$
 $V_{s1} = 0.123 \text{ cm/s}$

For discharge (Q) = 200 ml

Coefficient of permeability $K_2 = (Q \times L) / (A \times H \times t_{avg})$

$K_2 = (200 \times 8) / (81.713 \times 101.5 \times 43.67)$
 $K_2 = 0.442 \times 10^{-2} \text{ cm/s}$
 $K_2 = 0.00442 \text{ cm/s}$

Darcy velocity, $V_2 = Q / (A \times t_{avg})$
 $V_2 = 200 / (81.713 \times 43.67)$
 $V_2 = 0.0562 \text{ cm/s}$

Seepage velocity, $V_{s2} = Q / (A \times f \times t_{avg})$
 $V_{s2} = 200 / (81.713 \times 0.35 \times 43.67)$
 $V_{s2} = 0.160 \text{ cm/s}$

Precautions

Precaution to be considered before and while conducting of experiment is:

- Reservoir should have sufficient water.
- Steady state should be obtained before taking readings.
- Ensure removal of air bubbles from the flow pipe.
- Flow amount should be properly measured and the time taken accurately noted.
- Excess water should not fill up in the permeameter.
- Type of sample should be considered to determine type of test to be conducted.
- Before starting to take the reading, it should be insured that the soil sample and the filter are properly filled.
- Flow of water through sample should be made as laminar as possible.
- The sand should be filled freely in the permeameter without pressing.

Experiment Number 2

Objective: To test following sample to determine hydraulic conductivity, Darcy's velocity and seepage velocity falling head test.

Sample 1: fine sand

Apparatus: Darcy's setup, sand sample, timer clock

Theory

Darcy's Law: Darcy's Law is a generalized relationship for flow of porous media. It shows that the volumetric flow rate is a

function of a flow area, elevation, fluid pressure and proportionality constant.

$$K = (Q/t) (L/Ah)$$

K = hydraulic conductivity or coefficient of permeability (cm/sec)

Q = volume (ml) of water flowing through a sand in time t

t = time period (sec) for the volume Q to flow

h = change of head in water surfaces (cm)

A = horizontal cross-section area (cm²) of sand sample

L = length (cm) of a sand sample

Darcy's Flux: The Darcy's flux is the volumetric flow per unit area

$$q = Q/A$$

Where q = Darcy's flux

Seepage Velocity: While the Darcy flux has the unit of velocity, it is not the velocity of the water in the pores. The solid matrix takes up the some of the flow area. The average pore water velocity is termed the seepage velocity, v, and is given by

$$V = Q/A f = q/f$$

Where f is the porosity of the pores media. The maximum pore velocity is a function of the pore geometry and cannot be easily predicted except for simple shaped.

Typical permeability ranges

Soils exhibit a very wide range of permeability and while particle size may vary by about 3-4 orders of magnitude, permeability may vary by about 10 orders of magnitude.

Gravels	Fine sand Homogeneous	Silts		
	Weathered Clay	Clay		

10⁻¹ 10⁻² 10⁻³ 10⁻⁴ 10⁻⁵ 10⁻⁶ 10⁻⁷ 10⁻⁸ 10⁻⁹ 10⁻¹⁰ 10⁻¹¹

PROCEDURE

- Close all gate valves and fill the water in reservoir.
- Insert filter in permeameter.
- Fill permeameter with 6 cm height of sample.
- Close permeameter opening and connect inlet pipe to permeameter.
- Place discharge collecting plastic containers below permeameter.
- Open permeameter inlet gate valve and allow water to flow and collect in the discharge tube.
- Allow water to flow for sometime so that sand adjusts in the permeameter and steady state condition is obtained.
- Start timer and measure the time taken for 100 ml and 200 ml discharge of water.
- Repeat above step for two more readings (for same volume of discharge) and take average of three values as final time for calculations.

- Repeat above steps for sample length of 8 cm height of sand sample.
- Record results in observation table.

OBSERVATION TABLES:

Sample: fine sand

Length of sample (L) =6 cm

Diameter (D) =10.2 cm

Area of cross-section (A) =81.713 cm²

Porosity for sample (f) =44%

Dis charge (Q) cc	Pressur e Head (H) cm	Time Taken for Dischar ge Q (t ₁) sec	Time Taken for Discharge Q (t ₂) sec	Time Taken for Discharge Q (t ₃) sec	Average Time Taken for Discharge Q (t _{avg}) sec
100	101.5	108	113	115	112
200	101.5	170	192	208	190

Table3: observations for fine sand (L=6 cm)

CALCULATIONS:

For discharge (Q) =100 ml

Coefficient of permeability $K_1 = (Q \times L) / (A \times H \times t_{avg})$

$$K_1 = (100 \times 6) / (81.713 \times 101.5 \times 112)$$

$$K_1 = 0.646 \times 10^{-3} \text{ cm/sec, i.e.}$$

$$K_1 = 0.000646 \text{ cm/sec}$$

Darcy velocity, $V_1 = Q / (A \times t_{avg})$

$$V_1 = 100 / (81.713 \times 112)$$

$$V_1 = 0.011 \text{ cm/s}$$

Seepage velocity, $V_{s1} = Q / (A \times f \times t_{avg})$

$$V_{s1} = 100 / (81.713 \times 0.44 \times 112)$$

$$V_{s1} = 0.0248 \text{ cm/s}$$

For discharge (Q) =200 ml

Coefficient of permeability, $K_2 = (Q \times L) / (A \times H \times t_{avg})$

$$K_2 = (200 \times 6) / (81.713 \times 101.5 \times 190)$$

$$K_2 = 0.761 \times 10^{-3} \text{ cm/s}$$

$$K_2 = 0.000761 \text{ cm/s}$$

Darcy velocity, $V_2 = Q / (A \times t_{avg})$

$$V_2 = 200 / (81.713 \times 190)$$

$$V_2 = 0.0128 \text{ cm/s}$$

Seepage velocity, $V_{s2} = Q / (A \times f \times t_{avg})$

$$V_{s2} = 200 / (81.713 \times 0.44 \times 190)$$

$$V_{s2} = 0.029 \text{ cm/s}$$

Sample: fine sand

Length of sample (L) = 8 cm

Diameter (D) = 10.2 cm

Area of cross-section (A) = 81.713 cm²

Porosity for sample (f) = 44%

Discharge (Q) cc	Pressure Head (H) cm	Time Taken for Discharge Q (t ₁) sec	Time Taken for Discharge Q (t ₂) sec	Time Taken for Discharge Q (t ₃) sec	Average Time Taken for Discharge Q (t _{avg}) sec
100	101.5	156	160	163	159.67
200	101.5	253	280	302	278.33

Table 4: observations for fine sand (L=8 cm)

CALCULATIONS:

For discharge (Q) = 100 ml

Coefficient of permeability, $K_1 = (Q \times L) / (A \times H \times t_{avg})$

$$K_1 = (100 \times 8) / (81.713 \times 101.5 \times 159.67)$$

$$K_1 = 0.604 \times 10^{-3} \text{ cm/sec, i.e.}$$

$$K_1 = 0.000604 \text{ cm/sec}$$

Darcy velocity, $V_1 = Q / (A \times t_{avg})$

$$V_1 = 100 / (81.713 \times 159.67)$$

$$V_1 = 0.0076 \text{ cm/s}$$

Seepage velocity, $V_{s1} = Q / (A \times f \times t_{avg})$

$$V_{s1} = 100 / (81.713 \times 0.44 \times 159.67)$$

$$V_{s1} = 0.0174 \text{ cm/s}$$

For discharge (Q) = 200 ml

Coefficient of permeability, $K_2 = (Q \times L) / (A \times H \times t_{avg})$

$$K_2 = (200 \times 8) / (81.713 \times 101.5 \times 278.33)$$

$$K_2 = 0.693 \times 10^{-3} \text{ cm/s}$$

$$K_2 = 0.000693 \text{ cm/s}$$

Darcy velocity, $V_2 = Q / (A \times t_{avg})$

$$V_2 = 200 / (81.713 \times 278.33)$$

$$V_2 = 0.00879 \text{ cm/s}$$

Seepage velocity, $V_{s2} = Q / (A \times f \times t_{avg})$

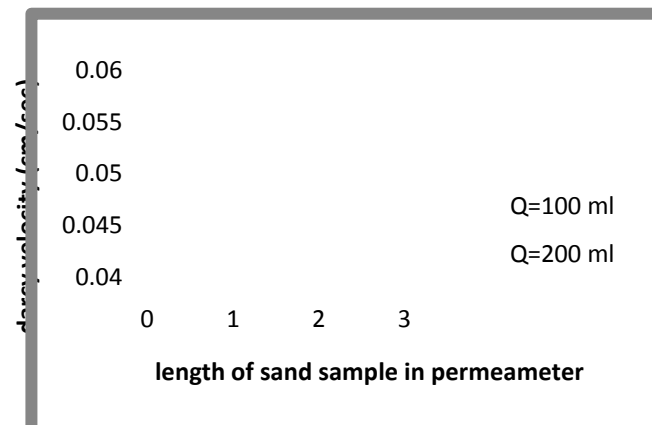
$$V_{s2} = 200 / (81.713 \times 0.44 \times 278.33)$$

$$V_{s2} = 0.0199 \text{ cm/s}$$

PRECAUTIONS

Precaution to be considered before and while conducting of experiment is:

- Reservoir should have sufficient water.
- Steady state should be obtained before taking readings.
- Ensure removal of air bubbles from the flow pipe.
- Flow amount should be properly measured and the time taken accurately noted.
- Excess water should not fill up in the permeameter.
- Type of sample should be considered to determine type of test to be conducted.
- Before starting to take the reading, it should be insured that the soil sample and the filter are properly filled.
- Flow of water through sample should be made as laminar as possible.
- The sand should be filled freely in the permeameter without pressing.



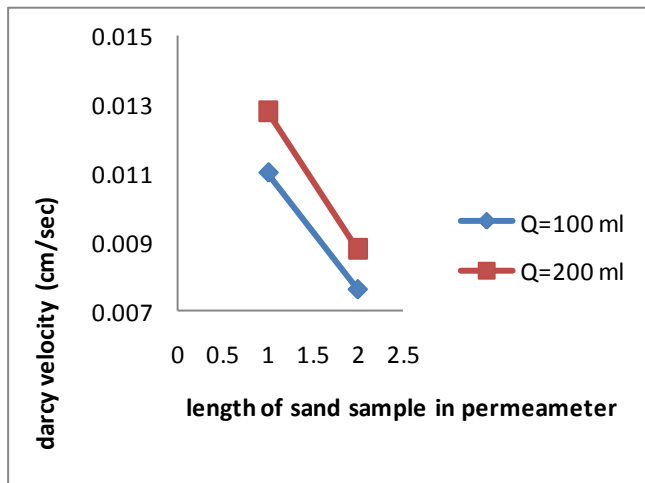
Scale on x axis, point 1=6 cm & point 2=8cm

Graph 1: length of sand sample of sandy gravel in permeameter versus Darcy velocity

Sample: sandy gravel

Series 1= discharge is 100ml

Series 2= discharge is 200 ml



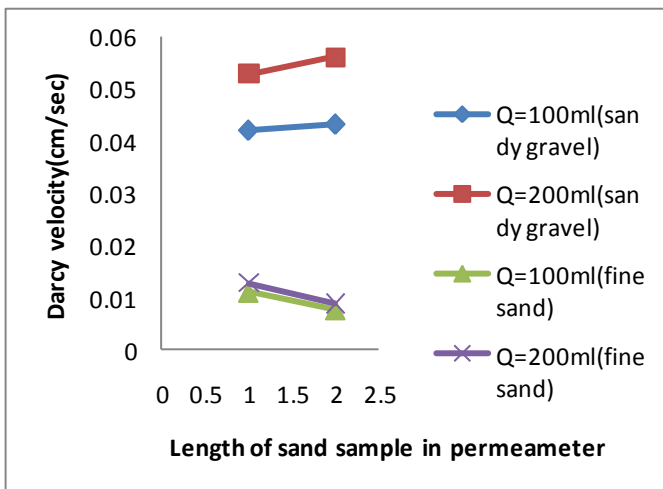
Scale on x axis, point 1= 6 cm & point 2= 8 cm

Graph 2: length of sand sample of fine sand in permeameter versus Darcy velocity

Sample: fine sand

Series 1= discharge is 100ml

Series 2= discharge is 200 ml



Scale on x axis, point 1 = 6 cm & point 2 = 8 cm

Graph 3: length of sand sample of fine sand and sandy gravel in permeameter versus Darcy velocity

Where,

Series 1= discharge is 100ml (sandy gravel)

Series 2= discharge is 200ml (sandy gravel)

Series 3= discharge is 100ml (fine sand)

Series 4= discharge is 200ml (fine sand)

V. RESULTS AND DISCUSSION

Results Table

Sandy Gravel

$L = 6 \text{ cm}$, $D = 10.2 \text{ cm}$, $A = 81.713 \text{ cm}^2$, $H = 101.5 \text{ cm}$

Discharge (Q) cc	Average Time Taken for Discharge Q (t_{avg}) sec	Hydraulic Conductivity (K) cm/s	Darcy Velocity (V) cm/s	Seepage Velocity (Vs) cm/s	L/H
100	29	0.00249	0.0421	0.120	0.0591
200	45.67	0.00316	0.053	0.153	0.0591

Table 5: results for sandy gravel ($L=6 \text{ cm}$)

Sandy Gravel

$L = 8 \text{ cm}$, $D = 10.2 \text{ cm}$, $A = 81.713 \text{ cm}^2$, $H = 101.5 \text{ cm}$

Discharge (Q) cc	Average Time Taken for Discharge Q (t_{avg}) sec	Hydraulic Conductivity (K) cm/s	Darcy Velocity (V) cm/s	Seepage Velocity (Vs) cm/s	L/H
100	28.33	0.00340	0.0432	0.123	0.0788
200	43.67	0.00442	0.0562	0.160	0.0788

Table 6: results for sandy gravel ($L=8 \text{ cm}$)

Fine Sand

$L = 6 \text{ cm}$, $D = 10.2 \text{ cm}$, $A = 81.713 \text{ cm}^2$, $H = 101.5 \text{ cm}$

Discharge (Q) cc	Average Time Taken for Discharge Q (t_{avg}) sec	Hydraulic Conductivity (K) cm/s	Darcy Velocity (V) cm/s	Seepage Velocity (Vs) cm/s	L/H
100	112	0.000646	0.011	0.0248	0.0591
200	190	0.000661	0.0128	0.0290	0.0591

Table 7: results for fine sand ($L=6 \text{ cm}$)

Fine sand

$L = 8 \text{ cm}$, $D = 10.2 \text{ cm}$, $A = 81.713 \text{ cm}^2$, $H = 101.5 \text{ cm}$

Discharge (Q) cc	Average Time Taken for Discharge Q (t_{avg}) sec	Hydraulic Conductivity (K) cm/s	Darcy Velocity (V) cm/s	Seepage Velocity (Vs) cm/s	L/H
100	159.67	0.000604	0.0076	0.0174	0.0788
200	278.33	0.000693	0.00879	0.0199	0.0788

Table 8: results for fine sand (L=8 cm)

Discussion of Graph

From graph between length of sand sample of sandy gravel in permeameter and Darcy velocity it is shown that:

With increases in the sample length (L), the value of Darcy velocity increases because as the length of sample increases, the average time decreases, and according to formula $\{V=Q/(A \times t_{avg})\}$ Darcy velocity is inversely proportional to t_{avg} .

For sandy gravels (same length), on increasing discharge collected, the value of Darcy velocity increases because Darcy velocity V is directly proportional to discharge Q.

Slight variation in the value of hydraulic conductivity or coefficient of permeability is seen due to exit of water, air bubbles in flow pipe, improper packing etc.

From graph between length of sand sample of fine sand in permeameter and Darcy velocity it is shown that:

With increases the sample length (L), the value of Darcy velocity decreases because as the length of sample increases, the average time increases and according to formula $\{V=Q/(A \times t_{avg})\}$ Darcy velocity is inversely proportional to t_{avg} .

For fine sand (same length), on increasing discharge collected, the value of Darcy velocity increases because Darcy velocity V is directly proportional to discharge Q.

Slight variation in the value of hydraulic conductivity or coefficient of permeability is seen due to exit of water, air bubbles in flow pipe, improper packing etc.

When we combine both graph (graph between length of sand sample of sandy gravel in permeameter and Darcy velocity & graph between length of sand sample of fine sand in permeameter and Darcy) it is shown that Darcy velocity of fine sand is less than sandy gravel sample because according to formula $(V=Q/(A \times t_{avg}))$. We calculate that the average time in case of fine sand is more than the average time in case of sandy gravel for a same discharge due to grain size of fine sand is greater than the grain size of sandy gravel [15].

V. CONCLUSION

There are so many permeability testers to measure the permeability now a day but this apparatus is simplification of Darcy's apparatus and is too simple to operate. By this apparatus it is easy to check the permeability of porous medium with good accuracy. This method also uses to calculate the Darcy velocity and seepage velocity.

This apparatus not only uses to calculate the permeability of sand but also uses to calculate the permeability of soil (except coarse grained soils) and clays. In casting industries there is a need of value of permeability of sand which is used in making mould sand for moulding purpose and permeability of sand is also needed in petroleum geology, wastage dumping, water harvesting for different working.

In our project we have measure the permeability of fine sand and sandy gravels by using falling head method at different length and different discharge. We calculate the

- Hydraulic conductivity or coefficient of permeability.

- Darcy velocity
- Seepage velocity or actual pore velocity
- L/H ratio which is constant for fine sand and sandy gravel

We also conclude that at different length of the sample in permeameter there is variation in Darcy velocity. By varying the length of sample (fine sand), Darcy velocity decreases while varying the length of sample (sandy gravel), Darcy velocity increases (shown in result and discussion). Slight variation in the value of hydraulic conductivity or coefficient of permeability is seen due to exit of water, air bubbles in flow pipe, improper packing etc. Darcy velocity of fine sand is less than sandy gravel sample (shown in result and discussion). Our results also evaluated with in a typical range of permeability (shown in experiments) so, this apparatus gives satisfactory results at different length of sample used and different discharge for sandy gravel and fine sand respectively.

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Biosurfactant – Isolation, Production, Purification & Significance

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Abstract- The present article is aimed to determine common cultivable surfactant producers from soil and contaminated oil, its purification and significance. Bio-surfactants are surface-active substances synthesized by living cells and as compared to synthetic surfactants, they are more effective, selective, environmental friendly and stable. They have the properties of reducing surface tension, stabilizing emulsions, promoting foaming and are generally non-toxic and biodegradable. Interest in microbial surfactants has been steadily increasing due to their diversity, eco-friendly nature, possibility of large-scale production, selectivity, performance under extreme conditions and potential applications in environmental protection. Bio-surfactants enhance the emulsification of hydrocarbons; have the potential to solubilize it to increase their availability for microbial degradation. These compounds can be used in enhanced oil recovery, environmental protection, herbicides and pesticides formulations, detergents, health care and cosmetics, pulp and paper, coal, textiles, ceramic processing and food industries, uranium ore-processing and mechanical dewatering of peat. Mostly bacteria and yeasts are known to synthesize bio-surfactants. These microorganisms synthesize a wide range of chemicals with surface activity, such as glycolipid (low molecular weight surfactants), phospholipids and others like polyanionic heteropolysaccharides (containing covalently-linked hydrophobic side chains or complexes containing both polysaccharides and proteins). In this study two unique isolates L4 and L15 (screened from soil contaminated with oil) are grown on MSM broth with 2% glucose for the production of bio-surfactant. Bio-surfactant was purified by Ammonium sulphate precipitation or $ZnCl_2$ precipitation method and identified by TLC.

Index Terms- Bio-surfactant, Amphipathic molecules, surface active agents, detergency, surface tension, bioremediation.

I. INTRODUCTION

‘**S**urfactant’ are amphipathic molecules with both hydrophilic and hydrophobic (generally hydrocarbon) moieties that partition favourably at the interface between fluid phases with different grades of polarity and hydrogen bonding such as oil/water or air / water interfaces. These polarities render surfactants capable of reducing surface and interfacial tension and forming micro emulsion where hydrocarbon can be solubilize in water or where water can solubilize in hydrocarbons. Such characteristics confer excellent detergency, emulsifying, forming and dispersing traits. Almost all surfactants

currently in use are chemically derived from petroleum; however, interest in microbial surfactants has been steadily increasing in due to their diversity, environmental friendly and easy production. Biosurfactants are amphiphilic compounds, structurally diverse group of surface active molecules excreted extracellularly, synthesized by large varieties of micro-organisms, which vary in their chemical properties and molecular size. These molecules reduce surface and interfacial tension in both aqueous solutions and hydrocarbon mixture.

The main functions of bio-surfactant in microbial cells are emulsification of water insoluble substrates such as hydrocarbons and facilitate its transport into the cell to stimulate the growth. Similarly adhesion and desorption of cell is essential for the survival of microbes in unfavourable conditions like toxin accumulation, limited nutrients availability.

In this article, have presented the application of bio-surfactant, methods used for its isolation, production and purification.

II. CLASSIFICATION AND MICROBIAL ORIGIN

Bio-surfactants are categorized mainly by their chemical composition and their microbial origin. A major class of bio-surfactants includes:

- **Glycolipids:** most common carbohydrate in combination with long chain aliphatic acid of hydroxyl aliphatic acid. The glycolipid can be categorised as Rhamnolipids (commonly produced by *Pseudomonas aeruginosa*), Trehalolipids (commonly associated with *Actinomycetes*, *Mycobacterium*, *Nocardia* And *Corynebacterium*), Sophorolipids (produced by different strains of *Yeast* and *Torulopsis bombicola* and *T. petrophilum*)
- **Phospholipids, Fatty Acid and Natural Lipids:** several bacteria and yeasts such as *Thiobacillus thiooxidans*, *Aspergillus spp.*, *Arthobacter*, *P. aeruginosa* etc. produces large quantities of fatty acid and phospholipids during growth on n -alkanes.
- **Peptides:** many peptides antibiotics are amphiphilic in nature and exhibit surface active properties. Dipeptide antibiotics (gramicidin), lipopeptide antibiotics (polymyxins) and cyclic lipopeptide produced by *Bacillus brevis*, *B. polymyxa* and *B. subtilis*, respectively were shown to possess remarkable surface active properties.
- **Polymeric biosurfactants:** most recognized polymeric biosurfactant are emulsan, liposan, mannoprotein, polysaccharide-protein complexes, which are mainly

produced by *Acinetobacter calcoaceticus*, *Candida lipolytica*, *Saccharomyces cerevisiae*, *Schizoneella malanogramma*, *Ustilago maydis* and *Pseudomonas Spp.*

- **Particulate bio-surfactant:** surface activity in most hydrocarbon-degrading micro-organisms are attributed to several cell surface constituents, which includes structures such as M protein and lipoteichoic acid in group A *Streptococci*, Protein A in *Staphylococcus aureus*, Layer A in *Aeromonas salmonicida*, prodigiosin in *Serratia spp.*, gramicidins in *Bacillus brevis* spores and thin fimbriae in *A. calcoaceticus*.

III. AREAS OF APPLICATIONS AND USES

Microbial surfactants are more effective and versatile than many synthetic surfactants owing to their selective action, biodegradable nature and stability at high temperature. There are numerous applications of bio-surfactant as paralleled to their chemically synthesised counterparts: are as follows:

- In food industry: It is used as food additives. Lecithin and its derivatives, fatty acid ester containing glycerol, sorbitol and ethoxylate etc. are now days used as emulsifier in food industries.
- Health care and cosmetic industries: an appropriate combination of sophorolipids and propylene glycol has remarkable skin compatibility and used commercially as moisturizer. A numerous compounds are prepared by enzymatic alteration of hydrophobic molecules by lipase and whole cell for cosmetic application.
- Medical industries: bio-surfactant is very useful for the treatment of many infectious diseases such as the succinoyltrehalose lipid of *Rhodococcus erythropolis* has been reported to inhibit *Herpes simplex virus* and *Influenza virus*. 1% emulsion of rhamnolipids is used for the treatment of leaves of *Nicotiana* infected with *TMV* and to control *Potato virus-x* disease.
- As environment pollution control: it can be efficiently used in handling industrial emulsion, control of oil spill, biodegradation and detoxification of industrial effluents and bioremediation of contaminated soil.
- Economic production: Depending on the application, biosurfactants can also be produced from industrial wastes and by-products (example for use of petroleum related technology).
- Other potential area where it is useful is pulp & paper, coal, textile and uranium ore processing industries.

IV. MATERIAL AND METHOD

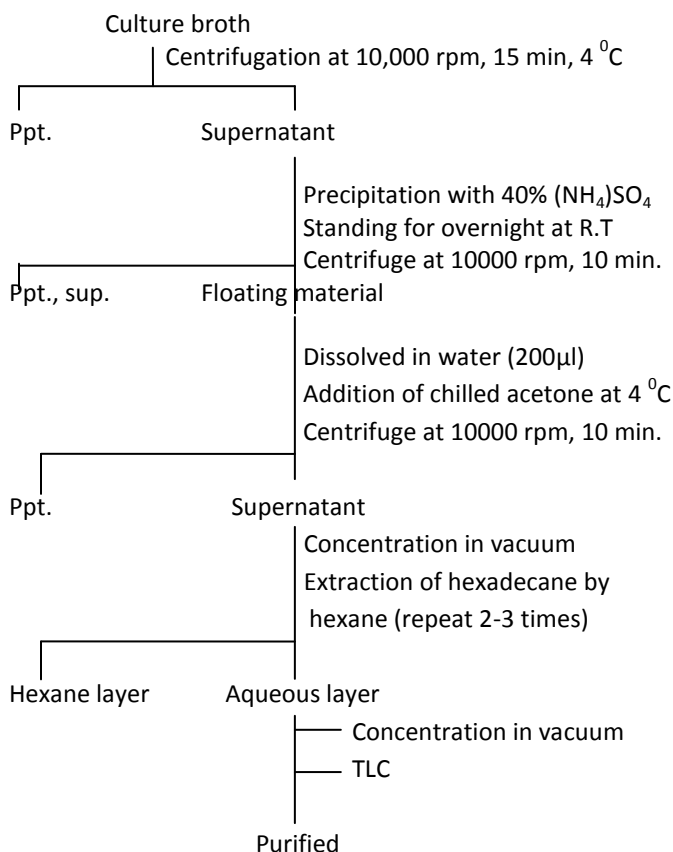
Isolation and screening: micro-organisms are the most versatile with regards to their ability to live on all kinds of substrates. Soil samples for this study were collected from numerous petrol pumps and waste oil dump areas and inoculated in Mineral Salt Medium (solution A: 2.5g of NaNO_3 , 0.4 g of $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$, 1.0 g of NaCl , 1.0 g of KCl , 0.05g of $\text{CaCl}_2 \cdot 2\text{H}_2\text{O}$,

10 ml of conc. Phosphoric acid(85%) pH of solution was adjusted at 7.2 with KOH pellets. Solution B (per litre): 0.5 g of $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$, 1.5 g of $\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$, 1.5 g of $\text{MnSO}_4 \cdot 2\text{H}_2\text{O}$, 0.3g of K_3BO_3 , 0.15g of $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$, 0.1 g of $\text{NaMnO}_4 \cdot 2\text{H}_2\text{O}$. One ml of Solution B was added to 1000 ml of Solution A). 0.5 g sample of each soil was placed in 250 ml of flask containing tap water (50 ml) and 5 ml oil (petrol, diesel and eatable oil). Mix properly and incubate at room temperature on shaker at 160 rpm for 20 days. On every 4th Day loop full sample were inoculated on nutrient agar, incubated at 37°C for 24 hrs. Micro-organisms are isolated on the basis of colony characteristics. Isolates were inoculated into 10 ml of MSM medium containing 2% glucose as energy and carbon source and incubated at shaker at 160 rpm for 7-9 days at room temperature.

Screening of isolates: approaches that measure directly the surface activity of bio-surfactants are interfacial tension measurement, axisymmetric drop shape analysis profile (ADSA-P), glass slide test, drop collapse method, blood cell lysis and oil spreading techniques. *Blood Agar lysis*- it has been used to quantify surfactin and rhamnolipids, as preliminary method to screen bio-surfactant activity. The increase in the diameter of lysis on blood agar as the conc. of surfactant increased. *Oil spreading technique*- this technique measures the diameter of clear zone produced when a drop of a bio-surfactant containing solution is sited on oil water surface (20 μl of crude oil on 50 ml distilled water into 25 cm petri plate). The diameter of clear zone on oil surface was measured. *Drop collapse method*- it depends on principle that a drop of liquid containing a bio-surfactant will collapse completely over oil surface. 2 μl of mineral oil was added to micro-titre plate and incubated at room temperature and then 5 μl of culture was added to the surface of oil, bio-surfactant producing cultures gave flat drops with scoring system ranging from partial to complete spreading on the oil surface after inspecting it for one minute.

Production of bio-surfactant: inoculums of working isolates are poured in the MSM medium with pH 7.2 and incubated at 25 °C on shaker at 160 rpm. Biomass was determined in triplicate by centrifuging of 10 ml samples (culture liquid) at 5500 rpm for 25 minutes at room temperature. The cell pellets was washed with distilled water, dried at 105 °C for at least 24 hours and then weighed. The supernatant was used for estimation of glucose, surface or interfacial tension and bio-surfactant concentration. Biomass was determined directly by taking the optical density of culture liquid at 545nm at calorimeter. Glucose was assayed by DNSA method.

Purification of bio-surfactant: isolates producing bio-surfactant were purified by two procedures- Ammonium sulphate precipitation method and ZnCl_2 precipitation method. *By Ammonium sulphate precipitation method:* it consists of four steps, ammonium sulphate fractionation, chilled acetone and hexane treatment, silica gel column chromatography.



By $ZnCl_2$ precipitation method: 10 ml of the culture supernatants were concentrated by $ZnCl_2$ to final concentration of 75 mM. The precipitated material was dissolved in 10 ml Sodium phosphate buffer (pH 6.5), extracted twice with equal volumes of diethyl ether. Pooled organic phase were evaporated to dryness and pellets were dissolved in 100 µl of methanol. Further purification was achieved by preparative TLC.

Analysis and Identification of bio-surfactant: the homogeneity was checked and the identification was made by percolated TLC plate spotted with samples (developing system chloroform/methanol/acetic acid at 85:13:02). The components on the plates were visualized by heating after spraying with 50% sulphuric acid. The quantification of bio-surfactant was analysed by the *Orcinol Assay*, extracellular glycolipid concentration was evaluated in triplicate by measuring the concentration of rhamnose. 10 ml of culture liquid is centrifuged at 4 °C at 10,000 rpm for 15 min, supernatant was extracted twice with 1 ml diethyl ether. Ether fractions were evaporated to dryness and 0.5 ml of water was added. To 100µl of each sample, 900 µl of solution containing 0.19% Orcinol (in 53% H_2SO_4) was added, after heating for 30 min at 80 °C the samples were cooled at room temperature. The absorbance is measured at 421 nm at UV Spectrophotometer. Standard graph were prepared and expressed as $mg\ ml^{-1}$.

V. RESULTS AND DISCUSSION

The soil samples were optimized and screened for bio-surfactant producers, 20 isolates (L1 to L20) are initially screened on nutrient agar on the basis of colony characteristics

and morphology, which were further grown in MSM broth containing 2% glucose, for week and then tested qualitatively for bio-surfactant production preliminary on blood agar lysing test and secondarily with oil spreading technique. On blood agar plate out of 20 isolates 06(L3, L4, L10,L12,L15, and L16) isolates gave positive result by showing lysis and out of that 06, L4, L12 and L15 given positive result on oil spreading technique, after 120 hours, 48 hours, 48 hours respectively, that means they were producing bio-surfactant. For bio-surfactant production out of 20 isolates 2 were selected on the basis of their efficiency to produce bio-surfactant. The oil spreading technique has shown that the area of displacement by a surfactant containing solution is directly proportional to the concentration of bio-surfactant.

The isolated strains L15 and L4 identified as *Pseudomonas* and *Bacillus* spp. on the basis of Gram character, cell morphology, biochemical reactions and DNA hybridization studies. Analysis of peptidoclycan, composition of cell wall and its components also has taxonomic importance.

When pure inoculum of L15 (*Pseudomonas* spp.) and L4 (*Bacillus* spp.) were cultured in MSM broth supplemented with 2% glucose, shown bio-surfactant production within 2-4 days and 7-11 days of incubation respectively(fig: 5.1).

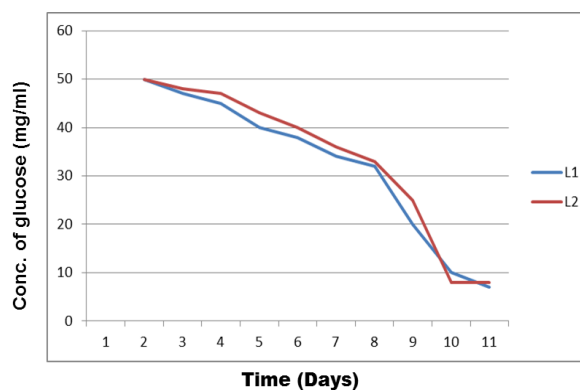


Fig:5.1: shows the profile of biosurfactant production obtained when the strains (L4 and L15) was cultivated in MSM medium with 2% glucose. Since biosurfactant is secondary metabolites main Glycolipids production was reached in the stationary growth phase.

The purification technique consists of two autonomous methods: Ammonium sulphate precipitation method and $ZnCl_2$ precipitation method. Floating material resulting from the treatment of 40% ammonium sulphate were collected by centrifugation and then dissolved in small fraction of water. The chilled acetone was added to it to remove proteins; the remained n-hexadecane was removed by extracting it 3 times with hexane. The resultant sample was applied to TLC plate equilibrated with chloroform/methanol (80:20) with standard (L-rhamnose) and one negative control (*E.coli*). The purified bio-surfactant sample produced by *Pseudomonas* spp. were detected as Rhamnolipid whereas the chemical nature of bio-surfactant produced by *Bacillus* spp. (L4) were also glycolipid.

The concentration of glycolipid is calculated from the standard graph prepared with the help of L-rhamnose by Orcinol assay, the graph was plotted on optical density vs. concentration (mg/ml). According to standard graph, the *Pseudomonas* spp.

(L15) produces 73.5 mg/ml glycolipid (bio-surfactant) whereas *Bacillus spp.* L4 produces 7.1 mg/ml glycolipid.

VI. CONCLUSIONS

The approach is to appreciate the utility and usefulness of bio-surfactant instead of chemically formed surfactant. They are generally non-toxic and ecofriendly. Bio-surfactants improve the emulsification of hydrocarbons; have the potential to solubilize it to increase their availability for micro-organisms.

The article directly highlights the application of bio-surfactant in treatment of diseases, environment pollution control, Health care and cosmetic industry, oil industries and paper and pulp industries.

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Clinical spectrum of tuberculosis in chronic renal failure patients on hemodialysis – A single centre experience

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Abstract- This study includes one hundred fifty patients of End Stage Renal Disease (ESRD), mean age 52.5 ± 14.56 years, during a period of two year from August 2009 to July 2011 were studied. Detailed clinical history, physical examination and laboratory investigations were recorded. Chi-square and Fischer-exact tests were used for statistical analysis. Thirty cases of tuberculosis were detected in 150 ESRD patients on hemodialysis. Twenty seven of them were pulmonary and three extrapulmonary cases. Increased association of tuberculosis were seen in diabetics as underlying cause for ESRD (82%), lower socioeconomic status (65%), male patients (67.3%), and patients > 30 years of age (83.3%). Anorexia was most common symptom (73.3%), followed by fever (60%) and cough (53.3%). Keeping in view of high incidence and prevalence of tuberculosis in developing countries like India patients of ESRD should always be screened for tuberculosis. If patients presenting with above symptoms requiring a high index's of suspicion.

Index Terms- End stage renal disease, Hemodialysis, Tuberculosis

I. INTRODUCTION

India has almost 30% of the global burden of tuberculosis and one person dies due to disease every minute.¹ Currently in India there are about 14 million suspected and about 3.5 million bacteriologically proved cases of pulmonary tuberculosis and prevalence of 4.84/ 1000 cases.² More recently, average prevalence of all forms of tuberculosis (TB) in India estimated to be about 5.05 per 1000.³ Due to certain risk factors like disturbance of skin and mucous membrane barrier, inadequate nutrition and acidosis, profound alteration in immune responses associated with uremia and exacerbated by dialysis, so there is increase in risk for developing active tuberculosis after primary infection.⁴ Frequent hospital contacts, older age and use of immunosuppressive drugs are additional factors explaining the higher prevalence of tuberculosis in these patients.

Tuberculosis in end stage renal disease patients on regular hemodialysis presents a number of diagnostic challenges. In these patients the symptomatology of TB is often insidious and nonspecific, where as the localization is often extrapulmonary. This makes the disease difficult to diagnose, delaying the initiation of curative treatment, which is a major determinant of the outcome. That is why annual skin testing with tuberculin skin test (TST) and chemoprophylaxis for all hemodialysis patients is

recommended if tuberculin skin test >10mm. However, even today with increased quality of dialysis there is a high rate of anergy reported among hemodialysis patients and anergic hemodialysis patients are at increased risk of developing tuberculosis.

II. MATERIAL AND METHOD

This was a hospital based study involved the detection of tuberculosis, both pulmonary as well as extrapulmonary in end stage renal disease on hemodialysis from outdoor and indoor patient in the Department of Medicine, CSM Medical University, Lucknow during a period of two year from May 2009 to June 2011. End stage renal disease (ESRD) from any cause in subjects of either sex and age were selected for the study.

Details of clinical history, physical examination and laboratory investigations were recorded in a special proforma. Specific symptoms which were looked in each case were persistent cough of about 3 or 4 weeks duration, continuous fever, chest pain, anorexia, weight loss and abdominal pain/distension, hemoptysis, swelling in the neck/axilla.

All patient investigated for automated blood count including general blood picture, ESR, renal function tests, creatinine clearance by Cockcroft-Gault formula, X-ray chest (PA/ lateral view), tuberculin skin test (PPD), sputum smears, ELISA for mycobacterium tuberculosis, cytology and biochemistry of fluid drawn from serous cavities, FNAC, biopsy of suspected tissues such as lymph nodes, peritoneum, pleura (when indicated), bone radiology, PCR for mycobacterium tuberculosis (if required) were done. Statistical analysis was done using Chi- Square and Fischer-exact tests.

III. RESULT

Thirty cases of tuberculosis were seen in 150 ESRD patient on hemodialysis in this study. Twenty seven of them were pulmonary, only three was extrapulmonary. Five of the cases had history of previously treated tuberculosis, thereby 25 new cases were detected. The incidence/prevalence seen in the present study is strictly not comparable to the general population.

The present study being a hospital-based study, prevalence tends to be higher since the sample is not truly representative owing to selection bias. Mean age of patients was 52.5 ± 14.56 years. Majority of patients were male (57.3%). Majority of ESRD patients were in age group 51-60 years (Table I). Major

baseline parameters were deranged. Patients were moderately anemic (mean Hb 7.8 gm%). Creatinine clearance was <10 (mean 7.1835). PPD (Mx) was positive in a three patient (10%). Mean ESR in persons suffering from tuberculosis was 82.92 mm/1st hour.

The main underlying etiology for ESRD was diabetes mellitus (54.6%), chronic glomerulonephritis (25.3%), and hypertension (13.3%) (Table II). Anorexia (73.3%), fever (60%) and cough (53.3%) were the most common symptoms (Table III).

Most of the patients suffering from tuberculosis were older than 35 years (88%). Males (67.3%) were more affected by tuberculosis than females. 13.3 per cent of diabetics as underlying cause for ESRD had tuberculosis. More of tuberculosis was seen in patients with lower socio-economic status. Twenty out of 30 tuberculosis patients belonged to lower socio-economic status.

IV. DISCUSSION

Worldwide TB infection in dialyzed patients range from 5-25% and a 6.9-52.5 fold risk of TB is reported as compared to the general population.^{5,6} India has almost 30 per cent of the global burden of tuberculosis¹. Advance age, diabetes mellitus and low BMI, are known factors of immunological imbalance, associated with TB development in the general population. In hemodialysis patients they have been also associated with depressed cell-mediated immune responses and anergy.⁷⁻¹¹ In our study, they were proved to be factors predisposing to active TB in the dialysis setting. Along with lymphocyte dysfunction and decrease in absolute lymphocyte counts, furthermore interferon production is depressed in uremia. In chronic renal failure the functions of polymorphonuclear leucocytes known as first line of non-specific defense against microbial infection, involving chemotaxis, bactericidal activity have been reported as diminished.¹²

As per etiology of the patients with end stage renal disease, diabetes mellitus (54.6%), chronic glomerulonephritis accounted for (25.3%) followed closely by then hypertension (13.3%), obstructive uropathy (3.33%) and others (3.33%). As for age is concerned, majority of patients were in age group 51 to 60 years, comprising of 28 males (27.7%) and 17 females (34.69%). Mean age was 52.5 years with standard deviation of 14.56. Majority of the patients were male (67.3%).

In the present study, we found 30 cases of tuberculosis out of 150 ESRD patients. 27 out of these were pulmonary and 3 was extrapulmonary. Amongst pulmonary, 24 cases were infiltrative, 4 cases of pleural effusion and 2 cases of consolidation. Extrapulmonary case included abdominal tuberculosis in form of intra-abdominal lymphadenopathy in which ultrasound guided FNAC revealed granulomatous lesion. IgM for mycobacterium tuberculosis was positive in it. Among pulmonary, 12 of the cases had sputum for AFB positive. In the rest, clinical suspicion, supportive investigations and response to the treatment were the criteria. Pulmonary form of tuberculosis as main form of tuberculosis was also observed in the studies done by Cengiz *et al.*¹³, Shohaib *et al.*¹⁴, Taskapan *et al.*¹⁵, Mohammed Al *et al.*¹⁶, Erkok *et al.*¹⁷. While extrapulmonary as

main form of tuberculosis was observed in several other studies.^{4,11,18}

As far as clinical symptoms amongst tuberculosis patients were concerned, anorexia was the most common symptoms seen in 73.3 per cent patients, next was fever seen in 60 per cent, cough in 53.3 per cent, weight loss in 60 per cent, chest pain in 33.3 per cent, hemoptysis in 40 per cent, pain abdomen in 3.33 per cent patients.

Thus, anorexia, fever and cough were the most common symptoms. Fever, weight loss, malaise were common symptoms noticed by Venkata *et al.*¹⁸, undiagnosed pyrexia, lethargy, weight loss by Kwan *et al.*¹⁹. Anorexia, loss of weight, low grade fever by Mitwalli *et al.*²⁰; anorexia, weight loss, fever by Cengiz *et al.*¹³; similar symptoms found by Shohaib *et al.*¹⁴, Mohammed Al *et al.*¹⁶.

Age of the patients suffering from tuberculosis varied from 22 to 70 years (mean 52.5 years). Most of the patients of tuberculosis in ESRD were more than 35 years old comprising 27 of 30 patients (90%) matching Taskapan *et al.*¹⁵, where age of the patients suffering from tuberculosis varied from 19 to 70 years with mean age 43.05 ± 3.72 years. Mean age in Shohaib *et al.*¹⁴ was 48 years in males and 47 years in female.

In present study, out of 20 patients, 14 patients (70%) were male and 6 (30%) patients were female. Similarly, Venkata *et al.*¹⁸ and Murthy and Pereira²¹ reported more males affected by tuberculosis.

Mean ESR was 33.12 in 150 patients whereas mean ESR was 82.92 in case of patients with tuberculosis with standard deviation of 20.64. ESR was found to be varied in tuberculosis patients of ESRD. Mean PPD (Mx) in 150 patients was 5.87. A recent conversion of positive has more value than an isolated positive PPD test in these situation. In contrast, a positive PPD test can be taken as an diagnostic aid to detect tuberculosis infection, in countries with low prevalence of tuberculosis. However, among dialysis patients, a positive PPD test was observed only in 40 to 60 per cent of patients with tuberculosis.⁴ The defective cell mediated immunity associated with uremia is the likely cause of low sensitivity of the PPD test in these patients.

Among 30 cases, 12 had sputum for AFB positive, 4 cases had IgM positive for mycobacterium tuberculosis. All the 4 pleural effusion cases had fluid as exudate and lymphocytic predominance. One of the pleural fluids had positive PCR for mycobacterium tuberculosis. Rests of the cases were unable to afford PCR. Once diagnosed, all the patients were put on short course chemotherapy.

All the patients were on regular follow-up except 3 patients who did not report for follow-up despite reminders. Five patients died during treatment. Cause of mortality was not directly attributed to tuberculosis in any of them. Rest of the patients improved symptomatically and radiologically. The present study conclude that keeping in view of high incidence and prevalence of tuberculosis, patients of ESRD should always be screened for tuberculosis, annually, testing with tuberculin test and chemoprophylaxis for all patients on hemodialysis if tuberculin test response is positive (≥ 10 mm), is recommended. Similarly recommended by American Thoracic Society: Controlling tuberculosis in United States 2005.

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Table-1: Epidemiological data

Age group (in Years)	Number of patients		Total number of cases
	Male (%)	Female (%)	
10-20	3(2.97)	2(4.08)	5
21-30	15 (14.8)	5 (10.2)	20
31-40	18(17.8)	7(14.2)	25
41-50	22(21.7)	8(16.3)	30
51-60	28(27.7)	17(34.69)	45
61-70	11(10.8)	8(16.3)	19
>71	4(3.96)	2 (4.1)	6
Total	101 (67.3)	49 (32.7)	150

Table-2: Co-morbid conditions.

Etiology of ESRD	With tuberculosis (N= 30)	Without tuberculosis (N= 120)	Total (N = 150)
Chronic glomerulonephritis	8	30	38 (25.3%)
Diabetes mellitus	20	62	82 (54.6 %)
Hypertension	2	18	20 (13.3 %)
Obstructive uropathy	Nil	5	5 (3.33 %)
Others	Nil	5	5 (3.33 %)

Table-3: Clinical presentation

Symptoms	Positive (N=30)	Frequency (%)
Anorexia	22	73.3
Weight loss	18	60
Fever	18	60
Cough	16	53.3
Hemoptysis	12	40
Pain chest	10	33.3
Pain abdomen/distension	4	13.3

Male (n= 22) 73.3% and Female (n= 8) 26.7% positive for Tuberculosis.

Improving Energy Efficiency through Transport Control Protocol in Wireless Sensor Network

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Abstract- Today, the study of energy efficient networking solutions in sensor networks has been focusing on networks with always-on connectivity between communication end-points and short link delays. The reliability of data transfer is vital for commercial and enterprise applications of Wireless Sensor Networks (WSN). Likewise, mission-oriented and critical military applications of these networks demand dependable and timely data transport. Designing a reliable transport protocol is a new challenging area in Wireless Sensor Networks (WSNs). Generally transport layer is responsible for congestion control and reliable packet delivery. Congestion is an essential problem in WSNs. Although TCP is a time-tested transport layer protocol of Internet that ensures reliability, flow control and congestion control, being a heavy protocol, it is considered unsuitable for resource constrained sensor networks. As a result new transport layer protocols have been developed for these networks. . In this paper we present a reliable transport protocol for wireless sensor networks which not only controls the congestion in the network, but also provides reliability in packet delivery.

Index Terms- Energy Efficiency, Congestion Control, Transport Protocol, Wireless Sensor Network

I. INTRODUCTION

A wireless sensor network (WSN) is a wireless network consisting of spatially distributed autonomous devices that use sensors to monitor physical or environmental conditions. These autonomous devices, or nodes, combine with routers and a gateway to create a typical WSN system. The distributed measurement nodes communicate wirelessly to a central gateway, which provides a connection to the wired world where you can collect, process, analyze, and present your measurement data. WSNs have many applications in different areas of technology. It is used in many different applications including commercial and industrial applications, environment applications, healthcare applications, home automation, traffic control and monitoring, object tracking and fire detection. Each node in a WSN is typically equipped with one or more sensors, a wireless communications device, a processor, and an energy source, usually a battery.

With a reliable transport mechanism we can achieve 100% packet delivery ratio in WSNs. In traditional communication networks, the transport layer is responsible for bridging the application and network layers using multiplexing and demultiplexing. It is also charged with providing end to end reliable data delivery and with performing congestion control by

regulating the amount of traffic injected into the network. Generally, transport control protocols, especially for connection-oriented transport protocols, may include two main functions: *congestion control* and *loss recovery*. As for congestion control, it is firstly required how to detect whether or not congestion happens, and when and where it happens. Congestion can be detected through monitoring node buffer occupancy and link (or wireless channel) load.

In addition to the challenges for reliable data transport in WSN, there exist additional challenges due to the unique requirements of the multimedia transport such as bounded delay and delay variation, minimum bandwidth demand, smooth traffic variation for multimedia streaming, and error control according to the specific requirements of the multimedia application. Therefore, it is important to develop a reliable transport protocol for WSNs to ensure that the often differing QoS requirements of various applications can be met.

II. FEATURES OF TRANSPORT CONTROL PROTOCOLS WHILE DESIGNING WSNs

Generally, the transport control protocol for WSNs should consider the following factors.

(i) It should provide congestion control mechanism and guarantee reliability, especially the latter. The most data streams are flowed from sensor nodes to sink in WSNs, so congestion might occur around sink. Also there are some high-bandwidth data streams produced by multi-media sensors. Therefore it is necessary to design effective congestion detection, congestion avoidance, and congestion control mechanisms for WSNs.

(ii) Transport control protocols for wireless sensor networks should simplify initial connecting process or use connectionless protocol so as to speedup start and guarantee throughput and lower transmission delay. Most of applications in WSNs are reactive which passively monitor and wait for event occurring before reporting to sink. These applications may have only several packets for each reporting, and the simple and short initial setup process is more effective and efficient.

(iii) The transport control protocols for WSNs should avoid as few packets dropping as possible since packet dropping means energy wastage. In order to avoid packet dropping, the transport protocol can use active congestion control at the cost of a bit lower link utility. The active congestion control (ACC) can trigger congestion avoidance before congestion occurs. An example of ACC is to make sender (or intermediate nodes) reduce sending (or forwarding) rate when the buffer size of their downstream neighbors overruns a threshold.

(iv) The transport control protocols should guarantee fairness for different sensor nodes in order that each sensor nodes can achieve fair throughput. Otherwise the biased sensor nodes cannot report the events in their area and system may misunderstand there is no any event in the area.

(v) It would be better if the transport control protocol can enable cross-layer optimization. For example, if routing algorithm can tell route failure to transport protocol, the transport protocol will know the packet loss is not from congestion but from route failure and the sender will frozen its status and keep its current sending rate to guarantee high throughput and low delay.

III. PERFORMANCE OF TCP IN WIRELESS SENSOR NETWORKS

TCP is time-tested transport layer protocol in Internet that implements end-to-end reliability, flow control and congestion control. This protocol was developed for wired links but lately Internet is being extended to include wireless links as well. For such wired-cum-wireless networks, TCP has been found to lack suitability as well as efficiency. There are some of the main factors that results in inferior TCP performance in these networks are:

(i) Low Bandwidth

Wireless Sensor Networks have limited bandwidths as compared to wired networks. In Wireless Local Area Networks (WLANs) bit rates are around 10-100 Mbps, Wireless Personal Area Networks (WPANs) bit rates are around 2-10 Mbps. In heterogeneous networks comprising wired cum wireless links, mismatched bandwidths of the two networks results in bottleneck that affects TCP. Thus limited bandwidth in wireless networks is responsible for degradation in TCP performance.

(ii) High Latency

As compared to wired links, latency of data transfer is more in wireless links. TCP congestion window at the sender end evolves in proportion to acknowledgements received from receiver. As a result of long delays in wireless links, congestion window evolves slowly which affects throughput.

(iii) Arbitrary Losses

The transmission losses on wireless links are considerably more as compared to wired links. The losses cause packets to drop thus resulting in sender not receiving acknowledgments inside the retransmit timeout. The sender retransmits packet, exponentially reduces timer and cuts the congestion window to unit. Thus when it occurs repeatedly, it results in reduced throughput. In wired-cum-wireless, wireless link is generally the last link and losses on this last link result in end-to-end retransmission by TCP and thus reduces throughput.

(iv) Wireless Network Mobility

When wireless networks support mobility like cellular networks where end users are mobile, handoff takes place when user moves from one cell to another such that new channel is allocated through other cell's base station and all control

information has to be shifted. There could be very short loss of connectivity resulting in losses which can cause reduction in TCP congestion window this causing reduced throughput. Similarly in ad hoc networks, topology changes can cause losses resulting in affecting throughput.

(v) Underutilization of Capacity

Services like web browsing and e-mail involve small amount of data transfer between the client and the server. The TCP sender increases its congestion window progressively as it receives acknowledgments from the receiver (Slow Start). There is a high probability that the transfer completes even before the sender's window reaches the maximum possible size. This results in under utilization of the network capacity.

(vi) Power Utilization

Power utilization is an important issue in case of battery operated end devices like laptops, PDAs, wireless phones and wireless sensor nodes. As stated earlier, TCP was basically developed for wired Internet. In order to make it suitable for wireless networks in terms of performance parameters like throughput and latency, it has to be adjusted. In this regard new transport layer protocols are suggested for different types of wireless networks according to their particular features. Protocols developed for cellular networks are specifically developed for conditions and issues in these networks, protocols developed for sensor networks are developed according to their features and so on.

IV. CONCLUSION

The transport protocol enables end-to-end reliable message transmission. Its main functions are: orderly transmission, flow and congestion control, loss recovery, and possibly QoS guarantees such as timing and fairness. Due to limited wireless bandwidth in WSNs, congestion may occur.

In this paper we proposed a reliable transport protocol for WSNs. The characteristics of WSN which are low cost, low power resource constrained end devices called sensor nodes very low link bandwidths and ad-hoc network topology make application of TCP even more challenging in these networks. This approach is classified as making TCP suitable for WSN by various methods like parallel TCP, link layer retransmissions, splitting TCP across proxy, distributed TCP caching and retransmissions as well as designing new transport layer protocols for WSNs according to the features and restrictions of these networks

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A Comparative Study of Groundwater Quality in Shallow and Deep Aquifers in Parts of Active Flood Plain Areas of Ganga and Yamuna Basin

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Abstract- The Indo-gangetic plains in India have got a number of river basins and these river basins by virtue of their hydrological characteristics provide the fluctuation in water quality range within the channel as well as through their aquifer system within the premises of active flood plains. The active flood plains are the dependent factors based on hydro-meteorological characteristics of the respective basins.

In Indo-gangetic plains Ganga and Yamuna river basins play a pivotal role for the water supply to the urbanized areas as well as agriculture land to their surroundings. The water resources of Ganga and Yamuna river basin are quite similar and maybe defined in terms of three major seasons for the generation of water resource system. These three major seasons are normal monsoon rainfall, snow-melt water and western disturbances.

The study area comprises of parts of Ganga basin as well as parts of Yamuna basin in case of Ganga basin the study area was taken from Rishikesh to Allahabad at Sangam passing through various districts like, Haridwar, Muzaffarnagar, Kanpur, Moradabad, Ghaziabad, Allahabad and Dehradun and in case of Yamuna basin starting from Dehradun, Yamunanagar, Panipat, Sonapat, Faridabad, Karnal and Allahabad.

Since the precipitation affects mostly the physical parameters like pH, electrical conductivity, total dissolved solids and temperature, therefore these parameters were selected for the impact assessment of seasonal fluctuation of precipitation vis-à-vis aquifer system. It was found that the Ganga basin area is affected by snow-melt condition therefore the groundwater quality in shallow aquifer system fluctuates from acidic to alkaline environment in its upper reaches which maybe a useful tool for assessing groundwater quality for the agricultural development, water supply and construction however the Yamuna water quality does not have much impact of snowmelt water, therefore it maintains the groundwater quality at shallow level as moderate and alkaline in reaction. In this way it is found that the difference in water quality of Ganga basin to Yamuna basin, however the Yamuna changes its quality due to urbanization factor in terms of pollution particularly in Delhi areas. It is therefore recommended that the water supply for agricultural, residential and industrial purposes maybe designed according to seasonal fluctuation in these aquifer systems separately for both the river basins. Apart from these many other aspects have been considered which maybe useful for planners, architects, engineers, philosophers working in these areas.

I. INTRODUCTION

The Ganga rises in the Garhwal Himalaya (30° 55'N, 79° 7'E) as the Bhagirathi. The ice cave of Gaumukh at the snout of the Gangotri glacier, at 3,892 metres above sea level, is recognized as the traditional source of the Ganga. The river cuts through the Himalayas until another head stream, the Alaknanda, joins at Devaprayag. It is below this confluence that the united stream of Bhagirathi and Alaknanda becomes known as the River Ganga.

After running some 250 kilometres from its source, the Ganga pierces through the Himalayas at Sukhi (near Rishikesh), before turning southwestwards for another 30 km where it finally descends into the vast Indo-Gangetic plain at Haridwar (elevation 283m). At this point, the river swells into a mighty stream of 750 metres width. At Allahabad (1020 km from the source), the Ganga is joined on the right by the River Yamuna, which actually contributes more water (57.24 billion cum / annum) than the main river itself, augmenting the flow volume of the Ganga significantly. Rainfall, subsurface flows and snow melt from glaciers are the main sources of water in river Ganga.

The river Yamuna, a major tributary of river Ganges, originates from the Yamunotri glacier near Banderpoonch peak (380 59' N 780 27' E) in the Mussoorie range of the lower Himalayas at an elevation of about 6387 meters in the district Uttarkashi of Uttarakhand state. Arising from the source, river Yamuna flows through a series of valleys, for about 200 kms, in lower Himalayas and emerges into the Indo-Gangetic plains

Flowing through Poanta Sahib it reaches Hathnikund/Tajewala in the Yamuna Nagar district of Haryana state, where the river water is diverted into Western Yamuna Canal (WYC) and Eastern Yamuna Canal (EYC) for irrigation and drinking purposes.

The river regains water from the ground water accrual and contributions received from feeding canal through Som Nadi (seasonal stream) upstream of Kalanaur before it reaches Delhi. It (in its later stages) receives water from important tributaries like Chambal, Betwa and Ken before joining the river Ganga and the mythical underground Saraswati at Prayag (Allahabad) after traversing a total length of about 1400 Km.

It enters Delhi near Palla village after covering a distance of about 400 Km from its origin and exits from Delhi (NCT) at the village Jaitpur after traversing a distance of 50 km within the NCT. Finally between Delhi and Uttar Pradesh, before the river

enters and flows through UP to finally merge with Ganga in Allahabad.

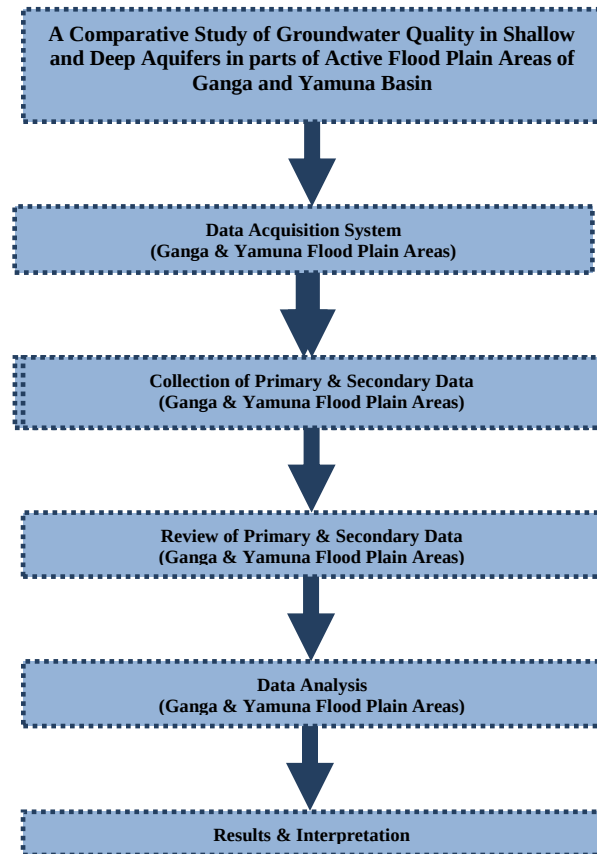
II. OBJECTIVE & SCOPE

The objective of the study was to:

- To delineate the active flood plain areas of Ganga river basin right from Gangotri glacier to the Sangam area at Allahabad with reference to urban settlements
- Delineate the active flood plain areas of Yamuna river basin right from Yamnotri glacier to the Sangam area at Allahabad with reference to urban settlements
- To delineate the deep and shallow aquifers in parts of Ganga river basin in the study area with the help of exploratory deep tubewells strata charts of Central Groundwater Board and shallow farmer tubewells
- To delineate the deep and shallow aquifers in parts of Yamuna river basin in the study area with the help of exploratory deep tubewells strata charts of Central Groundwater Board and shallow farmer tubewells
- To analyze the water quality with the help of specified sampling for deep and shallow aquifers with the help of deep and shallow tubewells in study area for pre-monsoon season
- To analyze the water quality of Gangotri river basin and Yamnotri river basin with special reference to urbanization factor
- To analyze the variation in water quality from the upland areas of Yamnotri and Gangotri to their confluence at Sangam Allahabad
- Finally to establish the relationship of water quality between Yamuna and Ganga river basin and prevention of contamination of groundwater in shallow and deep aquifers by doing the study of groundwater condition and behavior for both the river basin areas and its impact on the shallow and deep aquifers

III. METHODOLOGY

The methodology adopted for accomplishing the above study is illustrated and detailed below.



To delineate the active flood plain areas of Ganga and Yamuna river basin right from origin to Sangam area at Allahabad with reference to urban settlements

In order to delineate the active flood plain areas of Ganga and Yamuna river basin from origin to Sangam at Allahabad the toposheet of Survey of India maps were considered to identify the spot locations of the sampling stations. In this regards secondary sources through published and unpublished literature were also reviewed. The satellite images as well as google maps were also utilized to complete the map.

Apart from these the Ganga and Yamuna active flood plain data published by various organizations like National Institute of Hydrology, Central Water Commission, Central Groundwater Board, Irrigation and Flood Control Departments at district level and state level were also considered. Besides these the Indian Meteorological Data was also referred.

To delineate the deep and shallow aquifers in parts of Ganga and Yamuna river basin in the study area with the help of exploratory deep tubewells strata charts of Central Groundwater Board and shallow farmer tubewells

The following district wise hydro-geological reports of Central Groundwater Board were considered in order to delineate the deep and shallow aquifers in parts of Ganga river basin in the study area

Gangotri to Sangam Area

- Groundwater Brochure District Dehradun, Uttarakhand
- Groundwater Brochure of Hardwar District, Uttarakhand
- Groundwater Brochure of Muzaffarnagar, District, Uttar Pradesh
- District Brochure of Kanpur Nagar, District, U.P
- District Brochure of Moradabad, District, U.P
- Groundwater Brochure of Ghaziabad District, Uttar Pradesh
- Groundwater Brochure of Allahabad, District, Uttar Pradesh

Yamnotri to Sangam Area

- Groundwater Brochure District Dehradun, Uttarakhand
- Groundwater Brochure of Yamunanagar, District, Haryana
- Groundwater Brochure of Karnal, District Haryana
- Groundwater Brochure Panipat, District, Haryana
- Groundwater Brochure Sonipat, District, Haryana
- Groundwater Brochure Faridabad, District, Haryana
- Groundwater Brochure of Allahabad, District, Uttar Pradesh

To analyze the water quality with the help of specified sampling for deep and shallow aquifers with the help of deep and shallow tubewells in study area for pre-monsoon season

In order to fulfill the requirement of analysis of water quality with the help of specified sampling for deep and shallow aquifers with the help of deep and shallow tubewells the following methodology was adopted:

For analyzing Yamuna river water quality secondary data were used with the help of published reports of Central Pollution Control Board, National Institute of Hydrology, published research papers as well as proceedings of the seminars and conferences.

For the analysis of groundwater quality of shallow and deep aquifers the published reports of Central Groundwater Board, Central Pollution Control Board, State Groundwater Board, State Pollution Control Board and published research papers as well as proceedings of the seminars and conferences.

Beside this samples were also collected for shallow and deep aquifers through handpumps and tubewells in parts of Ganga river basin area at locations such as Dehradun, Haridwar, Muzaffarnagar, Kanpur, Moradabad, Ghaziabad and Allahabad.

Samples were also collected for shallow and deep aquifers through handpumps and tubewells in parts of Yamuna river basin area at locations such as Dehradun, Yamunanagar, Karnal, Panipat, Sonipat, Faridabad and Allahabad.

IV. RESULTS & INTERPRETATIONS

Delineation of Active Flood Plain Areas of Ganga Basin from Gangotri to Sangam at Allahabad

The Ganga River (about 2525 km long) is fed by runoff from a vast land area bounded by the snow peaks of the Himalaya in the north and the peninsular highlands and the Vindhya Range in the south. The basin encompasses an area of more than a million square kilometers (1,186,000 sq.km) spread over four countries: India, Nepal, Bangladesh and China. With 861,404 sq.km within India itself, the Ganga basin is the largest river basin in India and covers approximately 25 per cent of India's total geographical area. The Ganga River flows through the five states of Uttarakhand, Uttar Pradesh, Bihar, Jharkhand and West Bengal. The extent of the entire Ganga basin is, however, spread over six more states (Delhi, Haryana, Himachal Pradesh, Madhya Pradesh, Chattisgarh and Rajasthan) in addition to the aforementioned five.

The extent of river Ganga within these states is given in Table 1. In the entire basin, Uttar Pradesh and Uttarakhand together share the maximum basin area of 34%, followed by Madhya Pradesh, Bihar and Jharkhand.

Table:1 State-wise Distribution of the Drainage Area of Ganga River in India

S. No.	State	Total Geographical Area (SqKm)	Per Cent of Total Geographical Area
1	Uttar Pradesh & Uttarakhand	294364	34.2
2	Madhya Pradesh	198962	23.1
3	Bihar & Jharkhand	143961	16.7
4	Rajasthan	112490	13.1
5	West Bengal	71485	8.3
6	Haryana	34341	4.0
7	Himachal Pradesh	4317	0.5
8	Delhi	1484	0.2
Ganga Basin (Total)		861404	100.0

After running some 250 kilometres from its source, the Ganga pierces through the Himalayas at Sukhi (near Rishikesh), before turning southwestwards for another 30 km where it finally descends into the vast Indo-Gangetic plain at Haridwar (elevation 283m). At this point, the river swells into a mighty stream of 750 metres width.

The weather in the Ganga basin is characterized by a distinct wet season during the period of south west monsoon (June to September). The air temperature starts falling with the onset of the monsoon from June onwards, making the weather more humid and equable. The diurnal range between the daily mean minimum and the daily mean maximum temperature reduces progressively as the monsoon advances. Eventually, the lowest diurnal range of temperature occurs at the peak of the monsoon, which is usually in August, though sometimes in July. As soon as the monsoon is over, the diurnal range of temperature

starts increasing rapidly to a maximum attained during the month of November.

Rainfall, subsurface flows and snow melt from glaciers are the main sources of water in river Ganga. More than 60 per cent of the water flowing into the Ganga basin comes from the Himalayan streams joining the Ganga from the north. The Peninsular streams combine to contribute only 40 percent of the water, despite the fact that the catchment area of the peninsular streams extends well over 60 percent of the entire Ganga basin

The mountainous section stretches from the river's source to Rishikesh. This section has an average bed slope of 1 in 67 and a mean flow rate of 850 cubic metres per second at Rishikesh. The subsequent upper plain section extends from Rishikesh downstream until Allahabad at a slope of 1 in 4,100 and a mean flow rate ranging between 850 and 1,720 cum per second before its confluence with the Yamuna.

Due to their high gradient and a tremendous velocity, Himalayan rivers including the Ganga have a strong erosive power. The geological fact that the Himalayan rivers run through poorly consolidated sedimentary rocks affected by folds and faults results in high rates of erosion and silt deposition. Landslide debris further aggravates the sediment load of river and its deposition and erosion are main cause of flooding in Ganga river basin.

Delineation of Active Flood Plain areas of Yamuna basin from Yamnotri to Sangam at Allahabad

Yamuna is the largest tributary of Ganga river. Starting from Yamnotri it joins river Ganga again at Allahabad where the point of confluence is known as Sangam. The total length of Yamuna from its source at Yamnotri to its confluence with Ganga near Allahabad is about 1376 km, of which about 970 km is in Uttarakhand, 30 kms from the common boundary between Himachal Pradesh and Uttar Pradesh 328 kms from the common boundary between Haryana and Uttar Pradesh and the balance of 48 kms in the Union Territory of Delhi

In the upper reaches of River Yamuna, there are several hill streams join together to form the main stream. There are four main rivers that joins Yamuna in the higher Himalayan ranges, these are Rishi Ganga, which joins on the right bank of Yamuna, where as Unta and Hanuman Ganga joins on left bank. In the lower Himalayan ranges the Yamuna River receives Kamal, Tons, Giri & Bata on its right bank and on left banks receives Aglag & Asan. The Chambal, Betwa, Sindh & Ken are the important tributaries joining Yamuna on right bank in plain & on left bank Hindon river joins River Yamuna. Among all these tributaries, Tons at hills and Chambal at plains are the most important tributaries in terms of their discharges. The Tons is the principal source of water in mountainous range and generally carries more water than mainstream. In plains, during non-monsoon period, River Chambal contributes about 5-10 times more water to the Yamuna than its own flow.

However, since the year 2003, there is a significant reduction in the water quantity that River Chambal discharges into the Yamuna River.

The water flow characteristics of Yamuna River changes significantly from monsoon to non-monsoon seasons. Yamuna river can be divided into four segments from origin to sangam.

The first segment having a length of 157 km starts from Yamnotri and terminates at Hathnikund / Tajewala barrage. The major source of water in this segment is melting of glaciers. The water flow in this segment terminates into Western Yamuna canal (WJC) and Eastern Yamuna Canal (EJC) for irrigation and drinking water purposes in command areas.

The second segment having length of about 224 km lies between Hathnikund / Tajewala barrage and Wazirabad barrage. The main source of water in this segment is ground water accrual. Few small tributaries also contribute water in this segment. The water is diverted in this segment from WJC through drain No. 2 to fulfill the raw water demand for drinking water supply in Delhi. The water segment is terminated into Wazirabad reservoir formed due to stagnation of water at Wazirabad barrage. The reservoir water is pumped to the various water works as raw water for treatment to meet drinking water demand of the capital city. No or very little water is allowed to flow downstream Wazirabad barrage during lean seasons.

The third segment having length of 22 kms is located between Wazirabad barrage and Okhla barrage. This segment receives water from seventeen sewage drains of Delhi and also from WJC and Upper Ganga Canal via Najafgarh drain and Hindon cut canal respectively. Little contribution of water is also made in this segment by Surghat, where Ganga and Yamuna water is provided for bathing purposes. This river segment terminates into Agra Canal, which is used to augment its flow for irrigation in the states of Haryana and Uttar Pradesh.

The fourth segment having a length of 973 km initiate immediately downstream to Okhla barrage and extends upto confluence to Ganga River at Allahabad. The source of water in this segment are ground water accrual, its tributaries like Hindon, Chambal, Sindh, Ken, Betwa etc. and waste water carrying drains of Delhi, Mathura-Vrindavan, Agra and Etawah. The water of this segment is used for drinking and industrial uses at Mathura & Agra.

In the Himalayan stretch, the Yamuna River has a steep fall with an average of 19.1 metre/km. In plain stretch the river flattened gradually with an average of 0.2 metre/km. The rate of fall in various stretches of river is presented in Table 2. As reflected from Table 2 there is remarkable difference in rate of fall in valley profile of the Himalaya and Plain stretch. The maximum rate of fall i.e. 59 metres per km is in the first 25 km of river from its origin, while it is minimum (0.08 metres per km) in the 768 km long tail end starting from Agra.

Table 2: Rate of fall in Yamuna River Stretches

S.No	Stretch	Length of Stretch (km)	Rate of Fall (m/km)
1	Upper Himalaya Stretch	25	59
2	Himalaya Stretch	152	19.1
3	Total Plain Stretch	1224	0.2
4	Lower Plain Stretch	768	0.08

The ground elevation in the Yamuna River basin varies from about 6320 meters above mean sea level (MSL) near Yamnotri Glacier to around 100 m above MSL near the confluence of Yamuna River with River Ganga at Allahabad. The topography of the Yamuna basin can be classified into three groups i.e. Hilly Region – more than 600 m above MSL; Foot hills and Plateau region – 300 m to 600 m; Plains and valleys 100 m to 300 m above MSL. On the basis of this topographic classification 11700 km² basin area (about 3.19%) can be classified as hilly, while remaining equally divided between plains and plateau regions with 161,231 km² & 172,917 km² respectively.

Analysis of Aquifer System in Active Flood Plain Areas of Ganga and Yamuna River Basin

Analysis of Shallow Aquifer System in Ganga Basin from Gangotri to Sangam at Allahabad

The cities selected for carrying out this study have been assigned number for preparation of curves i.e in case of Ganga basin Haridwar (1), Muzaffarnagar (2), Kanpur (3), Moradabad (4), Ghaziabad (5), Allahabad (6) and Dehradun (7) and in case of Yamuna basin starting from Dehradun (7), Yamunanagar (8), Panipat (9), Sonipat (10), Faridabad (11), Karnal (12) and Allahabad (6). The locations are shown in fig. 1 below:

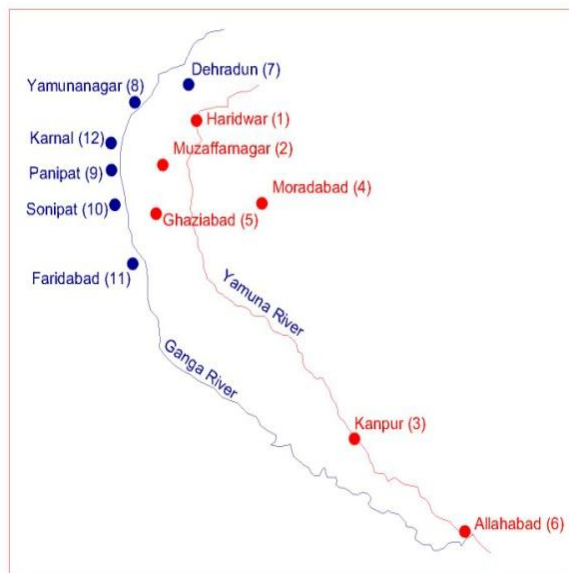


Fig. 1, Location of Cities along Ganga and Yamuna rivers in India

The location numbers mentioned in fig.1 above are same as those on the curves in the Comparative Study of Surface and Groundwater Quality between Active Flood Plain Areas of Ganga River basin from Gangotri to Sangam at Allahabad and Yamuna River Basin from Yamnotri to Sangam at Allahabad section.

Haridwar

Alluvium is the main water bearing formation in the area, which consists of coarse sand, fine sand and silt. Ground water in

Haridwar district occurs under unconfined, confined and semi-confined conditions. The aquifers are separated with thick clay with considerable thickness, which act as confining layers. The water level data suggests the presence of multilayer aquifer system. The first one is unconfined and the others are semi-confined to confined. The depth of first unconfined aquifer ranges from 4 to 8 m bgl and the others are 18 to 25 m bgl, 40 to 60 m bgl and 90 to 120 m bgl. Due to variable thickness of clay layers, the aquifers become double layered from west to east.

Muzaffarnagar

The entire Muzaffar Nagar district underlain by the quaternary alluvium deposited by Ganga and Yamuna river system. Lithologically the alluvial sediments comprise of sand, silt, clay and kankars in varying proportions. The perusal of all available lithological logs of the tubewells in the area reveal the complex configuration of alluvial sediments showing quick alteration from finer to coarser lithology. By and large the four distinct groups of permeable layers occurs in the area down to 450.00 mbgl. The top sandy clay bed 3-75 m in thickness covers the entire district. After top clayey layer first aquifer starts and with varying thickness at different places continues down to 185 mbgl. Lithologically the aquifer comprises mostly medium to coarse sand but gravels and kankars are also encountered sometimes. This aquifer at places, can be sub divided into two sub groups due to the presence of either clay lenses or sub regional clay layers.

The second aquifer occurring at varying depths between 115 and 235 mbgl is separated by 10-15 m thick clay layer from the first upper aquifer. The second group of aquifer consists of less coarse sediments than that of first one and at places kankar and clay lenses also occur.

The third aquifer is separated by second aquifer by thick clay layer. The fine textural third aquifer ranges in thickness between the depths 255 to 329 mbgl. The third aquifer is followed by a clay layer. The thickness of the fourth aquifer varies between the depths 355-488 mbgl.

The aquifer material becomes coarser from west to east. The top clay layer is thickest at Lakkheri, Rajpur and Budhana in the south western part of the district but is almost absent at Sukratal in the eastern most part of the district. In general it can be observed that the river Ganga has deposited coarser material compared to those deposited by river Yamuna.

Kanpur

The Kanpur Nagar District is part of Indo Gangetic Plain. The silt, gravel, and sands of different grades are main water bearing formations. The ground water occurs under unconfined condition in phreatic zones and under confined condition in deeper zones. The sedimentological constitution of the subsurface granular zones shows remarkable variation in the depth and the nature of occurrence in north and southern part of the district. In southern part specially along Yamuna river, feldspar-quartz, Jasper sands and gravel (Mourum) are the main constituents of the granular zones that occurs comparatively at shallow levels i.e. 24 to 57 mbgl whereas in the northern parts along the Ganga river, these reworked sedimentary formations are existing at deeper levels i.e. 265 to 310 mbgl. The provenance of these sedimentary formations is mainly

Bundelkhand Granite Complex of Archean age and Vindhyan Sandstone of Puranas. In the northern part the silt and clay sediments forming thin lensoid beds are frequently occurring in depth.

In the district shallow aquifer in the depth range of 20-96 mbgl have been tapped or utilized through cavity and stainer wells. The specific yield of unconfined aquifer is 12%. The deep drilling down to basement by CGWB has revealed the existence of potential granular zones in the depth range of 250-450 mbgl. The transmissivity of deeper aquifer varies between 1705 to 6000 m²/day.

Moradabad

The district is underlain by alluvial sediments having thickness of around 1000m (ONCG) comprising clay, silt and various grades of sand. Limited drilling carried out for ground water exploration down to a depth of 450 mbgl reveals the presence of potential aquifers with a marked change in sedimentation below 390mbgl. The sediments down to 390 m can be broadly divided into two aquifer groups. The upper aquifer group down to 180 m being exploited extensively by state & private tubewells. The second potential aquifer group present below 180 m depth, still remains to be fully harnessed for optimum utilization. For proper management of ground water resources, it is recommended to tap this aquifer in future. Deep drilling below 400 m is the need of the area for proper understanding of deeper aquifers.

The cumulative thickness of screened granular zones in these aquifer groups varies from 36 to 112 m. The average yield varies from 1445 to 5220 lpm for drawdown ranging from 1.85 m to 8.7 m. The specific capacity of tubewells varies from 222 to 1263 lit/min/m of drawdown.

Ghaziabad

On the basis of exploratory drilling carried out in the area three tier aquifer system has been identified down to a depth of 450 mbgl. The first aquifer system extends down to a depth of 125 mbgl and extends down to 200 mbgl in north part of the district. Thickness of aquifer decreases in the western part of the district and depth of bedrock is shallow. The aquifer material is medium to coarse grained sand exception being trans Hindon area. The yield varies between 1000 and 2500 lpm. Transmissivity ranges from 300-2000 m²/day. The quality of formation water is good in the eastern part of the district and deteriorates in the western part of the district in trans Hindon area. Second aquifer system exists in the depth ranges of 170-350 mbgl. The aquifer is medium to fine grained sand with occasional coarse grained sand. The quality of formation water is good. The tubewells are yielding 1000-2000 lpm at a considerably high drawdown. The third aquifer system occurs below 350m and continues down to depth explored of 450 m. Since no tubewell has been constructed in this aquifer group, therefore aquifer parameters are not known. As per electrical log the quality of formation water seems to be good.

Ground water occurs in the pore spaces of this unconsolidated sediments in this zone of saturation. The ground water generally occurs under unconfined conditions and depth to water level ranges between 1.70 to 24.60 mbgl during pre-monsoon period (May 2005) and during post monsoon period

(Nov. 2005) if varies between 2.20 to 23.37 mbgl where as piezometric head of deeper aquifers rests between 3.04 to 16.37 mbgl. The general slope of water table is from north to south and broadly follows the direction of surface slope. The hydraulic gradient varying from 0.4 to 4.8 m/Km. The maximum water level fluctuation (4.83) was observed in Rajapur (Pz) of Rajapur block. The water level elevation varies from 192 mamsl to 214 mamsl. The long-term water level trend in 10 years (1998 to 2007) is observed 0.2125 m/year during monsoon and 0.3016 m/year during post monsoon period.

Allahabad

Allahabad district covers an area of 5246 sq.km and falls in the in Doab of famous Ganga and Yamuna river. Thickness of alluvium encountered in Trans-Ganga area is upto 350.m while it is very less in Trans Yamuna area i.e. maximum up to 75.00m.

Exploratory drilling data of the district reveals that there are three tier aquifer system in Trans Ganga area while fractures are encountered in Trans Yamuna area. Yield of tubewells in alluvial area varies from 1000-3000 lpm with 6.00m drawdown. Potential Zones are encountered in Central as well as younger alluvium in the district.

Water table elevation contour map the groundwater flow is towards river Ganga and Yamuna (limited portion) Level of G.W. draft is 69.12% and all blocks of the district is under "SAFE" category. Maximum ground water development is 89.48% and minimum in Koraon block (32.62%). Ground water quality in general is fresh and potable except few pockets. Deeper aquifer also reveals that there is no contamination or pollution of groundwater.

Analysis of Deep Aquifer System in Ganga Basin from Gangotri to Sangam at Allahabad

Yamunanagar

The ground water exploration in the district reveals that clay group of formations dominates over the sand group in the district area. Ground water in the district occurs in the alluvium under water table and semi-confined to confined conditions. These aquifers consist of sand, silt, gravels and kankar associated with clay and form highly potential aquifers. In alluvium, the permeable granular zones comprise fine to medium grained sand and occasionally coarse sand and gravel. Their lateral and as well as vertical extent is extensive. In Kandi belt, which has not been explored fully boulders cobbles and pebbles, constitutes the major aquifer horizon. Siwalik Hills occupy marginal areas in the northeastern parts of the district constitute a low potential zone.

In Kandi areas, the shallow aquifers are isolated lenses embedded in clay beds whereas aquifers in alluvial areas occur on regional scale and have pinching and swelling disposition and are quite extensive in nature. These aquifers generally consists sands (fine to coarse grained) and gravels and are often intercepted by clay and kankar horizons. These aquifers are under unconfined to semi-confined conditions and support a large number of shallow tubewells within the depth of 50m only. The discharge of these tubewells varies between 100lpm and 500 lpm for moderate tubewells.

Karnal

The area falls in the Upper Jamuna Basin and the principal ground water reservoir in the area is unconsolidated alluvial deposits of Quaternary age. Groundwater in near surface zone occurs under water table conditions and occurs under semi confined to confined conditions in deeper aquifers. Rain fall and seepage from the river Yamuna, canal networks and irrigation is the principal source of ground water recharge in the area.

The study of exploratory boreholes drilled in the district during the Upper Jamuna Project of Central Ground Water Board indicated presence of three aquifer groups upto 450m depth below ground level.

Aquifer Group-I: The aquifer group I is composed of different sand and clay lenses and extends from surface downwards to different depth varying down to 90m to 180m at different places and occurs all over the area. This is composed of relatively coarser sediments. This group of aquifers is underlain by a clayey horizon 10-15m thick which is regionally extensive. The average transmissivity of this group was calculated by the Upper Jamuna Project of CGWB to be of the order of 2200 m²/day, lateral permeability of the order of 24m/day and average storativity as 0.12.

Aquifer Group-II: This group is composed of different sand and clay lenses and lies below aquifer group-I and occurs at varying depths ranging between 115m and 195 m to 215m and 285m. The sediments of this group are less coarse and are mixed with some kankar. This group is underlain by another clayey horizon, which is considerable thick at places and appears to be regionally extensive. The average transmissivity of this group is 700m²/day, the average lateral permeability is 7.2m/day and the average storativity is 1×10^{-3} .

Aquifer Group-III: The aquifer group III is composed of thin sand layers alternating with thicker clay layers and occurs at variable depths ranging between 314 m to 405m.bgl. The granular material of this group is generally finer and more so in the southerly direction. This group has an average transmissivity value of 525 m²/day, and average lateral permeability and average storativity values of the order of 7.1m/day and 4.5×10^{-4} respectively.

At shallow depths the aquifer are under unconfined conditions whereas at deeper levels these are under semi confined or confined conditions. Under exploratory drilling programme Central Ground Water Board has constructed 9 deep tubewells in the district. The depth of these tubewells are in the ranges of 202m to 316m. The discharge of these wells ranges from 825 to 4542 lpm for draw down varying from 4 - 20m. Depth to water level in the district ranges between 3.96m bgl to 22.54 m bgl. In the pre monsoon period.

Panipat

The district forms a part of Indo gangetic plain and lies in Yamuna Sub basin of main Ganga basin. Physiographically, the district is characterized by two distinct features i.e. vast upland plain and Yamuna flood plain. The width of the flood plain varies according to the amount of shift experienced by the river. It is narrow in the Northern part and widens downstream. The district is mainly drained by the river Yamuna and its tributaries.

The district is occupied by geological formations of Quaternary age comprising of Recent alluvial deposits belonging to the vast Gangetic alluvial plains. The Central Ground Water Board has drilled four exploratory boreholes in the depth range of 103 to 460 m and 25 piezometers in the depth range of 33 to 348 m to delineate and determine potential aquifer zones, evaluation of aquifer characteristics, behavior of water levels etc. The ground water exploration undertaken by CGWB has revealed the existence of 8 – 23 granular zones down to a maximum depth of 460 m. These zones mainly comprise of various grades of sand and gravel. The first granular zone forms the water table aquifer and occurs down to 50 - 150 m below ground level. The second aquifer occurs between 130 and 250 m depth, the third one exists between 286 and 366 m depth. Total thickness of the alluvium is not precisely known. However, the bedrock has not been encountered up to 460 m depth at village Dadlana (deepest exploratory borehole) in the district. The discharges range from 605 to 3258 lpm for 6 – 20 m of draw down. The transmissivity of the aquifers lies between 350 and 1990 m² / day.

Sonipat

Ground water occurs in alluvial sand, silt, kankar and gravel, which form potential aquifer zones. Depth to water level during pre-monsoon varies from 1.41 – 23.22m while during post-monsoon it varies from 0.99 – 24.46m. The depth to water level lies within 10m below the land surface in most parts of the district. It rests between 2 to 25m deep in the eastern side and 2 to 10m in the north western parts of the district. Only in small patches in the Rai block, water table is deeper having range of 20m to 40m. Water table elevations range from 230 to 220m amsl and the general ground water flow is from northwest to southeast. In general, the water table has declined all over the district over the past decade. During past few decade the district has recorded a fall of less than 1m to 7m. The decline was 2 to 4m in most parts of the district. Long term water level fluctuations indicate rise of water level over a period of last one decade in Mundlana, Kathura, Kharkhoda and Rari blocks. The trend of rise of water level is in the range of 0.05 to 0.32m/year.

The trend of decline of water level is 0.05 to 0.95m/year. Central Ground Water Board has drilled 15 wells under ground water exploration programme; 8 are exploratory wells, 5 are piezometers and 2 are slim holes. Out of 8 boreholes drilled for ground water exploration, 7 were abandoned due to poor quality of ground water or due to inadequate thickness of permeable granular zones. Granular zones exist down to 460m depth i.e. to depth explored.

However, the chemical quality of ground water is not fresh in deeper horizons in most parts of the district and in shallow horizons; in some parts. In general, the quality of ground water in shallow dugwell zones is fresh in the eastern and north, northwest parts and gradually gets deteriorated in the western and southwestern parts. Also the deep zones below 150m depth contain brackish / saline ground water. A number of shallow tubewells exist in all the blocks – more in number in Sonipat, Rai and Ganaur block and these tap water bearing zones in the shallow unconfined aquifer group. These tubewells yielded 300 to 600 lpm for moderate drawdowns. Detailed test drilling has established occurrence of three distinct aquifer groups, down to

450m depth in Upper Yamuna Basin which includes Sonipat district.

Aquifer group-I which was in unconfined state extends from water table down to 70m depth. A tubewell located at Khera in the eastern part of the district and tapping this aquifer group-I, yielded 4540 lpm for about 7.5m of drawdown. Aquifer characteristics at Khera site were – transmissivity: $2340\text{m}^2/\text{day}$, lateral hydraulic conductivity – $36\text{m}/\text{day}$ and specific yield – 2.15×10^{-1} (21.4%). This aquifer group-I contains fresh water in eastern parts of the district.

Aquifer group-II which is under semi-confined/confined state occurs in the depth range of 90 to 200m and has not been tested for its yield and aquifer characteristics since the formation water is saline. Aquifer group-III which too is under confined state occurs in the depth range of 250 to 400m and contains brackish saline ground water.

Faridabad

Ground water occurs in alluvium and the underlying weathered/ fractured quartzites. Alluvium comprises sands silt, Kankar and gravel which form the principal ground water bearing horizon. In Quartzite formation, occupying the north-western part of the district, ground water occurs in weathered and jointed fractured horizons. Weathering and fracturing has resulted in formation of semi-consolidated sand beds (BADARPUR SANDS) which form potential aquifer zones. This quartzite formation has not been explored for ground water occurrence.

In alluvium, granular zones are evenly distributed in entire thickness which is negligible near the quartzite outcrops to over 350 m in the eastern parts near Yamuna River.

The ground water exploration in Faridabad district has been undertaken at large number of locations by the Central Groundwater Board. Out of these, 38 exploratory wells one slim hole and 19 piezometers were constructed in the district. 12 exploratory wells were abandoned due to poor quality of ground water and lack of promising aquifers. In general, 6-14 granular zones mainly comprise fine sand, silt, clay and kankar. The discharge of successful exploratory wells varies between 200 and 6629 lpm with draw down of 2.39-9.12 m. To assess the aquifer parameters, aquifer performance tests were conducted. The transmissivity values in the area vary between 125 and $1645\text{m}^2/\text{day}$.

Analysis of Deep Aquifer System in Yamuna Basin from Yamnotri to Sangam at Allahabad

Dehradun

Several water samples were collected from different groundwater structures located in District Dehradun, during Pre-monsoon, 2007. The samples were got analyzed for their electrical conductivity (EC), pH, calcium, magnesium, carbonate and bicarbonate. The groundwater is suitable for domestic and irrigation purposes, in respect of these parameters.

The EC, in District Dehradun, ranges between 80 and 659 micro mhos/cm at 25°C. The higher values are there around the Dehradun and Doiwala townships.

Haridwar

The partial chemical analyses of samples of the district reveal that the chemical parameters of ground water are well within permissible limit and suitable for drinking and irrigation purposes.

Muzaffarnagar

Ground water in phreatic aquifer in general, is colourless, odourless and slightly alkaline in nature. The specific electrical conductance of ground water in phreatic zone ranges from 224 – 1885 $\mu\text{S}/\text{cm}$ at 25°C. Fluoride ranges from 0 – 0.79 mg/l, which is within permissible limit.

It is observed that the ground water is suitable for drinking and domestic uses in respect of all the constituents. Nitrate is found in excess of permissible limit 15 (>45mg/l) in few samples analyzed, which is likely due to return irrigation flow from agricultural fields and often improper waste disposal. Phosphate is not found in ground water. The Arsenic content is within limit of permissibility of BIS.

Kanpur

The ground water of Kanpur Nagar district is colourless, odourless and slightly alkaline in nature. The Electrical conductance ranges from 470-1560 $\mu\text{S}/\text{cm}$ at 25°C. The Fluoride is within the permissible range from 0.47-0.96 mg/l. Phosphate is found nil in the area. It is observed that quality of water is good for drinking, domestic and all other purposes. The arsenic content has been found ranging from Nd to 42mg/l. The trace metals Zn, Mn, Ni, Pb are within the permissible limit except for copper 1249mg/l and iron 6.236 mg/l at Kanpur.

Moradabad

Ground water in phreatic aquifers in general is colourless, odourless and slightly alkaline in nature. The specific electrical conductance of ground water in the phreatic zone ranges from 300-1080 micro siemens/cm at 25°C. The conductance below 750 micro siemens/cm at 25°C have been observed in 67% of the samples analysed. It is observed that ground water is suitable for drinking and domestic purpose in respect to constituents except nitrate. Nitrate is found in excess 45 mg/l in about 33% of samples analysed which is due to the use of fertilizers for agriculture and other untreated waste disposal. Phosphate is not found in ground water. The As (Arsenic) has been found ranging from nd to 70 micro gm/litre in Moradabad block (Ashiyana 70 microgram/litre).

Ghaziabad

Ground water in phreatic aquifers, in general, is colourless, odourless and slightly alkaline in nature. The specific electrical conductance of ground water in phreatic zone ranges from 527 to 3318 $\mu\text{S}/\text{cm}$ at 25°C. Conductance below 750 $\mu\text{S}/\text{cm}$ at 25°C has been observed in a 44% of the analysed samples, whereas, above 2250 $\mu\text{S}/\text{cm}$ at 25°C in 11% of the samples. It is observed that the ground water is suitable for drinking and domestic uses in respect to all constituents except for total Hardness & Nitrate. High concentration (>600 mg/l), total hardness is found in 11% of the samples with a maximum value of 990 mg/l from Bhojpura. Nitrate is found in excess of permissible limit (>45 mg/l) in 22% of the samples analysed with a maximum of 168 mg/l from

Bhojpur. High nitrate values may be due to return irrigation flow from agricultural fields where indiscriminate use of fertilizer is being done. The Arsenic content has not been detected in the ground water of the district.

Allahabad

The chemical analysis of shallow ground water consists of pH, E.C., Na, K, Ca, Mg, HCO₃, CL, SO₄, NO₃, F and TH as CaCO₃ reflects that there is no contamination of the shallow ground water in the district and all the constituents are well within the range. The chemical data of shallow aquifers reveals that the groundwater quality is more deteriorated in canal command area E.C. varies from 200-2080 μ siemens/cm at 25°C. It is interesting to find that different radicals in the shallow ground water have not changed over the year's in spite of upcoming canal irrigation and use of fertilizers.

Data of water samples from deeper aquifers are few but there analysis reveals that the water is safe and potable. It is observed that the E.C. and other salts are in higher concentration in alluvial area than hard rock area. The quality in hard rock area is inferior near the stream than away from the stream.

Analysis of variation in water quality from the upland areas of Yamnotri to its confluence at Sangam Allahabad

Dehradun

Several water samples were collected from different groundwater structures located in District Dehradun, during Pre-monsoon, 2007. The samples were analyzed for their electrical conductivity (EC), pH, calcium, magnesium, carbonate and bicarbonate. The groundwater is suitable for domestic and irrigation purposes, in respect of these parameters.

The EC, in District Dehradun, ranges between 80 and 659 micro mhos/cm at 25°C, for most part of the district the EC is around 200 micromhos/cm. The higher values are there around the Dehradun and Doiwala townships.

Yamunanagar

Central Ground Water Board has carried out studies for chemical quality of groundwater. The range of chemical constituents (anion and cation) along with pH and EC analysis of water samples from shallow aquifers reveals that ground water is alkaline in nature and moderately saline at few places. All chemical parameters are within the permissible limits for safe drinking waters set by BIS except nitrate and arsenic at a few locations. Among anions, bicarbonate is the dominant anion and among cations, none of the cation dominates. By and large, quality of ground water is suitable for drinking purposes.

Karnal

Data of chemical analysis of water samples from shallow aquifers indicates that ground water is alkaline in nature and is moderately saline. All chemical parameters are well within the permissible limits for safe drinking waters set by Bureau of Indian Standards (BIS) except fluoride and arsenic at a few locations. Among anions, bicarbonate is the dominant ion and among cations none of the cations dominate. By and large, quality of ground water is suitable for drinking purposes.

Panipat

The shallow ground water of the district is alkaline in nature and is of low to medium salinity. The data on chemical quality of water from shallow (Phreatic) aquifers indicates that all the chemical parameters i.e. major cations (Ca, Mg, Na & K) and major anions (CO₃, HCO₃, Cl & SO₄) are well within the permissible limits set by the BIS, 1991 in most areas but higher concentrations occur at some places. Among the anions, bicarbonate is dominant, and magnesium and sodium are the dominant cations. Marginal quality water is found in the south western parts of the district. High fluoride is found in large parts of the district more than 60%. High nitrate concentration is found in patches in Madlauda block. Ground water is found suitable for irrigation in general. However, for drinking some constituents are high and fluoride problem is prevalent in large parts. High concentration of heavy metals like Copper and Iron have been found.

Sonipat

The shallow ground water of the district is generally alkaline in nature and is moderate to highly mineralized with EC ranging from 597 to 6710 μ S/cm. at 25°C.

Ground water occurring in the southern and N-W parts of the district is more saline as compared to ground water occurring in the rest of the district. Among anions, either bicarbonate predominates or none of the anion dominates. Similarly, among cations, sodium predominates in 50% of the samples and in the remaining calcium + magnesium combined dominates.

On comparing the ionic concentration of major ions with the recommended limits prescribed by Bureau of Indian standards for drinking waters, it is found that more than half (68%) the ground waters are not suitable for drinking purposes mainly due to salinity and fluoride contents that exceed the maximum permissible limits of these chemical parameters, which are 3000 μ S/cm. and 1.5mg/l respectively.

Plot of USSL diagram used for the determination of irrigation rating of ground waters indicates that ground waters at several places fall under C2S1, C3S1, C3S2, C4S2 classes of irrigation rating. These waters are, therefore, suitable for customary irrigation for salt tolerant crops like wheat, rice, maize, gram etc without any fear of salinity hazards to the crops. Waters falling under C4S3 and C4S4 classes are likely to cause salinity as well as sodium hazards. It would be better if such waters are used for irrigating salt tolerant crops along with appropriate amount of gypsum on well drained soils.

Faridabad

The shallow ground water of the district is alkaline in nature (pH 7.75 to 8.62) and is moderately to highly saline (EC 693 to 3590 μ S/cm). Among anions, bicarbonate predominates at some places, whereas at other places either none of the anion dominates or chloride is dominant. Among cations, by and large, sodium is the dominant cation. At some places mixed cationic character has been observed. Comparing the concentration values of major ions with the recommended desirable and permissible concentration- ion limits for drinking waters (Bureau of Indian Standards). It is found that more than half (75%) of the ground waters are not suitable for drinking purposes mainly due to

fluoride content that exceeds the maximum permissible limit of 1.5mg/l.

Analysis of Shallow and Deep Aquifer Water Quality in Ganga Basin from Gangotri to Sangam at Allahabad

The analysis of water quality is based on the secondary sources from Central Groundwater Board as well as State Groundwater Board and primary data was also generated in order to ascertain the groundwater quality in shallow and deep aquifer from shallow farmer wells ranging from 50 m to 90 m and the deep aquifers from deep tubewells of UP Jal Nigam as well as exploratory tubewells of Central Groundwater Board varying from 90 m to 320 m.

The interpretation of data was done for physical, chemical and bio-logical parameters in conformity with IS:10500. It was found that the upper Ganga basin in shallow aquifer system has got variation from alkaline condition to acidic condition especially during the recharging season i.e at the time of rainfall, snow-melt and western disturbances, however the deeper aquifers have got moderately hard and alkaline water condition throughout the year.

Analysis of Shallow and Deep Aquifer System in Yamuna Basin from Yamnotri to Sangam at Allahabad

The analysis of water quality is based on the secondary sources from Central Groundwater Board as well as State Groundwater Board and primary data was also generated in order to ascertain the groundwater quality in shallow and deep aquifer from shallow farmer wells ranging from 30 m to 50 m and the deep aquifers from deep tubewells of UP Jal Nigam as well as exploratory tubewells of Central Groundwater Board varying from 50 m to 123 m.

The interpretation of data was done for physical, chemical and bio-logical parameters in conformity with IS:10500. It was found that the upper Yamuna basin in shallow aquifer system is moderately alkaline and remains so throughout the year.

Comparative Study of Surface and Groundwater Water Quality between Active Flood Plain Areas of Ganga River basin from Gangotri to Sangam at Allahabad and Yamuna River Basin from Yamnotri to Sangam at Allahabad

The active flood plain of Ganga river basin is limited in its aerial extent in the upper Yamuna basin area, especially in the Gangotri region, because of the hard rock formation, however there is a drastic expansion in active floodplain areas at the time of emergence of Ganga river in the plain areas i.e Moradabad, Kanpur, Allahabad etc.

The surface water quality of Ganga river basin is fit for drinking and domestic purpose in its upper reaches, however contamination in small portion when the Ganga river enters cities like Kanpur and Allahabad where it is affected due to rapid urbanization, however the contamination will further increase with the pace of development of urbanization through tourism etc especially in its upper reaches.

In contrast to the surface water the groundwater condition and behavior of Ganga basin is better because of the presence of Sivalik Group of rocks which is highly permeable due to boulders and coarse sand followed by the Vindhyan system

overlain by thick alluvium mainly consist of coarser sand, gravel etc.

The active flood plain of Yamuna basin is mainly found in the areas like district Karnal, Panipat and Sonapat, and these flood plains decreases in its dimension in the lower region due to construction of dams, barrages, flow regulators etc.

The Yamuna basin on the other hand has got good water quality in its upper reaches, especially in Yamnotri upto Dehradun areas, however the quality of Yamuna as soon as it enters Delhi becomes highly polluted and is not fit for any use without proper treatment upto tertiary level.

The groundwater in Yamuna river basin is moderately hard and alkaline upto shallow depth and at places it is fit for drinking upto Panipat areas, however in the deeper aquifers, the groundwater is highly saline and alkaline in reaction because of the chemical leaching due to the presence of Aravali rocks which are weathered quartzite.

Pre-monsoon Depth to Water Level in Ganga & Yamuna Basin

The pre-monsoon depth to water level for the Ganga and Yamuna basin area is shown in fig. 2 below, the variation in pre-monsoon water level in Ganga and Yamuna basin indicates that the Yamuna basin doesn't have shallow water level whereas the Ganga basin has got shallow water level which clearly indicates that the response of the recharge is much better in Ganga basin and so the aquifer system is better in Ganga Basin

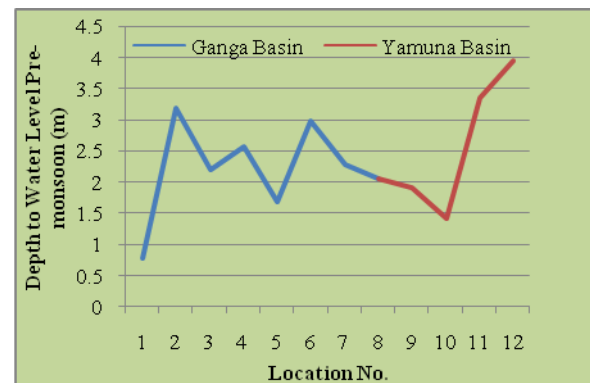


Fig. 2: Pre-monsoon Depth to Water Level in Ganga & Yamuna Basin

Post-monsoon Depth to Water Level in Ganga & Yamuna Basin

The post-monsoon depth to water level for the Ganga and Yamuna basin area is shown in fig. 3 below. It indicates that the Yamuna basin doesn't have shallow water level whereas the Ganga basin has got shallow water level which clearly indicates that the response of the recharge is much better in Ganga basin and so the aquifer system is better in Ganga Basin.

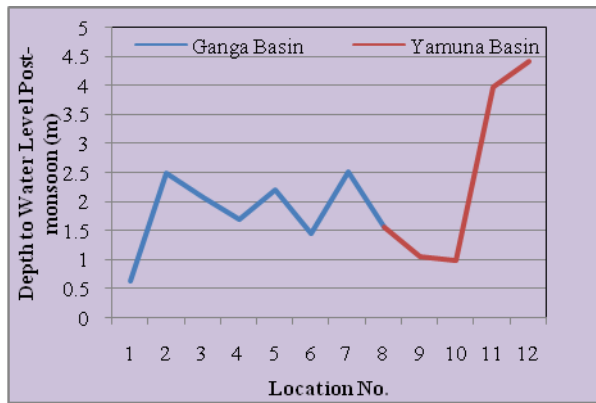


Fig. 3: Post-monsoon Depth to Water Level in Ganga & Yamuna Basin

Water Level Fluctuation in Ganga & Yamuna Basin

The water level fluctuation for the Ganga and Yamuna basin area is shown in fig. 4 below. It indicates that the fluctuation range is much higher in Ganga Basin whereas it is very less in Yamuna basin which further confirms that the aquifer system in Ganga basin is better and so is the Groundwater resource potential.

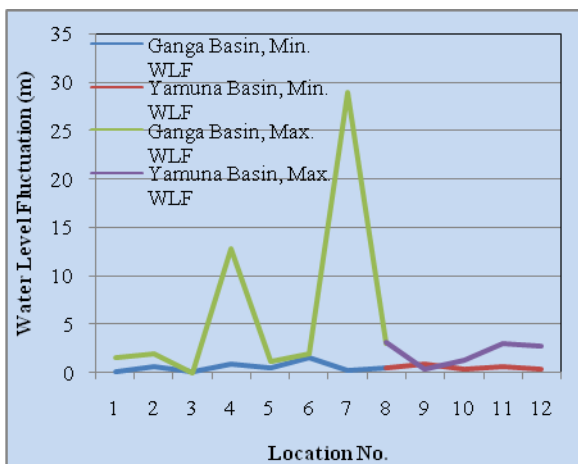


Fig. 4: Water Level Fluctuation in Ganga & Yamuna Basin

Temperature Variation in Ganga & Yamuna Basin

The temperature variation for the Ganga and Yamuna basin area is shown in fig. 5 below. The variation is recorded higher in Ganga basin than the Yamuna basin which clearly indicates the Physiographic features are undulatory in Ganga basin than the Yamuna basin. The Ganga basin has got comparatively higher altitude and the response of snowfall and climate change. With due respect of global warming.

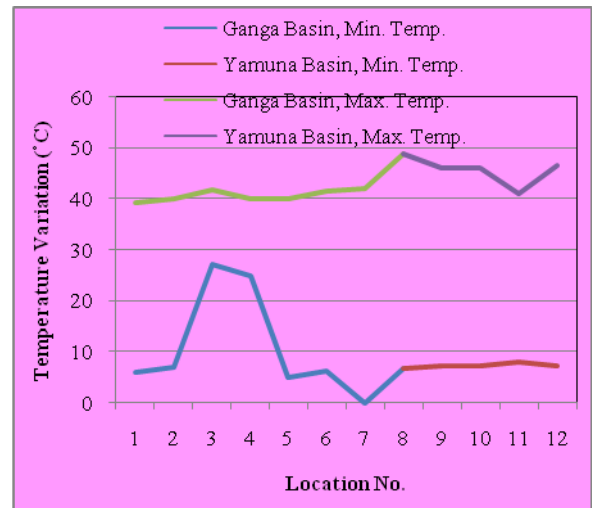


Fig. 5: Temperature Variation in Ganga & Yamuna Basin

Rainfall & pH variation in Ganga & Yamuna Basin

The rainfall and pH variation for the Ganga and Yamuna basin area is shown in fig. 6 below. The pH variation has got a direct response in Yamuna and Ganga basin which reciprocates to the rainfall, which means that higher the rainfall makes pH almost neutral to acidic in nature in Ganga basin whereas in Yamuna basin it is not much clear specially in lower Yamuna basin from Delhi to Allahabad, which clearly indicates that the impact of wastewater is more in Yamuna basin than Ganga basin and also the snowmelt has got more response in Ganga basin.

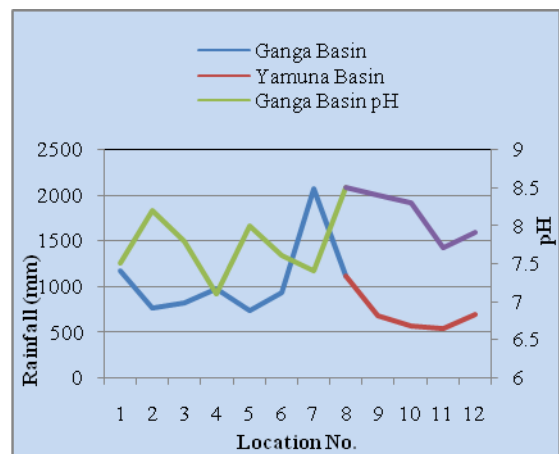


Fig. 6: Rainfall & pH variation in Ganga & Yamuna Basin

V. CONCLUSION & RECOMMENDATIONS

It is thus concluded from the above discussion that the Ganga basin has got the good hydro-geological and hydrological system and the local geology is found positive in nature which does not really react with rainwater as a result the groundwater quality remains good throughout the year except at few patches in its upper region where there is fluctuation from acidic to alkaline condition in the shallow aquifers. However the deeper aquifers are found to be moderately hard and alkaline in reaction throughout the year.

It is also found that there has not been much storage capacity created in the stretch of Ganga basin from Yamnotri to Allahabad by virtue of which the surface water always is found to be in running condition and maintain good quality due to regular flushing and aeration.

It is recommended therefore that in the Ganga basin the inter-mixing of shallow and deep aquifer water should be done in order to maintain the groundwater quality which will be almost neutral in reaction and will be fit for drinking and domestic purposes.

The storage capacities should not be encouraged rather the rainwater should be properly guided by virtue of watershed management in order to maintain and improve the surface water quality by providing proper runoff.

The local patches in Moradabad, Kanpur and Allahabad or wherever found contaminated should be treated properly by virtue of providing treatment plants on the nallas and drains falling in the Ganga river areas.

The Yamuna river basin has got very complex hydro-geological and hydrological system by virtue of which the Yamuna river becomes meandering in nature rather braided, by virtue of which the swamps and lakes are the natural storage feature which spoils the water quality of Yamuna river basin. Comparatively the Yamuna river basin has got limited recharge where partial snowmelt water comes which does not support the runoff of Yamuna river basin. The storage capacity in terms of dams, reservoirs and barrage etc further deteriorate the Yamuna river water discharge and quality and in fact it becomes dry in Panipat and Sonipat areas, however the Yamuna river water in Delhi has got a good amount of sewage and industrial waste water in the tune of 750 MGD by virtue of which the Yamuna becomes the sewage carrier river down below the Delhi areas until Chambal river, which dilutes the Yamuna river water quality.

