TEST Engineering & Management

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Accident Avoidance System by using Sensors Module

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Article Info

Volume 82
Page Number: 11123 - 11133
Publication Issue:
January-February 2020

Article History
Article Received*: 18 May 2019*
Revised*: 14 July 2019*
Accepted*: 22 December 2019*
Publication*: 21 February 2020*

Abstract

The aim of this study is to bring down the accident level and to protect the driver's life. Various sensor modules were used to reduce vehicle accidents mainly due to drunken driving and over speed. It is detected through the alcoholic sensor sense alcohol presence while driving and this system also ensures that drivers' have to wear the helmet which operates through its pressure sensor placed in the helmet. This sensor identifies the drunken drivers and makes the helmet mandatory for vehicle users. These sensors are connected to engine ignition if a particular raider is not worn a helmet or alcoholic raiders/ drivers, then these sensors will not allow starting the engine. Even there is a vibrating sensor that functions during the accidental time, it will be sent the instant SMS message to a nearby hospital, local police station and to their family members through GPRS connection. By implementing this system in practical life can able to control and monitor each driver's status.

Keywords: *Accident, Pressure Sensor, Alcohol Sensor, Vibrate sensor, GSM, GPS, Arduino UNO.*

1. INTRODUCTION

The two-wheeler motorcycles/bikes are considered as the most affordable vehicle by the middle class as well as for the low-income people based on their capacity. Even the higher income people are also using two-wheelers with the higher ended features. In Asian countries like India, number China and Japan had a of vehicle users and holding a major share in the entire world. Nowadays, vehicle driving is considered as unavoidable human activities in day-to-day life. In the 2 wheeler vehicle industry, there was a huge production over the two past decade due to the population explosion and the demand of vehicle users. According to the 2017 recent statistics, there are around 650 million units of two-wheelers were produced in the world (Arokiaraj, 2015). India is considered as the largest users of two-wheelers, especially in South India. The auto production of two-wheelers has been achieved a new record of 20 million units in 2016-17 followed by China 16.8 million (Sudhakar et, al., 2017). Among that Indian auto-market sold 17.59 million units of two-wheelers followed by China in the last one year.

India's two-wheeler manufacturers had played a major role in terms of production. During 1995-2015 have statistically recorded the total number of registered is 210 million were currently on the Indian road (Arokiaraj et, al., 2019). India's two-wheelers segment has estimated in 2020 will have more than 216 million two-wheelers. The CEO of Honda's company has officially said the production and sales of the automobile are increasing based on the demand for customer requirements (Honda's Guleria).

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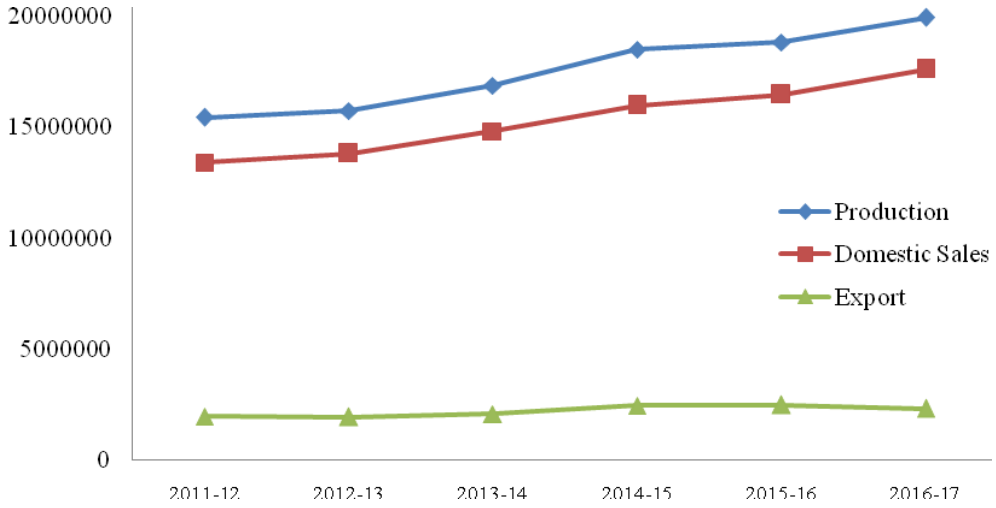

Figure 1: Status of 2 Wheelers in India

Source: SIAM

The market share of the Indian automobile segment was categorized into four is a passenger, commercial, three and two-wheelers vehicles among that two-wheelers occupied 80% in the Indian market.

