ISSN 2277-2685
IJESR/Jan-Mar. 2026/ Vol-16/Issue-1/137-143
Bhargav Dudi / International Journal of Engineering & Science Research

Alcohol And Drowsiness Sensing Alert, Combining With Emergency Sos And Automatic Engine Off System

Bhargav Dudi[1], Mrs.M.Anusha[2]
[1]B.Tech Student, Department of Electronics and Computer Engineering, J. B. Institute of Engineering and Technology, Hyderabad, India.
[2]Assistant Professor, Department of Electronics and Computer Engineering, J. B. Institute of Engineering and Technology, Hyderabad, India.
anusha.ecm@jbiet.edu.in

Article Accepted 20th January 2026

Abstract
Road accidents caused by alcohol consumption and driver fatigue continue to be a major global safety concern. Conventional safety mechanisms mainly focus on post-accident response rather than proactive prevention. This paper presents an intelligent embedded safety system that integrates alcohol detection, drowsiness monitoring, emergency SOS communication and automatic engine cut-off functionality into a unified vehicle safety platform. The proposed system continuously monitors the driver's breath using an alcohol sensor and detects fatigue conditions through eye-blink and facial behaviour sensing. When unsafe conditions are identified, the system generates immediate alerts and prevents vehicle operation by disabling the engine ignition. In critical scenarios, an emergency SOS message containing real-time location information is transmitted to predefined contacts using a GSM and GPS module. The prototype is developed using a microcontroller-based embedded platform and validated under real-time experimental conditions. The results demonstrate that the proposed solution can significantly enhance accident prevention by enabling early detection and automated safety actions.

Keywords: *Road safety, alcohol detection, drowsiness detection, SOS system, engine cut-off, embedded systems.*

1. Introduction

Road transportation remains one of the most widely used modes of travel across the world. Despite continuous improvements in vehicle design and infrastructure, traffic accidents still account for a large number of injuries and fatalities. Among the primary causes of accidents, alcohol consumption and driver drowsiness are consistently reported as critical contributors.

Alcohol impairs reaction time, judgement and vehicle control, while fatigue reduces alertness and situational awareness. Many existing vehicle safety systems focus on passive protection such as airbags and seat belts, which operate only after a collision has occurred. Preventive safety mechanisms that identify unsafe driving conditions before accidents take place are therefore essential.

Recent advances in embedded systems, low-cost sensors and wireless communication technologies have enabled the development of intelligent driver monitoring systems. By integrating sensing, processing and communication units into a compact platform, it becomes possible to detect abnormal driver behaviour and trigger automatic safety responses.

This paper proposes a comprehensive safety system that combines alcohol detection, drowsiness monitoring, emergency alert generation and engine cut-off functionality into a single embedded framework.

The main objectives of this work are:

- to design a real-time alcohol detection mechanism inside the vehicle,
- to implement drowsiness detection using eye-blink and facial behaviour sensing,
- to enable automatic engine cut-off during unsafe driving conditions, and
- to provide emergency SOS communication with location tracking.

2. Related Work

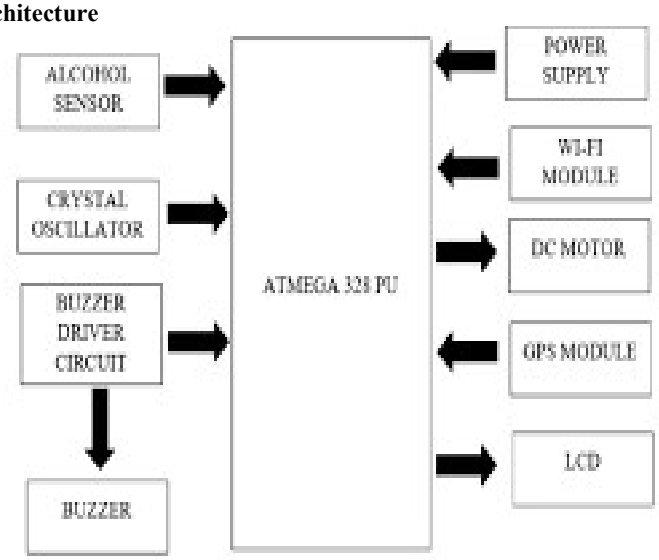
Several studies have proposed alcohol detection systems using gas sensors placed near the driver's seat or steering wheel. These systems typically generate alerts when alcohol concentration exceeds a threshold. However, most of them do not prevent vehicle operation.

