Automated Bus Crowd Management

Mr. Kruthik Gandhi H A
Information Science and Engineering
East Point College of Engineering and Technology
Bangalore, India

Dr. Udayabalan Balasingam
Information Science and Engineering
East Point College of Engineering and Technology
Bangalore, India

Mr. Manish G
Information Science and Engineering
East Point College of Engineering and Technology
Bangalore, India

Mr. Jerrin Joy
Information Science and Engineering
East Point College of Engineering and Technology
Bangalore, India

***Abstract*: Public transportation in many countries is been used as a means of transport for travelling and accordingly people would prefer this public transportation to be scheduled properly, on time and the frequency be increased for excursion to make good use of transportation. First there is a lot of confusion for the passengers regarding fares which lead to argufy. It has been found that quite an amount of research work has been carried out, in this sector, by way of using RFID technology in the public transportation systems towards the tracing of passengers when they board and exit buses. In addition, research have also been carried out in using GPS towards the tracking of buses along with RFID technology at traffic lights, bus stops, intercrossing etc. And displaying the expected arrival time on LCD screen at bus stops along with their current status. Taking these aspects into consideration, an intelligent mobile bus tracking system for the Jamaican Urban Transport Corporation as case study has been proposed which enables commuters towards tracking the bus of their choices and also knowing their expected arrival time. In addition to tracking, the proposed system notifies the passengers on their mobile towards topping up of credit balance in their RFID enabled smart tickets for traveling, well ahead in time. The above System proposed has been validated using Android in this research which allows commuters towards tracking of buses and knowing the fact expected arrival time. In the addition, excursion been reminded on their Android mobile handset towards topping the credit on their ticket towards travelling. The above two solutions would assuage the challenges faced by excursion in respect of referring to the static bus timetable or looking into LCD display screen which would inform the expected arrival time of the next bus. The implementation of the system has been carried out using Android emulator.**

Keywords - GPS, RFID, LCD, Android.

I. INTRODUCTION

Having hundreds of vehicles in a public transportation system employs numerous resources to keep them functional and efficiently serving the public needs. However, the efforts of these entities are baffle by inappropriate trip scheduling, which see the companies suffering substantial losses and commuters largely inconvenienced. Without adequate and proper scheduling, there's empty buses idly parked at termination points awaiting rigid departure times while potential passengers crowd bus stops due to unforecastable circumstances. The scenario results in having stranded passengers and a loss for the bus company in the form of wasting fuel and other resources. In addition, to the inappropriate trip scheduling, the issue of ticketing also bears some passenger difficulty. The is attributed to the fact which in respect of the Jamaican Urban Transport Company (JUTC) currently utilizes a combined cash and cashless system similar to that in many countries namely the UK, USA and Australia for the payment of fares and issuing of tickets. With as basis, we look into the possible ICT applications in public transportation system The scheduling and tracking of buses will also rely heavily on the capabilities of ICT in order to reflect in real time, the numerous actual events taking place in the field with regard to bus and excursion interaction and to facilitate the reduction of common problems resulting from the unpredictable nature of the variables involved. With ICT facilitating communication via telephone lines and wireless/mobile signals, the network of buses, excursion and reference points such as bus stops and traffic lights, will be strengthened and widespread, as the capability to function will hold true and be able to cover as much ground as is covered by existing telecommunications network. The advance a more complete picture of the actual environment in which tracking and scheduling will take place. With widespread use of cellular phones, landlines and even the presence of cable television, sending messages within the network will be virtually trouble free. In the event, where there is no landline or cable TV infrastructure, cell phone towers (base stations) or GPS satellites will take over the task of relaying messages. With, a message being sent each time the position of a bus is specialized and when a excursion keys in and there is an almost instant notifications of that event delivered to the appropriate receiver, and based

on the message's processing requirements, a response. The efficient method of message passing is ideal for optimal scheduling of buses, as drivers may be issued updated schedules informed of exception and presented with a view of the wider network with reference to the location and points of interest [1].