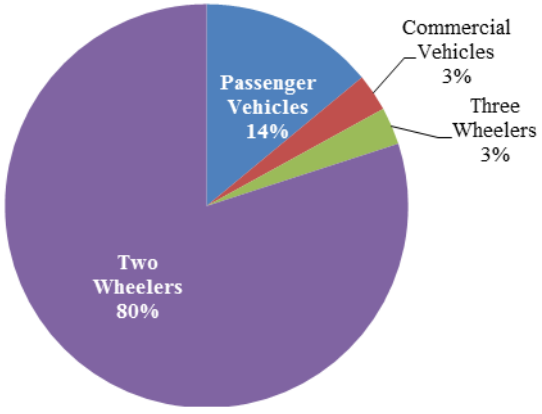

Figure 2: Market Share of Two-Wheeler in India

Source: SIAM

ROAD ACCIDENT IN INDIA

India is one of the leading producers of two-wheeler in the world. As a result, there are very high in the number of two-wheeler users in India. At the same time, there will be a high accident rate and lead to a high death rate. Recently a study has identified that the most dangerous road accident and highest dead rate occurs in Thailand followed by South Africa, Brazil, India, China, Malaysia, Russia, and others (Arokiaraj; Wei & Hanbo,[1] 2011).

Everyday peoples are dying due to drunken drivers and improper road facilities which considered as a major road accident which resulted in the loss of human lives (Wei & Hanbo, 2011; Thummula et, al., 2019; Arokiaraj David,

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2020). Nowadays a lot of people died because of crashes. The National Crime Records Bureau's data shows that in the 10 years between 2004 and 2013 road accidents have caused over a million deaths in India. The state-wise comparison shows that about 1.4 lakh road accidents were reported in Andhra Pradesh (11.4%) the highest in the country. It was followed by Tamil Nadu (11.3 %), UP (11%) and Maharashtra (10.5 %), Karnataka (7%) and others. At the end of 2017, the total number of people who died in the road accident is around 1, 36,500. Out of which 34% of accident occurs by the two-wheelers users followed by the cars 17%, buses 16%, trucks 13%, and other vehicles 20%.

Table 1: Statistical record of Road Accident

Vehicle Type	As per the 2016 record	Cause of Fatalities
Two-Wheelers	44366	Over speed – 73896 Overtaking – 9462 Drunk Driving – 6131 Wrong side driving -5705 Using a mobile phone – 2138
Car, Jeeps & Taxis	32599	
Truck, Tempo, Tractor & articulated Vehicle	24188	
Bus	12088	

According to the Road Transport Ministry of India has reported that every day around 1,374 accidents occurred in India. According to the recent statistics of India, last year around 5, 01,510 accidents occurred in India (David & Banumathi, 2014$_a$). The main causes are a drunken drive, over speed, violating traffic rules, overtaking, driving on the wrong side, using the mobile phone while driving, etc., (Taylor, 2001) every 1 hour, 57 accidents encountered and every 1 minute they will be 1 accident and it leads to 1 death in every 4 minutes due to accident. Delhi is considered the deadliest city in India followed by Chennai, Bengaluru, Kanpur, Mumbai, Lucknow, Allahabad, Jaipur, Agra, Raipur, etc. (Ruikar, 2013).

Most of the time, if the people get injured on the road due to an accident nobody is ready to admit to the hospital due to police case and court issues. The death occurred due to the accident on one hand and treatment delay is another reason. They are some other reasons are also such as the late arrival of an ambulance, nobody on the accident spot, communication delay, legal issues, etc. By understanding that situation, this study gives an appropriate solution to the above all the problems.

To resolve the problem, the sensor model was developed and tested in a real-time environment. The road accident can be avoided by making this system obligatory are,

a. To wear the helmet compulsory while on driving.
b. The alcoholic sensor detects the alcohol level of raiders.
c. The GPRS can able to locate the accident spot, so if a person had an accident, immediately it will be communicated to the ambulance to rescue those (Sriram & Ramya, 2013).

