IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 6, Issue 3, February 2026
Impact Factor: 8.2

Gas Leakage Detection System Using Arduino and GSM

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Abstract: *Gas leakage is one of the major causes of accidents in homes, industries, and laboratories. Leakage of LPG, methane, or other combustible gases can lead to fire hazards, explosions, and health risks. To prevent such accidents, an efficient gas detection and alert system is necessary.*
This project presents the design and development of a Gas Leakage Detection System using Arduino and GSM module. The system continuously monitors gas concentration using an MQ gas sensor.
When the gas level exceeds the predefined safety threshold, the system activates an alert mechanism including a buzzer/LED indication and sends an SMS notification to the registered mobile number using a GSM module. The system is low-cost, reliable, portable, and easy to install. It can be used in homes, industries, and commercial areas to enhance safety and prevent gas-related accidents..

Keywords: *Gas Leakage Detection, Arduino Nano, MQ Gas Sensor, GSM Module, Safety System, SMS Alert*

I. INTRODUCTION

Gas leakage accidents have become a serious issue in both domestic and industrial environments. Liquefied Petroleum Gas (LPG) and other combustible gases are widely used for cooking, heating, and industrial processes. However, leakage of these gases can cause fire hazards, explosions, and severe damage to life and property.

The Gas Leakage Detection System is designed to detect gas presence in the surrounding environment and alert users immediately. This project uses an Arduino Nano as the main controller, an MQ gas sensor for detecting gas concentration, and a GSM module for sending SMS alerts.

When the sensor detects gas above the safe level, the system activates a warning signal and sends a message to the user's mobile phone. The system ensures early detection and quick response, thereby improving safety.

II. LITERATURE SURVEY

Various researchers have worked on gas detection systems using different technologies. Earlier systems used simple gas sensors connected to alarm buzzers without remote communication. These systems only provided local alerts. With the development of microcontrollers like Arduino and communication modules like GSM, advanced gas detection systems have been developed. Researchers have implemented systems that not only detect gas leakage but also send SMS notifications and control valves automatically.

Studies show that MQ series gas sensors are widely used because of their sensitivity, low cost, and reliability. GSM modules such as SIM800L are commonly used for wireless communication due to their easy integration and low power requirements.

Modern gas detection systems focus on improving response time, accuracy, and remote monitoring capability.

III. PLATFORM TECHNOLOGY USED

The platform consists of the following main systems:

1. Microcontroller Platform

Arduino Nano is used as the main controller.

It processes sensor data and controls the output devices.

DOI: 10.48175/IJARSCT-31343

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2. Gas Sensing Technology
MQ gas sensor detects LPG, methane, propane, and other combustible gases.

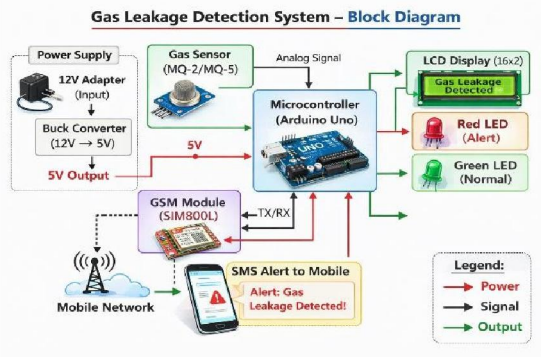
3. Communication Technology
SIM800L GSM module is used to send SMS alerts to the registered mobile number.

4. Display Technology
16x2 LCD display is used to show system status such as "Gas Normal" or "Gas Leakage Detected". 5. Power System
A 12V power supply and buck converter are used to regulate voltage for Arduino and GSM module.

IV. PROBLEM STATEMENT

Gas leakage can cause severe accidents and financial loss. Traditional gas detection systems only provide local alarms, which may not be sufficient if no one is present near the location.
There is a need for a smart gas detection system that can:
• Detect gas leakage accurately
• Provide immediate local alert
• Send remote SMS notification
• Operate with low power consumption
• Be affordable and easy to install

V. BLOCK DIAGRAM



VI. AIM AND OBJECTIVES

Aim
To design and develop a gas leakage detection system using Arduino and GSM module that provides real-time monitoring and SMS alert for safety purposes.

Objectives
1. To detect LPG and other combustible gases using MQ sensor.
2. To process sensor data using Arduino Nano.
3. To display system status on 16x2 LCD.
4. To send SMS alerts using GSM module during gas leakage.
5. To provide LED indication for normal and leakage conditions.
6. To design a low-cost and reliable safety system.

