IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 10, June 2025
Impact Factor: 7.67

Anti Sleep Alarm for Drivers Using Arduino

Kalyani Kumari Paswan[1], Kiran R A[2], Lakshmipriya V[3], Srilakshmi N M[4], Mrs. S Geetha Priyadharisini[5]

[1,2,3,4]BE Student, Department of Electronics and Communication

[5]Associate Professor, Department of Electronics and Communication

East Point College Of Engineering and Technology, Bangalore, Karnataka, India.

Abstract: *Drowsy driving is a significant cause of road accidents worldwide, often leading to severe consequences for drivers, passengers, and pedestrians. To address this issue, we propose Safe Drive, an innovative driver alert and vehicle control system designed to enhance road safety by detecting drowsiness and initiating preventive measures. The system uses an eye blink sensor to keep tracking how often the driver blinks, checking it in real-time. Upon detecting signs of drowsiness, the system triggers a buzzer to provide an audible alert, ensuring immediate driver attention. Additionally, a 12V water spray pump is activated via a relay to deliver a light spray of water onto the driver, effectively waking them up. For enhanced safety, the system incorporates a second relay to deactivate the DC motor, simulating the vehicle's halt to prevent potential accidents. Built on an Arduino UNO platform, the system is cost-effective, compact, and easy to implement in vehicles. This project demonstrates a practical solution to mitigate the risks of drowsy driving, contributing to safer road environments. Future extensions could include data logging, mobile app integration, and advanced alert mechanisms to further enhance functionality*

Keywords: drowsiness detection, road safety, eye blink sensor, Arduino, driver alert system, vehicle control

I. INTRODUCTION

Drowsy driving is a critical issue contributing to numerous road accidents globally. Studies indicate that driver fatigue and inattentiveness are among the leading causes of vehicular mishaps, often resulting in loss of life and property. As modern vehicles integrate advanced technologies to improve safety, systems that actively monitor and mitigate driver fatigue have become increasingly vital. The proposed project, SafeDrive, addresses this challenge by implementing a driver alert and vehicle control system designed to detect and respond to drowsiness. By leveraging an eye blink sensor, the system continuously monitors the driver's blinking patterns to identify irregularities associated with fatigue. Upon detecting signs of drowsiness, a series of corrective actions are triggered to ensure the driver's safety and prevent potential accidents. The system integrates three critical functionalities: 1. Driver Alert Mechanism: A buzzer sounds to immediately grab the driver's attention. 2. Wake-Up Assistance: A 12V water spray pump activates to provide a gentle spray of water, helping the driver regain alertness. 3. Vehicle Safety Control: The system deactivates the DC motor, effectively stopping the vehicle until the driver demonstrates wakefulness. This project is made using the Arduino UNO, which helps keep it low-cost and easy for anyone to use. By combining hardware components such as relays, a buzzer, and actuators with a robust algorithm for drowsiness detection, Safe Drive offers a proactive approach to enhancing road safety. The system is ideal for integration into personal vehicles, commercial fleets, and public transportation systems, addressing a wide spectrum of use cases. Besides its current use, this project can be improved in the future by adding features like mobile app alerts, saving data, and using advanced machine learning for better accuracy. Through this project, we aim to contribute to the development of safer roads and to minimize the risks associated with drowsy driving.

DOI: 10.48175/IJARSCT-28827

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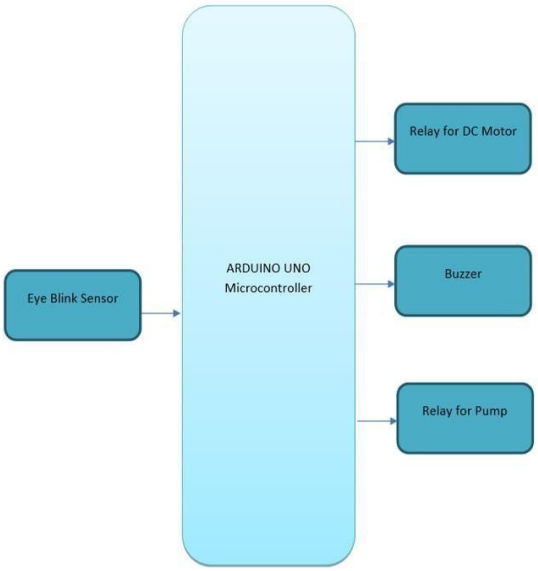

II. METHODOLOGY

The proposed Safe Drive system employs a combinig of hardware and software components to detect driver drowsiness, alert the driver, and take proactive measures to ensure safety. The methodology involves the following key steps.

