

IOT BASED VEHICLE INSTRUMENTATION USING RASPBERRY PI

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ABSTRACT

In the proposed system IoT based Vehicle Instrumentation system using RASPBERRY PI is presented here. The system uses the Thingspeak platform which allows us to aggregate, visualize and analyze live data streams in the cloud. The system is developed to monitor various vehicle parameters like vehicle speed, fuel level, accident alert, and tracking the live location of the vehicle. In this system we are using a Hall Effect sensor for speed calculation, GPS Module for location tracking, 3-Axis Accelerometer for accident alert, and an Ultrasonic sensor for measuring the distance between vehicles. These sensors and module information are collected by raspberry pi and are dispatched to the Thingspeak platform. The developed system takes care of vehicle and driver's safety.

Keywords: *GPS, GSM, Raspberry Pi, Sensors, Thingspeak.*

INTRODUCTION:

The Internet of Things (IoT) is an environment people are provided with unique identifiers and can transfer data over a network without involving human-to-computer or human-to-human interaction. IoT has developed from the convergence of micro-electromechanical systems (MEMS), wireless technologies, and the Internet. IoT has made our life more convenient and even the smallest of daily tasks are extremely efficient, both in the workplace and at home. Sensors and actuators for gathering the data and sending it across the internet are also included in this advancement. Cloud is used for not only storing the data but also for data analysis, gathering and visualization. As the expeditious of Internet of Things (IoT) is emerging and is accustomed to remote monitoring of the surrounding parameters and other stuff with the use of sensors that acquaint for wireless sensing of real-time data and transfer them into the desired form and help to forward the sensed data across the network cloud via 'Internet Connection'. Here the project work deals with The IoT 'Thing speak' web service which is a generous open API service that acts as a host for a variety of sensors to monitor the sensed data in the cloud.

In the present situation no less than one individual in the family has a vehicle, In the present age everybody inclination is changing regarding time, and they have to complete their works in restricted time, so the need to complete the work as fast as possible, because of that tendency they drive the vehicles very fast risking their lives to complete their work resulting to the cost of their life's. In some cases without the intervention of us even we may fall into accidents due to other's fault. In this present age, the vast majority of them surmise that driving quick is form and those individuals think it

is an exciting driving quick, yet they couldn't comprehend that it is the greatest hazard that may risk to their lives.

From the last two decades population is increasing rapidly and with the advancement in technology number of vehicles on the road and highways is also increasing. But with the increase in the number of vehicles, there is a rise in vehicle crime also. Automobile theft is a major contributor to the ever-increasing crime rate in India. Metro cities take the majority of the brunt when it comes to vehicle theft but it is prevalent in most parts of the country. According to government data, in 2016, there were more than 2 lakh cases registered for vehicle theft across the country. 2-wheelers are comparatively easier to steal as they are much more difficult to track and this trend is reflected in the government data. More than 60 percent of the total stolen vehicles were 2-wheelers which were either shipped to other countries to sell or were used for illegal activities like snatching etc. Considering the above-mentioned condition we are motivated to build a system which will be very useful to deal with the problems. [4] In this system, we are using a GPS module to trace the location of the vehicle by which will be easy to get the location of the vehicle if it is stolen. In case of an accident alert, this system is capable of detecting accidents and send the SMS of the current location using GSM detected by the GPS.

There has been extensive study in the field of transportation especially in accident detection and prevention. The Vehicular Ad-hoc Network (VANET) based methods proposes use of information gathered from neighbouring vehicles through VANET communication and machine learning approaches to predict accidents. Accidents are predicted by observing traffic behaviour from collected data. The survey on road accidents proposes the use of IoT technology in accident detection. Mainly the existing IoT systems were using embedded systems designed using micro controller boards like Arduino acquitted with piezoelectric sensors only [1][2].

LITERATURE REVIEW

This section represents the various different implementation sections associated with this topic or some relevance to this topic with their implementation method and mode of operation.

