REAL TIME DROWSINESS IDENTIFICATION BASED ON EYE STATE ANALYSIS

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Abstract
Identification of drowsiness is an emerging research area aimed at developing techniques to detect and prevent drowsiness-related accidents. This paper presents an abstract of a study that proposes an approach to detect drowsiness based on eye state analysis. The study uses machine learning algorithms and computer vision techniques to analyze the eye states of drivers and detect signs of drowsiness in real-time.The proposed system uses a camera to capture the driver's face and eyes, and then processes the images to identify and analyze the different states of the eyes, such as closed, partially closed, or open. The system then uses machine learning algorithms to classify the driver's eye states as drowsy or alert.
Keywords: Eye State Analysis, Machine Learning Algorithms

I.Introduction
The term "drowsy" appears to be quite straightforward, but it becomes more essential when someone is performing tasks that require intense focus. Such as driving a large car or working in the chemical industry. When someone is distracted from their right focus in a situation, a terrible calamity cloud happens. According to observations, most traffic accidents are the result of careless driving by drivers who are drowsy or in the process of falling asleep behind the wheel. According to the Ministry of Road Transport & Highway's report from 2018, which is based on data from road accidents in India, 4, 67, 044 accidents occurred in states and Union Territories Pandey et.al 1]. Also, the reports study reveals that 78% of all traffic crashes were caused by due to the driver's negligence. Hence, a model that could prevent such catastrophic traffic accidents and spare the priceless lives of people must be developed. Here, our suggested work complies with these specifications. A drowsy driver can be identified using a variety of techniques, but they can generally be categorized into three classes: physiological, behavioral, and vehicle parameter-based techniques. Among them, physiological and vehicle-based techniques. The issue with this approach was that it was exceedingly challenging to record the eye state in low illumination, especially in inclement weather we therefore used the histogram equalization technique, which uniformly distributes the intensity values throughout the frame, as a preprocessing step in our proposed study. As a result, it lessens the impact of uneven light distribution throughout each frame. Also, as a pre- processing step, we used the gamma correction approach to improve contrast by a nonlinear change between the input and output mapped values Pandey et.al. [1]

II.METHODOLOGY
In the suggested work, we first extracted the driver's frontal image from the input video stream. The face has then been identified by drawing a bouncing box around it. Here, we have imported the built-in face detection library from the dilb facial feature racker based on 68 facial landmarks for

constructing the bouncing box, furthermore, using the coordinates of specified landmarks provided in dilb, we have localized the ocular region of interest (ROI). After that, we computed the eye aspect ratio (EAR) and applied a threshold value to determine whether the eyes were open or closed. Hence, the blink duration and number of frames involved during the blinking are used to determine if a person is attentive or tired. We must measure the distance between the user's top and lower lips in order to detect yawning Bhowmic et.al. [2] . So, this distance will be inside a threshold or limit when a person is taking, but it will be substantially higher when the person yawns. Now that we have the landmarks of the lips, we need to calculate the distance between two lips. To do this, we will once more use the dilb's face landmark model. Next, all that is left to do is measure the distance between the midpoints of the upper and lower lips. And the system will notify the user to yawn if this distance exceeds the threshold Abdelmadjid Bouabdallah at.al. [3].

