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Survey Paper on the Driver Drowsiness Detection using IoT

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Abstract: *Traffic accidents caused by drowsy drivers represent a crucial threat to public safety. Recent statistics show that drowsy drivers cause an estimated 15.5% of fatal accidents. With the widespread use of mobile devices and roadside units, these accidents can be significantly prevented using a drowsiness detection solution. This device would be a valuable tool for helping to keep drivers safe on the road. It would be especially beneficial for drivers who are prone to drowsiness, such as long-haul truck drivers or shit workers. The system works by collecting data from the various sensors and using a machine learning algorithm. While several solutions were proposed in the literature, they all fall short of presenting a distributed architecture that can answer the needs of these applications without breaching the driver's privacy.*

Keywords: IOT, Drowsiness detection, Convolutional neural network (CNN), Sensors, Motors, Components

I. INTRODUCTION

Drowsy driving is a major cause of accidents on the road. According to the National Highway Traffic Safety Administration (NHTSA), drowsy driving is responsible for about 100,000 crashes each year, resulting in 700 deaths and 40,000 injuries. A smart safety device for car drivers to detectsleep and alert him by alarm and vibration motor can help to prevent these accidents. The device would use sensors tomonitor the driver's eye movement, head position, and other factors to detect signs of drowsiness. If the device detects that the driver is drowsy, it would sound an alarm or vibrate the driver's seat to alert him. The existing drowsiness detection solution are deployed on centralized that platforms. However due to limitations of these architecture in restricting the cooperations between different entities, they are not necessarily the best for data sensitive real-time applications, especially when it comes to safety critical problems such as drowsiness detection, where early detection can be save individual's lives. Also, centralized platforms require high computational performances, which is expensive and increases with amount of data collected from the real-life environment. Accordingly, distributed architectures have been proposed as an alternative to centralized solutions.

II. METHODOLOGY ADOPTED

IoT Sensors:

They are used for various reasons like data collection, real- time monitoring, driver's detection techniques, adaptability, customized alerts etc. While IoT sensors offer many advantages for driver drowsiness detection, it's important to address challenges like privacy, false alarms, and system calibration to ensure the technology's effectiveness and user acceptance.

Camera and Other Sensors:

Eye blink sensor: An eye blink sensor is a device that detects when a person blinks their eyes. It is typically used in applications such as sleep monitoring and eye tracking.

Fig. 1. Eye Blink Sensor

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ESP32

The ESP32 is a microcontroller that can be used tocontrol a variety of devices, including sensors, motors, and displays. It has Wi-Fi and Bluetooth connectivity, which allowsit to be connected to the internet or to other devices.

Fig. 2. ESP 32

IR sensor

An IR sensor is a device that detects infrared light. It is typically used in applications such as obstacle avoidance and motion detection.

Fig. 3. IR Sensors

Heart beat sensor

A heart beat sensor is a device that detects the electrical activity of the heart. It is typically used inapplications such as fitness tracking and medical monitoring

Fig .4 . Heartbeat Sensors

SpO2 sensor

A SpO2 sensor is a device that measures theamount of oxygen in the blood. It is typically used in applications such as sleep monitoring and medical monitoring.

Fig. 5. SpO2 Sensor

Cloud

The cloud is a term used to describe a network of remote servers that can be accessed over the internet. Cloud computing services can be used to store data, run applications,and process information.

Alert System

The effectiveness of the alert system iscrucial in preventing accidents due to drowsy driving. It ensures that the driver is aware of their drowsy state and takesappropriate action to maintain road safety. The alert system often requires driver acknowledgment. They will be of two types:

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Vibration motor

A vibration motor is a device that vibrates. It is typically used in applications such as hapticfeedback and alarms.

Fig. 6 Vibration Motor

Buzzer

A buzzer is a device that makes a sound. It istypically used in applications such as alarms and notifications

Fig. 7 Buzzer

III. LITERATURE REVIEW

Physiological Signals:

In the paper[3], Physiological data, such as EEG and EOG signals, are used to monitor the driver's brain activity andeye movements. Analyzing these signals helps in understanding the driver's cognitive state.

Wireless Sensor Networks

In the paper[4], Some studies explore the use of wirelesssensor networks for drowsy driving detection. These networks collect data from various sensors placed within the vehicle and communicate the information for analysis

Machine Learning and Deep Learning Approaches

In the paper [4] ,Many studies employ machine learning and deep learning techniques, such as convolutional neural networks (CNNs), recurrent neural networks (INNs), and hybrid models, to process data from cameras, sensors, and other sources for drowsiness detection. These models showpromise in identifying patterns associated with drowsiness.

Ontology-Based Approaches

In the paper[5],A newer area of research involves the use of ontologies to structure knowledge related to driver drowsiness. These on ontologies enable a more structured and semantic representation of the factors contributing to drowsiness.

Real-Time Monitoring

In the paper[6],Many studies focus on real-time monitoringof driver behavior. The ability to detect drowsiness promptly allows for timely interventions, such as alerts oradaptive vehicle control systems.

Text Detection and Recognition:

In the paper [6],Recognizing and analyzing text on the information from road signs and other visual cues is crucial for assessing driver attentiveness. Text detection methods are employed to extract and interpret information from the driver's environment.

