Driver Drowsiness Detection System for Accident Prevention System

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Abstract - *Driver fatigue is a major safety concern because reduced alertness can affect a driver's ability to respond to road conditions. This paper presents a driver drowsiness detection and accident prevention system using a Raspberry Pi, Pi Camera, OpenCV and image processing techniques. The proposed system continuously captures the driver's facial activity and detects the face and eyes using facial landmark based processing. Eye Aspect Ratio (EAR) is used to identify prolonged eye closure and determine possible drowsiness. When the EAR falls below the defined threshold for a sufficient number of frames, the system activates an audible warning and sends an alert message. The system also incorporates GPS based location tracking and collision sensing so that information about an accident can be forwarded to an authorized person or nearby assistance. The prototype combines real time computer vision, embedded processing, sensing and communication to provide a cost effective approach for driver monitoring and accident response. The reported testing involved ten individuals under different conditions and the system achieved a reported accuracy of 97.1 percent.*

Key Words: Driver Drowsiness Detection, Raspberry Pi, OpenCV, Eye Aspect Ratio, Computer Vision, GPS, Accident Prevention

1. INTRODUCTION

The theme of the project is "Driver Drowsiness Detection System for Accident Prevention System using Raspberry Pi." The goal of the project is to create a system that can detect if a driver is getting drowsy or falling asleep while operating a vehicle. This system will use a Raspberry Pi computer to monitor the driver's behaviour and alert them if they are showing signs of fatigue.

The project will involve using various sensors and machine learning algorithms to detect changes in the driver's behaviour, such as changes in facial expressions, eye movements, and head position. The Raspberry Pi will process this data in real-time and issue an alert if it detects that the driver is getting drowsy or falling asleep.

The main objective of this project is to reduce the number of accidents caused by driver fatigue. Real time drowsy driving detection is one of the best possible measures that can be implemented to assist drivers to make them aware of drowsy driving conditions. Such driver behavioural state detection systems can help in catching the drowsy driver conditions early and can possibly avoid mishaps. We are presenting techniques to detect driver drowsiness using OpenCV, raspberry pi and image processing.

Several studies have shown various possible techniques that can detect the driver's drowsiness. Such drowsiness can be measured or detected using physiological, ocular and performance monitoring. Among these, monitoring physiological and ocular changes can give more accurate results. Detecting and tracking physiological changes like changes in brain waves, heart rate, pulse rate, etc require attaching sensors physically to the driver such as connecting electrodes to the driver body. This leads to uncomfortable driving conditions. But ocular changes can be measured without physical connection. Ocular detection of the driver's eye movements and possible vision based on eye closure is well-suited for real world driving conditions, since it can detect the eyes remaining open / closed non-intrusively using a camera.

Additionally, the project will demonstrate the capabilities of the Raspberry Pi computer and how it can be used to create innovative solutions to the real-world problem of driver drowsiness.

2. LITERATURE REVIEW

Drowsiness detection can be carried out by two techniques. The first technique is intrusive and second is nonintrusive. The intrusive technique involves computation of mind wave monitoring, heart-beat rate etc. Non-invasive techniques are appropriate to find facial appearance for tiredness detection. Mouth gaping and Eye closure are the wellknown symptoms of the drowsiness detection [2]. The nonintrusive technique involves head pose, eye blinking rate, yawn detection, eye closure, etc., [1]. Another non-invasive way to detect fatigue can be divided into three scenarios: visual cues, physiological measurements, driving performance. Physiological and visual cues involve direct computation, whereas driving performance involves indirect computation [3]. It is suitable for the real-time application, because of no need for sensing electrodes.

1. Haar cascade classifier

-From (Viola, Paul, and Michael Jones, (2001) "Rapid object detection using a boosted cascade of simple features.")

Haar Cascade Classifier is one of the few object detection methods with the ability to detect faces. It offers high-speed computation depending on the number of pixels inside the rectangle feature and not depending on each pixel value of the image. This method has four steps for detecting an object namely as Haar-like feature, integral image, AdaBoost learning and Cascade Classifier [4]. The Haar features are used to detect the presence of feature in given image. The integral image could calculate values accurately and relatively quick by creating new presentation of image by using value of region previously scanned by specific Haar-like feature. The Cascade classifier can be divided into two which are strong classifier and weak classifier. Weak classifier means less accurate or also irrelevant prediction and strong classifier means more accurate or relevant prediction. Strong classifier made by AdaBoost can detect object level by level on a cascade.

