Drowsiness Detection System Using Web-App

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Abstract - In accordance with all rules that was set by our National Highway Traffic Safety Administration, each new year more than 90,000 reported accidents involving drowsiness driving. After further speculation these crashes led to 1,460 casualty and 61,430 injuries. The genuine number could be a lot higher, although it is not easy to calculate if the individual/driver who is driving the active vehicle was dizzy/drowsy at that particular moment when the actual accident occurred. Therefore, we tried to build a framework that predict whether an individual is drowsy or not and then and alert the person accordingly.The basic thing about drowsiness detection is very easy. First we need to determine the face using one of the python's dlib's frontal face detector. After the face is determined, try to detect the expressions on the face using the dlib's landmark predictor. The landmark predictor returns sixty eight(x, y) coordinates constituting various aspects regarding face, namely - both eyes and both eyebrows,mouth, jaw and nose. Undoubtedly, we didn't need each of the expressions,here we do only need to bring out the eye and the mouth area. The app can be accessed through a local website (Using HTMLCSS,JS) where we will build a start button to execute our project. If the system recognises an individual with his/her eyes closed for a period of time, an alarm will be activated to warn the individual. A graph of the same session will also be generated to study the situation more accurately. A dataset will be matched to bring accurate results with the help of Deep Learning Algorithms.

Keywords-Image Processing, Machine Learning, Open-CV, Computer Vision

1. INTRODUCTION

The driver tiredness could be a well worthy reason behind number of mishaps. The late measurements count that every year more than 1,100 passing and 66,000 wounds are attributable to tiredness related crashes which results in driver sleepiness and this could be a major issue which ends up resulting in various number of accidents. However, developing technologies which with efficiency can detect and stop sleepiness at the wheel and alert the actual reason before any mishap is one of the major challenges in the area of accident prevention systems. Knowing to the dangerous that tiredness/sleepiness will cause on the roads some ways have been introduced for developing software that are preventing in counteracting the effects. With the development of recent technology and the success in creating real time scanning systems, the cameras will stop major mishaps or accidents on the road by automatically alerting the driver who is actually feeling drowsy or being tired through a drowsiness detection system. The point of this endeavour is to make up a epitome sleepiness detection control system. The actual focus is going to be on coming up with a new and solid framework which will exactly monitor the opening or shutting condition of the drivers eyes in real time. By watching the eyes, it is recognised if the driver is showing symptoms of fatigue and the major process will be if these are deducted early enough to basically avoid an automotive accident. Detection of drowsiness involves the basic observation of the movements of eye and also the blink patterns in a very sequence of images.

2. PROBLEM DEFINITION

- Now that we have successfully mentioned the fact that drowsiness is actually one of the major reasons for accidents, we also need to find a solution for the same.
- The main aim of the proposed framework is to monitor the status of the individual/driver and then creating corresponding alerts if the system detects any suspicious eye activity.
- To design and develop a nearly accurate system which can continuously observe and detect the state of a person driving a vehicle and which also can check the sleepiness state of the driver in real timestamp. And then could determine if it is closed for a particular duration of time.

