Car Event Data Recorder (CEDR)

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Abstract: **Road accident toll is inevitable unless people obey the Rules as obligation. Then when it's come for filing a case, the Law Enforcement officials face many struggles. Most accidents are results of Alcohol intake, speeding and crossing the lane inappropriately. Typically, due to the less information innocents were convicted since the impact is on the rear part of the car. In some other cases, Murders were framed as an accidental death. Most of deaths are not caused during the crash but after the crash due to the lack of aid.To overcome these problems we came up with an idea which deals with detecting Alcohol, speed, location, lane shifts and crash, records these data in the 'black box(CEDR) and also to the parental control application(CEDR).The system will make eCalls to the emergency contacts. The parental control application will feed the information like number of people in the car, location, Level of Alcohol intake, lane shifts, fuel level, the 20 minutes video clip before the collateral damage and warning notification to the CEDR, if the speed is above 90km/hr or be fixing through the app. This Project will help the parents and for the post collateral investigating process of law enforcement officials.**

Keywords: **Car Accidents, Alcohol, Speed, lane shifts, parental control app, eCalls, Black Box.**

I. PROBLEM STATEMENT

A. *Post Investigation Works.*

In some cases, Accidents will take place in remote places i.e, no eye witness will be available for the investigation, the law enforcement officials will face inability to charge the right person for their fault, due to the less data and with assumed thoughts thecase will be closed or left unsolved. In our project the required data like speed, tilt after the collateral damage, time, location, safety systems status during the collateral will be stored in '*CEDR*'.

B. *Parental Control over Car.*

Most of the adult will use their parent's Car. Without the knowledge of the parent, adult will rise the speed of the car for theirenjoyment in some other cases adult will drunk and drive, without the seat belts on adults will cross the lane suddenly in this case they end up with accidents. In our system the parents required data will be recorded and live relayed to the App named 'CEDR' which is installed the parent's mobile.

II. SYSTEM OVERVIEW

A. *Detection Unit.*

a) Consumption of Alcohol

Consumption of alcohol is one of major cause of the accidents, if a driver found to be consumed alcohol, its easier for Charging him for accident. Alcohol detection device(fig 1.2) will sense theDriver's condition,by using *'Genuino 101'*, *alcohol sensor shield*. Genuino 101 plays vital role ,and which is a brain of a system. Alcohol sensor shield helps to find the concentration of alcohol in the air. If the driver consumes alcohol the data will stored.

It will be installed in the starring

Fig 2.1

b) Speed, fuel , Indicator , Navigation

The data of the speed, fuel level of the car, navigation will be inherited from the existing system of the car. The speed of the car will be used in the '*Processing unit*'. '*Indicator'* will be used in the '*lane detecting system*'.

c) Drowsiness detector

20% of the road accidents were due to the drowsiness. Long drives commonly early morning drives ends up with accidents, even this paves a way for the accident, this data will also helps the investigation. If the car is been driven for 3 hours in a row, the '*drowsiness detecting system'* will be turned on. A small *'USB webcam'*(fig2.3)above the starring will Visualize the drivers condition.
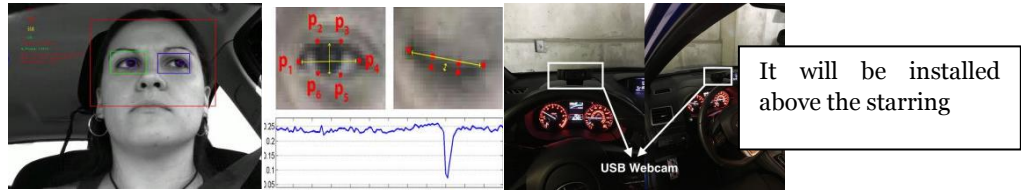
Fig 2.2(a)   Fig 2.2(b)   Fig 2.3

It will be installed above the starring

d) Number of people in the Car.

