Drowsiness Detection and Alert

Parth Mehta[1], Yash Jain[1], Rajit Subin[1], Harsh Gohil[1], Anuj Sardesai[1] , Poonam Kadam[2]

1. U.G. Student, Electronics and Telecommunication Department, DJSCOE, Vile-Parle (W), Mumbai –400056.
2. Asst. Professor, Electronics and Telecommunication Department, DJSCOE, Vile-Parle (W), Mumbai–400056.

***Abstract*— With the increasing number of accidents occurring due to driver's drowsiness and alcoholic intoxication there was a need to develop a system which can prevent such accidents. In this project we demonstrate a real time alcohol and drowsiness detection and alert system which can be incorporated in vehicles to reduce the chances of an unfortunate accident occurring. At first, when the driver enters the car he/she must blow into an alcohol detector (MQ-3) which records the alcohol intoxication by the driver if any. If the level of intoxication is above the permissible levels, the driver won't be able to start the engine. If the level of intoxication is within the permissible limits, the driver is then able to start the engine and the drowsiness detection of the driver is initiated. The drowsiness is detected using an image processing technique by a Raspberry Pi 3 and a USB webcam. The USB webcam continuously records the face of the driver and obtains the facial landmarks which is used to calculate the eye aspect ratio (EAR) of the driver. If the (EAR) is below a particular threshold level, the Raspberry Pi will indicate that the driver is drowsy and sound a buzzer to alert the driver. Along with the sounding of a buzzer the speed of the vehicle will be reduced to 50% of the current speed gradually and the parking lights of the vehicle will be switched on to alert the passerby drivers. Also, we have used a GSM module and a GPS module which are used to send the live coordinates of the driver to the driver's family/friends if the driver is intoxicated by alcohol or is drowsy to ensure that he/she gets help. The MQ-3 sensor, GPS and GSM module are interfaced with an Arduino UNO for an easier working of the project. With this project we aim to reduce a significant amount of vehicle accidents and thereby enhancing the safety of the driver.**

***Keywords*— Drowsiness detection, MQ-3 sensor, Image processing, Raspberry Pi 3, USB webcam, Eye Aspect Ratio (EAR), buzzer, GSM module, GPS module.**

I. INTRODUCTION

Nowadays, road accidents are increasing at an alarming rate and therefore major technologies are being adapted to bring them to a bare minimum. A major chunk of these accidents are caused due to driver's drowsiness or driver's alcoholic intoxication.

In 2018 itself around 10% of the total road accidents in India were caused due lack of sleep and fatigue and around 2% of the accidents were caused due to alcoholic intoxication and driving. It is a very exciting challenge to detect driver's drowsiness using image processing that would help prevent accidents. In past various efforts have been made to detect the driver's drowsiness and alcoholic intoxication. In the past 2 decades itself, various countries have started showing interest in automobile safety. Majority of the times even if the vehicles manufactured are flawless, it's the negligence of the driver which cause deadly accidents. Driver's loose the control of their vehicle while sleepy or under alcoholic intoxication which causes a threat to them as well as the ones near them. The technologies to prevent such accidents are implemented only in luxurious cars which are quite expensive. Therefore, the goal of this project is to develop a cost effective real time alcohol and drowsiness detection and alert system.

II. LITERATURE SURVEY

Driver fatigue and alcohol consumption have been one of the major causes of thousands of accidents every year.

[1] It is difficult to accurately tell the exact number of driver fatigue and alcohol consumption related accidents but department of traffic survey shows that driver fatigue may be a contributory factor in up to 20% and due to alcohol drinking it is about 31% of all the road accidents. This project aims to build a prototype of a vehicle accident prevention system which can reduce a significant percentage of the accidents occurring and thereby save lives of a lot of people. The entire project is divided into 2 parts namely alcohol detection and alert and drowsiness detection and alert.

[2] The first part of the project is the alcohol detection of the driver. This is done to determine whether the driver is in a conscious state to drive the vehicle or no. We've used a MQ-3 alcohol sensor to determine the alcohol content in a person's body. This sensor analyzes the amount of alcoholic vapors and indicates the amount of alcohol present. This device is more commonly referred to as a breath analyzer; as it analyzes the alcohol content from a person's breath. The device is mostly used by law enforcement to determine whether an individual has been driving under the influence of alcohol. Once the alcohol is detected the GSM and GPS

modules are used to send the exact location of the driver to the friends and family.