In paper [3], authors have proposed a system to detect accidents in an early time and also to prevent theft by using IOT devices and Raspberry pi and GPS. It uses machine learning-based image classification. The Raspberry pi will capture the image and the data will be sent to the Authority. The GPS is used to locate the accident place. To reduce the number of thefts and severe injuries in accidents this SVMS is implemented.

In paper [4], authors have explained Wireless System for Vehicle Accident Detection and Reporting using Accelerometer and GPS. In this paper, Accelerometer sensor is used to detect crash and GPS give the location of the vehicle. In case of any accident, the system sent an automated message to the pre-programmed number such as family member or emergency medical services via GSM.

In paper [5], authors have designed and implemented a model that is based on Raspberry Pi and a smartphone android application. The system mainly comprises of three things GPS/GPRS/GSM

SIM 900A. The entire setup is placed inside the vehicle. GPRS sends the information to the server and GSM is used for sending the alert messages to the vehicle mobile owner.

In paper [6], authors have proposed a wireless vehicle tracking system using the MEMS accelerometer, GSM, and GPS for monitoring accidental vehicles. The designed system can detect accidents as small or high from the accelerometer and GPS. After which short message service information will be sent via the GSM network. The second one detects the change of the driver's physiological characteristics such as brain waves, heart rate, and pulse rate. Despite the good accuracy, it will annoy the driver as some additional devices must be attached to the driver's body. The Third one detects the fatigue of a driver irrespective of their facial features, Accelerometer sensor is fixed on the vehicle, steering abrupt movements are monitored and also the threshold limits of acceleration are compared. If the values exceed the threshold, a warning message is displayed on the LCD, and audio prompts are generated to warn the driver. In this method drowsiness and rash driving are also detected.

An accelerometer measures the speed variations of anything that it's mounted on it. The tri-axis accelerometers measure acceleration in three directions perpendicular to each other. The Micro Electro Mechanical Sensor (MEMS) is a very sensitive sensor that is capable of detecting the tilt is used to detect the extreme right and extreme left turns to detect the accident. In India, so many traffic accidents are reported and there is no means to monitor or control the speed of vehicles running on the road. The proposed system is effective in the detection of rash driving and accident location and is also used to control vehicle speed. If the driving is reckless the designed system will detect the vibrations from the vehicle and then automatically control the vehicle's speed thus keeping people in safe mode and reducing accidents. Some peoples will participate in the races on the road and suddenly at some turning position they may get confused and it may turn into an accident. This system simply identifies and then passes the information to some predefined numbers thus saving human lives within a short time.

The system is developed to monitor various driver help parameters like distance between the vehicles and tracking of the live location of the Vehicle. The Ultrasonic sensor is placed in the front part of the vehicle, if any two vehicles draw near to one another then an alert message is sent to vehicle owner through Mobile application [7][8].