For sake of 'parents' the number of people travelling in the car has to be recorded. The number of people is detected through 'USB webcam'(fig 2.3) using the 'face detection softer'.
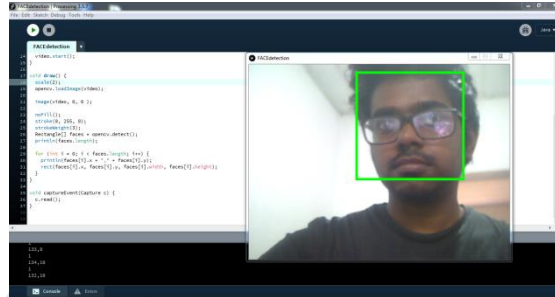

Fig 2.4(face detecting software)

e) Lane Detection

The sudden changes in the lane may cause accidents by the '*vehicle or car b*' which is coming behind the 'car a'. Since the impact is at the *'rear area' of car b*, mostly *car b* is charged for accident, though the mistake is done by *car a*. (fig 2.5)

Fig 2.5(a)   Fig 2.5(b)

The lane changes is detected using '*Canny edge Detector'(fig 2.6)* is a multi-stage algorithm optimized for fast real-time edge detection. The fundamental goal of the algorithm is to detect sharp changes in luminosity (large gradients(fig 2.6)), such as a shift from white to black, and defines them as edges.

The sudden changes in the lane can be found using canny edge algorithm and the indicator data is inherited from the car's system.

'If the car shifts the lane without indicating properly the device will record the location and time of the shift.'

Fig 2.6 Canny edge detectors Recognition

f) Crash detector

In this the impact of the car will be detected using 'Piezo vibration sensor(fig 2.7)' The PiezoVibration Sensor is based on piezoelectric transducer. It is commonly known that piezoelectric materials responds to strain (deflection) changes or applied force by generating a measurable output voltage. This output voltage is proportional to the strength of shock or vibration.

Fig 2.7

This Sensor(sw-420) will detect the impact or accidents even in the rest position.The system will also detects the time between '*time of crash to the time of rest*' using this data the actual accident location can be identified.

B. Storage unit.

   a) At Rest

When the car is at rest the CEDR will record majorly nothing except the crash.

   b) At Motion

When the car is at motion or in running status, the system will records all the information which mentioned in the Detection unit(II. A), apart from that the storage unit will record collateral information such as *prior to collateral, during collateral, post collateral,* by calculating Δv (sudden change in velocity) from the data of the car system(velocity) and the crash detection(II,A, *f*) from the Detection unit(crash instance).
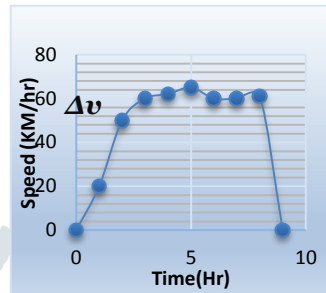

Fig 2.8

C. Processing Unit

   a) *Prior to Collateral*

Each data from the *'Detecting unit''* will be stored up to the storage level of the storage unit, old data will be deleted and the requested data will be relayed to the '*CEDR app*' continuously.

   b) *During the crash or collateral*

When the '*detection system*' identifies the crash, the system will store all the data at the instant then CEDR system will 'Turn off' the detection system. The system records the data which include *'the status of security system*.
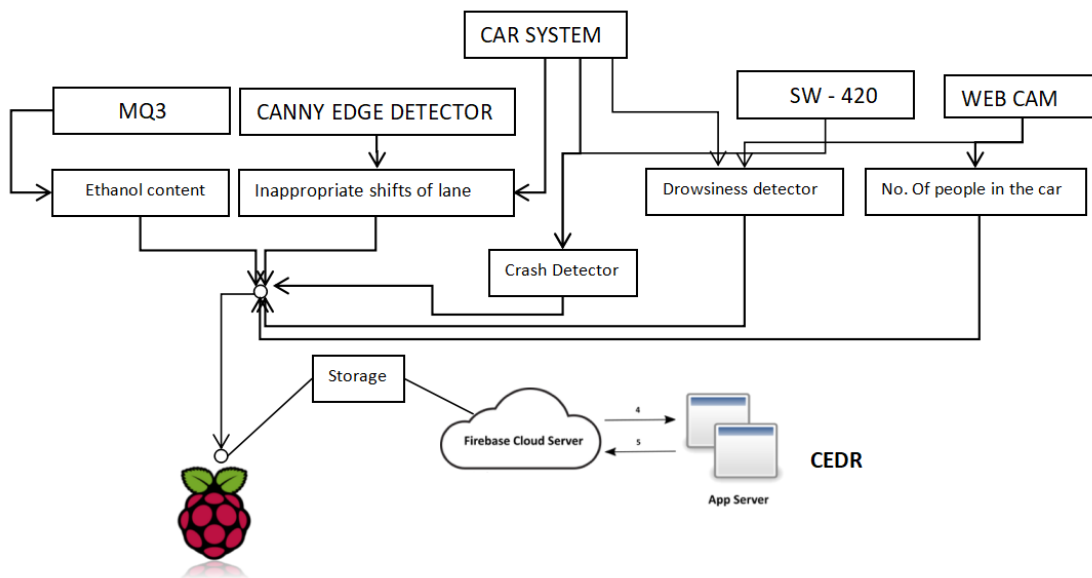
   c) *Post Collateral*

