

Driver Sleep Detection System

Minor Project II

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DECLARATION

We hereby declare that this submission is our own work and that, to the best of our knowledge and beliefs, it contains no material previously published or written by another person nor material which has been accepted for the award of any other degree or diploma from a university or other institute of higher learning, except where due acknowledgment has been made in the text.

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CERTIFICATE

This is to certify that the work titled “Driver Sleep Detection System” submitted by Ayush Makhloga, Kartik Singh and Ankit Sharma of B.Tech of Jaypee Institute of Information Technology, Noida has been carried out under my supervision. This work has not been submitted partially or wholly to any other University or Institute for the award of any other degree or diploma.

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Assistant Professor

Date : 27/04/2023

ABSTRACT

In current years, drowsy driver detection is the most necessary procedure to prevent any road accidents, probably worldwide. The aim of this study was to construct a smart alert technique for building intelligent vehicles that can automatically avoid drowsy driver impairment. But drowsiness is a natural phenomenon in the human body that happens due to different factors. Hence, it is required to design a robust alert system to avoid the cause of the mishap. In this proposed paper, we address a drowsy driver alert system that has been developed using such a technique in which the Video Stream Processing (VSP) is analyzed by eye blink concept through an Eye Aspect Ratio (EAR) and Euclidean distance of the eye. Face landmark algorithm is also used as a proper way to eye detection. When the driver's fatigue is detected, the IoT module issues a sound warning message along with impact of collision and location information, thereby alerting with the help of a buzzer speaking through the Arduino uno monitoring system.

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LIST OF ABBREVIATIONS

- i. IOT : Internet Of Things
- ii. IDE : Integrated Development Environment
- iii. EAR : Eye Aspect Ratio

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CHAPTER – 1 INTRODUCTION

1.1 Introduction

Driver fatigue has been the main issue for countless mishaps due to tiredness, tedious road condition, and unfavorable climate situations. Every year, the National Highway Traffic Safety Administration (NHTSA) and World Health Organisation (WHO) have reported that approximately 1.35 million people die due to vehicle crashes across the world. Generally, road accidents mostly occur due to inadequate way of driving. These situations arise if the driver is addicted to alcohol or in drowsiness. The maximum types of lethal accidents are recognised as a severe factor of tiredness of the driver. When drivers fall asleep, the control over the vehicle is lost. There is a need to design smart or intelligent vehicle system through advanced technology. This paper implements a mechanism to alert the driver on the condition of drowsiness or daydreaming. A camera monitors the driver's eye blinking, eye closure, face detection, head posture, etc. with face landmark algorithm and Euclidean distance in the behavioral-based approach. These characteristics help to measure driver fatigue and instantly alert him with the help of buzzer and forwarding an e-mail to a person (owner of vehicle) who can make him conscious. An e-mail is being transmitted to a destination using IoT module, which relies on wireless transmission.^[1]

1.2 Problem Statement

An IoT-based system is designed to avoid countless mishaps due to drowsy drivers' behavioral and psychological changes by focusing on driver's eye movements. In addition informing the dear ones about the same with the help of mail services.

1.3 Objectives

The basic objective of this project is to create a system for alerting the driver when they are feeling drowsy.

The basic objective of this project was to get familiar with concepts such as:

- Machine learning

- Internet of Things
- Real life problem solving
- Electronic Hardware

1.4 Methodology

The methodologies involved in this project are Python, C++ and Arduino. For taking input, a webcam is used.

1.4.1 Technology and Languages:

As in regular everyday practice, to speak with one another dialect is a significant medium, correspondingly to cooperate with the framework; programming dialects are a significant vehicle for the engineer. As, all things considered, there, individuals speak with various dialects, correspondingly, for driving with gadgets there are various dialects accessible, for example, C, C#, C++, Java, Python, and so on.

1.4.1.1 Python

Python is an interpreted, object-oriented, high-level programming language with dynamic semantics. Its high-level built in data structures, combined with dynamic typing and dynamic binding, make it very attractive for Rapid Application Development, as well as for use as a scripting or glue language to connect existing components together. Python's simple, easy to learn syntax emphasizes readability and therefore reduces the cost of program maintenance. Python supports modules and packages, which encourages program modularity and code reuse. The Python interpreter and the extensive standard library are available in source or binary form without charge for all major platforms, and can be freely distributed.

