Int. Conf. on Signal, Image Processing Communication & Automation, ICSIPCA

Comparison of Advanced Public Transportation Using RFID System and Other Technologies

Anusha Ramachandra Gudge[1], Bharadwaj.B M[2], Harshitha S[3]
[1, 2] Student, Dept. of E&IE, JSSATE, Bangalore, INDIA
argudge@gmail.com
[3] Asst. Prof., Dept. of E&IE, JSSATE, Bangalore, INDIA
harshithashivaprasad@gmail.com

***Abstract*— Intelligent Transport System involves the usage of short-range communication technologies such as the IEEE 802.11, WAVE or the dedicated short range communications standards. Long range communication technologies involve the WiMax, Global system for mobile communication or Global Positioning Systems. The sensor technology such as the Radio frequency identification has also been exploited. This technology ensures better results than the other methods imposed. One such application of intelligent transport system in the public transportation system is the tracking of buses using global positioning system and to inform the commuters about the real time position of the bus. This paper focuses on comparing three different technologies used to help the commuters regarding the positioning of the bus. The comparative study is done between the Advanced Transit Traveler Information Systems, Data warehouses and global positioning system tracking methods. Here, we perform the comparison of the Radio frequency identification technology of determining the bus arrivals being more efficient by message alerts than the other three technologies mentioned above..**

***Index Terms*— GSM, RFID READER, Arduino controller.**

I. INTRODUCTION

We seek to apply Advanced Public Transportation Systems (APTS) for management of transport and to make information available and accessible to public transport management systems in order to increase their efficiency of functioning. APTS applications include passenger information as real time systems, automatic vehicle location systems, bus arrival alert systems, and systems having main concern about passengers load of buses. Research regarding about application related to new communication and connecting technologies for transit has been bounded. Public transportation makes reliable use of connectivity and communication, but this is mainly in the form of predictable analog and communication services.

The newer smart and digital transportation systems and the implementation of smart-vehicle and effective technologies demand more of support in terms of communication concerning about the time of arrival of the buses and the capacity of the persons travelling in it. The alternative, public transportation netwrok makes use of geographic information systems (GIS), which are programmed systems in which databases are related to one another by means of a common set of location coordinates. Currently GIS is being used for the maintenance of schedule information on bus routes and in presenting the information to customers

Grenze ID: 02.ICSIPCA.2017.1.2

satisfactorily on automatic vehicle location systems. Automatic display of number of passengers boarding's and alighting by time and location is being increasingly in need to give information regarding the number of people travelling in the particular bus. The reason for using such kind of information is to inform the traveler to know about the crowd inside the bus so that which helps him to decide on prior. The one way to achieve this ideology is by equipping the buses by automatic counters that can be traversed about the system to take the data availability. One of the solutions being travelling by reducing the long waiting periods near the bus stops. The designed method of alerting in-vehicle information permits the driver to concentrate on driving. Bus loads, which depict the number of passengers on a bus, reflect bus crowding along it. Another major module which we have introduced is RFID. RFID is similar to bar-coding technology, in which the data/information from a tag or label is captured by a device that stores the data in a certain databases. It plays a main role in the determining how many bus stops has been covered and messages to be convey to the passengers. The output being a simple message alert on phones reduces the need of internet service and work on non smart phones too. Hence it minimizes the use of GPS technology which can reduce the cost as well as complexity of the whole system.

II. LITERATURE SURVEY

In the recent times, ITS has grown to exploit the maximum benefit out of the technology advancements. However, the methods used earlier were also an upgrade for the functioning of the public transportation system.

