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Anti Sleep Alarm For Drivers Using Arduino

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ABSTRACT

An Anti-Sleep Alert System is a safety device made to prevent accidents caused by drowsiness, especially while driving. Many road accidents happen because drivers feel sleepy and lose focus. This system helps to detect when a person is getting tired and gives a warning to wake them up. The system works by monitoring signs of sleep, such as eye blinking, eye closure, or head movement. It uses sensors to observe the driver's face. If the system notices that the driver's eyes are closed for too long or the head is nodding repeatedly, it understands that the driver may be falling asleep. When drowsiness is detected, the system immediately gives an alert. The alert can be a loud buzzer sound, This helps the driver become alert again and avoid possible accidents.

Keyword: Driver drowsiness detection, Arduino, IR eye blink sensor, embedded system, road safety.

1. INTRODUCTION

Road accidents became a matter of concern due to the huge increase in traffic. The primary cause of accidents is due to the drowsiness of drivers in the night time. Fatigue and drowsiness are some of the leading causes of major accidents on Highways. The only solution to this problem is detecting the drowsiness and alerting the driver. So, in this project, we have thought of building a Driver Drowsiness Detection and Alerting System for Drivers using Arduino Nano, Eye blink Sensor.

1.1 Objectives

- **To detect driver drowsiness**
  The main objective is to identify signs of sleepiness such as long eye closure, frequent blinking, or head nodding.
- **To prevent road accidents**
  The system aims to reduce accidents caused by drivers falling asleep while driving.
- **To provide immediate alerts**
  It gives warning signals like a buzzer sound, vibration, or voice alert when drowsiness is detected.

1.2 Scope of study

[1] The scope of the Anti-Sleep Alert System study is to design and develop a system that can detect when a driver feels sleepy. It focuses on monitoring signs like eye blinking and head movement.

[2] The study includes using sensors or cameras to identify drowsiness. It also involves creating an alert system to warn the driver. The main goal is to reduce accidents and improve road safety.

1.3 Literature Review

Many researchers have studied sleep alert systems because driver drowsiness is one of the main causes of road accidents. Studies show that when drivers are tired, their attention and reaction time decrease, which increases the risk of crashes. Early systems were simple and used alarms based on steering movement or vehicle behavior. Later, sensor-based systems were developed to monitor eye blinking and eye closure. Camera-based systems became more common, using image processing to detect facial features, yawning, and head movement. Some advanced systems use infrared cameras for night detection and artificial intelligence to improve accuracy. A few studies also explored heart rate and brain signals to detect fatigue, but these methods can be expensive and complex. Overall, research shows that sleep alert systems are effective in improving driver safety and reducing accidents caused by drowsiness. Early research focused on vehicle-based systems that monitored steering wheel movement, lane position, and speed variation. If the driving pattern became abnormal, the system assumed the

driver was tired and gave an alarm. However, these systems were sometimes inaccurate because road conditions could also affect vehicle movement.

2. PROPOSED SYSTEM

The proposed system consists of an IR eye blink sensor, Arduino UNO, buzzer and LED indicator. The sensor is positioned near the eye of the driver. The Arduino continuously monitors sensor output and activates the alarm when drowsiness is detected.

2.1. System Architecture

The block diagram and circuit diagram represent the interconnection of hardware components. The sensor output is connected to a digital pin of the Arduino. The buzzer and motor are connected to output pins through suitable current limiting resistors. The anti-sleep alert system block diagram explains how the system detects driver drowsiness and prevents accidents. When the system starts, the IR eye sensor continuously monitors the driver's eyes to check whether they are open or closed.

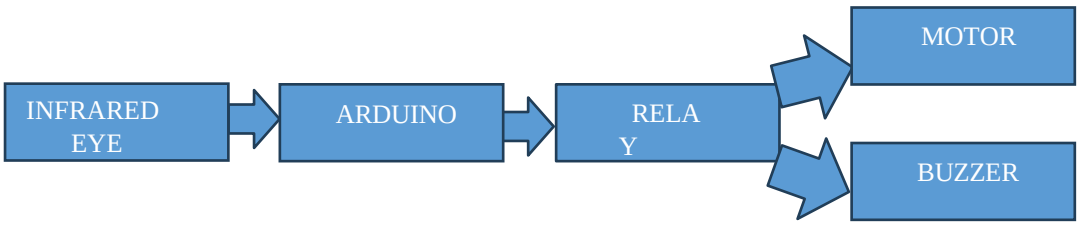

Fig-1: Block Diagram of Anti Sleep Alarm for Driver Using Driver.

