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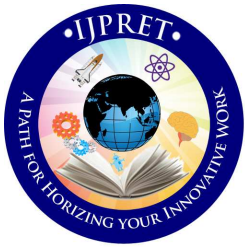

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A PATH FOR HORIZING YOUR INNOVATIVE WORK

DESIGN OF SMART & RELIABLE PUBLIC TRANSPORTATION SYSTEM

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Abstract

In this speed age a public transportation system plays very important role. There are lots of efforts being made by public transport corporations to improve public vehicle occupancy by requesting the public to use public transport over other modes of transportation. However rapidly increasing vehicles puts a complex burden on traffic management. It can be noted that if the passenger knows with high confidence that the bus is going to come, he/she will definitely wait rather than opting for other modes of transport. Hence waiting for the bus becomes wastage of time so, in order to reduce these types of problems we use automatic bus recognition. Therefore a proposed system uses a supervisory system based on GSM & GPS, technology that gives practically significant & feasible results.

I. INTRODUCTION

In this modern era of communication and automation, usage of every new technology is increased.

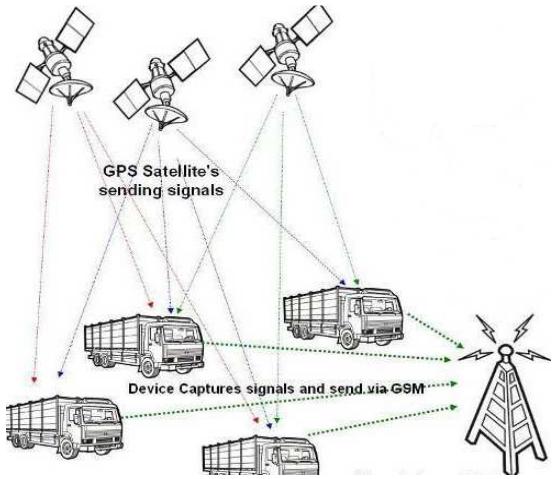

Fig1: A typical public transportation system

Many of the investigations or improvements currently used take into the account some parameters to improve passenger comfort, such as [1], where the VOLVO Company explained the ITS4mobility system that provides information to the user about arrival and departure time; also in [2] where the author analyzed critical service points in the British transport as waiting time, design, payment and other factors in the bus stops; and in [3, 4] where bus information is delivered to the user through PDA.

Now days the interest is going on developing the application about the RFID [5, 6].

II. EXISTING TECHNOLOGY OVERVIEW

One popular technique on which most of the moving objects tracking schemes rely is GPS. It provides specially coded satellite signals that can be processed in a GPS receiver, enabling the receiver to compute position, velocity and time.

Another technique used for vehicle tracking is Dead-Reckoning [12], in which the location of the vehicle is calculated by integrating the travelled distance in various directions in relation to a known initial location, often the previous location. The different wireless technologies available today have resulted in the reliable & faster communication.

The cellular communications with frequency multiplexing are used to achieve effective use of frequency resources. Hence nowadays, the cellular wireless communications are mainly used.

III. METHODOLOGY

A. System communication using GSM:

A GSM modem (as shown in figure 2) is wireless modem that works with a GSM wireless network [11].The connection between the modem is given in Figure 3.

Fig. 2: GSM Modem

The system is composed by a microcontroller and a GSM phone.GSM available service like SMS (Short Message Service) service is suited for remote control applications that requires small amount of data and rare activation, like sending alarms, or emergency commands [9].

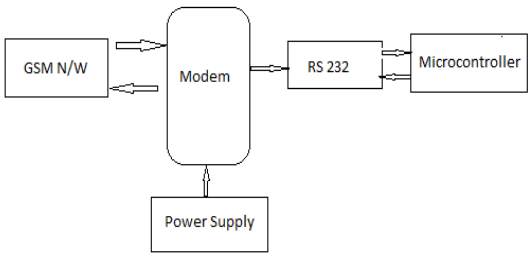

Fig 3: Block diagram of GSM interfacing

The communication between microcontroller and modem is done using USART. A serial driver IC is used for converting TTL voltage levels to RS-232 voltage levels.