[3] The design is based on computer vision and image processing application principles. For the detection of drowsiness, it detects the landmarks of the eyes. After obtaining the landmarks of the eyes, the eye closing rate of the person is determined. Haar feature based cascade classifier method is used for closed eye detection. If the eye is continuously closed for a certain amount of frames, the driver is alerted to pay attention on the road.

III. HARDWARE REQUIREMENTS

3.1. Raspberry Pi 3

Raspberry pi 3 is the size of a credit card, designed for education. It was inspired by the BBC micro (1981). It has 40 GPIO pins. It has four inbuilt USB ports. These ports are used to connect mouse, keyboard, display or anything else you want to connect to the raspberry pi. Power can be supplied to the raspberry pi by plugging any USB power supply into the micro USB port. It has a Broadcom BCM2837 SoC. This makes raspberry pi 3 50% faster than Raspberry Pi 2. It comes with a 1.2 GHz Broadcom VideoCore IV GPU.

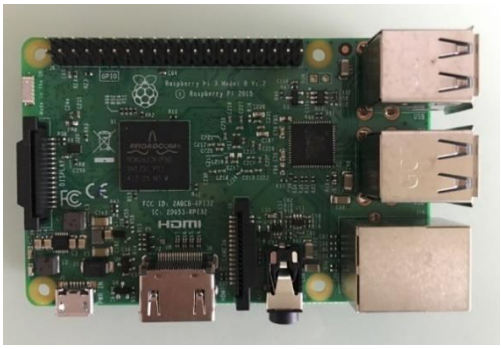

Fig 1. Raspberry Pi 3

3.2. Arduino UNO

It is an open-source microcontroller board based on the Microchip ATmega328P. The board is comprised of sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards and other circuits. The board has 14 Digital pins, 6 Analog pins, and 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 9volt battery, though it accepts voltages between 7 and 20 volts.

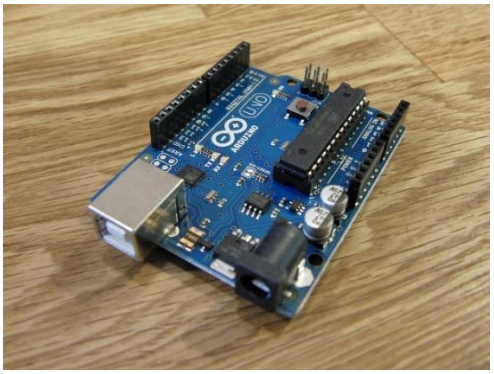

Fig 2. Arduino UNO

3.3. Ethanol detector

The sensitive material in MQ-3 gas sensor is SnO2. It has lower conductivity in clean air. When the gases of alcohol exist, the sensor's conductivity gets higher along the gas concentration ring. Before its use it is supposed to be preheated for at least two minutes. Its output can be obtained in analog as well as digital form.

Fig 3. Ethanol detector

3.4. USB Camera

In this system, the video acquisition is considered as first stage of the drowsiness detection because without the image processing drowsiness cannot be detected. It is the process of getting a video from source, usually using a camera. The image obtained is taken as it is i.e. it is the actual video.

Fig 4. USB Camera

3.5. Buzzer and DC motor

It is an electrical device which produces a buzzing sound when programmed to. It is a class of machine which converts electrical power to mechanical power. It has been added to the project to demonstrate the gradual slowing down of the vehicle when drowsiness is detected.

Fig 5. Buzzer

Fig 6. DC motor

3.6. GSM SIM 300

GSM (Global System for Mobile communications) is a standard developed by the European Telecommunications Standards Institute (ETSI) to describe the protocols for second-generation (2G) digital cellular networks used by mobile devices such as mobile phones and tablets. It has been added to the project particularly to send the location coordinates got by the GPS (Global Positioning System) module. SIM 300 is a GSM modem with a simple serial interface. SIM 300 modem can accept any GSM network operator SIM card and act just like a mobile phone with its own unique phone number. With this module one can send/receive sms, connect to internet via GPRS and receive calls. The modem can either be connected to PC serial port directly or to any microcontroller.

Fig 7. GSM SIM 300 Module

3.7. GPS Neo 6M

The Global Positioning System (GPS), originally Navstar GPS, is a satellite-based radio navigation system owned by the United States government and operated by the United States Air Force. It is a global navigation satellite system that provides geolocation and time information to a GPS receiver anywhere on or near the Earth where there is an unobstructed line of sight to four or more GPS satellites. Obstacles such as mountains and buildings block the relatively weak GPS signals. It is used in the project to send the live co-ordinates of the driver using the GSM module.

