SLEEP ALARM SYSTEM

A Project-I Report

Submitted in partial fulfillment of requirement of the

Degree of

BACHELOR OF TECHNOLOGY in COMPUTER SCIENCE & ENGINEERING

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Report Approval

The project work **"SLEEP ALARM SYSTEM"** is hereby approved as a creditable study of an engineering/computer application subject carried out and presented in a manner satisfactory to warrant its acceptance as prerequisite for the Degree for which it has been submitted.

It is to be understood that by this approval the undersigned do not endorse or approved any statement made, opinion expressed, or conclusion drawn there in; but approve the "Project Report" only for the purpose for which it has been submitted.

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Declaration

We hereby declare that the project entitled **"SLEEP ALARM SYSTEM"** submitted in partial fulfillment for the award of the degree of Bachelor of Technology of Computer Applications in 'Computer Science & Engineering' completed under the supervision of **Mrs. Ruchi Patel, Assistant professor, Computer Science & Engineering,** Faculty of Engineering, Medi-Caps University Indore is an authentic work.

Further, we declare that the content of this Project work, in full or in parts, have neither been taken from any other source nor have been submitted to any other Institute or University for the award of any degree or diploma.

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Certificate

I, **Mrs. Ruchi Patel** certify that the project entitled **"SLEEP ALARM SYSTEM"** submitted in partial fulfillment for the award of the degree of Bachelor of Technology of Computer Science and Engineering by **Aakash Anand, Aayush Khandelwal** is the record carried out by them under my guidance and that the work has not formed the basis of award of any other degree elsewhere.

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ABSTRACT

This document is a review report on the research conducted and the project made in the field of computer engineering to develop a system for driver sleep detection to prevent accidents from happening because of driver fatigue and sleepiness. The report proposed the results and solutions on the limited implementation of the various techniques that are introduced in the project. Whereas the implementation of the project give the real world idea of how the system works and what changes can be done in order to improve the utility of the overall system.

Furthermore, the paper states the overview of the observations made by the authors in order to help further optimization in the mentioned field to achieve the utility at a better efficiency for a safer road.

Keywords—Facial Coordinates; Driver drowsiness; eye detection; yawn detection; Eye Aspect Ratio.

Table of Contents

List of Figures

Abbreviations

Acronym	Full Form
EAR	Eye Aspect Ratio
MAR	Mouth Aspect Ratio

CHAPTER 1

INTRODUCTION

1.1 Introduction

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. However, there are some rules and codes of conduct for those who drive. One of them is staying alert and active while driving.
Neglecting our duties towards safer travel has enabled hundreds of thousands of tragedies.It may seem like a trivial thing to most folks but following rules and regulations on the road is of utmost importance. 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,Sleep alarm system is a safety technology that can prevent accidents that are caused by drivers who fell asleep while driving.

1.2 Objective

- The main aim of this is to develop a Sleep Alarm System 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 fatigue involves the observation of eye movements and blink patterns.

1.3 Scope

There are many products out there that provide the measure of fatigue level in the drivers which are implemented in many vehicles. The driver drowsiness detection system provides the similar functionality but with better results and additional benefits. Also, it alerts the user on reaching a certain saturation point of the drowsiness measure.

1.4 Problem Statement

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.

CHAPTER 2

SYSTEM REQUIREMENT ANALYSIS

2.1 System Feasibility

2.2.1Technical Feasibility:

- The project covers all the scope of practicality and is technically feasible.
- It will be built considering industry standards, and using the latest technologies which will ensure its smooth functioning.
- The project will run on users devices over internet.

2.2.2Economical Feasibility:

- The hardware requirements to access this project are appropriate computing device and a USB camera.

2.2 Platform Specification

2.3.1Hardware Requirements:

- Laptop: Used to run our code.
- Webcam/USB camera: An USB camera is used to continuously track the facial landmark and movement of eyes and lips of the driver. This project mainly targets the landmarks of lips and eyes of the driver. For detection of Tiredness, landmarks of eyes are tracked continuously.

2.3.2Software Requirements:

- **Python** :Python is an object-oriented programming language created by Guido Rossum in 1989. It is ideally designed for rapid prototyping of complex applications. It has interfaces to many OS system calls and libraries and is extensible to C or C++. Many large companies use the Python programming language include NASA, Google, YouTube, BitTorrent, etc. Python is widely used in Artificial Intelligence, Natural Language Generation, Neural Networks and other advanced fields of Computer Science. Python had deep focus on code readability. Python language is used by author due to his cross platform compatibility as main coding language for algorithm.

Tools and Libraries used:

- Jupyter notebook: The Jupyter Notebook is an open-source web application that allows you to create and share documents that contain live code, equations, visualizations and narrative text.

- OpenCV: OpenCV is a huge open-source library for computer vision, machine learning, and image processing. OpenCV supports a wide variety of programming languages like Python, C++, Java, etc. It can process images and videos to identify objects, faces, or even the handwriting of a human.

- Dlib: DLib is an open source C++ library implementing a variety of machine learning algorithms, including classification, regression, clustering, data transformation, and structured prediction.
  DLib also features utility functionality including
  -Threading
  -Networking
  -Numerical Algorithms
  -Image Processing
  -Data Compression and Integrity algorithms

- Scipy: SciPy, a scientific library for Python is an open source, BSD-licensed library for mathematics, science and engineering. The SciPy library depends on NumPy, which provides convenient and fast N-dimensional array manipulation. The main reason for building the SciPy library is that, it should work with NumPy arrays. It provides many user-friendly and efficient numerical practices such as routines for numerical integration and optimization. This is an introductory tutorial, which covers the fundamentals of SciPy and describes how to deal with its various modules.

