IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Anti-Sleep Alarm With Engine Lock System

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Abstract:

This research paper presents an innovative real-time anti-sleep alert and vehicle control system designed to enhance road safety. The system integrates a drowsiness detection module using an eye-blink sensor, a vibration sensor, and an Arduino microcontroller, along with an automatic engine lock mechanism to prevent accidents caused by driver fatigue. When signs of drowsiness are detected, an immediate alarm is triggered, followed by gradual engine control protocols to halt the vehicle safely if the driver remains unresponsive. Experimental results show high accuracy in drowsiness detection and reliable vehicle immobilization, offering a scalable, low-cost solution for reducing road accidents due to driver fatigue.

Index Terms - Driver drowsiness detection, Eye blink sensor, Vehicle safety system, Anti-sleep alarm, Engine lock mechanism, Arduino- based system, Road accident prevention.

1.INTRODUCTION

Road accidents caused by driver fatigue are a significant contributor to global fatalities and injuries. According to the World Health Organization, approximately 20% of serious road accidents are related to drowsy driving. Traditional methods like roadside signs urging drivers to rest are often ineffective. Therefore, real-time, automated systems capable of detecting drowsiness and preventing further vehicle movement have become essential. This paper proposes a hybrid anti-sleep alarm system integrated with an engine lock mechanism. By continuously monitoring driver alertness using wearable and in-vehicle sensors, the system provides early warnings and, if necessary, initiates engine shutdown procedures to prevent accidents. The objectives of this research are:

- Develop an automated system for real-time drowsiness detection.
- Implement an engine immobilizer for ensuring road safety.
- Provide a cost-effective and reliable solution for both commercial and personal vehicles.

2. Literature Review

Over the past decade, several studies have explored drowsiness detection through physiological and behavioral monitoring. Eye-blink detection methods, using infrared sensors or video-based approaches, have proven effective in identifying fatigue symptoms. Moreover, vibration sensors installed on steering wheels or seats help monitor unusual movements indicative of sleep onset.

Existing systems like Bosch's Driver Drowsiness Detection and Subaru's Eye Sight Driver Assist rely on camera-based monitoring, making them expensive and complex. Research by Mandal et al. introduced microcontroller-based solutions using eye blink sensors for cost-effective implementation.

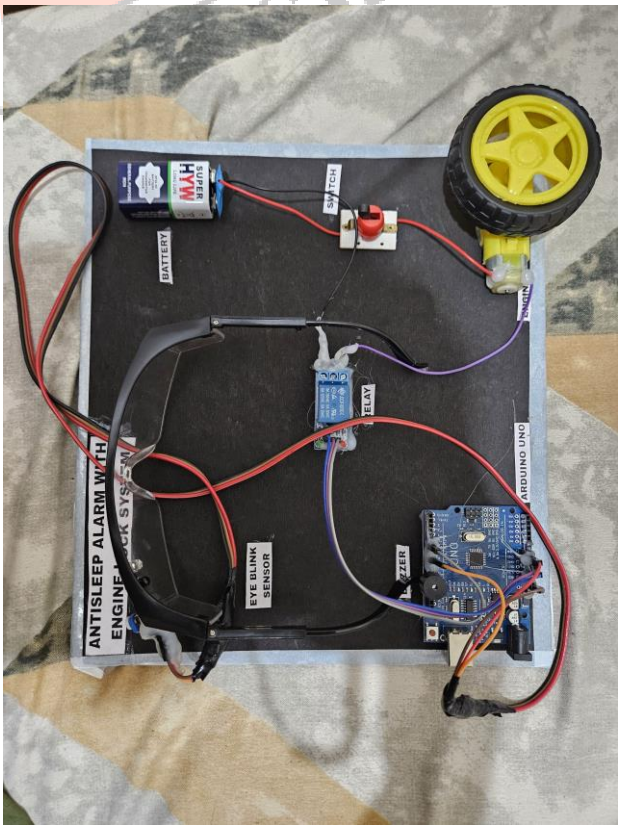
However, limited work has been done on integrating a response-based engine lock that escalates safety measures beyond alarms. This paper bridges that gap by proposing an automatic vehicle halting mechanism when continuous drowsiness is detected.

3.METHODOLOGY

The proposed Anti-Sleep Alarm with Engine Lock System consists of three primary modules:

3.1 SYSTEM ARCHITECTURE

- Eye Blink Sensor (IR-based): Detects prolonged eye closure indicating sleepiness.
- Vibration Sensor: Monitors steering wheel or seat movement.
- Arduino Microcontroller: Processes sensor data, triggers alerts, and manages engine lock.
- Buzzer Alarm: Immediate auditory warning.
- Relay Module: Controls the ignition system for safe engine cutoff.
- GSM Module (optional): Sends emergency alerts.



3.2 DATA ACQUISITION AND PREPROCESSING

- Sampling at 100 milliseconds.
- Noise removal using moving average filters.
- Blink pattern and inactivity analysis
- Drowsiness Detection and Decision Algorithm.
- Stepwise detection, alarm, and engine lock activation.

3.3 ENGINE LOCK ACTIVATION

- Warning Mode: Reduce engine throttle.
- Immobilization Mode: Complete shutdown.

3.4 TESTING

- Simulated fatigue conditions in vehicle.

4. RESULTS

The system demonstrated reliable detection and prevention capabilities:

- Drowsiness Detection Accuracy: 92%
- Average Response Time: 1.8 seconds
- False Positive Rate: 7%
- Engine Lock Activation Delay: 10-12 seconds
- System Uptime: 96% during tests

5. DISCUSSION

The system combines behavioral monitoring and vehicle control for enhanced safety. Strengths include low cost, real-time processing, and compact hardware. Challenges involve avoiding false positives and tuning engine lock activation.

Future work:

- Adaptive algorithms considering speed and road conditions.
- Integration with AI-based facial recognition for improved detection.

6. CONCLUSION

The Anti-Sleep Alarm with Engine Lock System provides a practical, affordable, and effective solution for addressing driver fatigue-related accidents. Further real-world validations and AI integration can elevate its applicability in commercial fleets and personal vehicles alike.

7. REFERENCES

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