DRIVER DROWSINESS DETECTION SYSTEM

A Dissertation submitted for the partial fulfilment of the degree of

Bachelor of Engineering in Computer Engineering

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Dissertation Approval Sheet

The dissertation entitled **"DRIVER DROWSINESS DETECTION SYSTEM"** Submitted by "**PRARBDH TIWARI "** and "**SHAKSHAM KHANDELWAL"** is approved as partial fulfilment for the award **Bachelor of Engineering in Computer Engineering** degree by **Devi Ahilya Vishvavidyalaya Indore (MP)**

Internal Examiner **External Examiner**

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Recommendation

The dissertation entitled **"DRIVER DROWSINESS DETECTION"** submitted by **PRARBDH TIWARI ,SHAKSHAM KHANDELWAL** is a satisfactory account of the bonafide work done under my supervision is recommended towards the partial fulfilment for the award of **Bachelor of Engineering in Computer Engineering** degree by **Devi Ahilya Vishwavidyalaya, Indore.**

Date: 06/05/2023

Mr Pravin Karma
(Project Guide)

Endorsed By :

Dr. GL Prajapati

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Candidate Declaration

We hereby declare that the work which is being presented in this project entitled Project Name in partial fulfilment of degree of Bachelor of Engineering in Computer Engineering is an authentic record of our own work carried out under the supervision and guidance of **Mr Pravin Karma**, **Assistant Professor** in Department of **Information Technology**, Institute of Engineering and Technology, Devi Ahilya Vishwavidyalaya, Indore

We are fully responsible for the matter embodied in this project in case of any discrepancy found in the project and the project has not been submitted for the award of any other degree.

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ABSTRACT

Drowsiness and Fatigue of drivers are amongst the significant causes of road accidents. Every year, they increase the amounts of deaths and fatalities injuries globally. In this paper, a module for Advanced Driver Assistance System (ADAS) is presented to reduce the number of accidents due to drivers fatigue and hence increase the transportation safety; this system deals with automatic driver drowsiness detection based on visual information and Artificial Intelligence. We propose an algorithm to locate, track, and analyze both the drivers face and eyes to measure PERCLOS, a scientifically supported measure of drowsiness associated with slow eye closure.

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Chapter-1 Introduction

1.1 Overview and issues involved

Nowadays Driver fatigue is a major factor in a large number of vehicle accidents. Recent statistics estimate that annually 1,200 deaths and 76,000 injuries can be attributed to fatigue related crashes. The development of technologies for detecting and avoiding drowsiness at the wheel is a major challenge in the field of accident avoidance systems. Because of the hazard that drowsiness presents on the road, methods need to be developed for counteracting its affects.

The aim of this project is to develop a prototype drowsiness detection system. The focus is on designing a system that will accurately monitor the open or closed state of the drivers eyes in real-time. By monitoring the eyes, it is believed that the symptoms of driver fatigue can be detected early enough to avoid a car accident. Detection of drowsy involves a pattern of images of a face, and the observation of eye movements and blink rate. The analysis of face images is a popular research area with applications such as face recognition, virtual tools, and human identification security systems.

This project is used the localization of the eyes, which involves looking at the image of the face, and determining the position of the eyes by developing matlab program. Once the position of the eyes is located, the system is designed to determine whether the eyes are opened or closed, and detect drowsiness. The purpose of this study is to detect drowsiness in drivers to prevent accidents and to improve safety on the highways.

A method for detecting drowsiness in drivers is developed by using a camera that point directlytowards the drivers face and capture for the real time video. Once the video is captured, monitoring the face region and eyes in order to detect drowsy. The system able to monitoring eyes and determines whether the eyes are in an open position or closed state. In such a case when drowsiness is detected, a warning signal is issued to alert the driver. It can determine a time interval of eye closure as theproportion of a time interval that the eye is in the closed position. If the drivers eyes are closed cumulatively more than a standard value, the system draws the conclusion that the driver is falling asleep, and then it will activate an alarm sound to alert the driver.

1.2 Problem Definition

Current drowsiness detection systems monitoring the driver's condition requires complex computation and expensive equipment, not comfortable to wear during driving and is not suitable for driving conditions; for example, Electroencephalography (EEG) and Electrocardiography (ECG), i. e. detecting the brain frequency and measuring the rhythm of heart, respectively.

A drowsiness detection system which use a camera placed in front of the driver is more suitable to be use but the physical signs that will indicate drowsiness need to be located first in order to come up with a drowsiness detection algorithm that is reliable and accurate. Lighting intensity and while the driver tilt their face left or right are the problems occur during detection of eyes and mouth region.

Therefore, this project aims to analyse all the previous research and method, hence propose a method to detect drowsiness by using video or webcam. It analyses the video images that have been recorded and come up with a system that can analyse each frame of the video.

