A Review on Smart Bus Ticketing and Tracking System using IoT

Bhat Apoorva
Dept of CSE
Alva's Institute of Engineering and Technology

Kavitha C
Dept of CSE
Alva's Institute of Engineering and Technology

Bharath M
Dept of CSE
Alva's Institute of Engineering and Technology

Nitesh Narayan Vaidya
Dept of CSE
Alva's Institute of Engineering and Technology

Prof. Harshitha G M
Dept of CSE
Alva's Institute of Engineering and Technology

***Abstract*:- The most vital transport challenges are frequently identified with urban territories and happen when transport system, for a variety of reasons, cannot fulfill the various prerequisite of urban versatility. Keeping in mind the end goal to manage these negative aspects, in this paper, we proposed smart bus ticketing and tracking system that any passenger with an application on the smart phone can get information like current location of the bus, bus routes on a map and crowd on the bus and the list of every single conceivable buses arriving in within fifteen minutes. An IoT empowered system application gives three principle information services for bus users: 1) Micro-navigation and 2) Crowd-aware route recommendation 3) Bus arrival time estimation. Micro-navigation alludes to fine-grained relevant direction of travelers along a bus travel by recognizing boarded bus vehicles and tracking the traveler's journey advance. Crowd-aware route recommendation gathers and predicts crowd levels on bus voyages to recommend better and less crowded courses to bus riders Bus arrival time estimation gathers bus locations and predicts the evaluated landing time to traveler's area with shared route details.**

General Terms:- Interactive Polyline Encoder Utility algorithm

Keywords:- Global Positioning System, Google, Smart, phones, Real-time systems

1. INTRODUCTION

As the population in urban areas keep on growing there dependably exists a vulnerability as for time of arrival of bus at the bus stop and bus networks in thick urban territories are frequently considered as mind boggling and hard to navigate. Additionally infrequently transports are crossed out because of their breakdown strikes water signing on the streets or some other reasons, the workers are never educated about such cancellation of buses. The "bus Ticketing and Tracking system" that is proposed intends to give a powerful and effective framework to enable facilities to track buses, know evaluated time of entry of any bus, capacity to book tickets ahead of time and to keep up a database for ticketing transaction by means of a flexible application on the android platform.

Real time vehicle tracking to follow routes and locations driven by a bus is done with the help of global positioning system (GPS). Users can likewise see bus routes on the map with their geographic and nongeographic qualities. GPS and Google maps are utilized for showing current areas of buses on the maps together with the related course data [8]. The RFID tags are utilized to recognize individuals and other data like payment, validity etc. Bidirectional sensor on the door is utilized to take the people count tally in the bus. Arduino UNO is a microcontroller to program with real time clock (RTC). A real time clock is a computer clock that monitors the present time. In light of IOT the travelers can get to this data of a transport in view of user source and destination through the android application [5].

The challenge here is to give all the required tracking and landing data and in addition the ticketing facilities to the traveler. In spite of the fact that these facilities can be given at a bus stop, it crushes the point of giving adaptability which is an essential piece of this task. Subsequently the android application is created as a User Interface. The principle reason for this application is to give a simple interface to get to all the different highlights of the system and to make full utilization of its functionality. A large portion of the facilities provided by this framework will wipe out the issues looked because of vulnerability of arrival of buses.

2. LITERATURE SURVEY

Research on open transportation has generally centered around techniques to enhance the effectiveness of the physical transport framework. For example, service scheduling is considered as a critical issue for productive transport activity [7]. Be that as it may, Camacho et al. [3] contend that this point of view is simply inspired by the interests of transport administrators and misses the mark regarding the data needs of travelers in the advanced age. Rather than settling operational transport issues, they recommend to outline traveler driven data framework that can enhance the traveler's journeys.

A critical change of public transport data accessibility has been the improvement of portable transport applications. One Bus Away is the main portable application that brought estimates arrival times of transports on cell phones [6]. The creators indicated experimentally that pervasive

access to expected waiting times essentially expanded fulfillment with public transport administrations. Then, various versatile transport applications have been produced for transport frameworks in numerous urban areas around the globe. Some of these applications use on the inherent sensors of cell phone gadgets to give personalization and setting mindfulness [8], example by utilizing GPS for proposing transport stops in the surroundings of a user. This gives knowledge into the crude context of the user, for example, his present area, however does not catch a more extensive thought of transport setting including the collocated physical transport system, example the bus vehicle and bus line on which a user is riding.