1.4.1.2 C++

C++ is a general-purpose programming language that was developed as an enhancement of the C language to include object-oriented paradigm. It is an imperative and a compiled language. C++ is a

high-level, general-purpose programming language designed for system and application programming.

1.4.1.3 IOT

IoT stands for Internet of Things. It refers to the interconnectedness of physical devices, such as appliances and vehicles, that are embedded with software, sensors, and connectivity which enables these objects to connect and exchange data. This technology allows for the collection and sharing of data from a vast network of devices, creating opportunities for more efficient and automated systems. Internet of Things (IoT) is the networking of physical objects that contain electronics embedded within their architecture in order to communicate and sense interactions amongst each other or with respect to the external environment.^[2]

1.4.2 IDE, Softwares , OS, Libraries and Plugins

1.4.2.1 Visual Studio Code

VS code is a free & open source code editor made by Microsoft for Windows, Linux and macOS. Its features include debugging support, syntax highlighting, intelligent code elimination, captions, code retrieval, and Git embedding. In visual studio code users can change the display theme, update keyboard shortcuts, preferences, and can install extensions that adds extra functionality.

1.4.2.2 Arduino IDE

The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino hardware to upload programs and communicate with them.

1.4.2.3 Libraries

Dlib : Dlib is an open-source C++ library implementing a variety of machine learning algorithms, including classification, regression, clustering, data transformation, and structured prediction.

OpenCV : OpenCV is an open-source computer vision library accessible in python coding language to code for visionary capabilities of our smart pc. It is used for doing pre-processing on images that we receive from webcam before supplying them for further calculation.

NumPy : It is a Python library that provides a multidimensional array object, various derived objects (such as masked arrays and matrices), and an assortment of routines for fast operations on arrays

Imutils : A series of convenience functions to make basic image processing functions such as translation, rotation, resizing, skeletonization, displaying Matplotlib images, sorting contours, detecting edges, and much more ^[3]

1.4.3 Components

1.4.3.1 Arduino Uno board

Arduino Uno is a microcontroller board based on the ATmega328P (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator (CSTCE16M0V53-R0), a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started

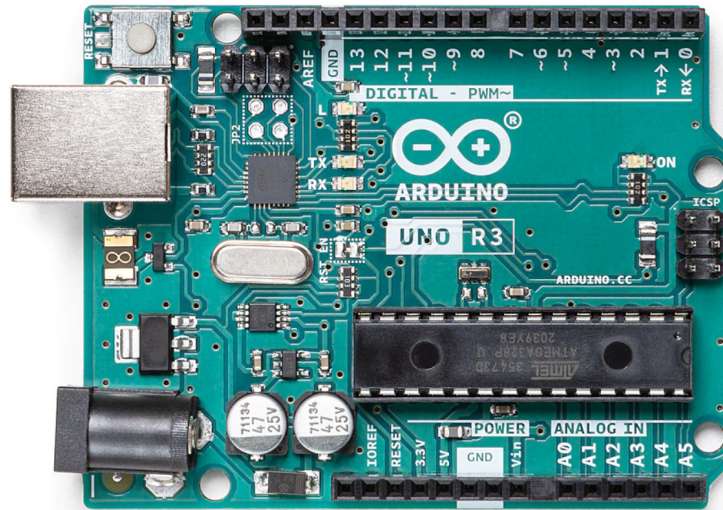


Fig 1.1 : Arduino Uno Board

1.4.3.1 Piezo Buzzer

A Piezo buzzer is a device that is used to generate beep sound (generally a warning or alert in embedded system). It is a two leg device the longer leg is positive. If voltage is supplied it generates beep sound. Through analog write volume of beep can be controlled. If a buzzer is switched with different time intervals it generates a melody. simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started ^[4]



Fig 1.2 : Piezo Buzzer

CHAPTER – 2 LITERATURE SURVEY

A considerable amount of research has been done on the working a performance of agricultural marketing in India, by the academicians & researchers. The literature obtained by the investigator, in the form of reports and research studies, is briefly reviewed in this part. Drowsiness of driver can be determined with different aspects using vehicle-based, psychological, and behavioral measurements implemented through different predictive algorithms as discussed in the following sections.