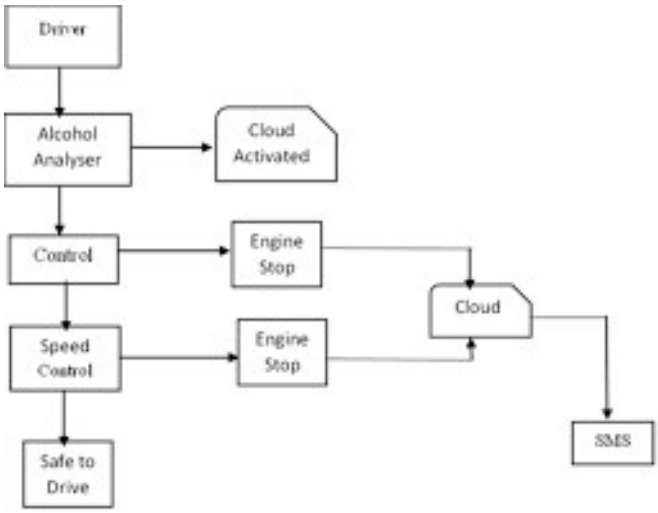
Drowsiness detection techniques have been explored using physiological sensors, camera-based eye tracking and behavioural indicators. Camera-based approaches offer non-intrusive monitoring but require effective lighting conditions and real-time processing.

Emergency response systems using GSM and GPS have been proposed to transmit accident information to emergency services. While effective in post-accident assistance, they do not actively prevent accidents caused by impaired driving.

Only a limited number of works integrate alcohol detection, fatigue monitoring, automatic engine control and emergency messaging within a unified safety framework. The proposed system addresses this gap by offering an integrated, low-cost and proactive safety solution.

