

Driver Drowsiness Detection System

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ABSTRACT

Drowsy drivers cause several accidents every year. It's a major contributor to vehicular mishaps in the modern era. According to recent data, driver fatigue is a leading cause of accidents. Thousands of people lose their lives every year in vehicle accidents brought on by sleepy drivers. Drowsiness contributes to almost 30% of all accidents. A system that can detect driver fatigue and provide an alarm in time to avert an accident is essential. In this study, we provide a method for identifying sleepy drivers. In this system, the driver is constantly watched over by a camera. The driver's face and eyes are the primary targets of the image processing used in this model. The device takes a picture of the driver's face and uses eye tracking data to guess when he or she will blink. To quantify perclos, we use an algorithm to follow and analyse the driver's face and eyes. A warning tone is played if the blink rate is too high.

Keywords:-Drowsiness, Distraction, Eye detection, Eye Tracking, Face Detection, Perclos

INTRODUCTION

The use of personal automobiles is on the rise in today's technologically advanced society. Long-distance driving is boring and tiresome because of how long it takes. Lack of sleep and relaxation during lengthy trips is a major contributor to the driver's vigilance. If the driver is feeling sleepy, they may take a nap.

A snooze of even a few seconds may put your life in jeopardy, and an accident might easily be fatal. Constant monitoring of the driver's attentiveness is necessary to avoid such accidents, and the driver should be notified immediately upon the detection of sleepiness. This will help us prevent some percentage of accidents, which will ultimately save lives. Most car accidents may be attributed to drivers falling asleep behind the wheel. In addition to endangering everyone on the road, drowsy driving may lead to serious injuries and even death, as well as significant financial

losses. When drivers are drowsy, they

may nod off at the wheel or have trouble keeping their eyes open. In India, driver distraction is the leading cause of accidents. Drowsiness impairs the driver's performance over time. To prevent this from happening, we designed a system that can identify when a driver is becoming sleepy and sound an alarm. This setup records moving pictures through a camera, identifies faces, and pinpoints eye locations. Next, the eyes are analysed using the perclos algorithm to identify signs of sleepiness. In case of sleepiness, the result triggers an alarm to notify the driver.

METHODOLOGIES

The level of driver fatigue may be determined in a number of ways. The following are the three broad classes into which they fall:

First, there are methods based on

behavioral parameters, such as gauging the driver's level of weariness from observation alone. Driver behavior may be assessed by monitoring eye-opening rates, blink rates, yawning, head-position, and facial expressions. The ratio of the driver's closed eyes is now employed as a parameter in this system.

Measurement of driver weariness using vehicle driving patterns is included in the second category, which is "based on vehicle parameters." Variables such as lane-changing frequency, steering angle, grip force, vehicle speed, and many more may be measured.

Third, physiological parameters-based methods assess driver fatigue by monitoring physiological markers. Rates of breathing and heart rate are two examples of such variables rate, body heat, and a lot of other things. Because of their foundation in the driver's biology, these physiological characteristics outperform competing methods.

There are benefits and drawbacks to each of the methods discussed above. Any method may be employed depending on the precision with which the final result is required to be determined. The driver must physically wear the devices as part of the physiological approach. Some drivers may feel uneasy with the idea of having electrodes on their skin to monitor their heart rate while they drive. It's also not certain that the driver will always be wearing such equipment, thus the findings may be subpar even if they do.

