A Smart Travel Companion Application with Location Base Scheduling

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In urban life style traveling inside and outside of the city takes a major role. Because cities have, high density of population and high density of vehicles, and this will lead to the problem of city traffic and scheduling. This problem will cause big interruptions to working class citizens and undergraduates like being late to work, missing appointments, and missing lectures. To solve this, past few year's companies like Google introduced navigation systems with predicted traffic. Still people does not often use these resources to improve their lifestyle. With the help of the google Maps, "ROADIE" is focused on filling the gap between the user and the information through an intelligent voice assistant by learning and analyzing users' habits and introducing the integration of Navigation with Location base scheduling. Users can schedule appointments considering traffic conditions and receive feedback through text or voice base about the reachability of the destination. Users can plan their day according to the travel schedule and increase the productivity. In addition, users can contribute by posting traffic updates that system will analyze and send to the community to optimize existing predictions. The research team believes that the proposed application will contribute to solve the scheduling and traffic problems that faced by urban working class citizen.

Keywords: City; out-door Navigation; companion; Android; urban citizen; intelligent

I. INTRODUCTION

In the busy urban lifestyle, traveling is a main activity. People use different mode of travel to reach their destination. There are many problems related with day today traveling. In a busy city area, too many vehicles create traffic. When traveling by public transportation most often people might get stuck in the traffic or end up taking the wrong bus, and arrive at lecture/work place late or when using the private transportation people might use the wrong route without knowing traffic conditions and waste time. Through there are many narrative navigation systems and route traffic displaying applications there have not been any companion infrastructure based navigation system that learns form user habits and interact with the user to present navigation data in an understandable manner in the simplest form.

The usage of android devices are increasing, According to the recent research reports, there are above five billion mobile users in the world currently and approximately one billion among them are smart phone users. [1]

"Roadie" collects data/information from Weather from google weather API, Google maps location database, user/admin created routes and compute/mine them with users' (Roadie user) travel data collected from different users, using data mining techniques and shortest path calculation algorithms to predict and suggest the best route for the user based on users preferences, habits and travel system.

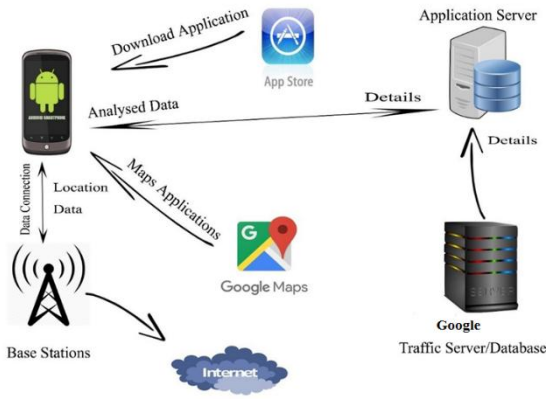

Figure 1 High Level Diagram

II. LITERATURE REVIEW

As congestion, problems in day today travelling become a greater concern to urban citizens. Solutions, which alleviate them, were needed to improve the performance of the transportation system.

In an article written by Paul Borokhov, they present system which enables users of smartphones to obtain directions generated using an algorithm which provides an optional routing policy for reliable on time arrival that is directions which seek to maximize the probability of arriving to the destination within a given time budget, rather than to minimize the travel time based on posted speed limits [2].

Article, published by student Kari Torkkola and some other students of Intelligent System Labs in USA, says that "Traffic Based on Route Prediction", Traffic advisories can be delivered to assist travels in avoiding congested areas and reaching their destination in a timely manner. They collected Location and route data from fourteen participants, representing 6 undergraduate students, 5 office employees and 3 independents. Each participants was provided with a commercially available mobile phone. Each participant used the phone and the GPS receiver for a two to three month period. Context data logging software is "context phone", public domain software from University of Helsinki, Finland. The logged context variables consist of the following;

- GPS data from Bluetooth GPS receiver
- Current GSM cell ID
- Bluetooth devices around the phone
- Phone profile
- Active phone application
- Phone idle/active time
- Battery status and charger status
- Incoming/outgoing calls
- SMS or multimedia messages
- User interaction with the Phonebook and recent call log
- Media captured with the device (e.g. :photo, video)

[3].

