VIT®

Vellore Institute of Technology

(Deemed to be University under section 3 of UGC Act, 1956)

School of Computer Science & Engineering

CSE3009 – Internet of Things – A1 Slot – FALL 2022 -23

J Component Report

Project Title	**:** Car Accident detection and tracking system using Arduino and GPS
Review Number	**:** 3
Date of Submission	**: 2022/11/16**

Members

1. Abhay Rathi 20BCE2905

Faculty In charge:

Prof. KRISHNAMOORTHY A

Professor

SCOPE

Table of contents

ABSTRACT

-- Transportation has great importance in our daily life and it's development has made many of our chores much easy. IoT based vehicle accident detection system using GPS and WIFI has gained attention. When accident occurs, this system sends short message to a mobile number via Wi-Fi over internet. Message will give longitude and latitude values. From these values location of accident can be determined.

Vehicle accidents are one of the most leading causes of fatality. The time between an accident occurrence and the emergency medical personnel are dispatched to the accident location is the important factor in the survival rates after an accident. By eliminating that time between an accident occurrence and the first responders are dispatched to the scene decreases mortality rates so that we can save lives. One approach to eliminate that delay between accident occurrence and first responder dispatch is to use An Accident Alert and Vehicle Tracking System, which sense when a traffic accident is likely to occur and immediately notify emergency occurred. In this paper, that system is described the main application of which is early accident detection. In this system, initially the GPS continuously takes input data from the satellite and stores the latitude and longitude values. If we have to track the vehicle, we need to send a message to GSM device, by which it gets activated. It also gets activated by detecting accident on the shock sensor connected to Arduino Uno. Parallely activates GPS with the help of relay .Once GSM gets activated it takes the last received latitude and longitude positions values from the buffer and sends a message to a central emergency dispatch server which is predefined in the program. This system uses the things i.e. Arduino, Vibration Sensors, GPS and GSM modules to detect traffic accidents.

KEYWORDS: Arduino, Accident alert, GPS, GSM

Introduction:

The Internet of Things (IoT) is the interconnection of uniquely identifiable embedded computing devices within the existing Internet infrastructure. Typically, IoT offers advanced connectivity of devices, systems, and services that goes beyond machine-to-machine communications (M2M) and covers a variety of protocols, domains, and applications. The interconnection of these embedded devices (including smart objects), is implemented in nearly all fields of automation enabling advanced applications like a Smart Grid. The term things in the IoT refers to a wide variety of devices such as heart monitoring implants, biochip transponders on farm animals, electric clams in coastal waters, automobiles with built-in sensors, or field operation devices that assist fire-fighters in search and rescue. Current market examples include thermostat systems and washer/dryers that utilize Wi-Fi for remote monitoring.

The high demand of vehicles has also increased the traffic hazards and the road accidents. Life of the people is under high risk. This is because of the lack of best emergency facilities available in our country. An automatic alert system for vehicle accidents is introduced in this paper. The proposed system which can detect accidents in significantly less time and sends the basic information to first aid centre within a few seconds covering geographical coordinates, the time and angle in which a vehicle accident had occurred. This alert message is sent to the central emergency dispatch server in a short time so that the emergency dispatch server will inform to the ambulances which are near to that location, which will help in saving the valuable lives. A Switch is also provided in order to terminate the sending of a message in rare case where there is no casualty, this can save the precious time of the ambulance. When the accident occurs the alert message is sent automatically to the central emergency dispatch server. The message is sent through the GSM module and the location of the

accident is detected with the help of the GPS module. The accident can be detected precisely with the help of vibration sensor. This application provides the optimum solution to poor emergency facilities provided to the roads accidents in the most feasible way.

In this project we describes about “IoT BASED VEHICLE ACCIDENT DETECTION AND TRACKING SYSTEM USING GPS TECHNOLOGY”. We are using Arduino in our project. When the system is switched on, LED will be ON indicating that power is supplied to the circuit. The vibration sensors that we are using in our project sense the obstacle, and then it sends interrupt to Arduino. The GPS receives the location of the vehicle that met with an accident and gives the information back. This information will be sent to a mobile number through a message. This message will be received using internet present in the circuit. The message will give the information of longitude and latitude values. Using these values the position of the vehicle can be estimated. Modem performs modulation during transmission and performs demodulation during reception.

