Real Time Driver Drowsiness Detection Using Visual Behavior

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***Abstract*- One of the main factors contributing to traffic accidents is falling asleep behind the wheel. Although it cannot be totally avoided, this model can help prevent it. A system called drowsiness detection keeps drivers from nodding off while operating a vehicle. Both passengers and other drivers will be safer thanks to this technology. The algorithm can monitor the space between the driver's eyes by employing an infrared camera in front of the vehicle. The technology sounds an alert to alert the driver to take control of the vehicle when the region comes under curtain measurement for a number of consecutive frames. The alarm goes off when the driver opens their eyes again and the area passes above the safe zone. As a result, this may wake up the motorist and save lives. The algorithm's accuracy is 96%.**

I. INTRODUCTION

Nowadays, many are too preoccupied with their jobs to give their health the attention it needs. Fitness alone does not equate to health. It also entails getting enough sleep. Every person has to sleep on a daily basis in order to preserve their health.

Although it is an inevitable natural occurrence, it is not a good idea to fall asleep while operating a motor vehicle due to the large number of individuals using the road and the possibility of unexpected events. One of the primary causes of traffic accidents is drunken driving, but other factors may also play a role, such as drivers who are irresponsible or careless, which can lead to collisions

After a long day at work, imagine returning home. You might not realise that you might fall asleep. A single moment of sleep deprivation might cause your car to veer or collide with another vehicle in the area. Think quickly about this. There will be incalculable harm done. It is not appropriate to take a quick nap on the road. Therefore, a more robust mechanism is required to address this prevalent problem.

Not only does driving while intoxicated hurt us, but it also damages the environment and our neighboring vehicle due to our negligence. Nowadays, people are in a rush and don't get enough sleep. This causes every issue.

II. LITERATURE SURVEY

The purpose of this concept is to prevent drivers from falling asleep. This model is really lightweight and simple to set up. Few system parameters are required for this model to process. This approach uses resources very well. Because of all these aspects, the model is inexpensive to use.

The Open CV Library is well known for its simple neural model; unlike [6], [19], this model doesn't need a very complex neural network. This significantly reduces the amount of time required to compute each frame.

Drowsiness can only be detected by following the eye; using the eyebrow and eyes to identify it complicates the model. [12],

[2] [I], [9] employed eyelid movement to determine whether the driver was sleeping, and lip opening position to determine the extent of yawning. The lower lip position was the only one used to gauge fatigue. Only one eye is taken into account. The algorithm has an 80% accuracy rate.

[3] used an infrared camera to track and identify tiredness in the pupils. monitors the motion of the eyeball to determine whether or not the driver has closed their eye. For this algorithm to anticipate the ideal outcome, a large amount of training data is needed.

[4] Determined if the eyes are rested, partially opened, or closed using the driver image analysis approach combined with EEG and EOG signal processing. The eye's movement has been detected using the ANN layer to determine sleepiness.

[5] This model detects sleepiness using the [2] & [3] algorithms. They are able to identify ocular closure. When the algorithm fails to locate the eyes, the system identifies tiredness.

[6] [13], and [16] converts each eye frame to a binary value in order to determine whether or not the eyes are closed. Because of the binary conversion of picture frames, this approach will be extremely inefficient. That takes a while, and the outcome will be displayed a few seconds later.

III. SURVEY STUDY REPORT

A) Primary Reason for road accidents

Every year, 150k individuals died in traffic accidents. About 41% of this was brought on by sleepiness. Most traffic accidents in the USA are attributed to sleepiness. Truck drivers are more likely to be involved in accidents since they are always required to work overtime,

International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 08 Issue: 04 | April - 2024 SJIF Rating: 8.448 ISSN: 2582-3930

B) High Death rate

30% of deaths are caused by traffic accidents. These folks wouldn't be able to drive since they would be unconscious. They were unable to escape what was about to happen. They also won't be able to think fast enough to get out of the precarious situation once it happens. Drowsiness-related accidents often impact other cars in the vicinity. Most of these incidents are poor quality.

IV. EXPERIMENTATION

In order to complete the voyage, one has to make sure they obtain adequate sleep and relax before setting off. If he or she starts to nod off, they can hand over the wheel to a fellow passenger or pull over and stop to catch some rest.

A. *Abbreviations and Acronyms*

EUD - Euclidean Formula

FVS -File Video Stream (Library) FR -

Face Recognition

EAR - Ear Aspect Ratio

B. *Units*

- *Euclidean distance* - cm
- *The area inside the eye*- cm'
- *Time* - Second (s).
- *Ratio* - No Unit.
- *Count*- No Unit

C. *Equations*

$$\text{distance} = \sqrt{\sum_{i=0}^{n} (x_i - y_i)^2}$$

Distance calculation formula

- **Xi** – Coordinates for X
- Yi - Coordinates for Y

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

Ear Aspect Ratio (EAR) formula

- Pi - Coordinates of the point

V. LIBRARIES

A) OpenCV

A cross-platform package called OpenCV aids our model in enlarging the input videos to a size where the FR can map the landmarks. Every time the video loops, OpenCV turns every picture into grayscale so that FR can plot the landmarks with ease. Since normal colour images are hard to trace out, they are transformed to greyscale.