This shows that the physiological method has its limitations. Every vehicle-based strategy relies on the skill and health of the driver. Constraints like road conditions and vehicle availability might vary on a regular basis and provide additional challenges. Therefore, the best course of action is to adopt a behaviorists strategy, with the use of a camera's eye view of the driver. The driver may not have any

devices on them at any time. Therefore, this method is the finest option and can be used in any car with no adjustments. Fatigue-related auto accidents cause a high number of annual fatalities. Drowsiness is a contributing factor in around 20% of all accidents each year, leading to an average of 90 fatalities every day. Constant motorists are more likely to experience fatigue. Thus, sleepiness detection and notification may greatly reduce accident rates. Some image processing methods, such as viola jones, Adaboost, haar cascade, gobar features, and facial land mark identification, aim to reduce such mishaps. Some techniques for spotting them are as follows:

Using an image's horizontal projection and a template-matching approach to monitor the face's components—including the driver's eyebrows, eyes, and mouth—M.A. Assari and M. Rahmati [1] suggested a system to identify driver sleepiness. The suggested approach has been built in MATLAB's Simulink simulation environment. Better face recognition was achieved with the use of IR illumination as light sources. A system using the face detection approach based on a cascade of classifiers trained with the Adaboost algorithm was reported by Tianyi Hong et al. [2]. In order to optimize this system, we use the original picture's integral image to create a clever filter for cascade processing, which in turn boosts speed. Better and quicker computing results have been achieved by using integrated performance primitives(IPP). The GENE-8310 embedded platform guarantees the reliability of this system.

Based on a physiological approach, B. Warwick et al. [3] suggested a system in which the driver wore a wireless biosensor dubbed BioHarness, a wearable device that could gather the driver's physiological data and use it to improve safety then sending it to a mobile device. Fast Fourier Transform (FFT) and Power Spectral Density (PSD) analysis of this

information provide the necessary vectored inputs for feeding into a Neural Network. The researchers use their technique into a smartphone app designed to identify signs of fatigue.

K. Dwivedi et al. [4] created a system that uses representational learning to detect driver sleepiness. For drowsiness detection, photos from a Haar-like face detector are fed into a 2-layer convolutional neural network, where features are retrieved and utilised to train a softmax layer classifier. The system's success in identifying tiredness and notifying the driver was confirmed by an impressive 78% success rate.

Images are transformed to grayscale using

the Sobel operator for edge detection, as described by J.J. Yan et al. [5]. The eye locations are determined using a template matching algorithm. The binarization and rapid sort methods verify the distribution of the black pixels in the grayscale picture, allowing for the determination of the eye states. In this analysis, P80 serves as a primary indicator of the driver's health. A pixel's value is compared to a threshold. If the number of black pixels is less than the value, the driver is regarded to be sleepy.

PROPOSED WORK

Architecture: The following framework was designed to identify sleepiness and the accompanying distraction.

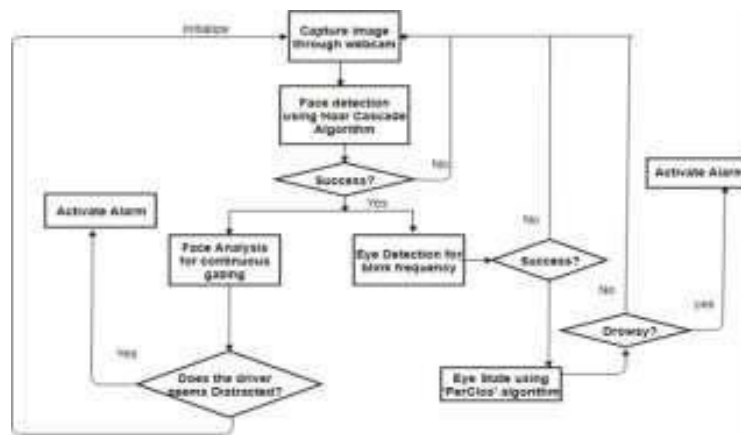


Fig.1:-Architecture of the drowsiness detection system

1. Driver fatigue detection architecture is shown in Figure 1. The system begins by taking photos via webcam, and then uses the haar cascade algorithm to identify human faces in those images. It is able to identify individuals by using haar characteristics. If the algorithm identifies it as a face, it will move on to the next step, which is locating the eyes. Blink detection and analysis rely on haar cascade characteristics extracted from the eye. Perclos algorithm will be used to identify eye condition. This approach allows us to calculate the amount of time during which the eyelids are closed. If it detects that the driver's eyes are closed, it knows that he or she is likely tired and will sound an alarm.