1.3 Proposed solution

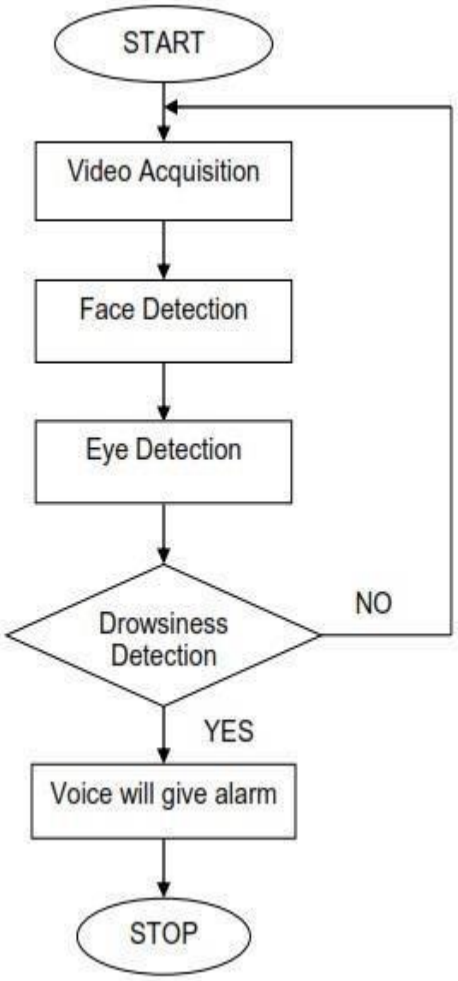


Fig 1.1 – Process Flow

We are here with our proposed solution of driver drowsiness detection . Based on acquisition of video from the camera that is in front of driver perform real-time processing of an incoming video stream in order to infer the driver's level of fatigue if the drowsiness is estimated then it will give the alert by sensing the eyes. A new approach towards automobile safety and security with autonomous region primarily based automatic automotive system is projected during this conception. A drowsy driver detection system and a traffic detection system with external vehicle intrusion dodging primarily based conception. So as to attenuate these problems, we've incorporated driver alert system by watching each the driver's eyes. Once its detected that the driver is drowsy then the particular score is generated and the alarm rings to make the driver aware..

Chapter-2 Literature Survey

2.1 Methodology

The methodology used to design the Drowsiness Detection System is an iterative research and analysis cycle. The research stage generates concepts and the analysis stage selects concepts, analyze requirements and constraints. The cycle is then repeated to generate more refined concepts and these concepts are further analyzed.

Requirements:

Reliability: The solution should reliably detect drowsiness so that it can serve its purpose as a system for promoting driver safety.

Real-time response: The operation of a vehicle can involve relatively high speeds, a system that cannot detect drowsiness and warn that driver promptly can lead to serious consequences.

Unobtrusive: It is very important that the solution is as transparent to the driver as possible.

Economical: Existing solutions to this problem are available today but the effective ones are usually too expensive for widespread implementation.

Flexible: To be effective, the solution should be designed so as to accommodate for all types of users, in terms of physical attributes.

Constraints:

Space: The solution needs to be implemented in a space-efficient manner. It must not interfere with the existing controls of the car.

Power: There will be a limited power source so the solution needs to designed so that it can operate properly on limited power requirements.

Proposed design

Eye detection algorithm:
The physiological properties and appearances of the eyes will be investigated and the method of capturing these properties of the eyes using infrared lighting will be explored. Kalman trackers will be used to determine eyes

and head dynamics between successive images and a probabilistic model will be used to calculate the driver's vigilance.

Lane tracking detection algorithm:
Using image processing techniques measures the behaviour of a driven vehicle with respect to the vehicle's position to the surroundings.

2.2 Existing Solutions

There are many techniques available for approaching this problem and each has its sets of pros and cons. We are gonna list some and then infer why we chose one for our use.

1. EEG based

Electroencephalogram (EEG) signal of driver measured with a single electrode neuro-signal acquisition device and a fatigue index or activity level calculated which in turn tells if the driver is likely to fall asleep. This is a wearable type system. It is fairly robust but has to be specifically tuned for different individuals in some cases.

2. Steering mounted

It works by recording the steering behavior of the driver at different points in the trip and infer the level of activity of driver. It is often used in conjunction with monitoring different behaviors such as pressure on the acceleration pedal, movement of the car, etc.

3. Yawning based

Video feed of the driver's face is continuously scanned for gestures such as yawning which indicates fatigue state of the driver. A small camera placed inside the vehicle which records the behavior of the driver and the feed is either locally or over a server scanned for yawning and such behavior.

4. Eyeblink measurement

Similar to yawning-based method a camera records the driver's face and checks if the driver's eyes are closed or open. The estimated average blinking duration is between 100-400ms according to the Harward database of useful biological numbers. If the camera sees that the eye of the driver closes for a duration far more than that it marks the driver as asleep and some sort of alarm raised. This method has proven to be the most effective measure and easiest to implement providing satisfactory results. Hence we are going to be using the same for our project, along with yawning measurement.

