Implementation of Driver Drowsiness and other Features using Arduino and Raspberry PI

Megha.A[1] Kavya.S[2] Akshatha.C.Tilagar[3] Divya.D.V[4] Prof. Vanishree Abhay[5]
[1,2,3,4]Student [5]Assistant Professor
[1,2,3,4,5]Dr. Ambedkar Institute of Technology, India

Abstract— Drowsiness, drunken driving, mobile usage causes the road accidents. This paper proposes a real time detection of driver's drowsiness as well as detects alcohol intoxication, mobile usage and subsequently alerting them and this paper also detects the pothole and alerts when an accident is occurred. The main aim of this proposed system is to reduce the number of accidents due to driver's Drowsiness and alcohol intake to increase the transportation safety. The proposed system detects the driver's drowsiness and if detected alert will be given through buzzer, if the driver doesn't wakes up then vehicle slows down and moves to left and will be stopped. This system is also designed to detect the pothole, mobile usage, alcohol intoxication and accident and it subsequently alert the driver. This system also detects the behavior of the driver through the sensors whether he/she drowsy/drunk, the speed vehicle is stopped. This system is more securable reliable and economical.

Key words: Drowsiness Detection by Eye Open and Closure Rate, Alcohol Intoxication Detection, Mobile Usage Detection, Accident Detection, Pothole Detection

I. INTRODUCTION

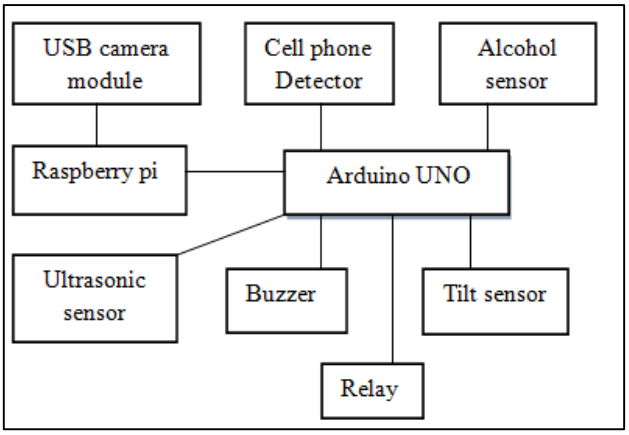
Most of the road accidents are caused because of drowsiness and drunk driving and also working environments, reduced sleep and time factor. Driver drowsiness and fatigue drunk driving reduces the driver decision making capability and perception level. And even if driver is using is mobile while driving his full interest will be not on driving which may be another cause for accident. These situations affect the ability to control the vehicle. There are some techniques which are used to detect drowsiness in drivers like by sensing of driver operation or physiological characteristics of driver like or vehicle movement etc. 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 road accidents. The primary purpose of this drowsiness and alcohol detection system is to develop a system that can reduce the number of accidents from drowsiness and drunk driving of vehicle. And this system is also designed to find the pothole, mobile usage and accident detection. The proposed system makes use of the IOT device as Raspberry Pi 3 Model B as a core. It mainly includes alcohol concentration detection sensor, facial recognition to safeguard the drowsy driver. We use different type of safeguarding things such as Triggering an alarm and Automatic ignition off etc. With the growing population the use of vehicles has become superfluous and this has led to the accidents increasing at an alarming rate resulting in a large loss of property and human life. This project aims at finding the occurrence of any accident and alerting them via buzzer

In the first part of the this project is detection of drowsiness ,for that we use a camera for detecting image or face, Eye detection is the important part of this project will be done using OpenCV.The Input 8 megapixel camera, which is capable of capturing real time images and video. The captured frame is to be processed by Raspberry pi. Raspberry pi algorithm is implemented using Python. Eye close detection is based on Haar cascade classifier and canny edge detection technique and performs several comparisons from a database of positive value and negative value of images and returns a red border rectangle over the detected area on matching. Eye closing rate is calculated after each 10 seconds, and if it crosses a predefined threshold value, then Raspberry pi sends a high pulse signal serially to its slave device Arduino Uno. On receiving the high pulse signal, the arduino performs a set of tasks like slowing down the vehicle speed and parking it to left side of the road. On the other hand alcohol sensor (MQ-3) is work as a breathalyzer and calculate blood alcohol content (BAC) from breath alcohol content (BrAC).The arduino is interface with MQ-3, buzzer, ultrasonic sensor, tilt sensor,relay.Arduino continuously checks alcohol content present in the air and also computes blood alcohol content in Percentage from it. If the calculated %BAC crosses the threshold limit, at that time it will get alarm through buzzer and will turn off the relay. And if the accident is caused the system will give indication to the people around through buzzer using the tilt sensor.