In of the findings, the elementary research was about finding the location of a vehicle. There are three most commonly used location technologies mentioned: stand-alone, satellite-based, and terrestrial radio-based. A typical satellite-based technology is global positioning system (GPS). A typical terrestrial radio-based technology is the "C" configuration of the Long Range Navigation (LORAN-C) system. It depends upon utilize the signals of the network to determine the mobile phone location or to help in the location determination [1]. Consequently, another work done was the vehicle location based on the received signal strength (RSS) from Global System for Mobile Communications (GSM) networks. Satellite infrastructure, through its most popular system, i.e., Global Positioning System (GPS), which is widely used to estimate a vehicle's location in an AVL system. But the accuracy of these systems has become low to the lane determination level. And as well as, there are urban areas with streets surrounded by tall and narrow buildings forming a sort of urban canyon. This environment was known to impair the availability of the GPS system [2].The following work done were the results of a set of extensive experiments carried out under both daytime and night time real traffic conditions. The xfcd system was tested in a198-min sequence recorded in real traffic scenarios under different weather and illumination conditions. The results were promising and demonstrating that the xfcd system was ready for being used as a source of traffic status information [3].

The newer technique developed by Rose Mary and John[4] proposes a new method to develop a dynamic monitoring system on the base of smart card and GPS data. First Data Warehouse of multi-source data from advanced public transport system (APTS) is descripting for monitoring system. Then the study develops a three-level algorithm to explore bus operation state and passenger travel characteristic, which helps better in the aspect of efficiency and accuracy and make an estimation of travel patterns based on Smart Card data but boarding stops cannot be acquired through smart card, thus other data are needed. A passenger uses one smart card in general. Here, another method introduced by Fajin Ma [5] based on combination of GPS and GSM/GPRS modem was discussed to help the people who utilize the public transportation for travelling. Based on this the user could change his schedule so that he/she can save the long waiting hours at the bus stop. Also the system would control the accidents due to over speed, by alerting the driver and passengers. Also the information was recorded for future reference whenever the vehicle over speeds by over speed detector.

Linan Zhang [6] stated that the Advanced Public Transportation System (APTS) is one of the major ITS applications which can help in relieving congestion by attracting more people to public transport by improving the efficiency of public transportation systems with help of technology. such APTS application will be to provide accurate information about bus arrival to passengers, leading to reduced waiting times at bus stops which is very helpful to people. This requires the prediction of travel time, which is the total elapsed time of travel, including bus stop and intersection delay, necessary for a vehicle to travel from one point to another over a specified route under existing traffic conditions. To estimate bus arrival times,

dynamic models may be developed using accurate data collected by new technologies (e.g., Global Positioning System (GPS) data). Since bus have travel time between stops depending on a number of factors (e.g., geometric conditions, route length, number of intermediate stops and intersections, turning movements, incidents, etc.), stochastic traffic conditions along the route and ridership variation at stops further increasing uncertainties[6].The implementation technique proposed by Manali [7] is a smart public transport system based on GSM GPS methodology to track the bus location based on which the Arrival time and delay time of buses approaching a bus stop are displayed on particular bus stops to inform passengers so that they can know before about the status of their buses and decide their mode of transport accordingly. There are three different modules: Transmitter module, receiver module and a smart phone. The transmitter module is fitted with the bus and the receiver module at the bus terminus. GPS module in bus transmits the latitude and longitude coordinates to the bus terminus via GSM, where the arrival and delay times are calculated by using these two coordinates. The timings are provided to users via smart phones and displayed on bus stops.

III. Proposed Methodology using RFID Technology

As mentioned earlier, the prototype we are using uses an RFID system which reduces the necessity to use GPS based systems which in turn cuts down on the overall cost of the system. A simple block diagram of the whole system is represented in fig1. As shown, the whole system is processor based. We use arduino uno for our prototype. We've interfaced a GSM module, RFID reader, and a new additional feature known as payload calculation using a simple load cell. The payload calculation unit gives information about how crowded the bus is to the passenger so that the passenger could choose to board it or wait for the next one. For using the GPS system, we need to track around 6500 odd buses in a city like Bangalore where in we need to install tracking devices on each bus which requires complex systems and incurs huge cost when compared to the number of people who participate in this system. Since most people who commute through public transport on a daily basis are still getting accustomed to using smart phones which requires basic internet to function. Hence the technology we propose eliminates the need for the usage of internet and can be done offline as well. In our prototype we have placed passive RFID tags in each of the bus stops with a certain range as to detect the bus which comes into the bus stop. The RFID reader is installed in each and every bus and a unique RFID number is given to each bus. Once the incoming bus is detected, the message alert informs us the particular stop and the crowd status is sent to the people who are participating in the system depending on the additional circuitries used such as load cell. Seeing this message the individual can choose to either take the bus at the appropriate time or wait for the next bus or use any other means of transport.