2. Face and Eye Detection by Machine Learning and Deep Learning

-From (R. Jabbar, M. Shinoy, M. Kharbeche, K. Al-Khalifa, M. Krichen, and K. Barkaoui, "Driver drowsiness detection model using convolutional neural networks techniques for android application,")

Jabbar et al. [5] proposed Convolutional Neural Network (CNN) technique of the ML algorithm to detect microsleep and drowsiness. In this paper, detection of driver's facial landmarks can be achieved through a camera that is then passed to this CNN algorithm to properly identify drowsiness. System works by analysing the eye movement of the driver and alerting the driver by activating the buzzer when he/she is drowsy. During monitoring, the system is able to decide whether the eyes were opened or closed. When the eyes were detected closed for too long, a signal was issued to warn the driver. The system can monitor the driver's eyes to detect short periods of sleep lasting 3 to 4 seconds. The system implemented in this approach runs at 8–15 frames per second. The application was implemented using Open CV in Raspberry Pi environment with a single camera view. This system formulates a number of drivers' faces, which works on multi-layered 3D CNN models to identify drowsy drivers and provide 92 percentage acceptance rates.

3. Eye Recognition System Based on Wavelet Network Algorithm

-From (O. Jemai, I. Teyeb, and T. Bouchrika, "A novel approach for drowsy driver detection using eyes recognition system based on wavelet network,") and (M. Babaeian, K. A. Francis, K. Dajani, and M. Mozumdar, "Real-time driver drowsiness detection using wavelet transform and ensemble logistic regression,")

Jemai et al. [6] introduced a technique for drowsy warning system using wavelet networking. That network tracks eyes with the help of classifying algorithms like Wavelet Network Classifier (WNC) that relies on Fast Wavelet Transform (FWT), which specifically leads to binary way decision (conscious or not). The physiological aspects are heart beat rate and electrocardiogram that are repeatedly extracted through wavelet transformation with regression technique for fatigue detection, designed by Babaeian et al. [7]. This principle worked on heart rate data classification through wavelet network which can find an average way of drowsiness alert system.

4. Fatigue Detection Using Vehicle State (Steering Wheel) Algorithm

-From (S. Arefnezhad, S. Samiee, A. Eichberger, and A. Nahvi, "Driver drowsiness detection based on steering wheel data applying adaptive neuro-fuzzy feature selection,") and

(K. Mutya, J. Shah, A. D. McDonald, and J. Jefferson, "What are steering pictures are worth? using image-based steering features to detect drowsiness on rural roads,")

Arefnezhad et al. [8] proposed a noninterfering drowsy detection system based on vehicle steering data using neuro-fuzzy system with support vector machine and particle swarm optimization algorithm. Mutya et al. [9] established a system to resolve the problem of drowsiness using steering wheel algorithm. It is basically based on image-formed or pictorial-based steering movement and the CNN algorithm. In addition, the system also has an option for making vibration when drowsiness was detected.

5. Designed Using Electroencephalography (EEG), Electrocardiography (ECG), Electrooculogram (EOG), and Electromyogram (EMG) Algorithm

-From (A. A. Hayawi and J. Waleed, "Driver's drowsiness monitoring and alarming auto-system based on EOG signals,")

This process effectively analyses the state of sleepiness using the brain indicator signal (EEG), camera, and sensors that are activated with the help of machine learning method to alert drowsy driver. Hayawi and Waleed [10] proposed a method to observe drowsiness through signal of Heart Rate Variability (HRV) which is obtained using EEG sensors.

6. Fatigue and Collision Alert System Using Smart Technique

-From (S. M. Gowri, P. Anita, D. Sri Vaishnavi, and M. Nithya, "Internet of things based accident detection system,") and

(V. Kinage and P. Patil, "IoT based intelligent system for vehicle accident prevention and detection at real time,")

Gowri et al. [11] implemented a smart glass to detect fatigue. The rear light of the vehicle is automatically flashed with a message being sent using the IoT module or cloud environment. Kinage and Patil [12] proposed a system to detect the drowsiness using eye blinking sensors and any accidents or collisions that happened; then, the vibration sensor was integrated with heart rate measurement sensor for forwarding alert message to the authorized user. So, it is also attached to the GPS and GSM device for tracking the location and transmission of message. the implementation of the IoT-based technique helps to smartly control the various issues of driver drowsiness by the automatic buzzing of alarm, easily tracing the mishap location, and warning to the owner by sending emails or messages.

7. Vibrating Chair and Spray Nozzle to Prevent Sleeplessness

-From (Afdal Luthfi, Eko Nevriansyah, Auliya Einsrizkianne Edray, Goani Marind drowtect – vibrating chair and spray nozzle to prevent sleepiness in car drivers based on image processing with drowsiness detection algorithm)

Based on data from the police of the Republic of Indonesia from 2014 to 2018 there was a significant increase in the number of motorized vehicles, namely 6.49% per year (Indonesian Central Statistics Agency, 2018: 22). To reduce the number of traffic accidents and their impacts, it is necessary to have a role from all parties. Based on this, the purpose of our research is to create a detection device system using image processing that is used to detect the eyes of the car driver, if the driver detects the data from the image processing will communicate and to a tool called a nozzle, then the nozzle will issue The air sprays into the driver's face slowly and in the driver's seat is also installed a dc motor that can cause a low level of shock to the driver, so that the driver can regain consciousness and focus on the traffic.

