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Bus Tracking System using IoT

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***Abstract:** Safety is the major concern of today's era. In which the vehicle tracking system based on IoT can play a crucial role. The bus tracking system proposed in this paper can be used in any vehicle in an efficient way. The proposed model uses popular technologies such as Smartphones and microcontrollers which make this project inexpensive and easily accessible. The vehicle has an embedded RFID card which is used to maintain the record of the passengers in and out the bus. The microcontroller is used to manage the GSM and GPS/GPRS technologies. The GPS module is used to get the location of the vehicle at different times. The paper contains the experimental result of the proposed project and the hardware description.*
***Keywords:** GSM, GPS, GPRS, RFID, Vehicle tracking, Microcontroller.*

I. INTRODUCTION

Increase in the number of cases of kidnapping, accidents etc. is the major concern in today's society. This issue has a great impact on the society, the parents are worried for their students when they are on the way for school, families worry for their member when they travel through public transport. To solve this major issue, here in this paper we present a way in which we can keep a track of our loved ones when they are travelling. Through this the delay caused due to public transport can also be managed efficiently. The technology we propose here is Bus Tracking System using IoT which constitute of a smartphone and a microcontroller on a broader view. These two devise are very common today. According to the study presented in [1], it has been stated that almost 100 percent of people in today world have smartphones with internet connection, the graph given in [1] is shown in figure 1. The tracking of the vehicle is done by the SMS tracking system using GSM, this is also very cost efficient as now a days the SMS charges are very less. The system used a RFID card to maintain the record and store it in cloud database, GPS is used to keep the track of longitude and latitude of the locations followed by the bus.

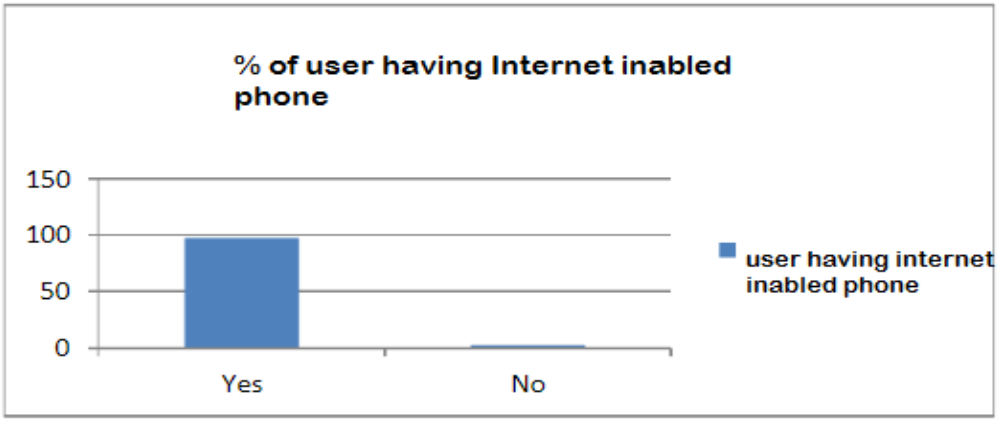


Fig 1: graphical data of percentage of mobile user with internet connection.

II. RELATED WORKS

Many systems related to the proposed topic has already been made and developed all across the world. Many students along with researcher have presented many system including the use of smartphone, an android app, a website designed for tracking propose. The author of [2] have proposed a system which has vehicular tracking using open source, it includes GSM, GPS, and GPRS system. The author in [3] has developed a bus tracking system based on SMS for the proper functioning of the bus in Beijing Olympics. The author in [4] uses latitude and longitude coordinates to mark the exact location on the google map using KeyHole MarkUp Language. In [5] an intelligent tracking system has been developed that used AI techniques to track the the vehicle. The author of [6] [7] has developed a bus tracking system along with the security tag with the help of RFID tags which has been used in our project too to mark the attendance of the passengers in the bus.

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III.PRAPOSED SYSTEM

The proposed model consists of both hardware and software part. The hardware model is used for the tracking system while the software part is for keeping the database updated and keep the client updated with the location and prediction of arrival and departure time of the vehicle. The hardware diagram of the proposed system is given in figure 2. The hardware consist of the GSM, GPS, Microcontroller modules, a LCD screen, a RFID module. The software part contains the a website which is developed for tracking the vehicle, the data of passengers on the vehicle is updated in the database at regular intervals. The website keeps the track of vehicle movement and the passengers in the vehicle. The GPS module is used to provide the location to the client with the help of the SMS alert. The SMS provide the client with the longitudes and latitude of the vehicle at present location.

