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Detecting Driver Drowsiness Using Sensors

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Abstract: Countless people use the roadways at all hours of the day and night. Sleep deprivation affects all sorts of drivers and long-distance travelers. Accidents occur as a result of this. The number of accidents caused by tiredness is substantially larger than the number of accidents caused by drunk driving, according to several research. As a result, precautions must be taken to avoid such mishaps. The Detecting Driver Drowsiness system is one such measure.
Detecting Driver Drowsiness system is a car safety technology that helps to save the driver's life by preventing accidents when the driver is getting drowsy. The system will use OpenCV with eyelid-related parameters to gather the images from the webcam. The system can identify face landmarks and extract eye landmarks before computing the Eye Aspect Ratio (EAR) and comparing it to a threshold.

The main objective of this paper is to identify driver drowsiness, which is a critical role in a number of intelligent real-world applications. Due of the uncontrolled pictures of the actual world, detecting them correctly with existing approaches is difficult. Behavioural measures performance is much better than traditional measures, it's being utilised a lot more these days. Image classification is very important in this system. This form of image classification analysis would have been technologically unfeasible only a few decades ago, but current advances in machine learning may be up to the challenge. Python libraries are used to detect the face and find facial landmarks using dlib then extract the eye landmarks from it. Many scientists employed handcrafted conventional ways in acquiring characteristics before the world of machine learning. With the aid of python libraries and their capabilities, one can now quickly understand the features of various areas in an image and construct from the ground up. Python libraries make easily to do any working towards the image classification process.

Keywords: Classifier, Detection, Drowsiness, Eye Aspect Ratio.

1. INTRODUCTION

Drowsiness is the sensation of being sleepy. Sleep deprivation affects all sorts of drivers and long-distance travelers. Accidents occur as a result of this. According to various studies, the number of accidents caused by drowsiness is much higher than the number of accidents caused by drunk driving a person's drowsiness may have an impact on those around them. This might results road accidents and death of driver and also claims thousands of lives every year. As a result, precautions must be taken to avoid such mishaps. The Detecting Driver Drowsiness system is one such measure.
Detecting Driver Drowsiness system is a car safety technology that helps to save the driver's life by preventing accidents when the driver is getting drowsy. Drowsiness has not yet been deeply tackled by anyone because of its nature. Drowsiness is extremely difficult to quantify, unlike alcohol, which has readily available testing. As there is no clear way to detect drowsiness, we are using the basic features like eyes to detect the drowsiness, based on closing the eyes for more than the time required to blink the eye.

The technology will sound an alert if the driver closes his or her eyes for a certain period of time. The system will use OpenCV with eyelid-related parameters to gather the images from the webcam. Before computing the Eye Aspect Ratio (EAR) and comparing it to a threshold to determine if a person's eyes are open or closed, the system can recognise face features and extract eye landmarks.

2. LITERATURE SURVEY

In [1], the authors M.Mohanadeepti, K.Rani , J.Angelperl Veronika & S.Teja Sri proposes a Real Time Drowsiness Detection System For Driver Monitoring with the help of computer vision and machine learning algorithms Face and Eye Detection by CNN Algorithms In this paper a novel approach to critical parts of face detection problems is given, based on analogic cellular neural network (CNN) algorithms. The proposed CNN algorithms find and help to normalize human faces effectively. Time requirement is a fraction of the previously used methods. The algorithm starts with the detection of heads on colored pictures using deviations in color and structure of the human face and that of the background. By normalizing the distance and position of the reference points, all faces should be transformed into the

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same size and position. For normalization, eyes serve as points of reference. Other CNN algorithm finds the eyes on any grayscale image by searching characteristic features of the eyes and eye sockets. Tests made on a standard database show that the algorithm works very fast and it is reliable.

In [2] a real time vision based method is proposed by the authors Snehal S.Bharambe & P. M .Mahajan to monitor driver fatigue. This research approach adopts the Viola-Jones classifier to detect the driver's facial features. The proposed system in this analysis provides accurate detection of driver fatigue. The analysis and design of driver drowsiness detection system is presented. The proposed system is used to avoid various road accidents caused by drowsy driving and it can also help drivers to stay awake when driving by giving a warning when the driver is sleepy. And also this system used for security purpose of a driver. During the monitoring, the system is able to decide if the eyes are opened or closed. When the eyes have been closed for too long, a warning signal is issued. Image processing achieves highly accurate and reliable detection of drowsiness. This was achieved by interfacing a webcam to a PC and recording test videos and frame database under different lighting condition. The calculation speed, accuracy and robustness will be influenced by using combined algorithm.

