Divers Drowsiness Detection System Using Raspberry Pi

A Project Report

Submitted in partial fulfillment of the

Requirements for the award of the Degree of

MASTER OF SCIENCE (INFORMATION TECHNOLOGY)

By

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Under the esteemed guidance of

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4. Teaching experience of the Guide?

5. Is this your first submission?   Yes   No

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Signature of the Coordinator

Date: …………………….

ACKNOWLEDGEMENT

We are extremely delighted for getting an opportunity to express our gratitude for all those good souls who were more than guiding stars in helping us to complete the project.

Our first and foremost thanks goes to **Patkar-Varde College** and our faculties from whom we have learnt a lot.

We are deeply indebted to our principal **Dr. Shrikant B. Sawant**, our Chief Education Officer **Dr. (Mrs.) Mala Kharkar** and our coordinator as well as our project guide **Ms. Jetashree Shirodkar**. Their valuable feedback helped us tremendously to improve our project in many ways.

The infectious chain of gratitude would be far from complete without our friends who were with us through the difficult times and who taught us many things that matter in improving our project.

DECLARATION

We hereby declare that the project entitled, **"Divers Drowsiness Detection System Using Raspberry Pi"** done at **Patkar-Varde College,** has not been in any case duplicated to submit to any other university for the award of any degree. To the best of our knowledge other Than us, no one has submitted to any other university.

The project is done in partial fulfilment of the requirements for the award of degree of **MASTER'S OF SCIENCE (INFORMATION TECHNOLOGY)** to be submitted as final semester project as part of our curriculum.

Mr. Tejas Tamboskar, Mr. Chirag Jyothi

Signature………………………

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Chapter 1

Drowsiness Detector System in Automobile Using Raspberry Pi

1.1 Background

The project made in the field of Information Technology to develop a system for Drowsiness Detector System in Automobile Using Raspberry Pi. As we know truck drivers or people who drive cars for longer hours who transport the cargo and heavy materials over long distances during day and night time, they often suffer from lack of sleep. fatigue and drowsiness are some of the leading causes of major accidents on Highways. The automobile industries are working on some technologies that can detect the drowsiness and alert the driver about it Drowsy driving is one of the major causes behind fatal road accidents. One of the recent studies shows that one out of five road accidents are caused by drowsy driving which is roughly around 21% of road accidents, and this percentage is increasing every year as per global status report on road safety 2015, based on the data from 180 different countries. This certainly highlights the fact that across the world the total numbers of road traffic deaths are very high due to driver's drowsiness. Driver fatigue, drink-and-drive and carelessness are coming forward as major reasons behind such road accidents. Many lives and families are getting affected due to this across various countries.

Introduction

Real time drowsy driving detection is one of the best possible majors that can be implemented to assist drivers to make them aware of drowsy driving conditions. Such driver behavioral state detection system can help in catching the driver drowsy conditions early and can possibly avoid mishaps. With this paper, we are presenting technique to detect driver drowsiness using of Open CV, raspberry pi and image processing. Several studies have shown various possible techniques that can detect the driver drowsiness. Such driver drowsiness detection can be measured using physiological measures, ocular measure and performance measure. Among these physiological measure and ocular measure can give more accurate results. Physiological measure includes brain waves, heart rate, pulse rate measurements and these requires some sort of physical connection with the driver such as connecting electrode to the driver body. But this leads to discomfortable driving conditions. But ocular measure can be done without physical connection. Ocular measure to detect driver eye condition and possible vision based on eye closure is well suited for real world driving conditions, since it can detect the eyes open/ closed state non-intrusively using a camera.

1.2 Objectives

HUMAN PSYCHOLOGY WITH CURRENT TECHNOLOGY

Humans have always invented machines and devised techniques to ease and protect their lives, for mundane activities like traveling to work, or for more interesting purposes like aircraft travel. With the advancement in technology, modes of transportation kept on advancing and our dependency on it started increasing exponentially. It has greatly affected our lives as we know it. Now, we can travel to places at a pace that even our grandparents wouldn't have thought possible. In modern times, almost everyone in this world uses some sort of transportation every day. Some people are rich enough to have their own vehicles while others use public transportation. However, there are some rules and codes of conduct for those who drive irrespective of their social status. One of them is staying alert and active while driving.

Neglecting our duties towards safer travel has enabled hundreds of thousands of tragedies to get associated with this wonderful invention every year. It may seem like a trivial thing to most folks but following rules and regulations on the road is of utmost importance. While on road, an automobile wields the most power and in irresponsible hands, it can be destructive and sometimes, that carelessness can harm lives even of the people on the road. One kind of carelessness is not admitting when we are too tired to drive. In order to monitor and prevent a destructive outcome from such negligence, many researchers have written research papers on driver drowsiness detection systems. But at times, some of the points and observations made by the system are not accurate enough. Hence, to provide data and another perspective on the problem at hand, in order to improve their implementations and to further optimize the solution, this project has been done.

1.3 Purpose, Scope and Applicability

1.3.1 Purpose

Fatigue is a safety problem that has not yet been deeply tackled by any country in the world mainly because of its nature. Fatigue, in general, is very difficult to measure or observe unlike alcohol and drugs, which have clear key indicators and tests that are available easily. Probably, the best solutions to this problem are awareness about fatigue-related accidents and promoting drivers to admit fatigue when needed. The former is hard and much more expensive to achieve, and the latter is not possible without the former as driving for long hours is very lucrative.

1.3.2 Scope

The driver abnormality monitoring system developed is capable of detecting drowsiness, drunken and reckless behaviors of driver in a short time. The Drowsiness Detection System developed based on eye closure of the driver can differentiate normal eye blink and drowsiness and detect the drowsiness while driving. The proposed system can prevent the accidents due to the sleepiness while driving.