- Playsound : The playsound module is a cross platform module that can play audio files.

CHAPTER 3

SYSTEM ANALYSIS

3.1 Information Flow Representation

3.1.1 Activity Diagram

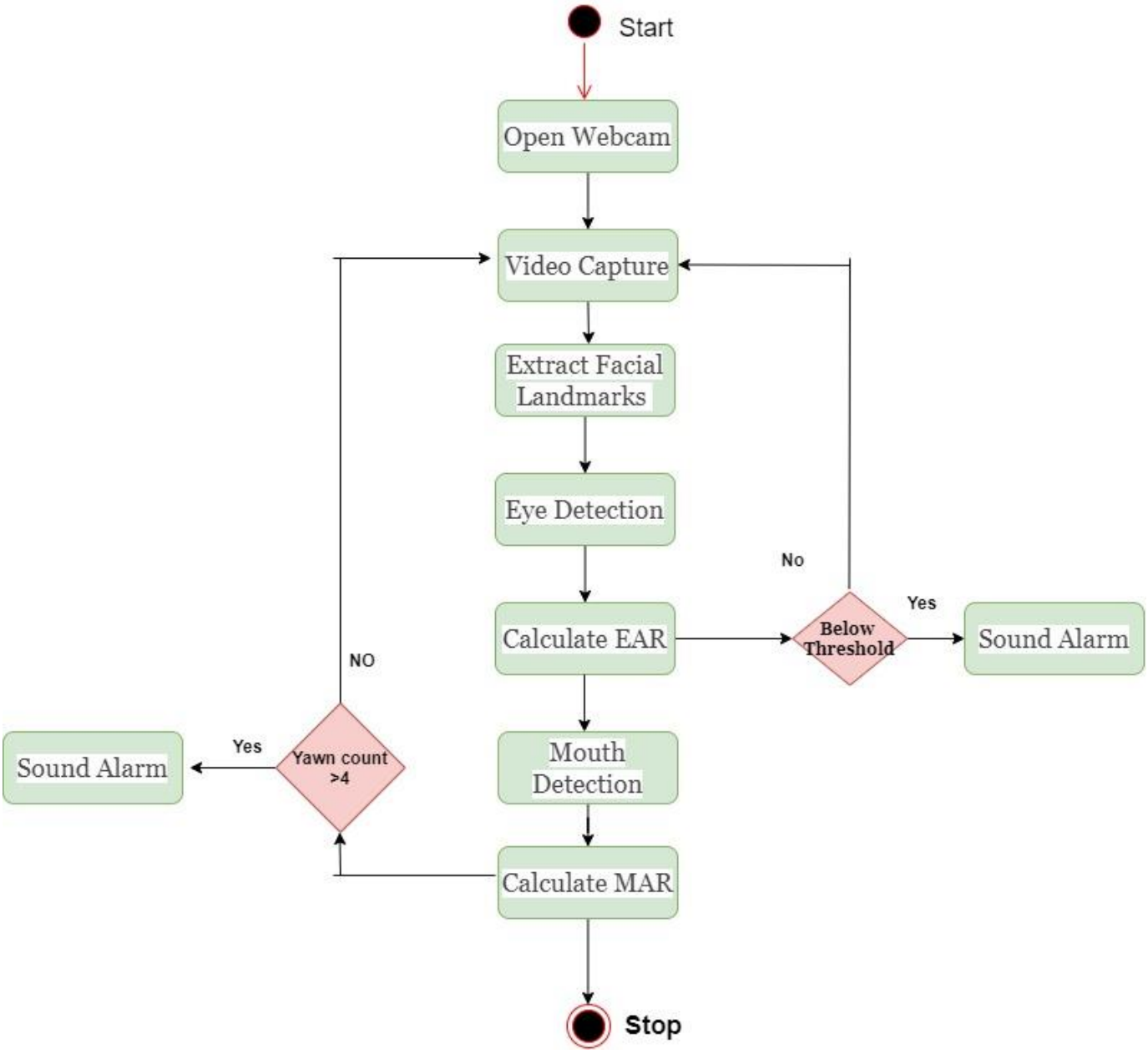


Fig.1.1 Activity diagram

3.1.2 Use Case Diagram

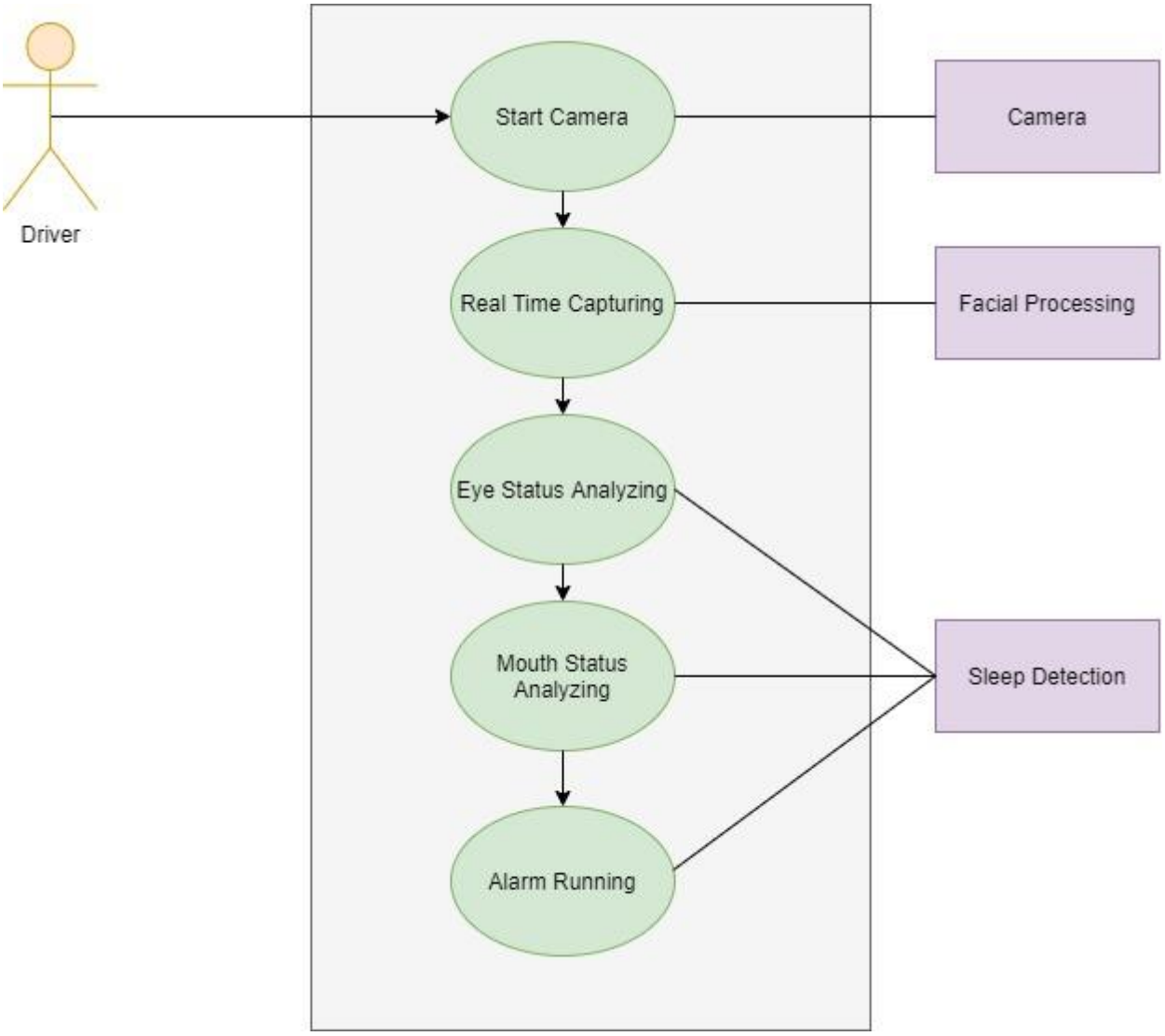


Fig.1.2 Use Case diagram

3.1.3 Class Diagram

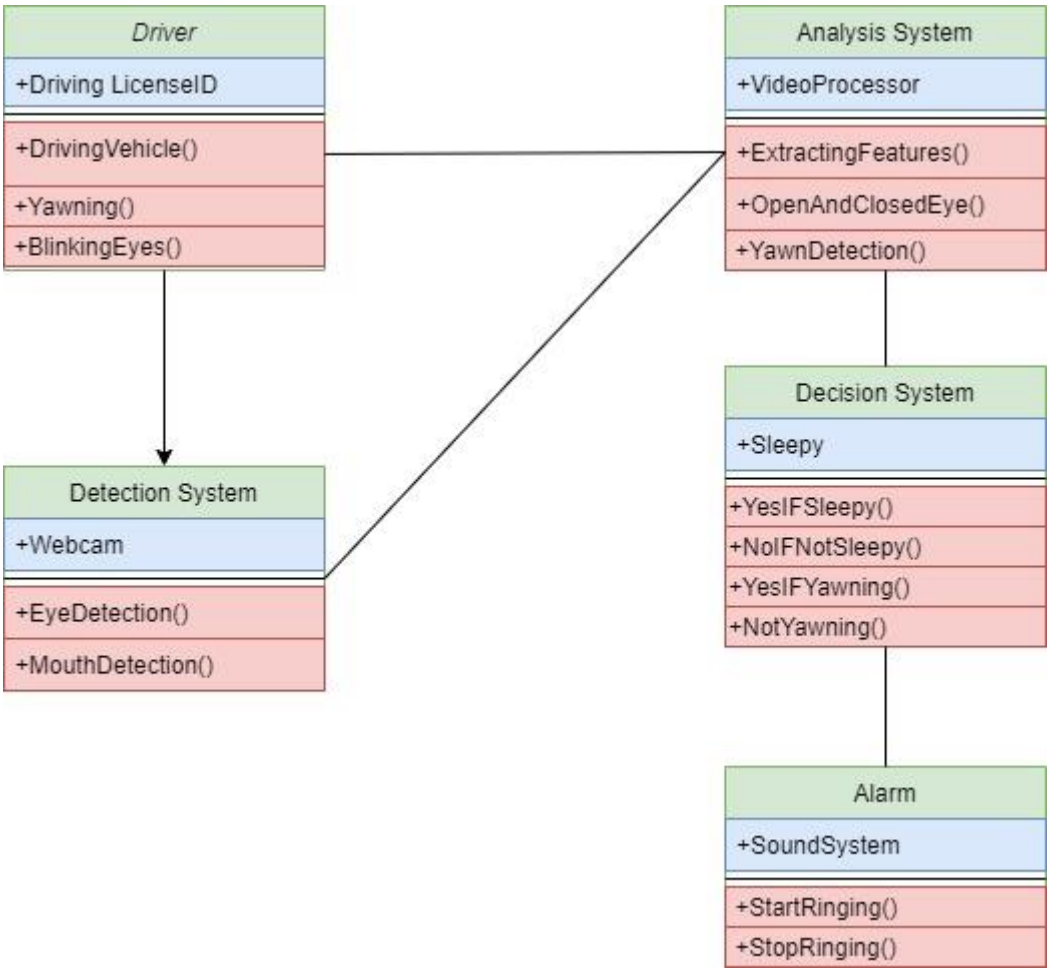


Fig.1.4 Class diagram

CHAPTER 4

DESIGN

4.1 Face Detection

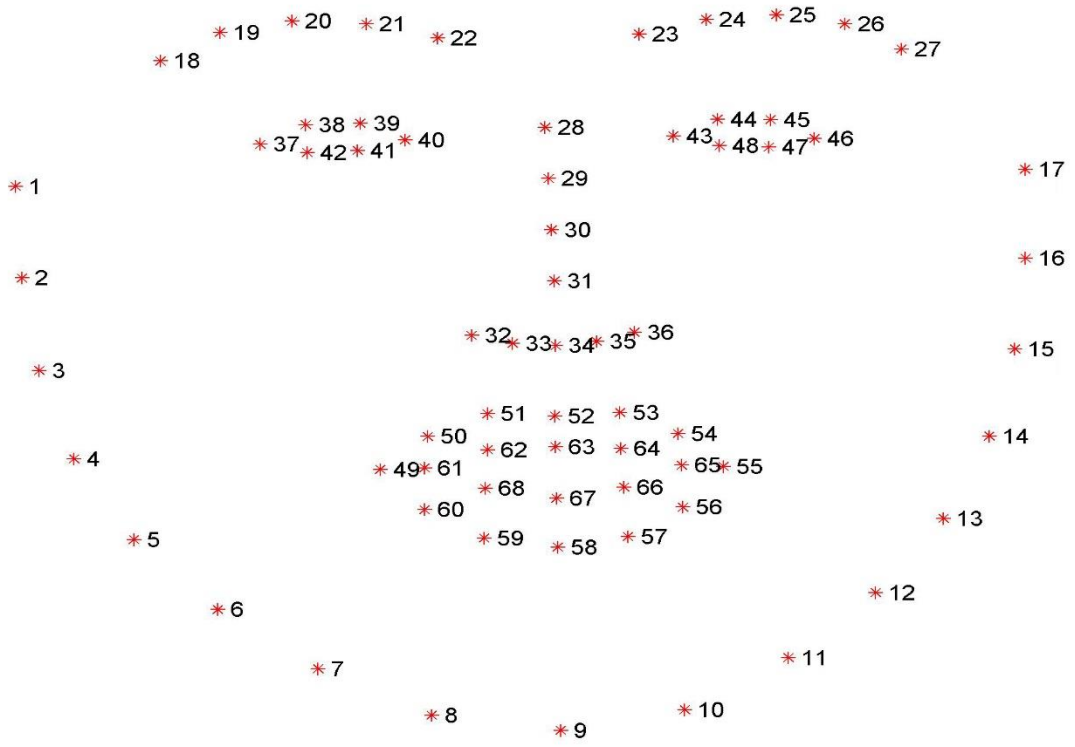
In computer vision, one essential problem we are trying to figure out is to automatically detect objects in an image without