Chapter-3 Analysis & Design

3.1 Software Requirements

1) You need to have Python (3.6 version recommended) installed on your system, then using pip, you can install the necessary packages.

2)OpenCV – pip install opencv-python (face and eye detection).

3)TensorFlow – pip install tensorflow (keras uses TensorFlow as backend).

4)Keras – pip install keras (to build our classification model).

5)Pygame – pip install pygame (to play alarm sound).

6) Operating System

- Windows or Ubuntu

3.2 Hardware Requirements

I. Laptop with basic hardware.

II. Webcam

III Eye tracking Sensors

3.1 Analysis Diagrams

3.2.1 Use Case Model

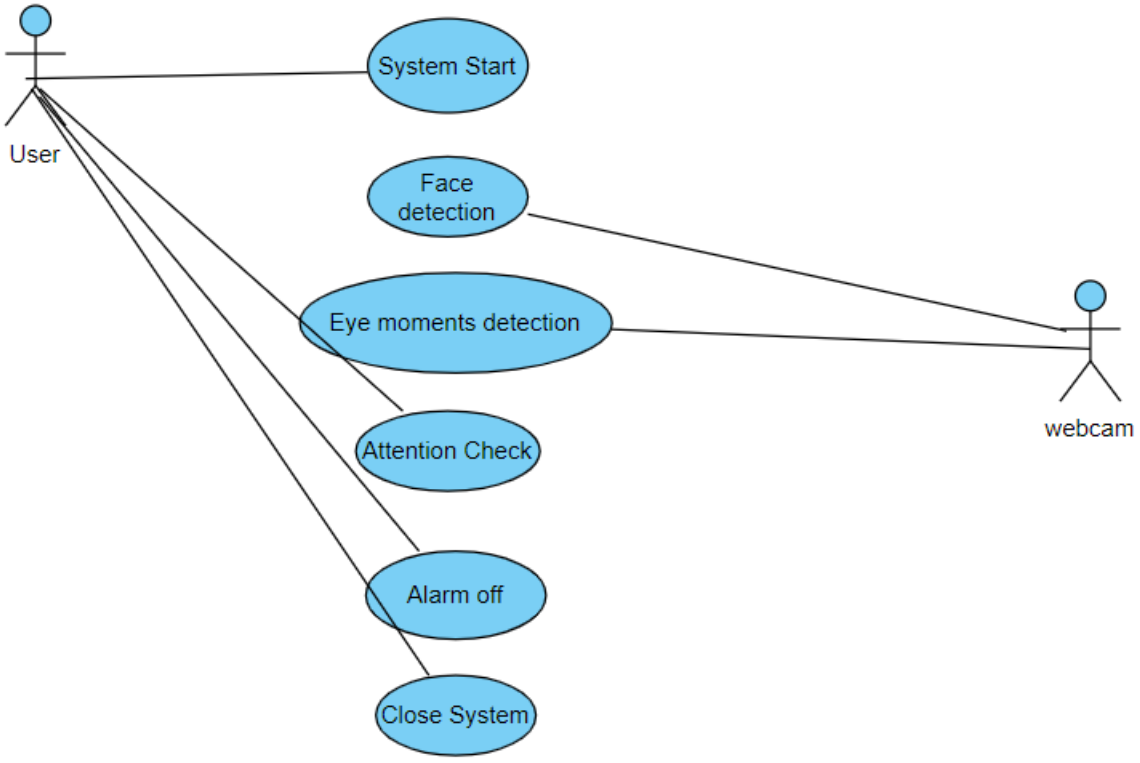


FIG 3.1 - USE-CASE DIAGRAM

3.3 Use Case Description

Serial no	USECASE	DESCRIPTION
1	Use Case Description	Driver Starts the camera and with the help of webcam take facial image as input for Drowsiness Detection
2	Actors	Driver
3	Precondition	Webcam must be proper for perfect image capturing
4	Postcondition	After image detection if the score is greater than the threshold than an alarm will beep to alert the driver that his condition is drowsy.

3.4 Design Diagrams

3.4.1 Architecture Diagram

The model we used is built with Keras using Convolutional Neural Networks (CNN). A convolutional neural network is a special type of deep neural network which performs extremely well for image classification purposes. A CNN basically consists of an input layer, an output layer and a hidden layer which can have multiple layers. A convolution operation is performed on these layers using a filter that performs 2D matrix multiplication on the layer and filter.

