Accident Prediction and Crash Recovery by using Car Black Box

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Abstract: Millions of peoples are losing their lives because of accidents that occur every year. The main cause of death was recorded due to the unavailability of medical services at the time of accident, and also the reason for the cause of accident is also not known. So to overcome these problems, a car black box system came into existence. Data received from the sensors are stored on the SD card mounted on raspberry pi for investigation purpose after the accident. This paper presents a technique for designing and development of GSM-GPS based intelligent vehicle tracking system using Raspberry pi controller. The proposed system uses light sensor, MQ135 Alcohol sensor, temperature sensor, Accelerometer, video recorder, Limit switch sensor, GPS and GSM modems to prevent vehicles from collisions and alert the collision of vehicles to owners. The data recorded is used for investigation purpose. The additional feature of this project is that it warns the driver whenever the sensor values exceed than the normal specification value. The data is stored in the SD card that is externally connected to the raspberry pi.

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 design 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 the nearest rescue team for help.

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In this project memory device is used to store the data like gas leakage detection, engine temperature, alcohol detection. 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. 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.

I 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.
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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
Current: 23mA
Temperature: -40°C to 85°C

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: 0°C to 50°C

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 people 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.
An SMS is sent to the pre-stored numbers when an accident occurs and also when the sensor values exceed 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 5.27 cm 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 3: Monitor display of raspberry pi**

### V. CONCLUSION

The prototype of car black box system was designed and implemented successfully. The designed system consists of 10 sensors that are interfaced to raspberry pi board in automobile. Every sensor was tested and is desired to give absolute outputs. The data is stored in a SD card and is encrypted. The description can be performed whenever we want the information. The camera records the video and is stored as a file in a SD card. An alert message is sent to the driver when he/she crosses the sensor specification values. After the crash occurred the GSM sends an SMS for help to the pre-stored numbers. 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.

### VI. 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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