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Sleep Detection System for Driver

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Abstract: *India is a fast paced developing country in world. The number of vehicles in the country has increased over the last decade as the population rises. Though road networks have improved, the increased vehicle population has also increased safety concerns. It is a very popular quote that "Our health is more important than wealth." Road safety is a major public health concern, and attention needs to pay for road safety measures. Drowsiness while driving causing vehicle accidents is one of major issue for which we need to pay attention towards it. Drowsiness caused by fatigue driving is becoming more common thing this days. Our project is primarily concerned with road accidents that occur when people are sleepy or half asleep or drowsy while driving The project employs an infrared sensor to determine whether a person is drowsy or not based on whether their eyes are closed or open. When the driver's eyes are closed for more than 3 seconds, then it detects driver as sleepy and alerts the driver via alarming sound like beep sound or "The driver is sleepy" voice. Accidents can occur as a result of lack of concentration, which is controlled and prevented by the alarm. The main goal of this purposed design project is to detect sleepiness of drivers in order to prevent major accidents and improve highway safety. Here in our design, we have used Arduino nano technology to detecting driver drowsiness/sleepiness. All of this is done with help goggle where system is fitted in order to work. The goal is to make drivers safer and reduce the fatalities caused by drowsy driving.*

Keywords: Sleep, Drowsiness, Arduino, Accident, Vehicle, Driver

I. INTRODUCTION

Every year, around 1.5 million people are dying in vehicle accidents, which is one of the leading cause of death. The majority of these accidents are caused by drunk and drive, distractions or driver drowsiness. The recent construction of high-speed, high-quality highway roads had reduced the driver's margin of error. Every day and night, many people travel long distances on the highway roads. A lack of sleep or distractions such as a phone call, talking with a passenger, and so on may result into a major accident where people may loss their lives. In recent years, driver fatigue has been one of the main reason of vehicle accidents around the world. According to the National Highway Traffic Safety Administration (NHTSA), approximately 100,000 people lost their lives in car accidents caused by drowsy drivers. Drivers' attention levels deteriorate as a result of insufficient sleep, long periods of continuous driving like goods carrier truck drivers or tourist drivers, or any other medical condition such as brain disorders, among others. When a driver drives for more than actual normal for a person, it increses fatigue level as well as tiredness, which causes the driver to fall asleep or lose consciousness. Drowsiness is a multifaceted occurrence characterized by a reduction in the driver's levels of attentiveness and awareness. At the moment there is no way to measure or detect drowsiness level, To avoid such vehicle accidents, we propose a system that alerts the driver. So, we have created a goggles that detects a person's sleep and alerts him with a buzzer alarm. The objective of this project is to develop a prototype for a system that can detect drowsiness. Detecting thedriver's drowsiness is important in order to save lives and avoid accidents on today's roads.

1.1 Need for the System

The Driver Sleep Detection System is a safety technology integrated into goggles that serves to prevent accidents resulting from drowsy driving. According to various studies, fatigue is responsible for about 20% of all road accidents. Hence, there is a need for a new system.

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1.2 Detailed Problem Definition

Drowsy driving is a huge issue. Drowsy driving poses a significant problem as individuals are often unaware of when sleep overtakes them. This hampers the driver's capacity to maintain focus on the road and make rational judgments. According to the National Highway Traffic Safety Administration, drowsy driving has resulted in approximately 100,000 traffic accidents, leading to over 1,500 fatalities and more than 70,000 injuries. Fatigue also plays a prominent role as a contributing factor in car accidents.

1.3 Objective

- The primary objective of this project is to detect drowsiness during driving and timely alert the driver to prevent any accidents. The project utilizes an infrared sensor to determine the drowsiness level by detecting whether the driver's eyes are closed or open.
- The overarching aim of the project is to enhance driver safety and minimize the occurrence of fatalities resulting from drowsy driving.

1.4 Scope:

- Record the steering behaviour of individual drivers when they are drowsy.
- To validate the algorithm, conduct supplementary simulator experiments encompassing a wider range of road
- conditions and a diverse pool of drivers.
- Utilize on-road test data to evaluate, refine, and fine-tune the algorithm. Additionally, conduct research on
- integrating warning systems with the detection system.
- Its purpose is to mitigate road accidents and enhance road safety.

