PIMPRI CHINCHWAD EDUCATION TRUST'S

PIMPRI CHINCHWAD COLLEGE OF ENGINEERING

SECTOR NO. 26, PRADHIKARAN, NIGDI, PUNE- 411044.

PROJECT BASE LEARNING REPORT

Drowsiness and alcohol detection using raspberry pi

Project ID:- B24

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DEPARTMENT OF ELECTRONICS & TELECOMMUNICATION

S.Y.B.Tech (E&TC) 2021-2022

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We also thank our Director **Dr.G.N.Kulkarni** sir for his continued support and encouragement and motivating us.

We record our thank to our friends in our class for interaction and help during the course of Project Base Learning.

Abstract

Road accidents have been a major reason for fatalities in recent times. Accidents not only cause loss of life but also causing implications on road safety turned into a major challenge in the automobile industry. Among various reasons for road accidents drunk and drive and driver drowsiness are taking a major proportion, continuous monitoring of driver's alertness will help in minimizing the crashes. Driving while drowsy or in a drunk state are the two main reasons for traffic accidents and its related financial losses. Most countries cost 3% of their GDP due to road crashes and nearly about 1.35 million people die each year. In the case of India, India constitutes 1% of the vehicle population but 6% of total global road accidents and approximately 151 thousand road accident deaths. One of the primary agencies that conducts research on road and driver safety is the national highway traffic safety administration. In a study looking at critical reasons for road accidents 94% of car accidents are caused by drivers out of which 25 to 30% of accidents are caused due to drowsiness and drunk driving. Our idea uses alcohol and drowsiness detection in order to analyze the risk factor.Unique approach used in our idea is to only turn on the camera when someone is there or when alcohol is detected thus reducing the load on the microprocessor.

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1. INTRODUCTION

Based on the World road statistics India is ranked third in the world for number of road accidents .India sees around 4,50,00 road accidents every year out of which 1,50,000 die i.e with average fatality rate of 69.80%. Which is a concerning fact as people which are involved in accident are from the age range of 18-45 which is upcoming generation of india.Among various reasons for road accidents drunk and drive and driver drowsiness are taking major proportion, continuous monitoring of driver's alertness will help in minimizing the crashes.In study looking at critical reasons for road accidents 94% of car accidents are caused by drivers out of which 25 to 30% of accidents are caused due to drowsiness and drunk and drive.

1.1 Background

Road accidents have been a major reason for fatalities in recent times. Accidents not only cause loss of life but also causing implications on road safety turned into a major challenge in the automobile industry. Among various reasons for road accidents drunk and drive and driver drowsiness are taking a major proportion, continuous monitoring of driver's alertness will help in minimizing the crashes. Driving while drowsy or in a drunk state are the two main reasons for traffic accidents and its related financial losses. Most countries cost 3% of their GDP due to road crashes and nearly about 1.35 million people die each year. In the case of India, India constitutes 1% of the vehicle population but 6% of total global road accidents and approximately 151 thousand road accident deaths. One of the primary agencies that conducts research on road and driver safety is the national highway traffic safety administration. In a study looking at critical reasons for road accidents 94% of car accidents are caused by drivers out of which 25 to 30% of accidents are caused due to drowsiness and drunk driving. Our idea uses alcohol and drowsiness detection in order to analyze the risk factor.Unique approach used in our idea is to only turn on the camera when someone is there or when alcohol is detected thus reducing the load on the microprocessor.

1.2 Problem statement

Title of Project: Drowsiness and alcohol detection using opencv and raspberry pi.

This project focuses on the problem of drink and drive and driving while being fatigued which increases the risk of road accidents. It will help in detection of these cases and after detection to report or to send messages to authority or to the emergency numbers set on the GSM module. It will also focus on accident detection and sending the message of help if there is an accident so that accident victims can get aid as fast as possible.

1.3 Objective

1. Based on the World road statistics India is ranked third in the world for number of road accidents .India sees around 4,50,00 road accidents every year out of which 1,50,000 die i.e with average fatality rate of 69.80% Which is a concerning fact as people which are involved in accident are from the age range of 18-45 which is upcoming generation of india.
2. This project will focus on detection of drowsiness and alcohol and will only allow a person driving a car to drive if the alcohol level is below allowed levels and there is no drowsiness detected by the camera module. It will also help truck and heavy vehicle drivers because they are generally fatigued due to long trips and this system will only allow them to drive if they are not tired. This device will help in making driving safe for everyone. This system can also be used with the GSM module to send the message to the numbers saved in case of an accident making it easier for emergency services to reach the accident destination.
3. Most of the accidents occur due to drink and drive to reduce these cases continuous detection of alcohol is done using alcohol detection sensors.

1.4 Brief Application areas

Health and Transportation : This project help peoples by preventing from fatal accidents by detecting alcohol consumption of driver and drowsiness of driver. If a driver consumed alcohol above a certain level or he/she feels drowsiness it can be detected by face detection and an alcohol sensor fitted inside the car and will not be allowed to drive the car so that unwanted road crash/accidents can be prevented and helpful for saving precious lives of people.

Technology:This project leads to more hands for updating the ideas and innovations in this sector leading to more safety for us and easy detection of faults or mistakes that can be avoided.

