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Iot Based Alcohol Detection System

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ABSTRACT: *This paper presents the development and implementation of an IoT-based alcohol detection and alert system intended for road safety enhancement. The system uses a semiconductor-based alcohol sensor to detect the concentration of alcohol in the ambient air and compares it against a defined safety threshold. The device utilizes an Arduino Uno microcontroller for sensor reading and decision logic, an LCD module for real-time display, and a SIM800 GSM module to send alert messages via SMS. When alcohol is detected beyond the threshold, the system notifies a predefined contact. The system minimizes energy usage by sending alerts only when a change in status is detected. The results show the system's effectiveness in detecting alcohol in real-time and issuing timely alerts.*

Keywords*: Iot, Alcohol Detection, GSM, Arduino, SMS Alert, Road Safety*

SECTION ONE

INTRODUCTION

Driving under the influence of alcohol is a persistent global challenge and a major cause of fatal road accidents. According to the World Health Organization (WHO), over 1.3 million people lose their lives annually due to traffic-related incidents, and alcohol impairment remains a dominant factor [1]. In countries such as Tanzania, the situation is worsened by inadequate enforcement of traffic laws and limited access to advanced vehicle safety technologies.

Advances in the Internet of Things (IoT) have introduced new paradigms in smart safety systems by enabling real-time data collection, processing, and communication. These technologies offer promising solutions for mitigating the risks associated with drunk driving. By leveraging sensors, microcontrollers, and wireless modules, it is now possible to develop compact, affordable, and intelligent systems that detect alcohol levels and automatically issue alerts to relevant parties.

This study presents the design and implementation of an IoT-based alcohol detection and alert system that detects the presence of alcohol in a driver's breath and transmits real-time notifications via GSM.

The project aims to contribute to public road safety by offering a low-cost, scalable, and adaptable solution suitable for both urban and rural settings [2][3].

BACKGROUND

The rapid evolution of IoT technologies has transformed how real-time monitoring and automation are applied across domains such as health, agriculture, manufacturing, and transport safety. Alcohol detection systems, particularly those integrated with IoT, have gained traction due to their ability to provide real-time feedback and connectivity, which are crucial in mitigating road accidents [2].

Traditional alcohol detection methods, including handheld breathalyzers and vehicle-installed ignition locks, are often expensive, require manual operation, and are rarely accessible to low-income or rural populations. Moreover, many lack remote communication features, limiting their usefulness in large-scale safety enforcement.

Recent innovations focus on embedding smart sensors within vehicle systems and enhancing their capabilities with GSM and GPS modules. Such systems allow authorities, guardians, or fleet managers to receive alerts remotely, enabling timely intervention. This project extends that concept by integrating a low-power MQ-3 alcohol sensor, GSM module (SIM800L), and LCD display with Arduino control, allowing real-time detection and alerting even in areas without internet connectivity [3].

PROBLEM STATEMENT

Drunken driving and alcohol misuse contribute to significant road accidents and health crises globally. Existing detection systems are either too expensive, lack realtime feedback, or fail to integrate additional health parameters for comprehensive monitoring. This project addresses the need for a robust system capable of detecting alcohol levels while monitoring key physiological parameters to reduce risks associated with alcohol misuse. This method aims to save lives, lessen accidents, and enhance road safety, especially in places where public transportation is widely used.

OBJECTIVES

The main objective is to develop an IoT Based Alcohol Detection System. The specific objectives of this project are as follows:

i To gather requirement for IoT-based alcohol detection system

ii To design IoT-based alcohol detection system

iii To implement IoT-based alcohol detection system

iv To test the IoT-based alcohol detection system

v To deploy the IoT-based alcohol detection system

CONTRIBUTION

This technology has the potential to significantly improve public health outcomes by reducing alcohol-related accidents, promoting responsible drinking habits, and empowering individuals to make informed decisions about their health and well-being. Also, this project will help to detect in real-time monitoring and alerting of alcohol levels and vital signs. Also, enhanced accuracy in alcohol detection and health status analysis.

SECTION TWO

METHODOLOGY OF STUDY

The waterfall development methodology was used for systematic implementation.