Fig 8. GPS Neo 6M Module

IV. BLOCK DIAGRAM/WORKING

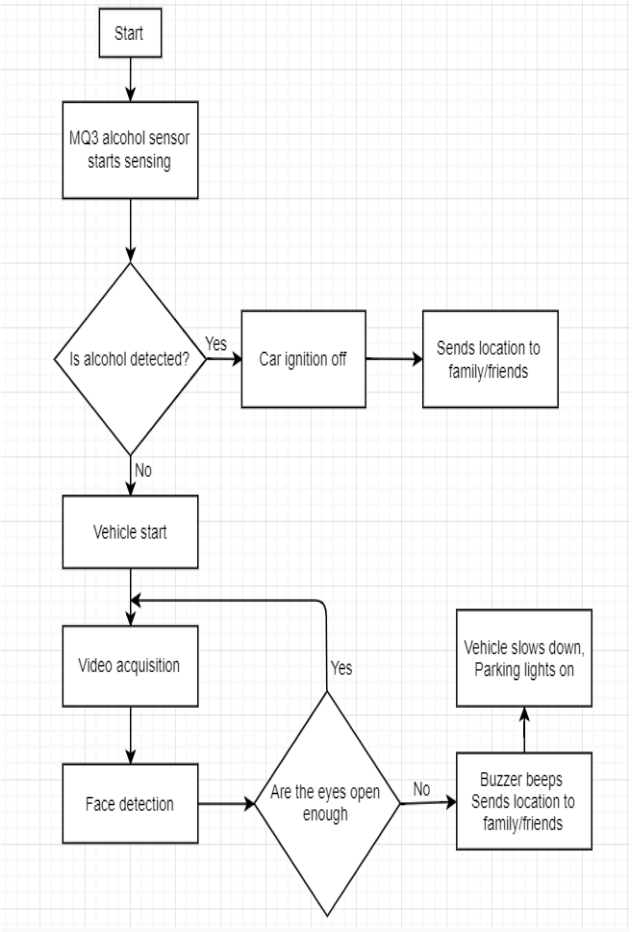

Fig 9. Methodology

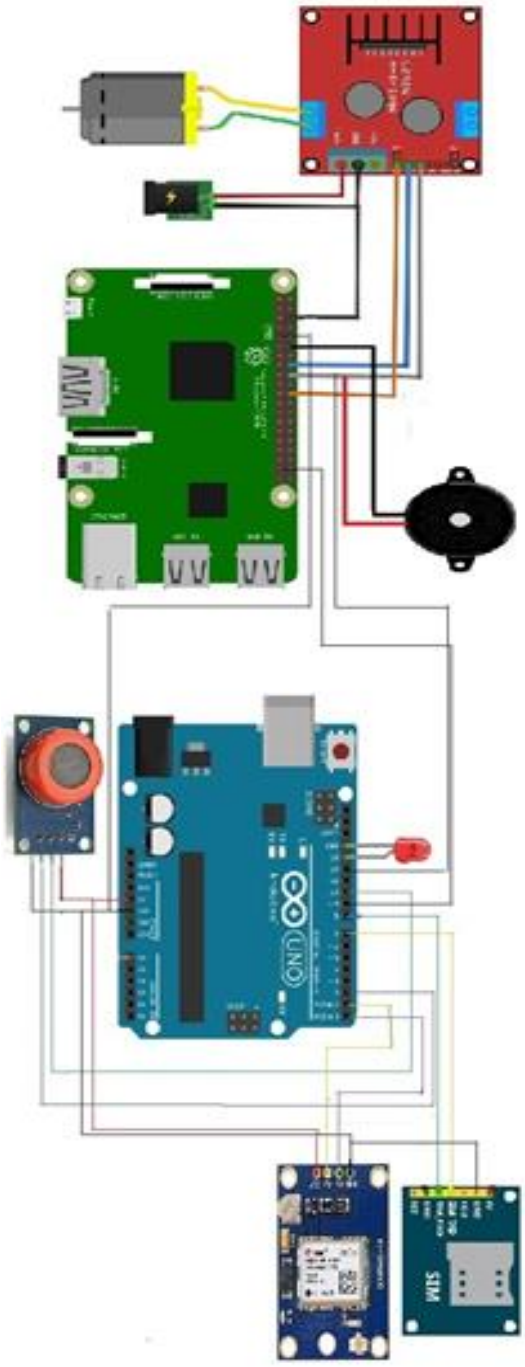

Fig 10. Interfacing all the components of the proposed model with Raspberry Pi 3 and Arduino UNO.