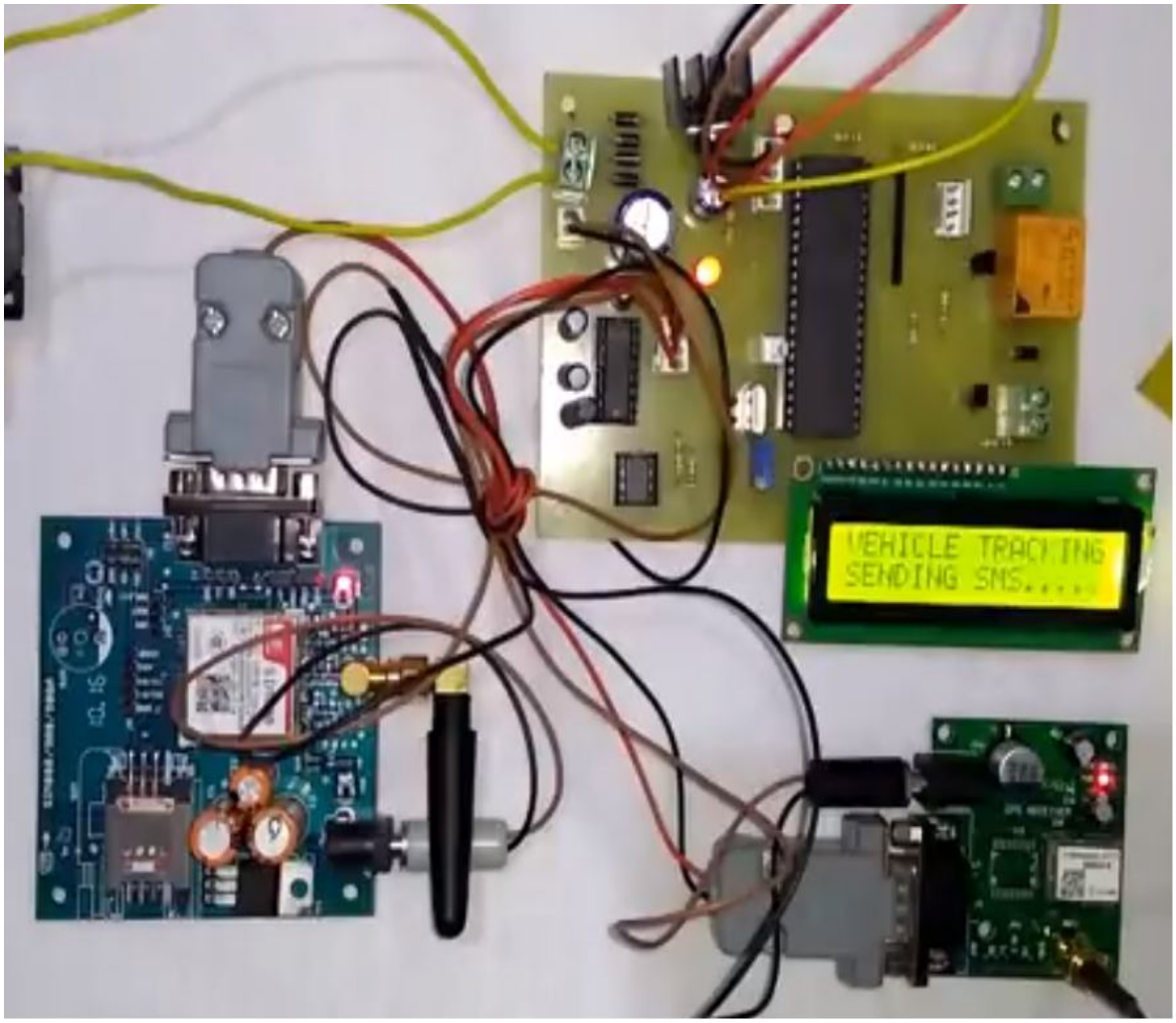


Fig 2: Hardware model of the proposed system.