2. Literature Survey

2.1 Recent Trends in the project (Existing System)

2.2 Literature Survey

Sr. No.	Title of Paper	Publication details	Methodology	Limitation
1.	Drunk driving and drowsiness detection	2022 IEEE	For drowsiness detection, we will be concentrating on the Visual Feature-based approaches as it is proven to provide better results than physiological and driver behavior methods. Visual features consist of capturing Eye State, Head Position, Yawning. Drunk state detection would be done using an Alcohol sensor to detect whether the driver is drunk or not.	1. Due to continuous video input the processing speed of raspberry pi decreases very rapidly which makes the process inaccurate and laggy, increasing the load on this microprocesso r.
2.	Drowsiness detection	2019	Derived an optimal set of EEG features,	It is possible to perform drowsiness

	using portable wireless EEG	SCIENCE DIRECT	that give maximum detection rate for the drowsy state. In addition, heart rate was also recorded concurrently with EEG and correlation between heart rate and the EEG features corresponding to drowsiness was also studied.	detection using the Muse-2 headband by extracting three features derived from temporal electrodes of the headband.
3.	Driver Alcohol Detection System Based on Virtual Instrumentation	2019 SCIENCEDIRECT	The BAC threshold value is set by means of GUI. Also, the alcohol sensor requires a preheating time (tph). Than the user is expected to blow into the sensor during a certain time (tb), into a wait finite loop.The Arduino board will start reading the sensor data, the maximum value is determined and converted into voltage, outside the loop	The paper describes a breathalyzer based on Arduino Uno and virtual instrumentation, in the actual context of increasing interest in preventing drunk driving by self-testing.proposed embedded system is connected to the car's electronic system, when the driver is drunk the engine ignition system is disabled

4.	Prediction of level of drowsiness using an adaptive	2018 SCIENCE DIRECT	Compute a GBM model either once for the whole signal, or repeatedly for the sub-signal corresponding to each position of a fixed-length, sliding window extending up to the present.eyeglass-based photo oculographic system developed in our group that produces validated LoD signals	The very preliminary work reported here indicates that the GBM appears useful for predicting future LoD values, including adaptively using a moving estimation window.
5.	Alcohol and risky behavior in traffic among motorcyclists involved in accidents in a city.	2017 SCIENCEDIREC T	This was an exploratory cross-sectional study among injured drivers who were hospitalized in the traumatology department of the Restoration Hospital.	This study showed that, in the population studied, riding a motorcycle under the effects of alcoholic drinks was associated with other risky forms of behavior in traffic

2.3 Summary of Literature Survey

From the above literature review we came to know that various researches are done on alcohol detection and drowsiness detection by using EEG detection and visual features based operations by doing physiological and driver behavior methods. But these methods are not useful or not able to replace the detection by using Gas detection sensor so this may be an effective way and can be replaced over simple gas sensor as automatic detection and controlling.

3. **Specification**

Specifications for power supply

- 5V DC power supply (input:230V,50HZ output:5V DC)

2. **Specifications for sensor:**

1. **MCP3008(10 Bit 8 channel ADC):**

- 10-bit resolution
- Eight single-ended channels
- SPI interface
- ±1 LSB DNL
- ±1 LSB INL
- 200 ksps sample rate at 5V
- -40 to +85°C temperature range
- AEC-Q100 Grade 3

MCP3008 Datasheet

2. **MQ3 Sensor :**

- Power requirements: 5 VDC @ ~165 mA (heater on) / ~60 mA (heater off)
- Current Consumption: 150mA
- DO output: TTL digital 0 and 1 (0.1 and 5V)
- AO output: 0.1- 0.3 V (relative to pollution), the maximum concentration of a voltage of about 4V
- Detecting Concentration: 0.05-10mg/L Alcohol

- Interface: 1 TTL compatible input (HSW), 1 TTL compatible output (ALR)
- Heater consumption: less than 750mW
- Operating temperature: 14 to 122 °F (-10 to 50°C)
- Load resistance: 200kΩ
- Sensitivity S: Rs(in air)/Rs(0.4mg/L Alcohol)≥5
- Sensing Resistance Rs: 2KΩ-20KΩ(in 0.4mg/l alcohol)
- Dimensions: 32 x 22 x 16 mm
- 

3. Camera Module for raspberry pi:

- Fully Compatible with Both the Model A and Model B Raspberry Pi
- 5MP Omnivision 5647 Camera Module
- Still Picture Resolution: 2592 x 1944
- Video: Supports 1080p @ 30fps, 720p @ 60fps and 640x480p 60/90 Recording
- 15-pin MIPI Camera Serial Interface - Plugs Directly into the Raspberry Pi Board
- Size: 20 x 25 x 9mm
- Weight 3g
- Fully Compatible with many Raspberry Pi cases.

