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DETECTION OF DRIVER DROWSINESS USING EYEBLINK SENSOR

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ABSTRACT

Driver fatigue remains a significant cause of road accidents globally, necessitating the development of effective drowsiness detection systems to enhance road safety. This project presents a prototype for a non-intrusive real-time drowsiness detection system utilizing an Arduino Nano board and infrared (IR) sensor technology. The system focuses on monitoring the driver's eye movements, particularly eye blinks, as indicators of drowsiness. By analyzing the frequency, duration, and intensity of eye blinks, the system triggers an alarm and sends warnings to the driver if prolonged eyelid closure is detected, signaling potential drowsiness. Leveraging computer vision techniques, including facial landmark detection and eye aspect ratio calculation, the system provides a cost-effective and efficient solution for mitigating the risks associated with driver fatigue. Validation through real-world testing and integration with existing driver assistance systems further demonstrates the system's potential to contribute to overall road safety and accident prevention.

Keywords: Eye Detection, IR Sensor, Arduino Nano, Alarm, Eye blinking

I. INTRODUCTION

Being drowsy means feeling sleepy when you shouldn't, and it can be really dangerous even if it lasts just a short time. This happens because of tiredness, which makes it hard to stay focused and alert. Drowsiness often occurs when driving long distances without enough sleep or driving when you'd normally be asleep. The big issue is that a drowsy driver might not pay enough attention, leading to a slow response to things happening on the road. The good news is that we can spot drowsy driving early and warn the driver to prevent accidents. Drowsy drivers show signs like yawning a lot, frequently closing their eyes, and drifting out of their lane. Actually, there's been a lot of research on ways to detect drowsy driving in recent years.

In fact, the Driver Drowsiness Detection and Alert System using the Arduino Nano board is an innovative solution designed to enhance road safety. Leveraging the capabilities of the Arduino Nano, this system employs various sensors to monitor key indicators of driver drowsiness, such as eye movements and head positioning. By continuously analyzing these parameters, the system can detect early signs of fatigue or drowsiness. Upon detection, an alert mechanism is activated, utilizing visual and auditory signals to warn the driver and prompt immediate attention. The integration of Arduino Nano allows for real-time processing and responsiveness, ensuring timely intervention to prevent potential accidents caused by drowsy driving. This cost-effective and efficient solution holds immense promise in mitigating the risks associated with driver fatigue, contributing to overall road safety and accident prevention.

II. LITERATURE REVIEW

Recent advancements in computer vision technology have enabled the development of prototype systems for monitoring driver vigilance in real-time. (1) These systems typically utilize video cameras and specialized hardware to acquire and analyse images of the driver's face. The system looks for specific visual behaviours that indicate reduced alertness, like extended eye closure, head nodding, and gaze diversion away from the road. By non-intrusively tracking these behaviours, the system can assess the driver's level of drowsiness and trigger alerts when necessary.(2)

Initial testing of these vigilance monitoring systems has yielded promising accuracy despite diverse conditions. The systems have proven robust when tested on subjects of different ages, genders, ethnicities, and with or without glasses. (3) Furthermore, the systems maintain reliability under varying lighting environments, from daytime to nighttime driving. The successful performance across such a heterogeneous set of drivers and settings highlights the potential of computer vision for generalized driver fatigue detection.

A critical component of any driver monitoring system is the algorithm for detecting and tracking the eyes in real-time video. (4) This eye detection mechanism must operate accurately despite head motion and changes in lighting and driver appearance. Researchers have explored the use of machine learning techniques like support vector machines (SVMs) combined with image feature extraction methods to build robust eye detectors. (5) Recently, a method using SVMs with invariant image moments was proposed for real-time eye tracking. This technique extracts unique patterns from eye images that are invariant to rotation and scale. By training the SVM classifier on these features, the system can reliably detect open, closed, and blinking eyes in diverse conditions.(6)