With the increase in world's population, there has been increasing load on the infrastructure. Roads have been flooded with the vehicular traffic. It has become increasingly difficult to manage this traffic. This is the prime motivation behind making a vehicle intelligent enough to aid driver in various aspects.

One of the increasing problems the roads are facing is worsened road conditions. Because of many reasons like rains, oil spills, road accidents or inevitable wear and tear make the road difficult to drive upon. Unexpected hurdles on road may cause more accidents. Also because of the bad road conditions, fuel consumption of the vehicle increases; causing wastage of precious fuel. Because of these reasons it is very important to get the information of such bad road conditions, Here we propose design of pothole detection which assists the driver in avoiding potholes on the roads, by giving him prior warnings. Warnings can be like buzzer if the driver is approaching a pothole. This system senses the pothole from a distance and slows down the speed of the vehicle which avoid vehicle's from shocks, suspension and accidents.

II. BLOCK DIAGRAM



A. Arduino UNO

Fig. 2: Arduino UNO development board

Arduino is an open source project that created microcontroller based kit interactive objects that can sense and control physical devices. Arduino is a prototype platform based on an easy-to-use hardware and software. It consists of a circuit board, which can be programmed (referred to as a microcontroller) and a ready-made software called Arduino IDE (Integrated Development Environment), which is used to write and upload the computer code to the physical board. Arduino provides a standard form factor that breaks the functions of the micro-controller into a more accessible package.

In Arduino Uno (represented in Figure.2),"Uno" means one in Italian and is named to mark the upcoming release of Arduino 1.0 version. The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega8U2 programmed as a USB-to-serial converter.

1) Advantages of Arduino Technology are

It is cheap. It comes with an open supply hardware feature that permits users to develop their own kit. The software of the Arduino is well-suited with all kinds of in operation systems like Linux, Windows, and Macintosh, etc. It also comes with open supply software system feature that permits tough software system developers to use the Arduino code to merge with the prevailing programming language libraries and may be extended and changed.

B. Raspberry PI.

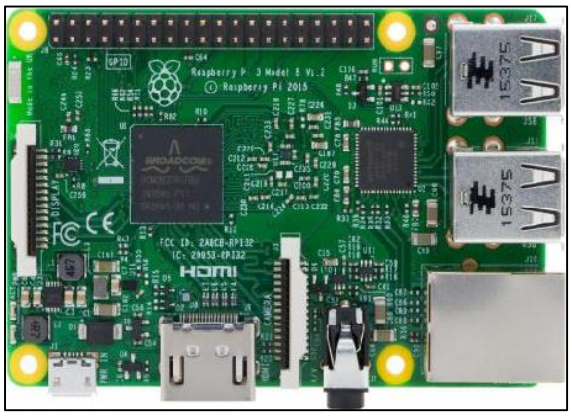


Fig. 3: Raspberry pi model B

The Raspberry Pi is a Broadcom BCM2835 SOC (system on chip board). It comes equipped with a 700 MHz, 512 MB of SDRAM and ARM1176JZF-S core CPU. The USB 2.0 port of the raspberry pi boars uses only external data connectivity options. The Ethernet in the raspberry pi is the main gateway to interconnect with other devices and the internet in model B. This draws its power from a micro USB adapter, with a minimum range of 2.5 watts(500 MA). The graphics, specialized chip is designed to speed up the manipulation of image calculations. This is in built with Broadcom video core IV cable, that is useful if you want to run a game and video through your raspberry pi.