Accordingly intelligent system architecture, towards tracking the bus and ticketing was proposed earlier which would first cut the way for commuters not to rely on static timetable of bus or the challenge of standing at bus stops looking for updates the Display screen on the next bus arrival. The above system proposed has now been validated using Android in this research paper where excursion can use their Android powered mobile handset to track the bus of their route anywhere and knowing the expected arrival time of bus using GPS and also the reason for delay in bus arrival like traffic obstruction, bus breakdown etc. by corresponding with the bus which are novel in design. In addition, in this system the daily traveler will be reminded to top up ticketing credit also, once the credit runs low thereby disabling travel which is another novel feature. The bus company from their computer would keep tracing the movement of the bus based on information being communicated wirelessly by RFID Readers installed at bus stops and GPS tracker fitted on each bus which forms part of another of publication and the details are not discussed in the paper. The rest of paper is organized as under. Literature survey gives the Tracing in public transportation using RFID & GPS and Cashless ticketing system. Section3 talks on system architecture of intelligent mobile based bus tracking and ticketing system. Section IV gives the implementation using android. Section V is conclusion and Future work.

II. LITERATURE SURVEY

In this section we will survey the brief on the various literatures citing the ICT usage in public transport towards tracing and scheduling

A. GPS Tracking in Public Transportation

Automated Fare Collection (AFC) System also known as the Transit Smart Card System provides advantages over a manual fare collection system towards lowering labor costs and increasing efficiency in fare collection and management of the corresponding data so collected. Every bus will have a camera which will capture the image of the crowd density of the bus and the image will be processed on the bus

The desire to extract more data than just a deduction of fare from transit smart cards has led to the research efforts in extracting data such as In an effort to enhance the service, forecast bus movement [5]. C. CASHLESS TICKETING starting point of passengers would board a bus and have these data recorded as the passengers' smart cards are scanned. To achieve this, a Markov chain-based Bayesian decision tree algorithm has been developed in this study, where the algorithm is verified with the use of public transportation vehicles that are outfitted with GPS tracking and data loggers. Decisively, it is stated that the data collected to represent points of origin when a passenger's transport smart card is scanned, is crucial to the process of transit system planning

In another research the GPS technology is employed towards tracking and scheduling of buses. The government of Ahmedabad, India, created and implemented a GPS-enabled Bus Rapid Transit System (BRTS) solution to address the city's transportation demands. a sustainable fashion. Introducing, of the BRTS was motivated to the need for increased reliability and security with importance on reduced travelling times. The tracing and scheduling of all buses on all routes is centrally controlled from an integrated control center. The system offers passenger information systems, vehicle prioritizing, driver assistance, and automation technologies in addition to GPS-enabled buses. [1].*RFID in Public transportation for Scheduling*

RFID technology consists of the following three components: Tag, Reader and the Middleware which interacts with the back-end database. Many applications for RFID technology have been proposed over the years. However, these efforts have been challenged with regard to viability, deployment, management, privacy and security. One such study uses RFID to track potential passengers as they enter and exit a bus by passing through a simulated bus door that has been outfitted with RFID readers and antennae that are readily available on the market. It was found that RFID technology can be effectively used for this type of application, however, it should be noted that in cases of no "line of sight" between smart cards and readers in conformity with the radiation patterns and positioning of antennas, there may be performance fluctuations as these factors are critical to recognition [4].

Research has also looked, at automated bus tracking that can be used to generate helpful predictions of bus arrival times and ultimately improve passenger convenience. This can be utilized to alleviate challenges encountered by public transportation agencies in large cities. An event, condition, and action (ECA) architecture is used in a real-time tracking and monitoring system.. This facilitates, effectively removing irrelevant or erroneous data points before categorizing useful data through aggregate. Additionally, the use of obtained data is explored.