Literature survey:

EXISTING SAFETY MEASURES

Presently a lot of methodologies are available in vehicles that allow vehicle protection and tracking.Airbags are one of the most mandatory elements in vehicles. Front airbags have been standard on all new cars since 1998 and light trucks since 1999. Seat belts are also available in four wheelers. tire-pressure monitoring system (TPMS) is an electronic system designed to monitor the air pressure inside the pneumatic tires on various types of vehicles. TPMS report realtime tire-pressure information to the driver of the vehicle, either via a gauge, a pictogram display, or a simple lowpressure warning light.An anti-lock braking system or anti-skid braking system (ABS) is an automobile safety system that allows the wheels on a motorvehicle to maintain tractive contact with the road surface according to driver inputs while braking, preventing the wheels from locking up (ceasing rotation) and avoiding uncontrolled skidding. Traction control and electronic stability control go hand in hand and is designed to designed to prevent loss of traction of driven road wheels. The latest implementation techniques move along the lines of providing help to the driver even if he is trapped in a remote location unable to respond

Many researchers carried out their studies on accident detection system. Aishwarya S.R expained an IoT based vehicle accident prevention and tracking system for night drivers .In this paper provides Eye Blink Monitoring System (EBM) that alerts the subject during state of drowsiness.[1] Sadhana B have explained Smart helmetintelligent safety for motorcyclist using raspberry pi and open CV. The idea is obtained after knowing that there is increased number of fatal road accidents over the years. This project is designed to introduce safety systems for the

motorcyclist to wear the helmet properly.[2] Sarika R. Gujar explained advanced Embedded System of Vehicle Accident Detection and Tracking System. The main objective of this system is to first detect the accident location and call for the emergency services. Vehicle accident detection is possible with the help of sensors. A GPS and GSM module helps to trace the vehicle. [3] Shailesh Bhavthankar 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 location of vehicle. In case of any accident, the system send automated message to the preprogrammed number such as family member or emergency medical services via GSM. [4]Jagdish A.Patel explained Raspberry Pi based smart home. This paper aims at designing a basic home automation application on Raspberry Pi through Interfacing camera as security purpose and the algorithm for the same is implemented in developed in python environment which is the default programming environment provided by Raspberry Pi.

- **Technology prospective**
  The problem can be solved by developing IoT based vehicle accident detection system using GPS and WIFI. In this system when accident occurs, this system sends short message of a mobile number via Wi-Fi over internet. Message will give longitude and latitude values. From these values location of accident can be determined which help to rescue the people in accident.

List Of Issues:

- Approximately 1.35 million people die in road crashes each year; on average 3,700 people lose their lives every day on the roads.
- An additional 20-50 million suffer non-fatal injuries, often resulting in long-term disabilities.
- More than half of all road traffic deaths occur among vulnerable road users—pedestrians, cyclists, and motorcyclists.

- Road traffic injuries are the leading cause of death among young people aged 5-29. Young adults aged 15-44 account for more than half of all road deaths.
- More than 90% of all road fatalities occur in low- and middle-income countries, even though these countries have approximately 60% of the world's vehicles.
- Road crashes may cost countries 2-8% of their gross domestic product.
- Road crashes are the single greatest annual cause of death of healthy U.S. citizens traveling abroad.

Issue On Focus:

The main focus is on rescue of the people in the accident to reduce death. Many people lost their life in accident just because they are not taken to hospital in time. In most of the accident cases people lost their life because, on the spot of accident their no one to inform to hospital or police station, or taking them to hospital. So, the main focus is on developing sensor device to reduce the number of deaths by rescuing the people.

Socioeconomic problem:

There's no question that road crashes have a devastating impact on victims and their families. The World Health Organization states that road crashes kill 1.25 million people and injure 20 to 50 million people every year. Road crashes also bear a heavy economic cost. According to statistics from the Together for Safer Roads' Expert Panel White Paper "Investing in Road Safety: A Global Imperative for the Private Sector," crashes come at a cost of USD $518 billion per year to the global economy. The White Paper outlines these eye-opening statistics on the cost of crashes.

