International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 06 Issue: 05 | May - 2022 Impact Factor: 7.185 ISSN: 2582-3930

Accident Avoidance System using Drowsiness Detection based on ML & IP

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Abstract - Drowsy driving is the cause of many accidents. It is becoming one of the most common reasons for traffic accidents. Numerous accidents happen by drowsy driving. Drowsiness is responsible for more than 30% of all accidents. To avoid this, a system is needed that detects drowsiness and alerts the driver, saving the driver's life. We offer a strategy for detecting driver sleepiness in this research. A webcam is utilised to keep a constant eye on the driver. This model employs image processing algorithms that are primarily focused on the driver's face and eyes. The driver's face is extracted, and the algorithm predicts eye blinking from the eye region. To assess perclos, we utilize an algorithm to track and evaluate the driver's face and eyes. If the blinking rate is too fast, the system sounds an alert to the driver.

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

1.INTRODUCTION

Eye closure, head nodding, and brain activity are examples of real-time drowsiness behaviors linked to fatigue. As a result, we can monitor drowsiness by measuring changes in physiological signals like brain waves, heart rate, and eye blinking, or by looking at physical changes like sagging posture, leaning of the driver's head, and open/closed condition of the eyes.

While the former method is more accurate, it is not practical since highly sensitive electrodes would have to be placed directly to the driver's body, which can be irritating and distracting. Long periods of work would also cause perspiration on the sensors, reducing their ability to detect precisely. The second technique, which uses a video camera to detect changes in physical state (such as because it is non-intrusive, it is very well for real-world circumstances (open/closed eyes to assess weariness). Micro sleeps, which are brief sleeps lasting 2 to 3 minutes, are also good indicators of exhaustion. Thus, by continuously monitoring the driver's eyes, one can detect the driver's tired state and provide immediate assistance.

2. MOTIVATION

Driver drowsiness is a significant factor in the increasing number of accidents on today's roads and has been extensively accepted. Many researchers have confirmed this proof by demonstrating links between driver tiredness and traffic accidents. Although it is difficult to establish the actual number of drowsy driving accidents, it is most likely to be underestimated. The preceding remark demonstrates the need of doing research with the goal of minimizing the risks of accidents caused by drowsiness. Researchers have attempted to model the behaviors so far by establishing correlations between tiredness and key vehicle and driver indicators.

Previous techniques to sleepiness detection relied heavily on assumptions about vehicle-based and ambient data. The vehicle industry has also attempted to develop many methods to predict driver drowsiness, but only a few commercial products are currently available. The technologies mentioned above ignore driver behaviors such as eye closure and yawning. The vehicle-based measures and surrounding factors only contribute 4% and 5% respectively to road accidents. So, we have proposed a system that deals with the Driver's Behavioral Measures.

3. METHODOLOGY

This section discusses various sleepiness detection techniques (SDT) and its benefits and drawbacks. These techniques are often divided into three groups:

A) Behavioral Based Drowsiness Detection Methods: Behavioral parameters are non-invasive measures of drowsiness detection. These techniques calculate drivers' fatigue based on driver's behavioral parameters such as eye aspect ratio (EAR), eye blinking, facial expressions, etc. Yawning-based detection is another time method for image processing that helps to determine the variations in the geometric shape of the mouth of a drowsy driver.

B) Vehicular-Based Drowsiness Detection Methods: Vehicular-based methods for Drowsiness Detection are those methods that detect driver fatigue based on various vehicular metrics such as lane changing patterns, accelerator movement, vehicle speed variability, the steering angle of wheel, and grip force.

C) Physiological Parameters Based on Drowsiness Detection Methods: The Physiological based on drowsy methods are those that identify drowsiness based on the physical and environmental factors of the driver, such as heartbeat, body temperature, pulse rate, rate of response, and so on.

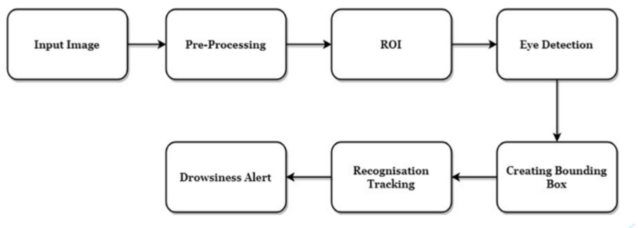
4. SOFTWARE DESCRIPTION

Python is the programming language that we use. Python is a high-level computer language for general-purpose programming that is interpreted. Python has a design philosophy that prioritises code readability, which includes a lot of spacing. It has structures that allow for clear programming at both small and large sizes. Python has a dynamic type system and memory management that is automated. It features a big and extensive standard library and supports several programming paradigms, including object-oriented, imperative, functional, and procedural. The below libraries are being used:

- Dlib
- Scipy
- OpenCV
- Imutils

5. PROPOSED WORK

Architecture: The following is the architecture for detecting drowsiness and distraction.



