

# Enhancement of Public Transportation Services Using Wireless Technologies

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**Abstract**— One of the major issues now a days is controlling of traffic. The main motive in bringing up this paper is to develop a user friendly system for transportation purpose by involving wireless technologies like Zigbee, RFID, GSM and GPS. The application consists of modules like Base Station module, In-Bus module, Bus-Stop module and Bus- Station module. The first module consists of a PC and GSM. The second module consists of Micro-controllers, GSM Modem, GPS, Zigbee, RFID, LCD and Infrared Sensor. Any of the micro-controllers like PIC, 8051/AT89S52 and ARM7TDMI processor can be employed in building this application. RFID is nothing but radio frequency identification used for identifying an object or a person in space and is used for ticketing purpose, whereas GSM and GPS is used for mobile data transmission. Zigbee is a wireless sensor network which takes full advantage of Zigbee technology, which is used for transmitting and receiving data through networking and this is interfaced with micro-controller to send information from one bus to another bus.

**Keywords**— Zigbee, RFID, GPS, GSM, PC, LCD

## I. INTRODUCTION

Transportation plays a dominant role in our day to day life. The primary Obstacle of using transportation is the uncertainty of waiting at bus stops for longer duration, non-availability of tickets due to some bands and curfews, due to traffic jam, due to any other factors like poor maintenance of buses, all these directly effects the people. This application helps us to overcome all these factors. The operation of this application is broadly classified into a series of phases, where in the first phase if at all the route is deviated/any problem in the route, the driver gets the information from the base station through GSM and the response is sent from the base station to the bus driver. If any driver is in want of any data they will message to the base station and acquire the specified data. The In-Bus module operates the RFID for ticketing functions and IR detector for tallying the quantity of getting into and exiting passengers. The data that is fetched is stored in the database. Today's transport management wants associate degree integrity to approach the dynamic and uncertainty. In

terms of safety, security, efficiency and mobility the analysis problems area unit undertaken to optimize the quality of the folks. Currently now- a-days the interest goes on developing the appliance regarding the RFID for managing the general public Transport Systems. Gift system uses paper and pass primarily based ticketing. During this projected system we tend to area unit implementing the idea of RFID and wireless technologies like GSM, GPS and Zigbee. During this context, RFID is employed by removing the paper primarily based price tag.

### A. System communication using GSM and GPS

A good approach would be to introduce a technology based transportation management system that will help the passengers in getting informed about the exact schedule of buses. The existing wildly used & proven technology known as Global Positioning System (GPS) can be used to manage this traffic chaos very intelligently and more economic manner. These systems offer an effective tool for improving the operational efficiency and utilization of vehicles along with Global System for Mobile (GSM) & General Packet Radio Service (GPRS) technology can be used to communicate the real-time location, velocity & time data from moving Bus to central monitoring & control authorities on application like Google map or any customized city map. If this application is being used in city bus with purpose of centralize monitoring & control to enable the authorities or a third party to track the vehicle's location, collecting data in the process from the field and deliver it to the base of operation to track the fleet throughout the city in real-time on city map & it will also help commuter as navigation aid tool and bus stop information in audio and visual mode.

The application device with GPS & GSM/GPRS module on every bus will receive location co-ordinates from satellite & regularly update the central Monitoring & Control base about the station it arrives at. Also it will alert the passengers about the present and next station based on comparison of real-time GPS co-ordinates and already stored data of co-

ordinates for respective location on LCD display in bus and also announcement using speaker. The movement of buses can be monitored on City Map or Google Map application & it can be made available to public to access as web based application.

The most basic function in all bus tracking & public information system is the vehicle tracking component. This component is usually GPS-based, or a cellular triangulation platform. Once vehicle location, direction and speed are determined from the GPS components, additional tracking capabilities transmit this information to a fleet management software application. In this system we use the GSM/GPRS module for data transmission between central command and moving bus. The block diagram of the proposed system is shown in Fig. 1.