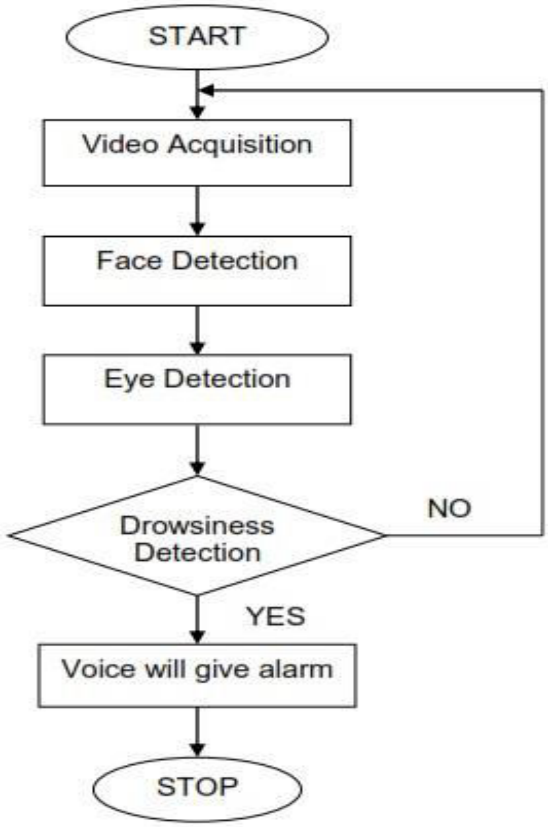


Fig-1: Flow-Chart about how system operates

The above figure is the flowchart of the proposed framework. The camera acts as a source to capture input in the form of the image and sends the same to the integrated processor which works through the installed Open-CV mechanism that has image processing capabilities.

3. RELATED WORK

[1]. In 2017,P Kingston Stanley; S SibinLal; T Jaya Prahash; P Vijay Daniel (2017) through their paper they showed the use of sensor, primarily the EEG sensor. This type of system actually monitors the state (mainly cognitive state) of the individual and in return it helps in providing the feedback to the active driver at the time when he is not in stable state i.e when he is dizzy or drowsy and it then automatically detects the fluctuation in performance of the driver with respect to his brain.[2]. In 2017,M. PrayadiSulistyanto; Dian Artanto ;ErvanErryPramesta; Ign. DeradjadPranowo, they wrote the paper and published the theory that presents a basic prototype on how a low cost EMG can help in detection of drowsiness and the framework was based on the term called Myoware, that actually helps in the detection of the closure of the eye-lid so that we can detect when the eyes are closed and when they are open and raise the attention of the driver accordingly.[3]. In 2016,BelhassenAkrout; Walid Mahdi, they showed their approach that actually evaluates the YawDD which is called yawning detection dataset and our very own MiraclHB that was used as a support for the detection. This research is pretty unique and solid too.[4]. In 2020,Luis DaríoSincheCueva; Jorge Cordero showed an analysis of the methods used for the detection of drowsiness by computer vision is performed, focusing on the use of facial reference points, advanced driver assistance systems ADAS..[5]. In 2016,Md. KamrulHasan; S.M. HasnatUllah; ShantanuSen Gupta; Mohiuddin Ahmad the use of another algorithm known as the viola-jones. This algorithm is used and appropriate for the detection of eye and also the face. However it struggles during the low light conditions. But it can be coupled with a physical device to check other human attributes to detect the drowsiness.[6]. In 2019,KhalifaAl-Khalifa; Mohsen JafariShanJiang; RatebJabbar; Mohamed KharbecheWaelAlhajyaseen, the paper they

published introduced the use of CNN which known as the "Convolutional Neural Network". The paper showed the use of CNN to create a clear picture quality environment. The research also explained implementation of CNN in a more clear way to achieve better results.[7]. In 2016,Mansoor Ahmed; C. V Anilkumar; R Sahana; P. S Anisha; R Thejashwini, published the theory that was introduced showed the actual targeting and tracking of the head movement so that in case of unusual tracking the software can easily detect the effect of drowsiness. The result was achieved using the image processing which required a camera to be mounted to take input stream. Also, the heart beat was also kept in record for better understanding of the accident if that occurs..[8].In2018,RajanShankaran; AnuvaChowdhury; Md. MokammelHaque; ManolyaKavakli, with their research showed how they investigated the support of all the physiological activities of an individual and how certain activities can actually help in finding the state of a driver and measure the drowsiness. Main methods that were included: EEG,EMG,ECG.[9]. In 2019,TheekapunCharoenpong; WisarootTipprasert; ChamaipornSukjamsri; ChamapornChianrabutra,with their research showed how an infrared camera can be used to capture and detect the closure of the eye of the driver through a well mounted input stream/system camera. The main thing was that it can work well even in low light conditions..[10]. In 2021,MkhuseliNgxande; FrancoisNel, with their research proposed the usage of RESNET i.e Residual Neural Networks. The RESNET works in a way that it makes use of the spatio which is known as the spatio-temporal 3D (three dimensional) kernels that are used to perform the detection of the distracted driver behaviour using some mathematical operations along with the proposed framework.