1. System Setup

• Hardware Components.
• Eye Blink Sensor: Monitors the driver's blinking patterns and provides input signals to detect drowsiness.
• Arduino UNO: Acts as the central processing unit to process the sensor data and to control the system.
• Buzzer: Provides an audible alert when drowsiness is detected.
• Relays: Relay 1: Controls a 12V water spray pump to wake the driver.
Relay 2: Controls the DC motor, simulating the vehicle's engine.
• 12V Water Spray Pump: Activates to spray water on the driver.
• DC Motor: Represents the vehicle's engine, which is turned off when drowsiness is detected.
• Power Supply: Provides the required voltage and current to power the components.

2. Data Acquisition

• The eye blink sensor keeps watching the driver's eyes all the time.
• Sensor data is transmitted to the Arduino UNO for processing.

3. Drowsiness Detection Algorithm

• The Arduino processes the sensor input to detect abnormal blinking patterns, such as:
• Prolonged eye closure.
• Rapid blinking indicating fatigue.
• A threshold is set for blink frequency and duration to classify drowsy behaviour.

4. Alert Mechanism If drowsiness is detected:

• The buzzer is activated to audibly alert the driver.
• Relay 1 is triggered to activate the 12V water spray pump, spraying a light mist to wake the driver.

5. Vehicle Safety Control

• Simultaneously, Relay 2 is triggered to deactivate the DC motor, simulating a vehicle stop.
• This prevents potential accidents by ensuring the vehicle does not remain in motion when the driver is drowsy.

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6. System Reset and Monitoring

• After a pre-defined delay or upon confirming the driver is awake (through blinking or manual reset), the system resumes normal operation by:

• Stopping the water pump and buzzer. Reactivating the DC motor via Relay 2.

7. Testing and Validation

• The system will be tested under various scenarios to ensure accurate drowsiness detection and proper functioning of alerts and controls.

• Simulations will evaluate the system's responsiveness and reliability.

III. HARDWARE REQUIREMENTS

The components needed for the SafeDrive drowsiness detection and vehicle control system:

1. Arduino UNO: This is the main control board that reads data from the sensors and manages the other parts of the system

2. Eye Blink Sensor: Detects the driver's blinking patterns to monitor for signs of drowsiness.

3. Buzzer: Provides an audible alert to notify the driver when drowsiness is detected.

4. Relay Module (2 Relays):

Relay 1: Controls the activation of the 12V water spray pump. Relay 2: Controls the DC motor to simulate the vehicle's engine, turning it off when drowsiness is detected.

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4. 12V Water Spray Pump: Delivers a light spray of water to help wake up the driver when drowsiness is detected.

5. DC Motor: Simulates the vehicle's engine, which is turned off to prevent further movement when drowsiness is detected.

6. Power Supply (12V DC Adapter): Provides necessary power to the pump, motor, and relay module.
7. Wires and Connectors: For connecting the various components such as the Arduino, sensors, relays, and actuators.

