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IoT Based Advanced Accident Alert and Vehicle Monitoring System

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***Abstract*— Everyday people lose their lives due to accidents and poor emergency facilities. If medical facilities are provided at the right time,these lives could have been saved. In this regard, an advanced accident alert and vehicle monitoring system based on Internet of things (IoT) is developed in this paper. Whenever a vehicle is met with an accident, instantaneously accelerometer sensors will notice the accident and sends it to the raspberry pi 3b. An alertmessage will be sent through IoT about the location to the guardians, police station or a rescue team,so that immediate action can be taken by tracking the location of accident through the Global Positioning System module soon after receiving the information**.

I. INTRODUCTION

In India most of the people are dying due to road accidents, insufficient medication at the right time. Nobody is ready to help accident victim. There is a high risk in people's life due to lack of emergency facilities in our country. This problem would be solved by proposing an efficient system that helps to get the accident location in significantly less time so that guardian or nearby authorities can save the victim life. The system also checks for the severity of the accident.Only when the severity reaches the final level, an alert message is sent to the user. To measure the severity, pushbuttons and accelerometer sensors are used. The user will retrieve the data from the cloud database to the mobile application. This real time application saves many valuable lives.Internet of things (IoT) is the connectivity of everyday objects through internet.Embedded electronics devices, software, hardware (for example, sensors) can convey and interact with others via Internet, and they can be remotely checked and controlled. Modern vehicle tracking systems usually use Global Positioning System (GPS) technology for finding the vehicle.

The main aim of this system is to implement a cost-effective advanced vehicle monitoring system which is used for identifying and retrieving the information about accident without third party involvement using GPSand IoT. The system tracks the geographical position of the accident spot through GPS module and sends information about accident location to guardians and nearby authorities. The objectives that can be achieved through this system are (i) Detecting the frontal impact of accident and the location of accident can be sent to the guardian and to nearby authorities. (ii) Accident identification due to the tilting of vehicle is done and sends accident spot to guardians. (iii) Sending information about the accident location of the vehicle using GPS module via IoT. Through this system, life of accident victim can be saved by giving proper location to the hospitals.

The paper is organized as follows. Section I deals with the introduction about theIoT based advanced accident alert and vehicle monitoring system. Section II provides a detailed literature survey on the existing accident alert systems. Theblock diagram of system is provided in Section III. Section IV contains the circuit diagram of the proposed system. Section V provides the results obtained after execution. Section VIconcludes the work.

II. LITERATURE REVIEW

Raspberry pi and RFID technology based on animproved traffic management systemwas developed in [1]. Raspberry pi controller present in the vehicle is interfaced with sensors like temperature sensor, gas sensor and shock sensor. When an accident is met, a message is sent through global system for mobile communication (GSM). The GPS module also sends the location of the vehicle which is interfaced with the controller. An ARM controller in ambulanceprovides a clear route. But this system [1] fails to use IoT. In [2], sensors like vibration sensors were used which senses the vibration in the vehicle. Crash sensors which triggers when the vehicle is involved in a crash [3], accelerometer and gyroscope sensors which reads the tilting angle of the vehicle [4], push button have been used for the detection of the accident [5]. However, the vibration sensors even detect the small jerks, which may lead to false detection of accident. Simply after the crash sensor gets smashed the message will be passed.The readings of accelerometer are not enough to detect an accident. GPS module has been used in order to trace the location of the vehicle [5,6].

The system [7] has used GSM for sending the accident alert, through which only a text message can be sent. Radio frequency transmitter has been used to transmit the alert message [8], which is neither accurate nor cost effective. A web based multiplatform is used as a server to send accident

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alert [9]. However, this suffers from large delay in sending the information.

IoTpermitsthe objects to be sensed and can be remotelycontrolled across present network infrastructure;generating opportunities for direct mix of the physical world into PC based systems and bringing about improved efficiency, precision and financial advantage.

In this paper, an attempt is made to develop a new system in order to overcome the drawbacks of existing systems by using IoT as a medium to send the accident alert, which does not make any delay to send the data. For the accident detection, series of push buttons and accelerometer is used in the system. Severity of the accident is not taken care in the existing systems. Whereas,the proposed system will ensure accident severity,by making sensor to read three levels, which is helpful in avoiding the false alert message about the accident. When third level is reached the alert message and accident location link will be sent to the mobile using GPS module.

Existing accident alert systems have used GSM modules through which only a message alert can be sent and in order to increase the coverage, repeaters are required to be installed. Whereas in the proposed system, GPS module is used to send the accident location via IoT to user mobile as well as to the desktop of nearby authorities and repeaters are not required for IoT. GSM provides limited data rate capability. Accuracy of IoT is more than that of GSM. This motivates to use IoT for the proposed system.

III. SYSTEM BLOCK DIAGRAM

The block diagram of the proposed system is shown in fig.1.