In this paper, they present "Moode", a practical mobile application based on a novel hybrid model of factor graph model combined with a deep neural network (DNN), main technical contributions of Moodee are:

1) Design a convolutional neural network (CNN) with cross auto encoders (CAE) to generate user-level content at tributes from tweet-level content attributes.

2) Define a partially-labeled factor graph (PFG) to combine social interaction attributes with user-level content attributes for stress detection [4].

In a research paper called "The Research of Travelling Companion Algorithm Based on Fuzzy Clustering Analysis", the algorithm research of Travelling Companion is based on the fuzzy clustering analysis. The result of the empirical research with indicates that the algorithm research of travelling companion is faithfully and reasonably designed and has guiding significance to solve relevant problems in the future [6].

Fleisher describes development and deployment of GPS (Global Positioning System)/GSM (Global system for mobile communications) based Vehicle Tracking and Alert System. This system allows inter-city transport companions to track their vehicles in real-time and provides security from armed robbery and accident occurrences [7].

Cell tower triangulation similar to GPS tracking in many ways. Multiple towers were used to track the phones' location by measuring the time delay that a signal takes to return back to the towers from the phone. This delay is then calculated into distance and gives a fairly accurate location of the phone. Detecting which antenna of the tower of signal bounced off of can further refine the location. This gives a more specific location when used congruently with multiple towers calculated by multiple dishes on each tower [8]

In one research paper which has been published by a student in university of Electronic Science Technology of China Chengdu it is mentioned that BLSPM algorithm is more efficient and time saving

in finding the shortest path a given destination with road traffic data.

Following points are considered by the algorithm when giving the solution to the user,

- Traffic Status (Free Flow, Heavy , Congested, Impossible)
- Travel Times (Elaborated, Free flow and Normally Expected)
- Traffic Values (Measured values e.g. Flow, Speed, Congestion)
- Weather Value (Precipitation, Wind, Temperature, Population, Road Surface, Condition and Visibility)
- Obstruction (Animal Presence, Vehicle Obstruction, Infrastructure damage)
- Driving Condition Type (Impossible, Hazardous, Passable with care, Normal) [5]

In the research paper published by student of an engineering college of Jordan they have develop a website for tracking, navigation and finding a shortest path for a destination and tracking the user position for the city of Amman. Their tracking function operation can be summarized as follows.

(1).Auto-refresh which means updating the location of the car every interval chosen by the user.

(2).Interval to receive location update info, which means the update time used to receive location of car (0.5 sec), means receive location info by (SMS or GPRS) every 0.5 sec.

Their tracking system is based on the dynamic layer (GeoEvent Function). A GeoEvent is a moving object. Example includes vehicles, aircraft and satellites systems. If the user wishes to track and display on the map. Then the GeoEvent in the Animation Layer may be refreshed without reloading the map image. The user can utilize the animation Layer and GeoEvent objects to track and display the location of a vehicle in real time. [11]

For our data collection, they used CellOScope – a smartphone data-collection system. The CellOScope application tracks the user's geographical locations using the GPS coordinates. In case the GPS coordinate are unavailable, it uses the location coordinates provide b the cellular operator. CellOScope has two components: a) an Android based smartphone app which was installed on participants' smartphones manually and was also made available on google play for download and b) a data collection server. CellOScope data collection involves three important components of the user's smartphone data. [9]

III. METHODOLOGY

The system is using the prototype methodology of Software Development Life Cycle (SDLC). The software prototyping was refers to building software application prototypes which display the functionality of the product under development but may not actually hold the exact logic of the original software.

Initializing of the project was done by this planning phase. The goal of planning was to examine the feasibility of the project. In addition, decisions were made concerning who is the project is carryout, the system has two main components. Android application and server.

The project team analyzed hardware and software requirements in order to start the project and the related research papers about the topic. The team's work plan was done firstly the interfaces designing and then implementation of the android application. While working on the mobile application plan was also to start the developing of web server, then checking compatibilities between the devices and the server and testing.

