**Project Report**

**on**

# Driver's Drowsiness Detection

**Submitted as partial fulfillment for the award of**

# BACHELOR OF TECHNOLOGY

# DEGREE

**Session 2021-22**
**in**

## Computer Science and Engineering


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**Under the guidance of**

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## ABES ENGINEERING COLLEGE, GHAZIABAD

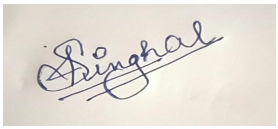
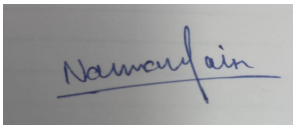
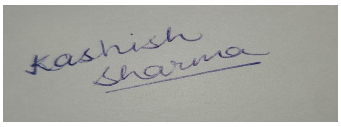


**AFFILIATED TO**
**DR. A.P.J. ABDUL KALAM TECHNICAL UNIVERSITY, U.P., LUCKNOW**
**(Formerly UPTU)**

# STUDENT'S DECLARATION

We hereby declare that the work being presented in this report entitled "DRIVER'S DROWSINESS DETECTION" is an authentic record of our own work carried out under the supervision of Dr. ANIL KUMAR DUBEY . The matter embodied in this report has not been submitted by us for the award of any other degree.

**Dated:** **Signature of students(s)**

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This is to certify that the above statement made by the candidates is correct to the best of my knowledge.

**Signature of Supervisor**
**(Dr. Anil Kumar Dubey)**
**(Assistant Professor)**
**(Computer Science & Engineering Department)**

# CERTIFICATE

This is to certify that Project Report entitled “ Driver’s Drowsiness Detection ” which is submitted by Anshika Singhal, Naman Jain, Kashish Sharma in partial fulfillment of the requirement for the award of degree B. Tech. in Department of Computer Science and Engineering of Dr. A.P.J. Abdul Kalam Technical University, formerly Uttar Pradesh Technical University is a record of the candidate own work carried out by him/them under my supervision. The matter embodied in this thesis is original and has not been submitted for the award of any other degree.

**Supervisor**

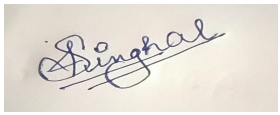
**Date**

# ACKNOWLEDGEMENT

*It gives us a great sense of pleasure to present the report of the B. Tech Project undertaken during B. Tech. Final Year. We owe special debt of gratitude to Professor Dr. Anil Kumar Dubey Department of Computer Science & Engineering, ABESEC Ghaziabad for his constant support and guidance throughout the course of our work. His sincerity, thoroughness and perseverance have been a constant source of inspiration for us. It is only his cognizant efforts that our endeavors have seen light of the day.*

*We also take the opportunity to acknowledge the contribution of Professor (Dr.) Divya Mishra, Head, Department of Computer Science & Engineering, ABESEC Ghaziabad for his full support and assistance during the development of the project.*

*We also do not like to miss the opportunity to acknowledge the contribution of all faculty members of the department for their kind assistance and cooperation during the development of our project. Last but not the least, we acknowledge our friends for their contribution in the completion of the project.*

*Signature:* 

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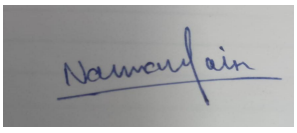
*Signature:* 

*Name : Naman Jain*

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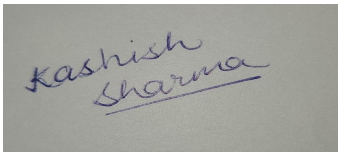
*Signature:* 

*Name : Kashish Sharma*

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# ABSTRACT

***As Humans we have always tried to develop machines that is good for the human race, to protect it and to bring their life at ease. No matter what field, we have engulfed with technology and are constantly improvising it .With the advancement in technology, the transportation facilities and their modes are also increasing and so is our dependency on it and that too in exponential order.***

***Now we can travel from place to place within no time. In this modern era, most of the people use some or the other kind of vehicle, some use the public transport while some who are rich enough own a vehicle. But there are same rules for the one who is driving irrespective of their social standard i.e. the driver should stay alert and active while driving.***

***When on road an automobile uses the most power and if it is in irresponsible and careless hands it might become a cause for destruction. Such carelessness can lead to the loss of lives of both people inside the car and those on the road. According to the report published by National Transportation Safety Board (NTSB) in the United States, there are around 52% of the heavy truck related accidents due to driver's sleepiness. So there is a strong need to bring such things to an end.***

***Nowadays the driver safety in the car is one of the most wanted system to avoid accidents. And in most of the accident cases driver drowsiness is a significant factor. This motivates us to make project on drowsiness detection to ensure the safety and reduce the number of car accidents.***

***For this the methodology followed by us would be, First we will be taking input through the camera and then detect the face of the person and create region of Interest (ROI).Then the person's eyes would be detected from ROI and will be fed to the classifier. From there the classifier will check if the eyes are open, fully closed or partially closed and will predict a score depending on that.***

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# LIST OF FIGURES

# LIST OF SYMBOLS

| | |
|---|---|
| ≠ | Not Equal |
| ∈ | Belongs to |
| ρ | Synthetic eye template |
| _ | Optical distance |
| _o | Optical thickness or optical half thickness |
| Σ | Sum of |

# LIST OF ABBREVIATIONS

| | |
|---|---|
| CNN | Convolution Neural Network |
| MTCNN | Multi-Task Cascaded Convolution Neural Networks |
| NTSB | National Transportation Safety Board |
| PCA | Principal Component Analysis |
| ROI | Region of Interest |
| IT | Information Technology |
| SVM | Support Vector Machine |
| AI | Artificial Intelligence |
| EAR | Eye Aspect Ratio |
| RAM | Random Access memory |

# CHAPTER 1

# INTRODUCTION

Artificial Intelligence (AI) is quite a diversified branch of Computer Science when it comes to developing automated machines. It possess the ability and capability to perform the tasks that have human intelligence as their requirement. Machine Learning and Deep Learning which are a part of Artificial Intelligence have been widely explored but have also been equally misunderstood. With this first having a good understanding of what machine learning and Deep Learning is? Is really important.

Understanding the basic terminologies and the algorithms used for various predictions. Then explaining how the proposed algorithm is related to other parts of the project and is fit to the data set.

As they encounter some new data, they first check it with the current data set and use the already trained model for prediction. The already trained model shows them the matching characteristics with all the data set it has been fed to and gives user the most optimal result I.e. the result is acquired from the data set depending on the comparison of other attributes. There are ideally four types of machine learning algorithms namely Supervised machine learning algorithm, Unsupervised machine learning algorithm and Reinforcement Learning.

Since we are developing a Dizziness system, previously many studies have been conducted in the same field. Earlier studies conducted proved that studies conducted used the idea of creating a region of Interest over the face and then used several algorithms such as SVM, MTCNN. There the binary SVM classifier is used for detecting the dizziness. There the system showed the rate of 97.8% accuracy and 98.6% detection rate.

