

Gas Detection Using IoT

K.Keerthi Priya¹, G. Renuka², B. Geethika³, V. Pavitra⁴

^{1,2}Department of Electrical & Electronics Engineering, G. Pulla Reddy Engineering College, India

Abstract: Gas leakage from combustible gases such as LPG and methane poses serious risks to human life and property. This paper presents an IoT-based gas leakage detection system using an ESP8266 microcontroller and MQ-2 gas sensor for real-time monitoring. The system continuously measures gas concentration and sends data to a mobile application through the Blynk platform. When the gas level exceeds a predefined threshold, a buzzer is activated and instant alerts are sent to the user. An LCD display is also used for local status indication. The proposed system is cost-effective, reliable, and ensures quick response to hazardous situations. It is suitable for applications in homes, industries, and smart safety systems.

Keywords:

IoT, Gas Leakage Detection, ESP8266, MQ-2 Sensor, Blynk IoT, Real-Time Monitoring, Safety System.

I. Introduction

Gas leakage is a significant safety concern in residential, industrial, and commercial environments due to the widespread use of combustible gases such as LPG and methane. Undetected leakage can lead to fire accidents, explosions, and serious health hazards. Traditional gas detection systems mainly provide local alarms and lack remote monitoring capabilities. With the advancement of Internet of Things (IoT) technology, real-time monitoring and instant alert systems have become feasible. This paper presents an IoT-based gas leakage detection system using an ESP8266 microcontroller and MQ-2 sensor. The system continuously monitors gas concentration and sends alerts to users through a mobile application. It enhances safety by enabling quick response and remote accessibility. The proposed solution is cost-effective, reliable, and suitable for modern smart environments.

II. Material And Methods

The proposed IoT-based gas leakage detection system is developed using hardware components such as ESP8266 microcontroller, MQ-2 gas sensor, I2C LCD display, buzzer, breadboard, and jumper wires. The MQ-2 sensor is used to detect combustible gases like LPG, methane, and smoke by sensing changes in resistance and generating an analog output. This output is continuously monitored by the ESP8266 microcontroller, which acts as the main processing unit.

The system is programmed using Arduino IDE, where the sensor readings are compared with a predefined threshold value. The ESP8266 is connected to a WiFi network to enable real-time data transmission through the Blynk IoT platform. The LCD display provides local visualization of gas levels and system status.

When the detected gas concentration exceeds the threshold, the microcontroller activates a buzzer to alert nearby individuals and simultaneously sends notifications to the user's smartphone via the Blynk application. The system operates continuously to ensure real-time monitoring.

The experimental setup is tested under different environmental conditions to analyze performance, response time, and reliability. The results are validated based on the system's ability to accurately detect gas leakage and generate timely alerts.

Procedure methodology

The system begins operation by powering the ESP8266 microcontroller and initializing all connected components, including the MQ-2 gas sensor, LCD display, and buzzer. The ESP8266 establishes a connection with the WiFi network and the Blynk IoT platform for real-time communication. The MQ-2 sensor continuously senses the surrounding environment and generates an analog signal corresponding to the gas concentration.

This signal is read by the ESP8266 and processed to determine the gas level. The measured value is displayed on the LCD screen and simultaneously transmitted to the Blynk application for remote monitoring. The system compares the sensor value with a predefined threshold level.

If the gas concentration exceeds the threshold, the ESP8266 activates the buzzer to provide an audible alert and

displays a warning message on the LCD. At the same time, a notification is sent to the user's smartphone through the IoT platform. If the gas level is within safe limits, the system continues monitoring and displays a "Safe" message. This process is repeated continuously, ensuring real-time detection and immediate response to hazardous conditions.