In future it can implement drowsiness detection system in aircraft in order to alert pilot.
• The alcoholic sensor is also used for drunk drivers
• In future it can implement drowsiness detection system in schools and colleges to alert the staffs to find the drowsy student in class

1.3.3 Applicability

The system works well even in case of drivers wearing spectacles and even under low light conditions if the camera delivers better output. Information about the head and eyes position is obtained through various self-developed image processing algorithms.

During the monitoring, the system is able to decide if the eyes are opened or closed. When the eyes have been closed for too long, a warning signal is issued. Processing judges the driver’s alertness level on the basis of continuous eye closures

Achievements

This system is used for Driver & Road safety system. Based on computer vision techniques, the driver’s face is located from a color video captured in a car. Then, face detection is employed to locate the regions of the driver’s eyes, which are used as the templates for eye tracking in subsequent frames. The tracked eye’s images are used for drowsiness detection in order to generate warning alarms.

The proposed approach has three phases: Face, Eye detection and drowsiness detection. The role of image processing is to recognize the face of the driver and then extracts the image of the eyes of the driver for detection of drowsiness. The face detection algorithm takes captured frames of image as input and then the detected face as output. It can be concluded this approach is a low cost and effective solution to reduce the number of accidents due to driver's Drowsiness to increase the transportation safety.

Chapter 2: Description of the problems/topics

2.1 Problem and State why it matters

Humans have always invented machines and devised techniques to ease and protect their lives, for mundane activities like traveling to work, or for more interesting purposes like aircraft travel. With the advancement in technology, modes of transportation kept on advancing and our dependency on it started increasing exponentially. It has greatly affected our lives as we know it. Now, we can travel to places at a pace that even our grandparents wouldn't have thought possible. In modern times, almost everyone in this world uses some sort of transportation every day. Some people are rich enough to have their own vehicles while others use public transportation. However, there are some rules and codes of conduct for those who drive irrespective of their social status. One of them is staying alert and active while driving.

Neglecting our duties towards safer travel has enabled hundreds of thousands of tragedies to get associated with this wonderful invention every year. It may seem like a trivial thing to most folks but following rules and regulations on the road is of utmost importance. While on road, an automobile wields the most power and in irresponsible hands, it can be destructive and sometimes, that carelessness can harm lives even of the people on the road. One kind of carelessness is not admitting when we are too tired to drive. In order to monitor and prevent a destructive outcome from such negligence, many researchers have written research papers on driver drowsiness detection systems. But at times, some of the points and observations made by the system are not accurate enough. Hence, to provide data and another perspective on the problem at hand, in order to improve their implementations and to further optimize the solution, this project has been done.

According to the National Highway Traffic Safety Administration, every year about 100,000 police-reported crashes involve drowsy driving. These crashes result in more than 1,550 fatalities and 71,000 injuries. The real number may be much higher, however, as it is difficult to determine whether a driver was drowsy at the time of a crash. So, in order to make the driver aware before any such accident occurs, we have made this system. It predicts the eye and mouth landmarks in order to identify if a person is falling asleep, by checking if his or her eyes are closed or if he, she is yawning. Interaction between driver and vehicle such as monitoring and supporting each other is one of the important solutions for keeping ourselves safe in the vehicles. Although active safety systems in vehicles have contributed to the decrease in the number of deaths occurring in traffic accidents, the number of traffic accidents is still increasing.

Fatigue is a safety problem that has not yet been deeply tackled by any country in the world mainly because of its nature. Fatigue, in general, is very difficult to measure or observe unlike alcohol and drugs, which have clear key indicators and tests that are available easily. Probably, the best solutions to this problem are awareness about fatigue-related accidents and promoting drivers to admit fatigue when needed. The former is hard and much more expensive to achieve, and the latter is not possible without the former as driving for long hours is very lucrative.

2.2 Description of work

The working of this system can be divided into two parts:
Detecting or Localizing the face.
Predicting the landmarks of important regions in the detected face.
Once the landmarks are predicted, we use only the eye landmarks and the mouth landmarks to determine the Eye Aspect Ratio (EAR) and Mouth Aspect Ratio (MAR) to check if a person is drowsy.

2.3 Propose solution and benefits of proposed solution

One solution to this serious problem is the development of an intelligent vehicle that can predict driver drowsiness and prevent drowsy driving. The percentage of eyelid closure over the pupil over time is one of the major methods for the detection of the driver's drowsiness. Physiological measurements like electroencephalogram (EEG), electrocardiogram (ECG), capturing eye closure, facial features, or driving performance (such as steering characteristics, lane departure, etc.), are used for drowsiness detection. When drowsiness is detected while driving, audible sound vibrations or warning messages on a display are generally used to warn the driver to concentrate on driving or to take a rest. These methods help the drowsy driver to prevent drowsiness-related crashes in a moment, but it is hard to get rid of drowsiness by just being aware of it. As we found in the literature review, most of the methods need lot of equipment which is not possible in real life implementations.

Also, most of the methods which rely on camera input for detection of opening and closing eyelids are not to be tested like they can be implemented in real time as most of the scholars take image as camera is fixed in front of the driver's road view. As for clear view, it is not possible to put the camera on front mirror. Secondly most of papers have drawbacks when there is high luminance caused by sunlight as well as during dim light conditions like bad weathers.