## 1.1 Problem Introduction:-

*A*s Humans we have always tried to develop machines that is good for the human race, to protect it and to bring their life at ease. No matter what field, we have engulfed with technology and are constantly improvising it .With the advancement in technology, the transportation facilities and their modes are also increasing and so is our dependency on it and that too in exponential order. Now we can travel from place to place within no time. In this modern era, most of the people use some or the other kind of vehicle, some use the public transport while some who are rich enough own a vehicle. But there are same rules for the one who is driving irrespective of their social standard i.e. the driver should stay alert and active while driving.

When on road an automobile uses the most power and if it is in irresponsible and careless hands it might become a cause for destruction. Such carelessness can lead to the loss of lives of both people inside the car and those on the road. According to the report published by NTSB in the United States, there are around 50% of the heavy truck related accidents due to driver’s sleepiness. So there is a strong need to bring such things to an end.

### 1.1.1 Motivation:

Nowadays the driver safety in the car is one of the most wanted system to avoid accidents . And in most of the accident cases driver drowsiness is a significant factor. This motivates us to make project on drowsiness detection to ensure the safety and reduce the number of car accidents.

### 1.1.2 Project Objective:

The main objective of this project is to develop a drowsiness detection system by monitoring the eyes of the driver and as and when the driver sleeps, the system detects drowsiness ,it alerts both the drivers and the passengers by giving them a loud beep which helps them to avoid accidents because of drivers sleepiness. As in approximately it has been found in a survey that cause of 40% of the accidents is driver was sleepy which proves dangerous for both driver and the passengers and also other people on the road.

### 1.1.3 Scope Of Work:

- This Anti-drowsiness Alarm will help the driver wake up at the right moment before any mishappening.
- It will also help people to avoid Drink and Drive.
- The System will ensure great amount of security.
- The system can be used not only for automobiles but also for various other modes of transportation such as airplane, trains, etc.

## 1.2 Related Previous Work:

Earlier many studies were conducted for the driver's fatigue and that too for various areas. It has proved to be very beneficial for every domain. Many it, non-it industries have designed fatigue detection in order to increase their revenue. The following measures are used widely for monitoring drowsiness of the driver:

i) Vehicle-based measures—A number of measures, like deviations from lane position, movement of the steering wheel,, etc., are constantly monitored .

ii) Behavioral measures— The behavior of the driver, which includes yawning, eye closure, eye blinking, head pose, etc., is monitored through a camera.

iii) Researchers have also used subjective measures where drivers are asked to rate their level of drowsiness either verbally or through a questionnaire.

The system considering all the above measures had an accuracy rate of approximately 93.4%.

Since we are developing a Dizziness system, previously many studies have been conducted in the same field. Earlier studies conducted proved that studies conducted used the idea of creating a region of Interest over the face and then used several algorithms such as SVM, MTCNN. There the binary SVM classifier is used for detecting the dizziness. There the system showed the rate of 97.8% accuracy and 98.6% detection rate.

| Sr.No | Paper/Book Title | Authors | Publication Details | Summary |
|---|---|---|---|---|
| 1. | Driver Fatigue Detection Based on Convolutional Neural Networks Using EM-CNN | Zuopeng Zhao,Nana Zhou,Lan Zhang, Hualin Yan,Yi Xu,and Zhongxin Zhang | Computational Intelligence and Neuroscience | In the proposed algorithm, the multitask cascaded convolutional network (MTCNN) architecture is employed in face detection and feature point location, and the region of interest (ROI) is extracted using feature points. |
| 2. | Real Time Driver Drowsiness Detection | Eddie E Galarza, Franklin Silva, Eddie Galarza,Paola M.Vilasco | Proceedings of the International Conference on Information Technology & Systems (ICITS 2018) | Real Time Driver Drowsiness Detection Based on Driver's Face Image Behavior Using a System of Human Computer Interaction Implemented in a Smartphone |
| 3. | Drowsiness Detection System using Machine Learning | S. Jansi Rani1 , Anand Rajasekharan2 , Chandrasekhar A R 3 | INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH IN TECHNOLOGY | This research uses Convolutional Neural Network to predict drivers drowsiness. |

## 1.3 Organization Of The Report:

Chapter 1: This chapter is basically the introduction of the Problem, the real motivation behind the creation of this project and also the previous work that has been conducted in this field.

Chapter 2: In the various research papers studied by us there were different methodologies followed and suggested by different authors. Each had their own way to represent the data and result. Some used the Convolutional Neural Network (CNN), while some used Support Vector Machine (SVM).They first employed the CNN architecture in face recognition and then used feature point extraction to extract the Region of Interest (ROI) on face. Another methodology that supported the research suggested to use SVM and by locating the support vectors try to find out if the driver is dizzy or not.

Chapter 3: It basically comprises of the System design and methodology used to develop the project .It comprises of the use case designs and the work flow of the system.

Chapter 4: It consists of the Implementation details and the result thus obtained through it. It shows the basic detection done by the system and the consideration taken while doing its implementation.

Chapter 5: This comprises of the basic result thus obtained. As it is observed in various cases that when the driver is drowsy, his head is always sloping downwards. So, with that consideration, according to the statistical data we found that the correlation coefficient lies in the range of 0.7 to 0.8 for of head position and fatigue degree. Also with increase in his dizziness the system detects the steering wheel movement and its pattern which starts to show absurd patterns and the handgrip strength on the steering wheel becomes larger.

# CHAPTER 2

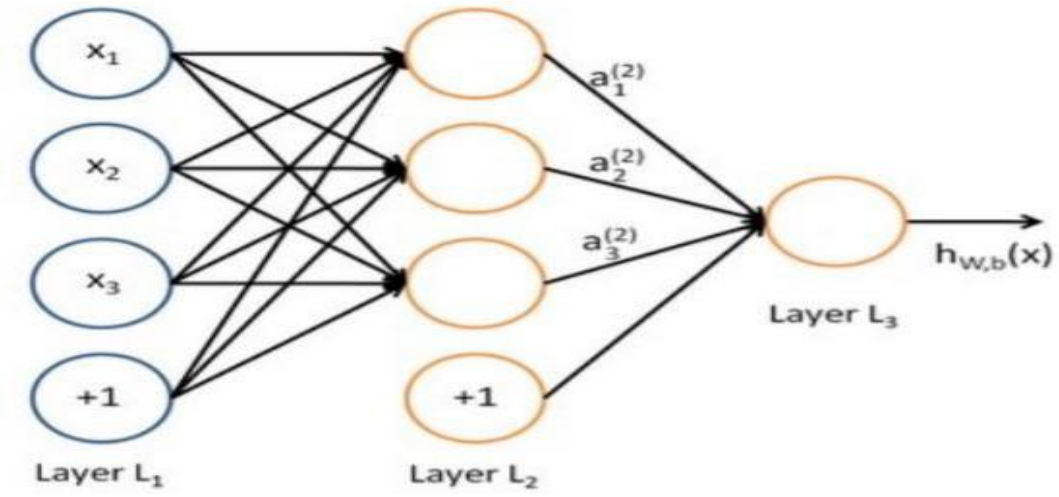
# LITERATURE SURVEY

In the various research papers studied by us there were different methodologies followed and suggested by different authors. Each had their own way to represent the data and result. Some used the Convolutional Neural Network (CNN), while some used Support Vector Machine (SVM).They first employed the CNN architecture in face recognition and then used feature point extraction to extract the Region of Interest (ROI) on face. Another methodology that supported the research suggested to use SVM and by locating the support vectors try to find out if the driver is dizzy or not.