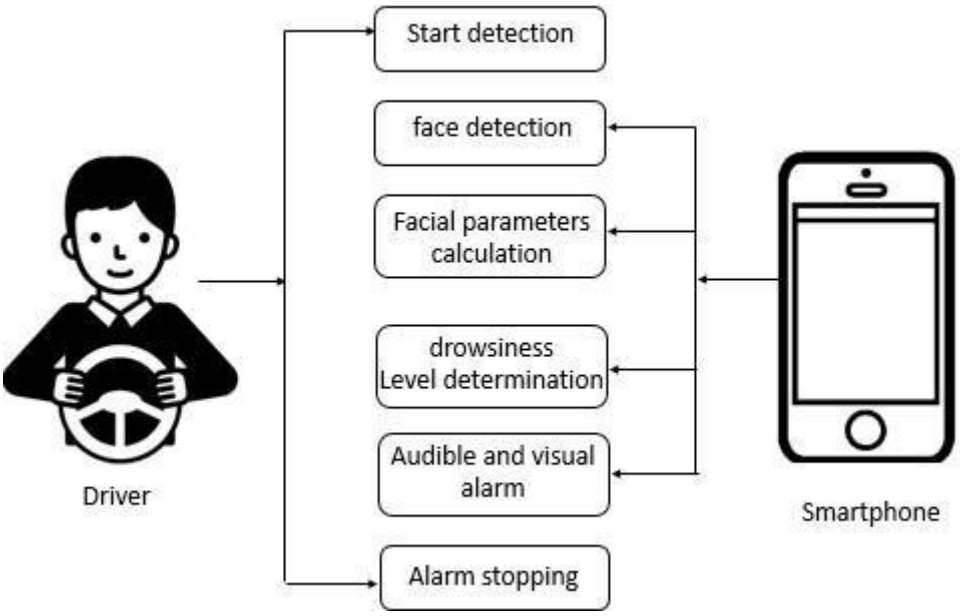


FIG 3.2 – Architecture Diagram

Chapter – 4 Implementation and Testing

The methodology used to design the Drowsiness Detection System is an iterative research and analysis cycle. The research stage generates concepts and the analysis stage selects concepts, analyze requirements and constraints. The cycle is then repeated to generate more refined concepts and these concepts are further analyzed.
Steps Required:

1. Installing and importing all the modules needed for the code.
2. pip install numpy
3. pip install opencv-python
4. pip install time
5. pip install keras
6. pip install dlib
7. pip install tensorflow

2. Access the camera and mark the landmarks from the (.dat) file to predict the location of the ear and eyes.

3. Using the Euclidean distance function to calculate the distance between landmarks on the opposite sides of the eyes. This function requires two points in a plane to calculate the distance.

Euclidean distance formula: d
=√[(x2 – x1)2 + (y2 – y1)2]

4. Mark the eye points in a face so that it will be really easy for the user to get the detection.

5. Calculate the aspect ratio for the left and right eyes and set the criteria for the closing of eyes (drowsiness detection).

Import Modules and libraries: import cv2 import
os
from keras.models import load_model import numpy as np from pygame import mixer import time
Face landmark mapping points:

Here, the image below shows all the masking and landmarks numerically-wise of all the critical points in a normal face with the reference of the right and left eye accordingly.