The cheapest technology by using microcontrollers such as Arduino and other current technologies such as GSM Module and Bluetooth has been explored too in the previous projects [13-15]. But there are limitations that can be found in projects. For example, the Arduino output pins were connected to several modules such as GSM Module and Bluetooth HC-05 Module. The GSM Module provides limited data capability and higher data rate for GSM advanced version devices. The input for the prototype also had too many sensors that did not have specific placement for the driver to use it.

3. SYSTEM COMPONENTS

1. Pi Camera V2

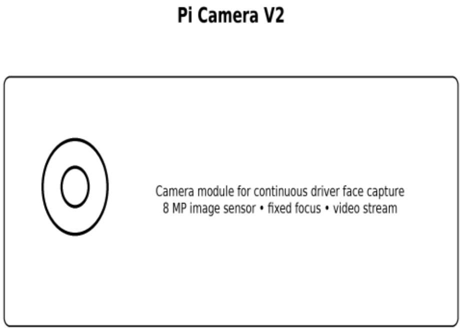

Fig. 1. Pi Camera V2 used for continuous driver face capture. Original schematic prepared by the authors.

Uses:

The 8MP Raspberry Pi Official Camera Module v2 can be used to take high-definition video, as well as stills photographs. It uses high quality 8-megapixel Sony IMX219 image sensor custom designed add-on board for Raspberry Pi, featuring a fixed focus lens.

Specification:

The Raspberry Pi Camera Module v2 is a high quality 8-megapixel Sony IMX219 image sensor custom designed add-on board for Raspberry Pi, featuring a fixed focus lens. It's capable of 3280 x 2464-pixel static images, and also supports 1080p30, 720p60 and 640x480p60/90 video.

2. GPS Tracker:

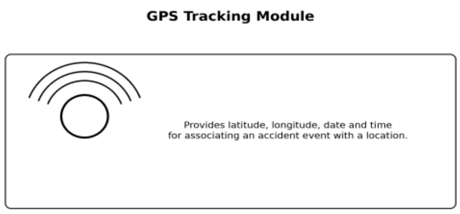

Fig. 2. GPS tracking module and its role in accident location reporting. Original schematic prepared by the authors.

Uses:

GPS tracking requires a tracking device to be installed in a vehicle, on an asset, or to be worn by a person. The device then provides information about its exact location and subsequent movements, enabling tracking in real-time A

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GPS tracking device is a portable unit that allows users to monitor and track its location. These devices are most commonly used in vehicles as car tracking systems. While tracking devices are similar to in-car navigation systems.

Specifications:

Power Acquisition:25mA, Power Tracking:20mA.
Compliant with GPS, SBAS.
Programmable bit rate up to 300 kbps.
Serial Interfaces UART: Adjustable 4800~115200 bps, Default: 9600bps.
Update rate:1Hz (Default), up to10Hz.
Protocols: MEA 0183, PMTK.
Horizontal Position Accuracy: Autonomous <2.5 m CEP.

3. Speaker:

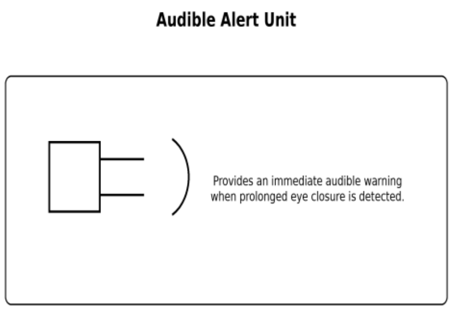

Fig. 3. Audible alert unit used to warn the driver. Original schematic prepared by the authors.

Uses:

The Speaker for the Raspberry Pi robot gives your Raspberry Pi robot a voice and sound. This speaker connects to the aux jack on the Raspberry Pi and can be used to play music, voice, and alerts. The Raspberry Pi Speaker has a rich and loud sound. It has its own power supply that can be charged with the USB port.

Specification:

Fully Compatible with the Raspberry Pi.
100 Hz - 18 KHz frequency response.
Power requirements: 5VDC 1A peak (at max volume output)
4 Ohm impedance speakers, 3W each.
Speaker Dimensions: (Height x Width x Depth) 80mm x 70mm x 70mm.
Cable Length: 1m.