This application will give information to the policemen too, whether the raider wears the helmet and at the same time, it detects whether the rider is drunk or not. Further, if the raider met an accident immediately it communicates the location to nearly the hospital, police station, and also to their family members and relatives through GSM (Global System for Mobile Communication) module and microcontroller present in the circuit board (Sriram & Ramya, 2013). This GSM module also connected with a SIM-Card and it helps them to send SMS to the exact location of the accident spot. This technology gives information by sending SMS to the concerned

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persons to save a life. By sending an SMS alone cannot save a person's life. This system is directly connected to the latitude and longitude values well (Sriram & Ramya, 2013; David & Banumathi$_b$). It will be able to locate the extract accident spot. The ambulance locates the accident spot and provides first aid instantly.

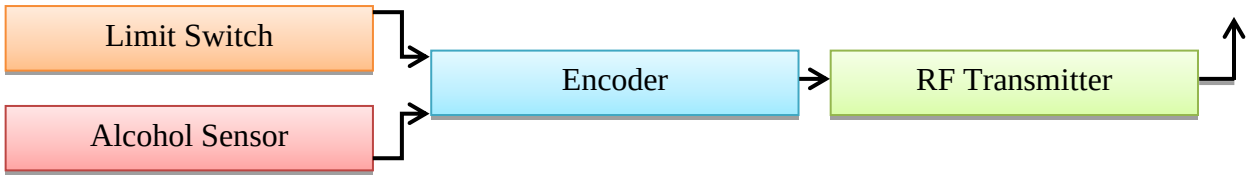

Figure 3: Block Diagram of Helmet Section

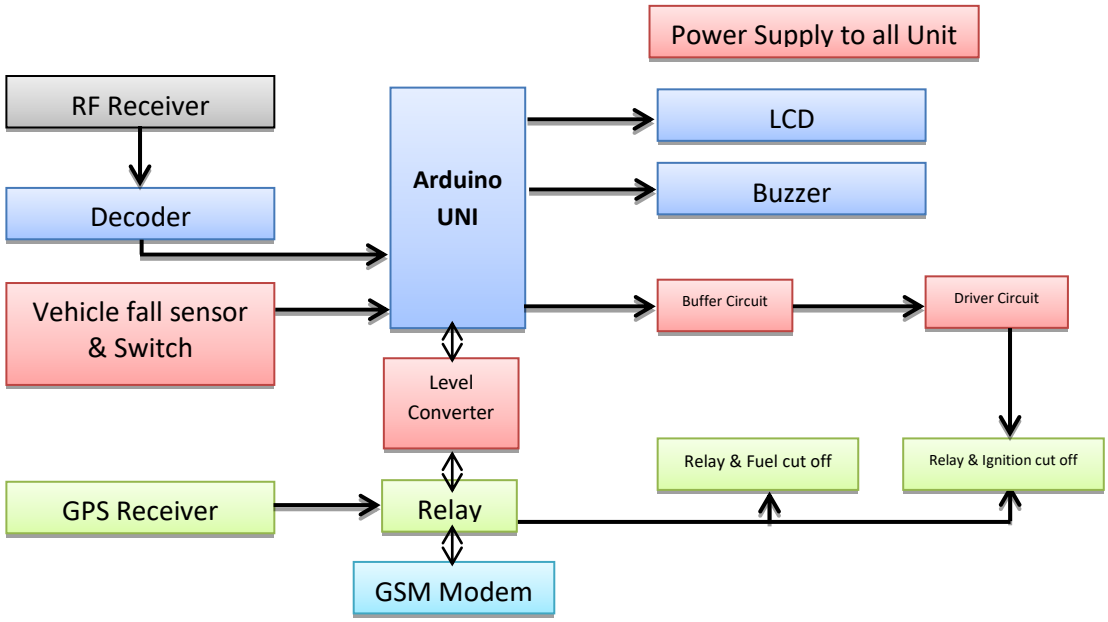

Figure 4: Block Diagram of Vehicle Section

In this Module, the Arduino UNO controller is employed. Once this system is switched on, an LED display will turn it ON with the help of the circuit Module. Radio Frequency (RF) is fixed in the two-wheeler for the purpose of checking whether the driver/raider is drunk the alcohol or not. The alcohol sensing element is additionally connected with this module. Suppose if a raider is drunken means that right away it'll not allow to begin the two-wheeler engine. Because the tiny voltage produced for ignition of the two-wheeler is connected to the ground that makes the vehicle engine to be in off-condition. Further, it will be ready to observe the two-wheeler user tired helmet or not. It is also detected through the pressure sensor element; senses the pressure and therefore the Radio Frequency transmitter intimate to the FM modulated signal. Once the RF receiver is activated which was connected to the 2 wheeler that receives the emitted signal will instantly activate the relay. After relay removes the ignition connection from the bottom and which was activate the starter switch enables the 2 wheelers to begin. At constant time, once a driver met with associate degree accident the vibration sensing element in a flash sends a message to the microcontroller and therefore the GPS indicates the accident location and accident time. This data are sent to

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the involved mobile variety through a message with none additional delay (Sridhar, 2012). Aurdino UNI microcontroller may be a user-friendly module that is simple to interface and run numerous hardware and sensing element modules like Global System for Mobile Communication (GSM), and Vehicle fall sensing element, Switch, and Global Position System (GPS).

Some of the difficulties were known whereas implementing this method are,

- How the SMS send to their victimization and how they are exactly located?
- When ought to this entire do?
- When the accident happens, however, can the microcontroller observe the accident?