4. **Buzzer:**

- The frequency range is 3,300Hz
- Operating Temperature ranges from – 20° C to +60°C
- Operating voltage ranges from 3V to 24V DC
- The sound pressure level is 85dBA or 10cm
- The supply current is below 15mA

5. **Raspberry Pi 3B+ :**

- SoC: Broadcom BCM2837B0 quad-core A53 (ARMv8) 64-bit @ 1.4GHz
- GPU: Broadcom Videocore-IV
- RAM: 1GB LPDDR2 SDRAM
- Networking: Gigabit Ethernet (via USB channel), 2.4GHz and 5GHz 802.11b/g/n/ac Wi-Fi
- Bluetooth: Bluetooth 4.2, Bluetooth Low Energy (BLE)
- Storage: Micro-SD
- GPIO: 40-pin GPIO header, populated

- Ports: HDMI, 3.5mm analogue audio-video jack, 4x USB 2.0, Ethernet, Camera Serial Interface (CSI), Display Serial Interface (DSI)
- Dimensions: 82mm x 56mm x 19.5mm, 50g

Specification for final circuit.

1. **Ranges of respective sensor:**

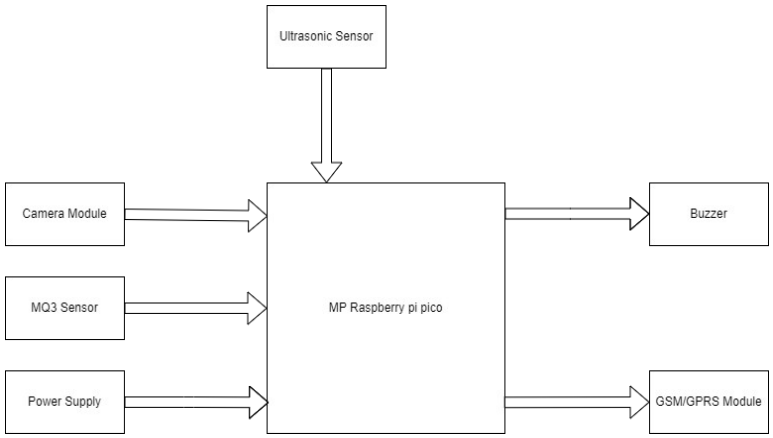
   MQ3 sensor:25 to 500ppm

4. Proposed Methodology

4.1 Introduction to the project

Based on the World road statistics India is ranked third in the world for number of road accidents .India sees around 4,50,00 road accidents every year out of which 1,50,000 die i.e with average fatality rate of 69.80%. Which is a concerning fact as people which are involved in accident are from the age range of 18-45 which is upcoming generation of india.Among various reasons for road accidents drunk and drive and driver drowsiness are taking major proportion, continuous monitoring of driver's alertness will help in minimizing the crashes.In study looking at critical reasons for road accidents 94% of car accidents are caused by drivers out of which 25 to 30% of accidents are caused due to drowsiness and drunk and drive.

4.2 block diagram



4.3 Selection Criteria for each block

1. MQ3 :
    1. It is available at low cost.
    2. It requires simple driver circuit.
    3. It offers higher sensitivity and hence offers fast response.
    4. It is very simple to use and easy to interface.
2. Raspberry pi :
    1. Low cost
    2. Huge processing power in a compact board
    3. Many interfaces (HDMI, multiple USB, Ethernet, onboard Wi-Fi and Bluetooth, many GPIOs, USB powered, etc.)
    4. Supports Linux, Python (making it easy to build applications)
    5. Readily available examples with community support
    6. Developing such an embedded board is going to cost a lot of money and effort