When all the data is stored, the system will make 'eCall' to 100 and 108 immediately, the location will be transmitted. Sends Notification to CEDR.
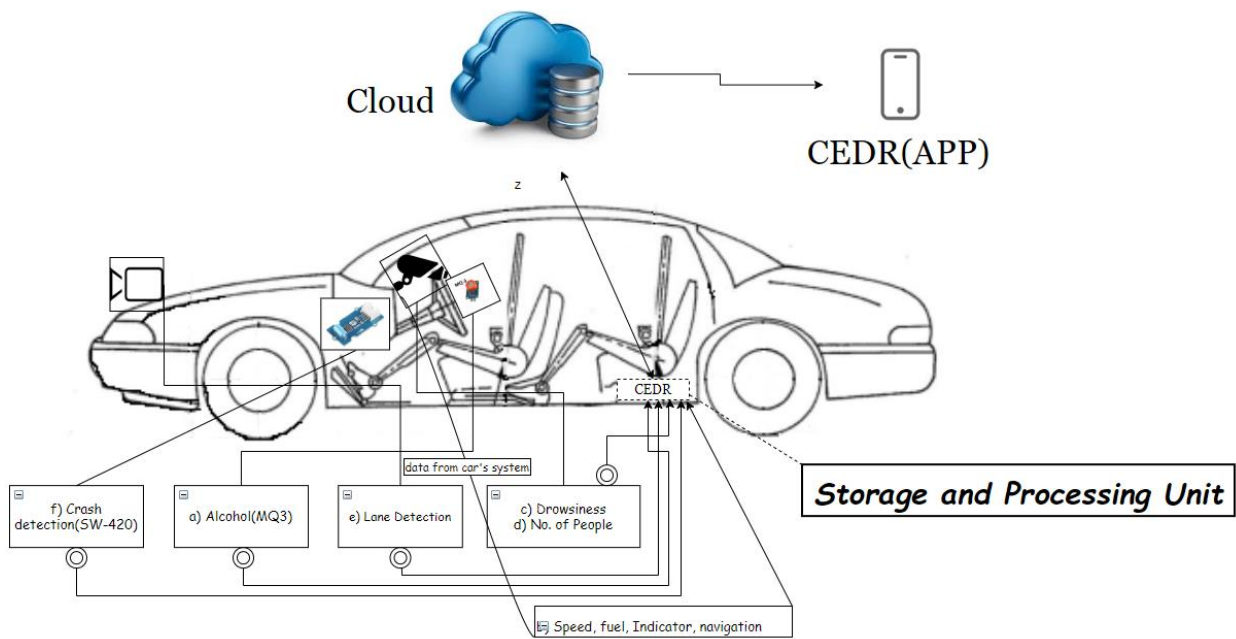
D. CEDR

The requested data from the detecting unit(II.A) will be coded to store in the Cloud and in the App(CEDR) server, data from the cloud is received and displayed in the installed smart phone.

III. BLOCK DIAGRAM

III. EXPERIMENTAL SETUP

IV. SCHEMATIC SETUP

A) *MQ-3*

Initially, *R Pi 3v* is connected to Bus *POS 1, R Pi GND* is connected to *Bus GND*. Alcohol Detector[MQ-3](II,A, *a) MQ-3'*s *GND* is connected to the *Bus POS*, then the *MQ-3*'s *VCC(5v)* is connected to the *R Pi 5v*. *MQ-3*'s *GND* and Analog output is short circuited 1k ohm resistor and *470 ohm resistor* respectively. *MCP3008-8 Channel* 10-Bit *ADC*, is used to interface multiple inputs from the *R Pi* to the *alcohol gas sensor(MQ-3)*

