A MINOR PROJECT REPORT

ON

(Real Time Warning System for Driver Drowsiness)

SUBMITTED IN PARTIAL FULFILLMENT FOR THE AWARD OF DEGREE OF

BACHELOR OF TECHNOLOGY

IN

ELECTRONICS AND COMMUNICATION ENGINEERING

Submitted By:

SHIVAM VARSHNEY 9916102136

MANISH KUMAR ROHILA 9916102173

HARSHVARDHAN SINGH DEOPA 9916102192

Under the Guidance of:

DR. KULDEEP BADERIA

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

JAYPEE INSTITUTE OF INFORMATION TECHNOLOGY, NOIDA (U.P.)

MAY, 2019

CERTIFICATE

This is to certify that the minor project report entitled, "**Real time warning system for driver drowsiness**" submitted by **Shivam Varshney, Manish Kumar Rohila and Harshvardhan Singh Deopa** in partial fulfillment of the requirements for the award of Bachelor of Technology Degree in **Electronics and Communication Engineering** of the Jaypee Institute of Information Technology, Noida is an authentic work carried out by them under my supervision and guidance. The matter embodied in this report is original and has not been submitted for the award of any other degree.

Signature of Supervisor:

Name of the Supervisor: Dr. Kuldeep Baderia

ECE Department,

JIIT, Sec-128,

Noida-201304

Dated: 8 May 2019

DECLARATION

We hereby declare that this written submission represents our own ideas in our own words and whereothers' ideas or words have been included, have adequately cited and referenced the origin sources. We also declare that we have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in our submission.

Place: Jaypee Institute of Information Technology, Noida

Date:8 May 2019

Name: Shivam Varshney

Enrollment: 9916102136

Name: Manish Kumar Rohila

Enrollment: 9916102173

Name: Harshvardhan Singh Deopa

Enrollment: 9916102192

ABSTRACT

The main reason for motor vehicular accidents is the driver drowsiness. This work shows a surveillance system developed to detect and alert the vehicle driver about the presence of drowsiness. For the detection of drowsiness, the most relevant visual indicators that reflect the driver's condition are the behavior of the eyes, the lateral and frontal assent of the head and the yawn. The system works adequately under natural lighting conditions and no matter the use of driver accessories like glasses, hearing aids or a cap. Due to a large number of traffic accidents when driver has fallen asleep this proposal was developed in order to prevent them by providing a non-invasive system, easy to use and without the necessity of purchasing specialized devices.

Nowadays, there are many systems are available in market like navigation systems, warning alarm systems etc. to make driver's work easy. Traffic accidents due to human errors cause many deaths and injuries around the world. Drowsiness and sleeping while driving are now identified as one of the reasons behind fatal crashes and highway accidents caused by drivers.

In this project drowsiness detection system has been implemented using anaconda frame works. The team have projected to work on the topic "Real time warning system for driver drowsiness", in which the application includes using various theorems and calculating the EAR (eye aspect ratio) which helps to find if the eyes are open or close. Hence, this system can be implemented in fields where driver's drowsiness plays an important role.

This system is designed using Python platform. The proposed system uses EAR theorem. Anaconda has been used here and implementation of the final output have been done with the help of flask.

ACKNOWLEDGEMENT

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ShivamVarshney	9916102136
Manish Kumar Rohilla	9916102173
Harshvardhan Singh Deopa	9916102192

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INTRODUCTION

Sleepiness is defined as, it is inversely proportional to hours slept, and difficulty falling asleep was more with a full-time job. Studies indicate that 8 to 9 hours of extended nocturnal sleep are needed to resolve sleepiness caused by decreased sleep time.

The increasing number of traffic accidents due to a driver's diminished vigilance level has become a serious problem for society. Drivers with a decreased observation level suffer from a serious danger to their own life and the lives of other people. Statistics show that a most important origin of critical or injury causing traffic accidents is due to drivers with a decreased awareness level.

This problem will increase day by day. So, there is a requirement of designing detection systems for the driver drowsiness or inattention and can produce some warning alarms to alert the driver and the further people in the vehicle. Driver's behaviors such as visual interruption, false determination on the environment and improper handling of emergencies just the accidents have close connection to crash.