1.5 Principle Components Requirement

1. Arduino Nano
2. IR Sensor
3. 3V Battery
4. Switch
5. Goggles
6. Buzzer

II. LITERATURE REVIEW

There are not many technologies to prevent accident due to drowsiness of driver of vehicle. Recently there is one technology which is being used in many cars which is made to prevent accident due to drowsiness by detecting through camera but there are certain discrepancies in that system such as following:

Limited visibility:

Cameras rely on clear visibility of the driver's face to detect signs of drowsiness accurately. However, visibility can be compromised in low lighting. Camera needs some amount of light to detect driver’s face. If driver is driving at night on low or no lightings on road then camera could not detect eyes properly due to lack of lighting on face. These can reduce the effectiveness of camera-based sleep detection systems. According to studies , chances of driver’s drowsiness at night are high. Hence this camera system may fail avoid accidents in such conditions.

Camera Positioning:

The positioning of the camera plays a crucial role in detecting facial and eye movements accurately. If the camera is poorly positioned or obstructed by other objects within the vehicle such as if camera placed behind steering wheel, it may not have a clear view of the driver's face. Additionally, if the driver's head or face is partially or completely occluded by other objects or passengers behind, the camera may fail to capture essential cues. If camera is placed slightly above and behind steering wheel level, still it may block some part of driver’s front vision while driving. For

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driver while driving it is essential to have clear view of front viewwithout any obstructions. If camera is placed at some side angle view between door and front screen at specific height , still it may not able to detect eyes of driver perfectly due to uneven view of perspective will happen because of angle of camera which might give wrong alerts.

III. ASSEMBLY OF PROJECT

The objective of this research paper is to detect drowsiness during driving and timely alert the driver to prevent any potential accidents. To achieve this, an alarm system was employed as a safety measure. An infrared sensor was utilized, along with separate LEDs connected through insulated copper wire. The sensor was positioned in front of the eyes, while the module was attached to the glasses' handle. Holes were drilled in the glasses to accommodate the fittings for the photodiode and IR sensor, which were secured using soldering wire. The necessary code was then implemented on Arduino to facilitate the functioning of the system. Additionally, a 3.8 V battery is installed along with an IR sensor module, which is affixed to the system. As a result, this innovative road safety project is now fully operational. When the driver's eyes remain closed for a duration exceeding 5 seconds, the system detects drowsiness and promptly activates an alarm using a buzzer, continuing to sound until the person is awakened. By effectively controlling and preventing drowsiness-induced accidents, the buzzer plays a crucial role in ensuring road safety.

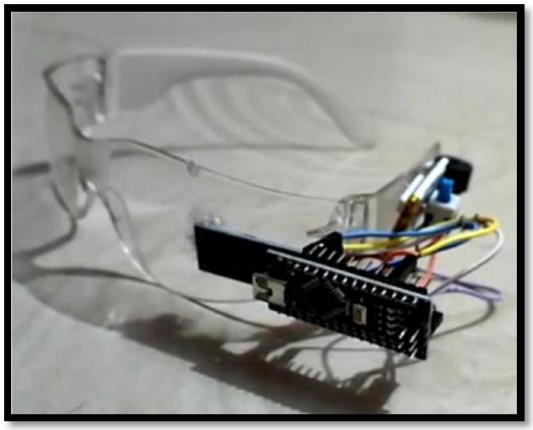

Fig. 1. Assembly of Module

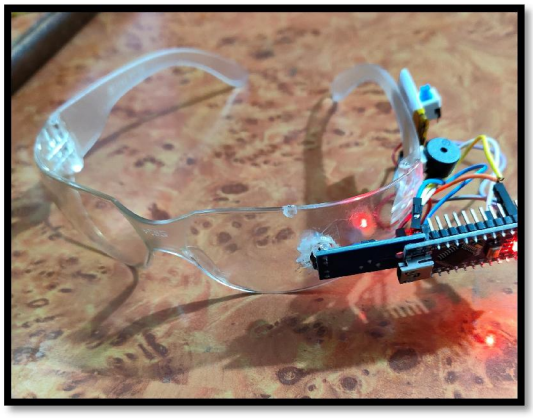

Fig.1. Working Module

IV. METHODOLOGY

In this project, various components are utilized, including an IR sensor, LEDs, Arduino Nano, Buzzer, and a 3.8 V battery. These components are interconnected in the following manner:

- The IR sensor's first pin (out) is connected to Arduino Nano's A0 pin.
- The second pin (GND) of the IR sensor is connected to the GND of the Arduino.