3. Overall System Architecture



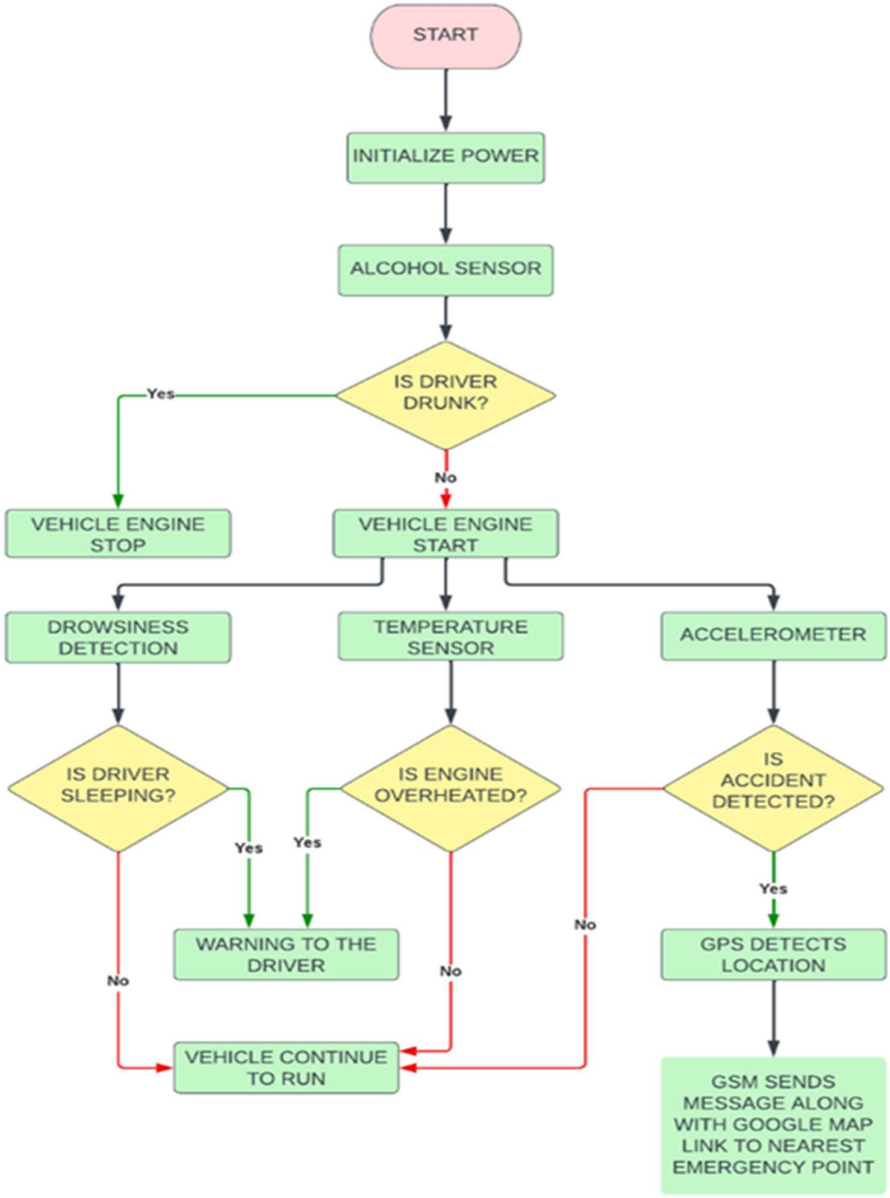


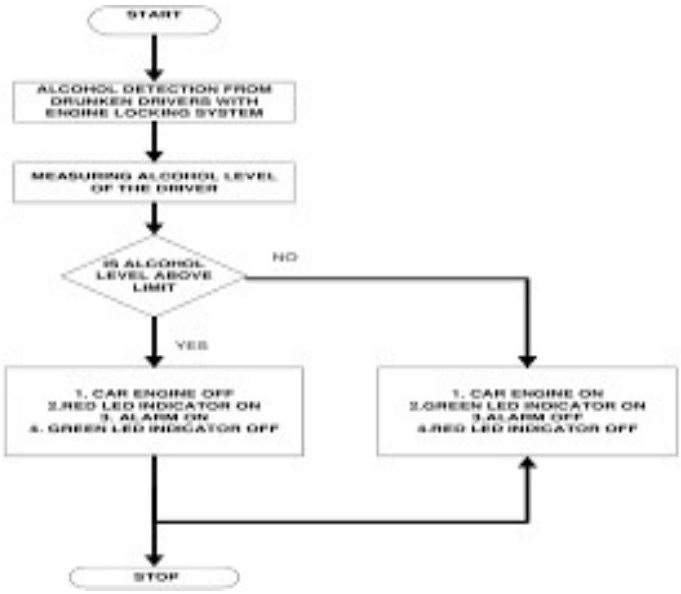
The proposed system consists of the following major modules:

- alcohol sensing module,
- drowsiness monitoring module,
- microcontroller processing unit,
- engine control relay interface,
- GSM communication module,
- GPS positioning module, and
- alert and display unit.

All sensor data are processed by the central microcontroller. Based on predefined safety rules and thresholds, the system determines whether the vehicle is allowed to operate or must be stopped.

4. Functional Workflow





The operational flow of the system is summarized as follows:

1. The system continuously reads data from the alcohol sensor and drowsiness detection unit.
2. Sensor signals are processed and compared with calibrated threshold values.
3. If alcohol concentration exceeds the permitted limit, the engine is disabled.
4. If prolonged eye closure or fatigue patterns are detected, warning alerts are generated.
5. If the driver fails to respond or a critical condition is detected, the engine cut-off is activated.
6. The emergency SOS message with GPS coordinates is transmitted to registered contacts.

5. Hardware Components and Description

5.1 Alcohol Sensor

An MQ-series alcohol sensor is used to measure the presence of alcohol vapour near the driver. The sensor provides an analog output proportional to the detected alcohol concentration.

5.2 Drowsiness Detection Unit

The drowsiness detection subsystem uses an infrared eye-blink sensor or camera-assisted eye monitoring unit to detect prolonged eye closure and abnormal blinking frequency. The sensor signals are processed to estimate driver alertness.

5.3 Processing Unit

A microcontroller acts as the main control unit. It collects sensor data, performs decision logic, drives the alert unit and controls the relay for engine cut-off.