SYSTEM WITH RFID The current cashless approach is mostly used in many nations and involves placing a

Smartcard on the bus's installed ticketing mechanism. The fare gets automatically subtracted and a ticket issued bearing the amount paid, date and time of the transaction along with the remaining value on the card, which is achieved via the use of an Electronic Ticketing Machine (ETM). The card may be customized and recharged, and it can be deactivated if requested in the event of loss or theft [6].

In addition to the Smarter Card making quick and easy cashless ticketing, the ability to board a bus and pay virtually hands-free is realized as the RFID enabled Smarter Card is appreciable not only when held in hand but also when carried anywhere on a excursion person. The excursion transition onto the bus is made even smoother as his or her ticket is expressly printed and ready for using as soon as he or she is successfully scanned entering through the access. The issued ticket includes the scheduled route, boarded bus number, date, and time of boarding in addition to the passenger and card information discovered during the scan. Research also been conducted on privacy concerns with respect to not just the collection of personal information but the aggregation and centralization of personal information. Individuals can be tracked using RFID-enabled cards in public transit, and the tracking information is maintained on a central server. This allows an individual’s entire history to be displayed as desired [7].

In one study, it was suggested to apply electronic payments, proxy re-encryption, and anonymity to the issue of privacy in public transit systems using electronic tickets. The suggested design meets the requirements of a typical metropolitan transportation system, upholds the user's and transit company's security demands, and improves passenger privacy. The chartering of passive RFID transponders and smart phones enables the use of active devices and allows for more robust security and privacy that surpasses the typical passive RFID transponder architecture [8].

Research was also done on the appropriate security and privacy requirements for e-ticketing via RFID technology while highlighting the inadequacy of existing proposals and presenting solutions for privacy-preserving e-tickets based on RFID technology, along with known cryptographic techniques which will help to disappoint ticket forgery. According to claims, the adoption of e-tickets will assist the transit authority cut operating and maintenance costs while providing faster and more easy verification for passengers than paper-based or cash-based payment. [9].

It is evident from the material that has been studied so far that GPS and RFID technologies have been used to track buses in real time. Additionally, by using a cashless system, RFID technology has become more popular in ticketing. So, considering both RFID and GPS technologies, we proposed a novel mobile-based bus tracking and scheduling system [2] wherein RFID tags & readers and GPS transmitters installed on buses are utilized. Bus stops fitted with RFID reader that would enable scanning or be scanned by an approaching bus, depending on the orientation of tags and readers for that particular scenario are essentially employed. Here, the bus's RFID tags and GPS transmitters would allow for locating the bus on a map using the bus's ID. However, the GPS transmitter would reveal the location of a bus bearing the bus id or route id in areas where RFID tag and reader interaction is not possible. In essence, each GPS transmitter on board the buses are given an id and therefore, the system would be able to recognize the bus id which is displayed on the map along with the respective location.

It may be mentioned that GPS technology also has a drawback where transmission may interrupt when traversing closed structures such as tunnels and any other canopy-like environments of a similar nature. The next part will examine the proposed system's architecture in depth and how it will be implemented.

III. MOBILE ENABLED BUS TRACKING AND SCHEDULING SYSTEM

A revolutionary Mobile bus tracking system design [2] utilizing RFID and GPS technologies has recently been developed and is based on a literature review on the use of GPS and RFID in public transportation. And validated in this research. The aforementioned system, which has been verified, enables commuters to track their bus from a mobile device by entering the route id, which then displays the location of the bus, its RFID tag or GPS tracker ID, as appropriate, and the anticipated time of arrival at each stop based on the bus’s current location on Google Map. Additionally, any delays brought on by a traffic jam will be posted on Bus company system to be communicated to commuter’s Mobile

handset too. Lastly the system does send reminder to excursion on mobile towards surpassing their credit on smart ticket for travelling. Along with, each smart card tag will be information about the holder of the smart card. This could prove useful if an individual has to be acknowledged for whatever reason. The details on how tracking is performed from Bus Company using RFID-GPS for calculating Expected time of arrival forms part of another publication formulate. Architecture for mobile-based bus tracking

