REAL TIME DROWSINESS DETECTION

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ABSTRACT

Every year, many individuals die as a result of deadly traffic accidents and sleepy driving around the world. One of the leading causes of traffic accidents and deaths is driving. NHTSA estimates that drowsiness contributes to more than 100,000 collisions each year, resulting in over 1,500 deaths and 40,000 injuries. Drowsiness increases the impairment caused by alcohol. Teenagers, professional drivers (including truck drivers), military personnel on leave, and shift workers are at particular risk. Fatigue and micro sleep at the driving controls are often the root cause of serious accidents. Initial indicators of fatigue can be identified before a crucial situation occurs, allowing for the detection of driver fatigue and other issues. Its significance is a study topic that is currently being investigated. Most of the traditional methods to detect drowsiness are based on behavioral aspects while some are intrusive and may distract drivers, while some require expensive sensors. As a result, in this paper, a simple, real-time sleepiness detection system for drivers is created and deployed on an Android application. As a result, in this paper, a simple, real-time sleepiness detection system for drivers is created and deployed on an Android application. The system records the videos and detects driver's face in every frame by employing image processing techniques. The system is capable of detecting facial landmarks and computes Eye Aspect Ratio (EAR) to detect driver's drowsiness based on adaptive thresholding.

Keywords: *Accidents, Drowsiness, Facial Landmarks, EAR*

I. INTRODUCTION

Driver sleepiness is one of the leading causes of fatalities in automobile accidents. Drivers easily become fatigued after driving for a lengthy period of time, resulting in driver fatigue and drowsiness. According to statistics, the majority of accidents are caused by driver weariness. Varying countries have different statistics on driver fatigue-related accidents. According to the report by "Ministry of Road Transport & Highways" there were 4,552 accidents reported every year in India, that took lives of thousands of people because of sleepy drivers (Road Accidents in

India 2016).Humans have always built devices and devised tactics to make and safeguard their lives easier and safer, whether for ordinary goals like going to work or for more intriguing ones like flying. Modes of mobility advanced in tandem with technological advancements, and our reliance on them grew enormously. It has had a significant impact on our lives as we know them. Every year, hundreds of thousands of tragedies are linked to this magnificent technology due to our failure to fulfill our responsibilities toward safer travel. Detail, but it is critical. It may seem like a trivial thing to most folks but following rules and regulations on the road is of utmost importance. While on road, an automobile wields the most power and in irresponsible hands, it can be destructive and sometimes, that carelessness can harm lives even of the people on the road. A type of irresponsibility is failing to admit when we are too fatigued to drive. Many scholars have written research papers on driver sleepiness detection systems in order to monitor and prevent the negative consequences of such neglect. However, some of the system's points and observations aren't always exact enough. Hence, to provide data and another perspective on the problem at hand, in order to improve their implementations and to further optimize the solution, this project has been done. We used Dlib, a pre-trained program trained on the HELEN dataset to detect human faces using the predefined 68 landmarks, to detect left and right eye features of the face after passing our video feed to the Dlib frame by frame. We then used OpenCV to draw contours around it. Now, we drew contours around it using OpenCV. Using Scipy's Euclidean function, we calculated the sum of both eyes' aspect ratio which is the sum of 2 distinct vertical distances between the eyelids divided by its horizontal distance. We'll now see if the aspect ratio is smaller than the threshold. If the value is less than that, an alert is sounded and the user is cautioned.

II. LITERATURE SURVEY

Franklin Silva and Eddie Galarza [1] published encouraging results when using artificial vision techniques to conduct vehicular driver surveillance in a smartphone. As long as the measurements are carried out under the prescribed parameters, the installed system provides for an efficient detection of the symptoms that arise in drowsiness. The increase in the processing characteristics in smartphones made possible to develop an application of artificial vision, capable of detecting the face and visual indicators present in a person who suffers from drowsiness such as: yawning, head movements and the state of the eyes. The implementation of 3 levels of sleepiness allows the system to alert the driver about their condition, not necessarily at a critical level where it may have serious repercussions, rather at early levels where drowsiness is just emerging.

Sukrit Mehta, Sharad Dadhich [2] proposes a real-time method for monitoring and detecting driver inattention in vehicles. A face of the driver has been detected by capturing facial landmarks and warning is given to the driver to avoid real time crashes. Non-intrusive methods have been preferred over intrusive methods to prevent the driver from being distracted due to the sensors attached on his body. The proposed approach uses Eye Aspect Ratio and Eye Closure Ratio with adaptive thresholding to detect driver's drowsiness in real-time. This is useful in situations when the drivers are used to strenuous workload and drive continuously for long distances. The proposed system works with the collected datasets under different conditions. The facial landmarks captured by the system are stored and machine learning algorithms have been employed for classification. The system gives a best-case accuracy of 84% for random forest classifiers.

Marco Javier Flores, Arutro de la Escalera, J M Armingol, in [3] proposed a non-intrusive driver's drowsiness system based on computer vision and Artificial Intelligence has been presented. This system uses advanced technologies for analyzing and monitoring driver's eye state at real-time and real-driving conditions. The proposed algorithm for face tracking, eye detection and eye tracking are robust and accurate under varying light external illuminations interference, vibrations, changing background and facial orientations. Furthermore, all drivers used in these experiments were exposed to a variety of difficult situations commonly encountered in a roadway.