5. Design and Implementation

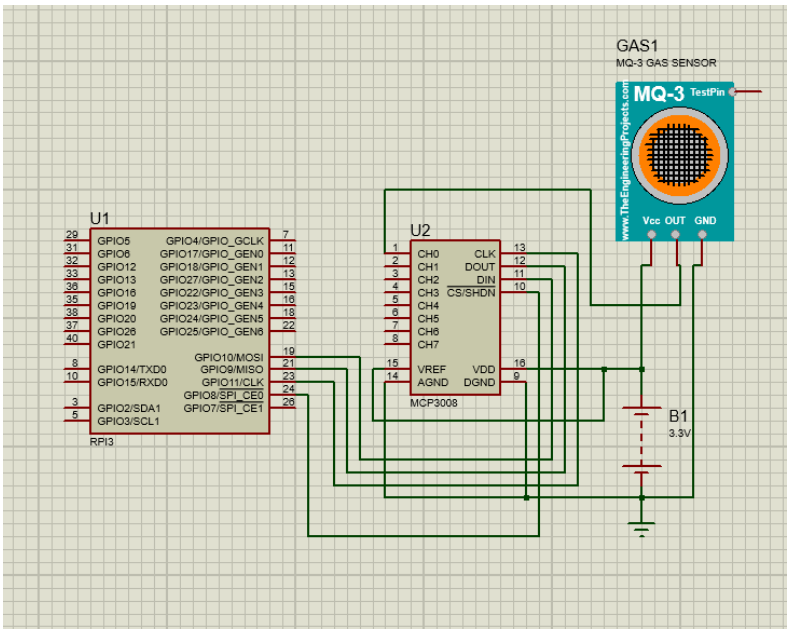
5.1 Design of power supply

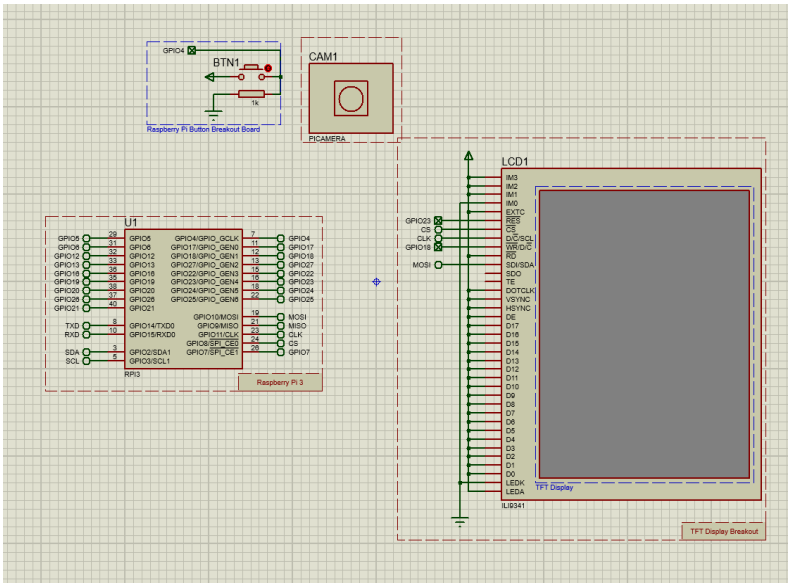
5.1.1 Design Calculation of power supply

- 5V-2A power supply for Raspberry pi 3B+.
- 3.3 V output pin of Raspberry pi for MCP3008 .
- 5 V output pin for MQ3 sensor.

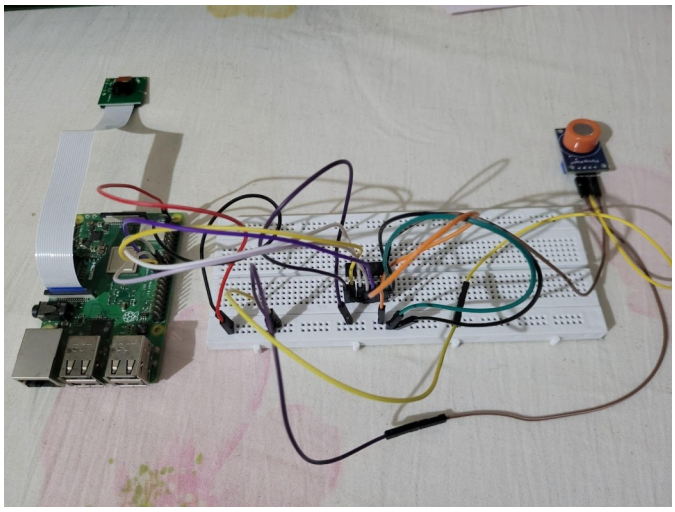
5.2 Design of main circuit

5.2.1 EDA Simulation result.


GAS1
MQ-3 GAS SENSOR
MQ-3
TestPin
Vcc OUT GND
U1
RPI3
U2
MCP3008
B1
3.3V


BTN1
CAM1
PICAMERA
U1
RPI3
LCD1
TFT Display
TFT Display Breakout

5.2.2 Testing and verification of circuit.



5.3 implementation.

DESCRIPTION:

Face detection :

The proposed system will start by capturing the video frames one by one. OpenCV provides extensive support for processing live videos. The system will Sdetect the face in the frame image for each frame. This system uses Viola-Jones object detector which is a machine learning approach for visual object detection (Paul Viola, 2004 and Paul Viola, 2001). This is achieved by making use of the Haar algorithm for face detection. Haarcascade is a well-known robust feature-based algorithm that can detect the face image efficiently. With the use of uses of cascade of stages, Haar algorithm able to remove the candidates that are nonface. And each stage consists of combination of different Haar features and each feature in turn is classified by a Haar feature classifier.

The inbuilt OpenCV "haarcascade_frontalface_68landmark.xml" file is used to search and detect the face in individual frames. This file contains a number of features of the face and constructed by using a number of positive and negative samples. First load the cascade file then pass the acquired frame to an edge detection function, which detects all the possible objects of different sizes in the frame. Since the face of the driver occupies a large part of the image, instead of detecting objects of all possible sizes, specify the edge detector to detect

only objects of a particular size i.e. for face region. Next, the output the edge detector is stored and this output is compared with the cascade file to identify the face in the frame. The output of this module is a frame with face detected in it. Only disadvantage in Haar algorithm is that it cannot extrapolate and does not work appropriately when the face is not in front of the camera axis. Once the face detection function has detected the face of the driver, the eyes detection function tries to detect the driver's eyes.

Eye + Drowsiness detection :
To extract the facial landmarks of drivers, Dlib library was imported and deployed in our application. The library uses a pre-trained face detector, which is based on a modification to the histogram of oriented gradients and uses linear SVM (support vector machine) method for object detection. Actual facial landmark predictor was then initialized and facial landmarks captured by the application were used to calculate distance between points. These distances were used to compute EAR value . EAR is defined as the ratio of height and width of the eye and was computed using equation 1. The numerator denotes the height of the eye and the denominator denotes the width of the eye and the details of the all the landmarks of eye are depicted by $EAR = (|p2 - p6| + |p3 - p5|)/ 2* |p1-p4|$ -(1) .
Landmarks of Eye in EAR Referring equation 1, the numerator calculates the distance between the upper eyelid and the lower eyelid. The denominator represents the horizontal distance of the eye. When the eyes are open, the numerator value increases, thus increasing the EAR value, and when the eyes are closed the numerator value decreases, thus decreasing the EAR value. In this context, EAR values are used to detect driver's drowsiness. EAR value of left and right eyes is calculated and then average is taken.