The architecture for recognizing a driver's tiredness. First, the system uses the webcam to capture photos, and then it uses the haar cascade algorithm to recognize the face. It employs facial recognition haar characteristics. If the algorithm recognizes it as a face, it moves on to the next phase, which is eye detection. Haar cascade characteristics are also employed to detect the eye and to calculate blink frequency. The perclos algorithm will be used to detect the state of the eye. We can calculate the proportion of time the eyelids are closed using this approach. If it detects closed eyes, it assumes the driver is tired and sounds an alarm. Continuous gazing can be used to measure distraction in some instances. The driver's face is constantly monitored for signs of distraction. If it is discovered, an alarm is triggered. The algorithms for detection are as follows:

The entire architecture is divided into 6 modules. 1. Face Detection 2. Eye Detection 3. Face Tracking 4. Eye Tracking 5. Drowsiness Detection.

1. Face Detection: This module gets video input from the camera and attempts to recognize a face. The Haar classifiers, specifically the Frontal face cascade classifier, are used to detect the face. The face is identified as a rectangle and transformed to a grayscale image before being saved in memory.

2. Eye Detection: in this module, the face of the eyes is focused to detect drowsiness. The eyes are detected through video input through the haar cascade eye classifier. The eyes are detected in frames.

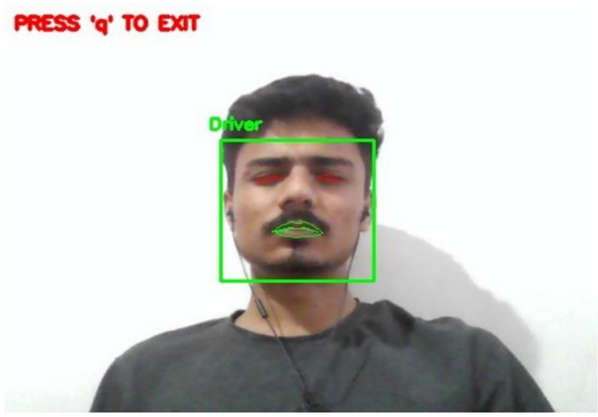
3. Face Tracking: Due to the real-time nature of the project, we need to track the faces continuously for any form of distraction. Hence the faces are continuously detected during the entire time.

4. Eye Tracking: The input to this module is taken from the previous module. The eyes state is determined through Perclos algorithm.

5. Drowsiness detection: In the previous module the frequency is calculated and if it remains 0 for a longer period then the driver is alerted of the drowsiness through an alert from the system

6. RESULTS

1. Face Detection:



Above is the output for the face detection module. The input to his module is a continuous stream of video and the output will be face detection within rectangular bounds. The face is detected by using the haar cascade algorithm. It uses haar features through which the face is detected in a rectangular frame. The Haar classifiers, specifically the Frontal face cascade classifier, are used to detect the face. The face is identified as a rectangle and transformed to a grayscale image, which is then saved in memory and used to train the model.

2. Eyes Detection:

Above is the output for eye detection. The system detects eyes in the given particular frame in rectangular frames. The algorithm used for detecting the eyes is haar cascade. It uses haar features which are used for detecting the eyes in rectangular frames.

3. Drowsiness Detection:

Above is the output for drowsiness detection. If the driver seems to be detected as drowsy then it will give an alert. The alert will be in the form of the message "YOU ARE SLEEPY. PLEASE TAKE A BREAK" and also in form of sound. The aim is to make the driver wake with that sound. The drowsiness is detected by using perclos algorithm. The algorithm calculates the distance between two eyelids and if it found the distance less than a threshold value then it raises the alarm.

7. CONCLUSION

The designed driver abnormality monitoring system is capable of identifying drowsiness, intoxication, and hazardous driving behaviours in a short period of time. The Sleepiness Detection System, which is based on the driver's eye closure, can distinguish between normal eye blink and drowsiness and identify it while driving. The proposed technology can help avoid accidents caused by drowsy driving. Various self-developed image processing methods are used to collect information about the head and eye location. The technology can determine if the eyes are open or closed during the monitoring. A warning signal is given when the eyelids are closed for too long. The driver's alertness level is determined by processing based on continual eye closure.

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