In the Arduino UNO Embedded Microcontroller module, there are three Applications are engaged. Thence when the embedded circuit module is switched-on then it turn-it-on the LED display and denotes the proper flow power supply to the embedded circuit module. The **first application** embedded is used to detect whether the two-wheeler rider is inhaled the alcohol contains or not which will be detected by using the alcohol sensors. It is placed inbuilt nearby both the side of the cheek of a helmet, in cases if a two-wheeler driver has inhaled any kind of liquor item immediately, the alcohol sensor value will be greater than the threshold value and instantly sends a command to the embedded module to turn-off the two-wheeler engine. Normally the two-wheeler engine needs to start with a small amount of voltage to ignition which is used to turn-it-on the vehicle engine.

Suppose when the two-wheeler rider has inhaled alcohol means the sensor will send a signal to the embedded module and which is connected with ignition voltage to the ground automatically and the vehicle engine will be turn-in-on. The **second application** in this embedded module we have used to recognize whether the two-wheeler rider/ driver wearied helmet or not. It will be to identify through this pressure sensor by sensing the pressure in the helmet. The pressure sensor output will be transmitted to the embedded module by using the radio frequency transmitter. Whenever the sensors detect the pressure more than the cutoff value then the embedded module will be activated. Once the pressure sensor is less than the threshold value then the embedded will deactivate the relay switch. The relay switch activation means removes the ignition wire from the ground. The relay deactivation means connection to the ignition wires to ground. It is connected to the starter switch enable the two-wheeler to start.

The **third application** related to the accident then there is an accident leads to sudden shaking in the sensor. By the time, the sensor value is more than the threshold value which sends a signal to the embedded module. By using the GPS locates the accident spot immediately and accident time also. These particulars have been sent to the concerned mobile numbers through SMS (relatives, nearby hospital and police station) without any further delay. The Arduino UNI microcontroller is a user-friendly module that is easy to interface and runs various hardware and sensor modules such as Global System for Mobile Communication (GSM), and Vehicle fall sensor, switches and Global Position System (GPS).

HARDWARE-SOFTWARE DESCRIPTION

The Arduino UNO controller with 64-kilobytes of flash program memory and it contains 1-kilobyte data of RAM. The flash program memory is used to interface both serial-parallel Programming mode and ISP programming. Arduino Uno microcontroller consists of one USB connection, ICSP header, a power jack, reset button, fourteen digital Input/ Output (I/O) pins and sixteen MHz quartz crystal. Out of fourteen I/O pins only six pins used for analog inputs, another six I/O pins applied for Pulse Width Modulation Outputs (PWMO). The key feature of the embedded microcontroller is P89V51RD2 which supports the clock X2 mode option. Which are used to run the application process at a clock rate of 12 clocks

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cycles per cycle? Arduino Uno controller can do the same application process by selecting the X2 mode which executes the instructions as per the six clocks cycling to maintain the same clock occurrence. Parallel programming mode can be used for gang-programming at a very high speed which also reduces the programming costs.