The groundwater quality in the shallow aquifers of Yamuna river basin is moderately hard and alkaline in reaction but in the areas like Delhi and further in downstream direction becomes contaminated. The areas from Sonipat to Agra in a stretch of 300-400 km has got really bad shape because the shallow aquifers are contaminated due to urbanization and industrial impact and deeper aquifers are saline in reaction.

It is recommended further that this stretch of Yamuna belt should be taken care properly with utmost urgency and proper treatment devices on the drains and nallah joining Yamuna should be provided on the drains joining Yamuna. For salinity removal it is recommended that for drinking purpose the reverse osmosis system maybe used and the reject water should be given to the salt resistant plants in the green belt areas. However, the attempt should be made for rainwater harvesting and groundwater recharging through proper watershed management. The emphasis should be given on the design of watershed, with the pace of urbanization. The rainwater harvesting system should also be designed for dilution of salinity in the deeper aquifers.

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High Speed, Power and Area efficient Algorithms for ALU using Vedic Mathematics

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Abstract- Digital signal processing (DSP) is the technology that is omnipresent in almost every engineering discipline. A typical processor devotes a considerable amount of processing time in performing arithmetic operations, particularly multiplication operations. Multiplication is one of the basic arithmetic operations and it requires substantially more hardware resources and processing time than addition and subtraction. In fact, 8.72% of all the instruction in typical processing units is multiplication. The core computing process is always a multiplication routine; therefore, DSP engineers are constantly looking for new algorithms and hardware to implement them.

Vedic mathematics is the name given to the ancient system of mathematics, which was rediscovered, from the Vedas between 1911 and 1918 by Sri Bharati Krishna Tirthaji. The whole of Vedic mathematics is based on 16 sutras (word formulae) and manifests a unified structure of mathematics. This paper presents the design of a low power high speed algorithms for arithmetic logic units using this ancient mathematics techniques and also their hardware implementation. Even convolution algorithms using this technique are discussed along with their FPGA implementation. Employing these techniques in the computation algorithms of the coprocessor has reduced the complexity, execution time, area, power. Further research prospects may include the design and development of a Vedic DSP chip using VLSI technology.

Index Terms- DSP, Vedic mathematics, Urdhva Tiryakbhyam Sutra.

I. INTRODUCTION

In any processor the major units are Control Unit, ALU and Memory read write. Among these units the performance of any processor majorly depends on the time taken by the ALU to perform the specified operation. Multiplication is an important fundamental function in arithmetic operations. Multiplication-based operations such as Multiply and Accumulate (MAC) and inner product are among some of the frequently used Computation Intensive Arithmetic Functions (CIAF) currently implemented in many Digital Signal Processing (DSP) applications such as convolution, Fast Fourier Transform (FFT), filtering and in microprocessors in its arithmetic and logic unit. Since multiplication dominates the execution time of most DSP algorithms, so there is a need of high speed multiplier.

The demand for high speed processing has been increasing as a result of expanding computer and signal processing applications. Higher throughput arithmetic operations are important to achieve the desired performance in many real-time

signal and image processing application. One of the key arithmetic operations in such applications is multiplication and the development of fast multiplier circuit has been a subject of interest over decades. Reducing the time delay and power consumption are very essential requirements for many applications. This work presents different multiplier architectures. Multiplier based on Vedic Mathematics is one of the fast and low power multiplier.

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.

In many DSP algorithms, the multiplier lies in the critical delay path and ultimately determines the performance of algorithm. The speed of multiplication operation is of great importance in DSP as well as in general processor. In the past multiplication was implemented generally with a sequence of addition, subtraction and shift operations. There have been many algorithms proposals in literature to perform multiplication, each offering different advantages and having tradeoff in terms of speed, circuit complexity, area and power consumption.

The multiplier is a fairly large block of a computing system. The amount of circuitry involved is directly proportional to the square of its resolution i.e. A multiplier of size n bits has n^2 gates. For multiplication algorithms performed in DSP applications latency and throughput are the two major concerns from delay perspective. Latency is the real delay of computing a function, a measure of how long the inputs to a device are stable is the final result available on outputs. Multiplier is not only a high delay block but also a major source of power dissipation. That's why if one also aims to minimize power consumption, it is of great interest to reduce the delay by using various delay optimizations.

In this thesis work, Urdhva tiryakbhyam Sutra is first applied to the binary number system and is used to develop digital multiplier architecture. This is shown to be very similar to the popular array multiplier architecture. This Sutra also shows the effectiveness of to reduce the $N \times N$ multiplier structure into an efficient 2×2 multiplier structures. Nikhilam Sutra is then discussed and is shown to be much more efficient in the multiplication of large numbers as it reduces the multiplication of two large numbers to that of two smaller ones. The proposed multiplication algorithm is then illustrated to show its computational efficiency by taking an example of reducing a 4×4 -bit multiplication to a single 2×2 -bit multiplication operation. This work presents a systematic design methodology for fast and area efficient digit multiplier based on Vedic

mathematics. The Multiplier Architecture is based on the Vertical and Crosswise algorithm of ancient Indian Vedic Mathematics.

II. OBJECTIVE

The main objective of this thesis is to design and synthesis of an ALU, which can be used in any processor application. The ever increasing demands in enhancing the ability of processors to handle the complex and challenging processes has resulted in the integration of number of processor cores into one chip still the load on processor is not less. This load is reduced by supplementing the main coprocessor which is designed to work on specific types of functions like numeric computations, signal processing, graphics etc. The speed of ALU depends on the multipliers. In algorithm and structure levels, numerous multiplication techniques have been developed to enhance the efficiency of multiplier which concentrates on reducing the partial product and their additions. But in this case principle behind the multiplication remains same. Use of Vedic mathematics for multiplication strikes difference in actual process.

III. ANCIENT VEDIC METHODS

The use of Vedic mathematics lies in the fact that it reduces the typical calculations in conventional mathematics to very simple ones. This is so because the Vedic formulae are claimed to be based on the natural principles on which the human mind works. Vedic Mathematics is a methodology of arithmetic rules that allow more efficient speed implementation. This is a very interesting field and presents some effective algorithms which can be applied to various branches of engineering such as computing.

3.1. Urdhva Tiryakbhyam Sutra

The given Vedic multiplier based on the Vedic multiplication formulae (Sutra). This Sutra has been traditionally used for the multiplication of two numbers. In proposed work, we will apply the same ideas to make the proposed work compatible with the digital hardware. Urdhva Tiryakbhyam Sutra is a general multiplication formula applicable to all cases of multiplication. It means "Vertically and Crosswise". The digits on the two ends of the line are multiplied and the result is added with the previous carry. When there are more lines in one step, all the results are added to the previous carry. The least significant digit of the number thus obtained acts as one of the result digits and the rest act as the carry for the next step. Initially the carry is taken to be as zero. The line diagram for multiplication of two 4-bit numbers is as shown in figure 1.

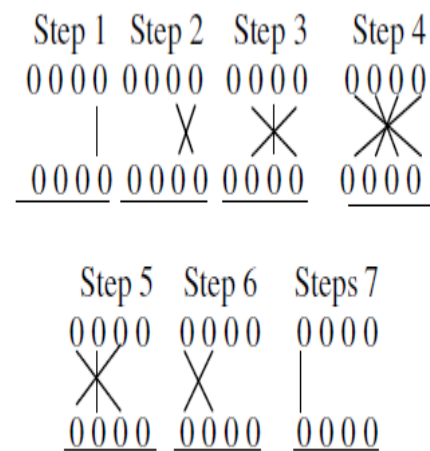


Fig.1: Line diagram for multiplication for two 4-bit Number

Line diagram for the multiplication is shown in Fig. 1. The digits on the two ends of the line are multiplied and the result is added with the previous carry. When there are more lines in one step, all the results are added to the previous carry. The least significant digit of the number thus obtained acts as one of the result digits and the rest act as the carry for the next step. Initially the carry is taken to be as zero. Now we will extend this Sutra to binary number system.

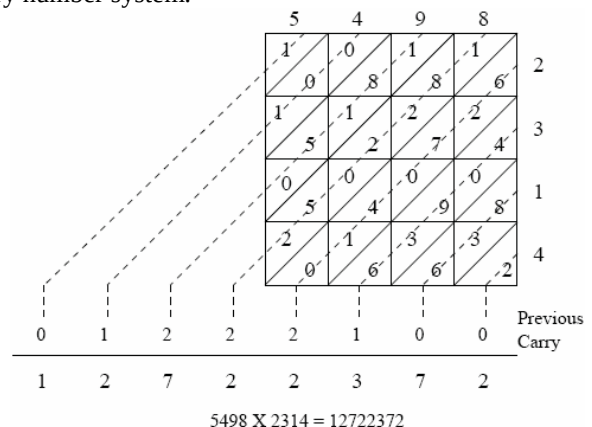


Fig.2: Alternate Method of multiplication by Urdhva tiryakbhyam Sutra

For the multiplication algorithm, let us consider the multiplication of two 4 bit binary numbers $a_3 a_2 a_1 a_0$ and $b_3 b_2 b_1 b_0$. As the result of this multiplication would be more than 4 bits, we express it as $\dots r_4 r_3 r_2 r_1 r_0$. As in the last case, the digits on the both sides of the line are multiplied and added with the carry from the previous step. This generates one of the bits of the result and a carry. This carry is added in the next step and hence the process goes on. If more than one line are there in one step, all the results are added to the previous carry. In each step, least significant bit acts as the result bit and all the other bits act as carry. For example, if in some intermediate step, we will get 011, then 1 will act as result bit and 01 as the carry. Thus we will get the following expressions:

$r0=a0b0;$ (1)
 $c1r1=a1b0+a0b1;$ (2)
 $c2r2=c1+a2b0+a1b1 + a0b2;$ (3)
 $c3r3=c2+a3b0+a2b1 + a1b2 + a0b3;$ (4)
 $c4r4=c3+a3b1+a2b2 + a1b3;$ (5)
 $c5r5=c4+a3b2+a2b3;$ (6)
 $c6r6=c5+a3b3$ (7)

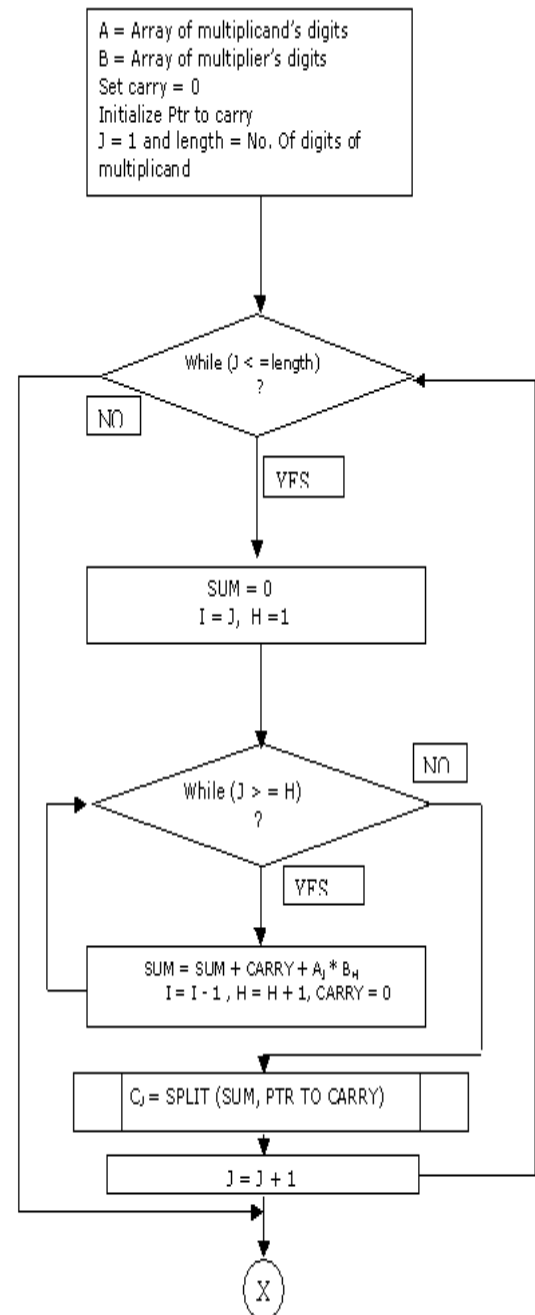
$c6r6r5r4r3r2r1r0$ being the final product. Hence this is the general mathematical formula applicable to all cases of multiplication. All the partial products are calculated in parallel and the delay associated is mainly the time taken by the carry to propagate through the adders which form the multiplication array. So, this is not an efficient algorithm for the multiplication of large numbers as a lot of propagation delay will be involved in such cases. To overcome this problem, Nikhilam Sutra will present an efficient method of multiplying two large numbers.

3.2. Nikhilam Sutra

Nikhilam Sutra means "all from 9 and last from 10". It is also applicable to all cases of multiplication; it is more efficient when the numbers involved are large. Since it find out the compliment of the large number from its nearest base to perform the multiplication operation on it. Larger the original number, lesser the complexity of the multiplication. We will illustrate this Sutra by considering the multiplication of two decimal numbers (96×93) where the chosen base is 100 which is nearest to and greater than both these two numbers. As shown in Fig. 5, we write the multiplier and the multiplicand in two rows followed by the differences of each of them from the chosen base, i.e., their compliments. We can write two columns of numbers, one consisting of the numbers to be multiplied (Column 1) and the other consisting of their compliments (Column 2). The product also consists of two parts which are distributed by a vertical line. The right hand side of the product will be obtained by simply multiplying the numbers of the Column 2 ($7 \times 4 = 28$). The left hand side of the product will be found by cross subtracting the second number of Column 2 from the first number of Column 1 or vice versa, i.e., $96 - 7 = 89$ or $93 - 4 = 89$. The final result will be obtained by combining RHS and LHS (Answer = 8928).

96×93			
Nearest Base=100			
	96	(100-96)	
	93	(100-93)	
	Column 1 Column 2		
Common	96	4	Multiplication Result
Difference	93	7	
	89	28	
Result= $96 \times 93 = 8928$			

Fig. 3: Multiplication by Nikhilam Method.

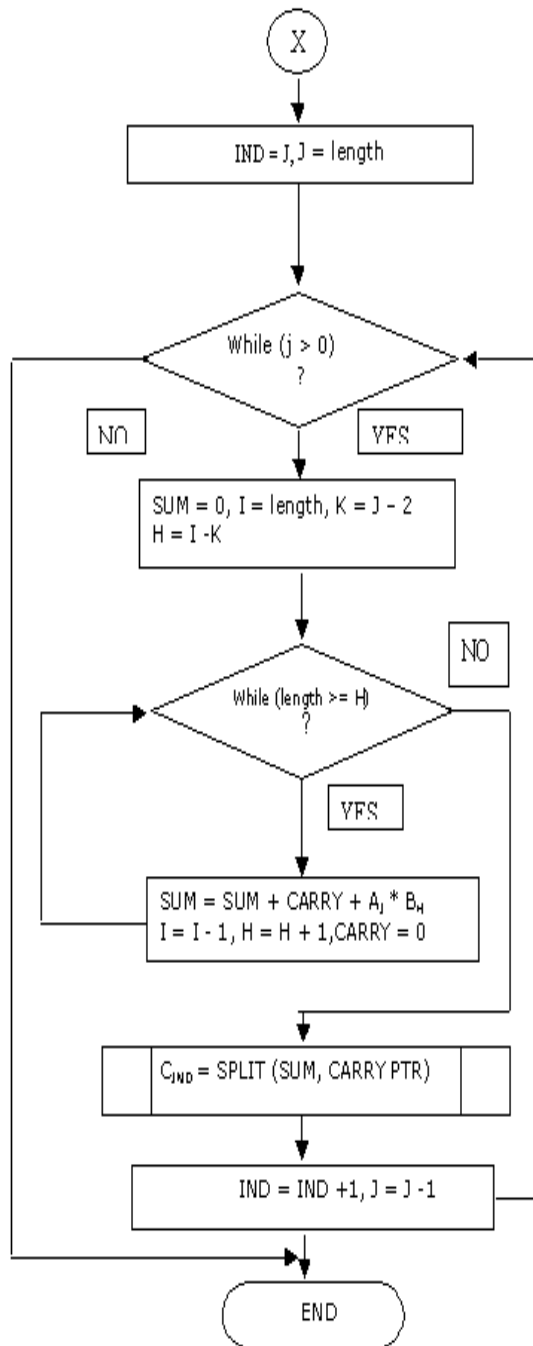


IV. HARDWARE IMPLEMENTATION

This hardware design of the vedic multiplier using Urdhva tiryakbhyam Sutra is very similar to that of the famous array multiplier where an array of adders is required to arrive at the final product. All the partial products are calculated in parallel and the delay associated is mainly the time taken by the carry to propagate through the adders

Fig.4: Flow Chart1 for implementing Vedic Multiplication in C language

Fig.5: Flow Chart2 for implementing Vedic Multiplication in C language



which form the multiplication array. The hardware can be implemented using Verilog HDL and simulation is done in Veriwell simulator and the power dissipation time delay tables are provided below.

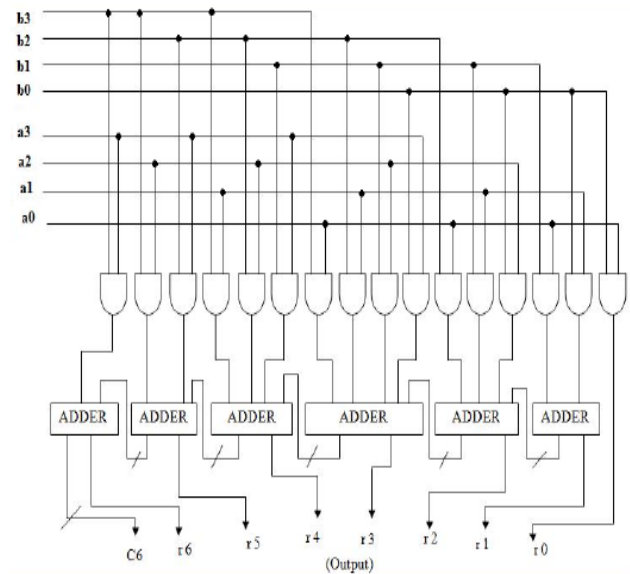


Figure 6: Hardware architecture of the Urdhva tiryakbhyam multiplier. Similarly hardware design for Nikhilam Sutra can also be designed and implemented using HDL.

V. COMPARISON AND DISCUSSION

FPGA implementation results show that multiplier Nikhilam Sutra based on Vedic mathematics for multiplication of binary numbers is faster than other multipliers. Vedic Multiplier has the advantages as over other multipliers also for power and regularity of structures.

TABLE I: VEDIC AND CONVECTIONAL MULTIPLIER

Type of unit	Cell Area	Total Power (nW)	Dynamic Power (nW)	Leakage Power (nW)
8x8 Conventional Multiplier	4417	466014.411	465984.874	29.536
8x8 Vedic Multiplier	4664	405745.509	405715.454	30.055

TABLE II: CONVENTIONAL AND VEDIC ALU

Type of unit	Operating Freq (MHz)	Total Power (nW)	Cell Area	Timing Slack (ps)
8x8 ALU using conventional Multiplier	150	2904404.604	17676	+1
	300	4614805.708	18871	-1719
8x8 ALU using Vedic Multiplier	150	2858470.659	16881	+2570
	300	4435907.151	17896	+3

There are number of techniques for logic implementation at circuit level that improves the power dissipation, area and delay parameters in VLSI design. Implementation of parallel Multiplier in CPL logic shows significant improvement in power dissipation. CPL requires more number of transistors to implement as compared to the CMOS and provides only a little improvement in speed. Pass Transistor Logic which offers better performance over both the CMOS and CPL in terms of delay, power, speed and transistor count. The PTL outperforms the CMOS implementation in speed and great in power dissipation, with approximately same transistor count. When compared to CPL, PTL is faster and shows improvement in power and transistor count.

TABLE III: Comparison between multiplier designs in three different Logics

Parameters	CMOS	Complementary Pass Transistor Logic	Pass Transistor Logic
Number of Transistor	Most	More	Less
Area	Maximum	Medium	Minimum
Power	Most	More	Less
Delay	Most	More	Less
Speed	Less	Medium	High

VI. CONCLUSION

Ancient Indian system of mathematics, known as Vedic mathematics, can be applied to various branches of engineering to have a deeper insight into the working of various formulae. The algorithms based on conventional mathematics can be

simplified and even optimized by the use of Vedic Sutras. We have discussed one such possible application of Vedic mathematics to digital signal processing. A simple Vedic multiplier architecture based on the Urdhva Tiryakbhyam (Vertically and Cross wise) Sutra of Vedic mathematics has been presented. The hardware architecture of the Vedic multiplier is also depicted and is found to be very similar to that of the so called array multiplier. This is just one of the many possible applications of the Vedic Mathematics to Engineering and some serious efforts are required to fully utilize the potential of this interesting field for the advancement of Engineering and Technology. Although, Vedic mathematics provides many interesting Sutras, but their application to the field of engineering is not yet fully studied. Knowingly or unknowingly we always use Vedic Sutras in everyday world of technology. As an example, whenever we use $i \leftarrow i+1$ or $i \leftarrow i-1$ in software routines, we use 'Ekadhikina Purvena' and 'Ekanyunena Purvena' Sutras respectively. Similarly the Vedic algorithms can be directly applied to solve many problems of trigonometry, plain and spherical geometry, conics, calculus (both differential and integral), and applied mathematics of various kinds. Hence, the vast potential of this interesting field should be exploited to solve the real world problems efficiently.

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Mathematical and Neural Network models for prediction of wear of mild steel coated with Inconel 718 – A Comparative Study

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Abstract- Many wear models can be found in the literature to predict the type and amount of wear but there is no general wear model which can be adopted for all wear problems due to the complex and dynamic nature of the phenomenon. In the present work, an attempt has been made to study the influence of wear parameters like applied load, speed and sliding distance on the dry sliding wear of mild steel coated with Inconel 718 using pin on disc apparatus and build Mathematical and Neural Network models. A plan of experiments based on Taguchi's orthogonal array was developed to acquire data in a controlled way for different sliding distances, under different loads, and different speeds. The experimental results were used to develop mathematical model using MINITAB 13 and ANN model using MATLAB7 successfully. The validity of the modeling approaches is demonstrated by comparing the predicted results with experimental results. The predictions of these models show a good agreement with experimental values.

Index Terms- Wear, INCONEL 718, Plasma spraying, Mathematical model, MINITAB13, ANN model, Matlab7

I. INTRODUCTION

When one surface is moving relatively over another, adhesive wear occurs. The adhesive wear is proportional directly to the load applied and the sliding distance and inversely with the hardness of the metal. It is found that the adhesive wear is 15% of the industrial wear. At the microscopic level, every surface is rough and contains microscopic irregularities. When two surfaces meet, the contact takes place at these projections called asperities. When load is applied on these surfaces, stresses induced at the asperities cross the elastic limit and they deform plastically and adhere to one another. When the surfaces slide against each other, the adhesion breaks. The contacting surface which is weaker breaks and gets deposited on the other surface. Since the wear occurs at the surface, applying wear resistant coatings on these surfaces offers a solution to this problem. In this direction, plasma spray coating technology has taken a prime position as it offers wide variety of substrates and coatings for thicknesses ranging from microns to a few millimeters. For predicting sliding wear of coatings, Design of Experiments (DOE) and Artificial Neural Networks (ANN) are useful tools. DOE is a powerful statistical technique for studying the effect of multiple variables simultaneously on the output. Generally, every

system is influenced by two sets of process variables. They are controllable and uncontrollable variables. The objective of experiments is to determine the most influential controllable variables on the output response, to minimize the output variations and to minimize the effects of uncontrollable variables. The Neural Networks are found to be good function approximators in many applications. They are the data processors and the data is collected from experiments carefully designed. [Hani Aziz Ameen et al., (2011); Chandra Mouli K.V.V. et al., (2006)].

Recently, several researchers have applied Taguchi's technique and Neural Networks in their studies in engineering. Dinesh et al (2004) used a plan of experiments, based on the techniques of Taguchi to study the dry sliding wear studies on hybrid MMC's and found that sliding distance is the wear factor that has the highest physical as well as statistical influence on the wear of the composite Al2219 reinforced with SiC and graphite reinforcements. Abbas Khammas Hussein (2009), used Taguchi approach to optimize pack aluminization parameters in carbon Steel and found that the use of 4%wt. of NH₄Cl at diffusion temperature of 700°C and diffusion time of 5hr to be the optimum condition. Chandra Mouli et al (2006) used Taguchi's method to predict the optimum process parameters for prediction of optimum output from a blast furnace under the influence of seven independent parameters. Khamlichi et al (2008) applied Taguchi's method to optimize friction behavior of clutch facings using pin on disk test and friction coefficient of clutch facing materials was found to be very sensitive to the interaction between the sliding speed and temperature. An experimental design based on the Taguchi method was applied by Pascal Deprez et al (2009) to optimize the use of a dynamic sealing element of water pump of automotive combustion engines. Basavarajappa et al (2009) used Taguchi approach and studied the effect of filler materials on dry sliding wear behavior of polymer matrix composites and developed a mathematical model using linear regression model. They studied the tribological behavior of glass epoxy polymer composites with SiC and Graphite particles as secondary fillers and investigated the influence of wear parameters like, applied load, sliding speed, sliding distance and percentage of secondary fillers, on the wear rate and concluded that the inclusion of SiC and Graphite as filler materials in glass epoxy composites will increase the wear resistance of the composite greatly. Thamizhmanii et al (2007) used Taguchi's method to show that the depth of cut has

significant role to play in producing lower surface roughness followed by feed and the cutting speed has lesser role to play on surface roughness. Sujan Kumar Pal and Prasanta Sahoo (2007) applied Taguchi method in the optimization of coating parameters for surface roughness in electroless Ni-P coating of mild steel specimen and found that the optimal process parameter combination for resulting surface roughness is 80 °C of bath temperature, 17 gm/liter use of sodium hypophosphite and 30 gm/liter use of nickel chloride and nickel sulphate. Subramanian et al (2009) studied the plating parameters and developed a model using artificial neural network and also developed a mathematical model using regression model . Chandra Mouli K.V.V. et al., (2006) used Taguchi's method to predict the optimum process parameters and forecasts the outputs at these parameters using neural networks for prediction of optimum output from a blast furnace under the influence of seven independent parameters.

In the present work, a study of adhesive wear of mild steel coated with Inconel 718 and consequently, to develop Mathematical and Neural Network model is undertaken.

II. TAGUCHI'S METHOD AND ARTIFICIAL NEURAL NETWORKS

A. Taguchi's Method

Taguchi's method of experimental design is an efficient way to determine the optimum factor level combinations to achieve a minimum standard deviation (variation) while keeping the mean on the target. It is a most efficient problem-solving tool that can update or improve the performance of the product or process design and system with a sufficient experimental data. The Taguchi approach to experimentation provides an orderly way to collect, analyze, and interpret data to satisfy the objectives of the study. By using these methods, in the design of experiments, maximum amount of information for the amount of experimentation used can be obtained. Taguchi suggested the use of orthogonal arrays, which are the shortest possible matrix of permutations and combinations. The main aim of this method is that all parameters are varied, at the same time the effect on the performance and in the interactions can be studied simultaneously. The orthogonal array (OA) requires a set of well balanced (minimum experimental runs) experiments. In this method, main parameters, which are assumed to have an influence on process results, are located at different rows in a designed orthogonal array. With such an array, completely randomized experiments can be conducted. Taguchi's method uses the statistical measure of performance called signal-to-noise ratios (S/N), which is logarithmic function of desired output to serve as objective function for optimization. Three categories of S/N ratios are used: lower-the-better (LB), higher-the-better (HB) and nominal-the-best (NB). The parameter level combination that maximizes the appropriate S/N ratio is the optimal setting. The experimental results are analyzed using analysis of means and variance to study the influence of factors. Once the experiments are conducted, the results are then analyzed using analysis of variance (ANOVA). According to Taguchi method, the S/N ratio is the ratio of signal (desirable value, which is the mean for output characteristic) and the noise (undesirable value which is

square deviation for output characteristic). The units of signal and noise are in decibel (dB). The S/N ratio is used to measure the quality characteristics. Mathematically it is computed using the following relationship

$$S/N = -10 \log_{10} \left[\frac{1}{n} \sum_{i=1}^n (1/Y_i^2) \right] \quad [2.1]$$

where n is the number of variables and y_i is the value of each variable. From the tabulated S/N ratios for each level in each parameter linear graphs are drawn. Based on the highest S/N ratio, the optimum level for each parameter is obtained [Dinesh et al.(2004); Chandra Mouli et al(2006); Thamizhmanii (2007)].

B. Artificial neural networks

The Neural Networks are data processors and are non-linear mapping systems that consist of simple processors, which are called neurons, linked by weighted connections. Each neuron receives inputs and generates an output that can be seen as the reflection of local information that is stored in connections. The output signal of a neuron is fed to other neurons as input signals via interconnections. Since the capability of a single neuron is limited, complex functions can be realized by connecting many neurons. It is widely reported that structure of neural network, representation of data, normalization of inputs-outputs and appropriate selection of activation functions have strong influence on the effectiveness and performance of the trained neural network. Number of neurons to be used in the hidden layer of a neural network is critical in order to avoid over fitting problems, which hinders the generalization capability of the neural network. Number of hidden layer neurons is usually found by using trial and error approach. A neural network usually consists of three layers i.e., input layers, hidden layers and output layer, where inputs are applied at the input layer and outputs are obtained at the output layer . Since a three layer neural network is universal in the sense that essentially any function can be implemented to any desired degree of accuracy with sufficient number of hidden neurons, the neural network in this study is limited to feed forward networks. Back propagation algorithm is well known for training neural networks. The feed forward back propagation network is a popular architecture among different types of neural networks and finds applications in several areas of Engineering. [Chandra Mouli et al (2006)]

III. EXPERIMENTAL DETAILS

A. Materials

In the present study, mild steel is used as the substrate and Inconel 718 powder is used for coating material. Table 1 and Table 2 give the Chemical properties of mild steel and Inconel 718.

Table 1: Chemical Properties of MS

C%	Mn%	Si%	S%	P%
0.20	0.51	0.19	0.011	0.010

Table 2: Chemical Properties of Inconel 718

Element	Carbon	Manganese	Silicon	Phosphorus
Max	0.08	0.35	0.35	0.015
Element	Cobalt	Aluminum	Boron	Titanium
Max	1.00	0.80	0.006	1.15
Nickel	Copper	Chromium	Sulfur	Molybdenum
55.0	0.15	21.0	0.015	3.30

B. Procedure of Coating

Atmospheric plasma spray coating was used for coating mild steel substrate with Inconel 718. To remove all dust particles, the substrate was cleaned with trichloroethylene. Before plasma spraying, it was grit blasted using 24 mesh Al_2O_3 grit blasting to create enough surface roughness to ensure a strong mechanical bond between coating and substrate. Inconel 718 powder is heated to about 10000°k so that it is melted and ionized to plasma state. Then it is sprayed with a flow of 100 gm/ min using a plasma spray gun from a stand-off distance of about 5 inches with a voltage range of 40 volts, a current of 800 amps, Argon as primary inert gas with a flow of 40 lpm and hydrogen as secondary inert gas with a flow of 0.4 lpm to obtain a thickness of about 100 μ m.

C. Procedure of Coating

DUCOM, Bangalore make computerized pin-on-disc wear testing machine with digital weighing balance was used for wear test of Inconel 718 coated mild steel. To investigate the dry sliding wear characteristics, the counter surface of high carbon EN31 steel having a hardness of HRC60 was used. Pins of diameter 10 mm and height 20 mm were machined and then coated. During the test, the pin was pressed against the counter surface by applying the load and rotated. After running through a fixed sliding distance, the specimens were removed, cleaned with acetone, dried and weighed to determine the mass loss due to wear. The difference in the mass measured before and after test gives the wear of the specimen. The wear of the specimen was studied as a function of the applied load, the sliding velocity and time.

D. Data Collection

DI.For Taguchi's Method

The experiments were conducted as per the standard orthogonal array. In the present work, with factors load and time at four levels and factor speed at two levels, from the standard orthogonal arrays tables, L16 is suitable. The table is as shown in Table 3.

The wear parameters chosen for the experiment are (i) load (ii) sliding distance (iii) speed. Table 3 indicates the factors and their levels. The experiment consists of 16 tests (each row in the L16 orthogonal array) and the columns were assigned with parameters. The first column was assigned to load, second column was assigned to sliding distance, and third column was assigned to speed. Wear was the response to be studied with the objective as smaller the better and was assigned fourth column. The experiments were conducted as per the orthogonal array with

level of parameters given in each array row. The wear test results were subjected to the analysis of variance.

DII For Neural Network Model

In addition to the data collected for Taguchi's Orthogonal array, intermediate data was collected during the wear experiments. A total of 108 data was collected out of which 76 data is used to train the ANN model and the remaining was used as testing data.

E. Mathematical Model

Linear regression technique was used to study the dry sliding wear of mild steel coated with Inconel 718. The generalized linear regression equation can be written as,

$$Y = a_0 + a_1 x_1 + a_2 x_2 + a_3 x_3 + a_4 x_1 x_2 + a_5 x_2 x_3 + a_6 x_3 x_1 + a_7 x_1 x_2 x_3 \quad [3.1]$$

Y is the wear height loss. The variables x_1 , x_2 , x_3 are the load, time and speed respectively. The a_1 , a_2 and a_3 are the coefficients of the independent variables x_1 , x_2 and x_3 respectively. The a_4 , a_5 , a_6 , and a_7 are the interaction co-efficients between x_1x_2 , x_2x_3 , x_1x_3 and $x_1x_2x_3$ respectively. Since the experiments were designed for two speeds only, the main effects only are considered and interactions are neglected. After calculating each of the coefficients of equation, the final linear regression equation for the wear of mild steel coated with Inconel 718 when tested against a pin on disc set up can be expressed in the following form

$$Y = a_0 + a_1 x_1 + a_2 x_2 + a_3 x_3 \quad [3.2]$$

F. Neural Network Model

The architecture of ANN consisting of three layers is shown in Figure 1. The layer where the input patterns are applied is the input layer, the layer where the output is obtained is the output layer, and the layers between the input and output layers are the hidden layers. Hidden layers are so named because their outputs are not directly noticeable. The addition of hidden layers enables the network to extract higher-order statistics which are particularly valuable when the size of the input layer is large [Schalkoff , 1997]. Neurons in each layer are interconnected to preceding and subsequent layer neurons with each interconnection having associated connection strength. The input signal propagates through the network in a forward direction, on a layer-by-layer basis. The hidden layers add non-linearity to the system. There are many hidden layers, i.e., many levels of non-linearity and interactions. The selection of number of hidden layers and neurons in them is the most important factor to be considered while solving a problem [Aleksendric and Duboka, 2006].

In the present work, an ANN was modeled using MATLAB® (MATLAB 7.7). A feed forward back propagation network was selected which uses LMBP (Levenberg–Marquardt algorithm Back propagation) algorithm with Mean Square Error (MSE) as the performance measuring parameter. The optimization process is obtained by using a TRAINLM function. TRAINLM is a network training function that updates weights and bias values in a back propagation algorithm according to Levenberg–Marquardt optimization. LMBP is a highly efficient method for solving non-

linear optimization problems [Hafizpour, Sanjari and Simchi, 2009]. The network is a three layer network with three neurons in input layer, one neuron in output layer and 9 neurons in the hidden layer. Speed, load and sliding distance are the parameters used as input and wear height loss as output. Since best neural network architecture was unknown in advance, trial and error method was used during training process to find out number of hidden neurons which optimized the network for matching a particular input/output function. Number of neurons in the hidden layer is varied and in the optimized structure of the network, this number is 9 and the number of cycles for optimizing the network for best performance is 14.

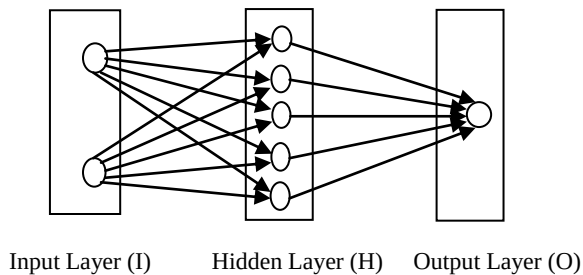


Figure 1: Architecture of three layer neural network

IV. RESULTS AND DISCUSSIONS

A. Wear test results

The wear tests were conducted using Pin on Disc tribometer in accordance with ASTM G99 standard. The speed was varied in two levels ie 200 and 400 rpm, load was varied in four levels ie 20, 30 40, 50 N and sliding distance was varied in four levels ie 339.34, 603.26, 867.19 and 1131.10 meters. To complete all the tests for all combinations, 16 tests were conducted as per the orthogonal array. The plan of tests was developed with the aim of relating the influence of load, sliding distance and speeds with the wear. On conducting the experiments, the wear results for various combinations of parameters were obtained and are as shown in Table 3.

Table 3: Wear Rate Results of All Combination of Parameters by Taguchi Approach

Load in	Sliding	Speed in	Wear in
20	339.34	200	2
20	603.26	200	4
20	867.19	400	6
20	1131.10	400	8
30	339.34	200	5
30	603.26	200	7
30	867.19	400	9
30	1131.10	400	10
40	339.34	400	9
40	603.26	400	10
40	867.19	200	13
40	1131.10	200	16

50	339.34	400	10
50	603.26	400	13
50	867.19	200	15
50	1131.10	200	18

B. Minitab Results

BI. Main Effects Plot

The main effect plot is shown in Figure 2. It is clear that the factor load has largest steep and hence has maximum effect on the wear. The optimum level for a factor is the level that gives the highest value of objective function. So the optimised parameters are at 20N, 263.93 and 200rpm where wear is minimum.

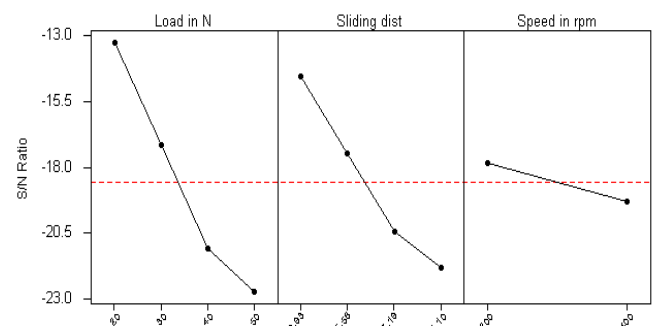


Figure 2: Main Effects Plot

BII. Analysis Of Variance

Table 4 shows the results of the ANOVA analysis. The purpose of conducting ANOVA is to determine the relative magnitude of the effect of each factor on the objective function and to estimate the error variance (F). The largeness of a factor effect relative to the error variance can be judged from the F column. The larger the F value, the larger is the factor effect. Referring to the F column of the ANOVA Table, the largest value of F is in the factor load row while the speed row has the least value of F. This means that the factor load has the greatest effect while the factor speed has the least effect on wear. The effect of sliding distance is in between the speed and load.

Table 4: Results of the ANOVA

Source	DF	Seq SS	Adj SS	Adj MS	F
Load in N	3	198.687	198.687	66.229	211.93
Sliding distance in m	3	94.688	94.688	1.563	101
Speed in rpm	1	1.563	1.563	1.563	5
Error	8	2.5	2.5	0.313	
Total	15	297.437			

BIII Mathematical model

Table 5 shows the results of Regression analysis. It helps to develop a mathematical model based on the main effects of speed, load and time. The Table 6 gives the values of coefficients of the factors in the mathematical model with R square value R-Sq = 97.7%. The general model considering the main effects is given by

$$\text{Wear} = a_0 + a_1 * \text{Load in N} + a_2 * \text{Sliding distance in m} + a_3 * \text{Speed in rpm} \quad [4.1]$$

Table 5: Regression Analysis

Predictor	Coefficients
Constant	- 6.3715
Load in N	+ 0.3125
Sliding distance in m	+ 0.0082411
Speed in rpm	- 0.003125

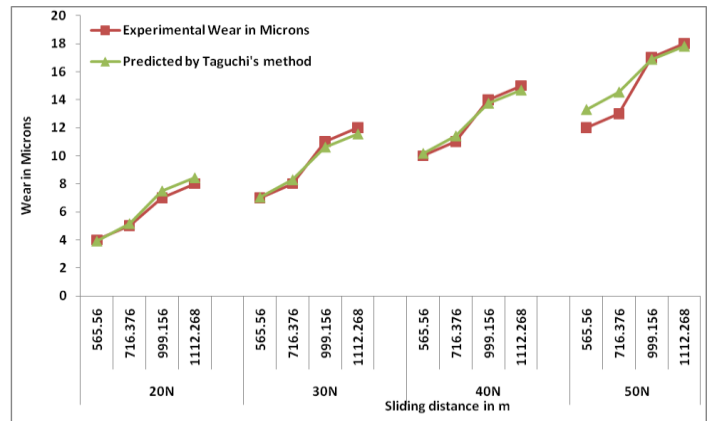
The mathematical model based on the results of regression results is given as

$$\text{Wear in micro m} = - 6.3715 + 0.3125 * \text{Load in N} + 0.0082411 * \text{Sliding distance in m} - 0.003125 * \text{Speed in rpm} \quad [4.2]$$

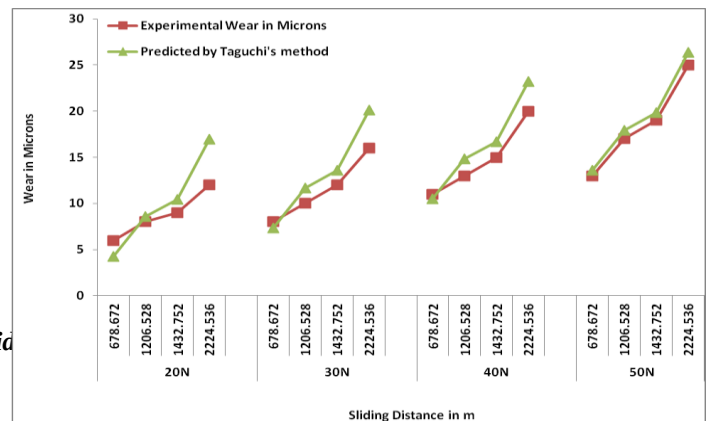
The average error on verification by comparing the experimental results with the values predicted by the above model was found to be -0.02397%.

BIV. Prediction

The prediction of mathematical model was tested with 8 data sets from the original process data. Each data set contained inputs such as speed, load, sliding distance. Predicted results were compared with experimental sets. Figure 3(a) and (b) present the comparison of predicted output values for sliding wear height loss by the mathematical model with those obtained experimentally at 200rpm and 400 rpm respectively at loads 20N, 30N, 40N and 50N. It is observed that the values of wear predicted by the mathematical model show good agreement with the experimental results.



(a) At 200rpm



(b) At 400rpm

Figure 3: Comparison graphs of experimental values of wear and values predicted by Mathematical Model

C. Artificial Neural Network

CI. Model Implementation

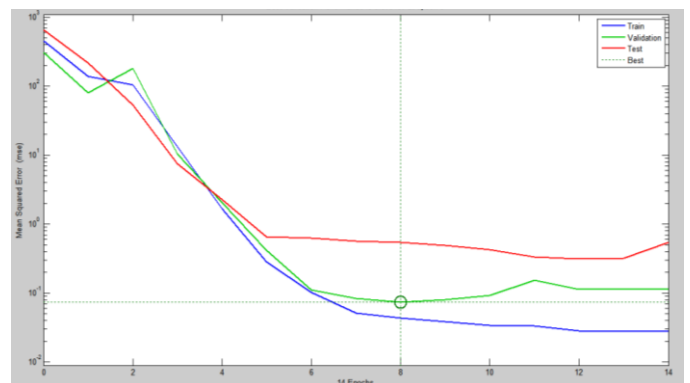
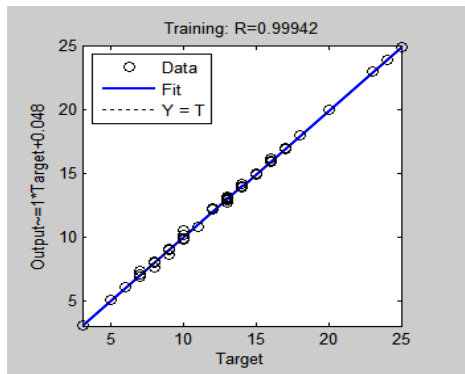
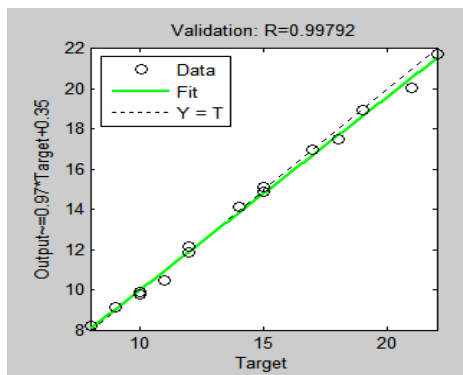


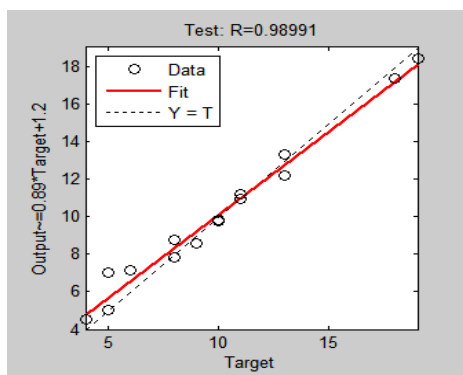
Figure 4: The Mean squared error (MSE) performance plot of ANN



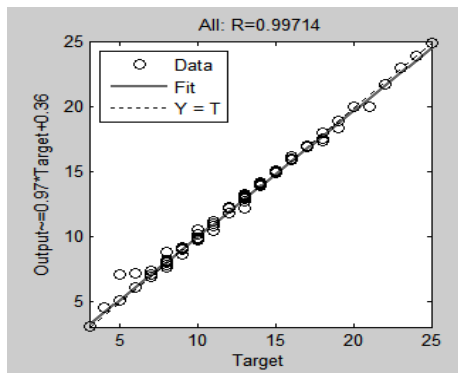
(a). Regression plot for training



(b). Regression plot for validation



(c). Regression plot for testing



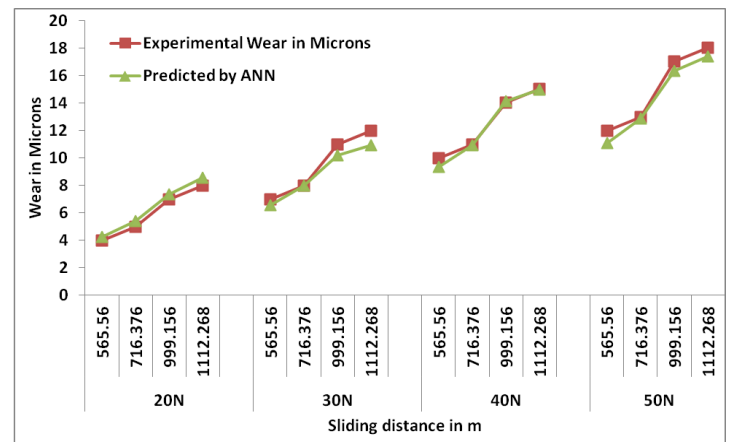
(d). Overall regression plot

Figure 5: The regression plots of training, testing, validation and average of all sets.

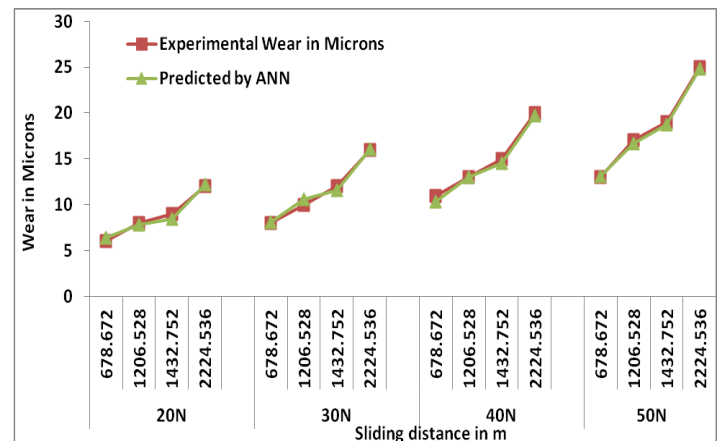
The performance of the network is shown in Figure 4. The performance is measured using MSE (Mean Square Error) over the epochs i.e., the number of iterations carried out by the network in order to achieve generalization. The ANN achieved stable state after 8 cycles of training. It is observed that the error decreases over the epochs or iterations carried out by the network during training, validation and testing. Generalization was stopped at the 14th epoch as there was no improvement. The best performance was obtained at the 8th epoch at which the MSE during training and validation was found to be 0.073437.

The results of regression plots of training, testing, validation and average of all are shown in Figures 5 (a) – (d). The plots show an average regression value of $R = 0.99714$ (a regression value close to 1) which means that the predicted values are in close relationship with the output as the data in the graphs lie on the best fit. The same can be attributed to training, testing and validation individually

CII Prediction



(a) At 200rpm



(b) At 400rpm

Figure 6: Comparison graphs of experimental values of wear and values predicted by ANN Model

The Neural network can be used to predict new results in the same knowledge domain after it is successfully trained. New input data in accordance with the experimental results are provided to the network for the prediction of wear height loss.

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Comparative Study of Compressive Strength of Bricks Made With Various Materials to Clay Bricks

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Abstract- The need for locally manufactured building materials has been emphasized in many countries of the world because of their easy availability & low cost. Bricks also have been regarded as one of the longest lasting and strongest building materials used throughout history. Ordinary building bricks are made of a mixture of clay, which is subjected to various processes, differing according to the nature of the material, the method of manufacture and the character of the finished product. After being properly prepared the clay is formed in moulds to the desired shape, then dried and burnt. On seeing the present day demand for bricks, an attempt was made to study the behavior of bricks manufactured using different waste materials like Rice Husk, Wood Ash, Fly Ash even cement was used to manufacture bricks. The main aim of this project was to compare the compressive strength of the bricks, so for this purpose different percentage of materials were separately added 4%, 8%, 12% & 16% by weight and then the compressive strength of the Bricks was established, and then with the help of graph a comparison between compressive strength of bricks, made out of Rice Husk, Wood Ash, clay, Fly Ash & Cement was determined. Before manufacturing the bricks, different properties of the materials (clay, wood ash, rice husk, cement & Fly ash) like sieve analysis, specific gravity was also verified. After that bricks were made & sun dried and some bricks were oven dried & then with the help of Compression Testing Machine (C.T.M.) finely their compressive strength was calculated. From this test in this project work it was concluded that the wood ash was that waste material, which gave the highest compressive strength. The effects of the addition of rice husk (for burning out) and wood ash admixtures by percent-clay mix was also investigated. The admixtures were added in various combinations of proportions by weight (from 4 to 16%). The wood ash admixture, in line with its pozzolanic nature, was able to contribute in attaining denser products with higher compressive strengths, higher softening coefficients, lower water absorption rates, lower saturation

Index Terms- Bricks, Rice Husk, Wood Ash, Fly Ash, Cement, Clay, Compressive Strength

I. INTRODUCTION

The need for locally manufactured building materials has been emphasized in many countries of the world. There is imbalance between the expensive conventional building materials coupled with depletion of traditional building materials. To address this situation, attention has been focused on low-cost alternative building materials. Bricks are masonry units composed of inorganic non-metallic material and are widely used as building components all over the world. The bricks could be sun-dried or burnt. Burnt bricks are usually stronger than sun-dried bricks, especially if they are made of clay or clayey material. There are different categories of the bricks, depending upon the admixtures and raw material used for making bricks. It is also common that certain admixtures are added to burnt brick raw mixes to produce different effects in the finished product. A second category of admixtures includes organic matter, such as rice husks, sawdust, coal, etc., which burn out when the bricks undergo firing. This category of admixtures serves three purposes:

1. As they burn out they leave pores in the product. This permits the control of the bulk density of brick products and help in producing lighter and more porous bricks.
2. The second purpose is that they result in more uniformly burnt bricks, especially when the firing is being done outside of factory conditions, in which case inability to reach the minimum desired temperature of 1000 °C results in un-burnt cores especially in solid bricks.
3. The pores produced as the admixtures are burnt out permit the heat to reach into the innermost part of the core, thereby avoiding un-burnt cores, while the admixtures on their own part serve as extra fuel which provides more heat for the firing.

Overall, there is a reduction in fuel and power expenditures. The temperature to which the brick is fired during burning is of paramount importance. The higher the firing temperature, the higher is the quality of the finished product. The third category of admixtures is the consolidating substances or fusing agents. These admixtures are added to increase the bond between the particles and thus the strength of the brick. Such admixtures are either cementitious or pozzolanic materials. Pozzolanic materials include the traditional lime. The recent non traditional pozzolanic

admixture used for brick production include rice husk ash, sawdust ash and wood ash. The materials which were used in bricks, their properties and different test & their compressive strength after the whole process, are described below.

II. MATERIALS USED FOR MAKING BRICKS

2.1 WOOD ASH:

Wood ash is a by-product created during the combustion of wood products for energy production at pulp and paper mills, sawmills and wood- product manufacturing facilities. Wood ash is composed of both organic and inorganic compounds. The physical and chemical properties of wood ash, which determines its beneficial uses, are influenced by species of the wood and the combustion method.

Advantages of Wood Ash Bricks:-

1. Due to high strength, practically no breakage during transport & use.
2. Due to uniform size of bricks mortar required for joints & plaster reduces almost by 50%.
3. Due to lower water penetration seepage of water through bricks is considerably reduced.
4. These bricks do not require soaking in water for 24 hours. Only sprinkling of water before use is enough.

2.2 RICE HUSK:

India has a major agribusiness sector which has achieved remarkable successes over the last three and a half decades. Rice husk a major by-product of the rice milling industry, is one of the most commonly available materials. Rice husk is an agricultural residue abundantly available in rice producing countries. The husk surrounds the paddy grain. During milling of paddy about 78 % of weight is received as rice, broken rice and bran. Rest 22 % of the weight of paddy is received as husk. India is a major rice producing country, and that's why the husk generated during milling can be easily available and can be used for bricks.

2.3 CEMENT

In the most general sense of the word, cement is a binder, a substance that sets and hardens independently, and can bind other materials together. The chemical reaction that results when the anhydrous cement powder is mixed with water produces hydrates that are not water-soluble.

2.4 FLY ASH

Fly ash is one of the residues generated in combustion, and comprises the fine particles that rise with the flue gases. Ash which does not rise is termed bottom ash. In an industrial context, fly ash usually refers to ash produced during combustion of coal. Fly ash is a waste material after burning of coal. Fly ash bricks are the stronger than other bricks. Fly ash bricks contain only cement, water and fly ash, but we are adding different percentages of fly ash in the clay brick.

2.5 CLAY

Due to the increasing cost of cement, the Forest Products and Industries Development Commission

(FORPRIDECOM) conducted a research that will produce blocks from soil and water. Clay particles because of their fineness of division must expose a large amount of external surface. There are also internal surfaces as well, the sum of which usually greatly exceeds that of a superficial character. These are the materials which we are using for different types of bricks.

III. MATERIALS TESTING

3.1 SIEVE ANALYSIS:

The grain size characteristics of soils that are predominantly coarse grained are evaluated by a sieve analysis. A nest of sieves is prepared by stacking test sieves one above the other with the largest opening at the top followed by sieves of successively smaller openings and a catch pan at the bottom.

3.2 SPECIFIC GRAVITY:

The object of the test is to determine the specific gravity of materials passing through 4.75 mm IS sieve by Pycnometer.

TABLE NO.3.1 SPECIFIC GRAVITY OF MATERIALS USED:

S.No.	Materials	Specific gravity
1	Clay	2.16
2	Wood Ash	2.16
3	Rice Husk	0.43
4	Cement	3.16
5	Fly Ash	2.31

IV. ANALYSIS & RESULTS

4.1 BRICKS COMPRESSIVE STRENGTH

TABLE NO. 4.1 COMPRESSIVE STRENGTH OF BRICKS

Percentage of materials	Compressive Strength of Clay Bricks 4.4 N/mm ²			
	Compressive Strength of Various Materials Bricks (N/mm ²)			
	Wood Ash	Rice Husk	Cement	Fly Ash
4%	5.78	3.15	5.78	2.89
8%	6.31	3.68	6.31	2.36
12%	7.36	2.10	10.30	2.10
16%	10.0	1.05	12.63	1.57

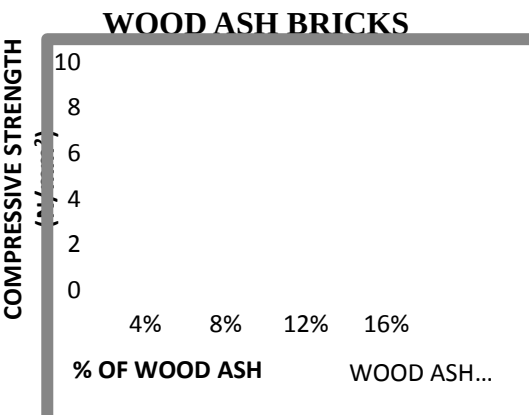


Figure 4.1: Compressive Strength of Wood Ash Bricks

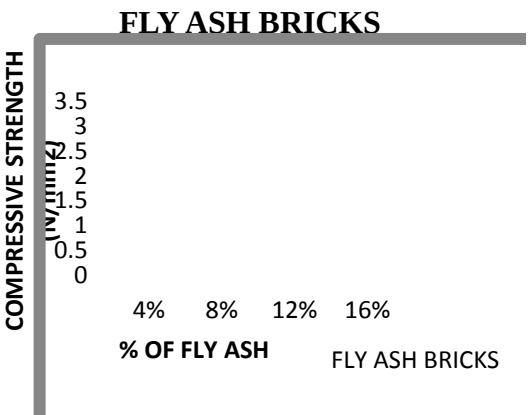


Figure 4.4: Compressive Strength Fly Ash Bricks

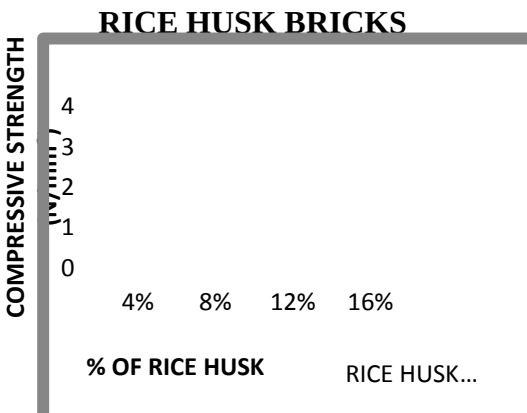


Figure 4.2: Compressive Strength Rice Husk Bricks



Figure 4.5: Fly Ash Brick



Figure 4.6: Rice Husk Bricks



Figure 4.7: Cement Brick



Figure 4.8: Weighing of Brick

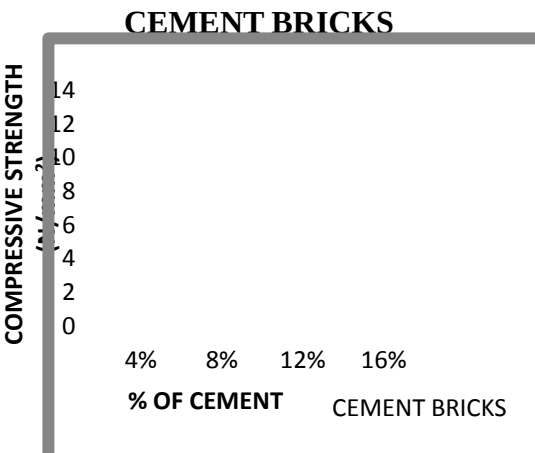


Figure 4.3: Compressive Strength Cement Bricks



Figure 4.9: Before Failure of Brick



Figure 5.0: After Failure of Brick

V. CONCLUSION

The present research replicates the effect of waste product like Rice Husk, Wood Ash, clay, Fly Ash on compressive strength of brick and following results were obtained:-

The clay bricks gave the compressive strength of 5.26 N/mm^2 , but when 4% of Wood ash was added by weight in the clay, then it gave the compressive strength of 5.78 N/mm^2 , again while increasing the percentage of wood ash as 8%, 12%, 16% by weight the compressive strength of Wood Ash brick also increases respectively $6.31, 7.36, 10 \text{ N/mm}^2$.

While different percentage of rice husk 4%, 8%, 12%, 16% was added by weight in the clay, the compressive strength of bricks decreased. In the clay, when different percentage of cement was added 4%, 8%, 12% & 16% by weight the compressive strength of bricks also increased. When different percentage of fly ash 4%, 8%, 12% & 16% was added in the clay by weight, the compressive strength of bricks decreased.

Thus from above study, this project concluded that, with the addition of waste material like wood ash in the clay, the compressive strength of bricks increases, but with rice husk & fly ash the compressive strength of bricks decreases. So for the economy purpose wood ash can be used in the place of cement.

Also when cement content was added in clay by weight, the compressive strength of bricks increased rapidly than with the wood ash. For different brick projects, we hope that this project will act as guidance in terms of compressive strength.

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Optimization of Public Transport Demand: A Case Study of Bhopal

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Abstract- Rapid growth in vehicles population has put enormous strains in all urban roads in all million plus cities in India, due to high vehicle ownership and poor supporting public transport facilities specially in the cities where the population is between 1 to 2 million. The major factor is very low ridership in public transport due to poor service quality and more traveling time. This study is concerned of assessment of public transport demand for Bhopal and identifies the major factors for poor ridership with estimation of the probable shift of personal vehicle users to bus due to the increase in its level of service also identifies ways to account for qualitative factors in the public transport project evaluation by adjusting travel time values to reflect comfort and convenience. This can help to find innovative solutions to the current problems such as increasing traffic congestion, energy-consumption etc. and can increase the efficiencies as well as support for alternative modes of public transport, making them more acceptable by the people & achieving their equity objectives and increased economic efficiency both also a new approach is required to estimate the actual public transport demand so that most feasible and suitable system can be selected to optimise the public transport demand.

Index Terms- Public transport, Optimisation Demand, Bhopal, transit demand factors

I. INTRODUCTION

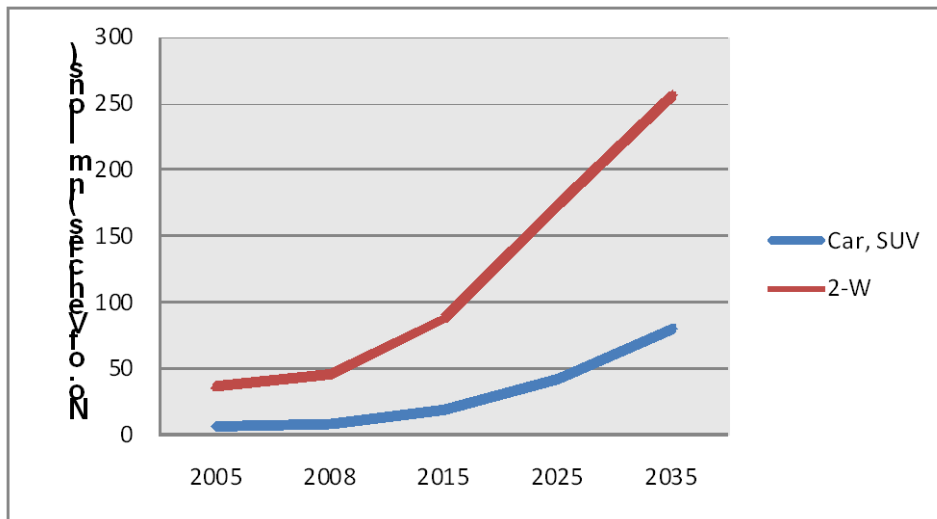
All the million plus cities in India facing a serious urban transport problems, due to the increases in population in urban areas as a result of both - the natural increase and migration from rural areas and smaller towns. The increase in the number of motorized vehicles and in the commercial and industrial activities has further added to transport demand in urban areas, as evident from **Table 1** & the corresponding **Figure 1**. In many cases, this demand has outstripped the existing road capacity. This is becoming more & more evident in the form of greater congestion and delays, which are widespread in Indian cities and indicate the seriousness of transport problems. A high level of pollution is another undesirable feature of these overloaded streets. The transport crisis also takes a human toll. Statistics indicate that traffic accidents are a primary cause of accidental deaths in Indian cities.

Table 1: Forecast of Vehicle Populations in India (in million vehicles)

Population	2005	2008	2015	2025	2035
2-W	35.8	46.1	87.7	174.1	236.4
3-W	2.3	3.0	5.3	8.8	13.1
HCV	2.4	2.9	4.6	9.1	16.2
LCV	2.4	3.2	5.7	12.5	26.9
Car, SUV	6.2	8.8	18.0	41.6	80.1
Grand Total	49.1	63.9	121.3	246.1	372.7

Source: Ministry of Urban Development, Government of India, New Delhi (2006)

Fig. 1: Forecast of Vehicle Populations in India

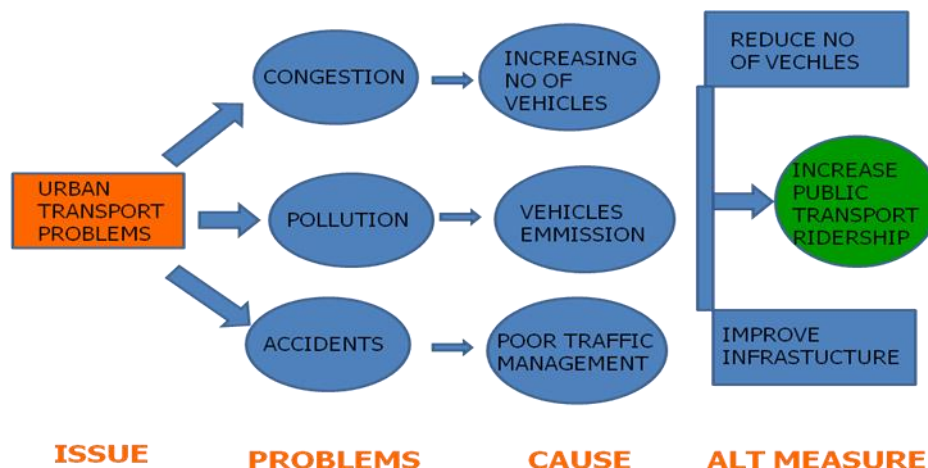


Source: ministry of urban transport 2010

The main reasons behind these problems are (i) Prevailing imbalance in modal split, (ii) Inadequate transport infrastructure, and (iii) Sub-optimal use of existing transport infrastructure. The existing public transport systems in the Indian cities have not been able to keep pace with the rapid and substantial increases in

demand over the past few decades. Particularly the bus services have much deteriorated, and their relative output is further getting reduced as passengers are continuously switching to personalized modes and intermediate public transport (Pucher J 2004).

Fig.2: Improving Urban Transport Problems by Public Transport



The above figure mention the major issue, problems cause and best alternative measure related to urban transport and shows that how public transport can reduce urban transport problem in Indian cities. These cities cannot afford to cater only to private cars and two-wheelers. There must be a general recognition that without public transport cities would be even less viable. There is a need to encourage public transport instead of personal vehicles. This requires both an increase in quantity as well as quality of

public transport and effective use of demand as well as supply-side management measures.

Hence, it is incumbent on the government to institute appropriate policy initiatives to increase the share of public transport by improving the service quality and comfort. Such interventions should identify & consider factors influencing the demand for public transport and should also quantify the impact of environmental and policy variables. Presently the public transport systems are either under crowded or overcrowded. That

means the demand measures which are used to project the actual demand are not appropriate.

In the Indian cities, the most serious traffic & transportation problems are encountered where the higher public transport facilities are found but the demand and the existing route cannot satisfy the requirements. In addition, many such available transport facilities are worn out and therefore do not satisfy the demand of passengers. There are many external and internal factors that affect the public transport demand. Whereas the external factors are associated with socio-economic development & are not subject to control (e.g. income, car ownership, population, employment, other household characteristics), the internal factors are characteristics of the public transport system and are subject to policy decisions (e.g. public transport fares, trip length, travel time and service levels).

The overall purpose of this study is to contribute to the understanding of how local public transport demand is affected by different factors. It will also identify the effect of parameters like land use, travel-time, travel-cost, accessibility, comfortability, density of study area, per capita trip-rate, affordability and flexibility onto the public transport demand. The key issues in the research will be the identification of factors influencing public transport demand and assessment of their impact on trip generation and modal split. Also, the role of these factors, i.e., how they can increase and stimulate the public transport demand so that most efficient and feasible public transport system can be introduced for the particular city, will also be looked upon so as to come up with innovative solutions for increasing the efficiencies as well as support for alternative modes of public transport.

II. PUBLIC TRANSPORT SCENARIO IN INDIAN CONTEXT

In the Indian context, the larger is the city size, the higher is the percentage of urban trips served by public transport. Thus according to this, 30 percent of urban trips are served by the public transport in cities with population between 1 and 2 million, whereas it's 42 percent for cities with populations between 2 and 5 million, and 63 percent for cities with populations over 5 million (Source: Census 2011). Thus, the especially rapid growth of large cities suggests a further rise in future demands for public transport in India.

Apart from the dependence of the urban trips on public transport based on the city size as shown in **Figure 3**, there is also a substantial variation in the public transport led urban trips among cities of the same size category. Almost 80 percent of all trips in Kolkata are by some form of public transport, compared to about 60 percent in Mumbai, and 42 percent in both Chennai and Delhi, as shown in **Figure 4**. Differences in land use and roadway supply explain some of the variation. Delhi and Chennai are lower density, more polycentric, and more spread out than Mumbai and Kolkata. Kolkata also have more restricted geographies, since both are situated on peninsulas that channel travel and land-use development in only a few directions. Such focused travel corridors especially encourage suburban rail use, as in Mumbai. Delhi has no such geographic restrictions and sprawls out in all directions. Thus, Delhi currently relies primarily on auto rickshaws, motorcycles, taxis, and private cars to serve the multi-destinational, less focused travel patterns of its residents (Pucher, J & Korattiyaropam, N 2005). Thus, apart from the city size, the demand for the public transport also depends substantially upon various geographical, transport supply & land use patterns of the city.

Fig. 3: Details of Urban Trips in Indian Cities (Based on City Size)



Source: Census 2011

In India most of transportation studies have been conducted only for metro cities in last few decades as these cities in priority in political and administrative point of view. Very few studies were conducted for small and medium towns due to their least priority

in transport sectors & the extensive transport planning was generally neglected while planning such cities.

Table 2: category wise existing Modal Split in Indian Cities (as a % of Total Trips)

City Population	Walk	Cycle	Two Wheelers	Car	Public Transport	IPT	Total
< 5 lakhs	34	3	26	27	5	5	100
5 – 10 lakhs	32	20	24	12	9	3	100
10 – 20 lakhs	24	19	24	12	13	8	100
20 – 40 lakhs	25	18	29	12	10	6	100
40 – 80 lakhs	25	11	26	10	21	7	100
> 80 lakhs	22	8	9	10	44	7	100

Source: W. Smith Association, Ministry of Urban Development, GOI, New Delhi (2008)

The Indian cities were classified in six categories for transport studies by ministry of urban development. Our study is more concern with category 3 cities of population of 10 – 20 lakhs.

Since in category 3 town rail transport is not feasible so more emphasis is given to bus transport as a public transport system.

Table 3: Classification the cities in following six categories

City Category	Population	Avg Trip Length (km)	Per Capita Trip Rate (PCTR)	No of cities
Category 1	< 5 lakhs	2.4	0.8	-
Category 2	5-10 lakhs	3.5	1	47
Category 3	10-20 lakhs	4.7	1.2	30
Category 4	20-40 lakhs	5.7	1.3	7
Category 5	40-80 lakhs	7.2	1.5	4
Category 6	>80 lakhs	10.4	1.6	2

Source: W Smith Association, Ministry of Urban Development, GOI, New Delhi.2008, census 2011

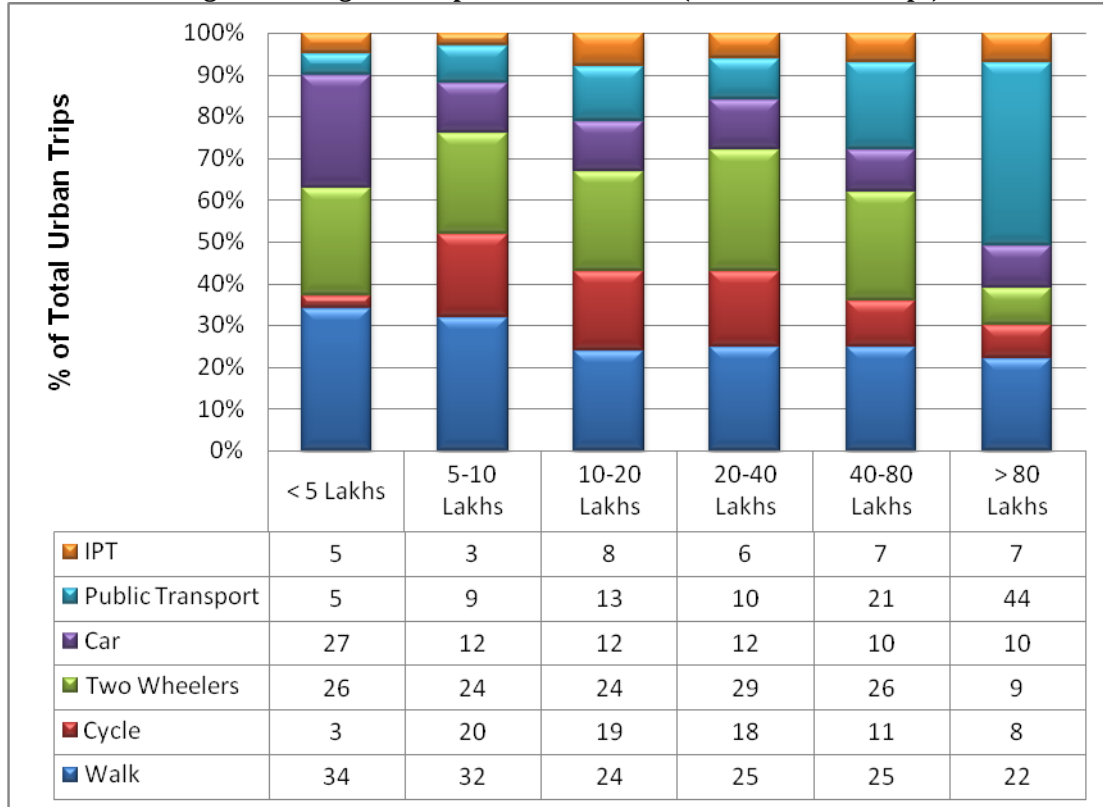
Table: 4 category wise daily trips of cities

City Category	Population	Passenger trips/day (in lakhs)			
		2007	2011	2021	2031
Category 1	< 5 lakhs	8.5	10	13.4	17.2
Category 2	5-10 lakhs	263.1	308.3	423	558.3
Category 3	10-20 lakhs	427.7	498.2	675.6	871.9
Category 4	20-40 lakhs	183.6	210.4	309.6	433.5
Category 5	40-80 lakhs	403.6	469.8	675.2	868
Category 6	>80 lakhs	992.1	1124.9	1552.4	2054.7
Total		2286	2630.4	3661.2	4819.2

Due to the urbanization and modernisation there are several cities of category 2 those will become in category 3 in near future. In those cities the best mode of public transport will be the bus transport only as they cannot meet the passenger demand of the

rail transport. So by doing the study of category 3 cities we can do the projection of demand assessment for category 2 cities in near future (Wilbur Smith Associates, 2008).

Fig. 4: Existing Model Split in Indian Cities (as a % of Total Trips)



Source: Ministry of Urban transport, GOI, New Delhi 2010

These two tables, i.e., **Table 2 & Table 5** shows that there was a huge gap of public transport share, especially in small and medium cities. So there is an urgent need to balance the desired model split. It occurred only after the introduction of JNNURM and National Urban Transport Policy (NUTP) that the emphasis was also given to small and medium towns also specially in

public transport sector. The basic emphasis was to increase the public transport share and change in ridership so that the various problems like congestion, pollution and accidents can be minimized in such cities as they have rapid growth due to urbanization and industrialization.

Table 5: Desirable Modal Split in Indian Cities (as a % of Total Trips)

City Population (in millions)	Mass Transport	Bicycle	Other Modes
< 5 lakhs	30-40	30-40	25-35
5-10 lakhs	40-50	25-35	20-30
10-20 lakhs	50-60	20-30	15-25
20-50 lakhs	60-70	15-25	10-20
50 lakhs +	70-85	15-20	10-15

Source: Ministry of Urban Development, Government of India, New Delhi (1998)

III. PUBLIC TRANSPORT SCENERIO IN BHOPAL: AN OVERVIEW

Bhopal is the capital of the Indian state of Madhya Pradesh and the administrative headquarters of Bhopal District and

Bhopal Division. Bhopal is also known as the Lake City for its various natural as well as artificial lakes and is one of the greenest cities in India.

Figure 6: Existing Road Network Pattern of Bhopal, Encircling Maximum Demand Nodes

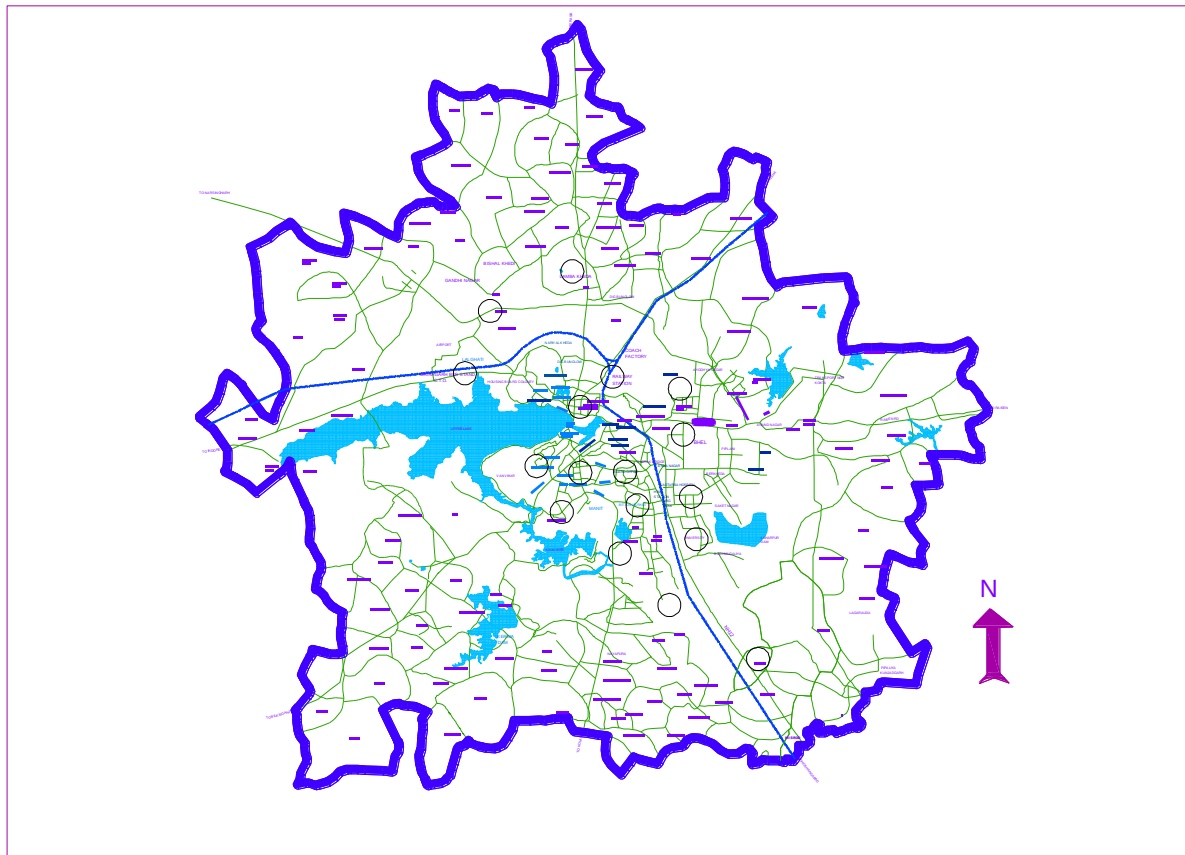


Table 6: Self contained Sub Cities of Bhopal

S. N.	Name of sub city	Estimated population (lakhs)
1	Bairagarh	2.00
2	Old city	4.00
3	Capital city (T T Nagar)	3.50
4	BHEL Township	2.50
5	Service Township (BHEL Extn)	2.50
6	Misrod	8.00
7	Neori	2.50
	TOTAL	25.00

Bhopal has a decent public transportation system comprising of buses, mini-buses, three wheeled autos and the odd looking tempos that are a major pollution concern for this growing city. Recently, under the scheme of JNNURM, a private

firm has plied a number of full-sized buses called Star-bus and Red buses in the city streets for public usage which are quite safe and fun to travel in. These have started to gain popularity and are increasing in number.

Bhopal has its own city bus service: Bhopal City Link Limited, which operates larger buses, which are under GPS

navigation and smaller Metro Buses. In addition, around 600 mini buses are run by private operators. Metro or Radio Taxis and auto-rickshaws are another major means of transport. In some parts in the old as well as new city, the new Tata Magic Vans are running successfully and have replaced the older and bigger diesel rickshaws — known as "Bhat". Bhopal is also implementing a "Bus Rapid Transit System", projected to become functional from the year 2013.

Bhopal is planned on a ring radial pattern with a hierarchical road network, as shown in **Figure 6**. The total road length in Bhopal is about 1500 km. The total road length increased from about 531 km in 1981 to about 800 km 1990-91 at the rate of 2.28 % per annum. There are 5 arterial roads of which three are national highway.

IV. ABOUT THE STUDY: ACCESSING THE PUBLIC TRANSPORT DEMAND

Today, the city of Bhopal is witnessing a major problem in the transportation front, mainly due to the following factors:

- Prevailing imbalance in modal split.
- Inadequate transport infrastructure and its suboptimal use.
- Disconnection between land use and transport planning.

As a multi functional city having & serving different roles simultaneously, an urgent need was felt to address the issue of urban transport in Bhopal, as it's a very important component for shaping urban development and providing quality transport service to the local community of the city.

The shift from private to public transportation can have numerous advantages as follows:

- **Ensures Safety-** Public transportation can be one of the safest modes of travel in the Bhopal. In fact, riding a transit bus is 91 times safer than car travel. Transit vehicle operators are highly trained to anticipate and avoid problems. Most transit vehicles are larger, newer and more substantial than autos or vans.
- **Saves Money-** Money is saved greatly in transportation costs to both highway and public transportation users. Studies have shown that public transport can save up to 2 to 3 times the money spent over private vehicles.
- **Eases Traffic Congestion-** Nearly half of all residents of the city believe traffic is a serious problem where they live, specially the people living in the space constrained Old City area. Most (about 57 percent) do not feel their commute will improve over the next three years, and nearly a quarter expect to spend more time commuting. Public transportation can help much to alleviate city's crowded network of roads by providing transportation choices.
- **Improves Air Quality-** Public transportation helps promote cleaner air by reducing automobile use, which can exacerbate smog and public health problems. For each kilometer travelled, fewer pollutants are emitted by

transit vehicles than by a single-passenger automobile. (Buses emit 80 percent less carbon monoxide than a car.) Each year, public transportation use avoids the emission of more than 126 million pounds of hydrocarbons, a primary cause of smog, and 156 million pounds of nitrogen oxides, which can cause respiratory disease.

- **Reduces Energy Consumption-** Public transportation can significantly reduce dependency on petrol, reducing auto fuel consumption by 1.5 billion gallons annually.
- **Fosters More Livable Communities-** Public transportation facilities and corridors are natural focal points for economic and social activities. These activities can help to create strong neighborhood centers that are more economically stable, safe and productive. Studies have shown that the ability to travel in an area conveniently, without a car, is an important component of a community's livability. Public transportation provides opportunity, access, choice and freedom, all of which contribute to an improved quality of life.

All this & many more can be only achieved by the effective implementation and proper working of the public transportation services in Bhopal. Thus, this study was done to access the capacity of the existing public transportation system of Bhopal, and to find the various drawbacks in the existing system and to identify the factors on which the public transport demand for the city will depend, so as to make the system more efficient.

Thus, for properly accessing the efficiency of the public transportation system of Bhopal, two surveys, namely the traffic Volume Survey, and the Origin Destination Survey along with the Occupation Survey and the Public Opinion Survey was done on various major routes of the city, so as to:

- Properly access the exact demand of the public transport,
- Check whether the existing or proposed system is sufficient, and
- Know the various measures for improving the accessibility of the public transportation system.

A number of primary traffic surveys were carried out as a part of the study. The surveys were intended to update the available data and to demarcate existing traffic flow. Traffic pattern and characteristics of intercity passenger and entering/ leaving the study area were recorded during different hours of days.

The study was confined only to the municipal boundary with some exceptional outer cordon points & the scope of work of the study consisted of the following aspects:

- Study of existing traffic and travel pattern of Bhopal by carrying out primary surveys related to existing traffic pattern of the study area & finding out the existing model split.
- Analyzing the data collected through surveys & determining the future demand generation for the public transport in study area.

- Measuring the efficiency of existing public transport system for catering the present demands of public transport.
- Identifying & categorizing various factors & parameters which effect the public transport demands.

4.1 Operational Characteristics of Existing Public Transport System in Bhopal

The average route length of the public transport system in Bhopal is about 27km. The average number of stops on any route is around 23. Out of the total stops around one forth are request stops. The above phenomenon leads to one stop after every two minute & as such, it lacks a dedicated exclusive schematic system for itself. Most of the routes pass through the Old City

Area, because of the high passenger demand directing towards this area of the city. The average number of passengers per trip comes out to be 46 per mode, whereas passengers on board at any time come out to be 14. Also, about 3 passengers either board or alight at a stop, whereas the average number of passengers waiting at a stop comes out to be 14. The most crucial data, i.e., the journey time ranges from 1 hr 5 min to 2 hr 15 min. & hence, the average journey time is calculated to be approximately 1 Hr 25 min.'s, where 50% of the time is spent either in boarding or alighting. Thus, the net travel time comes out to be 40 min.'s & the average travel speed is about 40 km's per hour.

Table 7: Existing Public Transport in Bhopal

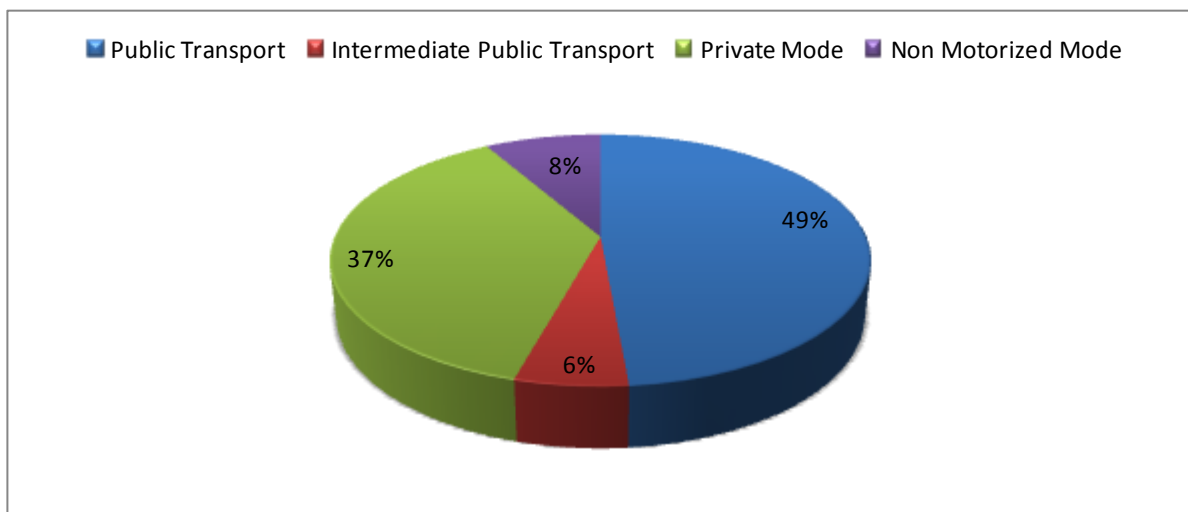
Type of Mode	Share of Passenger Trips (%)	Remarks (Total No. of Vehicles)	%
Public Transport	48.6	Standard Bus (39)	5.3
		Mini Bus (600)	31
		Tempos (450)	12.3
Intermediate Public Transport	5.7	Auto (3,000)	5.2
		Taxi	.5
		Two Wheeler (3,00,000)	34.5
Private Mode	37.4	Cars (50,000)	2.9
Non-Motorized Mode	8.3	Cycle	8.3
Total	100		100

(Source- B.M.C., 2009)

As of now, the public transit system of Bhopal is catering about 3 lakh passengers. It also amounts to around 8.6 lakh passenger's km/day. The maximum demands are observed at locations (nodes) along Hamidia Road, i.e. Bus Stand, Bhopal

Talkies, Alpana Tiraha. Habibganj Naka, Bharat Talkies, Lal ghati are other important place, which basically act as interchange between two routes, also represent high demand, as shown by small black circles in **Figure 7**.

Fig. 7: Existing Public Transport in Bhopal



(Source: B.M.C. 2009)

There are mainly ten prime corridor of traffic movement in Bhopal and some of them are as follows:

- Kamla Park - Polytechnic - Roshanpura - New Market – Board Office – Habibganj Naka – University.
- Board Office – Subhas Nagar – Khushipur on Eastern Side of Railway Station.
- VIP Road – Lalghati – Bairagarh.
- University – Misrod – Mandideep.
- Jahangirabad Police Control Room – Roshanpura – Jawahar Depot.
- Bharat Talkies – Pul Bogda – Raisen Road – Piplani – Anand Nagar.
- Mata Mandir Road – Main Road No. 3 – Kolar Road.

4.2 The Efficiency of Public Transportation System in Bhopal

Bhopal presents a classic example of a disorderly transportation environment amidst wide coverage and holding capacities of network. The problems have found their roots in the increasing urban sprawl, urbanization & the resulting haphazard growth of the city; and thus present many constraints on the way of proposing the ideal transportation system for catering the continuous increasing demands for the public transport system for the city. The transport supply demand situation is a matter of serious concern. The problems are numerous, some of them are as follows:

- Lack of integration between land use and transport.
- Concentration of activities in core areas of the city.
- Lack of effective utilization of existing road system.
- Lack of public transportation system.
- High growth rate of vehicle.
- Lack of traffic control and regulation.
- No organized parking space.
- Severe congestion and mixed traffic.

4.3 Factors Affecting the Public Transport Demand

The public transport demand largely depends on the fare

structure, service quality, operation plan, system efficiency and route allocation. These can be broadly categorized as the ones which effect public transport demand directly and others, which can play a role of catalyst, known as latent variables. Following are some of the direct and latent variables (parameters) (Balcombe, R and Paulley, N 2004):

- **Direct variables**

1. Travel Cost: cost from origin to Destination by any mode
2. Travel Time: time taken
3. Trip Length: distance from origin to destination
4. Comfort levels: posses inside and outside
5. Accessibility: approach to provide transport facilities
6. Availability of feeder services: vicinity for model interchange
7. Density: no of person per square kilometer

- **Latent variables**

1. Landuse: type of landuse
2. Income: for affordability of private and public mode
3. Per Capita Trip Rate (PCTR): ratio of total trips to total city polulation
4. Urban form and city structure:
5. System performance: efficiency of available system
6. Demographic: working population, age ratio, sex ratio
7. Social factor: income, employment, city characteristics

Several other sources like as mentioned in **Table 6**, have also identified the factors that directly or indirectly affect the Transit Ridership. More or less, these are more related to personal preferences & thus are largely subjective in nature & very diverse in nature.

Table 8: Factors Affecting Transit Ridership

Convenience	Increase transit service coverage and frequency.
Information	Provide information on where, when and how to use transit.
Price	Keep fares low and offer targeted discounts, such as commuter passes
Speed	Provide express commuter services and transit priority measures
Accessibility	Develop more accessible land use patterns and more diverse transport systems
Integration	Provide park & ride facilities, transit service to major transportation terminals.
Comfort	Provide adequate service so transit vehicles are not crowded
Security	Insure that transit vehicles, facilities and service areas are considered secure
Prestige	Treat transit riders with respect, and promote transit as a desirable travel option.

Source: (Kittleston & Associates)

Many studies have been conducted previously for identifying similar factors which directly or indirectly affect the demands of public transport & thus, can play a very crucial role in

determining the success & efficiency of a public transport system. Some of the similar studies undertaken in past by various authors/researchers have been summarized in **Table 9** as follows:

Table 9: Comparative Analysis in Different Countries for selecting Parameters Effecting Public Transport Demand

S. N	Country	Study	Parameters
1	Sweden (1999)	The Demand of Intercity Public Transport: The Case of Business Passenger by <i>Fredrik Carlsson</i>	Fare, Cost, Comfort and Reliability
2.	Bangalore India (2006)	Modeling Travel Demand in a Metropolitan City: Case Study of Bangalore, India by <i>Prem Pangotra & Somesh Sharma</i>	PCTR, Modal Split, Trip length, Population
3.	Bangkok (1999)	Analysis of Urban Travel Demand for Developing Countries by Integrating SP and RP data by <i>Dilum Dissanayake et al</i>	Travel Time, Travel Cost, Income
4.	India (2010)	Public Bus Transport Demand Elasticities in India by <i>Kaushik Deb, TERI University, New Delhi</i>	Transit Fare, Service Quality and Social Variables
5.	Shanghai, China (2006)	Study on the Demand Forecast Method for the Inter Urban Public Transport under the High-Speed Railways in Shanghai-Nanjing Corridor by <i>Prof. Rong Zhang</i>	Travel Time , Travel Cost
6	Ljubljana, Slovenia (2010)	Eva Mode Choice Model Parameters Estimation by <i>Irena Strnad, Marijan Žur</i>	Comfort, Time, Frequency
7.	Germany	Free Public Transport by <i>Herbert J Baum</i>	Fare, Travel Time, Vehicle Density, Length, Bus Kilometer
8	Great Britain (2004)	Demand of Public Transport: A Practical Guide <i>TRL Report 2004</i>	Fare Elasticity, Time and other Quality of Services, Urban Form, Income
9	Sweden (2008)	Study in Local Public Transport Demand for Sweden by <i>Johan Holmgren (2008)</i>	Time, Fare Service Qualities
10	Palestine	Ridership Demand Analysis for Palestine Intercity Public Transport	Fare, Population, Origin & Destination, Age Group
11	India, Chennai	Modeling for Optimization of Urban Transit system: A case study	Travel Time, Travel Cost and Accessibility
12	Hyderabad	Discrete Choice Model for Optimization of Urban Transit System	Travel Time, Travel Cost and Accessibility
13	England	Estimating The Demand for Urban Bus Travel by Paul Mullen	Travel time, Cost, Comfort and Convenience

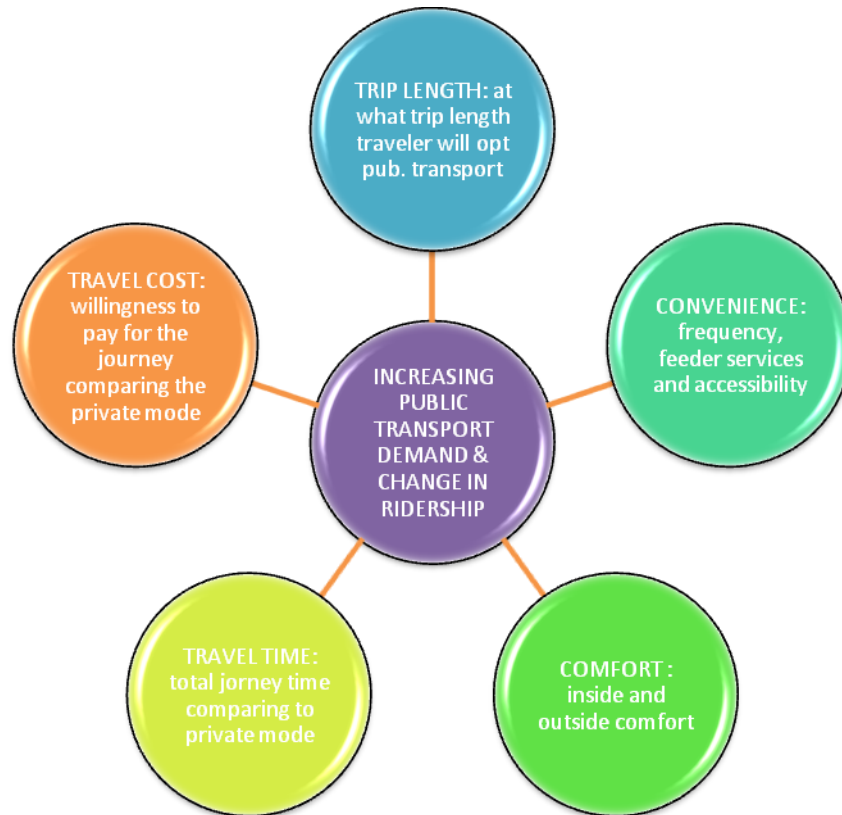
4.4 Selection of Parameters for Public Transport Demand Assessment

On the basis of previous studies undertaken in the past as mentioned in **Table 7**, it can be summarized that the public transport demand may depend on various factors, ranging from travel behavior parameters (travel cost, travel time, trip length, accessibility ratio, comfort level, frequency, convenience etc), to landuse, density, PCTR, etc. Although for the purpose & context of our study which was on the city of Bhopal, we selected only the parameters of travel behavior as they directly affected the demand generation in our context. Thus, the selected parameters

were travel cost, travel time, trip length, accessibility ratio, comfort level and convenience as mentioned in **Figure 7**. These parameters were selected on the basis of a detailed stated preference survey conducted for understanding the travel behavior of Bhopal.

- a. **Study of Travel Cost:** It basically represents the willingness of the potential user to pay for the journey as compared to what he'll pay for the private mode. As such, this is general perception that if the travel cost will increase in any of the mode, the demand for that mode of transport will decrease.

Fig. 8: Most Effective Parameters selected from the Stated Preference Survey



b. Study of Travel Time: Travel time is an important factor in the mode choice analysis. It includes egress and access time, waiting time, and journey time. Many of the factors that affect perceived travel time and unit travel time costs have significant implications for transit project evaluation. More accurate analysis tends to increase the relative value of transit improvements over a period of time.

It basically means total journey time spent in a mode of transport as compared to the time incurred in the private mode. A reduction in travel time not only adds to the value of the preferred mode, but can also be evaluated in monetary terms in the form of Time-Cost analysis; as very often, the saved time on a preferred mode of transport can result in more productive gain for the user of that transport, making the mode more preferred over others. Also, travel time can be of very important step while determining the traffic management schemes for synchronizing the existing infrastructure with the proposed one for making the public transportation system most efficient within the optimized use of energy & infrastructure.

c. Study of Comfort Level: It emphasizes on the extent of inside and outside comfort associated with the public transport system. Some examples of measures which can largely affect the comfort level are:

- The waiting areas at bus stops can be made

more clean, attractive, well-lit and accessible.

- Well maintained transit shelters can be placed at busy and/or exposed stops.
- Modern accessible buses in good repair are used to provide service so that they can be operated safely.
- Bus interiors and exteriors are clean and well-maintained with air condition facilities.

Such service quality factors can be very important but are difficult to quantify. For example, the perception that the travel in the proposed public transport system is unsafe or stigmatized (i.e., transit riders feel that they are treated with disrespect by operators or their peers) can significantly increase travel time or unit costs and discourage that transit use. It is quite difficult to monetize these attributes and results may vary depending on how questions are phrased and who is surveyed.

Some more steps which can be used for increasing the comfort level related to the public transport system are as follows:

- Increasing adequate space, comfortable temperature, cleanliness, quiet, and ensuring smooth vehicle movement.
- Improving walking and waiting conditions.
- Reducing waiting time.
- Increasing travel speeds and reliability.
- Improving user information (schedule

information, transit vehicle arrival time, route guidance, easy to understand announcements etc.).

- Informing the passengers of problems, delays, and expected arrival times.
- Increasing perceived safety and security.
- Improving transit travel respect and prestige.

d. Study of Convenience: Whereas studying the comfort emphasized on the extent of inside and outside comfort associated with the public transport system, the convenience emphasized on the attributes like the frequency, feeder services and accessibility. Thus, the steps which determine the good convenience of a public transport system can be like:

- Provision of a network of well-maintained sidewalks for providing access to transit stops.
- Ensuring that the stop platforms and shelters are well designed and maintained in good repair.
- Easily accessible buses are used for providing service.
- Service schedules identify the trips operated by accessible buses.
- Allowing wheelchair access to regular transit.

e. Study of Trip Length: It basically means identifying the minimum trip length above which the traveler will opt public transport over the private mode. It's only up to a certain extent, that the private mode remains the preferred choice for the user, above which the user prefers or can afford the public transportation system even on the costs of other parameters. Thus, a properly considered trip length can hugely affect the observed demands for the public transport services for an area &

if managed properly, can significantly increase the efficiency as well as trustworthiness of the public transportation.

f. Accessibility: It is concern of approach and availability of public transport facilities. The demand of public transport is highly depend on the distance for the availability of bus transit facilities, this is general perception that if the public transport is available up to 500 meters which is comfortable distance for walking the bus ridership will be high if the distance is more than 500 meters then the demand for public transport will decrease.

V. FINDINGS OF THE STUDY

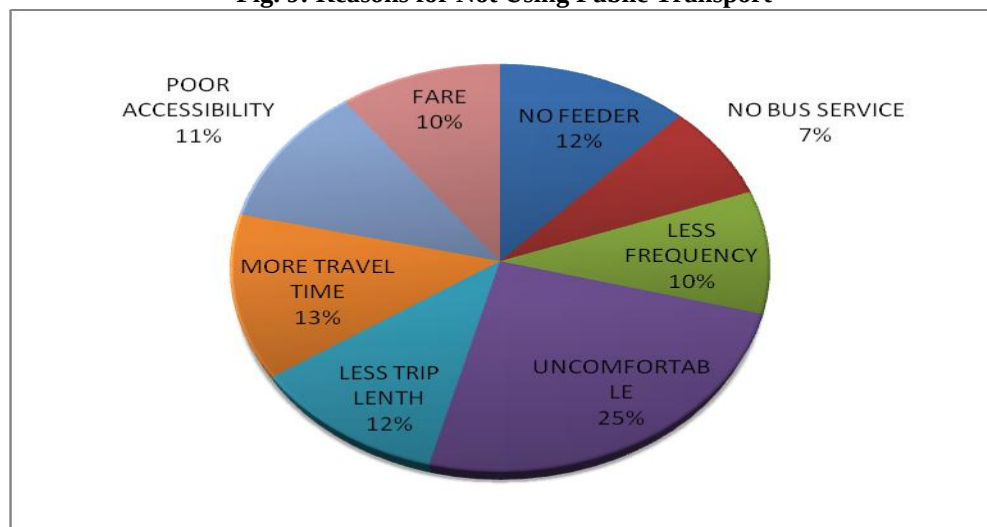
On the basis of above parameters a stated preference opinion survey was conducted at 16 locations spread all over the city of Bhopal on major nodes or hubs of transportation activities mainly to understand the reason for not using public transport system and also to identify the cost at which they will ready to shift their mode.

Figure 9 shows that the observed reasons for not using public transport. The population wasn't using the existing public transportation system mainly due to:

- (i) Poor accessibility (11%),
- (ii) Uncomfortable (25%),
- (iii) Less frequency between trips (10%),
- (iv) More waiting time (12%),
- (v) More travel time (13%) compared to owned vehicle,
- (vi) No feeder services (11%).

Hence the major reasons for not using public transport came out to be low accessibility, less comfort & more travel and waiting time as compared to the private transport modes.

Fig. 9: Reasons for Not Using Public Transport



Source: primary survey conducted on 2011

The analysis of opinion survey also showed that nearly 50% of people who were not using public transport were doing so because of less convenient travel, more incurred travel time, less frequency between the successive trips and lack of accessibility in the modes of public transport.

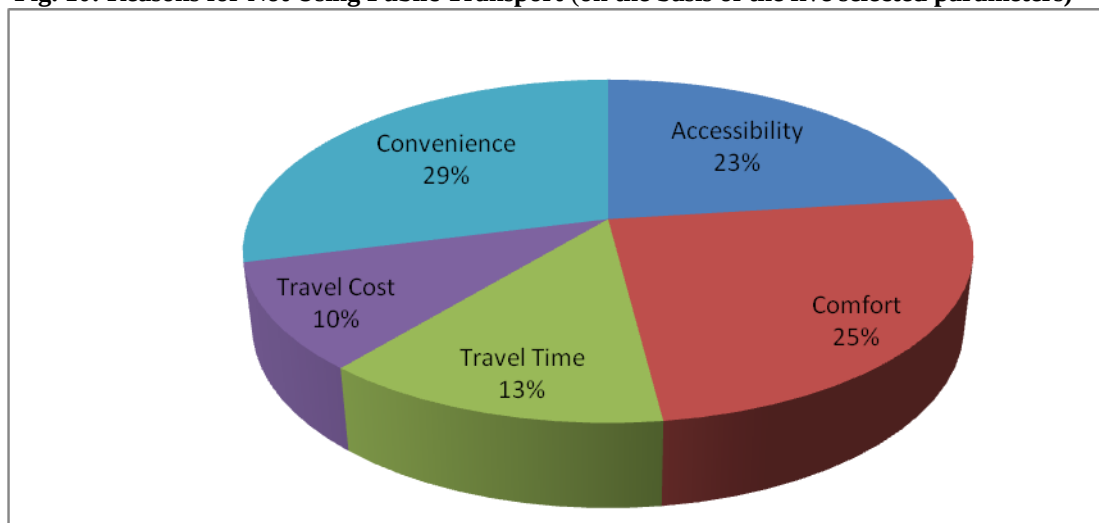
The findings of the study revealed that the problems with the existing public transport system being operated in the city is basically location dependent, i.e., on moving from one area to another, the attributes or reasons which determined the parameters for not using the public transport system varied significantly, thus showing the lack of synchronization between the existing operated transport systems. Upon further categorizing these attributes, it was revealed that the basic lacunas which significantly affected the overall efficiency of the public transport system & directly determined the demand generation in an area were broadly under the same five aforementioned parameters, namely the travel time, travel cost, comfort, convenience and accessibility.

However, due to the fact that the city of Bhopal is spread over a large uneven terrain having many areas of varying topography, during surveying it was felt that the trip length parameter taken alone could not suffice its individuality as all other parameters because the uneven terrain often posed numerous problems for the users & largely affected/determined his travel behaviors both in long & short distance trips. For example, due to a steep slope present in the Roshanpura Square, a majority of buses often avoided that steep climb & preferred to go on the alongside route, forcing the user to choose private vehicle to traverse on that route. However, if the user had to take his private vehicle for getting to the nearest bus stop, he then preferred going to his destination via his private mode itself due to unavailability of 'Park & Ride' styled bus stops. Furthermore, due to these steep slopes present in various parts of the city, users

were forced to depend significantly over the feeder services so as to make use of the available public transport system. Thus, this parameter of trip length was submerged into the accessibility parameter also taking along the 'no feeder services' parameter, as the accessibility to the existing public transportation system largely affected both the demand as well as the trip length of the user. Also, 'less frequency between trips', 'no bus service' & 'more waiting time' was considered to be included in the 'convenience' parameter as these three largely determined the convenience factor of the existing public transport system.

Thus, upon categorizing the reasons for not using the public transport under the five selected parameters, they came out as represented in **Figure 10**. As such, this study revealed that the major reason for not selecting the public transport system was the convenience, closely followed by the comfort & accessibility. It also revealed that the issues related to travel cost & travel time were not that significant in the case as they remained significantly low, being just 10% & 13% respectively. This clearly highlights that the most demand affecting parameters are related to the lacunas due to the inefficiency of the existing public transport system to properly cater & manage the existing demand as well as the transport system properly. It also showed the major hurdles to be overcome related to the synchronization of various different modes of public transport & highlighted the need to emphasize demand management strategies. Contrary to many assumptions which predicted travel cost & travel time to be the most responsible parameters affecting the demand, this study revealed that although they do have a major role to play, but given the other parameters like the comfort, accessibility & convenience are good, people are willing to prefer public transport over the private modes, thus solving most of the traffic related issued of Bhopal.

Fig. 10: Reasons for Not Using Public Transport (on the basis of the five selected parameters)



VI. CONCLUSIONS

We infer that in the context of Indian cities, the

dependence of the urban trips on the public transport is based on numerous parameters like the city size, geographical considerations, land use & functional segregation of activities

over the city. Also, due to the previous negligence in the transport planning exercise in case of Small & Medium Cities, there is an absolute need of complete overhauling of the existing transport facilities in these cities, especially in the public transport facilities, so as to make the system efficient for fulfilling the arising transportation demands in the cities & to make them competent for addressing the future demand projections. Also, it'll not only make the existing system efficient, but can also lead towards making the future public transport systems more acceptable & can help in switching the people towards alternative modes of transport.

Bhopal is developing majorly along the highway. New settlements are taking shape in the outskirts of the city. Stated preference survey showed that there is a huge demand of public transport but services are very limited. So, there is a need to develop a comfortable and efficient public transport system along the corridor especially newly developed areas so that people are used to travel by public transport only.

The proposed public transportation system for the city of Bhopal, due to the space constraints which it poses in the Old City area which generated a high demand, should be selected with an aim to cater the total maximum total travel demand to ensure the optimum use of the existing road infrastructure in a cost effective manner. For this purpose, the possibilities of a combination of alternative high capacity public transport system should be evaluated with an aim of providing an integrated multi-modal mass rapid transport system, which can work well in the existing space & infrastructure constrained Old City area, synchronizing itself with the proposed Mass Transit System in the New Bhopal area.

In enabling the economic efficiency, social cohesion & the physical integration of an urban area, transport has a very important and a key role. In developing the comprehensive transport system plan for the urban area of Bhopal, the following objectives have been identified till now, which should be appropriately fulfilled so as to achieve the desired results:

- To improve the mobility of the people and of the goods.
- To improve accessibility to opportunities in an economic and equitable basis.
- To enable function and spatial integration amongst the activities (land use) distributed over the city.