A. Hardware

The hardware layer of the proposed model contains the component listed in below table:

TABLE I. LIST OF COMPONENTS

S.No.	NAME OF COMPONET	COMPONENT NUMBER
1.	PIC MICROCONTROLLER	PIC 16F877a
2.	RFID(frequency range of 433 MHz)	Rc522
3.	GSM MODULE	Sim900a
4.	GPS MODULE	Neo 6m

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1) *Microcontroller:* The microcontroller used here is the PIC 16F877a microcontroller. This part serve as the main control unit of the entire tracking system. A program in HLL is saved in the microcontroller to do its proper functioning. This is an easy to program but a powerful microcontroller. The pin description of the PIC is shown in the below diagram. This is an 8-bit PIC which works on the voltage supply of 2 to 5.5 V. The RBx pins are connected to the programmer. The RAM of the PIC consists of 368 bytes [8]. The figure below shows the pin diagram of the PIC 16F77a microcontroller.

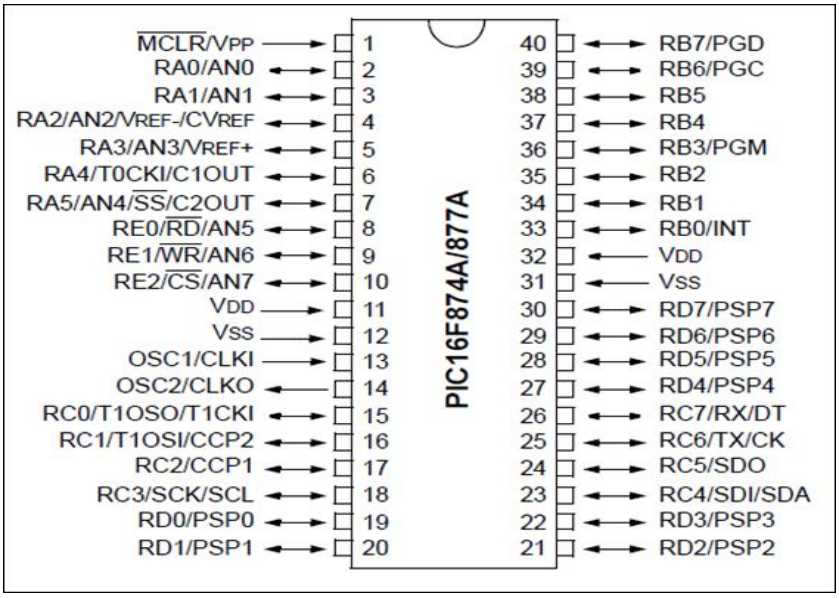


Fig 3: The above figure contains the microcontroller pin diagram.

2) *RFID Reader:* This is one of the key hardware component which keeps the record of the passenger on the bus. The rc522 RFID module works on the radio frequency of 433 MHz [9]. This is a radio frequency identification device which scans a tag which is issued to every passenger and keeps the record of their name and serial number and then this is procced for the further processing. The antenna in the RFID card is supplied with 5V power supply.
3) *GSM Module:* The sim 900a GSM module has a very powerful single-chip design. The transmitter and receiver pins of the modem and the microcontroller are connected together. This requires a power supply of 12 V [10]. This provides the communication between the in-vehicle design and the cloud server storing the data. [11]
4) *GPS Module:* The neo 6m GPS module used here is highly sensitive for indoor applications and has a build in voltage regulator which makes its woks well in a voltage supply of 3.3-5 V [12]. This has a baud rate of 9600. The transmitter pin in modem is connected to the receiver pin in the microcontroller. This offers an accurate and reliable tracking system with the help of GPS satellites. GPS receiver receives the signals in NMEA format. Here we use GPRMC signal, since it contains location information along with the speed. Format of GPRMC is given below. [13]

$GPRMC, 123519.000, A, 7791.0381, N, 06727.4434,
E, 022.4, 084.4, 230394,003.1, W*6A

B. Application

The system has two application programs.

1) *SMS Tracking System*: This is provided by the GSM modem which helps the user to get the longitude and latitude of the exact location of the vehicle at real time. With the help of this the client can easily monitor the stauts of vehicle and plan the rest accordingly. The operation of this is described below: [14][15]

a) *Input:* UART 1 Rx pin (RFID Reader OUT), UART 3 Rx Pin (GPS Receive OUT)
b) *Output:* UART 2 TX Pin (GSM IN)

i) Read the 12-character RFID data from EM 18 using Microcontroller.
ii) Read NMEA data from the GPS.
iii) Extract Date, Time, Latitude, Longitude and speed from NMEA data.
iv) Send the message to the recipient/cloud server using AT command through GSM modem.

