

# *Advanced Vehicle Monitoring and Tracking System based on Raspberry Pi*

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**Abstract** - An advanced vehicle monitoring and tracking system is designed for monitoring the school vehicle from any location A to location B at real time and provide safety environment to the traveler. The proposed system would make good use of new technology that based on Embedded Linux board namely Raspberry Pi and its advanced feature of storing database at real time. The proposed system works on Global Positioning System (GPS) and Global System for Mobile Communication (GSM) which is used for vehicle tracking and monitoring mechanism. For this purpose SIM908 Module is used which includes all the three things namely GPS GPRS GSM. The GPS gives current location of the vehicle; GPRS sends the tracking information to the server and the GSM is used for sending alert message to vehicle's owner mobile. The proposed system would place inside the vehicle whose position is to be determined on the web page and monitored at real time. In the proposed system, there is comparison between the current vehicle path and already specified path inside the file system of Raspberry pi. Hence if the driver drives the vehicle on the wrong path then the alert message will be sent from the proposed system to the vehicle's owner mobile and if the vehicle's speed goes beyond the specified value of the speed, then also the warning message will be sent from system to the owner mobile. The proposed system also took care of the traveler's safety by using LPG Gas leakage sensor MQ6 and temperature sensor DS18B20.

**Keywords-** *Raspberry Pi, Sensors, Embedded system.*

## I. INTRODUCTION

In last decade, we observe the drivers fatigue driving and vehicle theft activity which causes social real time problem like accidents and many more hazards conditions. We daily see or read such type of activities which are raising the question of our safety and security in both public and private sectors. So there is a need of real time monitoring and tracking the vehicle also storing and updating its database of certain situations. In the urban areas, human help is somewhat difficult in providing the database of tracked vehicle. In the proposed system, the

system provides a fully automated tracking and monitoring of the vehicle which helpful for school bus, their owners, children's safety and also it provides accurate arrival time of the vehicle at particular location or stop. And hence using accuracy in time, children can spend more time in studying, sleeping, or relaxing rather than waiting for a delayed bus. Spending less time waiting for a bus improves comfortable and effective time management of the student as well [4]. In order to reduce man power and saving of money, here the system provides easy tracking solution using Embedded Linux Board. The proposed system get tracking information of the vehicle like vehicle number (Unique ID), location, speed, Date, Time and store into the database of Raspberry Pi. The system also provides students safety mechanism with the help of temperature sensor and gas leakage sensor. Hence in the case of raising the temperature inside the vehicle due to some reason or leakage of the LPG gas inside the vehicle, the alert message get send to the driver as well as vehicle owner.

For tracking the vehicle using GPS and maintain its database, MySQL database system is use which advanced feature of Raspberry-Pi. In the database base monitoring and updating mechanism, the GSM/GPRS module is used which transmit the updated vehicle database to the server and user access the database using web page in Smartphone [3]. That shows the real time vehicle location in the Smartphone. Thus, users will be able to continuously monitor a moving vehicle on demand using the Smartphone and determine the estimated distance and time for the vehicle to arrive at a given destination.

## II. EASE OF USE

System Objectives:

- Continuously monitoring and tracking the school vehicle at real time using web page in the Smartphone and if the vehicle choose wrong path then system gives the alert message to the owner's Smartphone.
- Storing and updating the real time database of the vehicle like its Speed, Time, Location, and Date which

is useful in case of vehicle theft detection or in case of vehicle's accident.

- Provide safety environment to the children who travel through the vehicle using LPG gas leakage sensor and temperature sensor.