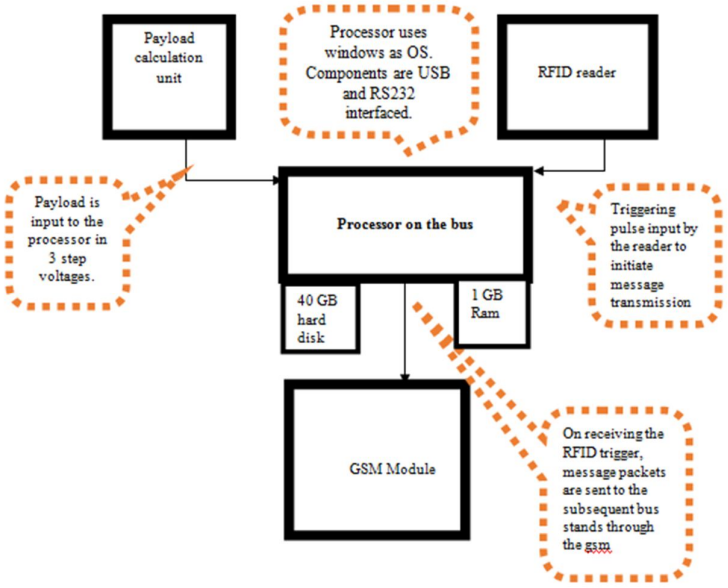

Fig1. Block diagram using RFID system

III. THREE TYPES OF TECHNOLOGIES

In the recent times, there has been a vast advancement in terms of technology used to make transportation system beneficial. In order to make travelling easy by bus a number of advancements were introduced. For example, an app developed could inform the commuter about the source and destination, the number of trips and the favorite route. The previous technologies and methods used were only with respect to GPS system and databases. They did not specify the load information which is a better choice for the commuter before boarding the bus. The three strategies compared are the ATTIS, Data warehouses and the GPS/GSM systems. Our prototype has a major advantage of not using the data connectivity and can easily be accessible by any person. In the ATTIS system is shown in the figure2.

This deals with improving transportation from commuter and from the service provider's point of view. Here, the information such as pre trip about the departure, during the journey and arrival is informed to the people waiting at the stop. Using the complex structures, the information could be conveyed to an individual or to a group of individuals. This method is not very successful because of the efficiency and also had diversified models developed based on each and every aspect of the commuter making it discrete. In figure 3, it depicts how the transit nature of system was taken a one of the features. The second method, using data warehouses is a dynamical operational research. In this method, a number of equipments using the GIS (Geographical information system) is used. It is based on a connectivity where the topology is super imposed over the network and then to determine the APTS. Here, a number of characteristics are dependent on the bidirectional communication. The figure 3 shows the required components details.

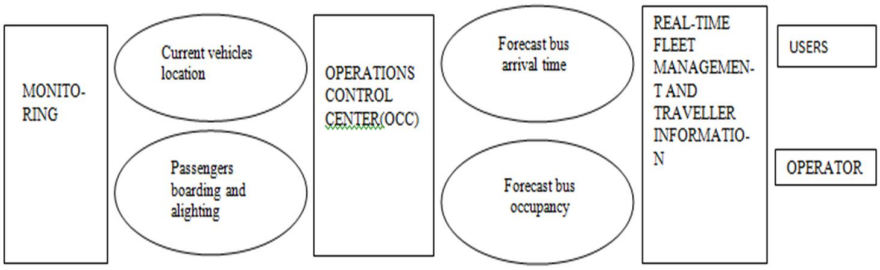

Fig.2 Advanced transit control and operating system

TABLE I. COMPONENTS FOR DATA WAREHOUSES

Data Name	Basic Components		
	Factors	Type	Source
GPS	Position, Speed and Time	Dynamic	AVL
Smart Card	ID, Time, Type	Dynamic	AFC
GIS	Geographic Information of Road Network	Fundamental	IDS
Line information	Line ID with Station	Fundamental	IDS
Bus information	Bus ID in the line	Fundamental	IDS
Station information	Station Coordinate	Fundamental	IDS

The figure 4 shows the processing cycle for getting the information. A number of assumptions are made, firstly where the person is using a smart card. Second, the passenger makes only one trip, third where he goes for shorter distance. Hence this system is not very reliable.