As it is observed in various cases that when the driver is drowsy, his head is always sloping downwards. So, with that consideration, according to the statistical data we found that the correlation coefficient lies in the range of 0.7 to 0.8 for of head position and fatigue degree. Also with increase in his dizziness the system detects the steering wheel movement and its pattern which starts to show absurd patterns and the handgrip strength on the steering wheel becomes larger.

## Convolutional Neural Network:

With the advancement in technology and development of neural networks, the computer science technology has created its large pace in the market. The Advancement is leading to lot greater achievements in the field and is continuously improving the lives of people day by day. To improve the performance of back propagation algorithm, the convolution neural network is used to reduce number of learning parameters. As it minimizes the pre-treatment of the input data to the network. Then that data is passed to each hidden layer of the network ,undergoes processing and the output is received from other as a single output layer.

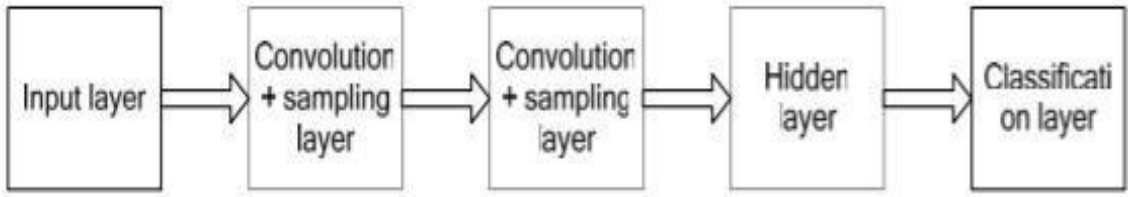



**Convolution Neural Network architecture**

Here X1, X2, X3 act as the input to this Neural Network and +1 is called the offset node also known as the intercept term. The layer comprising of X1, X2, X3 is the input layer. And the rightmost layer is the output layer used to get the final output. The layer L2 or the layer in between is the hidden layer or the layer at which all the pre-processing is done. All the computation is done at this layer.
If the parameters W, b are given where W is the connection parameter between the cells of layer 1 and layer 2 and b is some constant then, the output of a given Neural Network can be easily calculated using the formula:

$$a_1^2 = f\left(W_{11}^1 x_1 + W_{12}^1 x_1 + W_{13}^1 x_1 + b_1^{(1)}\right)$$
$$a_2^2 = f\left(W_{21}^1 x_1 + W_{22}^1 x_1 + W_{23}^1 x_1 + b_2^{(1)}\right)$$
$$a_3^2 = f\left(W_{31}^1 x_1 + W_{32}^1 x_1 + W_{33}^1 x_1 + b_3^{(1)}\right)$$
$$h_{W,b}(x) = a_1^3 = f\left(W_{11}^2 a_1^2 + W_{12}^2 a_2^2 + W_{13}^2 a_3^2 + b_1^{(2)}\right)$$

The CNN designed here is comprising of layers such as input layer, conv pooling layer, connected layer , output layer and convolution layer. The input is taken by the input layer which is further passed on to the conv pooling layer which divides the image to pixels and then the connected layer arranges those pixels according to the images given as an input, then those arranged pixels are further passed on to the output layer to be proceeded as output to the user .




## Support vector machine:

Support Vector Machines (SVMs) are very often used for the classification of data in a wide variety of machine learning applications. Given a set of training examples, the task of the SVM is to generate a model that enables it to
classify unseen examples into the appropriate targets. In general, for a training set D consisting of m examples,

$$D = \{(\vec{x}_1, y_1), (\vec{x}_2, y_2), \ldots, (\vec{x}_m, y_m)\}\ \vec{x} \in \Re^N, y \in \{-1, 1\} \quad (1)$$

Where Xi (arrow above) are feature vector n-dimensional, yi are target values and m is the total count of feature vectors.
Applying kernel trick, non-linear function maps data points onto higher dimension. after that SVM classifies transformed data points in new feature space. The mapping function is known as the kernel
function, and it is defined in terms of a transform φ. The Linear kernel function is given by:

$$K(x_i, x_j) = x_i * x_j$$

whereas the RBF kernel is defined as follows:

$$K(x_i, x_j) = \exp(-\gamma \left\| x_i - x_j \right\|^2)\ \gamma > 0$$

SVM has capability of classifying non-linearly separable data and also it is not affected by over-fitting.

## 2.1 Proposed System:

### 2.1.1 Eyes Location:

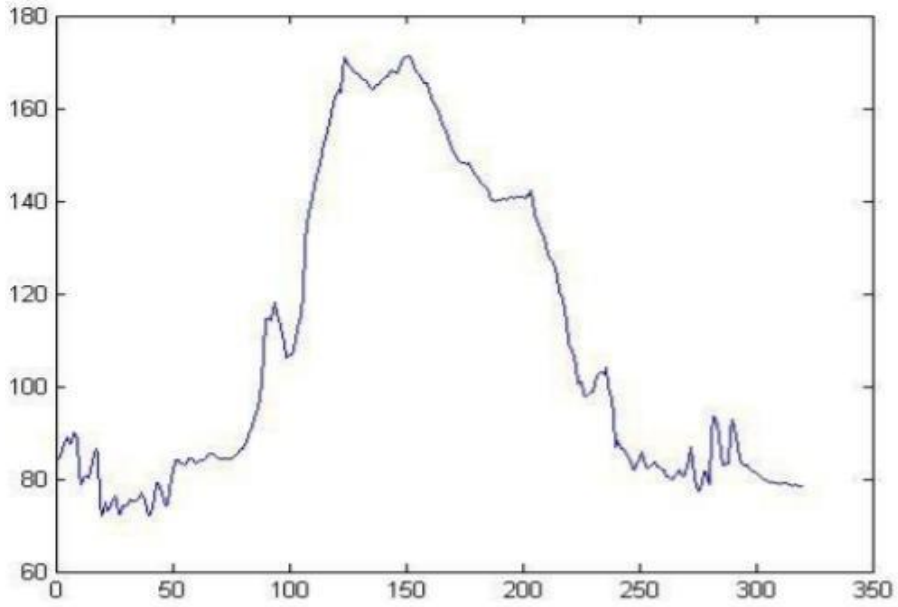
In order to make image smooth, we need to perform few steps like removing noise from the image and image enhancement which is a pre-requiste in order to achieve the best result.

**Step1: Locating the eye region**

Here considering the edge feature analysis, we make use of the vertical gray scale which is used to determine the left and right boundary of the face according to convex peak width.After that we use horizontal gray scale which is used to determine the top and bottom boundary of the eye region.

