GAS LEAKAGE DETECTION SYSTEM

1. Introduction

Gas leakage is a common safety hazard in residential, industrial, and commercial spaces. Detecting gas leaks at an early stage is crucial to prevent accidents such as fire, explosion, or suffocation. This mini project aims to develop a gas leakage detection system using sensors and microcontrollers to alert users and display gas concentration levels.

---

2. Objectives

- To design a reliable system for detecting gas leakage.
- To alert the user immediately upon detecting hazardous gas levels.
- To display the current gas concentration using an LCD screen.
- To understand the integration of gas sensors with microcontrollers.

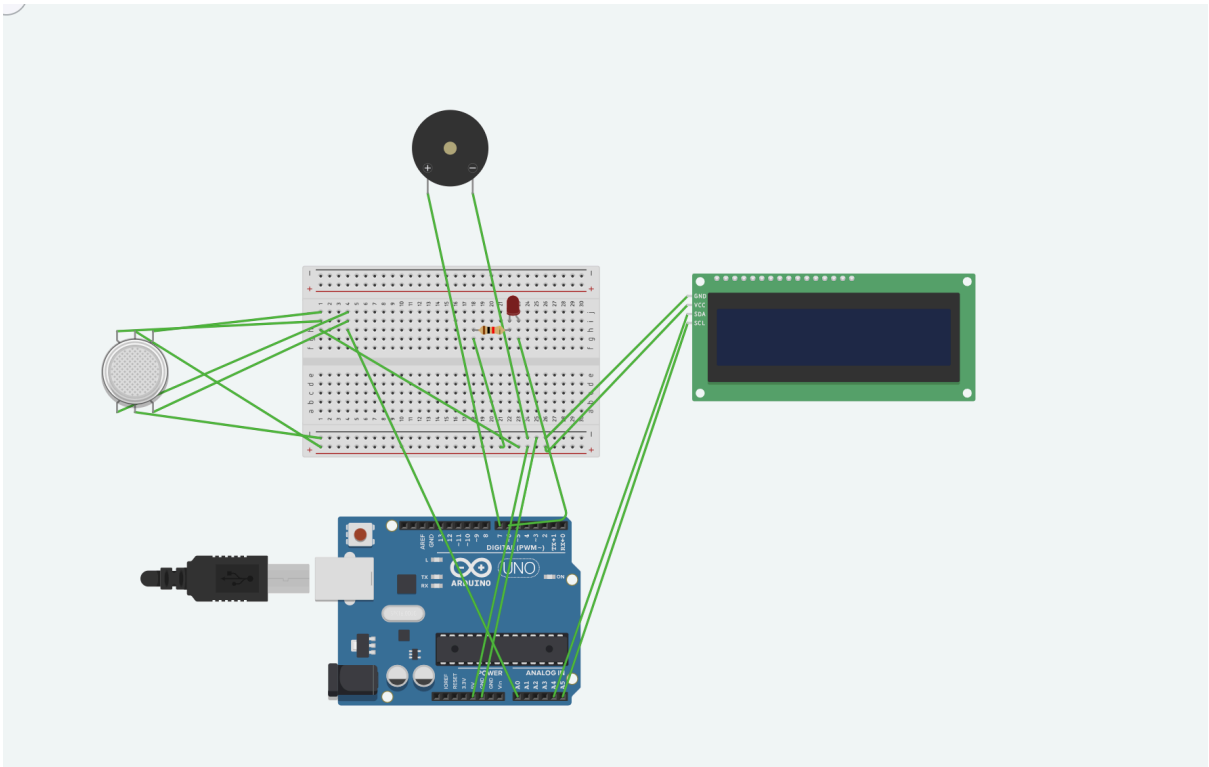
---

3. Components Used

- Arduino Uno (microcontroller)
- MQ-2 Gas Sensor
- Buzzer (for audio alert)
- LED (for visual alert)
- LCD Display (16x2)
- Resistors (as per circuit requirements)
- Jumper wires
- Breadboard (for testing)
- USB cable (for Arduino programming)

---

4. Circuit Diagram



5. Working Principle

The MQ-2 sensor detects gases like LPG, propane, and methane. It outputs an analog voltage corresponding to the gas concentration. This analog signal is read by the Arduino and processed.

- If the gas concentration crosses a certain threshold:
    - The buzzer is triggered.
    - The LED lights up.
    - The gas concentration is displayed on the LCD.

The threshold value can be set in the Arduino code, based on safety limits.

---

6. Software Implementation

- **ARDUINO IDE is used for programming**
- **Libraries Used:**
    - LiquidCrystal.h for LCD display
    - Wire.h if I2C is used
- The Arduino code continuously reads data from the sensor and updates the LCD.

7. Applications

- Residential kitchens for gas leak prevention
- Industrial gas plants
- Hospitals and laboratories
- Safety systems in hotels and restaurants

---

8. Results

This project demonstrates an efficient and practical way to monitor environmental gas levels using simple and cost-effective hardware. The combination of the MQ-2 gas sensor with an Arduino Uno and an LCD display provides real-time data that is easy to interpret. The alert system, using a buzzer and LED, ensures that any dangerous gas concentrations are quickly indicated, enhancing safety in domestic or industrial environments. The implementation proves to be reliable for basic gas leakage detection applications.

Observed Results:

- The gas sensor successfully detected varying levels of gas concentration in the environment.
- When gas concentration crossed the threshold value (170), the buzzer and LED were automatically activated.
- The LCD displayed the real-time gas values along with safety alerts or status messages.
- The serial monitor in the Arduino IDE also printed gas values and alert messages for additional monitoring.

---

9. Conclusion

The Gas Leakage Detection System project successfully fulfills its objective of detecting gas leakage and providing immediate alerts. By integrating the MQ-2 sensor with the Arduino Uno, along with a buzzer, LED, and LCD display, the system ensures that even small changes in gas concentration are monitored in real time. The use of simple components and straightforward logic makes this system not only effective but also affordable and easy to implement in real-world scenarios.

This project has helped us understand practical sensor interfacing, data visualization using an LCD, and the basics of designing embedded safety systems. It lays a strong foundation for further developments in the field of environmental safety and automation.