The application aims to create a system which shall detect when a driver is drowsy, and shall play an alarm in order to wake him/her up. The basic concept used is a formula called the eye aspect ratio (which is basically an estimate of the eye's opening state), a threshold value for which is set; used as a checking point to determine the safe distance between the two eyelids for a considerable period of time.

1.1Motivation and Theoretical overview

The motivation for doing this project was primarily an intrest in learning how a warning system could be developed to reduce road accidnt caused due to drowiness of the driver.

1.2Problem Statement

It has been estimated that drowsiness causes around 20% of accidents with dead and injured drivers, whereas the trucking industry shows 57% of fatal truck accidents for this fatality goes further as 30% of all traffic accidents have been caused by drowsiness. In USA drowsiness is responsible for 100,000 traffic accidents whose costs are about $12,000 million. In Germany, one of four traffic accidents have their origin in drowsiness, in England 20% off all traffic accidents are produced by drowsiness and in Australia 1,500 million dollars has been spent on this fatality. (6^{th} research paper). Therefore, the car companies should maintain a proper system for drowsiness detection.

1.3Scope of study

This includes

- PERCLOS algorithms.
- Using various libraries in Python.
- Working on Anaconda (platform for python).
- Web page implementation using flask.

Chapter 2

LITERATURE SURVEY

For our project motivation was from the research carried out by the following people and their

Published papers:

"Real-Time Nonintrusive Monitoring and Prediction of Driver Fatigue" (Qiang Ji, Zhiwei Zhu & Peilin Lan), they used cameras equipped with infrared illuminators to acquire video images of the driver. Typical characteristics that determine the level of alertness like eyelid, gaze, head and facial movement are extracted in real time to infer the fatigue level of the driver A probabilistic model is developed to model human fatigue and to predict fatigue based on the visual cues obtained.

"Driver Drowsiness Detection Using Face Expression Recognition" (Mohammad Amin Assari, Mohammad Rahmati), they used facial expressions to detect drowsiness. They proposed and implemented a hardware system which is based on infrared light. In this method, after face detection step, the facial components that are more important and most effective for drowsiness, are extracted and tracked in video sequence frames.

"Real-Time Warning System for Driver Drowsiness Detection Using Visual Information" (Marco Javier Flores, José María Armingol, Arturo de la Escalera), their system is based on Computer Vision and Artificial Intelligence and uses six modules- Face detection, Eye detection, Face tracking, Eye tracking, Drowsiness detection and Distraction detection.

"A Survey on Driver's Drowsiness Detection Techniques" (Jay D. Fuletra & Dulari Bosamiya), they have discussed the usage of a number of different techniques for analyzing driver's drowsiness. These techniques include Image Processing based techniques. Electroencephalograph based techniques, and artificial neural network based techniques. Image processing based techniques can be divided in three categories which are template matching technique, eye blinking technique, yawning based technique.

"Real-Time System for Monitoring Driver Vigilance" (Luis M. Bergasa & Jesús Nuevo), they calculated six parameters which were Percent eye closure (PERCLOS), eye closure

duration, blink frequency, nodding frequency, face position, and fixed gaze. These parameters were combined using a fuzzy classifier to infer the level of inattentiveness of the driver.

"Efficient Driver Fatigue Detection and Alerting System" (Miss. Kanchan Manohar Sontakke), they detected fatigue in this system by image processing method of comparing the images in video sequence and by using human features they detect whether the drivers fatigue or not. The key processes involved are Face detection, Fatigue Detection, Feature Extraction, Eyes location. They extracted images one by one. They compared these images with previous images. First of all they detect the feature from eyes is useful for finding and tracking of face. It decides whether eyes are closed or opened. After extracting the feature points in image they track the face and eye movements. If eyelids are 80% closed then the driver drowsiness is detected.

Chapter 3

DROWISNESS DETECTTION

3.1 Face Detection

With eye found in the face region, detection of the face is important to find the eyes. To achieve this, object detection algorithm is adopted in this system. Libraries such as dlib, OpenCv, imutils are used the face and mark points on them. 68 points face classifier have been used to mark the points. Once the face is detected and marked as our region of interest, it is cropped and passed to the next level where the eye will be detected.