(a) The Original Image

Fig 2.1 Original Image




(b) The result of projection from vertical direction

Fig 2.2 Result of Projection from vertical direction

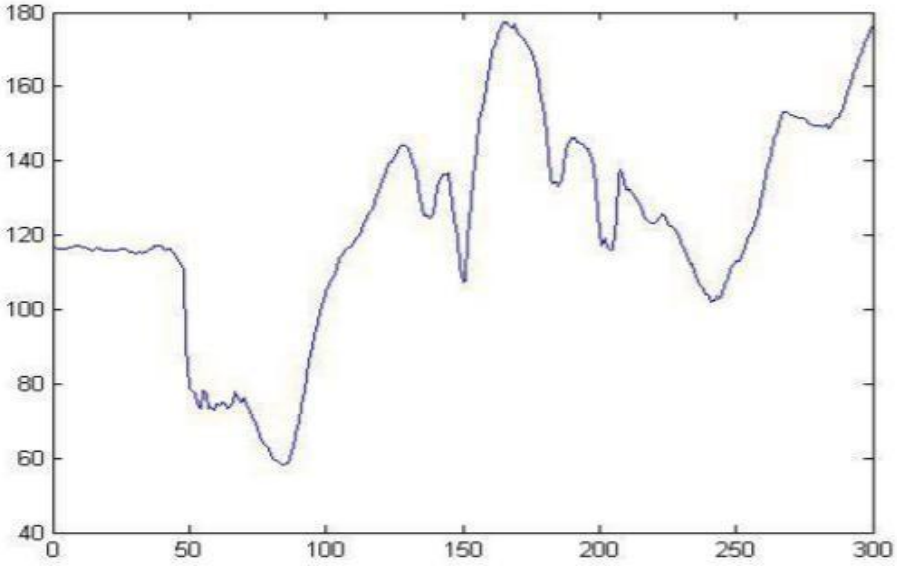



Fig 2.3 Result of Projection from horizontal direction

**Step2: Shifting the similar eye points to one side**

The main problem before the execution of the algorithm is the selection of the template prior to its matching.It is necessary to get the relative position or distance between two eyes. This is done to get the assurance that there are two real eye points among the number of similar eye points.

To select the synthetic eye template the formula is as shown:

$$\rho_{xy}=\frac{\sum_{i,j=1}^{M,N}\left(T(i,j)-\overline{T}\right)\left(S_r(i+x,j+y)-\overline{S_r}\right)}{M\times N\times\sqrt{\frac{1}{M\times N}\sum_{i,j=1}^{M,N}\left(T(i,j)-\overline{T}\right)^2}\times\sqrt{\frac{1}{M\times N}\sum_{i,j=1}^{M,N}\left(S_r(i+x,j+y)-\overline{S_r}\right)^2}}$$

**Step3: Obtain the real eye points**

We can get the real eye points through

$$a=\frac{\overline{Y}+(2-3)\times\sigma_y}{M},\quad b=\frac{\overline{X}+(2-3)\times\sigma_x}{N},\quad c=\frac{\overline{X}-(2-3)\times\sigma_x}{N};$$

### 2.1.2 Eye Tracking:

Now with the next step the eye movements would be tracked and depending on that the prediction would be done i.e if the eyes are partially closed or wide open or fully closed then accordingly the result would be processed.

# CHAPTER 3

# SYSTEM DESIGN AND METHODOLOGY

## 3.1 System Design

### 3.1.1 System Architecture:

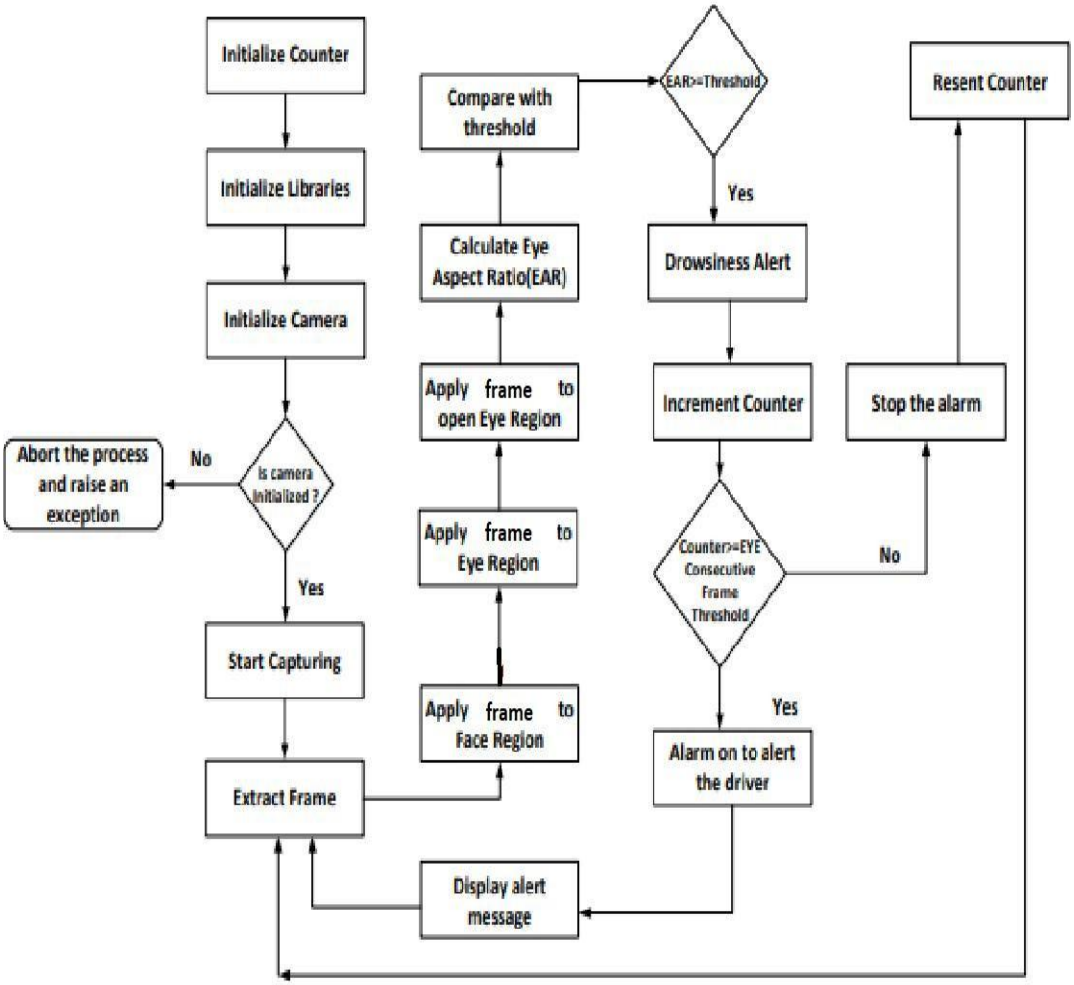



Fig 3.1 System architecture

First of all, we'll initialize counter, initialize libraries and initialize the camera. Then we'll check if our camera is properly working or not. If it's not working then we'll abort the process otherwise we'll continue with capturing. After that we'll extract the details from face region then from eye region and at last from open eye region. Then we'll calculate the eye aspect ratio and compare it with threshold value, if EAR is greater than threshold value then we'll give alarm to the driver and display alert message and increment the counter.