C. Cell phone Detector (Ring indicator).

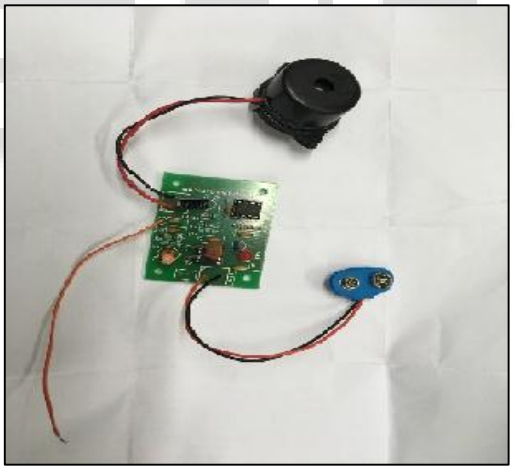


Fig.4.Ring Indicator

This can sense the presence of an activated mobile phone. This can detect both incoming and outgoing calls.

D. Buzzer.

A buzzer or beeper is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric. Typical uses of buzzers and beepers include alarm devices, timers, and confirmation of user input such as a mouse click or keystroke.

E. USB Camera Module.

The camera plugs directly into the USB connector on the Raspberry Pi. It's able to deliver clear 8MP resolution image, or 1080p HD video recording 30fps. This USB camera which has no infrared filter making it perfect for taking infrared photographs or photographing.

F. Alcohol sensor.

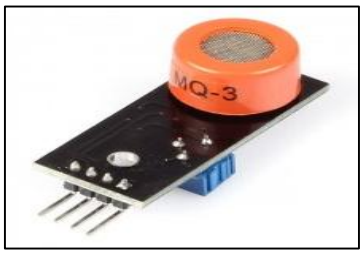


Fig.5.Alcohol sensor

It is suitable for detecting alcohol concentration on your breath, just like your common breathalyzer.

G. Tilt sensor.

This can sense the movements of the vehicle and if the threshold level varies then it alarm through buzzer that accident is occurred.

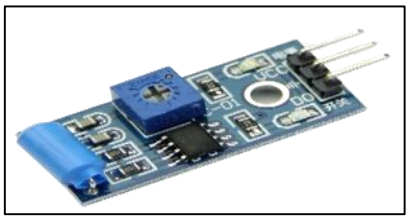


Fig. 6:Tilt Sensor

H. Ultrasonic sensor.

This senses the potholes present on the road and slow down the speed of the vehicle so that it can prevent from accidents.