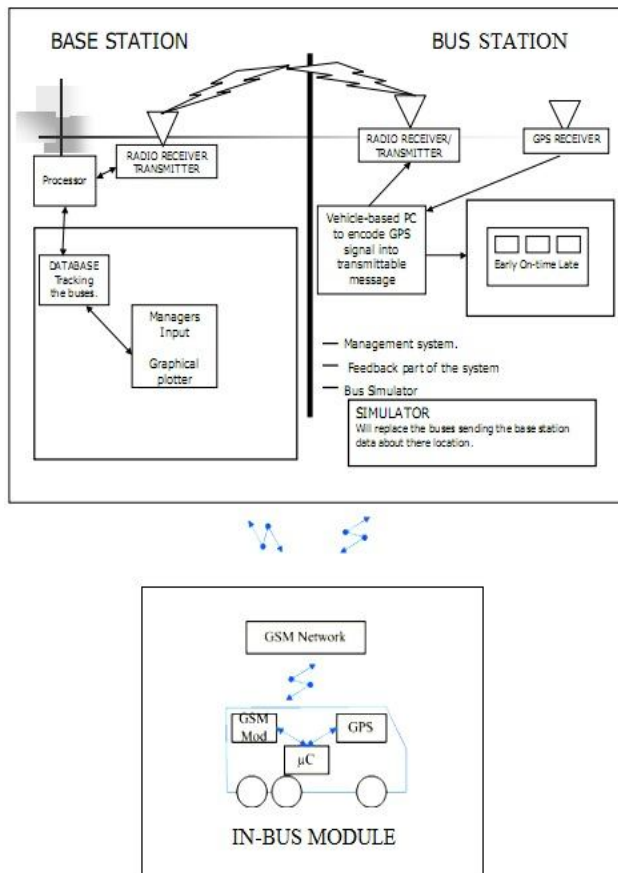


Fig. 1 Block Diagram of Transportation Management System

## II. SYSTEM OVERVIEW

### A. GPS Receiver

The Global Positioning System (GPS) is a U.S. space-based radio navigation system that provides reliable positioning,

navigation, and timing services to civilian users on a continuous worldwide basis -- freely available to all. For anyone with a GPS receiver, the system will provide location and time. GPS provides accurate location and time information for an unlimited number of people in all weather, day and night, anywhere in the world.

### B. GSM Modem

GSM is the most widely used mobile technology using a simple Subscriber Identity Module (SIM) it has taken the world of mobile communication to new heights. It is based on a simple architecture. Even with the introduction of new technologies like CDMA, GSM has stood its strength due to its efficiency and simplicity. A GSM modem is a wireless modem that works with a GSM wireless network. Computers use AT commands to control modems. Both GSM modems and dial-up modems support a common set of standard AT commands. So we can use a GSM modem just like a dial-up modem. The main difference between them is that a dial-up modem sends and receives data through a fixed telephone line while a wireless modem sends and receives data through radio waves. GSM is one of the most vital components in our set up since all the communication between the users and Centralized unit takes place through this modem.

### C. Microcontroller

AT89C52 microcontroller is selected because it is a powerful microcomputer which consumes low power and provides a highly flexible and cost-effective solution to many embedded control applications. It has 8K bytes of in system reprogrammable flash memory, 256 bytes of internal RAM, 32 programmable I/O lines, three 16 bit timers/counters, eight interrupt sources and a programmable serial channel.

### D. Alerts

The microcontroller unit in In-BUS Module sends different alarm signals for different events to BASE Station Module.

- 1) *Deviation*: When the bus deviates from the assigned route by a given margin, BASE station is notified.
- 2) *Delay*: When the bus is not covering a certain distance in a defined range of time, an alarm signal of getting late is sent to BASE station.
- 3) *Hold/Halt*: When the bus is stationary for more than a specified time, BASE station is informed by a stoppage alarm.
- 4) *Battery*: When the main battery is switched off, a notification is sent to BASE station.

