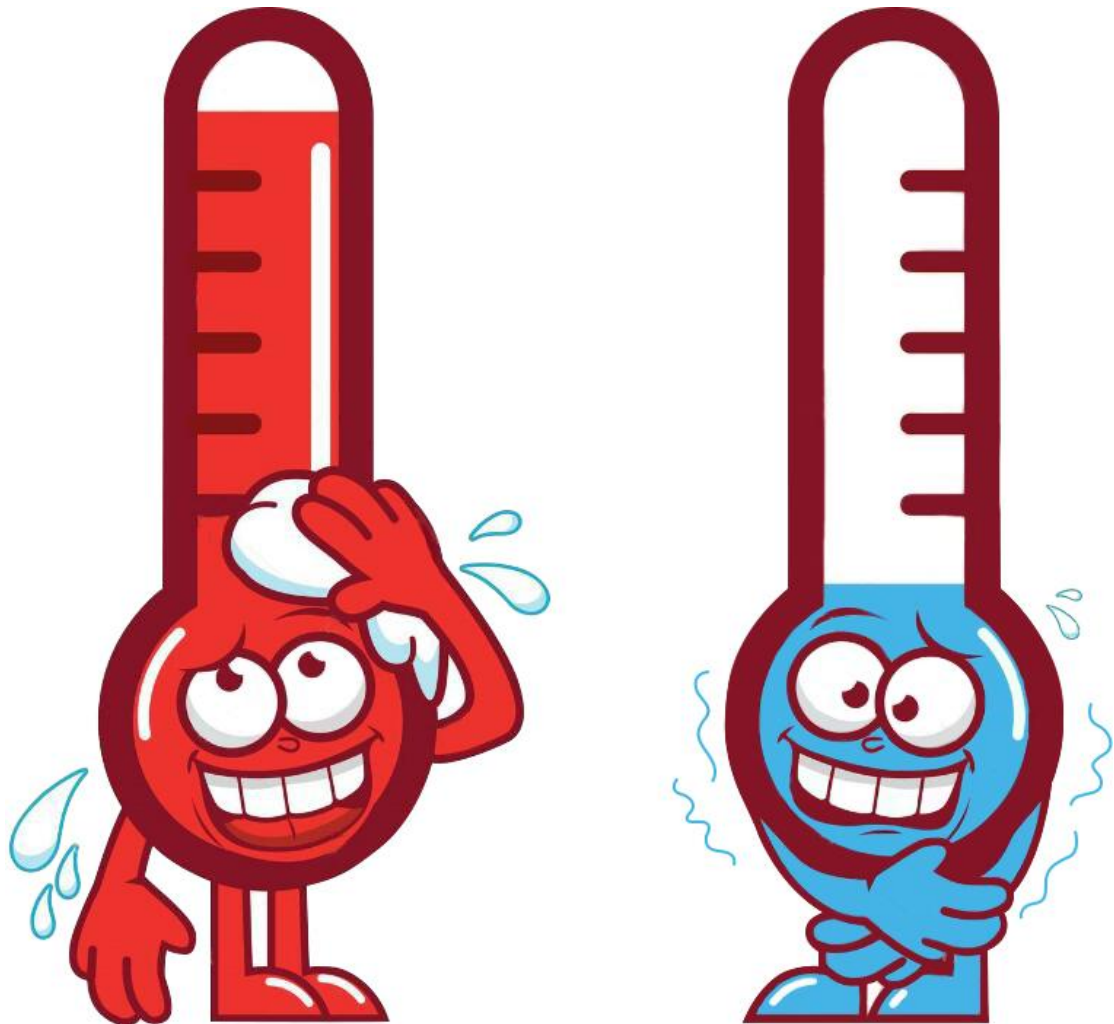


Project 24: Temperature Tester



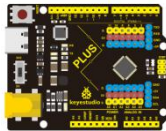
1. Project Introduction

LM35 is a common and easy-to-use temperature sensor. It does not require other hardware. You just need an analog port to make it work. The difficulty lies in compiling the code to convert the analog value it reads into Celsius temperature.