that demonstrates the channels of communication between the various parties. RFID readers installed at bus stops can read passive RFID tags attached to buses. As the bus with RFID tags reaches the bus stop, it sends a message to the dispatch center via base station or router to update the status of that bus's movement along the route, typically in the form of a timestamp. The number of RFID-enabled Smart Cards that have been found on board, as well as their boarding and departing behavior, are continually sent to dispatch by a second RFID scanner that has been placed inside the bus. Buses will have unique RFID tags, though, since they will be scanned for identification and tracking purposes. In addition to using RFID, this example also shows how connected the Global Positioning System (GPS) is.. Additionally, to the usage of RFID, the connectivity of the Global Positioning System (GPS) is demonstrated where a satellite has made contacts with Android phones belonging to the *Mobile User* and the *WaitingCommuter* built-in GPS capabilities. Also, a link is established with the bus as it has been fitted with a GPS transceiver. This technology will aid in determining the exact location of the bus to waiting excursion and mobile user as the location data is almost constantly relayed to dispatch via Mobile customers' smart phones and the bus's onboard internet-connected computer. This location data when processed will be represented using GMAP in real time, thereby allowing the mobile user and waiting excursion to see his or her own location in relation to the location of a desired bus on a map.

IV.IMPELEMENTATION USING ANDROID

The implementation of Mobile enabled bus tracing and scheduling system been carried out using Android emulator. In addition, reminder for surpassing the credit of RFID enabled ticket is also proclaimed on Android enabled handset of excursion. The implementation does not deal with details on enumerating Expected Arrival time of bus based on information received from RFID-GPS towards bus being traced and forms part of another publication.

Bus stop, traffic signal, toll booth, and other important characteristics that are featured on maps are not displayed to commuters on their mobile devices.

Let us consider, a scenario as shown in where the commuter keys in routed number of buses from the current location to know the location of bus and expected time of arrival to excursion location. Once entered, the smartphone contacts the bus company's server to retrieve the bus's current position, route, and anticipated arrival time.along with route and expected time of arrival of bus to commuter's mobile handset via GMAP as shows the location of Bus route id 19-Ax at toll booth and expected time of arrival of bus to excursion location which is bus stop as shown in green dot.

Let us consider a second scenario, where bus is Veen delayed at traffic stop light or bus stop on account of say traffic jam or some other reason. So now accordingly when the commuter keys in the same route id 19A as, commuter would be displayed his current location of bus and expected time of arrival of bus along with information on bus been detained as. This way excursion, are made aware of delay and also what would be expected time of arrival of bus in their current location on their mobile rather than relying on Display system in bus stop. shows that bus being delayed at traffic stop light by 3 minutes and also expected time of arrival of bus to excursion's location been updated as shown in green

dot. shows that bus being delayed at bus stop by 3 minutes and also expected time of arrival of bus to excursion's location been updated in green dot.

Expected time of arrival of bus to excursion's location been updated as shown in green dot. Lastly send reminder to excursion's mobile towards topping once the credit on their RFID based ticket for boarding goes low.

As we have seen so far, there has been a significant amount of study done on bus monitoring using RFID and GPS technology. Additionally, there are display systems at bus stops in several nations right now that show the anticipated arrival time and any delays.. But with the advent of mobile technology, it would make more sense for excursion to know current location of a bus and expected time of arrival and the delay if any before coming to bus stop or while waiting at bus stop without having to depend on display system and this has been the major contribution for our research.

The paper does not however, discuss in detail on how expected time of arrival is calculated by Bus Company based on information that received from RFID and GPS which is being published elsewhere by the author. In future, it would be better to subsume intelligence in dynamic scheduling of bus based on request received from passengers using RFID smart card and also taking the passenger pattern towards boarding and exiting along that route into consideration rather than relying on static timetable and avoiding the issue of crowding in the bus and bus stops.

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