PROPOSED SYSTEM

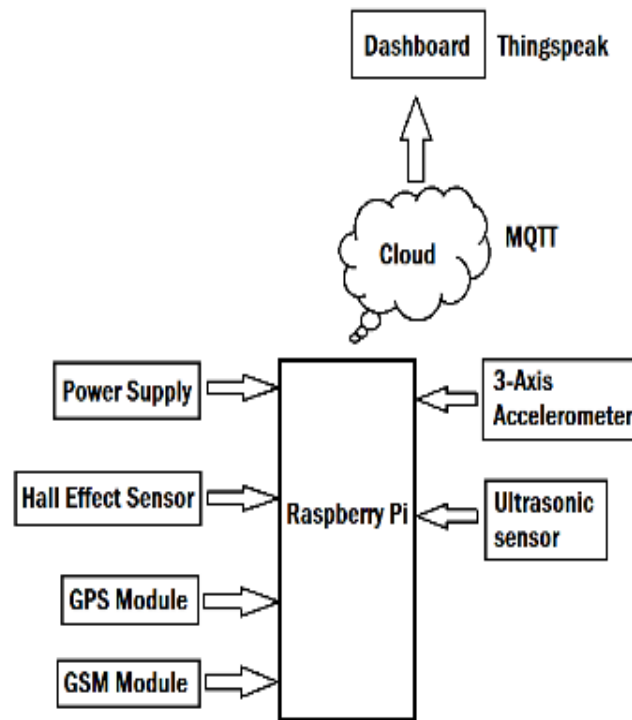


Fig 1. Block diagram of Proposed system

The proposed system is the system that tracks the vehicle's current location using a global positioning system (GPS), also the location of the vehicle will be displayed on google-map using android application. This product gives live updates of an accidental vehicle with their location details. The system also monitors the speed of the vehicle. Tracking System is working the same as follows. When an accident will occur then the system will directly send the accident alert message along with the location details of the accidental vehicle to emergency dispatch sever further it will send that alert message to the nearby ambulance so that it will go to that location. By using a system like this we can decrease the mortality rate which is lead by accident [9].

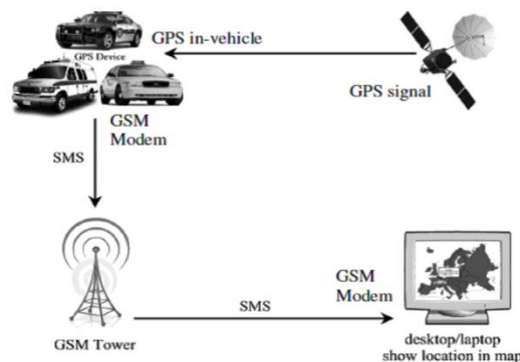


Fig 2. [7] Sending SMS using GPS and GSM module

- a. *Raspberry Pi Processor:* In this proposed system used Raspberry Pi is a credit-card-sized single-board computer developed in the UK by the Raspberry Pi foundation. This Raspberry Pi has a Broadcom BCM2835 system on a chip, which includes a sARM1176JZF-S 700 MHz

processor, video-core IV GPU, and originally shipped with 512 megabytes of RAM. It used only an SD card for booting and long time storage.



Fig 3. Raspberry Pi

b. *MQTT Protocol:*

MQTT is an OASIS standard messaging protocol for the Internet of Things (IoT). It is designed as an extremely lightweight publish/subscribe messaging transport that is ideal for connecting remote devices with a small code footprint and minimal network bandwidth. MQTT today is used in a wide variety of industries, such as automotive, manufacturing, telecommunications, oil and gas, etc.

c. *Thingspeak:* It is an Internet of Things (IoT) platform that lets you collect and store sensor data in the cloud and develop IoT applications. The Thingspeak IoT platform provides apps that let you analyze and visualize your data in MATLAB, and then act on the data. Your device or application can communicate with Thingspeak using a RESTful API, and you can either keep your data private or make it public. In addition, use Thingspeak to analyze and act on your data.

d. *Sensor:*

Choosing a sensor is a difficult task, according to the application requirements we have to choose sensors, if the system has to sustain for long time sensors should work accurately, they should be reliable

a) *MEM Sensor*



Fig 4: Accelerometer sensor

Features and Benefits

- 3-axis sensing

- Small, low-profile package
- 4 mm × 4 mm × 1.45 mm LFCSP
- Low power - 350 μ A (typical)
- Single-supply operation 1.8 V to 3.6 V
- 10,000 g shock survival
- Excellent temperature stability

B) Neo-6m GPS Module

GPS modules contain tiny processors and antennas that directly receive data sent by satellites through dedicated RF frequencies. From there, it'll receive timestamp from each visible satellite along with other pieces of data.

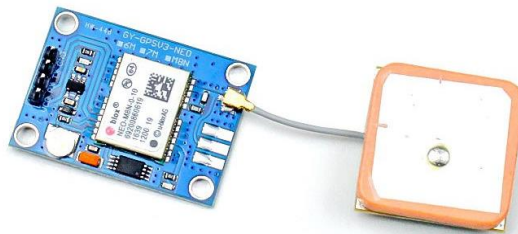


Fig.5. GPS module

C) Ultrasonic Sensor

An ultrasonic sensor is an electronic device that measures the distance of a target object by emitting ultrasonic sound waves, and converts the reflected sound into an electrical signal. Ultrasonic waves travel faster than the speed of audible sound (i.e. the sound that humans can hear).