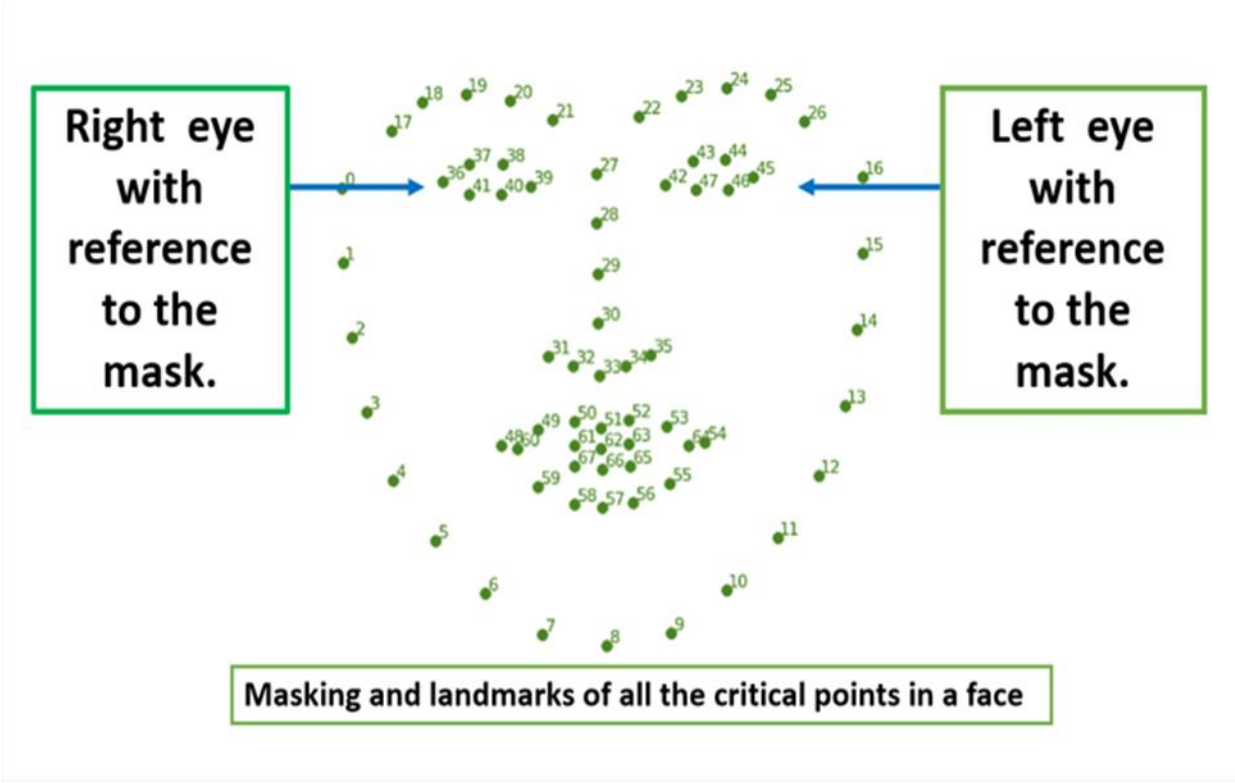


Fig 4.1.1 – Landmark Detection

Needed points in a face mask:

With reference to the above image, we are focusing on the right and the left eye and getting all the critical points connecting the eye.