The third technology was the GPS/GSM system as shown in figure 5.

In this technology, a transmitter is fixed and a receiver. The transmitter module is placed with the bus and receiver module at the bus terminals. The GPS system gives the longitude and latitude information and it can be displayed at the stops or sent as message to the people through various apps and data connectivity. Our model designed overcomes the difficulties faced. It not only reduces the GPS implementation but also ensures the working in any weather conditions.

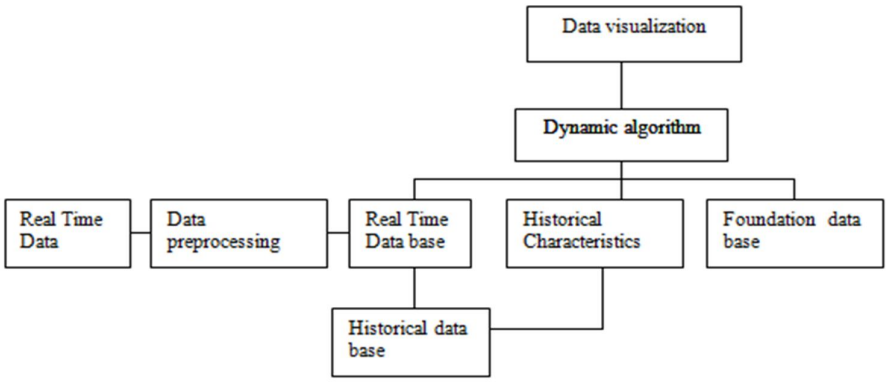

Fig4. Processing system

Fig.5 GPS/GSM based system for tracking of buses

IV. RESULTS

This proposed system requires only widely available cellular signals, the system provides a cost-effective and reliable solutions to the problem by reducing the use of GPS systems and providing an offline solution to the commuter which in turn saves his money for internet data charges. Many of the commuters might not be comfortable to share their location with the server, to resolve this problem instead of GPS module RFID reader plays major role here. The figure below shows the message alert obtained through our prototype. It gives the information about the near location of the bus. The commuters waiting at the successive stops get the message alert of the bus arrival at a particular stop along with the approximate load on bus. This gives a better choice for the commuter and also is a feasible way of operation as it does not require any smart phone specifically for it to function. This gives a major advantage to the user by not spending long hours of waiting for a bus at a stop or to miss a bus due to overcrowding. Since we're very intent on making this system offline, we are able to give information to the passengers waiting for the particular bus without the use of either internet services or GPS. Seeing this alert, the passenger can choose to board the particular bus or travel by any prior.

TABLE II. COMPARISON OF DIFFERENT TECHNOLOGIES

Sl. No.	Parameter	ATTIS Technology	Data Warehouse Technology	GPS/GSM Technology	Proposed Technology
1.	Size and compactness	Large/ Extensive	Large/ Extensive	Moderately small and discrete	Highly compact
2.	Server requirement	Yes	Yes	Yes	No
3.	Reliability	Less reliable	Less reliable	Moderately reliable	Highly reliable

The above table shows the results of comparison of various technologies in terms of server, size, reliability with the RFID used in the proposed technology. As it is seen, the RFID technology plays a vital role in solving the problems faced by the previous technologies and also increases the ease of operation.