Fig.6 Ultrasonic Sensor

D) Hall Effect Sensor

A Hall-effect sensor (or simply Hall sensor) is a device to measure the magnitude of a magnetic field. Its output voltage is directly proportional to the magnetic field strength through it.

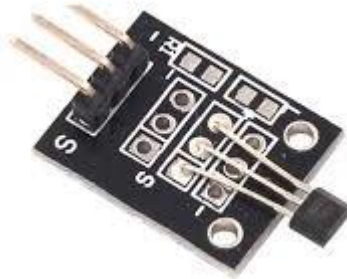


Fig. 7. Hall Effect Sensor

SOFTWARE'S REQUIREMENT:

1) Raspberry pi OS:

Normally a raspberry pi uses raspbian as an operating system it also uses a Debian based Linux operating system. A number of third parties operating systems is also available which include Snappy Ubuntu Core, Ubuntu MATE, and Windows 10 IoT Core.

2) Python:

Python is an extensively used general purpose, high-level, interpreted, dynamic programming language. It's a scripting language which gives code readability, and its syntax allows programmers to express concepts in fewer lines of code than possible in languages such as C++ or Java [10][11].

FLOWCHART

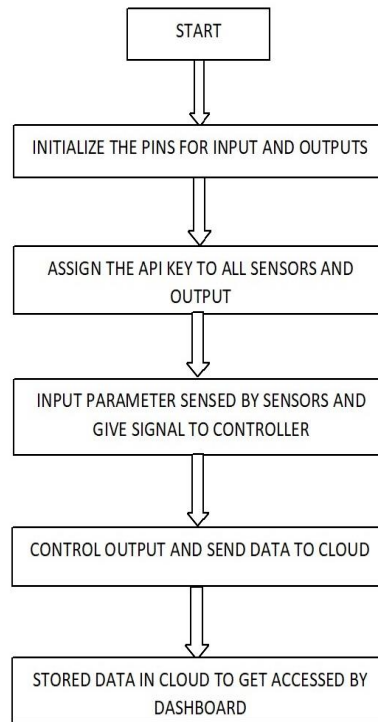


Fig.8. Flowchart of existing system

EXPERIMENTAL RESULTS:

In this project, we got our required output and a working prototype was implemented. The first output screen is the Python Shell where the output of the raspberry pi is shown. In this, the different parameters are shown with the data detected by the sensors which were sent to cloud using an IOT platform.



Fig.9. Hardware Setup

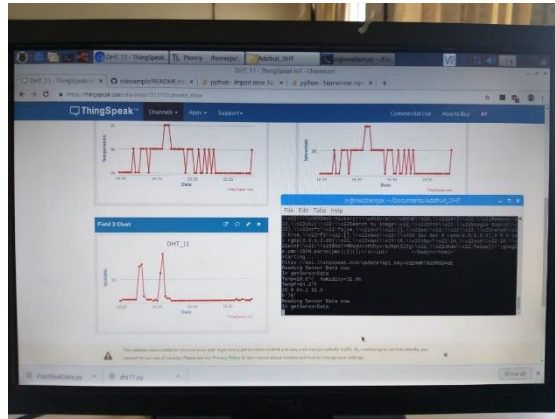


Fig.9. Data on Thingspeak Platform

Above image shows the successful uploading of sensors data on Thing speak Cloud Platform.

CONCLUSION

The system was successfully implemented by which parameters of a vehicle were monitored and controlled & also provides the remote control for the user by using smartphones. To control the parameters from anywhere, an IoT platform called 'THINGSPEAK' has been used. It is an IoT platform designed to help prototype and scale IoT projects. This project can be extended by taking the help of a Google map to indicate the nearby fuel station. Hence, accident location can be detected to rescue the person and it also used to locate the vehicle in case of theft.

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