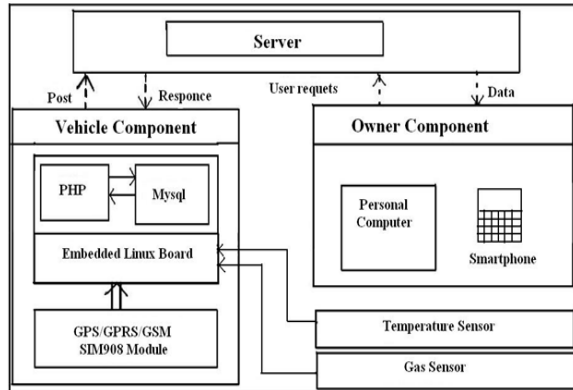


Fig. 1. System Block Diagram

The proposed system would get control with the help of Raspberry pi which placed inside the vehicle. The GPS GPRS GSM SIM908 module would get communicate to raspberry pi board with USB interface. The longitudes and latitudes of the current path received from GPS of GPS GPRS GSM SIM908 module get compared with the stored longitudes and latitudes in the particular file format inside the database of raspberry pi. If that longitudes and latitudes not match with the stored one then wrong path detection alert message will get sent to vehicle's owner mobile. Also the longitudes and latitudes of the current path received from GPS will get sent to the server with the help of GPRS which helps to track the vehicle's current location on the web page using Smartphone. Here for tracking the vehicle, the proposed system provides login facility on web page for vehicle's owner, students and their parents. Also student's safety gets provided with the help of DS18B20 temperature sensor and gas leakage sensor MQ6. These sensors get interface with raspberry pi. If the temperature crosses the specific value or LPG gas get leakage inside the vehicle then the alert message will sent to owner. Likewise the safety mechanism provided by the system.

#### A. System Specification

##### 1) Embedded Linux Board:

The Raspberry Pi board used in the proposed system which having following features:

- 5V@1A maximum power from an adaptor.
- 700 MHz ARM1176JZF-S core (ARM11 family, ARMv6 instruction set).
- 1GHz operating speed.
- 4 USB ports for Key board mouse or accessing external memory.
- 40 GPIO pins.

- Ethernet port for internet connectivity.
- VGA connector and HDMI connector.
- 3.5mm stereo jack for audio out to amplifier.
- MicroSD card interface slot to carry the OS.
- 512MB of SDRAM.

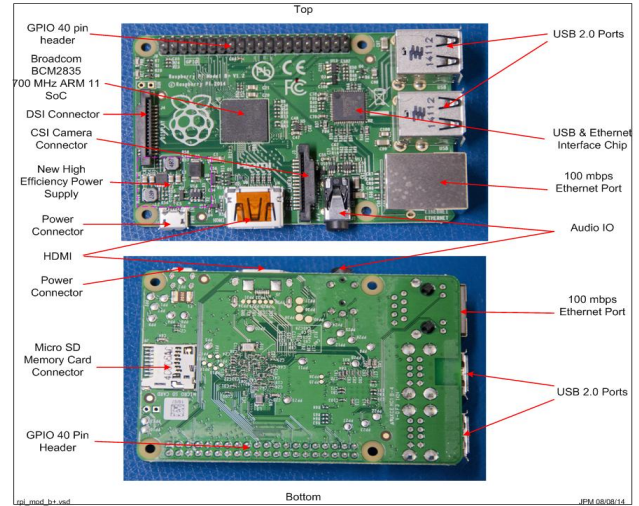


Fig. 2. The Raspberry Pi B+ Board

##### 2) Sensor:

###### a) Temperature Sensor:

Specifications:

- Unique 1 wire interface requires only one port pin for communication.
- Each device has unique 64 bit serial code stored in an On Board ROM.
- Requires no External components.
- Can be powered from Data line; power supply rang is 3.0v to 5.5v.
- Measures temperature from -55 to +125 Degree C.

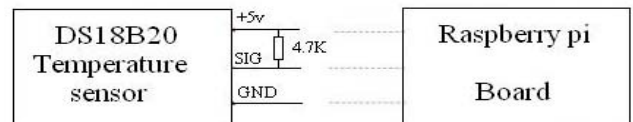


Fig. 3. The temperature sensor DS18B20.

*b) LPG Gas leakage sensor:*

Specifications:

- High sensitive to LPG Gas, iso-butane, propane.
- Small sensitive to alcohol, smoke.
- Fast response.
- Stable and long life.
- Simple drive circuit.



Fig. 4. The LPG Gas leakage sensor MQ6.

