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Accident Detection and Reporting System using Internet of Things

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Abstract

An accident is an unpredicted and unintentional event. Considering the alarming increase in the number of motor bike riders and the number of accidents happening in our country, this system ensures to make the two-wheeler driving safer than before for the rider. The lack of treatment in proper time is the major reason for half of the deaths in road accidents. This system aims at providing early detection of accidents and communicating the information immediately to the emergency responses on time to provide quick assistance for the injured person. When the rider met with an accident and the helmet hits the ground, the vibration sensor which is embedded in the helmet senses the vibration frequency and transfers the value to the raspberry pi module that is interfaced to it. While vibration threshold frequency exceeds the programmed maximum limit, the raspberry pi board extracts GPS data from the GPS module and the message with all the necessary information is sent quickly to the registered emergency contacts of the rider. This system assures to provide immediate assistance to the victim of the accident. The results give exact locations of the accident.

Keywords: GPS, Helmet, Internet of Things, Pushbullet, Raspberry pi, Slack, Vibration Sensors.

1. Introduction

The total count of registered motor vehicles in India is more than 21 million as per the report of 2015. The numbers of car users in India are 22,536,000 and around 17.6 million two-wheelers were sold to the customers in 2017. In India, 1214 road crashes occur every day. Out of total road crash deaths, 25% of them are two wheeler accidents. Recent survey states the maximum number of road crash injuries occur in the state

Tamilnadu. Figure 1.1 depicts the Accident report of Indian Roads in the year 2016. One death occurs every four minutes due to a road accident in India [1].

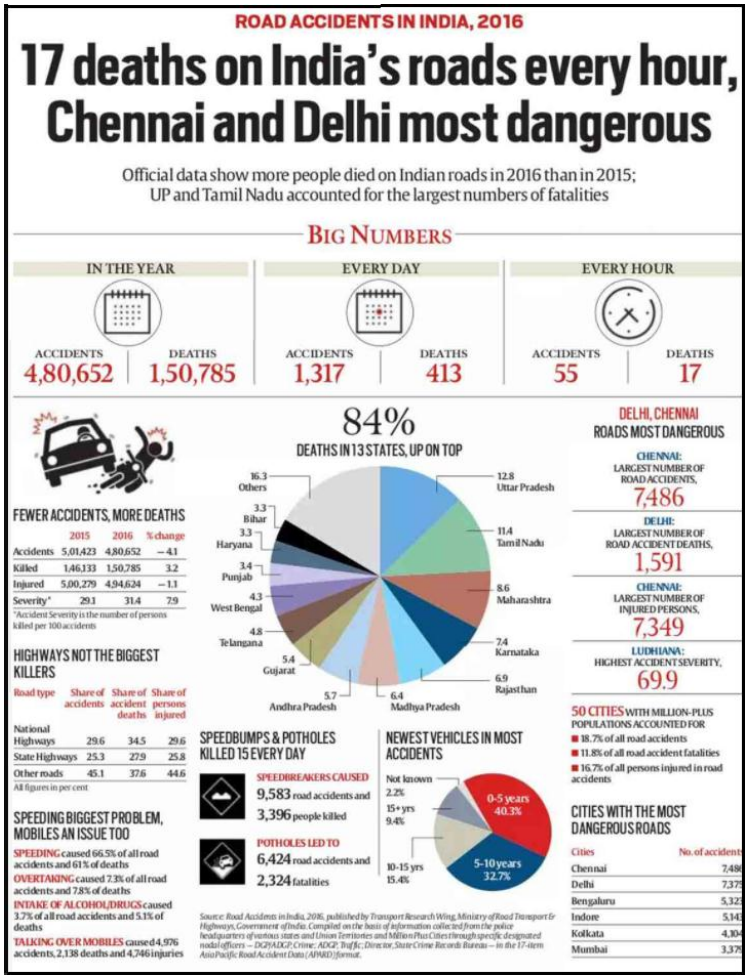


Figure 1.1: Accident Report of Indian Roads

Government of India revealed that more people died on road accidents in 2016 as compared to 2015 based on the survey published by transport research wing under ministry of road transport and highways. As per the data, 413 people died everyday in 1,317 road accidents. Also the data shows that at least 17 deaths occurred in road accidents every hour [2].

Internet of things has now become an essential part in our day to day life. The usage of electronic and digital devices is increasing more than 13 billion, in equals of 2 devices per person. Suitable example for the IoT is "SMART HOME", the smartest devices are developed with programmable and remote controlled appliances. Future growth in IoT is basically from every sector of the economy like commercial, industrial, health care and public safety [3].

