# Accident Prediction and Crash Recovery by using Car Black Box

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*Abstract: In the desire of experiencing the taste of speed and not following the traffic rules many people are losing their lives in the road accidents. As they were happening far from the living areas the others will not be aware about these accidents and also due to lack of information regarding the accident, the medical facilities were also not able to reach them. To overcome these situations we have designed a GSM-GPS based intelligent vehicle tracking system using Raspberry Pi controller. This system consists of light sensor, MQ135 Alcohol sensor, temperature sensor, accelerometer, video recorder, limit switch sensor, GPS and GSM modems to prevent vehicles from collisions and alert while colliding. All the sensors are connected to the Raspberry pi controller. In addition to this an SD card is provided to collect and save the data from the sensors. We can recover this data from this SD card to know the reason behind the accident and can avoid it from happening again. When an accident is occurred the information about the accident will be sent to the preregistered number through an sms. The main feature of this system is whenever the sensors records a value beyond the specified value whether it is about crossing the lane line, not wearing seat belt, the driver is drunk, or reaching close to the other vehicles etc.., an alert message will be sent to the preregistered number.*

*Key words: MQ135, Accelerometer, Raspberry Pi, Limit switch, GPS, GSM.*

## I. INTRODUCTION

Now a day, the technology has made amazing facilities to have well designed cars. Some of the cars have more facilities compared to branded cars. They have more speed and other Special features so that we are introducing devices which can control or monitor the parameters of car.

We have designed a system; In case any accident occurs, it records all the parameters and helps us to get rid from those accidents.

It is developed to record some parameters like informational data such as temperature of engine, gas leakage level, alcohol level etc., for some investigations when an accident occurs by using GPS&GSM technologies. One can able to find the location of the accident and GMS sends message to a particular phone number which the user already registered. So that first aid can be provided as early as possible. If any accident occurs then the details of that vehicle e.g. position of the car, area of an accident will send to the nearest rescue team for help. Here location of a particular vehicle or area can be identified by using 24 communication satellites which transmits signals globally round the clock and GPS receiver is used to verify the latitude & longitude accurately.

In this project memory device is used to store the data like gas leakage detection, engine temperature, alcohol detection and location of car etc., and this project is developed by using Raspberry Pi. This proposed system also having a security module which contains data encryption to secure the stored data on SD card and it aims to achieve analysis of an accident by sensors which are placed strategically around the vehicle.

## II. OVER VIEW OF THE SYTEM

Raspberry pi: A powerful feature of the raspberry pi is the row of GPIO (general purpose input/output) pins along the top edge of the board. A 40-pin GPIO header is found on all Raspberry pi boards. Raspberry pi is chosen over Arduino because of its additional features i.e., Bluetooth, Wi-Fi and video recorder. Accelerometer ADXL345 measures the acceleration of the vehicle when crash occurred. This sensor is applied in X, Y, Z directions for detection of accident. Here the accelerometer used is MEMS accelerometer. Light sensor detects the functioning of Flashers, Break lights, Head lights and Rear lights at the time of crash. Temperature sensor DHT11 measures the temperature of engine, also measure amount of heat energy or even coldness that is generated by an object or system by producing either an analogue or digital output. When the driver is high in alcohol the alcohol sensor MQ135 detects it and warns the driver. When a opposite vehicle approaches close to the vehicle the ultrasonic sensor (HC-SR04) gives warning to the driver. This sensor is used for measuring distance gauge .It works by sending sound waves. The Infra red sensor uses one or more cameras to recognize lane markings on the center and sides of the road. If the system detects drifting towards a lane marking, without a turn signal, it will warn the driver. A limit sensor is used to warn the driver, if the driver is not put on their seat belt . The sensor uses push button to determine it. A GPS module is used to find the location of accident occurred and it sends a message to the registered numbers by the use of GSM.

An alert message and reason for the happening of accident is also sent through an GSM module. By plugging a camera to the raspberry pi through the camera serial interface (CSI) slot, the video can be recorded in vehicle and stored in SD card.
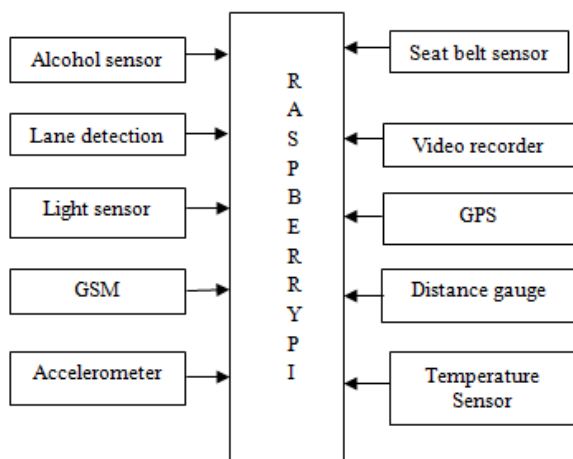