2.4 Summarizing the problem and solution

Various detection methods have been proposed by researchers and a few systems are available in the commercial market. In general, drowsiness detection methods fall into two major categories of monitoring physiological and physical conditions of the drivers and monitoring vehicle-related variables based on driver control functions that correlate with the driver's level of drowsiness. Each method has its advantages and shortcomings. A reliable detection method needs to be integrated with a safety system which may include advisory warning, semi-control, or full control of vehicle, i.e., braking and steering to achieve safe conditions

Chapter 3: Status of the research/knowledge in the field and literature review

3.1 Literature Survey

In 2010, Bin Yang described **'Camera-based Drowsiness Reference for Driver State Classification under Real Driving Conditions'**. They proposed that measures of the driver's eyes are capable to detect drowsiness under simulator or experiment conditions. The performance of the latest eye tracking based in-vehicle fatigue prediction measures are evaluated. These measures are assessed statistically and by a classification method based on a large dataset of 90 hours of real road drives. The results show that eye-tracking drowsiness detection works well for some drivers as long as the blinks detection works properly. Even with some proposed improvements, however, there are still problems with bad light conditions and for persons wearing glasses.

In 2011, M.J. Flores described **'Driver drowsiness detection system under infrared illumination for an intelligent vehicle'**. They proposed that to reduce the amount of such fatalities, a module for an advanced driver assistance system, which caters for automatic driver drowsiness detection and also driver distraction, is presented. Artificial intelligence algorithms are used to process the visual information in order to locate, track and analyze both the driver's face and eyes to compute the drowsiness and distraction indexes.
This real-time system works during nocturnal conditions as a result of a near-infrared lighting system. Finally, examples of different driver images taken in a real vehicle at nighttime are shown to validate the proposed algorithms.

In 2012, A. Cheng described **'Driver Drowsiness Recognition Based on Computer Vision Technology'**. They presented a nonintrusive drowsiness recognition method using eye-tracking and image processing. A robust eye detection algorithm is introduced to address the problems caused by changes in illumination and driver posture. Six measures are calculated with percentage of eyelid closure, maximum closure duration, blink frequency, average opening level of the eyes, opening velocity of the eyes, and closing velocity of the eyes. These measures are combined using Fisher's linear discriminated functions using a stepwise method to reduce the correlations and extract an independent index. Results with six participants in driving simulator experiments demonstrate the feasibility of this video-based drowsiness recognition method that provided 86% accuracy.

3.2 Existing System

In existing system, the driver drowsiness detection system involves controlling accident due to unconsciousness through Eye blink. Here one eye blink sensor is fixed in vehicle where if driver loses consciousness, then it alerts the driver through buzzer to prevent vehicle from accident.
Disadvantages of Existing System are

1.Not Reliable
2.May damage retina
3.Highly expensive
4.Intrusive

3.3 Survey of Technology

Requirement Analysis
Python: Python is the basis of the program that we wrote. It utilizes many of the python libraries.
Libraries:

- Numpy: Pre-requisite for Dlib
- Pygame: Used for sounding the alarm
- Dlib: This program is used to find the frontal human face and estimate its pose using 68 face landmarks.
- Imutils: Convenient functions written for Opencv.
- Opencv: Used to get the video stream from the webcam, etc.

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 detect the face in the frame image for each frame. This is achieved by making use of the Haar algorithm for face detection or shape predictor 68 face landmarks Recognition. 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 non-face. 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 dat “shape_predictor_68_face_landmarks.dat” 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.

Drowsiness Detection:

After getting eyes the algorithm then frames and determines the drowsiness. If the criteria are satisfied, then the driver is said to be drowsy. The buzzer connected to the system performs actions to correct the driver abnormal behavior. For this system, the eye and the face classifiers are required. The DAT Classifier Cascade files built-in there with the Open CV contains different classifiers for the face and eye detection. The inbuilt Open CV dat “shape_predictor_68_face_landmarks.dat”and function “Houghcircles ()” is used to search and detect the face followed by individual frames. The face detection and open eye detection have been carried out on each frame of the driver’s captured facial image. The face is assigned 68 values store the number in each frame.

A variable will store the number of successive frames in which the eyes found to be closed with the values like 0, 1, 2, 3… etc. Initially, this variable is set to 0. When both the eyes are open, and then Drowsy count will be 0. Drowsy count will increase when Eye’s total < 2. For an eye blink, Drowsy count value is raised by 1. If the eye blinks in more than 4 frames, i.e., variable count is greater than or equal to 4, then the condition for drowsiness is met and an alarm will be signaled at real time.

3.4 Technology Used

a. PYTHON - Python is an interpreted, high-level, general-purpose programming language. Python's design philosophy emphasizes code readability with its notable use of significant whitespace. Its language constructs and object-oriented approach aim to help programmers write clear, logical code for small and large-scale projects. Python is dynamically typed AND supports multiple programming paradigms, including procedural, object-oriented, and functional programming.

b. IMAGE PROCESSING - In computer science, digital image processing is the use of computer algorithms to perform image processing on digital images.

c. MACHINE LEARNING - Machine learning is the scientific study of algorithms and statistical models that computer systems use in order to perform a specific task effectively without using explicit instructions, relying on patterns and inference instead. It is seen as a subset of artificial intelligence. Machine learning algorithms build a mathematical model based on sample data, known as "training data", in order to make predictions or decisions without being explicitly told.

Chapter 4: Description of the methodology/approach.

4.1 Methodological approach

Fig: 1 System Diagram for Proposed Method

In the approach shown, the primary focus is given to the faster drowsiness detection and processing of data. The number of frames in which the eyes are kept closed is monitored and then counted. If the number of frames exceeds a threshold value, then a warning message is generated on the display showing that the drowsiness is detected. The system should be capable of detecting drowsiness in spite of the skin color and complexion of the driver, spectacles used by the driver and the darkness level inside the vehicle. All these objectives have been well satisfied by choosing the system using appropriate classifiers in OpenCV for eye closure detection. In this algorithm, first a driver's image is acquired by the camera for processing. In OpenCV, the face detection of the driver's image is carried out first followed by eye detection. The eye detection technique detects the open state of eyes only. Then the algorithm counts the number of open eyes in each frame and calculates the criteria for detection of drowsiness. If the criteria are satisfied, then the driver is said to be drowsy. The display and buzzer connected to the system perform actions to correct the driver abnormal behavior. For this system, the face and eye classifiers are required. The HARR Classifier Cascade files inbuilt on OpenCV include different classifiers for the face detection and the eyes detection. The inbuilt OpenCV dat file "shape_predictor_68_face_landmarks.dat" is used to search and detect the face in individual frames.