OpenCV operates quickly and effectively. The system resources used by OpenCV are not very high. With OpenCV, the majority of image processing functions are preset. Compared to the classic neural network model, the neural network has less complexity.

B) Face Recognition

Marking the markers for the eye area is aided by Face Recognition. An eye dataset is prewritten into the face recognition library, which compares the dataset with our real-time footage. Using the dataset, identify the eye's contour.

Although Face Recognition provides an unlimited number of points surrounding the eye, it only takes into account six of them. These six points are then applied to our computation to determine sleepiness. This library may be used to plot eyebrows, mouths, and ears in addition to stopping here. These can be applied to many kinds of undertakings.

VI. WORKING

With the aid of the Dlib Library and OpenCV, the model functions. The programme receives visual feeds from the live camera [8]. The OpenCV Library and Face Recognition assist in outlining the eyes and other relevant areas.

An internal Marking the ocular landmarks is aided by an internal dataset of the Face Recognition Library [I], [4]. Our model only requires six points to solve.

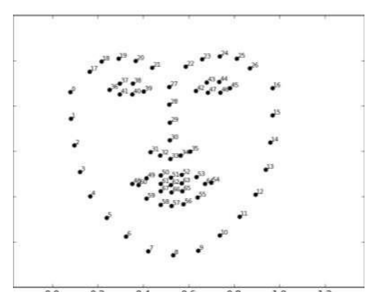


Fig 1: Eye landmark Detection

B) Identifying Eyes

Every frame of the movie is repeated, and the eye contour is continually monitored for every frame.

International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 08 Issue: 04 | April - 2024 SJIF Rating: 8.448 ISSN: 2582-3930

The tracking of the eye contour is handled by the Face Recognition library. Similar to the illustration below, that outline is designated with six points [11]. Following the drawing of the points, the program computes the area between the points by calculating the separation between two opposed points using Euclid's Distance formula.

We begin determining the area between the locations using the found distance. With the use of the unique EAR formula [lO], the region is located.

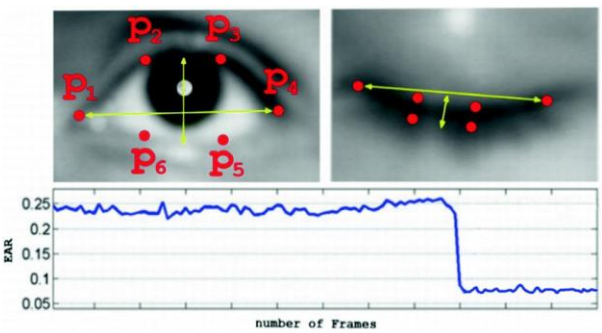


Fig 2: Eye visual landmarks

In order to alert the driver and force them to take control of the vehicle, the system sounds an alarm when the area drops below 0.25 EAR and stays below 0.25 EAR for six seconds.

The EAR climbs over 0.25 when the driver opens his or her eyes. Thus, the warning and alert are silenced [14]. By doing this, we can make sure the driver doesn't nod off throughout the trip and guarantee the security of both the passengers and any oncoming cars.

Failing to do so may result in further options such as those listed in IX. can autonomously park on the side of the road or be connected to the Internet of Things to notify family members or the police.

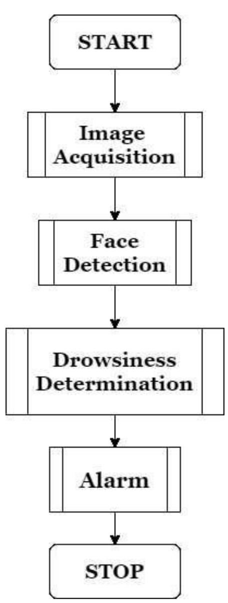


Fig 3: Flow Chart

The data flow procedure from the live camera to the prediction section is depicted in Fig. 3. The system receives live audio as input in the Image Acquisition section [5], [7]. The Face Recognition Library begins to write out the six dots that are evenly spaced around the shape of the eye during the Face Detection step.

The process of determining drowsiness involves the system locating the region included by the six points [! I]. When the area I <, below the ratio specified by the user. Then, the alarm is set off.

The alarm stops and waits for the next detection cycle when the area grows as the driver awakens.

A. Readings

a) Bright Light: An attempt will be made to evaluate the bright light conditions inside for experimentation reasons.

TABLE I. BRJGHTLIGHT READING

Test No.	Observed Value		
	Eye Position	*Eye ratio*	*Result*
I.	Opened eyes	0.39	Open
2.	Closed eyes	0.20	Close
3.	Tûrned Closed eyes	0.1	Close

Ninety-nine distinct bright light situations were examined, and the accuracy of the model developed was 96%. Additionally, there may be instances in which the motorist has turned their head. However, we ensured that those circumstances would not impact the outcome. when the head-turning angle is less than 40. The model will accurately forecast.

