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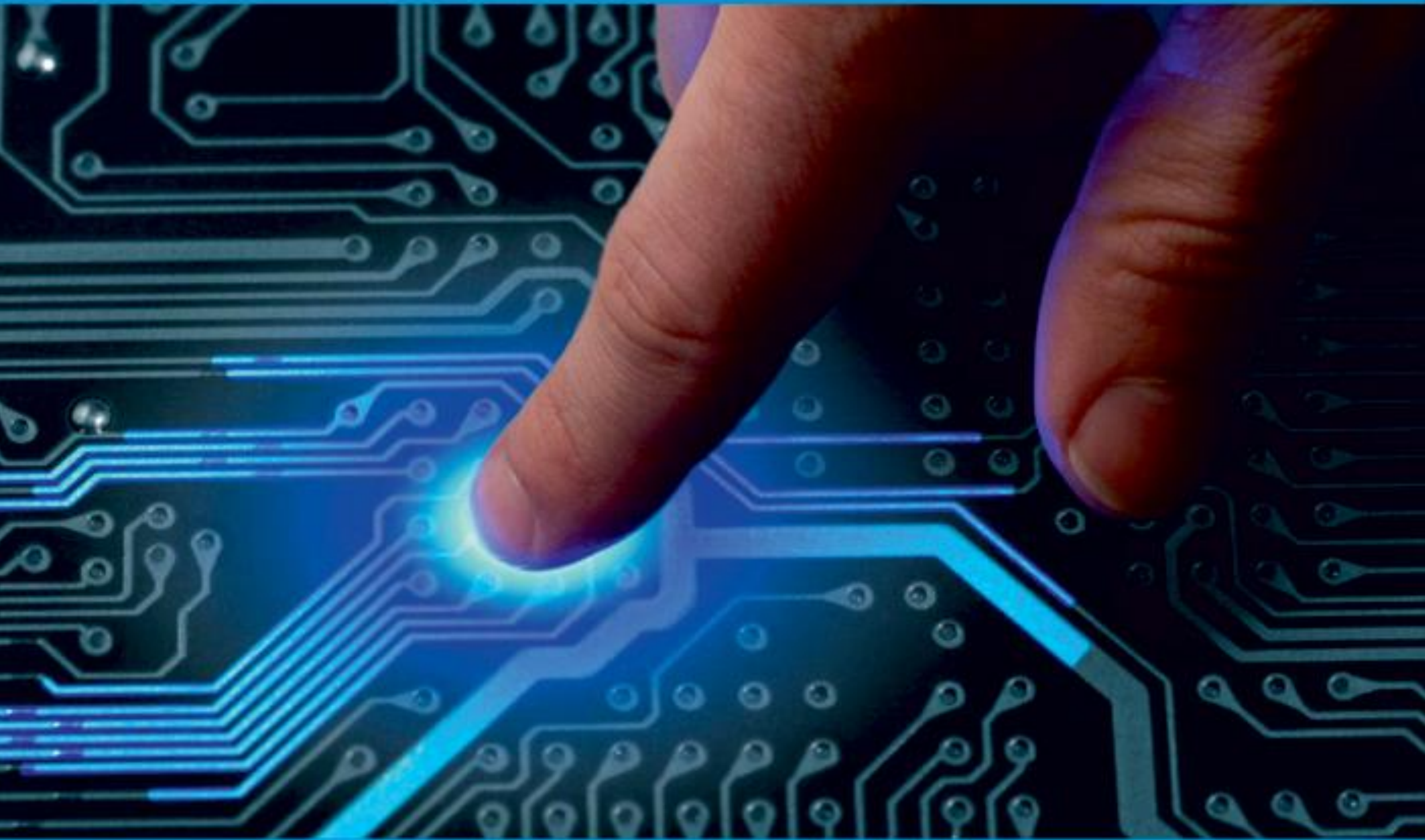

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A Novel Method for Real-Time Driver Drowsiness Detection using Object Detection Algorithm

Manish Gupta, Rajkumar Bharti

Assistant Professor, Buddha Institute of Technology, Gorakhpur, India

Final Year Student M.Tech CSE, Buddha Institute of Technology, Gorakhpur, India

ABSTRACT: The goal of the proposed system is to reduce the frequency of accidents caused by drowsy or fatigued drivers, hence improving overall transportation security. In recent years, this has been an increasingly prevalent cause of accidents. Drivers' sleepy eyes and yawning are two common indications of sleepiness and exhaustion, as are other facial expressions and body motions. The presence of these traits indicates that the driver's state of mind is not right. Drowsiness may be detected using the EAR (Eye Aspect Ratio), which calculates the ratio of distances between horizontal and vertical eye landmarks. The distance between the lower and upper lips is used to produce a YAWN value, which is then compared to a threshold value for yawn detection. If the driver is asleep or yawning, we employ a text-to-voice synthesiser (eSpeak) to notify them with a suitable voice alarm. Using this approach, we want to reduce the number of people killed or injured in automobile collisions and have a positive impact on the development of new technologies.

