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Anti - Sleep Alarm for Bus Driver

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A B S T R A C T

The World Health Organization (WHO) has predicted that about 2 million people will die in traffic accidents over the next 15 years. Due to this alarming forecast, researchers are intensifying their efforts to discover effective strategies to prevent traffic accidents and minimize fatalities. This project specifically targets the reduction of car crashes caused by driver fatigue or sleepiness, which is a significant factor in many road accidents.

To address this issue, we have developed an innovative solution: a customized goggle equipped with a microcontroller-based anti-sleep alert system designed for drivers. This device incorporates an infrared sensor to detect the presence of obstacles. Upon detection, the sensor sends a signal to an Arduino microcontroller, which then activates a buzzer. This alert mechanism is intended to immediately warn the driver, thereby reducing the risk of accidents caused by drowsiness. Moreover, the versatility of this device extends beyond its primary function. It can also serve as a communication tool for individuals with physical paralysis, enabling them to interact more effectively with those around them. Security personnel working at night might find it beneficial for maintaining alertness, and it has potential applications in medical settings, such as for patients in comas, to facilitate non-verbal communication or signal distress. This multifunctional device not only contributes to enhancing road safety by preventing accidents due to driver fatigue but also offers broader applications that can improve quality of life and safety for various user groups.

Keywords: Eye sensor, microcontroller, Arduino

1. Introduction

The Royal Society for the Prevention of Accidents (RoSPA) reports that every year, around 1.3 million people around the world lose their lives in road accidents. That's about 3,287 people dying every day, with another 20 to 50 million suffering injuries or becoming disabled because of these accidents. A lot of these tragic incidents happen because drivers get tired or dizzy while driving.

To tackle this issue, there are gadgets known as anti-sleep alarms that can really make a difference. Broadly, these alarms come in two flavors. Some are built into cars, using a mix of sensors, cameras, and other smart technology to figure out when a driver is getting sleepy and respond to keep them awake. The other type is a more personal device that the driver wears, usually around the ear, which wakes them up if it senses they're nodding off.

In our research, we're introducing a new kind of anti-sleep alarm that's not only easy to use but also very affordable compared to the options currently available in the market. We've created our device with an eye sensor and an Arduino (esp8366) at its core. The eye sensor works by sending out a lot of infrared (IR) rays when the driver's eyes are open and significantly fewer when they're closed. This change in IR rays can be turned into a voltage signal. Our device picks up on this voltage change to figure out if the driver's eyes are open or closed. If the eyes are closed, it sets off a buzzer to wake the driver up.

Throughout the rest of this paper, we'll dive into the nuts and bolts of our device, including the hardware we used, how we set up the circuit, the principles behind how it works, and the results we got from testing it. We'll wrap up with our conclusions and some thoughts on how this technology could be improved and used in the future.

Hardware Requirements

For our Anti-Sleep Alarm System designed specifically for bus drivers, we have integrated three essential hardware components to ensure its effectiveness and reliability:

a. **Infrared LED Sensor:** Illustrated in Figure 1, the infrared LED sensor plays a pivotal role in our system. This sophisticated electronic device is capable of sensing various characteristics of its environment. It achieves this by emitting or detecting infrared radiation. The sensor's design and functionality are crucial for the experimental setup, enabling us to accurately assess driver alertness through eye movement and blink

patterns. Our system utilizes both the latest sensing techniques and statistical methods to analyze data, ensuring that our findings are robust and up to date.