2.1. Face and Eye Detection by Machine Learning (ML) and Deep Learning (DL) Algorithms Jabbar 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. Here, the experimental classification of eye detection is performed through various data sets like without glasses and with glasses in day or night vision. So, it works for effective drowsiness detection with high precision with android modules. The algorithm of Deep CNN was used to detect eye blink and its state recognition as provided by Sanyal and Chakrabarty.^[5]

2.2. FPGA-Based Drowsiness Detection System A low-intrusive drowsiness detection system using field-programmable gate array (FPGA) has been designed by Vitabile. This system focuses on bright pupils of eyes which are detected by IR sensor light source embedded in a vehicle. Due to this visual effect, the retinas identified up to 90%, which helps to find drivers' eyes for analyzing drowsiness through a number of frames for avoiding serious mishaps. Navaneethan implemented a real-time system to track human eyes using cyclone II FPGA.^[6]

CHAPTER – 3 REQUIREMENT ANALYSIS

3.1 Requirements

3.1.1 Software Requirements :

Operating system: Windows 10/8 (incl. 64-bit), Mac OS, Linux

Language: Python 3, C++

IDE: Visual Studio Code, Arduino, Proteus

3.1.2 Hardware Requirements :

Processor/RAM : 4 GB

Primary Memory : 2GB or Higher RAM (8)

Display: 1024 x 768 or higher resolution monitors

Camera : 1

Arduino UNO board : 1

Buzzer : 1

3.2 Functional Requirements

- Recording the driver's behaviour, the moment the trip begins.
- Continuous evaluation of driver's facial features over the course of long trip.
- Raising an alarm if driver feels drowsy

3.3 Non - Functional Requirements

- Camera capturing the video should be of high resolution.
- Alarm raised should be of high volume to wake the driver up.