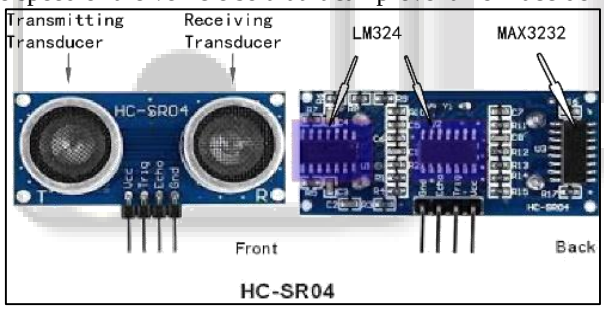


Fig. 7.Ultrasonic Sensor

III. LITERATURE SURVEY

- A survey done by National Highway Traffic Safety Administration estimated that there were 56,000 sleep related road crashes in the U.S.A in 1996. Another survey done in 2007 says that 18% of accidents involved fatigue as the main factor. In Britain up to 20% of serious road accidents were caused due to fatigue. Similarly, survey done by the Road and Traffic Authority states that in the year 2007, fatigue contributed to 20% of accidents caused on road. Accidents due to drowsy was prevented and controlled when the vehicle is out of control. Also, the drunken driving is detected by using alcohol detector in the vehicle. The term used here for the identification that the driver is drowsy is by using eye blink of the driver. These types of accidents occurred due to drowsy and driver could not be able to control the vehicle, when the driver wakes. The drowsiness was identified by the eye blink closure rate through camera which will be placed in the vehicle. If the driver is in drowsy state, then the system will give buzzer signal and the speed of the vehicle was reduced and the vehicle move to the left side of the road by auto steering and controlling and vehicle was parked with prior indications. In the recent years, many researchers worked on these devices and few approaches have been reported .
- One of the suggested methods is to monitor the movement of the vehicle to detect drowsiness of the driver. However this method has limitations as the results are influenced by the type of vehicle and the condition of road. Another method is to process the electrocardiogram (ECG) signals of driver. This approach also has limitations as ECG probes shall always be connected to the driver‘s body. That would disturb the driver. Few researches tried to assess the fatigue factor by monitoring the eye blink rate of the driver. Successful detection of eye blink rate has been the interest of many researchers proposed methods based on combination of projection and the geometry feature of iris and pupil. T.D Orazio and Z.Zhang use the fact that the iris and pupil are darker than skin and white part of the eye.
- Y.Lei proposed an algorithm based on the cascade AdaBoost classifier. T.Hong, a gray level image of an eye is converted to a binary image, using a predetermined threshold. Then, based on the number of black and white pixels of this binary image, state of the eye is determined.
- The algorithm presented by Ms. Devi used the Hough Transform to detect the iris and to determine openness of the eye. Some researchers are based on the projection of the image, to determine the state of an eye. Z. Liu the vertical projection of the image of both eyes is used. The horizontal projection image of an eye is used to determine the interval between eyebrows and eyelids and to recognize the state of an eye.
- The horizontal projection of the image of a face is calculated to determine state of an eye.
- Some works also are based on "Support Vector Machine" (SVM) classifier. The SVM classifier is used to detect state of the eye. F Smach used SVM classifier and Gabor filter to extract eye characteristic. In the above methods, the authors used some conditions which make some difficulties in the eye state recognition. The system detects the fatigue symptoms of the driver which consists of an eye blink sensor for driver blink attainment and an adaptive speed controller designed using stepper motor for providing actual positioning of the throttle valve to adjust the speed of vehicle. Advanced technology offers some hope to avoid these up to some extent. This paper involves measure and control of accidents by using alcohol sensor.
- It uses remotely located charge-coupled-device cameras with active infrared illuminators to acquire video images of the driver. Various visual signs that typically characterize the level of alertness of a person were extracted in real-time and systematically combined to infer the fatigue level of the driver. The visual cues employed characterize eyelid, gaze, head movements and facial expressions. A probabilistic model was developed to model human fatigue and to estimate fatigue based on the visual cues. The simultaneous use of visual cues and their systematic combination earns an

accurate fatigue characterization. This system was validated under real-life fatigue conditions with the human subjects of different ethnic backgrounds with or without glasses; and beneath different illumination conditions. It was found to be reasonably reliable, and accurate in fatigue characterization.

