INTERNATIONAL JOURNAL OF RESEARCH
In Advanced Engineering Technologies

Volume I, Issue 2 FEB 2014

GPS AND GSM MODEM INTEGRATION FOR PUBLIC TRANSPORT MANAGEMENT SERVICES

K. Bhaskar

ABSTRACT: This paper proposes the solution for improving the services provided by the transport management by using GPS and GSM modem integration. The system mainly consists of three modules. (1) Bus station module (2) Bus module (3) Base station module. The modules are connected to PC and GSM modem. The initial information containing the bus number and license plate from bus station module is sent to bus module and base station module using SMS. The location of the bus
and number of passengers in the bus is transmitted to the base station with the help of the micro controller based bus module, consisting mainly of GPS receiver and GSM modem. The base station module consists of a microcontroller unit and GSM modems interfaced to PC's so that to track the records of every bus, processes user request about a particular bus location out of bus station and updates buses location. Hence the transport service department needs to check the performance and services provided by them to common people. This developed system will help common people to use more services of transport management.

Keywords- GPS, GSM, public transportation management services, Bus Station Module, In-BUS Module, BASE Station Module, BUS Stop Module, rush statistical analysis.

I. INTRODUCTION

With the increasing population in places like metropolitan cities the problem of transportation services has been increased. The non availability of information about buses arrival schedule, people have to wait for longer time in bus stops especially in working hours and in office hours. Sometimes this leads to overload of buses.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. BASE station transmits the statistical data along with the recommendation report to Transportation Department through internet at the end day or as per request of transportation department.In this paper, a transportation management system is developed for enhancing public transportation services based on integration of GPS and GSM. GPS is used as a positioning device while GSM is used as communication link between different modules. These modules include BUS Station Module, Bus Module and Base Station Bus Station Module contains a GSM engine interfaced to PC and transmits the bus index and its license plate number to BASE Station. At the same time, it turns on GPS receiver installed in the bus. The bus then starts transmitting its location to the BASE Station. The BASE Station comprises of a GSM engine interfaced to a microcontroller for processing user request of bus location as well as a number of other GSM engines interfaced to various PCs each reserved for a separate bus to update the location information of that bus. The buses location data from BASE Station is sent to each bus stop.

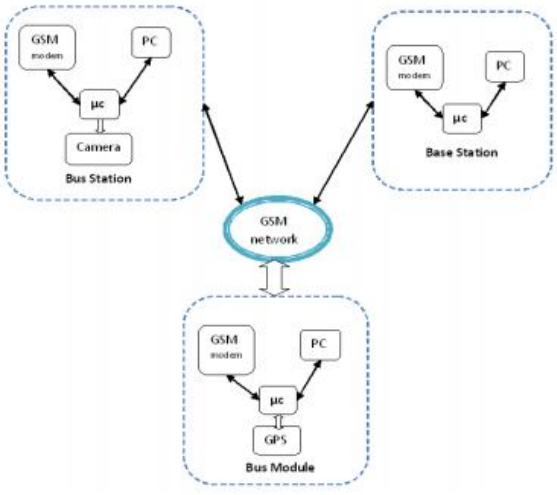

Figure 1. Block Diagram of Transportation Management System

of

II. HARDWARE SPECIFICATION

The following hardware components are used in building the entire system.

A. GPS Receive

The GPS is a satellite-based navigation system that sends and receives radio signals. GPS (Global Positioning System) technology is used to find the location of any object or vehicle to monitor a child continuously using satellite signals. Three satellite signals are necessary to locate the receiver in 3D space and fourth satellite is used for time accuracy. GPS will give the information of parameters like longitude, latitude and attitude. With the help of these parameters one can easily locate the position of any object. In this GPS technology, the communication takes place between GPS transceiver and GPS satellite. A GPS receiver acquires these signals and provides you with information. Using GPS technology, you can determine location, velocity, and time, 24 hours a day, in any weather conditions anywhere in the world for free. At least 24 GPS satellites orbit the earth twice a day in a specific pattern. They travel at approximately 7,000 miles per hour about 12,000 miles above the earth's surface. These satellites are spaced so that a GPS receiver anywhere in the world can receive signals from at least
four of them. GPS technology has many amazing applications on land, at sea, and in the air. You might be surprised to learn about the following examples of how people or professions are already using GPS technology.