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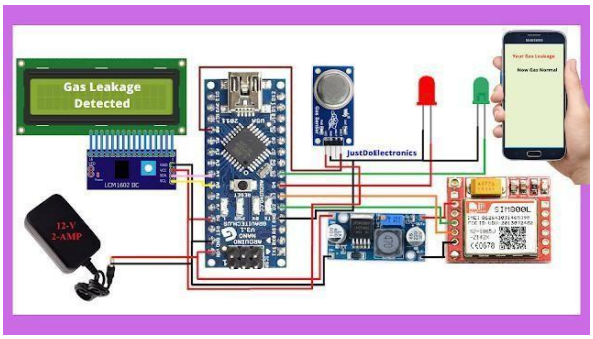
VII. CIRCUIT DESIGN AND SYSTEM ARCHITECTURE

7.1 Circuit Design



MQ Gas Sensor
Connected to Arduino analog input pin to measure gas concentration.

Arduino Nano
Acts as the central processing unit.

GSM Module (SIM800L)
Connected via serial communication (TX & RX pins) to Arduino.

LCD Display
Connected to digital pins of Arduino for displaying status.

LEDs
Red LED → Gas Leakage Green LED → Gas Normal

Power Supply
12V adapter → Buck converter → Regulated voltage to GSM and Arduino.

7.2 System Architecture

Battery/Power Supply
↓
Arduino Nano
↓
Gas Sensor Input
↓
Processing
↓
LCD Display + LEDs + GSM SMS

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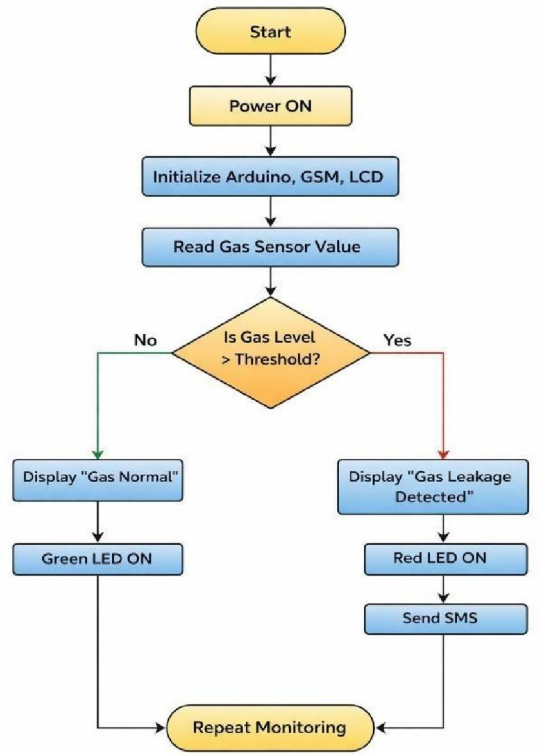
7.3 Flowchart



VIII. COMPONENTS AND MATERIALS

1. Arduino Nano
2. MQ Gas Sensor
3. SIM800L GSM Module
4. 16x2 LCD Display
5. Red LED
6. Green LED
7. 12V Power Supply
8. Buck Converter
9. Connecting Wires
10. PCB or Breadboard

IX. WORKING

When the system is powered ON, Arduino initializes all connected modules. The MQ sensor continuously monitors gas concentration.

If gas level is within safe limit:

• Green LED glows

• LCD displays “Gas Normal” If gas leakage is detected:

• Red LED glows

• LCD displays “Gas Leakage Detected”

• GSM module sends SMS alert to user

The system continuously monitors the environment and ensures safety.

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X. RESULTS

The system successfully detected gas leakage during testing.

- Sensor accurately responded to LPG presence.
- SMS alert was sent within a few seconds.
- LCD displayed correct status. LEDs functioned properly.
- System operated reliably with regulated power supply.

The project achieved its objective of providing real-time gas monitoring and remote alert.

XI. ADVANTAGES AND APPLICATIONS

Advantages

1. Low cost
2. Easy to install
3. Real-time monitoring 4. Remote SMS alert
5. Reliable and efficient
6. Low power consumption
7. Improves safety

Applications

1. Homes and kitchens
2. Restaurants
3. Industries
4. Laboratories
5. Gas storage areas
6. Chemical plants

XII. FUTURE SCOPE

The system can be improved by: Adding IoT for mobile app monitoring

- Automatic gas valve shut-off system
- Cloud data storage
- Wi-Fi monitoring
- Integration with fire alarm system
- Battery backup system

Future versions can be used in smart homes and industrial safety systems.

XIII. CONCLUSION

The Gas Leakage Detection System using Arduino and GSM was successfully designed and implemented. The system effectively detects gas leakage and sends SMS alerts to users. It is affordable, efficient, and suitable for domestic and industrial use. The project enhances safety by providing early warning and remote notification.

With further improvements, the system can be integrated into smart safety networks and large-scale monitoring systems.

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