4. APPLIED METHODOLOGY

The face of the driver is constantly captured all time employing a recording or video or net camera,, so that we detect the sleepiness as the very first primary goal is to find the face mistreatment the number of actual frames taken by the recorder (in this case a camera). Then the actual status or situation regarding attentions is being detected and membrane of the driver's eye is simply monitored. The taken picture is then actually shipped to the current working processor for picture processing. It then simply tries to convert the actual received pictures to the variant digital signal mistreatment in the Open CV. The received digital signal after processing is the being transmitted into to the receiver end and each time the actual transmitter and the present receiver are being paired up. After that then it is being transferred to the unique "LPC2148", which is a micro controller. If the formed signal actually crosses the edge price of the mathematical formula of the EAR and that too with respect to the given actual no. of frames, then simply the noise or the alarm then beeps and getting the attention the driver also reduce the speed of the vehicle if it gets back early during this process.

5. PROPOSED FRAMEWORK

We have used python's Open-CV which determines drowsiness using EAR (Eye Aspect Ratio) using Euclidean Distance. For computing the effectiveness of the proposed system, a data-set of more than 50 people was collected. The records of results captured by a tool were collected and examined with the help of machine learning classifiers.To produce facial landmarks on driver's face, a library called dlib was imported and deployed in our application. The library uses a pre-trained face detector algorithm, which is based on moderation to the histogram of oriented gradients and uses linear SVM (support vector machine) method for object identification. Actual facial landmark predictor then first initialized and facial recognition marks captured by the system was used to compute distance between the points. These distances were used to compute EAR value. EAR is the ratio of height and width of the eye and can be computed using the equation given below. The numerator indicates the height of the eye and the denominator indicates the width of the eye and the details of all the landmarks of the eye are predicted by the figure given below.

$$EAR = \frac{(\|p2 - p6\| + \|p3 - p5\|)}{2\,\|p1 - p4\|}$$

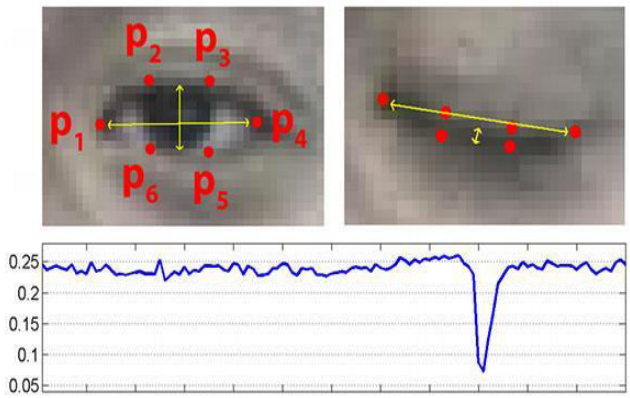


Fig-2: EAR (p) representation

5.1. OpenCV

OpenCV is associate open supply pc vision library accessible in python cryptography language to code for visionary capabilities of our sensible pc. OpenCV was expected for machine capability and having a high specialise in on-going image location and characteristic proof. OpenCV is developed through streamlined C. Progressively programmed improvement utilizing Intel models [Intel], you'll be able to purchase various other intel related libraries such as the IIP and the IPP. These type of libraries consists of a very basic structure in various algorithm based streamlined regions.

5.2. The Computer's Vision

The computer vision has played a major part for years in projects where experiments on various photographic structures were done. The computer vision is like a combination of computers eyes and mind through which it utilises its capability to bring the best results on the ground. The high level of understanding of the computer depicted through its nature to analyse the images and videos says a lot about its development over a period of time.

5.3 Mahalanobis

It is an algorithm that tells us about the properties of data.To find out mahalanobis the covariance of the data should be divided. If there is any case exist in which the covariance is actually the very well-known identity matrix, and this will be equivalence to the length/distance which is called as Euclidean distance.