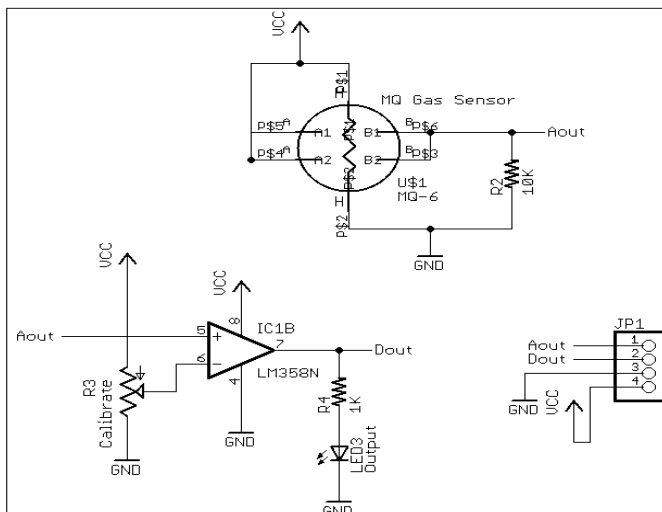


Fig. 5. Circuit diagram of Gas sensor MQ6

*c) GPS/GPRS/GSM SIM908 Module:*

MAIN FEATURES:

- GPRS multi-slot class 10 standard
- GPRS mobile station class B standard
- Meet the GSM phase 2/2 Standard
- AT command control (GSM 07.07, 07.05 and SIMCom enhanced AT command set).
- Support voltage range: GPRS: 3.2 ~ 4.8 V, GPS: 3.0 ~ 4.5V

- Low power consumption
- Operating temperature: 40 ° C to 85 ° C

SPECIFICATIONS FOR SMS VIA GSM / GPRS

- Point-to-point MO and MT
- SMS cell broadcast
- Text and PDU mode
- Specifications for data transfer
- GPRS class 8/10: max. 85.6 kbps (downlink)
- Coding schemes CS 1, 2, 3, 4
- CSD up to 14.4 kbps
- PPP-stack
- Integrated TCP/IP stack

COMPATIBILITY

- AT cellular command interface
- Specification for GPS
- Receiver type
- 42-channel
- High-performance STE engine

INTERFACES

- 80-pad with SMT type
- Interface to external SIM 3V/ 1.8V
- Dual analog audio interfaces
- SPI interface
- RTC backup
- A serial interface and a debug interface for GSM/GPRS.



Fig. 6. GPS GPRS GSM SIM908 Development Board

## B. System Design

### 1) Vehicle real time tracking and wrong path detection using GPS/GPRS/GSM SIM908 module:

GPS GPRS GSM SIM908 Module which gets interfaces with the Raspberry pi gives the real time tracking information of the vehicle such as Longitude, Latitude, Speed, and Time of the vehicle. That information related to the vehicle taken from USB interface and get stored into the database of raspberry pi and further will sent to the server using GPRS. The system gives tracking provision to the user on web page as follows:

- A) *Super user Login*: The vehicle's owner can track the vehicle in his Smartphone using Super User Login on the web page. Hence only owner can access this login.
- B) *Primary user Login*: The registered students can track the school vehicle in their Smartphone using Primary User Login on web page. Hence only those students who get registered into the system can access this login.
- C) *Secondary user Login*: The student's parents can track the school vehicle in their Smartphone using Secondary User Login on the web page. Hence only registered student's parents can access this login.

The Raspberry pi's file system stores longitudes and latitudes of the vehicle's owner decided path i.e. from location A to B in particular file format. Whenever driver drives the vehicle, these longitudes and latitudes of the path A to B will get compare with the current longitudes and latitudes received from GPS/GPRS/GSM SIM908 Module. If these longitudes and latitudes matches, then we can say that the vehicle is on the right path else the system gives alert message to the vehicle's owner mobile that the vehicle follows wrong path. Hence the wrong path detection problem will get solved. The longitudes and latitudes which are stored inside the raspberry pi's file system have been taken from Expert GPS Software. Using this Expert GPS Software we can trace any path from location A to B, hence that traced path gives longitudes and latitudes of that particular path which can be stored in particular file format inside raspberry pi's file system.