There are four members in the team. Requiring and gathering, Designing, Implementation and Testing of the developed system share among the members All the four members contributed in the implementation of the android application and the web server.

When the team analyzing existing map/navigation and scheduling systems we realize that yet there are information and data everywhere no company or system attempted fill the gap between the user and the information. We did not needed to re-invent the wheel technology was already there, so the team focus on how to present these data to the user. We used Houndify API to calibrate the voice assistant. Assistant will update user about traffic conditions and upcoming schedules/appointments according to the users' situation through voice or text base. To do that User habit analyzing component will track users usual traveling routes , sleeping and waking patterns , device monitoring data and users likes and dislikes. Also application will prompt questionnaires to user to gather information. When researching through previous work done in the field team realized that Maps/Navigation and Location base scheduling should be an integrated system. Placing appointments on a map based on locations users can get a clear idea about the reachability or

achievability of appointments using the information presented from the system by analyzing the time difference and traffic conditions between locations. By tracking users' movement and speed on the route application will re calculate the achievability or reachability of the destination. Also users can contribute to traffic data base using the tweet traffic function.

These data provided by the users' will be analyze and cross reference with the google traffic data and through confirming data by prompting questions to other users on the same route or near the location. Focus of the research team was to utilize only the hardware and software resources available in the users 'device. And as for technologies team mostly used Google API s for maps and geo location data gathering.

IV. RESULTS AND DISSCUSSION

"Roadie" has been successfully developed and it's able to predict traffic using google API, able to save places, ask questions based on geo locations, give feedback using a voice assistance and the application is successfully able to prove the need of integrating Navigation/Maps with Scheduling. Also users can contribute to the system using a tweet traffic feature. A walk through of the main interfaces of the system is shown below. Prior to Registering to the application user needs to answer to some questions predefined, or user can skip the process to start the main interface.

In the main interface of the android application will navigate to other main interfaces such as,

- Traffic
- Follow me
- Scheduling
- Shortest path
- My places
- My trip
- Tweet Traffic

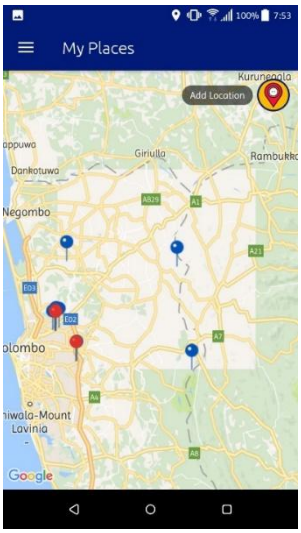

Figure 3: My places

Users can save places and get alerts and suggestions when the location is getting close. This suggestions and alerts will receive through text notifications or Voice assistant depending on user's situation.

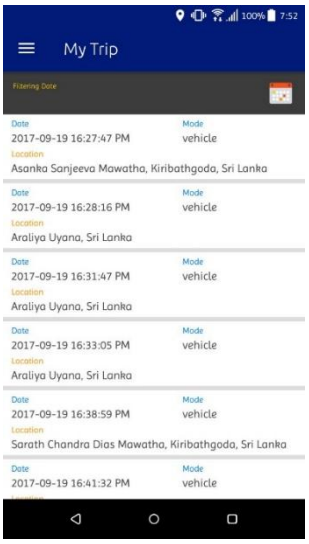

Figure 4: My Trip

Application will backup weeks' worth users travel data to learn user's habits, usual traveling places and routes and travel modes.

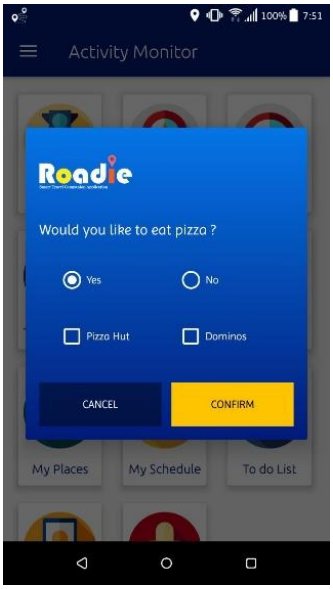

Figure 5: Prompting questions

And using these data apllication will ask questions randomly from user to store more data regurding users preferences and dislikes.