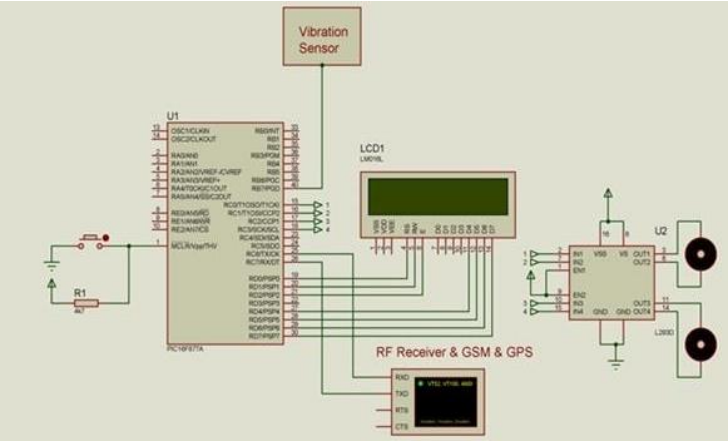

Figure 5: Simulation of Vehicle Section

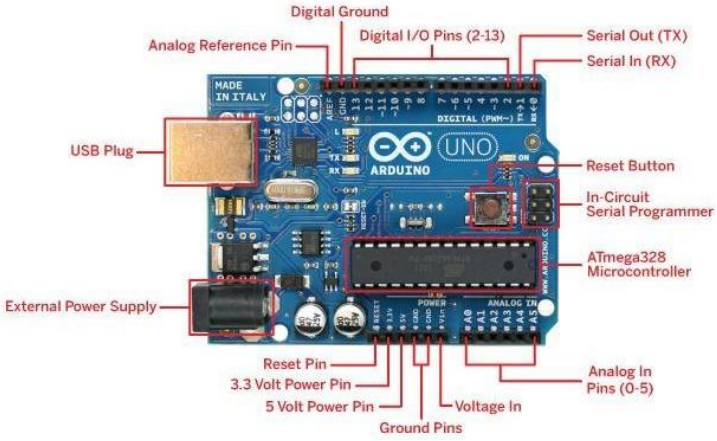

Figure 6: Arduino Board

LIQUID CRYSTAL DISPLAY (LCD)

The LCD is a display module that is applied to the interface in the embedded module used to display the status of ignition instructed them whether to ***"turn-it-on"*** *or* ***"turn-it-off"*** the two-wheeler engine. We have a 16 x 2 LCD display unit which shows the current position. This particular display mode is selected which can able to display 16 characters in a line. The motives behind this LCD display are economic and load the programmable codes easily and also have no limitation to display those special characters as well as alphanumeric variables. The Keil's software was applied to write and run the codification and it encrypted into the controller with the help of flash magic. We have used assembly language code to interface LCD with the microcontroller to display the values.

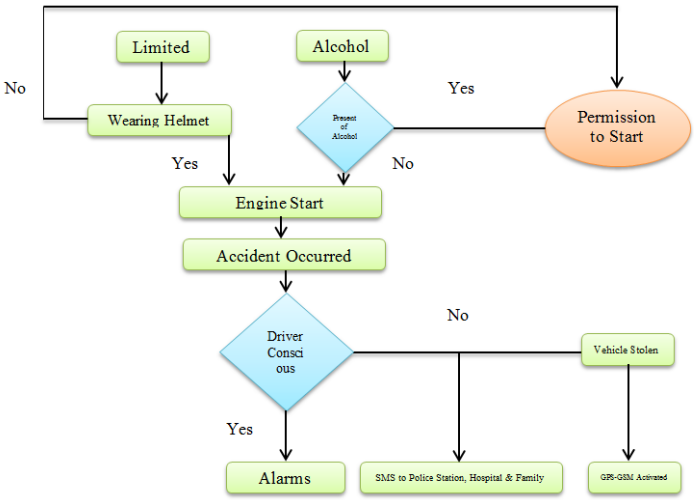

Figure 7: Flowchart of the Proposed System

ADC0809

The process of analog to digital conversion is a slow process, and the Embedded Microcontroller has to wait for the digital data until the conversion is over. After the conversion is over, the ADC sends the end of conversion EOC signal to inform the Embedded Microcontroller that the conversion is over and the result is ready at the output buffer of the ADC. These tasks of issuing an SOC pulse to ADC, reading EOC signal from the ADC and reading the digital output of the ADC are carried out by the Embedded Microcontroller.