B) *SW-420 or Piezo vibration sensor*

Piezo Vibration sensor is connected to the Bus POS 1, and the second terminal of the sensor is connected to the MCP3008 CH1.
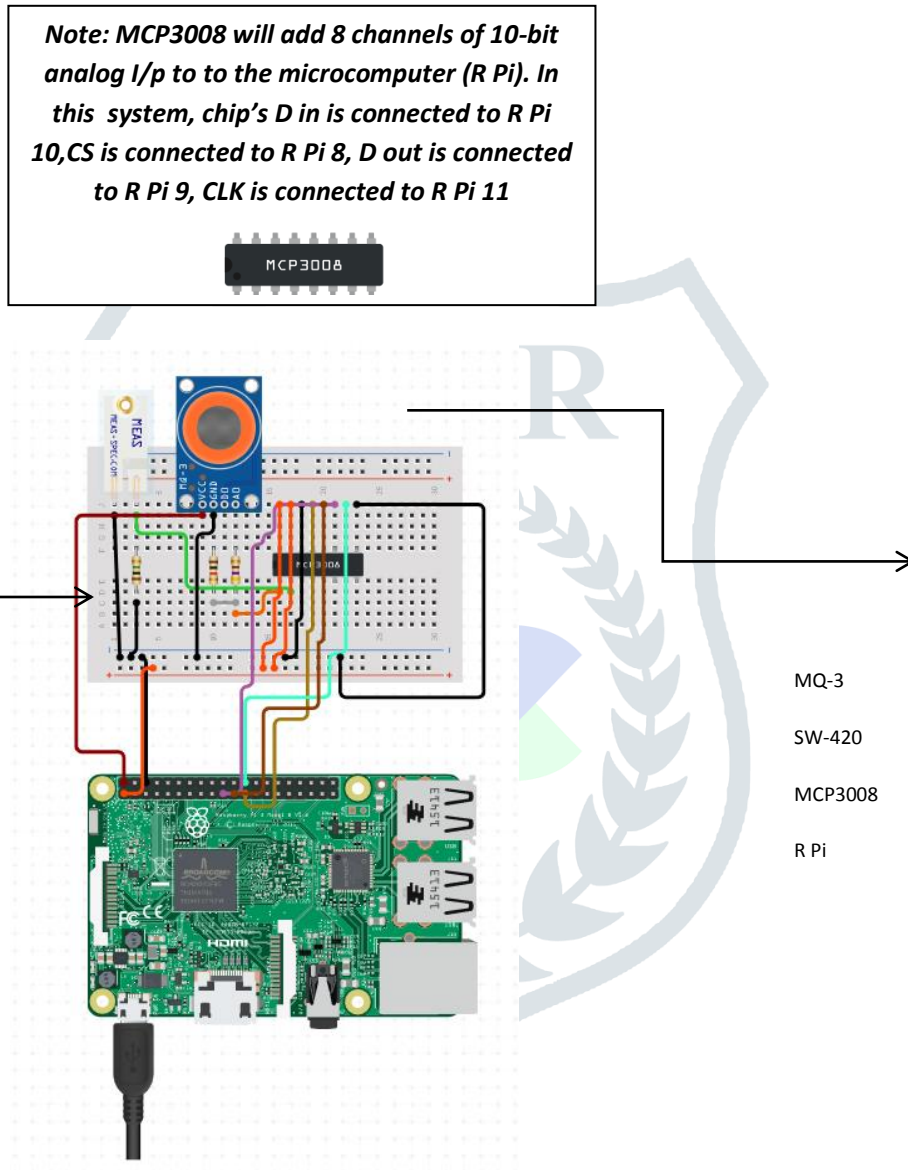

Note: MCP3008 will add 8 channels of 10-bit analog I/p to to the microcomputer (R Pi). In this system, chip's D in is connected to R Pi 10,CS is connected to R Pi 8, D out is connected to R Pi 9, CLK is connected to R Pi 11

MQ-3

SW-420

MCP3008

R Pi

Fig 4.1 Simulated Schematic design of the System

C) Raspberry Pi Camera.