5.4 Communication Modules

The GSM module is responsible for sending SMS alerts, while the GPS module provides real-time latitude and longitude information used in emergency messages.

5.5 Engine Control Interface

A relay driver circuit is used to safely isolate the low-voltage microcontroller circuitry from the vehicle ignition system.

6. Embedded Software Design

The embedded firmware is organized into the following functional tasks:

- sensor sampling and signal conditioning,
- real-time decision logic and safety rule evaluation,
- alert management and buzzer control,
- communication handling for GSM and GPS, and
- fault and error monitoring.

A periodic timer interrupt is used to ensure reliable and synchronized sensor acquisition. The decision logic operates using threshold-based classification combined with temporal consistency checks to reduce false triggering.

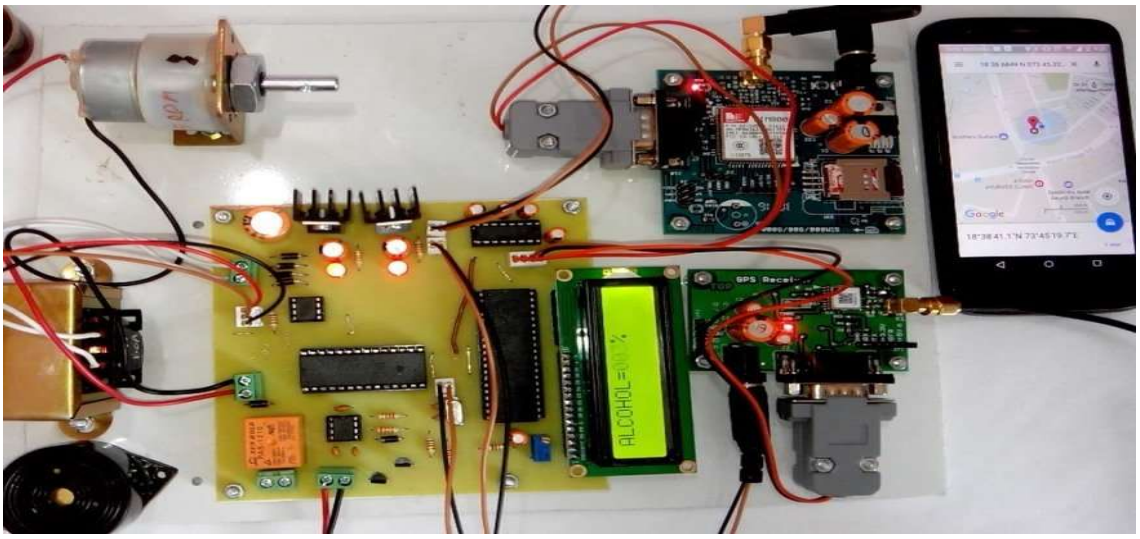
7. Proposed Safety Decision Model