### 3.1.2Use Case Diagram:

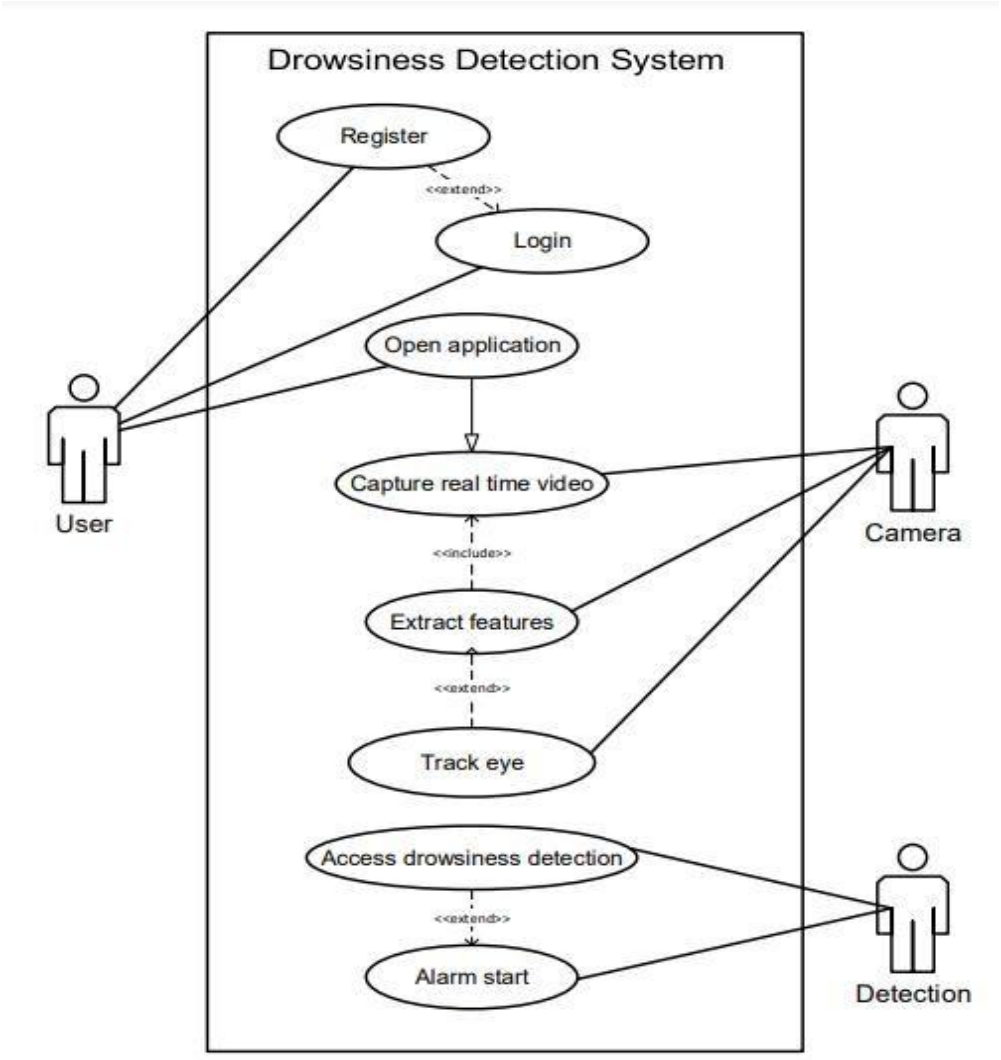



Fig 3.2 Use case Diagram

In our Use case diagram we have three actors:

1.) User

2.) Camera

3.) Detection

User can register and login to the system and get to main dashboard.

Camera captures the real time video and extract feature from it and track eye movement.

Detection detects the drowsiness and start the alarm and give alert message to the user.

### 3.1.1 Data Flow Diagram:

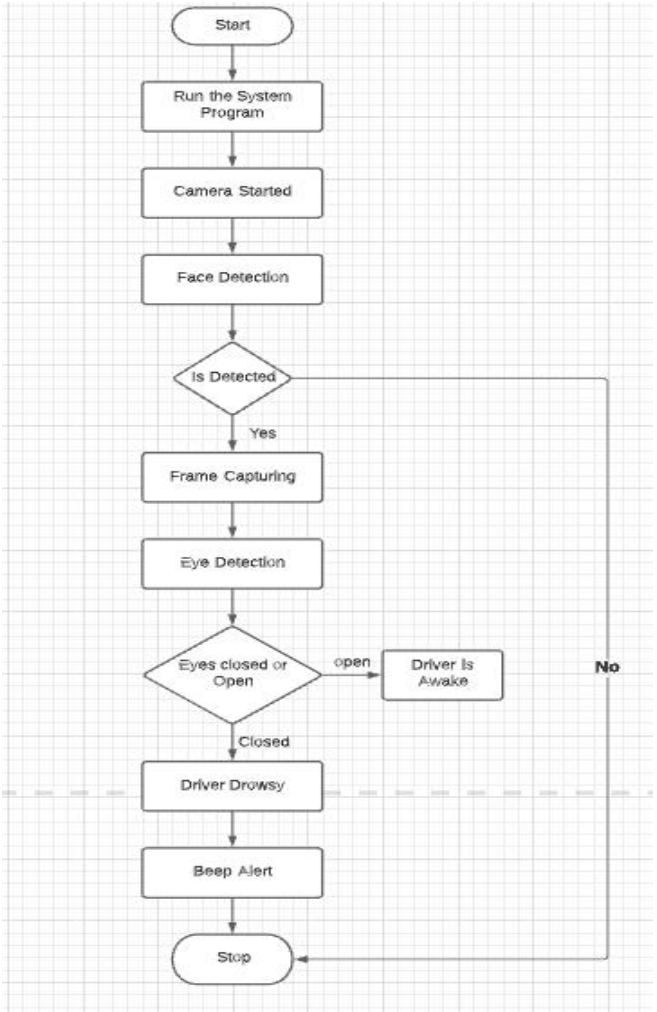



Fig 3.3 Dataflow Diagram

## 3.2 Algorithms:

The algorithm used by us in our model is convolutional neural network

### 3.2.1 Convolutional Neural Network:

With the advancement in technology and development of neural networks, the computer science technology has created its large pace in the market.The Advancement is leading to lot greater achievements in the field and is continuously improving the lives of people day by day.In order to improve the performance of back propagation algorithm, the convolution neural network is used to reduce number of learning parameters.As it minimizes the pre-treatment of the input data to the network.Then that data is passed to each hidden layer of the network ,undergoes processing and the output is received from other other as a single output layer.