4. Crash Sensors:

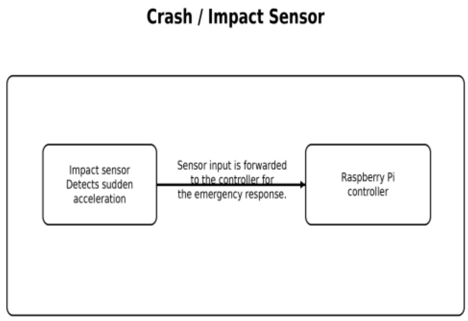

Fig. 4. Crash / impact sensor used to initiate the collision response. Original schematic prepared by the authors.

Uses:

When a car is stopped abruptly by an impact, all bodies or objects that are not firmly fixed to the car will continue to move at the impact speed. The sensors measure this acceleration and relay it to the control unit as usable data. Many of our cars are fitted with ultra-fast pressure sensors in the front doors.

Motion sensors in your phone or car sense when you're in a car accident. A personal safety app might also rely on your GPS, motion sensors, or accelerometer to tell, in real-time, when you've come to an abrupt halt or accelerated sharply.

Specifications:

Proposed Methodology

When the Pi camera model V2 is successfully integrated with Raspberry Pi3, it continuously records each movement of the driver's face. This proposed work specially focuses on behavioural measures of the driver with severity measurement of collision in following sections. The EAR is accurately calculated due to the use of Raspberry Pi3 model B and Pi camera modules to make a persistent recording of face landmarks that are localized through facial landmark points. But the Raspberry Pi3 model B and Pi camera modules are securely processed due to the operating system of the controller and predictable secure shell (SSH) keys. The use of SSH host keys provides secure network communications and helps to prevent unauthorized communications or file transfers. The IoT-based application is being developed through the integration of some IoT modules like wireless sensors, GPS tracker, Pi camera, and smart code for detecting drowsiness of the driver. So, the above modules are properly integrated with the Raspberry Pi controller module that intelligently controls and smartly warns a drowsy driver. The successful integration of IoT modules is robustly used to prevent the cause of mishaps and also warns the drowsy driver to avoid careless driving. The Internet of Things (IoT) is helping to manage various real-time complexities like handling complex sensing environments and also provides a very flexible platform to control multiple connectivities. The IoT module is a very reliable way of capturing images of the drowsiness of the driver as well as sending an alert message to the owner for awareness.

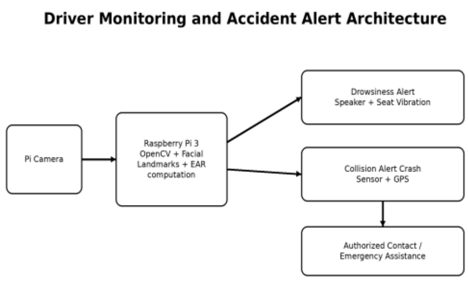

Fig. 5. Driver monitoring and accident alert architecture. Original figure prepared by the authors.

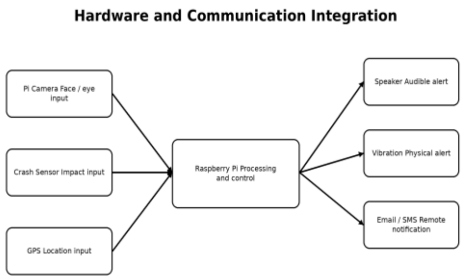

Fig. 6. Hardware and communication integration of the proposed system. Original figure prepared by the authors.

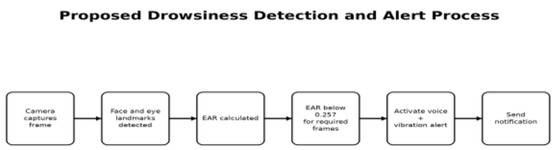

Fig. 7. Proposed drowsiness detection and alert process. Original figure prepared by the authors.

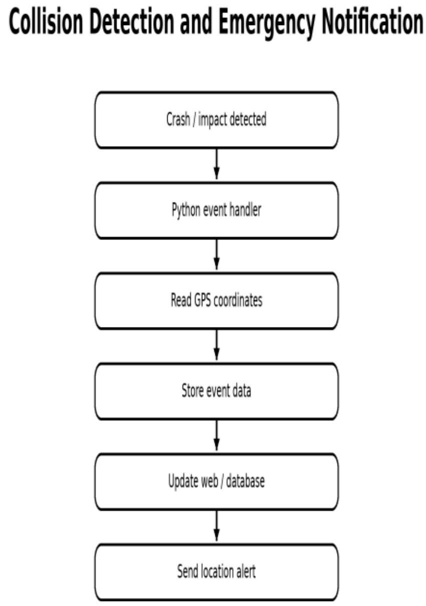

Fig. 8. Collision detection and emergency notification flow. Original figure prepared by the authors.