Study of stated preference shows that the public transport demand responses most sensitive on travel time, accessibility and convenience. Consequently it can be elaborated the effort on reducing travel time and more convenience with proper accessibility to attract more public transport ridership. Other factors like comfort level, frequency, headway, feeder service and fare will also consider for optimisation of public transport demand for Bhopal and similar million plus cities (Muthukannan et al. 2008).

6.1 Strategies to Achieve the Desired Public Transportation Share

Following are some of the proposed strategies for achieving the desired public transport share among the total

generated urban trips:

- a) **Subsidized Public Transport:** The fare levels in the public transport modes should be targeted to be affordable to a larger percentage of population specially, the lower income group.
- b) **Strengthening and Optimization of Bus Services:** In order to provide quick, convenient and economic service, measures like reserved bus lanes, priorities at intersection and good terminal facilities to improve turn round time should be undertaken.
- c) **Organized Public Transportation System:** A planned public transport system in terms of routing, scheduling and ticketing system would help in attracting more passengers.
- d) **Accessibility to the System:** The system can be made more accessible by expanding its influence area, reducing the walking time and proper information system.
- e) **Disincentives for Private Mode Users:** Taxation on motorist, high parking charges and other such ways should be introduced to discourage the use of private mode of transport.
- f) **Specific Bus Services:** Bus services targeting people from particular origin or destination can also help in increasing the share of public transport.
- g) **Special Consideration:** Consideration of various sections of society such as women, aged people, handicapped etc. while designing the public transportation infrastructure can also immensely help to increase its share.
- h) **Interchange facilities:** Provide major interchanges for bus services as in metro trains in Delhi, with proper parking space and informative services

Apart from these, there are many other possible ways to improve the transit service quality, including reduced crowding, increased service frequency, nicer waiting areas and better user information. Some more measures to improve the comfort ability & the convenience factor are as follows:

- Improving vehicle comfort and cleanliness.
- Increasing service frequency to reduce wait times and vehicle crowding.
- Improving wait areas and nearby walking conditions, including development of transit stations and shelters, and transit-oriented development.
- Improving boarding ease and speed, with pre-paid fare collection, wider doors and more convenient loading areas.
- Increasing fare options, discounts and passes purchased through work, school and communities, and for shoppers (similar to merchant-paid parking).
- Integrating fare systems, allowing free or discounted

transfers between routes and modes.

- Improving user information, customer service, and marketing programs.
- Parking pricing, parking cash-out, commute trip reduction programs, and similar programs that promote use of alternative modes.
- Modal integration, with transit service coordinated with walking and cycling facilities, taxi services, intercity bus, and delivery services (to facilitate shopping by transit).
- Improving accommodation of people with special needs, including people with physical disabilities, poor vision and difficulty reading signs.
- Improving security for transit users and pedestrians.

Because discretionary passengers (people who have the option of driving) tend to be particularly sensitive to service quality, these strategies often increase public transport ridership and can immensely reduce automobile traffic. Although few motorists want to give up driving altogether, many are willing to drive less and rely more on alternative modes, provided that those alternatives are comfortable, convenient and reliable. Improving transit service quality can therefore, as mentioned in **Transit Service Quality Improvement Benefits** (Litman 2005), provide many more benefits like:

- a) Benefits existing transit passengers (who would use transit even without the improvements).
- b) Benefits new transit passengers (who would only use transit if service is improved).
- c) Benefits society by reducing traffic problems (congestion, roadway and parking costs, consumer costs, accidents, energy consumption and pollution emissions).
- d) Benefits from economies of scale (increased ridership can create a positive feedback cycle of improved service, increased public support, more transit-oriented land use, and further ridership increases).
- e) Benefits transit agencies by increasing fare revenue.

6.2 Alternative approach to estimating bus transport demand

To estimate the bus passengers demand have always been important to service providers and bus operators. Forecasting public transport demand by conventional methods requires massive data and long time. So there is a need of such kind of models in general or city specific based on most effective parameters on which transit demand depends. Present study is the part of a research study to development a model for optimisation of public transport demand for Indian million plus cities.

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Impact of Relay Nodes on Performance of Vehicular Delay Tolerant Network

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Abstract- The main aim of this paper is to design and implement different protocols for the VDTN and also check the performance of the same. Here in this paper we will be developing and showing the result for Spray and wait protocol. Here we have to create a vehicular delay tolerant network for spray and wait protocol. We have to show that as the number of relay nodes increases the number of connectivity opportunities increases which in terms increases message delivery probability.

Index **Terms-** Message delivery
probability,Contacts,Average delay

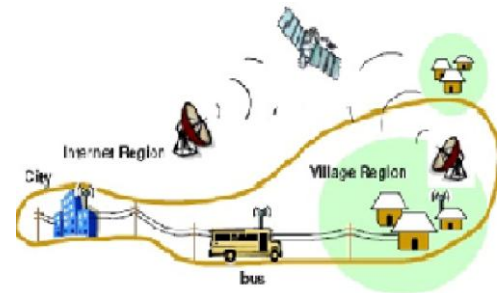


Fig 1: DTN model

I. INTRODUCTION

Wired and wireless networks have enabled a wide range of devices to be interconnected over vast distances. For example, today it is possible to connect from a cell phone to millions of powerful servers around the world. As successful as these networks have been, they still cannot reach everywhere, and for some applications their cost is prohibitive. The reason for these limitations is that current networking technology relies on a set of fundamental assumptions that are not true in all environments. The first and most important assumption is that an end-to-end connection exists from the source to the destination, possibly via multiple intermediaries. This assumption can be easily violated due to mobility, power saving, or unreliable networks. For example, if a wireless device is out of range of the network, it cannot use any application that requires network communication.

A. Delay Tolerant Network

Delay tolerant network (DTN) is a type of wireless mobile network that does not guarantee the existence of a path between a source and a destination at any time. When two nodes move within each others transmission range during a period of time, they contact or meet each other. When they are out of each others transmission range, the connection is lost. The message to be delivered needs to be stored in the local buffer. The message delivery in this kind of network is multi-hop and the connection between nodes is non-predictable [2]. One of the major properties of delay tolerant networks (DTN) is that there does not always exist a complete path from a source to a destination. What all existing communication solutions in DTN share in common is that mobile nodes must be exploited

to carry messages around the network to overcome path disconnection, which refers to store-carry-and-forward scheme. Most solutions for routing in DTN are reactive approach, where nodes rely on their inherent movements to disseminate data when nodes encounter each other. Due to unpredictable mobility, this random behavior leads to low delivery rates and large delays [3]. Examples of this sort of network include inter-planetary networks, wildlife tracking and habitat monitoring sensor networks, and etc [4]. DTNs deal with communication in extreme and performance-challenged environments, where continuous end-to-end connectivity cannot be assumed. In a DTN, nodes use opportunistic connectivity over intermittent links for communication. Such opportunistic links are generally provided by mobile routers. They offer connectivity by acting as data mules to carry data to and from servers with continuous network connectivity (i.e., Internet access). There are many applications for DTNs. In developing regions, especially rural areas, they can be used to provide network access for education, health care or government services. They can also augment low bandwidth Internet connections to transfer large files at low cost, while using the Internet connection for control messages. DTNs are also applicable in vehicular ad-hoc networks and undersea communication [8].

Fig 1 shows a hypothetical village served by a digital courier, a wired dialup Internet connection, and a store-and-forward LEO satellite .These satellites have low to moderate bandwidth (around 10 Kbps) and are visible for 4-5 short periods of time passes per day (lasting around 10 minutes

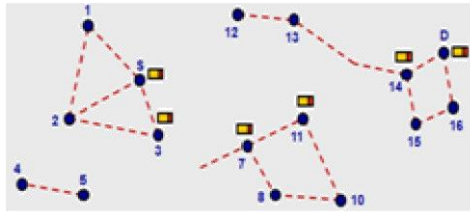


Fig.2: Spray and wait method

per pass, depending on the orbit inclination and location on Earth). We call the opportunity to communicate a contact, which is characterized by duration of time, a capacity, and a propagation delay. In addition, depending on the type of connection used, buffering constraints may also need to be considered. The digital courier service represents a high-bandwidth, high latency contact, the dialup represents a low-bandwidth, low-latency contact, and the LEO satellite represents a moderate-bandwidth, moderate-latency contact. The problem of selecting which contacts to carry messages and when represents an instance of the DTN routing problem. Route selection may depend on a variety of factors including message source and destination, size, time of request, available contacts, traffic in the system, or other factors [9].

II. ROUTING IN DELAY TOLERANT NETWORK

This method consists of two phases Spray phase: For every message originating at a source node, message copies are initially spread forwarded by the source and possibly other nodes receiving a copy to distinct relays. Wait phase: If the destination is not found in the spraying phase, each of the nodes carrying a message copy performs direct transmission (i.e. will forward the message only to its destination).

III. PROPOSED WORK

Delay Tolerant Networks (DTN) are a class of networks de-signed to address several challenging connectivity issues such as sparse connectivity, long or variable delay, intermittent con-nectivity, asymmetric data rate, high latency, high error rates and even no end-to-end connectivity. The DTN architecture adopts a store-and-forward paradigm and a common bundle layer located on the top of region-specific network protocols in order to provide interoperability of heterogeneous networks (regions). In this type of network, a source node originates a message (bundle) that is forwarded to an intermediate node (fixed or mobile) thought to be more close to the destination node. The intermediate node stores the message and carries it while a contact is not available. Then the process is repeated, so the message will be relayed hop by hop until reaching its destination.

A. PROPOSED WORK

The main aim of the project is to design and implement different protocol for the VDTN and also check the performance of the same. Here in the project we will be developing and comparing the results for two different protocol namely Epidemic and Spray and wait protocol. Here we have to create a vehicular delay tolerant network for two main protocols epidemic and spray and wait. We have to show that as the number of relay nodes increases the number of connectivity opportunities increases which in terms increases message de-livery probability. Then we compare both methods for message delivery probability and message average delay for different relay nodes.

B. Vehicular Delay Tolerant Network Model

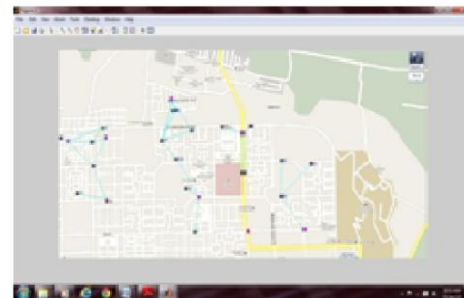


Fig.:3 VDTN model

In this project we exemplify the use of a Vehicular DTN (VDTN) to provide asynchronous communication between mobile nodes and relay nodes, on an part of a city (Fig 3). Mobile nodes (e.g., vehicles) physically carry the data, exchanging information with one another. They can move along the roads randomly (e.g. cars), or following predefined routes (e.g. buses). Relay nodes are stationary devices located at crossroads, with store-and-forward capabilities. They allow mobile nodes passing by to pickup and deposit data on them. We can also envision the possibility for the relay nodes to be able to exchange data with each other, and at least one of them may have a direct access to the Internet

C. Flowcharts

In these section flowcharts of algorithm is displayed.



(a) S and W protocol

(b) S and W protocol

Fig.5: VDTN model

The network model considered in our scheme consists of number of mobile nodes and relay nodes communicating with each other. We simulate using MATLAB tool. The network model is shown in fig

Simulation of system is highly considered because it may be too difficult, hazardous, or expensive to observe a real, operational system. Simulations help us to, analyze systems before they are built, reduce number of design mistakes, optimize design, analyze operational systems, create virtual environments for training, entertainment etc.

The following simulation input parameters are used in evaluating the performance of our proposed work.

Total mobile nodes(cars) $N = 25,50$ Total relay nodes (constant) $R = 10$ Car and car range = 60

Relay and car range = 150

Distance between two relay node = 100 Buffer size of car 150 MB

Buffer size of relay 500 MB message size 500 KB

Number of cars generates message per unit= 3 Total time 10 hours

Simulation time 200 units

In our scheme, we use a MATLAB tool to simulate our proposed scheme. N number of mobile nodes is generated. R number of relay nodes is generated. Set buffer size of relay as 500MB. Set buffer size of car as 150MB. Distance between two relay nodes as 100 units. Calculate distance between relay and car. Setup a communication path between car and relay, car and car. If relay is in the range of car exchange information. If car is in range of another car exchange information. Calculate total number of contacts. Calculate total received messages. Calculate total number of transmitted messages.

A computer simulation is a computer program that models the behavior of a physical system over time. Calculate message delivery probability using $MDP = \frac{\text{received messages}}{\text{transmitted messages}}$ Calculate average delay.

[illegible]

Fig.6: Spray and Wait Protocol.

Above fig 6 shows the snapshot for the coding results for Spray and wait protocol. As shown in the figure above we can see the time instant and the number of message transmitted to the nearby vehicle using the relay node in the design.

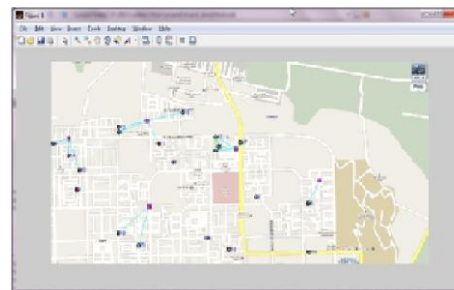


Fig.7: Map for spray and wait protocol.

Above fig 7 shows the snapshot for the map in spray and wait protocol. As shown in the figure above we can see the message is transmitted to different cars through relay. Pink color box represents a relay node and black color circle represents car. Blue line between two node represents the communication link.

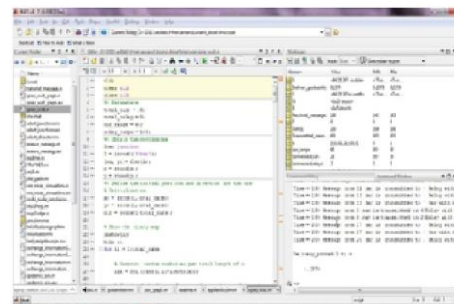


Fig 8: spray and wait protocol.

Above fig 8 shows the snapshot for the coding results for Spray and wait protocol. As shown in the figure above we can see delivery probability for network which is 0.2379.

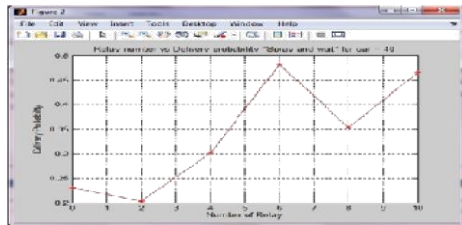


Fig 9: Snapshot for Delivery probability against number of node.

Above fig 9 shows the Snapshot for Delivery probability against number of node. We can conclude from the graph that the probability of delivery increases the total number of relay nodes in the network increases.

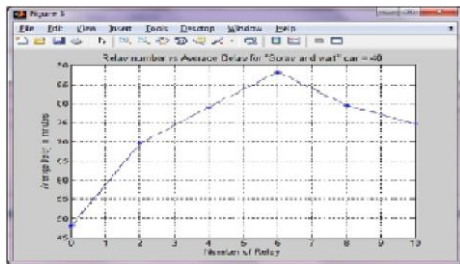


Fig 10: Snapshot for average delay in delivery of message against number of node.

Above fig10 shows the Snapshot for delivery of message against total number of nodes. We can conclude from the graph that the probability of delay in minutes is directly proportional to the total number of relay nodes in the network.

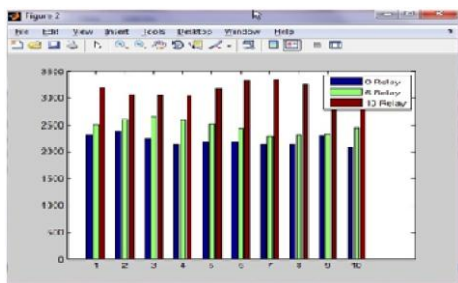


Fig 11: Contact graph for spray and wait..

Above fig 11 shows the Snapshot for delivery of message against total number of nodes. We can conclude from the graph that the probability of delay in minutes is directly proportional to the total number of relay nodes in the network.

VI. CONCLUSION

In this project we studied impact of relay nodes on a VDTN applied to an urban scenario. It was assumed a cooperative

opportunistic environment without knowledge of contact opportunities. The motivation for this work comes from the idea that placing relay nodes at crossroads allows data deposit and pickup by passing mobile nodes, which will increase the delivered messages (probability) to the final destination. Several simulations were conducted varying the number of mobile nodes, and deploying a different number of relay nodes in predefined map locations. It was observed that relay nodes significantly improve the message delivery probability on the routing protocol.

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Application of Genetic Algorithm in Graph Theory

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Abstract- In this paper, we address a single machine family scheduling problem where jobs, each characterised by a processing time and an associated positive weight, are partitioned into families and setup time is required between these families. For this problem, we propose a genetic algorithm using an optimised crossover operator designed by an undirected bipartite graph to find an optimal schedule which minimises the total weighted completion time of the jobs in the presence of the sequence independent family setup times. The proposed algorithm finds the best offspring solution among an exponentially large number of potential offspring.

Index Terms- Genetic algorithm, single machine scheduling

I. INTRODUCTION

Genetic algorithms are search algorithms based on the mechanics of natural selection and genetics. They combine survival of the fittest among string structures with a structured yet randomized information exchange to form a search algorithm with some of the innovative flair of human search.

The central theme of research on genetic algorithms has been Robustness, the balance between efficiency and efficacy necessary for survival in many different environments. The normal action of GA is to combine good individuals with characteristics to produce better.

Genetic algorithm optimizers are robust, stochastic search methods modeled on the principles and concepts of natural selection and evaluation.

PRELIMINARIES:

Definition 1

A simple genetic algorithm that yields good results in many practical problems is composed of three operators.

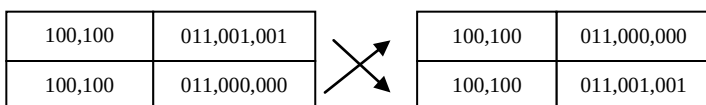
• Reproduction

Reproduction is a process in which individual strings are copied.



• Crossover

Crossover is a process of changing one type to the next type.



• Mutation

Mutations creates a sudden bit change.

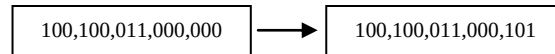


Figure 1

Definition 2

The objective function defining the optimization goal called a fitness function in the GA $[f: c \rightarrow R^+]$.

The mutation operator provides a means for exploring portions of the solution surface that are not represented in the genetic makeup of the current population.

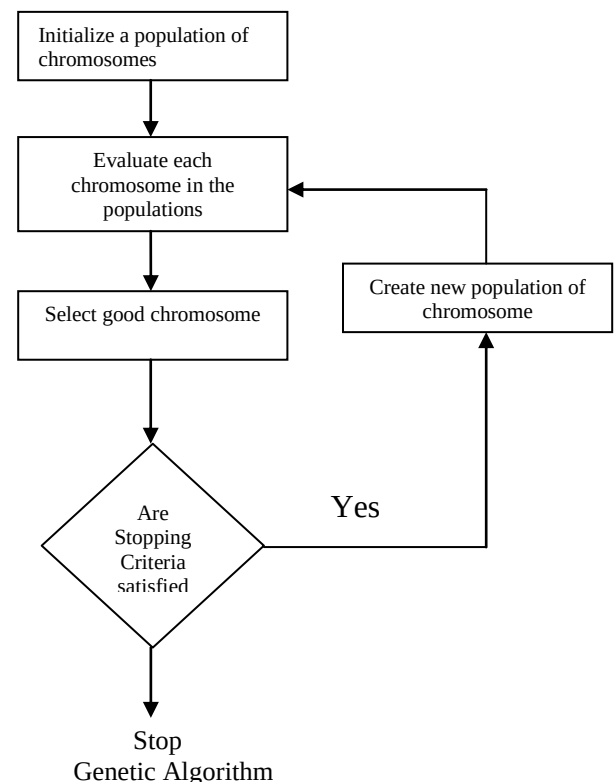


Figure 2

Definition 3

A natural way of encoding the problem would be to present each solution by a bit string. We use a binary $\{0,1\}$ representation that is proposed by Mason. Using this binary representation we can define the partition of families into

batches, where '1' means the first job in a batch and '0' means a contiguously sequenced job in a batch. The length of the individual corresponds to the number of jobs N .

Definition 4

The fitness function is used to evaluate the individuals which are introduced into the population. We define the fitness function using the property of SWPT (Shortest Weighted Processing Time) rule for batches developed by Mason and Anderson, in which there exists an optimal schedule that the batches appear in SWPT order. As mentioned earlier, a batch is a maximum group of contiguously scheduled jobs with in a family. A sequence independent family setup time S_f , is required at the start of the schedule and also whenever there is a switch in processing jobs from one family to jobs of another family.

Definition 5

A linear graph $G = (V, E)$ consists of a set of objects $V = \{v_1, v_2, \dots\}$ called vertices and another set $E = \{e_1, e_2, \dots\}$, whose elements are called edges. A graph that has neither self-loops nor parallel edges is called a simple graph.

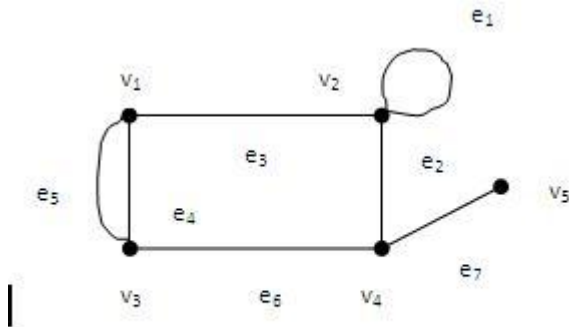


Figure 3

Definition 6

A graph G is called bipartite if its vertex set V can be decomposed into two disjoint subsets V_1 and V_2 such that every edge in G joins a vertex in V_1 with a vertex in V_2 .

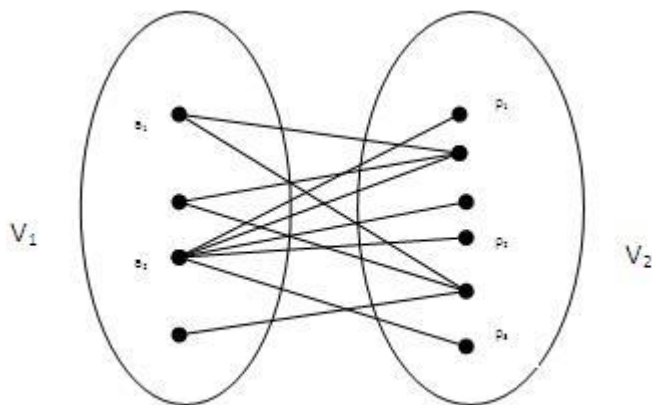


Figure 4

Definition 7

A directed graph G consists of a set of vertices $V = \{v_1, v_2, \dots\}$, a set of edges $E = \{e_1, e_2, \dots\}$ and a mapping ψ that maps every edge onto some ordered pair of vertices (v_i, v_j) . As in the case of undirected graphs, a vertex is represented by a point and an edge by a line segment between v_i and v_j .

Definition 8

Any set M of independent lines of a graph G is called a matching of G , we say that u and v are matched under M . we also say that the points u and v are M -saturated. A matching M is called a perfect matching if every point of G is M -saturated. M is called a maximum matching if there is no matching M' in G such that $|M'| > |M|$.

Examples

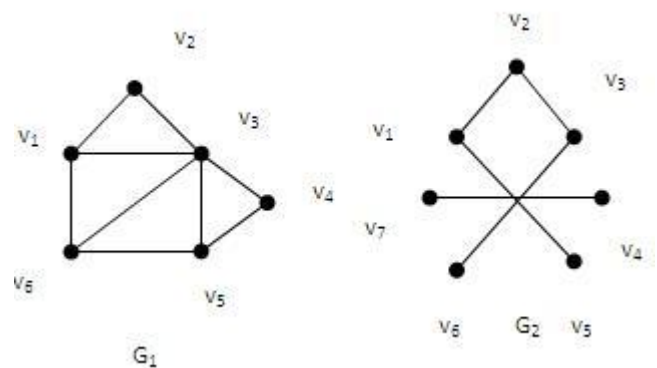


Figure 5

Consider the G_1 , $M_1 = \{v_1v_2, v_3v_4, v_5v_6\}$ is a perfect matching in G_1 . Also $M_2 = \{v_1v_3, v_6v_5\}$ is a matching in G_1 . However M_2 is not a perfect matching. The points v_2 and v_4 are not M_2 -saturated. For the G_2 ,

$M = \{v_8v_4, v_1v_2\}$ is a maximum matching but is not a perfect matching.

II. RESULT

Solution for single machine family scheduling problem by applying Graph theory in GA.

ALGORITHMIC REPRESENTATION

According to Aggarwal et al during the optimised crossover scheme, two parents produce two new children. The first child is called the X-child and the second child is called the Y-child. The X-child is constructed in such a way that have the best objective function value from the feasible set of children, while the Y-child is constructed so as to maintain the diversity of the search space. We propose an optimised crossover operator within genetic algorithm for the problem of $1 S_f \sum w_j c_j$. The proposed optimised crossover using an directed bipartite graph finds the two new children which are called X-child and Y-child. We will now explain the optimised crossover strategy on

determining the X-child and Y-child for the problem of $1 \mid S_f \mid \sum w_j C_j$.

Step-1

Identify the parent with the least weight $\sum w_j C_j$ as P_1 and select family within the P_1 , which contains the batch with the largest weighted processing time as family f , label another parent as P_2 . The family f will be used in both P_1 and P_2 .

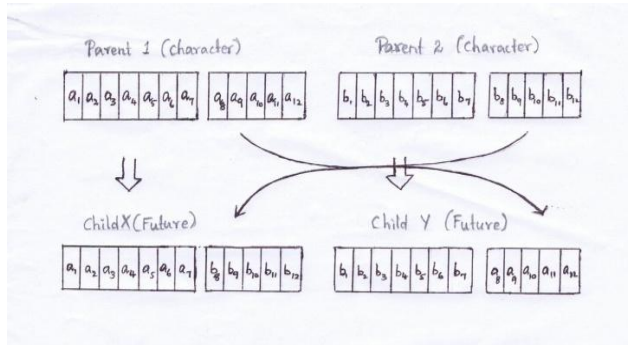


Figure 6

Step-2

Construct an undirected bipartite graph $G=(U \cup V, E)$ where $U=\{u_1, u_2, \dots, u_n\}$ representing the jobs of family f , $V=\{v_1, v_1, v_2, v_2, \dots, v_n, v_n\}$ representing bit situation of the jobs of family f in both P_1 and P_2 (i.e. $v_i, v_i \in \{1,0\}$), and E representing the arc set in the graph in which, $\{u_j, v_i\}, \{u_j, v_i\} \in E$ iff job j is represented with the bit situation v_i and v_i respectively.

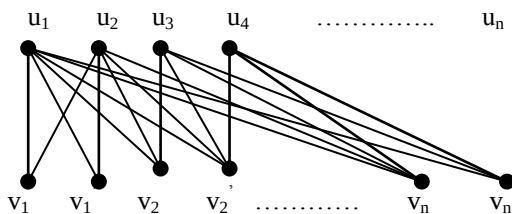


Figure 7

$\{u_1 v_1, u_2 v_1, u_3 v_2, \dots, u_n\}$,
 $\{u_1 v_1, u_2 v_2, u_3 v_2, \dots\}$.

Step – 3

Determine all the maximum matchings in graph G . Suppose that there are K jobs of family f that are represented with a different bit situation in the two parents. There will be exactly $2k$ maximum matching's in graph G .

Jobs

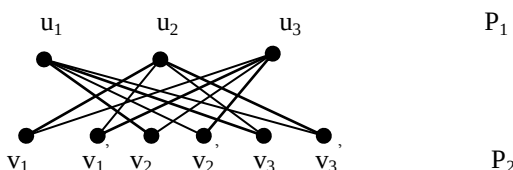


Figure 8

bit situation of jobs of family in both P_1 and P_2

Maximum matchings are

$\{u_1 v_2, u_2 v_1, u_3 v_1\}, \{u_1 v_2, u_2 v_1, u_3 v_2\}$
 $\{u_1 v_3, u_2 v_3, u_3 v_2\}, \{u_1 v_3, u_2 v_3, u_3 v_2\}$
 $\{u_1 v_3, u_2 v_1, u_3 v_1\}, \{u_1 v_3, u_2 v_3, u_3 v_1\}$
 $\{u_1 v_3, u_2 v_3, u_3 v_2\}, \{u_1 v_2, u_2 v_3, u_3 v_2\}$

Step-4

Generate a temporary offspring from P_1 by replacing the bit situations of the jobs in family f which corresponds to one of the maximum matchings in graph G . Repeat the procedure for $2k-1$ times to generate $2k$ temporary offspring. Note that one of the temporary offspring is exactly as P_1 , thus removed.

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Selection of Bayesian Chain Sampling Attributes Plans Based On Geometric Distribution

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Abstract- A formula to compute the average probability of acceptance of chain sampling plans (ChSP-1) by attributes under Beta- Geometric distribution is provided. The performance/ discriminating power of the beta-geometric sampling plans is also discussed by determining the operating characteristic curve. The Average Probabilities of Acceptance are compared with conventional sampling plans.

Index Terms- Bayesian Chain Sampling Plan, Beta-Geometric distribution, Operating Characteristic curve.

I. INTRODUCTION

Inspection of raw materials or semi-finished products, or finished products is one of the aspects of quality assurance. When inspection is done for the purpose of acceptance or rejection of lots of finished products based on adherence to a standard, the type of inspection procedure employed is usually called acceptance sampling. The acceptance sampling is used primarily for incoming or receiving inspection and it has become typical to work with suppliers to improve their performance. Acceptance sampling is also useful in situation where testing is destructive, the cost of 100% inspection is extremely high, the time taken would be too long, the inspection error rate is too high and the product liability risks are serious.

Dodge (1969) has given the major areas of acceptance sampling as

- Sampling by the methods of attributes, in which each unit in a sample is inspected on a go-no-go basis for one or more characteristics.
- Sampling by the methods of variables, in which each unit in a sample is measured for a single characteristics, such as weight or strength.
- Continuous sampling of a flow of units by the methods of attributes.
- Special purpose plans includes chain sampling, skip-lot sampling, small sample plans etc,

Bayesian Acceptance Sampling Plan

Bayesian statistics is directed towards the use of sample information. Thomas Baye's (1702 – 1761) was the first to use prior information in inductive inference and the approach to statistics, which formally seeks to utilize prior information, is called Bayesian analysis. Suppose a product due to random fluctuation these lots will differ in quality even though the process is stable and in control. This fluctuation can be separated into within lot (sampling) variation of individual units and between (sampling and process) variation.

Bayesian Acceptance Sampling approach is associated with utilization of prior process history for the selection of distribution viz., Gamma-Poisson, Beta-Binomial to describe the random fluctuation involved in an Acceptance sampling. Bayesian plans require the user to specify explicitly the distribution of defectives from lot to lot.

The prior distribution is the expected distribution of a lot quality on which the sampling plan is going to operate. The combination of prior knowledge, represented with the prior distribution and the empirical knowledge based on the sample leads to the decision of the lot.

Beta-Binomial distribution.

Let 'X' be the outcome of 'n' Bernoulli trials with a fixed probability 'p' and let the corresponding probability be denoted by

$$b(x, n, p) = {}^n C_x p^x q^{n-x},$$

Assuming that 'p' has a prior distribution with density $w(p)$, the marginal distribution of X, the mixed binomial distribution is given as

$$b_w(x, n, p) = \int_0^1 b(x, n, p) w(p) dp$$

Nicholas Lauer (1978) proposed a procedure for Acceptance Probabilities for Single Sampling Plans where the Proportion Defective has a Beta Distribution. Rajagopal, Loganathan, Vijayaraghavan (2009) provided a procedure for the selection of Bayesian Single Sampling Attributes Plans Based on Polya Distribution

Chain sampling plan (ChSP –1)

Sampling inspection in which the criteria for acceptance and non -acceptance of the lot depends on the results of the inspection of immediately preceding lot is adopted in chain sampling plan (ChSP–1) which is proposed by Dodge (1955). This plan make use of cumulative results of several samples help to overcome the short coming of the single sampling plan.

Conditions for Application of (ChSP –1).

The cost of destructiveness of testing is such that a relatively small sample size necessary, although other factors make a large sample desirable.

The product comprises a series of successive lots produced by a continuing process.

All the lots are expected to be of essentially the same quality.

The consumer has faith in the integrity of the producer.

Operating procedure:

The plan is implemented in the following way.

- For each lot, select sequence of sample of 'n' units and test each unit for conformance to the specified requirements.
- Accept the lot if d (the observed number of defectives) is zero in the sequence of sample of 'n' units, and reject if $d > 1$.
- Accept the lot, if 'd' is equal to 1 and if no defectives are formed in the immediately preceding 'i' sequence of sample size 'n'.

Dodge (1955) has given the operating characteristics function of ChSP-1 as

$$P_a(P) = P_0 + P_1 (P_0)^i$$

The chain sampling plan is characterized by the parameters n & i, where 'n' is the sample size and 'i' is the number of preceding samples with zero defective.

Geometric Distribution:

Thomas Ryan (2011) proclaims that, in recent years the Geometric distribution has been used as an alternative to the binomial, and also as an alternative to the Poisson distribution. In this study instead of binomial distribution geometric distribution is used to calculate the Average Probability of Acceptance.

Suppose if an experiment is repeated under binomial trails until getting the first failure, let 'n' be the number of trails for the first failure. In this context, 'n' is not a fixed number, In fact 'n' could be any of this numbers 1, 2, 3 What is the probability that our first failure comes on the 'n' trails. The answer is given by the Geometric Probability Distribution.

Conditions to apply Geometric Distribution:

- The problem presents a sequence of independent trails of some random process.
- All the trails must occur in a sequence.
- The outcomes of each trail are success and failure
- The outcomes of all trails are statistically independent.
- All trails have the same probability of success.

Construction of Tables:

The Average probability of acceptance for Bayesian chain sampling plan (ChSP-1) using Beta-Geometric Distribution is given by the equation (A)

For $i = 1$, $\bar{P}$ reduces to

$$\bar{P} = (1 - \mu) + \frac{s\mu(s - \mu s + \mu)}{(s + 2\mu)(s + \mu)} \quad \text{Where } \mu = s/s + t$$

For $i = 2$, $\bar{P}$ reduces

$$\bar{P} = (1 - \mu) \left(1 + \frac{s\mu(s - \mu s + 2\mu)(s - \mu s + \mu)}{(s + 3\mu)(s + 2\mu)(s + \mu)} \right)$$

For $i = 3$, $\bar{P}$ reduces to

$$\bar{P} = (1 - \mu) + \frac{s\mu(s - \mu s + 3\mu)(s - \mu s + 2\mu)(s - \mu s + \mu)}{(s + 4\mu)(s + 3\mu)(s + 2\mu)(s + \mu)}$$

Beta- Geometric Distribution:

The Beta-Geometric (s, t) distribution models the no of success that will occur in a binomial process before the first failure is observed and where, the Geometric probability 'p' is itself a random variable taking Beta (s, t) distribution.

Geometric variable 'x' giving the number of success that will occur before the first failure is given by

$$g(x, p) = p^x (1 - p).$$

Where 'n' is the number of trails in which the first failure occurs ($n = 1, 2, \dots$) and 'p' is the probability of success on each trail assuming 'p' has Beta-Geometric distribution is given by

$$g_w(x, p) = \int_0^1 g(x, p) w(p) dp$$

Bayesian chain sampling plan:

The operating characteristic function of ChSP – 1 given by Dodge (1955) is

$$P_a(p) = P_0 + P_1 (P_0)^i$$

The probability of Acceptance based on Geometric distribution will be

$$P(n, i/p) = (1 - p) + p (1 - p)^{1+i}$$

Using the past history of inspection, it is observed that 'p' follows a Beta distribution with density function.

$$w(p)dp = \frac{1}{\beta(s, t)} p^{s-1} (1-p)^{t-1} dp$$

The Average probability of acceptance is given by

$\bar{P} = \int_0^1 P(n, i/p) w(p) dp$ Can be written in terms of a beta distribution as

$$\bar{P} = \frac{t}{s+t} + \frac{s(t+i)(t+i-1)(t+i-2) \dots (t+i-1)}{(s+t+i+1)(s+t+i)(s+t+i-1) \dots (s+t)} \quad \dots (A)$$

For $i = 4$, $\bar{P}$ reduces to

$$\bar{P} = (1 - \mu) \left[1 + \frac{s\mu (s - \mu s + 4\mu)(s - \mu s + 3\mu)(s - \mu s + 2\mu)(s - \mu s + \mu)}{(s+5\mu)(s+4\mu)(s+3\mu)(s+2\mu)(s+\mu)} \right]$$

For $i = 5$, $\bar{P}$ reduces to

$$\bar{P} = (1 - \mu) \left[1 + \frac{s\mu (s - \mu s + 5\mu)(s - \mu s + 4\mu)(s - \mu s + 3\mu)(s - \mu s + 2\mu)(s - \mu s + \mu)}{(s+6\mu)(s+5\mu)(s+4\mu)(s+3\mu)(s+2\mu)(s+\mu)} \right]$$

Tables (shown below) give the Average Probabilities of Acceptance for different values of ' μ ' and the figures show the discriminating power of OC Curves for different values of ' i ' and for fixed value of $s = 1, s = 2, s = 3, s = 4, s = 5$.

Comparison with conventional plans

The values obtained in BChSP-1 are compared with conventional sampling plan.

Illustration-1

For $i = 1, s = 1, \mu = 0.1$ the average probability of acceptance in BChSP-1 is 0.9682 where as in conventional plan it is 0.9810

Illustration-2

For $i = 2, s = 1, \mu = 0.1$ the average probability of acceptance in BChSP-1 is 0.9577 where as in conventional plan it is 0.9729

Illustration-3

For $i = 4, s = 1, \mu = 0.1$ the average probability of acceptance in BChSP-1 is 0.9429 where as in conventional plan it is 0.9590

On comparison it is observed that Bayesian chain sampling plan is more advantageous to the consumer than the conventional sampling plan.

II. CONCLUSION

Bayesian Acceptance Sampling is the technique which deals with procedures in which decision to accept or reject the lot or process is based in the examination of past history or knowledge of samples. The present work mainly relates to the construction of tables of average probability of acceptance and OC curve for Bayesian chain sampling plan using Geometric distribution. Compared to the Binomial distribution, Geometric distribution is very easy to calculate and the tables provided here are tailor-made, handy and ready to use to the industrial shop-floor condition. It is also observed this plan will be more advantageous to the consumer.

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Table 1.1: Average Probability of Acceptance (i=1)

$\mu \backslash s$	1	2	3	4	5	$g(x,p)$
.1	0.9682	0.9740	0.9762	0.9774	0.9781	0.9810
.2	0.8952	0.9091	0.9147	0.9177	0.9197	0.9280
.3	0.8010	0.8194	0.8273	0.8316	0.8344	0.8470
.4	0.6952	0.7143	0.7226	0.7273	0.7303	0.7440
.5	0.5833	0.6000	0.6071	0.6111	0.6136	0.6250
.6	0.4682	0.4808	0.4857	0.4883	0.4899	0.4960
.7	0.3515	0.3595	0.3619	0.3629	0.3633	0.3630
.8	0.2342	0.2381	0.2384	0.2381	0.2376	0.2320
1.0	0	0	0	0	0	0

Table 1.2: Average Probability of Acceptance (i=2)

$\mu \backslash s$	1	2	3	4	5	$g(x,p)$
.1	0.9577	0.9644	0.9670	0.9684	0.9692	0.9729
.2	0.8714	0.8839	0.8892	0.8922	0.8940	0.9024
.3	0.7691	0.7823	0.7881	0.7913	0.7934	0.8029
.4	0.6606	0.6714	0.6759	0.6783	0.6798	0.6864
.5	0.5500	0.5571	0.5595	0.5606	0.5612	0.5625
.6	0.4390	0.4425	0.4429	0.4426	0.4423	0.4384
.7	0.3282	0.3290	0.3279	0.3268	0.3259	0.3189
.8	0.2181	0.2173	0.2157	0.2143	0.2132	0.2064
1.0	0	0	0	0	0	0

Table 1.3: Average Probability of Acceptance (i=3)

$\mu \backslash s$	1	2	3	4	5	$g(x,p)$
.1	0.9495	0.9563	0.9591	0.9606	0.9615	0.9656
.2	0.8556	0.8659	0.8704	0.8730	0.8746	0.8819
.3	0.7502	0.7592	0.7629	0.7650	0.7663	0.7720
.4	0.6420	0.6476	0.6495	0.6503	0.6508	0.6518
.5	0.5333	0.5357	0.5357	0.5354	0.5350	0.5313
.6	0.4252	0.4251	0.4238	0.4226	0.4217	0.4154

.7	0.3178	0.3163	0.3144	0.3130	0.3119	0.3057
.8	0.2112	0.2093	0.2076	0.2063	0.2055	0.2013
1.0	0	0	0	0	0	0

Table 1.4: Average Probability Acceptance (i=4)

$\mu \backslash s$	1	2	3	4	5	$g(x,p)$
.1	0.9429	0.9496	0.9523	0.9539	0.9548	0.9590
.2	0.8444	0.8527	0.8563	0.8584	0.8597	0.8655
.3	0.7382	0.7440	0.7462	0.7473	0.7479	0.7504
.4	0.6308	0.6333	0.6337	0.6336	0.6334	0.6311
.5	0.5238	0.5238	0.5227	0.5218	0.5210	0.5156
.6	0.4176	0.4161	0.4143	0.4129	0.4119	0.4061
.7	0.3123	0.3101	0.3082	0.3069	0.3060	0.3017
.8	0.2076	0.2056	0.2041	0.2032	0.2026	0.2003
1.0	0	0	0	0	0	0

Table 1.5: Average Probability Acceptance (i=5)

$\mu \backslash s$	1	2	3	4	5	$g(x,p)$
.1	0.9375	0.9438	0.9465	0.9480	0.9489	0.9531
.2	0.8364	0.8429	0.8456	0.8471	0.8481	0.8524
.3	0.7300	0.7336	0.7346	0.7350	0.7352	0.7353
.4	0.6235	0.6242	0.6237	0.6231	0.6226	0.6187
.5	0.5179	0.5167	0.5152	0.5140	0.5131	0.5078
.6	0.4130	0.4109	0.4091	0.4078	0.4069	0.4025
.7	0.3090	0.3067	0.3050	0.3040	0.3033	0.3005
.8	0.2055	0.2036	0.2024	0.2017	0.2013	0.2001
1.0	0	0	0	0	0	0

Figure 2.1: Comparison of OC curve for various values of i with $s = 1$

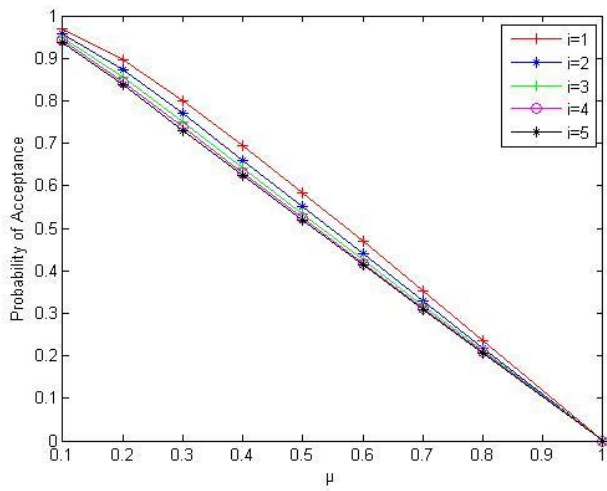


Figure 2.2: Comparison of OC curve for various values of i with $s = 2$

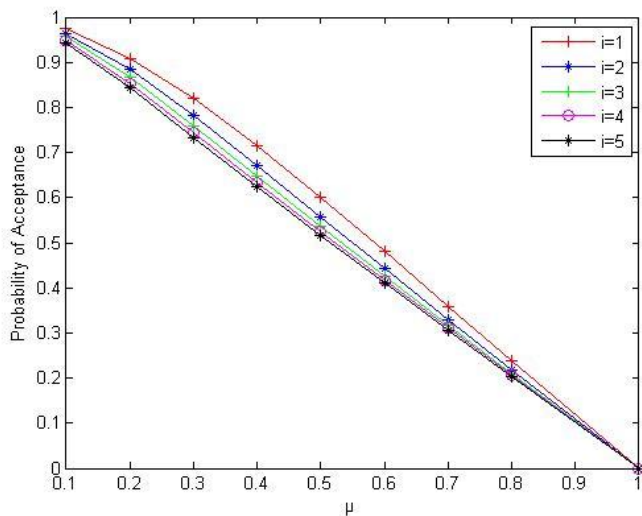


Figure 2.3: Comparison of OC curve for various values of i with $s = 3$

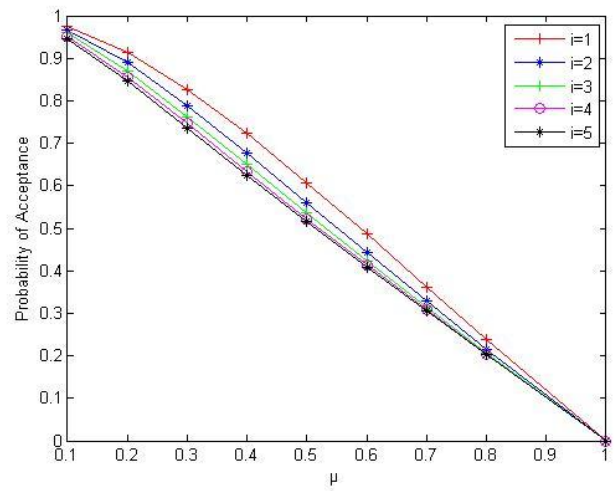


Figure 2.4: Comparison of OC curve for various values of i with $s = 4$

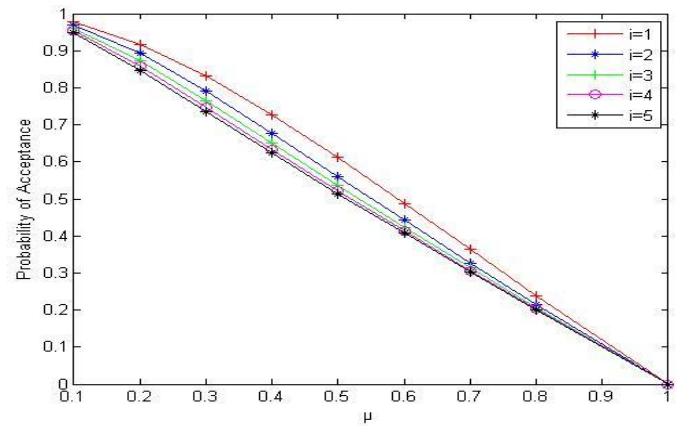
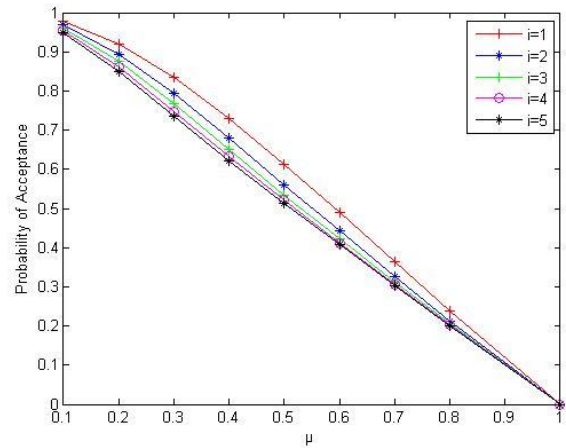


Figure 2.5: Comparison of OC curve for various values of i with $s = 5$



H_{∞} Filter Design for Anti-skid Braking System for Fighter Aircraft

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Abstract- Aircraft brake system plays a very important role in the safe takeoff and landing. On landing, skid phenomena is observed due to runway surfaces, pilot brake demand or due to other factors which creates unsafe for the aircraft while landing. So we use anti-skid braking system which will prevent tires from slipping extremely on the track and ensure aircraft landing safety and stability with maximum braking efficiency. Estimate of the slip is estimated using a technique called H_{∞} filter design. The purpose of estimation is to make the slip, error free, from the noises coming out from the sensors and other measuring devices which affect the system parameters. This paper presents modeling and simulation part of the work for the aircraft brake system.

Index Terms- μ -slip curve, slip-ratio, anti-skid, H_{∞} filter

I. INTRODUCTION

IN the last few decades, a number of techniques have been used to control the skid of the fighter jets and as well as the commercial aircrafts during landing process by using skid control devices. Number of aircrafts using this antiskid braking system has been increased over the years for the safe landing over different landing conditions. Due to the safety reasons and to avoid skidding, various techniques were in design process and were used, such as velocity-rate-controlled, pressure-bias-modulated [9]; slip-velocity-controlled, pressure-bias-modulated [1]; hydro-mechanically-controlled system [2] and slip-ratio-controlled system [5]. To provide maximum braking and complete antiskid protection under all weather conditions is demanded by the modern skid control devices. New design approaches and control techniques are used for better performance of these systems during landing process on all runway conditions. The work presented here uses the slip-ratio-controlled design technique to solve the skidding problem.

Nose wheel steering system is widely used for modern aircraft steering. The facts shown as follows put up high requirements to it: side tumbling will not occur in aircraft ground steering; the modern civil aircraft rollout and turnoff should be quick and reduce the runway occupancy time, the fighter should land, taxi, and take-off on the runway of harsh conditions to enhance rapid reaction capability in future war; the aircraft should keep the correct heading when it taxiing under asymmetric loads, such as: cross-wind landing, one side main wheel bursting, and one side main wheel brake failure.

Tests on life-size aircraft are obviously expensive and risky, and experiments on test-rigs (namely drop-test facilities) allow only limited deduction of information about the landing

gear dynamics. Based on dynamics theory, the virtual prototyping software has been used widely for aircraft ground maneuvers dynamics study [2]. Simulation technique demonstrated here well suits for this kind of design and analysis. Simulation combines the ability to simulate models including a large number of degrees of freedom, arbitrary non-linear motion, and highly non-linear force laws with powerful analysis methods and a fast model set-up using components from libraries and from neighboring engineering disciplines as established in MATLAB/SIMULINK. A PID antiskid controller is designed and control algorithm simulation model is established in MATLAB/SIMULINK.

Skid control calculations are performed in the following manner. The instantaneous speed of each wheel is periodically updated and compared to a calculated aircraft velocity. The difference between wheel speed and aircraft velocity represents wheel slip. The nose wheel is not braked. When the slip exceeds a given magnitude, braking effectiveness begins to decrease. The control unit detects this excessive wheel slip and produces a brake release signal proportional to the skid severity. The release signal commands a brake pressure reduction until the wheel slip returns to the optimal level. When slip is below the amount required to produce maximum braking, no release signal is generated. The pilot's brake pedal input controls the braking level [2]. The complete architecture of the aircraft is shown in the

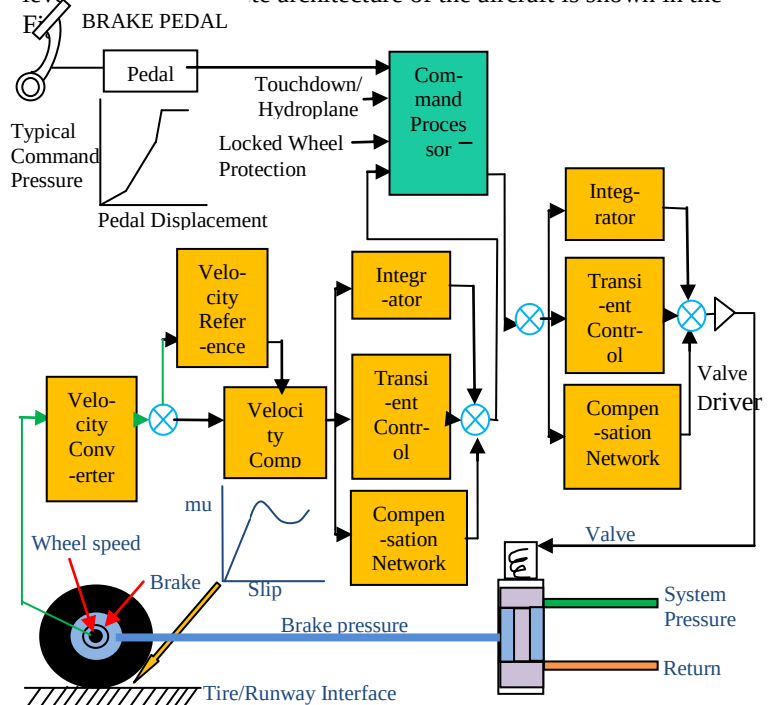


Figure 1 Architecture of Aircraft Brake System

II. CONTROL TECHNIQUE

The resultant friction coefficient between the tire base and the road surface is determined as a function of the resultant slip ratio. There is non-linear relationship between friction coefficient and slip ratio, and the runway conditions have great impact on that, as shown in Figure 2. The purpose of the anti-skid control is to make the slip ratio stay at the appropriate scope, so that the friction coefficient can reach the peak.

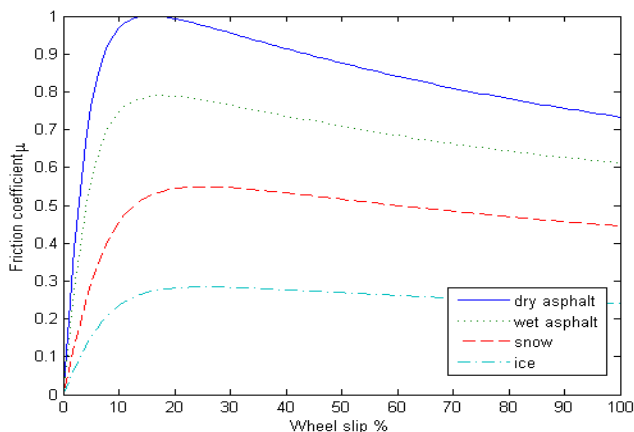


Figure 2 μ -slip curve

When braking force is applied to a rolling wheel, it will begin to slip. Slip ratio S is defined as the difference between aircraft velocity and wheel circumferential velocity, normalized to aircraft velocity –

$$S = \frac{V_x - \omega \cdot r}{V_x} \quad (1)$$

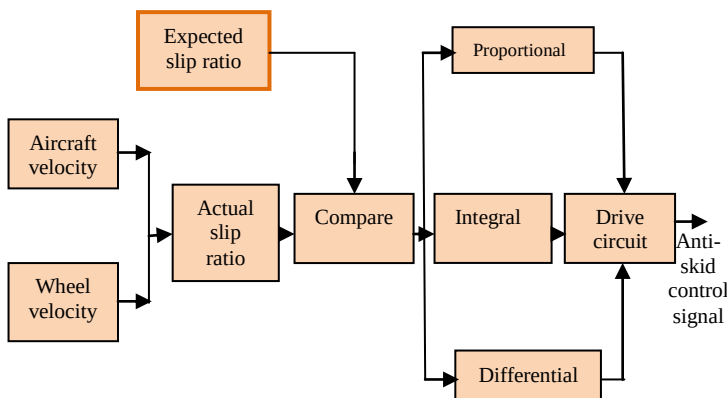


Figure 3 Principle diagram of slip-ratio control

The method used here is the slip-ratio-controlled mechanism as shown in Figure 3. In this we have the expected or desired slip ratio which we want to control. It is compared with the actual

slip ratio generated and is given to the control principle. And hence anti-skid control signal is generated.

The anti-skid control system consists of velocity sensor, control box, and electro hydraulic servo valve [4] as shown in Figure 4. The velocity sensor induces the velocity of the brake wheel and sends it to the control box. The control box outputs a current signal proportional to slip degree in

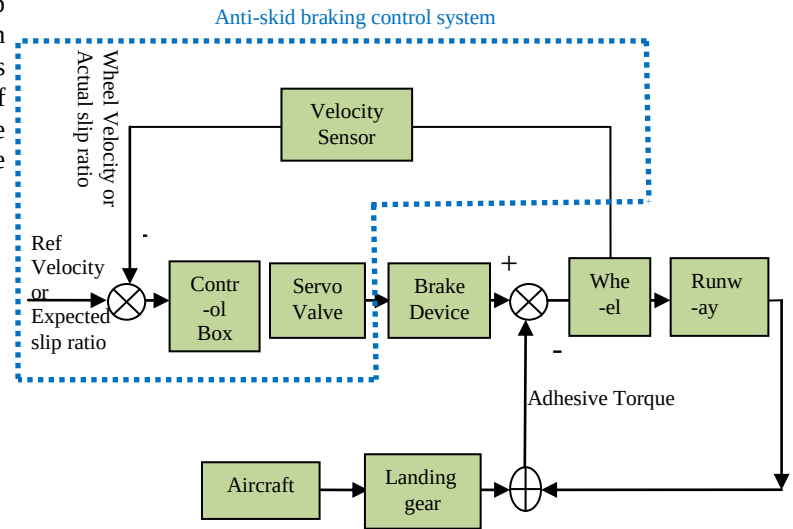


Figure 4 Principle diagram of anti-skid braking system

accordance with certain control strategy. The current signal regulates the output pressure of the electro hydraulic servo valve to change the brake force and lift slipping. The system obtains the best brake effect by regulating the brake. The control method is adopted to control brake force of the left and right wheels. Because the motion state of the two wheels is not very different from each other, the same control channel can be used to these two wheels. The control method, in Figure 4 is simplified to right and left wheels.

In the process of control, the difference of wheel velocity should be not too great, or else, that will lead to aircraft sideslip or roll phenomenon, and the movement will become the S-type, deviating from normal routes, threatening the safety of aircraft. For each side, the low wheel velocity is selected as the velocity of this group. Each side is controlled through a single channel. The cross protection doesn't work unless the velocity difference between left and right group is great.

III. DESIGN METHODOLOGY

A. Aircraft Brake System

Aircraft brake system is brake-by-wire systems consisting of hydraulic brakes mounted on left and right main wheels and are activated by electro-hydraulic servo valves. A digital electronics controller with embedded control law software is used to activate the servo valves. The brake pressure is maintained as demanded by the pilot through a (electrical) potentiometer mounted on a brake pedal for each brake. However, if the demand is high enough to result in tire skid, then, brake pressure is modulated to the maximum value that can be used without a tire skid.

B. Aircraft Loading Factor

Choice of the main wheel tire and nose wheel is made on the basis of the static and dynamic loading [10]. The total main gear load (F_m) is calculated assuming that the aircraft is taxiing at low speed without braking. As shown in Figure 5, equilibrium gives -

$$F_m = \frac{l_n}{l_m + l_n} W \quad (2)$$

where W is the weight of the aircraft and l_m and l_n are the distance measured from the aircraft cg to the main and nose gear, respectively. The design condition occurs at maximum takeoff weight/mass of an aircraft with the aircraft cg at its after limit [10]. The choice of the nose wheel tires is based on the nose wheel load (F_n) during braking at maximum effort, i.e., the steady braked load. Using the symbols shown in Figure 5, the total nose gear load under constant deceleration is calculated using -

$$F_n = \frac{l_n}{l_m + l_n} (W - L) + \frac{h_{cg}}{l_m + l_n} \left(\frac{a_x}{g} W - D + T \right) \quad (3)$$

where L is the lift, D is the drag, T is the thrust, and h_{cg} is the height of aircraft cg from the static ground line. Typical values for a_x/g on dry concrete vary from 0.35 for a simple brake system to 0.45 for an automatic brake pressure control system. As D and L are positive, the maximum nose gear load occurs at low speed. Reverse thrust affect can be given from [10], when $T = 0$ we have value of F_n -

$$F_n = \frac{l_m + h_{cg} (a_x / g)}{l_m + l_n} W \quad (4)$$

The design condition occurs at maximum takeoff weight/mass of an aircraft with the aircraft cg at its forward limit. To ensure that the loads will not be exceeding in the static and braking conditions, a 7% safety factor is used in the calculation of the applied loads [10].

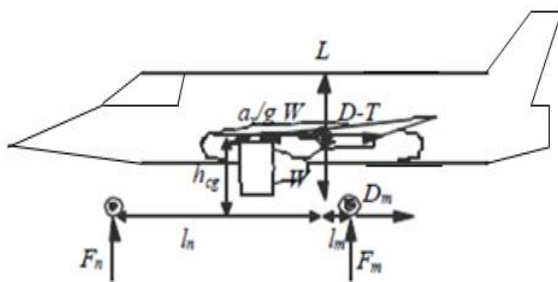


Figure 5 Forces acting on the aircraft during a braked roll

C. Wheel Dynamics

Although the dynamic model of aircraft taxiing is complex, by neglecting the air resistance and the suspension dynamics during the braking operation, a simplified mathematical model of single-wheel is adopted. The diagram of single-wheel is shown in

Figure 6. Where J is wheel inertia, ω is angular speed of the wheel, F_b is tire friction force, r is wheel radius, T_b is applied brake torque. V_x is aircraft velocity relative to ground and F_z is vertical load on the wheels(N). The equation of the rotation of the wheel is expressed as -

$$J\dot{\omega} = F_b \cdot r - T_b \quad (5)$$

For braking at a steady rotational velocity, Eqn. 5 yields -

$$\mu F_z = \frac{T_b}{r}, \text{ where } F_b = \mu F_z.$$

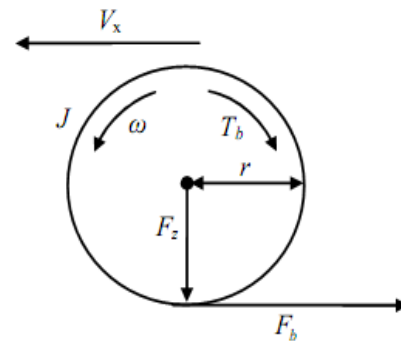


Figure 6 Wheel Dynamics

D. Hydraulic System

The reference model used for this study includes the elements to form a third order set (wheel dynamics, hydraulic system and its control). The mathematical representation of the behavior of the system is based on an intermediary modeling level allowing the main elements comprising its dynamics to be reconstructed.

The generation of the braking torque (C_{BRK}) from a braking pressure applied in the pistons (P_{BRK}) is relatively fast. For better representation, it is however in general represented by a first order transfer function -

$$C_{BRK}(s) = G_{BRK} \frac{1}{1 + \tau \cdot s} P_{BRK}(s) \quad (6)$$

Behavior of the brake discs is modeled by a gain G_{BRK} and the hydraulic lag is given by $-1/(1 + \tau \cdot s)$. The braking pressure is generated by the hydraulic system from a flow rate (Q_{BRK}) sent to the pistons [8] -

$$P_{BRK}(s) = \int_0^t \frac{\beta}{V_{BRK}} Q_{BRK} dt \quad (7)$$

Variable β represents a compressibility coefficient, which allows variations in the volumes of the pistons (and the nonlinear stiffness coefficient associated with it) to be compared to the compressibility of the hydraulic fluid. The value of β can vary according to the pressure applied in the pistons. The flow rate at piston inlet is generated by the difference between the supply pressure P_A and the return pressure P_R and is related to the position of the servo valve slide value (x_{BRK}). This flow rate is written -

$$Q_{BRK} = \eta S(x_{BRK}) \sqrt{\Delta P} \quad (8)$$

$$\Delta P = 0, \text{ if } -x_{BRK} = 0$$

$$\text{where - } \Delta P = P_a - P_{BRK}, \text{ if } -x_{BRK} < 0 \quad (9)$$

$$\Delta P = P_{BRK} - P_a, \text{ if } -x_{BRK} > 0$$

and η is the flow coefficient. $S(.)$ represents the section for the passage of the hydraulic fluid through the servo valve. The position of the servo valve slide valve can be deduced from the following equation –

$$S.(X_{BRK}) = K.X_{BRK} \quad (10)$$

The position of the servo valve slide value can be deduced from the following equation –

$$X_{BRK} = \frac{K_2 S_2 - K_1 S_1}{r} (a_{SVBRK} - ISV_{BRK}) + X_{0BRK} + \frac{S_2 - S_1}{r} P_{BRK} \quad (11)$$

ISV_{BRK} is the servo valve control current. S_1 and S_2 make reference to the slide valve sections in the left and right chambers of the servo valve. r is the stiffness of the spring re-centering the slide valve. Constants K_1 , K_2 and a_{SVBRK} characterize the behavior of the first stage of the servo valve. The control of the braking pressure can be approximated by a first order corrector.

Finally, the anti-skid control is a complex design. Its aim is to prevent the wheels from skidding. It limits the braking pressure target so as to maintain the slip velocity close to its optimum value. To do so, a detection algorithm compares the wheel velocities with the velocity of the aircraft as shown in the Fig. 7.

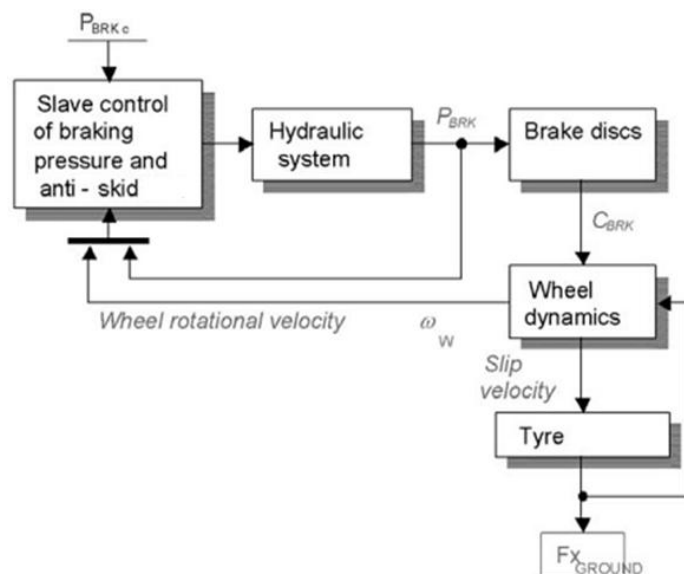


Figure 7 Schematic representation of braking system

IV. ESTIMATING SLIP CURVE BY H_∞ FILTERING

The tire μ slip curve is used to describe the developed friction of a braked wheel. It is empirical in nature. A formula that has been developed with many undetermined coefficients is so general that it has been called the “Magic Formula”. Unfortunately, the equipment needed to determine all the

parameters is beyond the means of modest wheel test facilities. For antiskid design, knowing only the amplitude and its location are sufficient. Therefore, we will use a much simpler formula that has only two parameters. They are the amplitude of the curve, μ (μ), and the x axis location of the peak, slip as shown in Figure 2.

We consider the continuous-time system;

$$\dot{x} = Ax + Bu + w$$

$$y = Cx + v \quad (12)$$

$$z = Lx$$

where L is a user-defined matrix and z is the vector that we want to estimate. Our estimate of z is denoted $\hat{z}$, and our estimate of the state at time 0 is denoted $\hat{x}(0)$. The vectors w and v are disturbances with unknown statistics; they may not even be zero-mean. In the game theory approach to H_∞ filtering we define the following cost function:

$$J_1 = \frac{\int_0^T \|z - \hat{z}\|_S^2 dt}{\|x(0) - \hat{x}(0)\|_{P_0}^2 + \int_0^T (\|w\|_{Q^{-1}}^2 + \|v\|_{R^{-1}}^2) dt} \quad (13)$$

P_0 , Q , R and S are positive definite matrices chosen by the engineer based on the specific problem [6]. Our goal is to find an estimator such that –

$$J_1 < \frac{1}{\theta} \quad (14)$$

The estimator that solves this problem is given by –

$$P(0) = P_0$$

$$\dot{P} = AP + PA^T + Q - KCP + \theta PL^T SLP$$

$$K = PC^T R^{-1} \quad (15)$$

$$\dot{\hat{x}} = A\hat{x} + Bu + K(y - C\hat{x})$$

$$\hat{z} = L\hat{x}$$

These equations are identical to the continuous-time Kalman filter equations, except for the θ term in the $\dot{P}$ equation. The inclusion of the θ term in the $\dot{P}$ equation tends to increase P , which tends to increase the gain K , which tends to make the estimator more responsive to measurements than the Kalman filter. This is a way of robustifying the filter to uncertainty in the system model [7]. The estimator given above solves the H_∞ estimation problem if and only if $P(t)$ remains positive definite for all $t \in [0, T]$. As with the discrete-time filter, we can also obtain a steady-state continuous-time H_∞ filter. To do this we let $\dot{P} = 0$ so that the differential Riccati equation above reduces to an algebraic Riccati equation.

V. SIMULATION RESULTS

Simulation shown here shows how the aircraft brake system can be controlled using the slip-ratio-controlled design. Further PID controller is used to control the slip generated. The main purpose of the simulation is to regulate the slip generated due the aircraft tire in all runway conditions while landing process of the aircraft. The simulation work is carried out in MATLAB & SIMULINK (R2010a) work environment. And the slip generated, is estimated using H_∞ filter and hence is compared with the measured slip for the optimal performance.

To model this system in SIMULINK, several subgroups are used to avoid confusion. Appendix shows the aircraft brake system design to control the antiskid phenomena. It consists of the brake pedal both left and right to control the aircraft during landing and stop process. Signal from brake pedals is commanded to the hydraulic box to control the brake pressure and hence in proportion brake torque is applied. During landing, aircraft parameters with the aircraft velocity are sent to the control box where aircraft velocity and the wheel velocity is used to calculate the slip ratio using Eqn. 1 and;

$$\dot{s} = \frac{\dot{V}(1-s) - \dot{\omega}r}{V} \quad (16)$$

where $\dot{\omega}$ can be manipulated using Eqn. 5. The generated slip is fed back to the antiskid control box, where the generated slip is subtracted from the desired slip. Hence the error is given to the PID controller, which in turn generates the control signal and is sent to the hydraulic control box for action.

The desired slip is kept at a value of 0.2, which is a constraint to avoid skidding. Initial value of the aircraft is taken as 90 m/sec with an angular velocity of 312 rad/sec. The wheel radius is taken as 0.341 m and with a rolling radius, r as 0.289 m. Moment of inertia in Eqn. 5 is taken as 1.84 kgm². The initial brake pressure used is 270 Psi with a maximum of 1600 Psi. Aircraft mass is taken as 5000 kg. Actuator used here is a second order linear actuator which has a natural frequency of 150 rad/sec and a damping ratio of 0.7. The hydraulic system is modeled as a lag element with a first order system having the transfer function as, $1/(0.01s + 1)$. And value of g is 9.8 m/sec² (32.2 ft/sec).

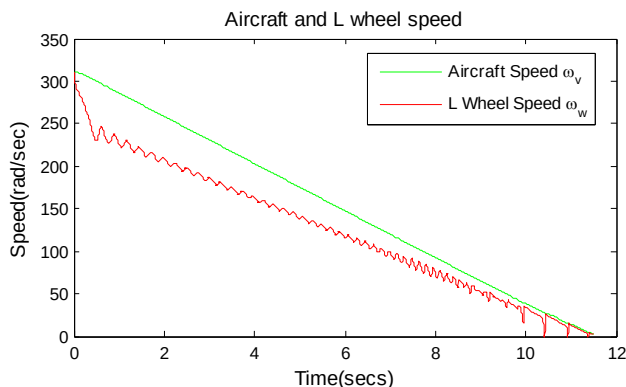


Figure 8 Aircraft and left wheel speed

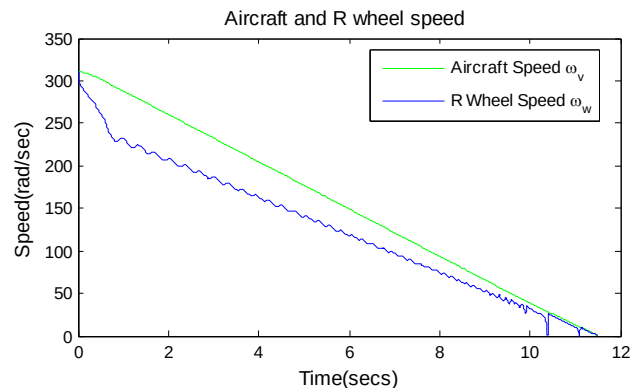


Figure 9 Aircraft and right wheel speed

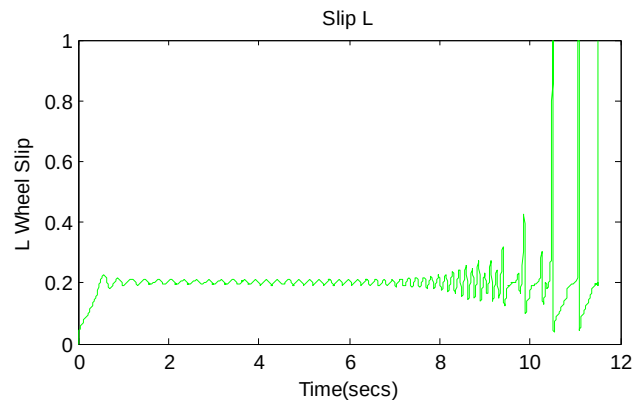


Figure 10 Left wheel slip

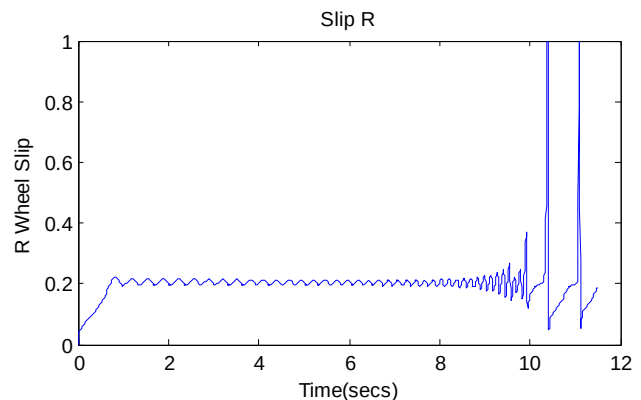


Figure 11 Right wheel slip

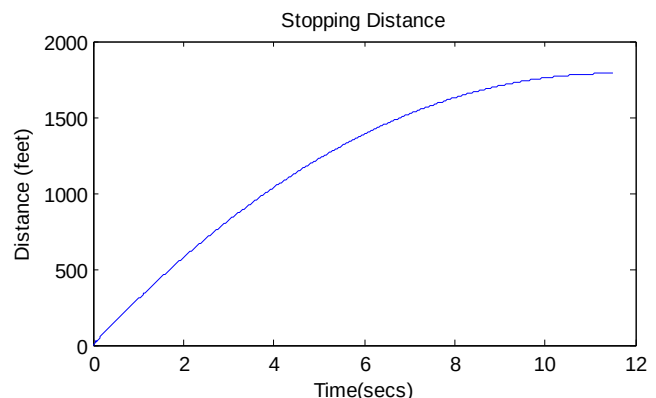


Figure 12 Aircraft stopping distance

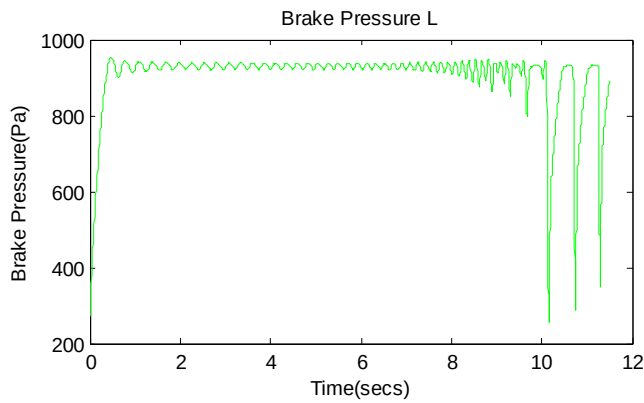


Figure 13 Left wheel brake pressure

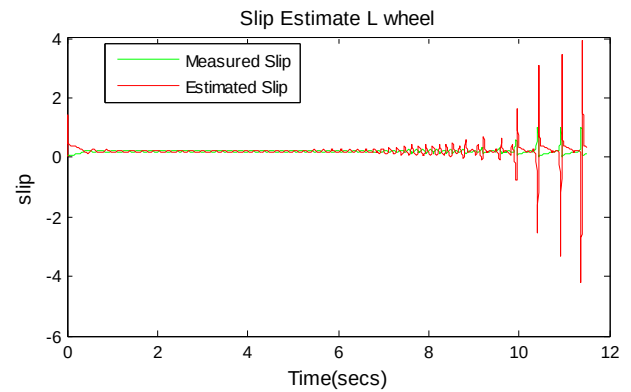


Figure 17 Left wheel slip estimate

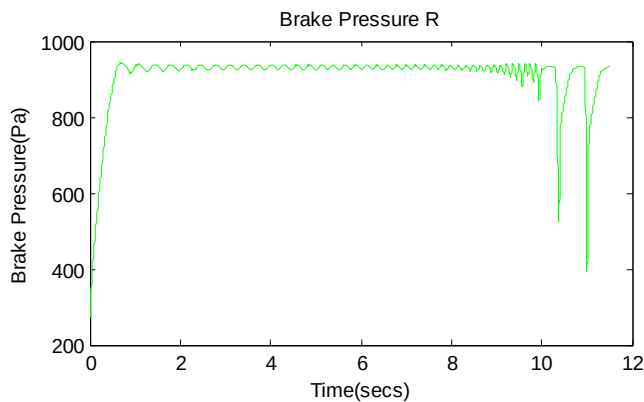


Figure 14 Right wheel brake pressure

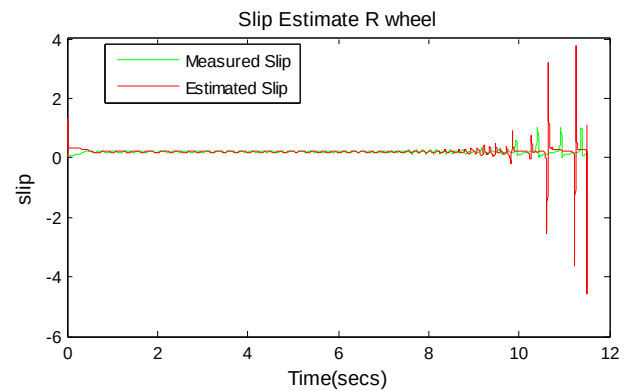


Figure 18 Right wheel slip estimate

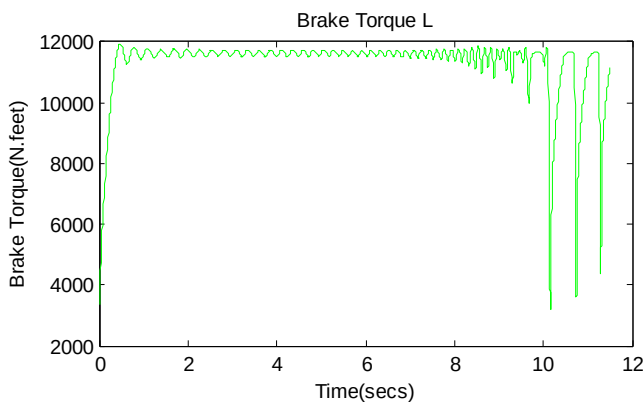


Figure 15 Left wheel brake torque

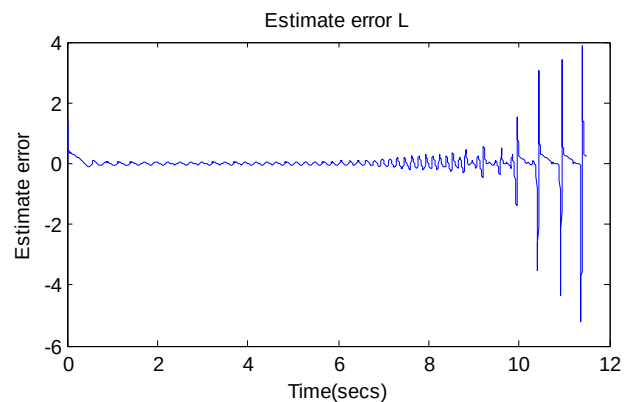


Figure 19 Left wheel estimate error

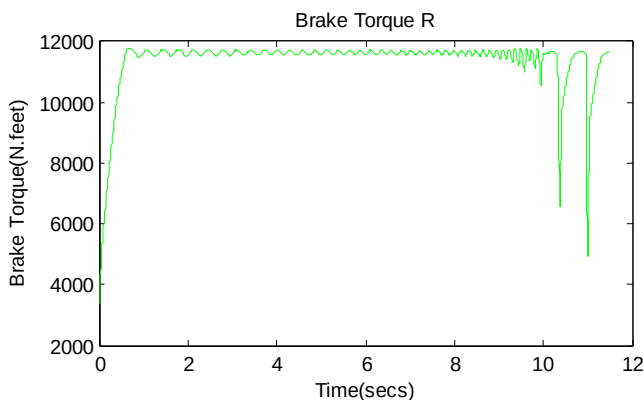


Figure 16 Right wheel brake torque

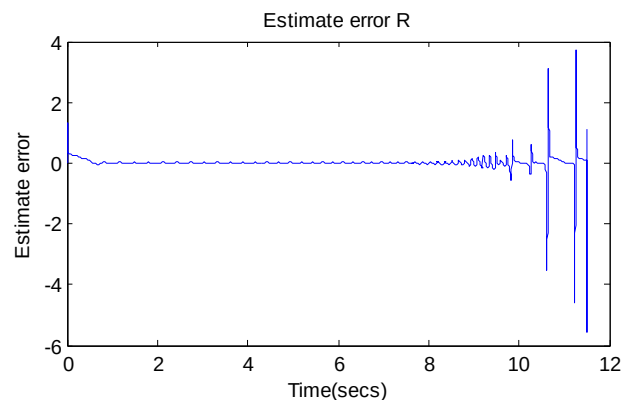


Figure 20 Right wheel estimate error

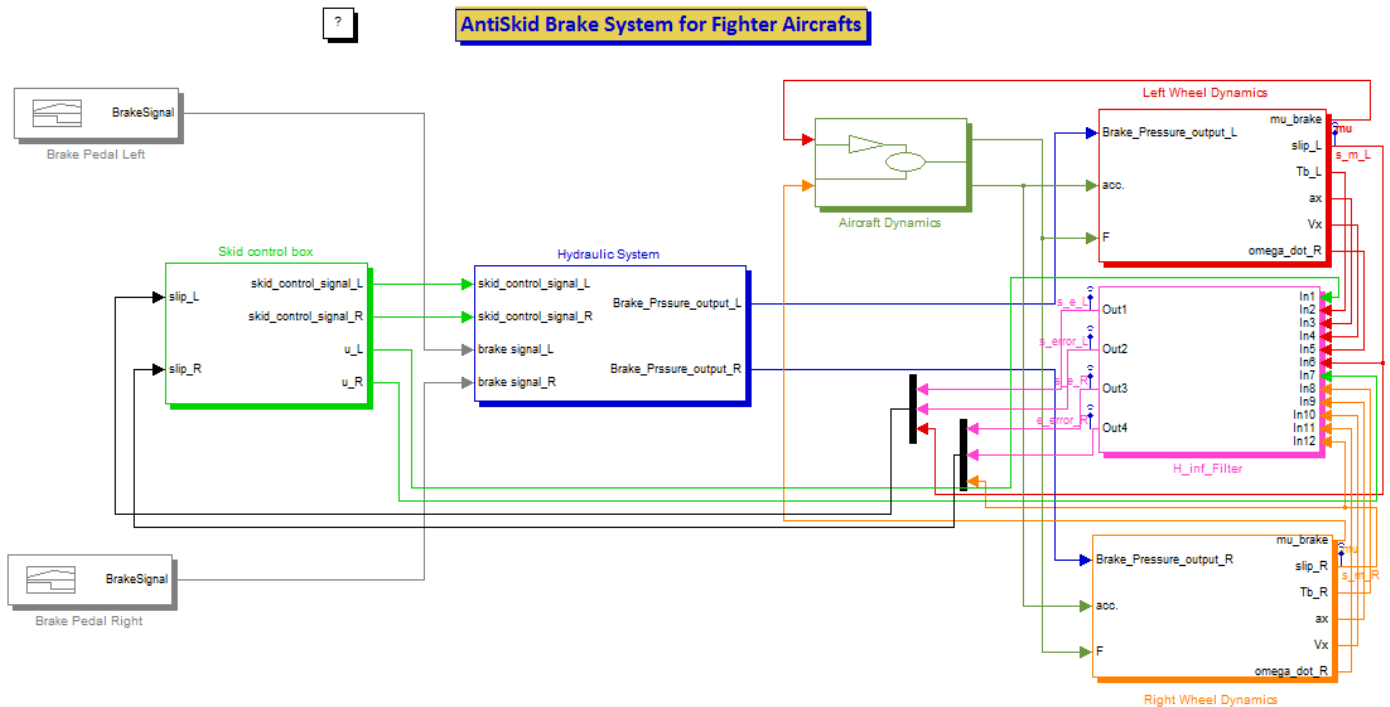
VI. CONCLUSION

The wheel velocity and aircraft velocity show the aircraft retardation with the applied brake to the wheels. This shows that the applied brake pressure to the brake discs to stop the wheels result in the brake torque. This in turn provides the maximum friction coefficient, which is applied by the wheels on the runway to slow down the aircraft. The control mechanism, slip-ratio-controlled design is successfully implemented in controlling the slip on the runway. And hence the antiskid control technique is developed. The slip signal which is fed back to the control device gets noise attached to it. So, the estimation made in this work estimates the slip using H_∞ filter design.

The estimated slip generated from the filter is almost same as the measured slip. Hence the filter designed to make noise free slip is achieved.

Hence the design and objective performance of antiskid brake system for fighter aircrafts is successfully simulated using the simulation environment. Modeling of individual components of the system is validated through specific tests. Validation of all subsystem modeling is carried out through specific subsystem level tests. Simulation results match closely with dynamometer response during specific taxi tests or dynamometer tests provided in the open literature and in the research papers.

APPENDIX



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Biosurfactant Characterization of Bacterial Consortium from Soil Contaminated Hydrocarbon in Cepu Area, Central Java, Indonesia

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Abstract- Biosurfactant have been recognized as an important microbial products which was applicable in a number of industries and bioprocesses. In these study, characterization of biosurfactant producing bacterial consortium isolated from soil a hydrocarbon-contaminated area in Cepu Area, Central Java, Indonesia were conducted by measuring the growth of bacterial consortium, surface tension, interfacial tension, emulsification activity and its chemical composition. The results revealed that growth of bacteria exponential phase was reached at 24 hours no different growth pattern. The biosurfactant was a complex compound which consist of carbohydrate, protein and lipid. The emulsification used E24 of 93.75% unit was for bacterial consortium. The surface tension was reduced to below 51 dynes/cm from 72.00 dynes/cm (water surface tension) of bacterial consortium and the lowest interfacial tension values were obtained 10.00 dynes/cm.

Index Terms- Biosurfactant, characterization, bacterial consortium, surface tension, interfacial tension, emulsification activities.

I. INTRODUCTION

Biosurfactant was an important product of biotechnology today, especially for industrial and medical applications processes. It was also reported to have the ability as an antibacterial, antifungal, antitumor, antimycoplasmic and antiviral properties [1,2]. The mechanisms of biosurfactant has the ability to reduce surface tension and interfacial tension between two liquid phases are mixed. In nature in a wide range of chemical structures including glycolipids, lipopeptide and lipoproteins, fatty acids, neutral fats, phospholipids, lipid and lipid particulate polymer [1]. The chemical has the ability to stabilize emulsions, form and produce foam and non-toxic and can degrade other compounds in biological, naturally friendly to the environment, the ability of large-scale production, selectivity ability, the ability to exist in extreme conditions and potential applications for environmental protection [3,4]. In the biological compound produced in the extracellular amphiphilic or as part of various cell membranes of microorganisms such as bacteria, yeasts, and filamentous fungi [5,6]. The product was a secondary

metabolite produced by microorganisms of various material substances include sugar, oil and waste [7].

Biosurfactant can provide a wider contact surface between the hydrocarbons and microorganisms through micelle formation, dissolution and emulsification of hydrocarbons and the release of droplets of a solution of non water from the pores of the solid particles due to surface tension reduction [8]. The properties are similar to synthetic surfactants and can be decomposed in the form of physicochemical properties such as critical micelle concentration (CMC), surface tension, interfacial tension and emulsion types that produced. Some of the biosurfactant showed a low CMC values and the reduction of surface tension in liquid fermentation approximately 30 mN/m.

Some advantages biosurfactant by [9,10] was to be biodegradable, low toxicity, biologically compatible and can be described as the application of cosmetics, pharmaceuticals and function as a food additive, available in rough material and production may be advantage economically, can also be used as a control environment and specific properties. A number of factors can affect the production of biosurfactant in nature including pH, salinity and temperature [11,12], agitation and oxygen availability [13], the availability of carbon substrate [14], the availability of nitrogen substrates [15], the source of carbon and nitrogen ratio (C/N) [16,17].

The purpose of this research is to characterize the biosurfactant produced isolates and bacterial consortium of the isolation of hydrocarbon-contaminated soil in the region of Cepu oil exploration, Central Java, Indonesia.

II. MATERIALS AND METHODS

A. Growth of Biosurfactant-Producing Bacteria

Four soil isolates (33, 34, 35, and 38 isolate) also a bacterial consortium (a combination of the isolates) obtained from the isolation in a hydrocarbon-contaminated area in Cepu Area, Central Java, Indonesia. Cultures were then stored at the Laboratory of Bioprocess Research Center of Biotechnology, Indonesia Institute of Science (LIPI), Cibinong Science Center. Study the growth of biosurfactant-producing bacteria started by growing colonies of bacteria on media nutrient agar (NA) at 37°C for 48 hours. After incubation, morphologically different colonies were isolated to obtain the pure isolates culture. Each of these isolate were then grown in nutrient broth (NB) medium

with was added by Arabic Liquid Crude Oil (ALCO) as a carbon source at 37°C and incubated for 72 hours.

B. Extraction of Biosurfactant

Biosurfactant extraction was done by pouring each of 250 ml of NB medium which contains the isolates (33, 34, 35, and 38 isolate) also the bacterial consortium aseptically into sterile Erlenmeyer, incubation for 5 days at 30°C, then centrifuged at 6000 rpm for 20 minutes at room temperatures to separate the bacterial cell. The supernatant was acidified up to pH 2 using HCl. The extraction from the supernatant using a solution of chloroform and ethanol with a ratio of 2:1. The bottom layer was extracted biosurfactant separated using a rotary evaporator at 40°C. The volume of each isolates and bacterial consortium are recorded and stored at a temperature -10°C to for further characterization.

C. Analysis of Carbohydrate Content

The presence of carbohydrate compounds was tested using a modified method of destruction rhamnose phenol-sulfuric acid [18]. A number of 0.5 ml of the supernatant was extracted with 0.5 ml of phenol solution and 2.5 ml sulfuric acid 5%, then incubated for 15 minutes, the absorbance was measured at 490 nm.

D. Analysis of Protein Content

The presence of protein compound was assayed using modified method of Bradford [19]. A number of 0.1 ml supernatant was mixed with 0.9 ml Bradford solution and then incubated for 15 minutes before the absorbance was measured at 595 nm.

E. Analysis of Lipid Content

The presence of lipid compounds was analyzed using modified method of blight and dyer [20]. A number of 1 ml of the supernatant solution was extracted with 20 ml of chloroform and then shaken using a vortex mixer for 1 hour. Chloroform evaporated and discharged while lipid content measured by analytical balance after drying in a hot plate at 50°C.

F. Emulsification Index (E24)

The ability of emulsification process was measured using the emulsification index (E24). Emulsification index of each isolate and a bacterial consortium was determined by adding 2 ml of oil Liquids Arabic Crude Oil (ALCO) and 2 ml of cell-free in nutrient broth medium in a test tube, then shaken using a vortex mixer at 6000 rpm for 2 min and allowed for 24 hours overnight. Emulsification index value (E24) was a high percentage of the emulsion layer (cm) divided by the total height of the solution (cm).

Percentage of emulsification index was calculated using the formula:

$$E24 = \frac{\text{High of emulsion formed} \times 100}{\text{High of total solution}}$$

[21,22].

G. Surface Tension Measurements

Supernatant which produced from the centrifugation process of isolates and bacterial consortium were measured the

surface tension by Surface Tensiometer (Model 21, catalog no. 59951-14, Cole-Parmer), du Nouy ring method at 6000 rpm for 25 minutes. Supernatant which will be measured to be transferred to a clean beaker glass and placed on the sample table. Sample table was moved up to the position under ring of platinum-iridium exactly. Then sample table was carried up to the ring immersed in the supernatant. The ring must be wetted by supernatant approximately 1/8 inch below the surface. The scale will be read at the breaking point of the supernatant which was the value of surface tension.

H. Interfacial Tension Measurements

Interfacial tension measurement procedure the same as the surface tension measurements; an equal volume of ALCO and the supernatant was poured into a beaker glass with a diameter of 4 cm and the resulting mixture was used for the measurement of interfacial tension. Balancing analysis of Surface tensiometer readings done during rings of platinum-iridium was completely absorbed in the phase of the ALCO and not the surface or interface of ALCO-supernatant. Ring of platinum-iridium was absorbed then put into the surfactant phase till rings platinum-iridium is separated from ALCO-supernatant interface [23]. Scale will be read at the breaking point between the ALCO and the supernatant.

III. RESULTS AND DISCUSSION

A. The growth of bacteria producing biological surfactant

Isolate 33, 34, 35, and 38 also bacterial consortium had indicated that no different time grown pattern. The results of measurements of optical density (OD) each isolate and bacterial consortium were in Figure 1:

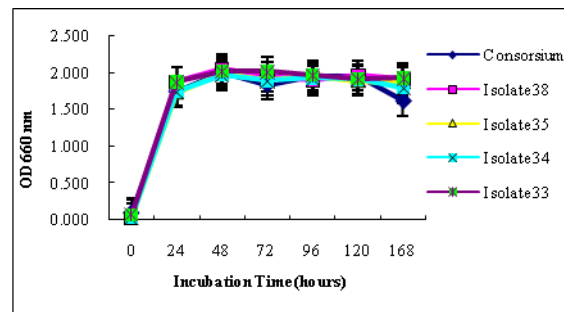


Figure 1: The growth pattern of isolates and bacterial consortium during incubation time

The results of measurement of OD on bacterial growth patterns showed that isolates and bacterial consortium achieve an exponential phase after incubation for 24 hours. After that, isolate 33, 34, 35, 38 and bacterial consortium enter the stationary phase up to 120 hours and finally to decline phase at 168 hours.

During the lag phase, increasing the cell size slowly. This phase is characterized by increasing macromolecular components, metabolic activity, and susceptibility to chemical and physical factors. Phase lag is a very important adaptation period to add metabolites in the cell group to achieve level of maximum cell synthesis [24].

In the exponential or logarithmic phase, cells were in a state of balanced growth. During this phase, mass and cell volume increases by the same factors in terms the average of cell composition and concentrations of metabolites are constant relatively. This phase was also characterized by the highness of cell proliferation rate that can be expressed by an exponential function naturally. Cell proliferation was determined by the intrinsic properties of bacteria and environmental conditions. In this case, there was a diversity of growth rate of isolates and bacterial consortium [25].

Based on figure 1, the stationary phase was a phase that resulting decrease in growth rate. It was begun by the accumulation of waste products, lack of nutrients, pH changes, and other factors which affect the growth culture,. During this phase, the number of living cells decline for different periods, culture cell population did not grow up, it began to occure swollen cell abnormally, or an aberration, a manifestation of unequal growth.

In the phase of population decline or death phase, nutrients of microorganisms growth is empty critically, occurred bacterial population decreased in number. In this phase, the current number of died cells are more than a life cell [26].

B. Analysis of carbohydrate

The result of carbohydrate in the biosurfactant shown in Figure 2:

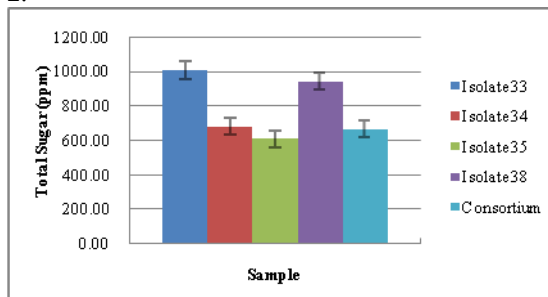


Figure 2: Average of total sugar content for each isolate and bacterial consortium

Analysis result of the average of total sugar content showed that four isolates (33, 34, 35, and 38 isolate) also a bacterial consortium have the ability to produce biosurfactant containing carbohydrate (total sugars) for 7 days of observation. The lowest total sugar content was found in the sample with treatment by isolate 35 (608.18 ppm) then followed by a bacterial consortium (666.36 ppm), isolate 34 (680.00 ppm), isolate 38 (940.30 ppm) and the highest is isolate 33 (1006.67 ppm). The use of ALCO compound as a carbon source for biosurfactant production by four isolates and a bacterial consortium are varies. This condition is related with emulsification activity during the incubation process [27].

Biosurfactant which produced by microorganisms has different of total sugar content, this is because of differences of the level of water solubility and availability of substrates for microorganisms. ALCO compound as a main substrate, in a particular concentration may be the effect of inhibiting the growth of microorganisms and biosurfactant production. The inhibitory effect was related with ALCO compound solubility and the difficulty level of four isolates and bacterial consortium

to gain access to nutrients in the culture media. The types, qualities and quantities of biosurfactant production are affected by the form and the availability of carbon substrates as an energy sources and the growth of microorganisms [28].

Based on the description above, the linkage of esterification in ALCO compound on isolate 33 and isolate 38 were enables hydrolysis reaction to release the total sugar in the production of biosurfactant rapidly. Thus, it is known that isolate 33 and isolate 38 are more capable to oxidize components of ALCO compound in the production of biosurfactant to produce carbohydrate.

C. Protein analysis

Characterization of biosurfactant which produced by isolates (33, 34, 35, and 38 isolate) also bacterial consortium in the form of protein content using modified method of Bradford [18], shown in Figure 3:

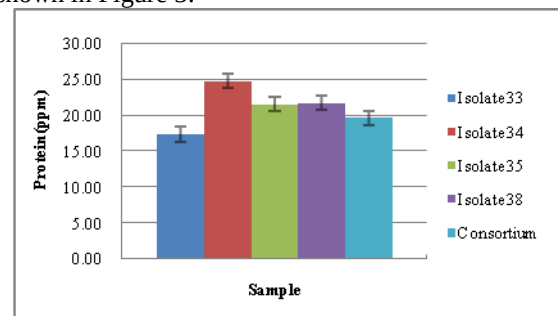


Figure 3: Average of protein content for each isolate and bacterial consortium

Analysis results of average of protein content showed that four isolates (33, 34, 35 and 38 isolate) also bacterial consortium are able to use the NH_3 compounds or nitrate or urea as a source of nitrogen for protein synthesis for cell growth. The availability of nitrogen sources as a macronutrient substrate in the growth of microorganisms was very important to obtain a high concentration of biosurfactant although every nitrogen sources was different in level of the effectiveness of protein synthesis [13].

Protein content in Figure 3, showed that the four isolates (33, 34, 35, and 38 isolate) and a bacterial consortium have the ability to produce biosurfactant. This was obtained from the production of biosurfactant by isolates and bacterial consortium which were distributed uniform containing protein. The lowest protein content was found in the sample with treatment by isolate 33 (17.44 ppm) then followed by a bacterial consortium (19.69 ppm), isolate 35 (21.57 ppm), isolate 38 (21.77 ppm) and the highest was isolate 34 (24.81 ppm).

The various of protein content on biosurfactant was caused by capability levels of nitrogen source conversion of each isolate and bacterial which are different in the transformation of one compound into another compound that can be utilized by isolates and bacterial consortium. This suitability with reported by [13], that the source of nitrogen may be an important key for the regulation of biosurfactant synthesis.

It can be seen in Figure 3, that isolate 34 and isolate 38 are more able to transform nitrogen source into a protein compound in the biosurfactant synthesis compared with isolate 33, isolate 35 and a bacterial consortium. This condition was appropriate

with the statement of [28], that the types, qualities and quantities of biosurfactant produced was influenced by culture conditions such as pH, temperature, agitation, and the dilution rate as well as the culture itself is also influenced by the properties of the carbon substrate, concentrations of nitrogen, phosphorus, magnesium, iron, and manganese ions in the medium.

Relating to the availability of nitrogen as a constituent of protein compound in the biosurfactant synthesis, the high concentration of nitrogen (N) in a growth medium with hydrocarbons as the main source of carbon can cause toxic to hydrocarbonoclastic bacteria [29].

D. Lipid analysis

Biosurfactant production has been demonstrated successfully with the availability of water-soluble substrates, hydrocarbons and oils. The results of the analysis of lipid compounds in the characterization of biosurfactant of four isolates (33, 34, 35 and 38 isolate) and bacterial consortium shown in Figure 4:

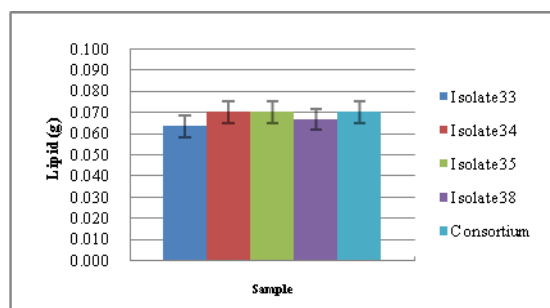


Figure 4: Average lipid content (g) for each isolate and bacterial consortium

Microorganisms utilize various organic compounds as carbon and energy source for their growth. When the source of carbon is not soluble substrates such as hydrocarbons (C_xH_y), microorganisms facilitate their diffusion into the cell by producing biosurfactant [13].

The results of the average lipid content analysis showed that four isolates (33, 34, 35, and 38 isolate) also a bacterial consortium have the ability to produce biosurfactant-containing lipids. The lowest lipid content was found in isolate 33 (0.070 g) then followed by isolate 34 and isolate 35 with similar lipid content (0.080 g) and the last isolate 38 (0.090 g). The highest lipid content was found on the bacterial consortium (0.120 g).

High and low lipid content is closely associated with the production of biosurfactant produced by isolates and bacterial consortium. Lipid content of the biosurfactant whose varies value is usually directly proportional to the ability of emulsification activity and surface tension reduction. The higher levels of lipid contained in the biosurfactant produced by microorganisms, usually is also higher the ability of emulsification activity and surface tension reduction [30].

Based on Figure 4, a bacterial consortium contain the highest lipid in its biosurfactant than isolates, it was believed to have strong relationship with its ability as an emulsifier and reduce surface tension. It also reported by [1], that types of biosurfactant are formed from the growth of microorganisms,

greatly influenced by the ability of the microorganism itself to form emulsion and to reduce surface tension.

Bacterial consortium and isolate 38 have a higher lipid content than 33, 34 and 35 isolates although the source of carbon for their growth come from the same substrate (ALCO). Bacterial consortium were more able to adapt the growth process. This was appropriate with the reported by [31], that biosurfactant production was closely related with metabolism increase of microorganisms on hydrocarbon substrates (e.g. benzene, hexadecane, etc.). As a carbon source, hydrocarbons are non-polar substrates. Therefore, biosurfactant production may increase the bioavailability of non-polar substrates with emulsification properties.

E. Emulsification activity (E24)

The analysis result of emulsification activity of biosurfactant on four isolates (33, 34, 35 and 38 isolate) also bacterial consortium shown in Figure 5:

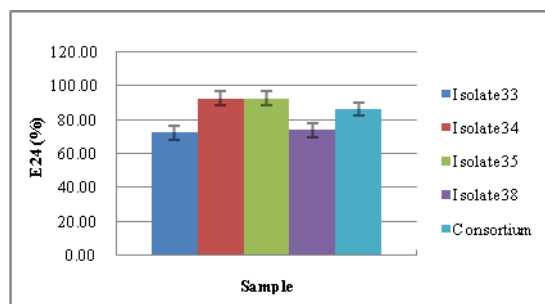


Figure 5: Percentage of emulsification activity for each isolate and bacterial consortium

The analysis result of percentage of emulsification activity showed that biosurfactant produced by bacterial consortium have the highest emulsification activity with emulsification index of 93.75% followed by isolate 34 and isolate 35 with emulsification index of 92.36%, isolate 38 with emulsification index of 73.61% and the last isolate 33 with emulsification index of 72.22%. In general, four isolates and bacterial consortium have the ability to optimize the absorption of hydrocarbons to produce biosurfactant through the mechanism of substrate emulsification until the contact between oil phase and water phase is to be larger.

It is also obtained that bacterial consortium, isolate 34 and isolate 35 showed a greater ability to produce an emulsion (oil droplet size is to be smaller) respectively. The ability of bacterial consortium and each isolate to form emulsion on the biosurfactant production process is influenced by many factors, as suggested [9]. Factors that affect the ability of bacteria in the emulsification process consists of : 1). Factors affecting the bacterial cell surface include : a) Species-specific genetic potential for cell wall biochemistry (hydrophobic, hydrophilic), b) Metabolic state of cell influencing expression of genetic potential involve of cell cycle (averaged in nonsynchronized cultures); availability of C, N, O; Substrate form (e.g. sugars vs alkanes), c) Physical organization of cell wall biochemicals at the cell surface, d) Binding of extracellular surface-active molecules of biological origin to the cell surface, involve of secreted metabolic byproducts; products of cell autolysis; lipids extracted from cells by organic substrates; 2) Factors of nonbiological

origin influencing interfacial and rheological properties of the system include organic phase composition, aqueous phase composition (salts and pH), nature of emulsion-stabilizing surfactants, presence of fine particulates (e.g. clays) and temperature.

Emulsification properties of the surfactant was measured in terms of emulsification activity (EA) and emulsification stability (ES) [32]. EA was the ability of a surfactant to form emulsions under certain conditions and directly related to the oil droplet size, the smaller of the size was the greater of the activity. Naturally, the emulsions were thermodynamic instability and the separation of a solution into the oil phase and the water phase [33].

Emulsion was formed when one of liquid phase is dispersed as microscopic droplets in another liquid phase. Emulsion activity is tested by the ability of biosurfactant to produce hydrocarbons suspension such as n-hexadecane [34] or kerosene [15] or a mixture of n-hexadecane and 2 - methyl naphthalene [35] and others in an aqueous test systems. Therefore, emulsification stability (ES) is a measure of slow/fast of an emulsion separate into oil phase and water phase rapidly.

F. Surface tension measurements

Analysis results of surface tension measurements on biosurfactant characterization produced by four isolates (33, 34, 35, and 38 isolate) also bacterial consortium shown in Figure 6:

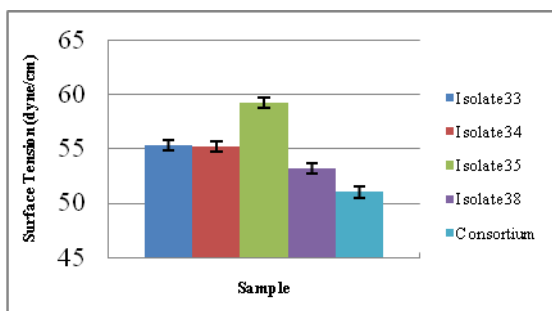


Figure 6: Surface tension value for each isolate and bacterial consortium

The highest of surface tension values was isolates number 35 (59.20 dyne/cm), the lowest surface tension values obtained in the sample with treatment by bacterial consortium of bacteria (51.00 dyne/cm), then followed by isolate 38 (53.20 dyne/cm). The low value of surface tension on bacterial consortium and isolate 38, indicating rapidly hydrolysis reaction to produce biosurfactant through the release of fatty acids and glycerol. Bacterial consortium and isolate 38 have more ability to adapt and oxidize hydrocarbons rapidly in the oil (ALCO) until resulting reduction of surface tension. [36] reported that one of the most important characteristics of the biosurfactant was the ability of a microorganism to reduce surface tension and interfacial tension between oil and water which can be measured by the method of du-Nouy ring classic. Surface tension values also showed that the biosurfactant produced was hydrophilic and can be used as a solvent agent, detergent and as an emulsifier between oil with water (O/W).

The results showed that most bacteria have an optimal capacity to degrade dissolved hydrocarbons compound through

the mechanism of substrate emulsification and or dissolution process and or removal cell hidropobicity, so that, the cell can directly contact with the oil phase to produce biosurfactant [27]. Surface tension measurement would be the choice of method to quantify biosurfactant production. However, it gave an indirect relationship to the concentration of biosurfactant available in the liquid [1]. Reduction of surface tension was indicative to the production of biosurfactant by the microbe. The higher reduction of surface tension would lead to the high concentration of biosurfactant available [37].

However, biosurfactant were also occurred in the form of micelles at which point reduction of surface tension could not be determined anymore thus, the presence of increasing concentration of biosurfactant during prolonged incubation could not be measured [38].

G. Interfacial tension measurements

The results of interfacial tension measurements of the four isolates and bacterial consortium shown in Figure 7:

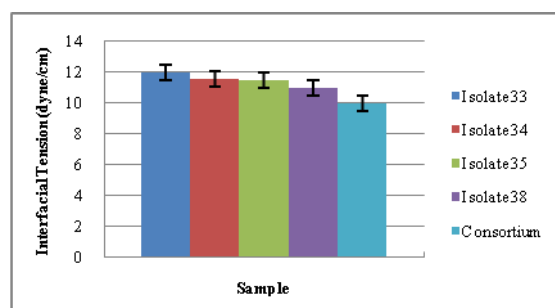


Figure 7: Interfacial tension value for each isolate and bacterial consortium

The result of analysis of interfacial tension showed that the lower value of interfacial tension was found in the samples with was treated by bacterial consortium (10.00 dyne/cm), then followed by isolate 38 (11.00 dyne/cm), isolate 35 (11.50 dyne/cm), isolate 34 (11.60 dyne/cm) and the highest is isolate 33 (12.00 dyne/cm). Reduction interfacial tension value indicates the ability of biosurfactant to enhance the contact between oil (ALCO) with supernatant by reducing the capillary tension between oil (ALCO) with supernatant until resulting mobilization of oil (ALCO) between the supernatant. In this case, a bacterial consortium have more ability to make contact between the oil with the supernatant.

Kaczorek et.al [39] reported that the values of surface tension and the interfacial tension on the characterization of biosurfactant depend on type factors: concentration of emulsifier, bioemulsifier, quantity and types of strain of bacteria, the complexity of hydrocarbons also products of emulsifier biodegradation. The influence of its resultant on the water can be expressed as a change in the surface tension and interfacial tension.

Analysis results of biological surfactant characterization of bacterial and consortium from the soil contaminated hydrocarbons in Cepu Area, Central Java, Indonesia can be summarized in the Table 1:

Table 1: Biosurfactant characterization of bacterial consortium from soil contaminated hydrocarbons in Cepu Area, Central Java, Indonesia.