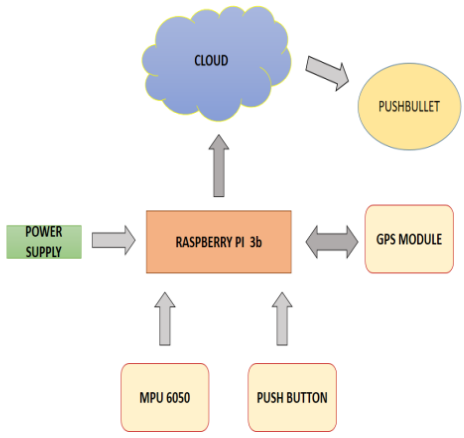

Fig. 1: Block diagram of the proposed system.

The system consists of raspberry pi 3b, GPS module, motion processing unit 6050 (MPU 6050) and push button sensor. Raspberry pi 3b monitors all devices through the instructions written in the program. The series of push button are used to measure the frontal impact. The severity of the impact is measured in three different levels.In series of push buttons, if the first push button is pressed, it indicates that vehicle has got some scratches. If first two push buttons are pressed, it indicates that vehicle has been damaged and if all the three push buttons are pressed, it indicates that accident has occurred.

MPU6050 sensor module is ancombined 6-pivotmovement device. It has a 3-axis accelerometer, 3-axis gyroscope, digital movement processor and a temperature sensor, all in a solitary IC. The sensor can receive inputs from different sensors such as pressure sensor or 3-axis magnetometer by means of its secondary Inter-IC (I2C) bus. MPU6050 module is used to determine the accident when the vehicle is tilted. Raspberry pi 3b can talk with MPU6050 module using I2C communication protocol.GPS module is used to track the accident location. An external 5V power supply will be provided to drive the raspberry pi 3b. When a vehicle met with an accident, raspberry pi 3b will receive signals from push button or MPU 6050 that will triggers the GPS module to track the vehicle location and sends longitude and latitude of accident location to raspberry pi 3b.Further, raspberry pi 3b will upload the location to cloud and then the location information will be retrieved by push bullet application present in the android devices.

IV. CIRCUIT DIAGRAM OF THE SYSTEM

The circuit diagram of the proposed system is shown in fig.2 that shows the interfacing of all the modules with the Raspberry pi 3b.

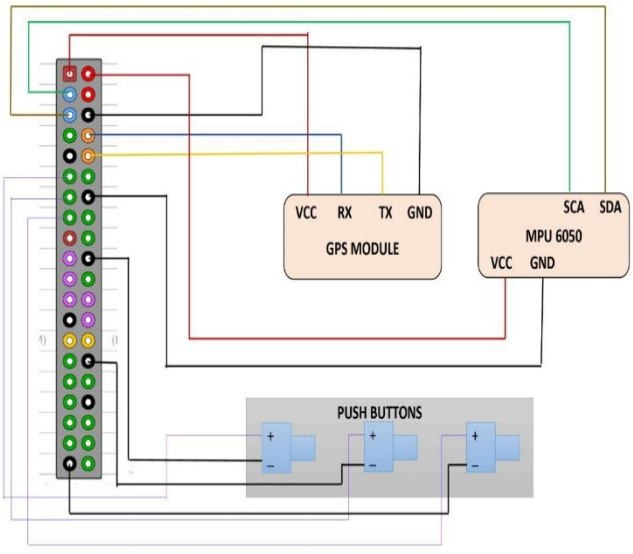

Fig. 2: Circuit diagram of the proposed system.

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The Raspberry pi 3b utilizes a Broadcom BCM2837B0 single on chip with a 64-bit quad-core ARM Cortex A53 processor of 1.4 GHzwith 512 KB cache. It has 40-pin extended general purpose input output (GPIO). GPS module has 4 pins Vcc, Gnd, RX and TX. Vcc and Gnd pins are connected to Vcc and Gnd pins of raspberry pi 3b. RX pin of GPS is connected to GPIO 14 (TXDO) of raspberry pi 3b and TX pin of GPS is connected to GPIO 15 (RXDO) of raspberry pi 3b. The TX pin of GPS will transmit longitude and latitude to the RX pin of raspberry pi 3b.

MPU 6050 has 8 pins in which the proposed system uses only 4 pins Vcc, Gnd, Serial Clock pin (SCL) and Serial Data pin (SDA). Vcc and Gnd pins are connected to Vcc and Gnd pins of raspberry pi, SCL pin of MPU 6050 is connected to GPIO3(SCLA1 I2C) of raspberry pi. MPU 6050 SDA pin is connected to GPIO2 (SDA1 LC) of Raspberry pi 3b.
Push buttons are having two terminals. The system uses three push buttons.Three terminals are connected to GPIO 17, GPIO 27, GPIO 22 of raspberry pi 3b and other three terminals are connected to ground pins of raspberry pi 3b.

The system uses python, virtual network computing(VNC) and push bullet software for various purposes. Python language is used to interface the GPS module, MPU 6050 and push buttons to raspberry pi.VNC is used for screen sharing between raspberry pi 3b to desktop computer.

Push bullet is one of the quickest and easiest approach to get links, notes, files, , lists, and addresses both from the personal computer to the mobile device and vice versa. To access push bullet an account has to be created. Every push bullet account has its own application program interface(API) key that has to be given to raspberry pi 3b. Whenever raspberry pi 3b gets a signal from sensors, it will upload information to the cloud then push bullet retrieve information from cloud and sends the information to android mobile application.