1. The cost of road crashes varies in different economies.
According to the WHO, crashes amount to approximately 1 percent of the gross domestic product (GDP); in middle-income countries the cost is 1.5 percent of the GDP; and in high-income countries the cost is 2 percent of the GDP. Some studies even cite

costs as high as 3 percent of the GDP (1, 2). The TSR White Paper says that the cost of crashes in the developing world often exceeds the amount of payments that those countries receive in financial aid. It also points out that because of poor reporting and lack of a central data system, we don't know as much as we'd like about the cost of crashes in many less developed countries.

2. On-the-job deaths leave a huge void at home and on the job.

In the U.S. alone, road crashes are the number one reason for on-the-job deaths. Annually, 2,100 people die and 353,000 are injured in crashes while working, according to the International Labor Organization. In the U.S., direct costs for a single traffic fatality are approximately USD$1.4 million, according to the NHTSA. A majority of those costs—87 percent—are connected to lost productivity at work and at home.

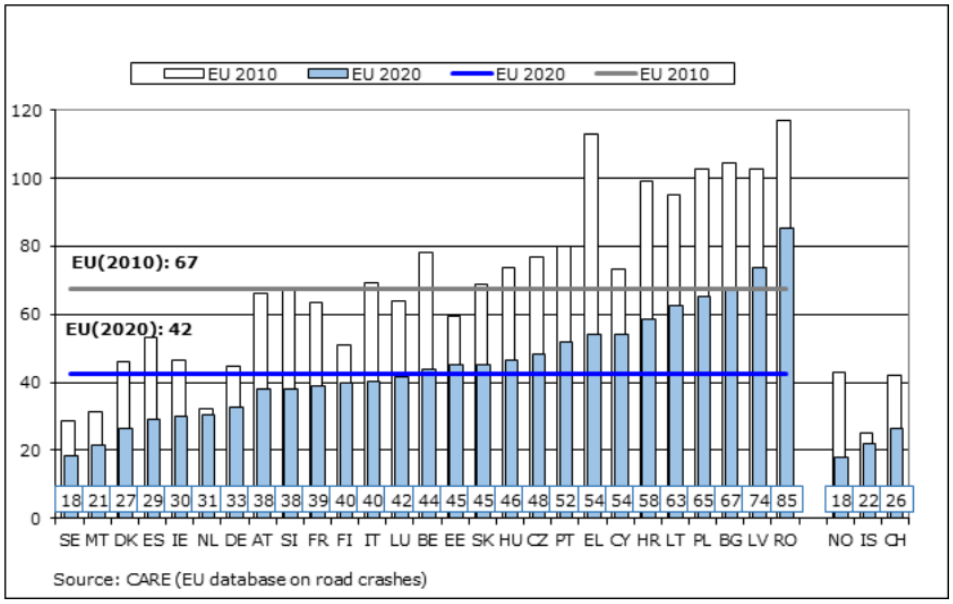
3. Other problem

- property damage;
- workplace productivity loss;
- household productivity loss;
- medical costs, traffic congestion, and other costs
- Statistics
- According to the World Health Organization, road traffic injuries caused an estimated 1.35 million deaths worldwide in 2016.
- That is, one person is killed every 25 seconds. Only 28 countries, representing 449 million people (seven percent of the world's population), have adequate laws that address all five risk factors (speed, drunk driving, helmets, seat-belts, and child restraints). Over a third of road traffic deaths in low- and middle-income countries are among pedestrians and cyclists. However, less than 35 percent of low- and middle-income countries have policies in place to protect these road users. The average rate was 17.4 per 100,000 people. Low-income countries now have the highest annual road traffic fatality rates,

at 24.1 per 100,000, while the rate in high-income countries is lowest, at 9.2 per 100,000.

