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 2, January 2026
Impact Factor: 7.67

Vehicle Tracking, Alcohol Detection and Engine Locking System using GSM and GPS

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Abstract: *Drunk driving remains a leading cause of fatal road accidents globally, often due to a lack of real-time intervention and monitoring. This project proposes an integrated safety system designed to prevent intoxicated individuals from operating vehicles while providing real-time tracking for authorities or owners. The system utilizes an MQ-3 alcohol sensor to continuously monitor the driver's breath for ethanol concentration. If the detected alcohol level exceeds a pre-defined safety threshold, the system immediately triggers a relay-based engine locking mechanism to immobilize the vehicle, preventing further movement.Simultaneously, the GPS (Global Positioning System) module retrieves the precise geographical coordinates (latitude and longitude) of the vehicle. This location data is then transmitted via a GSM (Global System for Mobile Communication) module to registered emergency contacts or law enforcement agencies as an automated SMS alert. A central microcontroller (such as Arduino or ATmega328) acts as the brain of the system, coordinating the sensor inputs and communication outputs. Experimental results demonstrate that the system is highly responsive, cost-effective, and capable of significantly enhancing road safety by providing a proactive solution to drunk driving and vehicle theft.*

Keywords: Drunk Driving Prevention, MQ-3 Alcohol Sensor, Microcontroller-Based Vehicle Safety System, GPS-GSM Tracking, Engine Immobilization, Real-Time Monitoring, Intelligent Transportation System

I. INTRODUCTION

1.1 Problem Statement

Conventional insurance systems rely on centralized databases and manual processes for managing policies and processing Driving under the influence of alcohol is a major cause of road accidents, injuries, and fatalities. Conventional vehicles do not have any automatic mechanism to detect a driver's alcohol consumption or prevent the vehicle from being started when the driver is intoxicated. Additionally, there is no real-time alert system for informing concerned authorities or owners when such an event occurs, nor a way to track the vehicle's location in case of misuse.
Therefore, there is a need for an intelligent system that can detect alcohol, immediately alert the owner through GSM, track the vehicle via GPS, and automatically lock the engine to prevent the vehicle from being started by an intoxicated driver. This project addresses these safety concerns by integrating sensors, communication modules, and a locking mechanism into a single automated solution.Despite continuous awareness campaigns and strict traffic laws, drink-and-drive cases remain a serious public safety concern, especially in developing countries where enforcement resources are limited. Human-based monitoring methods, such as police checkpoints, are not always efficient due to manpower limitations, time constraints, and the unpredictability of drunk drivers' behavior. Furthermore, in many reported incidents, intoxicated drivers attempt to operate vehicles even after being warned, leading to uncontrollable situations and serious accidents. Traditional vehicles lack built-in safety features that can autonomously assess the driver's condition before ignition, leaving a significant gap in preventive safety technology Objective

1.2 Scope of Project

• The project does not include advanced actuarial risk prediction, legal dispute handling, or integration with external government databases. Its scope is limited to secure insurance management and automated claim settlement. The scope

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of this project is to design and implement an intelligent alcohol detection and engine locking system to prevent drunk driving.

• The system continuously monitors the driver's breath using an MQ-3 alcohol sensor.
• When alcohol concentration exceeds a predefined threshold, the vehicle engine is automatically locked using a relay mechanism.
• The system provides real-time alerts through GSM by sending SMS notifications to pre-registered contacts.
• GPS technology is integrated to track and transmit the exact location of the vehicle during critical events.
• The solution is developed using a microcontroller-based platform (Arduino UNO) for reliable automation.

1.3 Project Context and Strategic Imperative

Alcohol detection with engine locking system using GPS and GSM module: Alcohol Detection System with Engine Locking using GPS and GSM" by G. G. Dahake and R. S. Bichkar. This paper discusses the design and implementation of an alcohol detection system with engine locking using GPS and GSM. The system uses a gas sensor to detect alcohol and sends an alert to the owner's phone through GSM if alcohol is detected.

"Development of a Smart Car Alcohol Detection System Based on GPS and GSM Technologies" by T. R. Liu et al. This paper describes the development of a smart car alcohol detection system based on GPS and GSM technologies. The system uses a gas sensor to detect alcohol and sends a message to the owner's phone through GSM if alcohol is detected.