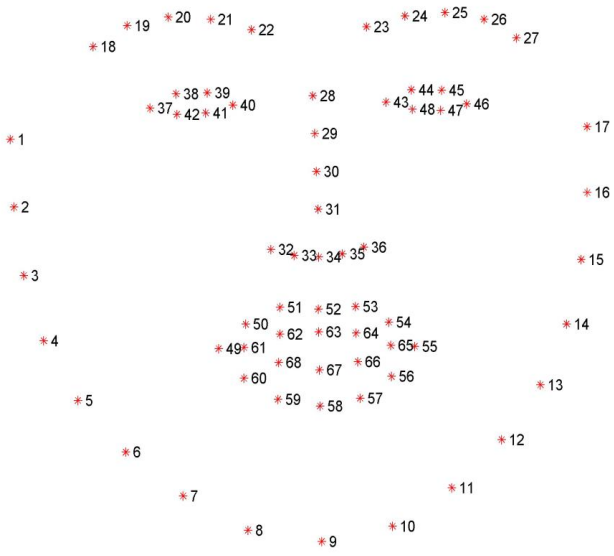

Figure 3.1: 68 point facial and mark [9]

Figure 3.2: Facial Land mark Analysis

3.2 Eye Detection

A similar approach is adopted in eye detection, from the face region obtain the eye classifier which is also adopted from the OpenCV package. This helps in reducing the training time required and eliminates the rigorous processes that are involved when testing the performance. Once the eye region is obtained, it is cropped and moved to the next level where the state (closed/open) of the eye is determined.

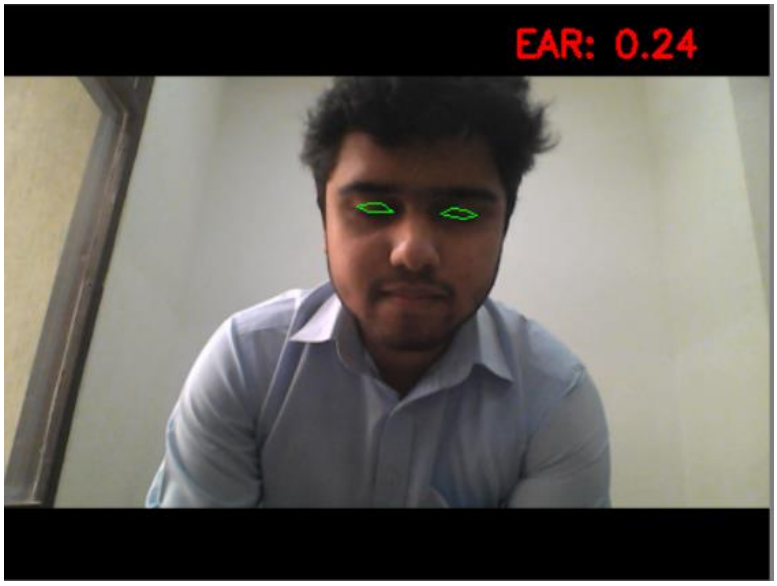

Figure 3.3: Eye Detection

3.3 Eye State Detection

When the eyes are detected, 6 points for each eye are obtained respectively. After that EAR (Eye Aspect Ratio) of both the eyes is computed and the average of both is considered.

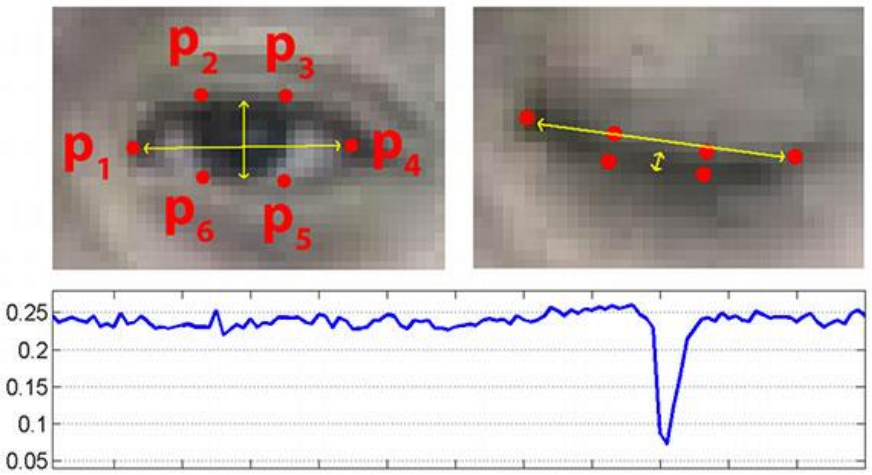

Figure 3.4: Eye state detection [8]

$$EAR= (|p2-p6|+|p3-p5|)/2*(|p4-p1|)$$

As threshold varies person to person computing is done on threshold EAR using–max (EAR)*0.75. When EAR goes be low threshold, eye is supposed to be closed.