KEYWORDS: Drowsiness, eSpeak module, Eye aspect ratio, Yawn Detection.

I. INTRODUCTION

One of the most prevalent causes of car accidents is drowsy or fatigued driving. Every year, more people die as a result of road traffic accidents. The goal of this study is to reduce the number of accidents caused by fatigued or sleep-deprived drivers. Transport safety will improve as a result. Driver drowsiness detection is a car technology that may help keep drivers safe and alert by alerting them when they are about to fall asleep behind the wheel. Drowsy driving may be detected using computer vision in this experiment. There has been an increase in transportation options as a result of technological advancements. Our reliance on it has begun to grow rapidly. It has had a profound impact on our lives in a number of areas. Regardless of one's socioeconomic level, there are a number of standards that all drivers must adhere to. One of the most important things you can do when driving is to be awake. Existing methods for detecting driver fatigue are either prohibitively expensive and only applicable to the most expensive automobile models, or they are less expensive but less reliable. Both options are available.

An cheap and effective sleepiness detection system is the topic of this article. Drowsiness may be detected using a technique based on geometric aspects of the eyes and lips. For the same purpose, this research suggests the development of an alert system to monitor and avoid a negative consequence from the carelessness of weariness. Increasing numbers of traffic accidents are linked to driver tiredness, which has been widely established. It's difficult to determine the precise number of accidents caused by drowsy driving since it's often underestimated. The change from exhaustion to snoozing is a gradual one, and the driver is seldom aware of it. This highlights the need of doing additional research in this area in order to minimise the number of accidents caused by drowsy driving and inspire us to create a system to detect driver fatigue.

II. LITERATURE REVIEW

The survey comprises current technologies and studies that are relevant to our project's subject matter. We want to gain a deeper appreciation for the work that has already been done in this area of research, as well as insight into the areas in which we should concentrate our efforts going forward. The existing sleepiness detection systems for facial landmark detection [7], blink detection, and yawn detection have been reviewed in this literature review. Deep CNN [13], Computer Vision [15], Behavioral measurements, and machine learning are a few of the methods used to identify sleepiness. Each of these approaches has its own benefits, drawbacks, and degree of accuracy. EAR and MAR-based blink detection and yawn detection devices have been studied. For motorised cars using Web Push Notifications, [1] titled "Computer Vision based sleepiness detection for motorised vehicles" A computer vision-based sleepiness system for automobiles with warning sounds and online push alerts has been developed in this study. To avoid an accident, the motorist will be alerted by these messages. If the driver isn't paying attention, the system will send a warning to indicate local coffee businesses. As a consequence, the system was able to identify the driver's fatigue and perform admirably throughout the test. To determine whether the eyes are open or closed, researchers turned to the Eye Aspect Ratio. When a buzzer was activated, the user was given a web push message that displayed local coffee businesses.

Due to the usage of the Raspberry Pi camera, the system was unable to function at night as described in the article. Using a night-vision camera would have been preferable. Real-time monitoring of driver sleepiness on mobile platforms using 3D neural networks is described in detail in [2] [2]]. Drivers' tiredness was detected from real-time facial footage using depth-wise separable 3D convolution techniques, and micro naps were discovered and reported to the vehicle's control panel. There is no need for a developer to pre-specify a set of characteristics since they may overlook elements like nose wrinkles, eyelid movement, and other facial motions based on the findings acquired. The dataset utilised in this study only contains 18 individuals, and the frames were not correctly tagged.

A driver monitoring system may be used to identify tiredness. Drowsiness was detected using a driver monitoring system (DMS) and a variety of sensors in this study. Other vehicle-based sensors have also been used to gather data. The models were shown to be successful in separating sleepiness into three levels: mild, moderate, and severe. However, the model's ability to distinguish between moderate and severe levels was inefficient. The paper's flaws include the model's inability to distinguish between mild and severe sleepiness. It's also a problem that the sample size employed in this study is somewhat tiny.

"Driver Drowsiness Detection System Using Computer Vision" is the title of [4]. Using E.A.R (eye aspect ratio) for simple, quick, and effective blink detection, the article aims to identify driver sleepiness by analysing human eye blinks. By delivering a dependably exact enough prediction of eye opening, the system was able to accurately identify driver tiredness. Facial landmark identification incurs a minor performance penalty, allowing this alert system to be utilised in real time. The paper's drawbacks include that a fixed blink length is assumed, despite the fact that everyone's blink duration is variable. Ear Position Ratio (EAR) is computed using two dimensional data, which does not account for out-of-plane head orientation and relies only on the eyes to identify sleepiness.