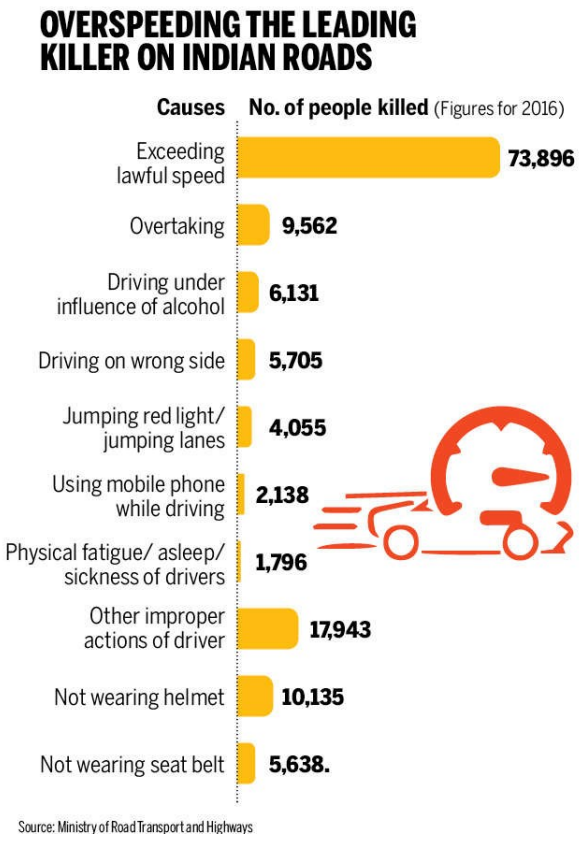
- 74 percent of road traffic deaths occur in middle-income countries, which account for only 53 percent of the world's registered vehicles. In low-income countries it is even worse. Only one percent of the world's registered cars produce 16 percent of world's road traffic deaths. This indicates that these countries bear a disproportionately high burden of road traffic deaths relative to their level of motorization.
- There are large disparities in road traffic death rates between regions. The risk of dying as a result of a road traffic injury is highest in the African Region (26.6 per 100 000 population), and lowest in the European Region (9.3 per 100 000).[3]
- Adults aged between 15 and 44 years account for 59 percent of global road traffic deaths. 77 percent of road deaths are males.
- The total fatalities figures comes from the WHO report (table A2, column *point estimate*, pp. 264–271) and are often an adjusted number of road traffic fatalities in order to reflect the different reporting and counting methods among the many countries (e.g., *"a death after how many days since accident event is still counted as a road fatality?"* (by international standard adjusted to a 30-day period), or "to compensate for under-reporting in some countries".

Figure 2: Trend in road fatality numbers per million inhabitants by country, 2010-2020



- # Accident statistic in India

Year	Total Number of Road Accidents (in numbers)	Change	Total Number of Persons Killed (in numbers)	Change	Total Number of Persons Injured (in numbers)	Chang
2015	501,423		146,133		500,279	
2016	480,652	-4.14	150,785	3.18	494,624	-1.13
2017	464,910	-3.28	147,913	-1.90	470,975	-4.78
2018	467,044	0.46	151,417	2.37	469,418	-0.33
2019	449,002	-3.86	151,113	-0.20	451,361	-3.85
Total in last five years	**2,363,031**		**747,361**		**2,386,657**	
Average	**472,606**		**149,472**		**477,331**	



Mathematical module:

- Time-Distance Based Parameters Algorithm The distance-time-based parameters (DTBP) approach was for the purpose of geo-location tracking and detection of vehicle traffic accident position. The Haversine (ζ) formula [16], [17] is used to develop the algorithm for calculating the reference points of the geo-location coordinates (longitude and latitude) to reduce rounding errors that may be generated before communicating with remote emergency unit as expressed in Equation 1. It provides both accuracy and speed advantages over other algorithms of geo-location distance calculation like great circle distance and spheroidal model. The algorithm for the computation of the distance-time based parameter is presented in Figure 1.

$$\left(\frac{d}{r}\right) = \xi(\varphi_2 - \varphi_1) + \cos(\varphi_1)\cos(\varphi_2)\xi(\lambda_2 - \lambda_1) \quad (1)$$

The distance d from Equation 1 is solved using the inverse sine function as given in Equation 2 and 3.

$$d = r\xi^{-1}(h) = 2r\sin^{-1}(\sqrt{h}) \quad (2)$$

$$d = 2r\sin^{-1}\left(\sqrt{\sin^2\left(\frac{\varphi_2 - \varphi_1}{2}\right) + \cos(\varphi_1)\cos(\varphi_2)\sin^2\left(\frac{\lambda_2 - \lambda_1}{2}\right)}\right) \quad (3)$$

where, r is the radius of the earth (6371 km), d is the distance between the two points (m), φ_1, φ_2 is the latitude of two points, and longitude of the two points is λ_2, λ_1.

where, r is the radius of the earth (6371 km), d is the distance between the two points (m), φ_1, φ_2 is the latitude of two points, and longitude of the two points is λ_2, λ_1.