Moreover, current versatile transport applications regularly depend on the vehicle data that is distributed by transport administrators as open information, example in form of the Google's general transit feed specification (GTFS). This information incorporates a depiction of the vehicle network including routes, schedules, and landing times while subjective travel data is absent as a reason for educated travel decisions of transport users. Crowding on public transport framework is a measurement of subjective travel data that is known to have a big effect on travel satisfaction and cause an abnormal state of pressure and inconvenience [9]. To recognize crowd levels on public transport frameworks, some public transport offices embrace mechanized toll gathering framework which can give measurements about the quantity of travelers with advanced tickets [10]. In any case, because of considerable speculation costs these frameworks are just conveyed in chosen urban communities and frequently need combination with explorer data frameworks. Without committed following foundation bolstered by transport specialists, crowdsourcing applications have been produced to secure extra continuous transport data. The possibility of these application is to permit transport clients act in a cooperative way and gather content information about true transport conditions experienced amid their journeys. For example, Tiramisu empowers transport travelers to utilize their cell phones for physically sharing travel encounters, for example, regardless of whether adequate free seats are accessible on transports. In any case, to detect real time crowd data across large-scale public transport networks, completely programmed approaches are required which can work without steady, manual mediations of transport users. Current traveler data system offer help in singular travel context, example before an excursion is begun, while scanning for a nearby stop or while waiting for a bus. With a specific end goal to offer continuous direction for movement exercises, the possibility of route frameworks has been effectively connected in different portability situations, specifically for people on foot and auto drivers. The equivalent of a navigation system for public transport systems is currently missing as of now. There has been inquire about into cell phone based frameworks to identify the method of transport of voyaging users. These frameworks can separate transport ride movement from other transport modes by perceiving designs in sensor information acquired from the user's cell phones. However, a route benefit which continually goes with an public transport client and chooses how to best offer help from begin to end of his adventure is yet an open research challenge [8]. The WI Rover System (WRS) has been running on the buses since April 2010 giving Wi-Fi hotspots to the utilization of travelers. On the review, 17,567 novel customer gadgets were associated with the WRS. This framework gives outline, administration systems for the system. This demonstrates individuals are towards the use of network facilities. The area construct administrations are finished focusing with respect to mobile guides, transport support, assistive innovation and so forth. The necessities openings in every zone are gathered, assessed and applications are spoken to in view of the request of open travel benefit. Those applications that beat the specialized and monetary difficulties are executed for public utilization.

The exploration in Dublin downtown area having two goals i.e., to analyze the feeling of anxiety and to decide solace and reliability level of public transport administrations. This overview demonstrated that pressure was high and solace and reliability level diminished impressively. Thus to defeat this multinomial logic model was utilized to kill crowded and untrustworthy services [2]. Components influencing the reliability of urban transport administrations thinks about twelve urban areas regarding vitality use and ozone depleting substance outflow [GGE]. Every city audited had expanded vitality utilization, GGE, and private vehicle use. Here creator says that private vehicle utilization is expanding since individuals don't bargain on solace and unwavering quality of public transport framework.

Transportation Research Record says that there are a number of factors like traffic congestion, weather conditions etc. which affects the predetermined bus arrival schedule and hence results in increasing passenger waiting time. So there is a need for the system to predict the accurate bus arrival time and hence reduce the passenger waiting time.

Models for anticipating transport delays, says that travel period dependability is a noteworthy factor in public transport framework and led an investigation on estimating of reliability and standard travel times utilizing transport information from Chicago region focuses on nature of administration and reliability offered by open travel administrations. From information gathered for a situation investigation of automated vehicle location (AVL), it displays the Transit Capacity and Quality of Service Manual (TCQSM) strategy for level-of-benefit (LOS) estimation. Other than usability and effortlessness, once in a while the framework is conflicting since the framework does not consider defer sum, does not states the impacts of early flights. The Urban Bus Navigation (UBN) [1] framework has been incorporated into the metropolitan transport foundation in Madrid, Spain, and is accessible to general society as a free cell phone application that has been utilized by many transport riders. The technical components of the UBN system, give insights into user experiences from real-world field trials and share important lessons have learned in providing a connected transport application for bus passengers. Subjective criticism from

genuine transport clients demonstrated diminished intellectual exertion for overseeing bus journeys, increased motivation of using bus transport and better accessibility of travel information.