Isolates	OD (48 hours)	Carbo hydrate (ppm)	Protein (ppm)	Lipid (gr)	Index of Emulsification (%)	Surface Tension (dyne/cm)	Interfasial Tension (dyne/cm)
33	2.004	1006.70	17.44	0.070	72.22	55.30	12.00
34	1.965	680.00	24.81	0.080	92.36	55.20	11.60
35	2.006	608.18	21.57	0.080	92.36	59.20	11.50
38	2.058	940.30	21.77	0.090	73.61	53.20	11.00
Consortium	2.075	666.36	19.69	0.120	93.75	51.00	10.00

IV. CONCLUSION

The results revealed that growth of bacteria exponential phase was reached at 24 hours. The biosurfactant was a complex compound which consist of carbohydrate, protein and lipid. The emulsification used E24 of 93.75% unit was observed for bacterial consortium. The surface tension was reduced to below 51 dynes/cm from 72.00 dynes/cm (water surface tension) of bacterial consortium and the lowest interfacial tension values were obtained 10.00 dynes/cm.

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Data Security in DNA Sequence Using Random Function and Binary Arithmetic Operations

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Abstract- The main target of this research paper is to propose an algorithm to implement data security using encryption and decryption method in binary sequence of original text message. The binary sequence of message is converted into DNA sequence, which consists of nucleotide letter A,T,G,C., then by using random function, which generates the sequence of random numbers for each nucleotide. The generated random numbers are used to cryptography the ASCII values of binary DNA sequence of original text message, with binary addition and subtraction method. Hence, this paper aims to describe and review about the data security by using the random function in DNA sequence.

Index Terms- Binary Sequence; DNA sequence; Random number generator function; data security, Binary addition and Binary subtraction.

I. INTRODUCTION

In network it is very important to protect the data. In order to achieve this there are several technologies being used. One of the secured way to protect the data is encryption and decryption method. Because of increasing the number of Internet users, data security has become very important task of sending and receiving the data.

Therefore, now a days it has become more significant to secure the data. Before employing biological properties of DNA sequence, the popular symmetric cryptography algorithms include the old Data Encryption Standard (DES) and the new advanced Encryption Standard (AES)[1], argue that the AES system suffers from an obvious weakness, the key must be known to both parties. Thus the problem of confidential communication reduces to that of how to distribute these keys securely.

The new class in cryptosystem is an asymmetric cryptography algorithm. In Asymmetric cryptography algorithm a different key is used for encryption and decryption. So, a user has a pair of keys like public and private key. Cryptography aims to construct schemes or protocols that can still accomplish certain tasks even in the presence of an adversary. A basic task in cryptography is to enable users to communicate securely over an insecure channel in a way that guarantees their transmission is private and authenticated. Providing privacy and authenticity remains a central goal for cryptographic protocols. Cryptography's aim is to construct schemes or protocols that can still accomplish certain tasks even in the presence of an adversary. A basic task in cryptography is to enable users to communicate securely over an insecure channel in a way that

guarantees their transmissions are guaranteed. Providing privacy and authenticity remains a central goal for cryptographic protocols, but the field has expanded to encompass many others, including e-voting, digital coins, and secure auctions.[2]

Two different kinds of genetic material exist, deoxyribonucleic acid (DNA) and Ribonucleic acid (RNA) present in a cell. DNA consists of 4 types of nucleotides like, Adenine (A), Thymine (T), Cytosine(C), and Guanine (G). James D.Watson and Francis Crick were the two co-discoverers of the structure of DNA in 1953. They used x-ray diffraction data collected by Rosalind Franklin and proposed the double helix or spiral staircase structure of the DNA molecule. Their article, Molecular Structure of Nucleic Acids: A Structure for Deoxyribose Nucleic Acid is celebrated for its treatment of the B form of DNA (B-DNA), and as the source of Watson –Crick Base pairing of nucleotides. They were, with Maurice Wilkins, awarded the Nobel Prize in Physiology or Medicine in 1962.[3]

Binary sequence is a sequence, which contains 0's and 1's. As CPU understands only machine level language, so processing with binary numbers is efficient and processing speed will be high.

A random function is a type of random element in which a single outcome is selected from some family of functions, where the family consists some class of all maps from the domain to the co domain. For example the class may be restricted to all continuous functions or to all step function. The values determined by a random function is evaluated at different points from the same realization would not generally be statistically independent but, depending on the model, values determined at the same or different points from different realizations might well be treated as independent.[4].

The National Center for Biotechnology Information (NCBI) provides data analysis, retrieval and resources that operate on the data in GenBank and a variety of other biological data is available through NCBI's Web site. NCBI data retrieval resources includes Entrez, PubMed, Locus Link and the Taxonomy Browser. Data analysis resources includes BLAST, Electronic PCR, OrfFinder, RefSeq, UniGene, Database of Single Nucleotide Polymorphisms (dbSNP), Human Genome Sequencing pages, GeneMap'99, Davis Human-Mouse Homology Map, Cancer Chromosome Aberration Project (CCAP) pages, Entrez Genomes, Clusters of Orthologous Groups (COGs) database, Retroviral Genotyping Tools, Cancer Genome Anatomy Project (CGAP) pages, SAGE map, Online Mendelian Inheritance in Man (OMIM) and the Molecular Modeling Database (MMDB). Augmenting many of the Web applications are custom implementations of the BLAST program optimized to search specialized data sets. All of the resources can be accessed

through the NCBI home page at: <http://www.ncbi.nlm.nih.gov> [5].

Cryptography is one of the most active area of research in computer science. It survives only where efforts to reduce computational complexity have failed, because the intractability of various problems keeps unwanted intruders at bay. Predicting its future, however, is difficult. Researchers are constantly devising new cryptosystems that are often based on new, untested intractability assumptions. For every cipher that a cryptanalyst breaks, two more seem to sprout up in its place. Despite the fact that revolutionary discoveries in algorithmic might render entire classes of cryptosystems obsolete overnight, the field likely will continue to survive due to its breadth and diversity alone[7].

DNA SEQUENCE AND RANDOM NUMBERS

A living organism consists of different organs. Organs are made up of group of tissues and cells. Each group of cells performs different functions based on structure and origins in the body.

Each cell consists of cell membrane, cell wall, mitochondria, nucleus etc., each nucleus consists of nucleolus, which consists of DNA's. Deoxyribonucleic acid (DNA) consists of Purines are Adenine (A) and Guanine(G).Pyrimidines are Thymine(T) and Cytosine(C). Fig.1. shows the structure of double stranded Helix DNA sequence.

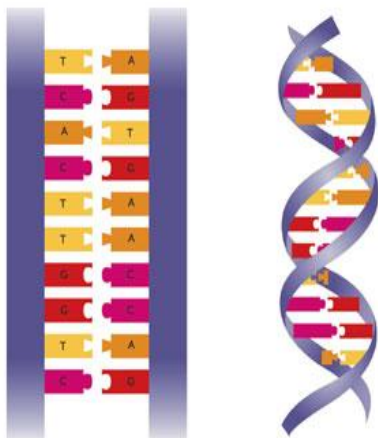


Fig.1: Structure of double stranded DNA.

The detection of the distortions of the sequence when the host sequence changed to some degrees. That was the best spot to start the wholly detection of the secret data . By advent of biological aspects of DNA sequences to the computing areas, new data hiding methods have been proposed by researchers, based on DNA sequences. The key portion of their work is, utilizing biological characteristics of DNA sequences. In order to convert binary data into amino acids as a DNA sequence, the base pairing rules must be used. Synthesizing nucleotides in real environment (biology) is done in constant rules [6].

The table I give the binary values for DNA sequence.

**TABLE I
NUCLEOTIDE SEQUENCE FOR BINARY SEQUENCE**

Binary Sequence		Nucleotide
0	0	A
0	1	T
1	0	C
1	1	G

The table II, gives the ASCII values for A,T,G,C and its binary equivalent representation.

**TABLE II
ASCII VALUES FOR NUCLEOTIDE**

Nucleotide	ASCII values	Binary Representation
A	65	1000001
T	84	1010100
G	71	1000111
C	67	1000011

Random number generator

A random function is a type of random element in which a single outcome is selected from some family of functions, where the family consists of some class of all maps from the domain the co domain.

The sequence of random numbers are generated using the function rand()and modulus(%) operator, within the range of 50 numbers.

Encryption and Decryption

Encryption method is done by Binary addition of ASCII values of ATGC and random key generated. Decryption method is done by binary subtraction of encrypted binary numbers with random key values.

Binary addition and Binary subtraction

Binary addition and binary subtraction performs operations only on 0's and 1's based on rule [8].

Table III is used to perform binary addition between the binary representation of ASCII values of DNA sequence and the binary representation of random numbers.

Table IV is used to form a binary subtraction between key generated by random numbers with encrypted binary sequence for the length of 8 bits.

**TABLE III
RULES FOR BINARY ADDITION**

A	B	A+B	Carry
0	0	0	0
0	1	1	0
1	0	1	0
1	1	0	1

TABLE IV
RULES FOR BINARY SUBTRACTION

A	B	A-B	Borrow
0	0	0	0
0	1	1	1
1	0	1	0
1	1	0	0

II. IMPLEMENTATION

The algorithm to implement data security in binary representation of DNA sequence is done by using the random function as well as using encryption and decryption algorithm, based on the method of binary addition and binary subtraction rule.

Algorithm for Encryption

- Step 1: Convert text message into binary message.
- Step 2: Convert binary message into DNA sequence using table 1.
- Step 3: Generate a random numbers for each nucleotide of DNA sequence , using rand() function.
- Step 4: Convert DNA sequence of step 2 into standard ASCII values, using table 2, then convert into Binary values.
- Step 5: Convert random numbers of step 3 into binary numbers.
- Step 6: Perform binary addition for step 4 & step 5.
- Step 7: Repeat step 6 for entire length.
- Step 8: gives out the complete binary encrypted message of original message.

Algorithm for Decryption

- Step 1: Read the sequence of encrypted binary message with random numbers
- Step 2: Apply Binary subtraction from key generated by random numbers with encrypted binary sequence for the length of 8 bits.
- Step 3: Convert the result of step 2 into decimal number and convert to ATGC using table 2.
- Step 4: Convert the result of step 3 into binary sequence using table 1.
- Step 5: Results the original binary message.

III. DISCUSSION

Finding exact match of binary sequence is very difficult task. To break the data security, intruder has to know all possible combinations of binary representation of A,T,G and C Random number key value, Binary arithmetic operations. The probability is to find exact two bit binary message is $1/2^{30}$.

IV. CONCLUSION

One of the major problems in network is data security. Considering DNA characteristics and random keys, achieve new ideas in data security. This paper focus on the data security

issues for providing a secure and effective encryption and decryption method by random number keys generation. Through this system model we can secure our data in a network.

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An Approach to Design and Simulate Synchronous Machine with Excitation System Modeling

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Abstract: Synchronous motors are designed to run at synchronous speed. Synchronous speed defines the natural rate of rotation of the magnetic field generated in the stator of an AC machine. This rate of rotation is governed by the frequency of the voltage applied to the machine and the number of pole pairs built into the stator, and is defined by the following equation:

$$\text{Synchronous Speed, } N_s = (60 \text{ seconds/minute}) * (\text{Cycles per Second}) \text{ (RPM)} \quad [2]$$

The stator of a synchronous motor is wound in the same manner as a three-phase induction motor, with distributed poles. When a three-phase source is applied to the stator, a rotating magnetic field develops at synchronous frequency. The rotor of a synchronous motor, however, differs greatly from that of an induction motor. In an induction motor, voltages are induced in the rotor as its windings cut lines of flux created by the rotating stator field. The induced voltages cause a flow of current in the rotor winding, creating a magnetic field in the rotor and developing torque.[2]

In a synchronous motor, applying a DC current to the rotor winding via a separate source creates the magnetic field in the rotor. This constant magnetic field could be considered a "sail" which is caught in the rotating stator field, forcing the rotor to turn at synchronous frequency. However, it must be noted that synchronous motors are not self-starting. The DC field in the rotor will only synchronize with the rotating field in the stator if the rotor is already turning at some high percentage (say 90%) of synchronous speed. Therefore, synchronous motors are never started under load and must use some sort of starter that will accelerate the rotor to near-synchronous speed while the DC excitation circuit is de-energized. A starter may be an external motor, connected to the rotor shaft during startup and disconnected when the rotor is able to synchronize with the stator field. More commonly, a squirrel cage winding is incorporated

into the rotor assembly, allowing the synchronous motor to self-start as an induction motor.[2]

Index Terms- AC, N_s , RPM

I. INTRODUCTION

A Power system is said to be stable when perturbed synchronous machines: (1) come back to their original state when there is no net change of power (2) obtain a new state without losing synchronism. For large systems stability study, state space modeling technique is used. Techniques of linear system analysis such as root-locus plots, Nyquist criterion and Routh-Hurwitz criterion are used to understand dynamic behavior of the system. The given system consists of synchronous machine, exciter, amplifier portion, and regulator components.

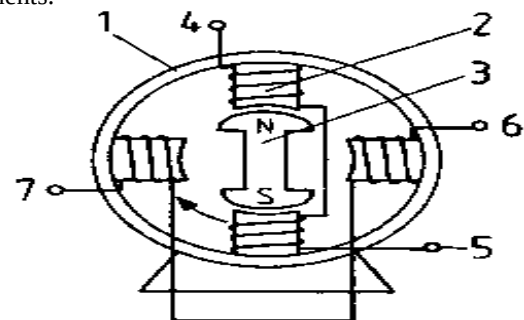


Figure 1.1: A Synchronous Machine

The numbers in the figure depicts the following

1 Casing, 2 Stator, 3 Field spider, 4 Beginning winding one, 5 End winding one, 6 Beginning winding two, 7 End winding two

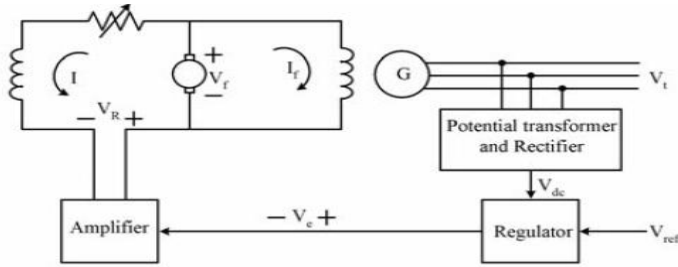


Figure:1.2 Synchronous Machine and its excitation system [1]

Three phase synchronous generators driven by turbines are used for large scale power generation. It consists of a stationary and rotating parts called as stator and rotor respectively. Armature windings arranged on stator are used for generating three phase balanced voltages and developing magnetic poles as the field winding on the rotor. A short circuited winding called as damper winding is also placed on rotor. The field circuit is excited by DC and excitation is done through slip rings and brushes by AC generators. The given synchronous machine is assumed to have three stator windings, one field winding and two damper windings. All these windings are magnetically coupled which is a function of rotor position. Therefore, flux linkage is also function of the rotor position. The instantaneous terminal voltage V of any winding is given by $V = \pm \sum ri \pm \sum \lambda$ here ' λ ' is the flux linkage, ' r ' is winding resistance and I is stator current in a direction flowing out of the generator terminals.[3]

II. MATHEMATICAL MODELING OF A SYNCHRONOUS MACHINE CONNECTED TO AN INFINITE BUS SYSTEM

For transient analysis, the idealized synchronous machine is represented as a group of magnetically coupled circuits with inductances which depend on the angular position of the rotor. The resulting differential equations describing the machine have time varying coefficients, and a closed form of solution is not feasible. A great simplification can be made by transformation based on two-axis theory. Park's Transformation for space vector control:

For obtaining mathematical model of synchronous machine, certain transformation of variables called as Park's transformation is done which converts all stator quantities from three phases to equivalent d-q axis. Axis along rotor winding is called direct axis and that of along neutral axis of the field winding is called quadrature axis.

$$i_{qaxis} = \left(\frac{2}{3}\right) \left[i_a \sin \theta + i_b \sin\left(\theta - \frac{2\pi}{3}\right) + i_c \sin\left(\theta + \frac{2\pi}{3}\right) \right]$$

$$i_{daxis} = \left(\frac{2}{3}\right) \left[i_a \cos \theta + i_b \cos\left(\theta - \frac{2\pi}{3}\right) + i_c \cos\left(\theta + \frac{2\pi}{3}\right) \right]$$

By definition of parks transformation

$$i_{odq} = P i_{abc}, V_{odq} = P V_{abc}, \lambda_{odq} = P \lambda_{abc} \text{ Where } P \text{ is given by}$$

$$P = \sqrt{\frac{2}{3}} \begin{bmatrix} \frac{1}{\sqrt{2}} & \frac{1}{\sqrt{2}} & \frac{1}{\sqrt{2}} \\ \cos \theta & \cos\left(\theta - \frac{2\pi}{3}\right) & \cos\left(\theta + \frac{2\pi}{3}\right) \\ \sin \theta & \sin\left(\theta - \frac{2\pi}{3}\right) & \sin\left(\theta + \frac{2\pi}{3}\right) \end{bmatrix}$$

The above matrix is for RMS quantities. (Constant $2/3$ is used for peak value quantities)

Location of d-axis of rotor is given by

$$\theta = \omega_R t + \delta + \pi/2$$

Where δ is the location of q-axis or the angle between machine

EMF E and terminal voltage V and $\omega_R t$ is the location of reference axis.

Figure given below is the schematic diagram of synchronous machine. [2]

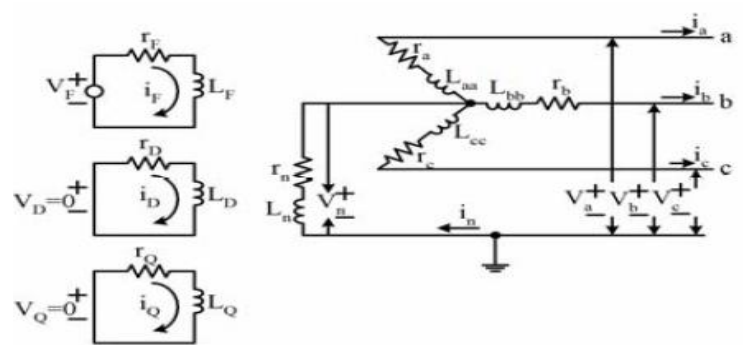


Figure: 2.1 Schematic diagram of synchronous machine

The voltages of generator in the rotor frame of reference in per unit is given by the equation

$$v = -ri - \dot{\lambda} + v_n$$

Where v_n is the neutral voltage matrix, r is the resistance diagonal matrix.

The machine equation in the rotor frame of reference following a three phase short circuit is given by

$$\begin{bmatrix} v_d \\ -v_f \\ v_D=0 \\ v_q \\ v_Q=0 \end{bmatrix} = - \begin{bmatrix} r & 0 & 0 & wL_q & wkM_q \\ 0 & r_f & 0 & 0 & 0 \\ 0 & 0 & r_D & 0 & 0 \\ -wL_d & -wkM_f & -wkM_D & r & 0 \\ 0 & 0 & 0 & 0 & r_Q \end{bmatrix} \begin{bmatrix} i_d \\ i_f \\ i_D \\ i_q \\ i_Q \end{bmatrix} - \begin{bmatrix} L_d & kM_f & kM_D & 0 & 0 \\ kM_f & L_f & M_D & 0 & 0 \\ kM_D & M_f & L_D & 0 & 0 \\ 0 & 0 & 0 & L_q & kM_Q \\ 0 & 0 & 0 & kM_Q & L_Q \end{bmatrix} \begin{bmatrix} i_d' \\ i_f' \\ i_D' \\ i_q' \\ i_Q' \end{bmatrix}$$

The above matrix is written by omitting the zero- sequence voltage which is dependent on v_o and i_o i.e. we are assuming that system is balanced but not necessarily steady state conditions.

The above matrix is converted to per unit values by considering three base quantities such as voltage, current and time. (Time base is fixed by rated radian frequency)

Compact notation in state space of above matrix is given by

$$\dot{V} = -(R + wN)i - L\dot{i} \quad (\text{Or})$$

$$\dot{i} = -L^{-1}(R + wN)i - L^{-1}v$$

Where

$$L_d = L_s + M_s + \frac{3}{2}L_m, \quad L_q = L_s + M_s - \frac{3}{2}L_m$$

R- Resistance matrix

N- Matrix of speed- voltage inductance coefficients

L- Inductance matrix

The above equation can be schematically represented by the following figure

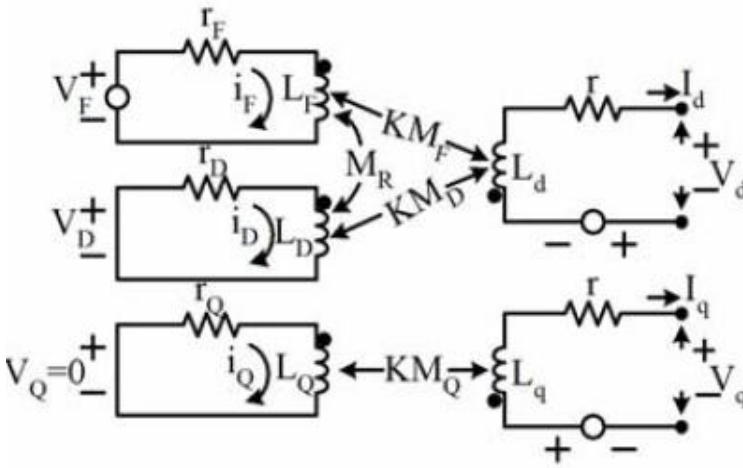


Figure 2.2 Equivalent d-q axis circuit

In the above figure, speed voltage terms represent the controlled sources.

Three phase power is given by:

$$P_{3\phi}(t) = i_0 v_0 + i_d v_d + i_q v_q$$

Note: The power output is invariant under park's Transformation.

Torque equation in d-q axis is given by

$$T_E = \frac{\partial P}{\partial w} = i_d \lambda_q - i_q \lambda_d$$

Here state space analysis is based on current formulation because it has an advantage of offering simple relations between the

voltages v_d and v_q and the state variables.

Now incorporating the state variables δ and w in the state space equation gives the overall system state space equation as given by

$$\begin{bmatrix} \dot{i}_d \\ \dot{i}_q \\ \dot{\delta} \\ \dot{w} \end{bmatrix}_{7 \times 1} = \begin{bmatrix} -L^{-1}(R + wN)_{5 \times 5} & 0 & 0 & 0 \\ 0 & -\frac{L_d i_q}{3\tau_j} & -\frac{k M_F i_q}{3\tau_j} & -\frac{k M_D i_q}{3\tau_j} \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix}_{7 \times 7} \begin{bmatrix} i_d \\ i_q \\ \delta \\ w \end{bmatrix}_{7 \times 1} + \begin{bmatrix} -L^{-1}v_{5 \times 1} \\ \frac{T_m}{3\tau_j} \\ -1 \end{bmatrix}_{7 \times 1}$$

Now we have set of load equations for each machine in the form given by

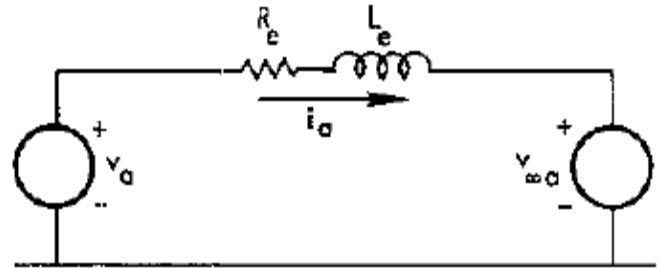
$$\dot{x} = f(x, v, T_m)$$

Let us assume that v_F and T_m are known. But the above equation does not completely describe the synchronous machine

because there are 2 auxiliary variables v_d and v_q . For writing additional equations for those variables we need to know the terminal conditions of the machine. Terminal voltage of synchronous machine is controlled by excitation system. For simple illustration, load constraint can be satisfied by one machine-infinite bus system.[3]

2.1 One machine-Infinite bus system

Below figure represents the synchronous machine connected to infinite bus through a transmission line having resistance R_e and inductance L_e whose voltages and current only for one phase are shown with an assumption of no mutual coupling between phases.



We can write KVL equation as

$$v_{abc} = v_{\infty abc} + R_e U i_{abc} + L_e \dot{U} i_{abc}$$

The above equation after transforming to 0-d-q frame of reference by park's transformation we get

$$v_{0dq} = P v_{abc} = v_\infty \sqrt{3} \begin{bmatrix} 0 \\ -\sin(\delta - \alpha) \\ \cos(\delta - \alpha) \end{bmatrix} + R_e i_{0dq} + L_e \dot{i}_{0dq} - w L_e \begin{bmatrix} 0 \\ -i_q \\ i_d \end{bmatrix}$$

Where $\dot{\delta} = w$

It can be observed that above equation have two nonlinearities: one due to speed voltage term and other due to trigonometric functions in the first term. Linearizing the above equation about

an equilibrium point $(\delta_0, w_0, i_{q0}, i_{d0})$ we get:

$$v_{d\Delta} = -\sqrt{3}v_\infty \cos(\delta_0 - \alpha) \delta_\Delta + R_e i_{d\Delta} + w_0 L_e \dot{i}_{q\Delta} + i_{q0} L_e w_\Delta + L_e \dot{i}_{d\Delta}$$

$$v_{q\Delta} = -\sqrt{3}v_\infty \sin(\delta_0 - \alpha) \delta_\Delta + R_e i_{q\Delta} - w_0 L_e \dot{i}_{d\Delta} - i_{d0} L_e w_\Delta + L_e \dot{i}_{q\Delta}$$

For small displacements, the above equations can be written as:

$$v = -Kx - M\dot{x}$$

Matrices M and K represents the synchronous machine constants, transmission line constants, and infinite bus voltage.

The above equation in state space representation is given by

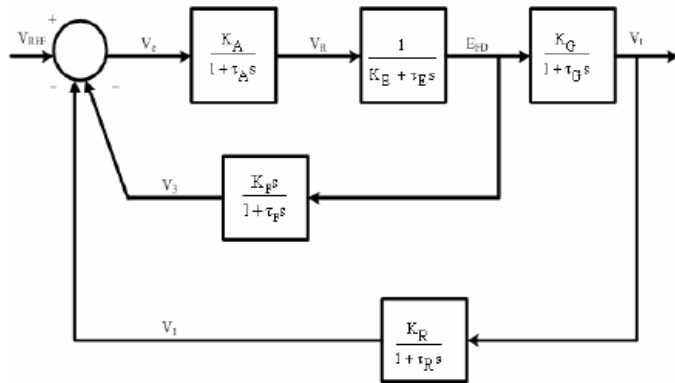
$$\dot{x} = -M^{-1}Kx - M^{-1}v \quad [3]$$

2.2 Buck-Boost Excitation system

A power system is nearly a constant voltage source and is made so because of system component design and close voltage control. This means that Thevenin's impedance seen looking in

to source is very small. Fast excitation helps keep this impedance small during disturbances and contributes to system stability by allowing the required transfer of power even during disturbances. Therefore excitation system is of significant importance in the power system.

Given below is the block diagram for the buck-boost excitation system with compensation. This compensation makes the root locus bend near $j\omega$ axis crossing in order to improve stability substantially.



From the block diagram, the equations of excitation system which controls the generated EMF of generator are given by:

$$\dot{v}_1 = \left(\frac{k_R}{\tau_R}\right) v_t - \left(\frac{1}{\tau_R}\right) v_1$$

$$\dot{v}_3 = \left(\frac{k_F}{\tau_F}\right) E_{FD} - \left(\frac{1}{\tau_F}\right) v_3$$

$$\dot{v}_R = \left(\frac{k_A}{\tau_A}\right) v_e - \left(\frac{1}{\tau_A}\right) v_R$$

$$E'_{FD} = \left(\frac{1}{\tau_E}\right) v_R - \left(\frac{S_E + k_E}{\tau_E}\right) E_{FD}$$

$$v_e = V_{REF} + v_t - v_1 - v_3$$

Using the above data state space matrix was constructed. Characteristic Matrix A was constructed and it was observed that the roots have negative real parts which indicate that system is stable. Then terminal voltage and machine currents were calculated from state space equations and corresponding plots are plotted. Analysis of the current plots show that they consist of Fundamental frequency component which is symmetrical with respect to the time axis and its superposition on the dc component gave an unsymmetrical waveform. The degree of asymmetry depends upon the point of the voltage cycle at which the short circuit takes place. Field current has dc and ac components with ac component decaying. Ac component of field current consists of fundamental as well as second harmonic but its second harmonic is relatively small.[3]

III. SYNCHRONOUS MACHINES

Rotating machine that rotate at a speed fixed by the supply frequency and number of poles are called Synchronous

machine. The speed of synchronous is given by

$$N_s = \frac{120 f}{P}$$

where f = frequency of supply, P = Number of poles. There are two types of synchronous machines

(i) Rotating armature type (ii) Rotating field type

3.1 Advantages of Rotating field

Most alternators have the rotating field and stationary armature. The rotating field type alternator has following advantages over the rotating armature type alternator.

A stationary armature has more ease to insulate for high voltage. This generated voltage may be as high as 33 KV (33000 Volt).

The armature winding can brace better mechanically against high electromagnetic forces due to large short circuit current when the armature windings are in the stator.

The armature winding, being stationary are not subject to vibration and stresses due to centrifugal forces.

The rotating field is supplied with direct current. Usually the field voltage is in between 100 to 500 V, which is easily fed to rotating field with the help of slip rings.

The output current can be taken directly from fixed terminals on the stationary armature without using slip rings and brushes etc.

The weight of the armature windings is substantially greater than the windings of the poles. The size of machine is therefore reduced.

Rotating field is comparatively light and can be constructed for high-speed rotation.

The armature of large alternators are forced cooled with circulating gas or liquids so stationary armatures are easy to cool.

3.2 Stator Construction

The stator has various parts such as frame, stator core, stator winding and cooling arrangement. The frame may be of cast iron for small size machines and welded steel type for large size machines. In order to reduce Hysteresis and eddy current losses, the stator core is assembled with high grade silicon steel laminations.

3.3 Rotor Construction

3.3.1 Salient Pole Rotor:

The salient poles are made of thick steel laminations riveted together and fixed to rotor by a dove tail joints. The pole faces are usually provided with slots for damper winding. These dampers are useful to prevent rotor oscillations during sudden changes in load. The pole faces are so shaped that the radial air gap length increases from the pole center to the pole tips so that the flux distribution over armature is sinusoidal. The ends of the field windings are connected to a dc source through slip rings carrying brushes. The salient pole field structure has following special features [4]:

- They have large diameter and short axial length.
- The pole shoes cover about 2/3 of pole pitch.
- They are suitable for low speed operation (100 to 375 rpm). So they are used in hydraulic turbines.

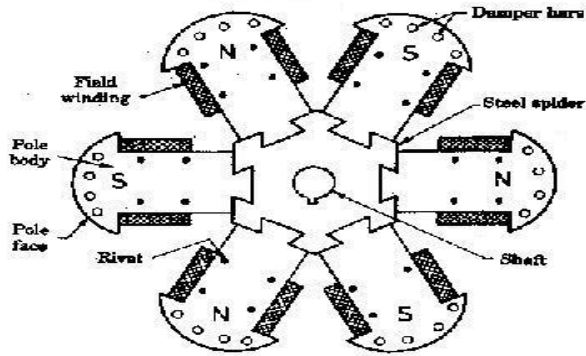


Figure 3.1 Salient pole Rotor

3.3.2 Cylindrical Rotor: Cylindrical rotors are used in very high speed alternators driven by steam turbines in thermal power plants. To reduce the peripheral velocity, the diameter of the rotor is reduced and axial length is increased. Such rotors have two or four poles. The cylindrical rotors are made from solid forgings of high-grade steel. In about two third of rotor periphery, slots are cut at regular intervals and parallel to the shaft. Due to long axial length and small diameter limits the centrifugal forces and has greater mechanical strength. So this type of construction is suitable for high-speed operation. Cylindrical rotors has following special features:

- They are of small diameter and very long axial length.
- Less windage losses.
- High operating speed (3000 rpm)
- Robust construction and noiseless operation.

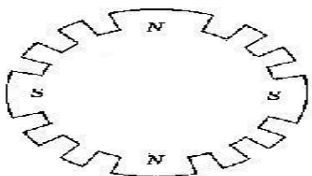


Figure 3.2 Cylindrical Rotor

3.3 Production of Rotating Magnetic Field: A rotating magnetic field is a field which is constant in magnitude but axis of direction rotates in space.

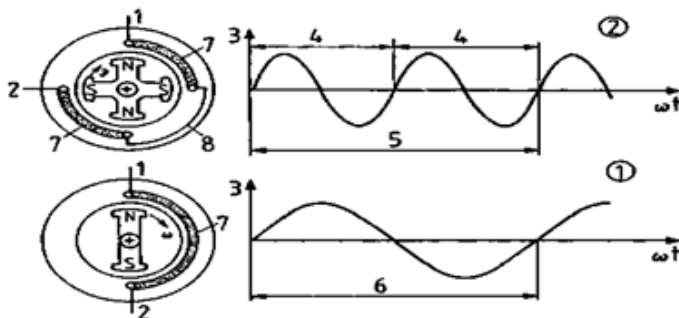


Figure 3.3 Interdependence of pole pair number and frequency in a synchronous machine

(1) Two-pole generator, (2) Four-pole generator

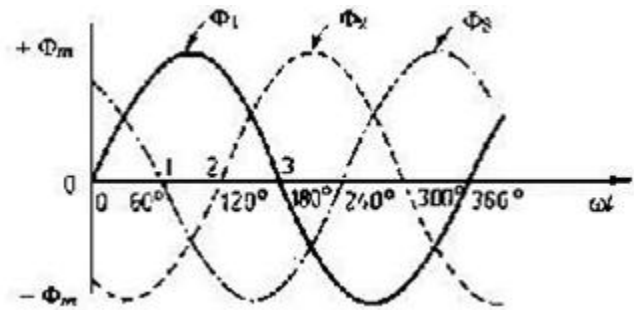
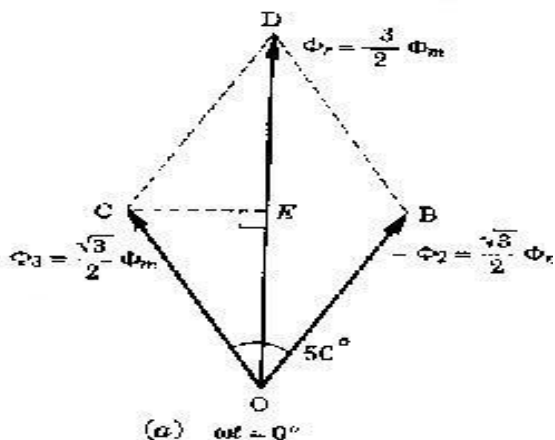


Figure 3.4 Waveform of fluxes produced by the three coils.

The maximum value of the flux due to the three phases is ϕ_m .

The resultant flux ϕ_r at any instant is equal to the phasor sum of the fluxes due to three phases. We shall determine the value of ϕ_r at four instants 60° apart corresponding to points 0, 1, 2, 3 in fig. (b).



(i) When $\omega t = 0$

$$\phi_1 = \phi_m \sin \omega t = \phi_m \sin 0 = 0$$

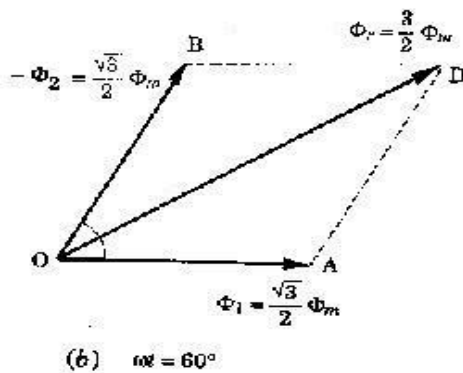
$$\phi_2 = \phi_m \sin(\omega t - 120^\circ) = \phi_m \sin(-120^\circ) = -\frac{\sqrt{3}}{2} \phi_m$$

$$\phi_3 = \phi_m \sin(\omega t + 120^\circ) = \phi_m \sin(120^\circ) = \frac{\sqrt{3}}{2} \phi_m$$

ϕ_2 is shown by OB, ϕ_3 along OC. The resultant flux ϕ_r is the phasor sum of OB and OC. Thus ϕ_r is equal to phasor OD

$$\phi_r = OD = 2 OC \cos 30^\circ = 2 * \frac{\sqrt{3}}{2} \phi_m \frac{\sqrt{3}}{2} = \frac{3}{2} \phi_m$$

(ii) When $\omega t = 60^\circ$



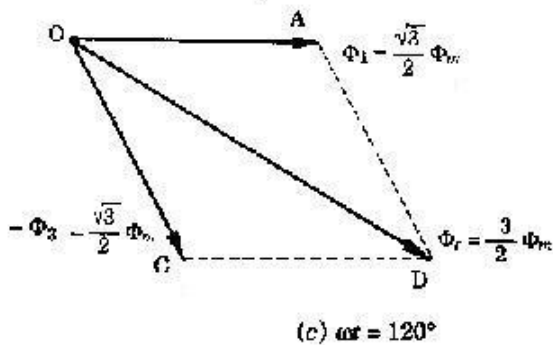
$$\phi_1 = \phi_m \sin 60^\circ = \frac{\sqrt{3}}{2} \phi_m$$

$$\phi_2 = \phi_m \sin(60^\circ - 120^\circ) = \phi_m \sin(-60^\circ) = -\frac{\sqrt{3}}{2} \phi_m$$

$$\phi_3 = \phi_m \sin(60^\circ + 120^\circ) = \phi_m \sin(180^\circ) = 0$$

$$\phi_r = OD = 2 OAC \cos 30^\circ = 2 * \frac{\sqrt{3}}{2} \phi_m * \frac{\sqrt{3}}{2} = \frac{3}{2} \phi_m$$

(iii) When $\omega t = 120^\circ$



$$\phi_1 = \phi_m \sin 120^\circ = \frac{\sqrt{3}}{2} \phi_m$$

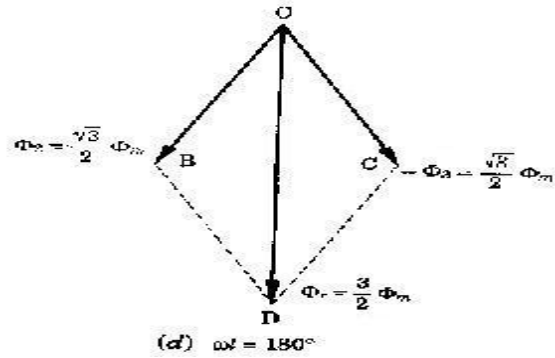
$$\phi_2 = \phi_m \sin(120^\circ - 120^\circ) = \phi_m \sin(0^\circ) = 0$$

$$\phi_3 = \phi_m \sin(120^\circ + 120^\circ) = \phi_m \sin(240^\circ) = -\frac{\sqrt{3}}{2} \phi_m$$

$$\phi_r = OD = 2 OAC \cos 30^\circ = 2 * \frac{\sqrt{3}}{2} \phi_m * \frac{\sqrt{3}}{2} = \frac{3}{2} \phi_m$$

(iv) When $\omega t = 180^\circ$

$$\phi_1 = \phi_m \sin 180^\circ = 0$$



$$\phi_2 = \phi_m \sin(180^\circ - 120^\circ) = \phi_m \sin(60^\circ) = \frac{\sqrt{3}}{2} \phi_m$$

$$\phi_3 = \phi_m \sin(180^\circ + 120^\circ) = \phi_m \sin(300^\circ) = -\frac{\sqrt{3}}{2} \phi_m$$

$$\phi_r = OD = 2 OBC \cos 30^\circ = 2 * \frac{\sqrt{3}}{2} \phi_m * \frac{\sqrt{3}}{2} = \frac{3}{2} \phi_m$$

$$\phi_r = \frac{3}{2} \phi_m$$

It is seen that the resultant flux is constant in magnitude but changing in direction.

IV. SYNCHRONOUS MOTOR

In the synchronous motor the field structure is energized by direct current, whereas the armature winding is connected to a 3 ϕ AC supply. Such a machine requires two sources one is DC to excite the field and other is AC for driving the armature.

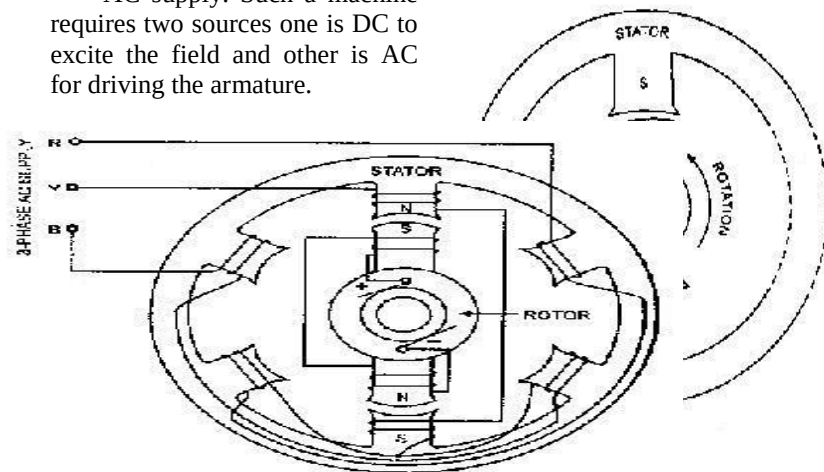
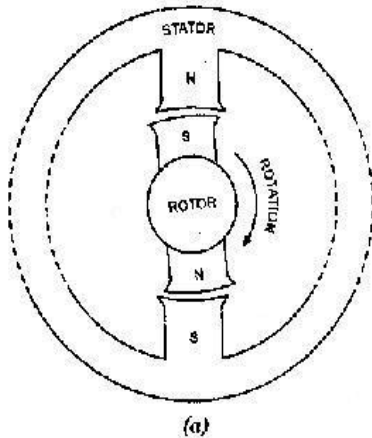


Figure 4.1 Three Phase Synchronous Motor

A synchronous motor may have either a revolving armature or a revolving field, but the revolving field construction is more common. The essential parts of a 3 phase synchronous motor are (1) Laminated stator core with 3 phase armature winding (2) Rotating field structure with damper winding and slip rings (3) Brushes and brush holders (4) Two end shields to house the bearings that support the rotor shaft. Damper windings are also used for starting.

4.1 Principle of operation of Synchronous motor:- Figure shows a 3 phase, two pole synchronous machine. The rotor has two poles and stator has two poles per phase. As motor is excited from DC supply, so the poles of the rotor retains the same polarity throughout but the polarity of stator poles changes as it is connected to an AC supply.

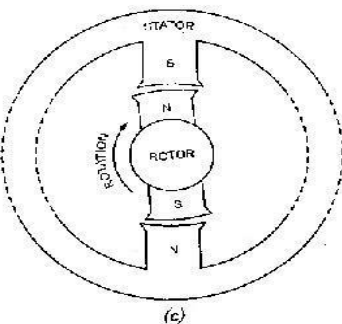


Initially the rotor is stationary as shown in fig. (a). At this instant of the rotor S-pole is attracted to the stator N pole and therefore, the rotor tends to rotate in clockwise direction. After half time period $\left(\frac{T}{2} \text{ Sec}\right)$ the polarity of stator pole is reversed but polarity of rotor poles remains same.

At this instant S-pole is repelled by the stator S-pole as shown in fig.(b). Thus the torque acting on the rotor of synchronous motor is of pulsating nature not unidirectional. Due to inertia rotor will not move in any direction. **So the synchronous motors have no self starting torque or synchronous motors are not self starting.**

Now consider the rotor is rotating in clockwise direction by some external means. The rotor S-poles is attracted to stator N-pole and torque act on rotor in clockwise direction. After half a time period the polarity of stator pole is reversed. But if the rotor is rotated at such a speed by some external means at starting moment that rotor S-pole advances by a pole pitch so that it is again under the influence of stator N-pole as shown in fig. (c). The torque acting on the rotor will again in clockwise direction. Hence a continuous torque will be obtained. Hence to obtain a continuous torque it is necessary that the rotor rotates at such a speed that it moves through a distance equal to pole pitch in half

the time period i.e. $\frac{T}{2}$ or $\frac{1}{2f}$ seconds. If there are P poles the complete revolution should take $\frac{P}{2f} * 60$ revolution per minute.



Hence to obtain continuous torque the rotor should rotate at synchronous speed i.e.

$$N_s = \frac{120 f}{P}$$

4.2 Effect of Load on Synchronous Motor: All the electric motors, whether DC or AC act as generator at the same time they are motoring. This is true because an emf is always induced and opposes the applied voltage. The opposing induced emf limits the armature current. In case of synchronous motors the speed is remains constant irrespective magnitude of load. Since the synchronous motor has no self-starting torque therefore first it is driven by some external means and is synchronized with the supply. At the instant of synchronizing the induced emf across the stator of motor is equal to the applied line voltage V but opposite in the direction. After synchronizing the external means is removed and the motor tends to slow down. There is no change in speed. There is a little shift in relative position of two poles, which continue to rotate at synchronous speed. The rotor poles fall back a little relative to stator pole. The angular displacement between the rotor and stator pole is known as delta and it is denoted by δ . The applied voltage and induced emf are no longer in direct opposition since induced emf at this instant lags behind the induced emf at the synchronizing instant by an angle δ_0 .

$$I_0 = \frac{E_R}{Z_s}$$

The resultant voltage ER causes a current I_0 to flow in the stator winding, where Z_s is the synchronous impedance per phase of the armature circuit. I_0 lags ER by an angle θ , called

$$\theta + \tan^{-1} \frac{X_s}{R_e}$$

the internal angle where X_s and R_e being the stator synchronous reactance and effective resistance respectively. Hence on no load motor draws power equal to $V I_0 \cos \phi_0$ from the supply mains. Now when the motor is loaded, it shows down momentarily to adjust itself to the change in loading conditions, so the poles falls back a little more relative to the stator pole. Now the torque angle increases with the increase in load. Due to increase in load angle δ , the resultant voltage ER across the armature circuit increases so the current drawn from supply increases. Thus a synchronous motor is able to supply increased mechanical load, not by reduction in speed, but by shift in relative position of rotor and rotating magnetic field. If the load is increased to a very high value the rotor will pull out of synchronism, after which it will come to stand still.

4.3 Effect of Varying Excitation On Armature Current And Power Factor:

The change in field excitation neither affects the speed of motor nor the output of motor. It only affects the power factor. The operation of a synchronous motor at a constant supply voltage demands nearly constant flux. When DC excitation is weak, the flux produced by it is weak and needs strengthen, so stator draws current lagging behind the supply voltage by 90°, so the input current results in low lagging power factor as shown in fig (b).

If the excitation increases up to 100%, the magnetizing current drawn from supply is reduced and power factor improves as shown in fig (a). If the excitation further increased such that

power factor becomes unity, the stator draws only energy or active component and DC field circuit supply all the current necessary to magnetizing the rotor. Further increase in excitation the field produced by it becomes stronger than it is required and needs demagnetizing. The motor draws the leading current so as to demagnetize the main field. In this condition machine behaves like "**Synchronous Condensor**".

Advantages of Damper Winding: When the motor is over loaded it does not stop. It continues running as a squirrel cage induction motor. When the speed falls below synchronism due to over loading an emf is induced in damper winding. Due to this emf a torque is produced which keep motor running.

Disadvantages: Since damper winding resistance is low so at the time of starting it takes large current from supply mains.

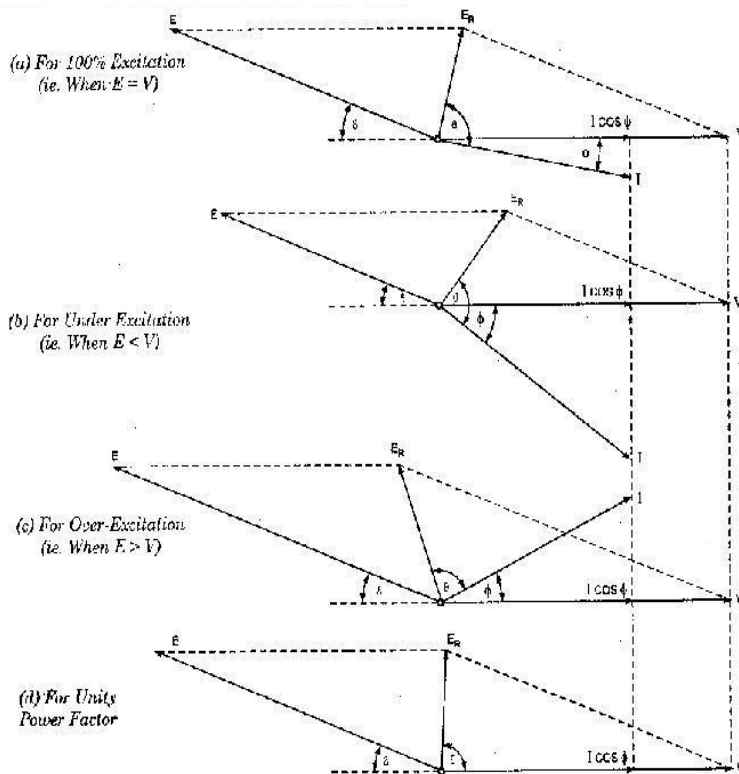


Figure 4.2 Effect of Varying Excitation on Armature Current and Power Factor

4.4 Merit and Demerits of Synchronous Motors

Merits:

- Power factor can easily be controlled.
- The speed is constant and independent of load.
- These motors can be constructed with wider air gap than induction motors.
- These motors usually operate at higher efficiency.

Demerits:

- Cost per KW is higher than induction motor.
- It requires DC excitation.

- Synchronous motors are not self-starting, additional arrangements are used to make it self-starting.
- It has tendency to hunt.
- It cannot be used for variable speed jobs as there is no possibility of speed adjustment.
- It may fall out of synchronism and stop when over loaded.

4.5 Applications of Synchronous Motors:

Synchronous motors are mainly used in constant speed applications. The development of semiconductor variable frequency sources, such as inverters and cycloconverters, has allowed their use in variable speed applications such as high power and high speed compressors, blowers, induced and forced fans, mainline traction, servo drivers etc. The synchronous motors behaves like variable inductor or variable capacitor, it is used in power transmission systems to regulate the power factor.

V. RESULTS

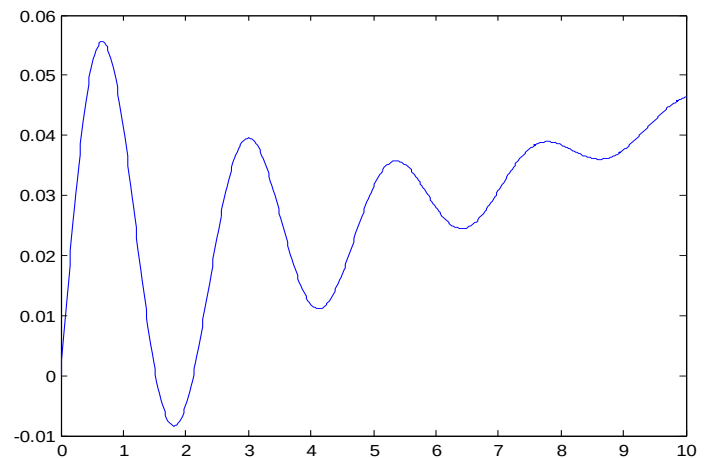


Figure 5.1: Output Field current

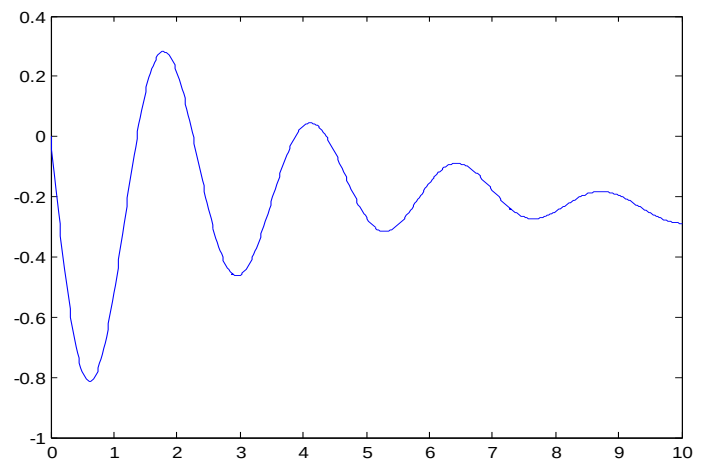


Figure 5.2: d-axis stator current

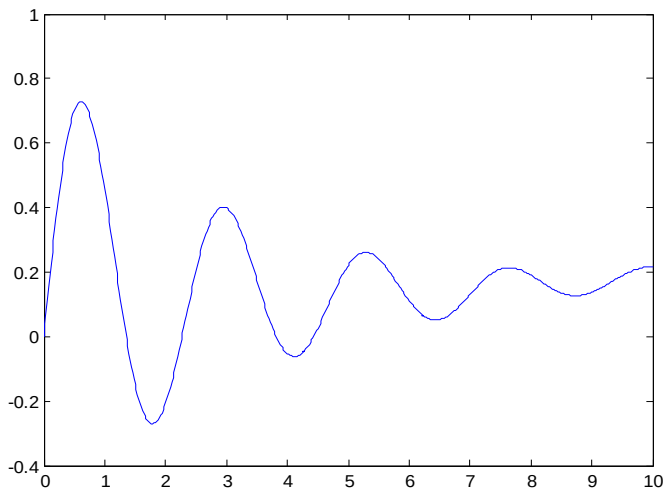


Figure 5.3: d-axis damper current

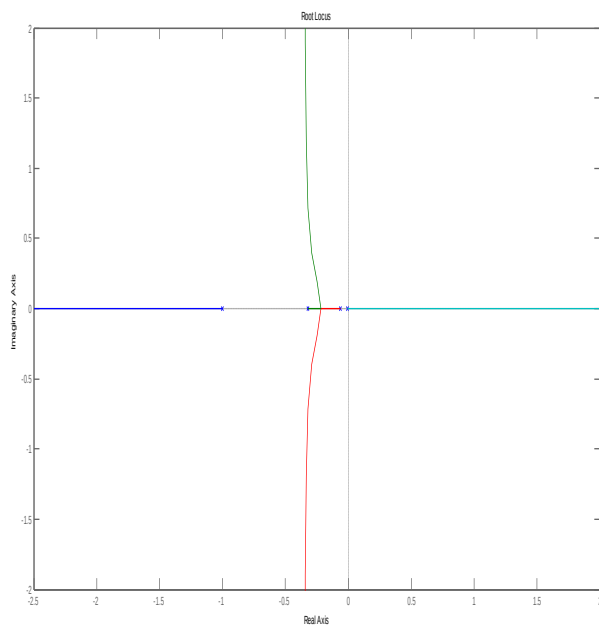


Figure 5.4 Root Locus

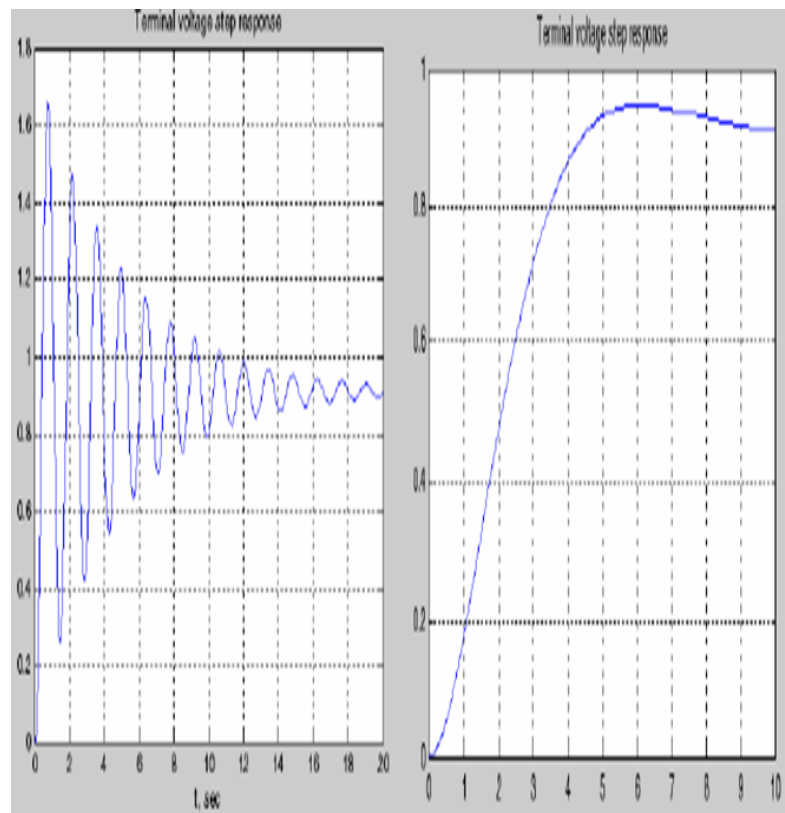


Figure 5.5: Step response of Terminal Voltage

(a) Without stabilizer feedback
(b) With stabilizer feedback

VI. CONCLUSIONS

A mathematical model of synchronous machine with buck-boost excitation system has been developed. Sample data has been taken from [1] in order to perform the required numerical calculations for state space representation. In the project important concepts such as per unit system, park's transformation, one machine-infinite bus system, state space modeling, Linearization, buck-boost excitation system. Using MATLAB, the transient and control performance of overall system is studied. Eigen value method for close loop system and Root locus plots for open loop system have been used to determine the steady state power system stability. For load change observed, exciter has stabilizing effect due to its ability to maintain flux linkages and voltage nearly constant. The simulation results indicated that response is highly oscillatory with a large overshoot and long settling time. And also it was observed that there is a tradeoff between steady state error and satisfactory transient response.

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Participation of Rural Women in Agricultural Activities: A study of Marh Block of Jammu District

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Abstract- Women are a vital part of Indian economy. Over the years, there is a gradual realization of the key role of women in agriculture development and their vital contribution in the field of agriculture, food security, horticulture, processing, nutrition, sericulture, fisheries, and other allied sectors. Women form the backbone of agriculture, in India, Comprising the majority of agricultural laborers, women have been putting in lab our not only in terms of physical output but also in terms of quality and efficiency. Women are critical to the well-being of farm households. A sample of 50 farm women belonging to different villages of Marh block of Jammu District were selected using purposive sampling technique with the objective of studying their daily activity schedule which included both farm and house-hold activities and problems being faced by them in doing these activities. For data collection interview schedule, field observations and case studies were framed. Data was analyzed both quantitatively and qualitatively.

Index Terms- Role of women in Agriculture, results and Problems.

I. INTRODUCTION

Agriculture is the major stay of our economy. Women are active partners in farming and undertake management along with men. There are certain unit operations both in production agriculture, post-harvest management and agro processing.

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 pause of rural development (Singh 2003).About 60% of agricultural operations like sowing seeds, transportation of sapling, winnowing, storage of grains etc are handled exclusively by women (Aggarwal 2003).Women work is getting harder and more time consuming due to ecological degradation and changing agriculture technology and practices. Women are involved in different operations of the crop-production, collection of cow dung and composting of manure, weeding, land harvesting, sowing, transplanting, winnowing and threshing etc. They also help the men in preparing the field, hoeing, picking cotton, plucking maize cobs and millet ear heads, stripping sugar canes before crushing, carrying heavy load of fodder crops on their heads to the home, storing the food grains and looking after these to avoid any pilferage(Sharma 1981).Women's contribution in farm activities is still considered to be the 'Invisible work force' their significant role in farm as well as household activities are not usually recognized and counted in formal activities even though they are essential productive

workers engaged in farm operation either as cultivators or as agricultural laborers.

Keeping these in mind, the present study has been undertaken to study the time use pattern of rural women in farm activities and also to assess the problems being faced by them is doing these activities.

II. RESEARCH METHODOLOGY

Sample description: A sample of 50 farm women in the age group of 20 – 40 years belonging to 4 different villages of Marh Block of Jammu District were selected using purposive sampling technique.

Data Collection: Following tools were selected for data collection.

1. Interview schedule for assessing the basic information respondents in addition to other relevant operation.
2. Field observations to observe the farm activities of women. Photographs were also taken for this purpose.

III. RESULT AND DISCUSSION

After interviewing respondents it was found that majority (38%) of the respondents were in the age-group of 36-40 years and 66% of the women were illiterate (Table 1) **Table1**

Profile of respondents

Variables	Categories	Frequency	%
Age	20-25 years	9	18%
	26-30 years	11	22%
	31-35 years	11	22%
	36-40 years	19	38%
Education	Illiterate	33	66%
	Up to primary	7	14%
	Primary to matric	6	12%
	Graduate	4	8%

Most of the respondents (64%) get up early in the morning i.e. between 5-6 am because they have to perform dual responsibility of work at home and outside in the agricultural field(Table 2)

Table 2
Time of getting up from Bed

Time	Number	%
4-5 a.m.	12	24%
5-6 a.m.	32	64%
6-7 a.m.	6	12%

This is also supported by the finding of Reddy (2003) that rural women had a very busy work schedule. She started doing domestic work at an early age of 9 years.

In the present study majority of the respondents are busy for 5-7 hours in the farm activities and stated that Agriculture is everything for them (Table 3).

Table 3
Time Spent in Farm

Time	Number	%
1-3 hrs.	8	16%
3-5 hrs.	13	26%
5-7 hrs.	29	58%

Table 4
Time Spent in Daily Activities

Activities	In Season		
	Time Spent in hrs.	N / 50	%
Cooking	0-1 hrs.	35	70%
Washing Utensils	0 - ½ hrs.	38	76%
	½ - 1 hrs.	12	24%
Cleaning House	0 - ½ hrs.	27	54%
	½ - 1 hrs.	23	46%
Washing Clothes	0-1 hrs.	23	46%
	1-2 hrs.	27	54%
Fetching Water	0-1 hrs.	16	32%
	1-2 hrs.	34	68%
Collection of Fuel	0-1 hrs.	30	60%
	1-2 hrs.	20	40%
Child Rearing	0-2 hrs.	25	52%
	2-4 hrs.	8	16%

Shows time spent by rural women in all the daily activities both inside the house and outside. 70% of the respondents spent 0-1 hour in cooking, 76% spent 0-1/2 hour in washing utensils, 54% spent half as hour in cleaning house, 54% respondents spent 1-2 hours in washing cloths, 68% spent 1-2 hours in fetching water, 60% spent 0-1 hour in collection of fuel and 52% spent 0-2 hours in child rearing.

60% of the respondents spent 1-2 hrs is making of cow dung cakes. Majority of the respondents spent 1-2 hours in cleaning of animal shed. 62% respondents spent at least half an hour in milking cows. Majority of the respondents (60%) spent 1-2 hrs in feeding the cattle while 74% spent 1-2 hours in fodder harvesting.

In the present study, it has also been observed that 64% of the respondents spent 1-2 hours in bathing the cattle and 72% of the respondents spent 1-2 hours in grain storage activities. 40%

of the women spent less than 0-1 hour in personal care. 36% of the respondents showed awareness about the new technologies because of their interest is adopting new technologies (Table 5). and they used to read newspaper and watch T.V regularly and update themselves regarding the new technologies so that it could help them is improving their crapping growth in the farms which would result in raising their capital.

Problems Faced by Farm Women

Majority of the women (64%) responded that they face problems pertaining to health viz. fatigue, backache, headache and restlessness where as others (42%) responded that unhygienic conditions in the field also of adds to their problem. 42% respondents said that they feel shy to work with their in-laws as at times they had to veil in front of male elder members. 64% respondents said that they are unable to manage time

between farm and household activities. While 84% replied that they have a difficulty in carrying out major farm operations viz. crop harvesting, transplanting, rice cultivation and sowing.

46% respondents stated that they feel satisfied at the end of the day as they have utilized their time in an appropriate way.

IV. RECOMMENDATIONS

After finding the results, following recommendations have been made:-

1. Policy maker must realize the constraints experienced by farm women, financial aid and support needs to be provided by the Govt' to assist the women.
2. There is a need to impart training to these women in order to strengthen the knowledge about farm activities.
3. These women be assisted to develop saving and credit mechanism to become self-reliant.
4. In order to improve women's work efficiency, Govt and Extension worker should plan an execute need based training programmers.

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Sustainable Tourism Development through Integrated Planning In Uttarakhand

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Abstract- This paper focuses on the sustainable development of tourism activities through integrated planning in Uttarakhand. Uttarakhand is a state in the Northern Himalayan Region in India and it has been a hot spot of tourism due to its magnificently diverse landscapes, high biodiversity enough religious tourist potential and rich cultural heritage, which has also generated a good source of income and employment to youths and rural masses. Tourism is one of the biggest and fastest-growing economic sectors in the global economy and has significant environmental, cultural, social, and economic effects, both positive and negative. Tourism has been noted as the world's largest and fastest-growing industry. The main objectives of the study are formation of tourist circuits, find out the problems and suggest a suitable plan for sustainable tourism development in Uttarakhand.

A field based systematic survey was carried out on the basis of questionnaire in some selected tourism destinations to find out the problems and the data has been calculated on the basis of simple percentage methods. Further the maps have drawn through GIS Arc-view 3.1 for the better results. Sustainable tourism is one of the pre-requisites of achieving sustainable development in this region. This form of sustainable tourism, oriented toward the viability of tourism industry, is referred to as the 'economic sustainability of tourism' or 'tourism imperative'.

In order to achieve this, the primary aim of tourism development requires physical resources to facilitate its expansion. Maintaining the quality of the environment, however, is usually also among the main goals of sustainable tourism. Sustainable tourism can be taken in four different interpretations that include economic sustainability of tourism, the ecologically sustainable tourism, sustainable tourism development with both focus of environment as well as long term feasibility of the industry and finally tourism as a part of a strategy for sustainable development. Therefore, the purpose of this research is to adopt integrated approach and establishment of new plans for the sustainable development of tourism in Uttarakhand. And finally to synthesis all the findings and give feasible suggestions and recommendations for further development of tourism in this region.

Index Terms- Sustainable development, ecologically, development, employment, environmental

I. INTRODUCTION

Tourism as an industry has been flourishing and growing since time immemorial, but it has been in the last few decades that specific attention has started to be given to this

smokeless industry. Tourism has emerged as an important as well as organized industry which scattered its benefits over large segments of the population. Uttarakhand, 27th of India republic, known universally as the abode of gods, is one of such states of India which offers variety of experiences to the tourist. Thus there is every need to focus our attention to achieve the required prosperity, well-being and high quality of life for the people of the state, from the income generated in this sector (Tourism). Tourism industry is also called the "Smokeless Industry" because without using any chimney, having more advantages than disadvantages. Tourism comprises of biggest component of the tertiary sector. In fact one in every 16 workers in worldwide owes his or her job in tourism. Tourism will become the world's number one export industry by the turn of century (Mohanty, 1992).¹

The tourism is already developed in this region but tourists facing lot of problems by which the tourism industry is not developed at par with the other regions of India like Rajasthan. In Uttarakhand there is potentiality to develop the tourism industry. Tourists want to see new places which are close to nature and away from hustle and bustle of city. So the new concepts in tourism have been emerged like ecotourism, new age tourism, rural tourism, health tourism, medical tourism etc. In Uttarakhand the nature is not polluted at par with other states in India, so that is why there is enough potential and have a future development of tourism in this region. To achieve the heights in the development of tourism in Uttarakhand sustainable tourism development through integrated planning is needed.

II. OBJECTIVES

The present study has certain specific research objectives. They are as follows:

1. To identify the major tourist circuits or nodes which have enough potentiality for development.
2. To identify the factors which create hindrance in the sustainable development of tourism in Uttarakhand.
3. To find out proposed plans for sustainable development of tourism in Uttarakhand.
4. Enumerate the measures and suggestions for future prospects of tourism development.

III. METHODOLOGY

1. In order to assess the sustainable development of tourism through integrated planning in Uttarakhand, a field based systematic survey was carried out on the basis of

questionnaire in some selected tourism destinations. 15 indicators suggested for the purpose of this study.

2. The first part of the questionnaire contained two questions that were aimed at the determining the importance of the rural tourism within local authorities. While in the final part of the questionnaire respondents were asked to rate each of the 20 indicators using a five – point Likert scale.
3. The selected tourist destinations have been surveyed for problems and hindrances coming for the development of tourism, find out the sustainable tourist potentials and integrated planning for tourism development of the region.
4. Information has been collected on the basis of questionnaire and interview method from tourist, local people, tourist officials and workers engaged in tourism industry. On simple percentage methods the results has been calculated. Besides secondary data is also used to get the results.
5. The information is geographically interpreted and sustainable development of tourism through integrated planning has been development.

IV. STUDY AREA

Uttarakhand State (Fig.1) (area 53586.53 km²) one of the newly emerged state of India, born on 9th Nov., 2000 with 13 districts and Dehradun as its working capital. Uttarakhand is drained by main perennial and non perennial river systems i.e. Ganga, Yamuna, Ram Ganga, Kali, Sarayu, and Kosi. Presently it has Two Divisions (viz; Garhwal and Kumaun), 13 Districts (viz; Almora, Bageshwar, Champawat, Chamoli, Dehradun, Haridwar, Nainital, Pauri, Pithoragarh, Rudrapur, Tehri, Udham Singh Nagar and Uttarkashi. Bounded on the west by Himachal Pradesh, Tibet in the North and Uttar Pradesh in the South and Nepal in the east.

V. SOCIAL INDICATORS OF TOURISM IN UTTARAKHAND

Social indicators play an important role for the development of the tourism industry in a region. Although both the social as well as the environmental indicators are interdependent on each other, but in the modern concepts of tourism more emphasis given on the social indicators. Social indicators include place of living, health, longevity nutrition, literacy, employment, education, people, transport, tourist services and more others. These modern days the environment influences less on people as compared to the human impacts on the environment. Man controls the environment wholly and solely and less impact of environment on man.

It has been observed from the Table that 1000 tourists have been interviewed, out of which 90 percent tourists feel that Uttarakhand is the best place to visit while 10 percent surveyed tourists feel average not too good not too bad.

Their concept regarding the accommodation also shows a great variation in the tourist concepts. 52 percent feel accommodation is good while 25 percent feel average and 37

percent below average. In general the given table shows that tourists visited Uttarakhand are not happy with the food transport. Mostly tourists like the climate and more than 50 percent surveyed tourists feel that tourist service is good in Uttarakhand.

VI. INTEGRATED PLANNING FOR TOURISM DEVELOPMENT IN UTTARAKHAND.

Although in the region the tourist potentials are in abundance but not explored at par with the neighboring region like Himachal Pradesh. The region has been identified as an important ecotourism destination and others tourist potentials in the form of types of tourism are found. There are intraregional as well as interregional disparities with in the region in the tourist flow. The Haridwar alone receives more than 50 percent of total tourist coming to Uttarakhand because due to well connectivity by roads as well as railways. There is need to develop the vertical connectivity means Haridwar should be connected with the Char Dham and other remote regions like Uttarkashi, Chamoli and Pithoragarh by a good network of railway. It was the duty of top priority government to develop railway tracks and connect the region with railway.

Only the best source of moving the heavy machineries from one place to another by means of railway. When we enable to join the region from last more than 50 years after independence how can we develop the country. The railway tracks which were developed by the British government remain same no change is there. There is a need to introduce the integrated plans for the development of the region. The transport plays a key role to develop a region. If a region is not well connected the resources are hidden and the best use of resources is not possible. Same is the condition with Uttarakhand although the region is having enough potentiality to develop tourism and other related sectors but due to lack of connectivity and transportation facilities the region is lacking behind. So there is a need to develop a toy train track by which the tourists get benefited and save the time to visit whole state. In fig. 2 and 3 there is a proposed plan for railway development in this region. If that dream map come in reality that enhances the tourist flow and socio-economic development of the region. The Uttarakhand has identified tourist nodes and tourist circuits, (Fig.1) which are popular tourist destinations. The Uttarakhand has the fortune of being endowed by prominent circuits belonging to different religious ideologies. Above all, a circuit route has been established all along the places related to natural beauty. Secondly the projected plans should be introduced in the most attractive region i.e., Uttarkashi, Pithoragarh, Chamoli, Almora and Tehri. The projected toy train tracks and tourist nodes as shown in Fig.3. Basically the tourist destinations of erstwhile Uttarakhand could be defined and categorized into eight distinct circuits. These are:

- 1) **Ranikhet Haldwani and Pithoragarh Circuit:** This circuit includes the important tourist destinations like Ranikhet, Pithoragarh, Almora, Champawat, Ramswar Panchsagar, Jagheswar, Bageshwar, Haldwani, Bhimtal, and Nainital. Nainital is dotted with lakes;

Nainital's unending expanse of scenic beauty is nothing short of a romance with awe-inspiring and pristine Mother Nature. Ranikhet is a place, which has preserved its virginity and pristine charm. **Pithoragarh Fort** is on the top of a hill on the outskirts of the town and was built by the Gorkha rulers. **Patal Bhuvaneshwar** is an enormous limestone cave with stalagmite and stalactite formations that are considered to be holy figures. This tourist circuit is famous for natural beauty and having geological importance. Besides Pithoragarh region offers many adventure sports such as hang gliding, paragliding, trekking, skiing, canoeing, river rafting and fishing. (Aggarwal).

- 2) **Landsdowne - Corbett - Ramnagar Circuit:** This lies in the southern part of Uttarakhand. This is a natural and wildlife tourist circuit which is having important tourist spots like Lansdowne, Corbett, Kalagarh, Tarkeshwar, Ramnagar etc. Both flora and fauna attractions are found in this circuit. This tourist circuit includes The Corbett National Park has reptiles, fish eating gharial, mugger, sporting fish such as mahseer and malee that thrive in the river and lake. Tigers are the biggest attraction and also include elephant, leopard, hog, bear, deer, sambar, fox and muntac. This park has over 300 species of birds and the common birds are snipe, herons, ducks, egrets, spotted eagle, darter, harrier, cormorants, wood pecker and thrushes. **Ramnagar** is situated in the rich farm belt of Terai, on the southeastern fringes of the great forests; the busy market town of Ramnagar is the main administrative centre for Corbett National Park and Project Tiger. Lansdowne is a hill station surrounded by beautiful oak, silver fir, spruce, bamboo and pine forests, it is a summer getaway for nature lovers and romantics. (Rawat, A. S. 1989).
- 3) **Rudraprayag, Bageshwar, Chaukhutiya:** - This tourist circuit is located at the central part of Uttarakhand. This region is famous for the religious tourism as well as cultural tourism. Besides this region is very rich in cultural diversity as well as in natural beauty. The important tourist destinations of this circuit are Baijnath, Rudraprayag, Bageshwar, Kausani, Guachar, Gairsain, Chaukhutiya, Gwaldam and Dunagiri. Rudraprayag is a small pilgrim town on the holy confluence of river Alaknanda and Mandakini which is venerated as one of the five sacred confluences or the 'Panch Prayag'. Chaukhutiya is a picturesque place derives its name from a Kumaoni word Chakuta which means four ways. This circuit has religious significance.
- 4) **Valley of Flowers, Chamoli Pindari Glacier:** - This tourist circuit is located at the Norther part of Uttarakhand. This circuit is most dynamic and diversified tourist circuit having all the tourist potentials ranging from tasteful water to high and mighty glaciers. This tourist circuit includes, Badrinath, Vishuprayag, Joshimath, pipalkoti, Chamoli Nandprayag, Karnaprayag, Gwaldam, Kafni Glacier, Pindari Glacier, Sunderdunga Valley, Nanda Devi Sanctuary and Valley of Flowers. It is one of the most easily accessible of all the Himalayan glaciers. Pindari's rugged beauty offers a breathtaking sight, especially for the trekker who is in love with nature in all its pristine glory. The Pindari Glacier is located in the Pindar Valley. The colour of Pindari Glacier is very white and at some places, spots of light blue and brown may also be seen. The world famous Valley of Flowers is situated in the upper expan- sions of Bhyundar Ganga in the far interior of Garhwal Himalayas. The splendour and the scintillating beauty of the valley attract tourists from all over the world. (Kandari, 2001).
- 5) **Badrinath, Gangotri, Yamnotri, Kedarnath and Harkidum:** - This tourist circuit lies in the north part of Uttarakhand. This is most important religious tourist circuit known as the char-dham. The four holy shrines of Yamunotri, Gangotri, Kedarnath and Badrinath - collectively known as the Chardham are the most sacred of all pilgrimages. For centuries saints and pilgrims, in the search for the divine, have walked these mystical valleys and mountains. Today, pilgrims make a beeline to Char Dhams in the summer to get a slice of peace and spirituality. The Char Dhams receive their holy water in the form of four streams- Yamuna (in Yamunotri), Bhagirathi (in Gangotri), Mandakini (in Kedarnath) and Alaknanda (in Badrinath). Owing to the significance of this religious circuit, devotees from all over the world, come here to experience the eternal bliss.. The picturesque surroundings of the mountainous region are simply enthralling, giving the visitors a perfect opportunity to unwind themselves by filling their lungs with fresh air. (Guha, R. 2000).
- 6) **Dehradun and Roorkee tourist circuit:** - This circuit is famous for educational activities. The students from all over India came to this circuit for getting education. This circuit has two important educational places like Dehradun and Roorkee. So important need to develop this circuit further because the future of the country depends upon the education status.
- 7) **Uttarkashi, Chakrata and Massoorie:** - This circuit is famous for natural tourism, which is having diverse landscapes, water falls, rapids and other physical features are found in this circuit. The important tourist destinations in this circuit are, Uttarkashi, Tehri, Mussoorie, Kempty fall, Tiger fall, Chakrata,, Dakpathar, Deoban, Lakhamandal etc. So this circuit is lacking of well connectivity, although it is connected through roads but a toy train track is important for sustainable development of this region.
- 8) **Haridwar- Pauri- Devprayag and Rishikesh:** - This is the most important religious tourist circuit not only in Uttarakhand but well known in whole India. This tourist circuit is well connected with railways as well as

roadways so more than 60 % of the Uttarakhand's tourists visit this circuit. This circuit is located in the southern part of the State.

Concentric Circles Model for Sustainable Tourism in Uttarakhand (ST)

In this work author tried to develop the model for Sustainable Tourism. The aim is not to bring the new definition of Sustainable Tourism, but rather to search in various definitions and guidelines for common threads, and translate them into something that is understandable and meaningful in practice. These findings were combined with some of the main issues in various codes and principles. The outcome of this study is Concentric Circles Model of Sustainable Tourism (Fig. 1). The model consists of three concentric circles of sustainability. The center of the model is the **intergenerational equity (IE)**, as the main objective of the sustainable development as stated in **Brundtland Report** "...without compromising the ability of future generations to meet their own needs". The aim of IE can not be pursued without sustaining capital stock. (First circle - sustainability of local capital stock). This includes environmental, socio-cultural and economic capital. For sustainability of local capital stock, the interactions between capital stock and stakeholders, and interactions within stakeholders shall be sustainable (second circle - equity of stakeholders). In order to reach such equilibrium, sustainable strategies should be implemented (third circle- sustainability of strategies). The outer circle of model consists of tools for sustainable strategies: planning, management, integration into local economy, partnership and cooperation, assessment, training and education, research.

Quantitative Results: Assessment of local people for sustainable development of tourism

This section deals with the quantitative components of the study. The study attempted to investigate which attributes satisfy local people for the sustainable development of tourism. The first part of the section provides the demographic characteristics of the respondents. The second part presents distribution of responses to for various indicators for sustainable tourism development in Uttarakhand.

i. Demographic Characteristics of the Respondents (N= 500)

The gender distribution of the respondents was quite uneven, with 65% male respondents and 35 % female respondents. It is observed that majority of the respondents in study area i.e., 51 % are fall in the category of 20-40 years, followed by below 40-60 years (32%), below 20 years (17 %).

ii. Indicators used in study

Frequency distribution and measurements in the form of means and standard deviations (SD) for the perceived indicators are reflected in the table 2. A higher mean indicates a stronger level of agreement with the statement. Respondents to the indicators of Uttarakhand offer sustainable tourism development through various indicators on the five Likert scale questionnaire, respondents perceived the indicator, Social impact (4.2899), Attractiveness (4.0811), Contribution to local economy (4.0688),

Local tourism (4.0123), Local Satisfaction (4.0098) were rated high. This is also confirm by their means scores which have values above 4, and shows stronger level of agreement for these variables by respondents. The indicators which have values more than 3 and below 4 show level of agreement but it is between Average and Agree which confirm these indicators have also great impact for sustainable development.

The resultant mean values of the variables having values more than 2 and below 3 Education and training (2.3391) and Gender equity (2.5780) show little level of agreement by the respondents.

S. No.	Attributes	N	Mean	Type
1.	Social impact	500	4.2899	Social
2.	Development control	500	3.6462	Planning
3.	Waste management	500	2.3786	Ecological
4.	Planning process	500	3.6929	Planning
5.	Local tourism	500	4.0123	Social
6.	Employment	500	3.3243	Economic
7.	Contribution to local economy	500	4.0688	Economic
8.	Local involvement	500	3.3538	Social
9.	Attractiveness	500	4.0811	Ecological
10.	Local Satisfaction	500	4.0098	Social
11.	Economic diversity	500	3.9386	Economic
12.	Energy consumption	500	4.0123	Ecological
13.	Marketing	500	3.9705	Economic
14.	Education and training	500	2.3391	Economic
15.	Gender equity	500	2.5780	Social

Results Based on current Research Practices

VII. CONCLUSIONS AND SUGGESTIONS

After going a long discussion regarding the sustainable tourism development through integrated planning in Uttarakhand it may be concluded that there is enormous tourist potential, the Uttarakhand has been receiving a large number of tourists annually since ancient times. The present influx of tourists to the Uttarakhand can be attributed to enumerable number of factors. The existing tourist potential in terms of natural beauty, historical and archeological sites, games and sports activities, culinary and religious sites and other factors as the major pull factors. Tourism in Uttarakhand is still in a discovering stage. Many sites are still lying untapped. Not only the natural or historical sites, but also huge reservoirs of traditional and cultural heritages still remain to be unearthed. People are fully keen to explore it all, for the development of whole state. But the political factors create problems for development of tourism in the Uttarakhand. The important suggestions for integrated planning of tourism development through sustainability in Uttarakhand given below.

1. Developing a detailed master plan is very important.
2. It is very important to raise awareness of among local people in a simple way.

3. Micro level studies should be incorporated for the development of tourism in Uttarakhand like recent study for development of heritage tourism, rural tourism.
4. Roads, local railway like toy trains, CNG Buses should be introduced for sustainable development of tourism in Uttarakhand Kashmir Valley.

Table: 1 Tourists opinion regarding various social indicators in percentage.

Opinion regarding	Excellent	Average	Below average
Place	90	10	00
Accommodation	52	25	23
Food	24	39	37
Transport	12	29	59
Tourist service	52	33	15
Security (Feel secure)	70	25	05
Climate	80	15	05

Source: - Based on the field survey of 500 tourists conducted in 2007

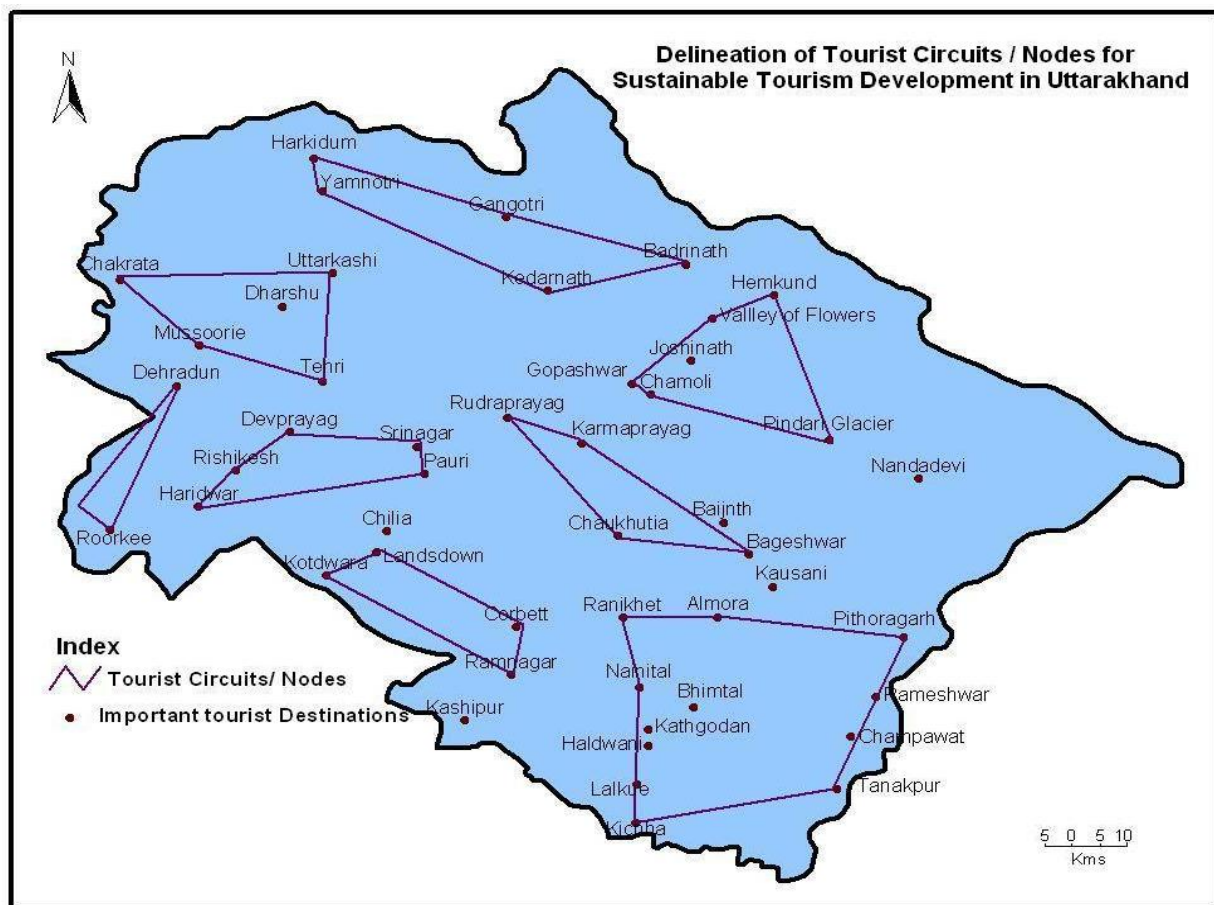


Fig.1

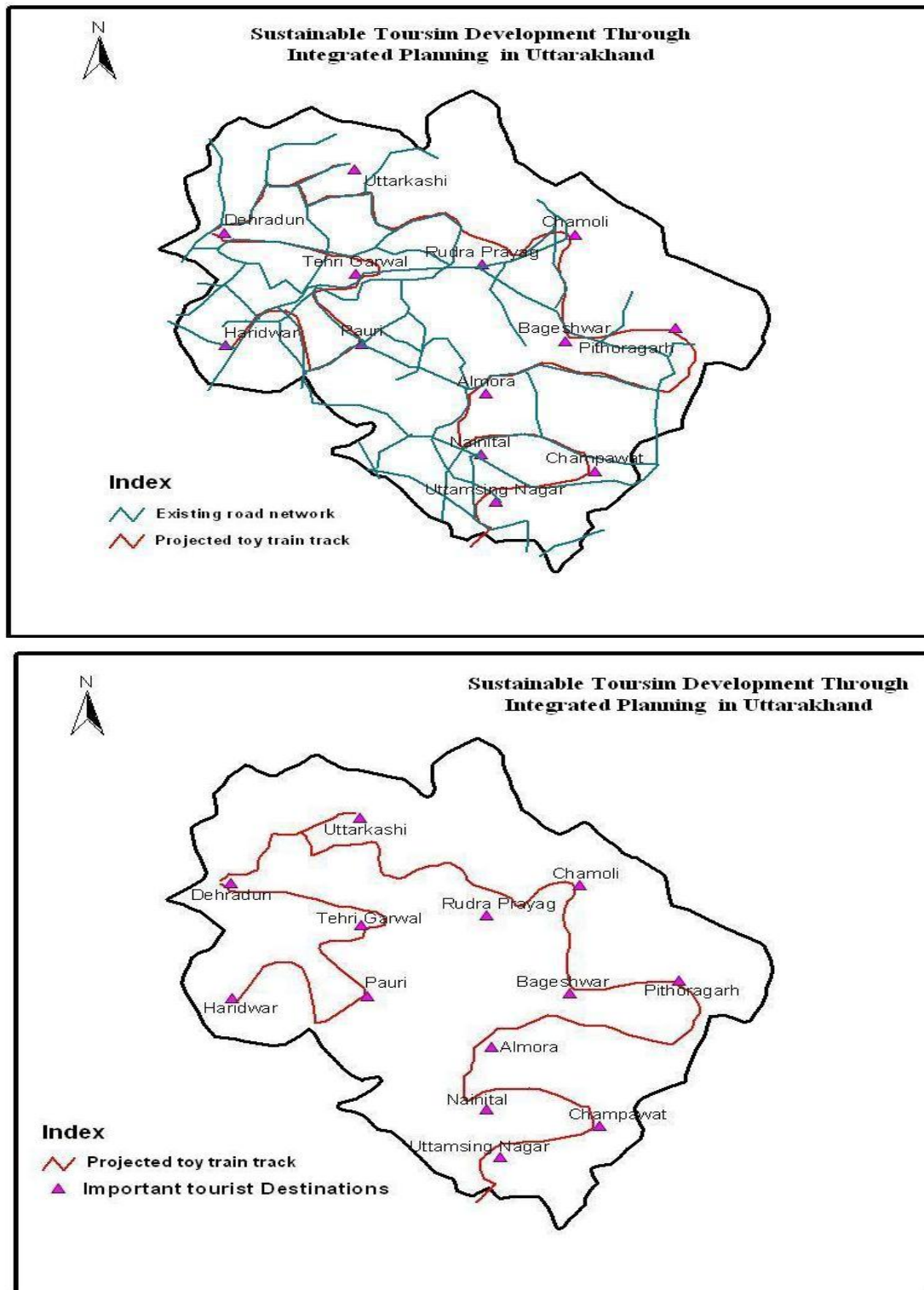


Fig 2 & 3

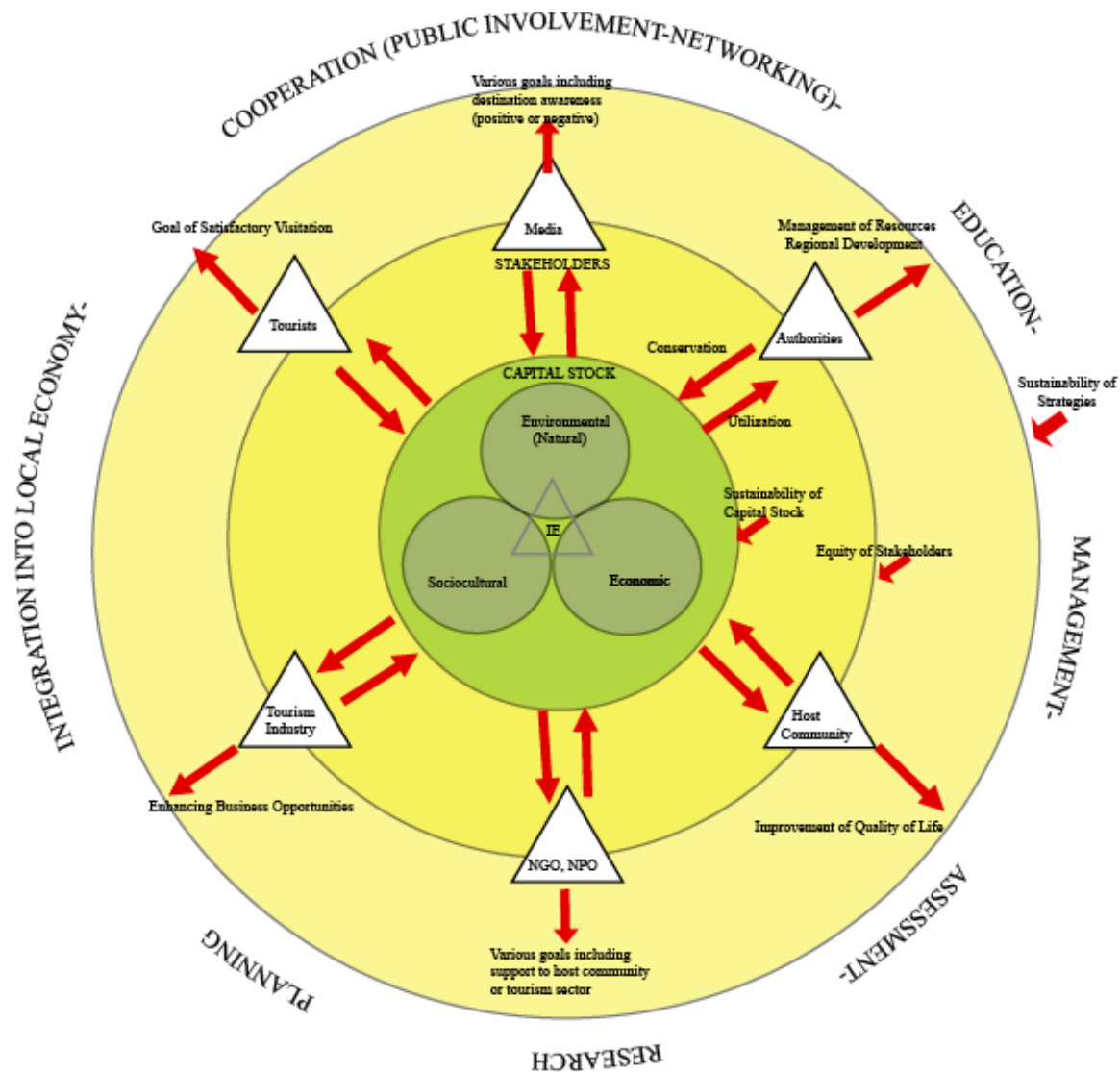


Fig 4: Concentric Circles Model of Sustainable Tourism

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High Capacity Data Embedding Technique Using Improved BPCS Steganography

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Abstract- The improved bit-plane complexity segmentation (BPCS) steganography carries on different processing's to different bit-planes, with setting high threshold value at the high bit-plane and low threshold value at the low. Steganography is an important issue in the filed of information safety. This paper concretely designs and carries out a steganography of the text secret information. RSA algorithm is used for encryption of the text secret information, so that others not privy to the decryption mechanism. The introduction of chaos theory conveniences to the test of steganography characteristics and enhance the safe of steganography. Not only provides good visual imperceptibility and data embedding capacity, this scheme also is capable of resisting the analysis of the whole histogram.

Index Terms- chaos; RSA; carrier image; text secret information; steganography; bit-plane blocks; threshold value

I. INTRODUCTION

IN recent years, information security issues have been paid more and more attention, and information hiding has become a hotspot in the research field of information security. Through embedding unnoticeable secrets into digital media signals such as images, audio and video, information hiding realizes the function of copyright protection and secret communication. Information hiding mainly consists of two main branches, which are digital watermark and steganography.

As an important branch of information hiding, steganography is mainly used in secret communication. It is an information security technology about secure transmission of secret information, which is using images, audio and other digital media as a cover [2], embedding the secret information to be sent into the carrier signal, transmitting as an unnoticeable way through public channels, especially the internet, aiming at sending out the information secretly and safely without causing suspicion of the behavior of hiding message.

The design of this paper is applied in secret information of text, and introduces chaos theory into steganography; it is easy to realize data encryption and simulation of binary data flow. RSA (Rivest, Shamir and Adleman) is an algorithm [7] for public-key cryptography. It is the first algorithm known to be suitable for signing as well as Encryption, and was one of the first great advances in public key cryptography. RSA is widely used in electronic commerce protocols, and is believed to be secure given sufficiently long keys and the use of up-to-date implementations.

BPCS is the development of least significant bits (LSB) method, and it has better performance than the simple LSB method. The major idea is that multiple bit-planes of the cover images are divided into fixed-size blocks. This technique makes use of the characteristics of the human vision system whereby a human cannot perceive any shape information in a very complicated binary pattern; therefore, we can replace all of the "noise-like" regions in the bit-planes of the vessel image with secret data without deteriorating the image quality. So this method has better visual imperceptibility.

Adopting an improvement type BPCS steganography with RSA and Chaos encryption, not only provides good visual imperceptibility and high data embedding capacity, this scheme also is capable of resisting the analysis of the whole complexity histogram.

II. RELATED WORK

In steganography, data is hidden inside a vessel or container that looks like it contains only something else. A variety of vessels are possible, such as digital images, sound clips, and even executable files [10]. In recent years, several steganographic programs have been posted on Internet home pages. Most of them use image data for the container of the secret information. Some of them use the LSB of the image data to hide the data. Other programs embed the secret information in a specific band of the spatial frequency component of the carrier. Some other programs make use of the sampling error in image digitization. However, all those steganographic techniques are limited in terms of information hiding capacity. They can embed only 5-15 % of the vessel image at the best.

We have invented a new technique to hide text secret information in a color image. This is not based on a programming technique, but is based on the property of human vision system. Its information hiding capacity can be as large as 50% of the original image data. This could open new applications for steganography leading to a more secure Internet communication age. Besides, for the secret can be embedded in several bit-planes, compared with the LSB method it has greater data embedding capacity.

III. THE CONVERSION OF TEXT INFORMATION

The meaningful text messages need to be translated into encrypted binary data stream. The data stream is used for the embedding of carrier image, which makes preparations for the steganography. The conversion is shown as Fig. 1.

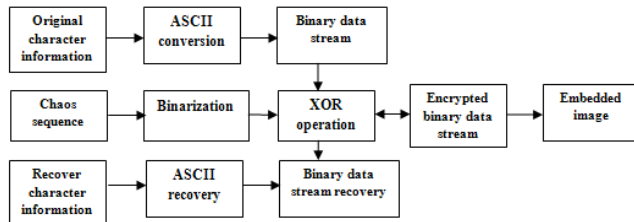


Figure 1: Conversion of text information

IV. RSA ALGORITHM

The RSA algorithm, named for its creators Ron Rivest, Adi Shamir, and Leonard Adleman, is currently one of the favorite public key encryption methods. RSA algorithm [7] is applied for the encryption of text information which is secure against a man-in-the-middle attack. It is very simply to multiply numbers together, especially with computers. But it can be very difficult to factor numbers. Steps involved in RSA algorithm:

A. Key generation:

1. Choose two distinct prime numbers p and q .
2. Compute $n = pq$.
3. Compute $\phi(pq) = (p - 1)(q - 1)$. (ϕ is Euler's totient function).
4. Choose an integer e such that $1 < e < \phi(pq)$, and e and $\phi(pq)$ share no divisors other than 1 (i.e., e and $\phi(pq)$ are coprime).
 - e is released as the public key exponent.
5. Determine d (using modular arithmetic) which satisfies the congruence relation

$$de \equiv 1 \pmod{\phi(pq)}$$
 - d is kept as the private key exponent.

The **public key** consists of the modulus and the public (or encryption) exponent. The **private key** consists of the private (or decryption) exponent which must be kept secret.

B. Encryption:

$$c = m^e \pmod{n}$$

Where m is an integer $0 < m < n$

C. Decryption:

$$m = c^d \pmod{n}$$

V. CHAOS THEORY

Chaos is a kind of behavior about nonlinear dynamics law control. This paper adopts Logistic mapping method to generate chaotic sequence:

$$a_{k+1} = \mu \cdot a_k \cdot (1 - a_k), \quad k = 0, 1, 2, \dots$$

The value traverses in the interval $[0, 1]$, and μ is a control parameter or a bifurcation parameter. When $3.5699456 \dots < \mu \leq 4$, the logistic map works in chaotic state. The data stream generated is disordered, and it's similar to random noise.

The new binary sequence, which is the binarization of acquired chaotic sequence, has two main functions in this paper.

1. It is used to the encryption of text data information, steganography.

2. It is used to stimulate the binary data stream, which can facilitate the process of various experiments.

VI. IMPROVED BPCS STEGANOGRAPHY

A. BPCS steganography

The arithmetic of BPCS steganography is as follows:

- 1) The carrier image is divided into 8 different Bit-Planes. All the bit-planes are divided into small pieces of the same size, which is called bit-plane blocks, such as 8×8 .
- 2) Calculate the complexity of every block. The complexity is defined as the amount of all the adjacent pixels that get different values (one pixel is 0, and the other is 1). The maximum possible value of the complexity is denoted as C_{max} .
- 3) Setting the complexity threshold of the bit-plane block is αC_{max} , here α is a parameter. The bit-plane block whose complexity is larger than αC_{max} is used to embed secret information. The smaller the value of α , the more secret information can be embedded.
- 4) Secret information is formed into bit-plane blocks. The bit-plane block can replace the original one straightly if its complexity is greater than αC_{max} . Yet, it need to take conjugate processing with the checkerboard pattern block (as shown in Fig. 2) if the complexity is less than or equal to αC_{max} , than take the new block replace the original one.

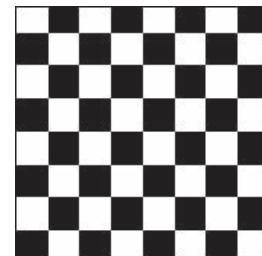


Figure 2: Checkerboard pattern block

- 5) Make a record of the blocks that have taken conjugate processing and this information also need to be embedded into the carrier. The embeddings of this extra information can not produce an effect on the embedded secrets, and it must be correctly picked up.

The process of secret information extraction is simple. Firstly, pick up all the pieces of the carrier data whose complexity is greater than αC_{max} , and then pick up the extra embedded information mentioned in step (5) to confirm the blocks that have taken conjugate processing. These blocks need take XOR operation with tessellated check to get the recovery of secret.

B. Improved BPCS steganography

The original BPCS algorithm divides the carrier image into serious bit-planes, and there is high correlation between the bit-planes. The higher the bit-plane is, the stronger the correlation between the pixels of the bit-planes is [4]. So setting the same embedding strength for different bit-planes is sure to have an influence on the correlation between the bit-planes, leading to abnormalities of the complexity histogram, consequently, the security of steganography will be affect. Through detecting the complexity histogram, the analyst can analysis the existence of secret information, besides, he can estimate the embedding

threshold value accurately [5]. In order to resist this statistical analysis method, this paper improves the BPCS algorithm.

The correlation of adjacent pixels is relatively strong when the bit-plane is high, and we can see the sketchy outline of the image. There is a certain degree of regularity among these pixels. Yet, the dates of the lower bit-planes are similar to random noise. Therefore, we shall make better use of HVS (human vision system) characteristic and consider the local characteristic of the image when embedding secret information, and treat different bit-planes with different way, with setting greater threshold for the higher bit-planes and smaller for the lower ones. Trough different bit-planes using different embedding strength, not only does this scheme resist statistical analysis, but also it can realize that embedding less secret information in higher bit-planes to have good visual imperceptibility and embedding more in lower bit-planes to have high data embedding capacity, solving the problem that keeps the balance on the contradiction between embedding capacity and visual imperceptibility.

Different bit-planes make different contributions to carrier image, this design sets greater threshold for the higher bit-planes and smaller for the lower ones.

VII. DESIGN AND IMPLEMENT

The technique of improved steganography text based on Chaos, RSA and BPCS designs as Figure 3.

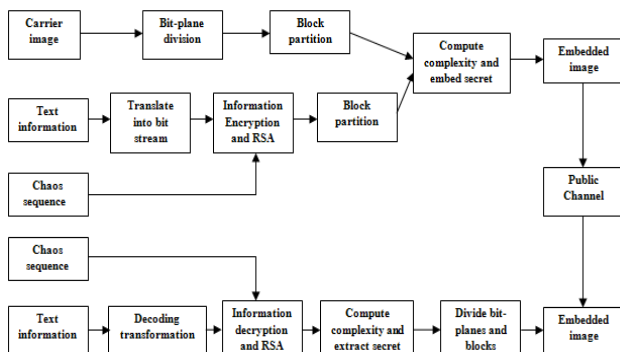


Figure 3: The technique of improved steganography text based on chaos, RSA and BPCS

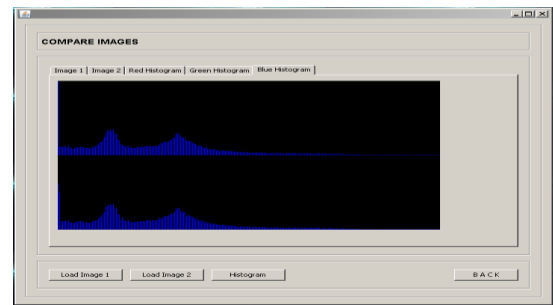
VIII. ANALYSIS

Select standard 24-bit “pepper” image

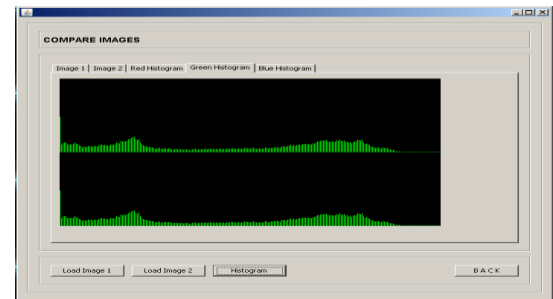


Figure 4: The image “pepper” before and after steganography

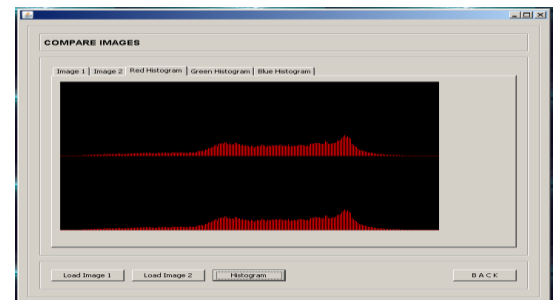
1) Histogram measure:



a) Blue histogram before and after steganography



b) Green histogram before and after steganography



c) Red histogram before and after steganography

Figure 5: Histogram measure before and after steganography

We can see that, there is no obvious difference in histograms before and after steganography. Then the design has high security.

IX. CONCLUSION

The main performances of steganography include visual imperceptibility and embedding capacity. The technique of improved steganography text based on chaos and BPCS apply to text secret information, the design has good visual imperceptibility and high data embedding capacity, and furthermore, it has a great advantage in resisting the analysis of the steganalysis. By introducing chaos theory and RSA algorithm, it is convenient to test the performance of steganography, and the design has higher security and reliability. Results show that the design of the paper has certain of theory value and application value.

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Problems and Prospects of E-Banking in Bangladesh

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Abstract- The tremendous advances and the aggressive infusion of information technology had brought in a paradigm shift in banking operations. With the rapid proliferation of Internet Technology banking sector now takes a different approaches often termed as E-banking. The adoption of E-banking becomes a necessity for the banking which wishes to maintain its share of market and retain its customers. In one hand, it offers ease of operation for both customers and consumers. On the other hand, it overcomes the geographical bars between the countries. But such improved services have come at the cost of rigorous adaptation of business rules and policies as well as to cope with the new technology. This paper reveals the current situation of E-banking in Bangladesh and the impact of E-banking on banking activities. The new challenges of E-banking are to develop and apply policy from the perspectives of society, banks, and regulatory authorities as like as government are addressed in the study.

Index Terms- E-Banking, ATM, POS, PDA, Internet, ICT

I. INTRODUCTION

Information technology is becoming an important factor in the future development of financial services industry, especially the banking industry. The banking sector is based on sharing of information, which itself heavily relies on information and communication technology (ICT) in order to acquire, analyze and deliver data to all relevant users. The ICT is crucial not only for information analysis, but also enables the banking sector to differentiate its offer from competitors and thereby make it a market leader. In this context, banking sector are obliged to continuously innovate and update their marketing strategies in order to closely meet the demands and the requirements of the individual customers. It also provides safe and confidential services which best suit customers' needs.

Therefore, when media (e.g. computers, EDI, ATM, Internet, TV etc) and transmission mediums (e.g. telecommunications, cable, electronics etc) complement and overlap one another, the banking agency is no longer considered to be an inevitable right for the customers. The customer wants more flexibility without paying more, and his demands are clear: Make transactions wherever, whenever, and however he wants. Hence, the development of the concept of electronic financial services, more commonly known as "E-banking". Many banks have adopted the "E-banking" concept for their day-to-day transactions which meets the expectations its internal users (employees) and external users (customers, suppliers, or institutional partners). A business can simplify or improve its human resources by introducing various internet technologies. Benefits include the improvement of administrative systems,

better information tracking, and time and cost effectiveness. Under this condition, the transition to "E-banking" has become a necessity for banks: In one hand it offers the major opportunities in terms of competitive advantages. On the other hand, it improves efficiency and operational effectiveness within the company and develops a stronger and more durable business relationship with its customers.

1.1 Objectives of the Study

The objectives of the study are to

- Present the current scenario of E-banking in Bangladesh.
- Identify the problems as well as prospects of E-banking in Bangladesh.
- Suggest measures for growth of E-banking in Bangladesh.

1.2. Methodology

The study has been conducted mainly on the basis of secondary information. For this purpose, different recognized census, government rules and regulations, policies have been discussed. Various seminar papers and summary of discussions in those seminars, taskforce report of research organizations and some periodicals, national and international journals, newspapers, magazines, Bangladesh Bank publications have been surveyed. Some bank specialists have also been personally interviewed in order to collect some primary information used in this study. Besides this, internet has been used as another source of information.

II. E-Banking

Electronic banking (e-banking) is the newest delivery channel for banking services. The definition of e-banking varies among the researches partially because electronic banking refers to several types of services through which bank customers can request for information and carry out most retail banking services via computer, television or mobile phone (Daniel, 1999; Mols, 1998; Sathye, 1999). Burr (1996) describes E-banking is an electronic connection between bank and customer in order to prepare, manage and control financial transactions. E-banking is considered to be a segment of e-business to the extent that banks are involved in the conduct of business transactions via electronic media; other non-banking financial products and services (e.g. insurance), not to mention products and services from other sectors of business may be sold electronically as well.

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 by using an intelligent electronic device, such as a personal computer (PC), personal digital assistant (PDA), automated teller machine (ATM), kiosk, or Touch Tone telephone (Federal Financial Institutions Examination Council, n.d).

E-banking or internet banking or online banking are analogous and defined as the conduct of banking services by using electronic delivery channels such as ATM, telebanking and PC banking. Under this banking process, the branches of a bank are connected electronically in such a way so that a client or a customer of a particular bank can draw the money or make deposits anytime anywhere of the country or the world. Large number of banks world-wide offer e-banking/web banking/internet banking, whereby their customers manipulate their personal finances and execute transactions via the internet. Banks and others financial institutions advertise frequently on the significance and convenience of the e-banking facilities. Banks are encouraging their consumers to be benefited from e-banking services. E-banking will soon mature into an offensive business strategy rather than a passive (Hirst, 1999).