"Design and Implementation of an Alcohol Detection System with Engine Locking Using GPS and GSM" by N. A. Bhat and V. D. Shinde. This paper describes the design and implementation of an alcohol detection system with engine locking using GPS and GSM. The system uses a gas sensor to detect alcohol and sends a signal to the engine control unit to prevent the engine from starting if alcohol is detected.

"Alcohol Detection System with Engine Locking Using GPS and GSM" by S. S. Patil et al. This paper discusses the design and implementation of an alcohol detection system with engine locking using GPS and GSM. The system uses a gas sensor to detect alcohol and sends a signal to the engine control unit to prevent the engine from starting if alcohol is detected.Real-Time Alcohol Detection System with Engine Locking Using GPS and GSM" by S. D. Kore and P. D. Dumbre. This paper presents the design and implementation of a real-time alcohol detection system with engine locking using GPS and GSM. The system uses a gas sensor to detect alcohol and sends a signal to the engine control unit to prevent the engine from starting if alcohol is detected.

In summary, these papers highlight the importance of alcohol detection systems with engine locking using GPS and GSM modules in preventing drunk driving and ensuring road safety

II. METHODOLOGY

The alcohol detection and engine locking system using GPS and GSM works by continuously sensing the driver's breath using an alcohol sensor (like MQ-3). The microcontroller compares the sensor reading with a preset threshold, and if alcohol is detected above the limit, it checks vehicle speed and ignition status using GPS data. If the vehicle is stationary, the controller activates a relay-based immobilizer to lock the engine and prevent the vehicle from starting. At the same time, the GSM module sends an SMS alert with the vehicle's location to the owner or authorities, and continues to share updates or warnings. If the driver is below the alcohol limit, the system keeps the engine unlocked and allows normal operation.

III. RELATED WORK AND THEORETICAL FOUNDATION

A. Alcohol Detection Systems in Automotive Safety

Alcohol detection systems have received significant attention in the field of automotive safety due to their potential to reduce accidents caused by drunk driving. Previous research highlights the use of gas-based alcohol sensors, such as the MQ-3 sensor, to detect alcohol vapors present in a driver's breath. These sensors operate on the principle of resistance change in the presence of alcohol molecules, allowing real-time monitoring of intoxication levels. Studies indicate that integrating such sensors with microcontroller-based systems enables continuous supervision without requiring manual

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breath tests. Theoretical models emphasize that early detection of alcohol before or during vehicle operation can significantly lower accident rates and enhance road safety.Fraud Prevention and Data Security.

B. Engine Locking and Embedded Control Systems

Engine locking mechanisms play a crucial role in preventing vehicle operation under unsafe conditions. Research in embedded automotive control systems demonstrates that microcontrollers can be effectively used to control ignition circuits through relays or motor drivers. When alcohol levels exceed a predefined threshold, the control logic automatically disables the engine, preventing the vehicle from being started or continued in motion. Existing literature confirms that automated engine immobilization reduces human dependency and eliminates the possibility of driver negligence. Theoretical foundations of embedded control systems focus on real-time decision-making, sensor-data processing, and fail-safe operation to ensure reliable vehicle control.

C. GSM and GPS-Based Monitoring and Alert Systems

Vehicle monitoring using GSM and GPS technologies has been widely studied for safety and tracking applications. Prior work shows that GSM modules enable instant communication through SMS alerts, while GPS modules provide accurate real-time location information. In alcohol detection systems, these technologies enhance system effectiveness by notifying vehicle owners, authorities, or emergency contacts when intoxication is detected. Research highlights that combining location tracking with alert mechanisms improves response time during critical situations. The transparent and automated nature of GSM-GPS- based alert systems increases accountability and strengthens overall transportation safety.