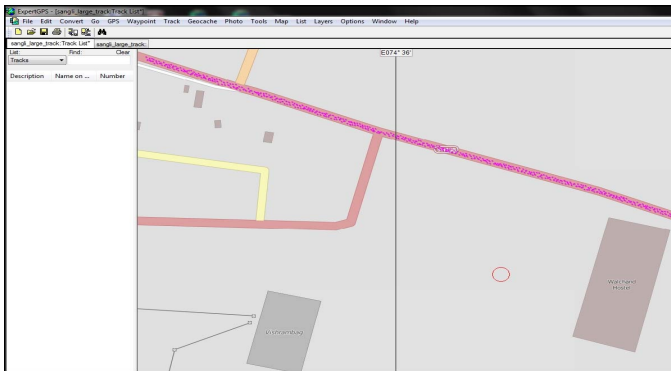


Fig. 7. Longitudes and latitudes of vehicle's owner decided particular path A to B taken from Expert GPS Software

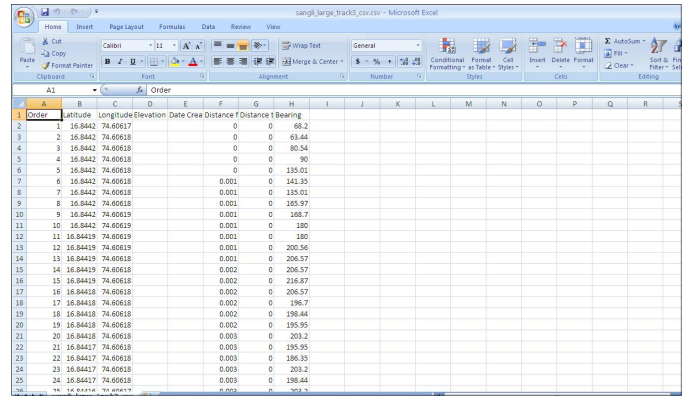


Fig. 8. Spreadsheet containing longitudes and latitudes of particular path from location A to B.

### 2) Vehicle tracking information database monitoring system using LAMP (Linux, Apache, MySQL, and PHP):

The vehicle tracking system works upon an algorithm in which, real time information of vehicle such as Longitudes, Latitudes, Speed, Date, and Time get store into the database of Raspberry pi using Linux, Apache, MySQL, and PHP i.e. LAMP system. The GPRS of SIM908 Module would sent this vehicle information to the server, which make easier for tracking a vehicle at real time on web page using web browser on Smartphone which gives more accurate result of current location.

### 3) Students Safety mechanism using temperature Sensor and LPG gas detect sensor:

The proposed system takes care of the children's safety by using LPG Gas leakage sensor and temperature sensor. The temperature sensor DS18B20 which works on the 1 wire protocol gives a digital output hence can be get directly interface with the Raspberry Pi. The threshold value of the temperature set in the program. If that threshold temperature value gets cross by output value of the temperature sensor due to some reason then alert message will be sent to the vehicle owner's Smartphone. Also the LPG Gas leakage sensor get interface with Op-amp LM358N which gives a digital output. That output voltage can be controlled by using current limiting resistors which helps the Raspberry pi's gpio from damage. Likewise both sensors output driven through Raspberry pi would get compare with threshold values and if limit crosses then the alert message will be given to vehicle owners mobile using GSM of SIM908 module. In following results, the threshold value set at 30 Degree Celsius.

## III. TESTING RESULTS

### 1) Testing of DS18B20 Temperature sensor using Raspberry pi:

The sensor testing and their results are taken as follows:



As temperature sensor DS18B20 works upon 1 wire protocol, the sensor gives digital output data whenever receives input voltage from raspberry pi and it get stored in file system of raspberry pi. Using file system programming, the sensor data get easily access and processed further for giving alert message.