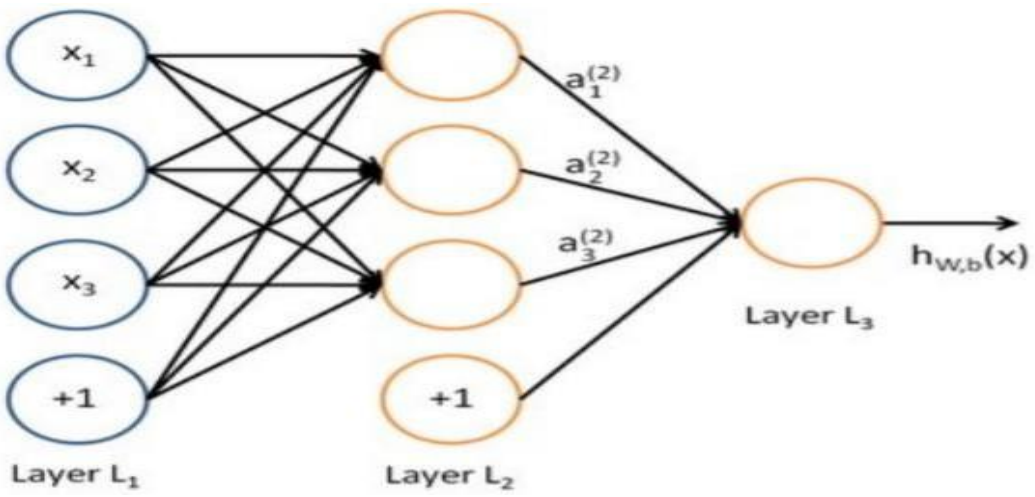



Fig 3.4 Convolution Neural Network architecture

Here X1,X2,X3 act as the input to this Neural Network and +1 is called the offset node also known as the intercept term.The layer comprising of
duration the person has closed his eyes. The score increases on closing eyes and decreses on opening eyes.

X1,X2,X3 is the input layer.And the rightmost layer is the output layer used to get the final output. The layer L2 or the layer inbetween is the hidden layer or the layer at which all the pre-processing is done.All the computation is done at this layer.

### 3.2.2 Used Algorithm:

**Step1:- Taking image of the person driving as an input through Camera**

First with the help of a web cam we will take the image of the person driving as an input .Inorder to access the webcam,we made an infinite loop that will capture the frames.To access the camera we used the already builtin method cv2.VideoCapture(o) by opencv which access the webcam and cap.read() to read each frame.

**Step 2:-Detection of face and creation of Region of Interest**

Since we are using Open CV and it takes only grayscale images as input .So,we first need to convert our images to grayscale images.For the detection of face we will be using the haar cascade classifier.

faces = face. detectMultiScale(gray) which returns us a detection array with x,y coordinates and height and width of the boundary box.

**Step 3:-Detect the eyes from ROI and give as an input to classifier**

**The procedure to detect the eyes is same as that to detect the face.Here we will use left_eye = leye.detectMultiScale(gray) for setting the classifier.And for extracting the frame we use** l_eye = frame[ y : y+h, x : x+w ].This will be fed to the Cnn classifier.

**Step 4:- Classifier will categorize if the eyes are opened or closed:**

- First we will convert coloured images to grayscale images using r_eye = cv2.cvtColor(r_eye, cv2.COLOR_BGR2GRAY).
- Then we resize the image to 24*24 pixels using cv2.resize(r_eye, (24,24)).
- We loaded our model using model = load_model('models/cnnCat2.h5') .

- Prediction is done using lp = model.predict_classes(l_eye). If the value of lp[0][0] = 1, it conclude that eyes are open, if value of lp[0][1] = 0 then, it conclude that eyes are closed.

**Step 5:- <u>Result based on Score:</u>**

Result depends on the score. The score basically tell us that for how much

# CHAPTER 4

# IMPLEMENTATION AND RESULTS

## 4.1 Software and Hardware Requirements

Software Requirements:-

### 4.1.1 Python:

- Jupyter Notebook / Python IDE

### 4.1.2 Libraries

- Numpy - Used for mathematical operations.
- Keras - Used to make the implementation of neural networks easy.
- Opencv - Used to get video stream from webcam, etc.
- Pygame - It provides sound library for alarm in our code.

### 4.1.3 Operating System

- Windows

Hardware Requirements :-

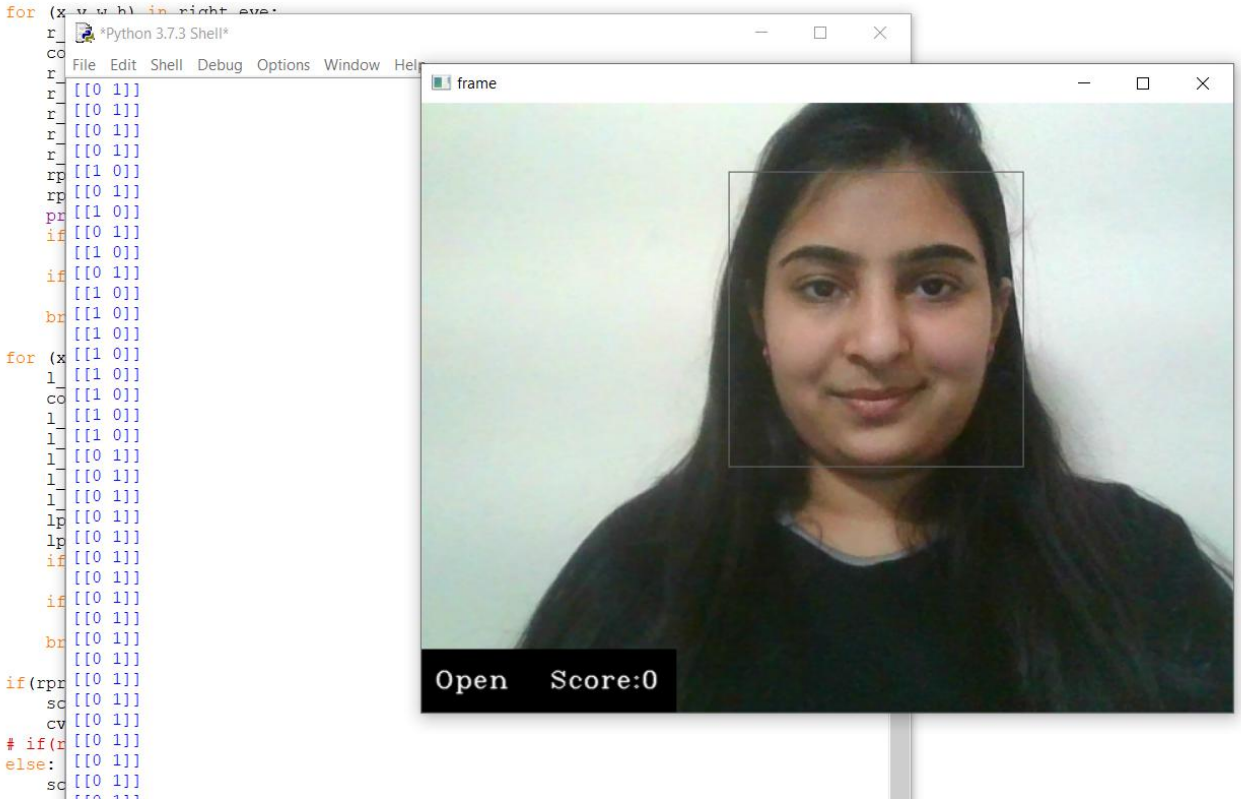
- A PC or Laptop
- RAM (8 GB)
- I5 Processor (Minimum)
- Webcam

## 4.2 Assumptions and dependencies

- Person who is driving must be in front of webcam.
- There must be a minimal amount of light required to detect eye.
- Person who is driving need to set the webcam according to his/her height

## 4.3 Implementation Details

### 4.3.1 Snapshots of Interface




Here we see a frame, showing person's image captured through webcam and a rectangle on person's face capturing the face features ,detecting eyes position.