3.4 Drowsiness Alert Module

If the driver remains drowsy for 30 consecutive frames, surveillance is activated and an alarm is activated, until the driver get back to non-drowsy state.

Chapter 4

METHODOLOGY

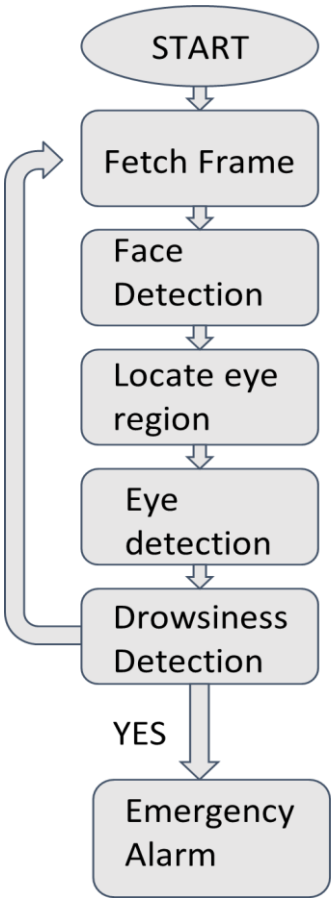

Figure 4.1: Process involved

1. First setup a camera that monitors a stream of faces.
2. If a face is found facial landmark is applied detection and extract the eye region.
3. Now there's a eye regions, the **eye aspect ratio** can be computed to determine if the eyes are closed.
4. If the **eye aspect ratio** indicates that eyes have been closed for a sufficiently long enough amount of time, an alarm will beep to wake up the driver.

Chapter 5

PYTHON

Python is an interpreted, high-level, general-purpose programming language. Created by Guido van Rossum and first released in 1991.

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.

It has simple easy-to-use syntax, making it the perfect language for someone trying to learn computer programming for the first time.

Figure 5.1: Python logo [7]

5.1 Package's Used

1. Distance
2. VideoStream
3. Face_utils
4. Threads
5. Numpy
6. Playsound
7. Argparse
8. Imutils
9. Time
10. Dlib
11. Cv2

5.2 Flask

Flask is a Python framework for creating web applications. From the official site, Flask is a micro framework for Python based on Werkzeug. When thinking about Python, the de facto framework that comes to our mind is the Django framework. But from a Python beginner's perspective, Flask is easier to get started with, when compared to Django.

Setting up Flask is pretty simple and quick. With pip package manager, all that needs to be done is:-

1. pip install flask

Once you're done with installing Flask, create a folder called FlaskApp. Navigate to the FlaskApp folder and create a file called app.py. Import the flask module and create an app using Flask as shown:

```
1 from flask import Flask
2 app = Flask(_name_)
```

Now define the basic route/ and its corresponding request handlers:

```
1 @app route("/")
2 defmain():
3 return "Welcome!"
```

Next, check if the executed file is the main program and run the app:

```
1 if__name__=="__main__":
2 app run()
```

Save the changes and execute app.py:

```
1 python app.py
```

Chapter 6

IMPLEMENTATION

This module will aim at processing the acquired video images. The processing will target to detect the drivers face from the video stream; once the face is detected, the region of interest that is the eyes will then be located from the facial features. The state of the eye will then be computed using the pixel intensity difference and a threshold value. Basic development utilities were installed into the system and OpenCv also installed into the system, which provides image processing capabilities.

6.1 Webpage Design

Designing of webpages is done using CSS, HTML.CSS is used for describing the presentation of Web pages, including colors, layout, and fonts. It allows one to adapt the presentation to different types of devices on the other hand HTML is used for basic layout and structuring of webpages. In this process 2 webpages are used the other one being the Thank You page.