The authors V B Navya Kiran, Rakshar, Anisoor Rahaman, Varsha K N & Dr.Nagamani N P presented an all-inclusive survey of recent works related to driver drowsiness detection and alert system in [3]. They also present the various machine learning techniques such as PERCLOS algorithm, HAAR based cascade classifier, OpenCV which are used in order to determine the driver's condition. This paper provides a comparative study on papers related
to driver drowsiness detection and alert system. In order to provide a solution to the problem of detecting the state of drowsiness, an arithmetic based method is used. This system uses eye movement in order to detect fatigue. Eye movement is detected using a camera. This is done to recognize the symptoms of fatigue in order to avoid accidents. It is based on the concept of eye-tracking. In order to obtain finer results, a hundred and fifty images of different people have been used. If the state of fatigue has been identified, an alarm system is turned on. Computer vision with embedded systems are used. A software algorithm is developed. It was partially tested and found to be effective. There is much scope for further improvements. The proposed system detects drowsiness if the eyes have been closed for a period of four or more frames. The detection system differentiates the normal eye blink from drowsiness. The developed system is a non -invasive system. The system can be further developed by adding various types of sensors. The system is based on Computer vision. It makes use of the viola Jones algorithm AdaBoost classifier and CAMSHIFT algorithm. A low-cost application can be devised by implementing this system using a raspberry-pi module. The main aim of the paper is to develop a software tool detection of the state of fatigue. It was found to be a timely and accurate technique. Here, input is captured by a camera, processed by the Raspberry-pi module, and the output is in the form of a buzzer that alerts the user, as and when, drowsiness is detected. It groups drowsiness detection techniques into two kinds, driver based and vehicle based. It also provides a survey of numerous driver and vehicle-based techniques. This system is based on the shape predictor algorithm. It provides a non-intrusive approach for drowsiness detection. In future, the frequency of yawning can also be used as a parameter to detect drowsiness. In order to detect drowsiness, certain facial features were identified. This system uses the concept of video processing. It also mentions certain disadvantages of the proposed system and methods to overcome those disadvantages.

Studies show that around one quarter of all serious motorway accidents are attributable to sleepy drivers in need of a rest, meaning that drowsiness causes more road accidents than drink driving. As described throughout the paper, many technologies exist to detect driver fatigue. The paper [4] tries to look at the emerging technologies and determine the best approaches in trying to prevent the number one cause of fatal vehicle crashes. Currently, the number one selling product in the market is the market is nothing more than a reed switch to detect head angle tilt. This product is extremely limited and not very effective. The product made by BMW and integrated into their high end cars to detect driver fatigue behaviour is slightly more effective is detection but lack proper notification to warn a driver. The current market and technologies is in its infancy mode. New technologies keep emerging using different techniques.

In paper [5], we discuss a method for detecting drivers' drowsiness and subsequently alerting them. The aim is to reduce the number of accidents due to drivers fatigue and hence increase the transportation safety. This article introduced a new method for detection of driver drowsiness, based on yawing action. The proposed method is based on number of algorithms, which are insensitive to the changes in lighting conditions, skin types, and geometrical facial features. The robustness of implemented technique is due to the fact that several verification criteria are used to avoid false detections. Moreover, we have chosen to avoid complex algorithms in order to be one step closer to the real implementation of the system.

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3. EXISTING SYSTEM

Various methods are developed to detect driver drowsiness, each with differing degrees of accuracy. Behavioural, Vehicle-based and Physiological measures are the three types. To detect tiredness in drivers, physiological tests such as electrooculography (EOG) are performed.

It is inconvenient for the driver to have electrodes on at all times during physiological measurements. As a result, behavioural data are used to identify driver tiredness. Behavioral measurements are the most useful method. Individuals, not vehicles, are the focus of behavioural measures. The suggested system uses the Eye Aspect Ratio (EAR) formula to detect driver drowsiness. It is easy to understand and faster to implement.Here the webcam is used to capture the driver information. Before computing the Eye Aspect Ratio (EAR) and comparing it to a threshold to determine if a person's eyes are open or closed, the system can recognise face features and extract eye landmarks.