Drowsiness detection from [5] entitled "Eye Closure and Yawning detection" is discussed. Using Haar-cascade classifiers, the driver's eye and mouth movements are recorded in this work. This will aid in the detection of eye closure and yawning frequency. The technology also sounds an alert if the driver is tired or has fallen asleep behind the wheel. As a consequence, the algorithm correctly recognises needed faces and facial traits in around 85 percent of situations. Once the facial feature detection is affirmative, the algorithm is quick to identify tiredness. Due to poor illumination, the system's accuracy reduces, which is a shortcoming of the paper.

III. PROPOSED METHODOLOGY

As a first step, we are developing a system that accurately detects tiredness in a driver by the movement of eyelids and yawning, as well as a reliable voice warning system [6] in real time. Another goal is to create a system that can identify driver fatigue by continuously monitoring the retina of the driver's eyes. When the driver yawns repeatedly or has their eyes closed for a short period of time, the system should sound an alarm. Even if a motorist is wearing glasses, the method works. Poor illumination has no effect on the system.

Facial landmark detection is used to locate the subject's face in the photo. After that, significant aspects of the face may be detected using shape prediction algorithms. Pre-trained OpenCV HAAR cascades are used for face detection [14]. An already trained facial landmark detector from the dlib package is then used to estimate the position of 68 (x, y)-coordinates that correspond to face structures in the next step(s). The iBUG 300-W dataset is also used to train it. In order to detect tiredness, the EAR [8] uses the ratio of distances between horizontal and vertical eye landmarks. In order to identify yawns, the distance between the upper and lower lip will be determined and the distance will be compared to a threshold value [9]. Drivers may be alerted when they are yawning or starting to nod off with the use of an eSpeak module (a text-to-speech synthesiser).

Drowsiness must be detected by the suggested technology in a real-time driving situation. The quality of the camera will also have an impact on the performance. Due to the system's well-designed and user-friendly UI, it is suitable for day and night drivers alike. In order to accomplish their goals, users may follow the interface step by step. If the user's system matches the given standards, the proposed system must be accessible to the user at any time. In the event of a sudden application crash, the suggested system must be able to recover and be available for usage again. Python 3 will be used to implement the software functionality of the sleepiness detection prototype on the Raspberry Pi microcontroller board, along with the appropriate peripheral hardware.

IV. SYSTEM ARCHITECTURE DESIGN

A. System Architecture

The driver's face is collected by a camera and transformed into a video feed when the driver is behind the wheel. After that, the software analyses the video to see whether the user seems tired or sleepy, and it also measures their current degree of exhaustion. Among the most important aspects to analyse at this stage are the driver's face tracking, the driver's tiredness condition, the recognition of critical areas of the face based on eye closure and yawning [10]. Finally, a voice alarm will sound if sleepiness is detected.

High-Level System Architecture is shown in Fig. 1 as a series of inputs to the model as well as pre-processing and assessment in phases. The first step is to prepare the video stream for face tracking by preprocessing it. excision of

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face features like the eyes and mouth is the second step. In this stage, we look for signs of tiredness, such as eye closing or blinking, and we also look for yawning.

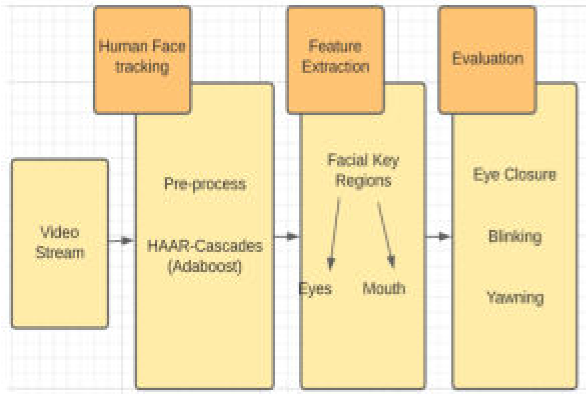

Fig. 1. System Architecture

B. Detailed Design

Driver alertness is constantly monitored, and an appropriate alarm is triggered if predetermined standards of alertness are found to be defaulted or violated. Consequently, action is done to avoid deaths. System Design of Driver Drowsiness and Yawn Detection System is shown schematically in Figure 2. When sleepiness or tiredness is detected, a voice-activated warning is sent via an onboard system in the dashboard, which uses a camera to constantly monitor the driver's face.