E-Banking is an umbrella term for the process by which a customer may perform banking transactions electronically without visiting a brick-and-mortar institution. The following terms refers to one form of electronic banking: personal computer (PC) banking, Internet banking, virtual banking, online banking, home banking, remote electronic banking, and phone banking. PC banking and Internet or online banking is the most frequently used designations. It should be noted, however, that the terms used to describe the various types of electronic banking are often used interchangeably.

2.1. Different Forms of E-banking

The terms 'PC banking', 'online banking', 'Internet banking', 'Telephone banking' or 'mobile banking' refer to a number of ways in which customers can access their banks account without having to be physically present at the branch of a bank. E-banking may be understood as the term that covers all the ways of banking business electronically.

2.1.1. Tele-banking

Tele-banking service is provided by phone. To access an account it is required to dial a particular telephone number and there are several options of services. Options included

- Checking account balance
- Funds transfer between current, savings and credit card accounts
- Bill payments
- Stock exchange transaction
- Receive statement via fax
- Loan payment information \

2.1.2. PC Banking

The increasing awareness of the importance of literacy of computer has resulted in increasing use of personal computers

through the entire world. Furthermore, incredible plummet of cost of microprocessor has accelerated the use of computer. The term 'PC banking' is used for banking business transacted from a customer's PC. Using the PC banking or home banking now customers can use their personal computers at home or at their office to access their accounts for transactions. For subscribing to and dialing into the banks' Intranet proprietary software system is use for password.

Basically, there are two types of PC banking.

The first type is online banking, in which bank transactions are conducted within closed networks. The customer needs specialized software provided by his bank.

The second type is Internet banking, which German banks have been offering since the mid-nineties, although the only product they were offering at the time of information. Unlike closed networks, Internet banking permits the customer to conduct transactions from any terminal with access to the Internet.

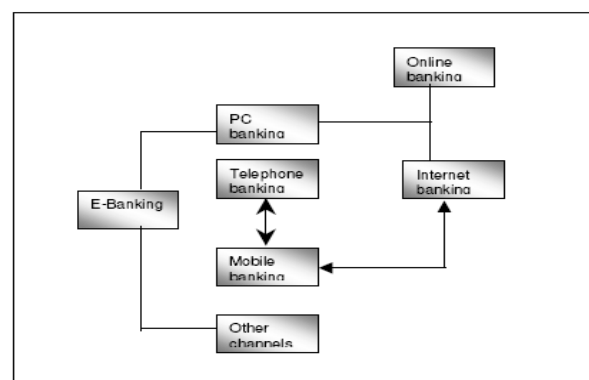


Figure 1: Types of E-banking

2.1.3 Internet Banking

Internet banking would free both bankers and customers of the need for proprietary software to carry on with their online banking transactions. Customer behavior is changing rapidly. Now the financial service is characterized by individuality, independence of time, place and flexibility. These facts represent huge challenges for the financial service providers. So the Internet is now considered to be a 'strategic weapon' to satisfy the ever-changing customers' demand and innovative business needs. Adequate legal framework and maximum security are the two essential factors for Internet banking. The comprehensive security infrastructure includes layers of security from the network to the browser, including sophisticated encryption that protects customers' from intrusion when they access the bank over the public network.

2.1.4 Mobile Banking

Actually mobile banking is a variation of Internet banking. Mobile banking is a good example of how the lines between the various forms of e-banking are becoming gradually blurred. Due to the new transmission technologies such as WAP (Wireless Application Protocol), portable terminal like mobile phones, personal digital assistant (PDA) or small hand-held PCs are providing bank customers with access to the Internet and thus paving the way to Internet banking. It assures immense

flexibility and makes the financial services independent of time and place. However, the use of mobile banking is still in a nascent state. The slower transmission speed of the WAP standard and the limited amount of information available are just two of the factors inhibiting the use of those terminals.

3.1. Banking sector in Bangladesh

According to the Scheduled Banks Statistics; (October-December, 2006) by Bangladesh Bank, the entire banking sector comprised 48 scheduled banks (commercial banks plus specialized banks i.e.DFIs) and 4 non-scheduled banks. It had all told 6562 branches. Total credit (net assts) and the total deposits (liabilities) of the sector stood Tk.156254.52 and Tk.182925.60 crores respectively as on end December, 2006. The detailed position is given below:

Table 1: Banking Sector: December, 2006

Bank types	Number of banks	Number of branches
NCBs	4	3384
PCBs	30	1776
DFIs	5	1354
FCBs	9	48
Total	48	6562

Source: Bangladesh Bank Statistics , 2006

It appears the above figures that the banking sector is dominated by four nationalized commercial banks (NCBs) followed by the private commercial banks (PCBs). Nationalized commercial banks not only had the highest number of branches, but also held the highest amount of credit and deposits. Out of total 6562 branches, the NCBs had 3384 branches i.e. 51.57 percent.

In terms of business, next highest position is held by the private commercial banks (PCBs). There are thirty commercial banks in the private sector including Islami banks. The third position is held by five development finance institutions (DFIs). On the other hand, nine foreign commercial banks stood in forth on year end 2006.

3.2. ICT in Banking Sector

Penetration of Computer in Banks is very rapid. All banks now are computerized at least at head office level. If we go at branch level only; 19% branches of NCBs, 38% branches of PCBs and 97 % branches of FCBs are computerized. ITRC survey found that overall computer density in the banking sector is 1.64. Only 1,131 branches have at least one computer. For foreign commercial banks the computer density is 45.34, where as for NCBs the ratio is only 0.41. The specialized bank scenario is almost same as the NCBs, 0.43. On the other hand, private commercial banks have comparatively higher ratio, 4.94. As a whole 61.81 percent bank does not have any LAN. LAN penetration ratio [considering the branch level] is also very poor for overall banking sector, 0.07. The ideal ratio should be 1. Only FCBs have satisfactory picture in this regard. The PCB has an

acceptable ratio, 0.22. Generally in NCBs other than the major two cities [also not each branch] banks are working in stand-alone environment. The problem is, NCBs is the unique market player with more than 50 percent of market share, so ICT penetration is more crucial for this category of banks. Some midrange and mainframe computer systems are available in the banking sector. Only 11% of banks have inter branch connectivity through ICT network [WAN]. 70 percent of solution provider for WAN are of local origin. At the head office level 95.45 percent banks use banking software. 24 types of banking software are available in banks. 95 percent banks have Management Information Systems. But only 38 percent MIS are integrated to the transaction processing system [TPS].

If we consider head office level in service processing the use of computer or electronic device is very encouraging: 96.5 percent of banks use computer or some sort of electronic device, the similar figures are 58.62 percent in corporate banking, 68.97 percent in foreign exchange, 41.38 percent in fund transfer, 37.93 in investment banking. A broad spectrum of electronic banking services is available in Bangladesh with different degree of penetration. Credit card service is provided by 23. 1 percent banks, both PCBs and FCBs are there. The credit card service is from VISA and Master Card. Telebanking is second most penetrated e-banking service in Bangladesh. Credit card is becoming very popular service in major cities of Bangladesh. During 1999 the growth of credit card market is almost 100 percent.

Majority of banks is planning to introduce ICT for integration of banking services and new ICT based banking services, which will play a vital role in penetration of e-commerce in Bangladesh. 75 percent banks have strategic plan and implement it in IT and e banking. According to the survey the electronic banking service will observe an exponential growth in the next two years.

3.2. E-Banking in Bangladesh

In recent years the banking industry has undergone massive changes in providing service to their customers by using information technology. Developments in information technology and telecommunications have set in a motion an electronic revolution in the Bangladeshi banking sector. Foreign Commercial Banks (FCBs) in Bangladesh are playing a pioneer role in introducing modern financial products and services. Private Commercial Banks (PCBs) have started to follow the same pattern. On the other hand Nationalized Commercial Banks (NCBs) and the Specialized Banks (SBs) could not yet show notable performance regarding the issues. But due to the demands of the time, they are now taking initiatives to launch modern and innovative products and services. Currently most of the banks in Bangladesh are providing electronic products and

services to their Customers'. We cannot say they are completely following electronic way. Because they offer some of the functionalities of the complete electronic banking like intra-bank transactions, Letter of Credit (LC) and foreign exchange etc. Banks products and services are categorized into two broad groups (i) Traditional Products and Services; and (ii) Modern and Innovative Products and Services which is called E-banking.

Table 2: Payment and Transaction of Products and Services offered by Category of Banks in Bangladesh

Category of Bank	Traditional		Modern and Innovative
	Used Domestically	Internationally	Used Domestically/ Internationally /Both
NCBs, SBs, PCBs, FCBs	- Savings Deposit A/c - Current Deposit A/c - Short Term Deposit A/c - Demand Draft - Pay Order	NOSTRO Account	- Debit Card - ATM - SWIFT Router
NCBs, PCBs	- Fixed Deposit A/c - Cash Credit Account - SOD Account - Telegraphic Transfer - Mail Transfer - Pay Slip	- Foreign Demand Draft - Foreign Documentary Bills Purchase - Foreign Bills Purchase - Foreign Bills for Collection - Payment against Documents - Inland Foreign Bills Purchase	- POS - Internet - On-line (e-banking)
PCBs, FCBs, Islamic Banks	- Demand Draft - Telegraphic Transfer - Pay Order	- FC Account - Resident F.C Deposit A/c - Non-resident F. C Deposit A/c - Foreign Demand Draft	- Debit Card - ATM - On-line (e-banking) - SWIFT and Router
NCBs	Deposit Pension Scheme A/c		
SBs	- Fixed Deposit A/c - Mail		

	Transfer		
PCBs	- Monthly Savings Scheme - Special Savings Scheme	- Non-Resident Taka Account - Travelers' Cheque - International Credit Card	- Moneygram - Xpress Money - Credit Card
FCBs	- Access Account - Recurring Deposits - Cash Credit Account	- Travelers' Cheque - International Credit Card	- Credit Card - POS - Internet Card - Cheque Prepaid
Islamic Banks	- Mudaraba Savings Deposit A/c - Mudaraba Term Deposit A/c - Al-Wadia Current Deposit A/c - Mudaraba SND A/c - Hajj Deposit A/c - Pension Scheme - Cash WAQF - Term deposit	- NOSTRO Account - Foreign Tele Transfer	

Source: Survey output conducted on Commercial Banks in Bangladesh.

The existing modern and innovative banking products and services in Bangladesh are: modern and innovative products like-Debit Card and Credit Card, modern and innovative services like Automated Teller Machine (ATM), Point of Sales (POS) and e-services like On-line banking, , Society for Worldwide Inter-bank Financial Telecommunication (SWIFT)etc.

Table 3: Number of Banks Adopting Modern Products and Services

Products and Services	July, 2005					July, 2007				
	NC Bs	SB s	PC Bs	FC Bs	Tot al	N C B s	SB s	PCB s	F C B s	Tota l
No of Banks	4	5	30	9	48	4	5	30	9	48
Credit Card	0	0	11	1	12	1	1	16	6	24
Debit Card	3	1	13	2	19	3	1	17	5	25
ATM	2	1	15	4	22	3	1	20	7	31
POS	2	0	8	1	11	2	0	10	3	15
Internet	1	0	3	3	7	1	0	8	5	14
Phone Banking	0	0	2	2	4	0	1	6	5	12
Online	1	0	19	4	24	1	1	21	5	28

Swift	4	2	21	6	40	4	2	29	7	42

Based on a recent survey on the scheduled banks in Bangladesh, it is found that during the last couple of years, the use of debit card, credit card and ATM as a smart payment rapidly increasing the transaction of products and services. ATM facility was available only in 22 banks (2 NCBs, 1 SB, 15 PCBs and 4 FCBs) at the July of 2005, but at the July of 2007, the number reached to 31 (3 NCBs, 1 SB, 20 PCBs and 7 FCBs) (Table 1). The Credit Card, Debit Card, On-line banking and SWIFT facilities also reached to 24, 25, 28, and 40 banks respectively over the period. Efforts of PCBs in offering modern and innovative products and services increased substantially during the period 2005-2007 (Table 1).

3.3. Constraints to E-Banking in Bangladesh

Foreign and private banks offered a broad range of services over the internet. Public sector banks lag behind in offering wider range of internet banking services and products.

- At present, there is no proper infrastructure for performing Electronic banking activities in Bangladesh.
- Slow uptake of internet access and PCs.
- Poor telecommunication network policies and slow paced regulatory initiatives.
- Very minimum number of users of internet.
- The banking infrastructure in terms of electronic payments and inter-bank connectivity is poor.
- Limitations of supportive legal system.
- Lack of skilled IT workforce.
- Absence of cyber law.
- Absence of EFT (Electronic Fund Transfer) legislation.
- Absence of need based business plan for on-line banking
- ATMs may have network problems, unavailability and shortage of money.
- High price of computer, compute hardware and banking software.
- Lack of awareness at government level of e-banking issue.
- Lack of awareness at customer level of e-banking issue.
- Weather has a direct effect towards e-banking. If create heavy rain, flood or cyclone then the entire network is down.

3.4. Prospects of E-Banking

Information technology environment changes rapidly. It is estimated that the number of Internet users in Bangladesh will increase in a recent years. The number of physical branches will be decreased (the profile of physical branches will change to advice and support centers) and most of the transactions will be concluded via main e-banking channels: online Internet bank and m-banking services. Rapid growth of e-banking in Bangladesh is expected.

4. Recommendations and Conclusion

4.1. Recommendations

In order to ensure a successful practice of e-banking in Bangladesh, we recommend the following.

- E-banking systems should be simple to use, fast and user friendly.
- E-banking services should be standardized so that wherever the solution is used the customer is familiar with the procedure followed.
- Government should compel the banking sectors to automate their operation and going online by a specific period.
- Provide adequate training and technological support to develop the manpower.
- Appropriate legal framework.
- Proper infrastructure development.
- Government should implement the cyber laws to ensure proper security about customers information (i.e. Credit card number)
- Government should establish proper educational institution to create efficient IT professionals to support e-banking in Bangladesh.
- Developing of integrated e-banking software.
- Government, in collaboration with the banks, should educate and inform its citizens and customers on the workability and effectiveness of E-banking. This will increase the confidence level of customers.
- The clearing house operation in Bangladesh should be fully automated system.
- Banks should have adequate research and technological background in this regard.
- Bank can charge normal profit to enlarge the market size on the electronic banking products.
- Political commitment to improve governance and institutional strength is essential for successful application of e-banking.
- As e-bank users mostly use ATMs and POS in most cases, the banks should emphasize on providing uninterruptible service.

4.2. Conclusion

E-banking as a vehicle to boost up trade, especially international trade has already been recognized by international business community, especially in European Union, North American and some of the other developed nation like Japan, Singapore, and Hong Kong etc. However e-banking and its related technologies are still in its infancy stage in Bangladesh. Since the world is moving towards e-everything, so we should try to overcome all the barriers and also try to develop such environment that is favorable for the development of E-banking. In order for E-banking to continue to grow, the security and the privacy aspects need to be improved. With the security and privacy issues resolved, the future of E-banking can be very prosperous. The future of electronic banking will be a system where users are able to interact with their banks "worry-free" and banks are operated under one common standard.

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Improve QoS (Quality of Service) by destructing Security Issues

Rachana Kamble (MTech Scholar), R.K Pateriya

Abstract- VoIP services are scarifying, due to delay in transmission of voice packets (Latency), echo, jitter, packet loss and other Quality of Service (QoS) problems arrived in VoIP phones. The weakness on QoS is managing by voice and data service together on a VoIP network. In this paper we dedicated to studying the response of data transmission quality, characteristic of voice quality, the service quality and diagnoses the problem arrived on VoIP protocol suite. For this reason, we suggest, to manage the weakness of VoIP related protocol by design of measurement management process model also use to analyzed quality item driven per voice service that can increase the quality and come up the result of MOS, delay, jitter, packet loss value, voice processing, filtering, try to achieve Qos requirements, removing the miscellaneous QoS security issues, Improving QoS, and obtained the idea about Software Queueing Mechanisms etc.

Index Terms- VoIP; Performance and Improvement of QoS; QoS Security Issues; Testing QoS and Measuring Process; QoS Software Queueing Mechanisms;

I. INTRODUCTION

This research paper guides a stepwise overview about QoS improvement through destruct the vulnerabilities. According to TIA (Telecommunications Industry Association), more than 75% private branches are IP-based. In telecommunications some places the bandwidth is no longer an issue there is a lot of space for data and voice to be dispatched together only two main things to worry about in VoIP calls, first is Latency (data packets are delivered too slowly, due to network congestion) and second is Jitter (variation in delay of packets, leading to packet loss) thus, enough bandwidth is not the only solution for safe, secure and fast telephony. Further, Internet telephony development has many of the secure methods of transmitting voice, data, fax and related services using IP based networks. Voice over IP (VoIP) is the transmission of voice and data over networks using the internet Protocol. IP networks have become very popular in the past few years, due to the exponential growth of the public Internet leading the way in to the IP world. Voice over IP (VoIP) is the set of protocol that allow voice traffic to be transported on IP networks. The simplest way for transmission of audio signals across the IP network is to digitize an analog signal first to produce data file and packetized at the sender at regular intervals, using an encoding algorithm and then sent over IP network using transport protocol such as User Datagram Protocol (UDP) or the enhanced Real-Time transport Protocol (RTP).When voice packets are received at the destination, they are reordered and

converted back to analog for audibility. VoIP systems as a packet-based technology has several advantages are lower cost, highly flexible and provide better service.

II. RELATED WORK

In this paper we estimate the current work related to VoIP, the objective method and observed the performance of the system. The objective of this research is to minimize the error, introduced in channel due to the network deterioration and hence improve the quality of sound, analyze the voice quality by using channel coding scheme. There are two QoS measuring techniques first is subjective method and second is objective method. In subjective method we measure the Mean Opinion Score (MOS) and in objective methods we use matching algorithms to measure the difference between decoded outputs of source coding system and joint with source-channel coding system. Then we used E-Model to illustrate the attempts to develop QoS measures which provides better solution for monitoring QoS, There are different methods for estimating the packet delay used in E-Model to calculate delay from the header fields of the RTCP packets calculation by using the RTCP stream. This method is the good for calculating delay and proposed a new algorithm to measure the packet loss burst Ines in the ITU E-Model. E-Model has a new parameter called equivalent random packet loss used to replace the random probability of packet loss in order to calculate the R-Factor and MOS value and achieved improved measurement accuracy under burst packet loss conditions. Many QoS system solutions have been proposed for monitoring voice quality for VoIP, but not accepted to give full efficient solution for transmission factor (R). Our proposed work is targeted for the improvement of the VoIP quality measures in the future networks with new coding schemes that should be improved control of system quality, improved the measurement of customer satisfaction and provide the efficiency for network mechanisms example, system performance progress and billing. This paper illustrate various QoS security issues where we discuss problem about latency, jitter and packet loss, Discuss how to improve Quality of Services, Testing QoS and Performance measured, QoS design issue, Factors Affecting Voice Quality & Quality Item to be measured and at last we illustrate QoS software Queueing Mechanism which includes First-In First-Out (FIFO) (default), Priority Queueing (PQ), Custom Queueing (CQ), Weighted Fair Queueing (WFQ), Class-Based Weighted Fair Queueing (CBWFQ), Low-Latency Queueing (LLQ).

III. MISCELLANEOUS QOS SECURITY ISSUES

SIP phone endpoints may freeze, and crash due to high rate of network traffic. SIP proxy servers may experience failure, with VoIP-specific signaling attack which is less than 1 MBPS. This research paper gives several security steps of an irreversible chain of effects on Quality of Service of VoIP systems.

A. Latency

Latency refers how much time it takes for a voice signal to go from source to destination. Ideally, it should be zero, but it has upper and lower toleration limits. In the United States, the acceptable limit is 150 ms for one-way traffic and for international calls; it is 400(ms). The VoIP service provider should allow a Latency budget, which may look like this:

Table1. Sample Latency budget

Delay Source (G.729)	Budget(ms)
Device Sample Capture	0.1
Encoding Delay(Algorithmic Delay + Processing Delay)	17.5
Packetization/DePacketization Delay	20
Move to Output Queue/Queue Delay	0.5
Access (up) Link Transmission Delay	10
Backbone Network Transmission delay	Dnw
Access(down) Link Transmission Delay	10
Input Queue to Application	0.5
Jitter Buffer	60
Decoder Processing Delay	2
Device Playout Delay	0.5
Total	121.1 + Dnw

B. Jitter

Jitter refers to non-uniform packet delays. It occurs in low bandwidth situations. Jitter may cause packets to arrive, and processed out of sequence. When jitter is high, the packets arrive at their destinations in that situation several automobiles coming to a unplanned stop at a traffic signal. There are basically three useful mechanisms to control jitter for Usage buffer:

- It is used at the endpoint of traffic, where the buffer has to release its buffer packets once every 150 ms.
- Routers with effective headers are regulated using routers with headers, or buffer instruments.
- Efficient use of bandwidth; a great deal of jitter is taken care of by effective use of bandwidth.

C. Packet Loss

In VoIP occurs extreme manner of packet loss while communication of IP network. Packet loss is a byproduct of excessive latency or jitter. The Combination of the packet loss problem is trust on RTP, which uses unreliable UDP for transfer.

By that time a packet get reported for something, QoS always gets exceeded. Packet loss is an inescapable reality, and apart from increasing bandwidth, there are no other independent solutions for counteracting packet loss.

IV. QUALITY OF SERVICE DESIGN ISSUES

The design of Voice Quality is concern of the main issue through VoIP. VoIP is a synchronous and real time application. When it comes together with IP the call quality problems may arrive. For considering the VoIP design, we must examine the factors that negatively affect voice quality, and the fault tree analysis must take a subjective account into the quality of service which being addressed as a central issue.

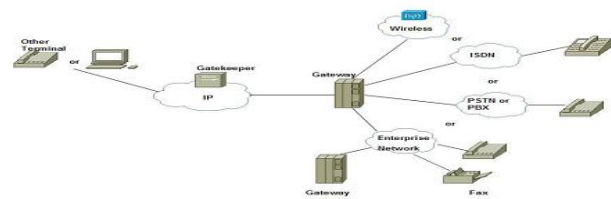


Fig 1: Design of VOIP Network

To sensed voice quality is a function of many factors: jitter, delay, Echo and packet loss. Echo, is occurred when hybrid circuits in a telephone network convert between a four-wire circuit, and a two-wire circuit. Echoing occurs when there is an audible leak between sending and receiving areas. Echo reduced by physically shortening the distance between the sending and receiving circuits. To building a reliable security substructure comes at the cost of declined satisfaction in Quality of Service (QoS) for VoIP communications. Here are several appropriate measures designed to improve this factor In order to quantitatively describe the performance of VOIP modules, it is important to consider over QoS issues, the following performance table is useful:

Table2. Voice Quality Measurement

Parameter	SCORE				
	1	2	3	4	5
Latency (ms)	< 50	50 – 75	75 – 100	100 – 200	>200
Jitter (ms)	> 5	5 – 10	10 - 50	50 – 100	>100
Packet/Loss (%)	0	0 – 1	1 - 2	2 - 3	>3

VoIP deployment: Table 2 helps for Project Simulation. A Deployment for a new product has always been a great challenge so it's a responsibility of network administrators, to balance the productivity with costs and integrate with existing infrastructure. Other issues deserve priority of troubleshooting, teething and compatibility problems during initial stage, and performance tuning and maintenance later. So that in this paper, we discuss different parameters connected with a reliable p2p (peer to peer) VoIP deployment.

A. Bandwidth

We know that a voice is more sensitive than data so the bandwidth requirements must automatically go up. The configuration of VoIP device, use bandwidth-intensive codec, such as G.729-A, which can use 87.2 kbps of NEB (Nominal Ethernet Bandwidth) Also the existing traffic patterns on the network should be identified. If it is overcrowded with a lot of broadcast traffic then it will affect to response time. For the best results for p2p communication, it should not be merge with other signals, such as TV and Radio. At the time of VoIP deployment, it is mandatory to have a separate VLAN, which will keep the voice and data networks separate. About bandwidth the design criteria is to clarify the number of simultaneous voice calls that can be made over WAN links. For that the compression technique should be known for payload size of voice packets. For deployment of bandwidth several VoIP calculators are available on www.voip-calculator and www.ixiacom.com.

B. QoS

Toll-Quality calls require at least 16-20 kbps of bandwidth. There are also bandwidth management solutions.

C. Handling power problems

All p2p phones suffer from power outages. So that good-built UPS is an effective solution. However, a good bit of power planning from source end is desired, as to how much backup power is needed.

D. Security issues

Apart from security mechanisms discussed in the paper, the network should be subject to routine maintenance, taking regular back-ups, installing antivirus software, etc. Also, implementing VoIP performance analyzers, like "Appmanger 6.0" from NetIQ for smooth functioning of VoIP is a good idea. At each LAN, network architecture should be such that at least 70% throughput is achieved within 10 msec.

V. MEASUREMENT BASED ADMISSION CONTROL

Measurement based admission control consists of two parts: first is measurement, which is used to estimate the current network load and second is admission control based on estimated network load. So the measurement-based admission control algorithm can be classified into two types, local load measurement-based and end-to-end load measurement-based. Where in local load-based measurement algorithms, each router along the flow path measures its local load status and conducts admission control where End-to-end measurement based admission control algorithms, rely on the end hosts or edge nodes to estimate the available network resources. The end hosts and edge nodes may actively send probe messages to get the network status. The core routers usually do not involve in the estimation. If we compare with the traditional parameter-based admission control algorithm then measurement-based admission control algorithm suffers a certain degree of QoS degradation and it can only provide the soft QoS guarantees. Several measurement-based admission control algorithms have been used in existing VoIP products: Cisco's measurement-based call admission control algorithm and traffic matrix-based admission control algorithm (TAMC). Cisco's measurement-based call admission control algorithm has two types: Advance Voice Busy out (AVBO) and PSTN Fallback. They both use Security Assurance Agent (SAA) to conduct measurement. SAA adopts Response Time Reporter

(RTR) method to measure the network performance, such as delay, packet loss, delay jitter and ICPIF (Calculated Planning Impairment Factor, ITU-T G.113), etc., and feeds the measurement results back to source gateway for admission control. When the network performance is below the pre-determined threshold then admission control unit will be activated. The difference between AVBO and PSTN Fallback is that PSTN Feedback doesn't configure IP addresses statically and uses cached addresses. Those two mechanisms can only be used in the network with the support of Cisco's SAA. Traffic Matrix admission control (TMAC) provides QoS guarantees within a single domain or multi-domains. It uses Clean House architecture to provide intra- and inter- QoS guarantees to Voice over IP networks. TMAC uses four metrics: demand metrics, upper-bound Matrix, Node-level Traffic Matrix and POP-level Traffic matrix to describe the total bandwidth requirements, the resource threshold, and measured load of each entering pair or pop pair respectively. Therefore the admission control only checks whether the sum of the peak rates of the new flow and the measured traffic of the same path exceeds the corresponding upper-level item. In summary, measurement-based admission control can only provide soft (rather than deterministic) delay guarantees for voice traffic. It relies on the measurement period to reflect the dynamics of network status. In Short the measurement period, conduct more frequently and reflect the networks better, but consumes more network resources by this reason longer measurement period cannot reflect the network dynamics well. Also in some cases the research messages are not payload messages themselves, which may not be able to reflect how the network treats the real voice packets.

VI. QUALITY ITEM TO BE MEASURED

About traffic parameters which point to quality features like dial tone delay, post dialing delay and rate of transmission at VoIP service call occurred in connection quality. And other parameters which point to quality features like loss, delay, phase jitter, bit error ratio and noise at transmission phase occurred in transmission quality.

Table3. Quality features classification

Classification	Contents	Quality Item
Connection Quality	Quality related to Call setup, Call retain, Call clear	-Dial Tone Delay -Post Dialing Delay -Rate of Transmission
Transmission Quality	-Data Transmission Quality after call setup -Clarity of call	-Loss -Noise -Phase Jitter -Echo

Table4. Connection Quality Measurement Process

Dial tone delay	-Measuring unit for dial tone delay is set for 1/1000sec. -Measure dial tone delay time from switch connected to measuring device of

	transmitting side -Measure time from point of off-hook of measuring unit of transmitting side (subscribers' aspect) to hear the dial tone
Post dialing delay	-Measuring unit for dial to noise ratio is dB -Measure noise ratio and signal arrived at receiving side by transmitting test call of standard frequency from transmitting side -Measuring unit is 1/100sec for post dialing delay -Measuring section is set from transmitting side's measuring unit to receiving sides. -Measure time from the point of ending of dialing of transmitting measuring unit to tone receiving at receiving side
Rate of transmission	Measuring unit is % for the rate of transmission -Measuring section is from measuring unit of transmitting side to measuring unit of receiving side -Rate is calculated by the ratio between call success and total call made from measuring unit of transmitting side to measuring unit of receiving side

Table5. Transmission Quality Measurement Process

Rate of transmission	-Measuring unit is % for the rate of transmission. -Measuring section is from measuring unit of transmitting side to measuring unit of receiving side Rate is calculated by the ratio between call success and total call made from measuring unit of transmitting side to measuring unit of receiving side.
Loss	-Measurement unit for loss is in dB. -Internal impedance of measuring unit of both sides is set for 600. -Standard signal is transmitted from receiving side (transmitting side) and receiving level is measured at transmitting side (receiving side). -Measured value is the difference of transmitting level [dB] and receiving level [dB].
Noise	-Measurement unit for noise is in dB. -Set impedance of both measuring unit to be 600. -Apply CCITTO.41 standard's Psophometric Weighting filter method for measuring noise.
Phase jitter	-Measurement unit for phase jitter is in degree. -Measure phase jitter at signal level with frequency of 4~300Hz (LF+ Standard Filter).
Echo	-Measurement unit for echo is in dB. -Measure voice echoed back to the speaker. -Measure echo delay and echo loss -Measurement unit for echo is 1/1000sec
Bit Error ratio	-Measurement unit for bit error ratio is in error bit -Measure error bit by transmitting test pattern with Connection between transmitting side and receiving side retained -Range from 2400bps to 14,400bps can be used to measure when using internal modem -Measuring time is set for 15 minutes and it can be changed.

VII. TESTING QOS & PERFORMANCE TESTS

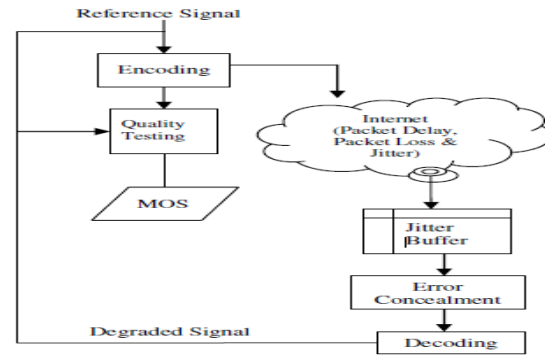


Fig 2: QoS Model Diagram

Assumed that two computers were utilized in different cities of Brazil (Ananindeua, Terminal A, and Belem, terminal B), both using technology ADSL (operator) to 256 Kbps and the ethereal to generate the grid of sending and receiving data and being measured at A and B with a pattern lecture utilization packets. We separately tests for each system and analyzed with the sniffer in each situation and saw the behavior and function of each system as meeting the common traffic between the internet users, observing the packing characteristic and the way how the protocols work during the conversation, besides measuring the audio that could qualify the understanding of the sent texts (talked). Many loss packets analysis can be calculated based on specific network information as follows

A. SUBJECTIVE LISTENING TESTS

The proposed work judges the worth or quality measures for audio in CODEC G.711, G.729, AMR and GSM-FR. The challenge for the audio CODECs is the output quality. This work will use the subjective method for evaluating audio quality where the classical objective measures are considered insufficient. Subjective listening tests are considered most accurate and most reliable method for assessing the quality of CODEC and widely supported by the ITU. The combined efforts of ITU and the three telecommunications companies that specialize in the evaluation of audio quality: Opticom, Psytechnics, Swissqual have been working With direction to and developing an “objectively subjective” solution for live network monitoring which is based on the customer experience to provide the industry with customer information about the performance of their real-time systems. The live audio tests will be conducted using people as subjects to measure the pre-recorded audio samples. An automated system will use the pre-recorded samples and play them out to the live subjects, then rate the perceived quality of the speech on a scale 1 to 5. The rating scale will be based on the MOS scoring system where score of 1 is being lowest and 5 is being the highest score. The audio samples will contain recorded sentences with female and male voices in 8 different languages, each in duration of 10 seconds. To assure reliability of the measured data, the live testing will include a wide number of human subjects, as well as a diverse group with both genders and a wide range of age groups. The proposed number of subjects will be in the total of 241, female and male each testing 10 samples, and the age spanning from 18 to 50+. This will cover all possible combinations of 2401 scenarios to test and the new VoIP-eM

equation proposed. We choose several different languages, since research has shown a variation between the languages in scoring the voice quality, and following the ITU Recommendations P.800 the testing should be conducted in the subject's native language. Conducting the listening tests from the public domain and targeting a large number of human subjects certainly may attract people from non-English speaking background. The live measurements perform with different background conditions and using different CODEC types. The automated system will play out VoIP voice-recording samples using a relative testing approach, where a reference signal is played first and followed by the degraded file. The subjects will be asked to rate the perceived quality using the MOS, ACR, and CCR scaling system. The Absolute Category Rating (ACR) scale is recommended by the ITU P.800/830 as the most suitable. The MOS scoring will be used in evaluating the smaller impairments, such as echoes. When it measures the subjective quality of a given CODEC, then it may be allow considering a more detailed scale when conducting subjective listening tests. This gives an example of a world satellite communication system for a 16-bit rate CODEC where a more precise scale has been used. The CCR (Comparison Category Rating) is described in ITU-T Recommendations P.800/P.830 and is indicating to be used for evaluation of large deterioration. The testing will follows the standard ITU recommendations. Method of conducting a subjective test experiment is described in detail in the ITU-T Recommendation P.830. The results from live tests will be collected and analyzed, and the new coding algorithm can be derived based on the measured impairments.

B. Speech coding/decoding schemes

In this paper we chose four types of speech coding algorithms: CODEC G.711, G.729, AMR and GSM-FR for their suitability in heterogeneous networks. ITU CODEC G.711 uses Pulse Code Modulation (PCM) coding format and it operates at a higher rate of 64 kb/s. The Packet-Loss Concealment (PLC) can be added to the G.711 to decrease the loss in the transmission. ITU CODEC G.729 uses a conjugate-structure algebraic code worked up linear-prediction (CS-ACELP) coding format and operates at 8 kb/s. The error concealment is already included in G.729 to reduce the impact of the lost frames. AMR (Adaptive Multi-Rate) is an ETSI speech-coding scheme which is mainly used in wireless VoIP networks and is compulsory for UMTS, but is also suitable for wired VoIP networks. AMR codec uses Algebraic Code Excited Linear Prediction (ACELP) coding format and it operates at a multi-rate between 4.7 and 12.2 kb/s, and it includes packet loss concealment. GSM-FR CODEC uses RPE-LTP coding format and it operates at 13 kb/s. GSM-FR is designed for the use in UMTS network. The mention signals as recommended in the ITU-T Recommendations P.800/P.830 will be used in the experimental testing.

C. E-Model

E-Model is used for significant testing of QoS. The E-Model, defined in ITU-T G.107 has computational tools that measure the transmission parameters which affect the conversation quality. The output of the E-Model is a transmission-rating factor R that combines with all the deterioration parameters into a total value. The transmission factor R equation consists of the base quality

value R_o , the impairment (harm) factors I_s , I_d and I_e and of an prospect or advantage factor A . The formula for the transmission factor R is as follows: $R = R_o - I_s - I_d - I_e + A$ where, R_o represents the signal to noise ratio at the 0dB point I_s , is the parameter for simultaneous impairments like excessive loudness ratings, uncomfortable side tone levels and simple quantization distortions I_d contains of impairments due to echoes and delays I_e represents the impairments from transmission equipment A is a factor that adjusts the quality value the transmission factor R is shown at a scale from 0 to 100 but is typically ranging between 50 and 90. The conversion from R to MOS is shown in Table 6. In subjective testing, the standard formula to calculate MOS based on the number of participants (represented by "n") that rated the quality is as follows: $MOS = [(n*5) + (n*4) + (n*3) + (n*2) + (n*1)] / 100$ (2)

Table6: R-Factor and MOS Value

R Factor	User Satisfaction	MOS
90 – 100	Best	4.34 – 4.50
80 – 90	High	4.03 – 4.34
70 – 80	Medium	3.60 – 4.03
60 – 70	Low	3.10 – 3.60
50 – 60	Poor	2.58 – 3.10

The principle of E-Model is based on the premise that transmission impairments can be transformed into psychological factors and that psychological factors on the psychological scale are linearly additive.

D. Suitability to VoIP

E-Model is good for an accounting for the impairments currently the E-model provides only limited and inflexible values for the I_e parameters, so the writers proposed a new formula for calculating I_e that depends on packet loss. Moreover they extended the current formula for calculating the R-factor by adding a new parameter I_j , the jitter impairment factor. This work will aim to develop a novel QoS method that is designed for the new VoIP systems, and propose experimental measures to achieve this.

Table 7: VoIP Impairments Analysis

Impairments	Coverage	VoIP Applicability	Importance
Impairments due to packet loss	I_e random not for all CODEC	Applicable	High
Impairments due to packet delay	I_d not for all CODEC	Applicable	High
talker echo	I_d	not applicable	Low
Loudness rating	I_s	Not applicable	Low
Quantization distortion	I_s	Not applicable	Low
side tone rating	I_s	Not applicable	Low
errors due to coding/decoding		Not applicable	Low
Quality Adjustment	A	Not applicable	NIL

VIII. SOFTWARE QUEUEING MECHANISM TO SIMPLIFY THE QOS SERVICES

All voice call traffic has been placed into QoS classes, based on QoS requirements, here we need to provide bandwidth guarantees and priority servicing through an intelligent output queueing mechanism. In order to provide a preferred level of service for high-priority traffic, some form of software queueing must be used. Software queueing techniques can include:

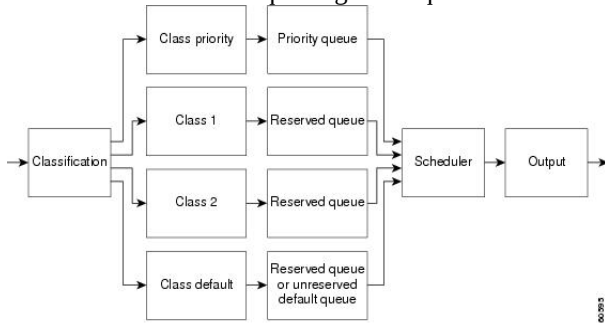


Fig 3: Queueing Mechanism

- A. *First-In First-Out (FIFO) (default)*
- B. *Priority Queuing (PQ)*
- C. *Custom Queuing (CQ)*
- D. *Weighted Fair Queuing (WFQ)*
- E. *Class-Based Weighted Fair Queuing (CBWFQ)*
- F. *Low-Latency Queuing (LLQ)*

Software queueing normally employs multiple queues, and each is assigned a specific *priority*. Traffic can then be assigned to these queues, using access lists or based on classification. Traffic from a higher-priority queue is serviced before the traffic from a lower-priority queue.

Table 8 Software Queueing Mechanism

Software Queueing Mechanism	Description	Benefits	Limitations
FIFO	Packets arrive and leave the queue in exactly the same order.	Simple configuration and fast operation.	No priority servicing or bandwidth guarantees are possible.
WFQ	A hashing algorithm places flows into separate queues whose weights are used to determine how many packets are serviced at a time. You define weights by setting IP Precedence and DSCP values.	Simple configuration. Default on links less than 2Mbps.	No priority servicing or bandwidth guarantees are possible.
Custom Queuing (CQ)	Traffic is classified into multiple queues with configurable queue limits. The queue limits are calculated based on average packet size, maximum transmission unit (MTU), and the percentage of bandwidth to be allocated. Queue limits (in number of bytes) are dequeued for each queue, therefore providing the allocated bandwidth statistically.	Has been available for a few years and allows approximate bandwidth allocation for different queues.	No priority servicing is possible. Bandwidth guarantees are approximate, and there are a limited number of queues. Configuration is relatively difficult.
Priority Queuing (PQ)	Traffic is classified into high, medium, normal, and low priority queues. The high priority traffic is serviced first, then medium priority traffic, followed by normal and low priority traffic.	Has been available for a few years and provides priority servicing.	Higher priority traffic can starve the lower priority queues of bandwidth. No bandwidth guarantees are possible.
Class-Based WFQ (CBWFQ)	MQ is used to classify traffic. Classified traffic is placed into reserved bandwidth queues or a default unreserved queue. A scheduler services the queues based on weights so that the bandwidth guarantees are honored.	Similar to LLQ except that there is no priority queue. Simple configuration and ability to provide bandwidth guarantees.	No priority servicing is possible.
Priority Queue WFQ (PQ-WFQ), also called IP RTP Priority	A single interface command is used to provide priority servicing to all UDP packets destined to even port numbers within a specified range.	Simple, one command configuration. Provides priority servicing to RTP packets.	All other traffic is treated with WFQ. RTP traffic is not prioritized. No guaranteed bandwidth capability.
LLQ (Previously called PQ-CBWFQ)	MQ is used to classify traffic. Classified traffic is placed into a priority queue, reserved bandwidth queues, or a default unreserved queue. A scheduler services the queues based on weights so that the priority traffic is sent first (up to a certain policed limit during congestion) and the bandwidth guarantees are met.	Simple configuration. Ability to provide priority to multiple classes of traffic and give upper bounds on priority bandwidth utilization. You can also configure bandwidth guaranteed classes and a default class.	No mechanism for providing multiple levels of priority—all priority traffic is sent through the same priority queue. Separate priority classes can have separate upper priority bandwidth bounds during congestion, but sharing of priority queue between applications may introduce jitter.

IX. CONCLUSION AND FUTURE WORKS

In this paper we proposed VoIP Quality of Service as a absorbing development path ahead, and develop a naturalistic Design framework for this technology area, and verify our design parameters for QoS successfully. QoS is a important issue for VoIP industry and it competes with other technologies. The Key issues include the linearity of the existing models, the relevance of all impairment factors and the validity of the model in the face of background, noise and language types, and the treatment of errors in bursty traffic conditions. The key research develops a new method for QoS determination and dynamic control of the network that is applicable to VoIP industry. This followed on our established experimental means to conduct live subjective testing of VoIP quality. The adequate measurement of QoS is important to the VoIP industry for various reasons, mainly for the cost reduction and high user satisfaction. Inadequate quality monitoring can beginning to undesired problems. For example too high QoS rating is costly, and sudden changes in the network may put down QoS to the level that bothers clients. The network reporting mechanisms will be used for detecting immediate problems, and forecasting trends. In this paper we calculated delay, bytes tax, packets per second, packet loss, utilizing Ethernet to capture the packet to be analyzed, explained all the established communication between the terminal where is observed each packet being sent from one terminal to the other. After the analysis of the utilized protocols behavior for each system, the results were that the Skype is the best software for voice over IP conversation, because it has more voice quality with less phonetic loss, since the transmitted information, with the bigger broadband among the analyzed software, at 69Kbps, through the TCP protocol, allows the quality VoIP messages

delivering. Our future work will consist of integrating the new algorithmic approach into a dynamic monitoring system for VoIP QoS. The new VoIP system will be integrated into the LINUX based CORBA middleware for the industry solution, work on QoS Protection Mechanism of VoIP Systems, New routing methods over better links for an active network control based on our new quality estimator, new priority and path selection mechanism, Analysis the requirements of how VoIP will provide QoS guarantees also improve the quality to VoIP message delivering. Fragmentation and interleaving actually VoIP transmissions are extremely delay-sensitive.

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Behaviour of Concrete Subjected To High Temperature

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Abstract- With the mode toward urbanization, rate of construction and hazards related to it has increased to high extend. One such major source is Fire accidents. Structure can undergo fire accident, but because of this the structure cannot be denied neither abandoned. To make a structure functionally viable after the damage due to fire has become a challenge for the civil engineering community. The problem is where to start and how to proceed. The root for such problem lies in the strength parametric study of component material that are use in construction industry. One such major item is concrete, which have very distinct chemical and physical properties because of its elemental components.

The study done in this paper is basically for normal M20 grade of concrete subjected to various temperature and thus the changes in properties are marked and highlighted. This paper aims to show the behavior of concrete at various temperature and changes in its compressive strength and physical properties. Results show markable behavior of concrete which make it further more topic of interest. The study reveals that concrete has very distinct bonding properties that change with change in exposure conditions.

Index Terms- Mean compressive strength, parametric study.

I. INTRODUCTION

The study of 16 industrialized nations (13 in Europe plus the USA, Canada and Japan) found that, in a typical year, the number of people killed by fires was 1 to 2 per 100,000 inhabitants and the total cost of fire damage amounted to 0.2% to 0.3% of GNP. In the USA specifically, statistics collected by the National Fire Protection Association (USA) for the year 2000 showed that more than 4,000 deaths, over 100,000 injuries and more than \$10bn of property damage were caused by fire. The loss of business resulting from fires in commercial and office buildings runs into millions of pounds each year. The extent of such damage depends on a number of factors such as building material, design and use, structural performance, fire extinguishing devices and evacuation procedures. One such material which has major sharing is concrete. Concrete can be defined as a composite binding material having constituents as aggregate, finer sand and fine cement and water in predefined proportion so as to achieve required strength. Concrete is a composite having properties that change with time. Durability of concrete depends on many factors including its physical and chemical properties, the service environment and design life.

II. BASIC PROPERTIES OF CONCRETE

A. Basic Properties Of Normal Concrete

The composite material with ingredients like aggregate, sand, cement and water achieving compressive strength of 10 MPa to 40 MPa after 7 days and achieve 80 % of its strength after or about 28 days with initial setting time of 30 minutes subjected to exposed condition is termed as Normal concrete.

B. What Happens To Concrete In A Fire ?

Fires are caused by accident, energy sources or natural means, but the majority of fires in buildings are caused by human error. Once a fire starts and the contents and/or materials in a building are burning, then the fire spreads via radiation, convection or conduction with flames reaching temperatures of between 300°C and 1200°C. Harm is caused by a combination of the effects of smoke and gases, which are emitted from burning materials, and the effects of flames and high air temperatures.

Concrete does not burn – it cannot be ‘set on fire’ like other materials in a building and it does not emit any toxic fumes when affected by fire. It will also not produce smoke or drip molten particles, unlike some plastics and metals, so it does not add to the fire load. For these reasons concrete is said to have a high degree of fire resistance and, in the majority of applications, concrete can be described as virtually ‘fireproof’.

The rate of increase of temperature through the cross section of a concrete element is relatively slow and so internal zones do not reach the same high temperatures as a surface exposed to flames. Even after a prolonged period, the internal temperature of concrete remains relatively low; this enables it to retain structural capacity and fire shielding properties as a separating element.

The surface appearance of structural members give an idea on the extent of heat to which these members might have been subjected to during the fire. The structural conditions as observed give a great deal of information on its physical condition and help to assess the physical damage suffered by the members.

III. EXPERIMENTAL WORK DONE

A. Sample/ Specimen Preparation

The M20 grade concrete as per IS 10262-2009 were prepared.

Type of Cement	= OPC 53 grade
confirming to IS-12269-1987	
Maximum Nominal Aggregate Size	= 20 mm
Minimum Cement Content	= 250 kg/m ³
Maximum Water Cement Ratio	= 0.5%

Workability (MORT&H 1700-4)	= 25 mm
(Slump)	
Exposure Condition	= Normal
Degree of Supervision	= Good
Type of Aggregate	= Crushed
Angular Aggregate	
Maximum Cement Content (MORT&H Cl. 1703.2)	= 540 kg/m ³

IV. OBSERVATIONS AND CALCULATIONS

Table 1: Observation tabulated.

Temp	Weight Loss	Color change	Cracks	Remark
150°C	650 gm	Light green	Absent	No white spots marked
300°C	655 gm	Yellowish Brown	Absent	Bonding moderate
450°C	800 gm	Faint Brown	Hair Cracks	Bonding moderate and no white spots marked
600°C	900 gm	Dark Brown	Present	Weak bonding and white spots marked

B. The procedure of making the test cubes is as follows -

The clean cube mold of standard dimension 50 mm is used. After fixing and application of proprietary mold oil on internal faces of mold the sample concrete is poured say about 45-50 mm thick and then tempered. same procedure is followed till the cube is filled up to top, Further the surplus concrete is removed and with marking number it is kept to achieve initial setting time. The cubes were placed in water tank for curing up to 28 days.

C. Thermo-Effect Methodology and Process

Pit Type tempering furnace

The electric furnace is used to heat the specimens. The maximum temperature attained in this furnace is 1000°C. The inner depth of the furnace is 2.5m.

- Initially 3no. of cubes were kept in the furnace.
- Furnace closed tightly so that no air enters inside.
- Furnace was set at required temperature i.e. 150°C and duration was 1 hour.
- 35 minutes were required to reach the desired temperature.
- After one hour the specimen were removed from furnace.
- Specimen was allowed to come up to room temperature i.e. 34°C.
- Again other 3 specimen were kept in the furnace.
- Furnace closed tightly so that no air enters inside.
- Furnace was set at required temperature i.e. 300°C and duration was 1 hour.
- 45 minutes were required to reach the desired temperature.
- After one hour the specimen were removed from furnace.
- Specimen was allowed to come up to room temperature.
- Same procedure was repeated for other temperatures i.e. 450°C and 600°C.

D. Post-parametric Test

Formula for calculation of compressive strength –

Compressive Strength = P/A

Where, P = Ultimate compressive load of concrete (KN)

A = Surface area in contact with the platens (mm²) (150 mm × 150 mm)

Various relationship observed are Plotted as below- Compressive Strength -

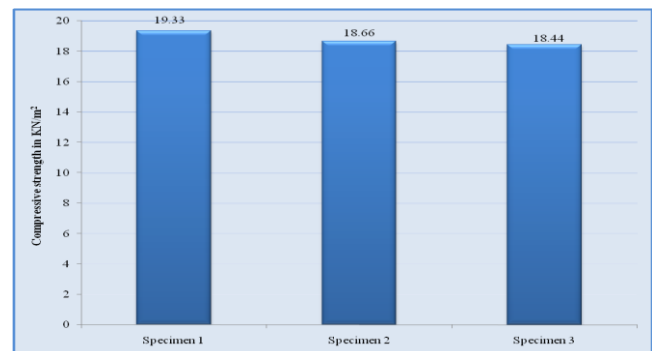


Figure no.1: At 34°C mean value 18.81KN/m².

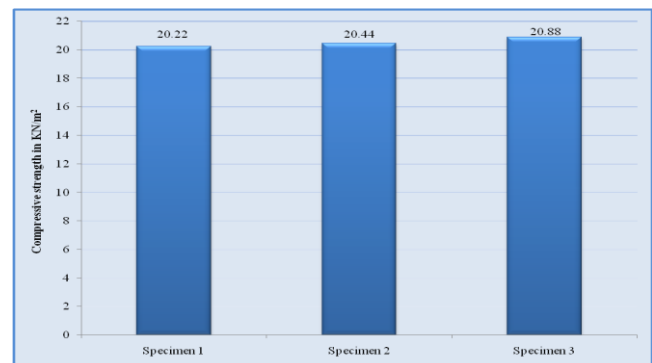


Figure no.2: At 150°C mean value 20.51 KN/m².

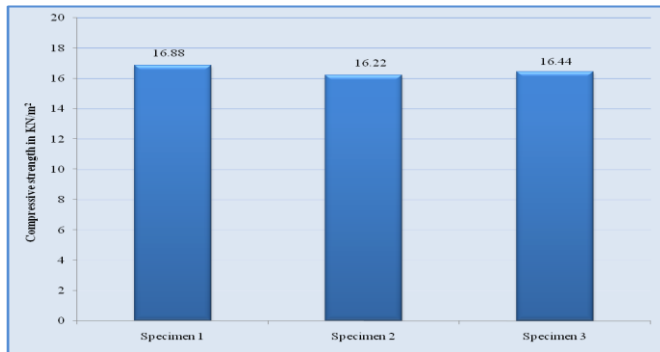


Figure no.3: At 300°C mean value 16.51 KN/m².

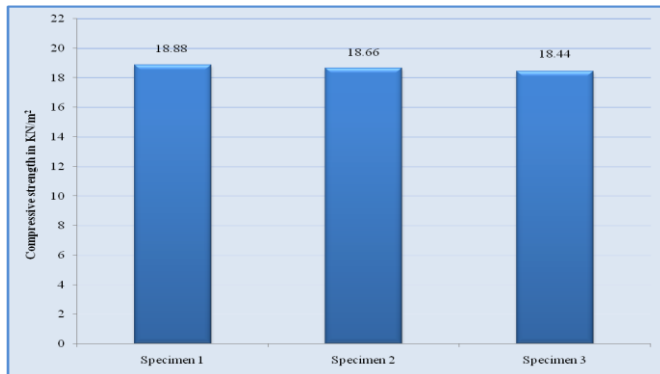


Figure no.4: At 450°C mean value 18.66 KN/m².

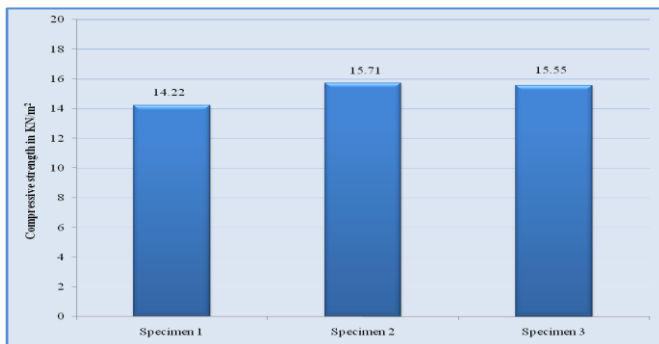


Figure no.5: At 600°C mean value 16.16 KN/m².

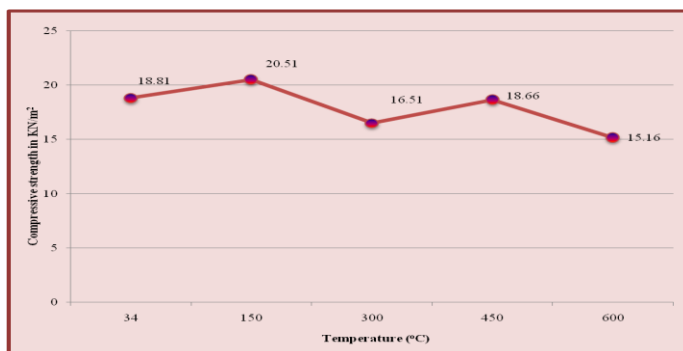


Figure no.6: Relation between Compressive strength and Temperature of experimental

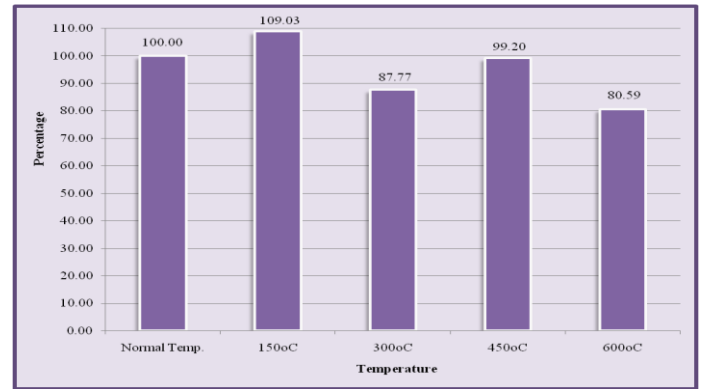


Figure no.7: Relative Compressive strength relation at various Temperatures

CONCLUSION

As per the test results of compressive strength of specimens, it can be seen that at Room temperature i.e. 34°C strength obtained is 18.81 KN/m² where as when the specimen is subjected to 150°C the compressive strength increases up to 20.57 KN/m². However at 300 °C the compressive strength got decreased up to 16.51K N/m². Further increase in temperature increased the strength of concrete cube to the value 18.66K N/m² at 450°C. At the temperature of 600°C the specimen got damaged , showing weak bond ,cracks white spots and resulted decreased compressive strength of 15.16 KN/m².

Thus it can be seen that at 150 °C the strength increases by 9.03% and at 300°C it got decreased by 12.23%. Further at 450°C the strength was decreased by 0.80% and at 600°C the concrete got poorly damaged. The reduction in the strength was 19.41%. This means that up to 150°C the strength of concrete increases to some extent after that strength decreases.

The behavior of Normal concrete is distinct and requires further more attention so as to mitigate accidents due to fire hazards , since the failure of structure occurs at its collapsible strength , the study over here highlight the strength parametric behavior of concrete at various temperature.

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A Technique for Constructing Even-order Magic Squares using Basic Latin Squares

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Abstract: Tomba (2012) introduced a technique for construction (n x n) magic squares (when n is odd) using basic Latin Squares by fixing the pivot element and arranging other elements in an orderly manner [10]. However, even-order magic squares can't be constructed using the same procedure because of duplication in diagonal elements. In this paper, a technique for constructing (n x n) magic squares (when n is doubly even) using basic Latin square is developed. Doubly even magic squares are made by fixing the column associated with the elements, adjacent to the pivot element and arranging in an orderly manner that generates a magic parametric constant (T, known as Tomba's constant) and sub-magic parametric constants (T_i) and finally derived by minor adjustment on the values of T_i s. The technique can provide weak magic squares for singly even cases. The construction is illustrated with suitable examples.

Key-words: Latin square (basic), singly even and doubly even magic square (normal), weak magic squares, magic parametric constant and sub-magic parametric constants
AMS Classification No: A- 05 and A-22

I. INTRODUCTION

Magic squares are practically important of the properties of equality in the sum of its rows, columns, diagonals. Latin squares and Greco-Latin squares are used in statistical research particularly in agricultural sciences and design of experiments whereas magic squares are used in puzzle games of cubes, pattern recognition and magic carpet constructions, magic square cipher in Cryptology etc.

II. LATIN SQUARES

In a Latin square, Latin letters are seen once in each row and column. In a Latin square, the sums of rows and columns are equal but not the sums of diagonals.

A basic (4 x 4) Latin square can be represented with Latin letters A, B, C and D as:

$$\begin{bmatrix} A & B & C & D \\ B & C & D & A \\ C & D & A & B \\ D & A & B & C \end{bmatrix} \text{ represented as } \begin{bmatrix} a_{11} & a_{12} & a_{13} & a_{14} \\ a_{21} & a_{22} & a_{23} & a_{24} \\ a_{31} & a_{32} & a_{33} & a_{34} \\ a_{41} & a_{42} & a_{43} & a_{44} \end{bmatrix} \quad [1]$$

Where, $\sum_i a_{ij} = \sum_j a_{ij}$ but $\sum_i d_{ij} \neq \sum_j d_{ij}$ with diagonal notation d_{ij}

2.1 Symmetric properties of Basic Latin Squares

Lemma-1: A basic (n x n) Latin square (n is odd) is symmetric and non-duplicated.

Let a (3 x 3) basic Latin square be

$$\begin{bmatrix} A & B & C \\ B & C & A \\ C & A & B \end{bmatrix} \Rightarrow \begin{bmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{bmatrix}$$

Here $a_{ij} = a_{ji}$, for all i and j but $a_{11} = A$ $a_{22} = C$ $a_{33} = B$ [2]

The diagonal elements are not equal or repeated
 $\Rightarrow$ non-duplicated

Lemma-2: A (n x n) basic Latin square (n is even) is symmetric but duplicated

Again, let a (4 x 4) basic Latin square be

$$\begin{bmatrix} A & B & C & D \\ B & C & D & A \\ C & D & A & B \\ D & A & B & C \end{bmatrix} \Rightarrow \begin{bmatrix} a_{11} & a_{12} & a_{13} & a_{14} \\ a_{21} & a_{22} & a_{23} & a_{24} \\ a_{31} & a_{32} & a_{33} & a_{34} \\ a_{41} & a_{42} & a_{43} & a_{44} \end{bmatrix}$$

Clearly, $\{a_{ij}\} = \{a_{ji}\}$ for all i and $j \Rightarrow$ Basic Latin squares (of all orders) are symmetric.

but, $a_{11} = A$, $a_{22} = C$, $a_{33} = C$ $a_{44} = C$ [3]

The diagonal elements are equal or repeated $\Rightarrow$ duplicated

Lemma-3: Conversely, a (n x n) square (n is odd), satisfying the symmetric and non duplication properties is a basic Latin square.

Lemma-4: In a basic Latin square (n is odd), one of the sum of diagonal is equal to the sum of rows or columns.

Lemma-5: In a basic Latin square (n is even for singly even or doubly even), the diagonal elements are equal or repeated $\Rightarrow$ duplicated

III. MAGIC SQUARES (normal)

An arrangement of non repeated integers ($n \geq 0$) in an array of equal rows and columns such that the sums of its rows, columns and diagonals are equal.

For a normal magic square, the following properties can be established

(i) Elements or numbers ($n \geq 0$) are consecutive and not repeated

- (ii) Sums of the rows, columns and diagonals are equal to the magic sum, S

$$\Rightarrow \sum_i b_{ij} = \sum_j b_{ij} = \sum_i d_{ij} = \sum_j d_{ij} \quad i, j=1, 2, \dots, n \quad [4]$$
- (iii) Equality property of the rows, columns and diagonals remain unaltered for rotations and reflections.

3.1: Odd order Magic Squares, derived from basic Latin Squares

For any n (n is odd), a magic square constructed using basic Latin square, the following theorem holds

Theorem: A (n x n) matrix $\{b_{ij}\}$, developed by using basic Latin square format when the pivot element is fixed and rearranging in an orderly manner represents a magic square of order n (n is odd). [For details; See IJSRP, May 2012: Tomba I.

3.2 Other Magic squares

There exists different (n x n) magic square not satisfying these properties. Examples of such magic squares, not satisfying the above properties are: magic squares (special or random, prime numbers etc.)

Examples: (i) MS (special)
$$\begin{bmatrix} 1 & 14 & 14 & 4 \\ 11 & 7 & 6 & 9 \\ 8 & 10 & 10 & 5 \\ 13 & 2 & 3 & 15 \end{bmatrix}$$

(ii) MS (prime numbers)
$$\begin{bmatrix} 17 & 39 & 71 \\ 113 & 59 & 5 \\ 47 & 29 & 101 \end{bmatrix}.$$

It satisfies; $\sum_i b_{ij} = \sum_j b_{ij} = \sum_i d_{ij} = \sum_j d_{ij}$ however these

magic squares are not normal because (i) the elements are repeated and non-consecutive and in (ii) the numbers (prime) are not repeated but non-consecutive.

3.3 Weak magic squares (normal)

A (n x n) array $\{b_{ij}\}$ with diagonal notation d_{ij} satisfying the properties

- (i) Elements or numbers ($n \geq 0$) are consecutive and not repeated
- (ii) Sums of diagonals are equal to the magic sum, S $\Rightarrow$

$$\sum_i d_{ij} = \sum_j d_{ij} \quad i, j=1, 2, \dots, n$$
- (iii) Sums of the rows, columns are equal to the magic sum (S), except for some I and j

$$\Rightarrow \sum_i b_{ij} = \sum_j b_{ij} \quad i, j=1, 2, \dots, n \quad [6]$$
- (iv) Equality property of the rows, columns and diagonals remain unaltered for rotations and reflections.

Then the matrix $\{b_{ij}\}$ satisfying the above properties can be treated as weak magic squares

Lemma 6: Magic squares are weak magic squares but the converse is not true.

Since the elements are consecutive, non-repeated and diagonal sums are equal in both magic squares and weak magic squares. Sums of the rows and columns are equal (except for some rows and columns) in case of weak magic square, whereas sums of rows and columns are equal for the magic squares, hence the lemma holds.

3.5 More Properties

- (i) For the consecutive numbers ($n \geq 1$), then magic sum, S

$$= \frac{1}{2} \{n(n^2 + 1)\}$$
- (ii) If the consecutive number ($n \geq 0$), then it gives the lowest magic square.
- (iii) If the consecutive number starts from s+1 where $s \geq 1$, then $S = n \left\{ s + \frac{(n^2+1)}{2} \right\}$
- (iv) The magic parametric constant, sub-magic parametric constants can be determined

3.6 Alternate Structures of (n x n) magic squares

Let $\{a_{ij}\}$ be a magic square satisfying the properties (a) to (d).

Equality in the sums of rows, columns and diagonals will remain unchanged for rotations and reflections. Hence alternate structures of a magic square can be expressed (if the rotation is clockwise or anticlockwise for $(k \frac{\pi}{2}); k = \pm 1, \pm 2, \dots, \pm m$) as $\{a_{ij}(k)\}$ where $\{a_{ij}\} = \{a_{ij}(k)\}$ for all $i = 0, 4, 8, \dots$

3.7 More properties on alternative structures

Infinite number of magic squares can be generated by multiplying or adding by a number $p \geq 1$ to each element of the given magic square.

If the minimum element/number is 0, then $\{a_{ij}\}$ gives the lowest magic square

Sum of two magic squares in the same rotation/reflection gives a magic square

Sum of two magic squares in different rotation are not magic squares.

Product of two magic squares is not a magic square

Magic squares in the same rotation/reflection are additive

IV. METHODOLOGY

For constructing (n x n) magic square using basic Latin squares when n is even

The technique of constructing doubly even magic square using basic Latin square principle can be expressed as follows:

Let the n^2 matrix $\{a_{ij}\}; i, j=1, 2, \dots, n$ with the consecutive elements/ numbers be arranged in Basic Latin square format as;

$$\begin{bmatrix} a_{11} & a_{12} & \dots & a_{1n-1} & a_{1n} \\ a_{22} & a_{23} & \dots & a_{2n} & a_{21} \\ \dots & \dots & \dots & \dots & \dots \\ a_{nn} & a_{n1} & \dots & a_{nn-2} & a_{nn-1} \end{bmatrix}$$

$$\text{Where, } \sum_i a_{ij} = S \text{ for all } i, S = \frac{1}{2} \{n(n^2 + 1)\} \quad [7]$$

This condition will be true for all n (odd or even) due to basic Latin square property.

The pivot element is unique for n is odd but when n is even, it lies between two elements.

Since the pivot element is not fixed, we select the column, associated with the numbers adjacent to the pivot element and assign it as the diagonal elements and arrange the other elements in an orderly manner to get a new matrix $\{b_{ij}\}; i, j=1,2,\dots,n$, satisfying the property of

$$\sum_i d_{ij} = \sum_j d_{ij} = S \text{ for all } i \text{ and } j \quad [8]$$

Again, retaining the diagonal elements unchanged, make symmetric transformations of $\{b_{ij}\}$ to $\{b_{ji}\}$, to find out the extreme corner blocks and central block of (2 x 2) each.

Reverting rows and columns systematically, a magic parametric constant (T) and a set of sub magic parametric constants ($T_1 T_2 \dots$) can be determined.

By adjusting the values in the parametric constants and sub parametric constants, the required magic squares (even order) can be constructed as

$$\begin{bmatrix} b_{11} & b_{12} & b_{1j} & b_{1n} \\ b_{21} & b_{22} & b_{2j} & b_{2n} \\ \dots & \dots & \dots & \dots \\ b_{n1} & b_{n2} & b_{nj} & b_{nn} \end{bmatrix}$$

$$\text{Satisfying } \sum_i b_{ij} = \sum_j b_{ij} = \sum_i d_{ij} = \sum_j d_{ij} \quad [9]$$

$\Rightarrow \{b_{ij}\}; i, j=1,2,\dots,n$ is a n^2 (doubly-even) magic square.

4.2. Steps for constructing magic square (n is even)

Construction of magic square using basic Latin square is expressed in the following steps:

Step-1: First arrange the consecutive numbers ($a_{11} a_{12} \dots a_{1n}$), ($a_{21} a_{22} \dots a_{2n}$), $\dots$ ($a_{n1} a_{n2} \dots a_{nn}$) in basic Latin square format.

Step-2: Find the range of $\frac{1}{2}(a_{11} + a_{nn})$ and select the column associated with this range assign it as diagonal elements and arrange other elements in an orderly manner, giving diagonals sums equal $\sum_i d_{ij} = \sum_j d_{ij}$

Step-3: Retaining the diagonal elements unchanged, make transformations of $\{b_{ij}\}$ to $\{b_{ji}\}$, to construct the extreme corner blocks of (2 x 2)..

Step-4: Reverting rows and columns in a systematic manner, a magic parametric constant (T) and a set of sub-magic parametric constants ($T_1 T_2 \dots$) can be determined.

The reversion process can be made as follows: Depending upon n

(i) n (singly even), $2 \leq \left\{ \frac{n}{2} \pm 2k \right\} \angle (n-2)$ for $k = 0, 1, 2 \dots n$

(ii) n (doubly even), $2 \leq \left\{ \frac{n-2}{2} \pm 2k \right\} \angle (n-2)$ for $k = 0, 1, 2 \dots n$

Step-5: Main adjustments should be made on the elements corresponding to the magic parametric constant (T), whereas minor adjustments should be made on other elements of sub-magic parametric constants to get the magic square $\{b_{ij}\}; i, j=1,2,\dots,n$ satisfying the properties of $\sum_i b_{ij} = \sum_j b_{ij} = \sum_i d_{ij} = \sum_j d_{ij}$

The technique can be used for constructing doubly even magic squares. For singly even cases, it can provide weak magic squares only. Illustrations are shown as follows:

V. NUMERICAL EXAMPLES (doubly even cases)

5.1: To construct (4 x 4) magic square using basic Latin Square

Step-1: Let the numbers be (1 to 16) arranged in square format be

1	2	3	4
6	7	8	5
11	12	9	10
16	13	14	15

The arrangement gives the column totals equal, $\sum_i a_{ij} = 34$ for all i

$$\text{Here, } S = \frac{1}{2} \{n(n^2 + 1)\} = 34 \text{ for } n = 4$$

and $\left\{ \frac{1}{2} (1 + 16) \right\}$ lies between 8 and 9. [10]

Step-2: Select the row associated with these elements (say 3, 8, 9, 14) and assign it as diagonal elements.

Rearranging the other elements in an orderly manner to get a new (4 x 4) array $\{b_{ij}\}$ satisfying $\sum_i d_{ij} = \sum_j d_{ij} = 34$

15	11	7	3
16	12	8	4
3	9	5	1
4	10	6	2

Step-3: Retaining the diagonal elements un-changed, make transformations of $\{b_{ij}\}$ to $\{b_{ji}\}$ to generate the extreme corner blocks of (2 x 2).

15	6	10	3
1	12	8	13
4	9	5	16
14	7	11	2

The extreme corner blocks: $\begin{bmatrix} 15 & 6 \\ 1 & 12 \end{bmatrix} \begin{bmatrix} 10 & 3 \\ 8 & 12 \end{bmatrix} \begin{bmatrix} 4 & 9 \\ 14 & 7 \end{bmatrix} \begin{bmatrix} 5 & 16 \\ 11 & 2 \end{bmatrix}$

No central block is created

Step-4: Here, $\{\frac{1}{2}(n-4)\} = 0$ for $n = 4$ and therefore no magic parametric constant is available.

Step-5: No minor adjustment needed and therefore the construction of (4 x 4) magic squares is completed in Step-3.

5.2 To construct (8 x 8) magic square

Step-1: Let the consecutive numbers be (1, 2, 3,... 64), arranged in 8 rows and 8 columns be rearranged in Latin Square format as:

1	2	3	4	5	6	7	8
10	11	12	13	14	15	16	9
19	20	21	22	23	24	17	18
28	29	30	31	32	25	26	27
37	38	39	40	33	34	35	36
46	47	48	41	42	43	44	45
55	56	49	50	51	52	53	54
64	57	58	59	60	61	62	63

Step-2: Select the row associated with the element (32 and 33) and assign this row as diagonal elements. Rearranging the other elements in an orderly manner to get a new matrix giving the diagonal sums equal satisfying

$$\sum_i d_{ij} = \sum_j d_{ij} = S \text{ where } S = 260$$

61	53	45	37	29	21	13	5
62	54	46	38	30	22	14	6
63	55	47	39	31	23	15	7
64	56	48	40	32	24	16	8
57	49	41	33	25	17	9	1
58	50	42	34	26	18	10	2
59	51	43	35	27	19	11	3
60	52	44	36	28	20	12	4

Step-4: Retaining the diagonal elements unchanged, make transformations of $\{b_{ij}\}$ to $\{b_{ji}\}$ to construct the extreme corner blocks and central block of (2 x 2) each

61	12	20	28	36	44	52	5
3	54	19	27	35	43	14	59
2	10	47	26	34	23	50	58
1	9	17	33	25	41	49	57
8	16	24	40	32	48	56	64
7	15	42	31	39	18	55	63
6	51	22	30	38	46	11	62
60	13	21	29	37	45	53	4

Extreme corner blocks: $\begin{bmatrix} 61 & 12 \\ 3 & 54 \end{bmatrix} \begin{bmatrix} 52 & 5 \\ 14 & 59 \end{bmatrix} \begin{bmatrix} 6 & 51 \\ 60 & 13 \end{bmatrix} \begin{bmatrix} 11 & 62 \\ 53 & 4 \end{bmatrix}$

Central block: $\begin{bmatrix} 33 & 25 \\ 40 & 32 \end{bmatrix}$

Step-5: Reverting the 3th column and 5th column and 3th row and 5th row, keeping the diagonal elements, extreme corner blocks and central block unchanged, a magic parametric constants (T) can be determined

61	12	21	28	37	44	52	5	260
3	54	22	27	38	43	14	59	260
58	50	47	26	39	23	10	2	260
1	8 ₊₁	48	40	32	41 ₋₁₇	49	56 ₊₁	275
64	57 ₋₁	17	33	25	24 ₊₁₇	16	9 ₋₁	245
7	15	42	31	34	18	55	63	260
6	51	19	30	35	46	11	62	260
60	13	20	29	36	45	53	4	260
260	260	236	260	260	284	260	260	260

Step-6: Here $T = 65$ (sum of the elements in 4th column and 5th column or 4th row and 5th row).

Sub-magic parametric constants are $T_1 = 49$ (3th column and 4th column), $T_2 = 81$ (5th column and 6th column), $T_3 = 59$ (3th row and 4th row), $T_4 = 71$ (5th row and 6th row).

Main adjustments on the values of T and then on the values of sub parametric constants

61	12	21	28	37	44	52	5	260
3	54	22	27_{+11}	38_{-11}	43	14	59	260
58	50	47	26_{+5}	39	23	10	2	255_{+5}
1	9	48	40	32	24	49	57	260
64	56	17_{+24}	33	25	41_{-24}	16	8	260
7	15	42	31_{-5}	34	18	55	63	265_{-5}
6	51	19	30_{+5}	35_{-5}	46	11	62	260
60	13	20	29	36	45	53	4	260
260	260	260	244_{+16}	276_{-16}	260	260	260	260

Secondary adjustments are made on the values of the sub-magic parametric constants as shown above and finally the necessary magic square of 8x8 is available as follows;

61	12	21	28	37	44	52	5	260
3	54	22	38	27	43	14	59	260
58	50	47	31	39	23	10	2	260
1	9	48	40	32	24	49	57	260
64	56	41	33	25	17	16	8	260
7	15	42	26	34	18	50	63	260
6	51	19	35	30	46	11	62	260
60	13	20	29	36	45	53	4	260
260	260	260	260	260	260	260	260	260

Alternative approach

Step-5: Suppose the central block is assumed as $\begin{bmatrix} 32 & 40 \\ 25 & 33 \end{bmatrix}$

Reverting the 4th column and 5th column, keeping the diagonal elements and extreme corner blocks unchanged, sub-parametric constants derived are :

T_1 (3rd row + 4th row), T_2 (5th row + 6th row), T_3 (3rd column + 4th column) and T_4 (5th column + 6th column).

Here, $T_1 = 49$, $T_2 = 81$, $T_3 = 59$, $T_4 = 71$.

And the parametric constant can be determined indirectly as $T = 65$ (3rd row + crossed 5th row or 4th row + crossed 5th row or 3rd column + crossed 5th column or 4th column + crossed 5th column)

$65 = (20 + 45), (19 + 46)....$ or $(29+36), (30+35)$ or $(2+63), (10+55).....$ or $(64+1), (56+9).....$

61	12	20	29_{+8}	37_{-8}	44	52	5	260
3	54	19	30_{+8}	38_{-8}	43	14	59	260
2	10	47	31	39	23	50	58	260
57	49	41	32	40	17	9_{+7}	1_{+7}	246_{+14}
64	56	48	25	33	24	16_{-7}	8_{-7}	274_{-14}
7	15	42	26	34	18	55	63	260
6	51	22	27_{+8}	35_{-8}	46	11	62	260
60	13	21	28_{+8}	36_{-8}	45	53	4	260
260	260	260	228_{+32}	292_{-32}	260	260	260	260

Step-6: Since $T_1 = 49$, $T_2 = 81$, $T_3 = 59$, $T_4 = 71$

Minor adjustments are made on the values of these sub-magic parametric constants as shown above and finally the necessary magic square of (8 x 8) is available as follows;

61	12	20	37	29	44	52	5	260
3	54	19	38	30	43	14	59	260
2	10	47	31	39	23	50	58	260
57	49	41	32	40	17	16	8	260
64	56	48	25	33	24	9	1	260
7	15	42	26	34	18	55	63	260
6	51	22	35	27	46	11	62	260
60	13	21	36	28	45	53	4	260
260	260	260	260	260	260	260	260	260

5.3 To construct a (12 X 12) magic square

Step-1: Let the consecutive numbers be (1, 2, 3,... 144), be arranged in 12 rows and 12 columns in basic Latin square format. Selecting the column associated with 72 and 73 as diagonal element, rearranging in an orderly manner, a new matrix is available which satisfies the property

$$\sum_i d_{ij} = \sum_j d_{ij} = S \text{ where, } S = 870$$

139	127	115	103	91	79	67	55	43	31	19	7
140	128	116	104	92	80	68	56	44	32	20	8
141	129	117	105	93	81	69	57	45	33	21	9
142	130	118	106	94	82	70	58	46	34	22	10
143	131	119	107	95	83	71	59	47	35	23	11
144	132	120	108	96	84	72	60	48	36	24	12
133	121	109	97	85	73	61	49	37	25	13	1
134	122	110	98	86	74	62	50	38	26	14	2
135	123	111	99	87	75	63	51	39	27	15	3
136	124	112	100	88	76	64	52	40	28	16	4
137	125	113	101	89	77	65	53	41	29	17	5
138	126	114	102	90	78	66	54	42	30	18	6

Step-2: Retaining the diagonal elements unchanged make symmetric transformations $\{b_{ij}\}$ to $\{b_{ji}\}$ to construct the extreme corner blocks and central block of (2 x 2) each.

Extreme corner blocks: $\begin{bmatrix} 139 & 18 \\ 5 & 128 \end{bmatrix} \begin{bmatrix} 126 & 7 \\ 20 & 137 \end{bmatrix} \begin{bmatrix} 8 & 125 \\ 138 & 10 \end{bmatrix} \begin{bmatrix} 17 & 140 \\ 127 & 6 \end{bmatrix}$

Central block: $\begin{bmatrix} 33 & 25 \\ 40 & 32 \end{bmatrix}$

139	18	31	42	55	66	79	90	103	114	126	7
5	128	32	41	56	65	80	89	104	113	20	137
4	16	117	40	57	64	81	88	105	33	124	136
3	15	34	106	58	63	82	87	46	111	123	135
2	14	35	38	95	62	83	59	107	110	122	134
1	13	36	37	60	84	72	85	108	109	121	133
12	24	25	48	49	73	61	96	97	120	132	144
11	23	26	47	86	71	74	50	98	119	131	143
10	22	27	99	51	70	75	94	39	118	130	142
9	21	112	45	52	69	76	93	100	28	129	141
8	125	29	44	53	68	77	92	101	116	17	140
138	19	30	43	54	67	78	91	102	115	127	6

Step-3 Reverting 3rd, 5th, 7th and 9th columns, 3rd, 5th, 7th and 9th rows retaining the diagonal elements, extreme corner blocks and central block unchanged, magic parametric constant and sub-magic parametric constants can be determined:

139	18	31	42	55	66	79	90	103	114	126	7	870
5	128	32	41	56	65	80	89	104	113	20	137	870
136	124	117	105	88	81	64+5	57-5	40+5	33	16	4	865/870
3	15	34	106	58	63+19	82-19	87+7	46	111	123	135	863/870
134	122	110	107	95	74-3	71+3	59	38+9	35	14	2	861/870
1	13	25+84	48+60	60+36	84	72	96-36	108-60	109-84	121	133	870
144	132	120	97	85	73	61	49	37	36	24	12	870
11	23	26+1	47-9	86	62	83	50	98	119-1	131	143	879/870
142	130	118+1	99	94-7	75	70	51	39	27-1	22	10	877/870
9	21	112	45-5	52+5	76	69-5	93	100	28	129	141	875/870
8	125	29	44	53	68	77	92	101	116	17	140	870
138	19	30	43	54	67	78	91	102	115	127	6	870
870	870	784/ 870	824/ 870	836/ 870	854/ 870	886/ 870	904/ 870	916/ 870	956/ 870	870	870	870

Step-4: Main adjustments are made on the elements of T (corresponding to the central block) and secondary adjustments are made on other elements as:

Finally the required (12x12) magic square is obtained as :

139	18	31	42	55	66	79	90	103	114	126	7	870
5	128	32	41	56	65	80	89	104	113	20	137	870
136	124	117	105	88	81	69	52	45	33	16	4	870
3	15	34	106	58	82	63	94	46	111	123	135	870
134	122	110	107	95	71	74	59	47	35	14	2	870
1	13	109	108	96	84	72	60	48	25	121	133	870
144	132	120	97	85	73	61	49	37	36	24	12	870
11	23	27	38	86	62	83	50	98	118	131	143	870
142	130	119	99	87	75	70	51	39	26	22	10	870
9	21	112	40	57	76	64	93	100	28	129	141	870
8	125	29	44	53	68	77	92	101	116	17	140	870
138	19	30	43	54	67	78	91	102	115	127	6	870
870	870	870	870	870	870	870	870	870	870	870	870	870

VI NUMERICAL EXAMPLES (Singly even cases)

For singly even cases, the technique generates weak magic squares only

6.1 To construct a (6 x 6) weak magic square

Step-1: Let the consecutive numbers be (1, 2, ...36) arranged in 6 rows and 6 columns be arranged in Latin square format as;

1	2	3	4	5	6
8	9	10	11	12	7
15	16	17	18	13	14
22	23	24	19	20	21
29	30	25	26	27	28
36	31	32	33	34	35

Satisfying $\sum_i a_{ij} = S$ for all i, where, $S = 111$. Since, $\frac{1}{2}(1+16)$ lies between 18 and 19

Step-2: Select the row associated with the element (18, 19) as (4, 11, 18, 19, 26, 33) and assign this row as diagonal elements

Rearrange the other elements in an orderly manner to get a new matrix $\{b_{ij}\}$ to make the diagonal sums equal,

34	28	22	16	10	4
35	29	23	17	11	5
36	30	24	18	12	6
31	25	19	13	7	1
32	26	20	14	8	2
33	27	21	15	9	3

Step-3: Retaining the diagonal elements unchanged, make symmetric transformations of $\{b_{ij}\}$ to $\{b_{ji}\}$, to construct the extreme corner and central blocks of (2 x 2) each.

The extreme corner blocks $\begin{bmatrix} 34 & 9 \\ 2 & 29 \end{bmatrix} \begin{bmatrix} 27 & 4 \\ 11 & 32 \end{bmatrix} \begin{bmatrix} 5 & 26 \\ 33 & 10 \end{bmatrix} \begin{bmatrix} 8 & 35 \\ 28 & 3 \end{bmatrix}$

And central block $\begin{bmatrix} 24 & 18 \\ 19 & 13 \end{bmatrix}$

34	9	15	21	27	4
2	29	14	20	11	32
1	7	24	18	25	31
6	12	19	13	30	36
5	26	17	23	8	35
33	10	16	22	28	3

A magic parametric constant, T (3rd row + 4th row) or (3rd column + 4th column) (except for the central block of 2x2) is determined as T = 37.

Step-4: Reverting the 3rd row and 3rd column, retaining the diagonal elements and central block unchanged, a (6 x 6) matrix is available, where T = 37 (3rd row + 4th row or 3rd column + 4th column) as;

34	9	16	21	27	4	111
2	29	17	20 ₋₆	11	32	111
31	25 ₊₅	24	18	7	1	106
6	12	19	13	30 ₋₅	36	116
5	26	14 ₊₆	23	8	35	111
33	10	15	22	28	3	111
111	111	105	117	111	111	111

Here, T = 37 (36+1 or 30+7 or 15+22 or 16 +21 or 20+17 or 14+23, or 24+13 or 19+18)

34	9	16	21	27	4	111
2	29	17	14	11	32	105
31	30	24	18	7	1	111
6	12	19	13	25	36	111
5	26	20	23	8	35	117
33	10	15	22	28	3	111
111	116	111	111	106	111	111

Step-5: After simple adjustments in the value of the magic parametric constants, we get the weak magic square, generated from Latin Squares (taking the central block as $\begin{bmatrix} 24 & 18 \\ 19 & 13 \end{bmatrix}$)

Adjustment to make row and column sums equal will affect the sum of the diagonals or adjustment to make diagonal sums equal will affect the sum of the rows and columns, generating only weak magic squares.

Depending upon the central block, different forms of weak magic squares can be generated (ii)

(a) Central block $\begin{bmatrix} 24 & 18 \\ 19 & 13 \end{bmatrix}$,

(i)

34	9	16	21	27	4	111
2	29	17	14	11	32	105
31	30	24	18	7	1	111
6	12	19	13	25	36	111
5	26	20	23	8	35	116
33	10	15	22	28	3	111
111	116	111	111	106	111	111

(ii)

34	9	16	21	27	4	111
2	29	23	14	11	32	111
31	30	24	18	7	1	111
6	12	19	13	25	36	111
5	26	20	17	8	35	105
33	10	15	22	28	3	111
111	116	117	105	106	111	111

(b) Central block $\begin{bmatrix} 13 & 19 \\ 18 & 24 \end{bmatrix}$

(i)

34	9	22	15	27	4	111
2	29	17	14	11	32	105
36	25	13	19	12	6	111
1	7	18	24	30	31	111
5	26	20	23	8	35	117
33	10	21	16	28	3	111
111	106	111	111	116	111	111

34	9	22	15	27	4	111
2	29	23	14	11	32	111
36	25	13	19	12	6	111
1	7	18	24	30	31	111
5	26	20	17	8	35	111
33	10	21	16	28	3	111
111	106	117	105	116	111	111

(c) Central block $\begin{bmatrix} 18 & 13 \\ 24 & 19 \end{bmatrix}$

(i)

34	9	16	21	27	4	111
2	29	17	20	11	32	111
31	30	18	13	12	1	105
6	7	24	19	25	36	117
5	26	14	23	8	35	111
33	10	22	15	28	3	111
111	111	111	111	111	111	111

(ii)

34	9	16	21	27	4	111
2	29	17	20	11	32	111
31	30	18	13	12	7	111
6	1	24	19	25	36	111
5	26	14	23	8	35	111
33	10	22	15	28	3	111
111	117	111	111	111	105	111

(d) Making rows and columns sums equal effects the diagonal sums (unequal)

34	9	16	21	27	4	111
2	29	17	20	11	32	111
31	30	24	13	12	1	111
6	7	18	19	25	36	111
5	26	14	23	8	35	111
33	10	22	15	28	3	111
111	111	111	111	111	111	117

Here, the diagonal sums are affected
It gives the diagonal sums as 105 and 117 (not equal)

VII. CONCLUSION

The technique can be used for finding magic squares from basic Latin Squares of any order ($n \geq 1$, for n is doubly even). The construction is done by fixing the column, associated with the adjacent elements to the pivot element and, assigning it as diagonal element and arranging other elements in an orderly manner with minor adjustments on the elements corresponding to the magic parametric constant and sub parametric constants.

However, for singly even cases, the technique can generate weak magic squares only and therefore separate techniques are to be applied further for making magic squares. For crypto-logical studies, magic squares and weak magic squares in different structures can be applied.

The application of magic squares, derived from Latin squares (when n is singly even) is expected to provide more security against using the actual magic squares, derived for any n (odd or doubly even).

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Xml-Based Security for E-commerce Application

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Abstract- E-commerce applications now a day are becoming very popular as it saves a lot of time and at the same time it is very secure. Developing E-commerce application from scratch is a tedious job. The requirements for securing e-commerce transaction are privacy, authentication, integrity maintenance and non-repudiation. In this paper we are suggesting security concerns for payment details of customer. We are using XML watermarking in combination with digital signature for this purpose. This can be done to check integrity of the payment details data. This paper provides directions for web and ecommerce applications security. In particular, XML security and payment database security issues pertaining to the web and e-commerce applications are discussed.

Index Terms- Watermarking, Integrity, Digital Signature, Xml watermarking, SHA-512, SHAwithDSA..

I. INTRODUCTION

Electronic commerce (e-commerce) is one of the fastest growing application areas for the World Wide Web. For the effective operation of the web and e-commerce applications, security is a key issue. The security threats include access control violations, integrity violations, sabotage, fraud, privacy violations, as well as denial of service and infrastructure attacks[1][2].

Web services security requires authentication (establishing identity), authorization (establishing what a user is allowed to do), confidentiality (ensuring that only the intended recipient can read the message, accomplished with encryption), and integrity (ensuring the message hasn't been tampered with, generally accomplished with digital signatures)[3].

The success of the Internet has made the communication very easy between parties and XML is one of the most used standard for information representation and exchange. A huge amount of data is crossing the Internet on the daily basis. Since the Internet is an unreliable network, XML data can be easily captured and tampered by unauthorized users. XML data is generally presented in plain text, thus hackers can access it during transmission across a network. Vendors have generally avoided encrypting the data because this would add size to already bulky XML files.

In this paper we are concentrating only on transaction data security of e-commerce application. This study is proposing a scheme that uses XML watermarking and digital signature to detect and localize any modification made to an XML data. The watermark embedding and detection processes are done online and use only a constant memory. Section I gives introduction to security concerns of e-commerce application, Section II describes the related work in the area of xml security. Section III

discusses the proposed system for securing transactional xml data. Paper concludes in section IV.

II. RELATED WORK

The purpose of Web security is to meet the security expectations of users and providers. To that end, Web security is concerned with

- client-side security,
- server-side security, and
- secure transmission of information.

Client-side security is concerned with the techniques and practices that protect a user's privacy and the integrity of the user's computing system.

Server-side security is concerned with the techniques and practices that protect the Web server software and its associated hardware from break-ins, Web site vandalism and denial of service attacks.

Secure transmission is concerned with the techniques and practices that will guarantee protection from eavesdropping and intentional message modification.

The wide acceptance of XML as the format for data representation and exchange clearly demonstrates the need for a general and flexible framework of secure access for XML databases. While security specification and enforcement are well established in relational databases, their methods and approaches cannot be easily adapted to XML databases. This is because an XML document stores information not only in its data nodes but also in the way it is structured. Consequently, the problem of secure access to XML databases has its own particular flavour and requires dedicated solutions. Watermarking is a known technique for hiding a copyright mark in a digital document, in a resilient manner. While such methods already exist for numerical streams, they do not meet the specific requirements of XML streams..Watermarking in the contexts of image, audio or video data is well-known to be an effective technique to protect the intellectual property of electronic content. Essentially, the technique embeds a secret message into a cover message within the content in order to prove the ownership of materials.

The existing watermarking technology has mostly been developed in the context of multimedia data, since such data has a high tolerance to noise and thus it is not easy to detect the watermark. Unlike multimedia data, XML data are diverse in nature: some are data-centric and numeric (e.g. regular scientific data) while some are document-centric and verbose (e.g. book chapters). It is challenging to develop an effective watermarking scheme which is invisible and is able to resist various kinds of attack[4][5]. Agrawal presents an effective watermarking

technique for the relational data[6][7]. This technique ensures some bit positions of certain attributes contain the watermarks.

Gross-Amblard [6][8] investigates the problem of watermarking XML databases while preserving a set of parametric queries. His work mainly focuses on performing queries on different structures and pay less attention to the watermarking scheme.

In [9], the scheme proposed is called WmXM. WmXM is described as a system for watermarking XML, which generates queries from essential semantics to identify the available watermarking bandwidth in XML documents. As further described, it uses query templates to represent data usability, generate queries from semantic, which allows elements identification and structure units for watermarking. It also considers the internal semantics to walk through vulnerabilities that come with redundancy found in XML data. This watermarking scheme starts with the initialization, where a schema is specified and XML data are validated. A set of query templates is specified to represent data usability. Using a secret key, a number of data elements or structure units is selected for the watermark embedding. Queries are then created. The process ends up with the Watermark Insertion. Just as above in [10], we note that this technique falls into robust watermarking.

In [11], a scheme for watermarking semi-structured data that uses a graph labelling is proposed; As other schemes mentioned before this one also falls into robust watermarking.

In [12], a scheme for fragile watermarking is proposed. The technique used here is a proven method for detecting and localizing malicious alterations made to a database relation with categorical attributes. Furthermore, the scheme is distortion free, which means there is no distortion made to the actual data. It prevents illegal embedding and verification, since the watermarking process is governed by a key. The watermark embedding process and verification can only be done by a person who possesses the necessary key. The original database relation with no embedded watermark is not required for watermark verification. Finally, in case the watermark verification fails, the embedded watermarks indicate where the modifications are.

The algorithm used in this scheme can be resumed as follow: In the watermark embedding phase, first a primary key hash value is calculated for each tuple according to a watermark key and the primary key of the tuple. According to their primary key hash value, all tuples are partitioned into relative groups. After grouping, all tuples in each group are sorted according to their primary: this is done for the purpose of synchronization. The watermark embedding process ends up by watermarking each group independently. One main thing to keep in mind which is very important is that the grouping and sorting operations are only virtual operations: there is no change of physical position of the tuples. In the watermark detection phase, the same operations as in the watermark embedding phase are repeated except that when the extracted bits from a group hash are retrieved; They are

checked against the position of the tuples to verify the watermark.

In [13], several techniques for hiding information in an XML document has been proposed.

III. PROPOSED SYSTEM

Transaction database security module provides stable storage for security -related data objects, including cryptographic keys, user information, customer transactional data etc against session hijacking attack. Transactional data, cryptographic keys are stored in XML files.

It has two sub-modules as shown in Figure 1.

A. XML Watermarking

In this module, watermarking of payment details is done to avoid session hijacking attack as user can see only the watermarked data. With development of data for copyright protection, Xml file watermarking can be used. At sender side payment details are stored in xml file, then we are partitioning the xml file, embedding hash values in bit positions of xml file. The working of watermarking of xml data has following sequence.

1. For watermarking we are using SHA-512 algorithm to get hash of transactional data or payment detail XML file.
2. Read xml file, partition xml data.
3. Then this Hash value is embedded in the bit positions of xml file.
4. Then we are computing digital signature of watermarked xml file.

B. Digital Signature

A digital signature's purpose is to ensure integrity and non-repudiation when files are transmitted. For calculating digital signature of watermarked xml data, we are using SHA1withDSA algorithm. It works in the following sequence.

1. It takes watermarked xml data.
2. SHA1withDSA hashing code is used to generate hash code of the message.
3. Message is sent to the receiver side with public key.
4. At receiver side the message is again watermarked first as mentioned above. Then the digital signature is generates a new hash code for the message and compares it with the decrypted hash code. If the two match, the message is accepted as authentic. That means payment details are secured. The combination of watermarking and digital signature provides an effective digital signature scheme.

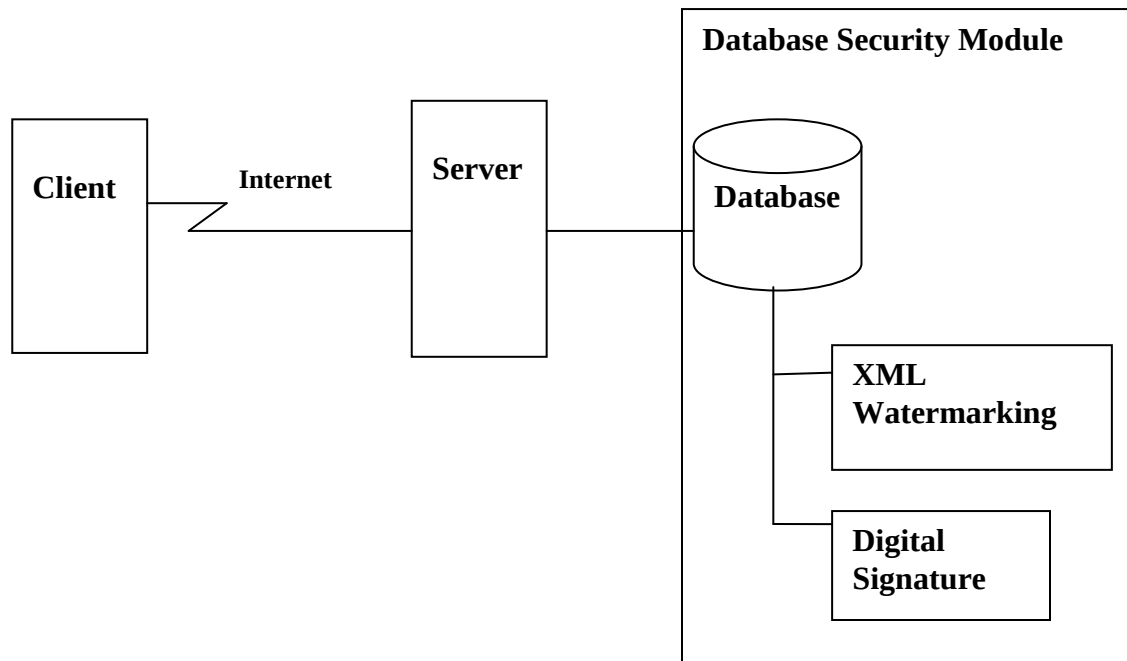


Figure 1: Proposed System Architecture

IV. CONCLUSION

For securing transactional database against message sniffing, session hijacking attacks we are watermarking the payment details xml file and then we are applying digital signature at client side. Finally sending it to the server side system. At server side system same decoding process will be done to check integrity of the original data. In this system even an attacker hacks the digital signature of the file still he/she can not get payment details as they can see only the watermarked xml data which is not in the human readable format.

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Network Intrusion Detection and Prevention techniques for DoS attacks

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Abstract: The Intrusion prevention system is the extension of Intrusion detection system. Network Intrusion Detection and Prevention system works on analyzing the packets coming and going through the interface. The paper illustrates the idea of detecting the DoS Attack. There are many methods available to Detect and avoid the DoS attack. On the network there are many types of DoS attack occurs due to which the service gets interrupted. This paper mainly deals with the DoS attacks.

Index Terms- IDS (Intrusion Prevention System), IPS (Intrusion Prevention System), NIDS(Network Intrusion Detection System)

I. INTRODUCTION

An Intrusion Prevention System is extension of Intrusion Detection System which is made by combining the Intrusion Detection System and Firewall.

The majority of intrusion prevention systems utilize one of three detection methods: signature-based, statistical anomaly-based, and stateful protocol analysis. [3][3][8]

Signature-based Detection: This method of detection utilizes signatures, which are attack patterns that are preconfigured and predetermined. A signature-based intrusion prevention system monitors the network traffic for matches to these signatures. Once a match is found the intrusion prevention system takes the appropriate action. Signatures can be exploit-based or vulnerability-based. Exploit-based signatures analyze patterns appearing in exploits being protected against, while vulnerability-based signatures analyze vulnerabilities in a program, its execution, and conditions needed to exploit said vulnerability.

Statistical Anomaly-based Detection: This method of detection baselines performance of average network traffic conditions. After a baseline is created, the system intermittently samples network traffic, using statistical analysis to compare the sample to the set baseline. If the activity is outside the baseline parameters, the intrusion prevention system takes the appropriate action.

Stateful Protocol Analysis Detection: This method identifies deviations of protocol states by comparing observed events with “predetermined profiles of generally accepted definitions of benign activity.”[3]

Intrusion detection is a set of techniques and methods that are used to detect suspicious activity both at the network and host level. Intrusion detection systems fall into two basic categories: signature-based intrusion detection systems and

anomaly detection systems. Intruders have signatures, like computer viruses, that can be detected using software. You try to find data packets that contain any known intrusion-related signatures or anomalies related to Internet protocols. Based upon a set of signatures and rules, the detection system is able to find and log suspicious activity and generate alerts. Anomaly-based intrusion detection usually depends on packet anomalies present in protocol header parts. In some cases these methods produce better results compared to signature-based IDS. Usually an intrusion detection system captures data from the network and applies its rules to that data or detects anomalies in it. Snort is primarily a rule-based IDS, however input plug-ins are present to detect anomalies in protocol headers.

1.1 Network IDS or NIDS[3,4]

NIDS are intrusion detection systems that capture data packets traveling on the network media (cables, wireless) and match them to a database of signatures. Depending upon whether a packet is matched with an intruder signature, an alert is generated or the packet is logged to a file or database. One major use of Snort is as a NIDS.

1.2 Host IDS or HIDS[3,4]

Host-based intrusion detection systems or HIDS are installed as agents on a host. These intrusion detection systems can look into system and application log files to detect any intruder activity. Some of these systems are reactive, meaning that they inform you only when something has happened. Some HIDS are proactive; they can sniff the network traffic coming to a particular host on which the HIDS is installed and alert you in real time.

II. RELATED WORK

As mentioned in the paper[1] efficient adaptive sequential and batch-sequential methods for an early detection of attacks that lead to changes in network traffic, such as denial-of-service attacks, worm-based attacks, port scanning, and man-in-the-middle attacks. These methods employ a statistical analysis of data from multiple layers of the network protocol to detect very subtle traffic changes. The algorithms are based on change-point detection theory and utilize a thresholding of test statistics to achieve a fixed rate of false alarms while allowing us to detect changes in statistical models as soon as possible.

Existing intrusion detection systems (IDSs) can be classified as either signature detection systems or anomaly detection systems (see, e.g., [14]). Signature detection systems

detect attacks by comparing the observed patterns of the network traffic with known attack templates (signatures). If the true attack belongs to the class of attacks listed in the database, then it can be successfully detected and, moreover, identified. Examples of signature-based IDSs are Snort [2] and Bro [23]. Anomaly detection systems compare the parameters of the observed traffic with “normal” network traffic. The attack is declared once a deviation from a normal traffic is observed. Examples of ad hoc anomaly IDSs are MULTOPS [11] and D-WARD [19].

A comprehensive security system consists of multiple tools, including:

- Firewalls that are used to block unwanted incoming as well as outgoing traffic of data. There is a range of firewall products available in the market both in Open Source and commercial products. Most popular commercial firewall products are from Checkpoint (<http://www.checkpoint.com>), Cisco (<http://www.cisco.com>) and Netscreen (<http://www.netscreen.com>). The most popular Open Source firewall is the Netfilter/Iptables (<http://www.netfilter.org>)-based firewall.
- Intrusion detection systems (IDS) that are used to find out if someone has gotten into or is trying to get into your network. The most popular IDS is Snort, which is available at <http://www.snort.org>.
- Vulnerability assessment tools that are used to find and plug security holes present in your network. Information collected from vulnerability assessment tools is used to set rules on firewalls so that these security holes are safeguarded from malicious Internet users. There are many vulnerability assessment tools including Nmap (<http://www.nmap.org>) and Nessus (<http://www.nessus.org>).

These tools can work together and exchange information with each other. Some products provide complete systems consisting of all of these products bundled together. Snort is an open source Network Intrusion Detection System (NIDS) which is available free of cost. NIDS is the type of Intrusion Detection System (IDS) that is used for scanning data flowing on the network.

There are some known attacks that are undetectable or difficult to detect; those for which signatures cannot be identified. Examples of these attacks are those with encrypted payloads and those that are polymorphic [5]. MDLC may be effective against polymorphic attacks. This needs to be evaluated.

In paper[7], designed an overlay mechanism for the defense of DDoS attack on converged networks. This defense mechanism consists basically of construction of hierarchical overlay, notification of attack detection, judgment of victims and decision of defense nodes, and notification of traffic detour.

In our approach, we consider the intrusion detection as a data analysis process. Network behaviors can be categorized as normal and abnormal. Due to the sheer volume of real network traffic, both in the amount of records and in the number of features, it is extremely difficult to process all the traffic information before making decisions. Data mining is a powerful tool to analyze the enormous data and extract the most relevant

information [17]. The task of generating classifiers based on rules using genetic algorithms and other evolutionary techniques the condition part of a rule has a tree structure, which is hard to represent with a linear structure. Some approaches to deal with the problem of representing the rules condition part as a header string are discussed in [10, 61]. CTree [51] uses linear representation scheme for evolving the fuzzy rules with complete binary tree data structure. The importance of real-time classification is very crucial in network intrusion detection. A faster and correct classifier can dramatically improve the performance of the IDS. In the approach proposed in paper[9] aims at developing an automated approach for building the IDS kernel - feature extraction and classification. It is extremely difficult to process in real time the large amount of network traffic to detect network attacks and take the appropriate actions. To process the network data in real time, we need to extract the most important data that can be used to efficiently detect network attacks. they use information theory to identify the most relevant features to be used in our online analysis of the traffic data.

We then apply data mining programs and genetic algorithm to compute linear classifiers that accurately capture the difference between intrusions and normal activities. Finally, we use the linear classifier with the trained thresholds and coefficients to detect a wide range of network attacks. This approach significantly reduces the need to manually analyze and encode normal usage profiles and intrusion models. These classifiers can be more effective because they are computed and validated using large amount of audit data.

Different types of network attacks are as shown below:

Table 1. Classes of Attacks[9]

Class	Attacks
DoS	Back, land, neptune, pod, smurf, teardrop
U2R(unauthorized access to local superuser (root) privileges)	Buffer-overflow, loadmodule, ped, rootkit
R2L	ftp-write, guess-passad, imap, multihop, phf, spy, warezclient, warezmaster
PROBE	Ipsweep, nmap, portsweep, satan

SVM [10] is a machine learning method based on the statistical learning theory, the key point of it is to improve the generation ability of the learning machine according to the Vapnik structural risk minimization principle, namely obtain small errors according to the limited training sets sample, and ensure the independent test sets keeping small errors. Moreover, the SVM algorithm is a convex optimization problem. Thus the local optimal solution must be the global optimal solution which other algorithms can not achieve. It can also be used in the limited sample data and not be sensitive to data dimensions. Therefore, SVM is

adapted to the intrusion detection field high dimension heterogeneous imbalance data set character, and it can be applied to intrusion detection.

III. DISCUSSION

For many platforms different firewalls are present like for Linux IPTable firewall is inbuilt firewall present which has to be accordingly by writing rules. It is rule-based Intrusion Prevention System. Same way for windows Net defender, WIPFW (windows firewall) which is based on BSD firewall ipfw. By writing ipfw rules the network or the system can be protected. There are two types of IDS one is Network Intrusion Detection System and other is Host based Intrusion Detection System. Network Intrusion Detection System tries to identify the malicious activity by monitoring the incoming and outgoing network traffic.

The following figure-1 shows the methods to detect the types of DoS attacks. To detect the attacks or malicious traffic on the network first step is to capture the packets. There are two types of mode present to capture the packet one is normal in that the packets intended to the system are only captured by the system. And other is Promiscuous mode in which every packet which is going through the interface is captured by the system. So to monitor the network traffic the system has to be operated in promiscuous mode.

In every NIDS or NIPS the overall architecture contains the following units.

1. Packet Sniffer unit: this unit captures the packet from the interface either in promiscuous mode or in normal mode. Promiscuous mode is explained above.
2. Intrusion Detection or Pre processing engine: in this unit it uses the different approaches to detect the attack depending on flow based analysis or protocol based analysis.
3. Countermeasures : in this the packets which contains the malicious code or if any abnormal flow of packets is observed the the particular action is selected to avoid the intruder to enter in to the network.

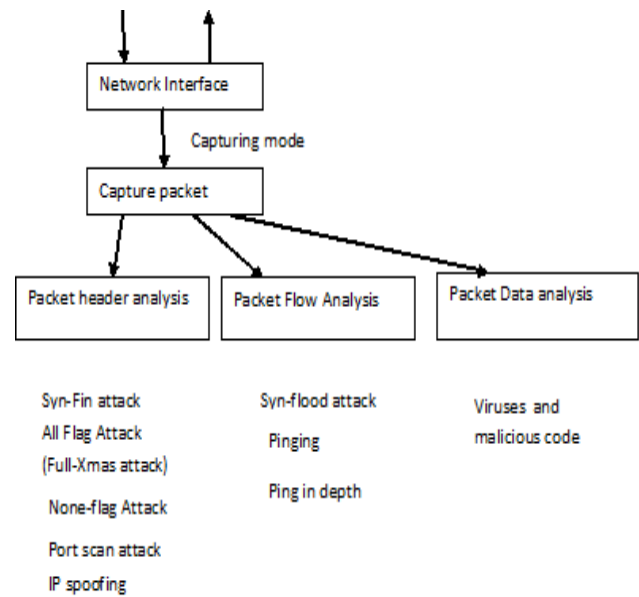


Figure-1 types of DoS attacks.

Flow based Analysis: A flow is defined as a set of IP packets passing an observation point in the network during a certain time interval. All packets belonging to a particular flow have a set of common properties.

The common properties are like Source IP address, destination Ip address, Source port and Destination port, and protocol. Using these common properties the flow direction can be determined and type of protocol it can be determined whether the traffic is normal or abnormal traffic.

the FIN or RST flags have been seen in a TCP flow. The packets which are coming and going for them the information related to sampling is stored and using probabilistic approach and the threshold the DoS attack is detected. For example the no of Syn packets are counted and if the number of syn packets are more than 20 per second then the Syn flood Attack is detected, 20 is the threshold value. and all the packets are dropped for the src_ip. Combination of random sampling and normal sampling is used to detect the flood attack.

The techniques which are used to detect the attacks in NIDS uses statistical approach and probabilistic approach and Information theory. Probabilistic approach is easy to implement because in the firewall rules itself we can specify the probability and threshold for dropping that packet or allowing that packets in the network. Like in ipfw rules we can mention the probability eg. *ipfw 0.5 deny from any to any TCP*

In the above rule it checks the probability 0.5 if it is greater than that then perform the action deny(drop) TCP packets coming from any to any.