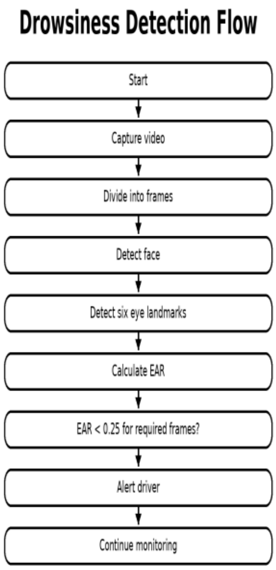

Fig. 9. Drowsiness detection flow from video capture to driver alert. Original figure prepared by the authors.

Drowsy Eyes and Face Detection

The step-by-step methods for detection of drowsy drivers in the scenario are previously explained in Figs. 5, 7, 8, and 9, and the various steps are as follows:

(i) Step 1: video recording
(ii) Step 2: face detection
(iii) Step 3: eye detection
(iv) Step 4: drowsiness detection (combination of steps 2 and 3)

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The Raspberry Pi3 camera is an 8-megapixel video camera which captures continuous video stream in good quality. Recorded video stream is converted into a number of frames which are forwarded to face detection step. The face detection is analysed by face landmark algorithm, which can detect eye, mouth, and nose from facial appearance. Actually, this detection technique works with Python-based library package like OpenCV. OpenCV is used for real-time image processing which is implemented by computer vision algorithm. When facial features are successfully detected, the next step, like eye detection of drowsy drivers, is possible to focus through facial landmark predictor algorithms. So, it can convert that image frame format to grey scale level, where detected eye areas are traced by six coordinates as depicted in Fig. 10. Now, it is needed to calculate EAR which measures the distance between vertical and horizontal eye landmark points by using a Euclidean distance (ED) method as in Equation (1). The calculation of the distance of the eyelid section is made as

$$iED(X_i, Y_i) = \sqrt{\sum_{n=1}^{n} (Y_i - X_i)^2}, \quad (1)$$

where $\mathrm{ED}(X, Y)$ is denoted as a Euclidean distance between X_i and Y_i; these are two Cartesian coordinate points. So it is represented in Python program which is explained below:

(i) $A = \mathrm{dist.euclidean(eye[2], eye[6])}$

(ii) $B = \mathrm{dist.euclidean(eye[3], eye[5])}$

(iii) $C = \mathrm{dist.euclidean(eye[1], eye[4])}$

From the above statement, dist is an object of distance package that belongs to *scipy* library file which is invoked a Euclidean (X_i, Y_i). Here, there are two coordinate points of an eye landmark. The variables (A, B, and C) are used for calculation of the EAR value of an eye. In order to find the EAR by using detected eye landmark coordinate values from ever video frames, it is being computed as

$$\mathrm{EAR} = \frac{\|x_2 - x_6\| + \|x_3 - x_5\|}{2\|x_1 - x_4\|}, \quad (2)$$

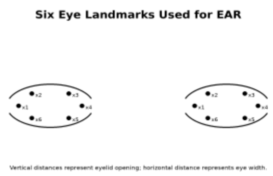


Fig. 10. Six eye landmarks used for Eye Aspect Ratio calculation. Original schematic prepared by the authors based on the cited EAR landmark method.

where x1, x2, x3, x4, x5, and x6 are 6 landmark coordinates which are shown in Fig. 10. The EAR value of the left and right eyes is averaged during synchronous eye blink. The threshold value of EAR remains constant when both eyes continue to be open, where values will be randomly changed during eye blink. The threshold range of EAR is above 0.25 that means the driver's eyes are unlatched. If any drowsiness of the driver is detected from video frames, it happens due to drop of its threshold value below 0.25. When the number of frames is more than 30, then the voice speaker is turned on and a mail is sent. So, the Raspberry Pi3 is programmed to operate a speaker by using a software which can convert text-to-speech (TTS) conversion technique. TTS in speaker is more reliable for a sleepy driver to be alerted than other sound. All the statements of the speaker are coded as follows:

The above code is having a text message like wake up; it will be converted to speech by espeak synthesizer and operating system (OS) module in Python. The Raspberry Pi also forwards a mail at the time of fatigue detection to the driver to be more vigilant to avoid a number of mishaps. The mails are transferred through Simple mail Transfer Protocol (SMTP) that is accessed as a predefined library smtplib in Python. The SMTP client session object is created by using smtplib module to send mail source to destination. Here, the MIME protocol is used to define a multipart section of a mail like subject, to and from parts. The mail is securely transferred from drowsy driver unit to an authorized person (owner of vehicle or any) through Transport Layer Security (TLS) and server port number 587 for http://smtp.gmail.com server, which is shown in program section Figure 6.

Mounting HotPot Membrane Potentiometer

From Figure, the colour of the red line indicates that the HotPot film potentiometer is installed on the baffle. Two pieces of this sensor are used to cover the entire exterior of the steering wheel. Sensor strips are 24 inches long and 0.6 inches wide. The active area is 0.25 inches wide. They are polymer thick film (PTF) devices whose electrical resistance decreases when pressure is applied to their surface. The sensor is connected to a simple amplifier circuit consisting of a voltage divider, an op-amp, and some additional power stabilizing components as shown in Figure.