- Another proposal of Watkins identifies the
- behaviors of a distracted driver associated with text messaging. The approach uses a cell phone programmed to record any typing done (pressing and releasing any key). An analysis can be performed to verify distractions through these records. Experiments were done with six participants used the cell phone as passenger and driver what distinct patterns of typing frequency were shown in each situation. The driver cannot reply the text messaging with an average frequency of 2 press keys by the second. This constraint detects the driver in 99% of cases, but it works with offline data processing.
- Over the last decade, there have been various studies done related to drowsiness detection and drunk driving. Features using a driver‘s Visual characteristics, Physiological and Driving behavior based studies have been conducted each having their own advantages for drowsiness detection and by using sensors for drunk driving detection. Sinan Kaplan et al., presented a survey that provides a comprehensive insight into the well-established techniques for driver inattention monitoring and introduces the use of most recent and futuristic solutions exploiting mobile technologies such as smart phones and wearable devices. The studies were categorized into two groups: driver drowsiness and distraction. A comprehensive compilation, used features, classification methods, accuracy rates, system parameters, and environmental details, was represented.
- Anirban Dasgupta proposed a robust real-time embedded platform to monitor the loss of attention of the driver during day and night driving conditions. The percentage of eye closure was used to indicate the alertness level. Face detected using HAAR -like features, the eye state was classified as open or closed using support vector machines. Boon-Giin Lee et al., proposed a method to monitor driver safety for fatigue using two distinct methods: Eye movement monitoring and Bio-signal processing. The monitoring system was designed on an Android-based smartphone, where it receives sensory data via wireless sensor network and further processed the data to indicate the current driving aptitude of the driver. The sensors used were a video sensor to capture the driver image and a bio-signal sensor to gather the driver Photoplethysmograph (PPG) signal.
- A warning alarm was also sounded if driver fatigue was believed to reach a defined threshold. G. M. Bhandari et al., presented an efficient driver‘s drowsiness detection system, by using yawning detection. The consideration of eye detection and mouth detection was done, detecting the driver‘s face using YCbCr method. After that, eyes and mouth positions by using HAAR features. Lastly yawning detection performed by using mouth geometric features. Wang dong et al., aimed at the serious phenomenon of drunk driving in modern society by using a MCU electronic circuit board in the system along with alcohol sensor MQ303A, the alcohol concentration was detected. Through ADC0809, the detection signal is converted to digital signal, which is handled directly by MCU.
- As per the digital signal, the car will be controlled automatically wherein it can't be driven after driver found drunk, thus avoiding the occurrence. Sampling of the works in the area of vehicle safety and security highlight the development of commercial devices for certain risks mitigation such as obstacle detection and anti-braking system, air bag , anti-theft and vehicle tracking vehicle tracking etc. Also, innovative ideas and methodologies towards vehicle safety, traffic management etc. have been projected by researcher‘s/ project developers over the recent years globally. In the case of alcohol detection, commercially and commonly used device is a breath analyzer which is a mouth device and requires blowing of deep breath to detect the alcoholic state of the driver. Generally, the device is manually operated by the traffic police that stops and checks the driver breath alcohol concentration and if it exceeds legal threshold limits, penalty/punishment is put on the defaulter as per DUI laws of the city/state.
- In one of the recent joint research project on driver alcohol detection system for safety (DADSS), the auto companies are investigating technological solutions based upon breathtype and touch–type alcohol sensing methods that can be reliable, cost-effective and can be integrated seamlessly in vehicles to stop the vehicle from moving. A few of the works indicated different sensing methodologies for drunk driver detection such as the use of chemical gas sensor, design of more accurate alcohol sensor with electric fan suction and oxygen level detection of exhaled breath, use of body area sensors for alcoholic and mood dysfunctional detection and detecting behavior pattern of driver using iris image capture and processing to detect eyes condition that is affected by blood alcohol concentration level.
- Many proposed the embedded hardware of the system without discussing the results such as an alcohol sensor with GSM module to send message, use of global position system to track drunk driver location or use of additional ultrasonic sensor to detect accident and track location. Others, proposed additionally different ideas of vehicle control to prohibit driving under the detection of drunk driver condition such as triggering of ignition interlock system. Also, the idea to use latest technology of vehicular area networks by incorporating the sensors in vehicles to communicate with other vehicles and/or with roadside sparse network devices was proposed for detecting drunk drivers on road. This would enable timely sharing of collectively information of drunk drivers, accidents or road congestion problem etc. among the vehicles on the road thus enhancing on-road safety of many vehicles. Visual observation is an option to detect driver fatigue. Zhu et al. have used two cameras on dashboard to capture the visual cues of drivers, such as eyelid movement, gaze movement, head movement and

facial expression, in order to predict fatigue with a probabilistic model.

IV. METHODOLOGY

A. Overview Design

The proposed work is to alert the driver when he is drowsy or distracted away from normal alert mode to non-alert mode by means of buzzer or vibration mechanism. In this project real time data is collected by video camera and other micro electro mechanical system devices (MEMS). This data gives information about driving condition of the driver which acts as input to controller. The appropriate measures are taken by the controller to alert the driver. The primary focus is given to the faster drowsiness detection and processing of data. The system is used to detect the eyes whether they are closed or open in real-time through the camera.

The buzzer is turned on when eyes are closed.Our proposed method is to design and develop a low cost system, which is based on embedded platform for drowsiness detection. To achieve these requirements Raspberry pi model B is used.