5.4 Face detector algorithm

This is an object detector algorithms particularly used for detecting the frontal face elements on the face of the driver. Different dlib inbuilt libraries are used for the same purpose and improves the result quality. This is one of the main algorithms to be used in or system.

5.5 Dataset

shape predictor 68 face landmarks.dat

- It is a landmark's facial detector which has predefined trained models, thedlib used to predict the location of 68 coordinates (x, y)that maps the facial points on a person's face like-image below:

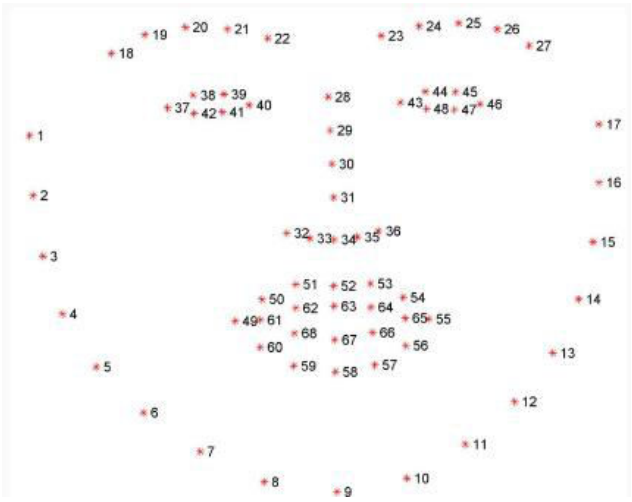


Fig-3: 68 point Facial Landmarks

5.6 Algorithm of K-mean

There are K pre-defined distinct subgroups where each data-set belongs to a single group.All the related cluster points are similarly maintained and the distance between the clusters are separated. Variation should be less within the clusters. The k means follow the procedure: the no of clusters are determined. shuffle the data-set and randomly determine the k data-set for centroid.

5.7 Algorithm of Naive Bayes

Now in this algorithm the actual presence of feature in a particular class is which is separated to the actual presence or participation of any other feature in that class. It is easy to create and also it is very useful for a huge amount of data sets. Along, it is used to outclass the other sophisticated classifications.

5.8 Algorithm of Decision Tree

This is associated with a branch of supervised learning algorithm. Clients use this algo to solve problems related to regression and classification. It learns rules and decides what to classify related to the algorithm.Training the data-set is more important quantity in this algorithm.In this algo we first start with the root and then compare the value with other attributes and then we choose our next move on the basis of the result calculated by comparing the values.

5.9 Algorithm of Expectation Maximization

Maximum likelihood of the latent variable is provided with the help of this algorithm.It is the estimation for the dataset.Firstly it estimates the value of variable then make a model then repeat the two steps until convergence.

6. STATISTICAL ANALYSIS

The initial model that was trained with various otherinputs as multiple faces in different states was used to calculate the average of **the Eye Aspect Ratio (EAR).** The average value that we obtained was around **"0.3",** and below this value the state of driver can be determined as drowsy.

7. EXPERIMENTAL RESULTS

The following test cases determine whether the alarm will resonate or not.
The condition should be met in order to resonate the alarm.

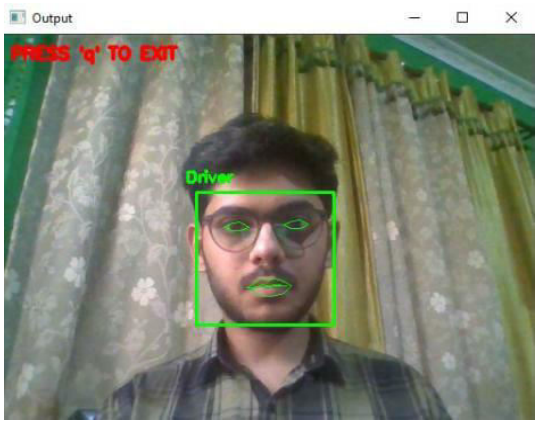
Test cases	Eyes Detected	Eye closure	Result
Case1	NO	NO	No Result
Case2	NO	NO	No Result
Case3	YES	NO	No Result
Case4	YES	YES	Alarm Beep

