LPG Gas Detection using Arduino

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Abstract: *This project presents the development of a low-cost LPG gas leakage detection system using Arduino. The system uses an MQ-2 gas sensor to detect the presence of LPG gas in the environment. Upon detection of gas concentration above a predefined threshold, the Arduino triggers a buzzer to alert users and rotates a servo motor to automatically turn off the gas regulator, preventing further leakage. Additionally, a cooling fan is activated to help disperse the leaked gas. This project aims to enhance safety in households and industrial areas by providing an early warning system for gas leaks, ensuring rapid response and reducing the risk of fire or explosion. The implementation is simple, reliable, and highly suitable for real-time gas monitoring applications.*

Keywords: LPG gas leakage.

I. INTRODUCTION

This project focuses on designing an automatic LPG gas detection and safety system using Arduino. It utilizes an MQ-2 gas sensor, which is sensitive to LPG, methane, and other gases. The Arduino microcontroller constantly monitors the gas level from the sensor. When the gas concentration exceeds a safe threshold, the system activates a buzzer for an audible alert, rotates a servo motor to shut off the gas regulator, and turns on a cooling fan to help disperse the leaked gas.

1.1 ABOUT THE CIRCUIT

The circuit of simply made by interfacing gas sensor MQ-5, SIM 900 GSM Module and an Arduino Uno Board. GSM module are expensive and there are various types of GSM module available in market like SIM 300, SIM 800, SIM 900 etc but you can use any of them. The components that are required are given below

1.2 COMPONENTS REQUIREMENTS

1.SIM -900 GSM Module

2. MQ-2 gas sensor

3. Arduino Uno Board

4. Buzzer

5. Resistors (100E and 10K)

6. 2N2222 Transistor

7. 5 volt Battery

8. Connecting wires.

1.3 WORKING

Assemble the circuit as shown in the circuit diagram. The arduino board is programmed with arduino programming which does the every processing. The MQ-2 detectects the gas like butane, methane, coal gas and other form of LPS gas. After it detects the gas, it sends the information to the arduino uno board. The SIM-900 GSM Module is also connected to Arduino board with sim in it. It sends the sms to desired number which is programmed early. On the other hand the buzzer also produces sound and alerts every individual.

II. LITERATURE OVERVIEW

This project developed system to detect the gas leakage and providing immediate alarm or intimation to the user. Later in 2013, few people developed the design proposed for home safety. This system detects the leakage of the LPG and alerts the consumer about the leak by buzzer. This project was developed using microcontroller ARM version 7 processor and simulated using Keil software.In the year 2014, Hitendra Rawat, Ashish Kushwah, Khyati Asthana, Akanksha Shivhare, designed a system, They provided security issues against thieves, leakage and fire accidents. In those cases their system sends SMS to the emergency number provided to it. In the proposed system we have designed "LPG gas monitoring with alert system". These report focus on detection of economic fuels like petroleum, liquid petroleum gas, alcohol..etc., and alert the surrounding people about the leakage through SMS. It also sense surrounding temperature, so that no fire accidents occurs. These projects alert the user by sending message to mobile through SMS in two conditions.

2.1 LPG Gas Sensor (MQ-2)

The MQ-2 is a gas sensor specifically designed for detecting combustible gases such as LPG, Methane, Propane, and Hydrogen. The sensitive material used in the MQ-2 sensor is SnO_2 (Tin Dioxide), which exhibits lower conductivity in clean air. When a target gas such as LPG is present, the sensor's conductivity increases proportionally with the gas concentration. A simple interface circuit is used to convert the analog signal output into corresponding concentration levels, which can be read by a microcontroller. The MQ-2 sensor is highly sensitive to LPG and is widely used in gas leakage detection systems due to its low cost, high sensitivity, and reliable performance. It is suitable for various applications in domestic, industrial, and commercial environments where gas leakage detection is critical.

Conclusion

The LPG Gas Detection System using Arduino offers a practical and cost-effective solution for early detection of gas leaks, thereby enhancing safety in homes and industries. By integrating the MQ-2 gas sensor with a buzzer, servo motor, and cooling fan, the system not only alerts users immediately upon detecting gas leakage but also takes preventive action by turning off the gas regulator and aiding ventilation. This automation significantly reduces the risk of fire or explosion caused by undetected leaks. The project demonstrates how embedded systems can be effectively utilized for real-time safety applications and serves as a foundation for further development into advanced IoT-based gas monitoring systems.