In this algorithm, first a driver's image is acquired by the camera for processing. In OpenCV, the face detection of the driver's image is carried out first followed by eye detection. The eye detection technique detects the open state of eyes only. Then the algorithm counts the number of open eyes in each frame and calculates the criteria for detection of drowsiness. If the criteria are satisfied, then the driver is said to be drowsy. The display and buzzer connected to the system perform actions to correct the driver abnormal behavior. For this system, the face and eye classifiers are required. The DAT files inbuilt on OpenCV include different classifiers for the face detection and the eyes detection. The inbuilt OpenCV xml

Fig 2: 68 Face Landmark

The classifier "shape_predictor_68_face_landmarks.dat" is used to detect 68 facial landmarks which are indexable which enables us to extract the various facial structures using simple Python array slices from the detected face. The system does not detect in the closed state of the eyes. The face detection and open eye detection have been carried out on each frame of the driver's facial image acquired from the camera.

4.2 Planning and Scheduling

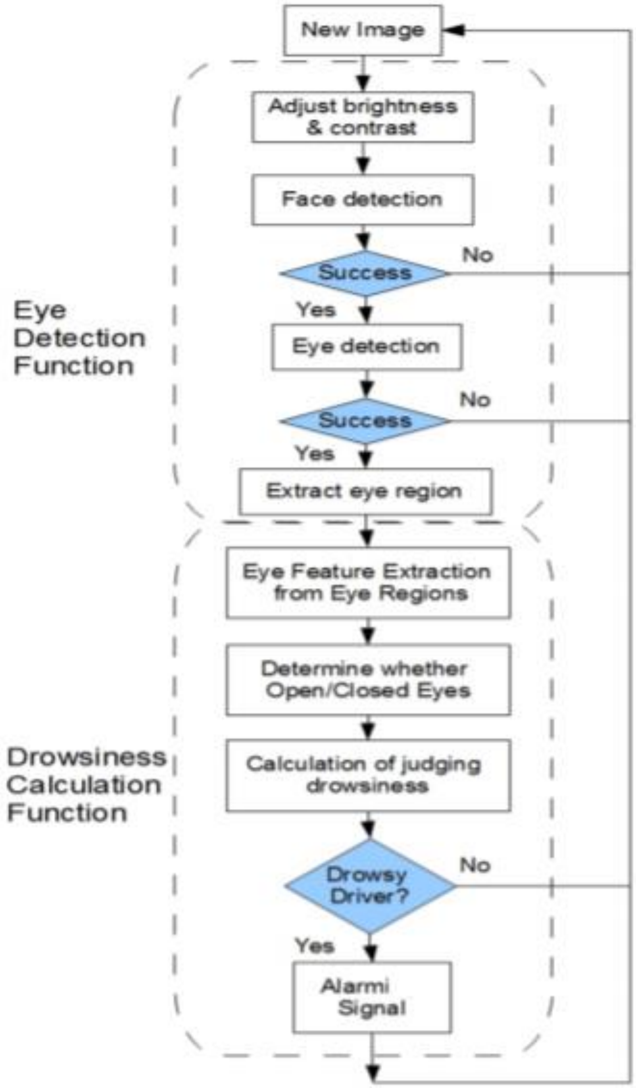


Fig 3. PERT CHART

In the eye detection stage, the processor receives facial images and, first, it adjusts their brightness and contrast. This helps to reduce dependence of accuracy of the system on light sensitivity. In next step, the top-down model approach is applied to detect the face region in order to narrow down the location of eyes. If the input image does not contain the driver's face, the program continues to grab new input images from the webcam until the face is detected. From there the eyes region can be extracted.

The system employs the Viola Jones technique and the standard Ada-Boost (Adaptive Boosting) training method to do the fast and effective eyes detection extraction.

4.2.1 SYSTEM MODEL

The framework is created utilizing the incremental model. The center model of the framework is first created and afterwards augmented in this way in the wake of testing at each turn. The underlying undertaking skeleton was refined into expanding levels of ability.

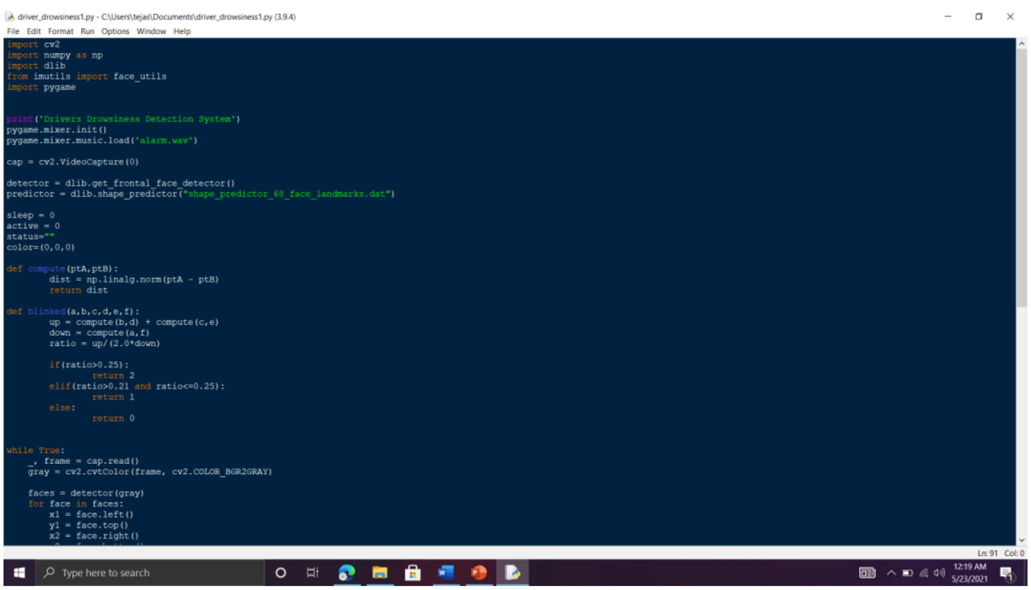
At the following incremental level, it might incorporate new execution backing and improvement.