## III. SYSTEM MODULES AND NETWORK OPERATION

### A. BUS Station Module

BUS Station Module is installed at bus terminals from where the bus will depart. It contains a LASER and a GSM

modem connected to a PC. When the bus enters the terminal pad, it is detected by the LASER sensor. The operator at the terminal enters the license plate number in database. A count number is then accordingly assigned to the bus e.g., bus leaving the terminal first will be assigned a number 1. The route number of bus along with the direction information, assigned count number and license plate number is sent to the BASE Station via GSM.

**B. In-BUS Module**

This module contains 2 PIC microcontrollers M1, M2. M1 interfaced with Zigbee, LCD, 2 management switches and 2 infrared sensors. M2 is interface with alphanumeric display, RFID, GSM, GPS and 4 management switches and one eight key computer keyboard. M1 controller can send bus details to stop when obtaining request from stop, when halting within the stop driver can open the door the investigation can begin, during this passengers can get into bus on front aspect and obtain out from back aspect, on each aspect sensors can count the passengers getting into and exiting and investigation stops when the door is closed. The Zigbee and M1 area unit want to create synchronization with stop and obtain the stop details and show that in alphanumeric display. The management switches area unit used for door open and shut purpose. M2 and RFID area unit used for ticketing purpose all the passengers having RFID tag can show it and obtain their tickets registered. Usually the passengers will get monthly, weekly, in the future passes passengers not having regular passes will get their price tag by giving cash to conductor, conductor have the common pass for that M2 with GSM, GPS area unit used for tracing the bus from the bottom station. The management switches area unit used for providing route details just in case of any route diversions, the new route is provided to the busman and also the different switch purpose is to tell any emergency state of affairs within the bus to the bottom station. The block diagram for this module is shown in Fig. 2.

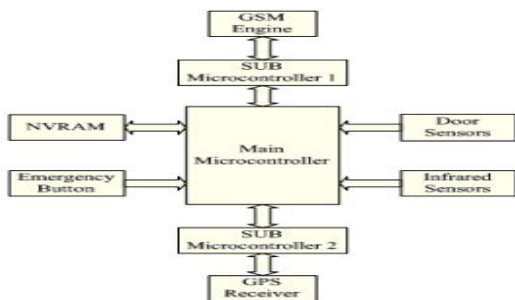


Fig. 2 Block Diagram of In-BUS Module

**C. BASE Station Module**

This module contains a GSM interfaced with PC, along referred to as organizer system, used for following the bus and showing the route diversion request and emergency things and conjointly accustomed to provide the response for route

diversions. The passengers can even provide request for obtaining bus data mistreatment through SMS. This module conjointly maintains the info for maintaining the bus data and current standing. The block diagram of the module is shown in Fig. 3.

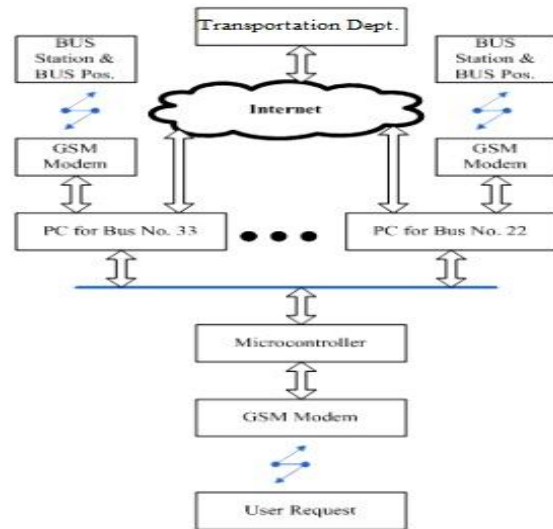


Fig. 3 Block Diagram of BASE Station Module

**D. BUS Stop Module**

This module contains one PIC microcontroller, LCD, Zigbee used for synchronization with bus, it will unendingly broadcast the request signal and await the reply signal for the provided request from the bus, if any bus on the market therein vary it'll synchronize therewith by obtaining bus id and validate whether or not the bus having the halt here or not and shows the bus info like route , cost , bus type, bus name within the LCD within the stop and additionally sends stop details to the bus. The block diagram of this module is shown in Fig. 4.