IV. CONCLUSION

The Network Intrusion System Based on Datamining takes the time to train the system and Also It does lot of processing to be performed backend to detect the attack and

prevent it. The Signature based method are effective but it can not detect the new attacks. Main source of attack on the network is DoS attacks and then gather the required information from the network. The DoS attack can be detected by analysing of incoming packet and outgoing packets. Data mining approach requires lot of processing on the data where as the statistical and probability approach requires less processing than the data mining approach.

the intrusion prevention module of network intrusion prevention system which bases on intrusion detection system Snort_inline and Netfilter firewall of IPtables and improved the possibility of its function Intrusion prevention system provides real time and active prevention ability, prevents the attack effectively and assures the normal data stream. Because of the character of intrusion prevention system, it could only be connected in the network is series. This kind of connection position could lead to potential problems. Utilizing SVM in Snort intrusion detection system, reduces the rate of miss and error report, and needs little rules. Which makes Snort combines with fi rewall can improve the defensive ability of the system, and makes the IPS very intelligent.

To execute the firewall on windows the WIPFW can be used at the place of netfilter. IPFW is same as iptable in linux.

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Using CSPro (Census and Survey Processing System) Experience from Large Scale Surveys in India

Prabhu Ponnusamy

Abstract- This paper will discuss how CSPro (Census and Survey Processing System) coped with data processing system in complex large scale survey. A recent large scale surveys used the CSPro package for data entry fact sheet and tabulation generation for the survey. The paper will discuss the outcomes of using CSPro and data processing system methods in such a large scale survey. It is suggested that the use of CSPro has achieved a better data quality than other data processing packages would have. The use of CSPro has a number of distinguished advantages, such as improvements in data quality and turnaround times. It will critically review how the quantitative method worked in this specific situation before placing the discussion in its wider data processing system methods and research environment context.

Index Terms- CSPro (Census and Survey Processing System), SURVEY EXECUTING SYSTEM (CASES), DATA COLLECTION, LARGE SCALE DATA PROCESSING

I. INTRODUCTION

The purpose of this paper is to outline the experiences of the large scale surveys using CSPro (Census and Survey Processing System) package for data processing in India. The survey team used the CSPro package for a data processing during the conduct of the large scale surveys in recent times. This paper provides an overview of each phase of the data processing for survey from preparation to performance. It is hoped the information shared in this paper provides key insight for those national and state level survey agencies, researchers and statistical offices that may be considering using CSPro as an alternative method for data processing for surveys.

Main Phases of Data Processing

a. Preparation

- Software and hardware selection
- Develop data process cycle
- Training in use of survey software

b. Processes

- Data processing in large scale surveys
- Software and Hardware Selection

Software Selection

An initial concern was the size and complexity of the large scale questionnaire and software could cope with a questionnaire of that magnitude. The survey data collection instrument contained 5 modules namely Household, Ever married women, unmarried women, Village and Health facilities were used. The ability to

include smooth data process with national level to field agency and skip instructions, define values and incorporate rules were important criteria. The most important requirement however, was to obtain easy-to-use software for use by the questionnaire designers and ultimately the field agency data managers and data entry operators.

After much research it was decided to develop in CSPro (Census and Survey Processing System) package for data processing and it was decided to develop in house IT - in-Charge with four member team in the project. The software has been used previously in much large scale globally using. Although it is the first in recent project Fact sheet and tabulation generation software also developed.

Why CSPro ?

CSPro (Census and Survey Processing System) is a package for entry, editing, tabulation and dissemination of census and survey data. CSPro was developed jointly by the U.S. Census Bureau, Macro International and Serpro S.A., with major funding from the U.S. Agency for International Development. This software can be downloaded from <http://www.census.gov/ipc/www/cspro/> and is available free of charge. CSPro includes a data entry application, a batch editing application and a tabulation application. Within the data entry application there are facilities for defining the structure of your data (the data dictionary), and creating data entry forms. During the data entry process there has the facility to verify data by retyping values and comparing them to the values entered previously. It also has the facility to compare two data files created during double data entry, and produce a report on the discrepancies found. With the tabulation application you can produce cross-tabulations and frequency tables which are useful for exploratory data analysis and error checking. When you need to transfer to a statistics package to analyse your data further, CSPro provides a useful Export feature that transfers the data to formats readable by Excel and a variety of statistical packages. If requested this feature will generate syntax files for STATA, SPSS and SAS that contain the instructions for reading the data and for labelling the variables. The above mentioned distinguished advantages, such as improvements in data quality and turnaround times it has used for recent large scale surveys in India.

Hardware Selection

Machine should have at least P4 processor with 256 RAM and windows XP with higher version operating system. Better to format Hard disk before start of project. Install latest virus protection on the machine.

survey controls were needed for the data process operations, such as weekly reporting to office staff, constant follow-up and increased observation of the recent survey data processing. However, the following outlines some of the benefits that can be assumed by using the CSPro package. Skip instructions, ranges and validation are built into the program in the data entry software provides greater security for data, improved data quality and large amount of survey data in limited time of delivery.

The recent survey optimistic in using CSPro as an efficient method of data process in large scale survey. As experience with the technology grows, its benefit hopefully can be exploited over a wide range of projects.

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Region-based weighted prediction with improved global brightness detection for H.264 Encoder

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Abstract- This paper presents an efficient region-based WP (weighted prediction) with improved global brightness change detection for real-time H.264 encoder. We improve WP for local brightness changes using the reference reordering, without additional memory bandwidth and computation for ME (motion estimation). A brute force way is choosing the best reference index that minimizes MV cost after performing ME with two references separately. However, it doubles the ME computation too. To reduce the computation, we propose the following MB-based WP.

Index Terms- Video Coding, Weighted Prediction, MV cost, motion estimation, MB-based

I. INTRODUCTION

WP has been introduced in the H.264/MPEG-4 AVC video coding standard to improve coding efficiency during the brightness changes between frames [1]. It can provide high coding efficiency for global brightness changes by determining WP parameters properly [2]. Nevertheless, there are still difficulties in handling local brightness changes because it is a kind of picture-level tool especially for single-slice pictures. WP could lead to significant quality loss if it is not applied carefully. The localized WP was proposed in [3] to handle this problem, which requires syntax changes of H.264/MPEG-4 AVC. Another solution is a brute force approach that encodes all MBs (macroblocks) twice with and without WP and makes a final decision. However, it is not adequate for real-time encoder due to its complexities.

In this paper, we address the local brightness changes with two smart methods, global brightness change detection and MB-based WP. First, with the current and reference frames that are divided into the same number and shapes of regions, we determine if luminance change is global so as to enable or disable WP for a whole picture. Second, when there are local luminance changes, we propose to apply WP adaptively based on the region by using the reference picture reordering to fully leverage the benefit of WP. The proposed algorithms are quite effective for real-time HD (high-definition) H.264 encoder. By carefully configuring reference picture buffer, we can make WP useful for local brightness changes without any additional memory bandwidth and computation in ME. Moreover, the region-based WP can be extended to MB-based only with the marginal increase of computation, which provides the similar performance to a brute force approach.

To compute weighted prediction (WP) parameters, various method and different regions may be considered for weighted prediction parameter calculation, such as, regions where

brightness have changed or all regions regardless of how brightness changes locally. In one embodiment, N reference indices may use reference picture reordering and associate N different WP parameters to each of N regions. Then, for each block, the corresponding reference index for motion estimation may be chosen according to its position. When a single block overlaps multiple regions, there are several criteria to decide which region the block is included in. In the current embodiment, we used top-left block position for the decision. Thus, in this case, the block is in the region where top-left pixel of the block is included.

A region based WP method to handle local brightness change as well as improved GBD method is proposed. First, improved GBD is employed to determine if there is local brightness change and to identify such regions. Once local brightness changes are found, region based WP is applied using reference picture reordering to efficiently handle such regions. Then, motion estimation (ME) for each block is performed over one reference index (frame) depending on whether the region, in which the block is located, has brightness change or not.] Such a solution is useful when there are strict limitations on resources, such as, cycle count, memory bandwidth, etc. In the current hardware implementation of H.264 encoder, a single reference is used for ME due to such resource constraints. Since one reference is loaded and one ME per block is needed, no additional computations and memory bandwidth for ME are needed.

II. PROPOSED ALGORITHMS

H.264/MPEG-4 AVC supports the explicit WP method by scaling motion-compensated reference using the multiplicative weighting factor, w and the additive offset, o . The performance of WP depends on not only how to estimate these parameters but also when and how to apply WP. While employing the same method in [2] for WP parameter estimation, we focus on the latter in this work. To describe the algorithms, we assume the case of single-slice frame picture coding with a single reference frame, without loss of generality.

2.1 Global brightness change detection (GBCD)

We divide the current and the reference frame into 5 regions as shown in Fig. 2. Then we apply the following GB CD method, by which we can identify as well the regions that have brightness changes.

1. Compute mean and variance of the n -th regions of the current and the reference picture, which denoted by $M_{cur}(n)$, $M_{ref}(n)$, $V_{cur}(n)$ and $V_{ref}(n)$, respectively. And calculate absolute difference between two mean values,

$Mdiff(n) = |Mcur(n) - Mref(n)|$.

2. Compare $Mdiff(n)$ to TH , which we set to 1 in the experiments. If $Mdiff(n)$ is larger than TH , increase $Rcount$, which is initialized to 0, by 1.

3. Repeat steps 1 and 2 for all 5 regions.

4. Check if either $Vcur(n) - Vref(n) \geq 0$ or $Vcur(n) - Vref(n) \leq 0$ for all regions. Based on our observation that the variances of all regions increase or decrease with fade-in or fade-out, respectively, as shown in Figure 1, this condition checks if the mean values change by fading. If it is true, we set $Fade$ to 1, otherwise, set $Fade$ to 0. If $Fade$ is equal to 1 and $Rcount$ is equal to 5, we estimate (w, o) and associate them to $refidx = 0$. Otherwise, we disable WP. In both cases, ME is done w.r.t. $refidx = 0$ for all MBs.

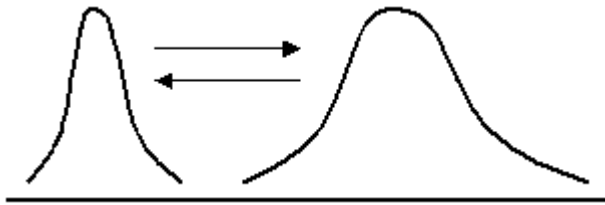


Fig. 1. Histogram changes with fade-in and fade-out. Variances change monotonically for all regions in general.

Fig 2: Reference picture reordering for local brightness changes. Shaded regions in the current frame have brightness change with respect to the reference.

FIG. 2 is an embodiment of a local brightness changes and association to reference index. In FIG. 1, the frames are divided into 5 rectangular regions; two of frames include luminance change (gray regions) and the others do not (white regions). In such a case, the reference list is reordered to put the same reference frame (frame $t-1$) into $refidx=1$ as well. Then, the computed WP parameters (WP0) is associated with $refidx=0$ and zero WP parameters (WP1) with $refidx=1$. Then we perform ME using $refidx=0$ for MBs in the gray regions and $refidx=1$ for MBs in the white regions.

2.2. Region-based WP

In the region-based weighted prediction, if the fade is set to 1 and $N_{min} < Rcount < N_{max}$, the reference frame is reordered in order for the same reference frames to sit in two places, $refidx=0$ and $refidx=1$, respectively. In such a case, WP parameters are computed and associated to $refidx$ equal to 0 and zero WP parameters are associated to $refidx$ equal to 1. The encoder may send reference reordering syntaxes for decoders. However, when

encoding each MB, if the MB is in the region with brightness change, ME is performed with $refidx$ equal to 0. However, if the MB is in the regions without brightness change, ME is performed with $refidx$ equal to 1. In one embodiment, if 2 reference frames are used without global brightness change, coding gains are lost due to the increased overhead bits to encode reference index. Such losses are very noticeable with normal sequences that have no fade-in, fade-out and brightness changes.

In one embodiment, one may consider the percentage of regions with brightness change for it. For example, the number of regions with brightness change is smaller than the other, zero WP may be associated with $refidx=0$. This is important because it affects the number of skipped blocks, whose $refidx$ should be 0.

FIG 3: is an embodiment of a flow diagram depicting a method for region-based weighted prediction with improved global brightness detection. The method starts at step 1 and continues to step 2. At step 2, the method determines if a change in global brightness was detected. If a change was detected, the method proceeds to step 3, wherein weighted prediction parameters are calculated. Otherwise, the method proceeds to step 4, wherein the method determines local brightness has changed. If there is no change, the method proceeds to step 5, wherein the weighted prediction parameters are set to zero (0). Otherwise, the method proceeds to step 10.

From steps 3 and 5, the method proceeds to step 6, wherein the method sets micro block index to zero (0) and proceeds to step 7. At step 7, the method sets motion estimation with $refidx$ to zero (0). At step 8, the method determines if it is the last micro block. If it is not the last block, the method proceeds to step 9 and sets micro block in increased by one (1). The method proceeds from step 9 to step 7. From step 4, if the local brightness changed, the method proceeds to step 10. At step 10, the method calculates the weighted prediction parameters and reference re-ordering. At step 11, the method step the micro block index to zero (0). At step 12, the method determines if the micro block is in the region of luminance change. If it is in the region, the method proceeds to step 14. At step 14, the method calculates motion estimation with $refidx$ set to zero (0). Otherwise, the method proceeds from step 12 to step 13, wherein the method calculates motion estimation with $refidx$ set to one (1) and weighted prediction parameters set to zero.

From steps 13 and 14, the method proceeds to step 15, wherein the method determines if it is the last micro block. If it is not the last micro block, the method proceeds to step 16, wherein the micro block index is incremented by one (1). From step 16, the method returns to step 12. Otherwise, the method proceeds from step 15 to step 17. The method ends at step 17.

coding gain is maximized by region-based WP and the overhead bits to encoder reference index are minimized. The proposed MB-based WP with best MV cost check requires motion estimation only with 1 reference for each block, but have the similar performance with microblock based WP with motion estimation with 2 references. Hence, better quality is achieved with marginal increase of computational complexity.

MB-based WP with final MV cost check: If $\text{Fade}=1$ and $N_{\min} < \text{Rcount} < N_{\max}$, we reorder the reference frame so that the same reference frames sits in two places, $\text{refidx}=0$ and $\text{refidx}=1$, respectively.

WP parameters are calculated and associated to refidx equal to 0 and associate zero WP parameters to refidx equal to 1. The encoder should send reference reordering syntaxes for decoders. When encoding each MB, motion estimation with zero WP parameters ($\text{refidx}=1$) are calculated first and get the best MV and its MV cost, which are denoted by MV_1 and $MVCost_1$. Then, for MV_1 , MV cost w.r.t. non-zero WP parameters ($\text{refidx}=0$) are calculated (denoted by MV_0 and $MVCost_0$). Decide the best reference index by comparing $MVCost_1$ and $MVCost_0$.

In the above algorithm, this is an issue on which reference index we will use for motion estimation. Motion estimation gets better when the actual content is not hampered by brightness change. Based on this fact, we can do motion estimation with non-zero WP in case of fade-in (i.e. $v_{\text{cur}}(n) - v_{\text{ref}}(n) \geq 0$). The above MB-based WP can be modified to use 2 references for motion estimation instead of final MV cost check. It is supposed to show the best performance. But the computational complexity will increase. We use this 2-ref MB-based WP as bench mark to evaluate the region-based WP and the (1-ref) MB-based WP with final MV cost check.

While the foregoing is directed to embodiments of the present invention, other and further embodiments of the invention may be devised without departing from the basic scope thereof, and the scope thereof is determined by the claims that follow.

Fig 3: Flow of this paper

The region-based WP can be extended to block based or macro-block (MB) based weighted prediction with marginal computation increase, but without any increase of memory bandwidth. In another embodiment, macro-block based weighted predictions are calculated with marginal computation increase, but without any increase of memory bandwidth. Thus, global brightness change detection is improved. Improving global brightness change detection (GBD) in order to produce a more accurate decision. If there is no brightness change or global brightness change, on/off weighted prediction switch is switched globally. If we detect local brightness change, we apply weighted prediction with reference list reordering to put the same reference in multiple reference list. With reference reordering, both region-based WP and MB-based weighted prediction are enabled. As a result, the quality loss by improved GBD method is minimized. The improved GBD is also critical to region-based WP. By careful decision on the use of region-based WP, the

III. RESULTS AND CONCLUSIONS

For the experiments, we used normal 1080p sequences and 1080p and 720p trailer sequences which have lots of fading, flashing and scene changes. We encoded them into the IPPP structure with a single reference frame using the following methods: (0) No WP, (1) Always WP, (2) GBD + WP, (3) GBD + region-based WP, (4) GBD + MB-based WP and (5) GBD + brute force MB-based WP. Tables 1 and 2 show the BD-PSNR [5] of (1) – (5) over (0) for the normal and the trailer sequences, respectively.

TABLE 1
PSNR IMPROVEMENTS OF (1) – (5) OVER (0) FOR NORMAL SEQUENCES

	(1) over (0)	(2) over (0)	(3) over (0)	(4) over (0)	(5) over (0)
stractor	-0.115	-0.000	-0.006	-0.000	-0.003
slceHockey	-0.366	-0.001	-0.019	-0.013	-0.013
sjuggle	-0.329	-0.002	-0.007	-0.004	-0.006
smaninrest	-0.461	-0.005	-0.042	0.019	0.023
sPanIceHockey	-1.201	-0.005	-0.024	-0.013	-0.014
sfish	-0.882	-0.001	-0.051	-0.018	-0.023
satonement	-0.431	-0.000	-0.042	-0.015	-0.019
sfoolsgold	-0.426	-0.044	-0.044	-0.044	-0.044
Average	-0.526	-0.007	-0.029	-0.011	-0.011

TABLE 2
PSNR IMPROVEMENTS OF (1) – (5) OVER (0) FOR TRAILER SEQUENCES

	(1) over (0)	(2) over (0)	(3) over (0)	(4) over (0)	(5) over (0)
9ttr	0.903	0.384	0.630	0.667	0.666
999ttr	0.541	0.254	0.512	0.548	0.550
300	0.402	0.089	0.508	0.514	0.523
adoration	1.644	0.480	1.465	1.486	1.539
astroboy	0.647	1.043	1.172	1.188	1.193
17again	-0.285	0.221	0.198	0.208	0.204
adamtlra	-1.994	-0.044	-0.334	-0.161	-0.191
guardian	-0.374	-0.048	-0.144	-0.076	-0.085
Average	0.185	0.297	0.500	0.546	0.549

We observe that applying WP without GBCD could be disastrous even for normal sequences. Because the GBCD is quite good in identifying brightness changes, we can remove such losses by (2), (3) and (4) for normal sequences as shown in Table 1. The advantage of the MB-based methods becomes obvious in Table 2. Applying only GBCD decreases coding gains for several trailer sequences. However, (3) and (4) show the coding gain close to (1) for these sequences.

Furthermore, the MB-based WP not only improves average PSNRs but also reduces quality losses caused by the region based WP for ‘adamtlra’ and ‘guardian’ sequences.

We can conclude that the proposed MB-based WP deals with local brightness changes successfully without additional memory bandwidth and computation for ME. As shown in Tables 1 and 2, the proposed MB-based WP achieves the similar performance to the brute force MB-based WP, with the additional computation only for a single MV cost.

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A New Type of Homeomorphism in Bitopological Spaces

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ABSTRACT

The aim of this paper is to introduce the concepts of $(1,2)^*$ - π gb-open map, $(1,2)^*$ - π gb-closed map, $(1,2)^*$ - π gb-homeomorphism and $(1,2)^*$ - π gbC-homeomorphism and study their basic properties. We also investigate its relationship with other types of functions.

2000 Mathematics Subject Classification: 54E55

Keywords and phrases

$(1,2)^*$ - π gb-open map, $(1,2)^*$ - π gb-closed map, $(1,2)^*$ - π gb-homeomorphism, $(1,2)^*$ - π gbC-homeomorphism, $(1,2)^*$ - π GBO-compactness.

1. INTRODUCTION

Andrijevic [1] introduced an innovative class of generalized open sets in topological space, the so-called b-open sets. Ekici and Caldas [6] already discussed this type of sets under the name of γ -open sets. Generalized closed mappings, wgclosed maps, rwg-closed maps, regular closed maps, gpr-closed maps and rg-closed maps were introduced and studied by Malghan[18], Nagavani[20], Long[9], Gnanambal[7] and Arockiarani[2] respectively. Vadivel and K. Vairamanickam[24] discussed rg-closed and rg-open maps in Topological Spaces. Further Lellis Thivagar and Ravi.O[11] initiated the study of the notion of a $(1,2)^*$ -g-closed map, $(1,2)^*$ -sg-closed map and $(1,2)^*$ -gs-closed map in bitopological spaces. The concepts of $(1,2)^*$ -semi-closed set, $(1,2)^*$ -generalized closed set, $(1,2)^*$ -semi-generalized closed set, $(1,2)^*$ -generalized semi-closed set, $(1,2)^*$ -g-closed map, $(1,2)^*$ -sg-closed map and $(1,2)^*$ -gs-closed map in bitopological spaces were initiated by Lellis Thivagar and O.Ravi [10,11,12,16,17]. Maki et al [19] introduced generalized homeomorphism and gc-homeomorphism which are generalizations of homeomorphism in topological spaces. Devi et al [5] defined and studied generalized semi-homeomorphism and gsc-homeomorphism in topological spaces.

This paper attempts to highlight the concepts $(1,2)^*$ - π gb-closed maps, $(1,2)^*$ - π gb-homeomorphism and $(1,2)^*$ - π gbC-homeomorphism.

2. PRELIMINARIES

Definition 2.1[21]: A subset A of X is called $\tau_1\tau_2$ -open if $S \in \tau_1\tau_2$ and the complement of $\tau_1\tau_2$ -open set is $\tau_1\tau_2$ -closed.

Definition 2.2[21] : Let A be a subset of X

- (i) The $\tau_1\tau_2$ -closure of A, denoted by $\tau_1\tau_2$ -cl(S) is defined by $\cap \{F/S \subset F \text{ and } F \text{ is } \tau_1\tau_2\text{-closed}\}$
- (ii) The $\tau_1\tau_2$ -interior of A, denoted by $\tau_1\tau_2$ -int(S) is defined by $\cup \{F/F \subset S \text{ and } F \text{ is } \tau_1\tau_2\text{-open}\}$

Definition 2.3: The finite union of $(1,2)^*$ -regular open sets [3] is said to be $\tau_{1,2}$ - π -open. The complement of $\tau_{1,2}$ - π -open is said to be $\tau_{1,2}$ - π -closed.

Definition 2.4 : A subset A of a bitopological space (X, τ_1, τ_2) is called

- (i) $(1, 2)^*$ -semi-open set[21] if $A \subset \tau_1\tau_2$ -cl($\tau_1\tau_2$ -int(A))
- (ii) $(1, 2)^*$ -preopen set [21] if $A \subset \tau_1\tau_2$ -int($\tau_1\tau_2$ -cl(A))
- (iii) $(1, 2)^*$ - α -open set[21] if $A \subset \tau_1\tau_2$ -int($\tau_1\tau_2$ -cl($\tau_1\tau_2$ -int(A)))
- (iv) $(1, 2)^*$ - π g α -closed [3] if $(1, 2)^*$ - α Cl(A) $\subset$ U whenever $A \subset U$ and U is $(1, 2)^*$ - π -open in X.
- (v) $(1, 2)^*$ -regular open [21] if $A = \tau_{1,2}$ -int($\tau_{1,2}$ -cl(A)). Complement of the $(1, 2)^*$ -regular open set is called $(1, 2)^*$ -regular closed set.
- (vi) $(1, 2)$ -b-open [15] if $A \subset \tau_1\tau_2$ -cl(τ_1 -int(A)) $\cup$ τ_1 -int($\tau_1\tau_2$ -cl(A)).
- (vii) $(1, 2)^*$ -generalized closed (briefly $(1, 2)^*$ -g-closed)[21] if $\tau_1\tau_2$ -cl(A) $\subset$ U whenever $A \subset U$ and U is $\tau_{1,2}$ -open in X.
- (viii) $(1, 2)^*$ - α -generalized closed (briefly $(1, 2)^*$ - α -g-closed) [21] if $(1, 2)^*$ - α Cl(A) $\subset$ U whenever $A \subset U$ and U is $\tau_{1,2}$ -open in X.
- (ix) $(1, 2)^*$ -generalized α -closed (briefly $(1, 2)^*$ -g α -closed)[21] if $(1, 2)^*$ - α Cl(A) $\subset$ U whenever $A \subset U$ and U is $\tau_{1,2}$ - α -open in X.

Definition 2.5[23]: A subset A of a bitopological space (X, τ_1, τ_2) is called $(1, 2)^*$ - π -generalized b-closed (briefly $(1, 2)^*$ - π gb-closed) if $\tau_1\tau_2$ -bcl(A) $\subset$ U whenever $A \subset U$ and U is $\tau_1\tau_2$ - π -open in X.

Definition 2.6[23] : A subset A of a bitopological space (X, τ_1, τ_2) is called $(1, 2)^*$ -b-open if $A \subset \tau_1\tau_2$ -cl($\tau_1\tau_2$ -int(A)) $\cup$ $\tau_1\tau_2$ -int($\tau_1\tau_2$ -cl(A)).

Complement of $(1, 2)^*$ -b-open is called $(1, 2)^*$ -b-closed.

Definition 2.7[23]: A subset A of a bitopological space (X, τ_1, τ_2) is called $(1, 2)^*$ -generalized b-closed (briefly $(1, 2)^*$ -gb-closed) if $\tau_1\tau_2\text{-bcl}(A) \subset U$ whenever $A \subset U$ and U is $\tau_1\tau_2$ -open in X . The complement of a $(1, 2)^*$ - π gb-closed set is called $(1, 2)^*$ - π gb-open.

Definition 2.8[11] : A map $f : X \rightarrow Y$ is said to be $(1, 2)^*$ -gc-irresolute if the inverse image of each $(1, 2)^*$ -g-closed set of Y is $(1, 2)^*$ -g-closed in X .

Definition 2.9[12] : A map $f : X \rightarrow Y$ is said to be $(1, 2)^*$ -g-continuous if the inverse image of each $\sigma_{1,2}$ -closed set of Y is $(1, 2)^*$ -g-closed in X .

Definition 2.10:[8] A function $f : (X, \tau) \rightarrow (Y, \sigma)$ is called π -continuous if $f^{-1}(V)$ is π -closed in X for every closed set V in Y .

Definition 2.11: A map $f : X \rightarrow Y$ is called

- (i) $(1, 2)^*$ -g-closed [12] if $f(U)$ is $(1, 2)^*$ -g-closed set in Y for every $\tau_{1,2}$ -closed set U in X ;
- (ii) $(1, 2)^*$ -g-open [12] if $f(U)$ is $(1, 2)^*$ -g-open set in Y for every $\tau_{1,2}$ -open set U in X ;
- (iii) $(1, 2)^*$ -continuous [14] if $f^{-1}(V)$ is $\tau_{1,2}$ -closed in X for every $\sigma_{1,2}$ -closed set V in Y ;
- (iv) $(1, 2)^*$ -semi-irresolute [13] if $f^{-1}(V)$ is $(1, 2)^*$ -semi-open in X for every $(1, 2)^*$ -semi-open set V in Y .
- (v) $(1, 2)^*$ - π gb-continuous [23] if every $f^{-1}(V)$ is $(1, 2)^*$ $(1, 2)^*$ - π gb-closed in X for every $\sigma_1\sigma_2$ -closed set V of Y .
- (vi) $(1, 2)^*$ - π gb-irresolute [23] if $f^{-1}(V)$ is $(1, 2)^*$ - π gb-closed in X for every $(1, 2)^*$ - π gb-closed set V in Y .
- (vii) $(1, 2)^*$ - π ga-closed map [4] if for every $\tau_{1,2}$ -closed F of X , $f(F)$ is $(1, 2)^*$ - π ga-closed in Y .

Definition 6.1[23]: A space (X, τ_1, τ_2) is called $(1, 2)^*$ - π gb- $T_{1/2}$ space if every $(1, 2)^*$ - π gb-closed is $(1, 2)^*$ -b-closed.

Definition 6.2[23]: A space (X, τ_1, τ_2) is called $(1, 2)^*$ - π gb-space if every $(1, 2)^*$ - π gb-closed is $(1, 2)^*$ -closed.

Definition 2.12: A bijection $f : X \rightarrow Y$ is called

- (i) $(1, 2)^*$ -homeomorphism [16] if f is bijection,
- (ii) $(1, 2)^*$ -continuous and $(1, 2)^*$ -open;
- (iii) $(1, 2)^*$ -generalized homeomorphism [22] (briefly $(1, 2)^*$ -g-homeomorphism) if f is both $(1, 2)^*$ -g-continuous and $(1, 2)^*$ -g-open.
- (iv) $(1, 2)^*$ -gc-homeomorphism [22] if f is $(1, 2)^*$ -gc-irresolute and its inverse f^{-1} is also $(1, 2)^*$ -gc-irresolute.
- (v) $(1, 2)^*$ -generalized semi-homeomorphism [22] (briefly $(1, 2)^*$ -gs-homeomorphism) if f is both $(1, 2)^*$ -gs-continuous and $(1, 2)^*$ -gs-open
- (vi) $(1, 2)^*$ -gsc-homeomorphism [22] if f is $(1, 2)^*$ -gs-irresolute and its inverse f^{-1} is $(1, 2)^*$ -gs-irresolute.

3. $(1, 2)^*$ - π gb-CLOSED MAPS

Definition 3.1: A map $f : (X, \tau_1, \tau_2) \rightarrow (Y, \sigma_1, \sigma_2)$ is said to be $(1, 2)^*$ - π gb-closed if for every $\tau_{1,2}$ -closed F of X , $f(F)$ is $(1, 2)^*$ - π gb-closed in Y .

Theorem 3.2: Every $\tau_{1,2}$ -closed (resp. $(1, 2)^*$ -g-closed) map is $(1, 2)^*$ - π gb-closed.

Proof: Proof straight forward.

However the converses need not be true.

Example 3.3: Let $X=Y=\{a,b,c\}$, $\tau_1=\{\emptyset, \{a\}, \{b\}, \{a,b\}, X\}$, $\tau_2=\{\emptyset, \{b\}, \{a,b\}, X\}$, $\sigma_1=\{\emptyset, \{a\}, \{a,c\}, Y\}$, $\sigma_2=\{\emptyset, \{a,b\}, Y\}$. $f : (X, \tau_1, \tau_2) \rightarrow (Y, \sigma_1, \sigma_2)$ be the identity map then f is $(1, 2)^*$ - π gb-closed but not $\tau_{1,2}$ -closed map, not $(1, 2)^*$ -g-closed map.

Proposition 3.4: If a mapping $f : (X, \tau_1, \tau_2) \rightarrow (Y, \sigma_1, \sigma_2)$ is $(1, 2)^*$ - π gb-closed then for every subset A of X , $(1, 2)^*$ - π gb-cl($f(A)$) $\subset f(\sigma_{1,2}\text{-cl}(A))$.

Proof: Let $A \subset X$. Since f is $(1, 2)^*$ - π gb closed, $f(\sigma_{1,2}\text{-cl}(A))$ is $(1, 2)^*$ - π gb-closed in Y . Now $f(A) \subset f(\sigma_{1,2}\text{-cl}(A))$. Also $f(A) \subset (1, 2)^*$ - π gb-cl($f(A)$). By definition, we have $(1, 2)^*$ - π gb-cl($f(A)$) $\subset f(\sigma_{1,2}\text{-cl}(A))$.

Converse need not be true as seen in the following example.

Example 3.5: Let $X=Y=\{a,b,c,d\}$, $\tau_1=\{\emptyset, X, \{c,d\}\}$, $\tau_2=\{\emptyset, X\}$, $\sigma_1=\{\emptyset, \{b\}, Y\}$, $\sigma_2=\{\emptyset, \{a\}, \{a,b\}, Y\}$, $f : (X, \tau_1, \tau_2) \rightarrow (Y, \sigma_1, \sigma_2)$ be the identity map. For every subset A of X , $(1, 2)^*$ - π gb-cl($f(A)$) $\subset f(\sigma_{1,2}\text{-cl}(A))$, but f is not $(1, 2)^*$ - π gb-closed map.

Theorem 3.6: A surjection $f : (X, \tau_1, \tau_2) \rightarrow (Y, \sigma_1, \sigma_2)$ is $(1, 2)^*$ - π gb closed iff for each subset S of Y and each $\tau_{1,2}$ -regular open set U containing $f^{-1}(S)$ there exists $(1, 2)^*$ - π gb open set V of Y such that $S \subset V$ and $f^{-1}(V) \subset U$.

Proof: Necessity: Suppose that f is $(1, 2)^*$ - π gb-closed. Let S be a subset of Y and U be an $\tau_{1,2}$ -regular open subset of X containing $f^{-1}(S)$. If $V=Y-f(X-U)$, then V is a $(1, 2)^*$ - π gb open set of Y , such that $S \subset V$ and $f^{-1}(V) \subset U$.

Sufficiency: Let F be any $\tau_{1,2}$ -regular closed set of X . Then $f^{-1}(Y-f(F)) \subset X-F$ and $X-F$ is $\tau_{1,2}$ -regular open in X . There exists $(1, 2)^*$ - π gb open set V of Y such that $Y-f(F) \subset V$ and $f^{-1}(V) \subset X-F$. Therefore, $V \subset f(F) \subset f(X-f^{-1}(V)) \subset Y-V$. Hence we obtain $f(F) = Y-V$ and $f(F)$ is $(1, 2)^*$ - π gb-closed in Y which shows that f is $(1, 2)^*$ - π gb closed.

Theorem 3.7: If $f : (X, \tau_1, \tau_2) \rightarrow (Y, \sigma_1, \sigma_2)$ is $(1, 2)^*$ - π gb-closed and A is $\tau_{1,2}$ -closed subset of X then $f|_A : (A) \rightarrow (Y)$ is $(1, 2)^*$ - π gb-closed.

Proof: Let $B \subset A$ be $\tau_{1,2}$ -closed in A . Then B is $\tau_{1,2}$ -closed in X . Since f is $(1, 2)^*$ - π gb-closed, $f(B)$ is $(1, 2)^*$ - π gb-closed in Y . But $f(B) = (f|_A)(B)$. So $f|_A$ is $(1, 2)^*$ - π gb-closed.

Remark 3.8: Composition of two $(1, 2)^*$ - π gb closed maps need not be $(1, 2)^*$ - π gb-closed map.

Example 3.9: Let $X=Y=Z=\{a,b,c\}$, $\tau_1=\{\varphi, X, \{a,b\}\}$, $\tau_2=\{\varphi, X, \{c\}\}$, $\sigma_1=\{\varphi, Y, \{a\}\}$, $\sigma_2=\{\varphi, Y, \{b\}\}$, $\eta_1=\{\varphi, Z, \{b\}\}$, $\eta_2=\{\varphi, Z, \{a\}, \{a,b\}\}$, $f: (X, \tau_1, \tau_2) \rightarrow (Y, \sigma_1, \sigma_2)$ and $g: (Y, \sigma_1, \sigma_2) \rightarrow (Z, \eta_1, \eta_2)$ be the identity maps then f and g are $(1, 2)^*$ - π gb closed maps, but $g \circ f: (X, \tau_1, \tau_2) \rightarrow (Z, \eta_1, \eta_2)$ is not $(1, 2)^*$ - π gb closed map.

Proposition 3.10: If $f: (X, \tau_1, \tau_2) \rightarrow (Y, \sigma_1, \sigma_2)$ is $\tau_{1,2}$ -closed and $g: (Y, \sigma_1, \sigma_2) \rightarrow (Z, \eta_1, \eta_2)$ be the $(1, 2)^*$ - π gb closed then $g \circ f: (X, \tau_1, \tau_2) \rightarrow (Z, \eta_1, \eta_2)$ is $(1, 2)^*$ - π gb closed.

Proof : Let A be $\tau_{1,2}$ -closed in X then $f(A)$ is $\sigma_{1,2}$ -closed in Y . Since g is $(1, 2)^*$ - π gb-closed, $g(f(A))$ is $(1, 2)^*$ - π gb-closed in Z . Hence $g \circ f$ is $(1, 2)^*$ - π gb-closed.

Theorem 3.11: Let $f: (X, \tau_1, \tau_2) \rightarrow (Y, \sigma_1, \sigma_2)$ and $g: (Y, \sigma_1, \sigma_2) \rightarrow (Z, \eta_1, \eta_2)$ be two mappings and let $g \circ f: (X, \tau_1, \tau_2) \rightarrow (Z, \eta_1, \eta_2)$ be $(1, 2)^*$ - π gb-closed. Then

1) If f is $(1, 2)^*$ -continuous and surjection then g is $(1, 2)^*$ - π gb-closed.

2) If g is $(1, 2)^*$ - π gb-irresolute and injective then f is $(1, 2)^*$ - π gb-closed.

Proof: (i) Let A be $\sigma_{1,2}$ -closed in Y . Since f is $(1, 2)^*$ -continuous, $f^{-1}(A)$ is $\tau_{1,2}$ -closed in X . Since $g \circ f$ is $(1, 2)^*$ - π gb-closed, $g(f^{-1}(A)) = g(f(f^{-1}(A))) = g(A)$ is $(1, 2)^*$ - π gb-closed.

ii) Let A be $\tau_{1,2}$ -closed in X . Since $g \circ f$ is $(1, 2)^*$ - π gb-closed, $(g \circ f)(A)$ is $(1, 2)^*$ - π gb-closed in Z . Since g is $(1, 2)^*$ - π gb-irresolute, $g^{-1}((g \circ f)(A)) = f(A)$ is $(1, 2)^*$ - π gb-closed in Y . Hence f is $(1, 2)^*$ - π gb-closed.

Definition 3.12: A map $(X, \tau_1, \tau_2) \rightarrow (Y, \sigma_1, \sigma_2)$ is said to be M -($1, 2$)*- π gb-closed map if the image $f(A)$ is $(1, 2)^*$ - π gb-closed in Y for every $(1, 2)^*$ - π gb-closed set A in X .

Remark 3.13: Every M -($1, 2$)*- π gb-closed map is $(1, 2)^*$ - π gb-closed map, but the converse need not be true as seen in the following example.

Example 3.14: Let $X=Y=\{a,b,c\}$, $\tau_1=\{\varphi, X, \{b,c\}\}$, $\tau_2=\{\varphi, X, \{a\}\}$, $\sigma_1=\{\varphi, X, \{b\}\}$, $\sigma_2=\{\varphi, X, \{a\}, \{a,b\}\}$. Let $f: (X, \tau_1, \tau_2) \rightarrow (Y, \sigma_1, \sigma_2)$ be an identity map, then f is $(1, 2)^*$ - π gb-closed map, but not M -($1, 2$)*- π gb-closed map.

Definition 3.15: A map $f: (X, \tau_1, \tau_2) \rightarrow (Y, \sigma_1, \sigma_2)$ is called $(1, 2)^*$ - π -irresolute if $f^{-1}(V)$ is $\tau_{1,2}$ - π -closed in X for every $\sigma_{1,2}$ - π -closed set V in Y .

Theorem 3.16: If $f: (X, \tau_1, \tau_2) \rightarrow (Y, \sigma_1, \sigma_2)$ is a $(1, 2)^*$ - π -irresolute and $(1, 2)^*$ -pre- b -closed map in X then $f(A)$ is $(1, 2)^*$ - π gb-closed in Y for every $(1, 2)^*$ - π gb-closed set A of X .

Proof : Let A be any $(1, 2)^*$ - π gb-closed set of X and V be any $\sigma_{1,2}$ - π -open set of Y containing $f(A)$. Since f is $(1, 2)^*$ - π -irresolute, $f^{-1}(V)$ is $\tau_{1,2}$ - π -open in X and $A \subset f^{-1}(V)$. Therefore $(1, 2)^*$ - $bcl(A) \subset f^{-1}(V)$ and hence $f((1, 2)^*$ - $bcl(A)) \subset V$. Since f is $(1, 2)^*$ -pre- b -closed, $f((1, 2)^*$ - $bcl(A))$ is $(1, 2)^*$ - π gb-closed in Y

and hence we obtain $(1, 2)^*$ - $bcl(f(A)) \subset (1, 2)^*$ - $bcl(f((1, 2)^*$ - $bcl(A))) \subset V$. Hence $f(A)$ is $(1, 2)^*$ - π gb-closed in Y .

4. $(1, 2)^*$ - π gb-homeomorphism in bitopological spaces

Definition 4.1: A bijection $f: X \rightarrow Y$ is called $(1, 2)^*$ - π gb-homeomorphism if f is both $(1, 2)^*$ - π gb-continuous and $(1, 2)^*$ - π gb-open map.

Definition 4.2: A bijection $f: X \rightarrow Y$ is called $(1, 2)^*$ - π gbC-homeomorphism if f is both $(1, 2)^*$ - π gb-irresolute and f^{-1} is $(1, 2)^*$ - π gb-irresolute.

Theorem 4.3: (i) Every $(1, 2)^*$ -homeomorphism is a $(1, 2)^*$ - π gb-homeomorphism.

(ii) Every $(1, 2)^*$ -g-homeomorphism is a $(1, 2)^*$ - π gb-homeomorphism.

Remark 4.4: Converse of the above need not be true as seen from the following example.

Example 4.5: Let $X=Y=\{a,b,c\}$, $\tau_1=\{\Phi, \{b\}, \{b,c\}, X\}$ and $\tau_2=\{\Phi, \{b\}, \{a,b\}, X\}$. $\sigma_1=\{\Phi, \{a\}, \{b\}, \{a,b\}, Y\}$ and $\sigma_2=\{\Phi, \{a\}, \{a,c\}, Y\}$. Define $f: (X, \tau_1, \tau_2) \rightarrow (Y, \sigma_1, \sigma_2)$ to be an identity mapping. Since $P(X)=(1, 2)^*$ - π GBC(X, τ_1, τ_2)= $(1, 2)^*$ - π GBC(X, σ_1, σ_2), f is a $(1, 2)^*$ - π gb-homeomorphism. But f is not $(1, 2)^*$ -continuous, $(1, 2)^*$ -g-continuous since the inverse image of closed sets $\{b\}, \{b,c\}$ in (X, σ_1, σ_2) are not closed and g-closed in (X, τ_1, τ_2) . Hence f is not a homeomorphism.

Remark 4.6: We say that the spaces (X, τ_1, τ_2) and (Y, σ_1, σ_2) are $(1, 2)^*$ - π gb-homeomorphic (resp $(1, 2)^*$ - π gbC-homeomorphic) if there exists a $(1, 2)^*$ - π gb-homeomorphism (resp $(1, 2)^*$ - π gbC-homeomorphism) from (X, τ_1, τ_2) onto (Y, σ_1, σ_2) respectively. The family of all $(1, 2)^*$ - π gb-homeomorphism, $(1, 2)^*$ - π gbC-homeomorphism from (X, τ_1, τ_2) onto itself is denoted by $\pi gbh(X, \tau_1, \tau_2)$, $\pi gbCh(X, \tau_1, \tau_2)$.

Proposition 4.7: For any bijection $f: X \rightarrow Y$, the following statements are equivalent.

- $f^{-1}: Y \rightarrow X$ is $(1, 2)^*$ - π gb-continuous.
- f is a $(1, 2)^*$ - π gb-open map.
- f is a $(1, 2)^*$ - π gb-closed map.

Proof: (a) $\Rightarrow$ (b). Let V be a $\tau_{1,2}$ -open set in X . Then $X-V$ is $\tau_{1,2}$ -closed in X . Since f^{-1} is $(1, 2)^*$ - π gb-continuous, $(f^{-1})^{-1}(X-V) = f(X-V) = Y-f(V)$ is $(1, 2)^*$ - π gb-closed in Y . Then $f(V)$ is $(1, 2)^*$ - π gb-open in Y . Hence f is a $(1, 2)^*$ - π gb-open map.

(b) $\Rightarrow$ (c). Let f be a $(1, 2)^*$ - π gb-open map. Let U be a $\tau_{1,2}$ -closed set in X . Then $X-U$ is $\tau_{1,2}$ -open in X . Since f is $(1, 2)^*$ - π gb-open, $f(X-U) = Y-f(U)$ is $(1, 2)^*$ - π gb-open in Y . Then $f(U)$ is $(1, 2)^*$ - π gb-closed in Y . Hence f is a $(1, 2)^*$ - π gb-closed.

(c) $\Rightarrow$ (a). Let V be $\tau_{1,2}$ -closed set in X . Since $f: X \rightarrow Y$ is $(1,2)^*$ - π gb-closed, $f(V)$ is $(1,2)^*$ - π gb-closed in Y . That is $(f^{-1})^{-1}(V)$ is $(1,2)^*$ - π gb-closed in Y . Hence f^{-1} is $(1,2)^*$ - π gb-continuous.

Proposition 4.8: Let $f: X \rightarrow Y$ be a bijective and $(1,2)^*$ - π gb-continuous map. Then the following statements are equivalent.

- (a) f is a $(1,2)^*$ - π gb-open map.
- (b) f is a $(1,2)^*$ - π gb-homeomorphism.
- (c) f is a $(1,2)^*$ - π gb-closed map.

Proof: (a) $\Rightarrow$ (b). Given f is bijective, $(1,2)^*$ - π gb-continuous map and $(1,2)^*$ - π gb-open map. Hence f is $(1,2)^*$ - π gb-homeomorphism.

(b) $\Rightarrow$ (c). Let f be a $(1,2)^*$ - π gb-homeomorphism. Hence f is $(1,2)^*$ - π gb-open. By Proposition 4.7 f is $(1,2)^*$ - π gb-closed.

(c) $\Rightarrow$ (a) Follows from Proposition 4.7.

Proposition 4.9: For any bijection, $f: X \rightarrow Y$, the following statements are equivalent.

- (a) $f^{-1}: Y \rightarrow X$ is $(1,2)^*$ - π gb-irresolute.
- (b) f is an $(1,2)^*$ -M- π gb-open map.
- (c) f is an $(1,2)^*$ -M- π gb-closed map.

Proof: (a) $\Rightarrow$ (b). Let U be $(1,2)^*$ - π gb-open in X . By (a), $(f^{-1})^{-1}(U) = f(U)$ is π gb-open in Y . Hence (b) holds.

(b) $\Rightarrow$ (c). Let V be $(1,2)^*$ - π gb-closed in X . By (b), $f(X-V) = Y-f(V)$ is π gb-open in Y . That is $f(V)$ is π gb-closed in Y and so f is an $(1,2)^*$ -M- π gb-closed map.

(c) $\Rightarrow$ (a). Let V be $(1,2)^*$ - π gb-closed in X . By (c), $f(V) = (f^{-1})^{-1}(V)$ is π gb-closed in Y . Hence (a) holds.

Remark 4.10: Composition of two $(1,2)^*$ - π gb-homeomorphism need not be a $(1,2)^*$ - π gb-homeomorphism as shown in the following example.

Example 4.11: Let $X=Y=Z = \{a,b,c\}$. $\tau_1 = \{ \Phi, \{a\}, \{a,b\}, X \}$ and $\tau_2 = \{ \Phi, \{b\}, \{a,b\}, X \}$. $\sigma_1 = \{ \Phi, \{a\}, \{a,b\}, Y \}$ and $\sigma_2 = \{ \Phi, Y \}$. $\eta_1 = \{ \Phi, \{c\}, Z \}$ and $\eta_2 = \{ \Phi, Z \}$. Define $f: X \rightarrow Y$ and $g: Y \rightarrow Z$ to be the identity map. Then f and g are $(1,2)^*$ - π gb-homeomorphism but $g \circ f$ is not a $(1,2)^*$ - π gb-homeomorphism.

Remark 4.12: Every $(1,2)^*$ - π gbC-homeomorphism is a $(1,2)^*$ - π gb-homeomorphism but the converse need not be true.

Example 4.13: $(1,2)^*$ - π gb-homeomorphism $\nrightarrow$ $(1,2)^*$ - π gbC-homeomorphism.

Let $X=Y=\{a,b,c\}$, $\tau_1 = \{ \Phi, \{a\}, \{a,b\}, X \}$ and $\tau_2 = \{ \Phi, \{b\}, \{a,b\}, X \}$. $\sigma_1 = \{ \Phi, \{a\}, Y \}$ and $\sigma_2 = \{ \Phi, Y \}$. Define $f: (X, \tau_1, \tau_2) \rightarrow (Y, \sigma_1, \sigma_2)$ to be an identity map. Since $P(X) = (1,2)^*$ - π GBC(Y, σ_1, σ_2) and π GBC(X, τ_1, τ_2) = $\{ \Phi, \{a\}, \{b\}, \{c\}, \{b,c\}, \{a,c\}, X \}$, f is a $(1,2)^*$ - π gb-homeomorphism but not a $(1,2)^*$ - π gbC-homeomorphism.

Example 4.14: $(1,2)^*$ - π gbC-homeomorphism $\nrightarrow$ $(1,2)^*$ -homeomorphism.

Let $X=Y=\{a,b,c\}$, $\tau_1 = \{ \Phi, \{a,b\}, X \}$ and $\tau_2 = \{ \Phi, X \}$. $\sigma_1 = \{ \Phi, \{a\}, Y \}$ and $\sigma_2 = \{ \Phi, \{a,b\}, Y \}$. Define $f: (X, \tau_1, \tau_2) \rightarrow (Y, \sigma_1, \sigma_2)$ to be an identity map. Since $P(X) = (1,2)^*$ - π GBC(Y, σ_1, σ_2) = π GBC(X, τ_1, τ_2). f is a $(1,2)^*$ - π gb-homeomorphism but not a $(1,2)^*$ -homeomorphism.

σ_2 to be an identity map. Since $P(X) = (1,2)^*$ - π GBC(Y, σ_1, σ_2) = π GBC(X, τ_1, τ_2). f is a $(1,2)^*$ - π gb-homeomorphism but not a $(1,2)^*$ -homeomorphism.

Example 4.15: $(1,2)^*$ -gc-homeomorphism $\nrightarrow$ $(1,2)^*$ - π gbC-homeomorphism.

Let $X=Y=\{a,b,c\}$, $\tau_1 = \{ \Phi, \{b\}, X \}$ and $\tau_2 = \{ \Phi, \{a,b\}, X \}$. $\sigma_1 = \{ \Phi, \{a\}, \{c\}, \{a,c\}, Y \}$ and $\sigma_2 = \{ \Phi, Y \}$. Define $f: (X, \tau_1, \tau_2) \rightarrow (Y, \sigma_1, \sigma_2)$ such that $f(a)=a$, $f(b)=c$, $f(c)=b$. Then f is a $(1,2)^*$ -gc-homeomorphism but not a $(1,2)^*$ - π gbC-homeomorphism.

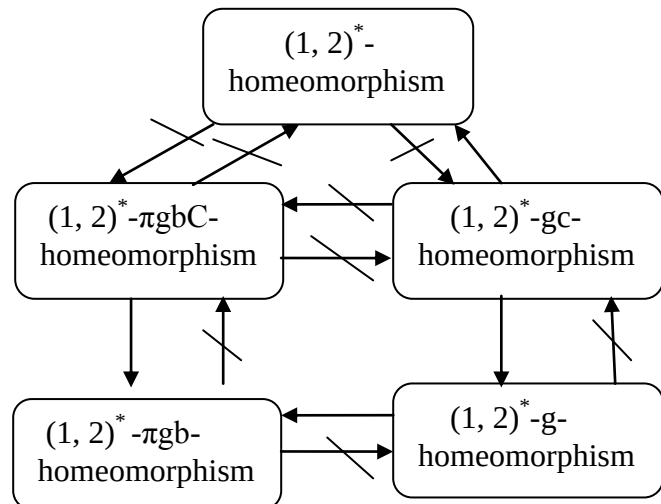
Example 4.16: $(1,2)^*$ - π gbC-homeomorphism $\nrightarrow$ $(1,2)^*$ -gc-homeomorphism.

Let $X=Y=\{a,b,c\}$, $\tau_1 = \{ \Phi, \{a,b\}, X \}$ and $\tau_2 = \{ \Phi, X \}$. $\sigma_1 = \{ \Phi, \{a\}, Y \}$ and $\sigma_2 = \{ \Phi, \{a,b\}, Y \}$. Define $f: (X, \tau_1, \tau_2) \rightarrow (Y, \sigma_1, \sigma_2)$ such that $f(a)=c$, $f(b)=b$, $f(c)=a$. Since $P(X) = (1,2)^*$ - π GBC(Y, σ_1, σ_2) = π GBC(X, τ_1, τ_2). Then f is a $(1,2)^*$ - π gbC-homeomorphism but not a $(1,2)^*$ -gc-homeomorphism.

Remark 4.17: $(1,2)^*$ - π gbC-homeomorphism and $(1,2)^*$ -gc-homeomorphism are independent concepts as seen from examples 4.15 and 4.16.

Remark 4.18: For any space (X, τ_1, τ_2) , $(1,2)^*$ - π gbCh(X, τ_1, τ_2) $\subset$ $(1,2)^*$ - π gbh(X, τ_1, τ_2).

The above discussions are summarized in the following diagram.



Proposition 4.19: If $f: (X, \tau_1, \tau_2) \rightarrow (Y, \sigma_1, \sigma_2)$ and $g: (Y, \sigma_1, \sigma_2) \rightarrow (Z, \eta_1, \eta_2)$ are $(1,2)^*$ - π gbC-homeomorphisms, then $g \circ f: (X, \tau_1, \tau_2) \rightarrow (Z, \eta_1, \eta_2)$ is also a $(1,2)^*$ - π gbC-homeomorphism.

Proof: Let U be a $(1,2)^*$ - π gb-open set in (Z, η_1, η_2) . Now $(g \circ f)^{-1}(U) = f^{-1}(g^{-1}(U)) = f^{-1}(V)$, where $V = g^{-1}(U)$. By hypothesis, V is $(1,2)^*$ - π gb-open in (Y, σ_1, σ_2) and again by hypothesis, $f^{-1}(V)$ is $(1,2)^*$ - π gb-open in (X, τ_1, τ_2) . Therefore $(g \circ f)$ is $(1,2)^*$ - π gb-irresolute. Also for a $(1,2)^*$ - π gb-open set G in (X, τ_1, τ_2) , we have $(g \circ f)(G) = g(f(G)) = g(W)$, where $W = f(G)$. By hypothesis, $f(G)$ is

$(1,2)^*$ - π gb-open in (Y, σ_1, σ_2) and again by hypothesis, $g(W)$ is $(1,2)^*$ - π gb-open in (Z, η_1, η_2) . Therefore $(g \circ f)^{-1}$ is $(1,2)^*$ - π gb-irresolute. Hence $g \circ f$ is $(1,2)^*$ - π gbC-homeomorphism.

Proposition 4.20: The set $(1,2)^* - \pi$ gbCh (X, τ_1, τ_2) is a group.

Proof: Define $\Psi: (1,2)^* - \pi$ gbCh $(X, \tau_1, \tau_2) \times (1,2)^* - \pi$ gbCh $(X, \tau_1, \tau_2) \rightarrow (1,2)^* - \pi$ gbCh (X, τ_1, τ_2) by $\Psi(f, g) = (g \circ f)$ for every $f, g \in (1,2)^* - \pi$ gbCh (X, τ_1, τ_2) . Then by proposition 4.19, $(g \circ f) \in (1,2)^* - \pi$ gbCh (X, τ_1, τ_2) . Hence $(1,2)^* - \pi$ gbCh (X, τ_1, τ_2) is closed. We know that the composition of maps is associative. The identity map $i: (X, \tau_1, \tau_2) \rightarrow (X, \tau_1, \tau_2)$ is a $(1,2)^* - \pi$ gbC-homeomorphism and $i \in (1,2)^* - \pi$ gbCh (X, τ_1, τ_2) . Also $i \circ f = f \circ i = f$ for every $f \in (1,2)^* - \pi$ gbCh (X, τ_1, τ_2) . For any $f \in (1,2)^* - \pi$ gbCh (X, τ_1, τ_2) , $f \circ f^{-1} = f^{-1} \circ f = i$. Hence inverse exists for each element of $(1,2)^* - \pi$ gbCh (X, τ_1, τ_2) . Thus $(1,2)^* - \pi$ gbCh (X, τ_1, τ_2) is a group under composition of maps.

Proposition 4.21 : Every $(1,2)^* - \pi$ gb-homeomorphism from a $(1,2)^* - \pi$ gb-space into another $(1,2)^* - \pi$ gb-space is a $(1,2)^* - \pi$ gbC-homeomorphism.

Proof: Let $f: (X, \tau_1, \tau_2) \rightarrow (Y, \sigma_1, \sigma_2)$ be a $(1,2)^* - \pi$ gb-homeomorphism. Then f is bijective, $(1,2)^* - \pi$ gb-continuous and $(1,2)^* - \pi$ gb-open. Let U be an open set in (X, τ_1, τ_2) . Since f is $(1,2)^* - \pi$ gb-open and since (Y, σ_1, σ_2) is $(1,2)^* - \pi$ gb-space, $f(U)$ is $(1,2)^* - \pi$ gb-open in (Y, σ_1, σ_2) . This implies f is open map. Let V be closed in (Y, σ_1, σ_2) . Since f is $(1,2)^* - \pi$ gb-continuous and since (X, τ_1, τ_2) is $(1,2)^* - \pi$ gb-space, $f^{-1}(V)$ is closed in (X, τ_1, τ_2) . Therefore f is continuous. Hence f is a homeomorphism.

Proposition 4.22: Every $(1,2)^* - \pi$ gb-homeomorphism from a $(1,2)^* - \pi$ gb-space into another $(1,2)^* - \pi$ gb-space is a $(1,2)^* - \pi$ gbC-homeomorphism.

Proof: Let $f: (X, \tau_1, \tau_2) \rightarrow (Y, \sigma_1, \sigma_2)$ be a $(1,2)^* - \pi$ gb-homeomorphism. Then f is bijective, $(1,2)^* - \pi$ gb-continuous and $(1,2)^* - \pi$ gb-open. Let U be a π gb-closed set in (Y, τ_1, τ_2) . Then U is closed in (Y, σ_1, σ_2) . Since f is $(1,2)^* - \pi$ gb-continuous $f^{-1}(U)$ is π gb-closed in (X, τ_1, τ_2) . Hence f is a π gb-irresolute map. Let V be π gb-closed in (X, σ_1, σ_2) . Then V is open in (X, τ_1, τ_2) . Since f is $(1,2)^* - \pi$ gb-open, $f(V)$ is $(1,2)^* - \pi$ gb-open set in (Y, σ_1, σ_2) . That is $(f^{-1})^{-1}(V)$ is $(1,2)^* - \pi$ gb-open in (Y, σ_1, σ_2) and hence f^{-1} is $(1,2)^* - \pi$ gb-irresolute. Thus f is $(1,2)^* - \pi$ gbC-homeomorphism.

CONCLUSION: This paper has attempted to compare $(1,2)^* - \pi$ gb-homeomorphisms with the other homeomorphisms in bitopological spaces. It also aims to state that the several definitions and results in this paper will result in obtaining several characterizations and also enable to study various properties. The future scope of study is the extension of $(1,2)^* - \pi$ gb-closed maps.

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Simulation and construction of Single-stage reciprocating pneumatic transmission system Engine

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Abstract: Based on the principle of gas expansion, a new structure of reciprocating air-powered engine is proposed. It can convert the reciprocal motion of piston into one-way rotary motion of the output shaft and provide engine power. According to the pneumatic transmission system dynamics, the mathematical model of the air-powered engine is established and simulated. Then analyze the influence of the air state parameters and system structure parameters on performance of the engine, and the principle prototype is processed. The results show that the structure design of the engine is feasible, the average output torque and rotational speed increase with the increase of intake pressure. Under the circumstance with the same intake pressure, the average output torque increases with the increase of cylinder bore, but the rotational speed decreases with the increase of it. The results lay a foundation of further study on optimizing structure design.

Index Terms: Single-stage reciprocating, Air-powered engine, Mathematical model, Simulation research

INTRODUCTION

Air-powered engine utilizes high pressure compressed air to produce dynamic, when the compressed air expands and do work in the cylinder. The compressed air engine does not consume fuel or emits exhaust pollution; it can alleviate the pressure of urban air pollution, so it is the main research direction of the new energy vehicles recently. Currently, related researches of compressed air are carried out all over the world [1]

The French company MDI has developed a partial commercial production of the air powered car. Research in

India on air powered cars carries out mainly in IIT and Amrita University, and it is still at exploring stage [2-4]. Domestic study on air-powered engine focus on improving the piston-crank air-powered engine, for the existing air-powered engine only provides one-way power during a single duty cycle, and the gas expansion contributes a lateral force on the crank, which causes the loss of partial expansion work.

Based on the principle of gas expansion, a new structure of reciprocating air-powered engine is proposed. Compressed air does work by expansion to drive the reciprocating motion of rack, through the transmission system, convert to one-way rotary motion of the output shaft.

1.1 The working principle

Fig.1 and Fig.2 is respectively the schematic diagram of control circuit and transmission system. Fig.3 is the principle prototype. High pressure air outflows from tank, achieves the pressure regulation by pressure reducing valve, changes the direction of the chamber or chamber without rod through directional control valve. Compressed air does work by expansion to drive the reciprocating motion of double-sided rack. Then rack drives the upper and lower gear with the first and second gear and the third gear at the same time, in order to produce sustained rotary motion with output shaft. Reciprocating two-way motion uses the whole output force of cylinder to do work, and outputs mechanical energy.

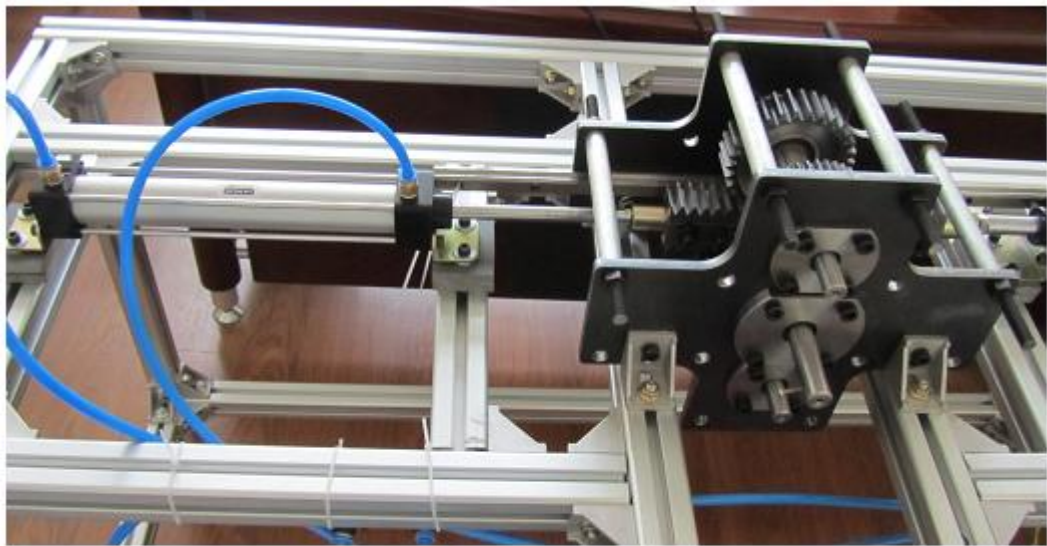
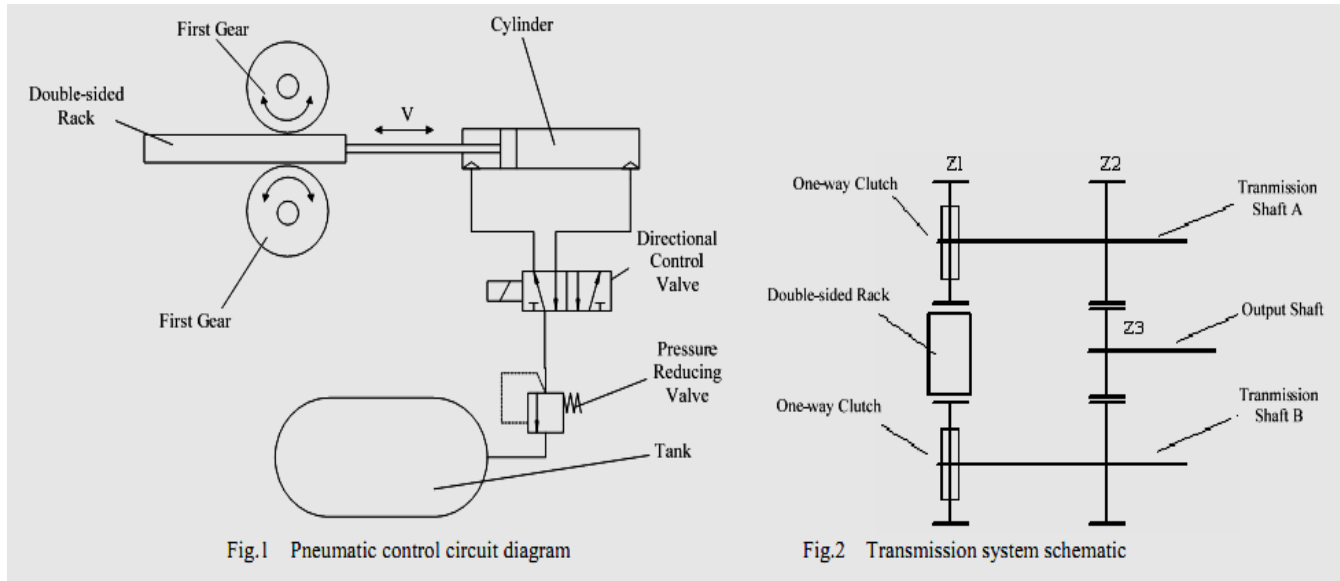


Fig.3 Principle prototype

2. THE MATHEMATICAL MODELING

The power plant of single-stage reciprocating air-powered engine is double acting pneumatic cylinder of single link (Fig.4). Here is a single duty cycle of engine. When compressed air flows into the chamber without rod, it expands and does work to push the rod to move to the right, then drives the double-sided rack to the right, outputs torque through pneumatic transmission system at last, with the chamber

exhaust. When the push rod reaches the end of the stroke, the directional control valve changes the direction, compressed air flows into the chamber, it expands and does work to push the rod to move to the left, then drives the double-sided rack to the left, and outputs torque through pneumatic transmission system at last, with the chamber without rod exhaust. The whole system is an open system. Chamber and chamber without rod are changing volume system.

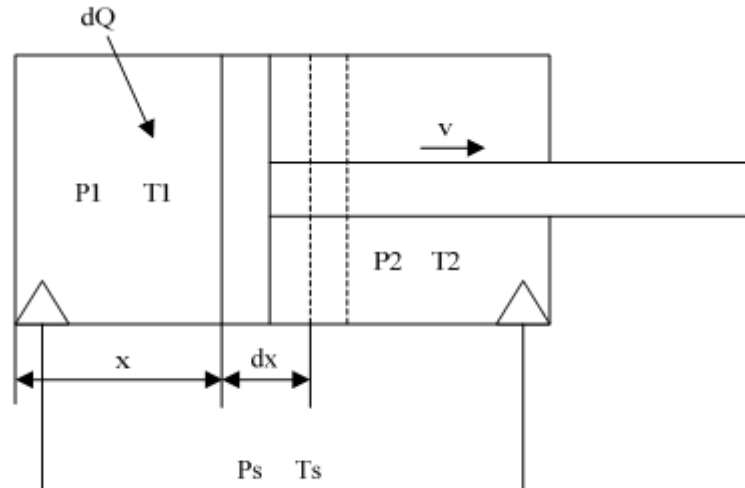


Fig.4 Thermal modeling of single-stage reciprocating air-powered engine

In order to simplify calculation, the compressed air that the engine uses is assumed as [5, 6]

- 1) The compressed air is ideal air
- 2) Supply pressure P_s is constant, temperature of supply air T_s is the temperature of the environment, $T_s = 293K$
- 3) The air flowing out and into the cylinder is stable
- 4) The work process of directional control valve is instantaneous
- 5) The cylinder and valve operation mechanism does not leak during the work process

① Gas energy conservation equation

Under the above assumptions, according to the first law of thermodynamics, the state change of air should satisfy the energy conservation equation during the work process;

Expressed as:

$$\frac{dU_i}{dt} = \frac{dQ_i}{dt} + \sum \frac{dm_i}{dt} h_i - \frac{dW_i}{dt}$$

Eq.1

Where

$$\left\{ \begin{array}{l} \frac{dU_i}{dt} = \frac{dQ_i}{dt} + \sum \frac{dm_i}{dt} h_i - \frac{dW_i}{dt} \\ \frac{dQ_i}{dt} = K \cdot A \cdot (T_e - T_i) \\ \frac{dW_i}{dt} = -p_i \frac{dV_i}{dt} \end{array} \right.$$

Eq.2

The specific internal energy and heat ratio of ideal air is

$$U_i = C_v \cdot T_i \text{ Eq.3}$$

Substituting Eq.(1) and Eq.(2) into Eq.(3), we get

$$\frac{dT_i}{dt} = \frac{\sum \frac{dm_i}{dt} h_i - C_v T_i \frac{dm_i}{dt} - p_i \frac{dV_i}{dt} + \frac{dQ_i}{dt}}{m_i C_v}$$

Eq.4

② The equation of ideal air

$$PV = mRT$$

Eq.5

Substituting Eqs. (1-4) into Eq.(5), and differential, we obtain

$$\frac{dP_i}{dt} = \frac{m_i R}{V_i} \frac{dT_i}{dt} + \frac{RT_i}{V_i} \frac{dm_i}{dt} - \frac{m_i RT_i}{V_i^2} \frac{dV_i}{dt}$$

Eq.6

For the chamber

$$V_1 = A_1 (x + s_1)$$

Eq.7

For the chamber without rod

$$V_2 = A_2 (s + s_2 - x)$$

Eq. 8

Under the above equations, subscript i stands for chamber and chamber without rod, $i=1, 2$, corresponds with Fig.4.

$\sum \frac{dm_i}{dt} h_i$ — the enthalpy flowing out and into each chamber

U_i —air internal energy of each chamber

W_i —the work done by air expansion of each chamber

V_1 —volume of chamber without rod

S_1 —clearance volume equivalent stroke of chamber without rod

A_1 —active area of chamber without rod

V_2 —volume of chamber

S_2 —clearance volume equivalent stroke of chamber

A_2 —active area of chamber

S —piston stroke

A —heat transfer surface area of Chamber

K —heat exchange coefficient

R, C_v —thermodynamic constant

③The kinetic equation of transmission system

Transmission system of rotary motion into an equivalent reciprocating piston, according to the Newton's second law, we obtain the kinetic equation of Piston under the air pressure acting in the cylinder.

Expressed as:

$$P_1 A_1 - P_2 A_2 - (f + \frac{M_1}{r_1} + \frac{2M_2}{r_1} + \frac{M_3 Z_2}{r_1 Z_3}) = (m_1 + \frac{2J_1}{r_1^2} + \frac{2J_2}{r_1^2} + \frac{J_3 Z_2^2}{r_1^2 Z_3^2}) \frac{dv}{dt}$$

Eq.9

In Eq.(9):

V —velocity of piston

f —friction of piston

m_1 —weight of piston and push rod

$1_r, 2_r, 3_r$ —radius of first gear, second gear and third gear

Z_1, Z_2, Z_3 —tooth number of first gear, second gear and third gear

J_1 —rotational inertia of first gear

J_2 —rotational inertia of second gear and transmission shaft

J_3 —rotational inertia of third gear and output shaft

M_1 —drag torque of first gear;

M_2 —drag torque of second gear and transmission shaft

M_3 —drag torque of third gear and output shaft

Combining Eqs.(1-9), the mathematical model of single-stage reciprocating air-powered engine is established.

2.1 The Performance Simulation and Analysis

According to the established mathematical model, simulate the performance of single-stage reciprocating air-powered engine under the circumstance with the different intake pressure and different cylinder bore. Simulation parameters are as follows, piston stroke is 200mm, the first gear module is 3mm, tooth number is 30, the second gear module is 2mm, tooth number is 40, the third gear module is 2mm, and tooth number is 25. Establish the simulation model based on Simulink, get the solution through fixed-step Runge-Kutta method, the fixed-size is 0.01ms.

2.2 The Influence of intake pressure

Fig.5 shows the pressure of chamber without rod at the cylinder bore of 40mm under different intake pressure. As

Shown in Fig.5, the pressure of chamber without rod is alternative variation, has certain periodicity. Intake pressure are 0.4Mpa, 0.6Mpa and 0.8Mpa, corresponding with cycle time which are 0.437s, 0.403s and 0.389s, the velocity of piston increases with the increase of intake pressure, and the cycle time decreases with the increase of it. Every alternation shows that the directional control valve changes the direction of the chamber or chamber without rod when piston moves to the end of stroke. And then the piston moves to the opposite direction. Compressed air does work by expansion to drive the reciprocating motion of rack, through the transmission system, convert to one-way rotary motion of the output shaft. The peak pressure of chamber in Fig.5 is higher than intake pressure. The result shows that the direction valve starts when the piston is about to reach the end of stroke, at the same time, the piston still has a certain velocity, air in discharge chamber is not completely drained, the residual volume is very small, the source of air fills into the discharge chamber of last cycle, leading to the peak pressure of chamber is higher than intake pressure.

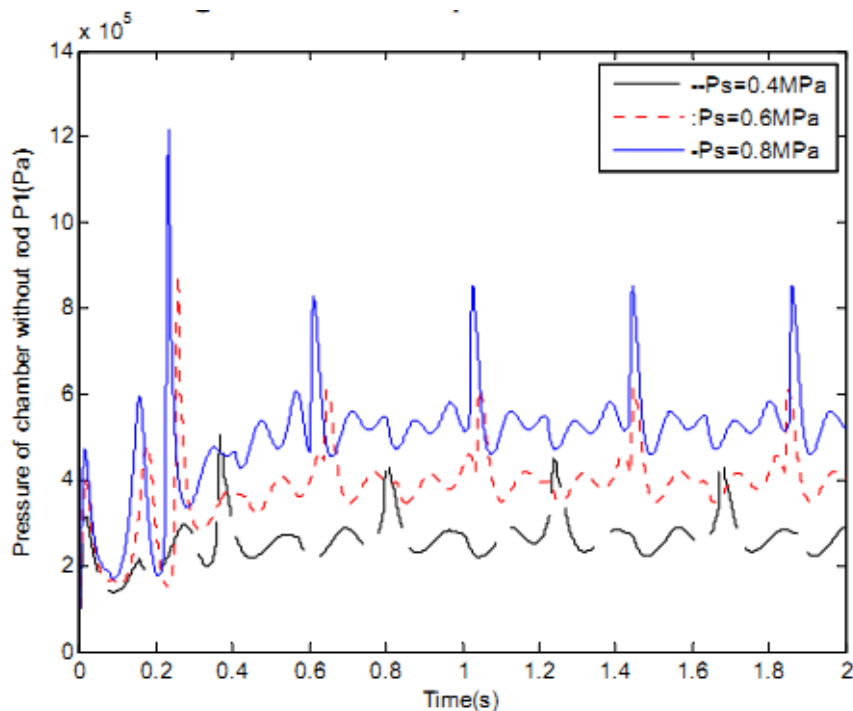


Fig.5 Pressure of chamber without rod under different intake pressure

2.3 The Influence of cylinder bore

The directional control valve changes the direction of the cylinder when piston moves to the end of stroke. The velocity of piston will fluctuate within a certain range, so that the output torque and rotational speed also fluctuate within a certain range. Take the average torque and rotational speed of output shaft for analysis, and compare their changes. Under the circumstance with different intake pressure and

different cylinder bore, Fig.6 and Fig.7 are the change curves of the average torque and rotational speed. The figures show that the average rotational speed increases linearly and the average of torque also increase with the increment of intake pressure when the cylinder bore are the same. For the same intake pressure, the average output torque increases with the increase of cylinder bore, but the rotational speed decreases with the increase of it. The average output torque is close at different cylinder bore when the intake pressure is between 0.2MPa and 0.5MPa.

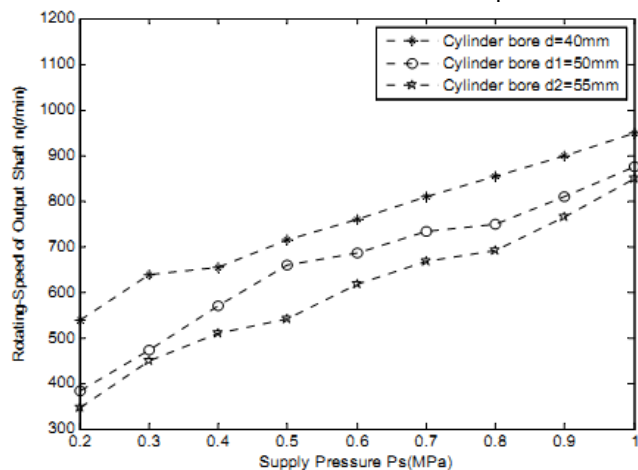


Fig.6 Rotating-Speed of output shaft under different intake pressure

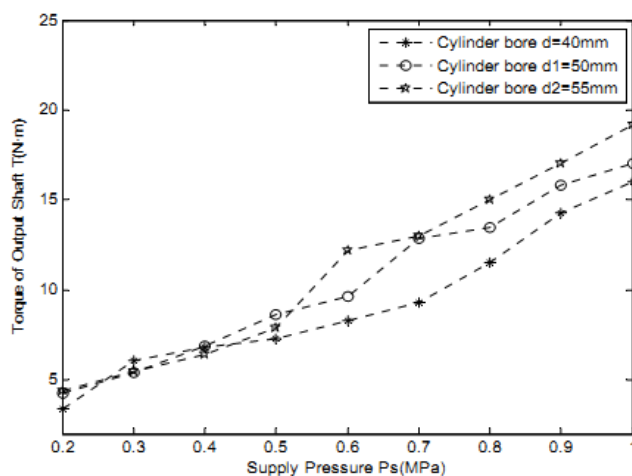


Fig.7 Torque of output shaft under different intake pressure

Conclusions

According to the principle of gas expansion, the overall structure of single-stage reciprocating air-powered engine is Designed. The operation of principle prototype confirmed the feasibility of the work principle. The mathematical model of the engine is established and simulated. The results show that the pressure of chamber and chamber without rod is alternative variation, has certain periodicity. The cycle time decreases with the increase of intake pressure. Moreover, the average output torque and rotational speed increases with the increase of intake pressure. Under the same intake pressure, the average output torque increases with the increase of cylinder bore, but the rotational speed decreases with the increase of it. Above research conclusions will provide significant reference for further study on optimizing design.

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Mass Transfer during Osmotic Dehydration of Banana Slices for Drying Process

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Abstract- Effects of Osmotic dehydration on water loss, solids gain, and weight reduction during osmotic dehydration were investigated in order to determine the usefulness of this technique as pre-treatment for further drying of bananas slices. Banana slices, 10 mm thick, were immersed in sucrose solutions with concentrations of 30, 40 and 50 Brix at 40, 50 and 60°C for 60, 90 and 120 minutes. Water loss, weight reduction and solids gain increased with treatment time. Longer treatment time in high concentrations of sucrose resulted in a very soft product, which is difficult to handle and unsuitable for further drying. Increasing concentration at the same temperature did not cause significant increments in weight change. Higher concentrations of sucrose caused higher rates of water removal.

The effective Normalized moisture content for water and Normalized solid content were determined, considering banana as slices configuration. The temperature was controlled using constant temperature stirred water bath. The ratio of the volume of slices to that of the medium was maintained at 1:4, 1:5 and 1:10 in order to ensure that the concentration of the osmotic solution did not change significantly during the experiment. The samples were withdrawn, rinsed quickly in water, blotted gently with a tissue paper in order to remove adhering water and then dried in a hot air oven at 70 °C for 18 hours. The regression analysis was done by response surface method.

Index Terms- Osmotic dehydration, solid gain, moisture loss, solid gain, weight reduction, normalized moisture content, normalized solid content, response surface method.

I. INTRODUCTION

Banana is the common name for herbaceous plants of the genus *Musa* and for the fruit they produce. It is one of the oldest cultivated plants. They are native to tropical South and Southeast Asia, and are likely to have been first domesticated in Papua New Guinea. Today, they are cultivated throughout the tropics. They are grown in at least 107 countries, primarily for their fruit, and to a lesser extent to make fibre, banana wine and as ornamental plants. Its fruits, rich in starch, grow in clusters hanging from the top of the plant. They come in a variety of sizes and colours when ripe, including yellow, purple, and red. Almost all modern edible parthenocarpic bananas come from two wild species – *Musa acuminata* and *Musa balbisiana*. The scientific names of bananas are *Musa acuminata*, *Musa balbisiana* or hybrids *Musa acuminata balbisiana*, depending on their genomic constitution. The old scientific names *Musa sapientum* and *Musa paradisiacal* are no longer used.

Banana is one of the most important major fruit crops grown in India. In respect of area it ranks second and first in production only after mango in this country. India leads the world in banana production with an annual output of about 16.820 mt. In India Tamil Nadu leads in total area and production with 2514729 T from 71088 ha. The banana culture in India is as old as Indian civilization. It seems that it is one of the earliest fruit crops grown by mankind at the dawn of civilization. In India, bananas are so predominant and popular among people that poor and rich alike like the fruit. Considering the nutritive value and fruit value of bananas, it is the cheapest among all other fruits in the country. Considering the year round availability of fruits, unlike the seasonal availability of other tree fruits, it has become an inevitable necessity in any household in India, for all functions. The bananas were grown in Southern Asia even before the prehistoric periods and the world's largest diversity in banana population is found in this area. Hence, it is generally agreed that all the edible bananas and plantains are indigenous to the warm, moist regions of tropical Asia comprising the regions of India, Burma, Thailand and Indo China.

Bananas must be transported over long distances from the tropics to world markets. To obtain maximum shelf life, harvest comes before the fruit is mature. The fruit requires careful handling, rapid transport to ports, cooling, and refrigerated shipping. The goal is to prevent the bananas from producing their natural ripening agent, ethylene.

This technology allows storage and transport for 3–4 weeks at 13 °C (55 °F). On arrival, bananas are held at about 17 °C (63 °F) and treated with a low concentration of ethylene. After a few days, the fruit begins to ripen and is distributed for final sale. Unripe bananas cannot be held in home refrigerators because they suffer from the cold.

Osmotic dehydration is an operation used for the partial removal of water from plant tissues by immersion in a hyper-tonic (osmotic) solution. Water removal is based on the natural and non-destructive phenomenon of osmosis across cell membranes. The driving force for the diffusion of water from the tissue into the solution is provided by the higher osmotic pressure of the hyper-tonic solution. The diffusion of water is accompanied by the simultaneous counter diffusion of solutes from the osmotic solution into the tissue. Since the cell membrane responsible for osmotic transport is not perfectly selective, solutes present in the cells (organic acids, reducing sugars, minerals, flavors and pigment compounds) can also be leached into the osmotic solution, which affect the organoleptic and nutritional characteristics of the product. The rate of diffusion of water from any material made up of such tissues depends upon factors such

as temperature and concentration of the osmotic solution, the size and geometry of the material, the solution-to-material mass ratio and, to a certain level, agitation of the solution. In osmotic dehydration, foods are immersed or soaked in a saline or sugar solution. This results in three types of counter mass transfer phenomenon (Ponting, 1973). First, water outflow from the food tissue to the osmotic solution, second, a solute transfer from the osmotic solution to the food tissue, third, a leaching out of the food tissue's own solutes (sugars, organic acids, minerals, vitamins) into the osmotic solution.

II. MATERIAL AND METHORD

Musa paradisiacal L varieties of bananas were obtained from the local market; Allahabad, Uttar Pradesh, India and experiment were conducted in Laboratory of Food Process Engineering Sam Higginbottom Institute of Agriculture technology and Sciences Deemed to be university, Allahabad. The tips of the bananas were first removed and its medium part, cut into slices of 1cm length with a knife. The average moisture content of fresh banana, determined by hot air oven drying at 70 °C, was found to be 75% on a wet weight basis. Commercial sugar was used as the osmotic agent.

The samples were taken from the same banana, blotted with tissue to remove external moisture, and then subjected to osmotic dehydration over a range of concentration (30-50 °B) and temperature (40-60 °C) of osmotic solution. The temperature was controlled using a constant temperature stirred water bath. The ratio of the volume of the pieces to that of the medium was maintained at 1:4, 1:5, and 1:10 in order to ensure that the concentration of the osmotic solution did not change significantly during the experiment. The samples were withdrawn, rinsed quickly in water, blotted gently with a tissue paper in order to remove adhering water and dried in a vacuum oven at 70 °C for 18 hours. The moisture and solid content at any time are expressed as kg of water/kg of initial dry solids and kg of solid/kg of initial dry solid, respectively.

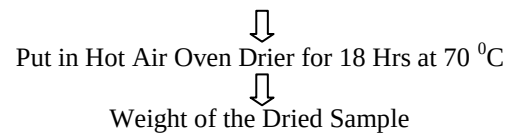
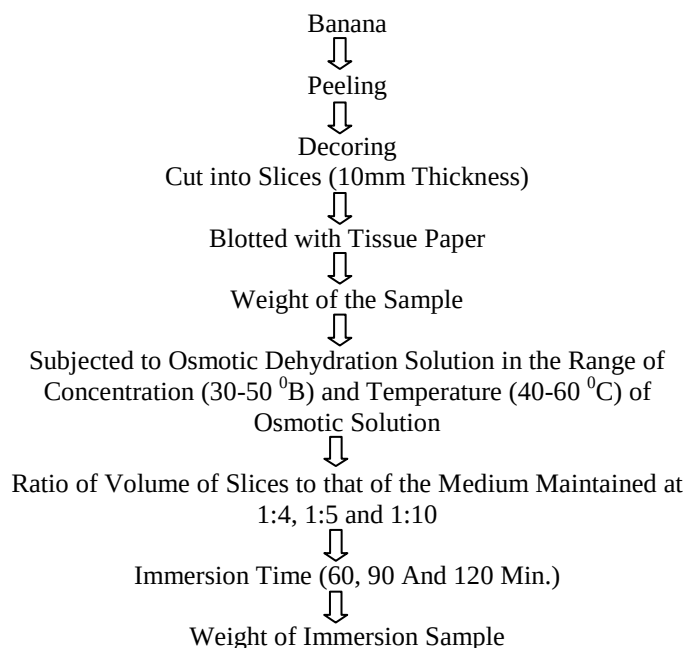


Figure 1: Flow Chart for Banana Dehydration Process

Determination of process parameters

Moisture content

$$\%, \text{M.C} = (\text{Mass of moisture}) / (\text{Mass of the sample}) \\ = \{(w_1 - w_2) \times 100\} / (w_1)$$

Where,

w_1 = weight of sample (g),
 w_2 = weight of final dried mass (g).

Moisture loss

$$\%, \text{Moisture Loss} = \frac{\text{Initial Moisture} - \text{Final Moisture}}{(\text{Initial Moisture})} \times 100$$

Solid Gain

$$\%, \text{Solid Gain} = \frac{\text{Initial Solid} - \text{Final Solid}}{(\text{Initial Mass Of Sample})} \times 100$$

Weight loss

$$\%, \text{Weight Loss} = \frac{\text{Initial Sample Weight} - \text{Sample Weight After OD}}{(\text{Initial Sample Weight})} \times 100$$

Normalized moisture content

$$\text{NMC} = \frac{\text{Moisture Content In The Sample After OD (G)}}{\text{Initial Moisture Content Of The Fresh Sample (G)}}$$

Normalized solid content

$$\text{NSC} = \frac{\text{Solid Content In The Sample After OD (G)}}{\text{Initial Solid Content In The Fresh Sample (G)}}$$

III. RESULT AND DISCUSSION

The initial moisture content of the banana used during the study was in the range of 75% wet basis and 25% dry matter. In this present study osmotic dehydration of banana was investigated by immersion of banana slices (10mm thickness) in to sugar solution in the range of (30-50 Brix) held at 40 °C, 50 °C, 60 °C temperature processed for 60, 90 and 120 minutes respectively.

Effect of Time and Temperature on moisture loss in banana slices:

- Concentration=40 Brix
- Sample to solution ratio=1:5

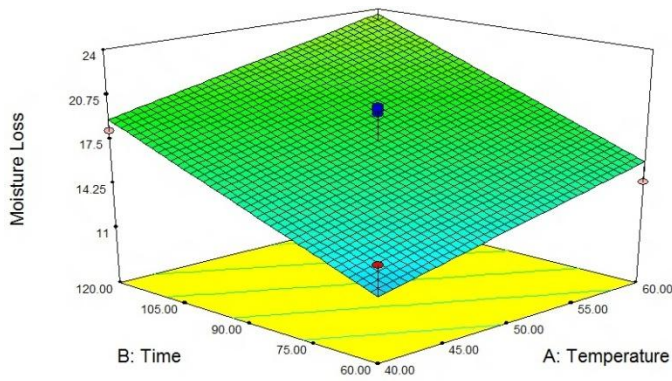


Figure 2: Moisture Loss Vs Temperature and Time

In Figure2 show the effect of time in moisture loss, According to this figure Concentration and sample to solution ratio are constant factors only time is varying. Here the moisture loss is increasing with increasing the time most efficient Moisture Loss occurred between 90 to 120 minute.

The effect of temperature in moisture loss. According to this Figure Concentration and sample to solution ratio are constant factors and temperature and time is varying. Here the moisture loss is increasing with increasing temperature. The higher temperature can effect on the texture of banana and it can be responsible for nutrition loss.

Effect of Concentration and Sample to Solution Ratio on moisture loss in banana slices:

- Temperature = 50 °C
- Time = 90 min

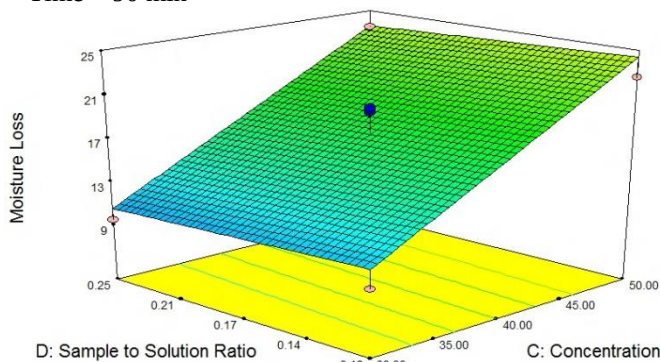


Figure 3: Moisture Loss Vs Concentration and Sample to Solution Ratio

In Figure3 show the effect of concentration in Moisture Loss. According to this Figure time and Temperature are constant factors only Concentration varies. Here the moisture loss is increasing with increasing Concentration.

The effect of Sample to Solution Ratio in moisture loss, according to this Figure time and Temperature are constant factors only Sample to Solution Ratio varies. Here the moisture loss is increasing with increasing Sample to Solution Ratio.

Effect of Temperature and Time on Solid Gain in banana slices:

- Concentration=40 Brix
- Sample to solution ratio=1:5

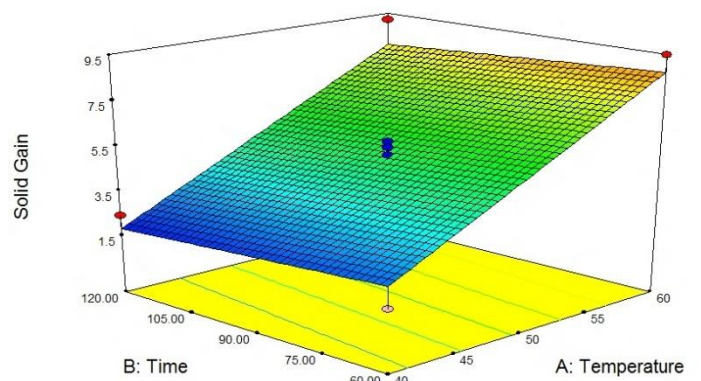


Figure 4: Solid Gain Vs Temperature and Time

In Figure 4 show the effect of temperature in solid gain, according to this Figure Concentration and sample to solution ratio are constant factors only temperature is varies. Here the solid gain is increasing with increasing the temperature .In osmotic dehydration temperature is important variable. The higher solid gain can effect on the texture of banana and it can be responsible for change in flavor.

The effect of time in solid gain, according to this figure Concentration and sample to solution ratio are constant factors only time is varies. Here the solid gain is increasing with increasing the time most efficient solid gain occurred between 60 to 90 minute indicating that it may not be necessary to carry out the osmotic treatment step for longer hours.

Effect of Concentration and Sample to Solution Ratio on Solid Gain in banana slices:

- Temperature = 50 0C
- Time = 90 min

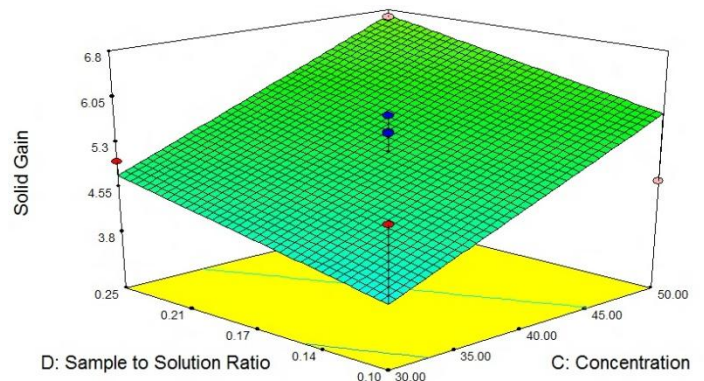


Figure5: Solid Gain Vs Concentration and Sample to Solution Ratio

In Figure5 show the effect of Concentration in solid gain, according to this Figure Time and Temperature ratio are constant factors only Concentration varies. Here the solid gain is increasing with increasing the Concentration.

The effect Sample to Solution Ratio in solid gain, according to this figure Time and Temperature are constant factors only Sample to Solution Ratio varies. Here the solid gain is increasing with increasing Concentration.

Effect of Temperature and Time on Weight Reduction in banana slices:

- Concentration=40 OB
- Sample to solution ratio=1:5

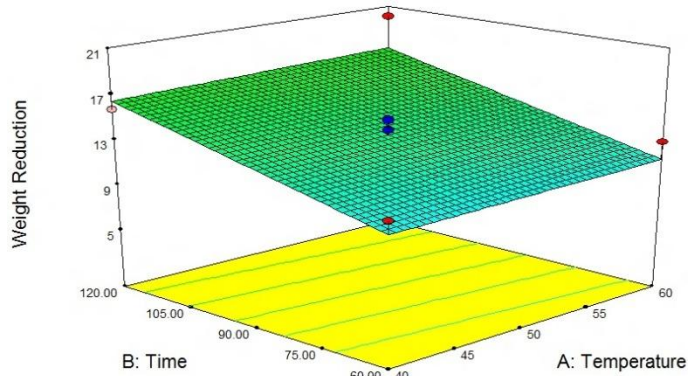


Figure 6: Weight Reduction Vs Temperature and Time

In Figure 6 show the effect of temperature in weight reduction, according to this Figure Concentration and sample to solution ratio are constant factors only temperature is varies. Here the weight reduction is increasing with increasing the temperature. In osmotic dehydration the weight reduction depends on the moisture loss and solid gain in banana slices.

The effect of time in weight reduction, according to this figure Concentration and sample to solution ratio are constant factors only time is varies. Here the solid gain is increasing with increasing the time most efficient weight reduction occurred between 60 to 90 minute indicating that it may not be necessary to carry out the osmotic treatment step for longer hours.

Effect of Concentration and Sample to Solution Ratio on Weight Reduction in banana slices:

- Temperature = 50 OC
- Time = 90 min

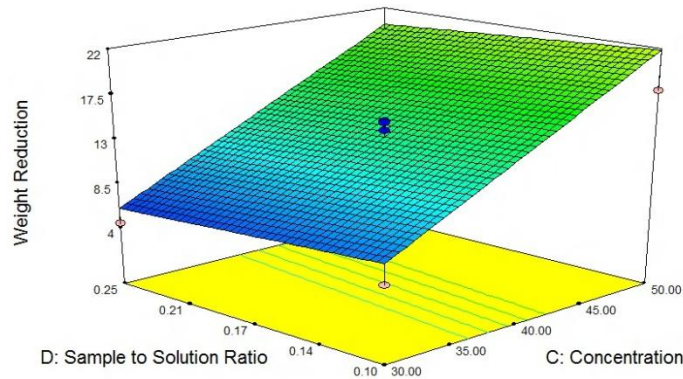


Figure 7: Weight Reduction Vs Concentration and Sample to Solution Ratio

In Figure 7 show the effect of Concentration in Weight Reduction. According to this Figure Time and Temperature are constant factors only Concentration varies. Here the Weight Reduction is increasing with increasing the Concentration.

The effect of Sample to Solution Ratio in weight reduction, according to this Figure Time and Temperature are constant

factors only Sample to Solution Ratio varies. Here the weight reduction is increasing with increasing Concentration
Analysis of Normalized Moisture Content (NMC) during Osmotic Dehydration:

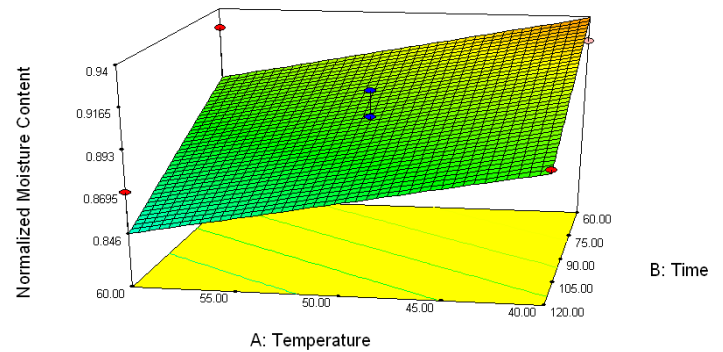


Figure 8: Normalized Moisture Content Vs Temperature & Time.

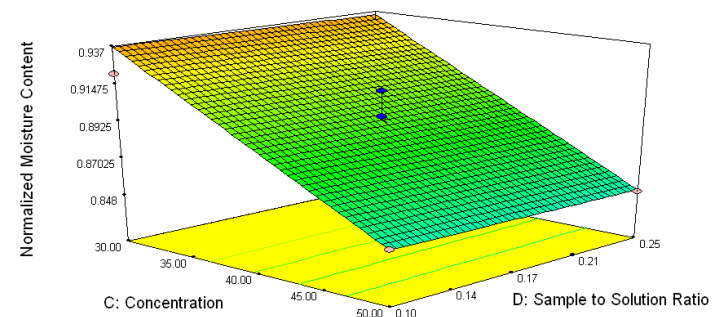


Figure 9: Normalized Moisture Content Vs Concentration & Sample to Solution Ratio.

Normalized Moisture Content (NMC); is ratio between Moisture Content in Banana before Osmotic Dehydration & Moisture Content in Banana after Osmotic Dehydration. From Figure No. 4.13, it is obtained that Moisture Content with in Banana sample is gradually decreasing with the increase of Time & Temperature. As well as from Figure No. 4.14, Moisture Content is decreasing within the Sample of banana taken for osmotic dehydration with increase of Concentration & Moisture Content is slightly increasing with Sample to Solution ratio.

Analysis of Normalized Solid Content (NSC) during Osmotic Dehydration:

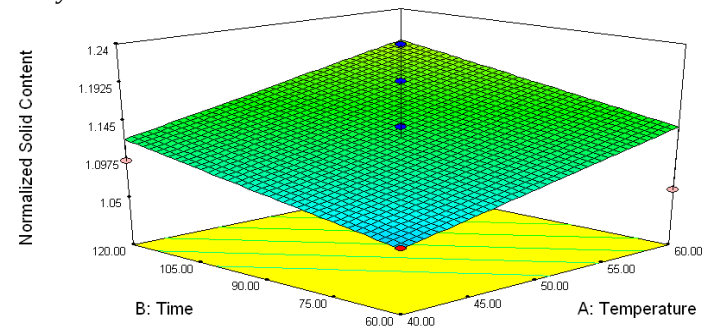


Figure 10: Normalized Solid Content Vs Temperature & Time.

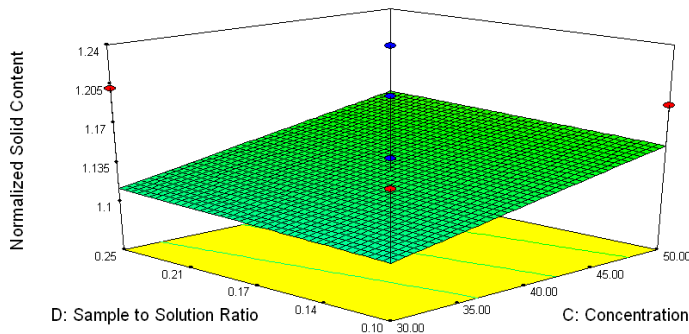


Figure 11: Normalized Solid Content Vs Concentration & Sample to Solution Ratio.

Normalized Solid (NSC); is ratio between initial Solid Content of Banana before Osmotic Dehydration & Solid Content of Banana after Osmotic Dehydration. From Figure No. 4.15, it is obtained that Solid Content within Banana sample is gradually increasing with the increase of Time & Temperature. As well as from Figure No. 4.16, Solid Content is increasing within the Sample of banana taken for osmotic dehydration with increase of Concentration & slightly increasing with Sample to Solution ratio.

Analysis of Moisture Loss, Solid Gain & Weight Reduction during Osmotic Dehydration

Weight Reduction was attributed to the Moisture Loss and the Solid Gain it is observed from plots the experimental results. It helps to confirm whether the observed mass change (Weight Reduction) is due to Moisture Loss and Solids Gain or if there are other significant mass transfer changes taking place that are not being controlled.

This could be attributed to the softening of the banana slices after longer time of osmotic treatment at high temperature and high concentrated solution, leading to unaccounted for mass losses, during wiping the slices of the sugar solution and overall process inefficiency due to structural collapse. This implies that it should not be recommended to employ high temperatures and longer time during the osmotic dehydration of the banana slices since a firm texture is important for further handling during subsequent drying operations. Despite a general noticeable improvement in Moisture Loss due to increasing the osmotic solution concentration at the same temperature, appreciable increments were realized only at 40°C. For other conditions the increments were not significant as expected.

The ratio between Solid Gain and Moisture Loss ($\Delta SG/\Delta ML$) is a very useful parameter to select the most appropriated process conditions to be use in the osmotic pretreatment. The values of $\Delta SG/\Delta ML$ ratio obtained at different working conditions were important differences can be appreciated during the 90 minutes of treatment. The results therefore suggest that treatments carried out at lower temperature are the ones were lower ratios of $\Delta SG/\Delta ML$ are obtained, and hence an optimal Moisture Loss without an excessive Solid Gain, being also advantageous in terms of energy saving.

Contreras and Smryl, (1981) reported that increasing the osmotic solution concentration to 65% did not result in faster weight. Higher concentration (50°B) appreciably improves Moisture Loss with respect to Solid Gain.

Results obtained indicated though there was a general increase in Moisture Loss in samples treated with a Sample to Solution Ratio, the increments were not significant. There was, however, a significant increase in soluble solids content. This occurs because when a low pressure is applied to the sample capillary impregnation is promoted and when the atmospheric pressure is restored, pores are extensively flooded with external solution hence high soluble solids gain (Fito *et al.* 2001).

These results suggest that since the Sample to Solution Ratio did not appreciably improve Moisture Loss, and instead improved Solids gain. The primary objective of osmotic pretreatment is Moisture Loss.

IV. CONCLUSION

Osmotic dehydration of Banana was done using sugar solution for Banana slices; sugar osmotic solution has been reported to be more effective for Banana. Most efficient Moisture Loss occurred between 60 to 90 Minutes indicating that it may not be necessary to carry out the osmotic treatment step for longer hours. However, Moisture Loss, Solids Gain and Weight Reduction increased with longer time of treatment.

The results also suggest that for bananas, temperature is an important variable. Due to the soft texture of bananas, osmotic treatment of bananas needs not to be done at extreme conditions of temperature and concentration.

Results obtained suggest that a product for further drying could be obtained by treating the slices at temperatures not more than 40°C and using osmotic solutions at 45 or 50 Brix.

- Osmotic dehydration rate increased with the concentration of osmotic solution and process temperature.
- The Moisture loss, Solid Gain and the Weight Reduction during osmotic dehydration of Banana slices were influenced positively by the temperature, concentration.
- The obtained models for the responses of Moisture loss and weight reduction were significant, while for Solid Gain this did not happen.
- Normalized Moisture Content (NMC) is reduced within Banana slices with temperature, concentration and Time.
- Normalized Solid Content (NSC) influenced positively within Banana slices with temperature, concentration and Time.

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Performance Analysis of Digital Audio Broadcasting System through AWGN and Rayleigh Channels

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Abstract-This paper presents the performance analysis of Eureka-147 DAB system. DAB transmission mode-II is implemented. A frame-based processing is used in this study. Performance studies for AWGN and Rayleigh channels have been conducted. For all studies SER has been used as performance criteria.

Index Terms- Radio, Digital Audio Broadcasting (DAB), Eureka 147, European Telecommunications Standards Institute (ETSI), Symbol Error Rate (SER), coded Orthogonal Frequency Division Multiplex (COFDM), and Frequency Response.

I. INTRODUCTION

Radio broadcasting is one of the most widespread electronic mass media comprising of hundreds of programme providers, thousands of HF transmitters and billions of radio receivers worldwide. Since the broadcasting began in the early 1920s, the market was widely covered by the AM services. Then came the FM and now we live in a world of digital communication systems and services. Digital telecommunication has advantages over analog systems such as storage capacity, reliability, and quality of service, miniaturization and many more.

The new digital radio system, Digital Audio Broadcasting (DAB) has the capability to replace the existing AM and FM audio broadcast services in many parts of the World in near future. This was developed in the 1990s by the Eureka 147 DAB project. DAB is very well suited for mobile receivers and provides very high tolerance against multipath reception and inter symbol interference (ISI). It allows use of single frequency networks (SFNs) for high frequency efficiency. In several countries in Europe and overseas, broadcasting organizations, network providers and receiver manufacturers are already implementing digital broadcasting services using the DAB system. Perceptual audio coding (MPEG-2), Coded Orthogonal Frequency Division Multiplexing (COFDM), provision for the multiplex of several programmes and data transmission protocols, are the new concepts of digital radio broadcasting.

II. RELATED WORK

During its development DAB system has been publicly demonstrated many times. It has been subject to extensive computer simulations and field tests in Europe and

elsewhere. It is now in regular service in many European countries and throughout the world. In 1995, the European DAB Forum (Euro Dab) was established to pursue the introduction of DAB services in a concerted manner world-wide and it became the World DAB Forum in 1997 [1]. As a result of developments within the Eureka 147 project, the DAB Standard or DAB Specification in the form of EN 300401 was approved by the European Telecommunications Standards Institute (ETSI), which defines the characteristics of the DAB transmission signal, including audio coding, data services, signal and service multiplexing, channel coding and modulation [2].

The first digital sound broadcasting systems providing CD-like audio quality was developed in early 1980s using Satellite technology. The system employed very low data compression and was not suitable for mobile reception. It used frequency in the range 10-12 GHz. Therefore it was not possible to provide service to large number of listeners. It was realized terrestrial digital sound broadcasting would do the job and to develop this new digital solution an international research project was necessary. So, in 1986 few organizations from France, Germany, United Kingdom and The Netherlands signed an agreement to cooperate in the development of a new standard and with this Eureka-147 project was born [2] [6]. Members of European Broadcasting Union (EBU), who were the part of work on the satellite delivery of digital sound broadcasting to mobiles in the frequency range between 1 and 3 GHz, also joined the Eureka-147 project. Later International Telecommunications Union (ITU-R) and the European Telecommunications Standards Institute (ETSI) started the standardization process.

Following goals were set up for DAB from the beginning with the sole aim of quality audio for mobile reception:

- High quality digital audio services (near CD quality).
- Well suited for mobile reception in vehicles, even at higher speeds.
- Efficient frequency spectrum usage
- Transmission capacity for ancillary data.
- Low transmitting power.
- Terrestrial, cable and satellite delivery options.
- Easy tuning of receivers.
- Large coverage area than current AM and FM systems.

Eureka 147 consortium alone started choosing the most appropriate transmission method based on thorough simulation and field test. Results showed that broadband solutions performed better than the narrow-band proposal, while the frequency-hopping solution was considered too demanding

with respect to network organization. Since the spread-spectrum was not developed as hardware therefore coded Orthogonal Frequency Division Multiplex (COFDM) system was chosen finally.

The next issue was audio coding standard selection for the Eureka-147 project. By that time the MPEG (Moving Pictures

IV. SIMULATION AND PERFORMANCE EVALUATION

The above system was simulated in MATLAB's Simulink.

The following are the results obtained from the software imitating the DAB quite successfully.

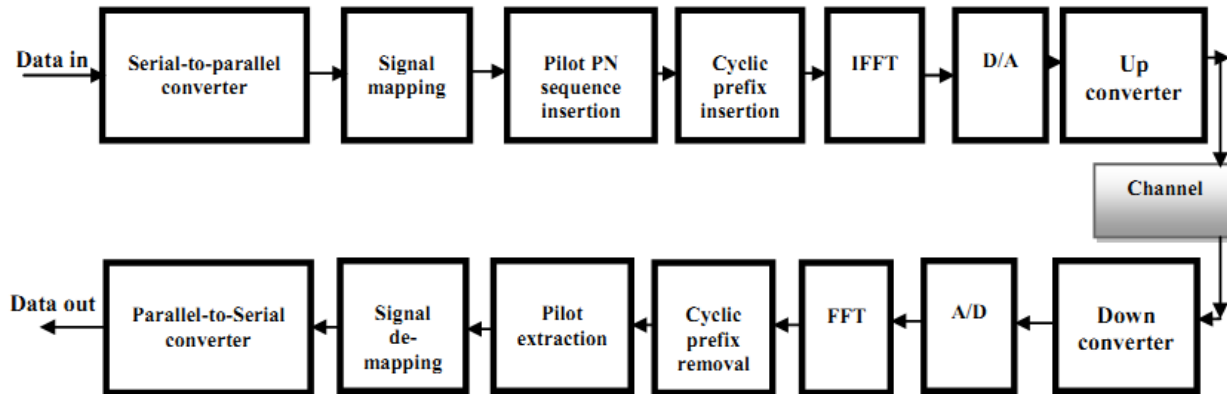


Figure 2: Basic block diagram of OFDM system

Expert Group) had already been standardized for data compression both video and audio coding. The solutions proposed by the Eureka-147 were sent to the MPEG Audio group to be evaluated with other several options from other countries. The performance offered by the methods submitted by the Eureka consortium was clearly superior so they were standardized by the MPEG as MPEG Audio Layers I, II and III. It took a long time until the final decision to which standard should be used for DAB was taken [4]. Finally, Layer II, also known as MUSICAM was chosen.