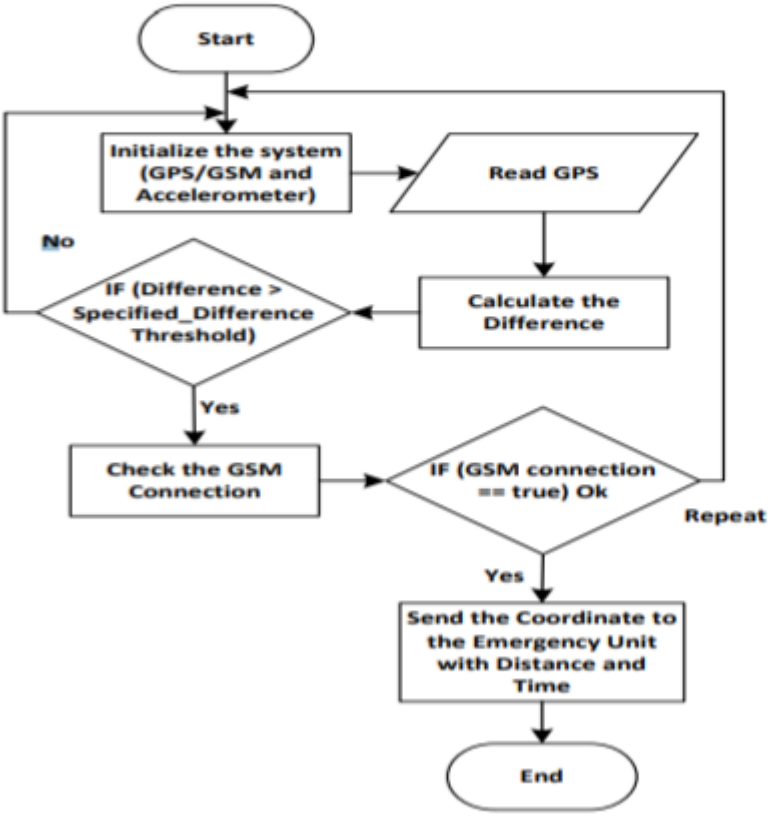
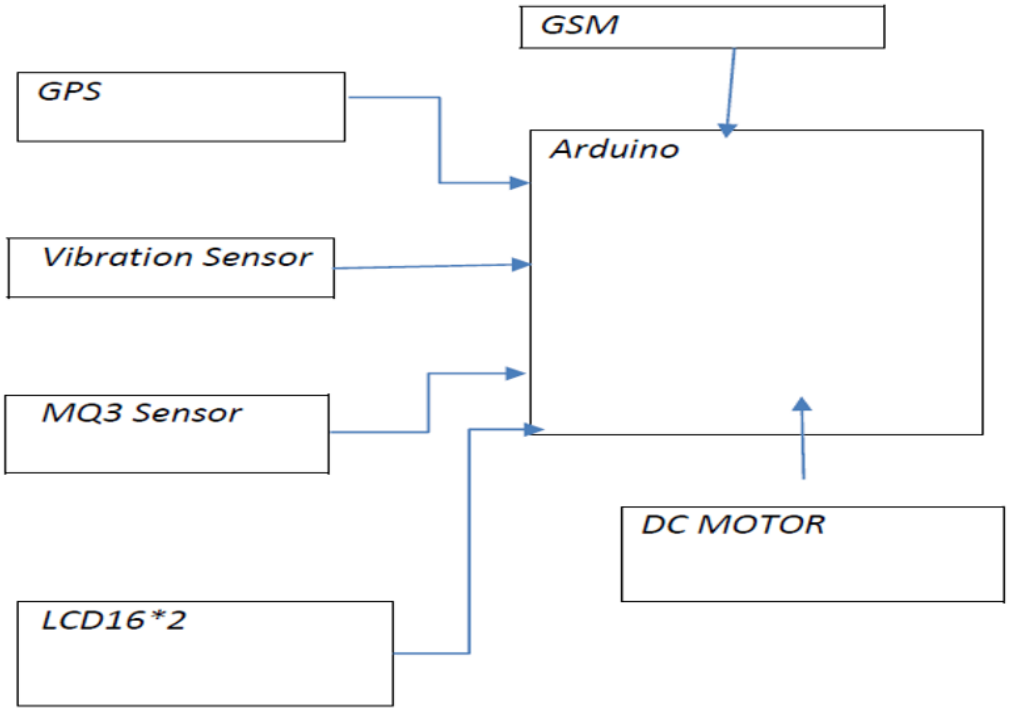


Figure. 1. Distance-time based geo-location computation

Block diagram:



MQ3 SENSOR: Gas Sensor (MQ3) module is **useful for gas leakage detection** (in home and industry). It is suitable for detecting Alcohol, Benzine, CH4, Hexane, LPG, CO. Due to its high sensitivity and fast response time, measurements can be taken as soon as possible.