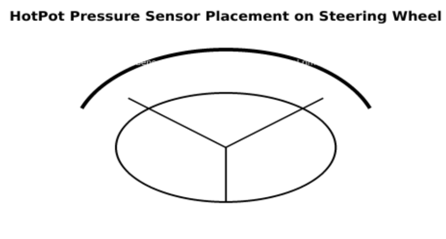


Fig. 11. HotPot pressure sensor placement concept on the steering wheel. Original schematic prepared by the authors.

Vibration Of Seat

Two motorized vibrators are mounted on the seat drive and require 12V DC power for activation. The two red circles in the photo shows that two vibrators are installed.

The car vibrator should be placed in an appropriate position parallel to the driver's thigh while driving. When the driver is sleepy, the vibration is felt in both thighs. The two wires of the seat will be connected to the electric circuit, the motor voltage should not be less than 12V 1.5A. If the power supply is less than the required power, the vibrator will vibrate slowly. A car vibrator mounted on the driver's seat. This is very important because when the driver becomes drowsy or tired while driving, the vibration is not felt by the driver due to less power and the driver is immediately warned. If this happens, it can be dangerous for the driver when he becomes drowsy or tired, as it puts the driver at high risk of an accident and also reduces the functionality of the system.

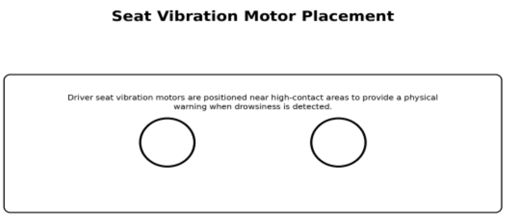


Fig. 12. Seat vibration motor placement concept for driver alerting. Original schematic prepared by the authors.

Collision Detection

The collision alert system is generally constructed by a combination of crash sensor and force sensitive register for providing data about collision impact [11]. So, the data related to impacts of collision are collected to measure the severity of mishaps due to drowsiness or unconscious driving. The cause of severity is monitored through following stages:-

(i) Stage 1: Python script
(ii) Stage 2: local database
(iii) Stage 3: update server (web page)

```
while alarm_status: do
    print('call')
    s = 'espeak' '+' wake up '+'
    os.system (s)
end
```

Code 1

Code 1

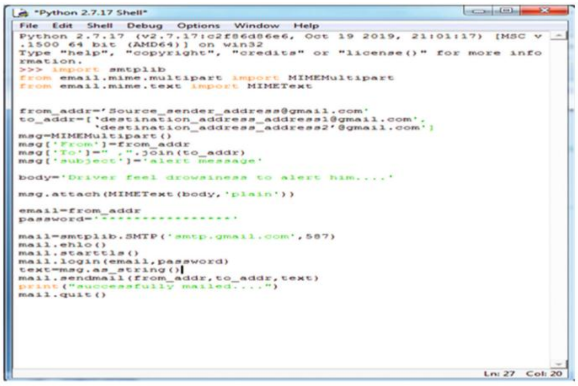
The IoT module or server forwards detected data to program script which is based on Python. Here, Python script is specially preferred for reliable communication with connected sensors. When any crashes of vehicle occur, then the respective sensors generate information which detects the range of severity as well as the location of collision that are recorded in database which is shown in Fig. 8. The location of accident is fetched from Google Maps link with longitude, latitude, time, and date that are accessed through the Raspberry Pi module. The longitude and latitude of a location are specially calculated by using the haversine technique to measure the distance of earth surface between two points which is represented as in Equations (3) to (5):

$$x = \sin^2\left(\frac{\Delta\phi}{2}\right) + \cos\phi_1 * \cos\phi_2 * \sin^2\left(\frac{\Delta\lambda}{2}\right), \quad (3)$$