B. GSM Modem

GSM, the Global System for Mobile communications, is a digital cellular communications system, which has rapidly gained acceptance and market share worldwide, although it was initially developed in a European context. In addition to digital transmission, GSM incorporates many advanced services and features, including ISDN compatibility and worldwide roaming in other GSM networks. The advanced services and architecture of GSM have made it a model for future third-generation cellular systems, such as UMTS.
This paper will give an overview of the
services offered by GSM, the system architecture; the radio transmission.GSM (Global System for Mobile communications) is the technology that underpins most of the world's mobile phone networks. The GSM platform is a hugely successful wireless technology and an unprecedented story of global achievement and cooperation. GSM has become the world's fastest growing communications technology of all time and the leading global mobile standard, spanning 218 countries. GSM is
an open, digital cellular technology used for transmitting mobile voice and data services. GSM operates in the

C. Microcontroller

Arm7 microcontroller is selected because it is a powerful microcomputer which has low power consumption and provides a highly flexible and costeffective solution to many embedded control applications.
It has 8kB to 40kB of on-chip static RAM and 32kB to 512kB of on-chip flash memory. Embedded ICE RT and Embedded Trace interfaces offer real-time debugging with the on-chip Real Monitor software and high-speed tracing of instruction execution. Two 32-bit timers/external event counters (with four captures and four compare Channels each), PWM unit (six outputs) and watchdog.

D. Battery Backup

Bus Module is provided with an internal battery so that whenever power from main battery is disconnected, microcontroller continues to transmit the location to BASE station. A message is also sent to BASE station to notify it about the disconnection of main battery. When the power is resumed, the internal battery begins to recharge.

E. Alarms

The microcontroller unit in BUS Module sends different alarm signals for different events to BASE Station Module.
1) On Backup Battery: When the main battery is switched off, a notification is sent to BASE station.
2) Stoppage: When the bus is stationary for more than a specified time, BASE station is informed by a stoppage alarm. In case of an accident or any other fault occurred in bus, the driver can notify the BASE station by pressing a button in bus.
3) Getting Late: 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.
4) Route Deviation: When the bus deviates from the assigned route by a given margin, BASE station is notified

III. SYSTEM MODULES AND NETWORK OPERATION

The entire system/network comprises of three modules: BUS Station Module, BUS Module, BASE Station Module and the working and interconnection of these modules is described in this section.

A. BUS Station Module

BUS Station Module consisting of a LASER sensor and a GSM modem which are connected to PC. This module is installed at bus terminal form where the bus starts initially. When the bus enters the terminal pad, it is

900MHz and 1.8GHz bands GSM supports data transfer
speeds of up to 9.6 kbps, allowing the transmission of basic data services such as SMS.
detected by the LASER sensor. The terminal operator 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. An example of the transmitted header is of the form "113V01LZR7240" where '113' is the bus route number issued by Government Transportation Department, 'V' is the name of place where the bus goes '01' is the count number assigned to the bus and 'LZR7240' is license plate number of bus. An 'ON' signal is also transmitted to the In-BUS Module installed in the bus for initialization.
BUS station module is having camera to catch the thief. This camera is rotated with the help of a motor connected through the microcontroller and displays it in the PC.

B. BUS Module

A BUS Module is installed inside every bus and consists of a, GSM modem, infrared object counting sensors, door opening/closing sensors, an emergency button and GPS receiver. These all are interfaced to microcontroller. The initialization signal received form BUS Station Module, starts transmitting bus location to the BASE Station. When the driver opens the door, at each stop an interrupt is generated and microcontroller starts counting the numbers of passengers entering and leaving the bus with the help of infrared sensors. This information or count value on per stop basis is transmitted to the BASE Station. In case of an emergency situation i.e. when some problem occurs in bus, driver can press the emergency button to inform BUS and BASE Station units in thismodule continuously calculates the difference in consecutive GPS locations. If the difference remains near zero for more than a designated time, then a getting late message is transmitted to the BUS and BASE stations.

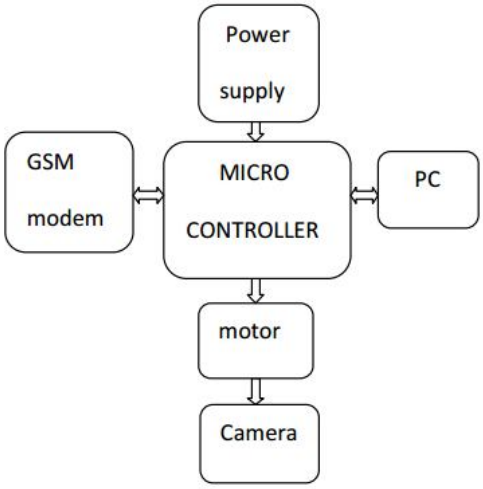

Fig.2. Block diagram of Bus Station

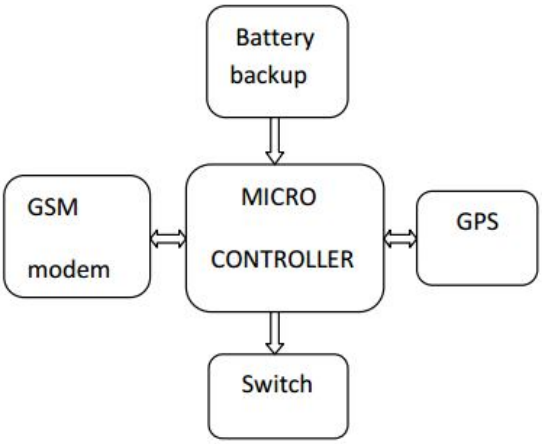

Fig.3. Block diagram of Bus module

In case of sparse GSM coverage, location information isstored in memory unit. After regaining the GSM network, previous locations are updated to the BASE station.