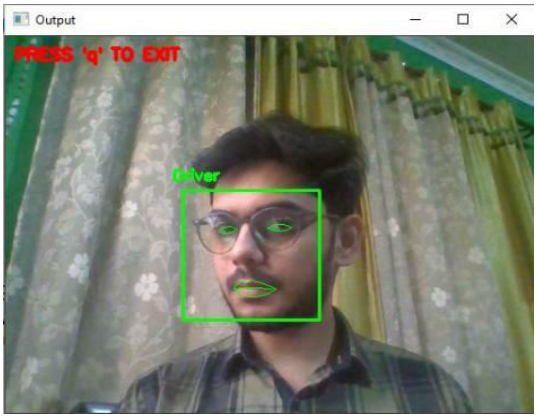
Table-1: Test Cases

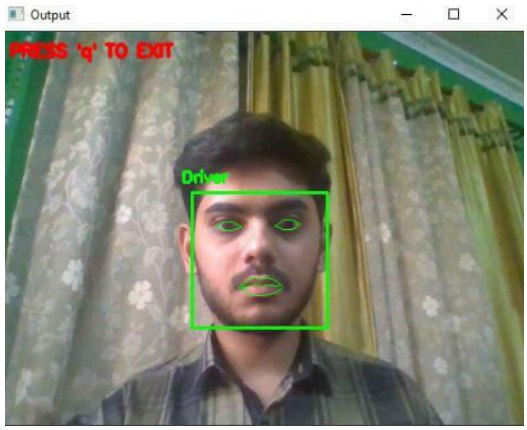
Table-2: Result Table

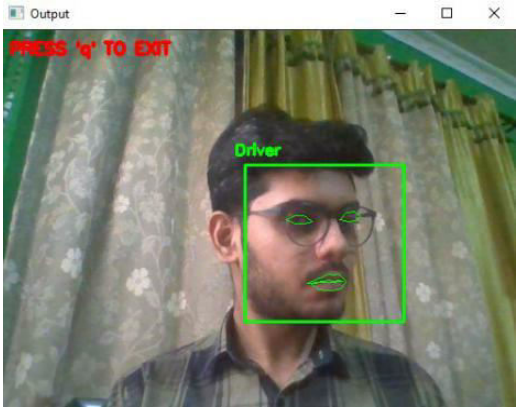
I/p	Eyes Detection Accuracy	Drowsiness Accuracy
Sample 1	100%	87.5 %
Sample 2	95%	100%
Sample 3	80%	62.5%
Sample 4	100%	87.5%
Sample 5	100%	100%
TOTAL	95%	87.5%

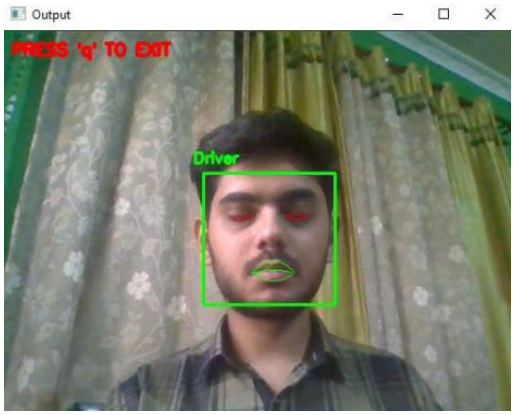
Sample Screenshots taken from the Drowsiness Detection System:

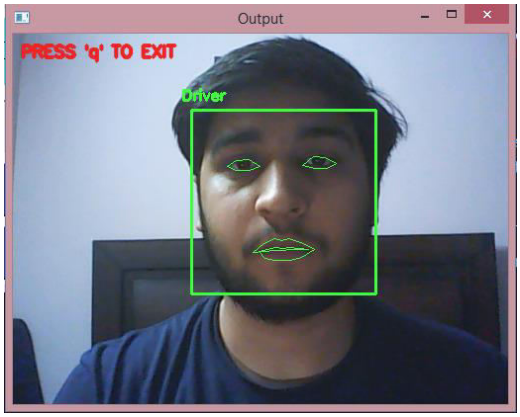


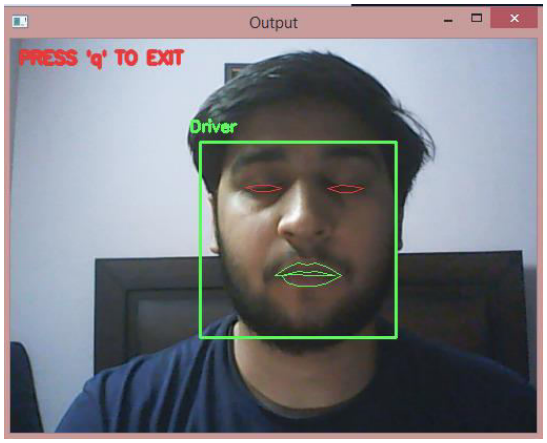


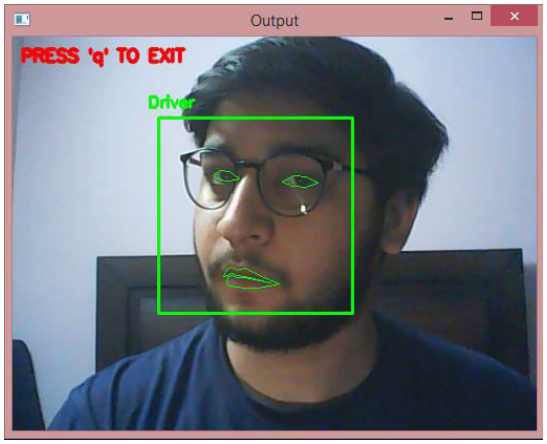


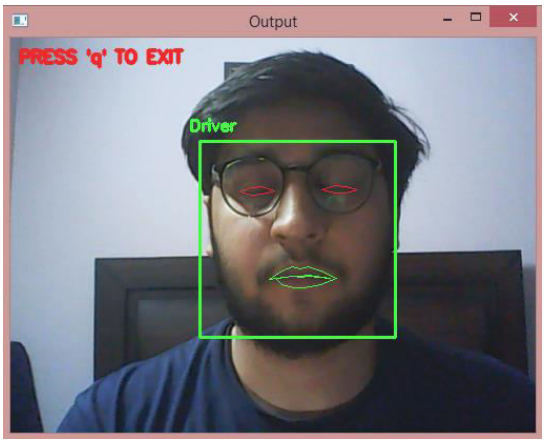


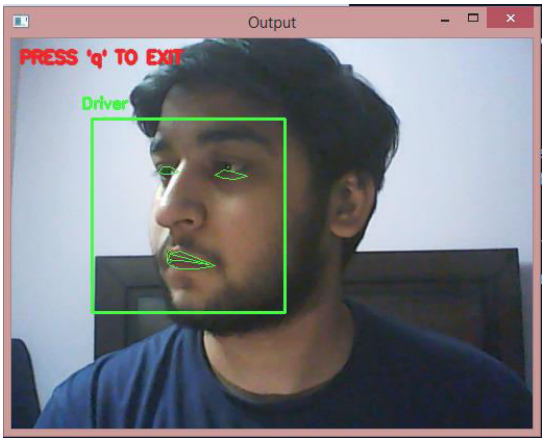












8. CONCLUSION

The conclusion regarding the project related Drowsy Driving is that we have created a project on Drowsy Driving of a person using different python libraries and Open-CV libraries. Which can furthermore detects on the face of the person driving the car. The system that we have made is to be tested and maintained periodically at later stages by our team and if there could be any restrictions which occur in the project,so it could be resolved by the team effort. When the state of drowsiness is detected through our algorithm,the alarm will pop off when the eyes of the person driving the car is detected closed for a longer period of time.The design and development of the Drowsiness Detection System is partially checked and is giving almost 95% accuracy.

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