AUTOMATIC LPG LEAKAGE DETECTION, CUT-OFF & DATA LOGGING SYSTEM

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Abstract
This paper describes an automated system for detecting LPG leaks and shutting off the supply, featuring integrated real time data logging. The setup employs an MQ-series gas sensor connected to an Arduino to continuously track LPG concentrations. If the detected gas level surpasses 400 ppm, a buzzer sounds, and a servo motor immediately closes the gas regulator. Additionally, Python is used to log live sensor data every second, supporting immediate analysis and alerts. Experimental findings show that the system reliably identifies leaks and performs prompt shut-off, significantly improving safety in both home and industrial environments.

Keywords: *LPG detection, Arduino, MQ sensor, Servo motor, Automatic cut-off, Data logging.*

I. INTRODUCTION

LPG (Liquefied Petroleum Gas) is widely used in households and industries due to its high energy content and efficiency. However, accidental leaks pose serious fire and explosion risks. Traditional gas detectors primarily provide alarms, which may not prevent accidents if unattended. To Safety, automated systems that detect leaks and cutting off the gas supply is essential. This paper proposes a system combining MQ series sensors, Arduino, servo motors, and Python based live data logging to detect LPG leaks in real-time. The system automatically activates an alarm and closes the regulator when gas concentrations exceed a predefined threshold. Additionally, Python software logs gas levels every second, providing a historical record for analysis and preventive measures.

II. LITERATURE REVIEW

In the proposed gas leak detection system, the MQ-6 sensor is interfaced with an Arduino Uno to continuously monitor combustible gas concentration and trigger an alert when the predefined threshold is exceeded. Upon detection, the Arduino communicates with the ESP32 module, which utilizes its built-in Wi Fi capability to transmit real-time alert notifications. Mahabooba et al. [1], presents the development of a microcontroller-based LPG detection system using an MQ-2 sensor and Arduino Uno to continuously monitor ambient air, when gas concentration exceeds a predefined threshold, the system activates a buzzer, drives a ventilation fan through an IRF540N MOSFET, and rotates a servo motor to simulate gas valve closure, with potential future integration of IoT for remote monitoring . Similarly, Mohite et al. [2] Liquefied petroleum gas (LPG), commonly used in residential, commercial, and industrial settings due to its flammable

nature and efficiency, requires advanced smart detection systems that can promptly identify leaks, activate alarms, notify stakeholders, initiate automatic shut-off mechanisms, and generate analytical data for preventive maintenance and safety optimization, as demonstrated in a metropolitan residential community that implemented such a system to mitigate gas-related risks. Vishwas et al. [3] Liquefied Petroleum Gas (LPG) is extensively used in domestic and commercial applications, but accidental leakage can lead to fire, explosion, or suffocation hazards. To address this issue, an LPG gas detection system with an automatic cut-off regulator using a DC servo motor is proposed, where an MQ-6 sensor continuously monitors gas concentration and a microcontroller processes the readings to compare them with a predefined safety threshold. Surveys by Patil et al. [4] Gas leakage presents a serious risk in residential and industrial settings, potentially resulting in fires and explosions. This paper introduces a Smart IoT-based Gas Leakage Detection and Auto Shut-off System that utilizes an MQ-6 sensor for real-time gas monitoring and a servo motor for automatic valve control, while providing alerts through an LCD display and buzzer. The study focuses on the partially implemented model emphasizing detection and auto shut-off features, demonstrating a cost-effective and responsive solution for preventing gas-related accidents, such as those by Faye et al. [5] and Mohanaprakash [6], In order to improve safety and prevent gas-related accidents in residential and commercial environments, this study presents an Internet of Things (IoT)-based LPG gas leakage detection and monitoring system that uses a MQ-2 gas sensor to continuously sense the presence of hazardous gases, interfaces with a NodeMCU (ESP8266) microcontroller for real-time data processing, transmits sensor data to a cloud platform for analysis and remote supervision, and generates instant alert notifications to us, V. Sangale Mayuri et al [7], To reduce potential risks, the suggested system incorporates a highly sensitive LPG gas sensor to identify leaks and start prompt safety measures. An LCD screen shows the gas concentration levels in real time as well as warning messages to notify those in the vicinity in the event of a leak. For quick communication, a GSM module is used to send SMS notifications and make alert calls to the user's registered mobile number. In order to effectively stop additional leaks, a servo motor that is connected to the gas regulator also automatically cuts off the gas supply upon detection. B. Venkataramanaiah, [9].Liquefied Petroleum Gas (LPG) is widely used but poses serious risks due to its flammable nature and potential for leakage. This project proposes an LPG gas leakage detection and alert system that uses gas sensors, a microcontroller, and GSM technology to monitor gas levels, trigger alarms, shut off the gas supply, and send SMS notifications to enhance safety in residential and industrial environments, B. Dharaskar, A. [9] , In commercial, industrial, and residential settings, gas leaks continue to be a major concern, requiring accurate and effective detection systems. This study suggests an Internet of Things (IoT)-based LPG gas detection and smart tracking system that uses gas sensors and Arduino to precisely locate dangerous leaks and send out instant alerts via Wi-Fi. Upon detection, the system activates alarms, notifies responsible authorities with location details, and employs a relay-controlled water pump to mitigate potential fire risks. Experimental evaluation demonstrates high accuracy, reliability, and real-time responsiveness, highlighting the system's effectiveness in enhancing gas safety through early detection and rapid intervention. S. K. Imam Basha, extend these systems by offering real-time monitoring, alert notifications, and cloud integration, although most focus on alerting rather than detailed threshold logging. While these studies provide a robust foundation for automated LPG safety systems, few works address live data logging and dynamic threshold monitoring using Python, which is a core contribution of this study.