6. Results

Simulation Results

6.1 Simulation Software tool Introduction

Proteus is used to simulate, design and drawing of electronic circuits. It was invented by the Labcenter electronic. By using proteus you can make two-dimensional circuits designs as well.With the use of this engineering software, you can construct

and simulate different electrical and electronic circuits on your personal computers or laptops. There are numerous benefits to simulate circuits on proteus before make them practically.

6.2 Simulation Software tool features

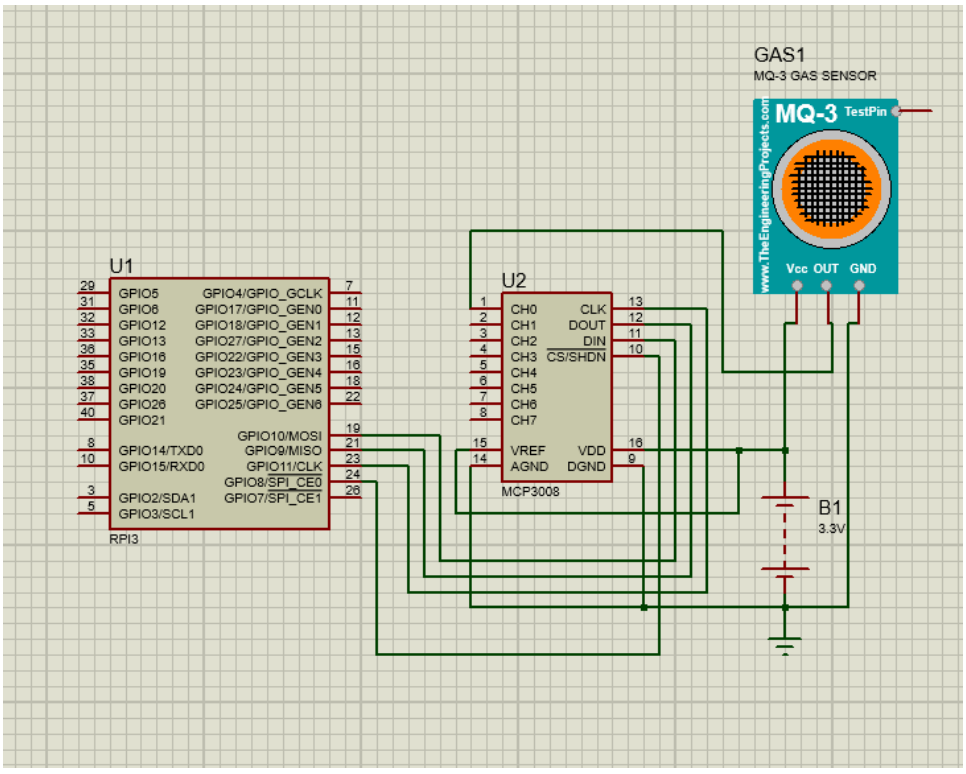
There are 2 main parts of proteus first is used to design and draw different circuits and the second is for designing of PCB layout.

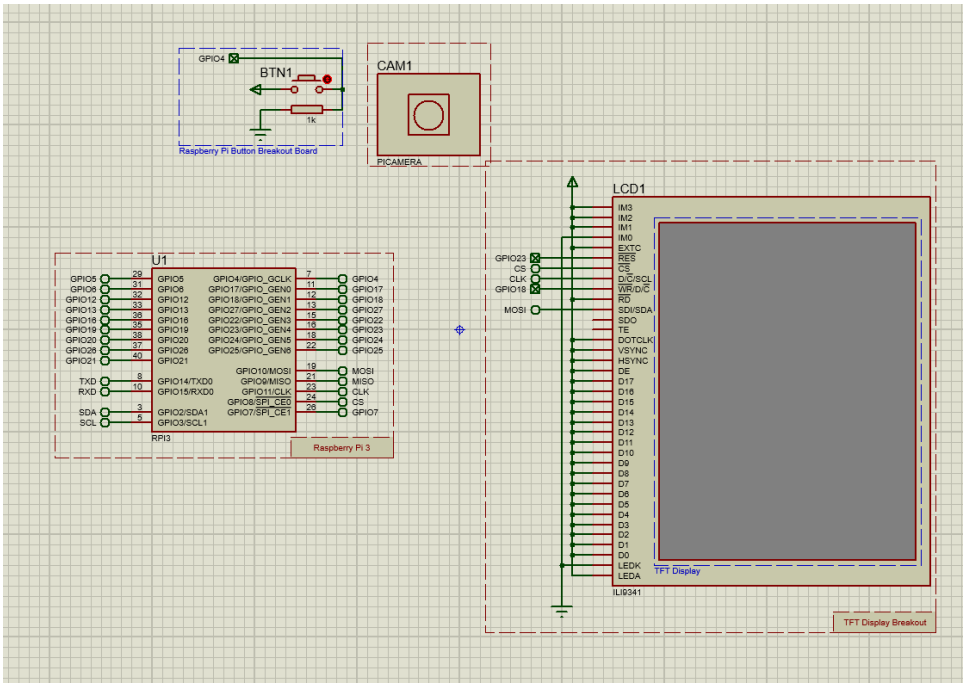
- First is ISIS that used to design and simulate circuits. And second is ARES that used for designing of a printed circuit board.
- It also provides features related to the three-dimensional view of design in PCB.