4.1. Alcohol consumption detection

The alcohol detector is controlled by an Arduino UNO. As the driver enters the vehicle he/she is supposed to blow into the MQ-3 ethanol detector. The MQ-3 sensor senses the vapors of alcohol if any. If the output value of the sensor is within the permissible levels of alcohol intoxication, he/she will be able to start the vehicle engine without any interruption. If the value at the senor is above the permissible levels of alcohol intoxication, the driver won't be able to start the engine of the vehicle. As the driver is not fit to drive the vehicle we send the exact coordinates of the driver received from the GPS module to his/her family/friends using the GSM SIM 300 module. If in case the driver does not blow into the ethanol detector, he/she won't be able to start the engine of the vehicle.

4.2. Drowsiness detection

Once the alcohol consumption detection has been implemented successfully, the drowsiness detection gets started. The USB webcam starts recording the face of the driver continuously and detects the eye using Haar feature based cascade classifier of the OpenCV library. The facial landmarks are detected using the Dlib library. Once, the facial landmarks are obtained it focuses on getting the landmarks of the eyes.

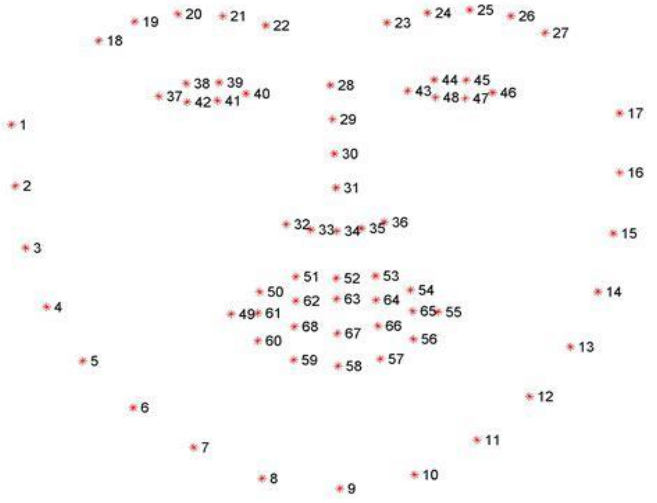

Fig 11. Facial landmarks

This is used to calculate the eye aspect ratio (EAR) which is used to determine whether the driver is drowsy or not. The EAR is calculated from the landmarks of the eye using the following formula.

$$\text{EAR} = \frac{||P2-P6|| + ||P3-P5||}{2||P1-P4||}$$

The EAR has a particular threshold value. If the EAR is below the threshold value for a certain number of frames, the driver will be declared as drowsy and a buzzer will start sounding until the driver opens his/her eyes again.

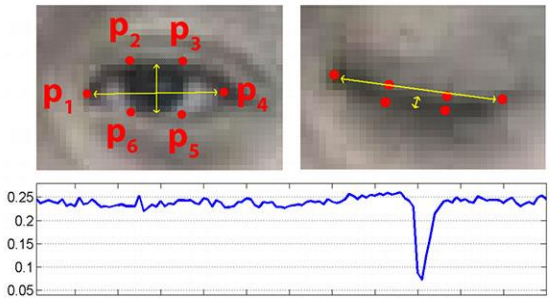

Fig 12: Visualization of eye landmarks when eyes are open and closed. Graph plotting EAR over time.

Along with the buzzer, to keep the driver safe the speed of the vehicle will be gradually reduced to 50% of the current value and the parking lights will be turned on to alert the nearby drivers. To enhance the safety of the driver more, the current location obtained by the GPS module is send through the GSM SIM 300 to the family/friends of the driver and help the driver if possible by calling them or by reaching them. Thereby increasing the safety of the driver.

V. CONCLUSION AND FUTURE SCOPE

Finally, we conclude that the number of accidents or the percentage of such accidents can be reduced by implementing such an accident prevention system or some similar technologies in every vehicle. Therefore, we have designed a cost effective, compact, real time driver alcohol consumption and drowsiness detection and alert system which is easy to be implemented in a particular vehicle. This entire system being very cost effective can be feasible for a wide range of vehicles. Moreover, the number of accidents can go lower if the normal people understand the dangers related to drunk driving and driving while sleepy. Therefore, we must try to create awareness among the people to avoid such careless situations.

Since the past decade most of the countries are trying to increase their automobile safety by implementing various technologies. Currently only the luxurious cars provide such an inbuilt accident prevention system in their cars, but these cars are expensive. Hence, the normal people cannot afford it. This system provides a very cost effective and efficient alternative to be implemented in cars for the common people. Thereby protecting a lot of lives.