$$y = 2 * x\tan 2\left(\sqrt{x}, \sqrt{(1-x)}\right), \quad (4)$$

$$z = \mathrm{Rad} * y, \quad (5)$$

where ϕ is denoted as latitude, λ is denoted as longitude, and earth's radius is denoted as Rad. Here, the mean radius is represented as 6,371 km. The GPS is automatically tracked by using this formula in Python script which perfectly puts the values of latitude and longitude of the location where the accident occurred. So, the tracking script is implemented by using a reserved library package, i.e., pynmea which is used for NMEA 0183 protocol. This protocol provides an interface to parse date, time, altitude, longitude, latitude, and location pin code with Google Maps links, which is programmatically represented as follows:



```
*Python 2.7.17 Shell*
File Edit Shell Debug Options Window Help
Python 2.7.17 (v2.7.17:c2f86d86e6, Oct 19 2019, 21:01:17) [MSC v
.1500 64 bit (AMD64)] on win32
Type "help", "copyright", "credits" or "license()" for more info
rmation.
>>> import smtplib
from email.mime.multipart import MIMEMultipart
from email.mime.text import MIMEText

from_addr='Source_sender_address@gmail.com'
to_addr=['destination_address_address1@gmail.com',
         'destination_address_address2'@gmail.com']
msg=MIMEMultipart()
msg['From']=from_addr
msg['To']=" ,".join(to_addr)
msg['subject']='alert message'

body='Driver feel drowsiness to alert him....'

msg.attach(MIMEText(body,'plain'))

email=from_addr
password='***************'

mail=smtplib.SMTP('smtp.gmail.com',587)
mail.ehlo()
mail.starttls()
mail.login(email,password)
text=msg.as_string()
mail.sendmail(from_addr,to_addr,text)
print("succesfully mailed....")
mail.quit()
Ln: 27 Col: 20
```

Figure 6: Source Code for sending mail to Server/Owner.

```
from pynmea import nmea
import serial, time, sys, threading, datetime, shutil;
message = pynmea. parse $ ("$GPGGA, 172245. 25, 20. 4377,
S, 85. 8997, E, 2, 0 9, 3. 7, 1 1 0. 0 0, M, −36.9 ,M,00013*7D")
```

Code 2

Code 2

This indicates the serial library for the port number of the GPS module; shutil library was used for copying nmea file to other text file in script, and other libraries are used for some additional activities in the system. These parameters are parsed through pynmea library object to create plot location of vehicle accident due to drowsiness or unconscious mind. After these parameters are retrieved for mishap location, they are forwarded to the database (MySQL, Oracle, etc.) for remote visualisation by everybody or authorized one (owner or hospital authority). So, the database is updated by fetched data; then, it is displayed in the web page of official websites which belong to stages 2 and 3 in this detection system. Simultaneously, an emergency message (URL link of collision web portal) is sent to a nearer hospital or owner of the vehicle for taking steps to recover from that situation.

5. CIRCUIT DIAGRAM

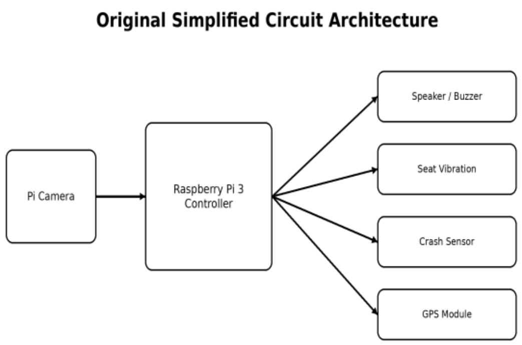


Fig. 13. Simplified circuit architecture for the proposed Raspberry Pi based system. Original figure prepared by the authors.

Result

An expectation of sleepiness. The eyes are open when the EAR value is greater than 0.25. This test demonstrates that the driver has not experienced visually obvious tiredness. Although being portrayed and being detected, the face is not recognised as being sleepy. Similarly, the driver's fatigue is picked up because the EAR value is less than 0.25, as illustrated graphically, and finally, a sleepy face is picked up as demonstrated. As seen in the preceding images, the eyelid motions regularly cause the EAR values to vary. When drowsiness is detected, the driver is informed with repeated voice alerts and a message is delivered through email.

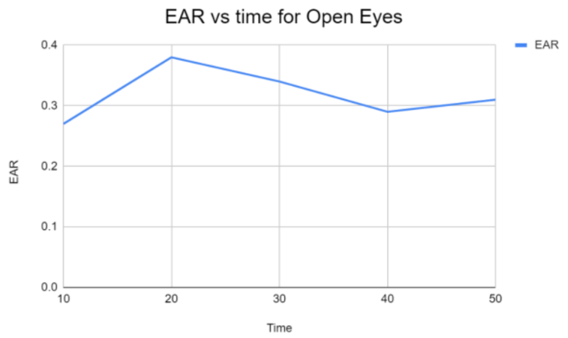


Fig. 14. EAR variation observed during the open-eye test. Original experimental result from this work.

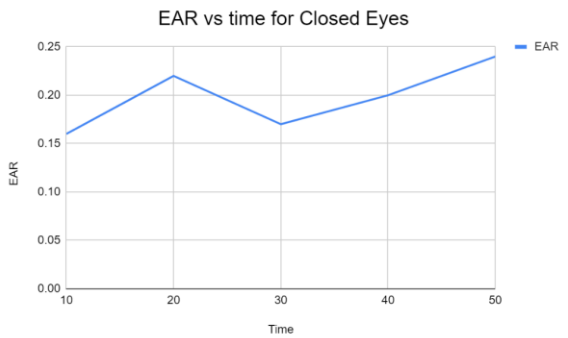


Fig. 15. EAR variation observed during the closed-eye test. Original experimental result from this work.