Current drowsiness detection systems, like electrooculography (EOG), which detect brain frequency, measure heart rhythm, and measure eye movement, require complex computation and expensive equipment that is uncomfortable to wear while driving and unsuitable for driving conditions. Detection driver drowsiness system that employs a camera in front of the driver is more suited, but physical indications of exhaustion must first be recognised before developing a reliable and accurate drowsiness detection algorithm. During the recognition of eyes, issues arise due to lighting intensity and driver tilting their face left or right. As a result, the goal of this project is to review all past research and methods, and then suggest a method for detecting sleepiness using a camera. It examines the photos that have been taken and develops a system that can analyse each image frame.

4. DESGIN AND METHODOLOGY

For the purpose of proper implementation and functioning we have performed the following steps:
1. Webcam
2. Extract frames
3. Find landmarks
4. Extract eye landmarks
5. Calculate Eye Aspect Ratio(EAR)
6. Comparing with threshold and taking decision

4.1 Webcam:

Webcams are cameras that keep on a car dash board, fix to a user's car board. In this project webcam continuously monitors driver, so that we can extract the frames of a driver.

4.2 Extract Frames:

After webcam captures image of a driver we need to extract frames from that image as shown in figure 1. We are extracting the face of a driver in this project.

Fig.1: Extract Frames

4.3 Find landmarks:

Once the face has been extracted we need find landmarks on that face of a driver as shown in figure 2. The different landmarks include eyes, nose, ears etc.

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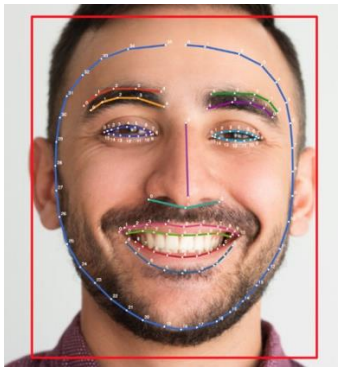

Fig. 2: Find landmarks

4.4 Extract eye landmarks:

Since this project is used to detect driver drowsiness, we need to extract eye landmarks as shown in figure 3.

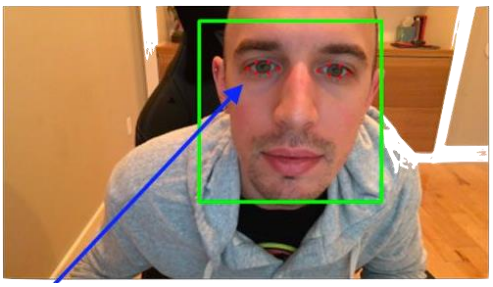

Fig. 3: Extract eye landmarks

4.5 Calculate EAR :

EAR stands for eye aspect ratio. The EAR formula may decide the close of eye by using the scalar value and is calculated with the formula and p values as shown in figure 4.

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

Where p4 and p1 calculates horizantal distanceof eye (“eye width”),while p6, p5, p3 and p2 calculates vertical distance of eye (“eye height”). When the eye’s is open, the eye aspect ratio remains same, but when the eye is closed, it gradually decreases.

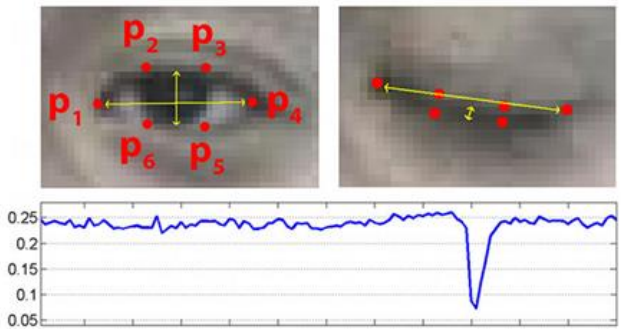

Fig. 4: Calculate EAR

4.6 Comparing with threshold and taking decision:

The EAR value is now checks with a threshold value. The comparison is shown in figure 5. If EAR value is less than the threshold for some amount of time(approx 4sec) then we raise an alert.