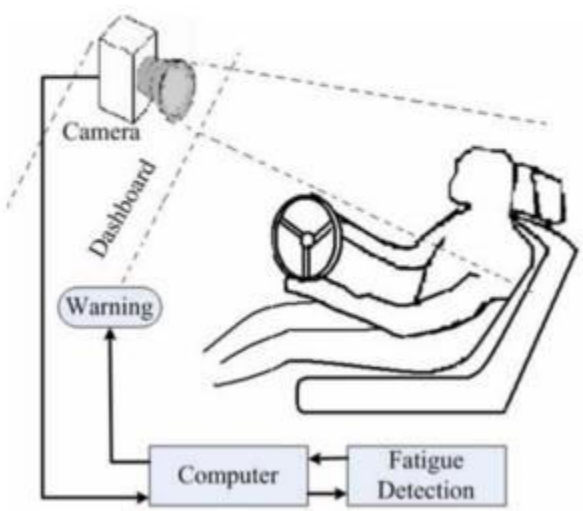

Fig. 2. System Design

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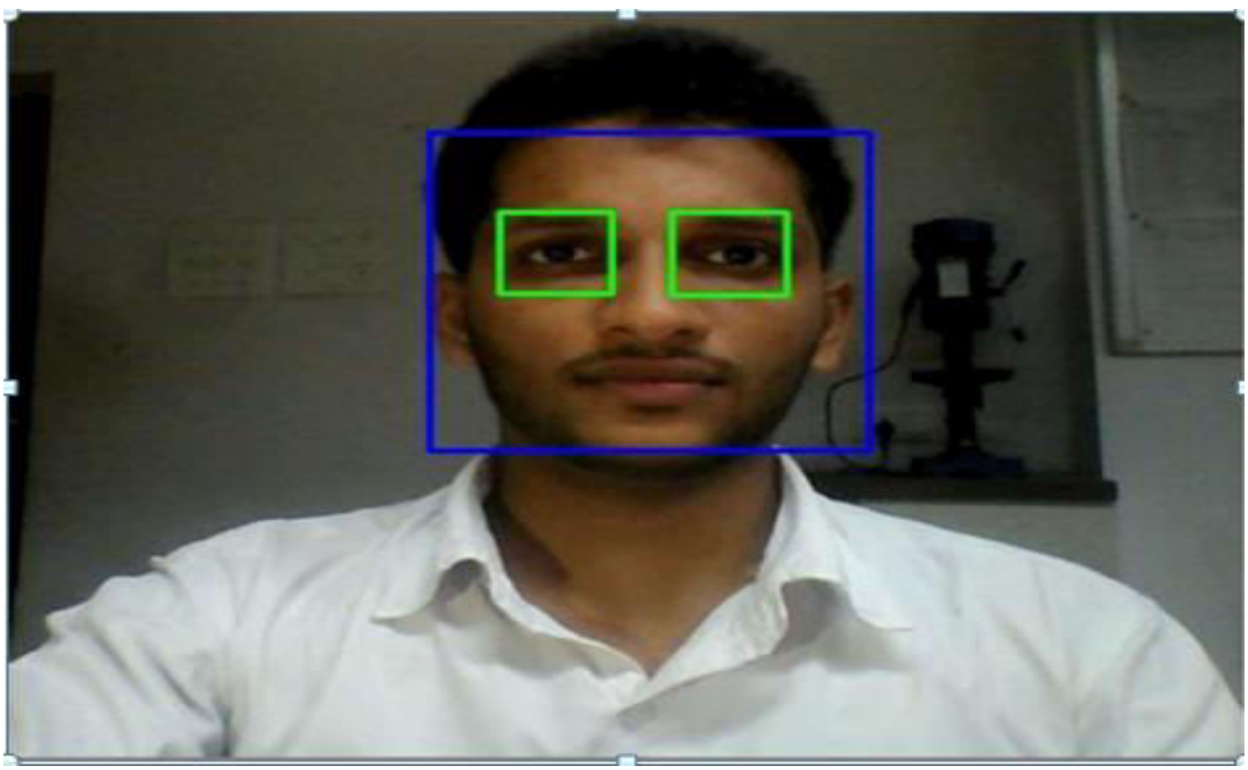
V. EXPERIMENTAL RESULTS

To get the results, a large number of movies were recorded and their consistency was assessed in order to detect eye blinks and drowsiness. We added a camera with a 0.3 megapixel resolution to the PC for this task. White LEDs were needed to light the camera. Instead of white LEDs, the system may employ infrared LEDs, which are less intrusive. When the driver's sleep falls below a specific level, a buzzer sounds an alarm. It has been tried by a number of people in a variety of environments (day and night). When the lighting of the camera is turned on and the face is positioned at an appropriate angle, the machine can detect flickering and sleepiness with over 90% accuracy. In real-time applications, this is also an excellent outcome. The outcomes under various situations are shown below in separate images. Photographs of the whole face and head were captured. Both strategies have a great deal of validity. We added a camera with a 0.3 megapixel resolution to the PC for this task. The camera was lacking in white LED light. In order to ensure that the system is not disruptive, infrared LEDs are employed instead of white LEDs in real time. A buzzer is a device that emits an alert sound to wake the driver up in the event that he or she has fallen asleep at the wheel. The technology has been put through its paces with actual people in a variety of lighting environments (day and evening). When the camera's lighting is turned on and the subject's face is positioned at an appropriate angle, the machine can detect flickering and sleepiness with over 90% accuracy. It's a great finding that can be used to real-time applications. Various photographs in the gallery below provide examples of outputs under various circumstances. Photographs of the whole face and head were captured. Despite the fact that both procedures are correct.