2.2 Working Principle

This block diagram shows how an anti-sleep alert system works using an IR eye sensor. First, the system starts and the IR eye sensor begins checking the driver's eyes. The sensor detects whether the eyes are open or closed. If the eyes are open, the motor stays ON and the buzzer remains OFF, which means everything is normal. If the sensor detects that the eyes are closed the motor turns OFF and the buzzer turns ON to alert the driver. The alarm sound helps wake up the driver and prevent accidents. After this process, the system continues monitoring or ends as shown in the diagram. The system keeps monitoring the eyes continuously. If the sensor detects that the eyes are closed, it assumes the driver may be feeling sleepy. This situation can be dangerous while driving. So, the system takes action immediately. When the eyes are closed, the motor turns OFF. This can slow down or stop the vehicle, depending on the design. At the same time, the buzzer turns ON. The buzzer produces a loud sound to alert the driver. The sound helps to wake the driver up quickly. This warning reduces the risk of accidents. The system works automatically without human control. It continuously checks the eye status again and again. The process repeats as long as the system is powered.

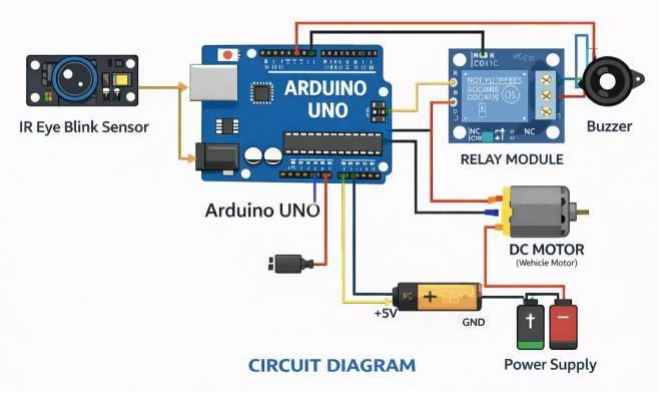

Fig-2: Circuit Diagram

2.3 Hardware and Software Requirements

Table-1: Components with Specifications

Components	Specifications	Quantity
Arduino UNO Board	ATmega328P microcontroller, 5 V operating voltage, 14 digital I/O pins, 6 analog input pins	1
IR Eye Blink Sensor Module	Infrared based eye-blink / eye- closure detection module, digital output (HIGH/LOW), 3.3 V–5 V supply	1
Relay Module	5 V single-channel relay module, opto-isolated, supports AC/DC load switching	1
Buzzer	5 V active piezo buzzer	1
DC Motor	6 V–12 V DC motor used to represent vehicle motor/load	1
Resistor	220 Ω resistor for LED current limiting	1
Jumper Wires	Male-to-male connecting wires	8-10
USB Cable	USB cable for programming and powering Arduino	1
Power Supply (optional)	5 V external supply or power bank (for standalone operation)	1
Arduino IDE	Used to write, compile and upload the program to the Arduino board	1 (Installed)

A. Arduino Nano

Fig-3 Arduino Nano

The Arduino Nano is a small, complete, and breadboard-friendly board based on the ATmega328 (Arduino Nano 3.x). It has more or less the same functionality of the Arduino, but in a different package. It lacks only a DC power jack, and works with a Mini-B USB cable instead of a standard one.

B. Infrared Eye Sensor with Glasses

Fig-4 Infrared Eye Sensor with Glasses

This Eye Blink sensor senses the eye blink using infrared. The Variation Across the eye will vary as per eye blink. If the eye is closed the output is high otherwise the output is low.

☆Feature and Specification:

EYE BLINK indication by LED
Instant output digital signal for directly Connecting to the microcontroller Compact Size
Working
Voltage
+5V DC

TTL output 5V or 0V use for digital Eye Blink monitor use for Vehicle Accident prevention. Suite for real-time driving applications. On-board 3-pin header

A. Buzzer

Fig-5 Buzzer

Input Voltage(Max.) : 12V Resistance: 120KΩ to 300MΩ Resonance Frequency: 2048 Hz
Sound pressure(dB(A)/10cm)min.: 80
Body Size : 12 x 9.5mm, External
Material: Plastic(Black) Pin Pitch: 6mm