In our Embedded module is interfaced with ADC (analog to digital converter) 0809 is an 8-bit CMOS, successive approximation converters. This technique is one of the fast techniques for analog to digital conversion. The conversion delay is 100µs at a clock frequency of 640 kHz, which is quite low as compared to other converters. These converters do not need any external zero or full-scale adjustments as they are already taken care of by internal circuits.

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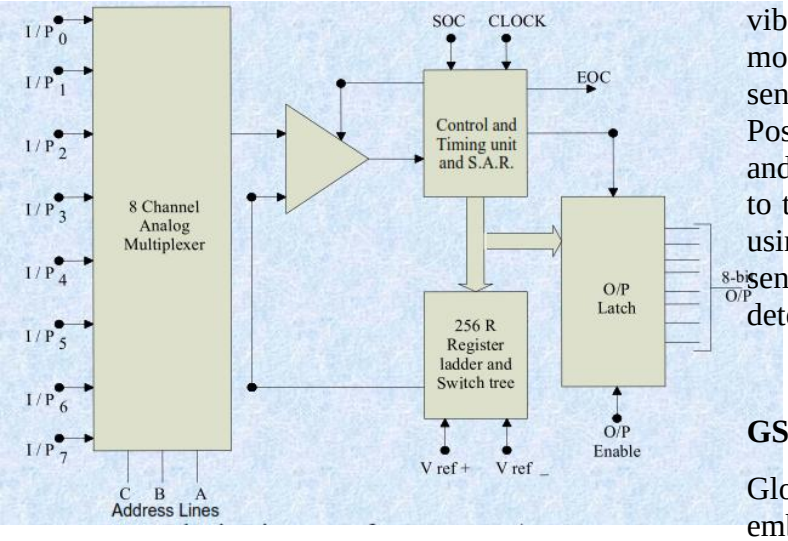

Figure 8: Analog to digital converter

These converters internally have a 3:8 analog multiplexer so that at a time eight different analog conversions by using address lines. ADD A, ADD B, and ADD C. using these address inputs, the Multichannel data acquisition system can be designed using a single ADC. The CPU may drive these lines using output port lines in case of multichannel applications. In the case of single input applications, these may be hardwired to select the proper input. There is a unipolar analog to digital converters, i.e. they are able to convert an only positive analog input voltage to their digital equivalent. These chips do not contain any internal sample and hold circuit (David & Ravi 2017; Pratheepkumar et, al., 2017).

VIBRATION SENSOR

This sensor buffers a piezoelectric transducer. The transducer is a device applied to transform from one form to another form of energy (Srivel et, al., 2018). Piezo means press electricity means the presence and flow of electric charge piezoelectricity mean it produces the electric charge in a cermanic material in response to the mechanical strain it produces the electric charge and the corresponding electric charge is converted into voltages (Zhao, 2000). The piezoelectric vibration sensor is used for the security practice, while vibration Piezo electro sensor alarm recognizes Accident movement or abrupt vibration; it sends a signal to the embedded module and the embedded modules recognize the sensor output and by using the GPS (Global Position System) indicates the accident location and accident time. This intimation will be shown to the concerned mobile number through SMS by using a GSM without any further delay. The high sensitivity security vibration detector which detects the signal in all 360^0 directions.

GSM MODEM SIM 800

Global system for mobile communication, in our embedded Module interface SIM800, is interfaced with Aurdnio UNO microcontroller (Mazidi, et. al., 2000). It uses a Tri-band GPRS/ GSM engine works on frequencies of EGSM 900 MHz, DCS 1800 MHz, and PCS1900 MHz SIM800 provides GPRS which supports the GPRS coding schemes CS-1, CS-2, CS-3, and CS-4. With the help of a very tiny configuration of 40 mm x 33 mm x 2.85 mm, SIM800 can perfectly suite in the required space, such as smartphones, PDA phones, and another mobile device too (David et, al., 2018).