2.1 Gaps in the existing system

The existing public bus transport systems have the capacity to absorb large masses of urban travelers, their public image often suffers from a negative perception. From a passenger's point of view, bus networks in dense urban areas are often considered as complex and difficult to navigate. In contrast to private modes of transport, traveling on busses offers only a low level of comfort and convenience. Bus journeys lack a sense of personal control and ownership that is valued by car users.

3. PROPOSED SYSTEM

The proposed framework has a navigation system for bus travelers that encourages the bus travelers to consistently interconnect with the real time public bus foundation. The proposed system comprises of an embedded bus computing smartphone system to detect the presence of passengers on buses, backend computing infrastructure and a mobile smartphone app for passengers that provides real-time navigation over the complete course of a bus journey. This proposed framework additionally has a web application for concede in the head office, clients can enlist any grievances, any crisis issues can be alarmed with the assistance of this application by conductors and also travelers. There is no need of regular ticket checking by getting into the bus instead this can be done by being seated in head office by checking ticket counts on the web server.

The proposed Iot system consists of mainly three modules:

3.1 The passenger navigation app

The travelers need to enroll and check with their email id and portable number once they login into the app. These data of the travelers will be put away in bus information database at head office.

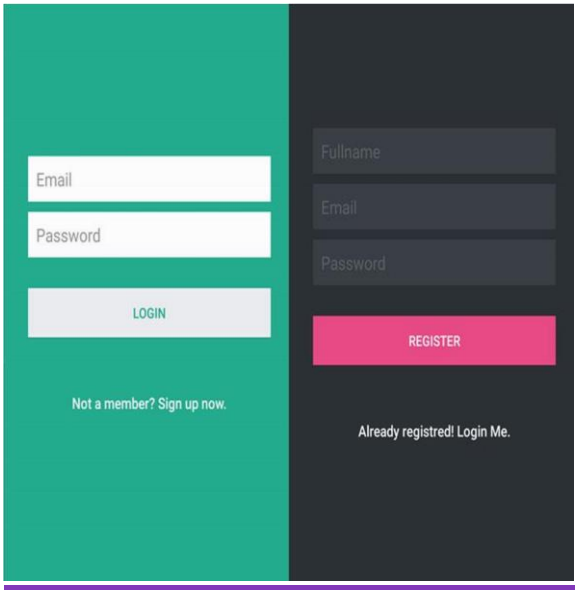

Figure 1: screenshot of passenger navigation app

App should provide current position and nearby bus stops details as a marker. The navigation app offers multiple routes to avoid traffic, highways, or tolls, and can automatically re-route on command or based on traffic conditions.

This app uses Android's built-in voice search, so you can speak destinations to search them quickly. This app provides Google Street View to display your destination when you arrive.

The navigation app uses Google Maps API like Geolocation API to assess location, Direction Service API is used to route the Directions and to calculate Distance between locations and to find the bus arrival estimation time details to the app passenger.

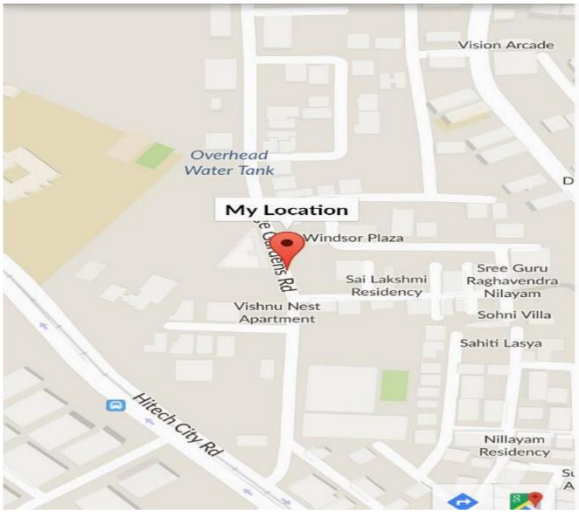

Figure 2: screenshot of users current location

The app also provides several menu options like:

3.1.1 Search buses

The source location is resolved through GPS; user needs to choose his desired destination. The server ought to give the transports points of interest progressively, which are arriving in next 15-20 mins. The recovered points of interest may contain single bus data or numerous buses to reach the destination. Once these details passenger got, he can choose among them which suits him better. When he selects one of the options: It should display current bus location on map, current crowd information, bus arrival estimation time details. In case of multiple buses, it should provide time gap between the buses, and total time to reach the destination. Once the user is done with the choice of bus, the seat selection and E-payment from wallet is to be done. If the user cancels the ticket the deducted amount should be refunded.

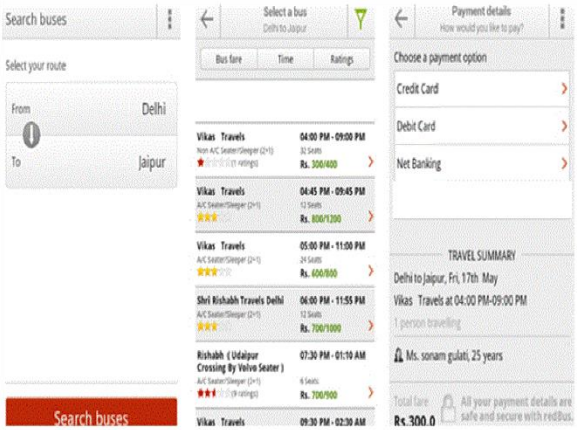

Figure 3: choosing boarding and destination location

3.1.2 *Wallet info*

Add cash to the wallet with the assistance of credit card,debit card or net banking an account. Data on included cash and expenditure on travelling will be updated.

3.1.3 *Payment details*

This will display the details about the payment done for tickets till now and the current wallet balance.

3.1.4 *Track journey*

This option will give information like next bus departure, prepare for alighting, missed alighting, wrong bus check etc.

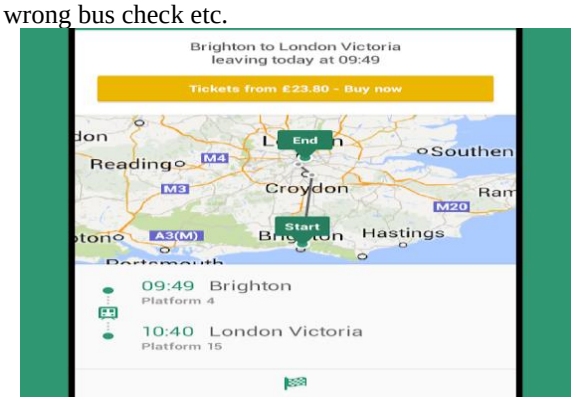

Figure 4: tracking passenger's journey

3.1.5 *Emergency option*

This option allows passenger to alert the driver, in case of any medical issues with passengers while travelling or any other emergency like traffic or curfew in the city etc.

3.1.6 *Complaints/feedback*

This options allows passengers to register any complaints about the problems faced by them while travelling in respective buses, any complaints with the bus facility or feedback about the proposed system.

3.1.7 *Sign-out*

This option allows the user to log out from his account.

3.2 *The bus information server*

The bus information server contains all the information about the buses in the city, the passengers who have registered in the app as well as real time information about the bus, its current location in real time and the bus stops in the city.

Interactive Polyline Encoder Utility algorithm is being used here in order to send multiple lat lag ana at a time to google maps. This utility uses the Google Maps JavaScript API. Specifically, encoding and decoding of paths are handled by the static methods encodePath() and decodePath in the google.maps.geometry.encoding namespace.

Polyline encoding is a lossy compression algorithm that allows you to store a series of coordinates as a single string. Point coordinates are encoded using signed values. If you only have a few static points, you may also wish to use the interactive polyline encoding utility.

The encoding process converts a binary value into a series of character codes for ASCII characters using the familiar base64 encoding scheme: to ensure proper display of these characters, encoded values are summed with 63 (the ASCII character '?') before converting them into ASCII. The algorithm also checks for additional character codes for a given point by checking the least significant bit of each byte group; if this bit is set to 1, the point is not yet fully formed and additional data must follow.

