Fire and Gas Detector Using Arduino with LCD Display – IEEE Style Project Report

Abstract

This project presents a low-cost, Arduino-based Fire and Gas Detection System that provides safety alerts via an LCD display instead of buzzer or LEDs. The system uses MQ-2 gas sensor and flame sensor to monitor hazardous conditions. When fire or gas is detected, the LCD shows a clear warning message. This solution improves safety in homes, laboratories, and workplaces by providing real-time alerts with visual messages.

Keywords

Fire detection, Gas detection, MQ-2 sensor, Flame sensor, Arduino Uno, LCD Display, Safety System.

1. Introduction

Fire accidents and gas leaks pose serious risks to life and property. Manual monitoring is unreliable, especially during emergencies.

This project develops an Arduino-based Fire and Gas Detector that provides **real-time warnings on an LCD display**. The system continuously monitors the environment and displays alert messages if dangerous levels of smoke, gas, or fire are detected.

2. Literature Review

Many fire and gas detection systems rely on buzzers, LEDs, or IoT alerts.
This project uses only an LCD display, making it simpler and more cost-effective while still providing immediate warnings.

- MQ-2 sensor is sensitive to LPG, smoke, methane, and other combustible gases.
- Flame sensor detects infrared light from flames.

This design focuses on **visual alerts only**, avoiding noise from alarms.

3. Problem Statement

Traditional alarms can be noisy and disturbing. Some environments require **silent, visual alerts**, such as laboratories, hospitals, or offices.
This system provides a **visual alert solution using LCD** for safer and user-friendly monitoring.

4. Objectives

1. Detect fire and gas using sensors.
2. Display real-time alerts on LCD.
3. Provide a low-cost and reliable solution.
4. Ensure continuous monitoring without audible alarms.

5. System Overview

Components:

- Arduino Uno (microcontroller)

- MQ-2 Gas Sensor
- Flame Sensor (IR-based)
- 16x2 LCD Display
- Breadboard & Jumper Wires

The sensors monitor gas and flame levels. If the readings exceed thresholds, the LCD displays **“Danger! Fire/Gas Detected”**, otherwise it shows **“Safe”**.

6. Block Diagram

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Environment → Sensors → Arduino → LCD Display → User
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7. Hardware Components

1. **Arduino Uno** – controls the system.
2. **MQ-2 Gas Sensor** – detects LPG, smoke, and methane.
3. **Flame Sensor** – detects infrared light from fire.
4. **16x2 LCD Display** – shows alert messages.
5. **Jumper Wires & Breadboard** – for circuit assembly.

8. Circuit Connections

- MQ-2 → Analog pin A0
- Flame sensor → Digital pin D2
- LCD pins → connected to Arduino digital pins (RS, EN, D4-D7)
- VCC → 5V, GND → GND

The LCD shows warning messages when dangerous levels are detected.

9. Working Principle

1. Sensors continuously monitor gas and flame.
2. Arduino reads the sensor outputs.
3. If sensor readings exceed preset thresholds:
    a. LCD displays: **“Danger! Fire/Gas Detected”**
4. If safe:
    a. LCD displays: **“Environment Safe”**
5. The system updates readings every few hundred milliseconds to ensure real-time monitoring.

10. Testing & Results

Test Scenarios:

- LPG leakage near sensor
- Flame source (lighter or candle)
- Clean environment for baseline

Observations:

- LCD displayed warning immediately when gas or flame detected.
- Display returned to “Safe” when environment was normal.
- System worked reliably without any buzzer or LED indicators.

11. Applications

- Labs, offices, and classrooms
- Home kitchens
- Hospitals
- Silent monitoring environments
- Industries where audible alarms are undesirable

12. Advantages

- Silent operation
- Clear visual alerts
- Low cost and simple assembly
- Real-time monitoring
- Easy to expand with IoT or GSM modules

13. Limitations

- Only visual alert, no audible alarm
- Sensor sensitivity affected by dust or humidity
- Limited coverage area depending on sensor placement

14. Conclusion

The Arduino-based Fire and Gas Detector with LCD Display is a reliable, silent, and cost-effective solution for monitoring fire and gas hazards. The system provides immediate visual warnings, enhancing safety in sensitive environments where audible alarms are not suitable. Future improvements could include mobile notifications or IoT integration.

References

1. Arduino Uno Documentation
2. MQ-2 Gas Sensor Datasheet
3. Flame Sensor Datasheet
4. Research Papers on Fire and Gas Detection Systems