4.3 Observation

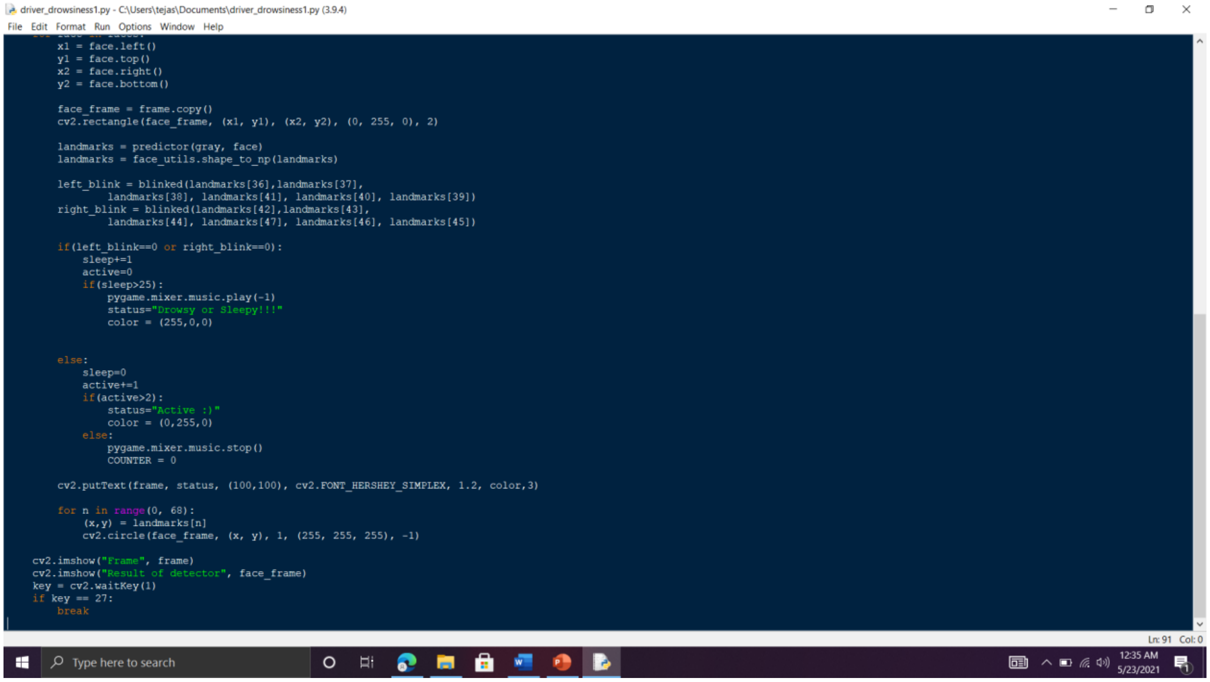
Different techniques have been found for detecting driver drowsiness and they use different types of data as input for their algorithm. After the survey of different types of methods, it is found that using camera is the best method which can be easily applied and appropriate in all conditions. We decide to explore this method of computer vision and proposed a noble method to detect driver drowsiness based on detecting eyelid closing and opening using artificial neural networks as classification algorithm. In this paper, first of all, the video frames are acquired from the camera which could be fixed in such a way that it should not obstruct the road-view of the driver. Secondly, the Lab Color Space technique is applied to each frame then thresholding is to be done in an image. After thresholding, the largest region is to be detected using Connected Analysis. The face of the driver will be found in the video in such a way that it should not affect the performance of accurate face detection in terms of varying lightning conditions

Once the code is ready, connect the Pi camera and buzzer to Raspberry Pi and run the code. After 10 seconds or earlier, a window will appear with the live streaming from your Raspberry Pi camera. When the device recognizes the face, it will print your face on the frame and start tracking the eye movement. Now close your eyes for 7 to 8 seconds to test the alarm. When the count becomes more than 10, it will trigger an alarm, alerting you about the situation.