CHAPTER – 4 DETAILED DESIGN

4.1 Use Case Diagram

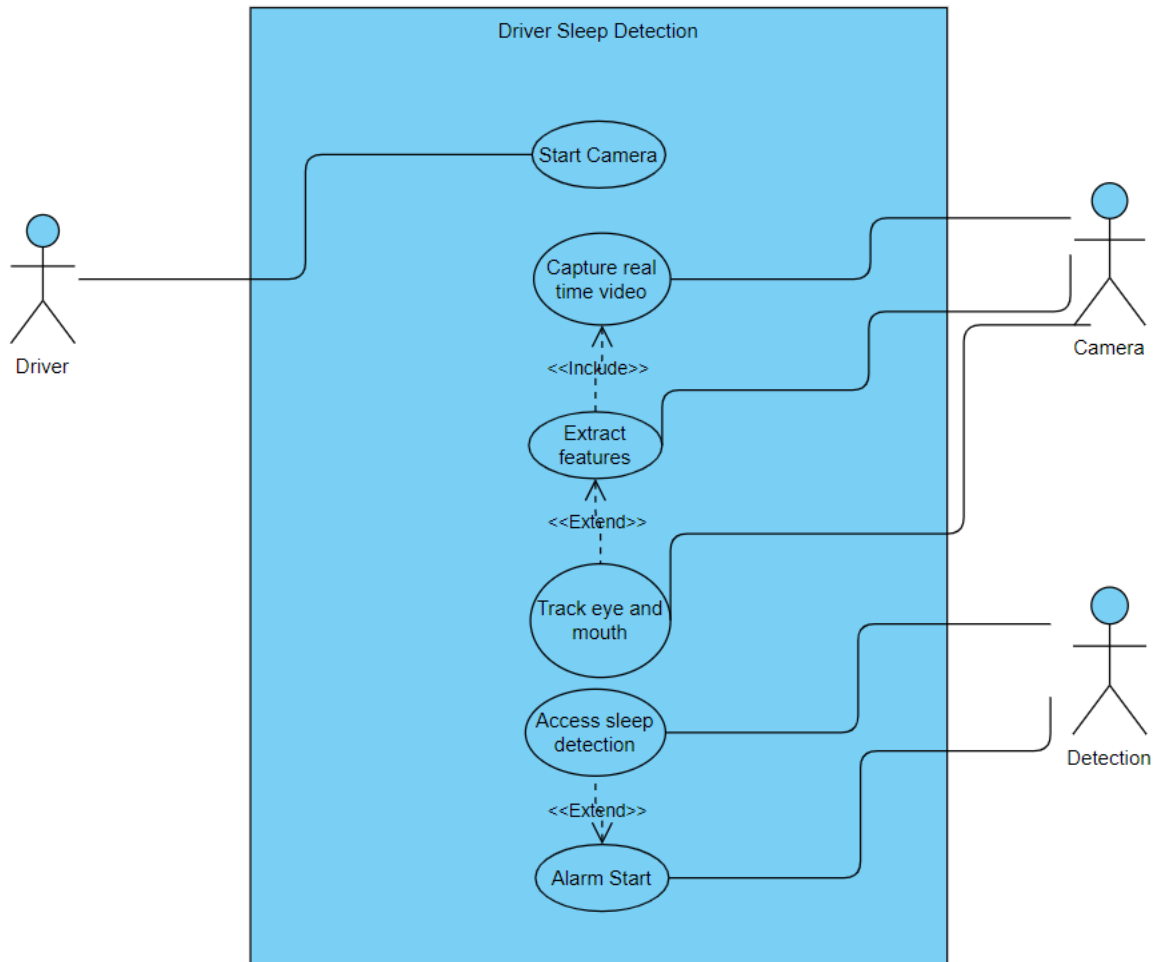


Fig 4.1 Use Case Diagram

4.2 Flowchart

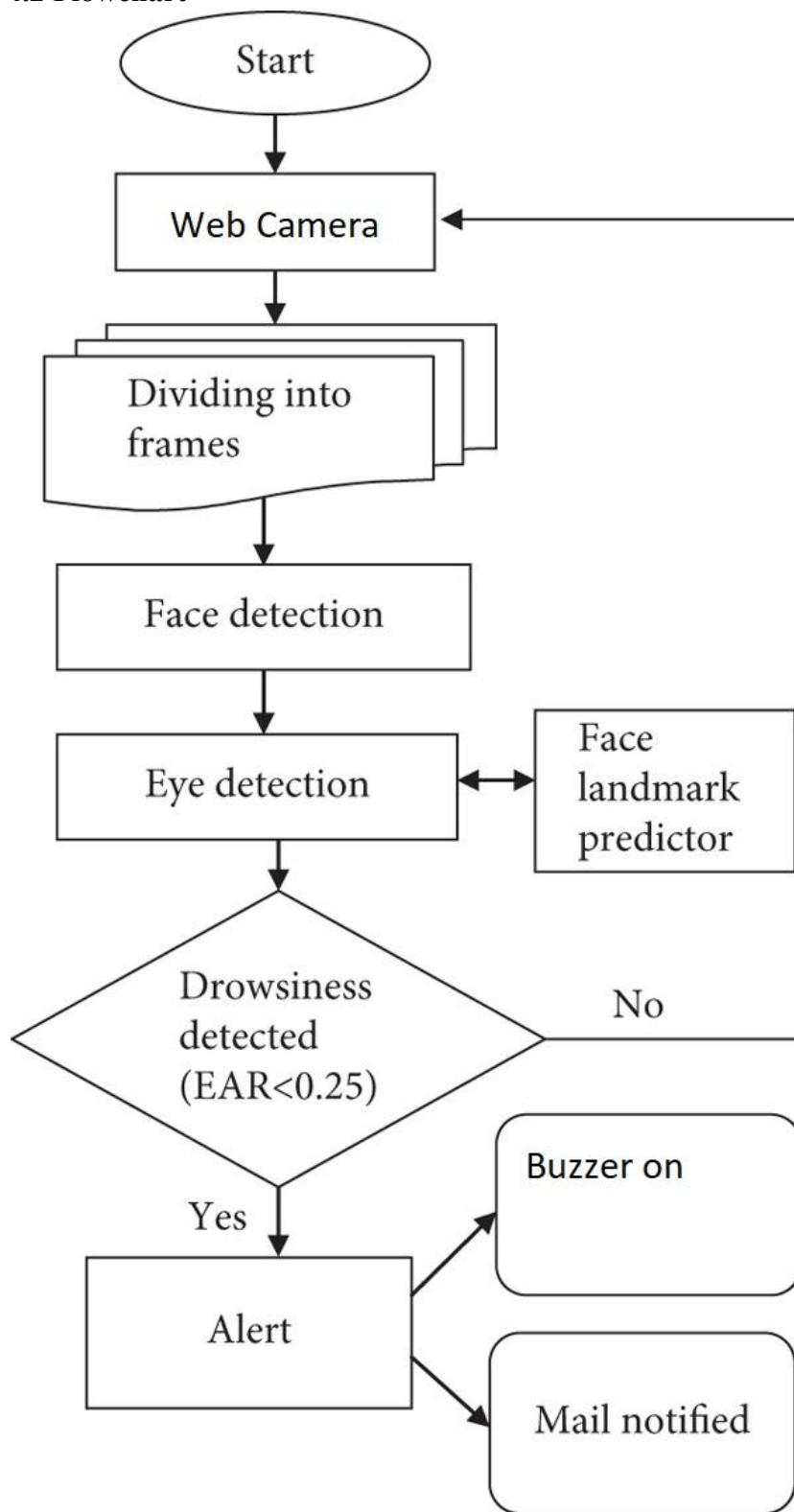


Fig 4.2 FlowDiagram

4.3 Circuit Diagram

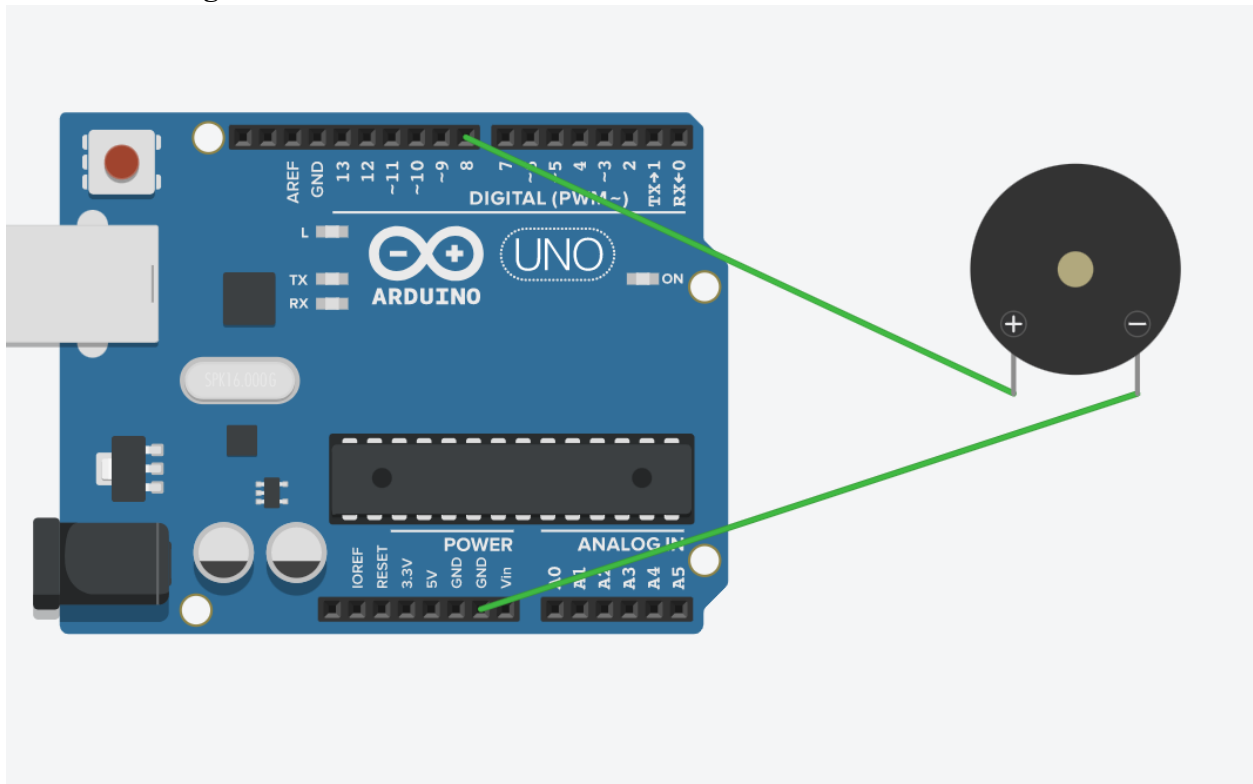


Fig 4.3 Circuit Diagram

4.4 Implementation

- System will capture the video directly from the webcam.
- After passing the feed of our video directly to the dlib frame by frame, we are able to detect left eye and right eye features of the face.