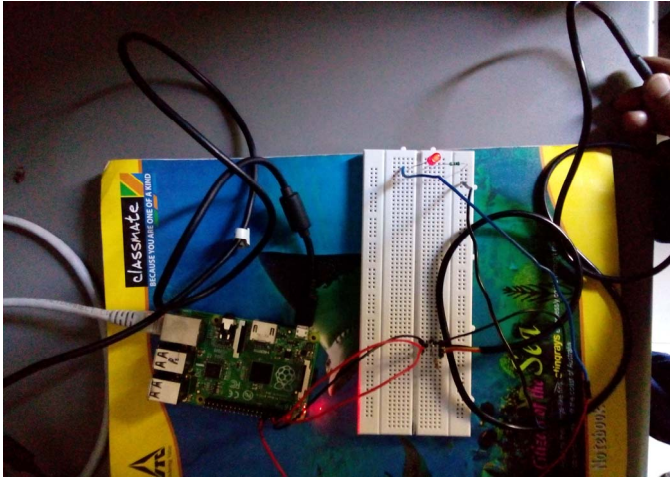


Fig. 9. Testing of DS18B20 Temperature sensor

```
pi@raspberrypi: ~
Device ID: 28-00000554e508 - Temp : 29.062000
Device ID: 28-00000554e508 - Temp : 29.125000
Device ID: 28-00000554e508 - Temp : 29.187000
Device ID: 28-00000554e508 - Temp : 29.250000
Device ID: 28-00000554e508 - Temp : 29.312000
Device ID: 28-00000554e508 - Temp : 29.437000
Device ID: 28-00000554e508 - Temp : 29.562000
Device ID: 28-00000554e508 - Temp : 29.687000
Device ID: 28-00000554e508 - Temp : 29.750000
Device ID: 28-00000554e508 - Temp : 29.875000
Device ID: 28-00000554e508 - Temp : 30.000000
Device ID: 28-00000554e508 - Temp : 30.062000
Temperature range crosses..!! take careDevice ID: 28-00000554e508 - Temp : 30.125000
Temperature range crosses..!! take careDevice ID: 28-00000554e508 - Temp : 30.250000
Temperature range crosses..!! take careDevice ID: 28-00000554e508 - Temp : 30.312000
Temperature range crosses..!! take careDevice ID: 28-00000554e508 - Temp : 30.375000
Temperature range crosses..!! take careDevice ID: 28-00000554e508 - Temp : 30.500000
```

Fig. 10. Testing results of DS18B20 Temperature sensor

#### 1) Testing of Gas Sensor MQ6 using Raspberry pi:

The Gas sensor MQ6 gives output as it receives 5V input. So whenever the sensor sense LPG gas it gives analog output which then given to LM358N Op-amp gives digital output. Then the digital output has driven through limiting resistor and further given to raspberry pi. The calibration of results of the output voltage has been taken using potentiometer. Hence by checking the raspberry pi's GPIO pin status, the sensor output data used for giving alert message of leakage gas to the vehicle owner Smartphone.

The sensor testing and their results are taken as follows:

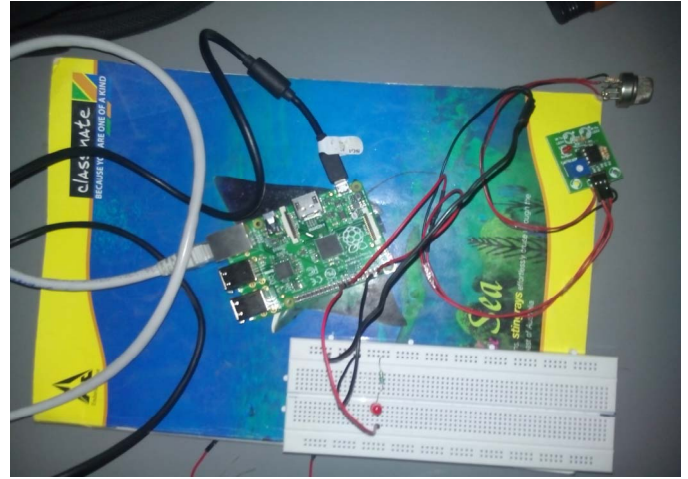


Fig. 11. Testing of MQ6 Gas sensor

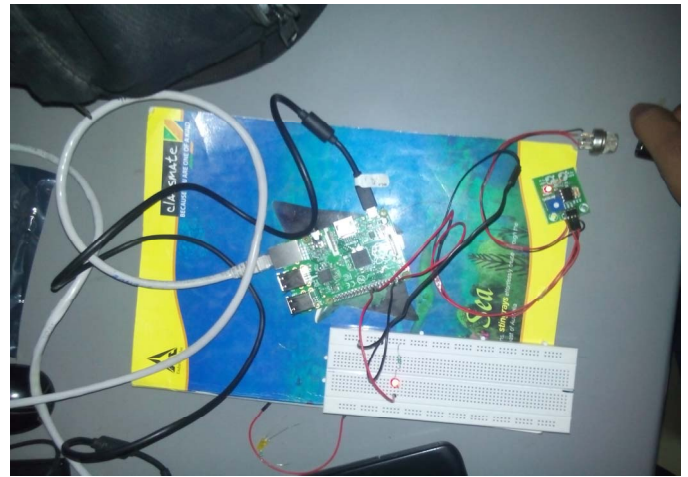


Fig. 12. Testing results of MQ6 Gas sensor

#### IV. FLOWCHART OF THE PROPOSED SYSTEM:

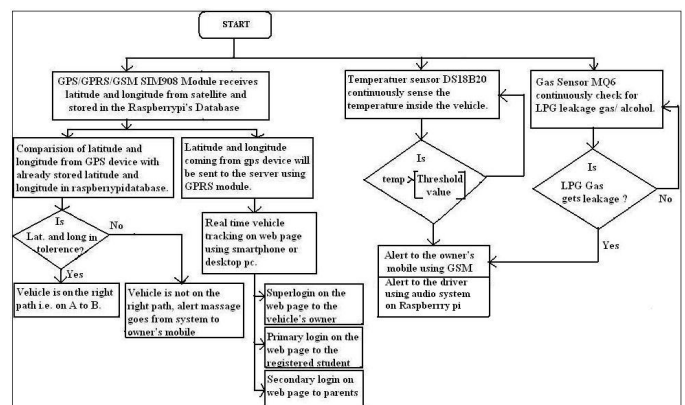


Fig. 13. Flowchart of proposed system

## V. CONCLUSION

The proposed system plays an important role in real time tracking and monitoring of vehicle and also provides safety and secure solution to the traveler using sensors. Whenever there is vehicle theft situation or vehicle's accident situation occurs, the proposed system provides the vehicle's current location, speed to the vehicle owner's mobile. Hence this benefits to track the vehicle as early as possible. In certain situations as per student's safety concern the proposed system given a provision of alert message on student parent's mobile which also plays an important role.

## REFERENCES

- [1] Tarapiah, S.; Atalla, S.; Alsayid, B., "Smart on-board transportation management system Geo-Casting featured," *Computer Applications and Information Systems (WCCAIS), 2014 World Congress on* , vol., no., pp.1,6, 17-19 Jan. 2014.
- [2] Kumar, R.; Kumar, H., "Availability and handling of data received through GPS device: In tracking a vehicle," *Advance Computing Conference (IACC), 2014 IEEE International*, vol., no., pp.245, 249, 21-22 Feb. 2014.
- [3] SeokJu Lee; Tewolde, G.; Jaerock Kwon, "Design and implementation of vehicle tracking system using GPS/GSM/GPRS technology and smartphone application," *Internet of Things (WF-IoT), 2014 IEEE World Forum on* , vol., no., pp.353,358, 6-8 March 2014.
- [4] Pengfei Zhou; Yuanqing Zheng; Mo Li, "How Long to Wait? Predicting Bus Arrival Time with Mobile Phone Based Participatory Sensing," *Mobile Computing, IEEE Transactions on*, vol.13, no.6, pp.1228, 1241, June 2014.
- [5] Liu; Anqi Zhang; Shaojun Li, "Vehicle anti-theft tracking system based on Internet of things," *Vehicular Electronics and Safety (ICVES), 2013 IEEE International Conference on*, vol., no., pp.48, 52, 28-30 July 2013.
- [6] Hoang Dat Pham; Drieberg, M.; Chi Cuong Nguyen, "Development of vehicle tracking system using GPS and GSM modem," *Open Systems (ICOS), 2013 IEEE Conference on* , vol., no., pp.89,94, 2-4 Dec. 2013.
- [7] Al Rashed, M.A.; Oumar, O.A.; Singh, D., "A real time GSM/GPS based tracking system based on GSM mobile phone," *Future Generation Communication Technology (FGCT), 2013 Second International Conference on* , vol., no., pp.65,68, 12-14 Nov. 2013.
- [8] Zhigang Shang, Wenli; He, Chao; Zhou, Xiaofeng; Han, Zhonghua; Peng, Hui; Shi, Haibo, "Advanced vehicle monitoring system based on arcgis silverlight," *Modelling, Identification & Control (ICMIC), 2012 Proceedings of International Conference on* , vol., no., pp.832,836, 24-26 June 2012.