Problem Statement

Problem:

Fire incidents can lead to severe property damage, injuries, and loss of life if not detected promptly. There is a need for an intelligent fire detection system that ensures rapid detection of flames, GAS sensors or excessive heat, improving response times and enhancing safety. The system must utilize ARDIUNO UNO R23 for wireless communication, integrating temperature and GAS sensors to provide alerts efficiently.

Scope of the Solution

Scope:

- Design a cost-effective and reliable fire detection system for residential, commercial, and industrial spaces.
- Provide real-time data monitoring and alerts using IoT (via ESP8266).
- Ensure scalability for integration with other IoT devices or smart systems.
- Enable remote monitoring via cloud platforms or mobile applications.
- Offer flexibility to include additional sensors such as gas detectors or flame sensors.

Required Components

Hardware:

1. Arduino uno R23

   The Arduino UNO serves as the central processing unit in fire detection and suppression systems, responsible for data acquisition, sensor interfacing, decisionmaking, and actuator control. Its versatility and programmability make it an ideal platform for managing various system functions, from processing sensor data to executing control algorithms. Equipped with a range of input/output pins and communication interfaces, the Arduino UNO enables seamless integration of sensors, actuators, and external devices. Its user-friendly programming environment and extensive community support facilitate system development and customization, empowering users to create tailored solutions for fire safety applications.

2. Temperature sensor (TMP36)

   The TMP36 is a low voltage, precision centigrade temperature sensor. It provides a voltage output that is linearly proportional to the Celsius temperature. It also doesn't require any external calibration to provide typical accuracies of ±1°C at +25°C and ±2°C over the −40°C to +125°C temperature range. We like it because it's so easy to use: Just give the device a ground and 2.7 to 5.5 VDC and read the voltage on the Vout pin. The output voltage can be converted to temperature easily using the scale factor of 10 mV/°C.

- Voltage Input: 2.7 V to 5.5 VDC
- 10 mV/°C scale factor

- ±2°C accuracy over temperature
- ±0.5°C linearity
- Operating Range: −40°C to +125°C
- Calibrated directly in °C
- 10 mV/°C scale factor
- Do not require any external calibration

3. GAS sensor

   The gas sensor is a device used to monitor the presence or level of gas in a stationary environment. Commonly used in coal mines, petroleum, chemical, municipal, medical, transportation, family, and so on. Gas sensors can measure the presence and concentration of combustible, flammable, toxic gases, or oxygen consumption.

4. LED indicators

   Led is a light emitting diode. It is made of an semiconductor material. It is used for an emergency indication whenever a fire excites in room the temperature will increase. The led will glow.

5. Buzzer

   The buzzer generates audible alerts or alarms to notify occupants or authorities of fire incidents or system malfunctions. Buzzers, or beepers, are audio signaling devices used in various applications such as alarms and timers. They can be mechanical, electromechanical, or piezoelectric, and are commonly used to signal user interactions or alerts.

6. Resistors and connecting wires
7. Breadboard or PCB
8. Power supply (e.g., USB or battery)

Software and IDEs:

1. Tinker Cad (for circuit simulation)

Simulated Circuit

Simulate the circuit using **Tinker Cad**

Include:

- ARDIUNO UNO connected to TMP36 and MQ-2/MQ-135 sensors.
- Output pins connected to an LED and buzzer for alerts.

Video of the Demo

https://drive.google.com/file/d/1VX6IRJhMJY_N1SCCFIxPX9HIf8BT4HAY/view?usp=sharing

Gerber File

Attached at the end of the document.

Code for the Solution

Write the Arduino code for ESP8266 to:

- Read data from TMP36 and MQ-2/MQ-135 sensors.
- Process the data to determine if smoke or high temperature is detected.
- Trigger an LED and buzzer for local alerts.
- Send data and alerts to a cloud platform for remote monitoring.

Code

```
float temp;
float vout;
float vout1;
int LED = 13;
int gasSensor;
int piezo = 7;

void setup()
{
 pinMode(A0, INPUT);
 pinMode(A1, INPUT);
 pinMode(LED, OUTPUT);
 pinMode(piezo, OUTPUT);
 Serial.begin(9600);
}

void loop()
{
 vout = analogRead(A1);
 vout1 = (vout / 1023.0) * 5000.0;
 temp = (vout1 - 500) / 10.0;

 gasSensor = analogRead(A0);

 if (temp >= 50)
 {
  digitalWrite(LED, HIGH);
```

```
 }
 else
 {
  digitalWrite(LED, LOW);
 }

 if (gasSensor >= 90)
 {
  digitalWrite(piezo, HIGH);
 }
 else
 {
  digitalWrite(piezo, LOW);
 }

 Serial.print("Temperature (°C) = ");
 Serial.print(temp);
 Serial.print("\tGas Sensor Value = ");
 Serial.println(gasSensor);

 delay(1000);
}
```

NOTE :-

- ESP8266 is not available in the thinker cad software stimulation.