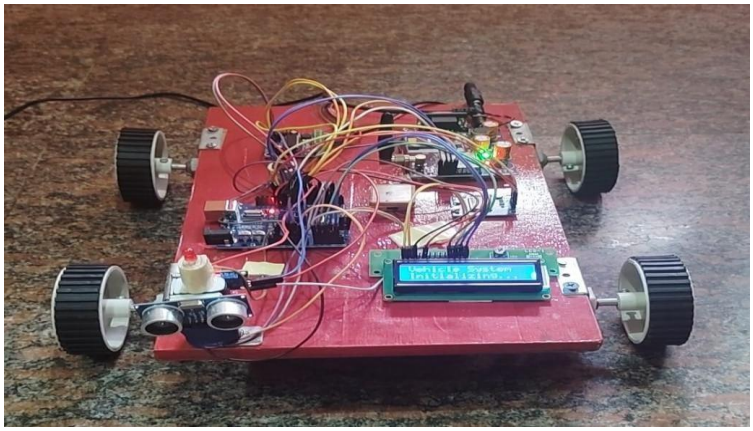

Fig. 1 Alcohol Detection and Engine Locking System during alcohol detection and alert transmission

Fig. 1 illustrates the operational interface of the proposed Alcohol Detection and Engine Locking System during alcohol detection and alert transmission. The figure represents the interaction between the alcohol sensor, Arduino controller, GSM module, and GPS unit. When the sensor detects alcohol beyond the permissible limit, the system triggers the engine locking mechanism and simultaneously sends an SMS alert containing the vehicle's location. The process operates automatically without human intervention, ensuring timely response, secure execution, and enhanced safety for both the driver and the public.

Fig. 2 illustrates the system input and monitoring interface that allows configuration and real-time evaluation of driver and vehicle safety parameters. The system continuously collects critical data such as alcohol concentration levels from the MQ-3 sensor, vehicle ignition status, and real-time geographic location obtained through the GPS module. These inputs act as key factors for determining the driver's sobriety condition and initiating safety actions within the system. The inclusion of location data supports accurate vehicle tracking and enables region-specific emergency response when intoxication is detected. Additionally, sensor readings and system status are displayed through the LCD interface, enhancing transparency and real-time awareness. Once the alcohol level exceeds the predefined threshold, the control

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logic triggers the engine locking mechanism and activates GSM-based alert transmission, securely communicating the incident details and vehicle location to predefined contacts for immediate action.

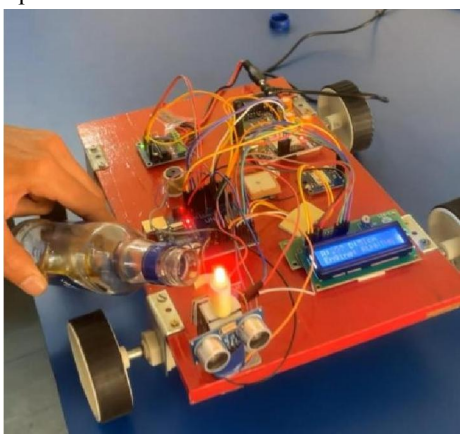

Fig. 2. the system input and monitoring interface that allows configuration and real-time evaluation

IV. CONCLUSION

The Alcohol Detection and Engine Locking System using GSM and GPS provides an effective and reliable solution to reduce drunk driving and improve road safety. By integrating the MQ-3 alcohol sensor with Arduino, GSM, and GPS modules, the system can accurately detect the presence of alcohol, prevent the vehicle from starting, and immediately send alert messages along with the vehicle's location to concerned authorities or family members. This automated response helps in quick decision-making and minimizes the chances of accidents caused by intoxicated drivers.The system demonstrates how embedded technology can be used to address real-life problems and enhance safety in both private and commercial vehicles. Although it has certain limitations such as network dependency and sensor sensitivity, the overall design is practical, low-cost, and easy to implement. With further improvements and proper calibration, this system has the potential to be widely adopted as a preventive safety measure to save lives and reduce road fatalities caused by drunk driving

V. ACKNOWLEDGMENT

We express our sincere gratitude to the Visvesvaraya Technological University (VTU) for providing us the opportunity to carry out this project as part of the academic curriculum. We are deeply thankful to the Department of Electronics and Communication and Engineering, Kalpataru Institute of Technology (KIT), Tiptur, for providing a supportive academic environment and necessary resources throughout the course of this work.

We would like to convey our heartfelt thanks to our project guide, whose valuable guidance, constant encouragement, and constructive feedback played a crucial role in the successful completion of this project. We are also grateful to the Head of the Department, faculty members, and laboratory staff for their continuous support and cooperation.

We extend our appreciation to our friends and classmates for their collaboration and motivation during various stages of the project. Finally, we are immensely thankful to our parents and family members for their unwavering support, encouragement, and understanding, which have been a constant source of inspiration throughout this endeavor.

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