Flame Sensor

Introduction

In the public places, say, hotels, buildings and other places are all equipped with fire alarm, then how does it perceive a fire? As we know, when the fire break out, there will be particularly strong infrared, the device can detect fire via infrared.

Photo of Flame Sensor

Working Principle

In the spectrum, we call light whose wavelength is from 0.76 to 400 micron as infrared, it is invisible. All materials which are above absolute zero (273.15 ℃) can produce infrared. It is called thermal radiation in modern physics. We know before that a photovaristor without light, there are weak reverse leakage current (dark current), the light-sensitive tube is not conducting at this moment. When struck by light, saturated reverse leakage current will rising immediately, then forms the photocurrent. It increases along with the change of incident light intensity within a certain range. Between the principles of infrared receiving tube and photovaristor, the only difference is that infrared receiving tube is not sensitive to visible light, only to infrared light. When there is no infrared light, the reverse leakage current is quite weak, and the infrared sensor is not conducting; when there is infrared, there will be photocurrent, and the on-resistance reduces along with the increase of infrared intensity. Given the flame-sensitive characteristics of flame sensors, flame can be detected by specially-made infrared receiving tube. As the flame grows, the on-resistance of infrared receiving tube will reduce.

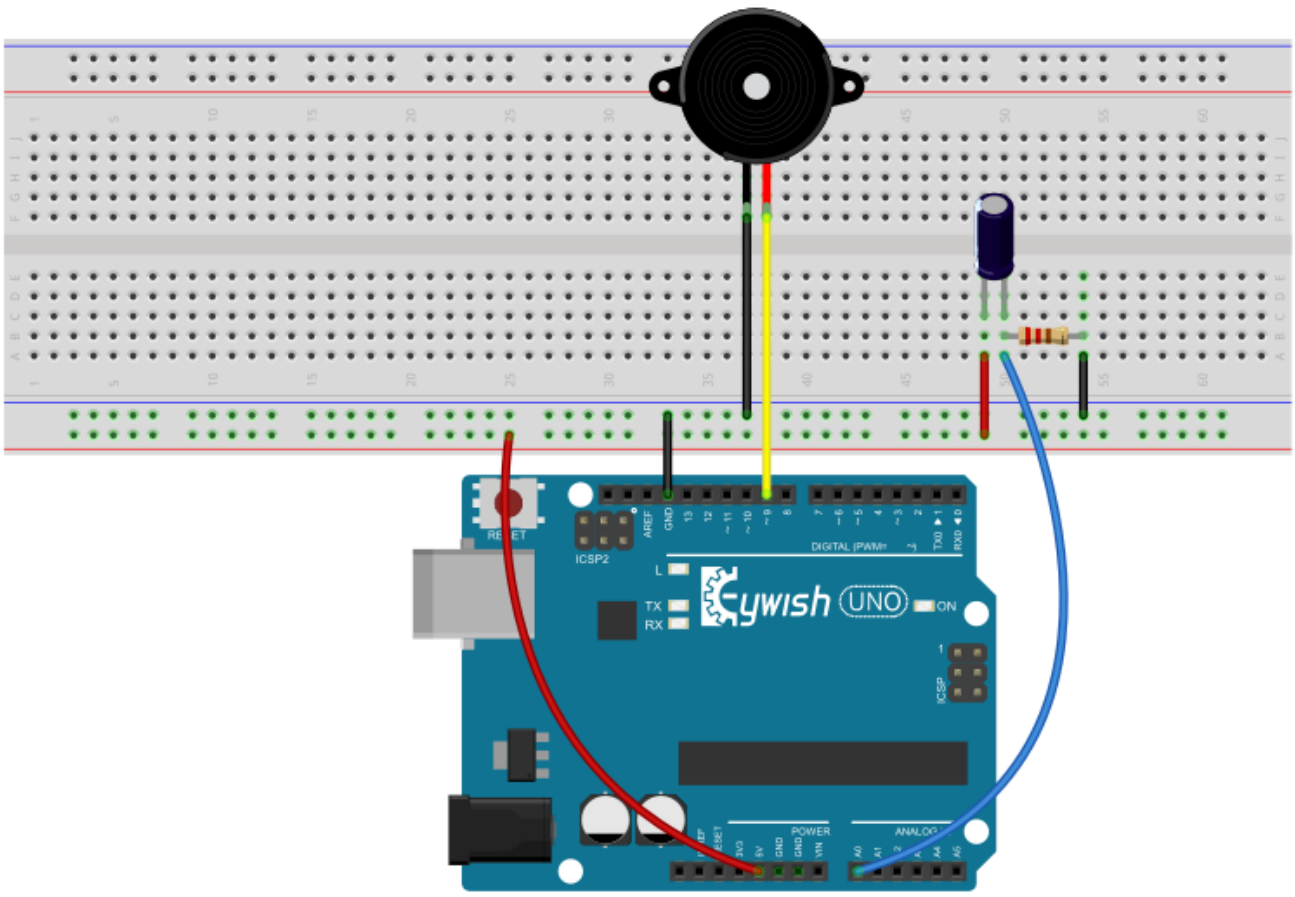
Wiring of Flame Sensor

The short lead of infrared receiving triode is the cathode, the long is the anode. We link the 5v interface to the cathode according to the diagram below, then connect 10k resistor to the anode, the other end of the resistor is left for the GND interface. At last, we insert a jumper into the anode column of the flame sensor, and the other side of the jumper links to analog interface.

Component List

- Keywish Arduino UNO R3 mainboard
- Breadboard
- USB cable
- Flame sensor*1
- Buzzer*1
- 10k Resistor*1
- Several jumper wires

Wiring of Circuit



Connecting the buzzer to number 8 interface, The flame sensor to number 5 interface to complete the whole wiring of the experiment.

Experiment Principle

The voltage value of analog interface is changing when there exists two kinds of circumstances--whether approaching the flame or not. Actually, if we measure the flame sensor without flame approached by a multimeter , the voltage value of analog interface is about 0.3 V; When approaching the sensor with flame, the voltage value is about 1.0 V. The closer the flame approaches, the higher the voltage value is.

So in the beginning of the program, we can firstly store a voltage value when no flame, then continuously read the voltage value j of analog interface. Carrying out the formula k = j - I, then we compare k with 0.6v. For fear of error we are sure flame actuates the buzzer if the difference value k is above 0.6v (Binary value is 123) five times in a row; if the difference is less than 0.6v, the buzzer stays silent.

Code

```
sint fire_pin = A0 ;       // define analog 0 pin for fire-sensor pin
int buzzer = 9 ;          // buzzer dirver pin
int val = 0;
int count = 0 ;
void setup()
{
    pinMode(buzzer,OUTPUT);          // buzzer pin is output
    pinMode(fire_pin,INPUT);         // fire-sensor pin is input
    Serial.begin(115200);            // init baud rate is 115200
    digitalWrite(buzzer,LOW);        // buzzer default value is 0
}
void loop()
{
    val = analogRead(fire_pin);     // get fire-sensor analog value
    Serial.println(val);
    if( val > 600 )                   // get value > 600 counet add
    {
        count++ ;
    }else
    {
       count = 0 ;
    }
    if( count >= 5 )                // count > 5 ensure infrared
radiation found and give an alarm
    {
        digitalWrite(buzzer , HIGH );
    } else
    {
        digitalWrite(buzzer , LOW );   // disable an alarm
    }
    delay(500);
}
```

This program can simulate the buzzer ringing when there exists fire, and everything is normal when no flame.