SENSOR CIRCUITS AND ACTUATORS
Mini Project – GAS LEAKAGE DETECTION SYSTEM

Abstract
Gas leakage is a significant hazard to life and property, particularly in residential, commercial, and industrial settings where gases such as LPG and methane are commonly used. This project introduces an advanced Gas Leakage Detection System built around the Arduino Uno microcontroller aimed at providing early warning and minimizing accident risks. The system integrates an MQ-2 gas sensor for continuous monitoring of combustible gas concentrations, alongside a flame sensor for fire detection. Upon sensing gas leakage or fire, the Arduino Uno triggers alert mechanisms through a buzzer for audible alarms. An LCD display allows for real-time presentation and alert of gas concentration and system status for user awareness. Powered by a regulated 5V supply, this project effectively combines embedded system technology with sensor-based safety measures to deliver a cost-efficient, reliable, and practical solution suitable for enhancing safety in homes, commercial spaces, and industrial environments.

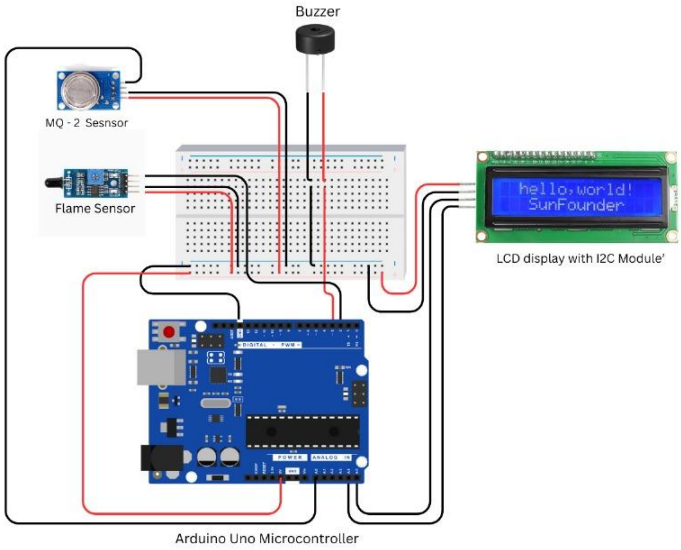
1. Introduction
This report presents the design and implementation of a Gas Leakage Detection System using sensors and actuators. The system monitors hazardous gas levels and triggers safety mechanisms. Below sections describe components, working principles, circuit diagrams, and code implementation.

2. Objectives
- Detect LPG or methane leakage using MQ-2 sensor
- Detect fire using flame sensor
- Trigger buzzer alerts on danger
- Display alerts and sensor values on LCD

3. Components Used
- Arduino UNO
- MQ-2 Gas Sensor
- Flame Sensor
- Buzzer
- LCD Display
- 5V Power Supply

• Connecting Wires

4. Circuit Diagram



5. Working Principle

The system continuously monitors gas concentration using the MQ-2 sensor. If values exceed threshold levels, the buzzer and LED indicators activate. The flame sensor detects fire and triggers the same alerts.

6. Arduino Code

```
#include <Wire.h>

#include <LiquidCrystal_I2C.h>

LiquidCrystal_I2C lcd(0x27, 16, 2);

const int MQ2Pin   = A0;

const int flamePin = 2;

const int buzzerPin = 3;

int gasThreshold = 300;

void setup() {
```

```
  Serial.begin(9600);
  lcd.init();
  lcd.backlight();
    pinMode(flamePin, INPUT);
  pinMode(buzzerPin, OUTPUT);
  digitalWrite(buzzerPin, LOW);
  lcd.setCursor(0, 0);
  lcd.print("Gas/Flame Detect");
  delay(1000);
}
void loop() {
  int gasValue   = analogRead(MQ2Pin);
  int flameState = digitalRead(flamePin);
  lcd.clear();
  lcd.setCursor(0, 0);
  if (gasValue > gasThreshold && flameState == HIGH) {
    lcd.print("Gas Detected!");
    digitalWrite(buzzerPin, HIGH);
  }
  else if (flameState == LOW) {
    lcd.print("Flame Detected!");
    digitalWrite(buzzerPin, HIGH);
  }
  else {
    lcd.print("All Clear");
    digitalWrite(buzzerPin, LOW);
```

```
  }
  lcd.setCursor(0, 1);
  lcd.print("Gas:");
  lcd.print(gasValue);
  lcd.print(" Flame:");
  lcd.print(flameState == LOW ? "Yes" : "No");
  Serial.print("Gas: ");
  Serial.print(gasValue);
  Serial.print(" Flame: ");
  Serial.println(flameState == LOW ? "Yes" : "No");
  delay(2000);
}
```

7. Applications

- Home safety systems
- Industrial gas monitoring
- Commercial kitchens
- Fire hazard prevention systems

8. Advantages

- Low-cost implementation
- Real-time detection
- Automatic ventilation system
- Works in multiple environments

9. Limitations

- Sensor accuracy may vary with environment
- Requires proper calibration
- Needs stable power supply

10. Conclusion

The Gas Leakage Detection System successfully demonstrates the use of sensors and actuators to monitor and respond to hazardous conditions. With further enhancements, such systems can be deployed in real-world applications for increased safety.

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