In this project, we use a temperature sensor and 3 LED lights

to make a temperature tester. When the temperature sensor touches different temperature objects, the LED lights will show different colors.

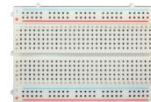
2. Project Hardware



Plus
Development
Board*1



Plus Board
Holder



400-Hole
Breadboard



USB Cable*1



LM35
sensor*1



Red M5 LED
*3



220Ω
Resistor*1

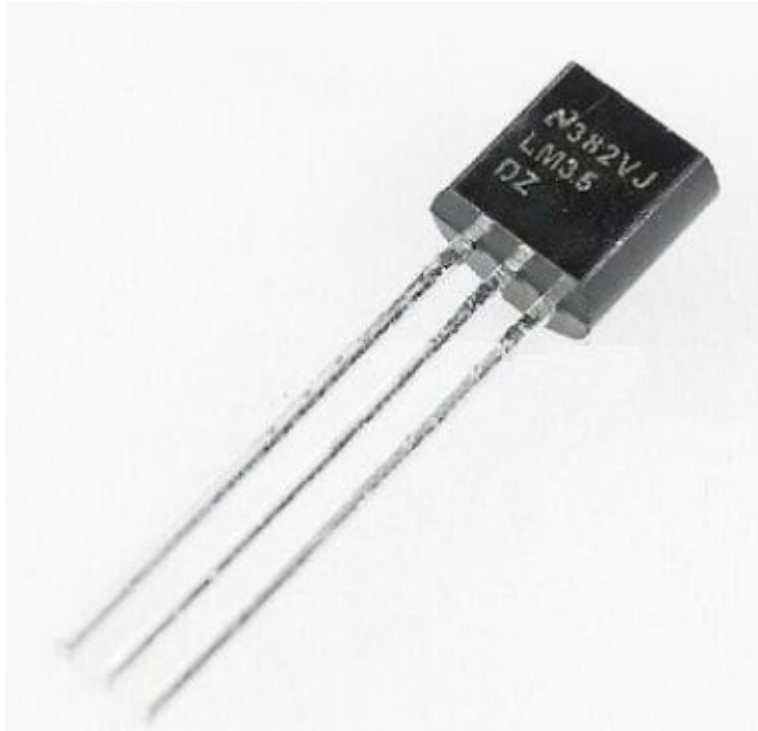


Jumper
Wire*10+

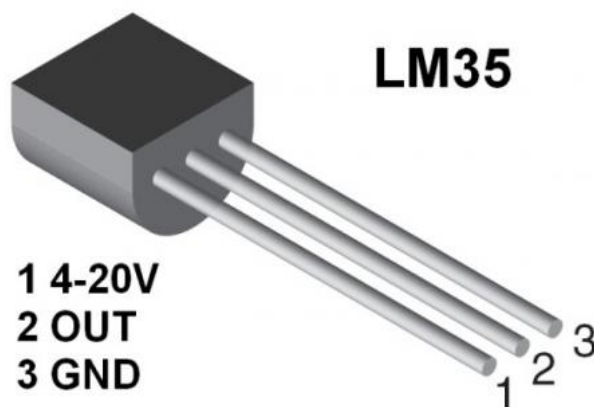


Temperature
tester Paper
Card*1

3. Temperature Sensor Working Principle



LM35 is a widely used temperature sensor with many different package types. At room temperature, it can achieve the accuracy of $\pm 1/4^{\circ}\text{C}$ without additional calibration processing.