B. Relay Module

Fig-6 Relay Module

☆ **Specification and Features :-**

》1 channel relay board
》Operating Voltage 5V
》Max Current : 20mA
》Relay Contact Current Capacity at AC250V: 10A
》Relay Contact Current Capacity at DC5V: 10A
》One normally closed contact and one normally open contact
》Triode drive, increasing relay coil
》High impedance controller pin
》Pull-down circuit for avoidance of malfunction
》Power supply indicator lamp
》Control indicator lamp
》Indicator for Relay output status
》Can Be controlled various appliances & other Equipment With Large current.
》Standard TTL Level logic controlled (AVR, Arduino, 8051, PIC, ARM)

C. **DC Motor**

Fig-7 DC Motor

Specifications of 150 RPM Single Shaft BO Motor - Straight:- Shaft length: 7 mm Shaft Diameter: 5.5 mm Size: 55 x 48 x 23 mm. Operating Voltage: 3 to 12V. Current (without loading): 40-180mA. RPM: 150 rpm. Output Torque: 0.8 kg cm.

2.3 Algorithm

[1] Start
[2] Initialize Arduino
[3] Read sensor values
[4] If eyes closed: Turn ON buzzer and OFF motor
[5] Else: Buzzer OFF and motor ON
[6] Repeat continuously

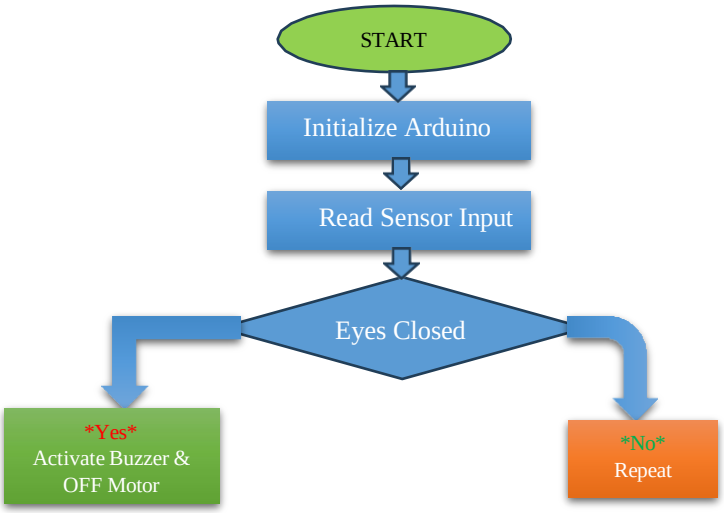

Fig-8 Flowchart

2. RESULTS & DISCUSSION

The prototype successfully detected prolonged eye closure and generated an alarm. The system response was fast and reliable under normal lighting conditions. The results demonstrate the feasibility of the proposed system for basic driver safety assistance The proposed anti-sleep alarm system successfully detected prolonged eye closure and activated the buzzer and OFF motor when the eye closed duration exceeded the predefined threshold. The system showed reliable operation for multiple test cases and provided immediate warning to the driver, thereby improving driving safety.

Table-2: Result Table

Eye Condition	Sensor Output	Buzzer Status	Motor Status	Remark
Eyes Open	HIGH	OFF	ON	Driver alert
Eyes Closed	LOW	ON	OFF	Drowsiness detected
Eyes Reopened after alarm	HIGH	OFF	ON	Driver Alerted System reset
Repeated eye closure	LOW	ON	OFF	Working properly

2.1 Applications

The system can be used in cars, buses, trucks and long-distance transportation vehicles. It can also be used in driver training and monitoring systems.

2.2 Advantages

[1] Avoid Accident While Driving.
[2] This sensor is Not Affected Due to Atmospheric Dust or Snow.
[3] It can Work in any Adverse Condition.
[4] It has Good enough Sensitivity.

2.3 Limitations

[1] Not 100% reliable
[2] Needs regular maintenance.
[3] Affected by lighting conditions.
[4] Sunglasses may block detection.

3. CONCLUSION

The Anti-Sleep Alert System is an important technology to improve road safety by preventing accidents caused by driver fatigue. It helps detect signs of drowsiness, such as slow blinking, eye closure, or head nodding, and immediately warns the driver with alarms or vibrations. By continuously monitoring the driver's alertness, the system ensures that the driver stays attentive during long or night-time journeys. Studies and practical applications show that using such systems can significantly reduce accidents, save lives, and make driving safer for everyone on the road. Overall, the Anti-Sleep Alert System is a simple but effective way to protect drivers, passengers, and others from fatigue-related accidents.

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