human intervention. Face detection can be thought of as such a problem where we detect human faces in an image. There may be slight differences in the faces of humans but overall, it is safe to say that there are certain features that are associated with all the human faces.

OpenCV is an image and video processing library and is used for image and video analysis, like facial detection, license plate reading, photo editing, advanced robotic vision, optical character recognition, and a whole lot more.

The dlib library, maintained by Davis King, contains our implementation of "deep metric learning" which is used to construct our face embeddings used for the actual recognition process .The face recognition library, created by Adam Geitgey , wraps around dlib's facial recognition functionality, and this library is super easy to work with and we will be using this in our code.

4.2 Facial Landmarks

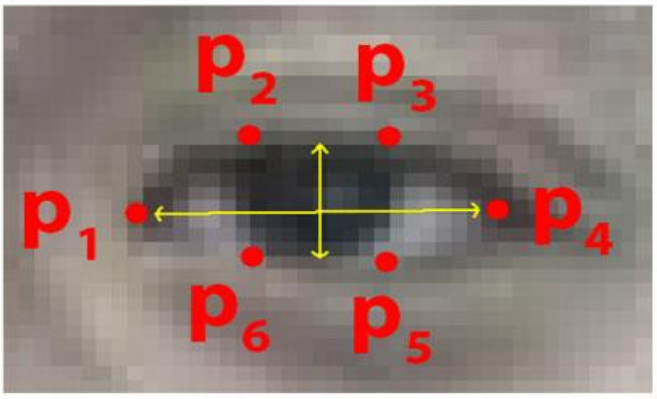
Facial landmark is a technique which can be applied to applications like face alignment, head pose estimation, face swapping, blink detection, drowsiness detection, etc. In this context of facial landmarks, our vital aim is to detect facial structures on the person's face using a method called shape prediction.