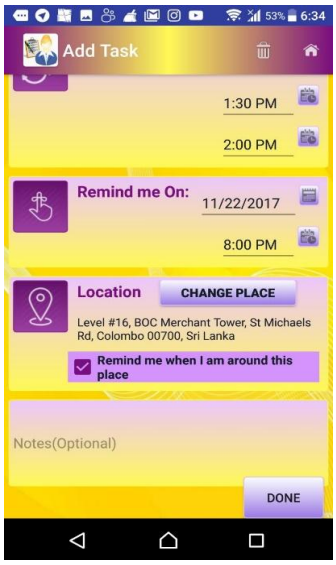

Figure 5: Scheduling & Appointments

When placing an appointment user can set a location of the appointment. Application will check the other appointments placed before with the location and calculate the distance between two destinations. Or it will calculate the distance from the user's current location. And system will alerts user through text and voice base whether he/she will able to reach the destination on time.

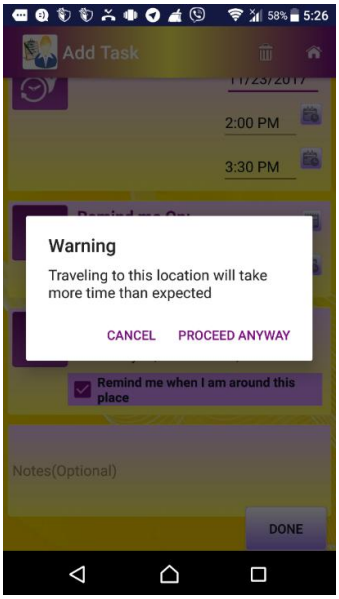

Figure 6: alerting user about the reachability

Users can contribute to the traffic database using Tweet traffic feature. Using hashtags user can insert traffic updates to the system. System will then verifies the content and push the traffic updates to users on the same route.

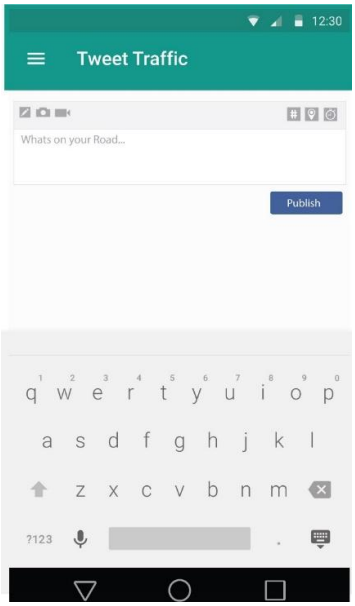

Figure 7: Tweeting Traffic

"Roadie" was developed to help urban busy travelling citizens to make their daily activities easy by integrating Maps/navigation with Location base scheduling. That was the main target of the research team. Team wanted the application to be much as hands-Off possible, because of this team integrated the system with an assistant. During the development of "Roadie" the team had to face some technical issues. Those were like, using GSM 2G network to locate the user modern cell towers rejected to allow access to their location manually. When there is no Active data connection confidence

of locating the user or recognizing the users activity (travel mode, running or walking etc.) is approximately 70 percent.