Before deploying drowsiness detection systems in real-world driving, their accuracy requires thorough validation. Driver fatigue indicators based on eyelid, gaze, and head movements are most reliably validated in controlled simulator studies. (7) However, recent work has focused on evaluating these measures during prolonged highway driving using unobtrusive cameras and sensors. Statistical analysis and classifiers applied to these large naturalistic datasets assess system performance. Though challenging, validation using on-road data will grow increasingly important as driver monitoring technology matures toward real-world implementation.(8)

This paper explores a vision system designed for the surveillance of a driver's facial features. Initially, the driver's face is identified within the input video sequence, followed by continuous tracking across subsequent images. Throughout the face tracking process, facial features, including eyes, mouth, and head, are consistently detected. Notably, feature detection and tracking occur concurrently, thereby enhancing precision. (9)

Engaging in a monotonous environment frequently results in reduced concentration or operator fatigue, which can, in turn, contribute to accidents due to non-vigilance. Consequently, early detection of a fatigued state is imperative in monotonous work settings such as driving vehicles or operating machinery. The onset of fatigue tends to occur gradually, manifesting identifiable symptoms. These diverse symptoms play a crucial role in assessing non-vigilance through various means.(10)

III. PROBLEM STATEMENT

The issue of fatigue is a safety concern that hasn't been fully addressed worldwide due to its challenging nature. Unlike alcohol and drugs, which have clear indicators and tests, fatigue is hard to measure or notice. The best solutions involve creating awareness about accidents caused by fatigue and encouraging drivers to acknowledge when they're tired. However, making people aware of fatigue-related accidents is difficult and costly. Additionally, it's challenging to get drivers to admit fatigue because driving for long hours is very profitable.

IV. PRODUCT SCOPE

Many products measures fatigue in drivers and are used in various vehicles. The driver drowsiness detection system does the same thing but gives better results and extra advantages. It also warns the user when the level of drowsiness reaches a certain threshold.

V. PROPOSED MECHANISM

Developing a robust driver drowsiness detection system relies on the meticulous integration of key components, primarily focusing on eyelid closure. Leveraging facial landmarks, the implementation encompasses the utilization of a facial landmark detector, specifically Dlib, with a pre-trained shape predictor. Essential constants, such as the eye aspect ratio threshold, serve as pivotal parameters for accurate drowsiness assessment.

Within the algorithmic framework, the eye aspect ratio (EAR) is calculated by measuring the ratio between the distances of certain facial landmarks, providing an effective metric for detecting eyelid closure. Subsequently, the system monitors consecutive frames, activating an alert if the computed EAR falls below a predefined threshold for an extended period, indicative of potential drowsiness.

The implementation incorporates real-time video feed processing, utilizing OpenCV for capturing frames and facilitating face detection. The integration of helper functions, especially eye aspect ratio calculation, enhances code modularity and readability. The code concludes with the necessary provisions for displaying the processed video feed and releasing resources upon completion, ensuring the system's operational efficiency. This concise yet comprehensive encapsulates the core functionalities and methodologies of a driver drowsiness detection system grounded in eyelid closure analysis.