Facial Landmarks

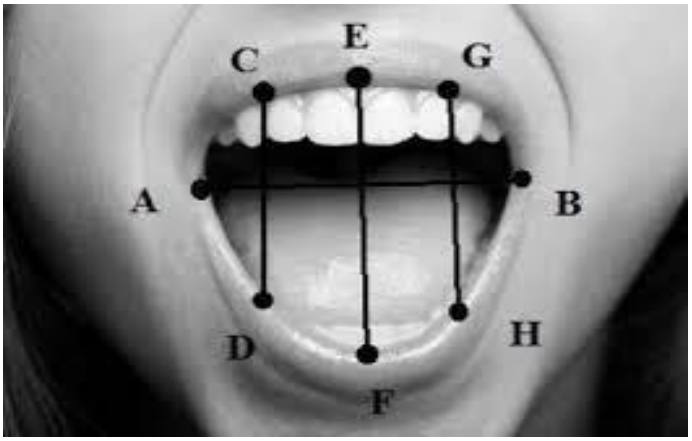
4.3 Eye Detection

After detecting the face of the driver, the calculation of drowsiness level of the driver is based on eye blink rate. The Eye Aspect Ratio (EAR) formula, which was proposed is able to detect the eye blink using the scalar value. For instance, if driver blinks eyes more frequently, it means that the drivers are in the state of drowsiness. Thus, it is necessary to detect the eyes shape accurately in order to calculate the eye blink frequency. From the landmarks detected in the image with face, the EAR is used as an estimate of the eye openness state. For every video frame, the eye landmarks are detected between height and width of the eye that had been computed. The eye aspect ratio can be defined as : EAR = (p2- p6 + p3- p5) / 2 (p1- p4)



4.4 Mouth Detection

To determine the yawning parameter the aspect ratio of the mouth is calculated. It is calculated by the following formula : MAR = (|CD| + |EF| + |GH|) / (3 * |AB|)