4.4 Coding details


driver_drowsiness1.py - C:\Users\tejas\Documents\driver_drowsiness1.py (3.9.4)

```
import cv2
import numpy as np
import dlib
from imutils import face_utils
import pygame


print('Drivers Drowsiness Detection System')
pygame.mixer.init()
pygame.mixer.music.load('alarm.wav')

cap = cv2.VideoCapture(0)

detector = dlib.get_frontal_face_detector()
predictor = dlib.shape_predictor("shape_predictor_68_face_landmarks.dat")

sleep = 0
active = 0
status=""
color=(0,0,0)

def compute(ptA,ptB):
        dist = np.linalg.norm(ptA - ptB)
        return dist

def blinked(a,b,c,d,e,f):
        up = compute(b,d) + compute(c,e)
        down = compute(a,f)
        ratio = up/(2.0*down)

        if(ratio>0.25):
                return 2
        elif(ratio>0.21 and ratio<=0.25):
                return 1
        else:
                return 0


while True:
    _, frame = cap.read()
    gray = cv2.cvtColor(frame, cv2.COLOR_BGR2GRAY)

    faces = detector(gray)
    for face in faces:
        x1 = face.left()
        y1 = face.top()
        x2 = face.right()
```




```python
        x1 = face.left()
        y1 = face.top()
        x2 = face.right()
        y2 = face.bottom()

        face_frame = frame.copy()
        cv2.rectangle(face_frame, (x1, y1), (x2, y2), (0, 255, 0), 2)

        landmarks = predictor(gray, face)
        landmarks = face_utils.shape_to_np(landmarks)

        left_blink = blinked(landmarks[36],landmarks[37],
                landmarks[38], landmarks[41], landmarks[40], landmarks[39])
        right_blink = blinked(landmarks[42],landmarks[43],
                landmarks[44], landmarks[47], landmarks[46], landmarks[45])

        if(left_blink==0 or right_blink==0):
            sleep+=1
            active=0
            if(sleep>25):
                pygame.mixer.music.play(-1)
                status="Drowsy or Sleepy!!!"
                color = (255,0,0)


        else:
            sleep=0
            active+=1
            if(active>2):
                status="Active :)"
                color = (0,255,0)
            else:
                pygame.mixer.music.stop()
                COUNTER = 0

        cv2.putText(frame, status, (100,100), cv2.FONT_HERSHEY_SIMPLEX, 1.2, color,3)

        for n in range(0, 68):
            (x,y) = landmarks[n]
            cv2.circle(face_frame, (x, y), 1, (255, 255, 255), -1)

    cv2.imshow("Frame", frame)
    cv2.imshow("Result of detector", face_frame)
    key = cv2.waitKey(1)
    if key == 27:
        break
```

Requirement Analysis

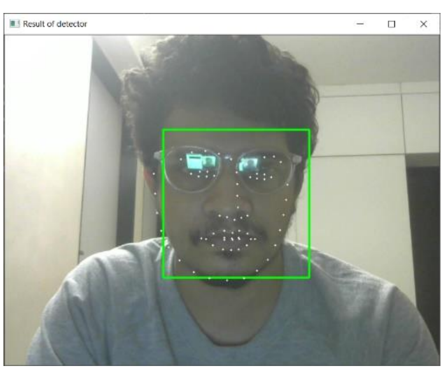
Python: Python is the basis of the program that we wrote. It utilizes many of the python libraries.

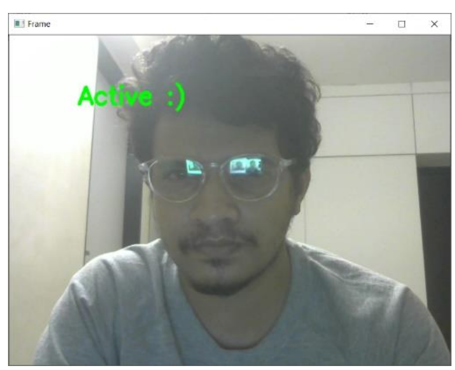
Libraries:

- Numpy: Pre-requisite for Dlib
- Pygame: Used for sounding the alarm
- Dlib: This program is used to find the frontal human face and estimate its pose using 68 face landmarks.
- Imutils: Convenient functions written for Opencv.
- Opencv: Used to get the video stream from the webcam, etc.

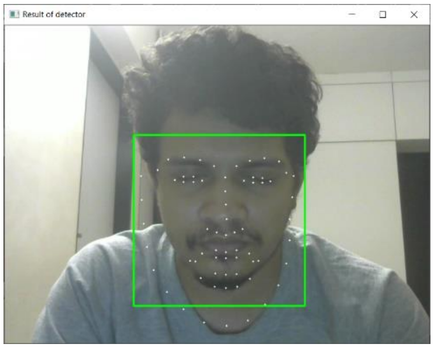
4.5 Test Cases

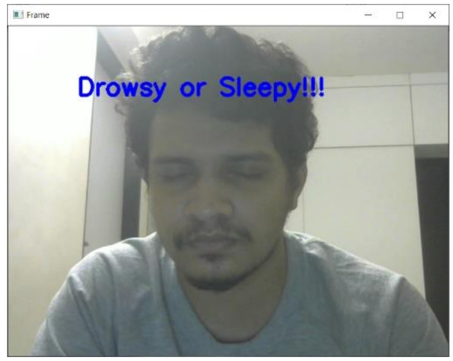
Test Case 1: **Drivers with spectacles**: When there is ambient amount of light, the automobile driver's face and eyes are successfully detected.



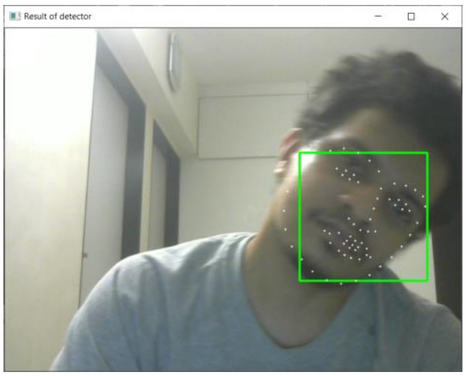


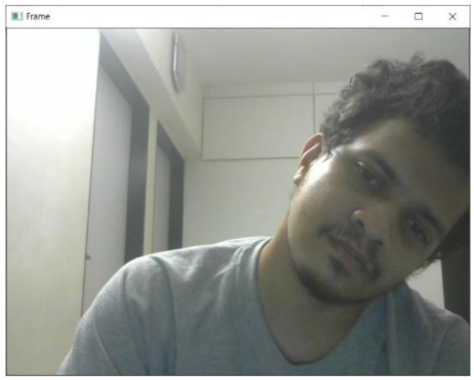
Test Case 2: **When the driver is sleeping**: When the driver is sleeping, the alert message pops up and alarm sounds takes place successfully





Test Case 3: **When the driver's head tilted/positioned at the right or left or up and down:** When face is not at the center position, it was observed that the detection of face and eyes failed





Chapter 5: Results

5.1 Test Reports:

The results of the proposed system in this study for 3 test instances, each experiment instance has been conducted by a different user.