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- The third pin (VCC) of the IR sensor is connected to the 5V pin of the Arduino Nano.
- The Arduino Nano's VIN pin (Voltage input) is connected to the positive terminal of the battery, while the GND
- pin is connected to the battery's negative terminal.
- The positive pin of the buzzer is connected to Arduino Nano's D13 pin, and the negative pin is connected to
- the GND of the Arduino Nano and the battery.
- The LEDs are extended in front of the glasses.

The innovative goggles in this project are designed to detect signs of sleepiness in a person and promptly alert them using an alarm triggered by the buzzer. If the person operating a car or bike feels drowsy and is unable to control themselves, and if their eyes remain closed for more than 5 seconds, the IR sensor detects this condition and activates the buzzer to continuously sound the alarm until the person wakes up. Once awakened, the person can stop the buzzer by pressing the button on the Arduino Nano.

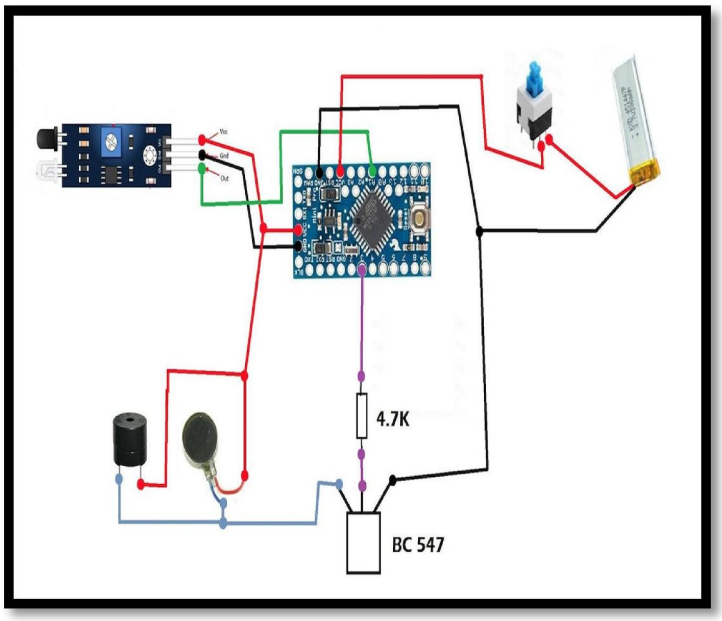

Fig. 3. Circuit Diagram

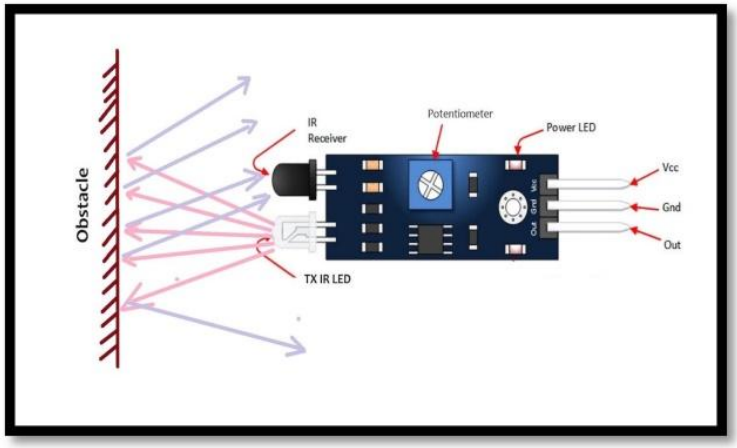

Fig. 4. IR Sensor Working

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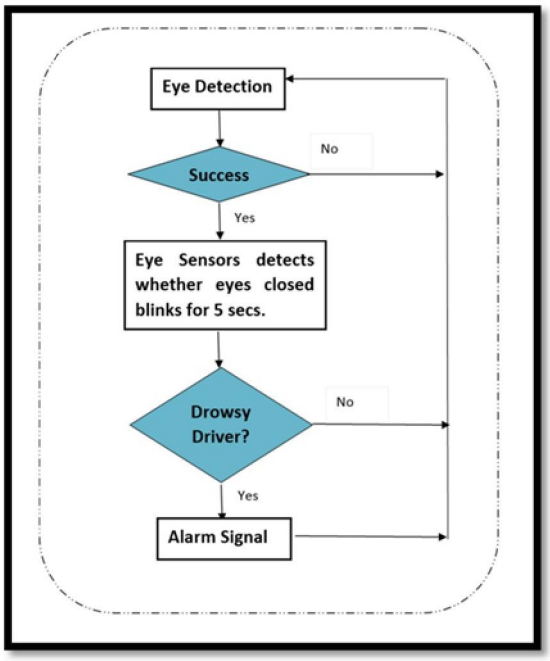

Fig. 5. Flow Chart of System

V. CONCLUSION

In conclusion, the development of a sleep detection system for drivers holds significant promise in addressing the issue of drowsy driving and enhancing road safety. This research paper has presented an innovative approach to detect driver drowsiness using an infrared sensor integrated into a pair of goggles. The system effectively alerts the driver when their eyes are closed for an extended period, indicating potential drowsiness.