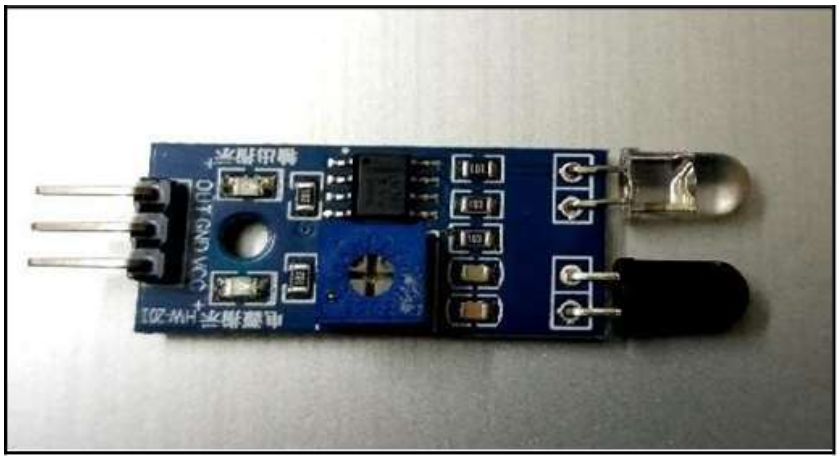


Fig 1: Eye Sensor

b. **Microcontroller (ESP8266):** Featured in Figure 2, the ESP8266 microcontroller is at the heart of our anti-sleep alarm. This open-source platform is incredibly versatile, allowing for the creation of a wide range of electronic gadgets. It encompasses a programmable circuit board that can be easily customized to meet our specific requirements. Together with the Arduino Integrated Development Environment (IDE), which facilitates the writing and uploading of code, this microcontroller enables the sophisticated processing and response actions necessary for our alarm system to function effectively.

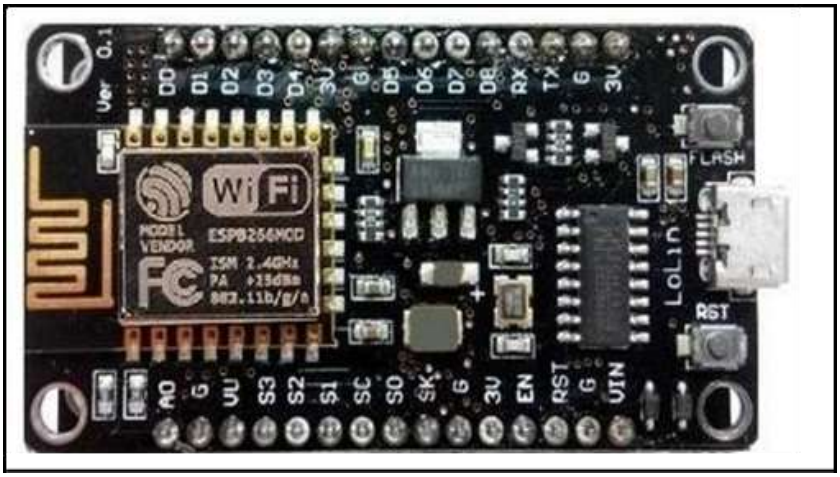


Fig 2: Arduino (esp8266)

c. Goggles: Depicted in Figure 3, the goggles are not just a frame for holding the eye sensor but a comprehensive platform that integrates the sensor, Arduino (ESP8266 microcontroller), and battery into a single, wearable device. This design ensures that the system is both user-friendly and efficient, allowing for continuous monitoring of the driver's alertness levels without causing discomfort or distraction. The inclusion of the goggles makes our anti-sleep alarm system uniquely portable and practical for real-world application.