7. DISCUSSION

Collision Effect. A severe issue is when a driver causes a traffic accident due to sleepiness or negligent driving. Hence, it's necessary to determine the condition of sensors, as well as the most crucial step, which is to find the accident's location for immediate hospital assistance.

As a result, the nearby hospital authority or owner is also given the emergency alert so they can take the necessary precautions.

This message is interpreted from a specific online page (web portal), and it contains summary information regarding the incident. This website was created using the Glassfish local server.

Also, it makes it easier to manage numerous incidents that occur virtually at the same time (JSP page). When a collision location is found using the online portal, a map link is specifically created for it.

Performance Evaluation:

The system tested ten different individuals under a variety of conditions, such as using glasses instead of glasses as an alternative viewpoint. So, the effectiveness is evaluated on various levels, including eye accuracy and accuracy in detecting sleepiness. This technique tested ten different individuals with samples under a variety of circumstances, including wearing glasses as an alternative to using glasses. Thus, various aspects of performance, including eye accuracy and sleepiness accuracy detection, are measured.

In order to monitor accuracy from video streams, 500 frames were employed to identify eye blinking and tiredness. TED frames were used for the overall analysis (Truly Eye Detect), Falsely Eye Detect (FED), Really Alarm Detect (TAD), False Alarm Detect (FAD), Truly Mail Detect (TMD), and False Mail Detect (FMD)

It is possible to compute and assess with accuracy how well the eyes are performing in terms of ocular accuracy and drowsiness in various contexts. We believe Eye accuracy detection is identified as EAD, and sleepiness is identified as DAD.

$$EAD=TED / (TED+FED). \tag{6}$$

$$DAD=(TAD+TMD) / (TAD+ FAD+TMD+FMD). \tag{7}$$

The results of the overall analysis of the tests indicate that the performance of using face landmarks is more accurate and does not alter under any circumstances.

than the cascaded approach. But compared to the cascaded method, this procedure takes a little longer to load at deep night vision. Thus, this suggested system has provided an effective or successful drowsy detection using the facial landmark technique in addition to another interface for detecting collisions caused by drowsiness or an unconscious state of driving. However, it is tested on 10 different individuals in a variety of scenarios, and drowsiness is detected and alerted to via speaking alarm and an attached email sent to the user. While the random data set sent to this system to test its functionality performed with a 97.1% accuracy. owner or authority. This makes the system more effective at detecting driver fatigue and the effects of collisions.

8. CONCLUSION AND FUTURE SCOPE

A. CONCLUSION:

All the objectives set at the beginning of the project are successfully achieved. Eye aspect Ratio (EAR) algorithms on raspberry pi model are used for development of image processing to predict sleepiness is successful development and executed throughout the project. As for eye blink detection; the resultant EAR value was approximately 0.318 when the eyes opened, whereas when the eyes closed, the EAR was 0.198. Although it was not possible to obtain zero average EAR value, the sudden drop in average EAR indicates that the driver was in a state of sleepiness. As a mechanism to alert the driver, the warning message of drowsiness appeared on the screen, and the buzzer immediately rang in less than 1 second after the eyes had been closed. The device was able to send SMS and email to another subject after the driver's somnolence was identified. The project has been executed to propose a hardware platform prototype using Raspberry camera sensor (pi camera V2) and the Raspberry Pi 3 model to operate image processing. Seat vibrators are installed to alert the sleepy driver. The main purpose of the project is detecting a drowsy driver using cost efficient methodologies i.e. When a sleepy driver is detected through Pi camera model V2 an alert message is activated along with a buzzer. PS tracking system is installed for emergency conditions in case of any accident takes place.

B. FUTURE SCOPE:

There are many ways to avoid accidents, but they all have their limitations, which is why below methods can be taken into consideration in future when technologies and systems would get more cost efficient and viable. Advance sensing and alerting methods could be used. Auto pilot systems and software can be installed so that it enables your car to steer, accelerate and brake automatically within its lane in case the driver is drowsy. Self-driving cars use sensors to perceive their surroundings, such as optical and thermographic cameras, radar, lidar, ultrasound/sonar, GPS, odometry and inertial measurement units. Control systems interpret sensory information to create a three-dimensional model of the vehicle's surroundings. Temperature and heartbeat sensors could be installed to measure health parameters of the driver. Haar Cascade classifier prototype can be used to detect the blink duration of the driver. It is possible to determine if a motorist is conscious or unconscious using a brain wave sensor. The buzzer will alert the driver if he or she falls asleep or becomes unconscious. Brain wave pulse ranges are provided by the data gathering system. The system will recognise that a motorist has fallen asleep if this brain wave pulse does not match the reference pulse.

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