In [4] H. Singh, J. S. Bhatia, Jasbir Kaur proposed a system that will monitor the driver's eyes using camera and by an algorithm we can detect symptoms of driver fatigue early enough to avoid accident. It detects driver fatigue in advance and will gave warning output inform of sound and seat belt vibration whose frequency will vary between 100 to 300 hertz. More-over the warning will be deactivated manually rather than automatically. So, for this purpose a deactivation switch will be used to deactivate warning. More-over if driver felt drowsy there is possibility of sudden acceleration or deacceleration hence we can judge this by Plotting a graph in time domain and when all the three input variables shows a possibility of fatigue at one moment then a Warning signal is given in form of text or red color circle. This will directly give an indication of drowsiness/fatigue which can be further used as record of driver performance.

III. METHODOLOGY

This section explains the suggested two-level technique of detecting driver drowsiness. The application is installed on any device used by a driver that runs any operating system (OS). The procedure begins with the capture of live images from the camera, which is then relayed to a local server. The Dlib library is utilized on the server to detect facial landmarks, and a threshold value is utilized to determine if the driver is drowsy or not. The EAR (Eye Aspect Ratio) is then calculated using these face landmarks and returned to the driver. The EAR value obtained at the application's end would be compared to a threshold value of 0.25 in our case. If the EAR value is less than the threshold value, it indicates that the person is tired. An alarm would be triggered if the driver or passengers became drowsy. The next section explains how each module works.

3.1 Data Procurement

If the driver is using the app for the first time, he or she must register. After signing up, the driver adds a ride by entering the ride's source and destination. Passengers will also have access to an interface where they may connect with the ride that the driver has added. The ride is then started by the driver. The proposed program then captures the driver's real-time visuals. Every time the program receives a response from the server, images are recorded. The process continues until the ride is terminated by the driver. A small sample of volunteers was gathered to test the efficacy of the proposed method. For recording EAR values, each participant was requested to blink their eyelids intermittently while looking at the camera. Machine learning classifiers were used to collect and analyze the logs of the results that were obtained by the program.

3.2 Facial Land Marking

To extract the facial landmarks of drivers, Dlib library was imported and deployed in our application in [5]. The library employs a pre-trained face detector that is based on a modification of the histogram of directed gradients and detects objects using the linear SVM (support vector machine) approach. The actual facial landmark predictor was then set up, and the application's facial landmarks were used to determine distance between spots. The EAR value was calculated using these distances as in figure 1 was used to calculate EAR, which is defined as the ratio of the eye's height and width. Figure 1 depicts the specifics of all the landmarks of the eye, with the numerator denoting the height of the eye and the denominator denoting the breadth of the eye.

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

Fig-1: EAR Equation

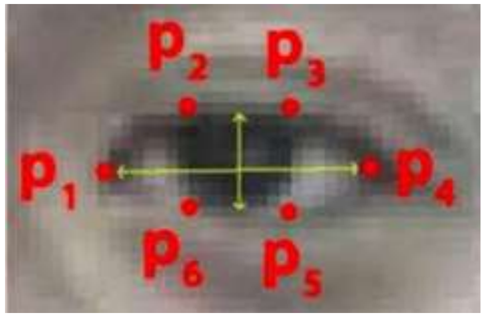

Fig-2: Landmarks of eye in EAR

The numerator determines the distance between the upper and lower eyelids using equation 1. The horizontal distance of the eye is represented by the denominator. When the eyes are open, the numerator value rises, raising the EAR value; when the eyes are closed, the numerator value falls, lowering the EAR value. EAR readings are utilized to detect driver drowsiness in this scenario. The average of the EAR values of the left and right eyes is determined. The Eye Aspect Ratio is watched in our sleepiness detector to see if it goes below the threshold value and does not increase above the threshold value in the next frame. In this instance, EAR readings are used to detect driver drowsiness. The average of the left and right eyes' EAR values is calculated. In our sleepy detector, the Eye Aspect Ratio is monitored to see if it falls below the threshold value and does not rise over it in the next frame. The block diagram of our suggested method for detecting driver drowsiness is shown in Figure 3. Figure 4 shows a snapshot of facial landmark points created using the Dlib software and used to compute EAR. The facial landmark points for the left and right eyes that were employed in the calculations are listed in Table 1.