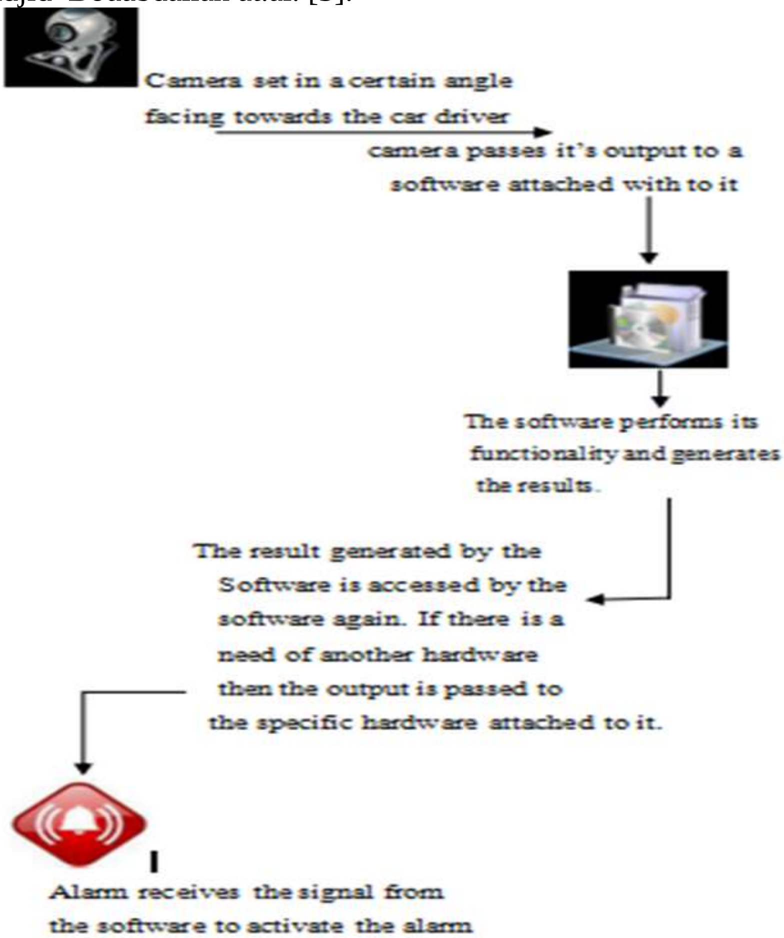

Figure 1 The computational flow of driver drowsiness detection

The most important step in preventing any traffic accidents today is drowsy driver identification. So, the goal of this project is to create a system that can recognize user tiredness and alert the user in order to avoid an accident. Also, this system will recognize when the user yawns and will alert them as a result. Now, any computer can be used to construct this system. No one is going to place a complete computer inside a car, so I also made this system compatible with a raspberry pi Belal et.al. [3]Alshaqaqiet.al [4]. This way, the entire system can be conveniently mounted in front of the diver in a vehicle moreover, every method I possess. The methods I employed in this system are all highly optimized, and as a result, it will operate in real-time, which is crucial for this application.

2.1 Facial recognition:

So, we first need to identify the user's face before determining whether they are sleepy. There are various algorithms available nowadays, but in this case, we need to choose one that is quick, accurate, and needs little computing power (so that it can operate on a raspberry pt). As a result, I choose to detect faces using the well-known "Vioal-jones" technique. More accuracy can be achieved with deep learning-based methods as well, but those cannot be used in real-time on the raspberry pi Shiwu et.al.[5].

2.2 Identifying open or closed eyes:

The state of the user's eyes must be determined in order to determine whether the user is asleep. Using the Eye-Aspect-Ratio, we may determine that (EAR). While the eyes The typical eye aspect ratio is 0.141, but when the eyes are closed, it is 0.339%, so we need to measure the distance between the user's top and lower lips in order to determine if they are yawning or not[6]. Hong.In other words, When our system recognizes a face, it will calculate the EAR. If it falls below the threshold (set by the user), it will warn the user and notify them continuously until the user opens their eyes.

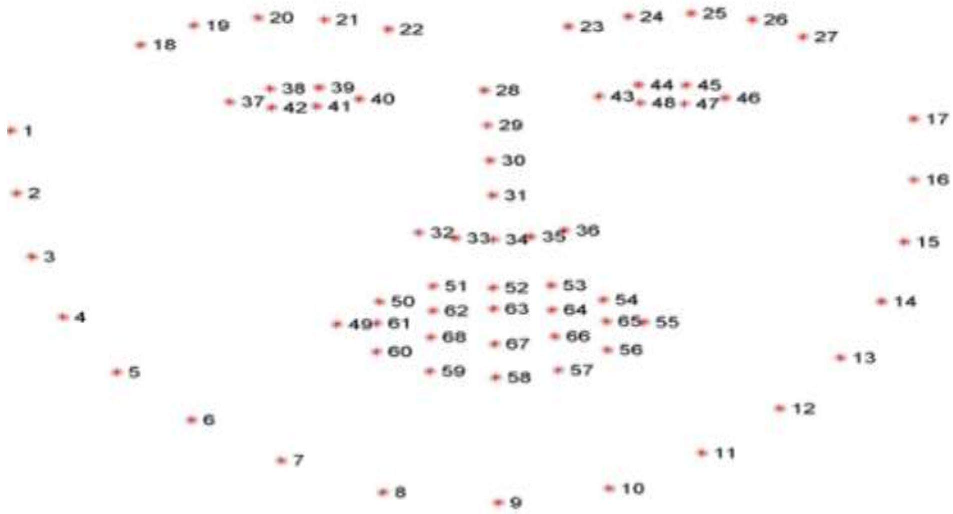

Fig. 2 ROI selection using 68 facial landmarks

The EAR calculation now requires finding the ocular landmarks in the face (as you can see in the figure). To recognise these features, we'll use the trained model Dlib's 68 face landmarks, which is compatible with Python. The formula (1) is used to find the approximate location of 68 coordinates (x, y) that represent the facial points on a person's face in the way depicted in the above figure. Cristiani et.al.(2010)[7] .

EAR=(|(P2-P6) | + |(P3-P5)|)/ (2*|(P1-P4)|)-------(1)

We can determine the EAR after obtaining the points. The system will notify the user whether this EAR value is or is not within the threshold after which.

Figure.3 Eye Blinking for opened Figure.4 Eye Blinking for closed

The ratio of the two eyes is explained in the fig. 3 above. The distance between their opened and closed eyes will be calculated. The EAR Ratio is the foundation of this approach. The eye aspect ratio (EAR) must be under 0.03. This is nothing more than the blinking of the eyes.

