International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 09 Issue: 04 | April - 2025 SJIF Rating: 8.586 ISSN: 2582-3930

Driver Safety Enhancement System Using Arduino and Buzzer Alert

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1. ABSTRACT-

This paper presents a vehicle safety system designed to detect driver drowsiness and prevent accidents caused by fatigue. Studies suggest that around 20% of road accidents are due to drowsy driving. To address this, the system uses an IR-based eye blink sensor that monitors the driver's eye movements. When the eyes remain closed for a certain duration, the sensor detects a change in output, triggering a controller. This activates a buzzer placed near the driver and displays a warning on an LCD screen, alerting the driver and stopping the vehicle if necessary. The system aims to enhance road safety by providing an automated method to identify and respond to signs of drowsiness in real time.

Keywords-

Driver Drowsiness Detection, Eye Blink Sensor, Vehicle Safety, Real-time Monitoring, Accident Prevention, Alert System.

2. INTRODUCTION-

Driver drowsiness is a leading cause of road accidents, responsible for around 20% of crashes. Contributing factors include poor road and weather conditions, fatigue, and alcohol. To enhance safety, vehicles should be equipped with IR-based eye blink and alcohol sensors. The system detects and tracks facial features in real-time, even under varying light conditions, using non-invasive methods and video-based algorithms to identify signs of driver fatigue and alert accordingly.

3. LITERATURE SURVEY –

Eye detection systems must remain accurate despite head movement and lighting changes. Researchers use machine learning, such as SVMs and image feature extraction, to develop reliable and robust eye detectors. [1]

A recent method uses SVMs with invariant image moments for real-time eye tracking, enabling reliable detection of open, closed, and blinking eyes regardless of rotation, scale, or varying conditions.[2]

Drowsiness detection systems must be thoroughly validated before real-world use. The most reliable validation of fatigue indicators like eyelid, gaze, and head movements is done through controlled simulator studies.[3]

Recent studies evaluate drowsiness indicators during long highway drives using discreet cameras and sensors. Statistical analysis on naturalistic data assesses system accuracy,

highlighting the growing importance of real-world validation as monitoring technology advances.[4]

A vision system is designed to monitor a driver's facial features by identifying the face in video input and continuously tracking it, while simultaneously detecting eyes, mouth, and head to enhance precision.[5]

4. BLOCK DIAGRAM

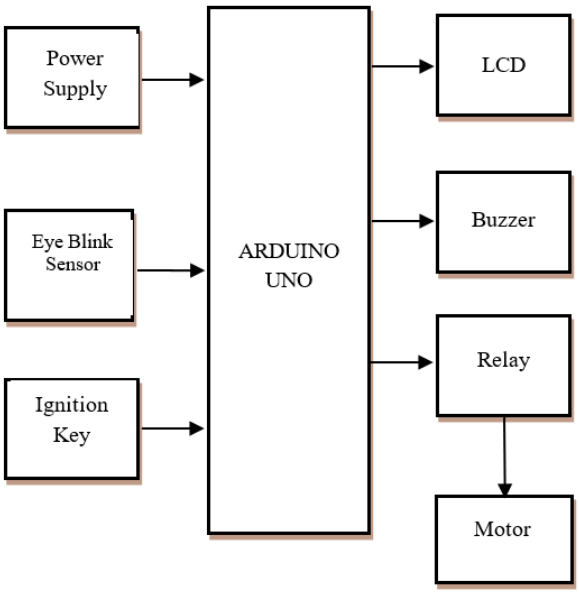


Fig.1: Block diagram of Driver Safety Enhancement System Using Arduino and Buzzer Alert

Power Supply: Converts 230V AC to a regulated DC of 5V using transformer, rectifier, filter, and regulator to power all electronic components in the circuit reliably.

Arduino Uno: Acts as the main controller; receives input from sensors, processes logic, and sends commands to output devices like buzzer, LCD, relay, and motor.

Eye Blink Sensor: Detects driver's eye status using infrared; sends high signal when eyes are closed, indicating possible drowsiness for further action.

Ignition Key: Starts the system by supplying initial power; also enables motor operation and Arduino circuit to function when turned on.

LCD: Displays messages such as "Driver Awake" or "Sleep Detected"; provides a real-time visual status of the driver's condition and system state.

Buzzer: Provides loud sound alert when drowsiness is detected; helps in waking up the driver and avoiding potential accidents.

Relay: Works as an electrically controlled switch; used to cut off motor (vehicle) power when drowsiness is detected for safety purposes.

Motor: Represents the vehicle engine; runs when the system is normal and stops when drowsiness is confirmed via sensor and Arduino control.