CHAPTER 5

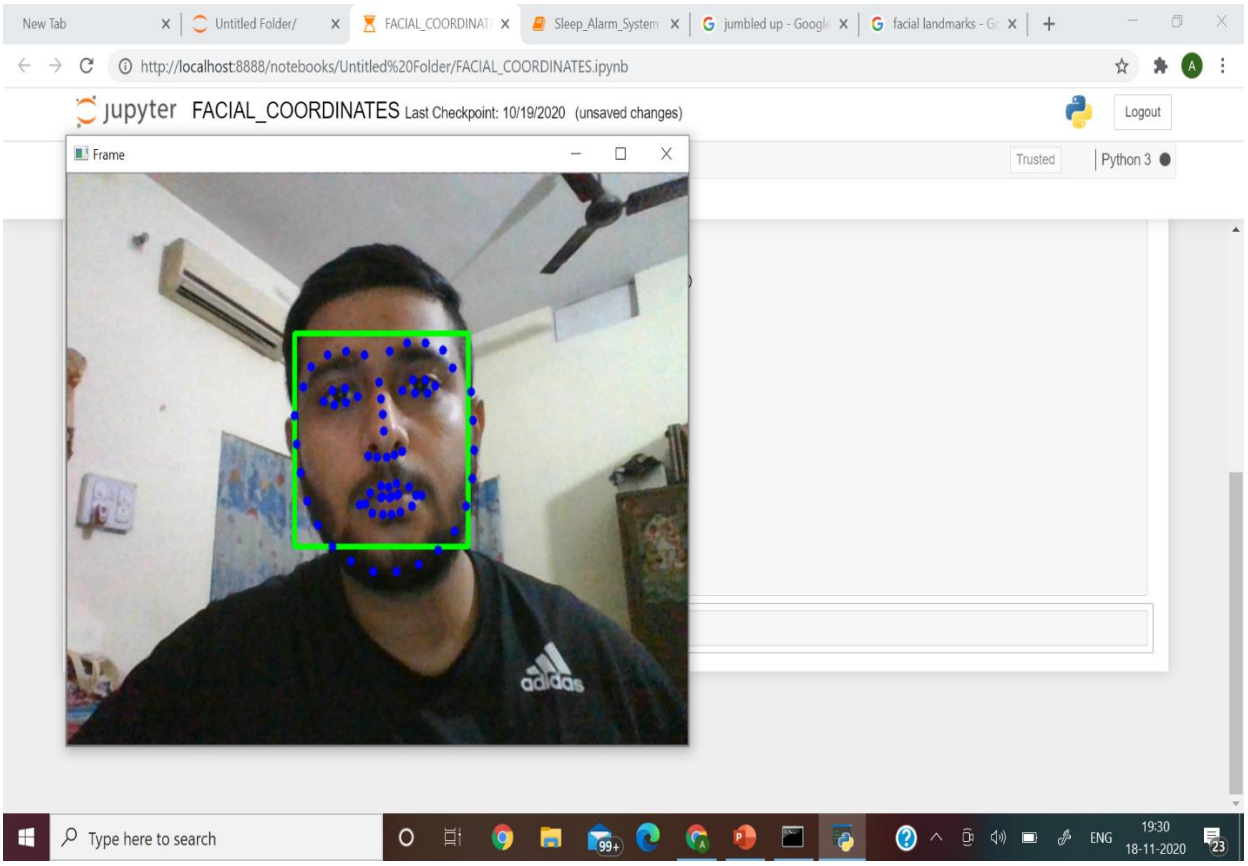
TESTING

5.1 Testing Objectives

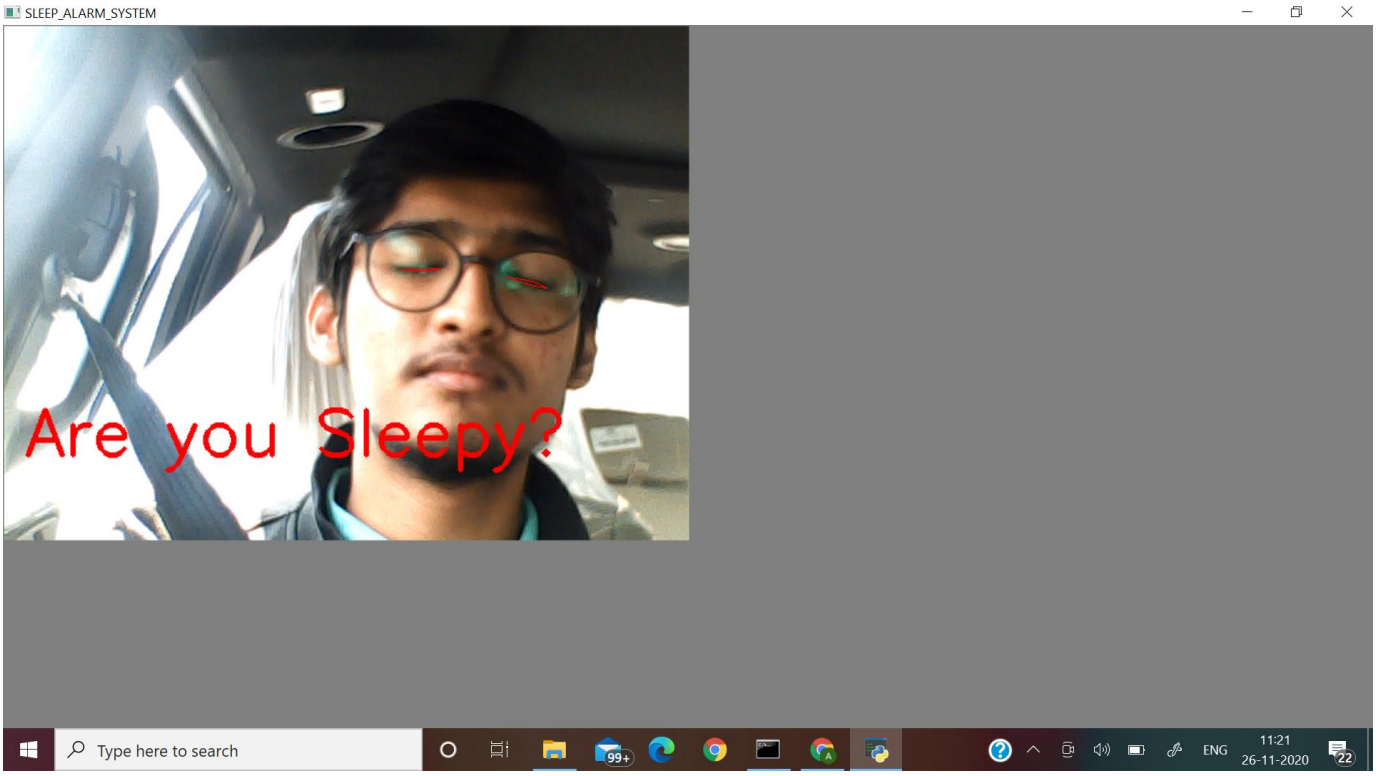
The main objective of the tests was to acquire behavioral and biomedical signals of the drowsy drivers while driving, but keeping them safe in a controlled environment. Therefore, the task of stopping the vehicle depended entirely on the system.