Eye contact is often used as a proxy for distraction. Constant facial analysis is performed to identify signs of distraction in the driver. Once discovered, an alert will be sent. The various detection techniques are as follows: A. Haar Cascade:

2. Paul Viola and Michael Jones's 2001 publication "Rapid Object Detection using a Boosted Cascade of Simple Features" is the inspiration for Haar Cascade's feature-based approach. It's an AI method where a cascade function is taught using examples of good and bad photos. It may be used to identify things in still or moving pictures. There are four phases to this algorithm:

3. Integral image generation and Haar

feature selection

Cascading classifiers (iv) Adaboost training (iii)

Haar Cascade is used for recognising faces in photos, although it is used to recognise a wide variety of objects. Adaboost is a feature selection and classifier training framework. In this method, a "strong" classifier is built by linearly combining many "weak" classifiers with different weights. The difference in the sums of the intensities of the pixels in two adjacent rectangular areas is the basis of the Haar feature, which takes into account adjacent rectangular regions at a specified place in a detection window. During the detection process, a window with a size equal to the target is swept over the input picture, and Haar features are computed for each region.

A learnt threshold distinguishing non-objects from things is then compared to this variation. Cascade classifiers are used to combine multiple Haar features into one robust classifier because each individual Haar feature is only a "weak classifier," meaning its detection quality is only slightly better than random guessing. Adaboost is a strategy for selecting the most relevant features and then training the classifiers that will make use of those features. Since we just need to identify the front of the faces, the "Haar Cascade Frontal Face" classifier is used in this approach. The whole structure consists of six parts.

4. Recognising People's Faces

Eye-Tracking System

Face recognition 3.

4 - Eye-Tracking Technology

5. Detection of Exhaustion Identification of Distractors

First, there's face detection, which uses camera data to search for human faces in the incoming footage. The Frontal face cascade classifier, one of the Haar classifiers, is used to make the detections. In order to save the recognised face in

memory, it is first transformed from its original rectangular shape into a grayscale picture.

Module 2: Eye Detection focuses on the eyes to identify signs of fatigue. Haar cascade eye classifier examines incoming footage for signs of human eyes. In-frame eye detection is performed.

Third, we need to constantly monitor the faces for signs of distraction since this is a real-time project. This means that the faces are always being detected the whole time.

Fourth, Eye Tracking, Module Input Is Derived From Module Three. The Perclos algorithm is used to ascertain the condition of the eyes.

Fifth, if the driver's frequency has been assessed to be zero for an extended amount of time in the preceding module, the system will issue an alert warning them that they may be drowsy.

The driver's face is constantly tracked by the system's face tracking module, which looks for telltale signs of distraction like blinking seldom or staring intently for an extended period of time.

A. PerClos

Perclos is a method for detecting sleepiness that tracks the degree to which one's eyelids are drawn downward over one's pupil. Many different sleepiness detection systems utilise it since it works well in real time. Different pieces of hardware are used by developers to accurately record the eyelid-closing motion. The camera for this project is installed in the dashboard of the car and is positioned such that the driver can be seen. This aids with face identification and the perclos measure of how often the eyes close. Each eye has six locations identified, from which the Euclidean distance may be determined. The average eye-aspect ratio is then determined using the individual eye aspect ratios.

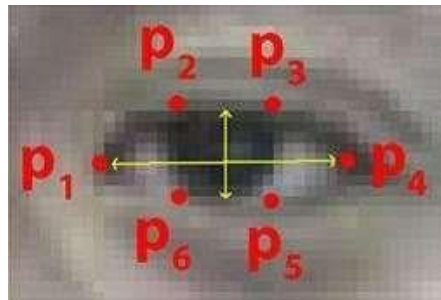


Fig.2:-points localisation in perclos algorithm

$$\text{ear} = (A + B) / (2.0 * C)$$

where A represents the space between points 2 and 6, B represents the space separating points 3 and 5, and C represents the space separating points 1 and 4.