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Multi-Modal Data Integration:

In the paper[7], To enhance accuracy, some research on integrates multiple data sources, such as facial expressions, eye movement, and vehicle-related data (e.g.,steering angle). This holistic approach provides a more comprehensive understanding of the driver's state.

Cognitive Load Analysis

In the paper[7],Several papers consider cognitive load analysis alongside drowsi?ness detection, as both factors can impact driver alertness and safety. Cognitive load is often assessed through signals and behavioral cues.

IV. STEP TOWARDS INTERNET OF THINGS(IOT)

There are numerous of accidents which we come across now-a-days, the accidents that takes place sometimes may be the mistake of driver feeling unhealthy. solution for driver drowsiness detection involves several key steps to ensure the successful deployment and operation of the system. IoT (Internet of Things) is used for driver drowsiness detection because it offers several advantages that make it an effective and practical technology for enhancing road safety by addressing the issue of drowsy driving. IoT allows for continuous and real-time monitoring of the driver's condition. Traditional methods, such as visual monitoring by another person, cannot provide round-the-clock surveillance.

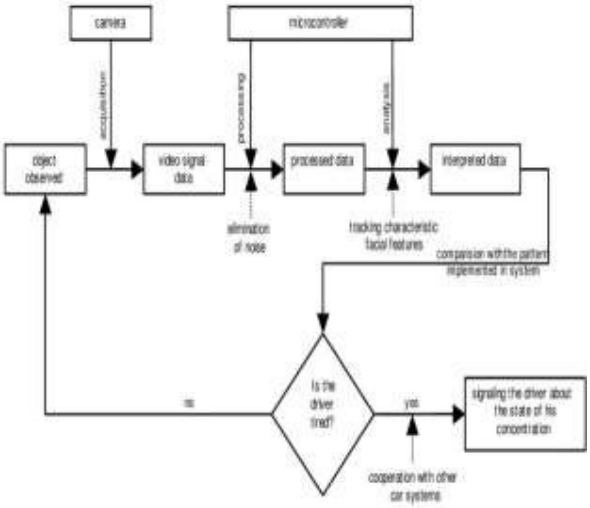

Fig. 8. System Architecture

A) INSIGHT

- Driver drowsiness detection systems using IoT (Internet of Things) can provide valuable insights into driver behaviour, road safety, and the effectiveness of the drowsiness detection system itself.
- These insights can be harnessed for various purposes, including improving road safety policies, enhancing driver behaviour, and refining the technology.
- This could include the time of day, road conditions, weather, and driver-specific factors, such as sleep patterns or medications.
- Insights are essential for reducing accidents caused by drowsy driving and making roads safer for all.

Production of Drowsiness Detection System:

- This device is mainly produced because according to National Safety Council (NSC) drowsy driving causes around 1,00,000 crashes which results in 71,000 injuries and 1,550 fatalities.
- By considering these numbers it's been so risky to avoid road accidents so this system runs real-time to reduce drowsy driving accidents.

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- This system offers 24/7 monitoring and also plays a very beneficial role on long routes.

Problems arising without detection system

- The absence of a drowsiness detection system contributes to a range of safety, economic, and social issues, making it essential to implement technology and policies that address the risks associated with drowsy driving.
- Without a drowsiness detection system, there is limited data available for analysis and understanding the prevalence of drowsy driving, patterns, and contributing factors. This makes it challenging to develop effective countermeasures and policies.

B) Errors

- Driver drowsiness detection systems, while valuable for enhancing road safety, may encounter various errors and challenges that can affect their accuracy and reliability.

TYPES OF ERRORS

- Variability of Driver's behaviour: Drivers exhibit drowsiness differently, and these variations can make it challenging to develop a one-size-fits-all detection system. Some drivers may exhibit signs like heavy eyelids, while others may display erratic steering patterns.
- Adaption to External Factors: The system may need to adapt to external factors, such as the driver's age, health, and medications, which can influence drowsiness patterns.
- Ethical and Legal Challenges: In the event of an accident, there may be ethical and legal questions regarding the system's responsibility and the driver's accountability. This can pose challenges for liability and legal matters.
- Cultural and Behavioural Differences: Cultural differences in driving habits and attitudes towards safety can affect the system's effectiveness in different regions.

V. OBJECTIVES

The project is aimed to develop a device that provides an accurate drivers drowsiness:
To develop a smart safety device for car drivers that can detect sleep and alert them by alarm and vibration motor. The device will use a combination of sensors, such as an eye-tracking sensor and a heartbeat sensor, to detect signs of drowsiness.
If the device detects that the driver is drowsy, it will sound an alarm and vibrate the motor to alert the driver. The device will also be able to send an alert to a designated emergency contact if the driver falls asleep.

VI. CONCLUSION

In this Project, various algorithms were experimented to implement Driver Drowsiness Detection. The Aim of this work is to focus on minimizing the number of road accidents caused every year. The purpose behind using IoT (Internet of Things) technology is a significant advancement in the field of road safety. This innovative system leverages IoT sensors, data analysis, and real-time monitoring to identify signs of driver drowsiness and provide timely alerts, ultimately reducing the risk of accidents caused by fatigue. The advantages of IoT-based drowsiness detection systems include early warnings, customization, and integration with alerting mechanisms, making them a valuable tool in enhancing road safety.

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