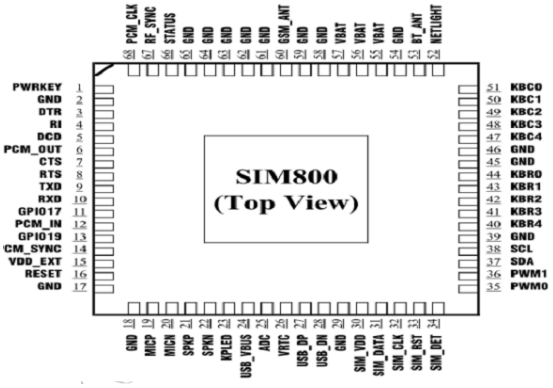

Figure 9: SIM 800 Module

TESTED OUTPUT IN THE REAL-TIME:

The pressure, alcohol, and vibrate sensors are successfully tested in real-life scenarios. The sensors are placed inside the helmet to detect vibration status on the drivers' helmet. So, if a raider drives at over-speed in a continuous manner due to nonstop vibration, it will instruct ignition to turn-off the engine (Ravi et, al., 2018).

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CASE 1: DURING ACCIDENT TIME

At the same time, whenever the driver/rider met with an accident the vibration sensor detects the vibrations level which is more than 1317.997/ 0.7731.42 as shown in the below ***Case number 2*** due to sudden crash a helmet hits on the ground and instantly the display of LCD shows as "***Accident Occurred Ignition On***" as shown in the below ***Case number 1*** then the microcontroller encountered the accident and immediately sent SMS about the accident and location with the help of GPS and GSM modules (Green & Thompson, 2016; Lagassey, 2008; Mimar, 2016).

CASE 2: VIBRATION FREQUENCY AND ALCOHOL CONCENTRATION

The alcohol sensor can able to sense the alcoholic level of a driver, whether he/ she drunks or not. If he/she drunks mean then this sensor will not permit to start the bike engine. It will be displayed on LCD as "***Alcohol Detected Ignition Off***" as shown in the below ***Case number 3***.

CASE 3: PRESENCE OF ALCOHOLIC CONCENTRATION

By using this pressure sensor which warns the rider/driver to wears the helmet. If he/she does not wear a helmet due to the absence of a pressure sensor on the helmet the LCD display shows as "***Wear Helmet Ignition Off***" as shown in the below ***Case number 4*** this sensor will not allow starting the bike engine.

CASE 4: NOT WEARING HELMET

Normally, ignition will operate when the driver wears the helmet and no alcohol consumption then only this sensors module will instruct the engine to start LCD display shows as "***No Alcohol Consumption Ignition On***" as shown in the below ***Case number 5***. This will ensure the driver to wear the helmet while driving and make it mandatory and also he/she drives consciously. This study is a real-time example, it will be monitoring the driver's consciousness level and protect their life and immediate necessary actions by locating accident spot (Green & Thompson, 2016; David et, al., 2019; Lagassey, 2008; Mimar, 2016).

CASE 5: ALCOHOL CONCENTRATION ZERO

CONCLUSION

It is concluded that, the alcohol sensor, pressure sensor, GPS and GSM module able to control and accident rate in India. These sensors are connected to engine ignition if a particular raider is not worn as a helmet or alcoholic person then this sensor will not permit to start the bike engine. At the same time, this system will able to accurately locate the accident spot. Instantly, it communicates to the concerned person to take immediate action to save a life. By implementing

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this system in the real-life scenario it can able to control the accident rate made by the drunken drivers. With this accident avoidance system, it will make Zero drunken drivers in our country. Further through the pressure sensor, it will protect the raiders/driver's life and make a helmet mandatory in practical life. Hence by implementing this system in practical life can able to control and monitor each driver's status.

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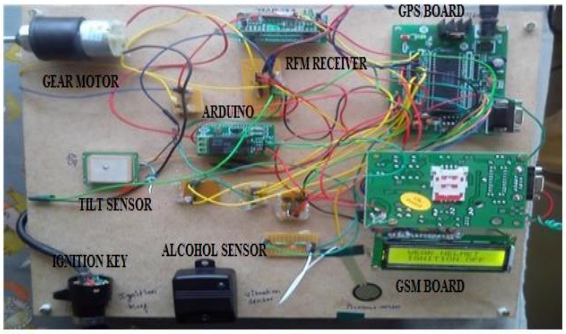

Figure 10: Overall Hardware Setup

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