C. BASE Station Module

This module is the central part of the network. It also receives the number of passengers entering and leaving the bus on per stop basis from BUS Module for statistical analysis. The message received is of the

about the location of bus. The BUS station operator can then adjust the schedule accordingly and send an additional bus forf acilitating the passengers. Microcontroller present

form
"20, 10, 2345.3522N, 09022.0288E". The first two digits tells us about the number of passengers entering and leaving the bus respectively and next two digit denotes the location information; all separated by commas. Where Another GSM modem is used to get the user request of location information of a particular bus. An example of the query put by the passenger is of the form "33V" or "113V10". In first instance i.e., "113V", '113'
is the route number and 'V' designates the direction flag while in second instance i.e., "113V10", additional digit
'10' denotes the bus stop number where the passenger is standing. The GSM modem attached to microcontroller passes on the user request to the PC dedicated for that route number. After processing the request data the PC sends desired location information in form of bus stop name to microcontroller. The microcontroller then transmits this information back to the user. The information received by the passenger contains the location of all buses out of terminal in desired direction in former query while in case of later query, he will get the location of those buses which are coming towards the particular bus stop number in desired direction along with time information. The time information is embedded in message to account for any delay in processing the user
request. The emergency situations are also monitored by base station which is transmitted from BUS Module. In addition to this, the bus station keeps record of security issues and traffic congestion conditions and directs the driver to change the route if needed.

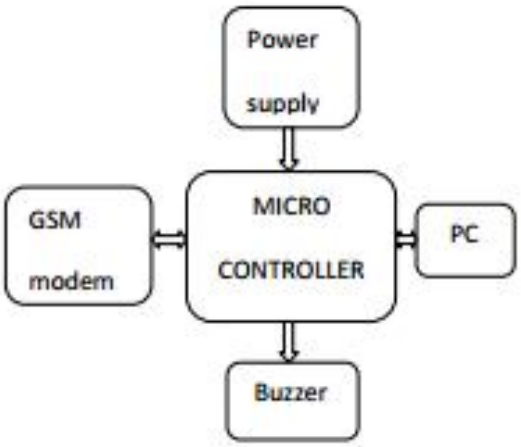

Fig.4. Block diagram of BASE Station.

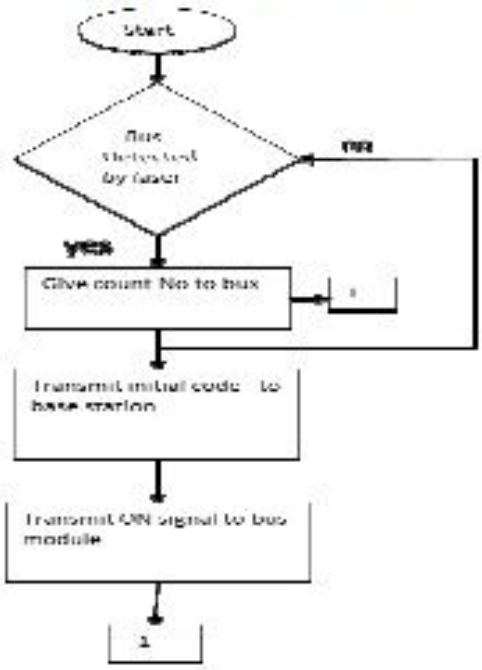

Fig. 5. Flow Chart for BUS Station Module

BASE Station Module equipped with a microcontroller unit and GSM modems interfaced to PCs is designed to keep track record of every bus, processes user request about a particular bus location out of BUS Station and updates buses location on bus stops.