1. The Arduino UNO is a widely used open-source microcontroller board based on the ATmega328P microcontroller and developed by Arduino.cc. [The board is equipped with sets of digital and analogy input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The board features 14 Digital pins and 6 Analog pins. It is programmable with the Arduino Ide(Integrated Development Environment) via a type B USB cable. It can be powered by a USB cable or by an external 9-volt battery, though it accepts voltages between 7 and 20 volts.

2. A power supply is an electronic device that supplies electrical energy to an electrical load. Here Arduino Uno, sensor, GPS, Moderates with DC 12V supply.

3. Vibration Sensor: Vibration sensor SW18010P is used for measuring and analysing linear velocity, displacement, or acceleration. Features of SW18010P. This is spring type directional vibration sensor. Which can detect vibration in any angle.

4. GSM: There are different GSM module are available in the market. SIMCOM developed different frequencies module includes 800MHz, 850MHz, 900MHz, 1800MHz, 1900MHz. We select SIM900a module for the proposed work. It is compact easy plug-in module. The baud rate of the GSM 900a module is 9600-115200. Initially modem is in auto baud mode. The modem needs only two wires (Tx, RX).

5. GPS: Global Position System (GPS) is a space-based satellite navigation system that provides location and time information in all weather conditions, anywhere on or near the earth where there is an unobstructed line of sight to four or more GPs satellite. The system provides critical capabilities to military, civil, commercial users around the world. It is maintained by the United States government and is freely accessible to anyone with a GPS receiver.

6. 16x2 LCD: 16x2 LCD means it can display 16 character per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, command and data. The command register stores the command instruction given to the LCD. A command is an instruction gives to LCD to do a predefined task like initializing it, clearing its screen, setting the curser position, controlling display etc. The data register stores the data to be displayed on the LCD.

Working:

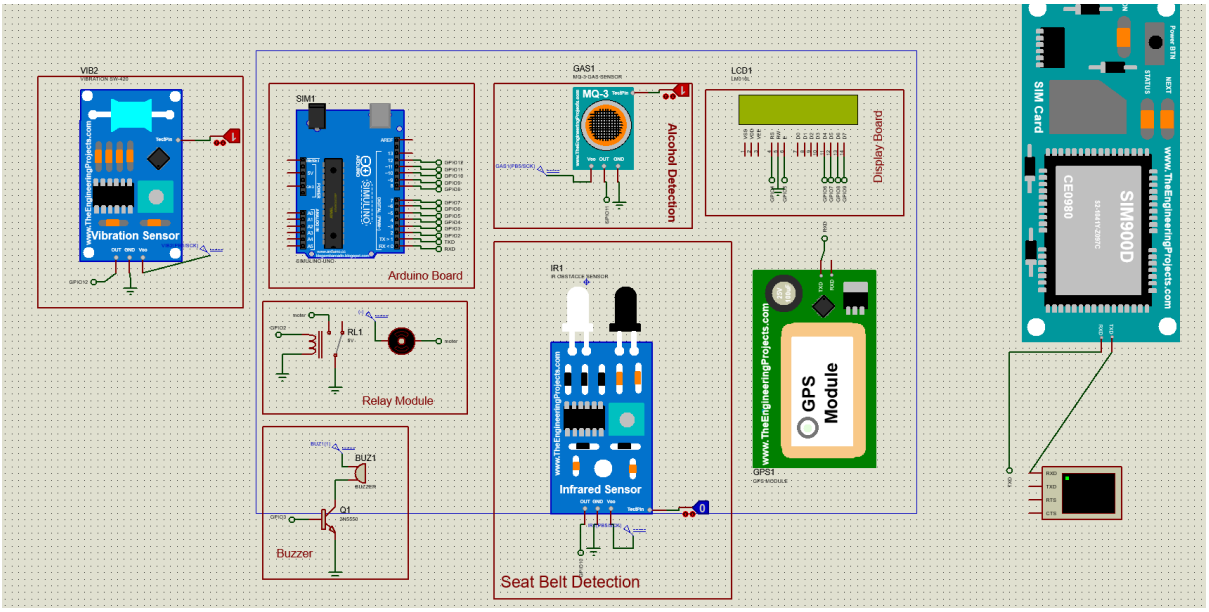
In this project we are using a Arduino. When the system is switched on, LED will be ON indicating that the power is supplied to the circuit. When the vibration sensor senses any obstacle, they send interrupt to Arduino. First IR sensor will detect whether the seat beat is locked or not. If locked and then check for alcohol if alcohol is also not present then start the motor, which means the vehicle is moving smoothing. If seat beat is not locked then it will not will not start checking of alcohol and vehicle stop moving.

