

# Fire Alert System

By: Dhriti Sharma  
B.Tech Electronics and Communication  
SENSE  
VIT

## Problem Statement:

Fire accidents frequently occur in industrial setups with flammable materials, electrical gadgets, or complicated machinery. Such setups increase the chances of ignition source meeting with combustible materials resulting in disastrous incidents. Given the convoluted and numerous industrial operations, fire can spread very fast, thus, early detection and prompt responses are needed to mitigate as much damage as possible. Hence the need arises for a reliable automated prototype that would guarantee rapid detection of fire incidents and aid in safe and orderly evacuation of workers with a view to minimizing injury, loss of life, and property damage.

## Scope of the Solution:

The outline solution intends to:

1. Detect fire accidents automatically at an industrial setup using sensors.
2. Raise immediate alerts using LED lights, buzzers, and relays of other alerting devices or pumps, for instance.
3. Help in evacuating by automatically directing workers along clear signals.
4. Present the system as a working prototype based on microcontrollers so that it can be further implemented as a comprehensive industrial safety system.
5. Include provisions for documentation, simulation, and codes for reproduction and further improvements.

## Required Components:

Hardware:

1. Arduino UNO (microcontroller board)
2. Temperature Sensor (LM35, analog, -55°C to 150°C, accuracy  $\pm 0.5^\circ\text{C}$ )
3. Gas Sensor (MQ-2 detects LPG, smoke, methane, CO, alcohol; analog output, 5V)
4. Buzzer (5V active)
5. Relay module (5V, single channel)
6. LED (5mm red, for visual alert)
7. 220 $\Omega$  resistor (for LED current limiting)
8. Breadboard (for prototyping)
9. Jumper wires

Software:

1. Arduino IDE (for coding and uploading firmware)
2. Tinkercad (for circuit simulation and diagram)
3. EasyEDA (for PCB design and Gerber file generation)

Simulated Circuit:

<https://www.tinkercad.com/things/bgxjr7iGDSU/editel?sharecode=xgvvfKRf6rZTtvTTFE1EsFeEKS0k1ekZ51t1GxxHlrQ>

Due to limitations of the simulation tools the following changes were made only for the simulation:

1. The simulated circuit includes TMP36 due to the lack of availability of LM35.
2. The buzzer is replaced by a LED in the circuit due to the lack of availability of the buzzer.

Code:

```
#define gasSensor A0
#define tempSensor A1
#define buzzer 4
#define led 5

int gasThreshold = 300;
int tempThreshold = 60;

void setup() {
  Serial.begin(9600);
  pinMode(buzzer, OUTPUT);
  pinMode(led, OUTPUT);
  digitalWrite(led, LOW); /
}

void loop() {
  int gasValue = analogRead(gasSensor);
  int tempValue = analogRead(tempSensor);
  float voltage = tempValue * (5.0 / 1023.0);
  float temperature = voltage / 0.01;

  Serial.print("Gas: "); Serial.print(gasValue);
  Serial.print(" | Temp: "); Serial.println(temperature);

  if (gasValue > gasThreshold || temperature > tempThreshold) {
```

```
digitalWrite(buzzer, HIGH);  
digitalWrite(led, HIGH);  
delay(300);  
digitalWrite(buzzer, LOW);  
delay(300);  
} else {  
    digitalWrite(buzzer, LOW);  
    digitalWrite(led, LOW);  
}  
delay(1000);  
}
```

#### Logic of the code:

##### Setup:

1. The Arduino will initialize the pins for the gas sensor, temperature sensor, buzzer, and LED.
2. It also starts serial communication so you can see sensor readings on your computer.

##### Loop:

1. The Arduino reads the values at its pins corresponding to the gas sensor and temperature sensor.
2. It performs the conversion of the temperature sensor's analog reading into degrees Celsius.
3. It prints the gas level and temperature to the Serial Monitor for observation.

##### Alert Logic:

1. If the gas level is too high or the temperature is above a preset level (for example, 60°C), the Arduino will perform the following actions:
2. Turn the buzzer and LED on as a warning.
3. If safe, both buzzer and LED remain off.

#### Summary:

The project presents an automated industrial fire safety system based on the working principles of temperature and gas sensors for continuously sensing conditions hazardous to the industrial environment. Any high temperature or dangerous gas level must immediately activate a loud buzzer and LED alerting workers. This enables them to react and evacuate the location quickly. The prototype was field-tested with positive results to detect and alert timely under simulated emergency conditions. In essence, the system acts as an inexpensive industrial safety tool enhancing industries while limiting possible hazards.