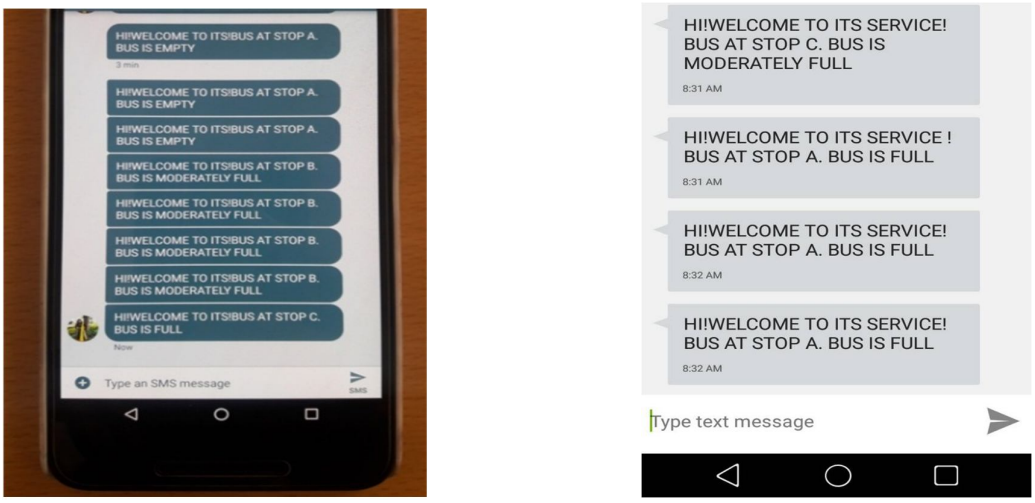

Fig 6. Screenshots of results

V. Conclusion

A number of systems have been designed under Intelligent Transport System. Participatory system is one of the cost effective system, but it has a major disadvantage. It involves more and more number of participants in the system where passengers who follows public transportation. The system proposed in our paper here is dependent on the RFID system and no GPS system involved. This reduces the cost and also the reliability on smart phones as a necessity. It also informs about the pay load which helps one choose a better means. The three methods discussed earlier provide solution via complicated circuitries and a major database of different networks and topologies and road network. They are constraint on working with maps and location which can be avoided by our proposed method. Hopefully we can build a platform for BMTC to expand this product to mobile applications and simulation software. If this is achieved, we can provide subscription options to commuters, making an environmental and socially viable project.

Future Scope

Upcoming improvements can be done in the form of integrated built in GPS systems which comes along with the buses nowadays which eliminates the need of installing tracking devices in old buses and provides us the option of choosing between going online or staying offline. Either way the commuter is informed about the status of the bus in an effective manner. Other improvements such as making use of solar power for the module system to function can be incorporated. Making use of arduino shield for better performance and durability. The ITS test run platform can be set up for performing the test run of such ideas.

References

[1] Mobile Phone location determination and its impact on intelligent transport systems-IEEE transactions on intelligent transport systems, Vol. 1, No. 1, march 2000
[2] Vehicle positioning using GSM and C-C ANN Structures, IEEE Transactions on intelligent transport system, Vol. 14, No. 1, March 2013.
[3] Extended Floating Car Data System: Experimental Results and Application for a Hybrid Route Level of Service.
[4] Smart Public Transport System Rose Mary John, Finky Francis, Joe Neelankavil, Alwyn Antony, Devassy Department of Electronics and Communication Engineering Jyothi Engineering College ,Thrissur679531 Kerala.
[5] The Prediction of Bus Arrival Time Using Global Positioning System Data And Dynamic Traffic Information Tongyu Zhu, Fajin Ma, Tao Ma, Congcong Li State Key Laboratory of Software Development Environment Beihang University Beijing, China.
[6] A Dynamic Method to Monitor Public Transport based on Smart Card and GPS Data . Xiaoguang Yang, Linan Zhang, Member, IEEE 2014 IEEE 17th International Conference on Intelligent Transportation Systems (ITSC) October 8-11, 2014. Qingdao, China.
[7] Smart Public Transport System Using Mobile phone based sensing Manali, Najme Zehra Naqvi Department of Computer Science and Engineering Indira Gandhi Delhi Technical University for Women,Delhi,India.