Another important specification for the DAB was the bandwidth consideration. From a network and service area planning point of view, one transmitter with the 7 MHz bandwidth of a TV channel was too much inflexible, but showed very good performance in a multipath environment [2]. Therefore considerable reduction in transmission bandwidth was necessary. In Canada experiments with the COFDM system also revealed that performance degradation begins around 1.3MHz and lower. Therefore appropriate bandwidth for a DAB channel was fixed at 1.5MHz.

With this one 7 MHz TV channel can be divided into four DAB blocks, each carrying ensembles of five to seven programs. The first DAB standard was achieved in 1993 and then in 1995 the ETSI adopted DAB as the only European standard for digital radio. The Eureka 147 DAB standard as digital radio is accepted Worldwide except, USA and Japan.

III. ARCHITECTURE

This section gives an overview of the conceptual architecture of Digital audio Broadcasting and describes the basic building blocks. The design decisions draw from several concepts and approaches. Since COFDM is the heart of Digital Audio Broadcasting (DAB), to be more precise OFDM, therefore the basic block diagram of the same is given below.

Figure 2 shows the real and imaginary parts of the Transmitted signal. This Composite signal is fed to the channel after the Parallel to serial converter block.

Figure 3 Shows the Real and Imaginary parts of the Received Composite signal at the output of the OFDM Receiver. As compared with the input signal the Wave shape, Frequency and Phase is the same as that of the input signal.

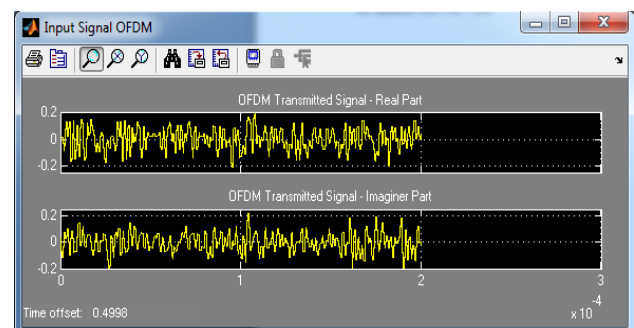


Figure2: Transmitted signal in the simulator.

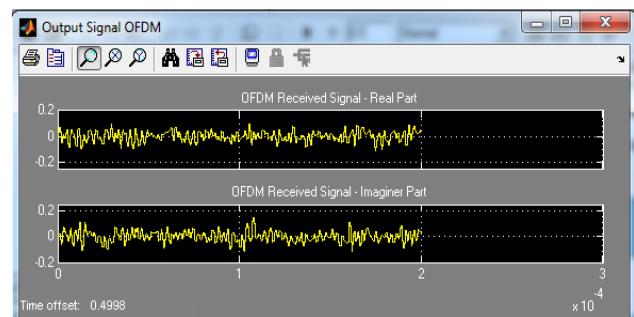


Figure 3: Received signal in the simulator.

The only difference between the two signals is the Amplitude level or the power level. The output signal has a lower power as compared with the input signal.

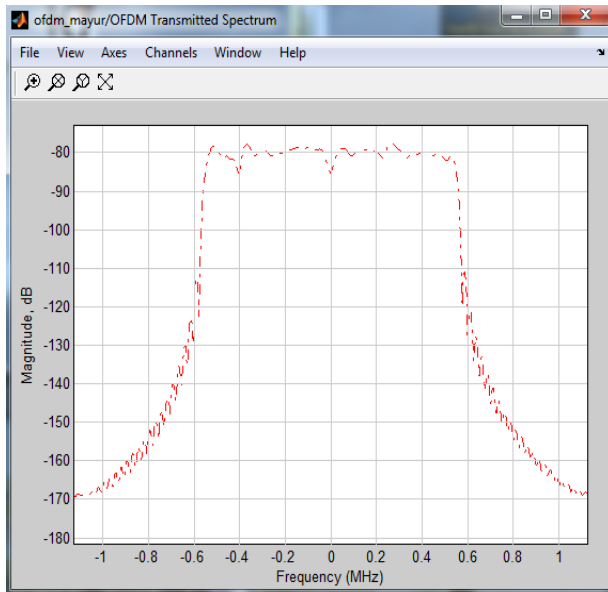


Figure 4: Spectrum of Transmitted Signal in the simulator.

Figure 4 Shows the Frequency Response of the Transmitted Composite signal. This can be seen on a spectrum analyzer places at the output of the parallel to serial converter block in the simulation

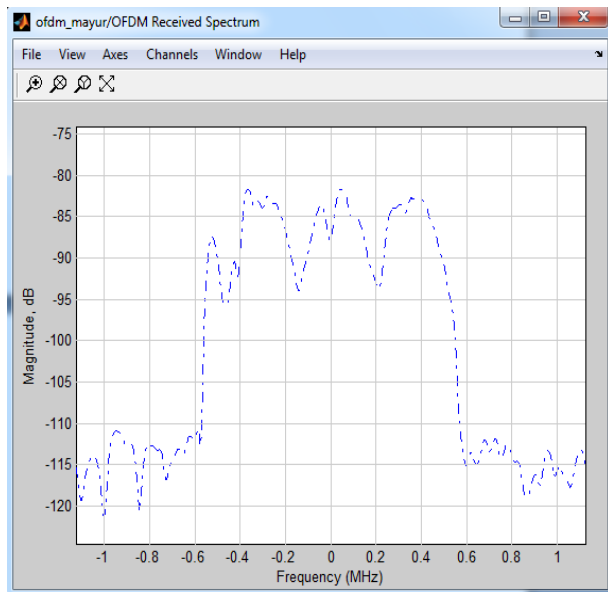


Figure 5: Spectrum of Received signal in the simulator.

Fig 5 shows the Frequency Response of the output signal, which can be seen at the Spectrum Analyzer placed at the output of the Decoder in the Receiver. As compared with figure 4.7, the spectrum is still in good condition. The magnitude has not decreased so much; it is not much affected by noise, as can be seen in the frequency axis from -0.6 to +0.6.

There is noise and distortion in the spectrum especially at higher frequencies outside the bandwidth of 1.5 Mhz, i.e. from -0.6 to -1 and from +0.6 to +1.

Table 4.1 Parameters of the main Composite signal.

Main Composite Analysis Signal			
Second	Total Symbol	Error Symbol	SER
20	1.683 _e +004	0	0
40	3.425 _e +004	0	0
1.00	5.168 _e +004	18	0.00035
1.20	6.928 _e +004	22	0.00032
1.40	8.661 _e +004	36	0.00042
2.00	1.033 _e +005	44	0.00043
2.20	1.197 _e +005	44	0.00037
2.40	1.375 _e +005	55	0.0004

Table 1 analysis the Main Composite signal, it shows that as the Total symbol bits increases with the passage of time, the Error symbols also increase. Initially the Error Symbols are Zero but at time = 1 minute it starts to increase, and goes up to 55 at time = 2 minute and 40 second. Also the Symbol Error Rate (SER) increases with Total symbols transmitted. It is zero initially but starts to increase at time = 1 minute. It goes upto 0.0004 at time = 2 minute and 40 second.

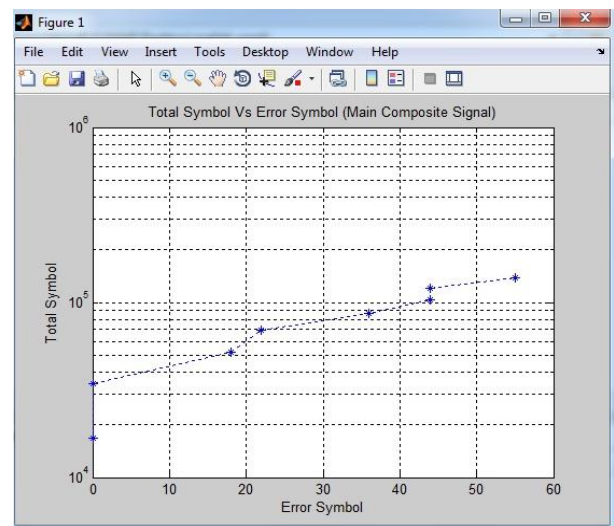


Figure 6: Total symbol Vs Error Symbol (Main composite Signal)

The graph shown in Figure 4.8 is a relationship between Total Symbols sent from Transmitter to Receiver and the Error symbols encountered at the receiver. The Total symbols are taken on Y – axis, and the values starts from 10^4 Symbols to 10^6 .

Error symbols are taken on X –axis. The value varies from 0 to 60 symbols. The error symbol is 0 when the Total Symbol varies from 10^4 up to $10^{4.3}$. Then it increases up to 60

when the Total Symbols vary from $10^{4.3}$ to $10^{5.05}$. Therefore the Error Symbols occur between $10^{4.3}$ to $10^{5.05}$.

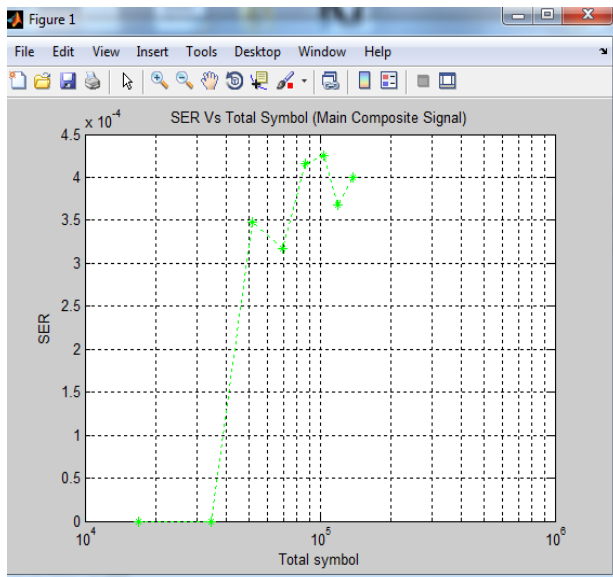


Figure 4.9 SER Vs Total symbol (Main Composite signal)

Figure 4.9 shows how Symbol Error Rate (SER) changes with respect to the Total symbols sent. On X – Axis Total Symbol are taken from 10^4 to 10^6 , but the SER varies only from $10^{4.08}$ to $10^{5.05}$.

On Y – Axis SER is taken. SER is 0 until when the Total symbol is at $10^{4.25}$. Then it rises up to 4.3×10^{-4} , which is in line with ETSI (EN 300 401).

Table 4.2 Parameters of the Encoded signal.

Encoded Signal Analysis			
Second	Total Symbol	Error Symbol	SER
20	2.295e+004	29	0.001264
40	4.671e+004	86	0.001841
1.00	7.047e+004	131	0.001859
1.20	9.447e+004	177	0.001874
1.40	1.181e+005	220	0.001863
2.00	1.409e+005	247	0.001753
2.20	1.632e+005	294	0.001801
2.40	1.875e+005	347	0.001851

Table 4.2 shows the analysis of the encoded signal. With the passage of time the Total Symbols increases. The Error symbols also increases from 29 to 347. The Symbol Error Rate (SER) also increases with respect to the increase in the Total symbol.

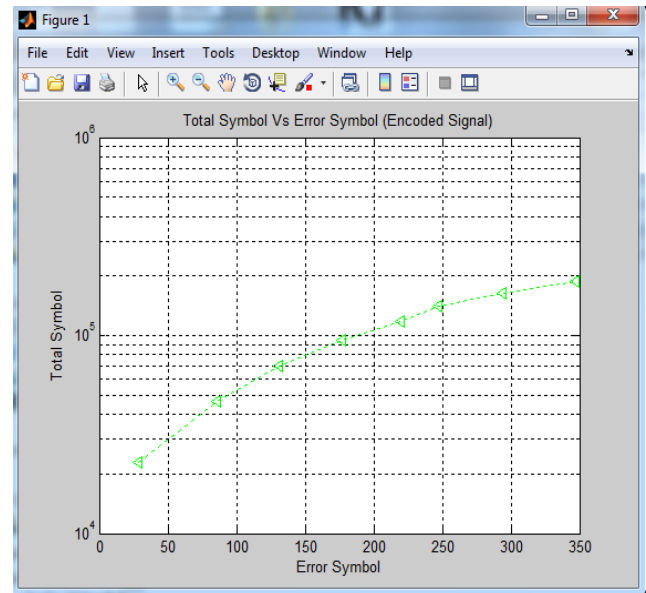


Figure 4.10 Total Symbol Vs Error Symbol in Encoded Signal.

On Y – axis Total Symbol has been taken from 10^4 to 10^6 . On X – axis Error Symbol is taken from 0 to 350. The Error symbol varies between Total Symbol $10^{4.12}$ to $10^{5.09}$. The Error Symbol increases from 30 onwards and becomes constant at 350.

Thus Coding helps to make the Error symbol stable. The Error symbol does not increase after 350, but remains constant.

On X – Axis Total Symbol are taken from 0.2×10^5 to 2×10^5 . On Y – Axis SER is taken. The SER increases from 1.26 to 1.84. Then it remains somewhat constant in the range of 1.75 to 1.88. Thus coding helps to stabilize the SER.

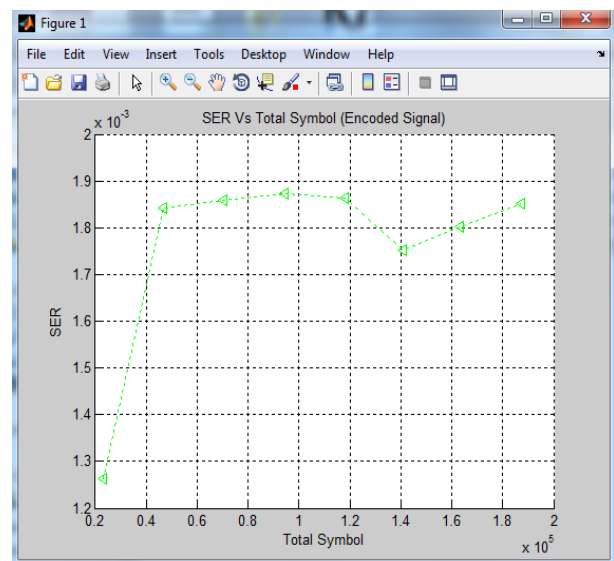


Figure 4.11 SER Vs Total Symbol in the Encoded Signal.

V. Conclusion

We presented the simulated model of DAB based on OFDM system, communicating in AWGN and Rayleigh channel. The performance analysis of the system shows that degradation is limited only to a certain part of the spectrum and also encoding and decoding at the Transmitter and receiver respectively lowers

the degradation. This work used the previous work of [25] as reference.

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STRESS AND DEPRESSION AMONG POST GRADUATE STUDENTS

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Abstract- Stress and depression can both be caused by life events and medical conditions. The one difference is that stress can be caused by pleasant events such as a promotion or marriage, while depression is associated with unwelcome events like financial difficulties or death. Life for many young people is a painful tug of war filled with mixed messages and conflicting demands from parents, teachers, coaches, employers, friends and oneself. The objective of this research was to study the relationship between stress and depression among post graduate students. Another objective was to study the effect of gender on stress and depression among post graduate students. The size of the sample was 51(27 male and 24 female). Beck's Depression Inventory and Hari's Stress inventory was used to measure the level of depression and stress among post graduate students. It was found that stress and depression among male students was higher as compared to their female counterparts. The correlation analysis states that as stress increases the level of depression also increases among male and female post graduate students. Gender had a significant effect upon the depression level of male and female post graduate students.

Index Terms- stress, depression, gender, students

I. INTRODUCTION

Stress among college students, leaving home for the first time and going away for school can be very difficult for some people. In many cases for college freshman this is their first time being away from their home and parents. Many times they get home sick and want to isolate themselves. They have to get into a new routine of going to school, and change can be very difficult. It is definitely hard to get into the swing of college. They have to navigate through classes in a new format while living away from all the comforts of parents. A college student's life usually consists of attending classes, long hours of studying, working at a job (sometimes), and having a social life.

Some students work at a job or study harder than others, but they are all trying to get degrees so maybe one day they will have meaningful and significant lives. It is a constant struggle for everyone who is trying desperately to make him or herself into a success. And every college student wants to be involved with something in order to further their education, or just have fun. There are lots of new opportunities out there. The struggle consists of demands on time, financial pressures, parental pressure and conflicts, interpersonal conflicts, managing freedom, peer and academic pressure and the transitional period to a new academic environment. All of these factors combined

can cause emotional disturbances and one of the most common is stress.

For most students, college is the first experience living away from home, family and friends. When things become difficult, their support system (including family and friends) may be miles away and their surroundings unfamiliar. This may bring feelings of homesickness, loneliness and isolation. Many students find college more academically demanding than they anticipated and feel stressed or anxious about not performing well. Petersen says, "Type A personalities or perfectionists, and are prone to these types of worries. They are often more likely to experience significant depressive symptoms because of negative self talk as a result of perceived failures."

Like any new life change, such as starting a job, college students have to negotiate an entirely new social network. Petersen says, "Teenagers spend years negotiating and establishing a social network in middle school and high school. All of a sudden, they are forced to do that all over again. These pressures can trigger or exacerbate symptoms of depression." The added pressure of greater exposure to drugs and alcohol can also play a role. On college campuses, much of social life involves alcohol and/or drug use. For someone who is at risk for or already depressed, substance use may serve to exacerbate risk or symptoms and serve as a means to self-medicate and avoid his/her personal problems.

Stress and depression can both be caused by life events and medical conditions. The one difference is that stress can be caused by pleasant events such as a promotion or marriage, while depression is associated with unwelcome events like financial difficulties or death. Stress and depression share some similar behavioral symptoms, including social isolation, increased or decreased eating, sleep disturbances and potential drug abuse. Facing repeated stress and the negative mindset of depression can result in feelings of helplessness.

A cause-and-effect relationship exists between stress and depression. Struggling with unrelenting stress increases the potential for depression. On the flip side, depression lowers the ability to cope, and any small daily challenge may trigger unusually high stress. Ongoing stress results in continuously elevated levels of biochemical, and that leads to medical conditions, including depression. Causes of female and male depression and anxiety might be quite different from each other. It is not known for sure if stress affects men and women differently. Generally, as the two genders often operate in different social contexts, both tend to develop different emotional dispositions and personality traits. Accordingly, their responses and coping mechanisms to stress situations vary.

II. OBJECTIVES

Objectives of the present study could be stated as follows:

1. To study the relationship between stress and depression among post graduate students.
2. To study the effect of gender on stress and depression among post graduate students.

III. METHOD

Sample

The sample was selected by using random sampling method. The sample consisted of 51 post graduate students within the age bracket of 20-22 from various post graduate departments of Ravenshaw University. Out of 51 post graduate students 27 were male and 24 were female.

Instruments

1. Beck Depression Inventory

The Beck Depression Inventory (BDI-II) is a 21-item self-report instrument intended to assess the existence and severity of symptoms of depression as listed in the American Psychiatric Association's Diagnostic and Statistical Manual of Mental Disorders Fourth Edition (DSM-IV; 1994). It is specifically designed to determine presence and severity of symptoms of depression. Each of the 21 items corresponding to a symptom of depression is summed to give a single score for the BDI-II. There is a four-point scale for each item ranging from 0 to 3. On two items (16 and 18) there are seven options to indicate either an increase or decrease of appetite and sleep. Cut score guidelines for the BDI-II are given with the recommendations that thresholds be adjusted based on the characteristics of the sample, and the purpose for use of the BDI-II. Total score of 0-13 is considered minimal range, 14-19 is mild, 20-28 is moderate, and 29-63 is severe. The reliability coefficient is 0.92.

2. Hari Stress Inventory

Hari Stress Inventory is a tool to measure the amount of stress you experience in daily life. The inventory consists of 66 items which is to be scored in a five point scale. The five options for each item were I Agree Fully, I agree, I Cannot Say, I Disagree, and I Totally Disagree. Test-retest coefficient of correlation was found to be 0.79. Item 2, 4, 6, 8, 11, 13, 14, 16, 17, 31, 43, 44, 46, 48, 49, 60, 64, 65 are reversed score items and rest are positive scored items.

Procedure

As indicated earlier, post graduate students from various departments were randomly sampled and selected for data collection. A good rapport was established between the investigator and respondent. The instructions of each part of the questionnaires were adequately explained and care was taken to ensure that they understood the questionnaire. Each participant was requested to respond to each item in the questionnaire freely and frankly without any hesitation. Each participant was asked to clarify for understanding before they attempted to respond. The participants were instructed to finish the entire questionnaire in a time of maximum one hour. Data was collected from 51 university students to assess stress and depression. Out of 51 students 27 were male and 24 were female. Each participants were administered both the questionnaire individually. They were asked to give a tick mark (✓) on the appropriate box. Strict confidentiality was ensured. The study was conducted in compliance with 'Ethical' principles or moral manner.

IV. RESULT

Table –I: Descriptive Statistics

DVs	Gender	N	Mean	SD
Stress	Male	27	193.0370	19.0798
	Female	24	186.1667	26.0228
	Total	51	189.8093	22.6451
Depression	Male	27	24.2222	10.2931
	Female	24	15.7083	6.5573
	Total	51	20.2157	9.6588

Table I shows the stress score for male is higher (193.03) as compared to the stress score of female (186.16). So male are more stressed than female. It also revealed that depression score for male is higher (24.22) as compared to the depression score of females (15.70). Male are more stressed as compared to female. Females show low level of depression as compared to males. Male are more stressed and more depressed as compared to their female counterparts.

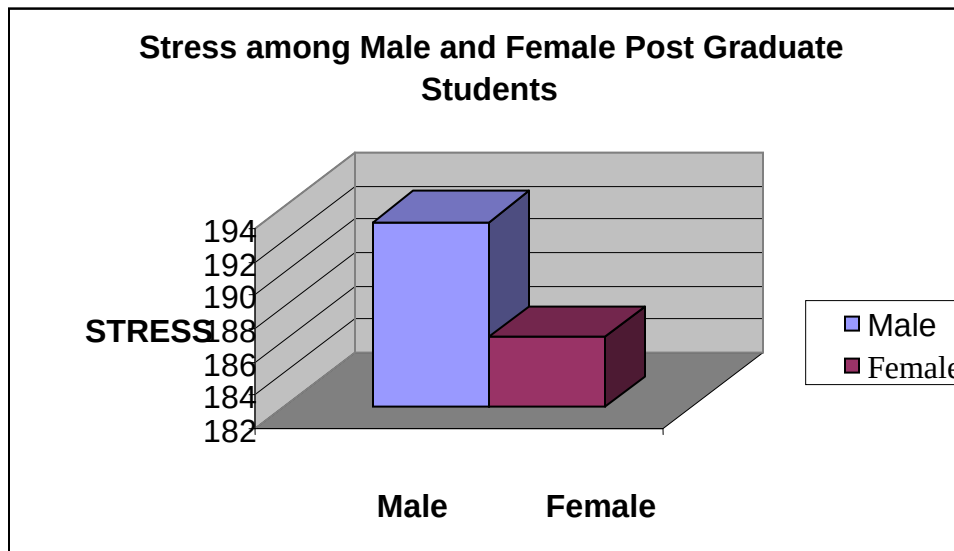


Figure I: Bar diagram showing stress among male and female postgraduate students. The above figure indicates that males are more stressed as compared to their female counterparts.

Figure II: Bar diagram showing depression among male and female postgraduate students. The above figure indicates that males are more depressed as compared to their female counterparts.

Table –II: Correlation Analysis

Variables	Stress	Depression
Stress	1.000	.330*
Depression	.330*	1.000

* Correlation is significant at the .05 level.

Table –II revealed that there exist a positive correlation between stress and depression. The correlation coefficient between stress and depression is 0.330. The obtained correlation of coefficient is significant at the 0.05 level of significance. So, as the level of stress increases the level of depression also increases among post graduate students. High level of stress is related with high level of depression. A student with high level of depression is more stressed and vice versa.

Table III
ANOVA showing the effect of Gender on Stress and Depression

Dependent Variable	Source of Variation	Sum of Squares	df	Mean Square	F	Sig.	
STRESS	Between Groups	599.743	1	599.743	1.174	.284	
	Within Groups	25040.296	49	511.026			
	Total	25640.039	50				
DEPRESSION	Between Groups	921.002	1	921.002	12.055	.000	
	Within Groups	3743.625	49	76.401			
	Total	4664.627	50				

Table III showed that the effect of gender upon stress is not significant, $F(1, 49) = 1.174$, $p = .284$. So there is no difference between post graduate male and female students with regard to their score on stress. Post graduate males and females experience same level of stress. The effect of gender upon depression is significant, $F(1, 49) = 12.055$, $p = .000$. There exist a significant difference between post graduate male and post graduate female with regard to their scores on depression. Post graduate males are more depressed (Mean=24.2222) than females (Mean=15.7083).

V. DISCUSSION

This section is organized around the research question posed in chapter III. In particular it relates the result and implication.

Major Findings

1. There is no significant difference among male and female with regard to their stress score.
2. There exists a significant difference among male and female with regard to their scores on depression.
3. There exist a positive significant relationship between stress and depression.
4. Male post graduate students are more depressed than female post graduate students.

Post graduate male students experience same level of stress as post graduate female experience. So both male and female experience same level of stress and equally adjust with their life. As stress increases the level of depression also increases among post graduate students. Both male and cope and adjust in their life in a same way. Post graduate male are more depressed than post graduate females. Male post graduate students are more depressed as compared to female postgraduate students. Positive relationship between stress and depression indicates as stress increases the level of depression also increases.

Men generally have a hard time dealing with the stigma of depression. They are more likely to deal with their symptoms with by drinking alcohol or abusing drugs, and/or pursue other risky behavior. Many men avoid talking about depressed feelings to friends or family. Male depression often goes undiagnosed. Men with depression often aren't diagnosed, for several reasons. Possible reasons behind male depression includes failure to recognize depression, fatigue, irritability, neglecting signs and symptoms, employment, lack of purpose in life, substance addiction and emphasis on self-control. So men should practice healthy coping skills rather than automatically turning to alcohol. So they need to set realistic goals and

prioritize tasks. They should seek emotional support from friends and family members. Understanding how men in our society are brought up to behave is particularly important in identifying and treating their depression. Depression in men often can be traced to cultural expectations. Men are supposed to be successful. They should rein in their emotions. They must be in control. These cultural expectations can mask some of the true symptoms of depression.

VI. CONCLUSION

Gender as a factor does not influence the level of stress rather it influence the level of depression among male and female students. The study was only restricted to the factor of gender. Attempt should be made to include factor such as emotional intelligence along with gender to know the difference between male and female undergraduate students with regard to stress and depression.

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Assessment of the knowledge, attitude and Practices regarding Biomedical Waste Management amongst the Medical and Paramedical Staff in Tertiary Health Care Centre

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Abstract- Biomedical waste also known as infectious waste or medical waste. This study was therefore, conducted to understand the awareness amongst the employees as regards to biomedical waste management practices to study the knowledge, attitude and practice of the respondent. The hospital chosen for the study is a premier tertiary level institute in India. This cross sectional study was carried out in Department of Obstetrics and Gynaecology, CSM Medical University, (Erstwhile KGMU) Lucknow. The study was conducted in 120 hours. 10 doctors and 20 nurses were included in the study. Two groups were made: Group A- Nursing staff (20 nurses, all females) Group B- Doctors (10 Junior Doctors, 8 from Obstetrics and Gynaecology, 2 from Paediatrics). 30% of the doctors and 20% nursing staff have more than 70% knowledge about biomedical waste management. 100% doctors and 60% nurses have a positive attitude towards biomedical waste management.

Index Terms- Biomedical waste management, Attitude, Knowledge, Practice.

I. INTRODUCTION

Biomedical waste also known as infectious waste or medical waste, is defined as any waste which is generated during the diagnosis, treatment or immunization of human beings or animals or in research activities pertaining there to or in the production or testing of biological and including categories mentioned in schedule I.

The large volumes of health care waste if not managed properly can lead to a global hazard. This could not only lead to the spread of highly contagious diseases but the hazardous chemical waste produced by the use of items can cause considerable damage to the ecosystem and the environment.

Thus health care waste, if not managed properly will be a cause in ushering of “disasters in making” by causing air, water, soil pollutions and helping in emergence of antibiotic resistant strains of microbial ingress of pollutants in the food chain and thus becoming a part of human consumption.

The scenario is no different in any metropolitan city of India. Therefore, the Department of Hospital Administration of a super-specialty tertiary hospital in Delhi designed a hospital

waste management manual to create awareness amongst the waste generators. To ensure implementation of the waste management system in accordance with the biomedical waste (Management and Handling) rules, 1998, the department of Hospital administration circulated manuals and memorandum amongst the concerned staff. However, the improper practice of segregation at the site of origin has been observed which causes mixing of infectious and non-infectious waste.

As such, there is an urgent need to demonstrate and promote best practices and techniques for health care waste management in countries that have not yet fully operationalized, and to facilitate operationalization by developing appropriate and affordable infectious waste treatment technologies that avoid formation and release of persistent organic pollutants (POPs) where none are yet available.

There is also growing concern about the spread of HIV, Hepatitis and other infectious disease that can be caused by needle-stick injuries and other forms of contagion that can result from the improper management of biomedical wastes by hospitals and other health care institutions.

As health systems are strengthened and health care coverage expanded in developing countries through efforts to meet the Millennium Development Goals, the releases of persistent organic pollutants (POPs) and other persistent toxic substances (PTS) to the environment can increase substantially. This is often an unintended consequence of choices in materials and processes that seek to improve health outcomes.

India already has biomedical waste management regulations including a ban on the incineration of biomedical waste with the exception of human and animal waste at the Union level, but their implementation and enforcement throughout the country has been inconsistent.

II. EFFECTS OF BIOMEDICAL WASTE ON HEALTH

Sharps: The reuse of syringes: Worldwide, an estimated 10 to 20 million infections of Hepatitis B and C and HIV occur annually from the reuse of discarded syringe needles without prior sterilization.

Accidental Contacts: This happens through contaminated air, water or food, by accidental contact with soiled dressings or by

injury from sharps. People are caught unawares because someone carelessly threw hazardous waste into the municipal bins and someone who had to treat the wastes and render them non-infectious and safe, did not do so.

Infections and diseases: Serious diseases may develop in health-care personnel, waste handlers, patients and the general public. In any healthcare establishment, nurses and house-keeping personnel are the main groups at risk of injuries, annual injury rates are 1020 per 1000 workers.

Highest rates of occupational injury among all workers who may be exposed to health-care waste are reported by cleaning personnel and waste handlers, the annual rate in USA is 180 per 1000.¹

There are reported cases of staphylococcal bacteraemia and endocarditis among housekeeping staff after a needle injury. Risk of infection of hepatitis B after needle stick injury-chances of susceptible health care workers (HCWs) is 6-30% after single needle stick exposure.

In USA, in June, 1994, 39 cases of HIV infection were recognized by the centers for disease control and prevention as occupational infections with the following pathways of transmission:

32 from hypodermic needle injuries.

- 1 from blade injury,
- 1 from glass injury (broken glass from a tube containing infected blood)
- 1 from contact with non-sharp infectious item,
- 4 from exposure of skin or mucous membranes to infected blood.

By June, 1996 the cumulative recognized cases of occupational HIV infection had risen to 51. All cases were nurses, medical doctors, or laboratory assistants. HCWs who are immunized are not at risk. Post exposure prophylaxis (PEP) with HB Ig and HB vaccine is 90% effective. However, Preexposure prophylaxis with HB vaccine is essential.¹ There are no vaccines against HIV. Post exposure prophylaxis with a two drug combination has to be administered within 6-12 hours for 80% effectiveness.

III. DOCUMENTED NEEDLE STICK INJURIES IN CMC VELLORE, INDIA

A total of 347 injuries occurred, mainly due to improper disposal of needles recapping and carelessness during use. The percentage of injuries attributed to improper disposal fell from 69.2% in 1995 to 38.5% in 1996 (after the education programme)².

A further decrease was noted after the additional introduction of small sharps containers. In 1995, 73% of injuries involved housekeeping staff, this fell to 12% in 1998.

It is recommended that all healthcare institutions should have a system of documenting needle-stick injuries and take measures to decrease their incidence (Richard et al, 2001).

According to WHO, HBV can survive in dry condition for a week or more. Worldwide more than 8 million Hepatitis B, more

than 2.3 million Hepatitis C and more than 8000 cases of HIV infections are estimated to occur yearly from the reuse of syringe and needles without sterilization.³ Thus there is need for proper health care waste management to ensure the safety of health care workers and the community at large.

This study was therefore, conducted to understand the awareness amongst the employees as regards to biomedical waste management practices to study the knowledge, attitude and practice of the respondent. The hospital chosen for the study is a premier tertiary level institute in India. Therefore, the current status of employee's awareness regarding biomedical waste management will help the authorities to develop the strategy for improving the situation in future. This study was designed to assess the knowledge, attitude and practices amongst the medical and paramedical staff of CSM Medical University, Lucknow. To improve the Biomedical Waste management training programme depending on the outcome. To recommend for improvisation of Biomedical waste management practices within the institution.

Methodology

- The study was conducted in the Department of Obstetrics and Gynaecology of CSM Medical University, Lucknow.
- This cross-sectional study was carried out in the month of March 2011.
- KAP (Knowledge, attitude and practices) study was conducted on the Medical and Paramedical staff of OTs and surgical wards. Knowledge and attitude of the medical and paramedical staff will be assessed towards the waste management practices.
- The study was conducted in 120 hours. 10 doctors and 20 nurses were included in the study. Two groups were made:
 - **Group A-** Nursing staff (20 nurses, all females)
 - **Group B-** Doctors (10 Junior Doctors, 8 from Obstetrics and Gynaecology, 2 from Paediatrics)
- The tool used for collection of data was a structured questionnaire which has a set of 3 questions concerning the knowledge, attitude and their practices on the subject.
- There were 11 such sets of questions.
- Information was gathered from the doctors and the nursing staff through this structured questionnaire.

Results:
Group A (Nurses, N=20) Data observed

S. No.	Code	Knowledge*				Attitude ⁺			Practices @		
		0	1	2	% ¹	0	1	% ²	0	1	% ³
1	1	0	4	7	64	1	10	91	3	8	73
2	2	1	3	7	64	1	10	91	3	8	73
3	3	1	4	6	55	0	11	100	4	7	64
4	4	2	1	8	73	3	8	73	3	8	73
5	5	1	3	7	64	1	10	91	2	9	82
6	6	1	2	8	73	1	10	91	2	9	82
7	7	2	2	7	64	3	8	73	2	9	82
8	8	1	3	7	64	0	11	100	3	8	73
9	9	1	5	5	45	0	11	100	4	7	64
10	10	0	5	6	55	0	11	100	3	8	73
11	11	2	3	6	55	1	10	91	4	7	64
12	12	0	3	8	73	0	11	100	3	8	73
13	13	2	3	6	55	1	10	91	5	6	55
14	14	0	5	6	55	0	11	100	3	8	73
15	15	1	3	7	64	6	5	45	4	7	64
16	16	1	2	28	73	5	6	55	3	8	73
17	17	1	3	7	64	7	4	36	2	9	82
18	18	1	3	7	64	4	7	64	3	8	73
19	19	3	2	6	55	6	5	45	4	7	64
20	20	1	3	7	64	7	4	36	4	7	64

*0- No Knowledge; 1-Inadequate knowledge, 2- Adequate knowledge
+ 0- Positive attitude absent, 1- Positive attitude present
@0- don't follow the right practices, 1- follow the right practices
%¹: Percentage of adequate knowledge
%²: Percentage of positive attitude
%³: Percentage of correct practices

Group B (Doctors): Data Observed

S. No.	Code	Knowledge*				Attitude ⁺			Practices @		
		0	1	2	% ¹	0	1	% ²	0	1	% ³
1	21	0	2	9	82	0	11	100	0	11	100
2	22	0	2	9	82	1	10	91	0	11	100
3	23	2	2	7	64	0	11	100	2	9	82
4	24	3	3	5	45	1	10	91	4	7	64
5	25	0	6	5	45	0	11	100	1	10	91
6	26	3	3	5	45	0	11	100	4	7	64
7	27	3	2	6	45	1	10	91	3	8	73
8	28	3	2	6	55	0	11	100	4	7	64
9	29	1	2	8	73	0	11	100	1	10	91
10	30	4	2	5	45	0	11	100	2	9	82

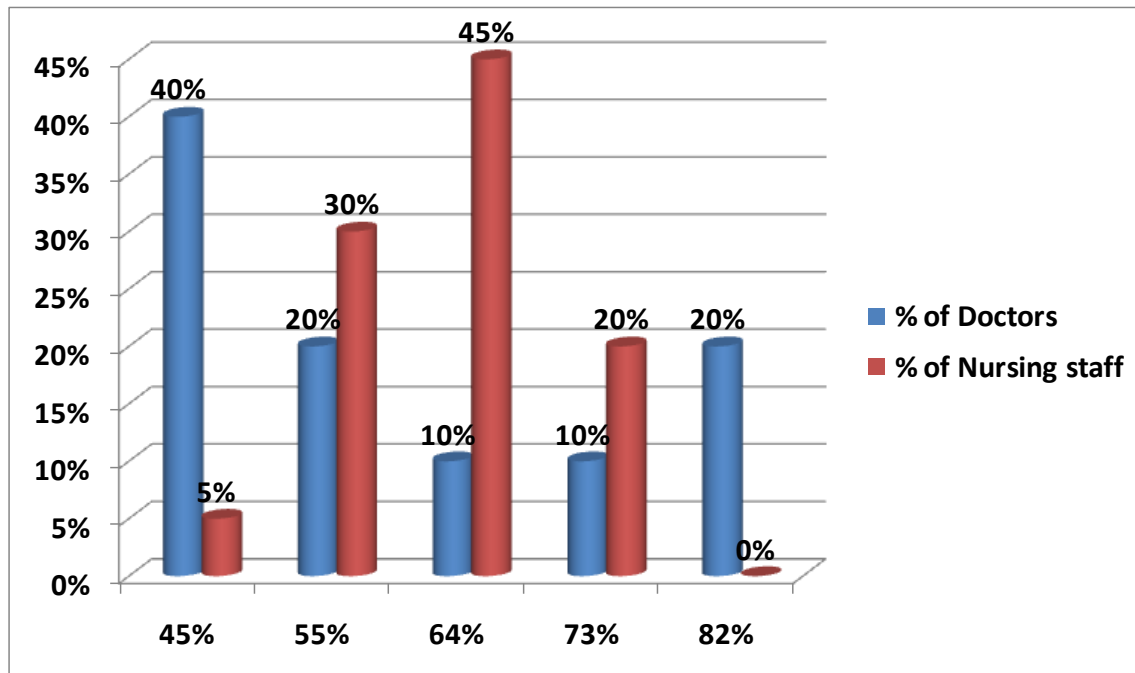
*0- No Knowledge; 1-Inadequate knowledge, 2- Adequate knowledge
+ 0- Positive attitude absent, 1- Positive attitude present
@0- don't follow the right practices, 1- follow the right practices
%¹: Percentage of adequate knowledge
%²: Percentage of positive attitude
%³: Percentage of correct practices

Analysis

Knowledge of the respondents:

The level of knowledge amongst Doctors and the Nursing staff.

Sl. No.	% of Adequate knowledge	% of Doctors	% of Nursing staff
1	45%	40%	5%
2	55%	20%	30%
3	64%	10%	45%
4	73%	10%	20%
5	82%	20%	0%



Percentage of adequate knowledge
X Axis- Percentage of adequate knowledge.
Y Axis- Percentage of respondents.

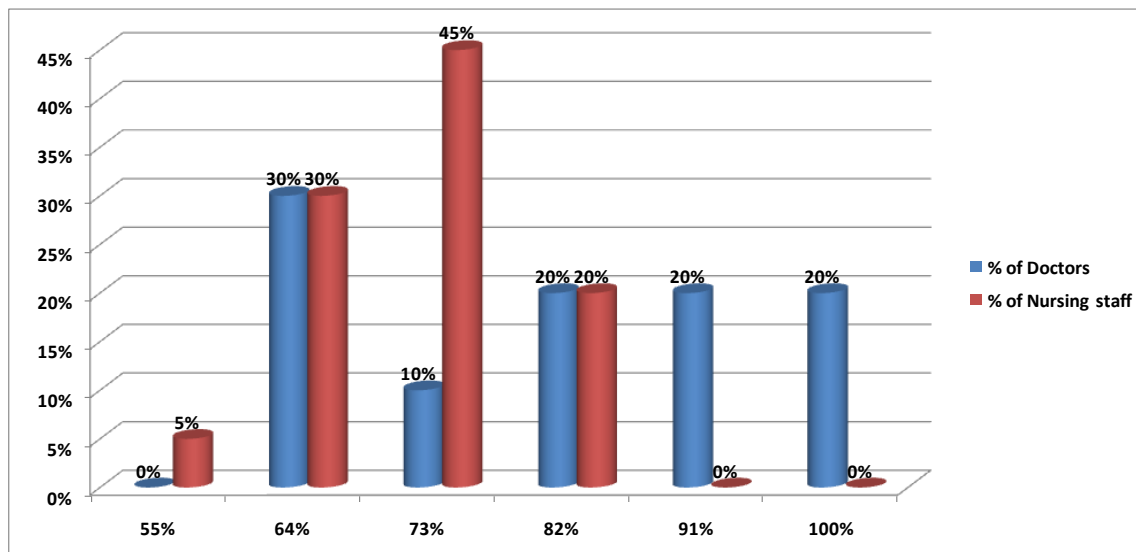
Attitude of the Respondents:

- 100% doctors have positive attitude towards waste management.
- 60% nurses have positive attitude towards waste management.

Practices

The degree of correct practices being followed by Doctors and the Nursing staff.

Sl. No.	% of Correct Practices	% of Doctors	% of Nursing staff
1	55%	0%	5%
2	64%	30%	30%
3	73%	10%	45%
4	82%	20%	20%
5	91%	20%	0%
6	100%	20%	0%



X-Axis – Percentage of correct practices.
Y- Axis- Percentage of respondents.

IV. DISCUSSION

The participants involved in this study were assessed for knowledge, attitude and practice of BMW management. Interestingly, this study revealed that the awareness and proper practice of biomedical waste management was not satisfactory. Our study showed that for:

Knowledge

- The majority of staff (Doctors and Nurses) were conscious of the measures for safe collection and final disposal of BMW, but only:
 - 30% of the doctors and
 - 20% nursing staff have more than 70% knowledge about biomedical waste management.
 - This shows that the people with higher education have more awareness about the environmental issues, national and International activities on biomedical waste management and the rules prescribed there in.
 - These findings are in similar to the study conducted by S. Saini et al.⁴

Attitude

Almost whole of the staff (Doctors and Nurses) showed a positive attitude towards the need for measures for safe collection and final disposal of BMW and supported the ongoing efforts.

- 100% doctors and
- 60% nurses have a positive attitude towards Biomedical waste management.

These findings are in contrast to the study conducted by S. Saini et al.⁴

Practices:

70% of the doctors and 65% of the nurses were practicing more than 70% of the correct practices as per the norms of the university.

These findings are in support to the Pandit et al.⁵ This study reported that proper hospital waste management was not being practiced.

The comparison of Knowledge, with Attitude and practice of groups shows that the people with high education, as doctors have better knowledge, attitude and practices of BMW management. This can be attributed to their accountability and commitment in patient and ward management.

Although nursing staff have relatively less knowledge about the BMW management rules, but a good percentage of this category has a positive attitude and follow the correct practicing habits.

Findings similar to that in our study were observed by Rao et al.⁶ In this study the need to periodically acquaint the participants with the updated BMW management and handling rules was felt.

V. CONCLUSION (RECOMMENDATIONS)

Based upon the observations of our study we recommend that:

All the employees of various designations are required to be aware of proper collection, segregation, and transport to the final disposal point.

A single training session is not sufficient for effective and complete practice of biomedical waste management.

There is a need for intensive training programs at regular time interval to repeatedly train and re-train all the staff with special importance to the new comers and to periodically acquaint them with updated BMW management.

There is also a need for orientation programs for newcomers to understand the hospital function and the proper collection and transport of hospital waste.

We recommend that strict supervision and surveillance should be followed in day-to-day hospital waste management activities.

The entire waste management practices should be a part of total hygiene practice of the society rather than confining to hospital and health facility.

ACKNOWLEDGMENT

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The RTA and the Assumption of Incest in the Drama of twins: Yama –Yami in the Rig Veda

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Abstract- Without scrutinizing the meaning, vitality, and significance of the rta in the Rig Veda, one can not appropriately approach those complicated and complex events and conducts like the Yama-Yami drama. The Rta is the dominant regulator and observed direction in the Rig Veda. It is the law of justified order of things and conduct. The sun, the moon, the stars, seas, oceans, and the phenomena of nature with human beings are ordered according to the rta. The rta is the controlling authority and core of the universe. It seems to be the unchanging law in the Vedic tradition. In addition, it also appears to be the moral codes of conduct of both the deities and mortal creatures. The rta is called holy law by the clever rsis and supported by the great lords of Deities like VARUNA, INDRA, MITRA, and ARYAMAN. No mortal and immortal creatures should violate the rta.

Yama could not have done but right deed. Otherwise the incest of Yama would have fumed furious anger of the lords of adityas of the Vedic Aryans.

Index Terms- the rta, incest, the first human couple, mythical drama, love, sin, tradition. Yama, Yami, Mashya, Mashyana, metaphorical setting, ethical.

I. INTRODUCTION

No one can disbelieve that the dramatic myth of Yama and Yami is, if not the only, but one of the most significant Vedic myths that denotes theologically semantic and ethical magnificence. So, using literary criticism's terminology, the act, react, conflict, rising action, climax, falling action, and the innocently peaceful resolution of this terse 'life commencing drama of man' must have been godly engineered though the rsis decorated the drama.

It could have, however, been a devastating catastrophe, violation, and destructive happening to the Rta if Yama had responded to Yami positively in their romantic stage of dialogue: (one of the most wonderful stages of talk in the earliest literature of mankind). But it could have been a fearful and endangering threat to social world of the Vedic belief if it had gone otherwise. If Yama had accepted the lusty-biological desire of his sister, Yami, to bed with her, Varuna, Mitra, and all supporters and superior deities of the rta would have been in frightening rage and furious unrest. Because the act of refusal and denunciation of the rta trembles the whole establishment of the rsis and established relations. Varuna and Mitra, and also other Adityas pursue the sinful and all creatures amongst human committers or

non human committers of all kinds. Because the rta indicates order, ethics, and the universal discipline and principles on the basis of which everything is regulated.

What Arthur Emanuel Christensen (1845-1875), the young Danish mythologist, and one of the first pioneers of Iranian studies in recent times has bravely said something about the 'manipulation of the drama by the Vedic rsis' does not seem to be right. At least, it is not well and convincingly evidenced. The Irano-European mythologist does not give reason and argumentation regarding his hypothesis. He fails to consider textual and historical reasoning. The assertion the writer goes to does not persuade the mind to get it more seriously than before; nor does it pass farther than the actual sayings in the Rig Vedic dialogue in the tenth Mandala. This may conceivably apply to most writers up to Wendy Doniger O'Flaherty who have written on Yama and Yami. The mythical dramas of both Vedic and Avestan narratives of the twins Mashya-Mashyana and Yama-Yami have, however, to be scrutinized together with the vedic rta, the functions of Varuna and Adityas, the Avestan Asa, and the functions of Ahura Mazda and Amesha Spentas. The inclusion of the latter is crucial in proper analysis and reliable comprehension of the above Indo-Iranian complex myths.

The rta is actually "the path of morality to be followed by man". It is the "law of righteousness observed even by gods." (Radhakrishnan, 2010, p.53. the first Edition, 1923).

Therefore, all deeds and acts are, and should be regulated according to the rta. Yama could have not done otherwise. Wedding of brother and sister is forbidden in the Vedic society. The dramatic myth of Yama and Yami within its structure represents significant issues and it challenges many faulty

misinterpretations and hypotheses about religious-human dilemmas.

II. THE WORLD OF MYTHS

It seems that in the world of myths usually everything can happen illogically, sometime less and perhaps in certain events logically. In the tragedy of Prometheus Bound written by Aeschylus, the Greek Prometheus there can steal fire from heavenly gods and give it to the earthly mortal creatures. Tiresias the wise and blind soothsayer, descended from Oudaeus, in the Sophocles' tragedy of Oedipus the King, can predict the future fate of Thebes happening to the people there. Cerci the bewitching whore, in the Homer's, can bewitch the bravest and the most powerful Greek heroes. One set of potential human couple Mashya and Mashyana grows like a set of plants out of forty years of processing being under the air, the sun, and the soil. They are metamorphosed and clutched together. There is apparently no specific limit or any fixed and distinguished laws or regulations. They eventually become complete male-female pair to reproduce their descendants.

Nonetheless, myths have their own logic, seeds, and clusters. The personification of things and forces, of phenomena, as well as abstractions are widely and repeatedly allowed and the composers have freedom and poetic license to manipulate and manufacture their imaginatively made- narratives. Myths have got their own logic, initiation, making process far more meaningful than Strauss's structural 'mythemes' and those of subjectivists' features space- timelessness and settingless dangling. It appears that the clusters, seeds, instruments, mental and non-mental means have been available to myth-makers are more possibilities than those to their critical and theoretical counterparts.

One of the first and also the best dramatic narratives and representations of the mentality of man in the earliest stages of his fictional creation that is still remained in the existing Rig Veda, Mandala X, hymn 10, is the drama of Yama and Yami: the first Aryan tribal couple, the first parents of men.

Moreover, the parallel of the Rig Veda's couple with the Iranian mythic couple of Mashya and Mashyana both make beautiful dramatic set. The latter is, however, more developed and dramatized (Wendy Doniger,1974,1994 Hindu Myths,p.64). Nevertheless, the plot and the story in its dramatic context, of course, are more extended and connected to later and the whole future generations of the races of man in Iranian versions of the Avestan Scriptures..These are absolutely the most ancient dramatic mythic literature of the world that man has ever inherited.

The Mythic Drama of Yama and Yami : Yama [male] and Yami [female] In the Rig Veda

However, both the interior and exterior formation and configuration of the two versions of the dramatic myth of the first Aryan couple from which many future generations initiate different human races on the earth are technically literary. Imaginations cultivate and sprout the plot. The versions are beautifully and imaginatively concrete fictional drama. Consequently, the credibility of the characters, of design, and of

the plot together make up the process of development explorable and also persuasive. It is like a sensible and modern drama.

The Iranian version and variation of this dramatic myth of the earliest literature of man is, particularly, plotted with necessary elements of plot structure, extended and profounder in length, height, depth, and horizon. In other words, the Iranian version of this drama of the first Aryan couple of the Indo-Aryan genealogy is well designed, structured and processed and constructed horizontally and vertically. It seems to have been musically composed. It is or can be in one way or another musical drama. It appears that the drama of Mashya and Mashyana has been positively made. The story of drama tracks and is hunted down to progenitor: Gayomart and his determination with Ahura Maza, his supported victory over devils and darkness, and therefore his overwhelming succession through life and regeneration of man. The drama and Gayomart also get going to the future.

The Drama of Yama and Yami: the Dialogue

Yama to Yami: " Surya is our father and his wife Saranyu is our mother. We are brother and sister." Why should you desire something deviating? It is certain formal norms, regulations, and ethical code to be observed. This is what Yama means, among other things.

Yami to Yama: "In this lonely and abandoned Island, I feel attracted to you You have been with me since I was in mother's womb." [Those norms, regulations, and watching agents and agencies are ignored. "I seek your companionship "....." She has emphatically a biological appetite to physically communicate with a male (her own brother)

Yama to Yami: "I, Yama, your brother do not agree with you. I do not want such companionship. Being my sister, it is not right for us to have such relation. The deities ... who reside in heaven, are watching us." This is a religious argument and theological reasoning. This portion of dramatic dialogue represents a sense of spiritual as well as moral transcendence that has been assumedly lead from certain believes available and held by the Vedic society and the rsis. It is not simply ritual, it is rather the set of codes of behaviour

Some scholars and writers who look into Indo-Iranian mythology, especially those modern Europeans, may see this seemingly loving dialogue between the female and the male as a break of law and tradition. It does contains such potentialities in itself. It seems, nevertheless, that tradition, responsibility, and honour resist against desire in the context of the drama at the time. It also appears that ancient Aryans in two – three thousand years before Jesus Christ had indeed the criteria of behavior, and deed held conventions of men or God and observed moral regulations. Yama and Yami, as many researchers emphasized, were not the definite ancestors of human race eventually. Religion and believes were so strong in Iran that people were not allowed so easily to break law and commit deviations.

The hymn of the tenth Mandala (=book) of the Rig Veda is a sort of dramatic exposition of Yama and Yami. It is a modern point of view of a dramatic setting as if you were reading one of those lovely and well structured Shakespeare's plays miniaturized. Nevertheless, in the hymn there is the self-exposition of siblings

with the parents named Surya as father, and Saranya as mother of the two. The hymn of the Rig-Veda represents a desirous dialogue with romantic tone and sensual appeal contains fourteen verses of considerable suggestive intonation, air, and erotic words but completely in a metaphoric setting. It is wonderfully a celebrated drama implicitly exploring theological issues of its own verbal nature

It represents a moral discourse with its own philosophical and ethical standards. Distinguishing between right deed and wrong act is significantly theological:

"We have never done such a thing before. We should not follow the path dishonor. We should be truthful and stay away from falsehood ... we are brother and sister." (RV. 10.4) That is not only a self-proclaim criterion, certainly.

It is interesting that the suggestion is emphatically from Yami (female) side and she justifies her lusty desire and sensual appeal: "such a relationship is banned for mortals, but we are not mortals." Disallowance is "for mortals" is a self-pronouncement decree arousing from an emotional trend and biological desire. And the rta is the clear law and ethical criteria which never allow such an act. On the other hand Yama is well aware and theoretically confident that this sort of behavior has never been taken place before. Moreover, the issue of Yami's saying of her being immortal with sensual appeal still questions the metaphor of love and desire of her femininity.

The issue indeed is something beyond the will and desire of Yama, the individual persona: "these ... deities... neither stop nor ever close their eyes to anything." Yama not only argues that the deed itself is not right but also emphasizes that there has been no any trace of this relationship in his line and stock of ancestors available. The reference standard is non-existent. The new reason is an additional prohibiting ban. The viewers, spies, and live spectators are present and watching us. "A person who commits intercourse with his own sister is considered to be a great sinner." "They can not give birth to any children legitimately whatever natural object they symbolize.

The last verse of the tenth song of the tenth mandala which is a dramatic piece of dialogue between Yama and Yami verbally and literally communicates devaluation, de-validation, and falsification of any incest assertion and inference from the myth. Perhaps, merely the direct semantic explication of the tenth Madala of the great Rig Veda concludes that the issue of mythic incest of the parents of the Aryan men and women in the world is out of question and of validity. The initiation of mythic incest is completely invalid. The whole hymn devalue the incest opinion of some writers and mythologists who may carelessly point to the surface of the dramatic dialogue of brother and sister as the first Aryan parents of man, : O "Yami! Like a vine or a rope, why do you not embrace another man? Let that man reciprocate your feelings. Try to win his heart and he would do the same. You should have intercourse with that man and be blessed with a son". (The Rig Veda, trans. by Dr. Ganga Sahai Sharma, Vishv Books, New Delhi, date?)

The Actual Dramatic Dialogue of Yama and Yami in the Rig veda

[the text is translated by Griffith, Ralph T.H: The Rig Veda, book X, hymn 10, pp. 422-24].

1. FAIN would I win my friend to kindly friendship. So may the Sage, come through the air's wide ocean, Remembering the earth and days to follow, obtain a son, the issue of his father.
2. Thy friend loves not the friendship which considers her who is near in kindred as stranger. Sons of the mighty Asura, the Heroes, supporters of the heavens, see far around them.
3. Yea, this the Immortals seek of thee with longing, progeny of the sole existing mortal. Then let thy soul and mine be knit together, and as a loving husband take thy consort.
4. Shall we do now what we ne'er did aforetime? we who spake righteously now talk impurely? Gandharva in the floods, the Dame of Waters-such is our bond, such our most lofty kinship.
5. Even in the womb God Tvastar, Vivifier, shaping all forms, Creator, made us consorts. None violates his holy ordinances: that we are his heavens and earth acknowledge.
6. Who knows that earliest day whereof thou speakest? Who hath beheld it? Who can here declare it? Great is the Law of Varuna and Mitra. What, wanton! Wilt thou say to men to tempt them?
7. I, Yami, am possessed by love of Yama that I may rest on the same couch beside him. I as a wife would yield me to my husband. Like car-wheels let us speed to meet each other.
8. They stand not still; they never close their eyelids, those sentinels of Gods who wander round us. Not me-go quickly, wantons, with another, and hastens like a chariot wheel to meet him.
9. May Surya's eye with days and nights endow him, and ever may his light spread out before him. In heaven and earth the kindred Pair commingle. On Yam! be the unbrotherly act of Yama.
10. Sure there will come succeeding times when brothers and sisters will do acts unmeet for kinsfolk. Not me, O fair one, seek another husband, and make thine arm a pillow for thy consort.
11. Is he a brother when no lord is left her? Is she a sister when Destruction cometh? Forced by my love these many words I utter. Come near, and hold me in thy close embraces.
12. I will not fold mine arms about thy body: they call it sin when one comes near his sister. Not me, prepare thy pleasures with another: thy brother seeks not this from thee, O fair one.
13. Alas! thou art indeed a weakling, Yama we find in thee no trace of heart or spirit. As round the tree the woodbine clings, another will cling about thee girt as with a girdle.
14. Embrace another, Yami; let another, even as the woodbine rings the tree, enfold thee. Win thou his heart and let him win thy fancy, and he shall form with thee a blest alliance.

III. THE RTA AND FICTITIOUS INCEST:

The Hermann Oldenberg's explanation of the rta is the reasonable conceivably in the whole ground and grammar of the context of Yama and Yami's drama in the Rig Veda (Oldenberg, 1896, 1916, pp. 106, 146, 149). Obeying Yami's request is breaking and violating the divine orders, and that is confronting the system of the Rta which is the holy realm of gods, great gods like Mitra, Varuna, Aryaman, and all magnificent Deities..The case is a forbidden zone. It is realized a great sin.

The rta, its existence, objectivity, concreteness, supported-controlling power, gods-backed superiority, and its overwhelming universality act through different and available means of cult reality and deities. It is a forceful and enforced rule and law as well as practical ethic that dominate over the world of mortals and immortals. The rta is an established sovereignty mighty enough that Yama can not ignore though his sister Yami persuades him to violate it. The rta manifests and demonstrates itself in every bit field of life. Yama and Yami as the first mortal pair with their rather complexities, have but subjected to the **rta**.

THE Mythical Drama in the Avestan Scriptures: Mashya, Mashyana:

And

The Races of Man

Mobad Rostam Shahzadi the Iranian writer in his Dictionary of Pazand (2007) also defines Mashya and Mashyani, or Mashya and Mashyane as follow: " Mashya is the first Aryan man of the sperms of Kayomarth (=Gayomart=Gayomard=Gayomartan= Gayomaten) and Mashyani is the first Aryan woman from the seed of Kayomarth (=Gayomart). These man and woman are born of a Rivas=Rhubarb" (Shahzadi, Rostam(ed. by Shahzadi, Mehrangiz, published by Farvahar, Tehran, 2007, P.302).

Also 'The Records of Mythic and Legendary Heroes and Characters in Shahnameh and other Persian Epics', the fourth chapter title of ' The Selected Articles of The Encyclopedia of Persian Language and Literature', the First edition, vol. 1, printed by The Academy of Persian Language and Literature, Tehran, 2011.pp. 297-689, spends a few pages on Gayomarth(Kewmarth) the father of the couple. This is one of the best and well evidenced chapters of an encyclopedia printed so far about the topic. This first edition of the latest articles is on the occasion of the International Congress of the Mellenium of Shahnameh and the great Persian epic poet: Abul Ghassem Ferdowsi(10th c.).

According to various and reliable recorded sources, researches, and the text introduced above (pp.299-307) Kewmarth(= Gayomard) literally means ' living mortal', ' mortal man'; his creation takes seventy days from "Ram day" to "Aniran day"(from 9th January to 20th March). He is holy man who does think good, do good, and do good. He has all three good attributes: Good will, Good speech, and Good deed. onHis death is the creation of life and the seeds of living. He is a paradoxical phenomenon: he is present in life as he passes away. After his producing man's seeds and generating eight basic and valuable metals, he dies. His seven descendants later govern seven countries.

In the existing mythical narratives there might be considerable number of parallel myths of mythical couples in

different versions and transformations. The first human couple in the Avestan literatures and Iranian mythology there are various pair name of the same stock: Mash-Mashan, Mishi, Mishan, Mishah-Mishani, Mahla-Mahlina, Meshah-Meshyanah sperms. These variations of the first human pair (the Aryan pair) are originally, as it is emphasized, from the back bone of Gayomart.

Arthur Emanuel Chritensen(1845-75), one of the youngest western Iranologists and scholars, and one of the good Danish friends of Iran's ancient culture, amongst other fair orientalists ,has also spent several pages of the first volume of his ' the First Man and the First King' on Mashya and Mashyana, and there he refers to different concerned Persian sources of classic and original authorities, such as the Avesta, the Avestan Scriptures, Ibn Athir, Alberuni, Shahrestani, Tabari, Ferdoussi's Shahnameh and so on.

Original story is that when the death time of Gayomart approaches, he falls down in his left side on the earth and his sperms pour into the earth and the process of their purification under the sun's warmth take place.

It is after forty years of being in the soil of the earth that the Gayomart's semens bear the pair in the form of Rivas plant (Rhubarb) with fifteen leaves. They were interwoven together in such a way that from their shoulders, hands and back were attached and connected with each other on the earth.

This dramatic and also the mythical story of Gayomart, Mashya and Mashyana(Mashyag, Mashyang) have been repeatedly recorded, narrated, and confirmed. Sometime it is commented by different Iranian writers both Muslim and Zoroathurian: Alberuni in his Athar al Baghiya, Tabari in his History, and Bala'ami in his Kings and Prophets. Yashts and Persian poetic works, like Shahnameh are also the most famous books talking about the mythical characters named.

Gayomart is indeed the first mythical man-like creature made on the earth to assist Ahura Mazda. Gayomart from whom the Aryan race is developed is called the prototyped man.. He is genuinely and meaningfully immortal mortal. This is a paradox that should be explained in its own contextual setting.

All Pahlavi documents, relevant texts and the Avestan

scriptures have narrated this mythical narrative of the pair who

are from rhubarb-Rivas-plant. (Christensen, Arthur, Les types du

premier homme et du premier roi dans l'histoire legendaire des

Iranien 2 vols, Persian trans. P. 67) The narrative avoids to

accept the normal blame of incest. John Russells Hinnells his

reports that Mashya and Mashyana do what their duties are to

generate " all human races"(Hinnells, 1975, 'the First Parents of

Man', Persian Mythology). Henrik Samuel Nyberg, the Swidish

Iranologist, in his 'Ancient Religions of Iran' holds that,

according to Zoroastrian belief, the mortal life of the present man

compounded with vices and sins is the result of the named couple's marriage in the third stage of the four three-thousand year categorized periods(Nyberg, 1938, ch.II) .

IV. METAMORPHOSIS

It can legitimately get away from the accusation of incest because it has undergone a fundamental metamorphosis. This phenomenon of metamorphosis is the great and impressive as well as deep challenging issue in the hard-cover binding of the incest book of Mashya and Mashyana

Ahura Mazda to this first human couple says: "you are men, I created you. You are the two predecessors of the human being of two of yourselves, I made you complete and the best in the best way of this kind:

Good thought, Good Deed, Good Word: Thou Do Not Pray Devils [DeeVs]

The scripture about Mashya and Mashyana is from a translation of the Farsi Avestan texts into English: Bundahishn 23, scriptures of Zoroastrianism , [http:// www. Hindu website. Com / sacred scripts/ zoroscripts/ Bundahishm. chapter X to XV.](http://www.hinduwebsite.com/sacred_scripts/zoroscripts/Bundahishn.chapter_X_to_XV)[See also the English versions of the Sacred Books of the East ,Oxford University Press, chapter XV.]

V. MASHYA AND MASHYA : THE SPREAD OF MEN

1. On the nature of men it says in revelation, that Gayomard, in passing away, gave fourth seed; that seed was thoroughly purified by the motion of the light of the sun, and Neryosang kept charge of two portions, and Spandarmad received one portion.

2. And in forty years, with the shape of a one-stemmed Rivas-plant, and the fifteen years of its fifteen leaves, Matro [Mashye] and Matroyao [Mashyane] grew up from the earth in such a manner that their arms rested, behind on their shoulders (dosh), and one joined to the other they were connected together and both alike.

3. And the waists of both of them were brought close and so connected together that it was not clear which is the male and which the female, and which is the one whose living soul (nismo) of Ohrmazd is not away.

4. As it is said thus: Which is created before, the soul (nismo) or the body? And Ohrmazd said that the soul is created before, and the body after, for him who was created; it is given into the body that it may produce activity, and the body is created only for activity;' hence the conclusion is this, that the soul (rhubarb) is created before and the body after.

5. And both of them changed from the shape of a plant into the shape of man, and the breath (nismo) went spiritually into them, which is the soul (rhubarb); and now, moreover, in that similitude a tree had grown up whose fruit was the ten varieties of man.

6. Ormazd spoke to Mashye and Mashyane thus: 'You are man, you are the ancestry of the world, and you are created

perfect in devotion by me; perform devotedly the duty of the law, think good thoughts, speak good words, do good deeds, and worship no demons!'

7. Both of them first thought this, that one of them should please the other, as he is a man for him; and the first deed done by them was this, when they went out they washed themselves thoroughly; and the first words spoken by them were these, that Ormazd created the water and earth, plants and animals, the stars, moon, and sun, and all prosperity whose origin and effect are from the manifestation of righteousness.

8. And, afterwards, antagonism rushed into their minds, and their minds were thoroughly corrupted, and they exclaimed that the evil spirit created the water and earth, plants and animals, and the other things as aforesaid.

9. That false speech was spoken through the will of the demons, and the evil spirit possessed himself of this first enjoyment from them; through that false speech they both became wicked, and their souls are in hell until the future existence.

10. And they had gone thirty days without food, covered with clothing of herbage (giyah); and after the thirty days they went forth into the wilderness, came to a white-haired goat, and milked the milk from the udder with their mouths.

11. When they had devoured the milk Mashye said to Mashyane thus: 'My delight was owing to it when I had not devoured the milk, and my delight is more delightful now when it is devoured by my vile body.'

12. That second false speech enhanced the power of the demons, and the taste of the food was taken away by them, so that out of a hundred parts one part remained.

13. Afterwards, in another thirty days and nights they came to a sheep, fat and white-jawed, and they slaughtered it; and fire was extracted by them out of the wood of the lote-plum and box-tree, through the guidance of the heavenly angels, since both woods were most productive of fire for them; and the fire was stimulated by their mouths; and the first fuel kindled by them was dry grass, kendar, lotos, date palm leaves, and myrtle; and they made a roast of the sheep.

14. And they dropped three handfuls of the meat into the fire, and said: 'This is the share of the fire.' One piece of the rest they tossed to the sky, and said: 'This is the share of the angels.' A bird, the vulture, advanced and carried some of it away from before them, as a dog ate the first meat.

15. And, first, a clothing of skins covered them; afterwards, it is said, woven garments were prepared from a cloth woven in the wilderness.

16. And they dug out a pit in the earth, and iron was obtained by them and beaten out with a stone, and without a forge they beat out a cutting edge from it; and they cut wood with it, and prepared a wooden shelter from the sun (pesh-khur).

17. Owing to the gracelessness which they practiced, the demons became more oppressive, and they themselves carried on unnatural malice between themselves; they advanced one against the other, and smote and tore their hair and cheeks.

18. Then the demons shouted out of the darkness thus: 'You are man; worship the demon! so that your demon of malice may repose.'

19. **Mashya** went forth and milked a cow's milk, and poured it out towards the northern quarter; through that the demons

became more powerful, and owing to them they both became so dry-backed that in fifty winters they had no desire for intercourse, and though they had had intercourse they would have had no children.

20. And on the completion of fifty years the source of desire arose, first in **Mashye** and then in **Mashyane**, for **Mashye** said to **Mashyane** thus: 'When I see thy shame my desires arise.' Then **Mashyane** spoke thus: 'Brother **Mashye**! when I see thy great desire I am also agitated.'

21. Afterwards, it became their mutual wish that the satisfaction of their desires should be accomplished, as they reflected thus: 'Our duty even for those fifty years was this.'

22. from them was born in nine months a pair, male and female; and owing to tenderness for offspring the mother devoured one, and the father one.

23. And, afterwards, Ormazd took tenderness for offspring away from them, so that one may nourish a child, and the child may remain.

24. And from them arose seven pairs, male and female, and each was a brother and sister-wife; and from every one of them, in fifty years, children were born, and they themselves died in a hundred years.

25. Of those seven pairs one was Siyamak, the name of the man, and Nasak of the woman; and from them a pair was born, whose names were Fravak of the man and Fravakain of the woman.

26. From them fifteen pairs were born, every single pair of whom became a race (sardak); and from them the constant continuance of the generations of the world arose.

27. Owing to the increase (zayishn) of the whole fifteen races, nine races proceeded on the back of the ox Sarsaok, through the wide-formed ocean, to the other six regions (karshwar), and stayed there; and six races of men remained in Xwaniratha.

went to the plain of the Tazhikan (Arabs); and of one pair Hooshang was the name of the man and Guzhak of the woman, and from them arose the Airanakan (Iranians); and from one pair the Mazendarans have arisen.

29. Among the number (pavan ae mar) were those who are in the countries of Surak, those who are in the country of Aner, those who are in the countries of Tur, those who are in the country of Salm which is Arum, those who are in the country of Seni, that which is Chinistan, those who are in the country of Dai, and those who are in the country of Sind.

30. Those, indeed, throughout the seven regions are all from the lineage of Fravak, son of Siyamak, son of Mashye.

31. As there were ten varieties of man, and fifteen races from Fravak, there were twenty-five races all from the seed of Gayomard[= Gayomarten, Gayomartan]; the varieties are such as those of the earth, of the water, the breast-eared, the breast-eyed, the one-legged, those also who have wings like a bat, those of the forest, with tails, and who have hair on the body.

VI. THE ISSUE OF INCEST, AND LOVE OFFSPRING IN THE MYTH OF YAMA AND YAMI

The view of incest [in the Mashya and Mashyana dramatic story, in the Avestan scriptures, and in the dialogue of Yama and Yami, in the Rig Veda] is not fully enough explicated and considered. The cores of the texts do not accept the opinion

of nicest accusation. That means the myths do not substantiate do not support and do not furnish the opinions and judgments of incest about themselves they do not assess and do not see the whole play on the stage of a drama of incest. The structural fabrication, the actual verbal dialogue, the systemic Vedic belief, and semantic suggestions and indications of versions of both the Rig Veda the Avestan scriptures do not support the hypothesis of incest.

The domination, enforcement application, observance, and seriousness of the enactment of the rta in the Vedic society would deny and encounter any sinful commitment of the worldly mortal and other worldly immortals.

The direct and clear response of Yama to Yami at the end of the dialogue denies and refutes the opinion of incest in the Rig Veda (see the actual texts and dialogue between Yama and Yami up to the end). The actual words and statements avoid immorality and illegitimacy. The complete drama rejects the belief of men being bastard or love offspring of illegal intercourse. The climax of the play in its falling action resolves the conflict in the benefit, calmness, and the release of man that is found not guilty.

It could have been a devastating catastrophe and violation happening to the Rta if Yama had responded to Yami positively in their romantic stage of dialogue: one of the most wonderful stages of talk in the earliest literature of mankind. But it could have been a fearful endangering threat to social world of the Vedic belief. If Yama had accepted the lusty biological desire of his sister: Yami, Varuna, Mitra, and all supporters and superior deities of the rta would have been in frightening rage and furious unrest. For the act of refusal and denunciation of the rta trembles the whole established relations. Varuna and Mitra, and also other Adityas pursue the sinful and all creatures amongst human committers or non human committers of all kinds.

The question of the story in the Avestan scriptures is different, in one way or another. The characters are completely and substantially metamorphosed in the Avestan texts.. The characters of the drama of the first Aryan couple of the world are metaphorically transformed to something freakish at the first sight. It becomes somehow incredible and grotesque. The contents and elements of the Avestan drama is not like that of the Rig Veda. (see Mashya and Mashyana). It does not seem to be the one that is established. So, the approach and plot appears to require different kinds of touch and criticism. Even the text is not well and enough explicated or semantically analyzed yet. The story, plot, contradiction, challenges, initiation, characterization, substance, nature and features of all ingredient "mythemes" (using Strauss's terminology) are simultaneously challenging with that of dramatic scene of Yama and Yami in the Rig Veda. Still we need, along with comparative explications and analyses, to look on those dramatic and romantic as well as theological aspects and issues of these particular myths and their literature and language significances.

As a comparative introduction to the sacred myth as well as sacred romance of the Vedic Yama and Yami of the Rig Veda (hymn 10, Book X), some comparison and analytical points are considered. Remember the above paragraphs, however, anticipate, and indeed, contextualize further analytical explication and comparison by other scholars and critics. So, this can be regarded as the smaller outline of a larger explication of the Vedic hymns and Avestan Scriptures by the first Aryan

migrants' literature with a common, and indeed pre-religious, mentality, familiarity, and homogeneous mind and soul,.

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MultiFrame Fast Search Motion Estimation and VLSI Architecture

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Abstract- This paper presents a fast Motion Estimation algorithm concept with reduction in execution time, which provides low power consumption in the design of hardware architecture. A new VLSI architecture for Integer Motion Estimation based on the Full search algorithm is proposed. This architecture uses Sum Of Absolute Difference (SAD) operation, the commonly used metric to determine the best match of the blocks. Computations and comparisons are performed using Carry Save Ahead Adder (CSA) and Carry Look Ahead Adder (CLA) for SAD operation. The design has been implemented on the Xilinx Spartan which depicts the characteristics of memory used, and power consumption. Fast search algorithm reduces search area by determining motion vectors for multiframe instead of single frame. The Motion Estimation algorithm is the most computationally intensive part of the encoder which is simulated using MATLAB. The proposed algorithm gives us a fast processing time schedule with a fixed number of computations. Multiframe motion estimation speeds up the computation time and the simulation results show that PSNR value is high compared with the single frame process and computation time is reduced with negligible performance degradation.

Index Terms- Motion Estimation, Fast search algorithm, SAD Hardware Architecture.

I. INTRODUCTION

Motion estimation and motion compensation are the predictive techniques for exploiting the temporal redundancy between successive frames of video sequence. For encoding, Block matching motion estimation takes a maximum part of the processing time. An MPEG video, is represented as a sequence of frames and the small differences existing between the frames are realized by the process of motion vector. This best motion vector is obtained by full-search block matching algorithm and various fast searching algorithms. Full search block matching algorithm provides the optimal solution by exhaustively comparing each (NXN) block of the current frame with all the candidate blocks of (N+2p)² search window. In video coding system, Motion estimation (ME) plays a key role to improve coding efficiency by reducing temporal redundancy within video sequence. ME takes more than 50% computational complexity in H.264/MPEG-4 AVC [1] which is the state-of-the-art video compression standard. Block matching algorithm, which is ME algorithm used in H.264/MPEG-4 AVC, is based on dividing a frame into MacroBlocks (MBs) (16x16 pixels), and

searches for the best matching block with current MB within search area in a reference frame. ME process requires very high computational complexity, and it has been implemented as a dedicated hardware with reduced memory area and low power consumption. Several search techniques like Full Search [2] Fast Full Search [3] and Fast Search are present. Full search algorithm matches all possible candidates with a minimal distortion to find the displacement. ME refines the best candidate for each sub blocks using two stages Integer Motion Estimation and Fractional Motion Estimation. [4] During the first stage 41 motion vectors are determined using various searches. In IME, to determine the Motion Vector (MV), the integer pixel searches the best matching integer position using performance cost metric Sum of Absolute Difference (SAD), Mean Square Error (MSE) and Mean Absolute Difference (MAD) which gives a numerical data about how similar two blocks are.

$$MAD = \frac{1}{N^2} \sum_{i=0}^N \sum_{j=0}^N |I(k+i, l+j) - I(k+i+m, l+j+n)| \quad (1)$$

MAD cost function's simplicity and ease of implementation in hardware tends to overemphasize small differences giving an inferior result to MSE.

$$MSE = \frac{1}{N^2} \sum_{i=0}^N \sum_{j=0}^N |I(k+i, l+j) - I(k+i+m, l+j+n)|^2 \quad (2)$$

$$SAD = \sum_{k=0}^{M-1} \sum_{l=0}^{N-1} |C(k, l) - R(k+l, l+j)| \quad (3)$$

In equations (1)&(2) $I(k+i, l+j)$ and $I(k+i+m, l+j+n)$ are the pixels of reference and current frames respectively. (j, n) represents the displacement of the candidate frame within the search window. In equation (3) $C(k, l)$ & $R(k+l, l+j)$ are the pixels of reference and current frame.

In algorithms [4] [5] center position of next searching step is not known until the minimum search step is found which leads to critical issues in latency and pipelining cycles. [6] Full search motion estimation algorithms follow a regular search pattern and usually provide superior visual quality in terms of PSNR compared to other motion estimation algorithms. [7] PSNR measures the difference between two images and gives a result in a figure of decibels. Higher values of PSNR result in small differences between two images [8].

In this paper, motion vectors for a single reference frame and multiframe are determined for sample sequences and a comparative analysis is done based on PSNR value and computation time for the cost metrics MSE and MAD. The rest of the paper is organized as follows: Section 2 deals with the features of PSNR values of multi frame motion estimation. Section 3 deals with the architecture design of SAD using CSA and CLA. Section 4 figures out the simulation results with the comparison chart. Section 5 concludes the paper.

II. FRAME MOTION ESTIMATION

Fast block matching algorithms Three Step Search (TSS), New Three Step Search (NTSS), Four Step Search (FSS), Diamond Search (DS), Adaptive Root Pattern Search (ARPS) reduces up the number of computations by decreasing the number of search points which leads to poor PSNR computations. Multiframe motion estimation is performed with reduced computation time and with minimum degradation in PSNR value of the motion compensated frame.

Table I represents the PSNR value and the Computation Time of Single Frame Processing for various video sequences using MSE

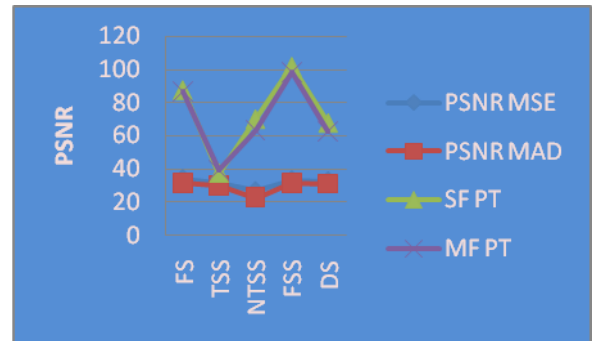
Video Sequence	Full Search(FS)		Three Step Search(TSS)		New Three Step Search(NTSS)		Four Step Search(FSS)		Diamond Search(DS)	
	PSNR	Computation Time	PSNR	Computation Time	PSNR	Computation Time	PSNR	Computation Time	PSNR	Computation Time
Akiyo_QCIF(518X350)@15 fps [2x2]	34.18	87.71	31.72	37.22	26.90	70.02	33.46	101.89	32.94	67.68
Car (320x240)@50fps[2x2]	23.8	122.0	20.9	50.57	17.3	90.3	26.6	113.58	23.51	178.3
Vipmen (160X120)@100fps[2x2]	27.80	30.93	26.12	13.6	22.92	22.21	31.18	24.02	27.75	37.37

Table II represents the PSNR value and the Computation Time of the proposed MultiFrame Processing for various video sequences using MSE

Video Sequence	Full Search(FS) (MultiFrames)		Three Step Search(TSS) (MultiFrames)		New Three Step Search(NTSS) (MultiFrames)		Four Step Search(FSS) (MultiFrames)		Diamond Search(DS) (MultiFrames)	
	PSNR	Computation Time	PSNR	Computation Time	PSNR	Computation Time	PSNR	Computation Time	PSNR	Computation Time
Akiyo_QCIF(518X350)@15 fps [2x2]	31.38	86.6	29.65	38.96	22.44	63.08	31.40	98.46	30.93	62.36
Car (320x240)@50fps[2x2]	19.97	120.03	17.9	50.06	15.45	88.9	22.4	122.86	23.51	173.8
Vipmen (160X120)@100fps[2x2]	21.62	28.67	21.69	13.5	18.50	22	27.51	25.41	23.8	37.00

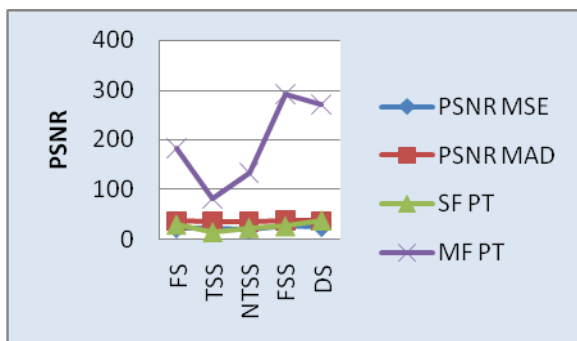
Table III represents the PSNR value and the Computation Time of the proposed MultiFrame Processing for various video sequences using MAD

Video Sequence	Full Search(FS) (MultiFrames)		Three Step Search(TSS) (MultiFrames)		New Three Step Search(NTSS) (MultiFrames)		Four Step Search(FSS) (MultiFrames)		Diamond Search(DS) (MultiFrames)	
	PSNR	Computation Time	PSNR	Computation Time	PSNR	Computation Time	PSNR	Computation Time	PSNR	Computation Time
Akiyo_QCIF(518X350)@15 fps [2x2]	51.20	88.95	48.8	39.46	44.44	69.65	51.16	103.38	50.3	169.4
Car (320x240)@50fps[2x2]	37.76	124.95	36.36	52.19	34.54	96.93	39.33	126.93	37.62	192.13
Vipmen (160X120)@100fps[2x2]	37.10	183.00	36.1	81.60	35.04	134.14	38.71	292.57	37.05	270.84



(a) Akiyo Video Sequence

(b) Car Video Sequence



(c) vipmen video sequence

Figure I(a)-(c) shows the PSNR value of MSE and MAD for the Akiyo video sequence. The Processing Time of Multiple Frame is minimum with slight degradation in the PSNR value. PSNR value of MAD gives best results when compared with MSE for Multiple Frames

III. VLSI ARCHITECTURE

The main characteristic of the proposed architecture is the large amount of Processing Element Units(PE's)that are used to calculate SAD (Sum Of Absolute Difference) metric. [8] The internal structures of the PE is composed by a large number of addition to calculate the SAD's. In this paper,SAD operation is very time consuming due to the complex nature of the absolute operation. For different search algorithms different address generation schemes are used. The resulting SAD's and motion vectors are stored in a small memory accessible through an external bus which acts as a communication bridge.[9]The Motion Estimation unit consists of Search Area (SA) memory, a processing array which contains 256 Processing Elements, Adder Tree, comparator and Decision unit. The data in the memory are stored in a ladder like manner to avoid delay. The 256 absolute differences are summed up by the adder tree and the outputs are the 41 block partitions. [10] Two types of adders CSA and CLA are processed and compared. The comparator updates the minimum SAD throughout the scanning process for the 41 block partition.

The proposed PE Units are proposed to calculate the SAD with reduced computation complexity and delay. The ME unit requires 256 clock cycles for each MB search. The input and output for the adder tree is 8 bits wide and the SAD output is 4 and 16 bits wide. These data are then input into the comparator, together with the current search location information.

Adder Unit:

The Carry Look Ahead [11] improves speed by reducing the amount of time required to determine carry bits. Carry Look Ahead logic uses the concepts of generating (G) and propagating (P) carries. The Carry-Look Ahead adder is broken up in two modules. Carry-Save Adders (CSA) is useful in situations when we need to add more than two numbers, since this design automatically avoids the delay in the carry-out bits. The proposed architecture is designed with CLA and CSA. Table IV results shows that replacement of CSA with CLA decreases the propagation delay and power consumption.

Figure 2: Generation of Motion Vectors

Table IV: Synthesis Report of Adder and SAD circuits

S.No	Parameters	Adder Unit		Motion Estimation Unit	
		CSA (8 bit)	Proposed CLA (16 bit)	SAD Unit (8 bit)	Comparator Unit (8 bit)
1.	Path Delay	21.831 ns	6.261 ns	6.236 ns	8.61 ns
2.	Memory Usage	185300 KB	156236 KB	160404 KB	160404 KB
3 .	Power Consumption	247 mw	227 mw	262 mw	167 mw

IV. CONCLUSION

In this paper an important coding tool of H.264 is the Motion Estimation matching algorithm. The motion estimation process from the current frame and the reference frame is simulated using Matlab software. The SAD architecture with the Adder units is implemented using Xilinx Spartan 3E FPGA. Five different algorithms for motion estimation are simulated and PSNR value for MSE and MAD values are determined. It is concluded that multiframe processing PSNR value of MAD

gives best results when compared with MSE value with increase in processing time.

APPENDIX

Appendixes, if needed, appear before the acknowledgment.

ACKNOWLEDGMENT

The preferred spelling of the word “acknowledgment” in American English is without an “e” after the “g.” Use the

singular heading even if you have many acknowledgments.

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Managing Changing Requirements

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Abstract- We cannot freeze requirements at the requirement gathering phase. Requirement changes after the requirement gathering phase because of various factors like business change, technology change, internal changes in the organization and better understanding of the problem. Managing Changing Requirements are very crucial for success of any software development and its organization. We have to manage the requirement so that we can achieve project objective as well as business objective. In this research paper, we will give a complete strategy that will work on the issues related to Managing Changing Requirements and will provide a solution to manage the Changing requirements. We will also give some precaution steps which can be used before implementing the strategy so that we can achieve requirement management in a more effective way.

Index Terms- Changing Requirements, Requirements, Requirement elicitation, Requirements Management.

I. INTRODUCTION

Requirements management for globally managed large scale projects is a complex task, primarily due to the involvement of several stakeholders, multiple technologies, enormous information, some internal changes in the organization and frequently changing business needs [1]. It has been identified that customer requests for changes in each development phase of a software project. However maximum change requests are received from customer in maintenance phase of the software project. It has been identified that if more changes are requested in early development phases, then fewer changes are requested in later development phases of a software project [2]. Managing Changing Requirements are very crucial for success of any software development and its organization. Although the analyst paid a full attention to collect the complete set of requirements, the requirements will still change after the analysis phase. If we do not manage these changing requirements we have to face various technical, economical and managerial problems.

Changing requirements is one of the major requirements related problems, and it is considered as a major cause of the failure of software projects [3, 4].

Before discussing the strategy, first I would like to discuss the various issues that are related to requirement management.

II. ISSUES IN REQUIREMENT MANAGEMENT

The major consequence of requirements problems is rework—doing something again that you thought was already done. Rework can consume 30 to 50 percent of your total development cost [5]. Requirements errors account for 70 to 85

percent of the rework Cost [6]. Getting the wrong requirements and developing a wrong system degrades the quality of the system. Another problem is ambiguity. It occurs when a single requirement has different meanings to different stakeholders, it leads to wasted effort. Another problem is gold plating, which means adding unnecessary features in the software which increase the cost of the software as well as the complexity. Managing requirements communicated through mediums such as emails, chat messages, etc. is difficult due the lack of explicit context and the extensive use of unstructured information. The result of all of these kinds of requirements problems is to slow the pace of software development. It doesn't do any good to work very efficiently on the wrong requirements. If we don't get the requirements right, it doesn't matter how well our team executes the rest of the project.

In some areas for example informal information gathering, implied functionality, inadequately defined requirements, and a casual change process, problem arise due to shortcoming in the ways that people acquire, document, agree on, and modify the product's requirements.

Therefore if we do not manage these changing requirements, we have to face various problems, for example-economic problems which are related to cost and schedule of a project, technical problems which are related to the defects, bugs and the low quality software, managerial problems which are related to the effect of technical and economical aspects on the sponsors and customers.

III. SIGNIFICANCE OF MANAGING CHANGING REQUIREMENTS

People often think that the changing requirements have bad impact to the software development process. The software development team needs to look at the optimistic part of changing requirements as it facilitates to reduce the risk of project failure and increase the quality of the resulting product. Getting the wrong requirements and developing a wrong system is the biggest risk to the project failure [7].

If we have a good quality software, than it will contain a very few bugs and errors which increase the customer satisfaction. If we manage requirements according to the market that the software will definitely compete well in the business which result the business success of the software. Adoption of latest technology will increase the success of the project. It also reduces the chance of system rejection upon rollout.

Therefore we must need a strategy, which will solve all the issues of requirement management and will provide a solution for it. Before I give the strategy for managing changing requirements, I want to give some precaution step before implementing this methodology on any software, so that we can achieve requirement management in more effective way.

IV. PRECAUTION STEPS

Precaution steps for managing changing requirement are given below-

4.1 Firstly we need to take care in requirement elicitation phase. We must gather only those requirements which are unambiguous, logically consistent, relevant, clear, can be completed within the available resources, realistic and improve the quality of the software. So that the requirements which does not fulfils these constraints cannot harm the software and development process in future.

4.2 During the development of the software, the development team must continuously interact with the stakeholders. In most of the organizations, during software development process, the development team interacts with the stakeholder only in requirement analysis phase. This should not be the case. The development team should ask the stakeholders about their problems and new ideas. It can be achieved by showing them the prototypes of the system. If we spend more time on requirements engineering in the early stages of a project, it's supposed to save our time later in the project.

4.3 Requirement creep occurs, when changes in the system requested by the stakeholders are very big such that it is impossible to control the cost and schedule of the system. Therefore we must avoid the big changes just to make the customer happy. We can add those extra features in other releases of the software.

4.4 There must be a way to maintain the requirement document. Every time when a new requirement is added or if there is any change in the requirement we must keep track of these things. It can be accomplished by giving a new version number to the requirement document. The changes can be highlighted in the requirement document. We can also store the old version of the documents for future analysis.

V. STRATEGY

This strategy consist of 8 steps, which are given below

5.1 First Step (Validating the new requirement)

First thing that we need to consider is look at the optimistic part of changing requirements. It means if we are not ready for implementing the changing requirements than for sure we cannot implement the changing requirements.

If from the start of the software development, we have no interest in working with these changing requirements, than at the latter stage of software development it will create a big problem because of our carelessness at the initial stages.

We have to set our mind for implementing these changing requirements. We need to consider that these changes are necessary and good for improving the quality of the software which will save our software from the biggest failure that is developing wrong software with wrong requirements. Therefore in first step we receive the changing requirements from any of the stakeholders.

5.2 Second Step (Appropriate classification of the requirement)

In second step we classify it according to its area. For example-Functional Requirement, Non Functional Requirement, Platform Requirement, Hardware Interface Requirement, Software Interface Requirement, External Interface Requirement, User Interface Requirement, Communication Requirement. It will help in clearly identify the different feature and properties of the proposed requirement. It also avoid various misunderstanding related to the particular requirement.

5.3 Third Step (Traceability)

In third step we perform traceability. That is we identify that if the proposed requirement is conflicting with other requirements. For example- if the new requirement is related to increasing the reliability of the software, than it will conflict with the complexity and usability requirement of the software.

Traceability matrix can help in tracing the requirement. It is used to verify that all requirements are met and to identify changes to the scope when they occur. Before implementing any new requirement or making changes in the existing requirement, we must have complete knowledge of the already existed requirements, so that we can find out the relation between the new or already existed requirements. Sometime, the new requirement can be added only when its previous related requirement is completed, traceability matrix gives us all these information regarding the already existed requirement.

Table 1: Traceability Matrix

Req#	Name	RFP#	DDD#	PPT#	TS#	Verification
1	Calculate DOB	CGA 001	DDD 001	3.2.3 4.1..2	TS 001 TS 015	Yes/NO
2						

Req#: Requirement Number; for each project requirement, begin to list them on the RTM in a numerical order and group them by function.

Name: Enter the name and brief description of the requirement

RFP #: Request For Proposal (RFP); specify the identification number of the requirement as listed in the RFP.

DDD #: Deliverable Definition Document (Also referred to as the Deliverable Expectation Document- DED); use the RFP requirement number as a reference for the DDD that is created for the requirement.

PPT #: List the MS Project Subtask and Task numbers that are associated with the requirement.

TS #: Test scripts should be prepared for the actual testing process.

Verification: Indicate the completion of the signoff process [8].

5.4 Fourth Step (Review of the requirement)

This step includes the review of the proposed requirement. All the stakeholders (end users, customers acquiring the product, requirements analysts, project managers, developers, testers, regulators and auditors, manufacturing staff, sales and marketing, and field support or help desk staff) are involved in the review. They give their opinion

for the proposed requirement. They also can accept or reject the proposed requirement. If any stakeholder reject the requirement than the owner of the requirement must modify his/her requirement according to the review of the stakeholder.

5.5 Fifth Step (Evaluation of the requirement)

A separate team which can be considered as the evaluation team for the proposed requirement evaluate all the reviews that are collected from all the stakeholders. Therefore In this step impact analysis is performed by the evolution team. The team evaluate the reviews on the basis of cost, schedule, risks, functionality, customer and external stakeholders. It will be accepted if, it clears the cost benefit analysis test, does not increase the schedule of the project to a uncontrollable range, does not conflict with other requirements, can be expressed in a clear and consistent notation, must be unambiguous, not over-constrain the design of the software, must be logical consistent, relevant and clear, must be achievable with the available resources, must be verifiable, it means there must be a way to test it for ensuring that it is correctly implemented, does not introduce the high level risks to the software for example- software failure, increase the functionality of the software or quality of the software and satisfy all the stakeholders, otherwise the team reject the proposed requirement.

5.6 Sixth Step (Documentation of the requirement)

According to evaluation result, if the proposed requirement is accepted than the owner of the requirement baseline the requirements. And it is documented and placed in subversion. Than all the parties affected by the new proposed requirement are informed, it is accomplish by the collaborative power of the Web to make requirements available to the entire team whenever and wherever they need them – not rely on a few individuals to remember to email out updates every time a change is made. And if the proposed requirement is rejected than the reason for disapproval of requirement are forwarded to the owner of the proposed requirement.

5.7 Seventh Step (Adjusting different activities)

At last we need to adjust the different activities or plan which reduce risks according to the new proposed requirement. For example- for a new programming language, we schedule training courses and time for the programmers to practice their new programming skills.

5.8 Eighth Step (Acceptance testing)

After modification the new copies of the software is released for user acceptance testing. And after verification and validation the master copies of the document will be replaced by the new one.

VI. FUTURE WORK

This strategy can be applied to any real life project, so that its efficiency can be measured. It will help a requirement management tool for managing the changing requirement.

VII. CONCLUSION

This Strategy is a real time process. It can be applied into any development process and any of the phases of software development life cycle. Project plans and commitments therefore

need to anticipate change, rather than expecting that an initial stage of gathering requirements is all that's needed.

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Behaviour of Reactive Routing Protocols of MANET Group Node Demanding Mobility (GNDM) Model

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Abstract- A mobile ad hoc network (MANET) is a collection of wireless mobile nodes forming a dynamic network Topology without the aid of any existing network infrastructure or centralized administration. Each node participating in the network acts as a host and as a router, means they have to forward packets and identify route as well. Random waypoint is the most common mobility model in most of the simulation based studies of various MANET routing protocols. The Group Mobility Model has been generated by Impact of Mobility Patterns on Routing in Ad-hoc Network (IMPORTANT). In the present communication is an attempt to develop a Group Mobility Model named Group Node Demanding Mobility (GNDM) model, which provide the facility to assign number of nodes in a group according to demand. We have analyzed the Packet Delivery Ratio (PDR), Average End to End delay, Average Throughput, Normalized Routing Load (NRL) and number of Drop packets in CBR traffic model using reactive routing protocol, AODV. Research efforts have focused much in evaluating their performance with same number of nodes in each group as well as different number of nodes in each group. Simulations has been carried out using NS-2 simulator

Index Terms- MANET, IMPORTANT, CBR, GNDM, PDR, NRL, NS-2.

I. INTRODUCTION

A Mobile Ad hoc Networks (MANET) represents a system of wireless mobile nodes that move arbitrarily and dynamically self-organize in to autonomous and temporary network topologies, allowing people and devices to seamlessly communicate without any pre-existing communication architecture. Such infrastructure less networks are usually needed in battlefields, disaster areas, and meetings, because of their capability of handling node failures and fast topology changes. The most important characteristics are dynamic topology, where nodes can change position quite frequently, so we require such routing protocol that quickly adapts to topology changes.

Normal routing protocol, which works well in fixed networks does not show same performance in Mobile ad-hoc Networks. In MANET routing protocols should be more dynamic so that they quickly respond to topological changes[1]. A number of protocols have been developed to accomplish this task.

Routing paths in MANET potentially contain multiple hops, and each node has the responsibility to act as router[2]. Routing in MANET has been a challenging task because of high degree of node mobility.

MANET routing protocol must have the following characteristics:

- 1) Keep the routing table up-to-date and reasonably small,
- 2) Select the best route for given destination and
- 3) Converge within an exchange of a small amount of messages[3].

There are several mobility models such as Random Way Point Model, Freeway Mobility Model, Manhattan Mobility Model and Reference Point Group Mobility Model (RPGM) and Gauss Markov Mobility Model etc.

Bindra, Maakar and Sangal[4] have studied performance evaluation of two reactive routing protocols of MANET using Group Mobility Model. In which they compare the performance of AODV and DSR with CBR and TCP traffic. In present paper, we have compared two routing protocols (AODV and DSDV) with CBR and TCP traffic with Group Mobility Model. PDR, Average End to End delay, Average Throughput, Normalized Routing Load and number of Drop packets has been evaluated as the function of Group and constant mobility speed..

This paper is organized in five sections. Section 2 gives brief description of studied routing protocols. Section 3 describes simulation environment, Reference Point Group Mobility (RPGM) Model and performance metrics. Simulation results are discussed in section 4. Section 5 describes our conclusion and future scope.

II. DESCRIPTION OF MANET ROUTING PROTOCOLS

Description of AODV protocol in brief is as follows:

2.1. AODV (Ad-hoc On demand Distance Vector)

AODV [5] is a reactive protocol, which performs Route Discovery using control messages route request (RREQ) and route reply (RREP) whenever a node wishes to send packets to destination. To control network wide broadcasts of RREQs, the source node uses an expanding ring search technique. The forward path sets up an intermediate node in its route table with a lifetime association RREP. When either destination or intermediate node using moves, a route error (RERR) is sent to the affected source node. When source node receives the (RERR), it can reinitiate route if the route is still needed. Neighborhood information is obtained from broadcast Hello packet. As AODV protocol is a flat routing protocol it does not need any central administrative system to handle the routing process. AODV tends to reduce the control traffic messages overhead at the cost of increased latency in finding new routes. The AODV has great advantage in having less overhead over simple protocols which need to keep the entire route from the

source host to the destination host in their messages. The RREQ and RREP messages, which are responsible for the route discovery, do not increase significantly the overhead from these control messages. AODV reacts relatively quickly to the topological changes in the network and updating only the hosts that may be affected by the change, using the RRER message. The Hello messages, which are responsible for the route maintenance, are also limited so that they do not create unnecessary overhead in the network. The AODV protocol is a loop free and avoids the counting to infinity problem, which were typical to the classical distance vector routing protocols, by the usage of the sequence numbers [6].

III. SIMULATION ENVIRONMENT

The simulation is done with the help of NS-2 simulator version 2.34 [7]. The network contains 60 nodes randomly distributed under 4 and 5 groups in a 1000m X 1000m area with speed of 5m/s as basic scenario. The simulation time is 600s.

Parameter	Value
No. of nodes	60
No. of Groups	4, 5
Protocols	AODV
Simulation Time	600s
Speed Deviation	5m/s
Angle of Deviation	15
Traffic Type	CBR
Mobility Model	RPGM, GNDM
Area	1000m X 1000m

Table 1: Basic Simulation Scenario

3.1. Reference Point Group Mobility (RPGM) Model

Group mobility can be used in military battlefield communication, where the commander and soldiers form a logical group. Here, each group has a logical center (group leader or commander) that determines the group's motion behavior. Each member of the group (soldier) is uniformly distributed in neighborhood of group leader (commander). Subsequently, at every instant, each node has a speed and direction that is derived by randomly deviating from that of the group leader[8].

Each node derives from its velocity randomly from that of leader. The movement in group mobility can be defined as follows:

$$|V_{\text{member}}(t)| = |V_{\text{leader}}(t)| + \text{random}() * \text{SDR} * \text{max\_spee} \dots\dots\dots(1)$$

$$|\Theta_{\text{member}}(t)| = |\Theta_{\text{leader}}(t)| + \text{random}() * \text{SDR} * \text{max\_angle} \dots\dots\dots(2)$$

Where $0 \leq \text{SDR}$ (Standard Deviation Ratio) and ADR (Angle Deviation Ratio) ≤ 1 .

SDR and ADR are used to control the deviation of the velocity of group members from that of the leader. Since the

group leader mainly decides the mobility of group members, group mobility pattern is expected to have high spatial dependence for small values of SDR and ADR.

3.2. Group Node Demanding Mobility (GNDM) Model

Generally, Reference Point Group Mobility (RPGM) model can be used with equal number of nodes assigned in a group. The Group Node Demanding Mobility (GNDM) model is developed to assign demanding number of nodes to each group.

The Algorithm for GNDM Model is as follows:

Assume:

in_name, mobilenode as Two Dimension Dynamic Array
x as One Dimension Array

Current_Time, Simulation_Time, GROUP_NUMBERS,
NODE_NUMBERS as Integer
SPEED_DEV, ANGLE_DEV as Real

Let:

Simulation_Time = 100 //second

Begin:

GROUP_NUMBERS = input("Number of Groups")

FOR I = 1 To GROUP_NUMBERS

x [I] = input("Number of node in Group")

NEXT I

SPEED_DEV = input("Speed of Deviation")

ANGLE_DEV = input("Angle of Deviation in degree")

ANGLE_DEV = ANGLE_DEV / 2.314 * 180

FOR I = 1 To GROUP_NUMBERS

n_name [I] = input("Reference Point trace file for Group")

NEXT I

FOR I = 1 To GROUP_NUMBERS

NODE_NUMBERS = x [I]

FOR J = 1 To NODE_NUMBERS

mobilenode [I][J].initialize_node() and save in
output trace file

NEXT J

NEXT I

FOR Current_Time = 0 To Simulation_Time

FOR I = 1 To GROUP_NUMBERS

NODE_NUMBERS = x [I]

FOR J = 1 To NODE_NUMBERS

mobilenode [I][J].update_node() and save in
output trace file

NEXT J

NEXT I

NEXT Current_Time.

End.

3.3. Performance Metrics

In present performance metrics, that we have been used for performance evaluation of ad-hoc network protocols. The following metrics are applied to comparing the protocol performance. These metrics are suggested by MANET working group for routing protocol evaluation [9].

Average Throughput: The sum of the data packets generated by every source, counted by k bit/s.

Average End to End Delay: This includes all possible delays caused by buffering during routing discovery latency, queuing at the interface queue, and retransmission delays at the MAC, propagation and transfer times.

Packet Delivery Ratio: The ratio between the number of data packets originated by the "application layer" CBR sources and the number of data packets received by the CBR sink at the final destination [10].

Normalized Routing Load: The sum of the routing control messages such as RREQ, RREP, RRER, HELLO etc, counted by k bit/s.

Number of Drop Packets: The number of the data packets originated by the sources failure to deliver to the destination.

IV. RESULTS

We have made an attempt to evaluate the performance of reactive routing protocol, AODV over 4 group and 5 group) of nodes using Reference Point Group Mobility (RPGM) and Group Node Demanding Mobility (GNDM) models in a area of 1000m X 1000m with CBR traffic. The results, which obtain are as discussed as follows

The Average Throughput with CBR Traffic Type of AODV in RPGM and GNDM models with 4 Group and 5 Group are shown in the figure 1.

Figure 1: Average Throughput of AODV in RPGM and GNDM models with 4 and 5 Group

Figure 1 shows Average throughput performance of AODV with CBR traffic in RGPM and GNDM with 4 and 5 groups. The Average Throughput with RGPM model is less than GNDM model in both groups. In RPGM model, Throughput is decreased with increasing group, while in GNDM model; Average Throughput is slightly increased with increasing group.

Figure 2: Average End to End Delay of AODV in RPGM and GNDM models with 4 and 5 Group

Figure 2 shows that Average End to End Delay performance of AODV with CBR traffic in RGPM and GNDM with 4 and 5 groups. The Average End to End Delay with GNDM model is much less than the RPGM model. In RGPM model, Average End to End Delay is slightly increases with increasing group, while Average End to End Delay is nearly same in GNDM model. However GNDM model perform well over the RPGM in both groups.

The Packet Delivery Ratio (PDR) with CBR Traffic Type of AODV in RPGM and GNDM with 4 Group and 5 Group are shown in the figure 3.

Figure 3: Packet Delivery Ratio of AODV in RPGM and GNDM models with 4 and 5 Group

Figure 3 shows that Packet Delivery Ratio (PDR) of AODV with CBR traffic in RGPM and GNDM with 4 and 5 groups. The Packet Delivery Ratio (PDR) of GNDM model with both groups is more than the RPGM group. In RPGM, the Packet Delivery Ratio is decreases with increasing number of groups, but in GNDM, the Packet Delivery Ratio is increases with increasing number of groups In both groups, the Packet Delivery Ratio in GNDM is better than RPGM.

These results indicate that reactive routing protocol AODV with CBR traffic in GNDM model perform well in comparison of RPGM model. In future the work will enhance to evaluate and measure performance of these routing protocols with more number of groups under these scenarios and other routing protocol as well.

Figure 4: Normalized Routing Load of AODV in RPGM and GNDM models with 4 and 5 Group

Figure 4 shows that Normalized Routing Load of AODV with CBR traffic in RGPM and GNDM with 4 and 5 groups. The Normalized Routing Load is increased with increasing groups with both mobility models. The Normalized Routing Load is very high in RPGM model in comparison of GNDM model. Thus GNDM model perform well over RGPM model in terms of Normalized Routing Load.

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Figure 5: Number of Drop Packets of AODV in RPGM and GNDM models with 4 and 5 Group

Figure 5 shows Number of Drop Packets of AODV with CBR traffic in RGPM and GNDM with 4 and 5 groups. The Number of Drop Packets in both mobility models increases with increasing number of groups. The Number of Drop Packets in GNDM model is less than the RPGM model. Thus, GNDM performs well over the RPGM in terms of Number of Drop Packets along with both groups.

V. CONCLUSION AND FUTURE SCOPE

From the above simulation results, we observe that Average Throughput, Average End to End Delay, Packet Delivery Ratio, Normalized Routing Load and Number of Drop Packets performance of AODV with CBR traffic in GNDM model with 4 and 5 groups is perform well over the RPGM model.

Intrapartum amnioinfusion as a preventive measure for meconium aspiration syndrome; a randomized controlled study

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ABSTRACT:

Background

The present study has been done to evaluate the role of amnioinfusion in patient with moderate to thick meconium under conditions of limited intrapartum foetal surveillance.

Methods

We performed a prospective randomised controlled study during July 2006 to December 2007 in which 200 pregnant women in labour at 37 or more weeks of gestation were stratified according to the presence of moderately or thickly meconium stained liquor and then randomly assigned to amnioinfusion or to standard care. The primary outcome measure was caesarean section rate and meconium below vocal cords of the baby. Secondary outcome measures included 1-minute and 5-minute apgar scores, meconium aspiration syndrome, admission to NICU and perinatal mortality.

Results

Meconium aspiration syndrome occurred in 8% of controls and in no patient from aminoinfusion group.

Conclusions

For women in labour who have thick meconium staining of the amniotic fluid, amnioinfusion reduces the risk of moderate or severe meconium aspiration syndrome and perinatal morbidity. Caesarean section rate for foetal distress, apgar score <5 at one minute and meconium aspiration syndrome were also significantly less frequent in the study group compared to those in the control group.

Key words: aminoinfusion, meconium, Apgar score, meconium aspiration syndrome

I. INTRODUCTION

Meconium staining of amniotic fluid is considered a harbinger of fetal compromise because of its direct correlation with fetal distress and increased likelihood of inhalation of meconium with resultant deleterious effect on the neonatal lungs. Meconium aspiration syndrome remains one of the most common causes of neonatal distress syndrome. Passage of meconium in utero has been noted in 5% to 25% of live births (1). Incidence rates of the condition in developing countries are found to be higher than in the developed world (2). The presence of meconium in the amniotic fluid is associated with increased perinatal morbidity and mortality.

The meconium aspiration syndrome is believed to result from aspiration of meconium during intrauterine gasping or at the first breath. Prophylactic pharyngeal suctioning and tracheal aspiration have not been shown to reduce the risk of the meconium aspiration syndrome (3). Amnioinfusion is a promising new technique with important implications for the care of pregnant women. It involves infusion of a sterile physiological solution into the amniotic cavity and can be done abdominally or transcervically. Transcervical amnioinfusion is a relatively simple procedure of augmenting amniotic fluid volume once the membranes have ruptured. Potential mechanisms include dilution of meconium, thus reducing its mechanical and inflammatory effects, and cushioning of the umbilical cord, thus correcting recurrent umbilical cord compressions that lead to fetal acidemia (a condition predisposing to the meconium aspiration syndrome).

The present study was conducted in our low resource area where facilities of electronic fetal monitoring and advanced intrapartum fetal surveillance are not available, to find whether amnioinfusion can reduce the incidence of meconium aspiration in newborns and decrease the rate of operative deliveries in cases of meconium stained amniotic fluid.

II. MATERIALS AND METHODS

This prospective randomized study was conducted in the Department of Gynecology and Obstetrics, Government Lalla Ded Hospital, Srinagar. Two hundred women were included in the study during the period from July 2006 to December 2007. Of these hundred women were randomly assigned to the study group and hundred women to control group. These were labeled as study group and control group respectively.