- Now, we draw contours around it using OpenCV.
- Using SciPy's Euclidean function, we calculate "Eyes aspect Ratio" E.A.R.

EAR ratio : Eye Aspect Ratio (EAR) is a scalar value that responds, especially for opening and closing eyes. Each eye is represented by 6 (x, y)-coordinates, starting at the left-corner of the eye (as if you were looking at the person), and then working clockwise around the remainder of the region.

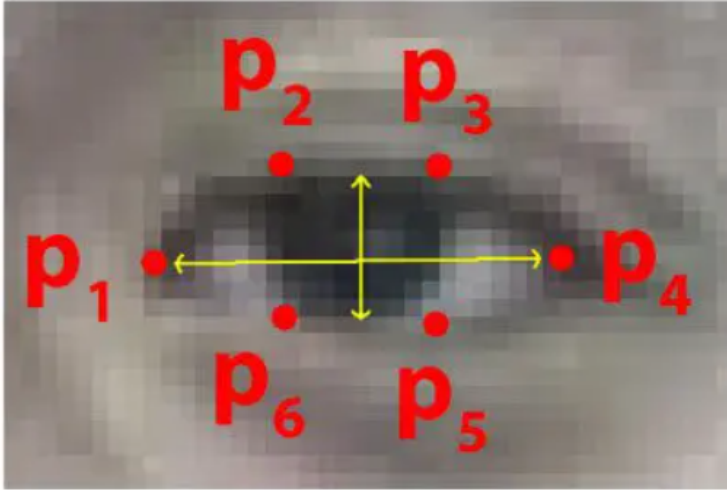


Fig 4.4 The 6 facial landmarks associated with the eye.

$$\text{EAR} = \frac{\|p_2 - p_6\| + \|p_3 - p_5\|}{2\|p_1 - p_4\|}$$

Euclidean Distance: The Euclidean distance between two points in Euclidean space is the length of a line segment between the two points.^[7]

- If person is detected as yawning and blinking less than a threshold value, then the alarm is sounded and user is warned