Raspberry Pi camera(fig 5.2 a) is available in the common market. The cable has to be inserted with the right orientation: the blue has to face the Ethernet port, and the silver side is facing the HDMI port. Insert the cable so that almost no blue is showing. As shown in the fig 5.2 (b).
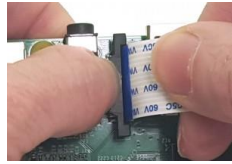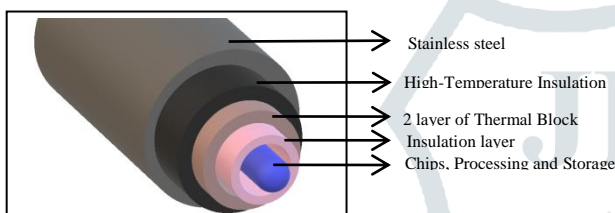

Fig 5.2(a)   Fig 5.2(b)

V. MECHANICAL SETUP

Stainless steel

High-Temperature Insulation

2 layer of Thermal Block
Insulation layer
Chips, Processing and Storage

Fig 6.1 Sectional view of CEDR(storage unit)

The initial layer the CEDR is Stainless steel in order to insulate the device from electricity. An huge current could spoil the chips. The second protective layer of the unit is thermal protection using either paraffin slab or titanium and third layer also follows the same thermal protection as the secondary protection. Eventually a thick insulating slab will protect the entire circuit.

VI. WORKING AND OPERATION

For the process of the CEDR system, speed, navigation, indicator, fuel level will be taken from the car system. Additionally couple of cameras and sensors will be installed in the frame of the car. Alcohol detection will be carried using MQ-3(fig2.1) device which has sensitive Tin Di-Oxide(SnO_2) ceramic layer, this acts as a semi-conductor, when the ethanol content in the air, touches the semi-conducting layer this produces acetic acid and hear this generates more electricity. Based on the heat and current the containment of the ethanol can be detected. In the couple of the cameras, one camera will face inwards and other faces rear view of the car. The camera which covers the interior portion will detect the drowsiness and number of people in the car. The camera will be connected with the micro computers, the existing programs for detecting the drowsiness and no. of people will dumped for the process. The other camera will work using Canny edge detector. Canny edge detector can be used to detect the lane shifts, the detector will scan the contrast edge of the image or video input. The usage of the indicator is inherited from the car's system, when the car shifts the lane suddenly without indication the system will record it has 'inappropriate lane shifts'. SW-420(fig 2.6) sensor can be used to detect the crash of the car.This is the only system which runs even when the car is at rest. If the sensor is at rest their will be an internal conduction the out is high, by the instant when the sensor experiences an impact or an intense vibration there will be an brief disconnection in the sensor resulting in low output. Using this data the system will record the crash. Each data which detected will be stored in the storage unit. The system will also process the time taken by the car to move into rest position from the instance of the crash, for assuming the tilt of the car due to the crash. The detection and the processing unit will be exposed barely to the accidents but the storage capsule will be protected with compact four layered chamber. The abstract of the entire data in the storage will be transmitted to the cloud base. Then CEDR application will display the data abstraction from the the storage.

VII.RESULT

Most of the accidents and deaths were occurred only by the young people. Our application will eliminate this since they will be under surveillance. CEDR will help for solving the cases with required data even if the accident happened in a remote area.

VII. CONCLUSION

As per the WHO Global report, among 195 countries, India ranks 1st in the number of road accident deaths. In the year 2019 the ministry of road transport and highway reported that the road accidents has been increased 0.49% when compared with last year 2018, based on this grave statistics we can understand the toll of the accidents is increasing gradually, this research will help to decrease at least small in number. When it comes financial aspects for the this system it takes around, a Lakh rupees(1300 $) For the installation of the CEDR system into a car need not to work with the frame work of the Car. So, this will easier for Installation, Handling, Accessing, even for the common people.

VIII. FUTURE WORK

There are some quit small amount of accidents due to the burst of the engine by over heating. So, thermometers reading will provide fine data. An engine gauges for indicating Oil Pressure, Temperature, Nitrous Pressure, Blower Pressure and other data detected in the system will be displayed in dashboard as user friendly. A Faulty fuel pressure regulator may cause Car to experience Misfires, the efficiency of the fuel will reduce, Fuel flow should be diagnosed frequently. Underwater Locator Beacon can be installed in case of accidents over the bridge, since it may spat the CEDR into the Water current.