Sample Images:-

Sample 1



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Face and eyes detected

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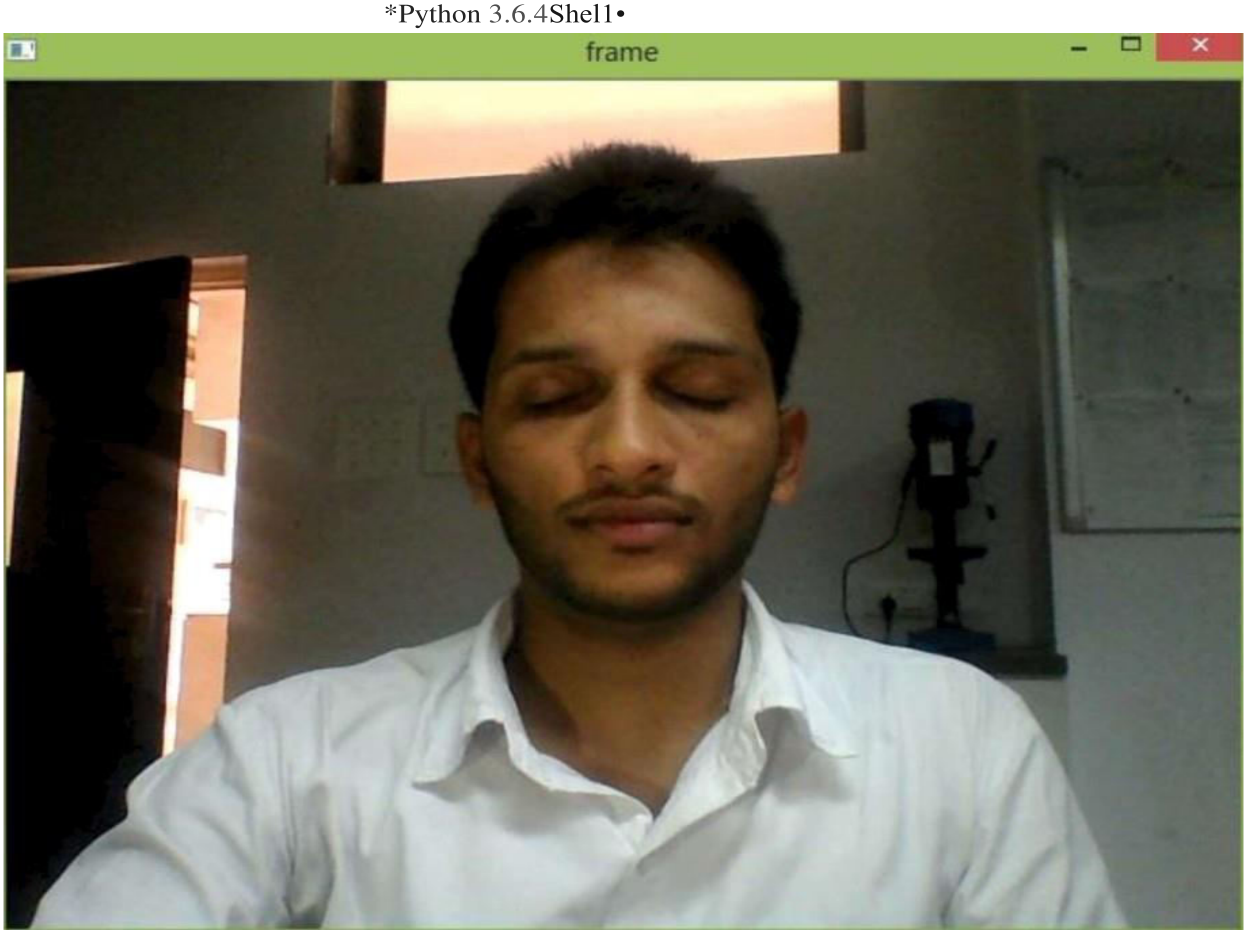

Drowsiness Detected!