Although the model functions well as long as the angle is less than 40, turning the head would result in a lower ratio since one eye would be covered.

b) Low Light: In an effort to conduct experiments, testing has been done in low light interior settings.

TABLE Jl. Low LIGHT READING

Test No.	Observed Value		
	Eye Position	*Eye ration*	*Result*
I.	Straight Opened eyes	0.31	Open
2.	Straight Closed eyes	0.23	Close
3.	30° turned Closed eyes	0.11	Close

The algorithm obtained 85% accuracy when evaluated in 60 distinct bright light scenarios. It is shown that area detection is highly dependent on light intensity. It's challenging for the model to mark the outline in low light.

Rather of using the regular camera to fix this problem, the Night Version IR Camera might be used. This could make things more expensive, but the precision stays the same.

VII. RESULTS

A) Drowsy Detection

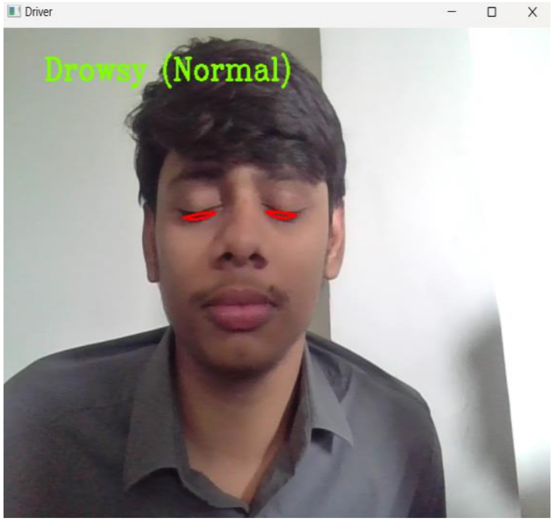
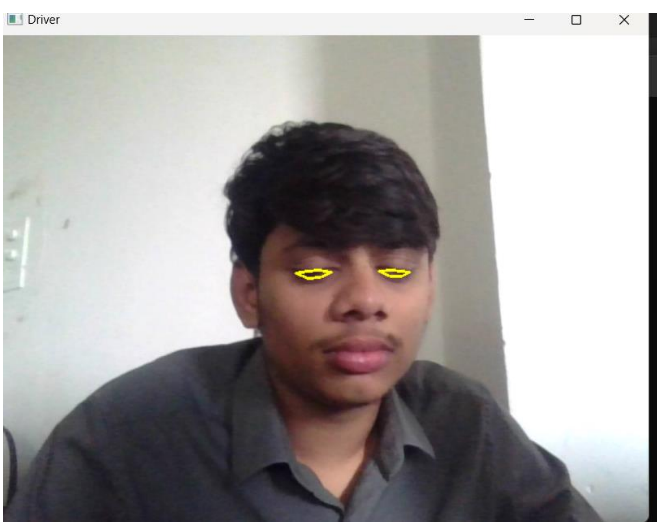


Fig 4: Bright Light Open

The eye outline created with the aid of the Face Recognition Library is seen in the image above. When the eye opens in a brightly lit environment, the model detects an area of 0.31 EAR. Since it is above the user who was specified,

With each shot captured from the live camera, the area is constantly changing.

B) Bright Light Eyes Closed



The model determines the region to be 0.19 EAR when the eyes are closed under bright light. The user is meant to take control of the car when the alarm is set off since it is below the user that was indicated.

VIII. CONCLUSION

In general, the model provides 96% accuracy in a range of illumination and positioning conditions. It demonstrates how unworkable this system is. The other models and algorithms need a lot of components and are very complicated.

There aren't many drawbacks with this model. A high-quality video frame and camera are all that are required. If there was insufficient light on the driver's face, the model would report a false positive. Also, because we must analyse each picture frame more quickly, the model's speed is dependent on the GPU being utilised. In order to prevent any false positions or erroneous situations, there needs to be taken care of. Furthermore, the User-defined Ratio (EAR) in the model needs to be accurate. Determining the permissible quantity of ocular area is crucial.

The model makes it easy to prevent being sleepy while driving. With the code, we may create an Android or iOS application, and the driver can attach the mobile device in front of them. This sets off the device's alert each time the driver takes a break.

150 different lighting locations were investigated for this model, and 144 produced the ideal outcome. The model has 96% accuracy in that regard. The precision may be further enhanced by raising the calibre and quality of the camera. The model's capacity to render faster warnings depends on the CPU and GPU. It is possible to employ a night version camera when going for a drive at night.

IX. FUTURE SCOPE

By alerting relatives, friends, and the nearby control room that the driver is not in control of the vehicle, IoT devices can further improve the model.

The car is gently parked on the side of the road by mechanically connecting the sensor to the brakes and steering.

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