The subjects included women in the first stage of labor who were found to have moderate to thick meconium on spontaneous or artificial rupture of membranes and a regular fetal heart rate. Moderate to thick meconium was defined as thick opaque material in the amniotic fluid. Labor was either spontaneous in onset or induced for an indication. Women with fetal malpresentations and malformations, previous uterine scar, severe hypertension, vaginal bleeding, intrauterine growth restriction and those needing immediate delivery like cord prolapse, severe fetal bradycardia, etc., were excluded from the study.

The women were divided randomly among two groups

alternately – study group where amnioinfusion was given and control group where amnioinfusion was not given. Written informed consent was taken in all cases. Women assigned to amnioinfusion underwent the procedure immediately after randomization. In the dorsal position a per vaginal examination was performed to rule out cord prolapse and confirm cervical dilatation and fetal presentation. A sterile nasogastric suction catheter no 8 was introduced transcervically to a depth of 30 cm between head and amniotic sac, and a bolus of 500 ml of sterile saline at room temperature was infused under the force of gravity over a period of 30 minutes. Cervical dilatation was noted before and after bolus infusion and if decision was taken to continue with monitoring of labor, infusion was continued at the rate of 2ml/minute to a maximum of 1500 ml. Vaginal effluent was judged by inspection of pads every 30 minutes. The use of oxytocin was permitted if there was a delay in the progress of labor or inadequate uterine contractions provided that the fetal heart-rate monitoring did not indicate that urgent delivery was necessary. Amnioinfusion was stopped just before delivery. The total volume of saline infused, the time taken for amnioinfusion, and the length of three stages of labor were noted. The control group did not receive any amnioinfusion. All women were monitored by fetal heart sound auscultation every 15 minutes and uterine activity was assessed every half an hour by palpation. Operative deliveries (vacuum extraction, caesarean section) were done for failure to progress or for fetal indications. After delivery all patients received prophylactic antibiotics.

A pediatrician who was blinded to the study was present in all deliveries. Infants underwent Delee suctioning on delivery of the head and before delivery of the shoulders. After delivery they were intubated by the pediatrician for vocal cord visualization and if meconium was present tracheal intubation and suctioning was done. Neonatal outcome was assessed by the pediatrician. Mothers and babies were followed for one week postpartum. Data on neonatal outcome were obtained from records in the pediatric department where staff was not aware of the allocation.

The primary outcome measure was caesarean section rate and meconium below vocal cords of the baby. Secondary outcome measures included maternal complications, 1-minute and 5-minute apgar scores, need for positive pressure ventilation, meconium aspiration syndrome, admission to NICU, antibiotics given to baby, and perinatal mortality. Patient demographics, labor and delivery characteristics and amnioinfusion details were also analyzed. Results were analyzed using Epi-info version 6.0. statistical significance was testing by chi-square test where appropriate. A 'P' value of 0.05 was considered as statistically significant.

Table1. Baseline Demographic and Obstetrical Characteristics of the Women.

III RESULTS

A total of 200 women were studied, 100 in each group. During the study period There 22921 deliveries took place in our hospital of which 2310 patients were discovered to have

Characteristic	Study group	Control group
Maternal age(yr.)	24.76±0.467	25.22±0.490
Maternal BMI	30.2±5.6	30.2±5.8
Gestational age(wk.)	39.12±0.182	39.5±0.183
Nulliparous (%)	60	64
Cervical dilatation (%)	4.3±0.151	4.3±0.159
Induced labor (%)	18	22
Delivery interval(min)	215.72±12.062	197.82±11.384
Oxytocin (%)	58	54
ARM (%)	48	54.6
Initial FHR(bpm)	138.72±0.945	137.36±0.909

meconium stained amniotic fluid. The incidence of meconium in our hospital was found to be 10.32%. The study groups were balanced with respect to sociodemographic and anthropometric variables, as well as baseline obstetrical characteristics (Table 1)

Table 2 shows the outcome of the trial.

Outcome	Study group	Control group
Volume of fluid(ml)	905.18±34.787	188.71±11.765
C-section for fetal distress (%)	2	26
Ventouse for AFD	2	6
Birth weight (kg)	2.725±0.044	2.74±0.050
Apgar Score<7 at 1 min (%)	30	56
Apgar Score<7 at 5 min (%)	4	8
Need for PPV (%)	16	42
Meconium below vocal cords (%)	6	32
Meconium aspiration syndrome (%)	0	8
NICU admission (%)	6	28
NICU stay>4 days (%)	4	14
Post-partum pyrexia (days/%)	4/4	6/6
Perinatal death (%)	0	2

IV DISCUSSION

The two groups were matched regarding various respects including parity, gestational ages, initial temperature, initial fetal heart rate, and most importantly the prevalence of IUGR and of post-dated pregnancies which are considered as predisposing factors for both passage of meconium and MAS. Women in the amnioinfusion group underwent amnioinfusion within 20 minutes after randomization, and the intervention continued until approximately 1 hour before delivery. The total volume of normal saline required for amnioinfusion ranged from 500 to 1400 ml. The incidence of meconium aspiration in our control group was 8% which is higher than the 2% incidence in the study group, despite aggressive tracheal suctioning, reported by Davis et al (1985).(3) The incidence of total operative deliveries was significantly reduced in the amnioinfusion group; 22% versus 54% (p=0.009), making our results in consensus with that of Wenstrom and Parsons, 1989(4). There were only two perinatal deaths in the whole study and these belonged to the control

group. Das Vinta(2001)(5) has reported a perinatal mortality of 1% in amnioinfusion group and 8.42% in control group($p=0.01$). Similar results have been given by Sahu Latika(2003)(6). From the study group 1.6% of babies and from control group 28% were admitted to the neonatal intensive care unit, the reduction in incidence among two groups being statistically significant(0.003; our results are roughly in agreement with those of Das Vinta, 2001(5)(5% versus 21.05%), Mahomed 1998(7)(12.8% versus 22.9%) and Sahu Latika. 2003(6). In our study we came across none of the maternal complications like uterine hypertonicity, scar dehiscence polyhydramnios, umbilical cord prolapse, pulmonary edema or chorioamnionitis.

V CONCLUSION

This review concludes that, in settings with limited intrapartum perinatal surveillance facilities, amnioinfusion in women with moderate or thick meconium staining of the amniotic fluid could improve some of the perinatal outcomes. The benefits might possibly be due to dilution of meconium, so that toxic effects of meconium, should it occur are diminished. It also corrects oligohydramnios and prevents umbilical cord compression and hence fetal gasping by vagal stimulation. However the procedure will not prevent meconium aspiration that may have already occurred before it is performed. It improved maternal morbidity by decreasing the rate of caesarean sections and instrumental deliveries. However reduction in the quantity of meconium below the vocal cords, a factor thought to be closely related to meconium aspiration syndrome, indirectly showed that amnioinfusion prevented meconium aspiration syndrome. More patients would be needed to definitively study the effects of amnioinfusion on these parameters. Hence, the results of the review are applicable in under-resourced settings where complications of meconium staining of the amniotic fluid are common and facilities for intrapartum surveillance are limited.

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SPECIAL PLANAR FUZZY GRAPH CONFIGURATIONS

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ABSTRACT - In this paper new fuzzy graphs are constructed using special graph configurations. Hamiltonian fuzzy graph, fuzzy Hamiltonian circuit, cubic fuzzy graphs and its properties are introduced. Algorithmic development of spanning trees in graphs, matching in bipartite graphs, maximum flows in network are discussed. This paper concludes that if a fuzzy graph is planar, cubic connected then the Hamiltonian circuit problem for this graph is NP – complete.

Index Terms- Hamiltonian circuit fuzzy graph – Non deterministic polynomial

I. INTRODUCTION

Fuzzy set theory was introduced by zadeh in 1965 in a seminal article, Fuzzy set theory idea showed to fuzzy graph theory through Angiel Rosen field. He introduced the important concepts like paths, connectedness fuzzy bridges, fuzzy cut nodes, fuzzy forests, fuzzy trees etc. fuzzy end nodes was investigated by Butani. In this paper planar fuzzy Hamiltonian circuit problem is discussed.

A number of special graph configurations will be used to construct new fuzzy graphs. In a graph a path which passes through every vertex exactly once and returns to its starting point is called A Hamiltonian circuit. A fuzzy Hamiltonian circuit in a fuzzy graph is a fuzzy path which passes through every vertex exactly once and returns to its starting point. To characterize the fuzzy graphs which contain Hamiltonian circuits many attempts have been made. A fuzzy Hamiltonian line in a fuzzy directed graph is a fuzzy directed path which passes through each vertex exactly once, but need not return to its starting point.

This paper deals with the problem of recognition of fuzzy Hamiltonian circuit

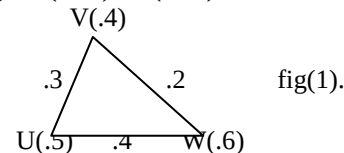
II. PRELIMINARIES

Definition 1:- A **fuzzy set** of a base set V is specified by its **membership function** σ where $\sigma : v \rightarrow [0,1]$ assigning to each $u \in v$ the degree or grade to which u belongs to σ

Definition 2:- A **fuzzy graph** $G = (\sigma, \mu)$ is a pair of function $\sigma : V \rightarrow [0,1]$ and $\mu : v \times v \rightarrow (0,1)$ where for all $u, v \in V$, we have $\mu(u, v) \leq \sigma(u) \cap \sigma(v)$

μ is considered to be symmetric

Example:- A **fuzzy graph** $G = (\sigma, \mu)$ where $\sigma = \{u/.5, v/.4, w/.6\}$ and $\mu = \{(u, v)/.3, (u, w)/.4, (v, w)/.2\}$

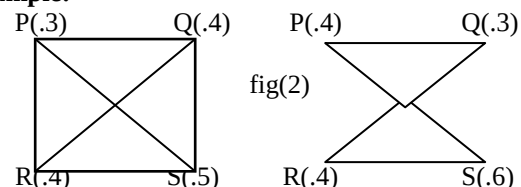


Definition 3:- A fuzzy graph that has neither self loops nor parallel edges is called a **simple fuzzy graph**.

Definition 4:- A simple fuzzy graph in which there exists an edge between every pair of vertices is called a **complete fuzzy graph**

Definition 5:- If fuzzy graph G has a spanning cycle Z , Then G is called a **Hamiltonian fuzzy graph**.

Example:-

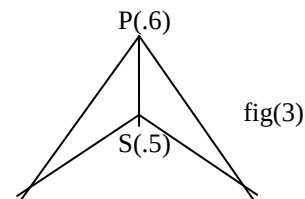


Definition 6:- A fuzzy graph is said to be **connected fuzzy graph** if there is at least one path between every pair of vertices in fuzzy graph.

Definition 7:- A **fuzzy Hamiltonian circuit** in a connected fuzzy graph is defined as a closed walk that traverse every vertex of G exactly once, except the starting vertex at which that walk also terminates.

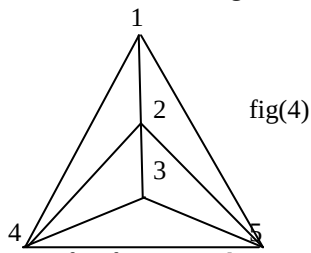
Definition 8:- A **cubic fuzzy graph** is 3 regular fuzzy graph (ie). Fuzzy graph whose vertices all have degree 3.

Example:-



Q(.3) R(.4)

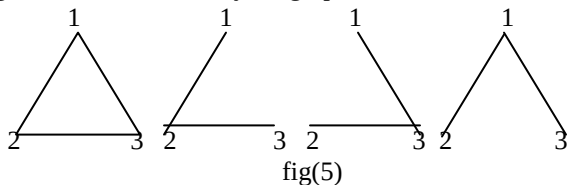
Definition 9:- A fuzzy graph G is said to be **planar** if there exists some geometric representation of G which can be drawn on plane such that no two of its edges intersect.



Definition 10:- If a fuzzy graph G can be drawn on a plane such that no two of its edges intersect than G is said to be **planar fuzzy graph**.

Algorithms are developed for minimum spanning trees in graphs, matching's in bipartite graphs, maximum increasing sub sequences, maximum flows in networks, and so on. All these algorithms are efficient, because in each case their time requirement grows as a polynomial function (such as n , n^2 , or n^3) of the size of the input.

To better appreciate such efficient algorithms, consider the alternative: In all these problems we are searching for a solution (path, tree, matching, etc.) from among an exponential population of possibilities. Indeed, n boys can be matched with n girls in $n!$ different ways, a graph with n vertices has n^{n-2}



Spanning trees, and a typical graph has an exponential number of paths from s to t . All these problems could in principle be solved in exponential time by checking through all candidate solutions, one by one. But an algorithm whose running time is 2^n , or worse, is all useless in practice. The quest for efficient algorithms is about finding clever ways to bypass this process of exhaustive search, using clues from the input in order to dramatically narrow down the search space.

III. DETERMINISTIC AND NON – DETERMINISTIC POLYNOMIAL

NP – COMPLETE PROBLEM

NP stands for “non-deterministic polynomial time” a term going back to the roots of complexity roots theory. Intuitively, it means that a solutions to any search problem can be found and verified in polynomial time by a special sort of algorithm, called a non-deterministic algorithm. Incidentally, the original definition of NP was not as a class of search problem, but as a class of decision problem: algorithm questions that can be answered by yes or no.

Example:-

Is there a truth assignment that satisfies the Boolean formula? But this too reflects a historical reality At the time theory of NP. Completeness was being developed by researches in the theory of computations were interested in formal

languages a domain in which such decisions problems are of central importance.

We have problems that can be solved efficiently, they are easy problems minimum spanning tree, shortest path, bipartite matching, independent set on trees, linear programming, Euler path, minimum cut. We have a bunch of hard nuts that have escaped efficient solution over many decades or centuries. They are hard problems traveling salesman problem, longest path, 3D matching, independent set, integer linear programming, Rundrata path, balanced cut can be solved by algorithms that are specialized and diverse: dynamic programming, network flow, graph search, greedy. These problems are easy for a variety of different reasons. In stark contrast, the easy problems are all difficult for the same reason. At their core, they are all the same problem, just in different disguises. They are all equivalent. Each of them can be reduced to any of the others.

A **search problem** is **NP** – complete if all other search problems reduce to it.

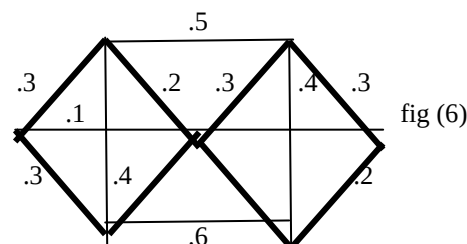
Class of problems with polynomial size certificate for a yes answer that can be verified in polynomial time.

Example:- (Fuzzy Hamiltonian cycle problem) If a given fuzzy graph contain a Hamiltonian cycle, we can give a Hamiltonian cycle as certificate. The size of this certificate is bounded. We can check that it is a Fuzzy Hamiltonian cycle in polynomial time.

THE DOMINATING SET PROBLEM IN FUZZY LINE GRAPHS -THE TRAVELING SALESMAN PROBLEM (TSP)

In the traveling salesman problem (TSP) we are given n vertices $1, \dots, n$ and all $n(n-1)/2$ distances between them, as well as a budget. we are asked to find a tour, a cycle that passes through every vertex exactly once, of total cost or less-or to report that no such tour exists. That is, we seek a one to one correspondence $T(1), \dots, T(n), T_1: V \rightarrow V$ of the vertices such that when they are toured in this order, the total distance covered is at most b :

$$d_{T(1),T(2)} + d_{T(2),T(3)} + \dots + d_{T(n),T(1)} \leq b.$$



TSP as a search problem: given an instance, find a tour within the budget (or report that none exists). But we are expressing that traveling salesman problem in this way, when in reality it is an optimization problem, in which the shortest possible tour is sought. The framework of search problems is helpful to compare and relate problems. Because it encompasses optimization problems like the TSP in addition to true search problems.

Turning an optimization problem into a search problem does not change its difficulty at all, because the two versions reduce to one another. Any algorithm that solves the optimization TSP also readily solves the search problem: find the

optimum tour and if it is within budget, return it; if not, there is no solution.

Some of these problems contain others as special cases (if we can solve one in polynomial time, we can solve both).

NP- complete special cases include the edge dominating set problem, is the dominating set problem in fuzzy line graphs.

NP- complete special cases include the minimum maximal matching problem which is essentially equal to the dominating set problem in fuzzy line graphs.

Example: If we can solve TSP problems in polynomial time, then we can solve all Hamiltonian cycle problems in polynomial time.

FUZZY HAMILTONIAN CIRCUIT GRAPH

- ❖ There is no known polynomial time algorithm that solves any single problem in the class.
- ❖ The existence of polynomial time algorithm for solving any particular problem in the class would imply that every problem in the class can be solved with a polynomial time algorithm.

It is widely believed that no NP-complete problem can be solved with a polynomial time algorithm and hence that all such problems are inherently computationally intractable.

The Hamiltonian line problem for directed planar fuzzy graphs is NP - complete. A fuzzy Hamiltonian line in a directed fuzzy graph is a directed path which passes through each vertex exactly once, but need not return to its starting point. The Hamiltonian circuit problems is NP-complete even for fuzzy graphs G satisfying the following conditions.

Let G is fuzzy graph in which no two of its edges intersect, which drawn on plane.

G is planar fuzzy graph.

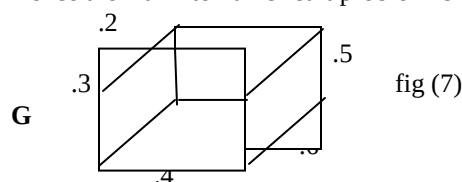
In the graph G every vertex is of degree 3

G is cubic fuzzy graph

There exists at least one path between every pair of vertices.

G is connected fuzzy graph.

Hence the Hamiltonian circuit problem is NP- complete.



Thus the Hamiltonian circuit problem for these highly restricted fuzzy graphs seems to be essentially as difficult as that for arbitrary fuzzy graphs.

A number of special fuzzy graph configurations will be used in our new construction and are illustrated in Figs. Consider the fuzzy graph G , Any fuzzy Hamiltonian circuit in a fuzzy graph G that contains this fuzzy graph as a vertex-induced fuzzy subgraph must appear locally, and thus must use an edge. That is, this fuzzy subgraph acts like a single degree-3 vertex which has one specified edge that is required to be used in any fuzzy Hamiltonian circuit of G which is NP-complete.

Any fuzzy Hamiltonian circuit in a fuzzy graph G which contains this fuzzy graph as a vertex-induced fuzzy subgraph must appear locally in one of the two states. Thus this fuzzy subgraph acts like two separate edges. with the constraint that

exactly one of these two edges must occur in any fuzzy Hamiltonian circuit of G . In this case, we say that the edges have been joined. Schematically, this will be represented by the abbreviation, which we shall call an exclusive-or line.

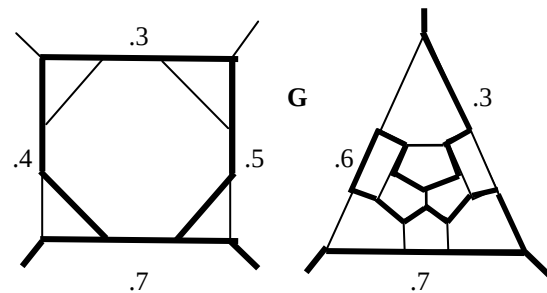


Fig (8)

The exclusive-or construction is crucial to the planarity of the fuzzy graph G . The key observation is that two exclusive-or lines joining different pairs of edges may cross each other without destroying the planarity of G . The property which permits this is that exclusive-or lines can be connected in series to cross over an edge of G , when that edge is required to occur in any fuzzy Hamiltonian circuit. The sequence of two exclusive-or's pictured there act like a single exclusive-or line joining the two outermost edges while permitting the required edge to pass between them. In particular, since all vertical edges in an exclusive-or fuzzy graph must occur in any fuzzy Hamiltonian circuit, we can use this property to allow two exclusive-or lines to cross each other. Figure shows schematically how this can be done and illustrates the possible states that can occur in a fuzzy Hamiltonian circuit graph which is NP- complete.

Result:

Thus the Hamiltonian circuit problem for planar fuzzy graphs is NP – complete.

IV. CONCLUSION

From our construction, we can conclude that the general planar Hamiltonian problems that were left open are all NP – complete. The undirected planar Hamiltonian circuit problem is NP - complete because it contains our problem as a special case. The directed planar Hamiltonian circuit problem is NP – complete because we can replace every edge in our construction with two directed edges and thus get a directed graph which has a Hamiltonian circuit if and only if our original undirected graph had one. Finally, the undirected planar fuzzy Hamiltonian line problem is NP – complete: A Hamiltonian line will exist if and only if the original graph had a Hamiltonian circuit. Note that the construction preserves connectivity and degree threeness, as well as planarity.

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Design and Implementation of a Two-Bit Binary Comparator Using Reversible Logic

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Abstract- Modern digital circuit designing is now focussing on the reversible circuits. It aims towards the designing of low power loss circuits in the area of nanotechnology, quantum computing, optical computing, signal processing etc. This paper presents an optimized two-bit binary comparator based on reversible logic using Feynman, Toffoli, TR, URG and BJN gates. Optimization of the comparator circuit is achieved on the basis of total number of gates used in the circuit and total number of garbage outputs generated. Proposed circuits have been simulated using ModelSim and implemented using Xilinx Spartan2 FPGA platform.

Index Terms- Reversible Logic, Circuit Designing using Reversible Gates, Reversible Logic Gates, Binary Comparator.

I. INTRODUCTION

Conventionally digital circuits were made up of basic logic gates which were irreversible in nature. These irreversible gates produce energy loss due to the information bits lost during the operation. Information loss occurs because total number of output signals generated is less than total number of input signals applied. In reversible circuits conventional logic gates were used for designing which were irreversible in nature, whereas in reversible logic these design entities are replaced by basic reversible logic gates. In 1961, R. Landauer has demonstrated that an irreversible circuit dissipates some energy for every bit of lost information [1], later in 1973, Bennett has shown that this energy loss of the circuit can be minimized or even removed if the circuit is constructed using reversible logic [2].

Reversible circuit designing is gaining wide scope in the area of Quantum computing, nanotechnology, low power CMOS design, advanced computing etc due to its ability to design low-loss or approximately lossless circuits. Reversible logic gates are (n,n) logic gates where (n,n) refers to the (number of input signals, number of output signals)[3]. In reversible gates input signal can be formulated by knowing the output signals. Reversible logic approach can optimize the design entity with less number of gates. The key issue of designing the reversible circuit apart from fewer gates is the minimization of garbage output signals generated [4, 5].

In this paper we propose the reversible circuit for two-bit binary comparator which is designed using the concept of implementing circuits for any two outputs of the comparator and then inferring the third output from this circuit. In this paper optimization of comparator circuit is achieved for the total number of gates used in the circuit and total number of garbage

outputs generated for the various combinations of basic reversible logic gates used for circuit design. The reversible two-bit binary comparator is optimized on the basis of number of gates used, number of garbage outputs generated and CPU usage. All the circuits are modelled and simulated with VHDL on ModelSim platform.

Structure of this paper is as follows: Section 1 gives the brief introduction about the reversible circuit designing. Section 2 provides the details of basic reversible logic gates used in the comparator circuit designing. In section 3, irreversible two-bit binary comparator circuit is explained. Section 4 includes the successive optimized approaches for reversible circuit designing. In section 5, the paper is concluded.

II. REVERSIBLE LOGIC FUNDAMENTALS

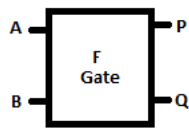
A. Reversible Logic Circuits

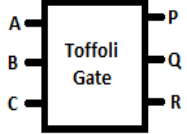
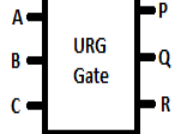
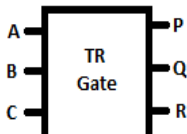
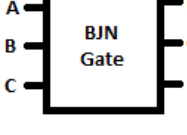
Reversible circuits are designed with the help of basic reversible gates which have the property of input signal being inferred from obtained output signal. In this logic information loss is tried to have minimum so the energy loss will be approximately zero. A circuit implemented using reversible gate should have no fan-out, no feedback, minimum garbage outputs and minimum delay. But to obtain an ideal circuit is practically very tedious [6, 7]. In the present investigation we had tried to attain an optimized reversible circuit of an irreversible comparator.

B. Reversible gates

Reversible logic gates have equal number of input and output signals. Basic reversible logic gates used to design two-bit comparator circuit are Feynman gate [8,9], Toffoli gate [4], R-Gate [10], URG gate [11], TR gate [12] and BJN gate [13]. Brief introduction of these gates are as given in the table 1.

Table 1: Basic Reversible Gates

S. No.	Gate	Block Diagram	Output
1	Feynman Gate		$P = A$ $Q = A \oplus B$

2	Toffoli Gate		$P = A$ $Q = B$ $R = A \cdot B \oplus C$
3	URG Gate		$P = (A + B) \oplus C$ $Q = B$ $R = A \cdot B \oplus C$
4	TR Gate		$P = A$ $Q = A \oplus B$ $R = A \cdot \bar{B} \oplus C$
5	BJN Gate		$P = A$ $Q = B$ $R = (A + B) \oplus C$

III. IRREVERSIBLE TWO-BIT BINARY COMPARATOR

A. Comparator Circuit

The comparator circuit is used to compare one or more than one bit numbers. In a comparator circuit output signals generated for either $A > B$, $A = B$, or $A < B$ where A and B are input binary numbers to be compared. Optimized one bit comparator circuit using reversible gate was presented by Nagami AN, Jayashree HV and HR Bhagyalakshmi [13].

In this paper we have proposed an optimized circuit for a 2-bit binary comparator with a comparative analysis in terms of total number of reversible gates used, total unused outputs generated (garbage output) and CPU usage in various designs.

B. Two-bit binary Comparator Circuit

Block diagram of an irreversible two bit binary comparator circuit is shown in figure 1 [14]. Here two input binary numbers are A (A_1, A_0) and B (B_1, B_0) and output signals are $F_{A>B}$, $F_{A=B}$, $F_{A<B}$.

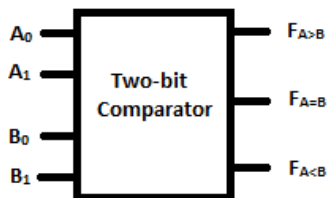


Figure 1: Block Diagram of Two-Bit Comparator

Above comparator compares two 2-bit numbers A and B and generate the comparison result in the form of three signals $F_{A>B}$, $F_{A=B}$ and $F_{A<B}$. The output functions of $F_{A>B}$, $F_{A=B}$ and $F_{A<B}$ can be expressed using K.map as follows-

$$F_{A>B} = A_1 \cdot \bar{B}_1 + A_0 \cdot \bar{B}_1 \cdot \bar{B}_0 + A_1 \cdot A_0 \cdot \bar{B}_0$$

$$F_{A=B} = \bar{A}_1 \cdot \bar{A}_0 \cdot \bar{B}_1 \cdot \bar{B}_0 + \bar{A}_1 \cdot A_0 \cdot \bar{B}_1 \cdot B_0 + A_1 \cdot \bar{A}_0 \cdot B_1 \cdot \bar{B}_0$$

$$F_{A<B} = \bar{A}_1 \cdot B_1 + \bar{A}_0 \cdot B_1 \cdot B_0 + \bar{A}_1 \cdot \bar{A}_0 \cdot B_0$$

C. Reversible Comparator Circuit Design

In order to design 2-bit binary comparator, we require two inputs. From these two given inputs we have derived two outputs using the concept of reversible logic. With the help of these two derived output we inferred the third output. The above approach can be summarised as under

1) Firstly we have designed reversible circuit for two output signals $F_{A=B}$ and $F_{A>B}$ of the comparator.

2) Then with the help of these obtained signals (in step a) third output signal has been generated through following logic

$$F_{A<B} = \bar{F}_{A=B} \cdot \bar{F}_{A>B}$$

IV. IMPLEMENTATION OF TWO-BIT COMPARATOR USING REVERSIBLE LOGIC

In literature there are so many combinations of reversible gates and approaches are available to design a combinational circuit using reversible logic [15, 16, 17]. In the designing of reversible comparator circuit we have used only Feynman, Toffoli, UGR, TR and BJN gates. In the present paper we propose three designs for comparator to achieve optimized circuit. These three designs have been simulated using ModelSim. The performances of circuits are analyzed on the basis of total gates, garbage outputs and macro statistics. Proposed design approaches have been presented in proceeding subsections.

A. Design 1

In this design Feynman gate which is a (2, 2) reversible gate and Toffoli, TR, URG and BJN gates which are (3, 3) reversible gate have been used. TR gates are used in input stage and the outputs are derived from URG and Toffoli gates. Output signal $F_{A>B}$ is derived from URG gate whereas output $F_{A=B}$ derived from Toffoli gate. These two outputs are utilised to derive $F_{A<B}$ using Toffoli gate. The block diagram of this design is shown in the figure 2. Here 14 reversible gates have been used in various configurations and number of garbage output signal generated are 17.

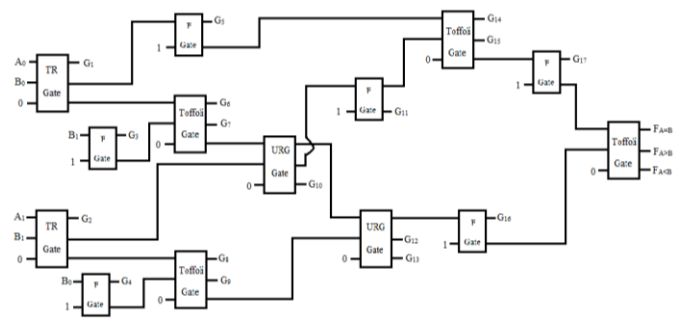


Figure 2: Design 1 of Reversible 2-Bit Comparator

B. Design 2

As shown in figure 3, in this design Feynman gate, a (2, 2) reversible gate and a combination of (3, 3) reversible gates i.e. BJN, URG, Toffoli and TR gates are used. In this proposed design the TR gates are used in input stage and the outputs are derived from Toffoli, URG and BJN gates. Output signal $F_{A>B}$ is derived from URG gate whereas outputs $F_{A=B}$ from Toffoli gate.

Utilizing these two outputs we have derived $F_{A<B}$ from BJN gate. In this design total number of reversible gates used is 12 and garbage outputs generated is 15.

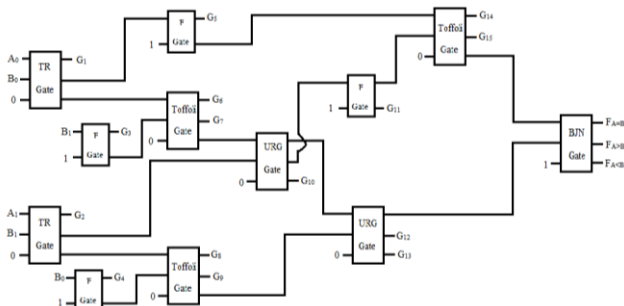


Figure 3: Design 2 of Reversible 2-Bit Comparator

It is more optimized reversible comparator circuit as compared to design 1. But it can be further optimised with respect to configuration and gates so that number of total gates used and garbage outputs can be minimized. So, moving towards the top of the optimization hierarchy we propose a better design in terms of various leading parameters.

C. Design 3

The most optimized reversible 2-bit comparator circuit is shown in figure 4. This design uses a combination of Feynman gate, a (2,2) reversible gate and TR, URG and BJN gates which are (3, 3) reversible gates. In this optimized design TR gates are used in input stage and outputs are derived from TR, Feynman gates. It has been further simplified and all three outputs have been derived from BJN gate. Here total gates used are 9 and garbage output generated is 10.

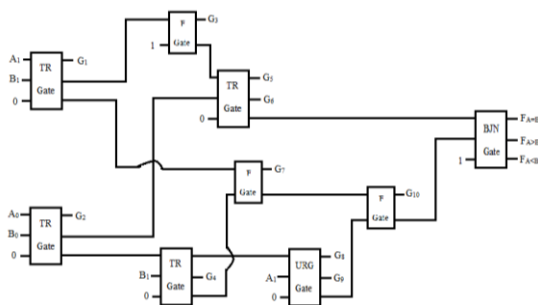


Figure 4: Design 3 of Reversible 2-Bit Comparator

D. Result and Analysis

The various proposed designs of reversible two-bit binary comparator have been analysed on the basis of performance parameters as shown in figure 5.

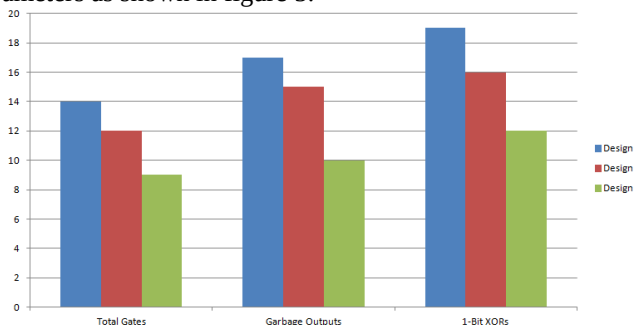


Figure 5: Comparison Chart

The above comparison chart shows the clear variations among all three designs. From above analysis we can conclude that design 3 is the most optimized configuration in terms of number of total gates used, number of garbage outputs generated, 1-bit XORs created and CPU usage as compared to other two designs. This design has been simulated using Modelsim simulator. Structural modelling has been used for the programming. Figure 6 shows the simulated waveform for each and every input and output signals.

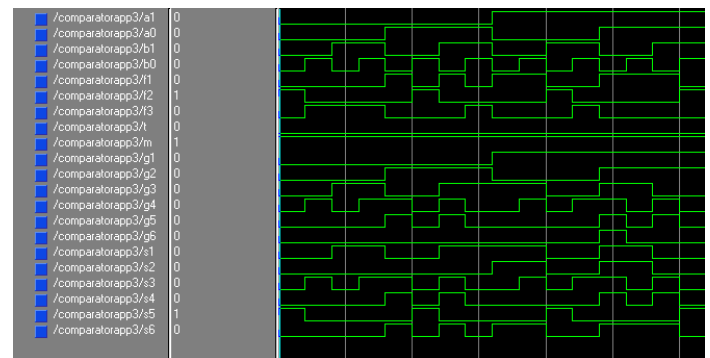


Figure 6: Simulated Waveform of Reversible Comparator

The optimized design is synthesized using Xilinx ISE 6.1i and implemented using Xilinx Spartan2 FPGA platform. Figure 7 shows the floor plan of the design.

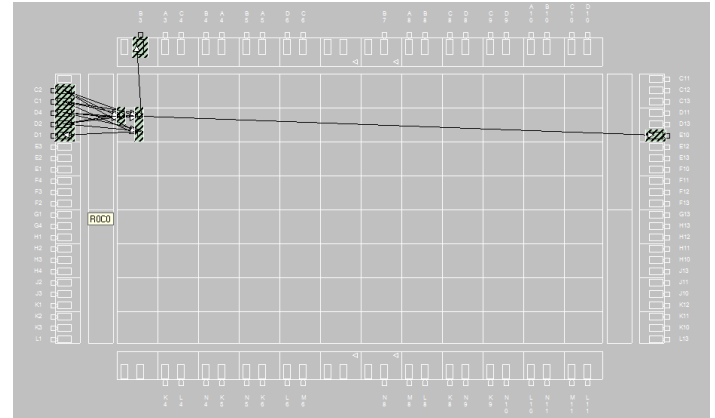


Figure 7: Floor Plan of Reversible Comparator

V. CONCLUSION

Reversible logic is becoming the modern way of digital logic circuit designing. Here in this paper we have tried to attain highly optimized two-bit reversible comparator circuit by using some of the basic reversible gates. The base of optimization is total reversible gates used and garbage outputs generated. Optimized comparator circuit (shown in figure 4) has 9 total reversible gates used and 10 unused outputs generated. This design can be employed in low power logical design applications.

ACKNOWLEDGMENT

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A Lightweight Privacy Preserved Buyer Seller Watermarking Protocol Based on Priced Oblivious Transfer

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Abstract- Advent of Internet has resulted in e-commerce replacing traditional selling of digital products (such as songs, videos, movies, software, books, documents, images, etc.) through shops. This mode of sale can bring the product price down as infrastructure cost in setting up shops and retail chain is reduced. On downside, however, this may increase problem of piracy as digital data can be easily copied, manipulated and transmitted. To protect copyright of owner, establish right of buyer on purchased copy and yet check data piracy, it is required that a trusted e-distribution system be built. Such a system should be able to ensure secure transaction between buyer and seller, check ownership and track the origin of unauthorized copies. The buyer seller watermarking protocols are heavyweight protocols. These protocols require large computation power and network bandwidth. The heavyweight protocols could not be used for the resource constrained devices since the devices does not support battery power. A lightweight protocol has been proposed which is best suited for the resource constrained devices. The protocol is based on a fast asymmetric encryption with novel simplification. In this approach the seller authenticates the buyer but does not learn which items are purchased. The protocol is designed in such a way that the buyers pay the right price without disclosing the purchased item, and the sellers are able to identify buyers that released pirated copies. The protocol is constructed based on the priced oblivious transfer and the existing techniques for asymmetric watermark embedding.

Index Terms- Buyer-seller watermarking protocol, fair exchange, priced oblivious transfer (POT).

I. INTRODUCTION

BUYER-SELLER watermarking protocols allow copyright protection of digital goods. Digital watermarks have recently been proposed for the purposes of copy protection and copy deterrence for multimedia content. In copy deterrence, a content owner (seller) inserts a unique watermark into a copy of the content before it is sold to a buyer. If the buyer sells unauthorized copies of the watermarked content, then these copies can be traced to the unlawful reseller (original buyer) using a watermark detection algorithm.

Fast growing information technology permits perfect duplication and cheap distribution for digital works. The problems associated with intellectual property protection have become important issues. In the realm of security, encryption and

digital watermarking are recognized as promising techniques for copyright protection. Encryption is to prevent unauthorized access to a digital content. The limitation is that once the content is decrypted, it doesn't prevent illegal replications by an authorized user. Digital watermarking, complementing encryption techniques, provides provable copyright ownership by imperceptibly embedding the seller's information in the distributed content. Similarly, digital fingerprinting is to trace and identify copyright violators by embedding the buyer's information in the distributed content.

The existing buyer seller watermarking protocols are heavyweight protocols. These protocols require large computation power and network bandwidth. The heavyweight protocols could not be used for the resource constrained devices since the device does not support battery power. A lightweight protocol has been proposed which is best suited for the resource constrained devices. The protocol is based on a fast asymmetric encryption with novel simplification. The protocol is designed in such a way that the buyers pay the right price without disclosing the purchased item, and the sellers are able to identify buyers that released pirated copies. Consequently, privacy concerns discourage online e-commerce [1], and regulations to enforce privacy protection are being promulgated [2].

II. RELATED WORK

Fingerprinting schemes deter people from illegally redistributing digital copies by enabling the seller of the data to identify the buyer. A scheme is said to be collusion-resistant [3] when it prevents a collusion of buyers up to a maximum size from producing nontraceable copies. In asymmetric fingerprinting schemes [4], the fingerprinted copy is only known to the buyer at the end of the purchase protocol. Thanks to this property, when the seller finds a redistributed copy, he can present it as a proof of the buyer's misbehavior, and the buyer cannot claim that the copy was produced by the seller. In order to protect privacy, fingerprinting protocols that provide buyers with anonymity have been proposed [5]. Buyer-seller watermarking protocols [6] are asymmetric fingerprinting schemes in which the fingerprint is embedded by means of watermarking techniques. The basic idea is that each buyer obtains a slightly different copy of the digital content. Such difference, the watermark, does not harm the quality of the copy and cannot be removed by the buyer. Some buyer-seller Watermarking protocols also provide buyers with anonymity [7]–[9]. As noted in [10], anonymous e-

commerce protocols have several disadvantages. First, they hinder customer management. For example, the seller cannot give discounts to regular buyers or apply other loyalty marketing techniques. Second, they have to be used together with anonymous payment protocols (e.g., anonymous e-cash), which makes it impossible to use currently deployed payment protocols. Finally, they require the use of an underlying anonymous communication network, such as Tor. It is well-known that achieving strong anonymity in such networks is a difficult goal. Furthermore, some applications allow side-channel attacks against anonymity. For example, in location-based services, the service provider learns a customer's location, and this information can be used to identify the *a priori* anonymous customer. Additionally, e-commerce protocols are usually analyzed in order to prove their fairness. Roughly speaking, fair exchange ensures that, at the end of the transaction, either the seller receives the payment and the buyer receives the purchased item, or both parties receive nothing. However, to the best of our knowledge, no fair buyer-seller watermarking protocol has been proposed. We propose a different approach to provide privacy protection in buyer-seller watermarking protocols. In our approach, based on oblivious e-commerce protocols, buyers are authenticated by the seller, but the seller does not learn which items are purchased. This overcomes the disadvantages of anonymous purchase. Since buyers are authenticated, customer management is eased and currently deployed methods of payment can be utilized. As possible disadvantages, one can argue that the seller can find it difficult to learn which. However, as noted in, this information can be obtained by other means, e.g., by conducting marketing research.

We define formally privacy-preserving buyer-seller watermarking (PSW) protocols, i.e., buyer-seller watermarking protocols in which the seller does not learn which items are purchased. We also provide a construction of such a protocol based on existing techniques for asymmetric watermark embedding and on priced oblivious transfer (POT). (POT is the key building block of oblivious e-commerce protocols.) Finally, we explain how to extend our protocol to provide fair exchange.

III. SYSTEM MODEL

The privacy preserving buyer seller watermarking protocol based on niederreiter encryption [11], which makes use of a particular asymmetric encryption.

Niederreiter Asymmetric Encryption

First, we review the cryptographic primitive — Niederreiter

Asymmetric encryption scheme. Setup. The public key and secret key are built by generating several matrices and an (n, k) -linear code. S : A random $(n-k) \times (n-k)$ binary non-singular matrix. H : An $(n-k) \times n$ parity-check matrix H for a binary (n, k) -linear code that can correct t errors, and for H an efficient decoding algorithm ψ is known.

P : A random $n \times n$ permutation matrix.

Make use of (S, H, P) to compute an $(n-k) \times n$ matrix

$K = SHP$, let

Public Key: $PK = (K, t)$

Secret Key: $SK = (S, P, \psi)$

Encryption. Given a clear text msg which is encoded as an n -bit binary vector, let KT denote the transpose of K , then the ciphertext is computed as follows:

$$c = msg \cdot KT$$

Where msg contains no more than t 1's. This is because Niederreiter scheme employs a (n, k) -linear code with the capability of decoding less than t errors. If the Hamming weight of clear text $WH(msg) \leq t$, then the mapping of clear text to ciphertext is injective.

Decryption. Given an input c , decryption algorithm computes cT from c , and S^{-1} from matrix S to get the following,

$$H(P \cdot msgT) = S^{-1} \cdot cT$$

where S^{-1} denotes the inverse of the matrix S . Since it is known by the decoder an efficient decoding algorithm ψ for H , when $WH(msg) \leq t$, the following holds:

$$P \cdot msgT = \psi(S^{-1} \cdot cT)$$

Hence, it is easy to compute cleartext msg by:

$$MsgT = P^{-1}(P \cdot msgT)$$

Remark. In particular, it is clear to see that quite simple matrix operations are needed in the encryption process. Thus, the encryption could be executed very fast.

A Basic Protocol

A direct application of asymmetric encryption would be to simply encrypt the real ID of the device with the server's public key, and send the resulting ciphertext c to the server. Then the server takes advantage of its secret key to recover all users' ID, which handles the ID directly after decoding and enjoys the convenience of the privacy (ID) management. Consequently, this protocol successfully avoids maintaining any synchronization or the exhaustive search in the database that typically costs a lot of resources when a huge number of IDs need to be managed. Obviously, the security of the above protocol relies on the Niederreiter asymmetric encryption [12]. Anyone who intends to know the encrypted ID will have to break the Niederreiter asymmetric encryption.

More importantly, it is noteworthy that not all secure asymmetric encryptions are eligible for our approach, because Most of the asymmetric encryptions are too heavy to run on severely resource-constrained devices. However, since the Niederreiter scheme has a very speedy encryption and especially by simplification technique, the operation of device can be efficiently accomplished. In the following, we describe the basic protocol. The protocol employs the Niederreiter encryption to generate ciphertext c according to the device's ID d and a randomly generated number r , such that clear text $msg = r||d$, where " $||$ " denotes the bit concatenation. Meanwhile, ciphertext c could be also considered as a PID corresponding to d .

Let R, ID denote the sets of random number and valid ID respectively, such that,

$$R = \{r \in \{0, 1\}^{n1} | WH(r) = t1\}$$

$$ID = \{d \in \{0, 1\}^{n2} | WH(d) = t2\}$$

Where all the integers are positive and $t = t1+t2$, $n = n1+n2$. It is obvious to see that the number of ID, $|ID| = \binom{n2}{t2}$, where $\binom{n}{k}$ is the binomial coefficient. Suppose K be composed of two sub-matrices K1, K2, corresponding to r, d respectively (See Figure.1). For a certain SK of the server and an ID d of the device, $c2 = d \cdot K2$ is fixed. Consequently, it is convenient to pre-distribute the value $c2$ to the device beforehand, and compute r and K1 to obtain $c1$, which drastically saves the computation for the device. Besides, $c2$ is stored instead of both d and K2, which further saves the memory cost. More precisely, the basic protocol consists of several phases, which are briefly described in the following. Key Generation. The system first generates public key and secret key of the server as (PK,SK), such that

$$PK = (K, t),$$

$$SK = (S, P, \psi). \text{ Since } c2 \text{ part of the computation of PID}$$

Fig. 1: Niederreiter Encryption

Public Key: $PK = (K1, t1)$
Secret Key: $SK = (S, P, \psi)$
The K1 is the left $(n - k) \times n1$ matrix of K, and K2 is
The remained $(n - k) \times n2$ part of K, namely $K = [K1K2]$.

ID Allocation. The server chooses $d \in ID$ as device's identity and computes

$c2 = d \cdot K2$
Then $c2$ together with K1 will be assigned to the device, where $c2$ needs to be kept secret.

Query and Reply. In this phase, the server queries the unknown device for its ID. The device chooses a random number $r \in R$, computes
 $c1 = r \cdot K1$
and then sends back the pseudo-ID PID to the server, as
 $PID = c1 \oplus c2$

ID Retrieval. Since PID is actually an encryption of $msg = r||d$ with public key PK, such that,
 $PID = c1 \oplus c2 = (r \cdot K1) \oplus (d \cdot K2) = (r||d) \cdot K$ on receiving the PID, the server makes use of secret key
 $SK = (S, P, \psi)$ to recover d .

IV. TECHNICAL PRELIMINARIES

A. Blind Watermarking

A blind and readable watermarking scheme consists of a setup algorithm, a watermark embedding algorithm, and a watermark detection algorithm. It outputs a secret watermarking key, a message space, and a watermark space. On input, message, and watermark, it outputs a watermarked message. The algorithm can be computed in the encrypted domain, where both the result and the watermark are encrypted with a public key of a public key encryption scheme. The algorithm outputs the watermark embedded in a secure watermarking scheme should be robust and collusion resistant. Let d be a distortion metric that quantifies the distortion suffered by a watermarked content when it underwent signal processing operations such as compression, filtering, noise addition, desynchronization, cropping, insertions, mosaicing, and collage. Let c be a distorted content. The robustness property requires that under a distortion metric and a distortion bound, given output by and output by, outputs with overwhelming probability if c . The collusion resistance property requires that collusion up to parties cannot manipulate or remove the watermark from a watermarked content by comparing or composing their differently watermarked copies. This property can be formalized

Definition 1 (Collusion Resistant Watermarking): The collusion resistance property is defined through the following game between a challenger and an adversary. • Challenge. Runs to get, picks random original content, and, for to, picks random watermark and runs. sends to. • Response. outputs watermarked content. wins if there exists such that and outputs watermark such that, for to, c . A blind watermarking scheme is collusion resistant if all p.p.t. adversaries win the game above with negligible probability. Current practical watermarking schemes do not provide collusion-resistance against any p.p.t. adversary. We assume that the watermarking scheme used to instantiate the protocol fulfills this definition, and thus we conclude that our protocol is secure against any p.p.t. adversary. When the protocol is instantiated with a concrete watermarking scheme, the security offered against malicious buyers is lowered to the security offered by the watermarking scheme.

B. Signature Schemes

A signature scheme consists of the algorithms, and. Outputs a secret key and a public key. Outputs a signature of message. Outputs if is a valid signature of and otherwise. A signature scheme must be correct and unforgeable. Informally speaking, correctness implies that the algorithm always accepts an honestly generated signature. Existential unforgeability means that no p.p.t. adversary should be able to output a message-signature pair unless he has previously obtained a signature on.

C. Homomorphic Encryption

A public key encryption scheme consists of the algorithms and. Outputs a public key and a secret key. Outputs a ciphertext on input a public key and a message. Outputs the message on input the ciphertext and the secret key. Roughly speaking, indistinguishability under chosen plaintext attack (IND-CPA)

guarantees that an adversary does not get any knowledge about from .

We employ a homomorphic public key encryption scheme that supports two operations. An operation that, on input two ciphertexts and that encrypts messages and, outputs a ciphertext that encrypts the addition of the messages, and an operation that, on input a message and a ciphertext, outputs a ciphertext that encrypts the multiplication of the messages. The homomorphic public key encryption scheme proposed by Paillier, and its generalization by Damgård and Jurik, support these operations, and therefore can be used to instantiate the encryption scheme. In our construction we need a function that, on input a bit and an encryption of a bit, computes the encryption of $b \oplus a$, where $\oplus$ denotes the exclusive or operation.

D. Zero-Knowledge Proofs of Knowledge

A zero-knowledge proof of knowledge is a two-party protocol between a prover and a verifier. The prover proves to the verifier knowledge of some secret input that fulfils some statement without disclosing this input to the verifier. The protocol should fulfil two properties. First, it should be a proof of knowledge, i.e., a prover without the knowledge of the secret input convinces the verifier with negligible probability. More technically, there exists a knowledge extractor that extracts the secret input from a successful prover with all but negligible probability. Second, it should be zero-knowledge, i.e., the verifier does not learn any information about the secret input. More technically, for all possible verifiers there exists a simulator that, without knowledge of the secret input, yields a transcript that cannot be distinguished from the interaction with a real prover. To express a zero-knowledge proof of knowledge, we follow the notation introduced by Camenisch and Stadler.

For example, $\text{zkp}(x, y)$ denotes a “zero-knowledge proof of knowledge of secret input x such that y .” Letters in the parenthesis, in this example, denote the secret input, while y and the function are also known to the verifier. We employ a proof of knowledge, i.e., a proof that is a correct encryption under the secret key related with public key y , so that a party in possession of the secret key related with y can recover from x . The verifiable encryption schemes proposed by Camenisch *et al.* And by Poupard and Stern, which are provided with such a proof of knowledge, can be employed to instantiate the encryption scheme used in our construction. We also use a proof of knowledge of the statement, i.e., a proof that the value encrypted in ciphertext under public key y is a bit.

V. PBSW PROTOCOL

Fig. 2: Phases of PBSW protocol: initialization (top), purchase (middle), arbitration (bottom).

PBSW protocol is based on POT. POT allows buyers to purchase messages from the seller without the seller learning which messages are bought. Existing secure POT schemes follow an assisted decryption approach in which the interaction between a seller and a buyer is divided into an initialization phase and several purchase phases. In the initialization phase, the seller encrypts the messages to be sold and sends the ciphertexts to the buyer. In each purchase phase, the buyer helps to decrypt one of the ciphertexts via an interactive protocol.

VI. SECURITY AND PERFORMANCE ANALYSIS

The security of the proposals relies on the Niederreiter encryption and the hash function h , which is shown in the following theorem.

Theorem 1 *If the Niederreiter encryption is one-way secure and the one-way hash function is collision-resistant, then the proposed protocols are secure against active attacks.*

Proof. Generally speaking, the intuition behind the security is that if the privacy information ID d is cracked or impersonated

By an active adversary A , then A can either break the Niederreiter encryption or find a collision of hash function h .

We show the security of explicit auxiliary protocol in details.

1. When an active adversary A intends to steal the ID from certain device D , A pretends to be S . A can select adaptive, non-random cha and send it to D . According to the response of D , the adversary gets the following. • What A can obtain from D is exactly the encryption of randomness r and ID, and a hash value aux . Note here that the cha chosen by A is not included in the cleartext, but is a partial pre-image of the hash value aux . The r is chosen by the D , and ID embedded in $c2$ is pre-computed and stored in the D , out of control of A . From a cryptographic point of view, it means that the attack employed by A is weaker than the chosen-plaintext attack, in which A can get the encryption of what he chooses. If A can guess the ID, then he must be able to *invert* the Niederreiter encryption and thus *break* its one-wayness, only by a weaker attack than chosen-plaintext attack! The above is contradicting to the security of Niederreiter encryption which is known as one-way secure against chosen-plaintext attack.

Without breaking the Niederreiter encryption, A has to invert hash function $h(c2||r||cha)$. The only advantage is that A is able to choose cha as he likes. It is obviously impossible if a secure hash function is applied. From the above, it is easy to see that A has to break the encryption or find full pre-image of hash function, to get the privacy information ID.

VII. FAIR PRIVACY-PRESERVING PBSW PROTOCOL

Recently, a transformation that takes as input a secure POT scheme and turns it into an optimistic fair POT scheme has been proposed. This transformation requires a neutral third party, an adjudicator, who is only involved in case of dispute between a seller and a buyer (hence the protocol is called optimistic). Other fair e-commerce protocols that do not protect privacy also require the involvement of a third party. The transformation is based on the use of verifiably encrypted signatures (VES). Roughly speaking, a VES is a signature encrypted under the public key of the adjudicator that can be publicly verified; i.e., the verifier can check that the ciphertext contains a valid signature without the secret key of the adjudicator. The transformation works as follows. The buyer computes a VES on her purchase request, and sends to the seller. Upon receiving a correct response from seller, the buyer reveals a valid signature on her request. This signature can be used by the seller to prove that the buyer accepted the result and that a payment was done. If a malicious buyer does not reveal the signature, the adjudicator, upon being requested by the seller, can verify that the seller fulfilled his delivery obligations and, in that case, extract a valid signature from the VES. Similarly, if a malicious seller does not fulfil his delivery obligations, the adjudicator, upon being requested by the buyer, can tell the seller to fulfil them and, in the end, send the seller a valid signature. We refer to for a detailed description. One of the appealing properties of this transformation is that it adds very little overhead in terms of communication and computation. Our PBSW protocol can also be extended to achieve fairness by applying this transformation to the POT scheme used as a building block. In our protocol, the

role of the adjudicator can be played by the judge. Both judge and buyers have to compute a key pair as defined in the VES scheme used and register the public key at the registration authority.

VIII. EFFICIENCY

The efficiency of our construction depends on the efficiency of the building blocks used to instantiate it. Efficiency measurements for the asymmetric watermark embedding technique we employ (algorithms , ,) can be found in [9], which describes and implements an instantiation based on the homomorphic public key encryption scheme due to Paillier [16]. In [9], images of size 512 512 pixels are employed as digital content offered by , whose size after embedding the watermark in the encrypted domain is 536, 870, 912 bits when each DCT coefficient is encrypted, or 6, 318, 080 bits when composite signal representation is used. In the following, we employ watermarked messages of those sizes as input to the POT scheme. To evaluate the performance of the whole PBSW protocol, we implement the POT scheme proposed in a workstation equipped with an Intel Core2 Duo processor at 3 GHz and 4 Gbyte of RAM. All the functionalities are implemented in the C programming language. We use the PBC library for elliptic curve and pairing operations. We select type A pairings constructed on the curve over the field for a 512-bit prime mod 4. For other cryptographic primitives, we employ the OpenSSL library.3 specifically; we employ RIPEMD-160 as hash function and AES in counter mode as block cipher. The efficiency of the POT scheme in terms of computation and communication depends on the selection of three parameters: the number of messages offered by, the size of the watermarked messages, and the values and that define the maximum deposit allowed. The performance of the initialization phase (algorithms and) depends on the number of messages and on the message size. Table I shows performance measurements when is 100, 1000, and 10 000, and when the message size is 536, 870, 912 and 6, 318, 080 bits.

IX. CONCLUSION

Copyright protection for the digital contents is provided. Buyers purchase from sellers without the seller learning the items they buy. Best suited for the resource constrained devices. Improved power consumption and network bandwidth utilization. It provides both buyers and sellers with optimistic fair exchange. The efficiency of the protocol is improved. The future work includes the signal processing using Discrete Wavelet Transform and Discrete Cosine Transform. The wavelet transform has emerged as a cutting edge technology, within the field of image compression. Wavelet based coding provides substantial improvements in picture quality at higher compression ratios. DWT yields higher compression ratio and better visual quality.

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Multiple Pattern String Matching Methodologies: A Comparative Analysis

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Abstract—String matching algorithms in software applications like virus scanners (anti-virus) or intrusion detection systems is stressed for improving data security over the internet. String-matching techniques are used for sequence analysis, gene finding, evolutionary biology studies and analysis of protein expression. Other fields such as Music Technology, Computational Linguistics, Artificial Intelligence, Artificial Vision, have been using string matching algorithm as their integral part of theoretical and practical tools. There are various problems in string matching appeared as a result of such continuous, exhaustive use, which in turn were promptly solved by the computer scientists. The more practical solutions to the real world problems can be solved by the multiple pattern string matching algorithms. String Matching Algorithms like Aho-Corasick, Commentz-Walter, Bit parallel, Rabin-Karp, Wu-Manber etc. are to be focused in this paper. Aho-Corasick algorithm is based on finite state machines (automata). Commentz Walter algorithm is based on the idea of Knutt-Morris-Pratt and finite state machines. Bit parallel algorithm like shift-or makes use of wide machine words (CPU registers) to parallelize the work. Rabin-Karp uses hashing to find any one of a set of pattern strings in a text. Wu-Manber looking text in blocks instead of one by one character combining idea of Aho-Corasick and Boyer-Moore. Each algorithm has certain advantages and disadvantages. This paper presents the comparative analysis of various multiple pattern string matching algorithms. A comparison of Aho-Corasick, Commentz-Walter, Bit-Parallel(Shift-OR), Rabin-Karp, Wu-Manber etc. type of string matching algorithms is presented on different parameters.

Index Terms— String matching, Aho-Corasick, Commentz Walter, Bit parallel, Rabin-Karp, Wu-Manber, FSM.

I. INTRODUCTION

String matching is a technique to find out pattern from given text. Let Σ be an alphabet. Elements of Σ are called symbols or characters. For example, if $\Sigma = \{a,b\}$, then abab is a string over Σ . String ab, ba, aba, bab are set of patterns over given string. The patterns strings are denoted by $P[1...m]$. The text string is denoted by $T[1...n]$. If P occurs with shift s in T , then we call s a valid shift; otherwise, we call s an invalid shift. The string matching problem is the problem of finding all valid shifts with which a given pattern P occurs in a given text T Figure 1 shows this definition[1].

These problems find applications in information retrieval systems like search engines, bioinformatics, computer security, and DNA sequence analysis.

“When I got to the bottom of the stairs, I saw that the stairs were high and steep. I took a deep breath and began to climb the stairs. When I reached the top of the stairs I looked around me.”

stairs

Input Text String and Pattern

“When I got to the bottom of the stairs, I saw that the stairs were high and steep. I took a deep breath and began to climb the stairs. When I reached the top of the stairs I looked around me.”

Output

Fig 1. Basic Definition

Two examples of multiple-pattern matching problems:

English:

Text: CPM_annual_conference_announce

Set of Symbols: { announce
annual
annually

DNA:

Text: AGATACGATATATAC

Set of Symbols: { ATATATA
TATAT
ACGATAT

String matching algorithms can be categorized basically in two types exact and approximate string

matching algorithms. Exact string matching algorithms are further divided into single and multiple pattern string matching. Each category can be applied to various areas of application. Multiple pattern matching algorithms have more practical and realistic applications like DNA sequencing[10][11], intrusion detection/prevention system (IDS/IPS)[13][14][15], data mining, search engines[12], detecting plagiarism[8][9], Music Technology[7] etc. Multiple pattern string matching algorithms are mainly discussed in this paper.

String matching algorithms are also used in Intrusion Detection Systems (IDSs) that have become widely recognized as powerful tools for identifying, deterring and deflecting malicious attacks over the network. Essential to almost every intrusion detection system is the ability to search through packets and identify content that matches known attacks. Space and time efficient string matching algorithms are therefore important for identifying these packets at line rate[4].

The paper is organized as follows. Section II survey on the most significant algorithms for multiple string matching algorithms like Aho-Corasick, Commentz Walter, Bit-Parallel(Shift-OR), Rabin-Karp, Wu Manber. Section III comparative study of various algorithms is described. Finally Section IV concludes comparative survey by putting strong points in favour of some algorithm in particular case of usage.

II. VARIOUS MULTI-PATTERN STRING MATCHING ALGORITHMS

A. Aho-Corasick Multi-Pattern Algorithm

The Aho-Corasick algorithm[1] (AC Algorithm) was proposed in 1975 and remains, to this day, one of the most effective pattern matching algorithms when matching patterns sets. Initially, the AC algorithm combines all the patterns in a set into a syntax tree which is then converted into a non-deterministic automaton (NFA) and, finally, into a deterministic automaton (DFA) as shown in Figure 2. The resulting FSM is then used to process the text one character at a time, performing one state transition for every text character. Whenever the FSM reaches designated "final" states that correspond to the identification of a pattern match as in Figure 3

The pseudocode for the matching phase of the algorithm is given below:

```
1: procedure AC(y,n,q0)
   /*Input:
   .y←array of n bytes representing the text input
```

```
.n←integer representing the text length
.q0←initial state
*/
2: state←q0
3:   for i=1→ndo //Matching
4:     while (state,y[i])= faildo
       //while g(state, y[i]) is undefined
5:       state←f(state)
6:     end while
7:     state←g(state,y[i])
8:     ifo(state)=∅ then
9:       output i
       //This an accepting state, i.e. state ∈ A
10:    end if
11:  end for
12: end procedure
```

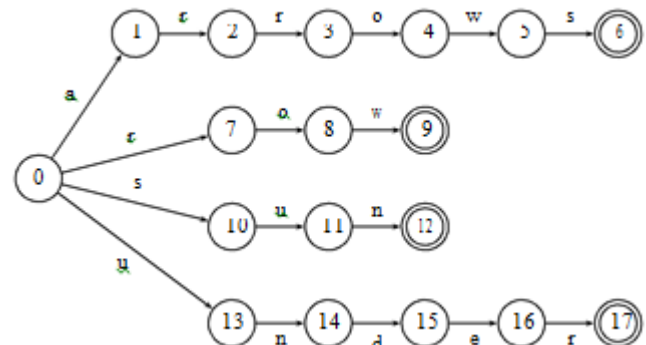


Fig.2. Finite State Automata for the keywords {arrows, row, sun, under

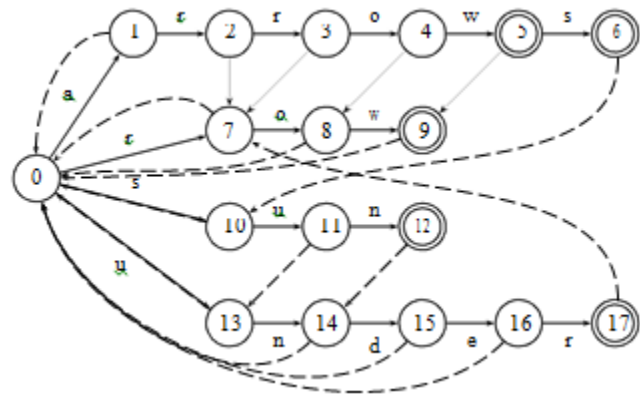


Fig.3. Failure Function for the above Automata

State(i)	1	2	3	4	5	6	7	8
Failure(i)	0	7	7	8	9	10	0	0

State(i)	9	10	11	12	13	14	15	16	17
Failure(i)	0	0	13	14	0	0	0	0	0

TABLE 1
FAILURE FUNCTION FOR ALL THE STATES OF THE ABOVE AUTOMATA

(i)	Output(i)
5	{row}

6	{arrows}
9	{row}
12	{sun}
17	{under}

TABLE 2
OUTPUT FUNCTION FOR THE ABOVE AUTOMATA

The AC algorithm has the significant advantage that every text character is examined only once, i.e. the lookup cost is $O(N)$ where N the length of the text, regardless of the number of patterns or their length. A major disadvantage of the AC algorithm is the high memory cost required to store the transition rules of the underlying deterministic finite automaton.

B. Commentz-Walter Multi-Pattern Algorithm

The popular GNU fgrep utility uses the Commentz-Walter algorithm for multiple string search [2]. Commentz-Walter algorithm combines the Boyer-Moore technique with the Aho-Corasick algorithm. In preprocessing stage, differing from Aho-Corasick algorithm, Commentz-Walter algorithm constructs a converse state machine from the patterns to be matched. Each pattern to be matched adds states to the machine, starting from right side and going to the first character of the pattern, and combining the same node.

In searching stage, Commentz-Walter algorithm uses the idea of Boyer-Moore algorithm. The length of matching window is the minimum pattern length. In matching window, Commentz-Walter scans the characters of the pattern from right to left beginning with the rightmost one. In case of a mismatch (or a complete match of the whole pattern) it uses a precomputed shift table (CWSHIFT[]) to shift the window to the right.

For pattern set {search, ear, arch, chart}, Figure 4 shows the Commentz-Walter state machine and the goto function. Table 3 shows the output function and Table 4 shows the shift distance.

If the text string is "strcmatecadnsearchof", Figure 5 shows the searching process. For seeing clearly, we draw the key characters in red and green, and with the same intention in Figure 4 and Figure 5.

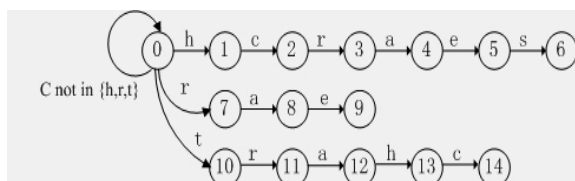


Fig.4. Commentz-Walter state machine and goto function

nodes	4	6	9	14
out	{arch}	{search}	{ear}	{chart}

TABLE 3.
COMMENTZ-WALTER OUTPUT FUNCTION

	a	c	e	h	r	others
0	1	1	2	3	1	3
7	1	1	1	2	1	3
8	1	1	1	1	1	2
9	2	2	2	2	2	2
others	3	3	3	3	3	3

TABLE 4.
CWSHIFT TABLE. CWSHIFT[0A]=1, CWSHIFT[0E]=2, ..., CWSHIFT[9R]=2, ETC.

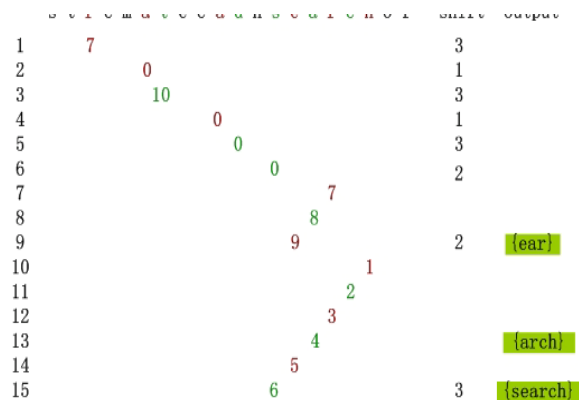


Fig.5. Commentz-Walter searching process.

In Figure 3, the length of matching window is 3. On step 1, when input is 'r', the state is 7, when input is 't', the state is 0, CWSHIFT[7t]=3, the text shift 3 characters. On step 2, when input is 'a', the state is 0, CWSHIFT[0a]=1, the text shift 1 character. On step 7, when input is 'r', the state is 7, when input is 'a', the state is 8, when input is 'r', the state is 9, the output is 'ear', when input is 's', the state is 0, CWSHIFT[9s]=2, the text shift 2 characters.

A multiple string matching algorithm that compares from the end of the pattern, like Boyer-Moore, using a finite state machine, like Aho-Corasick. In computer science, the Commentz-Walter algorithm is a string searching algorithm invented by Beate Commentz-Walter. Like the Aho-Corasick string matching algorithm, it can search for multiple patterns at once. It combines ideas from Aho-Corasick with the fast matching of the Boyer-Moore string search algorithm. For a text of length n and maximum pattern length of L , its worst-case running time is $O(nL)$, though the average case is often much better.

The pseudocode for the matching phase of the algorithm is given below:

```

1: procedure CW(y, n, m, p, root)
   /*. Input:
   . y ← array of n bytes representing the text input
   . n ← integer representing the text length

```

```

    . m ← array of keyword lengths
    . p ← number of keywords
    . root ← root node of the trie
    */
2:   v ← root //The current node
3:   i ← min{m[0], m[1], ..., m[p - 1]}
    //i points to the current position in y
4:   j ← 0 //j indicates depth of the current node v
5:   while i ≤ n do //Matching
6:     while v has child v0 labeled y[i - j] do
7:       v ← v0
8:       j ← j + 1
9:       if out(v) = ∅ then
10:        output i - j
        //Path from v to root matches y[i - j] to y[i]
11:      end if
12:    end while //Shifting
13:    i ← i + min { shift t2(v), max { shift t1(v), char(y[i - j]) - j - 1 } }
14:    j ← 0
15:  end while
16: end procedure

```

C. Wu-Manber (WM) Multi-Pattern Algorithm

Wu-Manber algorithm is a high performance multi-pattern matching algorithm based on Boyer-Moore algorithm. It only uses the bad-character shift, and considers the characters from the text in blocks of size B . Instead of one by one, it expands the effect of Bad-character shift. Wu-Manber algorithm also uses the hashing table to index the patterns in the actual matching phase, thus saving a lot of time. The best performance of Wu-Manber algorithm is $O(B \cdot n / m)$. The running time of the Wu-Manber algorithm does not increase in proportion to the size of the pattern set. The performance of the Wu-manber is dependent on the minimum length of the patterns. In practice Wu-Manber algorithm is one of the best performance in average case [4].

In preprocessing stage, Wu-Manber algorithm builds three tables, a SHIFT table, a HASH table, and a PREFIX table. The SHIFT table is similar, but not exactly the same, to the regular shift table in a Boyer-Moore type algorithm. It is used to determine how many characters in the text can be shifted (skipped) when the text is scanned. The HASH and PREFIX tables are used when the shift value is 0. They are used to determine which pattern is a candidate for the match and to verify the match. For pattern set {search, hear, arch, chart}, Table 5 shows the SHIFT table and Table 6 shows the HASH table for $B=2$.

BC	ar	ch	ea	ha	he	rc	se	others
shift	0	0	1	1	2	1	2	3

TABLE 5
WU-MANBER SHIFT TABLE

a	r	O	s	e	a	r	c	h
			h	e	a	r		
			c	h	a	r	t	

If the text string is "strcmatecadnsearchof", Figure 6 shows the searching process.



Fig.6. Wu-Manber searching process.

Wu-Manber combines the advantages of both Aho-Corasick and can index the document once as well as skip over words in a jump table. Wu-Manber algorithm performs well under scenarios with small or medium number of patterns, but it does not perform well under scenarios with large number of patterns, because the likelihood of shifting the text sliding window is decreased quickly with the increase of the number of patterns.

D. Rabin-Karp Multi-Pattern Algorithm

In computer science, the Rabin-Karp algorithm is a string searching algorithm created by Michael O. Rabin and Richard M. Karp in 1987 that uses hashing to find any one of a set of pattern strings in a text. [5] The Rabin-Karp string searching algorithm calculates a hash value for the pattern, and for each M-character subsequence of text to be compared. If the hash values are unequal, the algorithm will calculate the hash value for next M-character sequence. If the hash values are equal, the algorithm will do a Brute Force comparison between the pattern and the M-character sequence. In this way, there is only one comparison per text subsequence, and Brute Force is only needed when hash values match.

Consider an M-character sequence as an M-digit number in base b , where b is the number of letters in

the alphabet. The text subsequence $t[i .. i+M-1]$ is mapped to the number.

$$x(i) = t[i].b^{M-1} + t[i+1].b^{M-2} + \dots + t[i+M-1]$$

Furthermore, given $x(i)$ we can compute $x(i+1)$ for the next subsequence $t[i+1 .. i+M]$ in constant time, as follows:

$$x(i+1) = t[i+1].b^{M-1} + t[i+2].b^{M-2} + \dots + t[i+M]$$

$$\begin{aligned} x(i+1) &= x(i).b && // \text{Shift left one digit} \\ &- t[i].b^M && // \text{Subtract leftmost digit} \\ &+ t[i+M] && // \text{Add new rightmost digit} \end{aligned}$$

In this way, we never explicitly compute a new value. We simply adjust the existing value as we move over one character.

Let's say that our alphabet consists of 10 letters. Our alphabet = a, b, c, d, e, f, g, h, i, j. Let's say that "a" corresponds to 1, "b" corresponds to 2 and so on. The hash value for string "cah" would be:-

$$3 \cdot 100 + 1 \cdot 10 + 8 \cdot 1 = 318$$

If M is large, then the resulting value ($\sim b^M$) will be enormous. For this reason, we hash the value by taking it mod a prime number q . The mod function is particularly useful in this case due to several of its inherent properties:

$$\begin{aligned} - [(x \bmod q) + (y \bmod q)] \bmod q &= (x+y) \bmod q \\ - (x \bmod q) \bmod q &= x \bmod q \end{aligned}$$

For these reasons:

$$h(i) = ((t[i].b^{M-1} \bmod q) + (t[i+1].b^{M-2} \bmod q) + \dots + (t[i+M-1] \bmod q)) \bmod q$$

$$\begin{aligned} h(i+1) &= (h(i).b \bmod q // \text{Shift left one digit} \\ &- t[i].b^M \bmod q // \text{Subtract leftmost digit} \\ &+ t[i+M] \bmod q // \text{Add new rightmost digit} \\ &\bmod q \end{aligned}$$

For text of length n and p patterns of combined length m , its average and best case running time is $O(n+m)$ in space $O(p)$, but its worst-case time is $O(nm)$. In contrast, the Aho–Corasick string matching algorithm has asymptotic worst-time complexity $O(n+m)$ in space $O(m)$.

1: Procedure RabinKarpSet(string $s[1..n]$, set of string subs, m):
2: set hsubs := emptySet

```

3: for each sub in subs
4:   insert hash(sub[1..m]) into hsubs
5: hs := hash(s[1..m])
6: for i from 1 to n-m+1
7:   if hs ∈ hsubs and s[i..i+m-1] ∈ subs
8:     return i
9:   hs := hash(s[i+1..i+m])
10: return not found

```

Rabin-Karp is good for plagiarism[8][9], because it can deal with multiple pattern matching. It is not faster than brute force matching in theory, but in practice its complexity is $O(n+m)$. With a good hashing function it can be quite effective and it's easy to implement.

E. Bit-Parallel(Shift OR) Multi-Pattern Algorithm

Bit-parallelism is a technique introduced by Baeza-Yates and Gonnet in which takes advantage of the intrinsic parallelism of the bit operations inside a computer word, allowing to cut down the number of operations that an algorithm performs by a factor up to w , where w is the number of bits in the computer word. Bit-parallelism is particularly suitable for the efficient simulation of nondeterministic (suffix) automata.[6] in Figure 7 and Table 7 and 8.

Text= "hhello"
Pattern = { "hello", "world"}

The Bit Vectors are set in the following manner.
 $B[h]=11110$, $B[e]=11101$, $B[l]=10011$, $B[o]=01101$,
 $B[w]=11110$, $B[r]=11011$, $B[d]=01111$

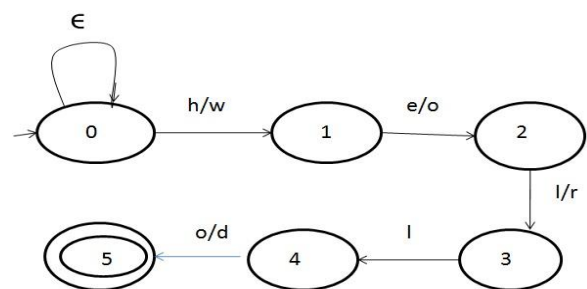


Fig 7. The Automaton recognizing the set of patterns is shown

1	Text = hhello D 11110 B[h] 11110 OR D 11110 D[0]=0 , so shift To next state	2	Text = hhello D 11100 B[e] 11101 OR D 11101 D[1]=0, so shift to next state
	Text = hhello D 11100 B[h] 11110 OR D 11110 D[1]=1 , so it remains in the same state		Text = hhello D 11010 B[l] 10011 OR D 11011 D[2]=0, so shift to next state
3	Text = hhello D 10110 B[l] 10011 OR D 10110	4	Text = hhello D 01100 B[o] 01101 OR D 01101

III. COMPARATIVE ANALYSIS OF SELECTED MULTIPLE PATTERN STRING MATCHING ALGORITHMS

In this paper, we analysed selected multiple pattern string matching algorithms on the basis of time complexity, search type, key ideas and approach parameters. Each algorithm has certain advantages and disadvantages.

The main advantage of the Aho-Corasick algorithm is that it runs in linear time to the input patterns regardless of the number of patterns. However, the main disadvantage lies in devising a practical implementation due to the large memory needed to store the FSM. So one of the primary area of focus in the IDS area is in devising a performance and area efficient strategy for the Aho-Corasick algorithm.

Commentz Walter algorithm combines Aho-Corasick with the Boyer-Moore single pattern matching algorithm [3], which achieves sub-linear running time by skipping characters in the input text according to the “bad character” and “good suffix” heuristics.

In Wu-Manber Algorithm when the length of patterns is short, the search time is long. As the length of the patterns increasing, the search time shortens obviously. It shows that the search time of double-character patterns is a little longer than the single-character patterns. That is because these two kinds of patterns have the same shift distance “1”. When the shift distance is same, the matching time of double-characters is longer than the single-characters.

The Rabin-Karp algorithm achieves an average case running time of $O(m+n)$ by using hashing. The worst case running time is still $O(mn)$ however. The Rabin-Karp algorithm exploits the fact that if two strings are equal, their hash values are also equal. Rabin-Karp is simple and can be easily extended to two-dimensional pattern matching.

The bit-parallel algorithms are more efficient than other string matching algorithms for small and long patterns respectively. Their running time decreases as the pattern length increases and they produce similar running times in all cases with the exception of the binary alphabet.

TABLE 7
EXAMPLE SHIFT-OR ALGORITHM

The pseudocode for the matching phase of the algorithm is given below:

```

1.procedureShift-Or(P,m,T,n)
2.for all  $i \in \Sigma$  do
3. $B[i] = 1^W$ ;
4.for  $i = 0$  to  $m-1$  do
5. $B[P[i]] = B[P[i]] \& 1^{m-i-1}01^i$ ;
6.  $D = 1^W$ ;  $mm = 0^{W-m}10^{m-1}$ ;  $i = 0$ ;
7. while  $i < n$  do
8.  $D = (D << 1) | B[T[i]]$ ;
9. if  $((D \& mm) \neq mm)$  then
10. Pattern detected beginning at  $T[i]$ ;
    
```

	0	1	2	3	4	5	6	7	8	9	10	11
0	a	b	a	a	b							
1		a	b	a	a	b						
2			a	b	a	a	b					
3				a	b	a	a	b				
4					a	b	a	a	b			
5						a	b	a	a	b		
6							a	b	a	a	b	
7								a	b	a	a	b

TABLE 8
THE ALIGNMENT MATRIX GENERATED FOR THE SAMPLE PATTERN
 $P = \{ABAAB\}$ WITH THE ASSUMPTION THAT COMPUTER WORD SIZE $W = 8$

Bit parallel Algorithms like shift-Or have advantage that it works at bit level of the string matching problems that results will be obtained faster compared with other techniques of string matching. Every coin has two side so as this algorithm, Patterns are required to be no longer than the computer word size. It means that maximum length of the pattern must not exceed 32 bits in case of 32 bit machine or 64 bits in case of 64 bit machine.

Algorithms		Aho-Corasick	Rabin-Karp	Bit-Parallel (Shift OR)	Commentz-Walter	Wu-Manber
1	Time Complexity	Linear	Linear	Linear	Linear	Sub-linear
2	Search Type	Prefix	Prefix	Prefix	Prefix	Suffix
3	Key Ideas	Finite automaton that tracks the partial prefix match.	Compare the text and the patterns from their hash functions	Bit-parallelism and q-gram for prefix matching.	it uses is to shift by as much as determined by the longest proper prefix of the pattern	Determine the shift distance from a block of characters in the suffix of the search window.
4	Approach	Automaton-based	Hashing-based	Bit-parallelism based	Automaton + Heuristic based	Heuristics based

TABLE 8
COMPARISON OF VARIOUS MULTIPLE PATTERN STRING MATCHING ALGORITHM

IV. CONCLUSION

This paper is based on multiple pattern string matching algorithms. There are various scenarios where we can use a particular type of algorithm. Aho-Corasick builds an automata of size proportional to the sums of the lengths of all of the substring patterns, and then running it over an input string in a single pass and gives substring matches. The Commentz-Walter algorithm has not emerged as a popular string pattern matching algorithm partly due to the difficulty in understanding it. The Wu-Manber algorithm had a better performance with bigger input texts than smaller one. The idea of the rabin-karp algorithm is that it first preprocesses the pattern and assigns a number for the pattern and then searches that number in the text repeatedly and in each step. It subtracts a value from the current value and adds a value to the current value. The Rabin-Karp algorithm can be very slow if the text contains a lot of false matches. The complexity of Shift OR algorithm is linear in the length of the text and in the size of set of patterns.

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Combined Economic Emission Dispatch Problem of Thermal Generating Units Using Particle Swarm Optimization

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Abstract- In this paper particle swarm optimization (PSO) algorithm is proposed to optimize Combined Economic emission Dispatch Problem (CEEDP) of thermal units. Combined Economic emission Dispatch Problem (CEEDP) is used to minimize both total fuel cost of generation and the emission of toxic gases of the thermal generating units simultaneously while satisfying the load demand and constraints of the system which makes it multi-objective problem. The bi-objective problem is converted into single objective problem by introducing price penalty factor to maintain an acceptable system performance in terms of limits on generator real power outputs, transmission losses with minimum emission dispatch. In this paper, the proposed algorithm has been applied to a standard IEEE 30-bus test system with six generating units and three generating units. The results obtained with the proposed approach are compared with results of genetic algorithm and other technique.

Index Terms- Economic Load Dispatch, Economic Emission Dispatch, combined Economic Emission Dispatch, Particle Swarm Optimization.

I. INTRODUCTION

In this paper, the work explores the economic thermal power dispatch problem with emission dispatch due to toxic gases. In seeking the solution for the combined economic emission dispatch problem (CEEDP) the main aim is to operate a power system in such a way to supply all the loads at the minimum fuel cost of generation and environmental pollution caused by emission of toxic gases of fossil based thermal generating units. An efficient and reliable solution which is applied to the CEEDP with minimum cost and minimum NO_x emission is particle swarm optimization (PSO) method. In electric power system operation, the objective is to achieve the most economical generation policy that could supply the local demands without violating constraints. Thermal stations, during power production, burn fossil fuels that generate toxic gases in their effluent and these become a source of pollution for the environment. The CEEDP calculation optimizes the static operating condition of a power generation-transmission system with security of quality of service. One of the most recent metaheuristic algorithms, the Particle Swarm Optimization (PSO), is a population based stochastic optimization technology [1, 2] by Eberhart and Kennedy in 1995, inspired by social behaviour of bird flocking and fish schooling. It is used for optimization of continuous non

linear functions. PSO is applied to different areas of power systems to minimize real power system losses [3]. The PSO is a swarm intelligence algorithm, inspired by the social dynamics and emergent behaviour that arises in socially organized colonies. The PSO algorithm exploits a population of individuals to probe promising regions of search space. In this context, the population is called swarm, and the individuals are called particles or agents. Each particle moves with an adaptable velocity within the regions of search space and retains a memory of the best position it ever encountered. The best position ever attained by each particle of the swarm is communicated to all other particles [4].

The concept of PSO originated as a simulation of a simplified social system. This method is based on researches about swarms such as fish schooling and a flock of birds. According to the research results for a flock of birds, birds find food by flocking (not by each individual). According to the observation of behaviour of people during a decision process, people utilize two important kinds of information. The first one is their own experience; that is, they have tried the choices and know which state has been better so far, and they know how good it was. The second one is other people's experiences; that is, they have knowledge of how the other individuals (agents) around them have performed. They know which choices of their neighbours have been found as more positive and also the positiveness of the pattern. Each agent decides the decision using individual experiences and other people's experiences [5].

In recent years, environmental constraint started to be considered as part of electric system planning. That is, minimization of pollution emission (NO_x , SO_x , CO_2 , etc.) in case of thermal generation power plants. However, it became necessary for power utilities to count this. Constraint as one of the main objectives, which should be solved together with the cost problem. Thus, we are faced with a multi-objective problem.

Spens and Lee [6] solved the economic load dispatch under environmental restrictions in a multi-hour time horizon minimizing fuel consumption cost for SO_2 and NO_x using an emission ton limit for the first one and an emission rate for the second one. Fan and Zhang [7] solved a cost minimization problem proposing a solution via quadratic programming, where environmental restrictions are modelled with linear inequalities.

In a previous paper [8,9], the authors proposed the use of a genetic algorithm with real coding on the CEEDP problem using as objective function the minimization of the fuel cost

and NOx emission control. More than 6 small-sized test cases were used to demonstrate the performance of the proposed algorithm. Consistently acceptable results were observed. In a recent paper [10, 11], the authors presented the application of the Particle Swarm Optimization (PSO) method to the Optimal Power Flow problem for a large scale power system. The objective function considers at the same time the cost of the power generation, the transmission loss and the voltage deviation. In this paper, Numerical results for IEEE 30-bus test systems with six generating units and with three generating units show that a PSO technique can generate an efficiently high quality solution and with more stable convergence characteristics than genetic algorithms (GA).

II. PROBLEM FORMULATION

The optimization of cost of generation has been formulated based on combined economic dispatch with emission and line flow constraints. For a given power system network, the optimization cost of generation is given by the following equation.

a. Economic Objective Function : The most commonly used objective 'Economic Load Dispatch with pollution' problem formulation is the minimization of the total operating cost of the fuel consumed for producing electric power within a schedule time interval.

$$\text{where} \quad (1)$$

F -is fuel cost of generator in \$/hr.
 -is the generator power output of generator in MW.
 - represents the corresponding generator (1,2,...,n)
 - represents number of generators.
 - are the fuel cost coefficients.

The equation (1) is subjected to the following constraints:

1. The inequality constraints on real power generation of each generation

$$(2)$$

Where and are respectively minimum and maximum values of real power generation

2. The cost is optimized with the following power system balance constraints.

$$(3)$$

Where

- is the real power generation of generator.
- is the load of the system in MW.
- is the transmission loss of the system in MW.
- is the total number of generators.

3. The total transmission network losses the power system is obtained by

$$(4)$$

Where

- are the transmission loss coefficients
 represent the number of lines

b. Emission objective function: The total emission release can be expressed as –

$$(5)$$

Where

- Total emission release in kg/hr
- is the generator power output of the generator in
- represents the corresponding generator (1,2,...,n)
- Total number of generator
- are emission coefficients.

To determine the combined effect of cost and emission, the price penalty factor has to be computed. It blends the generation and emission cost into single objective nature. The price penalty factor is computed by interpolating the values of

for last two units by satisfying the corresponding load demand and it is given by the relation (considering the power associated with each unit). The resulting array elements are arranged in ascending order, after arranging the maximum power of each unit is added one at a time starting from the smallest price penalty factor unit until the summation equals or exceeds the power demand. The price penalty factor at the unit when added exactly meets or exceeds the demand is represented as and the price penalty factor of the previous unit is represented as in recent analysis of Venkatesh et al. have shown that this method of calculation of price penalty factor furnished good result and it is represented by the following equation-

$$(6)$$

Where

- Price penalty factor in \$/Kg.
- Price penalty factor associated with the last unit in \$/Kg
- Price penalty factor with the current unit in \$/Kg.
- maximum power associated with the last unit in
- maximum power associated with the current unit in

c. Total objective function: The economic dispatch and emission dispatch are considerably different. The economic dispatch deals with only minimizing the total fuel cost (operating cost) of the system violating the emission constraints. On the other hand emission dispatch deals with only minimizing the total emission of from the system violating the economic constraints. Therefore it is necessary to find out an operating point, that strikes a balance between cost and emission. This is achieved by combined economic and emission dispatch (CEED). The multi-objective combined economic and emission dispatch problem is converted into single optimization problem by introducing price penalty factor.

$$\text{Minimize} \quad (\text{Rs./hr}) \quad (7)$$

new position of particle i .

III. PARTICLE SWARM OPTIMIZATION

a. Description of Particle Swarm Optimization method

Kennedy and Eberhart developed a PSO algorithm based on the behaviour of individuals (i.e., particles or agents) of a Swarm [11]. Its roots are in zoologist's modelling of the movement of individuals (i.e., fish, birds, and insects) within a group. It has been noticed that members of the group seem to share information among them, a fact that leads to increased efficiency of the group. The PSO algorithm searches in parallel using a group of individuals similar to other AI-based heuristic optimization techniques [12]. Each individual corresponds to a candidate solution to the problem. Individuals in a swarm approach to the optimum through its present velocity, previous experience, and the experience of its neighbours. The particle swarm optimization works by adjusting trajectories through manipulation of each coordinate of a particle. Let i x and i v denote the positions and the corresponding flight speed (velocity) of the particle i in a continuous search space, respectively. The particles are manipulated according to the following equations.

(8)

(9)

Where:

t : pointer of iterations (generations).

w : inertia weight factor.

c_1, c_2 : acceleration constant.

r_1, r_2 : uniform random value in the range (0, 1). (t)

: Velocity of particle i at iteration t .

: current position of particle i at iteration t .

: previous best position of particle t at iteration t .

: best position among all individuals in the population at iteration t .

new velocity of particle i .

b. PSO applied to ELDPP

Our objective is to minimize the objective function of the ELDPP defined by (6), taking into account the equality constraints and the inequality constraints.

The cost function implemented in PSO is defined as:

(10)

To minimize F is equivalent to getting a maximum fitness value in the searching process. The particle that has lower cost function should be assigned a larger fitness value. The objective of OPF has to be changed to the maximization of fitness to be used as follows:

(11)

Where,

the maximum of F , ()

The search of the optimal control vector is performed using into account the real power flow equation defined by (7) which present the system transmission losses (P_{loss}). These losses can be approximated in terms of B coefficients as [34]:

(12)

The B_{ij} coefficients are obtained from a power flow solution. These losses are introduced in the represented as a penalty vector given by:

(13)

In this method only the inequality constraints on active powers are handled in the cost function. The other inequality constraints are scheduled in the load flow process. Because the essence of this idea is that the inequality constraints are partitioned in two types of constraints, active constraints that affect directly the objective function are checked using the PSO-OPF procedure and the reactive constraints are updating using an efficient Newton Raphson Load flow (NR) procedure. Our objective is to search (P_{gi}) set in their admissible limits to achieve the optimization problem. At initialization phase, (P_{gi}) is selected randomly between $P_{gi_{min}}$ and $P_{gi_{max}}$. After the search goal is achieved, or an allowable generation is attained by the PSO algorithm. It is required to performing a load flow solution in order to make fine adjustments on the optimum values obtained from the PSO procedure. This will provide updated voltages, angles and points out generators having exceeded reactive limits. to determining all reactive power of all generators and to determine active power that should be given by the slack generator taking into account the deferent reactive constraints. Examples of reactive constraints are the min and the max reactive rate of the generators buses and the min and max of the voltage levels of all buses. All these require a fast and robust load flow program with best convergence

properties. The developed load flow process is based upon the NR algorithm using the optimal multiplier technique [35, 36].

The PSO algorithm applied to ELDPP can be described in the following steps.

Step 1: Input parameters of system, and specify the lower and upper boundaries of each control variable.

Step 2: The particles are randomly generated between the maximum and minimum operating limits of the generators.

Step 3: Calculate the evaluation value of each particle using the objective function.

Step 4: Calculate the fitness value of objective function of each particle using (12). x_{ibest} is set as the i th particle's initial position; x_{gbest} is set as the best one of x_{ibest} . The current evolution is $t=1$.

Step 5: Initialize learning factors $c1$, $c2$, inertia weight w and the initial velocity $v1$.

Step 6: Modify the velocity v of each particle according to (9).

Step 7: Modify the position of each particle according to (10). If a particle violates its position limits in any dimension, set its position at the proper limits. Calculate each particle's new fitness; if it is better than the previous x_{gbest} , the current value is set to be x_{gbest} .

Step 8: To each particles of the population, employ the Newton- Raphson method to calculate power flow and the transmission loss.

Step 9: Update the time counter $t=t+1$.

Step 10: If one of the stopping criteria is satisfied then go to step 11.

Otherwise go to step 6.

Step 11: The particle that generates the latest p_{gbest} is the global optimum.

IV. NUMERICAL EXAMPLES AND SIMULATION RESULTS

The proposed algorithm is implemented in two test systems and its performance is compared to other optimization techniques like GA, and other conventional methods.

a) Test System I

The IEEE 30- bus system with 6 generators is presented here. The total load was 700 MW. Upper and lower active power generating limits and the unit costs of all generators of the IEEE 30-bus test system are presented in Table 1 (a).

Table.1
Power generation limits and cost coefficients for
Six Generator unit systems
a. For Economic dispatch

Unit					
01	756.79886	38.5397	0.15247	10	125
02	451.33513	46.1592	0.10587	10	150
03	1049.9977	40.3964	0.02803	35	225
04	1243.5311	38.3055	0.03546	35	210
05	1658.5596	36.3278	0.02111	130	325
06	1356.6592	38.2714	0.01799	125	315

The NOx emission characteristics of generators are grouped in Table 1 (b).

b. For emission Dispatch

Unit	β	γ
01	0.00491	0.32767
02	0.00419	0.32767
03	0.00683	-0.54551
04	0.00683	-0.54551
05	0.00461	-0.514116
06	0.00461	-0.514116

The results including the generation cost, the emission level and power losses are compared for economic dispatch and emission dispatch using Particle Swarm Optimization (PSO).

Table.2
Comparison For Economic & Emission Results For PSO

Dispatch	Economic Dispatch	Emission Dispatch

P₁ (MW)	30.712	80.3178
P₂ (MW)	18.681	83.4732
P₃ (MW)	130.568	111.0704
P₄ (MW)	134.288	116.6904
P₅ (MW)	206.088	157.919
P₆ (MW)	198.252	167.0772
P_L (MW)	18.581	16.536
P_D (MW)	700	700
Fuel Cost (\$/hr)	1663066.3	1715938.0
Emission Release (kg./hr)	480.174	432.048

This table gives the optimum generations for minimum total cost for six generating units in three cases: minimum generation cost without using into account the emission level as the objective function ($\alpha=1$), a total minimum emission is taken as the objective of main concern ($\alpha=0$), and at last combined economic emission dispatch ($0<\alpha<1$). As seen by the optimal results shown in the table 3, there is a trade off between the fuel cost minimum and emission level minimum. The difference in generation cost between these two cases 48,411 \$/hr (1726402.5 \$/hr compared to 1677991.5 \$/hr), in real power loss 6.33MW (26.57 MW compared to 20.24 MW) and in emission release 54.382 kg./hr (495.348 kg./hr compared to 437.966 kg./hr) clearly shows this trade-off. The penalty factor is considered as $Z=2015.46$ \$/hr for 700 MW.

Table 3

Results of minimum total cost for IEEE 30-bus system in three cases

Case I. For Economic Dispatch

Method	Conventional	GA	PSO
Fuel Cost (\$/hr)	1677991.5	1671208.2	1663068.1
Emission Release (kg./hr)	495.348	489.559	494.9329
P_L (MW)	26.570	23.124	19.164
Execution Time (sec.)	0.25	1.21	1.16

Case II. For Emission Dispatch

Method	Conventional	GA	PSO
Fuel Cost (\$/hr)	1726402.5	1718388.0	1715940.0
Emission Release (kg./hr)	437.966	435.075	434.130
P_L (MW)	20.240	17.366	16.551
Execution Time (sec.)	0.26	1.21	1.32

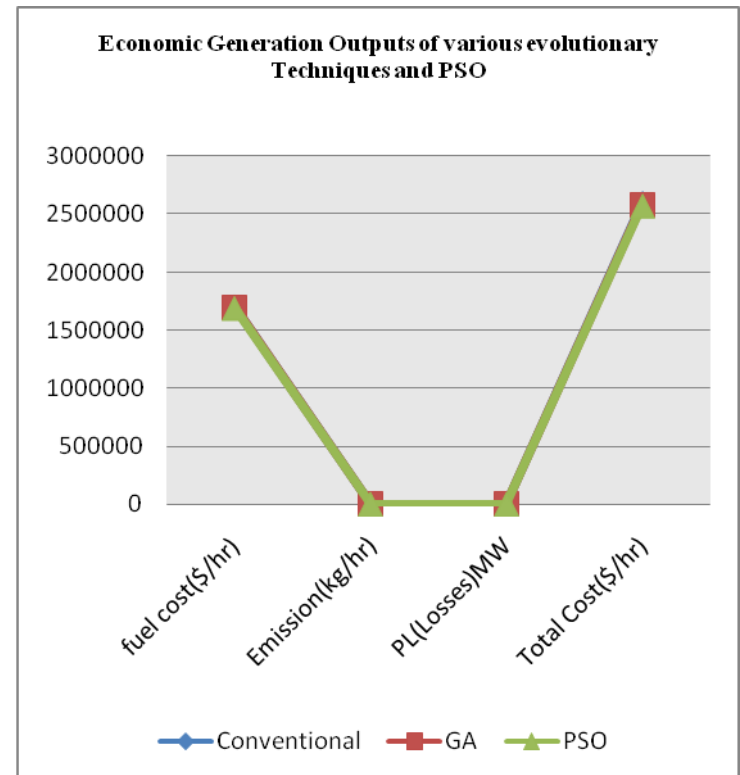
Case III. For Combined Economic Emission Dispatch

Method	Conventional	GA	PSO
Fuel Cost (\$/hr)	1700185.5	1671208.2	1663068.1
Emission Release	442.255	489.559	494.9329

(kg./hr)			
P_L (MW)	21.17	23.124	19.164
Total Cost (\$/hr)	2592167.25	2580578.55	2574855.00

The best solution is approached by PSO as shown in fig.b. In this figure the comparison of all outputs is compared with other evolutionary techniques.

Fig. (b) Economic Generation Outputs of various evolutionary techniques and PSO



PSO Based Combined Economic Emission Dispatch-

In the proposed approach the minimum solution is obtained for PSO based combined economic emission dispatch with line flow constraints for IEEE 30 BUS system. The line flows in MVA of the best generation schedule for IEEE 30 BUS system were shown in table 4 for different power demand as $P_D=500$ MW and price penalty factor $Z=1954.4$ & $P_D=900$ MW and price penalty factor $Z=2152.99$.

Table. 4

Comparison between PSO and GA results for Combined Emission & Economic Load Dispatch for Different Demand

P _D (MW)	Performance	Conventional	GA	PSO
500 Z=1975.4	Fuel cost(\$/hr)	1243723.	1246144.	1243710
	Emission (kg/hr)	5	9	263.263
	P _L (MW)	262.454	263.472	8.65
	Total Cost(\$/hr)	8.53	10.135	1763775
		1762177.	1766587.	

		5	5	
900 Z=2152.99	Fuel cost(\$/hr)	2200180.	2185537.	2172735
	Emission	5	5	695.383
	(kg/hr)	701.428	694.172	
	P _L (MW)			28.053
	Total	35.23	29.718	3669208
	Cost(\$/hr)	3709646.	3679398.	
		1	0	

b) Test system II

The proposed method is tested with three generating units. The input data for standard for three unit system is given in Table (I) and Table (II).

Table .5
Coefficient of fuel cost of 3-Unit Test system

Unit	a _i	b _i	c _i
I	561	7.92	0.001562
II	310	7.85	0.001940
III	78	7.97	0.004820

Table.6
Coefficient of Emission and capabilities of unit generators for 3-Unit Test System

Unit	β _i	Y _i	P _{min}	P _{max}
I	300	0.0315	100	600
II	200	0.0420	100	400
III	150	0.0630	50	200

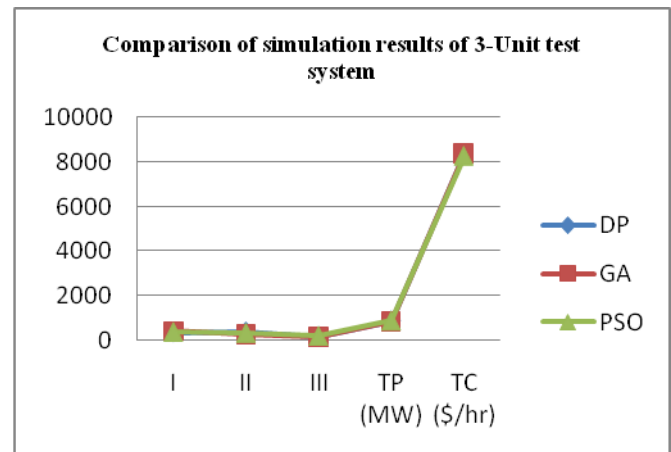
The simulation results of three unit test system are compared using proposed method with other techniques in table (III).

Table.7
Comparison of simulation results of ELDPE for 3-Unit test system

Unit	DP	GA	PSO
I	328	434	362
II	374	277	324
III	167	158	183
TP (MW)	869	869	869
TC (\$/hr)	8407	8398	8277

The comparison of total fuel cost is shown in figure-3. As seen in tabulated results, the PSO can obtain lower fuel cost and emission release than GA method and resulting in higher quality solution.

Fig.(c) Economic Generation Outputs of various evolutionary techniques and PSO



V. CONCLUSION

This paper introduces a Particle Swarm Optimization algorithm to solve the economic power dispatch of power system with pollution control. The fuel cost and emission are combined in a single function with a difference weighting factor. The main advantage of PSO over other modern heuristics is modelling flexibility, sure and fast convergence, less computational time than other heuristic methods. PSO requires only a few parameters to be tuned, which makes it attractive from an implementation viewpoint. The feasibility of the proposed algorithm is demonstrated on an IEEE 30-bus system. The results show that the proposed algorithm is applicable and effective in the solution of OPF problems that consider nonlinear characteristics of power systems with different objective functions. PSO can generate an efficiently high quality solution and with more stable convergence characteristics than Genetic Algorithm.

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Integrated Three Layer Mobile Architecture for seamless Roaming and User specific handoff in 4G networks

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Abstract- Seamless roaming and mobility management are the main challenges before heterogeneous 4G wireless networks. The existing methods for seamless roaming need changes in the implementation of TCP. User specific vertical handover is provided by introducing new entities in the existing networks. This paper presents three layer architecture to provide seamless roaming and user specific handoff without altering the current implementations. It also avoids the need for new entities. The first layer is a management agent and the next is information transfer. The final layer behaves as link agent. Management agent controls and shares the messages among different access networks. Information agent handles data streams. Link agent gathers details about the connected links and provides status updates.

Index Terms- seamless roaming, handoff, heterogeneous networks

I. INTRODUCTION

The aim of 4G communication is making the user to freely roam across various networks seamlessly and provide connectivity to any wired or wireless systems. The mobile agent has capable of handling multiple network interfaces like GSM/GPRS, WLAN, Ethernet etc. every network have its own scope and limitations. In 4G user is allowed to choose the network they like. One user wants very high data rate but accepts limited mobility may use Ethernet. The other user who likes wide coverage area with low data rate can opt for GSM/GPRS. Services like Wireless LAN provide moderate data rate and mobility. When the user move from one cell to another, according to the need of the user they might want to continue in the same network or like to connect to different networks. If the user moves to another cell without changing the access network, it is called horizontal handoff. This type of handoff can be provided without disturbing the current implementations of TCP. When the user wants to change the access network, it is known as vertical handoff. The existing methods uses additional entities like proxy or foreign agent to provide Vertical handoff. In this paper a Three Layer Mobile Architecture (TLMA) which does not require any change in current implementations for seamless

roaming is proposed. Also user specific handoff mechanism without additional entities is discussed.

II. RELATED WORK

All the available wireless technologies have handover mechanism for horizontal hand off. To provide vertical hand off different solutions are proposed. In TCP/IP protocol suite implementation of MSOCKS or TCP-migrate provides vertical handoff. But these methods require changes in existing TCP. Most of the mobility solutions are mobile IP based. To support seamless mobility IPV4 or IPV6 requires additional entities in the network. Also IP based methods cannot provide users specific handovers.

Mobility from one terminal to the other needs support of higher level layers. Network layer should rely on session layer for resolving these issues. SLM Session layer based mobility management solution provides a architecture to handle vertical hand over. SLM uses user location server (ULS) in the network. It does not have facilities to use the latest mobile independent handover (MIH) mechanism provide by wireless LAN technologies. Session initiation protocol (SIP) is the other method provides mobility based on location updates[24]. But it still has interoperability issues. It also requires proxy servers and registrars.

III. TLMA ARCHITECTURE

Seamless roaming and mobility can be provided by utilizing the intelligence of the network. Giving more intelligence in the network provides a way to ensure seamless roaming. On the other hand the sophisticated end equipments also provide a way to establish these things. The proposed TLMA architecture mainly utilizes the intelligence of end user mobiles for its frame work. This ensures the use of existing TCP implementations without any change. TLMA provides support for user specific handover which is not provided by TCP. It facilitates TCP rather than changing it. The difficulties of location management are reduced. Fig 1 shows the architecture of TLMA

Fig 1: Architecture of TLMA

A. Processing unit

TLMA consists of a processing unit which uses management agent and information agent. TLMA processing unit gathers all the details from information agent, send control information through management agent and establishes a link using link agent.

B. Management unit

Management agent makes association between applications when the end user mobile equipped with the proposed triple layer architecture. The applications using this frame work are aware of the user preferred handoff. Every TLMA has a reference number which is unique. It can handle multiple TCP connections. Whenever the vertical hand off is initiated it affects TCP connections. Then TLMA establishes new connection with TCP. But the unique reference number is not altered for new connection.

When a TLMA compatible end user is looking for a new connection the management agent of the user checks the other end user whether it uses TLMA frame work or not by sending a request to the server. Two type of request can be sent based on the other end user by the management agent , connection establishment request or connection alteration request. These request messages are connection less, uses user datagram protocol (UDP) .

Based on the response of the end user the management agent establishes connection. If the other end user is not using TLMA then TCP connection method is followed. If TLMA compatible user is found then both the users share a common reference number which is initially used for connection establishment. This reference number is a local parameter and it may be encrypted to ensure security. After sharing the common reference connection is established as per user preference. Forming a TCP connection under TLMA makes way for multiple connections.

C. TLMA information agent

Information agent in TLMA provides all the required details to initiate handoff. It gathers information from lower and upper layers and provides that to the TLMA processing unit. It interacts with the processing unit and act as inter layer information provider. At the lower layer information agent communicates with the user agent and using the upper layer it exchanges information with management agent. The information transfer agent makes sure the sequence of data streams unaffected because of new TCP connection created by management agent. It maintains multiple streams for single connection.

Handoff is forced in two situations. First one is regular handoff which is automatically forced when the user moves out of coverage range of a network. When it enters into the coverage area of a new network handoff must be initiated to maintain connection. Lower level layer attributes changes when the terminal enters into a new network. These changes are captured by information agent and sent to processing unit to initiate regular handoff. Second type of handoff provided based on user preferences. In 4G wireless environment the user is free to choose a network based on the application or service. When the parameters of higher level layer changes and expects connection change then user forced handoff is initiated. Here the need of the user is the vital parameter. Here the information agent interacts with the higher level layers and gets the required details to initiate user preferred handover.

D. Data transfer control unit

The data transfer unit of TLMA uses link agent to support user preferred handoff. The link agent interacts with higher level layers such as application layer and gives the details about user preferences network subscriptions. The user preferences are mainly depends on accessibility of a provider, cost considerations and service quality. Based on these factors the

user selects the home network and other preferred roaming networks.

The link agent provides the connection details to the user. The connection details like transit time, data rate, quality of service and all other possible routes for the data transfer are provided. In user preferred handover the destination network can be selected manually by the user or it can be selected automatically. If user preferences are well known then pre-defined the cross over levels can be maintained. If the parameter changes reach the cross over levels then user preferred handoff can be forced immediately. Avoiding the manual selection simplifies the approach. Frequent manual intervention might lead to wastage of resources.

IV. HANDOVER USING TLMA

As mentioned earlier handover can be initiated in two ways. Automatic handover initiation occurs when the user moves away from the existing access network. In the other way the user purposefully can force a handoff according to his preferences. User preferred handoffs are the facility provided by 4G initiatives. TLMA takes care of the handover procedure in both cases effectively.

A. Automatic handover

When the user moves out of the coverage area of the existing network it has to undergo automatic handover. The information agent of TLMA detects the signal strength of the access networks continuously. When the signal strength of the existing reduces it intimates it to the control unit of TLMA and handover is initiated. The methods for automatic handover are clearly defined in all type of networks. The required control information is exchanged between the new network and the user. The user registers itself successfully after the new network authorizes it to get access to the resources.

B. User specific handover

The user can opt for a handover as per his need in a heterogeneous networks environment. This facility is viewed as a very important initiative of 4G technology. To provide user specific handover the user must have access to different networks at the same time. The user should be permitted to switch to any network anytime. This need intervention of higher level layers. If the user decides to force a handover it is given to TLMA through information agent. The control unit receives the request and generates the required control messages. The management agent finds out the availability of the selected target network by sending request to the new network. Simple IP can be utilized for this purpose. The parameter of the new network is loaded into the control unit of TLMA through information agent. Dynamic Host Configuration Protocol (DHCP) is used to get the address information from the new target networks. After exchanging the required control details the link agent of TLMA establishes a new TCP connection with the target can get access to the target networks for the required time duration. It get access as if it belong to network. The user the home network.

V. CONCLUSION

The proposed TLMA architecture can handle vertical

handover effectively. The existing network implementation does not require much change. The management unit of TLMA utilizes TCP, UDP and DHCP for its operations and handles the handoff. This avoids any need for modification in the available network. It also avoids the need for any intermediate entities between the user and the new target network thereby avoid delays in vertical user specific handovers. The information agent makes registering and sharing the information with the target network easier.

APPENDIX

Appendixes, if needed, appear before the acknowledgment.

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The preferred spelling of the word "acknowledgment" in American English is without an "e" after the "g." Use the singular heading even if you have many acknowledgments.

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