Then if vibration sensor detects any vibration, then it sends signal to Arduino and it will load the geolocation of the vehicle.
The GPS receives the location of the vehicle that met with an accident and gives the information back. This information will be sent to a mobile number through message.

This message will be received using internet present in the circuit. This message will give the information of longitude and latitude values. Using these values, the position of the vehicle can be estimated. The received data is given to the Arduino.

Correspondingly it gives an acknowledgement in the form of a message to the mobile phone. LED used in the circuit displays the reception of messages. The Arduino interfaced to GPS modem via an internet, where the devices are activated using select lines internally built in the internet. Internet is interfaced to

Arduino via transmit and receive pin. LED is interfaced to any ports of Arduino; it is used to display the current status of the GPS modem, whether data is being read from GPS.



ADVANTAGES:

- We can monitor the speed of the vehicle.
- We can find the location of the vehicle.
- Alert message to mobile phone for remote information.
- Mobile number can be changed at any time.

LIMITATIONS:

- Costlier.
- Sending data not secure.
- This system is not applicable for poor network connection places.

Code:

Car_Accident_Detection_Aruduino_code | Arduino 1.8.17 Hourly Build 2021/09/06 02:33

File Edit Sketch Tools Help

Car_Accident_Detection_Aruduino_code

```
#include <LiquidCrystal.h>
#include <TinyGPS.h>
LiquidCrystal lcd(4, 5, 6, 7, 8, 9);

const int relay_Pin = 2;
const int buzzer_Pin = 3;
const int ir_Sensor = 10;
const int alcohol_Sensor = 11;
const int vibration_Sensor = 12;
TinyGPS gps;
long lat,lon;
bool ir_status = LOW;
bool alcohol_Status = LOW;
bool vibration_Status = LOW;

void setup() {
  pinMode(relay_Pin, OUTPUT);
  pinMode(buzzer_Pin, OUTPUT);
  pinMode(ir_Sensor, INPUT);
  pinMode(alcohol_Sensor, INPUT);
  pinMode(vibration_Sensor, INPUT);
  Serial.begin(9600);
  lcd.begin(16, 2);
  lcd.print("ACCIDENT DETECTION");
  lcd.setCursor(3,2);
  lcd.print("SYSTEM");

}
void loop() {
  ir_status = digitalRead(ir_Sensor);
  delay(100);
  if(ir_status == HIGH)
  {
    digitalWrite(buzzer_Pin, LOW);
    delay(200);
    lcd.clear();
```


Car_Accident_Detection_Aruduino_code | Arduino 1.8.17 Hourly Build 2021/09/06 02:33
File Edit Sketch Tools Help
Car_Accident_Detection_Aruduino_code
{
alcohol_Status = digitalRead(alcohol_Sensor);
delay(100);
if(alcohol_Status == LOW)
{
digitalWrite(buzzer_Pin, LOW);
delay(200);
lcd.clear();
lcd.print("No alchol detected");
lcd.setCursor(3,2);
lcd.print("Detected");
delay(500);
digitalWrite(relay_Pin, HIGH);
delay(200);
while(1)
{
lcd.clear();
lcd.print("Vehicle Started");
delay(500);
while(1)
{
vibration_Status = digitalRead(vibration_Sensor);
delay(100);
if(vibration_Status == HIGH)
{
lcd.clear();
lcd.print("Accident Detected");
lcd.setCursor(3,2);
lcd.print("Sending Msg");
delay(500);
Serial.println("AT+CMGF=1");   //Sets the GSM Module in Text Mode
delay(100); // Delay of 1000 milli seconds or 1 second
Serial.println("AT+CMGS=\"+916294379315\"\r");
delay(100);
Serial.println("Accident Detected ");// The SMS text you want to send
35