The flow chart of the accident alert system is depicted in fig. 3. The connection of all the sensors is verified. Raspberry pi 3b will be continuously monitoring the condition. If an accident is detected, location will be retrieved using GPS module and a message will be sent to push bullet android application.

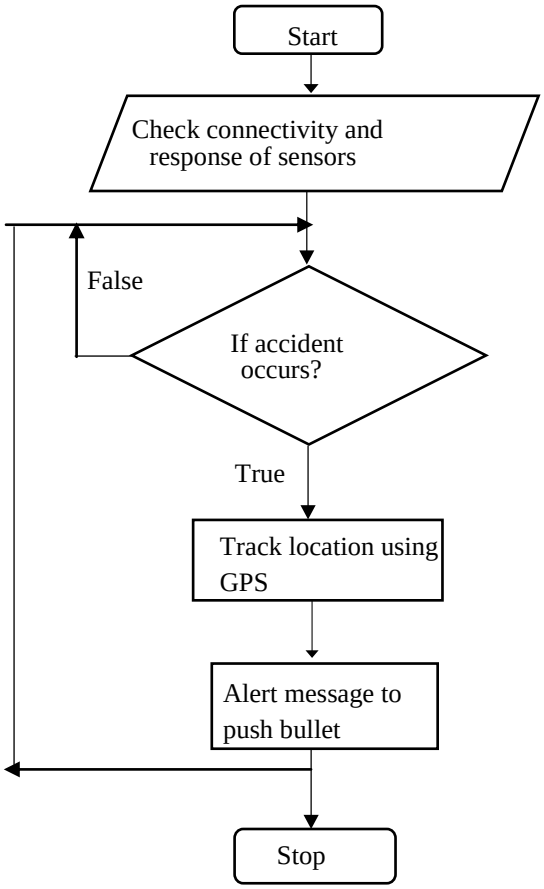

Fig 3: Flow chart of the system.

V. RESULTS

The complete model of the accident alert system mounted on the vehicle is depicted in fig. 4. The main components are raspberry pi 3b which is the main controller, MPU 6050 to measure the orientation of the vehicle, GPS module to track the locality of the vehicle and push buttons which detects the occurrence of the accident. The indication of different levels of severity is as shown in fig. 5. The alert message along with the link address of Google map is shown in fig. 6. The accident location is shared when push buttons reaches level 3.

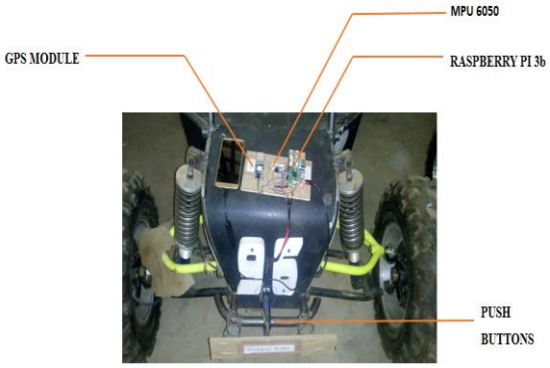

Fig 4: Model of the accident alert system.

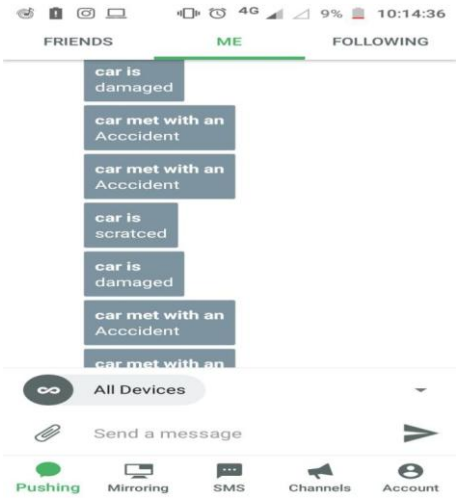

Fig 5: Severity of accident.

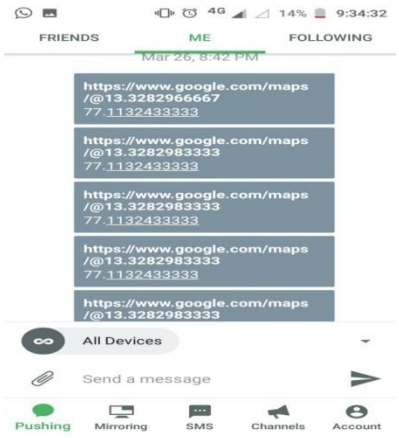

Fig 6: Link of accident location.

VI. CONCLUSION

The proposed system mainly improves the emergency action for the accident victim by providing an accurate accident location so that the life of the victim can be saved in a simple possible way. Emergency actions are taken when the accident alert is received. The work can be improvised by including additional tasks like accident alert system for the vehicle to detect the impact from all the sides and to detect the emergency situation like fire accidents in the vehicle.

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