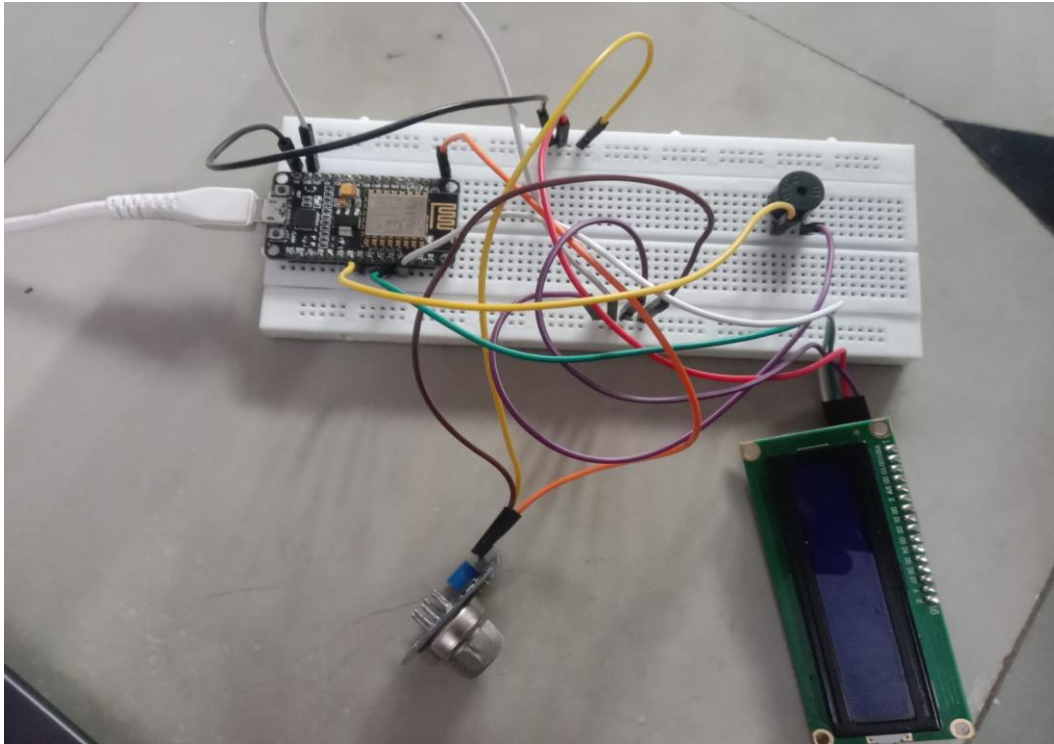


Figure : Complete Hardware Setup of IoT Gas Leakage Detection System

Statistical analysis

The system performance is evaluated based on accuracy, response time, and reliability. Sensor readings are compared with standard values to ensure accurate gas detection. Multiple trials under different conditions show consistent and stable performance. The response time is observed to be quick, enabling real-time alert generation. Overall, the system demonstrates reliable and efficient operation.

III. Result

The proposed IoT-based gas leakage detection system successfully detects the presence of combustible gases in real time. The MQ-2 sensor accurately senses gas concentration and the ESP8266 processes the data effectively. The system activates the buzzer immediately when the gas level exceeds the threshold and displays warning messages on the LCD. Real-time notifications are successfully sent to the user through the Blynk IoT application. The system performs reliably under different test conditions with quick response time. The results demonstrate stable operation and effective gas leakage detection.



Figure : LCD Display Showing Gas Leakage Detected

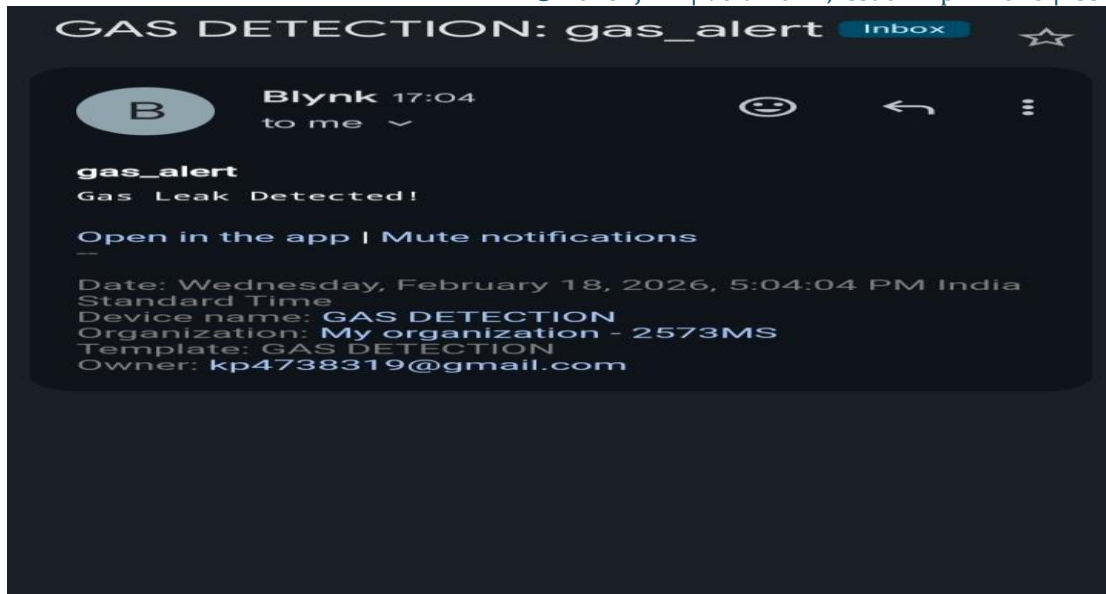


Figure : Blynk App Notification Screenshot

III. Discussion

The developed IoT-based gas leakage detection system demonstrates significant improvement over traditional gas detection methods. It provides real-time monitoring and remote alert capabilities, enhancing user safety. The integration of ESP8266 with the MQ-2 sensor ensures accurate sensing and reliable communication through the Blynk platform. The system shows consistent performance under different environmental conditions with minimal delay. However, sensor accuracy may vary slightly due to environmental factors such as temperature and humidity. Overall, the system proves to be efficient, cost-effective, and suitable for modern safety applications.

IV. Conclusion

The proposed IoT-based gas leakage detection system provides an effective solution for monitoring and preventing gas-related hazards. It successfully detects gas leakage and delivers instant alerts through both local and remote interfaces. The system is reliable, affordable, and easy to implement in real-world environments. The integration of IoT technology enhances safety by enabling continuous monitoring and quick response. The project meets all its objectives and demonstrates stable performance. Future enhancements can further improve system intelligence and automation capabilities.

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