Table 1 compares recent works with the proposed system.

Paper	**Year**	**Sensor**	**Microcontroller**	**Buzzer /Alarm**	**Automatic Cut-off**	**IOT/ Alerts**	**Novelty/ Notes**
Mahabooba et al. (2024)	2024	MQ-6 gas sensor	Arduino Uno	Piezo buzzer for audible alert on leak detection.	Servo motor (SG90) controls gas valve shut-off.	ESP32 WiFi module; Blynk app for mobile notifications and web dashboard for remote monitoring.	Comprehensive IoT integration with real-time PPM display, exhaust fan activation, and cloud-based emergency alerts; emphasizes remote control and historical data logging.
Mohite et al. (2025)	2025	MQ-2 sensor	Arduino Uno R3..	Active buzzer for high-decibel local alarm.	Servo motor for precise valve closure; MOSFET-driven exhaust fan.	None implemented (suggests future IoT addition).	Adds automatic ventilation via fan for gas dispersion; cost-effective (under ₹2000); includes LCD for PPM levels and focuses on household affordability.

L	2024	MQ-6	Arduino Uno.	Buzzer for immediate audible warning.	Relay module triggers solenoid valve; backup servo motor for redundancy.	No IoT (local alerts only).	Dual shut-off (relay + servo) for reliability; integrates exhaust fan; simple, low-power design with LED indicators for status.
Patil et al. (2025)	2025	MQ-6	Arduino/NodeMCU referenced	Multi-tone buzzer + RGB LEDs for visual/audible alerts.	DC servo motor for regulator valve; solenoid option.	Limited (GSM SMS in some surveyed systems).	Survey paper; highlights battery backup, precision servo control, and hybrid sensors; compares 10+ systems for optimal config; notes false positives mitigation
Faye et al. (2025)	2025	MQ-6	ESP32	Buzzer + LCD display for PPM and status.	Servo motor-driven shut-off valve	Full IoT via ESP32; cloud alerts to mobile/email.	"Smart" IoT with real-time dashboard; auto-resume on safe levels; prototype emphasizes low-cost scalability and remote override.
Mohanaprakash (2025)	2025	MQ-6	Arduino Uno + ESP8266..	Buzzer implied in alert sequence	Servo motor valve control.	IoT with ESP8266; mobile app for push notifications and location sharing.	Emergency response focus: GPS integration for alerts to services; auto-dial; similar to but adds geolocation for first responders.
Sangale et al. (2024)	2024	MQ-6	Arduino Uno.	High-intensity buzzer.	Solenoid valve via relay.	Basic GSM module for SMS alerts	Dual detection (leak + low gas level); prevents dry-run accidents; weight-based refill reminder.
Venkataramanaiah et al. (2024)	2024	MQ-6.	Arduino with ESP8266..	Buzzer + SMS.	Relay-controlled valve; auto-refill trigger.	IoT cloud for monitoring and ordering refills.	"Smart refill" system: auto-orders gas when low; integrates payment API; beyond detection to logistics.
Dharaskar et al. (2023)	2023	MQ-5/MQ-6 hybrid.	Arduino Nano..	Voice alarm module + buzzer.	Servo shut-off.	No (local only).	Compact design; voice alerts in local language; early prototype with threshold calibration.
Basha et al. (2025)	2025	MQ-6.	Arduino Uno.	Multi-buzzer array.	Electromagnetic valve.	GSM + buzzer for accident prevention	Crowd-sourced alerting: shares location via SMS to neighbors; vibration sensor for crash detection.
Proposed System	2026	MQ-6	Arduino Uno	Buzzer	Servo motor (MG996R) controls gas valve shut-off.	None implemented (suggests future IoT addition).	Automatic regulator cut-off,real-time PPM monitoring/remote control; addresses delayed detection/cost barriers; data logging for compli.

III. SYSTEM / DEVICE METHODOLOGY

A. Hardware Components

Fig. 1. MQ-6 gas sensor: Detects LPG concentration in parts per million (ppm)

Fig. 2. Arduino Uno: Microcontroller for processing sensor data and controlling outputs

Fig. 3. Servo motor: Automatically closes the gas regulator when the threshold is exceeded

Fig. 4. Buzzer: Audible alarm to alert nearby individuals

Fig. 5. Power supply / Battery: Powers the system

B. Software Components

- Arduino IDE: Programs the microcontroller to read sensor values and control the servo/buzzer.
- Python: Logs live data every second, compares it to the threshold, and can visualize trends.
- Threshold: Set at 400 ppm for triggering the alarm and cut-off .

IV. CONCLUSION

The proposed system effectively detects LPG leakage, triggers an alarm, and automatically shuts off the gas supply. Real-time data logging using Python provides continuous monitoring, enabling better analysis and preventive measures. The integration of sensors, Arduino, servo motor, and data logging makes this a low-cost, reliable solution suitable for domestic and industrial applications. Future work may include IoT-based remote alerts and mobile notifications for enhanced safety.

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