Smart Gas Leakage Detector BOT: An IoT-Based Real-Time Safety System

Aarti Nathani, Surendra Lodhi, Rahul Kumar, Sangita Patle, Dr. Neelesh Jain (Guide)
Sam Global University

Abstract- Gas leakage is a persistent hazard in both residential and industrial environments, posing serious threats to life and property. The "Smart Gas Leakage Detector BOT" presents a real-time, IoT-enabled solution to detect and alert gas leaks using a compact and low-cost device. It incorporates an ESP32 microcontroller, MQ-2 gas sensor, and Blynk IoT platform to offer mobile notifications and local alerts via buzzer and LED. This paper elaborates on the system design, architecture, hardware components, and implementation, while comparing similar works through an extensive literature review. The study demonstrates that integrating IoT with traditional gas detection significantly enhances responsiveness, remote access, and cost-efficiency.

1. INTRODUCTION

Gas leaks are among the leading causes of accidental fires and explosions globally. Traditional gas detectors typically lack connectivity, are bulky, or offer delayed response times. Modern technology, particularly the Internet of Things (IoT), offers a promising avenue for developing intelligent and connected systems for gas detection. This paper focuses on a prototype called the Smart Gas Leakage Detector BOT, which combines sensor data acquisition, threshold-based detection, and mobile alerting through the Blynk IoT app. Its real-time notification system and local alert mechanism make it a viable solution for homes, industries, and mobile environments.

2. LITERATURE REVIEW

Recent advancements in IoT have spurred the development of gas detection systems. Table 1 summarizes and compares seven relevant works based on parameters such as microcontroller used, connectivity, mobile integration, and sensor type.

Table 1: Comparative Analysis of Existing Gas Detection Systems

Paper ID	Author(s)	Year	Sensor	Microcontroller	Connectivity	Mobile App	Key Feature
P1	Sharma et al.	2022	MQ-2	Arduino Uno	WiFi	No	Basic audible alert system
P2	Rahman et al.	2021	MQ-5	Raspberry Pi	WiFi	Yes	Python-based cloud logging
P3	Patil and Raut	2023	MQ-6	NodeMCU	WiFi	Yes	Email-based alerts
P4	Verma et al.	2020	MQ-2	Arduino Uno	GSM	No	SMS-based notification
P5	Nair and Thomas	2022	MQ-3	ESP32	WiFi	Yes	Real-time analytics with Firebase
P6	Lee et al.	2023	TGS 2600	ESP8266	WiFi	Yes	AI-powered detection algorithm
P7	This Work	2025	MQ-2	ESP32	WiFi	Yes	Blynk, buzzer, LED alerts

Most existing works lack both local and remote alerts, while this work integrates buzzer, LED, and Blynk-based mobile notification in a compact and cost-effective setup, offering better coverage and user interaction.

3. METHODOLOGY

3.1 Hardware Components

• ESP32 Microcontroller – Dual-core, WiFi-enabled chip for processing and connectivity.
• MQ-2 Gas Sensor – Detects LPG, methane, propane (300–10,000 ppm).
• Buzzer & LED – Local alert mechanism.
• OLED Display (optional) – For local gas level display.
• Power Supply – 5V USB or battery pack.

3.2 Software Requirements

• Arduino IDE – To program ESP32 (C/C++).
• Blynk App – Remote gas leak notification.
• Blynk Library – Integration with ESP32 via Arduino IDE.

4. CIRCUIT DIAGRAM

Figure 1: Circuit diagram connecting ESP32 with MQ-2, buzzer, and LED.
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5. IMPLEMENTATION

5.1 Source Code Snippet

cpp
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```
#include <WiFi.h>
#include <BlynkSimpleEsp32.h>

char auth[] = "YourAuthToken";
char ssid[] = "YourSSID";
char pass[] = "YourPassword";

#define MQ2_PIN 34
#define BUZZER_PIN 25

void setup() {
  Serial.begin(115200);
  pinMode(BUZZER_PIN, OUTPUT);
  Blynk.begin(auth, ssid, pass);
}

void loop() {
  int gasValue = analogRead(MQ2_PIN);
  if (gasValue > 300) {
    digitalWrite(BUZZER_PIN, HIGH);
    Blynk.notify("Gas leak detected!");
  } else {
    digitalWrite(BUZZER_PIN, LOW);
  }
  Blynk.run();
}
```

This code continuously monitors gas levels and triggers alerts when the threshold is crossed.

6. SAMPLE PICTURES

Figure 2: Assembled Smart Gas Leakage Detector BOT

Figure 3: Real-time alert shown on Blynk App

(Insert actual images in Word and caption them accordingly.)

7. CONCLUSION

The Smart Gas Leakage Detector BOT is a robust, real-time safety solution integrating modern IoT capabilities. Compared to traditional systems, it offers superior sensitivity, remote accessibility, and user-friendly setup. The ESP32-MQ-2 combination allows for accurate and cost-effective gas leak detection with minimal energy consumption. With mobile alerts, local buzzer warnings, and easy scalability, it is suitable for smart homes, industrial environments, and transport systems.

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