Open up app.py and import render template, which will be used to render the template files.
1 from flask import Flask, render template

Modify the main method to return the rendered template file.
1 defmain():
2 return render_template('index.html')

Save the changes and restart the server. Point your browser to http://localhost:5000/ and you should have the below screen:

6.2System Flowchart

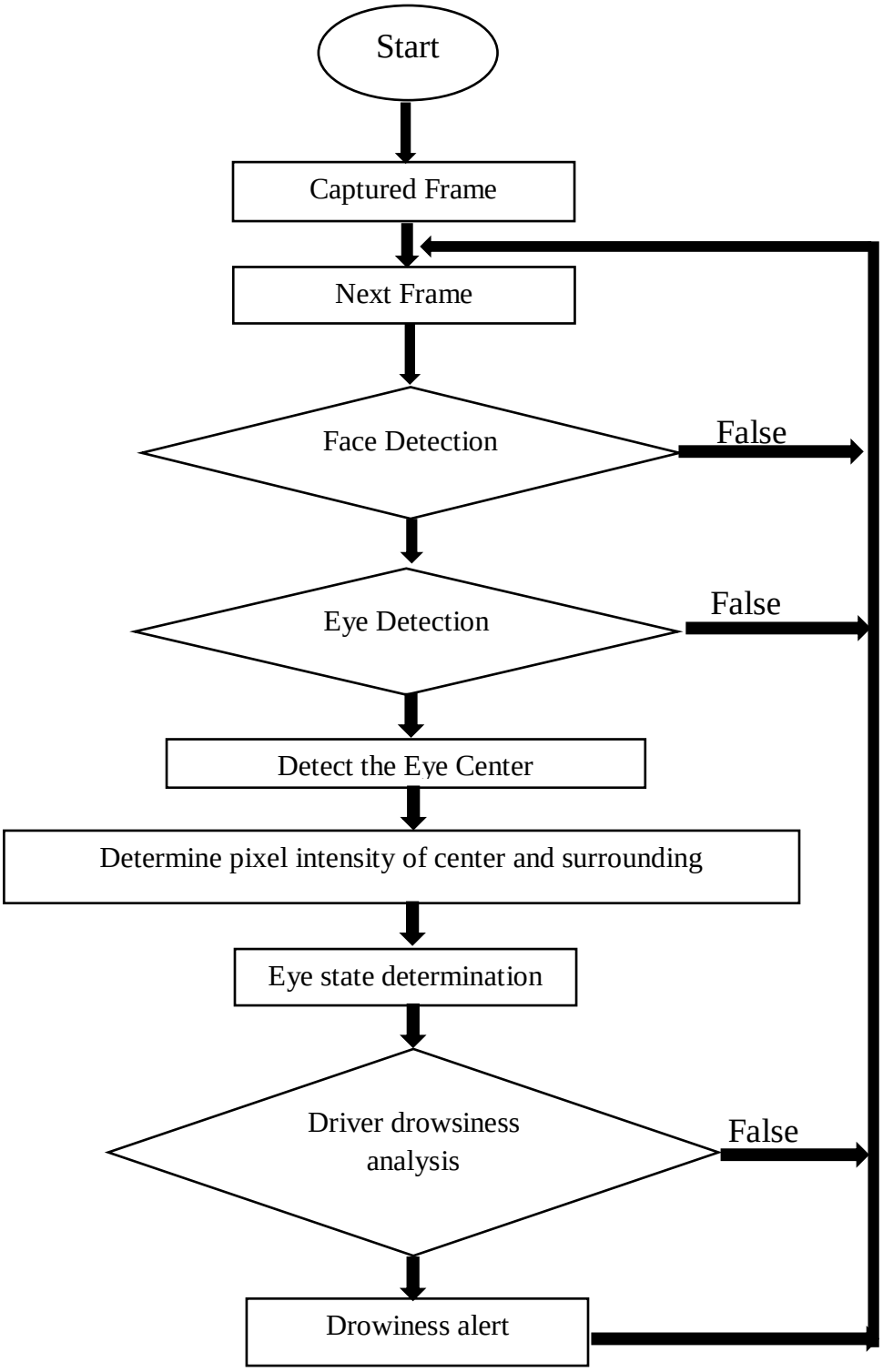

Figure 6.1: System Flowchart

Chapter 7

RESULT AND ANALYSIS

Using the all the functions database have been created, output was tested by using existing test images as well as in real-time. Following section, the screenshots of the output of different functions are given. The system have been tested with the help of three volunteers.