B. Face Detection and Eye Detection

Driver Drowsiness Detection requires a camera for capturing the video. The Drowsiness level will be detected by eye blinking rate. Therefore, there are several methods that are applied in this method.

1) Haar Cascade Classifier

1) A Haar Classifier is a machine learning approach for visual object detection originally developed by Viola & Jones. It was originally intended for facial recognition but can be used for any object.
2) Haar Cascade classifier has two stages-: training and detection of the object.
3) The Haar classifier will quickly reject regions that are highly unlikely to contain the object, and the object detection can move on to the further region. It does this by making use of the cascade of classifiers.
4) The classifier outputs '1' when it finds an object and '0' otherwise.
5) The necessary applications for implementing a Haar classifier are included in OpenCV and these can be used to train a classifier for detecting objects in an image.

2) Cascade Classifier Training

1) There are two types-: open_haar training & open_transcascade.
2) The open_transcascade support both the haar and Local binary pattern (LBP).
3) Steps in training and using a haar classifier-:

– Collect positive and negative training images.
– Markup positive images using object marker utility.
– Create a .vec file using create samples utility.
– Train the classifier using haar
– training utility.
– Run the classifier using cvhaarDetectObject().

4) Collect the training images- generally about 1000 images are required to train the classifier. It may include both positive and negative images.
5) Mark positive images- This step creates a data file containing the file name and the location of the object in the image. The data file is created using the object marker utility.
6) Create the vector file- It can be created using the create samples utility of the opencv, optionally we can set the –width and –height.
7) Train the classifier- The classifier is trained with the utility opencv_haartraining.
8) The final output will be .XML (extended markup language) file.
9) The final output of the classifier after training is an .xml file which has vector values of the objects to be detected. For example-:

– <threshold>5.6097120977938175e-003</threshold>
– <left_val>0.7382487058639526
– </left_val>
<right_val>0.3885168135166168</right_val>

3) Template matching Technique

1) There are two components-: source image(I) and template image (T).
2) The template matching is a technique for finding the area's of an image that match to a template image (patch).
3) To identify the matching area we have to compare the template image against the source image by sliding it.
4) For each location Of T over I, we store the metric in the result matrix (R). Each location (x,y) in (R) contain match metric.

a) Detailed process of template matching.

– Loads an input image and a image patch (template)
– Perform a template matching procedure by using the OpenCV function 'match Template'
– Normalize the output of the matching procedure
– Localize the location with higher matching probability using minMaxLoc.
– Draw a rectangle around the area corresponding to the highest match
– Method=CV_TM_SQDIFF
Eq.(1.1)

$$R(x,y) = \sum_{x',y'}(T(x',y') - I(x+x',y+y'))^2$$

– Method=CV_TM_SQDIFF_NORMED
Eq.(!.2)

$$R(x,y) = \frac{\sum_{x',y'}(T(x',y') - I(x+x',y+y'))^2}{\sqrt{\sum_{x',y'}T(x',y')^2 \cdot \sum_{x',y}I(x+x',y+y')^2}}$$

a. Eyes open b.Eyes closed
Fig. 8: Results of eye blink detection

C. Modules

1) The System comprises of 3 phases

First, Capturing where the image of the driver is captured using logitech camera, which is known for its clarity and cost effective. This camera creates a video clip and concentrates on single frame containing driver's eye blink. The captured video is then divided into frames for analyzing.

Second, Detection where in this phase first involves the detection of face of the driver.Face detection is done using facial landmark which results in locating the face in a frame. Only facial related structures or features are detected and all other types of objects like buildings, trees, bodies are ignored. In our method eye is the decision parameter for finding the state of the driver. Eye Aspect Ratio(EAR) is the ratio of number of eye blinks to the width of the eye.

Third, Correction where the actual state of the eye is found, if it is closed or open or semi closed or semi open.The identification of eye status is most important requirement warning message is channelized if obtained eyes are in close or semi close state to a particular threshold value. If the systems detects that the eyes are open then it is repeated again and again until closed eyes are found.

Here eyes are located with the help of trained cascade classifier.