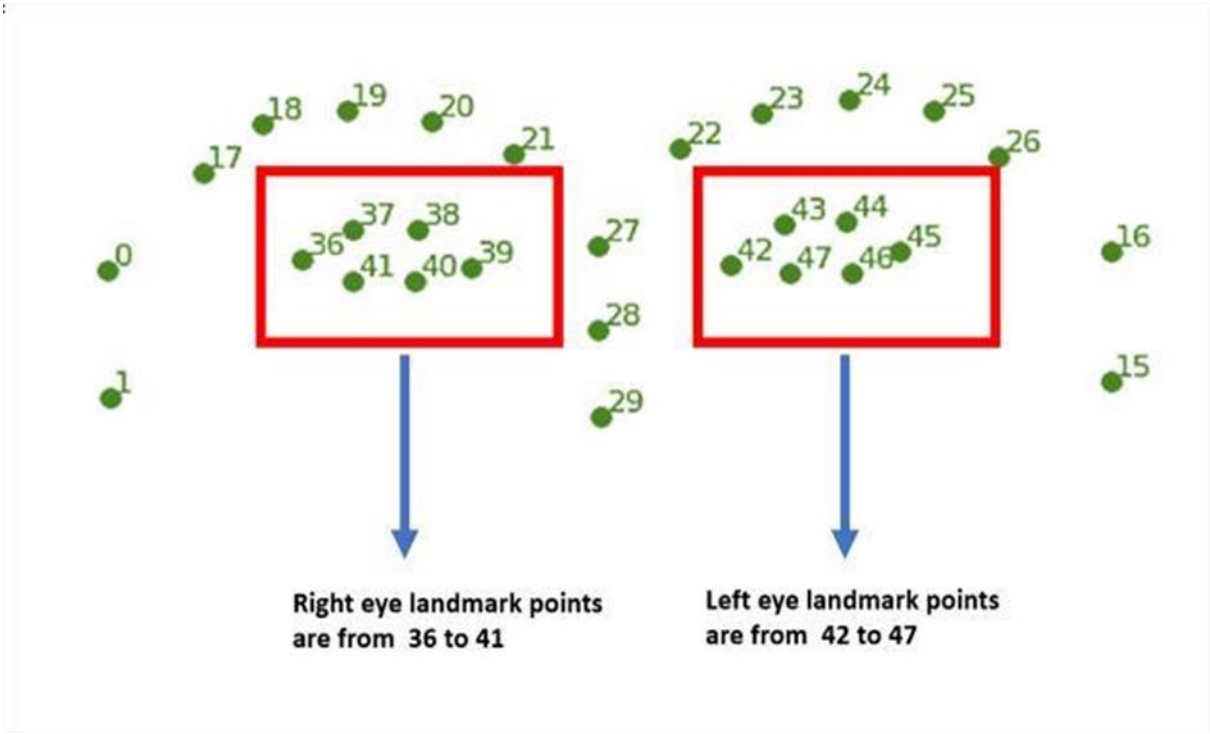


Fig 4.1.2 – Plotting Critical points on left and right eye

4.1 Class diagram

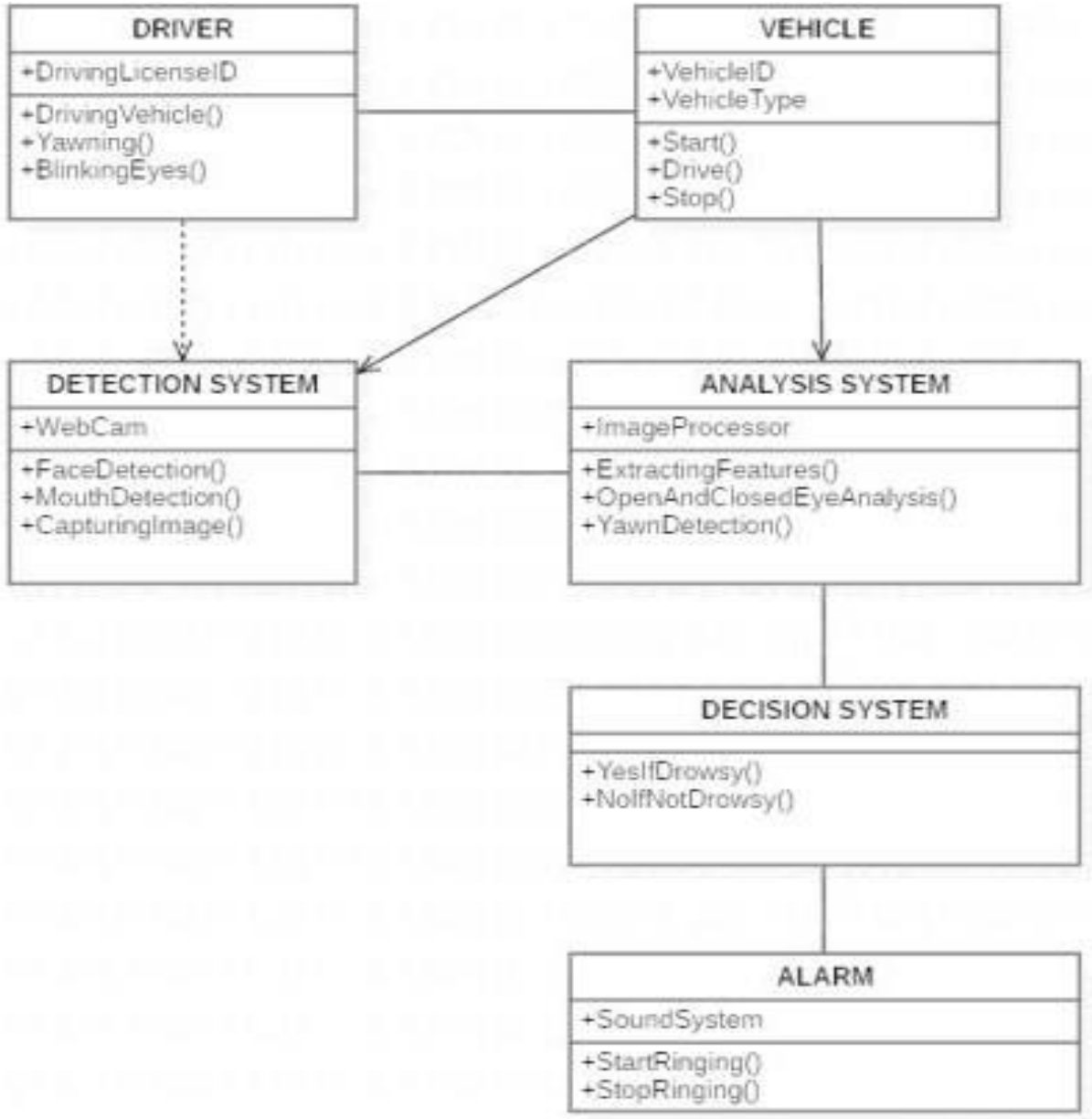


Fig 4.3 – Class Diagram

4.2 Test Cases

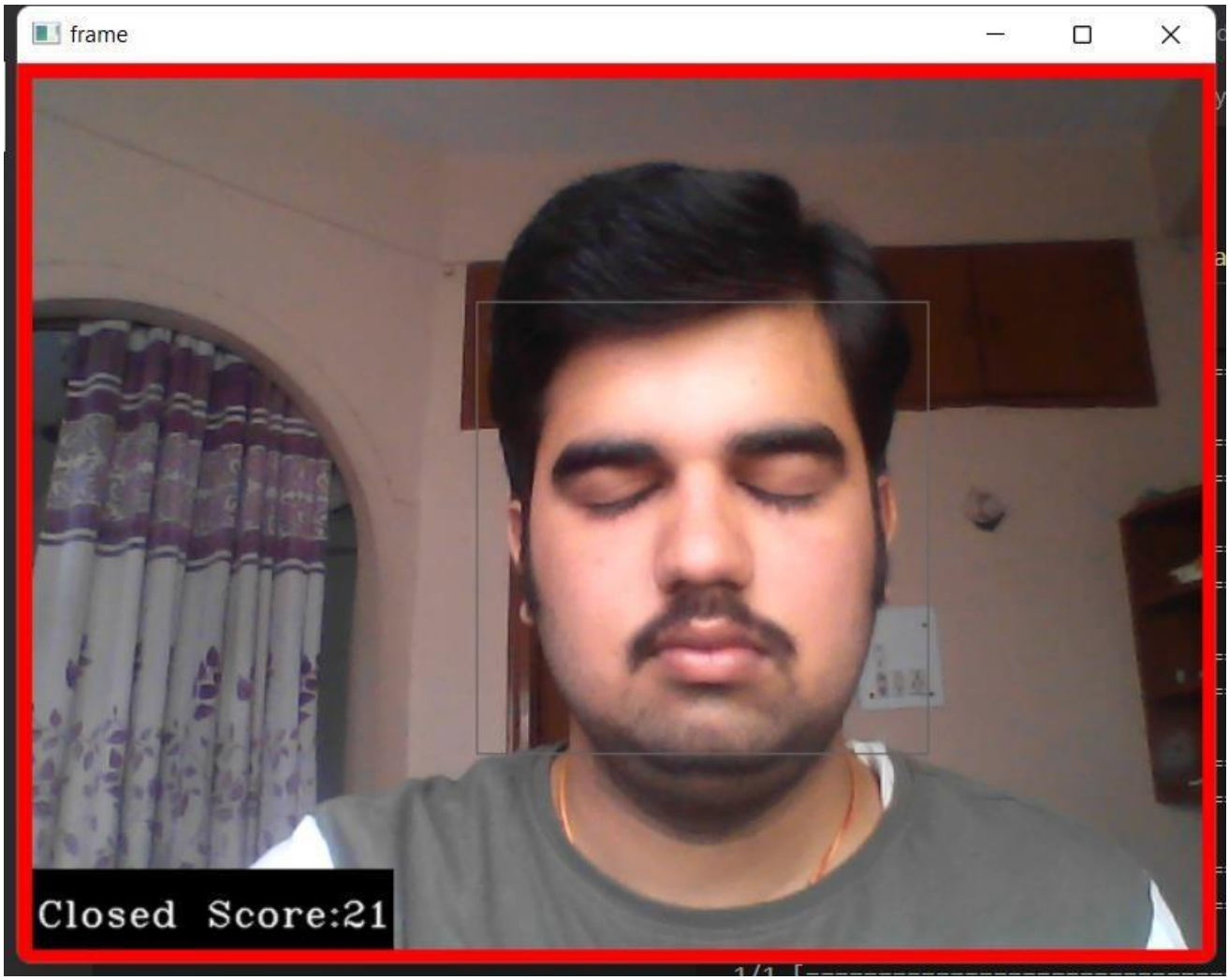
In our Driver Drowsiness Detection System as webcam detects the face of the and captures the frame as input multiple times in an infinite loop after capturing each frames it process the frame further and a score is generated as output if the score value is greater than **15** an alarm starts ringing giving warning to driver that his condition is drowsy and that he is not in a condition to drive the car.

Test 01: Test Case when Driver is Drowsy.