Additionally, to conserve space, points only include the offset from the previous point (except of course for the first point). All points are encoded in Base64 as signed integers, as latitudes and longitudes are signed values. The encoding format within a polyline needs to represent two coordinates representing latitude and longitude to a reasonable precision. Given a maximum longitude of +/- 180 degrees to a precision of 5 decimal places (180.00000 to -180.00000), this results in the need for a 32 bit signed binary integer value.

3.3 *The network enabled ticket machine*

The network enabled ticket machine has its own unique identification and fixed routes details about bus stops. It contains two main things 1) sensor for counting passengers 2) notification screen for the driver. The network enabled ticket machine is connected to the server in real time sharing useful information to the driver. It should have retrieved the no of passengers booked the tickets and display into the driver screen, he can cross verify the total count of passengers and sensor count to find non ticket taken passengers. It should provide voice notification for blind peoples about bus stops and traffic jam information to driver to take shortcut routes wherever possible.

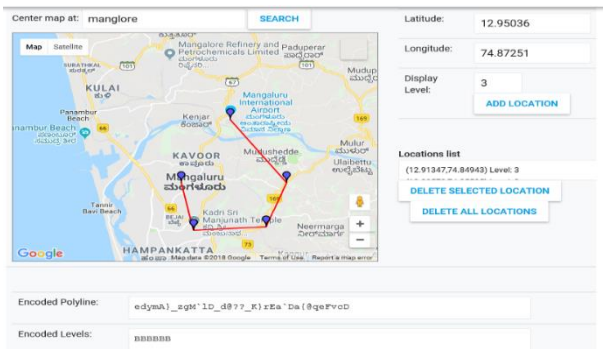

Figure 5: interactive polyline encoder utility algorithm for managing bus stops

4. CONCLUSION AND FUTURE WORK

In this paper, we have presented a navigation system for bus passengers that has the ability to interconnect bus passengers with the real world. This relies on IOT system, backend computing infrastructure and a mobile smart phone app to detect the presence of passengers on buses and provide continuous real time navigation of a bus journey.

In future it would be to incorporate machine learning in dynamic scheduling of bus and compare the waiting period duration of the bus journey and routes expected to be taken.

5. REFERENCES

[1] S. Foell et al., "Micro-navigation for urban bus passengers: Using the Internet of Things to improve the public transport experience," in Proc. 1st Int. Conf. IoT Urban Space (Urb-IoT), Rome, Italy, 2014, pp. 1–6.

[2] P. Zhou, Y. Zheng, and M. Li, "How long to wait? Predicting bus arrival time with mobile phone based participatory sensing," IEEE Trans.Mobile Comput., vol. 13, no. 6, pp. 1228–1241, Jun. 2014.

[3] T. D. Camacho, M. Foth, and A. Rakotonirainy, "Pervasive technology and public transport: Opportunities beyond telematics," IEEE Pervasive Comput., vol. 12, no. 1, pp. 18–25, Jan./Mar. 2013.

[4] Marcus Handte, Stefan Foell, Stephan Wagner, Gerd Kortuem, and Pedro José Marrón," An Internet-of-Things Enabled Connected Navigation System for Urban Bus Riders", *IEEE INTERNET OF THINGS JOURNAL, VOL. 3, NO. 5, OCTOBER 2016.*

[5] EMQTT, http://emqtt.io/docs/v2/index.html.

[6] B. Ferris, K. Watkins, and A. Borning, "OneBusAway: A transit traveler information system," in Mobile Computing, Applications, and Services. Heidelberg, Germany: Springer, 2010, pp. 92–106.

[7] V. Guihaire and J.-K. Hao, "Transit network design and scheduling: A global review," Transp. Res. A, Pol. Pract., vol. 42, no. 10, pp. 1251–1273, 2008.

[8] J. Raper, G. Gartner, H. Karimi, and C. Rizos, "Applications of locationbased services: A selected review," J. Location Based Services, vol. 1, no. 2, pp. 89–111, Jun. 2007.

[9] M. Cantwell, B. Caulfield, and M. O'Mahony, "Examining the factors that impact public transport commuting satisfaction," J. Pub. Transp., vol. 12, no. 2, pp. 1–21, 2009.

[10] Googlemaps,https://developers.google.com/maps/.