The utility components and all other day to day objects are combined with Internet connectivity and powerful data analytic capabilities, which are changing the way we live and work. Hence the term "Internet of Things" is defined as extending the network connectivity and computing capabilities, not only to computers but also to everyday items to generate exchange and consume data with minimal human intervention [4]. Despite wearing helmets, many lives could not be saved because of lack of immediate medical assistance. Our project aims at providing quicker communication to the people closer to the injured person so that faster medical aids could be provided to the victim. Smart helmet for motorcyclist is a project undertaken to increase the rate of road safety among motorcyclists. This paper is organized as follows. Section 2 describes about literature review of the existing work. Section 3 focuses on proposed methodology. Section 4 reveals results and discussion. Finally Section 5 says about the conclusion and future work.

2. Literature Review

The working scenario of the helmet is described [5], when the rider met with an accident and the helmet falls on the ground, the sensors sense the vibration and sends to the microcontroller board (P89V51RD2), Then controller senses the location information using the GPS module that is interfaced to it. When the vibration crosses it minimum stress limit then GSM module (SIM300) automatically intimates the information by sending message to the emergency responses.

Authors proposed a new helmet model [6], when an accident occurs; a cloud-based service is used to send the alert message with the details to the emergency contacts. The location of the vehicle is sensed through the GPS module. BMA222 accelerometer, Wi-Fi enabled processor (TI CC3200), sensors and cloud computing platforms are used for constructing the system.

The authors have designed a helmet for the riders to provide extra features like listening to music while riding, sending SOS messages along with the location in case of emergency via microcontroller (ATmega328P) [7]. This helmet is integrated with latest Bluetooth (HC-05 Module) technology through which it will get connected to the driver's Smartphone and can receive calls while driving through the Arduino Software (IDE).

Helmet is upgraded with peltier module for rider comfort [8], by Peltier module (TEC-12706T125), which maintains the heat inside the helmet by thermoelectric effect. The temperature sensor (LM35D) is used detect the temperature. If accident occurs the GPS module sends accurate location to the emergency contacts and in case of bleeding, it can be clotted by thermoelectric module so the risk of danger can be reduced.

Smart helmet works on GPS and GSM technology [9]. The accident is identified by the probability of vibration experienced by the helmet. Here vibration is detected by placing vibration sensor on the helmet and gives to microcontroller board (P89V51RD2). Then the controller finds the location by GPS module and sends message automatically to the pre-defined numbers by GSM module. To avoid accidents a GSM based helmet model is introduced by developers which the helmet acts as an intelligent system [10]. The developed system verifies the person that he /she is wearing the helmet and also senses the alcoholic smell before the rider starts the bike. If any of these conditions occur, transmitter on the helmet sends signal to the receiver on the bike via RF transmitter. These signals doesn't allow to start the bike and the signals are detected by a switch and alcohol sensor MQ-6. The signal and microcontroller (AT-89S552) are decoded by the receiver, and then messages are sent to concerned contacts by GSM module (SIMCOM SIM900A) accordingly.

For detecting the rider's head movement and detection of motorcycle's speed authors used, a Force Sensing Resistor (FSR) and BLDC Fan [11]**.** To communicate between transmitter circuit and receiver circuit, a 315 MHz Radio Frequency Module as wireless link is used. The entire component in the system is controlled by PIC16F84a microcontroller is used. The motorcycle will be started only when the rider wears and lock the helmet. Whenever the speed limit exceeds 100km/hr, the motorcyclist will be warned and an LED light will glow. This paper [12] discusses about the two modules affixed on the bike and the helmet with an alcohol sensor MQ-3 is used to detect whether the rider have consumed alcohol or not. Detecting the accident and notify them to the nearest police station is also possible with the help of GSM module (SIM 900A). The rider can avoid the message from sending by pressing the abort switch when the accident is not major.

In this paper [13] Smart Helmet is a Micro-controller (Intel Edison on Arduino Board) embedded inside the helmet along with Accelerometer (MPU6050), Headset (Intex), Camera (Logitech) and when the rider crashes and helmet hits the ground, from the accelerometer values Micro-controller detects accident and sends information to

phone via Wi-Fi and finally Smart Helmet connects to Smart phone via Bluetooth to give audio guidelines for navigating the rider, inform about emails and phone calls.

The Smart Helmet concept is proposed by the authors [14] having a control system inside the helmet which consists of a RF transmitter through pin17 of HT12E and a RF receiver system. The bike will not allow the user to start without wearing helmet, when user wears the helmet a RF signal radiates from transmitter and once this signal gets sensed by the receiver placed in the ignition switch of the bike, bike will get start for riding. To communicate with the bike a proposed helmet model [15] during the initiation of the ride all the time to detect if the person is wearing the helmet or not using ultrasonic sensor (HCSR04) and then the rider is asked for a password in the form of speech to unlock and ignite the bike by matching a user-independent password using voice encrypted password mechanism via microcontrollerATmega328. The primary objective is to force the rider to wear the helmet throughout.