Car_Accident_Detection_Aruduino_code | Arduino 1.8.17 Hourly Build 2021/09/06 02:33
File Edit Sketch Tools Help
Car_Accident_Detection_Aruduino_code
Serial.println("AT+CMGF=1");   //Sets the GSM Module in Text Mode
delay(100); // Delay of 1000 milli seconds or 1 second
Serial.println("AT+CMGS=\"+916294379315\"\r");
delay(100);
Serial.println("Accident Detected ");// The SMS text you want to send
Serial.println("please check location");// The SMS text you want to send
while(1)
{
gps_read();
}
}
else
{
/* Do nothing */
}
}
}
}
else
{
lcd.clear();
lcd.print("Alcohol ");
lcd.setCursor(3,2);
lcd.print("Detected");
delay(500);
digitalWrite(relay_Pin, LOW);
delay(200);
digitalWrite(buzzer_Pin, HIGH);
delay(200);
}
}
}
else
{
lcd.clear();
35


Car_Accident_Detection_Aruduino_code | Arduino 1.8.17 Hourly Build 2021/09/06 02:33
File Edit Sketch Tools Help
Car_Accident_Detection_Aruduino_code
}
}
else
{
lcd.clear();
lcd.print("Seat Belt");
lcd.setCursor(3,2);
lcd.print("not Detected");
digitalWrite(relay_Pin, LOW);
delay(200);
digitalWrite(buzzer_Pin, HIGH);
delay(200);
}
}
void gps_read()
{
byte a;
if(Serial.available())
{
a=Serial.read();
//Serial.write(a);
while(gps.encode(a)) // encode gps data
{
gps.get_position(&lat,&lon); // get latitude and longitude
Serial.println("Position: ");
Serial.print("lat:");
Serial.println((lat*0.000001),8);
Serial.print("log:");
Serial.println((lon*0.000001),8);
}
Updates available for some of your boards and libraries
Boards
Libraries

CONCLUSION & FUTURE SCOPE

The proposed system uses the IoT for vehicle accident detection and alarming the authorities regarding accidents, vehicle tracking using GPS Modem. In this project we have designed IoT based vehicle accident detection and tracking system using GPS Modem. Hence IoT can revolutionize the way the system interact and respond for the variety of applications especially in case of traffic control.

This system can be interfaced with vehicle airbag system that prevents vehicle occupants from striking interior objects such as the steering wheel or window. This can also be developed by interconnecting a camera to the controller module that takes the photograph of the accident spot that makes the tracking easier.

The proposed system is developed to provide the information about the accident occur and the location of the accident. It helps to easily provide the assistant and help to the victim of the accident. This system uses GPS module to locate the vehicle. GSM is used to provide the information of accident. The results of the proposed systems are satisfactory. Further this system can be implemented by using sound sensor, in order to make it more accurate and efficient to detect an accident. This is extended with alcoholic detection also. If the person took alcohol who is driving then the vehicle will be stopped immediately by giving alarm. This can also be developed by interconnecting camera to the controller module that takes the photograph of the accident spot makes tracking easier.

References:

REFERENCES

[1] Megalingam, R.K, Nair, R.N. And Pakya, S M(2010) Wireless Vehicular Accident Detection and Reporting system, 2010

[2] A Practical Animal Detection and collision avoidance system using Computer Vision Technique, 21 December 2016 publication, IEEE

[3] Global Status Report on Road Safety 2013, Executive Summary(IEEE), October 2013.

[4] P.Jyothi, G. Harish. Design and Implementation of Real time vehicle Monitering, Tracking and Controlling System, IEEE

[5] R. Kumar, H.Kumar, ‘’Availability and handling of data Recieved through GPS device; in tracking a vehicle”, Advanced Computing Conference(IACC) 2014, IEEE International

[6] Seok Lee, G. Tewolde, Jaerock Kwon, “Design and Implementation of vehicle tracking system using GPS, GSM technology and smart phone application, IoT 2014 IEEE