7.1 Command Promt (Anaconda)

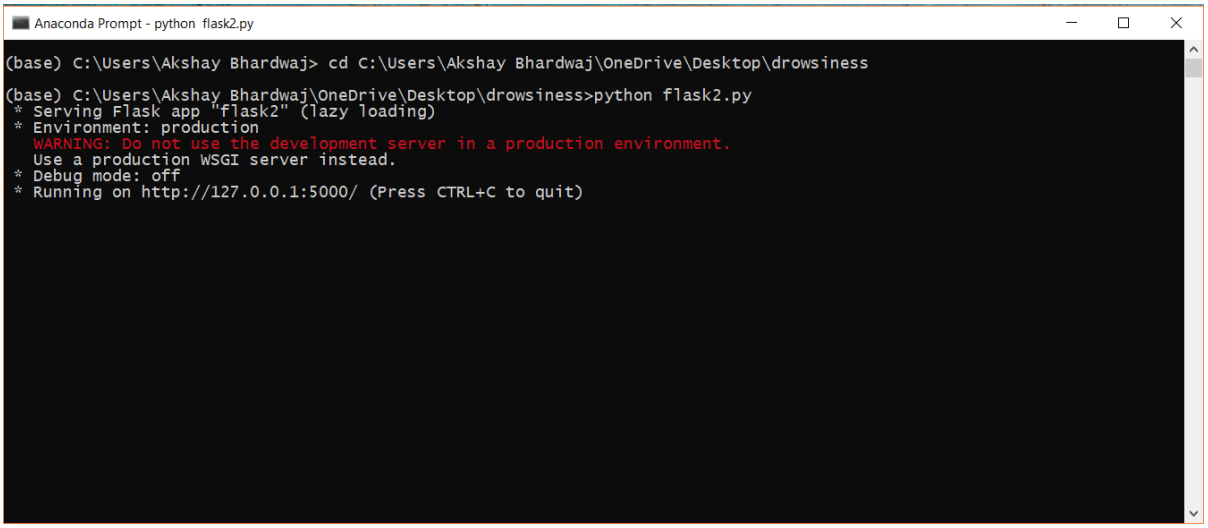

Figure 7.1: Command promt

7.2 Webpage

The webpage that have been made through html and css, and implemented through flask looks like this. The camera will start working when start icon is clicked on. It will show error screen if command promt is switched off and there is no internet connection. But this can be done without internet when the command promt is not closed.