Smart Helmet is proposed with Arduino controller, micro controller (ATmegal1280) and Arduino Wi-Fi unit by authors [16]. The presence of alcohol sensor (MQ-3) in the vehicular setup of the system detects presence of Alcohol Content in the person's breath and the pressure sensor (NPA 700) doesn't allow the vehicle to start in spite of the user wearing the helmet.

3. Proposed Methodology

At the time of accident, the process to intimate and locating the place of the victim is a bit difficult task that is to be discovered. The credentials of the victim are unknown which is tedious during crucial moments for the people at the accidental spot. The main motive of the project is to design an IOT detection and reporting system. The unique feature of the system is to locate the victim and report the accident with the relevant information to ambulances and his concerned people to provide a quick medical aid to the victim.

A raspberry pi module is used and a unique code is programmed in this module to achieve this functionality. Vibration sensors are interfaced with the raspberry pi module which senses the vibration frequency of the accident. A maximum stress limit of the vibration threshold is programmed in the module. The GPS module is connected to the raspberry pi and all these are embedded in the helmet. The GPS module will be helpful

for the family members and the friends, to track the victim's location. Figure 3.1 describes the data flow of the system.

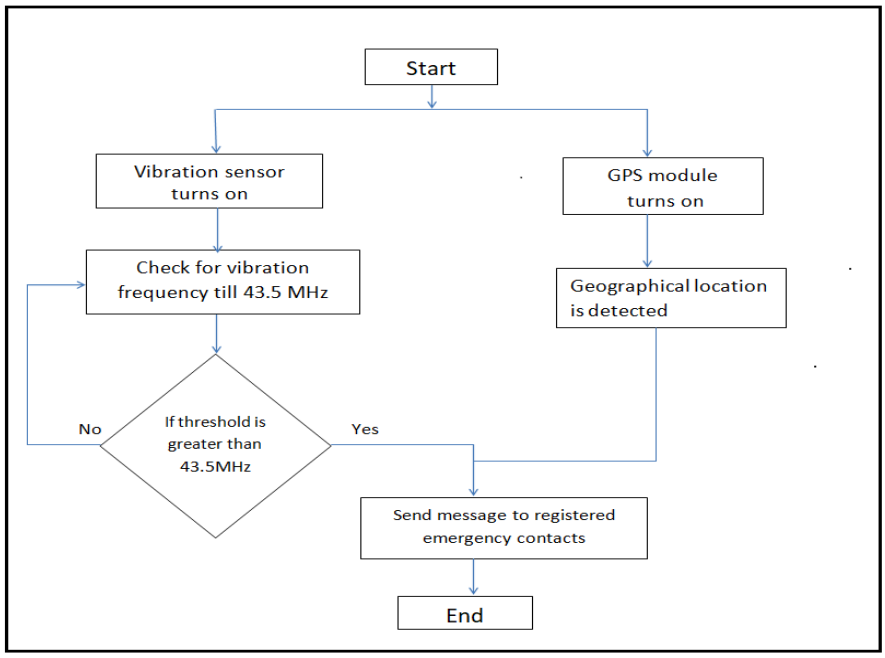


Figure 3.1: Data Flow Diagram

Slack application is installed in the rider's mobile and it is used to switch on and off the system. Slack API is used to sense and trigger a response in our IoT device when the specified threshold level is met. Pushbullet is an application that acts as a bridge between your mobile devices and desktop OS and sets the standard for developer updates. This application is installed on all the mobile devices of the registered emergency contacts. Any number of contacts could be stored in the raspberry pi and sent the message. Pushbullet provides the way to send notifications from raspberry pi to the mobile phones with a simple scripting. The access tokens of the respective Pushbullet and slack applications are programmed in the raspberry pi module. Figure 3.2 illustrates the circuit diagram of the system.