The system development life cycle includes requirements analysis, design, implementation, testing and deployment. The research approach is quantitative, focusing on data from alcohol sensor readings and system response times.

SYSTEM MODULE

The system comprises:

- MQ-3 alcohol sensor for ethanol detection.
- Arduino Uno microcontroller for data processing
- LiquidCrystal_I2C 16x2 LCD for visual output
- SIM800 GSM module for sending SMS alerts
- 5V regulated power supply using dual lithium-ion batteries

SECTION THREE
RESULTS

The developed IoT-based alcohol detection system was successfully assembled, programmed and tested in controlled conditions. The system utilizes an MQ-3 alcohol sensor to measure the concentration of alcohol in the air (in parts per million – ppm). During testing, the system was calibrated to interpret any reading above 200 ppm as indicative of alcohol presence beyond safe limits, prompting an alert, while values below 200 ppm were treated as safe. The Arduino Uno processes the analog input

from the sensor and displays the result on an LCD. If the reading exceeds the 200-ppm threshold, the system displays "Alcohol Detected" and triggers an SMS alert via the SIM800L GSM module. If the reading remains below 200 ppm, it displays
"Safe to drive" and sends a corresponding SMS notification. The system was tested using samples of human breath after alcohol consumption and control samples with no alcohol. The following table summarizes typical test readings:

Test scenario	Sensor reading	System response
Breath sample(no alcohol)	45 ppm	Safe to drive
Breath sample(low alcohol	150 ppm	Safe to drive
Breath sample(after 1 bottle beer)	290 ppm	Alcohol detected
Breath sample (after 2 bottles	390 ppm	Alcohol detected

DISCUSSION

The use of SMS as an alert mechanism ensures the system remains functional even in areas with limited or no internet connectivity, which is a common challenge in rural and semi-urban regions. The integration of a 10-second delay loop effectively prevents the system from sending multiple redundant messages, which conserves both power and mobile credits, making the solution more sustainable for long-term deployment.

Moreover, the system demonstrates practical efficiency by only sending alerts when a status change is detected—shifting from "safe" to "alcohol detected" or vice versa—thereby reducing noise and unnecessary communication. The real-time feedback on the LCD display also adds a user-friendly interface for immediate awareness by the driver or supervisor.

What sets this system apart is its simplicity and cost-effectiveness without sacrificing essential functionalities. It avoids the complexities of cloud computing, ensuring lower

maintenance costs while retaining essential safety features. The portability of the hardware and reliance on GSM make it suitable for fleet monitoring in remote areas, school buses, taxis, and even industrial transport settings.

Future versions could be enhanced with a GPS module for location tagging during alerts, integration with a central dashboard for fleet oversight, or mobile apps for guardians or supervisors. These upgrades would further strengthen its usability and commercial potential.

RELATED WORK

Several researchers have explored alcohol detection systems integrated with IoT for road safety. [2] proposed a vehicle ignition system controlled by alcohol sensors. However, such systems often lack remote alert capabilities. Smith and Brown [3] explored GPS-linked alcohol detection, but their system required cloud access, making it unsuitable for low-connectivity environments. In [5], a smart alcohol detection system with GSM and buzzer alert was developed, which enabled sending alerts to authorities; however, the system lacked LCD-based user feedback.

Similarly, Patel and Shah [6] proposed a GSM and GPS-based alcohol detection and vehicle locking system, but its cost and power consumption were relatively high. Kumar and Sharma [7] implemented a realtime Arduino-based solution for alcohol detection, focusing on ignition control, but it was not adaptable for public transport monitoring. This work distinguishes itself by combining SMS alerts, real-time LCD display, and an energy-efficient logic loop, allowing operation in low-connectivity rural areas. The use of SIM800L, MQ-3 sensor, and dual lithium batteries ensures portability, reliability, scalability.

SECTION FOUR

CONCLUSION

The IoT based alcohol detection system achieved its goal of real-time alcohol monitoring and alerting. By integrating an MQ-3 sensor with Arduino and GSM communication, the system offers a reliable and low-cost solution for improving road safety. It's especially useful for vehicle fleet management, public transportation and workplace enforcement. The system is scalable and can be enhanced further with GPS tracking, cloud data logging or mobile app interface

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