**Fig 1: Block diagram**

**Specifications:**
**Lane detection (IR module):**
Voltage: 3V - 5V
Current: 23mA
Detection Range: 2cm to 20cm
**Accelerometer (ADXL 345):**
Voltage: 2V to 3.6V
Power: 40uA
Temperature: - 40C to 85C.
**Distance gauge (HC-SR04):**
Voltage: DC 5V
Current: 15mA
Frequency: 40Hz
Range: 2cm – 4m
**Light sensor (LDR):**
Voltage: 3.3V to 5V
Current: 15mA.
**Gas sensor (MQ 135):**
Voltage: 5V
Pre heat durations: 20sec
**Temperature sensor (DHT-11):**
Voltage: 3.5V to 5.5V
Current: 0.3mA to 60uA
Temperature: 0C to 50C
**Seat belt sensor (Limit switch):**
Operating Force: 600gmax
Release Force: 100gmin
Pre travel: 2.0mmmax
Movement Differential: 0.8mmmax
Over travel: 0.8mmmin
Operating Position: 30±0.8mm

## III. METHODOLOGY ADOPTED

Raspberry pi is a tiny credit card sized computer that plugs into a computer monitor or TV, and uses a standard keyboard and mouse. It is a capable little device that enables peoples of all ages to explore computing, and to learn how to program in languages like scratch and python.

Operating system of the raspberry pi is Raspbian stretch .Raspbian is a version of Linux built specially for the raspberry pi. In this project Raspberry pi mainly uses python

language for programming the sensors. It is a single board computer and external storage has to be given by inserting an SD card through a SD card slot.
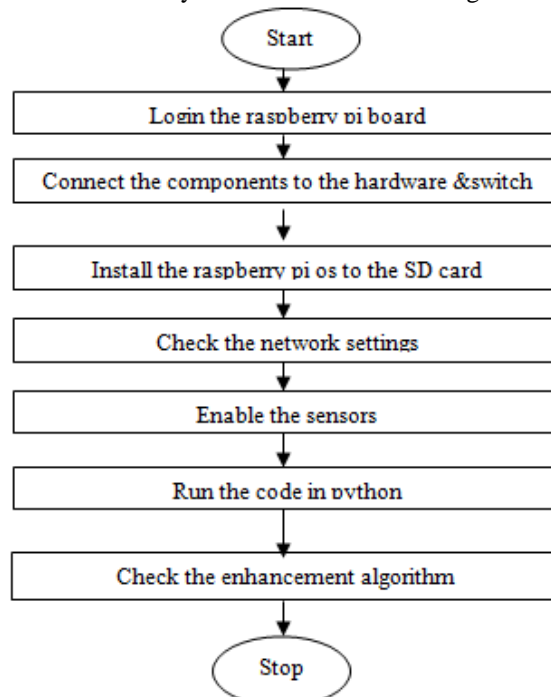
Flowchart for the system is shown in below fig.


**Fig 2: Flowchart**

Initially raspberry pi OS is installed into the SD card and all the sensors are connected to the hardware. Switch on the power supply and connect the raspberry pi to internet. Enable the sensors and write code for overall sensors. After that run the code in python. Finally check the enhancement algorithm.

## IV. EXPERIMENT RESULT:

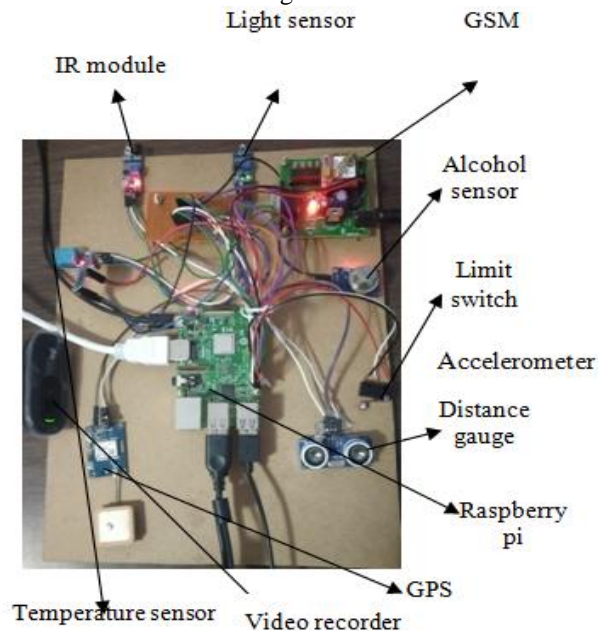The sensors interfaced with raspberry pi are shown in below fig.