6.3 Simulation Software tool Procedure used for project

In order to simulate this project in proteus the custom libraries and flowchart mode was used. MQ3 sensor library which is an Adafruit library is imported by using import function of proteus software camera module was taken from peripherals tab of flowchart mode. As Proteus won't allow interfacing of both camera module and alcohol sensor in a single project file we are testing alcohol sensor in a different file combined with the MCP3008 8channel 10 Bit ADC.

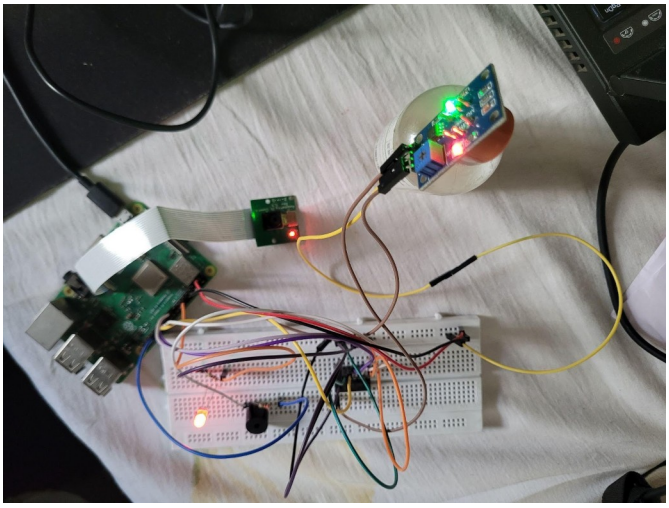
6.4 Simulated results (include snapshots)


GAS1
MQ-3 GAS SENSOR
MQ-3
TestPin
Vcc OUT GND
www.TheEngineeringProjects.com
U1
GPIO5
GPIO6
GPIO12
GPIO13
GPIO16
GPIO19
GPIO20
GPIO26
GPIO21
GPIO14/TXD0
GPIO15/RXD0
GPIO2/SDA1
GPIO3/SCL1
GPIO4/GPIO_GCLK
GPIO17/GPIO_GEN0
GPIO18/GPIO_GEN1
GPIO27/GPIO_GEN2
GPIO22/GPIO_GEN3
GPIO23/GPIO_GEN4
GPIO24/GPIO_GEN5
GPIO25/GPIO_GEN6
GPIO10/MOSI
GPIO9/MISO
GPIO11/CLK
GPIO8/SPI_CE0
GPIO7/SPI_CE1
RPI3
U2
CH0
CH1
CH2
CH3
CH4
CH5
CH6
CH7
AGND
CLK
DOUT
DIN
CS/SHDN
VREF
VDD
DGND
MCP3008
B1
3.3V

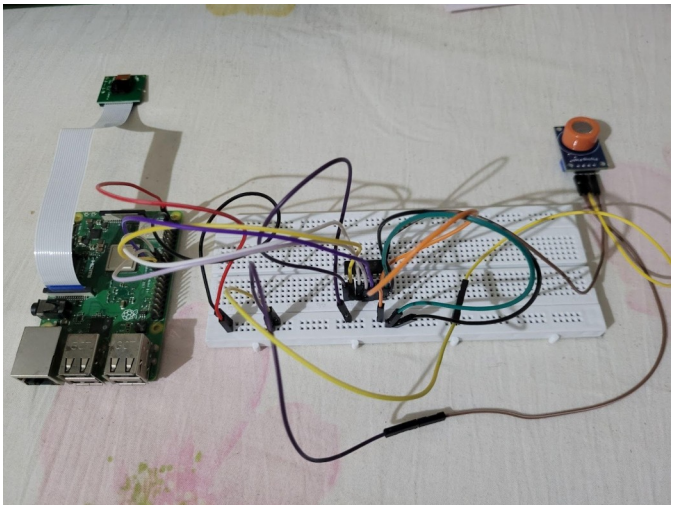

GPIO4
BTN1
1k
Raspberry Pi Button Breakout Board
CAM1
PICAMERA
U1
RPI3
Raspberry Pi 3
LCD1
GPIO23
CS
CLK
GPIO18
MOSI
TFT Display
ILI9341
TFT Display Breakout