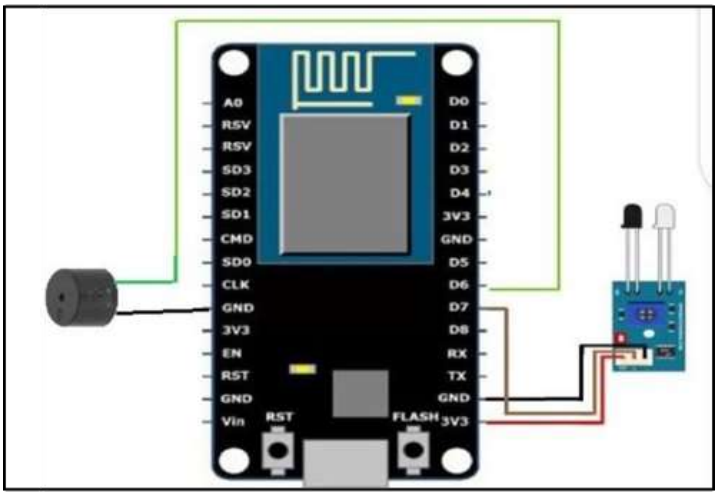
Fig 3: Goggles

Together, these components form a cutting-edge solution aimed at enhancing road safety by preventing accidents caused by driver fatigue. By leveraging advanced sensor technology, programmable microcontrollers, and ergonomic design, we are able to offer an innovative and practical tool that can significantly reduce the risk of fatigue-related incidents on the road.

Pin diagram and Connections

To set up our anti-sleep alarm system, we carefully connect the eye sensor and buzzer to the Arduino, ensuring each component communicates effectively for optimal performance. Figure 4 shows pin diagram and here's a simplified explanation of how we connect everything together:

Fig 4: Pin Diagram



a. Connecting the Eye Sensor to the Arduino:

- The eye sensor's ground (GND) pin is linked to the Arduino's GND pin, establishing a common ground between the two devices.
- Interestingly, we connect the eye sensor's 5V power pin to the Arduino's 3.3V pin. This step is crucial for powering the sensor with the appropriate voltage level supplied by the Arduino.
- The eye sensor's output pin, which sends the signal indicating whether the driver's eyes are open or closed, is connected to the Arduino's digital pin D7. This setup allows the Arduino to receive and process the sensor's data.

Table 1 - Connection between eye sensor and Arduino.

Eye Sensor	Microcontroller
1. Vcc	1. Vcc
2. Gnd	2. Gnd
3. Output	3. D 7

b. Connecting the Buzzer:

- The buzzer's first pin is connected to the Arduino's GND pin. This establishes a return path for the electrical current.
- The second pin of the buzzer, which is responsible for activating the buzzer's sound alert, is connected to another digital pin on the Arduino, D6. This connection enables the Arduino to control the buzzer, sounding an alarm when necessary based on the eye sensor's data.

Table 2 - Connection between buzzer and arduino

Buzzer	Microcontroller
1.pin 1	Gnd
2.pin 2	D6

c. Powering the System:

- We ensure the system is adequately powered by connecting the positive pin of the battery to the Arduino's Vin (Voltage input) pin. This supplies the necessary power to the Arduino.

- The battery's negative pin is connected to the Arduino's GND pin, completing the circuit and providing a stable power source for the system to operate.

Table 3 - connection between battery and arduino.

Battery	Microcontroller
1.(+) ve	Vin
2. (-) ve	Gnd

2. Working Principals

Our anti-sleep alarm system is designed to monitor the driver's eye blinking rate, which is typically around 20 blinks per minute under normal conditions. This natural blinking rate does not impact the system's functionality, ensuring that drivers are not unnecessarily alarmed during regular driving. Below in working principal in simple terms:

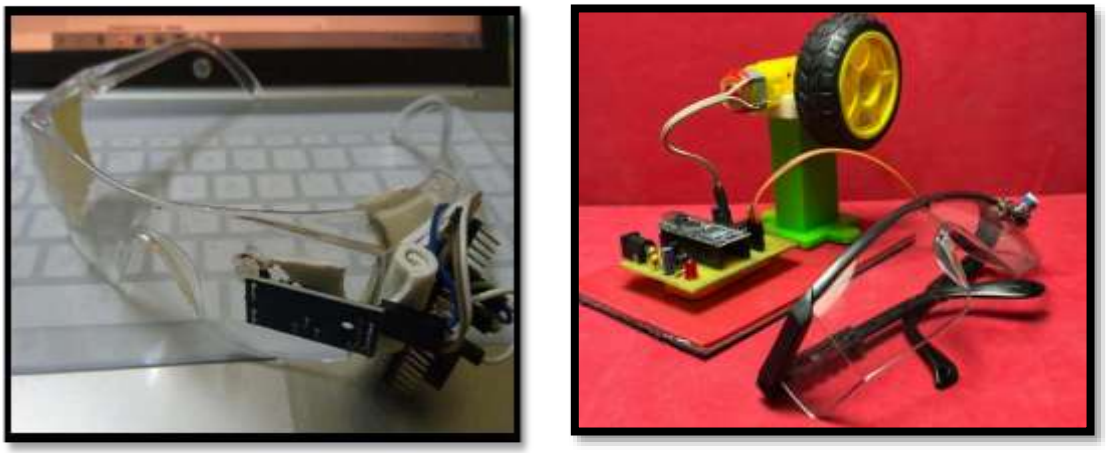


Fig 5: circuit using microcontroller

a. Monitoring Eye Blink Rate:

- The system uses an infrared (IR) sensor, which includes both an IR transmitter and an IR receiver. The transmitter sends out infrared rays directed towards the driver's eye, while the receiver detects these rays as they are reflected back.
- Normally, when the driver's eyes are open, a lot of light reflects off the eye, and the IR receiver picks this up, producing a high output signal.

b. Detecting Sleepiness:

- If the driver starts to fall asleep, their eyes will close. Since the skin part of the eye is opaque, less light is reflected back to the IR receiver when the eyes are closed. This situation leads to a maximum output voltage from the sensor, indicating that the eyes are closed.
- Upon detecting a closed eye condition, the microcontroller starts a timer. If it notes that the eyes remain closed for more than 3 seconds, this is interpreted as a potential sleepiness or unconsciousness state.

c. Activating the Alarm:

- When the system confirms that the driver's eyes have been closed for longer than 3 seconds, the microcontroller activates a buzzer. This alarm serves as an immediate alert, aiming to wake the driver or notify them to take a break if they're feeling drowsy.

This setup ensures that the system is sensitive to the natural blinking process while also being capable of detecting when a blink rate deviates from the norm due to sleepiness or unconsciousness. By monitoring the reflection of infrared rays and utilizing a logic circuit to process these signals, the anti-sleep alarm provides a critical safety feature that can determine the difference between normal blinking and prolonged eye closure. This technology is especially valuable for long-haul drivers, potentially reducing the risk of accidents caused by drowsiness behind the wheel.

3. Conclusion and Future Scope

Our anti-sleep alarm system is designed with the crucial goal of reducing and potentially preventing traffic accidents caused by driver drowsiness and fatigue. By alerting drivers when it detects signs of sleepiness, this device serves as an affordable solution to keep drivers awake and focused on the road. The impact of such a system on society could be significant, potentially saving lives by lowering the number of accidents due to fatigue.

Looking ahead, we see several exciting opportunities to enhance our device:

a. **Integration of a Micro Camera:** In the future, we plan to replace the current eye sensor with a small, sophisticated micro camera. This upgrade will enable more precise monitoring and analysis of the driver's state of alertness by capturing detailed visual cues that indicate drowsiness.

b. **Adding a GPS Module:** We also intend to incorporate a GPS module into our device. This addition will not only track the location of the vehicle but could also provide valuable data for monitoring driving patterns and identifying areas where drivers are more prone to fatigue, further contributing to road safety.

c. **Affordable Pricing and Marketing:** Recognizing the importance of accessibility, we are committed to keeping the price of our anti-sleep alarm system affordable. This approach will ensure that our life-saving technology is accessible to a wide range of drivers and fleet operators. We have plans to market this innovative product more aggressively in the future, aiming to make it a standard safety feature in vehicles.

In conclusion, our anti-sleep alarm system stands as a testament to our commitment to enhancing road safety through innovative technology. As we move forward, we are excited about the potential improvements and the broader adoption of our system, driving us towards a future with fewer accidents caused by driver drowsiness.

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