Text message may be sent through the modem by interfacing only three signals of the serial interface of modem with microcontroller i.e. TxD, RxD and GND.

B. AT Commands:

The following are the AT Commands and sequence of events performed for sending text message.

1. First select the text mode for SMS by sending the following AT Command to GSM Modem: AT+CMGF = 1.

2. Send the text message string by following AT command: AT+CMGS = “919422926175”.This command sends the mobile number of the recipient mobile to the GSM modem.

3. Send ASCII code for CTRL+Z i.e., 0x1A to GSM Modem to transmit the message to mobile phone. Every AT command is followed by i.e. carriage return and line feed.

4. Read sms command is given along with the reference no of received message. E.g. AT+CMGR=1.

5. Delete sms command is also given in a similar way like AT+CMGD=1.

C. System positioning using GPS:

The GPS module receives the GPS signals and outputs the data to the microcontroller via a TTL-level asynchronous serial (USART) interface [8].

Most GPS receivers output data in NMEA-0183 format at 1-s interval [10, 11]. NMEA stands for the National Marine Electronics Association. The data is sent via RS-232 at 4800 bps, 8 data bits, one stop bit & no parity.

The figure (4) illustrates the main components of a simple navigation system.

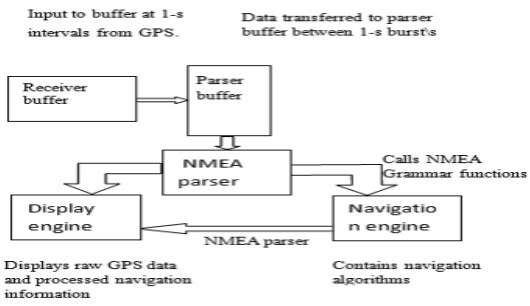

Fig 4: The simple navigation system architecture

And the figure (5) below shows the GPS receiver used in system design.

Fig 5: GPS receiver

GPS sentences beginning with the following specifications: $GPGGA, $GPGSA, $GPGSV, $GPRMC, and $GPVTG. And sentences also begins with $GPMSS, $GPZDA as shown in [table 1].

TABLE- 1 formats of NMEA Messages:

Sentence ID	Sentence ID
$GPGGA	GPS Fix Date
$ GPGSA	GPS Dilution of Precision and active satellites
$GPGSV	GPS Satellite in view
$GPRMC	Recommended minimum specific GPS/Transit data
$GPVTG	Track made good and ground speed
$GPMSS	Beacon Receiver status
$GPZDA	UTC Date/Time and Local time Zone Offset

D. Radio frequency Identification:

The acronym refers to small electronic devices that consist of a small chip and an antenna [7].An RFID tag is a tiny radio device that is also referred to as a transponder, smart tag, smart label or radio barcode.

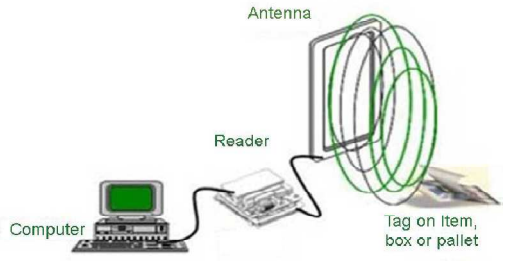

Fig 6: RFID basic operation

The tag comprises of a simple silicon microchip attached to a small flat aerial and mounted on a substrate. The whole device can then be encapsulated in different materials (such as plastic) dependent upon its intended usage. The finished tag can be attached to an object, typically an item, box or pallet and read remotely to ascertain its identity, position or state.

