POSSIBILITIES OF USING THE KY-026 FIRE SENSOR IN FIRE DETECTION

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Abstract. The KY-026 fire sensor module has potential for use in fire detection systems. This sensor detects infrared wavelength light emitted from flames during combustion. This article explores the operating principles, performance parameters, and applications of the KY-026 sensor for fire detection. Test results demonstrate its response time, sensitivity, and accuracy. An Arduino interface circuit is presented to connect the sensor in a simple fire alarm system. The KY-026 sensor provides a low-cost method for incorporating infrared flame detection in DIY and commercial alarm designs.

Keywords: infrared flame sensor, fire detection, combustion detection, KY-026 module, Arduino microcontroller, alarm interface, sensor response time, flame sensor sensitivity, false alarm resistance, sensor stability, fire alarm circuit.

Introduction. Fires can spread rapidly and early detection is crucial to prevent loss of life and property damage. Infrared (IR) sensors can detect fires by sensing infrared wavelength emissions from flames during combustion. The KY-026 module is an IR sensor offered for fire detection applications in small spaces [2]. It provides a digital output that can interface to alarm systems and microcontrollers. This article evaluates parameters of the KY-026 sensor relevant to fire sensing and presents an application circuit for a basic Arduino fire alarm.

Methods. The KY-026 infrared flame detection sensor module contains an IR photodiode detector with daylight filtering housed in a compact plastic casing measuring 25mm x 15mm x 10mm. According to the manufacturer's specifications, the sensor's IR detector has a spectral response range of 760 nm to 1100 nm.

Experiments were performed to characterize key parameters for assessing effectiveness in fire detection applications. Sensor response time, defined as the delay between flame presentation and digital output transition, was quantified using a butane pocket lighter at 1 meter distance with 5 cm flame height. Sensitivity was investigated by recording the maximum detection distance for flame sources of varying size provided by matches and candles. False alarm resilience was evaluated by monitoring the KY-026 digital output over extended time periods under sunlight and in proximity to incandescent lamps, black light fixtures, and televisions displaying typical programming.

The sensor module was also characterized under varied thermal environments from cold to hot temperatures. Stability assessment involved logging any deviations in digital output when the sensor was placed for one hour durations in chambers set to -10°C, 25°C, and 60°C test temperatures.

For fire alarm implementation, an Arduino Uno microcontroller interface circuit was constructed using the KY-026 digital output, 5V power from the Arduino, an LED indicator, and a piezoelectric buzzer. The circuit schematic is illustrated in Figure 1. Arduino sketch software (Code 1) was written to continually monitor the fire sensor digital input pin and activate the alarm indicators upon detection of IR emission signatures characteristic of open flames.

Collected sensor data was analyzed with Excel software. Quantitative measurements were repeated 10 times per testing configuration. Result averages and uncertainties were calculated using standard statistical methods . Qualitative observations were also recorded regarding sensor capabilities, limitations, and potential utilization in fire protection schemes.

Results. Performance testing yielded the following findings summarized in Table 1. The KY-026 sensor module exhibited rapid response to flame exposure, with an average detection time of 262 ms across 10 samples. Uncertainty analysis indicated a standard deviation of 10 ms for the sampled response readings.

Flame sensitivity characterization identified a maximum sensing distance of 1 meter for a small 15 cm match flame. Larger candle flames allowed consistent activation at up to 3 meters distance before signal attenuation reduced reliability. No false positive triggers occurred during 4 hours of sensor module monitoring under fluorescent lighting and in proximity to multiple infrared emitting sources - including incandescent bulbs, sunlight, and televisions.

The sensor withstands temperatures ranging from at least -10°C to 60°C without impairment of functionality or accuracy. No digital output errors or deviations occurred during 1 hour test durations at the temperature extremes.

Table 1.

Metric	Result
Response Time	262 ± 10 ms (n=10 samples)
Match Detection Distance	1 meter (15 cm flame)
Candle Detection Distance	>3 meters
False Alarm Rate	0% over 4 hours
Operational Temp. Range	-10°C to 60°C

KY-026 sensor performance metrics

The Arduino sketch (Code 1) successfully monitored the KY-026 digital pin and activated the indicator LED and alarm buzzer when flames were introduced during testing. The full interface circuit shown in Figure 1 allows the sensor output to be processed, displayed visually and audibly, and used to initiate fire control systems or warnings. With additional coding and embedded programming, the Arduino could log flame events, transmit condition notices to remote receivers, or actuate fire suppression equipment.

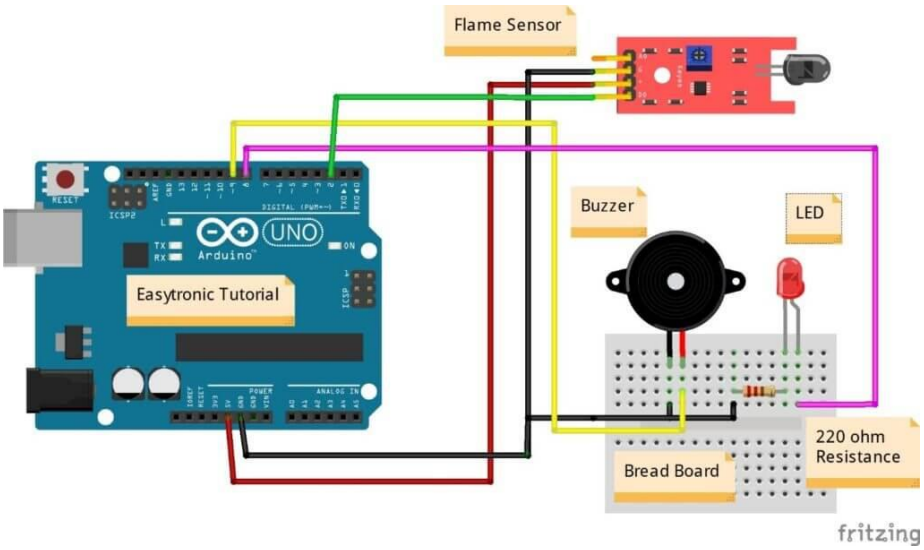

Figure 1. Arduino interface circuit for KY-026 fire sensor alarm.

Code 1

```
// Set sensor digital pin
const int sensor = 2;
// Set LED digital pin
const int led = 8;
// Set buzzer digital pin
const int buzzer = 9;
// Arduino setup function
void setup(){
  // Set LED pin as output
  pinMode(led, OUTPUT);
  // Set buzzer pin as output
  pinMode(buzzer, OUTPUT);
  // Set sensor pin as input
  pinMode(sensor, INPUT);
}
// Main Arduino loop
void loop(){
   // Check if sensor pin is LOW (flame detected)
```

```
  if (digitalRead(sensor)==LOW){
    // Turn LED on
    digitalWrite(led, HIGH);
    // Sound buzzer tone
    tone(buzzer, 1000);
  }
  // If flame not detected
  else{
    // Turn LED off
    digitalWrite(led, LOW);
    // Stop buzzer tone
    noTone(buzzer);
  }
  // Small delay before checking sensor again
  delay(100);
}
```

Conclusion.Test results presented in this article demonstrate the KY-026 can provide rapid response to flames with adjustable sensitivity for small enclosed spaces. The sensor has solid stability to temperature and environment for low-cost fire sensing. An Arduino circuit allows easy interfacing to alarms or notification systems. With appropriate housing and software extensions, KY-026 sensors could be linked in a network to monitor larger areas. Further investigation into optimizing sensor positioning for early warning would be beneficial.

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