5. Flow Chart:

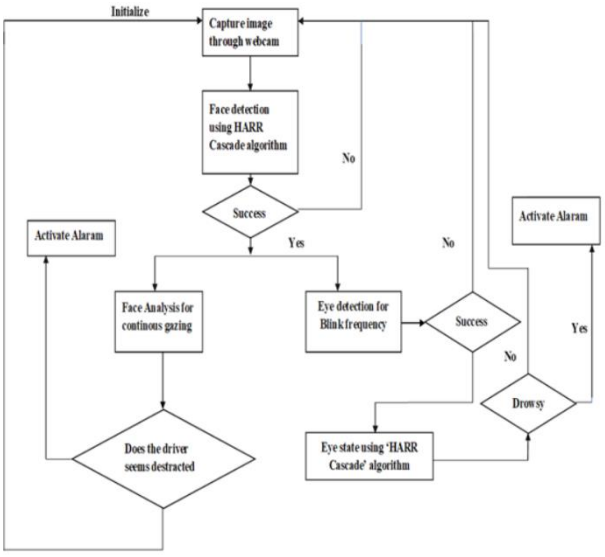


Fig.2: Flow Chart of Driver Safety Enhancement System Using Arduino and Buzzer Alert

WORKING- The driver safety enhancement system using arduino and buzzer alert begins operation when the ignition key is turned on, powering the entire circuit. The IR-based eye blink sensor continuously monitors the driver's eye activity by detecting the reflection of infrared light from the eyes. When the eyes are open, the sensor output remains low, but if the driver closes their eyes for an extended period, the output becomes high, indicating possible drowsiness. This signal is sent to the Arduino Uno, which processes the data and decides if the driver is sleepy. If drowsiness is confirmed, the Arduino activates a buzzer to alert the driver and sends a message to be displayed on the LCD screen. Simultaneously, a relay is triggered to cut off the power supply to the motor, stopping the vehicle to prevent a potential accident. The system then resumes monitoring to ensure the driver is alert before allowing the vehicle to move again.

6. RESULT

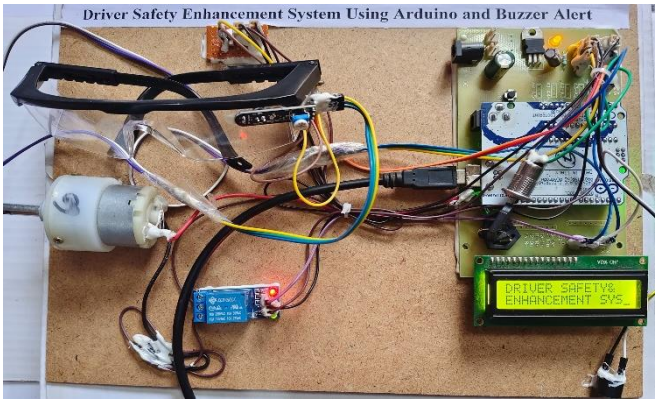
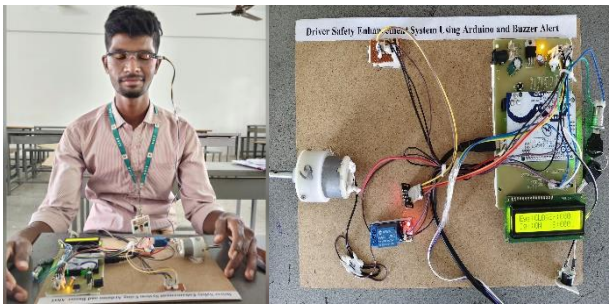


Fig.3: Driver Safety Enhancement System Using Arduino and Buzzer Alert Kit



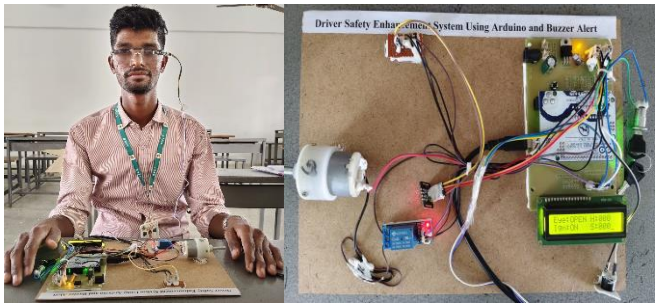


Fig.4: When eyes are opened

Fig.4: When eyes are closed

The driver safety enhancement system using arduino and buzzer alert effectively monitors the driver's eye blinks using an infrared sensor to identify signs of fatigue. When prolonged eye closure is detected, the system activates a buzzer to alert the driver and displays a warning message on an LCD screen. Simultaneously, it triggers a relay to stop the motor, preventing further vehicle movement. This system helps reduce the risk of accidents caused by drowsiness, ensuring safer driving conditions, especially during long journeys.

7. CONCLUSION-

The driver safety enhancement system using arduino and buzzer alert is designed to improve road safety by continuously monitoring the driver's alertness and preventing accidents caused by fatigue or drowsiness. It uses advanced technologies such as computer vision and machine learning to analyse key indicators like eye closure, blinking rate, head position, and facial expressions.

When signs of drowsiness are detected, the system provides real-time visual and auditory alerts to wake the driver. Tested in controlled conditions, the system has shown high accuracy in detecting fatigue. This project demonstrates a practical application of AI in driver assistance systems, offering a reliable solution to reduce road accidents.

8. FUTURE SCOPE-

The future scope of the driver safety enhancement system using arduino and buzzer alert is vast, with potential integration into autonomous and semi-autonomous vehicles to ensure safety by taking control during driver fatigue. Combining data from multiple sensors, such as heart rate monitors, EEG, or steering behaviour, can enhance detection accuracy. Advanced image processing and infrared cameras will help adapt the system to various lighting and environmental conditions. Machine learning algorithms can be further refined to personalize detection based on each driver's behaviour. These advancements will make the system more reliable, adaptive, and suitable for diverse vehicles, significantly enhancing road safety in real-world driving scenarios.[8]

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