



**Yarmouk University**  
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**Fire and Smoke Detection System**

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## link for online simulation:

[https://www.tinkercad.com/things/fjZCWK83kQr-mighty-blad-kieran/editel?returnTo=%2Fthings%2FfjZCWK83kQr-mighty-blad-kieran&sharecode=WWqFqe-jEDQQLTrkDOYIDDKnUu2Io\\_FNZuKqNPUwQLY](https://www.tinkercad.com/things/fjZCWK83kQr-mighty-blad-kieran/editel?returnTo=%2Fthings%2FfjZCWK83kQr-mighty-blad-kieran&sharecode=WWqFqe-jEDQQLTrkDOYIDDKnUu2Io_FNZuKqNPUwQLY)

## Introduction:

Fire Systems Services offers a variety of fire and smoke detection systems, from traditional fire alarm systems to addressable fire alarm systems.

Automatic fire detection and alarm systems

Automatic fire detection and alarm systems are designed to warn building occupants of the event of a fire; These systems generally do not interfere with the fire growth process unless they are connected to a fire suppression system.

These systems generally use smoke, heat, or flame detectors to detect the outbreak of fire and alert building occupants and the fire service. Manual call points that allow a building occupant who detects a fire to raise an alarm may also be built into the system.

## System Overview:

It is designed to detect fire, and harmful gases, triggering alarms and emergency responses through the system monitors environmental conditions. When any abnormal change is detected, the system automatically triggers alarms. And when it provides a rapid response, the system helps save lives and reduce potential risks.

## System Design and Components:

It is designed by integrating sensors that work cooperatively with a microcontroller (Arduino Uno) to monitor environmental parameters continuously. When any sensor exceeds its assigned threshold, the system analyzes the results and sends the appropriate response through output devices.

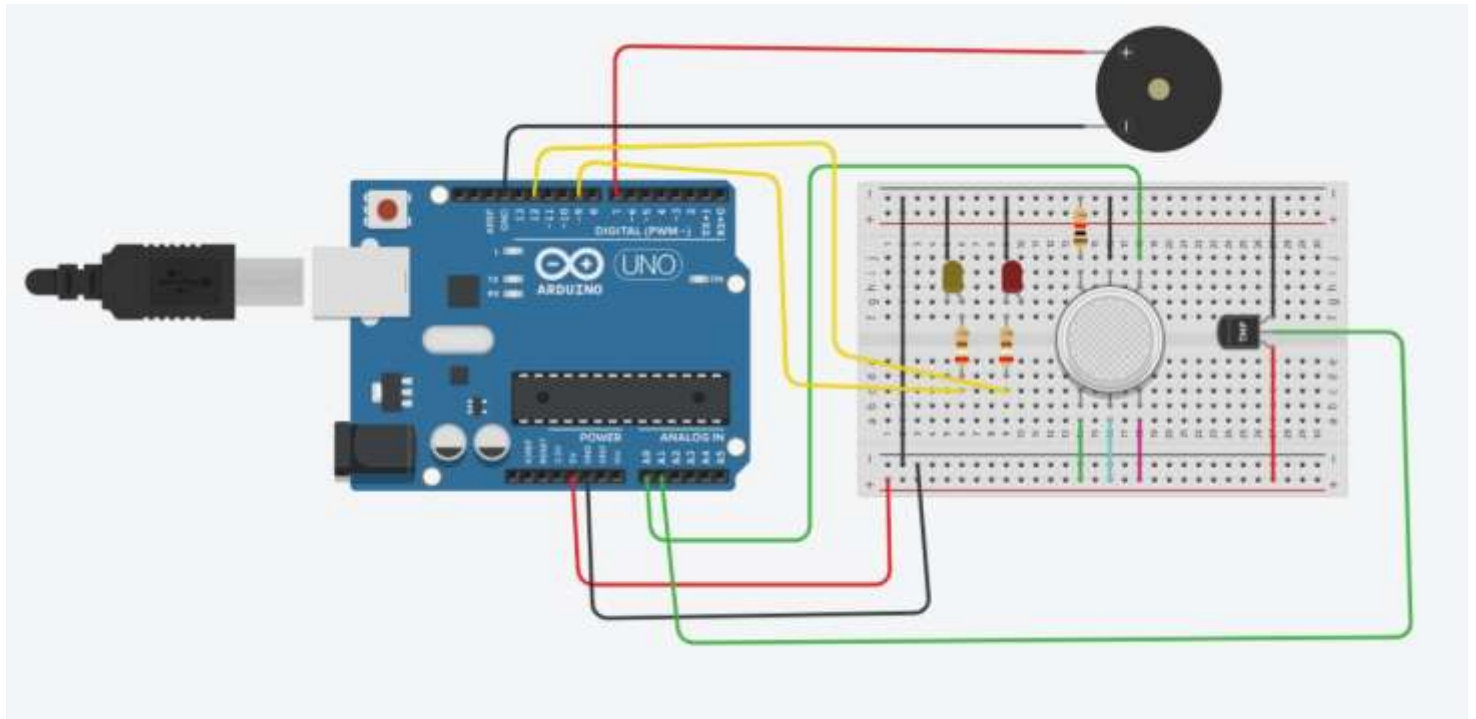
The components and their functions:

- **Gas Sensor (MQ series):** Detects harmful gases.
- **Temperature Sensor (TMP):** Measures the ambient temperature.
- **Buzzer:** Produces an audible alarm when smoke or high temperature is detected.
- **LEDs:** Indicate the status of smoke and temperature detection visually.
- **Arduino Uno:** The microcontroller board used to process sensor data and control outputs.
- **Resistors:** Used to limit current flow to the LEDs.

## Working principle:

The system incorporates a gas sensor that continuously monitors the air quality for the presence of smoke or hazardous gases. Upon exceeding a predefined concentration threshold, the system activates an audible alarm (buzzer) and illuminates the corresponding LED to alert users of gas detection. Concurrently, a temperature sensor tracks the ambient temperature. If the temperature surpasses 70°C, the system triggers the buzzer and illuminates the dedicated LED to signal a potential temperature-related hazard.

## Circuit Diagram:



## Connections:

- **Gas Sensor:**
  - VCC: Arduino 5V
  - GND: Arduino GND
  - OUT: Arduino A0
- **Temperature Sensor:**
  - VCC: Arduino 5V
  - GND: Arduino GND
  - OUT: Arduino A1
- **Buzzer:**
  - Positive: Arduino Pin 7
  - Negative: Arduino GND
- **LED for Gas Detection:**
  - Positive: Arduino Pin 4 (via resistor)
  - Negative: GND
- **LED for Temperature Detection:**
  - Positive: Arduino Pin 2 (via resistor)
  - Negative: GND

**Code:**

```
//AE CODE
int V_GasSen =0;
int V_TempSens =0;

void setup()
{
    pinMode(A0,INPUT);
    pinMode(7,OUTPUT);
    pinMode(4,OUTPUT);
    pinMode(A1,INPUT);
    pinMode(2,OUTPUT);
}

void loop()
{
    //Smoke Alarm
    V_GasSen = analogRead(A0);
    if (V_GasSen >=250)
    {
        tone(7,523,1000);    // play tone60 (C5 = 523Hz)
        digitalWrite(9,HIGH);
    }
    V_TempSens = -40+0.488155*(analogRead(A1)-20);
    if (V_TempSens >=70)
    {
        tone(7,523,1000);    // play tone60 (C5 = 523Hz)
        digitalWrite(12,HIGH);
    }
    delay(10);    //Delay a little bit to improve simulation performance
}
```

**Conclusion:**

Occupants and emergency responders enough time to act. The combination of automatic detection and advanced technology makes these systems highly effective in reducing risks and preventing damage.

The system's design integrates several types of sensors, each with a specific purpose, to continuously monitor the environment. Sensors like the flame detector, smoke sensor, and temperature sensor work together to identify even the slightest changes that might indicate a fire.

The Arduino Uno ensures that all these components work smoothly to analyze data and trigger the right response when needed.

Overall, the system helps provide quick and efficient responses to emergencies. This level of automation and precision helps save lives, reduce injuries, and these systems not only protect lives but also safeguard property and critical infrastructure. Fire detection systems like these are essential for maintaining safety and minimizing the impact of fire-related incidents.