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Eyes closed

Eyes closed

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Eyes closed

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Eyes closed

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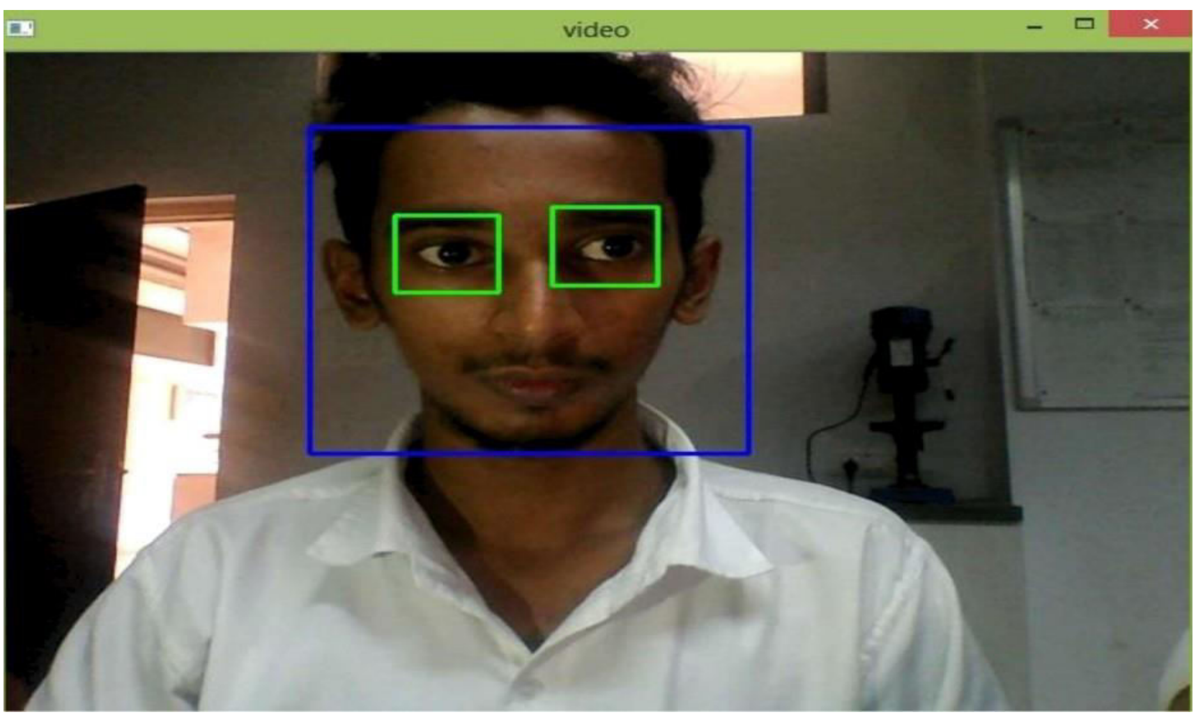
Eyes closed

Eyes closed

Drowsiness Detected ! ! !

Sample 2



Face and eyes detected

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"Python 3.6.1Shell'

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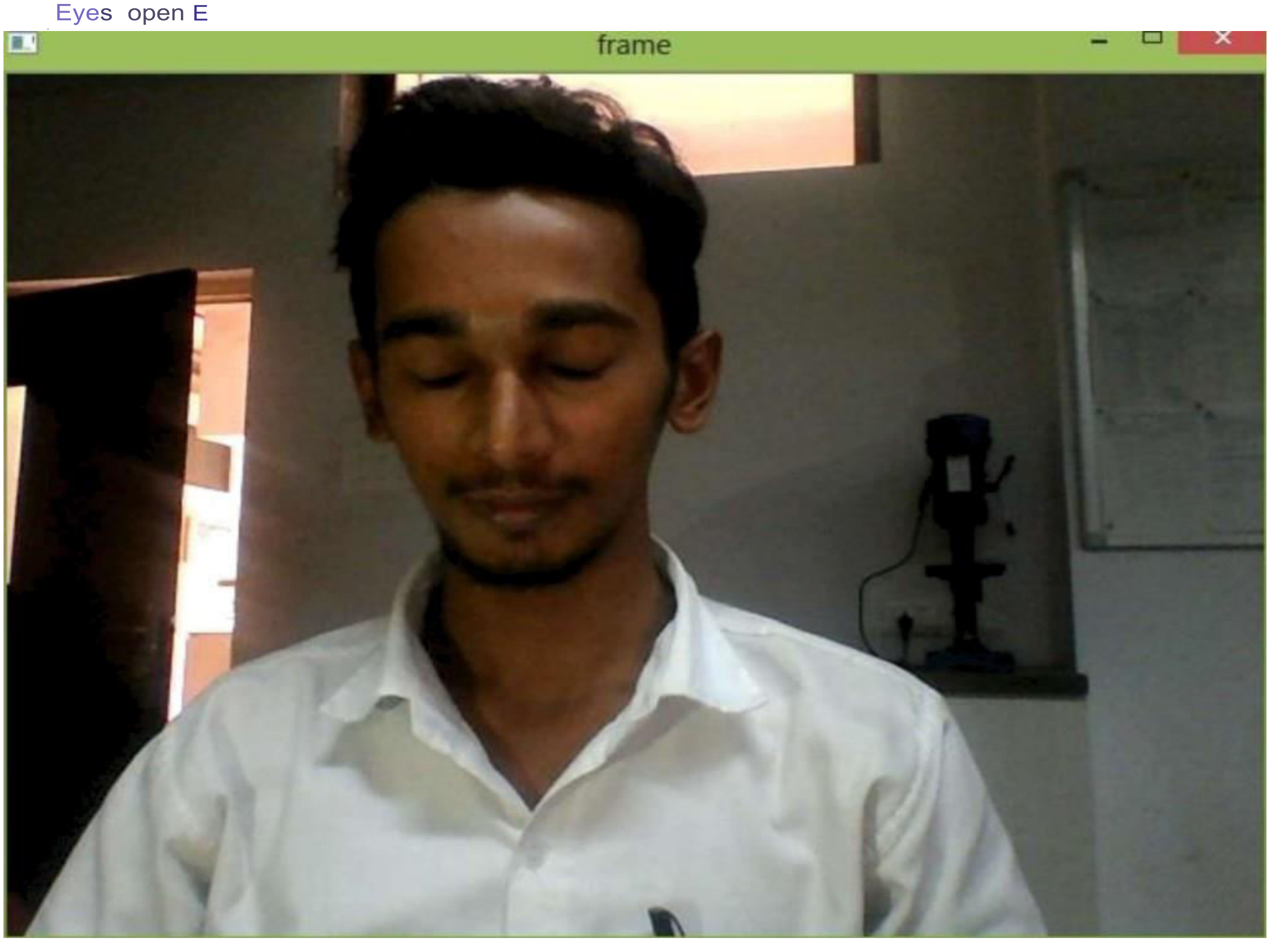