Problem Statement: LPG GAS DETECTION USING ARDUINO

LPG is a highly flammable gas commonly used in residential and industrial settings. However, accidental gas leaks due to damaged pipes, faulty regulators, or human negligence pose serious risks, including fire, explosion, and health hazards. Traditional detection methods often rely on human senses, which may not detect low concentrations or may respond too late. There is a critical need for an affordable, automatic gas leakage detection and prevention system that can instantly alert users and take safety measures to minimize potential damage. This project aims to design and implement a reliable LPG gas leakage detection system using Arduino that can detect leaks in real-time, generate alerts, and automatically respond to ensure safety.

Problem Statement (Point-wise Format)

LPG (Liquefied Petroleum Gas) is commonly used in households and industries for cooking and heating.
It is highly flammable, and even a small gas leakage can result in fire, explosion, or health hazards.
Many gas leakage incidents happen due to:

- Faulty regulators or pipelines.
- Human negligence or unawareness.
- Lack of real-time monitoring and automatic safety systems.
- Traditional detection methods depend on human senses (smell), which are not always reliable or effective.

- Commercial gas detectors are often expensive and may not include automatic safety features.
- There is a need for a low-cost, real-time, and automatic gas leakage detection system that:
- Detects LPG leaks quickly.
- Alerts the user through a buzzer.
- Takes preventive actions such as turning off the gas regulator and activating ventilation

Literature Review

Several research studies and projects have been conducted in recent years to develop effective gas leakage detection systems using embedded technologies. Most commonly, gas sensors such as the MQ-2, MQ-4, and MQ-6 have been used due to their high sensitivity to flammable gases like LPG, Methane, and Propane. These sensors are widely used in academic and industrial projects for real-time gas monitoring due to their affordability and ease of use.

Studies have shown that integrating these sensors with microcontrollers like Arduino improves the responsiveness and accuracy of the system. Projects often involve interfacing additional components such as buzzers, GSM modules for alert messages, servo motors for automatic control of gas valves, and fans for ventilation. These systems have demonstrated significant effectiveness in preventing accidents caused by gas leaks.

Strengths of the Project

✅ Cost-Effective: Uses affordable components like Arduino and MQ-2 sensor, making it budget-friendly and accessible for household use.

✅ Real-Time Monitoring: Continuously monitors gas levels, ensuring immediate detection of any leakage.

✅ Automatic Response System: The servo motor automatically shuts off the gas regulator, preventing further leakage.

✅ Audible Alert System: The buzzer provides an immediate sound alert to warn nearby individuals.

✅ Ventilation Support: The cooling fan helps to disperse leaked gas quickly from the area.

✅ User-Friendly Design: Simple setup and operation, suitable even for non-technical users.

✅ Portable and Compact: The system is lightweight and easy to install in kitchens or small rooms.

✅ Reliable and Efficient: Uses tested components that offer reliable performance in real-time scenarios.

Limitations of the Project

❌ **Limited Range of Detection:** The MQ-2 sensor has a limited sensing range and may not detect very small gas leaks over large areas.

❌ **No Internet Connectivity:** The system is not connected to the internet, so remote alerts (like SMS or mobile notifications) are not possible in its current form.

❌ **False Alarms:** The sensor may sometimes react to other gases or smoke, leading to false alerts.

❌ **Power Dependency:** The system requires continuous power; any power failure may disable the safety mechanism.

❌ **No Visual Display:** The project does not include an LCD or screen to display gas levels in real-time.

❌ **Fixed Threshold:** The gas leakage threshold is hardcoded and not adaptable to different environments or conditions.

❌ **Single Sensor Usage:** It monitors leakage from one area only; large spaces may require multiple sensors for full coverage.

Conclusion:

In this project, we successfully designed and implemented an LPG gas leakage detection system using an Arduino microcontroller and MQ-2 gas sensor. The system is capable of detecting the presence of LPG gas in the surrounding environment and alerting users through both visual (LED) and audio (buzzer) indicators when gas levels exceed a predefined threshold.

III. SYSTEM ARCHITECTURE
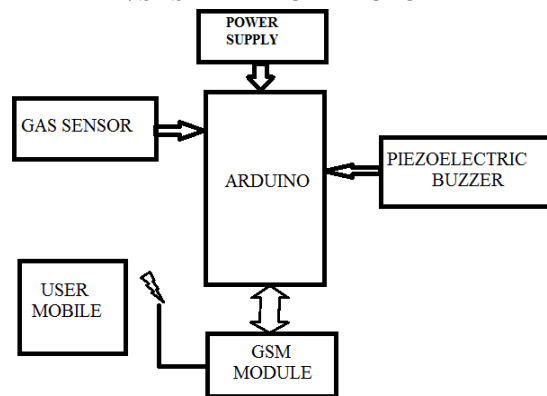
Fig: Block Diagram of Proposed System