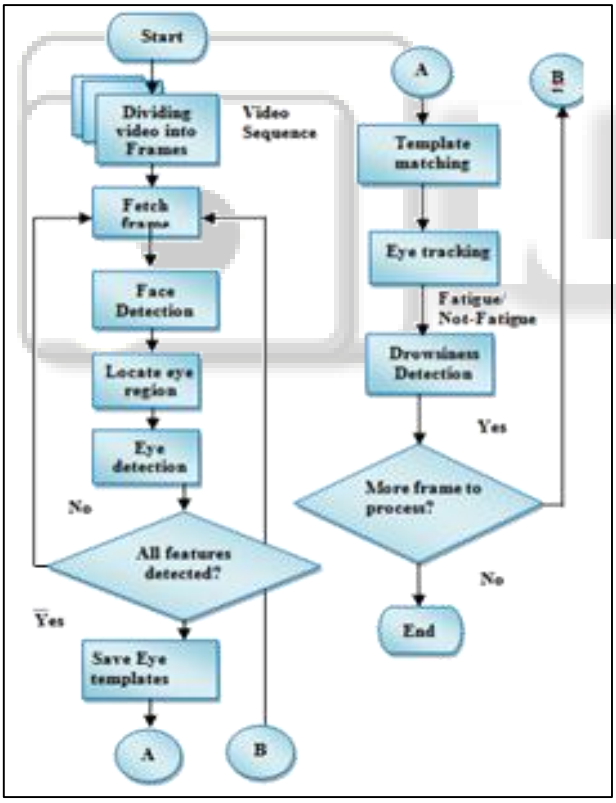


Fig. 9: Flowchart

D. Accident Detection.

This is sensed by using the Tilt sensor. If the vehicle movement is abnormal. The buzzer is turned on.

E. Pothole Detection.

This is sensed by the ultrasonic sensor. If the threshold value becomes more than the given value. The speed of the vehicle slows down and buzzer will be turned on to alert the driver.

F. Cell Phone Usage Detection.

This mobile phone detector circuit helps to track the presence of an activated cell phone by detecting the signals in the frequency range of 0.9 to 3GHz.

G. Alcohol Detection.

The alcohol sensor we will use is the MQ-3 sensor This is a sensor that is not only sensitive to alcohol, particularly ethanol, which is the type of alcohol which is found in wine, beer, and liquor. This type of sensor circuit can be used as a breathalyzer to check a person's blood alcohol level. Just as we exhale carbon dioxide when we breathe out, we also will breathe out some alcohol if we have alcohol in our blood. Any lactometer device can measure this alcohol content.

An alcohol sensor detects the attentiveness of alcohol gas in the air and an analog voltage is an output reading. The sensor can activate at temperatures ranging from -10 to 50° C with a power supply is less than 150 Ma to 5V. The sensing range is from 0.04 mg/L to 4 mg/L, which is suitable for breathalyzers. The passive alcohol sensor (PAS) is a device developed to assist police in identifying drinking drivers. . The PAS draws in mixed expired and environmental air from in front of the subject's face and passes it into a fuel cell sensor that can detect very small amounts of alcohol.

V. CONCLUSION & FUTURE SCOPE

A driver alertness detection system was proposed based on fatigue detection in real-time. The proposed method easily detects the eye blink and the drowsiness. Information about the eyes position was obtained through image processing algorithms. Image processing offers a noninvasive approach to detect drowsiness without any annoyance and interference. An algorithm for performing face recognition was used. It was found that with this algorithm, a good measurement of the blink rate was obtained. The proposed algorithm was able to detect the eyes at medium and high illumination and independent of gender and age, but for optimal detection the camera had to be positioned as front as possible. In order to prevent the effects of poor detection due to insufficient light, night vision camera was implemented so that better results, unaffected by lack of brightness, will be obtained. Safe driving will be ensured by indicating the driver using a buzzer indicator.