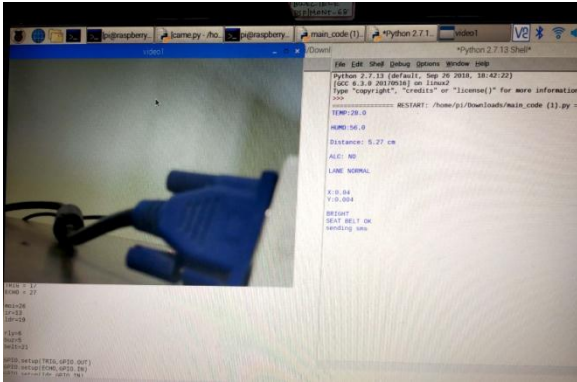**Fig. Interfacing of sensors with raspberry pi**

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**Fig. 3: Monitor display of raspberry pi**

An SMS is sent to the prestored numbers when an accident occurs and also when the sensor values exceeds than the given specification values. In the above figure the monitor display the sensor outputs, the indication is sent to the driver through a message if any fault in sensor value exists. In the above figure the temperature value is 28.0 and Humidity value is 56.0 which indicate normal nominal values. The object approaching distance is 5.27cm which indicates that the opposite vehicle is approaching very close to the vehicle. Then it immediately warns the driver by sending the message. The alcohol sensor shows the result as NO i.e., the driver was not drunk. The lane detection sensor also showed normal value, when it crosses the white colour lane mark it gives warnings. The accelerometer shows x-axis value as 0.04 and y-axis value as 0.004, which shows that the normal value is not exceeded. The LDR value is bright i.e., which is in safe mode. If the driver drives in the absence of light a warning is sent. The output of seat belt sensor shows that the driver wore the seat belt. The location of accident occurred is also sent through GPS using GSM.
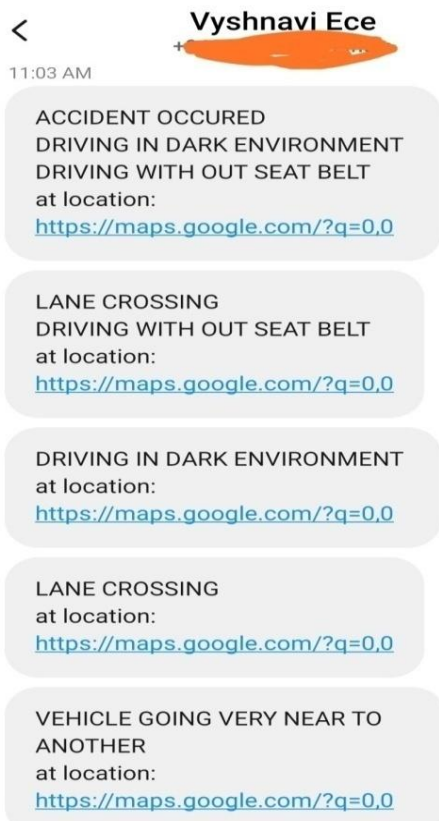


**Fig 4: Text message received through GPS**

## V. CONCLUSION

We hereby conclude that the prototype of car black box system was designed and implemented successfully. It consists of 10 sensors that are interfaced to raspberry pi board in automobile. These sensors are used to continuously monitor the various parameters of the vehicle like temperature value, alcohol content in the cabin etc.., and if something had happened it rescues the person inside by sending a message along with the GPS coordinates to the preregistered number. Every sensor was tested and is desired to give absolute outputs. This system uses an SD card which is continuously recording the information obtained from the sensors. The description can be performed whenever we want the information. This system can be implemented in any type of automobiles. In this project raspberry pi is used over Arduino because of its additional feature in Wi-Fi, Bluetooth and camera port. The data is recorded only when the driver starts motor. A new data is replaced over previous data until at the time of crash occurs.

### FUTURE SCOPE

The system can be implemented further by including face detection techniques and also including voice detection of the owner of the car. This helps the owner to protect his car from unauthorized persons. The face detection detects if the driver is awake or not while he was driving. This helps to prevent occurring of accident due to carelessness. The case protection to the sensors can also be given to protect them from crash.

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