2.3 Yawn detection:

Yawning is a common indicator of drowsiness and fatigue, and can be used as a cue to detect drowsiness in real-time. In the context of drowsiness identification, yawn detection involves analyzing video or image data of a person's face to identify patterns of yawning. This can be done using computer vision techniques and machine learning algorithms to recognize changes in facial features, such as mouth opening and movement, and other visual cues that are associated with yawning. By monitoring yawning patterns, it is possible to detect drowsiness and alert the driver or user to take necessary action to prevent accidents.

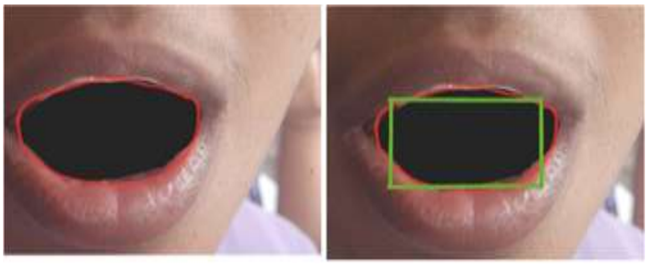

Figure. 5 Yawn detection

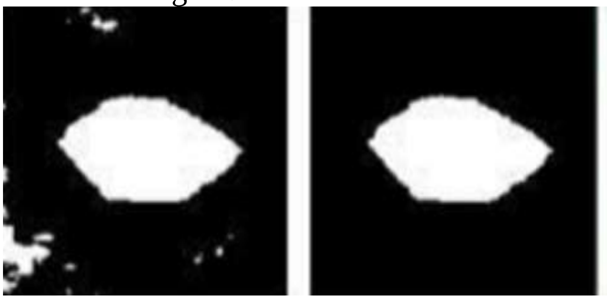

Figure 6 Shadow image of the yawn detection

The ratio is entirely based on the distance between the upper and lower lips, as seen in Fig. 5 above, and is calculated when we open our mouth based on lip movement. To identify a yawn, we need to know how far apart the user's upper and lower lips are from one another. The shadow image of the yawn detection is shown in Fig. 6.

2.4 Hardware configuration:

All we need to do to use a camera with a computer is connect it to the computer if we are running this configuration on a computer. The built-in camera on our pc will also function if it has one. So, if we are using raspberry pi for this activity, you can also utilize a webcam with it, but for best results, it's advised that you pair raspberry pi with a camera Dipu et.al [9] We just need to connect a webcam to the computer if we are running this configuration on a pc. And if we are using Raspberry pi for this activity, you may also utilize a webcam with it, but for better results, it's advised to pair Raspberry pi with a Raspberry pi camera Altameem et.al [10] .

The hardware for this project is represented in Fig. 7 and includes a Raspberry pi with 4G RAM and a camera with a high-quality lens. In order to begin this project, a camera must first be placed in front of a driver and connected to a Raspberry Pi for video input. The raspberry pi's function is to save the information that we have gathered from the driver. Using a cloud data set, the camera is used to capture video input. We should link the alarm buzzer for sleepiness alert by connecting these two. We can determine the driver's condition in a car by using these three key components: Raspberry Pi, Camera, and Alarm.

Figure 7 Hardware Components

III.Result and Discussion

The suggested design is tested using numerous video sequences, including the drivers with and without the proposed design is reviewed using a pc with the python language. Wearing glasses both during the day and night and the driver is distracted when driving while using a phone and eating. The tested video sequences have a resolution and the driver's facial width in the films ranges from 260 to 320 pixels also the examined movies include open or closed eye conditions in front face mode a rotated face mode by 30 degrees and varying light and shadow circumstances including a nodding facial expression. Which includes a movie of a driver with various facial cues is used to test our entire body of work. The videos are taken in two different ways in this dataset based on the placement of the cameras one over the drivers dash and one below the front mirror. We took into consideration for our suggested job the videos shot by the camera mounted on the driver dash. We have seen in our experiment weather or not eye blinking may be accurately recognized.

Figure 8. Processed frames from YawDD dataset.

The preceding fig. 8 explains that regardless of whether we have one eye open or closed, the result will still be calculated and displayed. The spectacle figure above shows that the outcome is unaffected. By using the example of the previous figure, we can state that the outcome is consistent. In the illustration above, the grayscale image in the rectangular form is represented by the red hue on the eyes.

IV Conclusion

We created this method to detect tiredness and yawn in this manner. One can now add several enhancements to this project. Other methods may be used to enhance the face detection component, but in that case, one must employ certain optimized techniques to enable real-time operations like the Raspberry pi. However, we must be careful to alter the amount of time that has gone since the detection of sleepiness. In the future, we would like to use sophisticated software, such as CNN-face detector, which could distinguish faces clearly even when heads moved violently in any direction. Considering the varying dimensions of the participants eyes made it difficult to determine the EAR threshold value. We would like to test more elements in addition to eye blinking in order to better adapt this circumstance in the future and increase the accuracy and efficiency of our system. These new aspects might include mouth, hand or leg movements, head movements, etc.

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