IV. SOFTWARE TOOL

The following software tools and libraries are required for the development and operation of the SafeDrive system:
1. Arduino IDE:
• Purpose: The primary software for programming the Arduino UNO. It provides an integrated development environment to write, compile, and upload the code to the microcontroller.
• Link: Arduino IDE
2. Arduino Libraries:
• Purpose: Libraries help connect and control hardware parts like the eye blink sensor, relays, and buzzer. These libraries simplify the coding process by providing predefined functions for hardware control. Some commonly used libraries are:
• Servo Library: For controlling servo motors (if applicable in the project).
• Relay Module Library (if using a specialized relay module): To control relays easily.
3. Sensor Libraries:
• Purpose: If the eye blink sensor is based on a specific type of sensor (e.g., infrared sensor, camera-based module, or any specialized blink sensor), corresponding sensor libraries will be needed to read the data and detect blink patterns. Examples include:
• Ada fruit Sensor Library (for certain sensors).
• TCS3200 or similar library (if using a color sensor or optical sensor for detecting eye blinks).
4. Serial Monitor (Arduino IDE Tool):
• Purpose: Used for debugging the system by displaying real-time sensor readings and system status messages during development.

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ADVANTAGES

- Helps to prevent accidents.
- Easy to use and works efficiently
- Especially helpful for people who drive long distances or late at night.
- Alerts the driver if they fall asleep while driving..
- Affordable and easy to carry due to its small size.

DISADVANTAGES

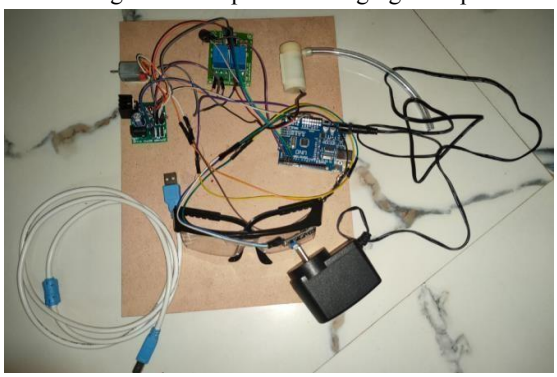
- The device may stop working if there is a fault in the system's circuitry.
- Actions like frequent yawning or rubbing eyes might trigger the system by mistake.

APPLICATIONS

- Tracks eyelid movement to detect signs of drowsiness.
- Efficiently detects sleepiness and gives alerts only when the driver is actually dozing off.
- Can be used in advanced cars to help prevent accidents.
- Useful not only for drivers but also in areas like, ATM Guard Security, Military Base Security, bank Security and so on.

V. FUTURE SCOPE

1. Fatigue Detection: Monitors driver behavior (e.g., eye movements, head position) to detect drowsiness.
2. Alert System: Sends loud sounds, vibrations, or flashing lights to warn the driver if they're getting sleepy.
3. Real-Time Monitoring: Tracks driving patterns (e.g., steering and lane changes) to spot signs of fatigue.
4. Customizable Alerts: Allows drivers to adjust alert sensitivity and sound preferences.
5. Health Reminders: Suggests breaks and reminds drivers to stay hydrated.
6. Data Logging: Keeps a record of drowsiness events for later review.
7. Emergency Stop: Automatically slows down and stops the vehicle if the driver doesn't respond to alerts.
8. GPS Integration: Suggests nearby rest stops when needed.
9. Driver Feedback: Provides feedback and rewards for staying alert.
10. Fleet Management: Monitors driver fatigue for companies managing multiple drivers.



VI. CONCLUSION

The Safe Drive drowsiness detection system provides a smart and effective way to fight one of the main reasons for road accidents—driver tiredness. By using a simple, cost- effective approach with an eye blink sensor, Arduino UNO, relays, and a water spray mechanism, this system can proactively detect signs of drowsiness and take corrective actions, such as alerting the driver and stopping the vehicle's motion to avoid accidents. The key advantages of the Safe Drive system lie in its affordability, ease of implementation, real-time monitoring, and low power consumption. It is suitable

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for a wide range of applications, from commercial vehicles and public transport to private cars and emergency vehicles. Its ability to detect drowsiness and respond quickly through mechanical actions significantly enhances driver safety, helping to reduce accidents caused by fatigue. This system helps make roads safer and can also be adjusted for different vehicles. It can be improved later with features like connecting to a mobile app. Overall, SafeDrive represents a valuable tool for ensuring safer roads and more alert drivers, ultimately reducing the risks associated with drowsy driving.

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