Drowsiness detected!

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Eyes closed

Eyes closed

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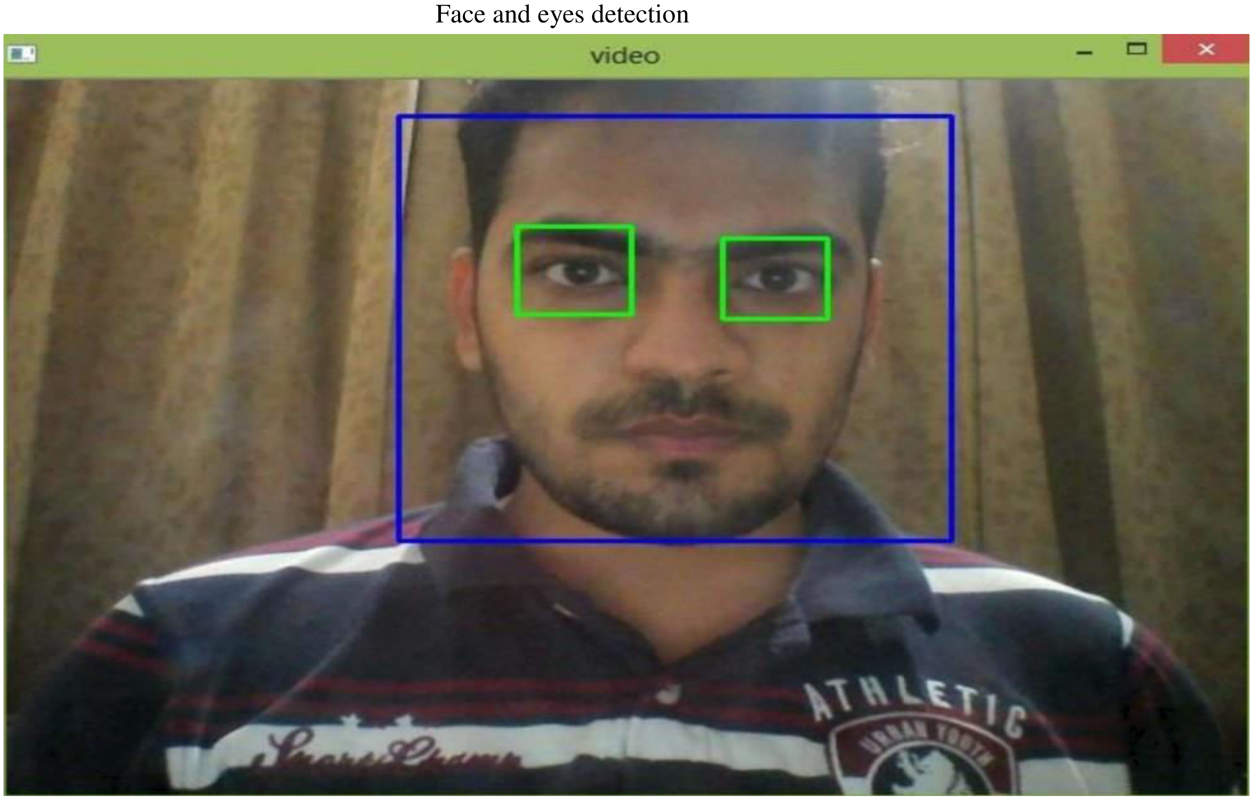
Eyes closed

Drowsiness Detected ! ! !

