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 6, Issue 14, April 2026
Impact Factor: 8.2

Smart Vehicle Safety System

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Abstract: *Road accidents are one of the major causes of death and property loss across the world. Most accidents occur due to driver negligence such as drunk driving, not wearing seatbelts, rash driving, and delayed emergency response after accidents. To overcome these problems, this project proposes a Smart Vehicle Safety System that combines prevention, accident detection, and emergency alert mechanisms.*
The system uses an MQ3 alcohol sensor to detect alcohol content in the driver's breath. If the alcohol level exceeds the threshold value, the vehicle ignition is blocked. An IR sensor is used to check whether the driver is wearing a seatbelt. If the seatbelt is not worn, the ignition remains OFF. An accelerometer sensor is used to detect sudden impact or abnormal vehicle movement. When an accident is detected, the GPS module fetches the exact location of the vehicle and the GSM module sends alert messages to family members, ambulance services, and police stations. This system improves road safety, reduces accident risks, and ensures quick emergency response. It is low-cost, reliable, and suitable for real-time implementation.

Keywords: *Road accidents*

I. INTRODUCTION

Road safety has become an important issue due to the increasing number of vehicles and road accidents. Human negligence such as alcohol consumption while driving and failure to wear seatbelts are major reasons for accidents.
Traditional systems focus only on protection after accidents. However, there is a need for a system that can prevent accidents before they occur and also provide immediate help after accidents.
This project develops a Smart Vehicle Safety System using IoT sensors and communication modules. It ensures safe driving conditions and sends automatic alerts during emergencies.

II. PROBLEM STATEMENT

Many road accidents happen because drivers drive under the influence of alcohol or ignore basic safety measures such as wearing seatbelts. In many accident situations, victims do not receive immediate help because there is no automatic alert system.
Existing vehicle systems are not sufficient to prevent unsafe driving conditions. There is a need for an intelligent system that can monitor driver behavior, detect accidents, and automatically inform emergency contacts.

III. OBJECTIVES

- To detect alcohol consumption using MQ3 sensor
- To ensure seatbelt usage using IR sensor
- To prevent vehicle ignition under unsafe conditions
- To detect accidents using accelerometer sensor
- To track vehicle location using GPS module
- To send emergency alerts using GSM module
- To reduce rescue delay and improve road safety

DOI: 10.48175/IJARSCT-34047

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IV. LITERATURE SURVEY

Several research works have been carried out in the field of vehicle safety systems.

Smart Accident Detection System

Uses accelerometer and GPS modules for accident detection and alert generation.

Driver Drowsiness Detection

Uses AI and cameras to detect driver fatigue and provide warnings.

Alcohol Detection System

Uses MQ3 sensors to identify alcohol presence and prevent ignition.

Seatbelt Monitoring System

Uses sensors to ensure the driver wears a seatbelt before driving.

Emergency Alert System

Uses GPS and GSM modules to send accident alerts with exact location details.

These studies helped in designing the proposed integrated smart vehicle safety system.

V. METHODOLOGY

The proposed system works in three stages:

5.1 Accident Prevention

Alcohol Detection

MQ3 sensor detects alcohol level from the driver's breath. If alcohol exceeds the threshold, the engine is locked.

Seatbelt Detection

IR sensor checks whether the seatbelt is properly worn. Without seatbelt, ignition remains OFF.

5.2 Accident Detection

An accelerometer (MPU6050) continuously monitors X, Y, and Z axis movements. Sudden impact or abnormal tilt confirms an accident.

5.3 Emergency Alert System

GPS module obtains location coordinates. GSM module sends SMS alerts and emergency calls to registered contacts.

VI. BLOCK DIAGRAM

Power Supply → MQ3 Sensor → IR Sensor → Microcontroller → Accelerometer → GPS + GSM → Emergency Alert

Working Flow:

Driver Check → Engine Control → Continuous Monitoring → Accident Detection → Alert Message

VII. HARDWARE REQUIREMENTS

- Arduino ESP32
- MQ3 Alcohol Sensor
- IR Sensor
- MPU6050 Accelerometer
- GPS Module (NEO-6M)
- GSM Module (SIM800)
- Relay Module
- Buzzer
- Power Supply (12V)
- Breadboard
- Jumper Wires

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VIII. SOFTWARE REQUIREMENTS

- Arduino IDE
- Embedded C / C++
- TinyGPS++ Library
- MPU6050 Library
- SoftwareSerial Library
- GSM AT Commands
- Serial Monitor

IX. IMPLEMENTATION

The system is implemented using Arduino IDE and embedded C programming.
The microcontroller reads sensor values continuously and makes decisions based on threshold values.
If alcohol is detected or seatbelt is not worn, the engine is blocked using relay control.
If sudden impact is detected, GPS fetches the location and GSM sends an SMS alert and makes an automatic call.
The system was tested successfully under different conditions such as alcohol detection, seatbelt validation, and accident simulation.

X. OUTPUT

Sample Emergency Alert Message
Accident Alert!
Location Detected
Latitude: 12.945945
Longitude: 80.247162
This message is sent automatically to emergency contacts.

XI. CONCLUSION

The Smart Vehicle Safety System successfully improves road safety by preventing drunk driving, ensuring seatbelt compliance, detecting accidents, and sending emergency alerts.
The system is cost-effective, reliable, and suitable for real-time applications. It reduces human errors and helps in saving lives by ensuring faster emergency response.
This project provides a practical solution for intelligent transportation systems.

XII. FUTURE ENHANCEMENT

- Mobile app integration for live tracking
- Cloud storage for vehicle monitoring
- AI-based driver behavior analysis
- Driver drowsiness detection using camera
- Better GPS accuracy improvements
- Faster communication systems
- Smart city emergency integration

These improvements can make the system more advanced and suitable for commercial applications.

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