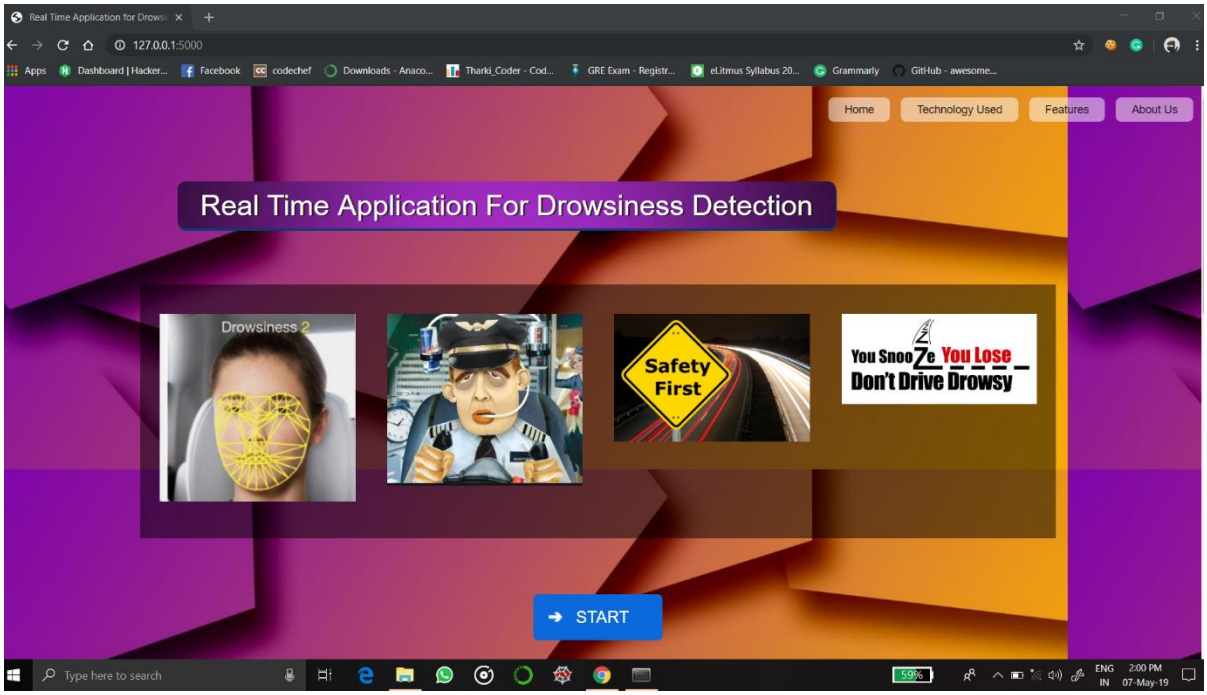

Figure 7.2 : Webpage display screen

7.3 Final Output

The final output will be shown in the camera window. The EAR will be displayed which will show the horizontal distance between the eyes. The EAR will continuously be changing in the output screen.

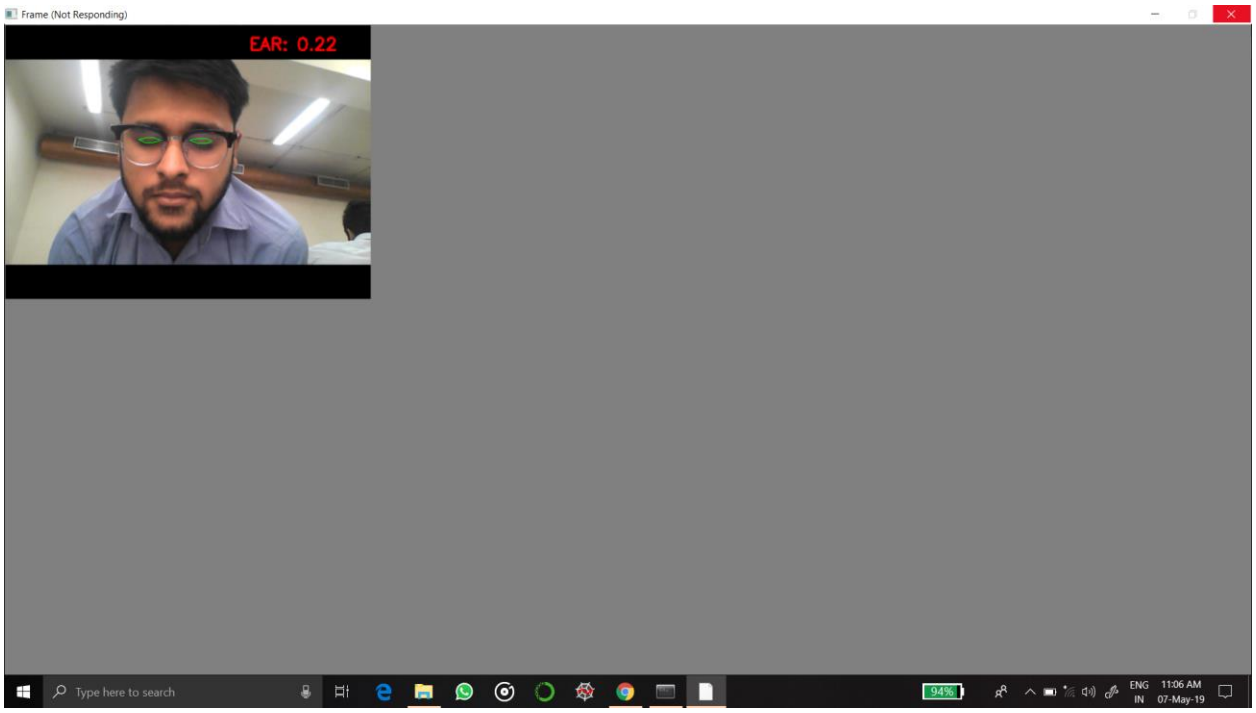

Figure 7.3: Drowsiness Detection (1)