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2) Cloud Storage: UBDITOS is a cloud service used to store the real time data. This is used here to store the data, location and speed of the vehicle. The UBDITOS [16] let us create application for IoT easily and in this it is easy to track and send SMS in form of information with the help of GSM. In this the RFID tags along with the GPS data is send to the cloud sever, which is then used for client side application.

C. Sequence Diagram

Figure 4 shows the Sequence diagram of the entire working process the system.

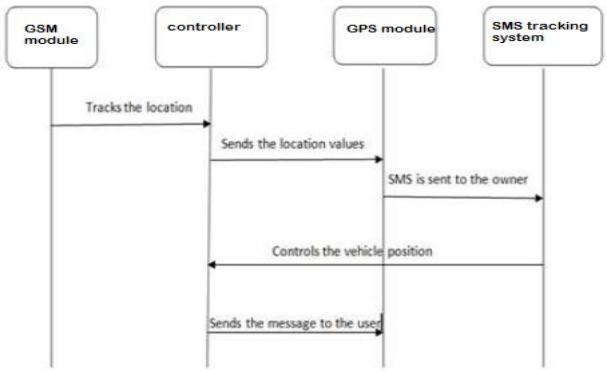


Fig. 4 The control flow of the system during operation.

IV. EXPERIMENTAL RESULT

The SMS tracking system was developed for the user convenience and it works in the following way:

When a client sends a text location from his/her smartphone then the GPS system send the location of the vehicle to the user as the longitude and latitudes values which can be easily viewed on the google map. The figure 4 shows the result of the SMS tracking system when the user requests the location of the vehicle at current time. Now the user just needs to put the co-ordinates to get the exact location of the vehicle. Such information is very handy for parents, who need not anxiously wait for uncertain durations, as they would have acquired recent location of the specified school bus.

Once when the user enters the co-ordinate on the map app then the location of the bus will be marked with a red pointer and linked with the GPS antenna.

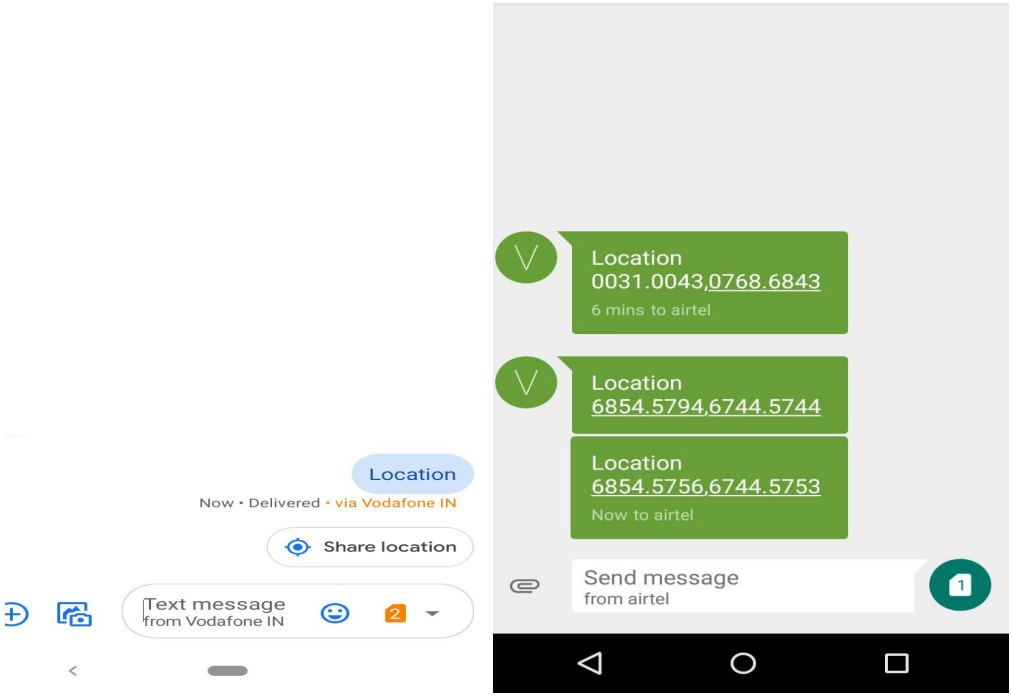


Fig 5: The above shows the SMS tracking system example with the help of a smartphone.