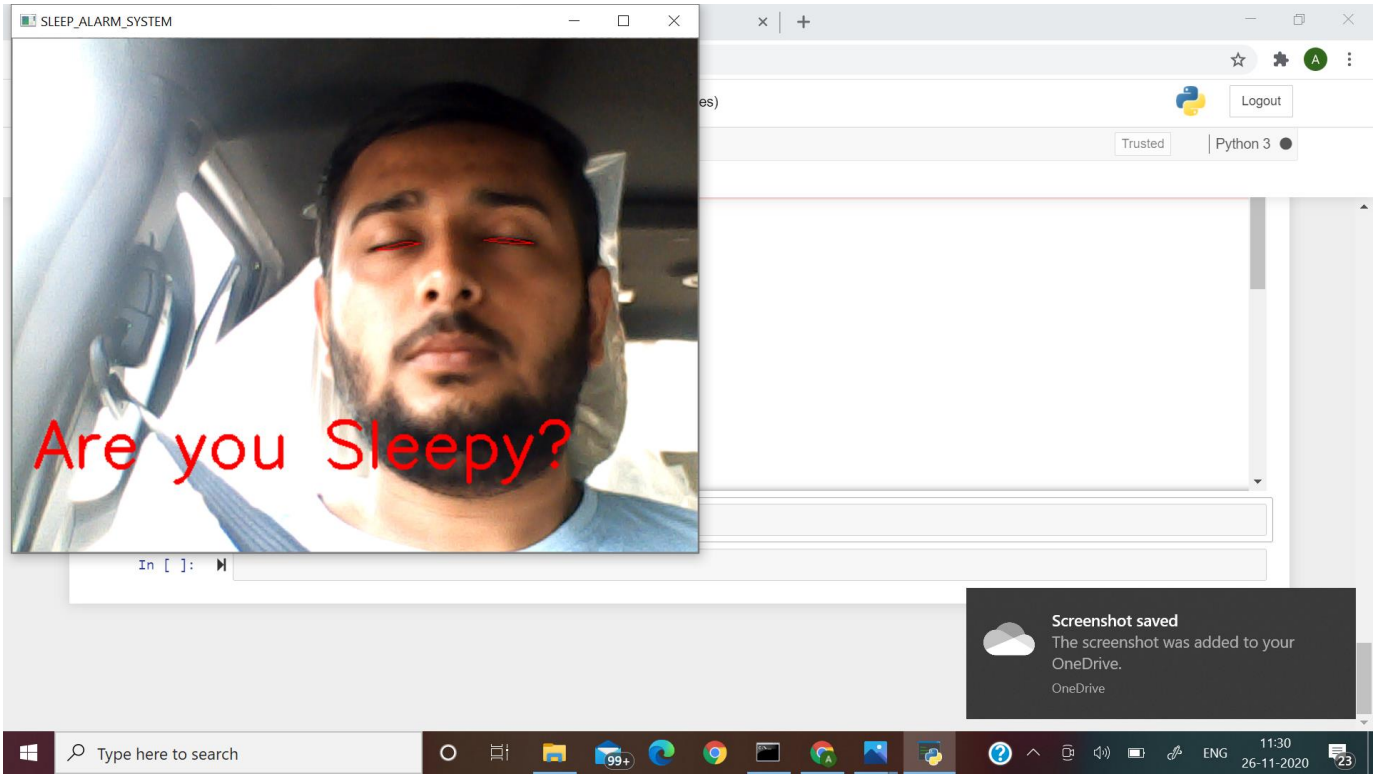
5.2 Testing Cases

5.3.1 Normal Face with Facial Landmarks

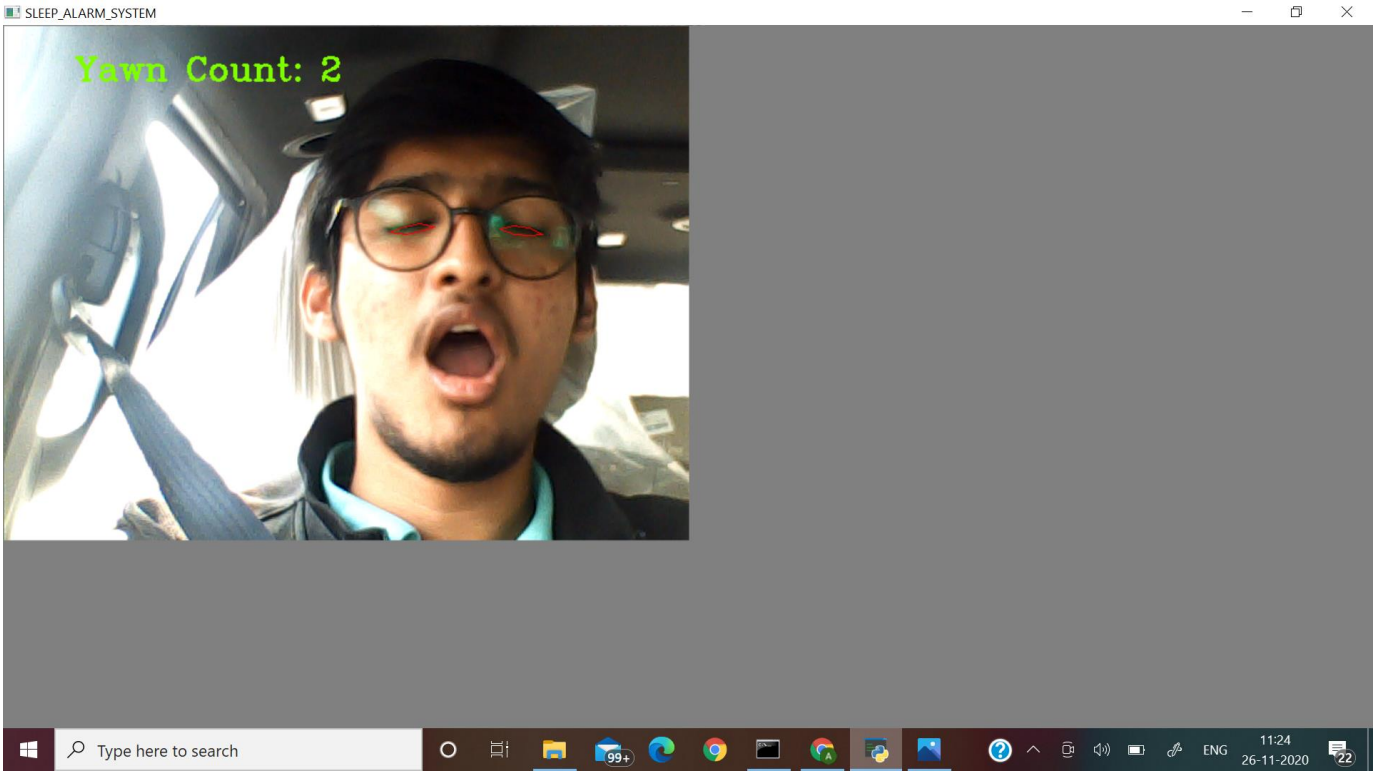


5.3.2 Sleep Detection

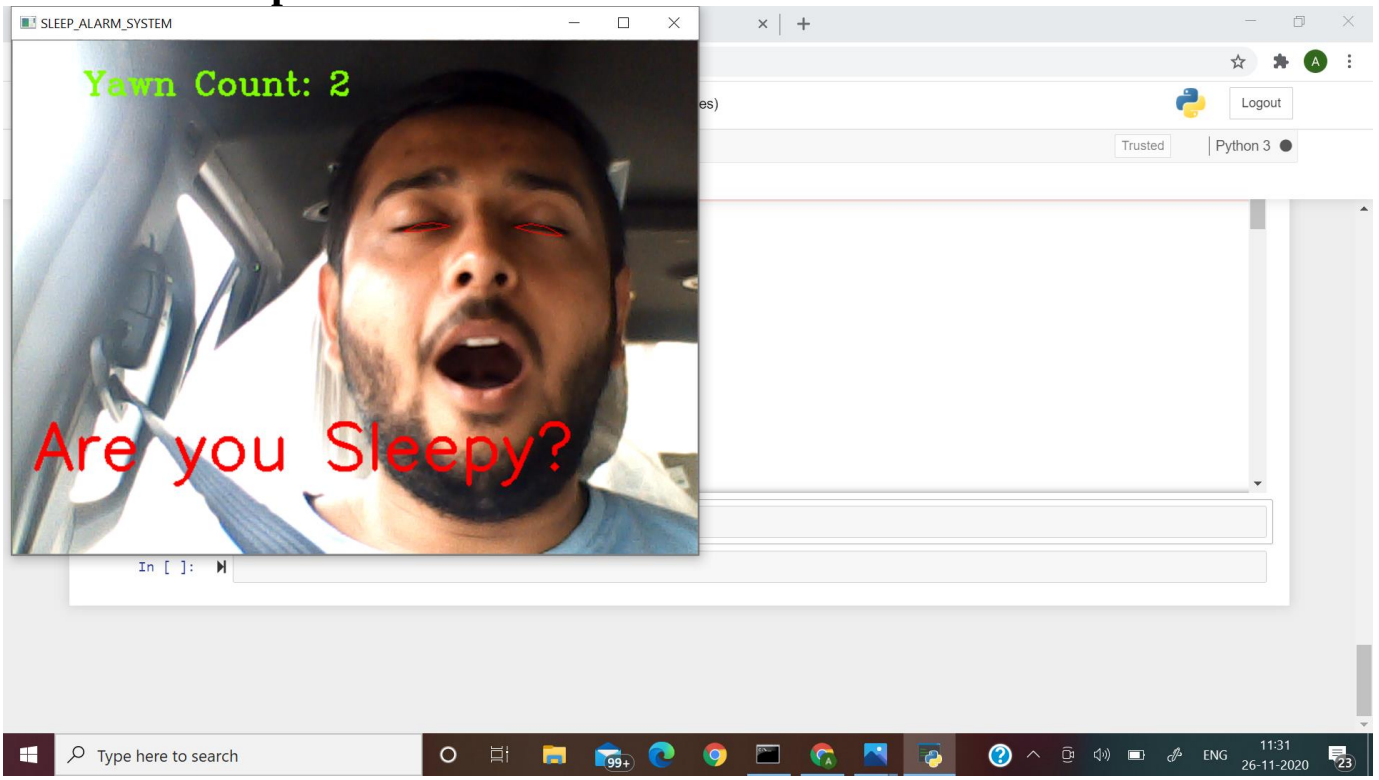




5.3.3 Yawn Detection



5.3.4 Both Sleep and Yawn Detection



5.3.5 Setup of the Project

CHAPTER 6

LIMITATIONS

- If the driver goes out of range of the camera while driving this project will not work.
- During less lighting conditions, we would require night vision cameras.
- Sometimes while talking it can count it as yawning.

CHAPTER 7

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.

- We plan to further work on the project 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.

CHAPTER 8

CONCLUSION

The primary goal of this project is to develop a real time sleep monitoring system in automobiles. We developed a simple system consisting of 5 modules namely(a) video capturing, (b) detecting facial landmarks, (c) face detection, (d) eye detection, and (e) yawn detection. Each of these components can be implemented independently thus providing a way to structure them based on the requirements. Four features that make our system different from existing ones are: (a) Focus on the driver, which is a direct way of detecting the tiredness (b) A real-time system that detects face, eyes, blink, mouth, and yawning (c) A completely non-intrusive system, and (d) Cost effective

The sleep detection and yawning system developed is capable of detecting tiredness in a rapid manner. The system which can differentiate normal eye blink and yawn detection which can prevent the driver from entering the state of sleepiness while driving.

We conclude that by designing a real time driver sleep detection system and alert system that combines EAR and MAR to accurately determine the real time fatigue level of the driver. A number of road accidents might then be avoided if an alert is sent to a driver that is deemed sleepy.

CHAPTER 9

REFERENCES

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