Eye Status: Closed

Drowsiness Score : 21

Is Drowsy: yes

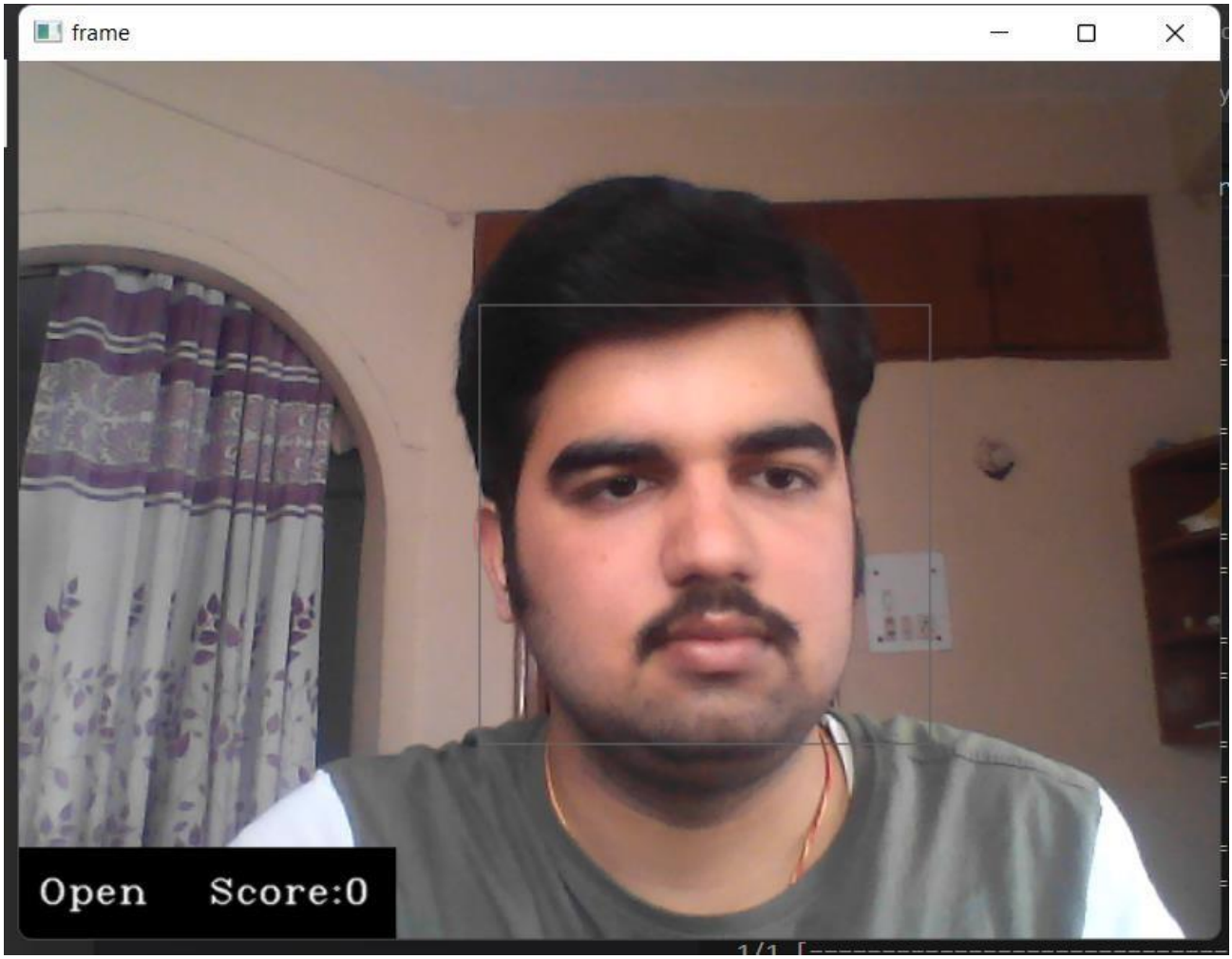


Test Case 02: Test Case when the driver is not drowsy and actively driving the car.

Eye Status: Open

Drosiness Score: 0

Is Drowsy: No


frame
Open Score:0

Chapter – 5 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 it's focal points and the fact that it takes care of the issue of stressing out for individuals having fatigue-related

When you run the code it will open the webcam and will capture the video and gives output based on your eyelid closure. This drowsiness detection system helps the drivers a lot and prevents many road accidents that are caused due to drowsiness. So far we have seen,

–> How to use transfer learning?

–> How to build the model, train the model?

–> How to change the layers according to our problem statement?

–> Finally implementation of the drowsiness detection system.

A non-invasive system to localize the eyes and monitor fatigue was developed. Information about the eyes position is obtained through self-developed image processing algorithm. 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. In addition, during monitoring, the system is able to automatically detect any eye localizing error that might have occurred. In case of this type of error, the system is able to recover and properly localize the eyes.

The following conclusions were made:

Image processing achieves highly accurate and reliable detection of drowsiness.

Image processing offers a non-invasive approach to detecting drowsiness without the annoyance and interference.

A drowsiness detection system developed around the principle of image processing judges the drivers alertness level on the basis of continuous eye closures.

With 80% accuracy, it is obvious that there are limitations to the system.

Future Scope:

This technology is still in the early research stage of development. Based on the work completed thus far, following modifications can be implemented:

Capture individual drivers steering activity while drowsy

Conduct additional simulator experiments to validate the algorithm, test additional road

conditions, and test a more diversified group of drivers,

Test and refine the algorithm based on the road test data, and conduct research on warning systems integrated with the detection system.

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46(1):93–102 [PMC free article] [PubMed] [Google Scholar]

6 .OpenCV – pip install opencv-python (face and eye detection).
OpenCV is a Python open-source library, which is used for computer vision in Artificial intelligence, Machine Learning, face recognition, etc.
https://www.javatpoint.com/opencv

7. TensorFlow – pip install tensorflow (keras uses TensorFlow as backend).
TensorFlow is one of the famous deep learning framework, developed by Google Team. It is a free and open source software library and designed in Python programming language, this tutorial is designed in such a way that we can easily implement deep learning project on TensorFlow in an easy and efficient way.
https://www.javatpoint.com/tensorflow

8. Keras – pip install keras (to build our classification model).

Keras is an open source deep learning framework for python. It has been developed by an artificial intelligence researcher at Google named Francois Chollet. Leading organizations like Google, Square,Netflix,

Huawei and Uber are currently using Keras. This tutorial walks through the installation Keras ,basics of deep learning, Keras models, Keras layers, Keras modules and finally conclude with some realtime applications. https://www.tutorialspoint.com/keras/index.htm