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V. CONCLUSION

We have developed a vehicle tracking system using GSM, GPS, RFID, Microcontroller system. GPS technology is used to track the location and that data is transmitted to the user using GSM. This system efficiently keeps record of the data of passengers in the bus plus the location of the vehicle. An easy smartphone based SMS tracking system has been developed to let the user know the location. This is a very cost efficient system with uses the common electronic device which can be accessed easily by every person in society. The vehicle tracking system uses the traditional components but add on IoT in it to ease the functioning of the system.

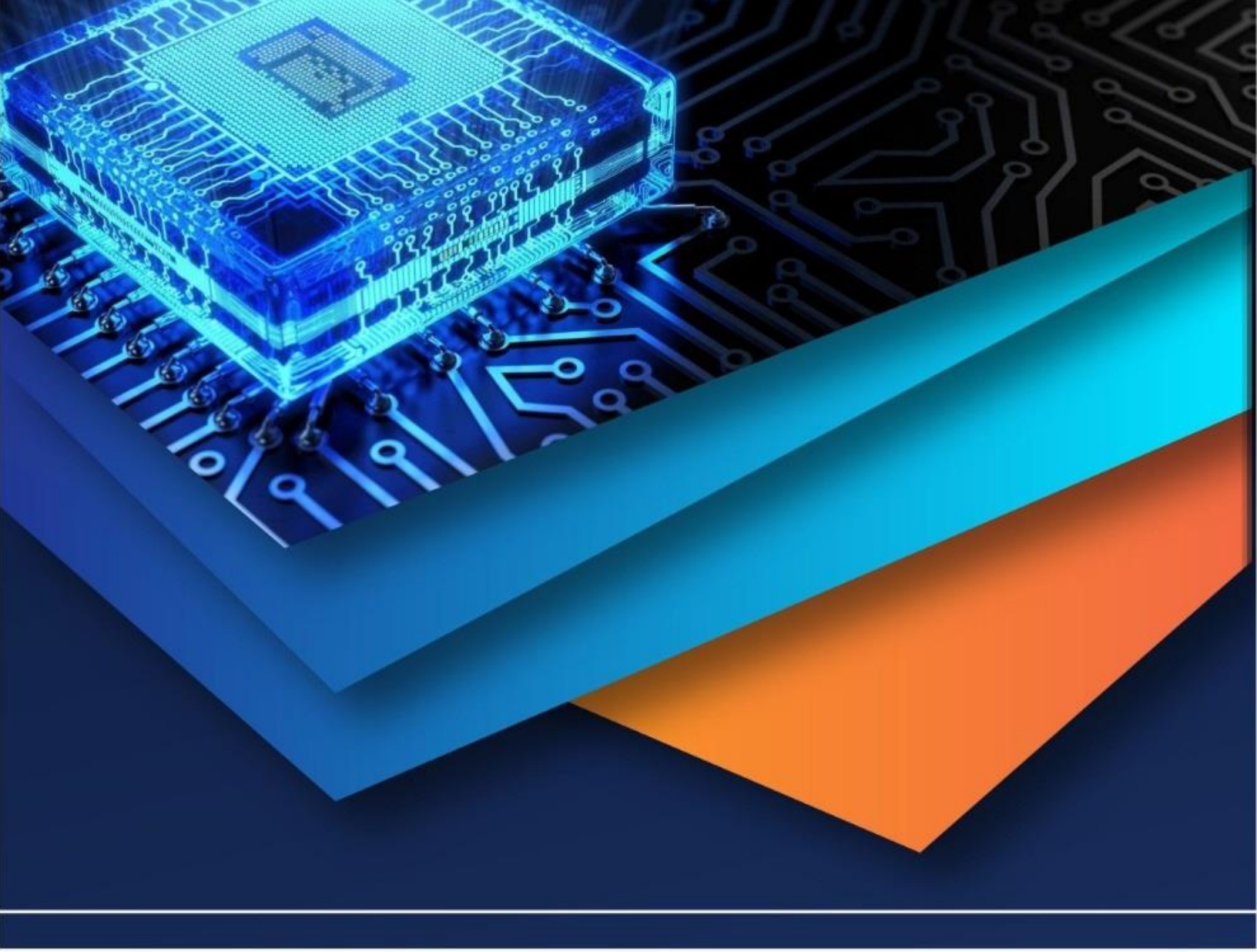
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