Two labels are present at left side of frame:-

i). Open: Showing position of face.
ii). Score: It's a value which increase or decrease when we open or close our eyes. If our eyes are partially or fully closed value will increase ,if open then decrease .If value crossed threshold value then alarm will produce a beep sound.

### 4.3.2 Test Cases

There are Three test cases :-

1. When eyes are open .
2. When eyes are partially closed .
3. When eyes are closed .

#### 4.3.2.1 Non – Drowsy Person

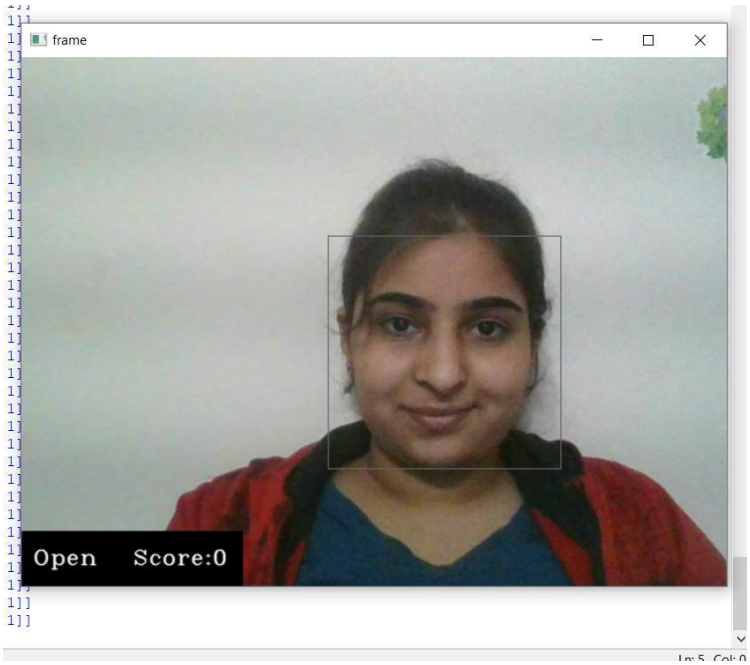



**Fig 4.1** Non – drowsy state

**Label= Open Score= 0**

Here eyes are in open state,that means person is not in drowsy state.

Label=Open represents eyes are open.

Score=0 represents value to compare with threshold value .Here score is below threshold value i.e below 15, so alarm is not beeping.

#### 4.3.2.2 Drowsy Person

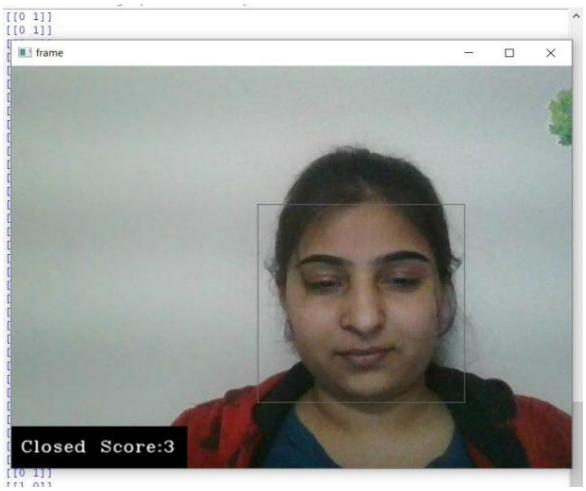



**Fig 4.2** Partially Closed

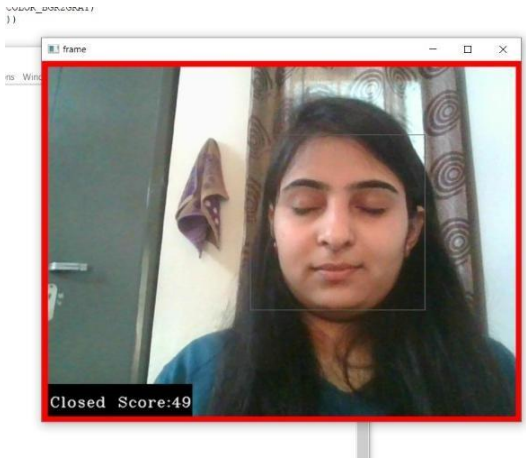



**Fig 4.3** Fully closed

(i) Label= Closed, here we are considering partially closed eyes as closed eyes.

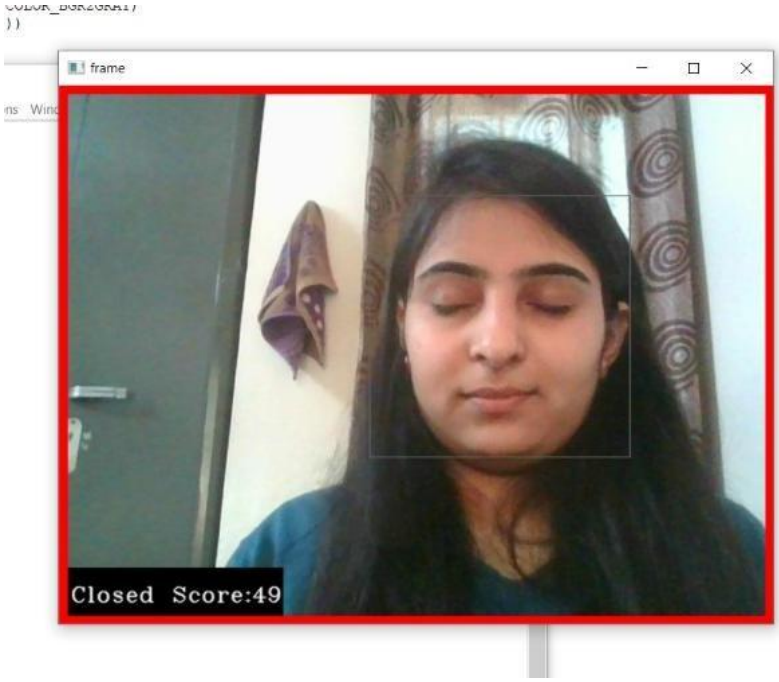
In this, the eyes are partially closed, as it is closed for less time and score has not crossed threshold value, so it's not showing any alarm frame but when eyes partially closed for more time and score increased above threshold then alarming frame with red color will be shown .Also there will be a beep which will alert both the driver and the fellow passengers.

(ii) Label= Closed, as eyes are closed.

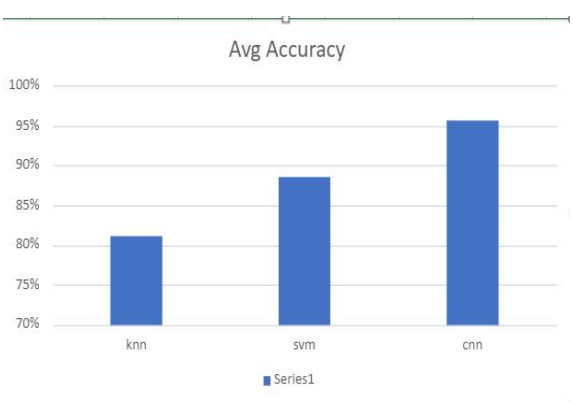
Score= 49, which is greater than threshold value.