CHAPTER – 5 RESULTS

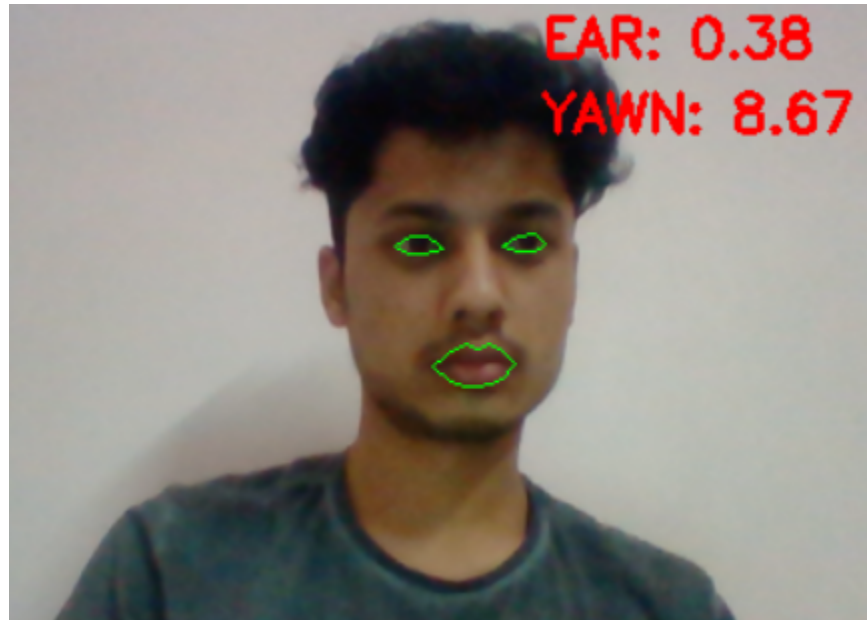


Fig 5.1 No sleep



Fig 5.2 Sleep Alert

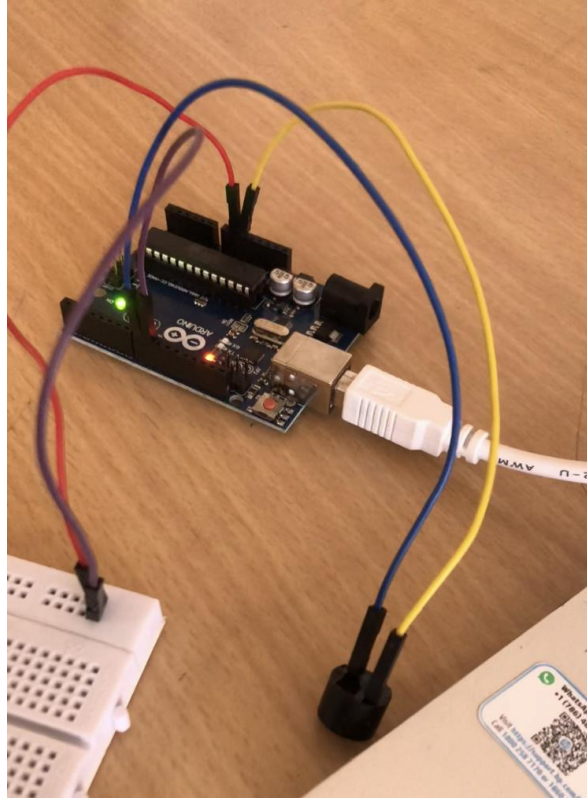


Fig 5.3 Board

CHAPTER 6 – CONCLUSIONS

6.1 Conclusion

Our current project develops a system for detecting drowsiness of the driver. This project is built using Python, OpenCV, ML model, Dlib and other open-source libraries. The system uses eye aspect ratio and mouth aspect ratio to detect blinks and yawning respectively and also a ML model is trained to draw the result based on them to achieve the main objective of project i.e., Driver's Drowsiness. The framework has reached a stable state in which all bugs have been eliminated. The results are discussed in testing section and are found satisfactory. Our project, provides a way through which a number of road accidents might be avoided if an alert is sent to a driver that is deemed drowsy. Our model is not only useful to the person who will install it in their vehicle but also for the other cars, trucks, buses and humans moving around it.

6.2 Future Scope

- The system can be made more accurate using various other parameters such as State of the Car, Detecting Foreign Substances on Face etc
- An application can be developed where it can alert or prevent the user from sleeping.
- Similar models and techniques can be used for various other uses such as Netflix, Hotstar and other streaming service platforms can detect whether the person is sleeping and stop the video accordingly

CHAPTER 7 - REFERENCES

1. <https://www.hindawi.com/journals/wcmc/2021/6627217/>
2. <https://www.geeksforgeeks.org/introduction-to-internet-of-things-iot-set-1/>
3. <https://ijert.org/papers/IJCRT2205363.pdf>
4. <https://sriparnaiot.wordpress.com/nodemcu-peizo-buzzer-on-arduino-ide/>
5. https://www.researchgate.net/publication/339200970_Driver_Drowsiness_Detection_Model_Using_Convolutional_Neural_Networks_Techniques_for_Android_Application
6. http://www.ann.ece.ufl.edu/courses/eel6935_11fal/papers/A%20real-time%20non-intrusive%20FPGA-based%20drowsiness%20detection%20system.pdf
7. <https://pyimagesearch.com/2017/04/24/eye-blink-detection-opencv-python-dlib/>