The result varies with respect to the following factors:
- No. of captured frames
- Size of the eye
- Eye clearance (with or without eyeglass)

The correct rate of drowsiness detection is higher than 99.2%(assumed) and the average correct rate can achieve 99.45%(assumed). The performance directly proportional with quantity (number of the face points) and the quality (variety of face points) of the training data.

5.2 Procedure

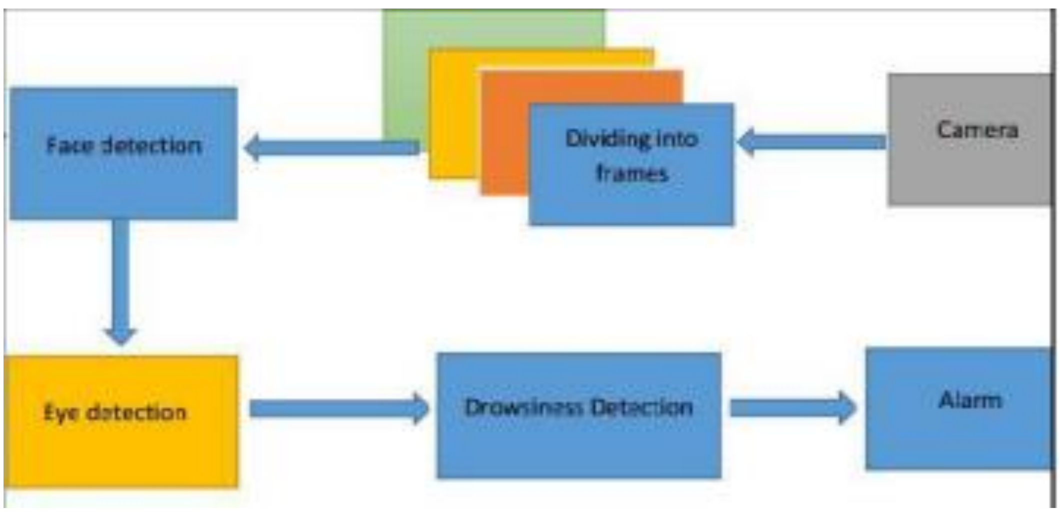


Fig 4: Flow chart showing entire process of drowsiness detection system

Sleepiness of an individual can be estimated by the all-inclusive timeframe for which his/her eyes are in shut state. In our framework, essential consideration is given to the quicker recognition and preparing of information.

The quantity of edges for which eyes are shut is observed. On the off chance that the quantity of edges surpasses a specific worth, at that point a warning message is created on the presentation indicating that the driver is feeling sluggish.

In our calculation, first the image is obtained by the webcam for handling. At that point we utilize the dataset to distinguish the countenances in every individual edge. On the off chance that no face is distinguished, at that point another edge is gained. In the event that a face is identified, at that point an area of enthusiasm for set apart inside the face. This place of plotting contains the eyes. Characterizing a district of intrigue essentially lessens the computational prerequisites of the framework.

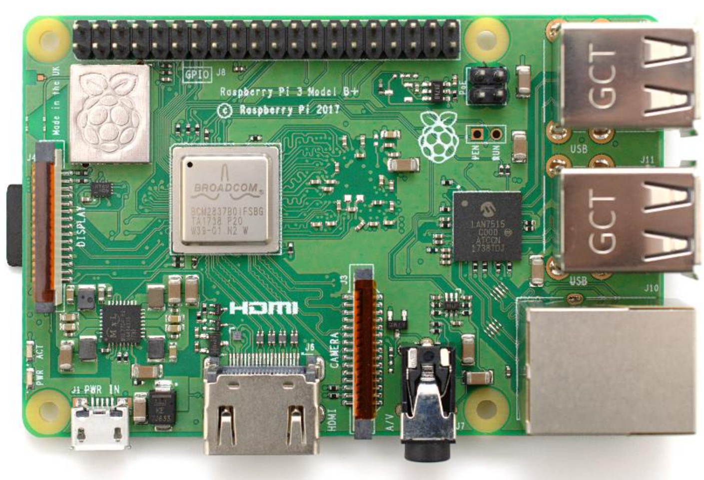
5.3 Working of software

Software and language used to create this project is "**Python IDLE**".

Python is a ground-breaking present day PC programming language. You are not compelled to characterize classes in Python (in contrast to Java) however you are allowed to do so when advantageous. However, Python is likewise free in other significant manners, for instance you are allowed to duplicate it the same number of times as you like, and allowed to examine the source code, and make changes to it. Python is a decent decision for numerical figuring, since we can compose code rapidly, test it effectively, and its language structure is like the manner in which scientific thoughts are communicated in the scientific writing

5.4 Components Used

1. RASSPBERRY PI 3 MODEL B



Raspberry Pi is a credit card sized single-board computer. It has 5 models. Model A, Model A+, Model B, Model B+, Generation 2 Model B. Model A has 256Mb RAM, one USB port and no network connection. Model A+ has 256Mb RAM, one USB port and network connection. Model B has 512Mb RAM, 2 USB ports and an Ethernet port. Model B+ has 512Mb RAM, four USB ports, Ethernet port and HDMI and camera interface slot. Generation 2 Model B also has 4 USB ports, 1 GB RAM, 2 camera interface and 1HDMI interface. We implemented raspberry pi tablet using Model B+. IT has a Broadcom BCM2835 system on chip which include an ARM1176JZF-S 700 MHz processor, Video Core IV GPU, and an SD card. The GPU is capable of Blu-ray quality playback, using H.264 at 40MBits/s. It has a fast 3D core accessed using the supplied Open GL ES2.0 and Open VG libraries. The chip specifically provides HDMI and there is no VGA support. The foundation provides Debian and Arch Linux ARM distributions and also Python as the main programming language, with the support for BBC BASIC and C.