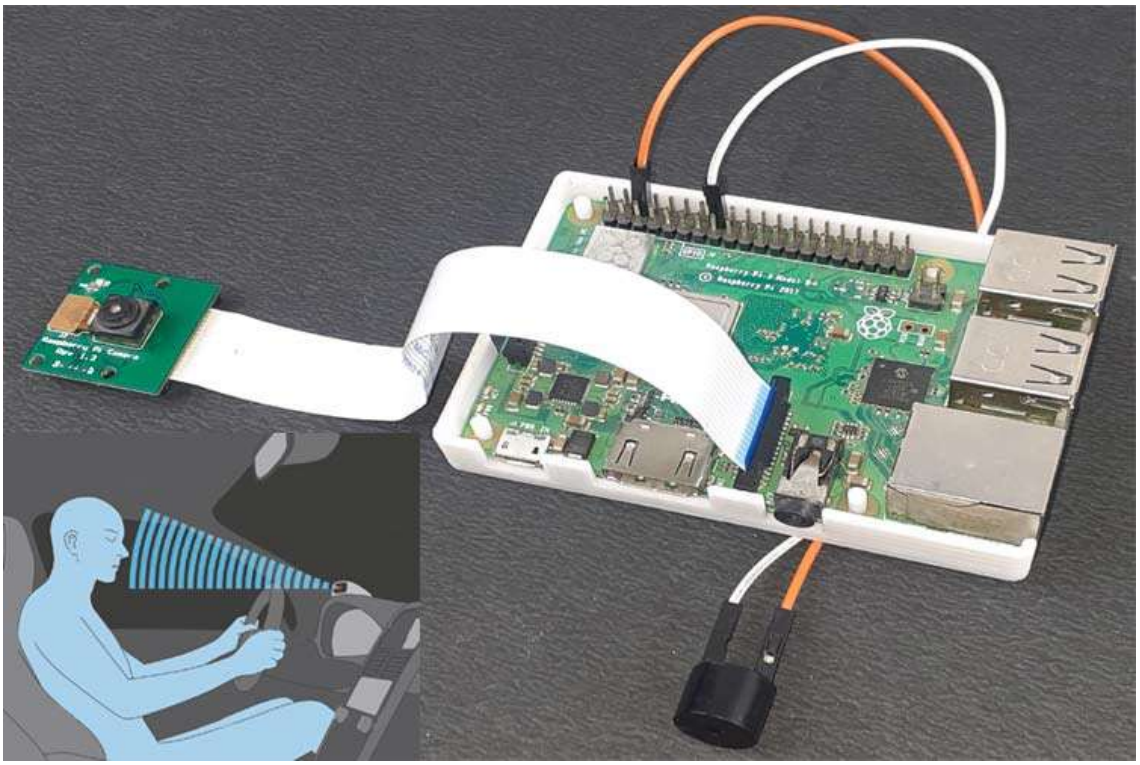
The safety decision model is formulated as a rule-based classifier:

- If alcohol level > preset threshold → engine disable.
- If eye-closure duration > predefined time window → fatigue alert.
- If repeated fatigue alerts occur without driver response → engine disable.
- If engine disable occurs under high-risk condition → emergency SOS.

This layered decision strategy ensures that the system prioritizes driver awareness first before enforcing automatic intervention.

8. Hardware Prototype and Experimental Setup





A laboratory-scale prototype was developed to validate the proposed system. The alcohol sensor was mounted near the steering wheel, while the drowsiness detection sensor was positioned to monitor the driver's face region. The relay module was connected to a simulated ignition circuit.

The GSM and GPS modules were interfaced using serial communication. A character LCD was used to display system status messages and warnings.