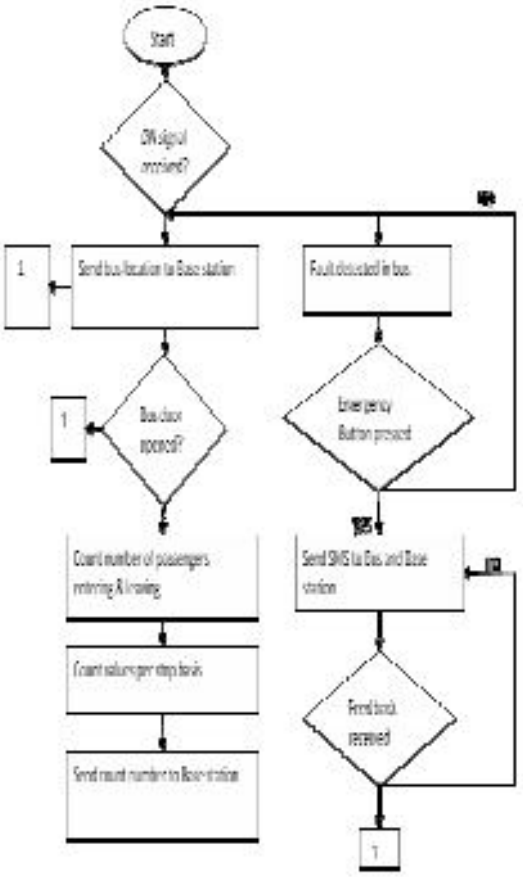

Fig . 6. Flow Chart for BUS Module

IV. CONCLUSION

In this paper the transport management, designed and developed a low cost system based on integration of GPS and GSM data is described. The system consists of different modules which are linked wirelessly with GSM modems. Cost effective SMS service of GSM network is used for the transfer of data between the modules. A new service, to facilitate the people who use public transport for traveling, is introduced inside the cities. The service provides the user with current location information of desired buses based on which the user can adjust his schedule accordingly. The service therefore completely minimizes the need of waiting for buses in the bus stop thus saving a lot of time. For the passengers those who are not utilizing the service, displays are installed at bus stop to let them know the buses location coming towards that stop. This system is also efficient in handling the emergency situations e.g., in case some kind of technical fault occurred in bus, the operator at bus terminal is informed and the departure time between the buses is reduced.

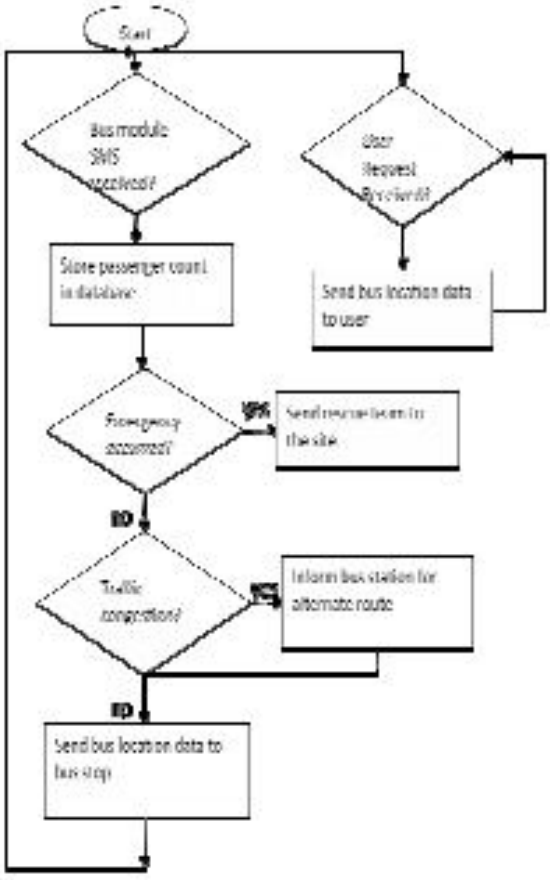

Fig.7. Flow Chart for Base station Module

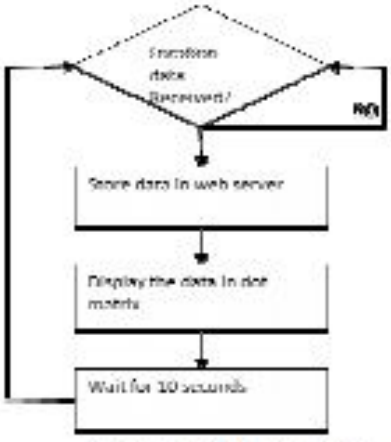

Fig.8. Flow chart for future scope

V. FUTURE WORK

The system can be made automatic by installing cameras at bus terminals which can automatically read the license plate number of buses thereby eliminating the operator. An automatic route guider display can be installed in buses to better update the alternative route in case of serious road congestions. The data can be stored
in a web server. It can accept location information of buses through respective GSM modems and maps the information on Google Map for visualization. Fare collecting system can also be automated by providing another mobile service to which all the passengers using public transport are subscribed.

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AUTHORS

Mr. K.Bhaskar ,Completed his M. Tech in Embedded Systems and Completed his B.Tech (EEE) from Hyderabad. Completed his Diploma (EEE) fromWarangal. His Interested areas of Research include Embedded Systems, Digital Electronics and Hardware Design.

EMail ID: bhaskar.kunusoth@gmail.com