VISION TO RASSPBERRY PI

The Raspberry Pi Camera Board plugs directly into the CSI connector on the Raspberry Pi. It's able to deliver a crystal clear 5MP resolution image, or 1080p HD video recording at 30fps The Raspberry Pi Camera Board features a 5MP (2592×1944 pixels) Omni vision 5647 sensor in a fixed focus module. The module attaches to Raspberry Pi, by way of a 15 Pin
Ribbon Cable, to the dedicated 15-pin MIPI Camera Serial Interface (CSI), which was designed especially for interfacing to camera.

2. Camera

Utilizing a web camera introduced inside the automobile we can get the picture of the driver. Despite the fact that the camera creates a video clip, we have to apply the developed algorithm on each edge of the video stream. This paper is only focused on the applying the proposed mechanism only on single frame. The used camera is a low-cost web camera with a frame rate of 30 fps in VGA mode. Logitech Camera is used for this process

3. SD Card

SD Card is required to load the raspberry pi and to store the data or the project. It works as a storage drive for the raspberry pi.

4. RJ 45 Cable

This cable is only required when raspberry pi needs to connected to the laptop and use the raspberry pi via VNC

5. HDMI Cable

HDMI cable is required to when the raspberry pi is connected to a monitor or a television to display the raspberry pi interface
We have implemented Face detection with the help of
(1) Raspberry pi.
(2) Web Cam.
(3) Raspbian operating system.
(4) Python IDLE.
(5) OpenCV (Open-source Computer Vision) for python with Harr object detection trainer.
(6) Program code for face detection written in Python Programming language.

Chapter 6: Conclusions and proposals for the future work

6.1 Limitations

Dependence on ambient light: The model developed for this purpose strongly depends on the ambient light condition. As our algorithm considers the eye sight as a dark region when it is closed and brighter region when it is open so if the ambient condition affects such that there may be possibility of brighter and darker condition depending on light source then it causes error in the result. Also, this model depends on certain minimum level of light condition otherwise it becomes very difficult to detect. To avoid this error, we can use either LED light for better detection or we can use an infrared camera.

Distance of camera from driver face: For best result we have assumed and designed the code according to the fact that the distance between camera and face should be nearly 100 cm. Hence the designed set up output may vary from vehicle to vehicle as different vehicle have different types of seat lengths.

Processor speed of hardware: We have used Raspberry Pi for implementation. The processor speed of Raspberry Pi is 700 MHz. So, this speed of processor is not competing enough to do video processing. Hence processor with very high speed is needed which will ultimately increase the cost of the product.

Use of shades: In case the user uses shades then it is difficult to detect the state of the eye. As it hugely depends on light hence reflection of shades may give the output for a closed eye.

Multiple face problem: If multiple face arises in the window, then the camera may detect a greater number of faces undesired output may appear. Because of different condition of different faces. So, we need to make sure that only the driver face come within the range of the camera. Also, the speed of detection reduces because of operation on multiple faces

Requirement Analysis

Python: Python is the basis of the program that we wrote. It utilizes many of the python libraries.
Libraries:
• Numpy: Pre-requisite for Dlib
• Pygame: Used for sounding the alarm
• Dlib: This program is used to find the frontal human face and estimate its pose using 68 face landmarks.
• Imutils: Convenient functions written for Opencv.
• Opencv: Used to get the video stream from the webcam, etc.

6.2 Conclusion

It completely meets the objectives and requirements of the system. The framework has achieved an unfaltering state where all the bugs have been disposed of. The framework cognizant clients who are familiar with the framework and comprehend its focal points and the fact that it takes care of the issue of stressing out for individuals having fatigue-related issues to inform them about the drowsiness level while driving. The driver abnormality monitoring system developed is capable of detecting drowsiness of driver in a short time.

The Drowsiness Detection System Using Raspberry Pi is developed based on eye closure of the driver can differentiate normal eye blink and drowsiness and detect the drowsiness while driving. The proposed system can prevent the accidents due to the sleepiness while driving. The system works well even in case of drivers wearing spectacles and even under low light conditions if the camera delivers better output. Information about the head and eyes position is obtained through various self-developed image processing algorithms.

During the monitoring, the system is able to decide if the eyes are opened or closed. When the eyes have been closed for too long, a warning signal is issued. Processing judges the driver's alertness level on the basis of continuous eye closures.

6.3 Future Scope

The model can be improved incrementally by using other parameters like blink rate, yawning, state of the car, etc. If all these parameters are used it can improve the accuracy by a lot.

Further work on this project can be done by adding a sensor to track the heart rate in order to prevent accidents caused due to sudden heart attacks to drivers.

Same model and techniques can be used for various other uses like Netflix and other streaming services can detect when the user is asleep and stop the video accordingly. It can also be used in application that prevents user from sleeping.

The alcoholic sensor is also used for drunk drivers or in future it can implement drowsiness detection system in schools and colleges to alert the staffs to find the drowsy student in class.

Our model is designed for detection of drowsy state of eye and give and alert signal or warning may be in the form of audio or any other means. But the response of driver after being warned may not be sufficient enough to stop causing the accident meaning that if the driver is slow in responding towards the warning signal, then accident may occur. Hence to avoid this we can design and fit a motor driven system and synchronize it with the warning signal so that the vehicle will slow down after getting the warning signal automatically. Also, we can avoid the use of RaspberryPi which is not so fast enough for video processing by choosing our own mobile phone as the hardware. This can be done by developing a proper mobile application which will perform the same work as RaspberryPi and response will be faster and effective.

6.4 Bibliography

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