Drunk and driving accidents are one of the major problems now a days. This paper provides much advanced facility in now a day's life as it can easily have implemented in vehicles with multi stage testing such a way that we can avoid accidents caused by Drunken driving. Thus, by this we can reduce the alcohol related road accidents and hence these kind of detectors has great importance in the future which we are going to implement with IOT. Through this project we present hardware programming of IOT device to facilitate as alcohol detector and preventive device. This work proposed a system to detect hand-held cell phone usage during the act of driving. The system uses ring indicator for detecting this activity. The system's output could be a warning that can regain the driver's attention exclusively to the vehicle and the road or a warning for a transport company or enable a buzzer. We are using the alcohol sensors to sense the consumption of the alcohol upto the preset percentage

The cell phone detection enhanced by the hybrid system solution was possible with machine learning for Movement Detection and new features from Optical Flow as: horizontal movement, the area of connected components, and the dimensions of region movement detected. The increase of the frame per second processing and the image resolution.

REFERENCES

[1] Data from NCRB, Government of India, available at http://ncrb.nic.in/StatPublications/ADSI/ADSI2014/ADSI2014.asp
[2] "Internet of Things Global Standards Initiative",ITU. Retrieved 26 June 2015. - http://www.itu.int/en/ITU-T/gsi/iot/Pages/default.aspx
[3] Z. Xiaorong et al, ―The Drunk Driving Automatic Detection System Based on Internet of Things‖, International Journal of Control and Automation.
[4] J. Dai, J. Teng, X. Bai, Z. Shen, and D. Xuan. "Mobile phone based drunk driving detection." In 2010 4th International Conference on Pervasive Computing Technologies for Healthcare, pp. 1-8. IEEE, 2010
[5] A. R. Varma, S. V. Arote, C. Bharti, and K. Singh. "Accident prevention using eye blinking and head movement." IJCA Proceedings on Emerging Trends in Computer Science and Information Technology-2012 (ETCSIT2012) etcsit1001 4 (2012)
[6] V. Savania, H. Agravata and D. Patela , ―Alcohol Detection and Accident Prevention of Vehicle‖, International Journal of Innovative and Emerging Research in Engineering, Volume 2, Issue 3, 2015, pp 55-59
[7] http://en.wikipedia.org/wiki/Global_Positioning_System.
[8] http://www.dadss.org/breath-based-technology.
[9] http://www.dadss.org/touch-based-technology.
[10] S sahabiswas, S sourav, Drunken driving detection and prevention models using Internet of things‖, Information Technology, Electronics and Mobile Communication Conference (IEMCON), 2016 IEEE 7th Annual, pp.1-16, IEEE,2016
[11] Open CV 2.4.11.0 documentation; Open CV Tutorials; objdetect module; Object Detection.
[12] Viola, Jones: Robust Real-time Object Detection, IJCV 2001.
[13] Open CV Computer Vision with Python; Tracking Faces with Haar Cascades
[14] S. Motorist, Driver Fatigue is an important cause of Road Crashes, Smart Motorist.
[15] Driver Fatigue and Road Accidents: A Literature Review and Position Paper
[16] Royal Society for the Prevention of Accidents, 2001.
[17] Road and Traffic Authority (RTA) Annual Report, Sidney, 2008.
[18] B. Praveenkumar, K Mahendrakan. "Prevention of Accident Due To Drowsy By Using Eye Blink." International Journal of Innovative Research in Science, Engineering and Technology(IJIRSET)Volume 3, May 2014.
[19] Stan, Ovidiu, Liviu Miclea, and Ana Centea. "Eye-Gaze Tracking Method Driven by Raspberry Pi Applicable in Automotive Traffic Safety. "Artificial Intelligence, Modelling and Simulation (AIMS), 2014 2nd International Conference on IEEE, 2014.
[20] Friedrichs, Fabian, and Bin Yang. "Camera-based drowsiness reference for driver state classi¿cation under real driving conditions." Intelligent Vehicles Symposium (IV), 2010,IEEE. IEEE, 2010.
[21] "Eye detection and recognition in the fatigue warning system." Intelligent Networks and Intelligent Systems (ICINIS), 2010 3rd International Conference on IEEE, 2010.
[22] Turan, Garima, and Sheifali Gupta. "Road Accidents Prevention system using Driver‘s Drowsiness Detection." International Journal of Advanced Research in Computer Engineering and Technology (IJARCET).