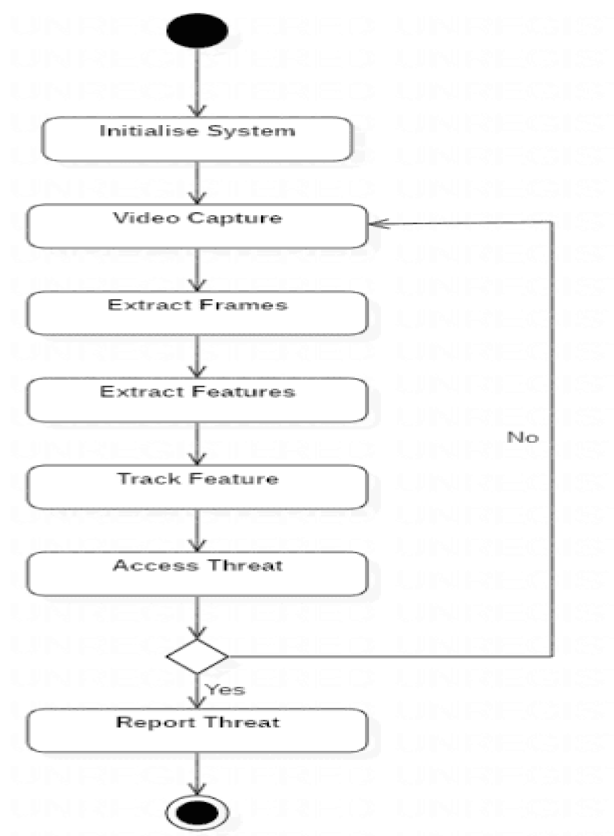

Fig-3: Block Diagram of Proposed Drowsiness Detection Algorithm

Fig-4: Facial Landmark Points according to Dlib library

Part	Landmark Points
Left Eye	[37 - 42]
Right Eye	[43 – 48]

Table-1: Facial Landmark points

IV. RESULTS AND DISCUSSION

The performance evaluation of the proposed technique is presented in this section, which includes an empirical analysis of the acquired results. To begin, the system gathers real-time data from the drivers. It then calculates the EAR values based on pictures collected by the user and the server's response to determine the drivers' sleepiness. We have considered various testcases considering the lighting conditions, regular glasses and cooling glasses. The results were obtained as follows

Test Id	Test Condition	Expected Results	System Behavior	Images
1.	Straight-Face, Good Light without Glasses	Non-Drowsy	Non-Drowsy	

2.	Straight Face, Good Light With Glasses	Non-Drowsy	Non-Drowsy	
3.	Straight-Face, Good Light With cooling glass	Non-Drowsy	Non-Drowsy	
4.	Straight-Face, Bad Light, Without glass	Non-Drowsy	Non-Drowsy	
5.	Straight-Face, Bad Light with glasses	Non-Drowsy	Non-Drowsy	

6.	Straight-Face, Bad Light with cooling glass	Non-Drowsy	Non-Drowsy	
7.	Tilt Face, Good Light, Without Glasses	Non-Drowsy	Non-Drowsy	
8.	Tilt Face, Good Light, With Glasses	Non-Drowsy	Non-Drowsy	
9.	Tilt Face, Good Light, With cooling glass	Non-Drowsy	NA	

10.	Tilt Face, Bad Light, Without glass	Non-Drowsy	Non-Drowsy	
11.	Tilt Face, Bad Light with glasses	Non-Drowsy	Non-Drowsy	
12.	Tilt Face, Bad Light, with cooling glass	Non-Drowsy	NA	
13.	Straight-Face, Good Light Without Glasses, Closed eyes	Drowsy	Drowsy	

14.	Straight Face, Good Light, With Glasses, Closed eyes	Drowsy	Drowsy	
16.	Straight Face, Bad Light Without glass, Closed eyes	Drowsy	Drowsy	
17.	Straight Face, Bad Light with glasses, Closed eyes	Drowsy	Drowsy	
19.	Tilt Face, Good Light, Without Glasses, Closed eyes	Drowsy	Drowsy	

20.	Tilt Face, Good Light, With Glasses, Closed eyes	Drowsy	Drowsy	
22.	Tilt Face, Bad Light, Without glass, Closed eyes	Drowsy	Drowsy	
23.	Tilt Face, Bad Light with glasses, Closed eyes	Drowsy	Drowsy	
25.	One eye closed	Non-Drowsy	Drowsy	

Table-2: Results

Note: Testing is performed manually

V. CONCLUSIONS

The proposal in this paper is for a real-time system that monitors and recognizes driver inattention. By recording facial landmarks, the driver's face has been detected, and a warning has been sent to the driver to avert real-time crashes. To avoid the driver from becoming distracted by sensors attached to the body, non-intrusive technologies have been useful over intrusive approaches. The suggested method detects driver tiredness in real time by combining Eye Aspect Ratio with adaptive thresholding. This is effective in cases where the drivers are accustomed to heavy workloads and driving for long periods of time. Under various scenarios, the proposed system works with the obtained data sets. The facial landmarks acquired by the system are saved, and classification is done using machine learning algorithms.

Integration of the suggested system with widely used services such as Uber and Ola could be part of future work. If the system is fully integrated, it has the potential to reduce the amount of fatalities and injuries caused by drivers who are drowsy. This experiment can be carried out as part of a pilot plan, i.e. for a few days/months in various parts of the world where similar instances are common. As a result, our suggested approach provides the same accuracy for persons who wear spectacles. With the increase in brightness of the surrounding environment, the accuracy of our proposed system improves. The work can be expanded to include additional sorts of users, such as cyclists, as well as new domains, such as railways and planes.

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VII. REFERENCES

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