VI. RESULT

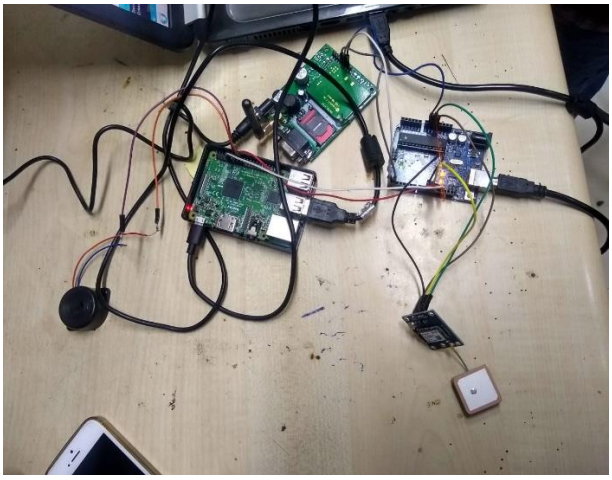

Fig 13: Implemented circuit of the project

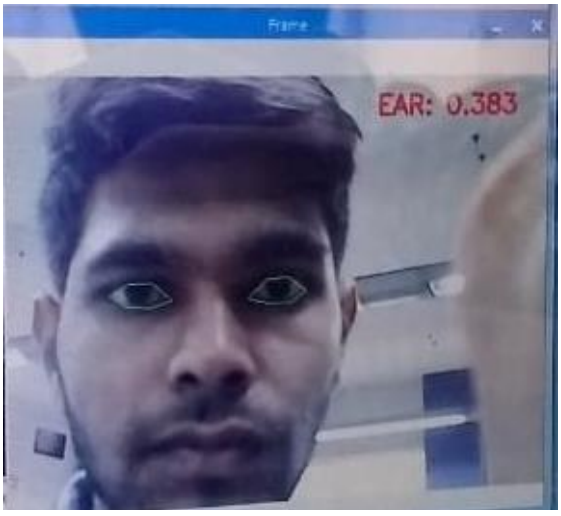

Fig 14: Live video recorded by the USB camera used to calculate the eye aspect ratio (EAR).

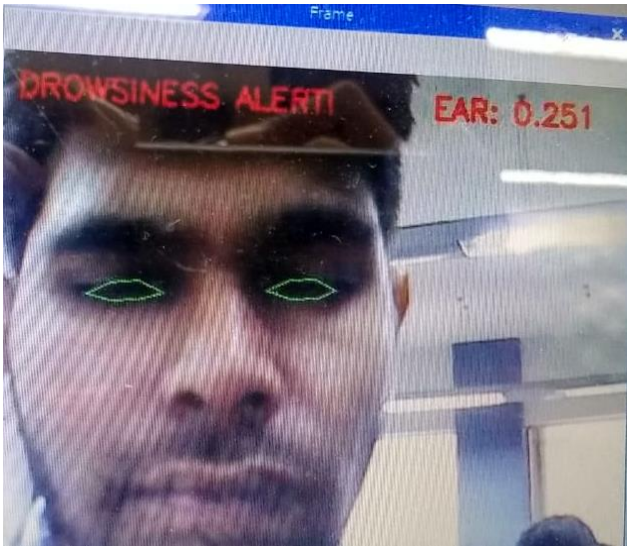

Fig 15: Alerts the driver when the EAR goes below the threshold value.

VII. REFERENCES

[1]. Dwipjoy Sarkar and Atanu Chowdhury, "A Real Time Embedded System Application for Driver Drowsiness and Alcoholic Intoxication Detection", International Journal of Engineering Trends and Technology (IJETT).

[2]. Vaishnavi.M and Umadevi.V, " Intelligent alcohol detection for car", International Journal of Scientific & Engineering Research (IJSER)

[3]. P. Viola, M. Jones, "Rapid object detection using a boosted cascade of simple features," Proceedings of the 2001 IEEE Computer Society Conference on Computer Vision and Pattern Recognition.

[4]. Anu K L, "Design and implementation of driver assistance", International Journal of Research in Engineering & Advanced Technology.

[5]. Prof. Saurabh Thakur, Shekhar Dure, Ajinkya Khutwad," Advance Vehicle Control and Safety Using Face Detection", International Journal of Advance Research In Science and Engineering(IJARSE).

[6]. Ashish Naire "Raspberry Pi Based Drowsiness Detection System" International Journal & Magazine of Engineering, Technology, Management and Research.