V. CONCLUSION

Data analytics lead in to take better decisions in order to prepare a solution for a real world problem. With the data gathered and the obtained results through analysis process, there are some notes to take prior to develop the entire system. Results showed that main occupants are working people and students. Most of those occupants are having smart mobile phones and it was a positive sign as far as the research is concerned. Without having a smartphone, it is useless in undertaking the developed solution. Majority of the respondents are travelling by bus, car and motor bicycle. Approximately 50% of those occupants are travelling by their own vehicles like cars and motor bicycles. The developed application is better suited for those who are travelling by their own vehicles and do not aware of routes and traffic jams. According to the analysis, 53% of respondents are using travel guidance application but they are not fully satisfied with it. Understanding their major requirement and compare the current solutions with the developed solution is advantageous prior to develop the application. Most of the respondents are from Colombo and others are around Colombo where different kinds of routes have been utilized. Consideration off almost every route in the map is very important in these circumstances. Higher percentage of respondents are using scheduling applications and they are not necessarily satisfied with it. Some of them have missed on their early meetings as well as lectures due to bad scheduling. Scheduling should be a part of the requirement for the application due to results of the analysis. Best part of the respondent are lacking location awareness and better interaction of users through the developed solution is highly beneficial for users. Majority of respondents are depending on Google Maps and they are having considerable amount of satisfaction with it. Studying and understanding of the process of Google Maps can be effective in developing the application. Higher percentage of respondents have understanding on intelligence applications, but they are not using them in effective manner. Speech Recognition component play a major role in the application. It is necessary to get traffic updates to avoid certain routes and majority of respondents are not getting updates on traffic in daily basis. Functionality to give daily updates on traffic is beneficial for users in many ways

References

[1] No author, "Number of mobile phone users worldwide from 2013 to 2019 (in billions)", The Statictics Portal, 2017

[2] Paul Borokhov, Sebastien Blandin, Samitha Samaranayake,Olivier Goldschmidt, and Alexandre Bayen,

"An adaptive routing system for location-aware mobile devices on the road network", In IEEE conference on intelligent transportation systems (ITSC), Washington DC, pp.1839-1845, October 2011,doi:10.1109/ITSC.2011.6083021.

[3] Kari Torkkola, Keshu Zhang, Haifeng Li, Harry Zhang, Christopher Schreiner, Mike Gardner," Traffic Advisories Based on Route Prediction", In Motorola, Intelligent Systems Lab, Tempe, AZ, USA

[4] Huijie Lin, Jia Jia, Jie Huang, Enze Zhou, Jingtian Fu, Yejun Liu, and Huanbo Luan, "Moodee: An Intelligent Mobile Companion for Sensing Your Stress from Your Social Media Postings" Department of Computer Science and Technology, Tsinghua University, Beijing 100084, China Tsinghua National Laboratory for Information Science and Technology (TNList) Key Laboratory of Pervasive Computing, Ministry of Education Academy of Art and Design, Tsinghua University in Proceedings of the Thirtieth AAAI Conference on Artificial Intelligence (AAAI-16)

[5] No author, "The Research of Traveling Companion Algorithm Based on Fuzzy Clustering Analysis",

By Natural Science Foundation of Hainan Province (under No. 613154), National Natural Science Foundation of china under (No.51164008).

[6] Adnan Shahzada, "Dynamic Vehicle Navigation: An A* Algorithm Based Approach Using Traffic and Road Information", International Conference on Computer Applications and Industrial Electronics, Lohore, Pakistan, 2011.

[7] (https://pdfs.semanticscholar.org/c19f/c9aa2d5d57139ac75869aa12d113f3e288a2.pdf) "DESIGN AND DEVELOPMENT OF GPS-GSM BASED TRACKING SYSTEM WITH GOOGLE MAP BASED MONITORING" Centre for Development of Advanced Computing, Mohali, Punjab, India

[8] (https://www.iiiweb.net/forensic-services/cell-phone-tower-triangulation/) Cell Phone Tower Triangulation

[9] Peng Huang," Improved Algorithm Based on Sequential Pattern Mining of Big Data Set", IEEE International Conference, Chengdu, China, 2016.

[10] Ramanujan K. Sheshadri , Ioannis Pefkianakisx, Henrik Lundgreny, Dimitrios KoutsonikolasAnna-Kaisa Pietilainenz, Augustin Souley, Jaideep Chandrashekar, "Characterizing Mobile User Habits: The Case for Energy Budgeting"

[11] Balqies Sadoun, Omar Al-Bayari and Samih Al-Rawashdeh, "THE DEVELOPMENT OF A WEB MAPPING SYSTEM AND ITS APPLICATION", IEEE, jodan, 18-21 july 2011.