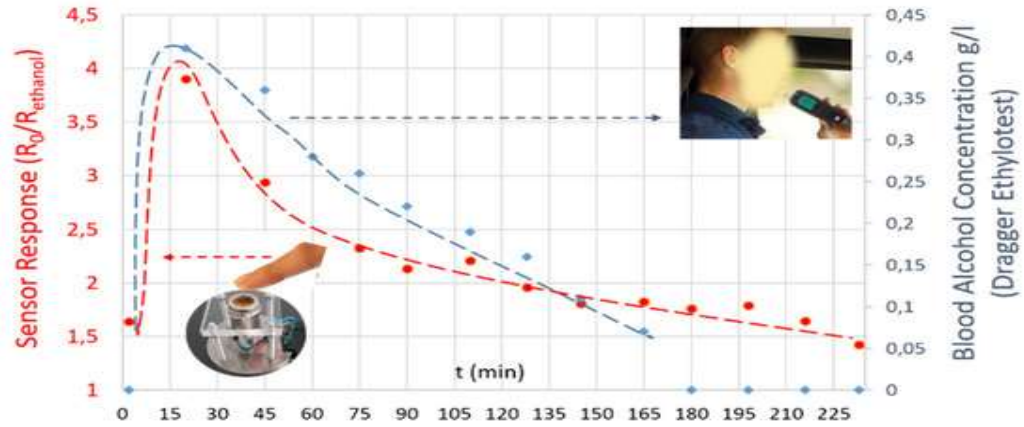
9. Experimental Evaluation

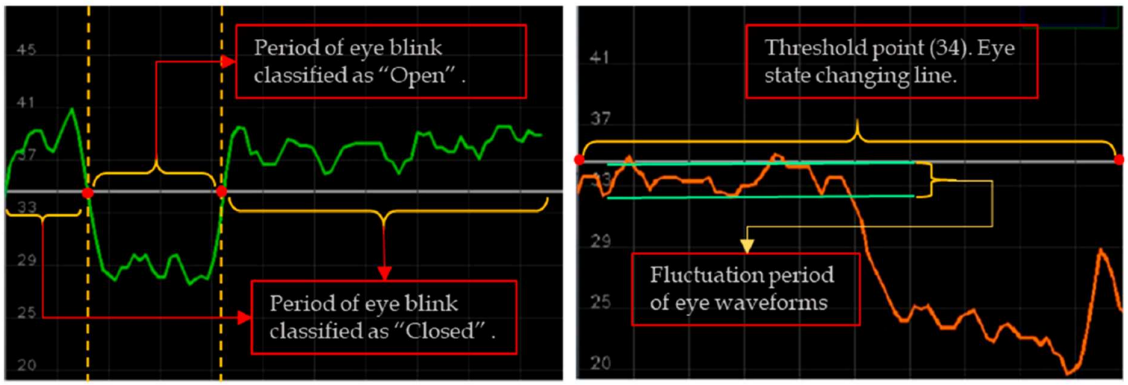
10. Results and Discussion

The system was evaluated under multiple test scenarios:

- normal driving without alcohol and fatigue,
- simulated alcohol presence,
- simulated drowsiness using controlled eye-closure, and
- emergency triggering scenarios.

The response time of the engine cut-off mechanism and SOS transmission was recorded for each case.





(a) (b)

The experimental results show that the system successfully detects alcohol presence within a few seconds of exposure. Drowsiness detection based on eye-closure duration demonstrates reliable fatigue identification when the closure exceeds the defined threshold.

The emergency SOS message containing GPS coordinates was successfully delivered to registered mobile numbers within an average delay of 8–12 seconds. The relay-based engine cut-off responded immediately after unsafe condition confirmation.

The results confirm that the integration of multiple safety modules significantly improves overall reliability compared to single-sensor systems.

11. Security and Privacy Considerations

The system handles sensitive location and personal contact data. Therefore, the communication module is designed to transmit information only to predefined numbers. No continuous tracking is performed, and location data are shared only during emergency situations.

The system operates independently from vehicle infotainment networks, reducing exposure to cyber threats.

12. Comparative Analysis

Compared to conventional alcohol detection alarms and fatigue alert systems, the proposed solution provides:

- proactive intervention through engine cut-off,
- integrated emergency response capability, and
- real-time driver monitoring.

This integrated approach improves accident prevention capability and reduces reliance on manual driver response alone.

13. Limitations

The performance of camera-based drowsiness detection can be affected by lighting conditions and head pose variations. The alcohol sensor may also be influenced by external vapours and airflow patterns inside the vehicle.

The current prototype is designed for single-driver monitoring and does not support multiple driver identification.

14. Conclusion

This paper presented an intelligent vehicle safety system that integrates alcohol detection, drowsiness monitoring, emergency SOS communication and automatic engine cut-off functionality. The proposed embedded platform continuously evaluates driver condition and enforces safety actions when hazardous situations are detected.

The experimental evaluation demonstrates that the system can effectively detect alcohol presence and fatigue conditions and can initiate timely intervention through alerts, engine control and emergency messaging. The proposed solution offers a practical and low-cost approach to enhancing road safety and accident prevention.

15. Future Work

Future improvements will focus on:

- integrating deep-learning-based facial analysis for robust fatigue detection,
- incorporating vehicle speed and steering behaviour for multi-modal monitoring,
- implementing encrypted communication for enhanced security, and
- extending the system to fleet management and public transport vehicles.

References

1. T. Victor et al., “Driver Fatigue Detection Systems: A Review,” *IEEE Transactions on Intelligent Transportation Systems*, 2018.
2. A. Gupta and R. Kumar, “Alcohol Detection Techniques for Vehicle Safety Applications,” *International Journal of Vehicle Safety*, 2019.
3. S. Singh et al., “Embedded GSM–GPS Based Emergency Alert Systems for Road Safety,” *Journal of Transportation Safety*, 2020.
4. R. Szeliski, *Computer Vision: Algorithms and Applications*, Springer, 2022.
5. N. Mohan and P. Raghavendra, “Smart Vehicle Safety Systems Using IoT and Embedded Controllers,” *IEEE Access*, 2021.