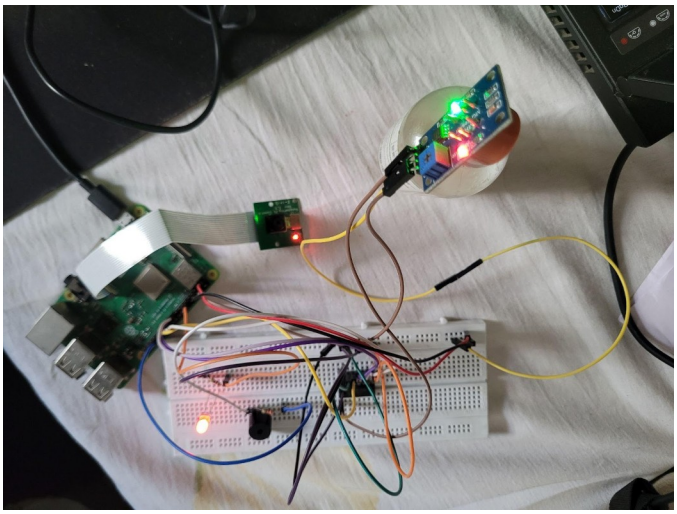
6.5
Hardware Results

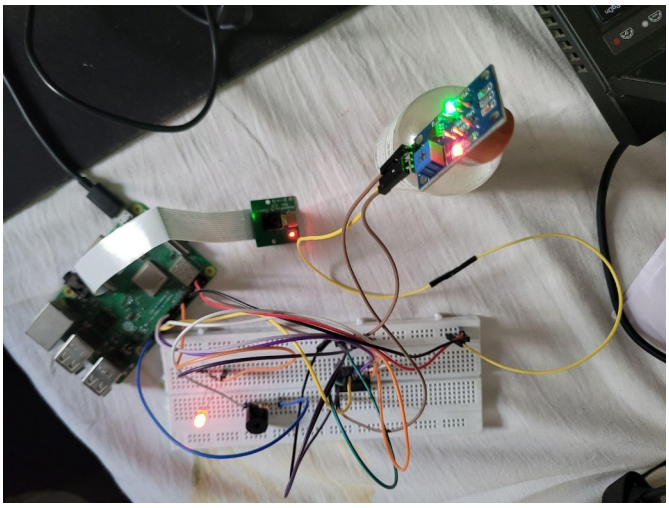
6.6 Sensor Circuit Testing (Brief Description + Snapshots

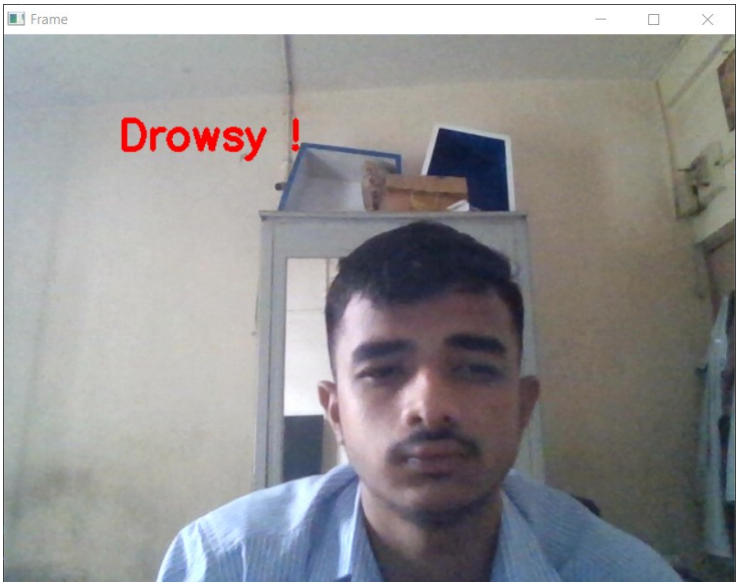


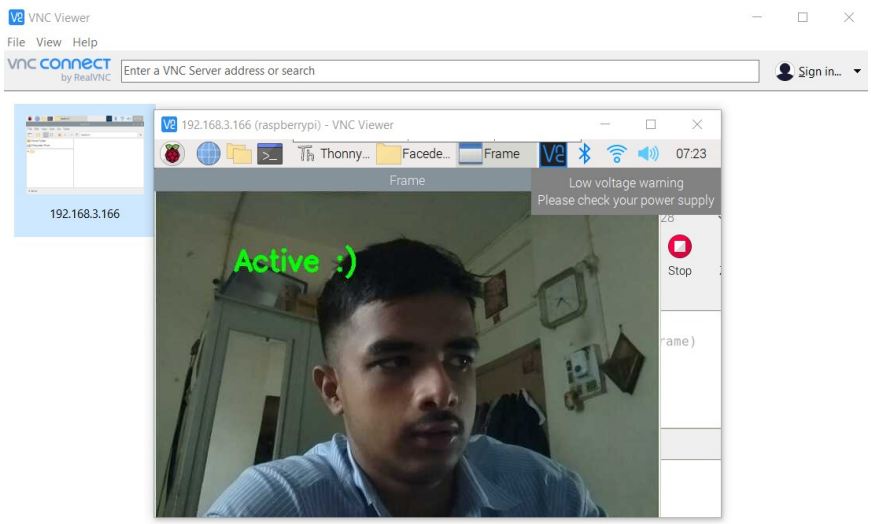
6.7 Full Hardware Results(Brief Description + Snapshots)








Frame
Drowsy !