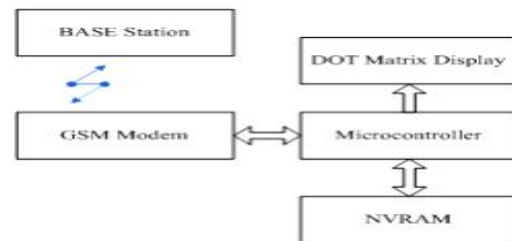


Fig. 4 Block Diagram of BUS Stop Module

**IV. STATISTICAL ANALYSIS AND RECOMMENDATIONS**

BASE station utilizes the passenger information on per stop basis to carry out the statistical analysis. A GUI, shown in Fig.

8, is developed in MATLAB® to analyze the results. A recommendation report is also generated by the software which highlights the regions of greater emphasis. These are the regions where buses are more overloaded. The solution to the problem lies in increasing the number of buses on routes which are densely crowded or introduce new overlapping routes to compensate the demand.

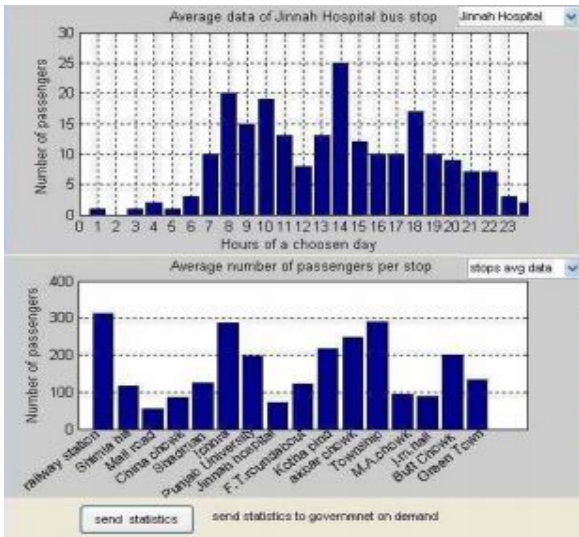


Fig. 5 GUI Statistical Analysis

### V. CONCLUSION

Resources ought to be integrated and coordinated with RFID, GSM within the transportation medium which might simply meet the demand, emergency and the requirement of general public. GSM-Based Mobile Tele-Monitoring and Management System for Inter-Cities Public Transportations is projected throughout this paper. The system takes advantage of wireless technology in providing powerful management transportation engine. The employment of GSM and GPS technologies permit the system to trace vehicle and provides the foremost up-to-date information regarding in-progress journeys. On the whole, this method proves to be terribly self-made and might be simply enforced in real time. The experimentation result shows that the system is incredibly economical and value effective. The service thus vanishes the requirement of waiting at the stop therefore saving lots of our time. For the passengers not utilizing the service, displays square measure kept at stop to allow them to recognize the buses location returning towards that stop. The system is additionally economical in handling emergency things.

### VII. FUTURE WORK

The system may be increased with the utilization of cameras at bus terminals which might mechanically browse the registration number plate/registration code and number of

buses. A route show may be put in buses to update the choice route just in case of dangerous road congestions. Fare collection system can even be forced by providing another mobile subscription service. Observation proves that this method prices low, has robust usability, responsibility and extendibility, has very broad promoted application prospect and has sure guiding significance to the intellectualized application of the embedded technology.

### ACKNOWLEDGEMENT

I would wish to take this chance to specify my sincere appreciativeness to the Almighty, my family, friends and well wishers while not their ethical support, the work would haven't been doable. I might conjointly wish to give thanks my co-authors for his or her constant suggestions and support in citing this analysis. Finally, I might wish to categorize my feeling to any or all people who helped me directly or indirectly in completion of this project.

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