IV. HARDWARE DEVELOPMENT

The system consists of three units, namely 1] Bus unit 2] Bus Stop unit and 3] Bus Station/Terminus unit as shown in figure 7.

A Bus Station/Terminus unit consists of microcontroller; RFID reader & a local LCD display which isinstalled at the bus depot or terminus. Time table of all the buses with their updated departure timings will be displayed continuously. When the bus enters the terminal pad, it is detected by the RFID reader by reading the front tag of the bus. And when the bus departs the terminal pad, it is detected by reading the tag at the back side of the bus.

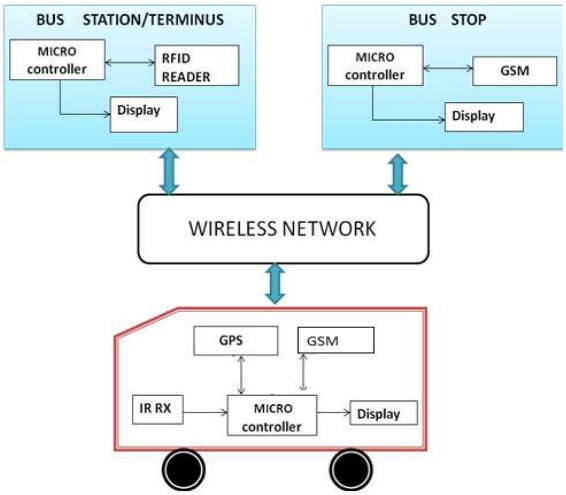

Fig 7: Block diagram of overall system

A Bus Stop unit consisting of microcontroller, GSM modem & a local LCD display is installed at the bus stops. Here the information like a bus no, distance travelled & to be travelled by the bus & the current passenger count in that bus will be

displayed on bus stop till the bus reaches that stop. When the bus leaves the stop that information will be cleared & new information of next bus will be displayed.

Lastly the Bus unit with microcontroller, GPS, GSM, IR sensors & local LCD display is mounted in every bus. This unit is battery operated as it can use the battery inside the bus.

Microcontroller present in this module continuously calculates the difference in consecutive GPS locations for providing the information regarding the distance travelled & to be travelled by the bus.In case of sparse GSM coverage, location information is stored in non-volatile RAM. After regaining the GSM network, previous locations are updated to the bus stops.

V. SYSTEM TESTING & RESULTS

System design is verified by testing after integration of all components of the system. A bidirectional people count is acquired with IR sensor as shown in figure 8.

Fig 8: interfacing of Bus unit

GSM modem is tested in lab &serial port of it was connected to a PC's COM port to see the results on HyperTerminal during its operation as shown in the Figure 9.

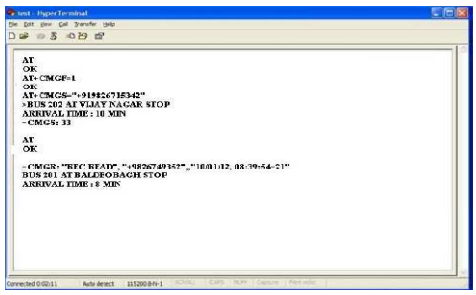

Fig 9: HyperTerminal image showing simulation results

A bus stop unit with GSM modem as well as the information to be displayed is as shown in figure10.

Fig 10: interfacing of Bus stop unit

For determination of arrival & departure of bus RFID reader is used in Bus Depot

Unit. The results of the same are as shown below.

Fig 11: Interfacing of Bus Depot Unit

VI. CONCLUSION

In this project, design and develop a low cost transportation system based on integration of GPS and GSM data. This system provides automated passenger information systems, designed to bring real-time information to transit passengers with local displays. Thus, the proposed system is beneficial for both passengers and the bus operators.

The proposed application will surely provide smooth and linear transmission of location information to the bus stations which led people to take decision either to wait for Bus or not & for onboard passenger it will help to get station information alert without dependency on others.

VII. ACKNOWLEDGEMENT

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