VII.PROPOSED WORK

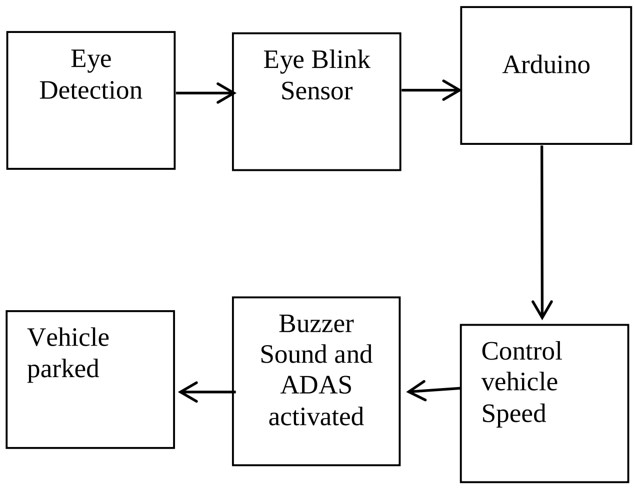

FIG. 1: BLOCK DIAGRAM

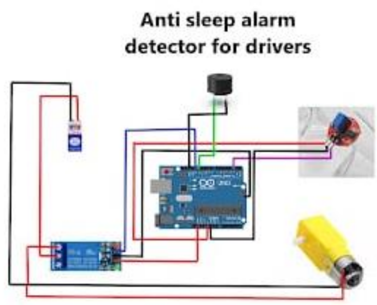

Fig. 2 : Anti-Sleep alarm detector circuit Diagram

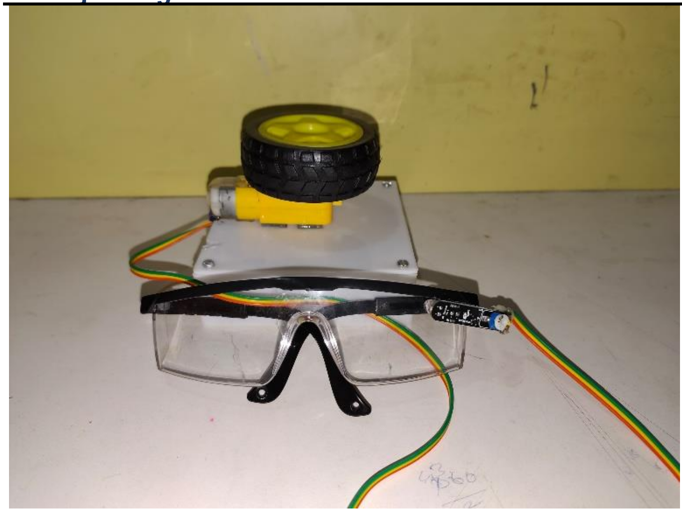

Fig 3 : Prototype

Instead of examining the driver's entire face for sleepiness detection, we focus just on the essential elements, such as eye blinking detection, which is accomplished utilising an eye blink sensor. This comprises data on the frequency, length, and intensity of eye blinks, which may take the form of an electrical signal such as voltage fluctuations or a waveform pattern. These signals can be used to analyse blink patterns.This might be beneficial for different application monitoring, awareness, and so on.
If the delay between eye blinks is compared to the pre-defined delay input. When the delay is greater, it determines that the driver is asleep and sends a signal to the ECU in the automobile, which reduces fuel distribution to the engine and combustion So the car's speed is reduced. If the delay is normal when compared to the specified delay input, the automobile runs smoothly and nothing happens.

This Arduino code recognises an item or person using an infrared (IR) sensor. The system comprises of an infrared sensor, a motor, and a buzzer.

The setup() method sets the pin modes for the motor, buzzer, and IR sensor. The motor is originally switched on.

The loop() function constantly monitors the state of the IR sensor. If the sensor is activated (showing that an item has been spotted), it captures the current time using the millis() method and begins a loop to wait for It will move away. During this period, the buzzer is switched off, but the motor remains operational.
Once the item has moved away and the sensor is no longer activated, the code uses the TimeDelay() method to determine how long it has been since the sensor was triggered. If three seconds have passed, the buzzer is activated to inform the user. If 4 seconds have elapsed, the engine combustion is gradually lowered, and the vehicle is halted by the automated lane detecting system.
The TimeDelay() method determines the time elapsed since the IR sensor was activated and returns the result in seconds.
After reducing the engine speed with the aid of the ADAS lane helping technology, the automobile was automatically parked on the left side of the road

X.CONCLUSION

This research introduces a strong method to tell if drivers are getting too tired and to measure how bad a collision might be. Usually, existing methods use psychology or focus on the vehicle to figure out if a driver is getting drowsy, and they measure the severity of a crash separately. But these approaches can be very invasive and fully engage the physical environment. The new system combines both aspects in one system without being intrusive. It uses a Arduino and a IR Sensor to continuously record facial landmarks, calculate EAR (eye aspect ratio), and check if the driver is drowsy. If the EAR value goes beyond a certain range, indicating open eyes, there's no change. If it falls below the range, the system alerts urgently using an alarm and sends a warning SMS to the owner for extra support.

XI.REFERENCES

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