

GLP-F020

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سجل التجارب للعام الدراسي 2024-2025

Experiment No. 2: Flame sensor

Introduction:

Flame sensors are crucial components in various industrial and domestic applications to detect the presence of a flame. They ensure safety and efficiency by monitoring combustion processes and shutting down systems in the event of a malfunction.

1. What is a Flame Sensor?

A flame sensor is a device designed to detect the presence of a flame in a burner system. It works by sensing the ultraviolet (UV), infrared (IR), or visible light emitted by the flame and generating a corresponding electrical signal.

Key Features:

- Monitors combustion.
- Enhances safety by detecting flame failure.
- Works in real-time.

Simple code for flame sensor :

```
const int flameSensorPin = A0;
const int buzzerPin = 9;
void setup() {
  pinMode(buzzerPin, OUTPUT);
  Serial.begin(9600);
}

void loop() {
  int flameValue = analogRead(flameSensorPin);

  if (flameValue < 500) {
    digitalWrite(buzzerPin, HIGH);
    Serial.println("Flame detected!");
  } else {
    digitalWrite(buzzerPin, LOW);
  }

  delay(100);
}
```

How the Code Works?

1. When a flame is detected (LOW signal from the sensor):
 - The buzzer is activated to produce a sound.
 - A message “Flame Detected!” is printed on the Serial Monitor.
2. When no flame is detected:
 - The buzzer is turned off.
 - A message “No Flame” is printed on the Serial Monitor.

Buzzer Wiring:

- Positive (+) pin of the buzzer connects to the digital output pin (e.g., D9).
- Negative (-) pin of the buzzer connects to GND on the Arduino board.

2. Working Principle

Flame sensors operate based on the type of light or heat a flame emits. Common types include:

- UV Flame Sensors: Detect ultraviolet radiation from a flame.
- IR Flame Sensors: Detect infrared radiation.
- Photocell Sensors: Use light-sensitive materials to detect visible light.

The sensor converts the detected radiation into an electrical signal, which is then sent to a control unit. If the flame goes out, the signal stops, triggering safety mechanisms.

3. Applications

- Industrial Boilers: Ensure proper combustion.
- Gas Furnaces: Detect flame failure.
- Power Plants: Prevent explosions by monitoring flames.
- Kitchen Appliances: Enhance safety in stoves and ovens.

4. Advantages

- Immediate flame detection.
- Reduces risks of gas leaks or explosions.
- Enhances energy efficiency.
- Requires minimal maintenance.

5. Limitations

- Sensitive to dirt and dust accumulation.
- Limited detection range for certain types.
- Requires proper alignment and calibration.

6. Maintenance Tips

- Regularly clean the sensor to remove dust or soot.
- Check the wiring and connections for wear and tear.
- Periodically test the sensor's functionality.

Conclusion

Flame sensors are vital for ensuring safety and operational efficiency in various systems. Understanding their working principles, applications, and maintenance can help prevent accidents and enhance system performance.