VNC Viewer
File View Help
vnc connect by RealVNC
Enter a VNC Server address or search
Sign in...
192.168.3.166
192.168.3.166 (raspberrypi) - VNC Viewer
Thonny...
Facede...
Frame
07:23
Frame
Low voltage warning
Please check your power supply
Active :)
Stop

7. Conclusion

- **Conclusion**

The project is useful in day to day life for small transportation workers to higher authorities' security purposes. By using this project one can detect whether the driver consumed alcohol or not and whether he is sleepy or not if find anything wrong then it will not allow the driver to drive the car and hence we can prevent accidents. Also this project uses alcohol sensor and raspberry pi which are economical and user friendly and can be easily fitted inside a vehicle without consuming large space so car manufacturers also work on pros and cons of this project.So by implementing this project it will be beneficial for society and for technological aspects too.

- Future Scope

To decrease the risk of accident and human loss faced by drivers while driving .

1. Try to provide the data to reduce the further risk of accidents and to find solutions for them.
2. To provide easy aid for the victims of accidents.
3. It can be further incorporated with different transducers present inside the car to further reduce the risk of accident.

- Applications

Health and Transportation : This project help peoples by preventing from fatal accidents by detecting alcohol consumption of driver and drowsiness of driver. If a driver consumed alcohol above a certain level or he/she feels drowsiness it can be detected by face detection and an alcohol sensor fitted inside the car and will not be allowed to drive the car so that unwanted road crash/accidents can be prevented and helpful for saving precious lives of people.

Technology: This project leads to more hands for updating the ideas and innovations in this sector leading to more safety for us and easy detection of faults or mistakes that can be avoided.

8. Bill of Material

Sr. No.	Material	Quantity	Price in Rs.
1	Raspberrypi ZERO	1	1200
2	Ultrasonic Sensor	1	60
3	Camera Module	1	300
4	MQ3 Gas sensor	1	300
5	GSM/GPRS Module	1	300
	Total		+-=

9. References

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5. Ebrahim Babaei Varnosfaderani, P.; Verly, J.G. (2017). *Prediction of level of drowsiness using an adaptive geometric brownian motion model, with application to drowsy driving accident prevention. Sleep Medicine, 40(), e86–.* doi:10.1016/j.sleep.2017.11.247

Appendix I : Datasheets

HANWEI ELETRONICS CO.,LTD MQ-3 http://www.hwsensor.com

TECHNICAL DATA MQ-3 GAS SENSOR

FEATURES

* High sensitivity to alcohol and small sensitivity to Benzine .
* Fast response and High sensitivity
* Stable and long life
* Simple drive circuit

APPLICATION

They are suitable for alcohol checker, Breathalyser.

SPECIFICATIONS

A. Standard work condition

Symbol	Parameter name	Technical condition	Remarks
Vc	Circuit voltage	5V±0.1	AC OR DC
V_H	Heating voltage	5V±0.1	ACOR DC
R_L	Load resistance	200KΩ	
R_H	Heater resistance	33Ω ±5%	Room Tem
P_H	Heating consumption	less than 750mw	

B. Environment condition

Symbol	Parameter name	Technical condition	Remarks
Tao	Using Tem	-10℃-50℃	
Tas	Storage Tem	-20℃-70℃	
R_H	Related humidity	less than 95%Rh	
O_2	Oxygen concentration	21%(standard condition)Oxygen concentration can affect sensitivity	minimum value is over 2%

C. Sensitivity characteristic

Symbol	Parameter name	Technical parameter	Remarks
Rs	Sensing Resistance	1MΩ - 8 MΩ (0.4mg/L alcohol)	Detecting concentration scope: 0.05mg/L—10mg/L Alcohol
Ω (0.4/1 mg/L)	Concentration slope rate	≤0.6	
Standard detecting condition	Temp: 20℃±2℃ Humidity: 65%±5%	Vc:5V±0.1 Vh: 5V±0.1	
Preheat time	Over 24 hour		

D. Structure and configuration, basic measuring circuit

	Parts	Materials
1	Gas sensing layer	SnO_2
2	Electrode	Au
3	Electrode line	Pt
4	Heater coil	Ni-Cr alloy
5	Tubular ceramic	Al_2O_3
6	Anti-explosion network	Stainless steel gauze (SUS316 100-mesh)
7	Clamp ring	Copper plating Ni
8	Resin base	Bakelite
9	Tube Pin	Copper plating Ni

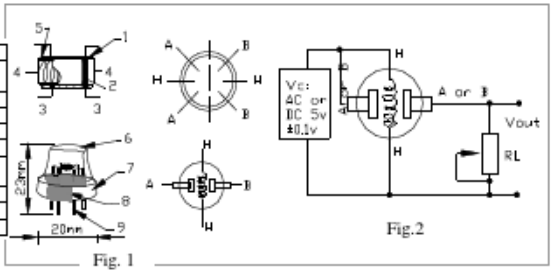
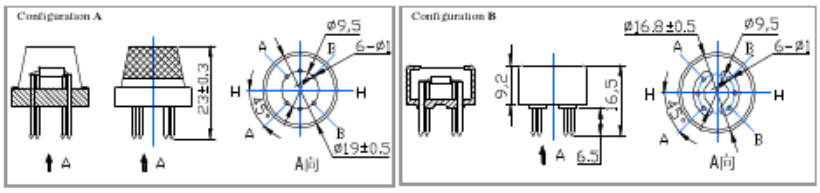


Fig.2

Fig. 1



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