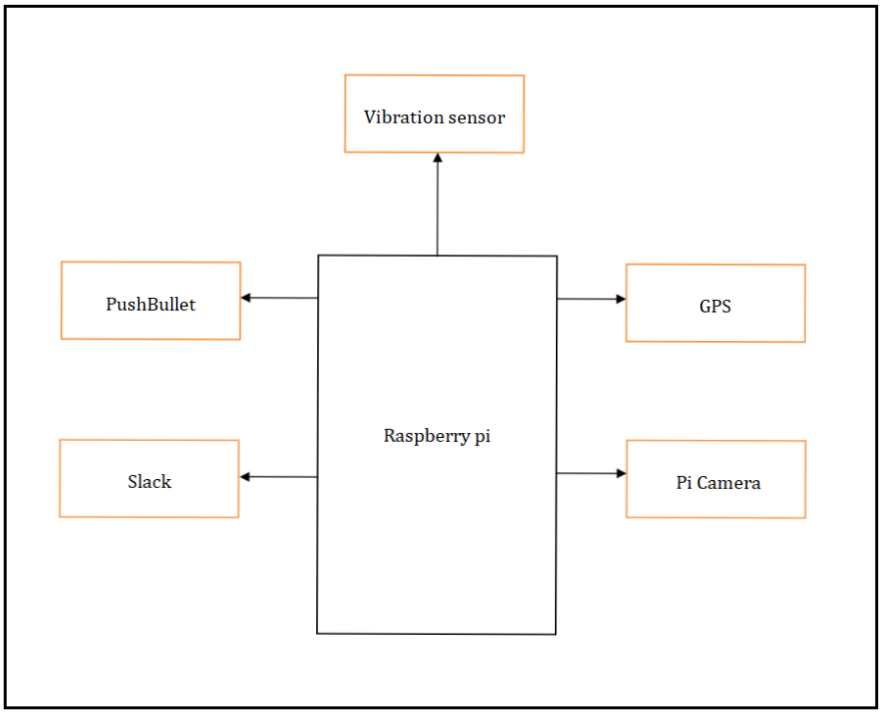


Figure 3.2: Circuit diagram

The rider wears the helmet and switches on the system through the slack application while the drive starts. When accident occurs and the rider crashes to the ground, the vibration sensors sense the threshold frequency and if the value is greater than the stress limit, the exact location of the spot is extracted from the GPS module. The information of the rider and the location in terms of latitudinal and longitudinal data is sent immediately to the registered emergency contacts. The maps will provide the exact location of the accident with the essential details in the message.

4. Results and Discussion

The accident detection and reporting system was tested at various locations after implementation. Table 4.1 tabulates the detected locations. The system reports the information to the emergency responses including the results of the rider's geographical position with latitude and longitude values, which helps to find the accurate location using Google maps.

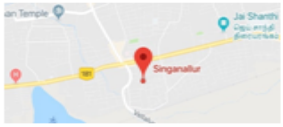
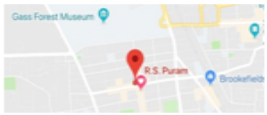
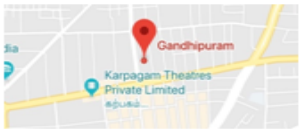
C0-ORDINATES	PLACE	MAP
LATITUDE:11.004556 LONGITUDE:76.961632	SINGANALLUR	
LATITUDE:11.0105 LONGITUDE:76.9499	R.S.PURAM	
LATITUDE:11.020522 LONGITUDE:76.966698	GANDHIPURAM	

Table 4.1: Detected Locations

Figure 4.1 depicts the display of the alert message. This information is received by the emergency contacts through the push bullet application installed in their mobile phones. Through this immediate assistance could be given to the rider with the immediate medical aid as soon as possible.

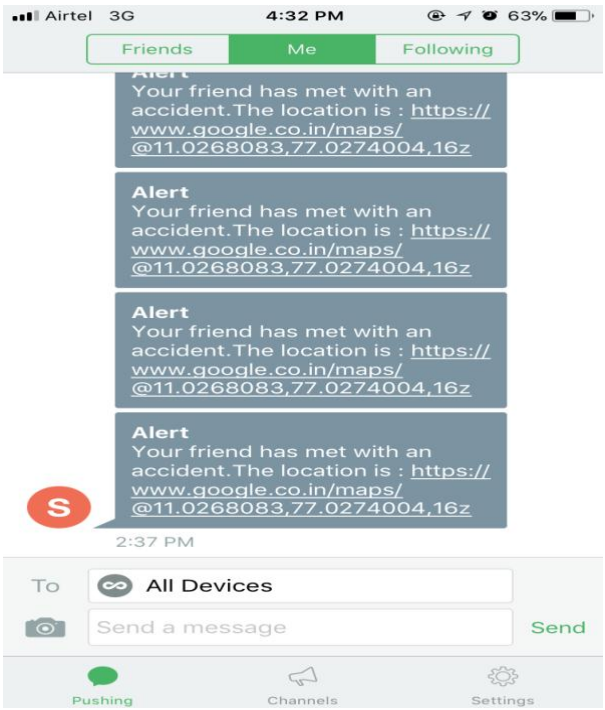


Figure 4.1: Received Alert Message

5. Conclusion

In recent days, the occurrence of most of the accidents is by motor bikes. This alarming rise in the motor bike accidents leads to loss of many lives. The lack of treatment in the proper time is the major reason for many deaths. The major causes may be the late arrival of ambulance or no person at the place of accident to give information to the ambulance or family members. The proposed work offers a solution to this problem by introducing accident detection and reporting system aiming to save at least half the lives that are lost due to bike accidents. In future, this system could be implemented for lock protection and for other safety purposes. It could also be implemented to control the speed of the vehicle and to prevent the rider from over speeding by passing the information to the rider's family. The early detection and reporting will account to the responsibility of saving many lives.

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