EXPERIMENTAL RESULTS

1. FaceDetection:



Fig.3:-output for face detection

Figure 3 shows the results of the face detection module. This module takes in a continuous video feed and outputs a rectangle region where faces have been detected. The haar cascade technique is used to identify the person's face. In order to identify people in square photos, it

makes advantage of haar characteristics. The Frontal face cascade classifier, one of the Haar classifiers, is used to make the detections. Rectangles of the faces are then transformed to grayscale images and saved in memory for further use in model training.

Eye Detection:



Fig.4:- output for eye detection

The results of an eye scan are shown in Figure 4. In rectangular images, the system can identify where an eye is located. The haar cascade method is used to identify the

2. Drowsiness Detection:

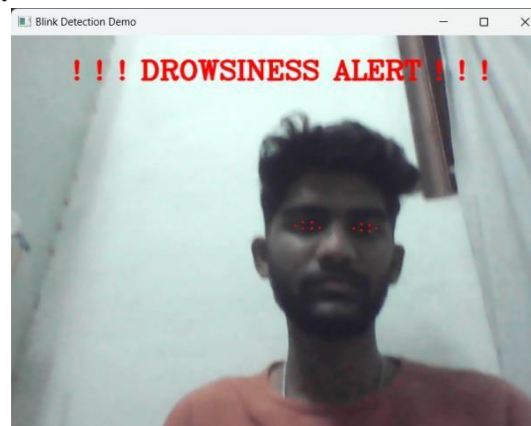


Fig.5:- Drowsiness Detection

Drowsiness detection results are shown in Figure 5. If it determines that the driver is showing signs of fatigue, an alarm will sound. Both a text message reading "DROWSINES ALERT" and an audible alarm will serve as the alert. The noise is meant to awaken the driver. The perclos algorithm is used to identify sleepiness. The algorithm measures the space between the eyelids, and if it's less than a certain value, it sounds the alert.

The time required to determine whether a person is drowsy is on the order of 8-10 seconds.

RACE COMMENTS AND
ALGORITHMIC PRECISENESS IN THE
HAAR CASCADE Quickly detects (78%)
even in direct sunlight. Low-light
practising is essential.

CNN The majority of cases (76%) can be
identified in a short amount of time. More
time is allotted for training.

GOBAR'S SIGNIFICANCE: 67% As a
consequence, detection times will
lengthen. It's important to train on a big
dataset.

In the table above, you can see how
several face and eye detection algorithms

eyes. Features employed for identifying
eyes in square and rectangular images
(haar) are put to use.

stack up against one another. There are
many criteria used in the comparison.
Speed and precision are taken into account
in the following table. For this purpose, we
used the haar cascade method. This
algorithm achieves around 79% accuracy
in its output. In bright environments, it can
identify a person's face in a matter of
seconds. Low-light detection is possible
after training the system.

The technology requires training to
recognise faces in low-light settings.
Convolutional neural networks (cnn) are
the alternative algorithm used. The
detection time is minimal, and the findings
are very reliable. If you want greater
results, you'll need to put in more time at
the gym. In order to train, massive
amounts of data are needed. Another sort
of features utilised for detection, Gobar
features have an approximate accuracy of
67%. The detection time increases. In
order to get optimal results, training on a
large data set is required

CONCLUSION

In this research, an automatic method of
identifying driver fatigue was created.
Drowsiness is detected by reading the

system's continuously streaming video. The haar cascade algorithm is used to make the discovery. Haar characteristics are used by the haar cascade method for face and eye detection. Various items may be detected using specified Haar characteristics. Blink frequency is determined by applying the haar characteristics to the picture and then using the perclos method. The driver will be warned that they are dozing off if the value stays at 0 for a certain period of time. The motorist is considered inattentive if the value maintains a constant for extended periods of time. The current method provides an answer with a 78% degree of certainty.

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