Through the implementation of this sleep detection system, the aim was to make drivers safer and reduce the number of fatalities caused by drowsy driving. By providing timely alerts to drowsy drivers, the system contributes to preventing accidents that could otherwise result from inattentiveness or falling asleep at the wheel.

The project has outlined the need for such a system, considering the alarming statistics of accidents caused by drowsy driving. Driver fatigue has been identified as a leading cause of accidents globally, making it crucial to develop effective solutions to mitigate this risk. The sleep detection system offers a proactive approach to address this issue, enabling drivers to take corrective actions and ensure their safety on the roads.

The scope of the project has been defined, focusing on capturing individual drivers' drowsy steering activity. Additionally, the system can be further expanded by conducting additional simulator experiments, refining the algorithm through on-road testing, and integrating warning systems with the detection system. These future prospects open avenues for continued research and development to enhance the accuracy and effectiveness of the sleep detection system.

VI. FUTURE SCOPE

The sleep detection system for drivers presented in this research paper lays the foundation for further advancements and expansion in the field of drowsiness detection and road safety. The following future scope outlines potential areas of development and improvement:

- **Integration of Advanced Technologies**: Incorporating advanced technologies such as machine learning, deep learning, and artificial intelligence can enhance the accuracy and reliability of the sleep detection system. These techniques can enable the system to learn and adapt to individual drivers' patterns, improving its ability to detect drowsiness accurately.
- **Data Analysis and Pattern Recognition**: Implementing advanced data analysis techniques to identify patterns and trends related to drowsiness can provide valuable insights. By analysing data from multiple drivers over

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extended periods, it becomes possible to identify common risk factors and develop preventive measures accordingly.

- **Integration with Vehicle Systems**: Integrating the sleep detection system with existing vehicle systems, such as adaptive cruise control or lane departure warning systems, can create a comprehensive driver assistance package. This integration can enable automated responses to drowsiness detection, such as adjusting vehicle speed, activating safety features, or even suggesting suitable rest stops.
- **Mobile Applications and Cloud-Based Systems**: Developing mobile applications or cloud-based systems can extend the reach and accessibility of the sleep detection technology beyond specific vehicles. This would allow drivers to utilize the system across different vehicles or even share drowsiness data with relevant authorities, further contributing to road safety on a broader scale.
- **Long-Term Monitoring and Driver Profiling**: Expanding the system to enable long-term monitoring and driver profiling can provide valuable data for research and analysis. By collecting and analysing data on driver drowsiness patterns over extended periods, it becomes possible to identify factors that contribute to chronic drowsiness and implement targeted interventions.
- **Collaboration with Automotive Industry**: Collaborating with automotive manufacturers and industry stakeholders can accelerate the integration of sleep detection systems into new vehicles. Such partnerships can ensure that the technology is incorporated into the design and manufacturing processes, making it readily available to a wider range of drivers.
- **Public Awareness and Education**: Emphasizing the importance of driver alertness and promoting public awareness about the risks of drowsy driving is crucial. Future efforts should focus on educating drivers, policymakers, and the general public about the benefits and significance of sleep detection systems, ultimately fostering a culture of responsible driving.

By pursuing these future scope avenues, sleep detection systems for drivers can continually evolve, becoming more sophisticated, accurate, and widespread. These advancements have the potential to significantly reduce accidents caused by drowsiness, enhance road safety, and save countless lives.

VII. ACKNOWLEDGEMENT

Perseverance, Inspiration, and Motivation have always been important factors in the success of any endeavour. It is difficult to understand the wide spectrum of knowledge at this level of understanding without proper guidance and advice, so we take this opportunity to express our heartfelt gratitude to our respected Project Guide, Dr.Minesh Ade, who as a guide evolved an interest in us to work and select an entirely new idea for project work. He has been extremely cooperative and helpful in resolving all of our problems. I would also like to thank my institution, my friends, and my faculty members, without whom this project would have been a distant reality.

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