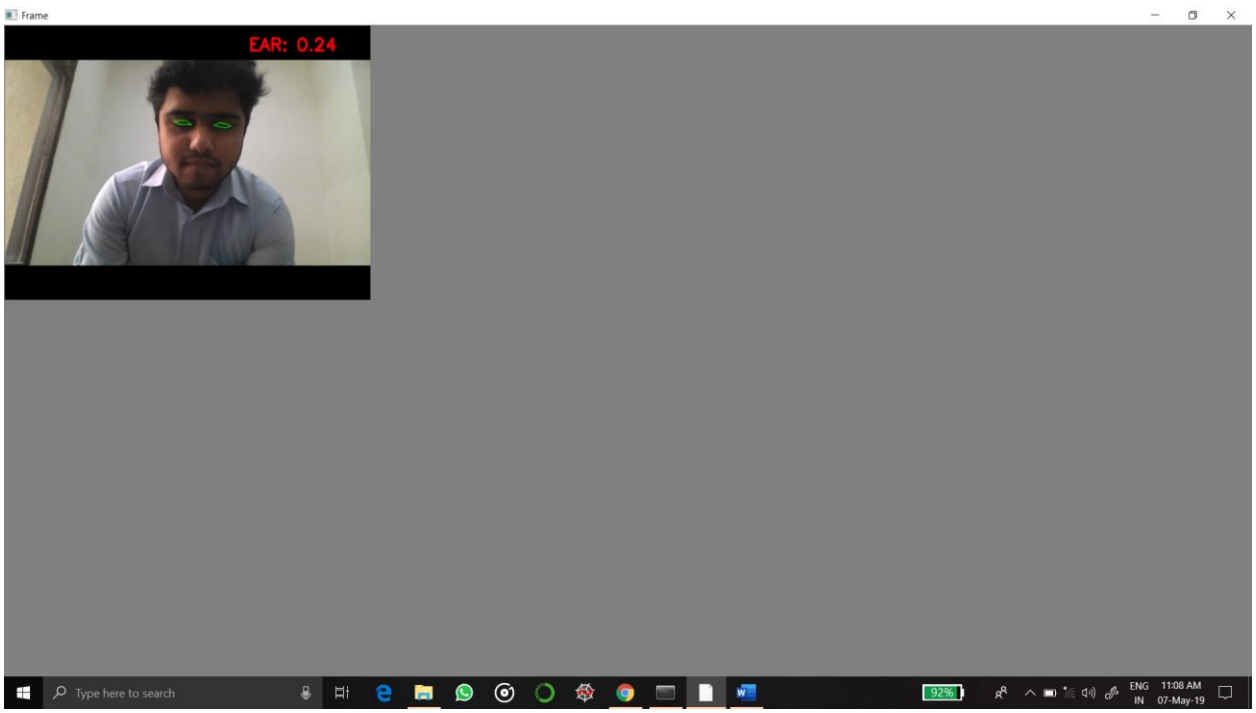

Figure 7.3: Drowsiness Detection (2)

Chapter 8

ADVANTAGES

1. Monitors real time drowsiness of the driver.
2. Implemented as a web application.
3. Easy to use, as it can be used by non-tech person also.
4. Helps in reducing road accidents during night

Chapter 9

CONCLUSION AND FUTURE SCOPE

This project details the great potential that image processing has. To conquer most of the world problem human perceive the world through vision, in a similar way adequate cheap technology is available for manipulating images to enable machines interact with their environment through vision. Through this, machine will be able to solve many problems.
The system provides a website having a cheap drowsiness detection method hence providing a solution to millions of people who are losing their lives and livelihoods in the hand of drowsy drivers both in the public service transport, track driving and in low income private vehicle owners. Through collaboration with various government agencies, the technology can be used in enforcing the driving rules. This system demonstrates the great potential that lies in the advancements made in image processing technologies and increased computing power on different board.

Our model is designed for detection of drowsy state of eye and give an alert signal or warning may be in the form of audio or any other means. In future, this system can be implemented in automobiles having inbuilt camera integrated with this mechanism. Rather using alarm Automatic Braking System can be used which will reduce the speed of the vehicle.

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APPENDICES

1. EAR=(|p2-p6|+|p3-p5|)/2*(|p4-p1|)

   This is the Eye Aspect Ratio, which is used to calculate the horizontal distance between the eyes.

2. max(EAR)*0.75

   This is used to calculate the threshold value for the closure of eyes