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Fig. 5: Comparing with threshold

5. RESULTS

The experiment is implemented by using Python with Open CV, Dlib, Numpy, SciPy libraries. The experiment is executed on different sample faces and is working very accurately. It gives an alarm whenever the eyes are closed and no alarm when the eyes are opened. One sample output result is shown in figure 6 and 7.

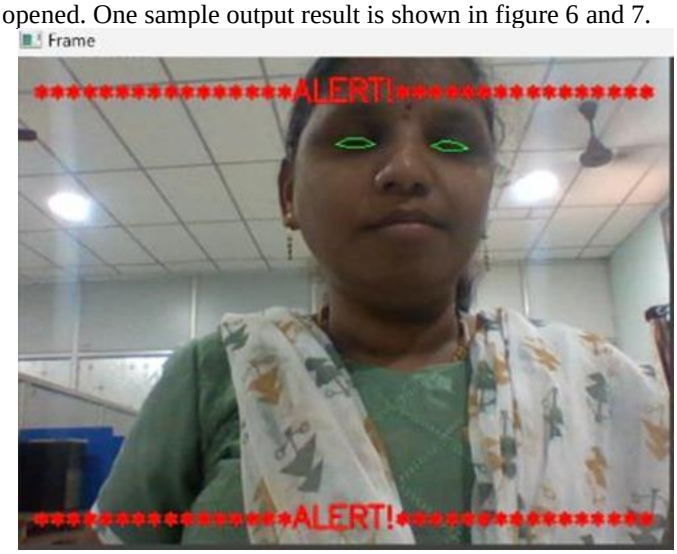

Fig. 6: Drowsiness alert when eyes are closed.

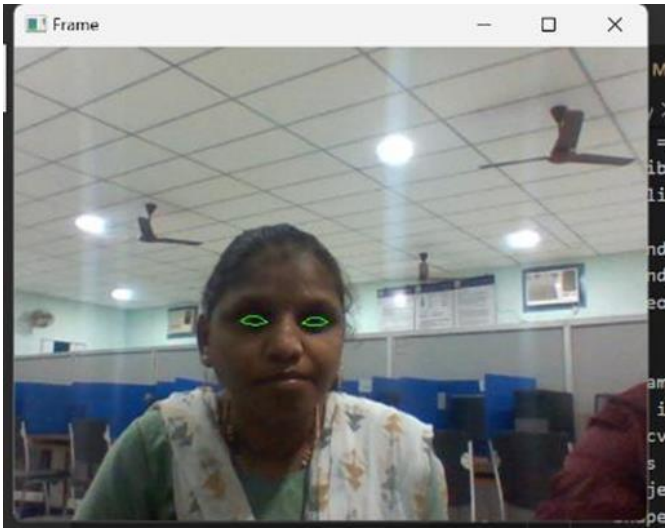

Fig. 7: No alert when eyes are open

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6. CONCLUSION

Face features and eyes were recognised from the image of a person driving in order to identify tiredness. Driver Drowsiness Detection was developed to help drivers stay alert while driving, reducing the number of drowsy-related automobile accidents. The research focused on sleepy drivers and their potential to cause automobile accidents. The system uses open source software called OpenCV image processing libraries to process the collected images. The car driver face has been recognised by recording facial landmarks, and a warning has been issued to the driver in order to avoid real-time collisions. To detect driver tiredness in real time, the suggested technique uses thresholding and Eye Aspect Ratio. Both the baseline detection method and the eye-state classification algorithm are enhanced using simple but effective customized algorithms to improve the system's reliability and accuracy.

This experiment might 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 occur often. Our suggested method provides the same accuracy for persons who use spectacles. The accuracy of our suggested approach improves as the brightness of the screen increases, giving the same accuracy to persons wearing spectacles. With the rise in brightness of the surrounding environment, the accuracy of our suggested system improves. Integration of the suggested system with widely used services such as Uber and Rapido might be part of future development. If the system is completely integrated, it will have the potential to minimise the amount of drowsy driving deaths and injuries. This system may be enhanced with features such as mobile usage recognition to determine whether the user is using a phone, and it can be enhanced in order to identify tiredness in various conditions, such as when the individual is wearing sunglasses.

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