Sample 3

Face and eyes detection



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“Python 3.6.1Shell'

File Edit Shell Debug Options Window Help

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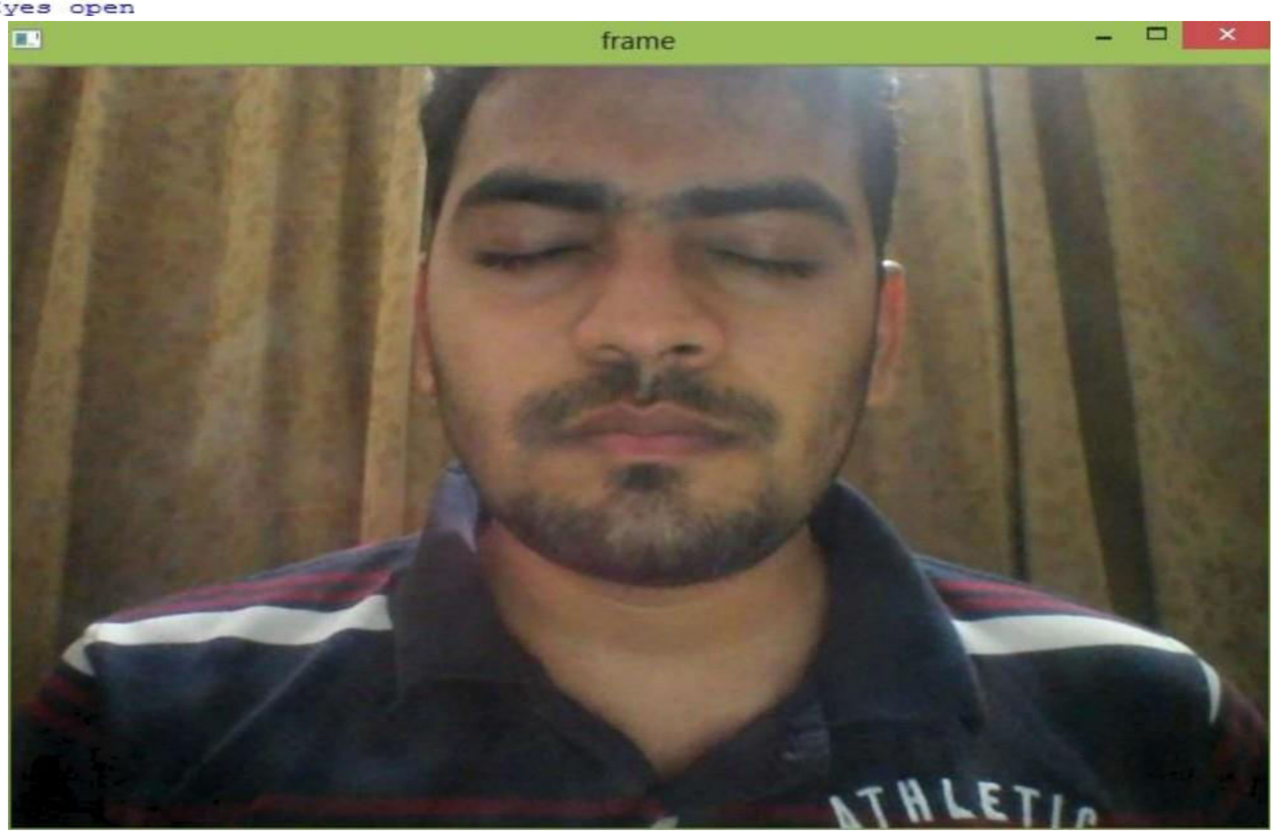

Drowsiness detected!

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VI. CONCLUSION

In order to determine if a person is sleepy, this model looks at their eyes and lips. It is possible to identify essential aspects on the face using shape prediction algorithms [16]. Facial landmarks collected from facial landmark detection are used as inputs for these algorithms. A function called EAR is used to calculate the ratio of the distances between the horizontal and vertical eye landmarks. This module covers this function. As part of the system, an eSpeak module (text-to-speech synthesiser) is utilised to inform drivers when they seem to be falling asleep or yawning. The overall purpose of the project is to reduce the number of accidents and to advance technology in order to reduce the number of people killed as a result of car accidents. The utilisation of extraneous elements to gauge exhaustion and sleepiness may be the subject of future research in this publication. [18] The weather, the status of the vehicle, the time of night, and mechanical data are all examples of external influences. Road safety is threatened by driver sleepiness, and commercial vehicle operators are especially vulnerable. 24-hour services, variable environmental conditions, high yearly mileage, and more demanding work schedules are all elements that contribute to this major safety concern. Keeping an eye on the driver's drowsy status and providing the driver with the information they need to take action is a key step in preventing this issue. At this time, there is no way to alter the camera's zoom or orientation while the system is running. [20] Even once they've been located, further work may be done to automatically zoom in on the eyeballs.

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