In this the eyes are fully closed and the score has crossed the threshold so it is showing the alarming frame with red color. Also there will be a beep which will alert both the driver and the fellow passengers.

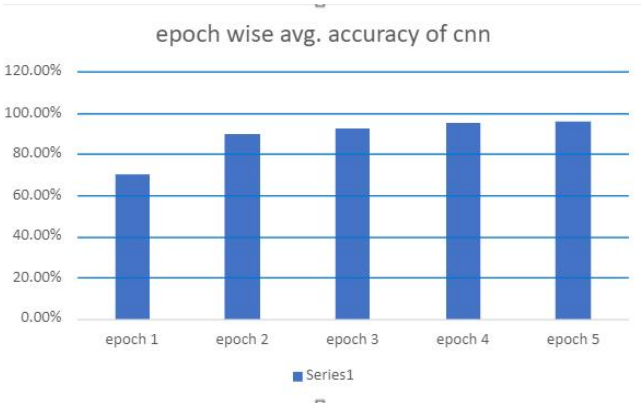
### 4.3.3 Results




Depending upon the number of time eyes closed or open, score value is calculated and if score value increased threshold value i.e 15 ,then system will produce a beep sound to make the driver come out of dizzy state and also reduces the chances of accident.




Graph-1




Graph-2

Graph1 is showing average accuracy of different algorithms including KNN, SVM, CNN in our system.

KNN with 82% accuracy, SVM with 88 % accuracy and CNN with the highest accuracy 96 %.

Graph 2 representing epoch wise accuracy of the CNN algorithm in our system

# CHAPTER 5
# CONCLUSION

Drowsiness detection system completely meets the objective and requirements .The main objective of this project is to monitor the eyes of the driver and as and when the driver sleeps, the system detects drowsiness, it alerts both the drivers and the passengers by giving them a loud beep which helps them to avoid accidents because of drivers sleepiness. It takes care of the issue of stressing out for individuals having fatigue-related issues to inform them about the drowsiness level while driving. As in approximately it has been found in a survey that cause of 40% of the accidents is driver was sleepy which proves dangerous for both driver and the passengers and also other people on the road.

## 5.1. Future Directions

- By using other parameters like yawning, state of car, distance from lane, head position, etc, one can improve model incrementally. Including these parameters can increase accuracy a lot.
- We can further add features like sensor to track the heart rate in order to prevent accidents due to sudden heart attacks to drivers.

Same model can be used for various purposes. For example, to prevent the users from sleeping. It can be used for other use Netflix and other streaming services, system will detect whether the person is sleeping or not and stop the video accordingly.

# Appendix

## ROI Extraction

Many eye detection method uses only one eye features to check drowsiness state but it is not that much accurate because when head of driver tilted one eye can give inaccurate result that's why the proposed method extract two eye features to check drowsiness state.

The position of driver's both eyes is obtained. Let say a1(x1,y1) and a2(x2,y2) is position of left and right eye respectively. Distance between eye is d1 and correspondence between width and height is as mentioned below.

$$d1 = \sqrt{x1 - x2^2 + y1 - y2^2},$$
$$w1 = 1.5\, d1,$$
$$h1 = d1.$$

# References


*[1]* C Rahmad, R A Asmara, D R H Putra, I Dharma, H Darmono and I Muhiqqin (Jan. 2020). "Comparison of Viola-Jones Haar Cascade Classifier and Histogram of Oriented Gradients (HOG) for face detection." *The 1st Annual Technology, Applied Science, and Engineering Conference* 29–30 August 2019, East Java, Indonesia. 28 January 2020

*[2]* M. Turk and A. Pentland (Jun. 1991). "Face Recognition Using Eigenfaces." *Proceedings of CVPR IEEE Computer Society*

*[3]* Navneet Dalal and Bill Triggs (Jun. 2005). " Histograms of Oriented Gradients for Human Detection. " *IEEE Computer Society*

*[4]* Dadi HS, Pillutla GM. "Improved face recognition rate using HOG features and SVM classifier" . *IOSR Journal of Electronics and Communication Engineering*. 2016 Apr;11(04):34-44.

*[5]* Geng C, Jiang X. Face recognition using SIFT features. I*n2009 16th IEEE international conference on image processing (ICIP)* 2009 Nov 7 (pp. 3313-3316).IEEE.

*[6]* Albiol A, Monzo D, Martin A, Sastre J, Albiol A. Face recognition using HOG–EBGM. *Pattern Recognition Letters*. 2008 Jul 15;29(10):1537- 43.

*[7]* Anila S, Devarajan N. "Preprocessing technique for face recognition applications under varying illumination conditions". *Global Journal of Computer Science and Technology*. 2012 Jul 31.

*[8]* Wilson PI, Fernandez J., (2006). Facial feature detection using Haar classifiers. Journal of Computing Sciences in Colleges.

*[9]* T. Danisman, I.M. Bilasco, C. Djeraba and N. Ihaddadene., (2010). Drowsy driver detection system using eye blink patterns, Universite Lille 1 & Telecom Lille 1, Marconi, France.

*[10]* Y. Gao, Z. You, H. Zhang, J. Zhang, M. Zhou, and C. Wu, (2016). A study on driver fatigue recognition based on SVM method, in *Proceedings of the 4th International Conference on Transportation Information and Safety ICTIS*, pp. 693–697, Banff, Canada.

*[11]* J.-J. Yan, H.-H. Kuo, Y.-F. Lin, and T.-L. Liao, (2016). Real-time driver drowsiness detection system based on PERCLOS and grayscale image processing, in *Proceedings of the 2016 International Symposium on Computer, Consumer and Control (IS3C)*, pp. 243–246, Xi'an, China.

*[12]* X. Zhao, S. Xu, J. Rong et al., "Discriminating threshold of driving fatigue based on the electroencephalography sample entropy by receiver operating characteristic curve analysis," *Journal of Southwest Jiaotong University*, vol. 48.

*[13]* F. Rohit, V. Kulathumani, R. Kavi, I. Elwarfalli, V. Kecojevic, and A. Nimbarte,(2017). Real-time drowsiness detection using wearable, lightweight brain sensing headbands, *IET Intelligent Transport Systems*, vol. 11, no. 5, pp. 255–263.

*[14]* A. Kulathumani, R. Soua, F. Karray, and M. S. Kamel, (2017). Recent trends in driver safety monitoring systems: state of the art and challenges, *IEEE Transactions on Vehicular Technology*, vol. 66, no. 6, pp. 4550–4563.

*[15]* M. K. Soua and M. M. Bundele, (2015). Design & analysis of k means algorithm for cognitive fatigue detection in vehicular driver using oximetry pulse signal, in *Proceedings of the IEEE International Conference on Computer Communication and Control (IC4)*, Indore, India.

*[16]* M. V. Ramesh, A. K. Nair, and A. Kunnathu, (2011). "Thekkeyil: intelligent steering wheel sensor network for real-time monitoring and detection of driver drowsiness," *International Journal of Computer Science and Security (IJCSS)*, vol. 1, p. 1.

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