LM35 temperature sensor can produce different voltage by different temperature

When temperature is 0°C , it outputs 0V; if increasing 1°C ,

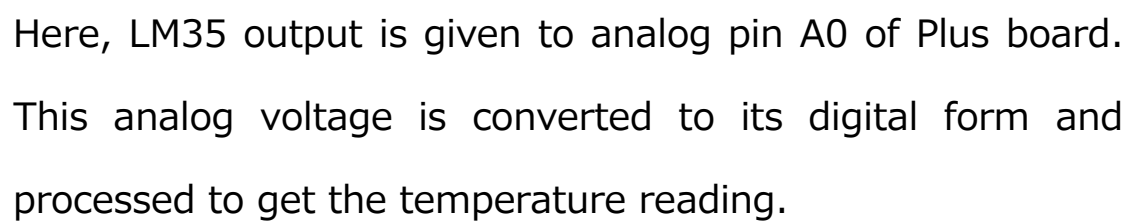
the output voltage will increase 10 mv.

The output temperature is 0 °C ~ 100 °C , the conversion formula is as follows:

$$V_{\text{out_LM35}}(T) = 10 \text{mV}/^{\circ}\text{C} \times T^{\circ}\text{C}$$

4.Read Temperature Value

We first use a simple code to read the value of the temperature sensor, print it in the serial monitor, and wire it as shown below.

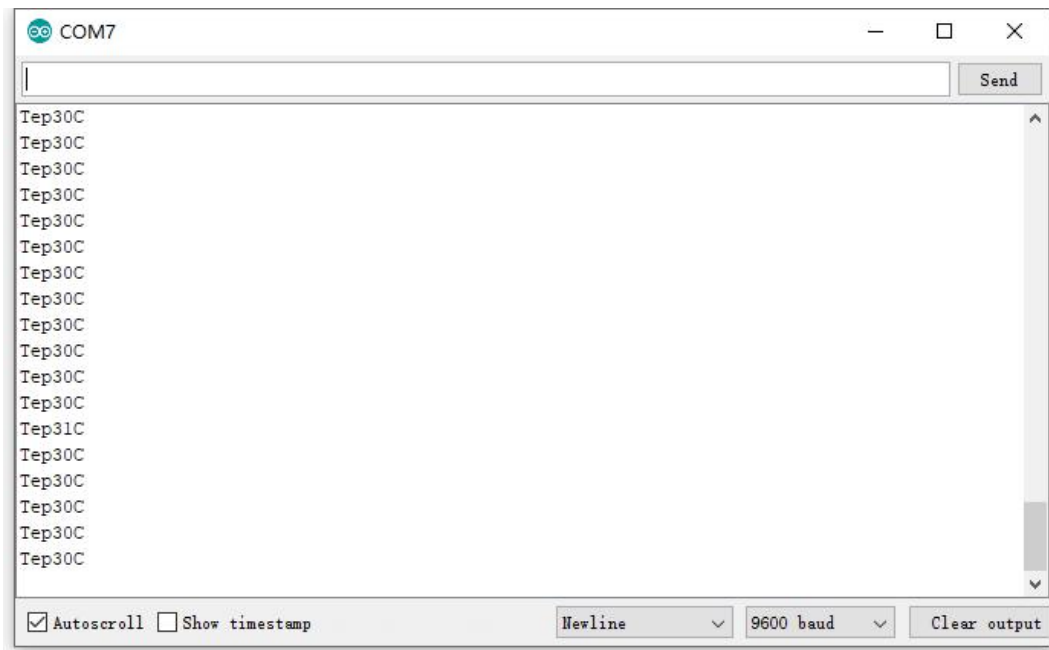


```
/*  
keyestudio STEM Starter Kit  
Project 24.1  
Read temperature value  
http://www.keyestudio.com  
*/  
  
#define sensorPin  A0  
  
void setup()  
{  
    Serial.begin(9600);  
}  
  
void loop()  
{  
    int reading = analogRead(sensorPin);  
    float voltage = reading * 5.0;  
    voltage /= 1024.0;  
    float temperatureC = (500 * reading) / 1024 ;  
    float temperatureF = (temperatureC * 9.0 / 5.0) + 32.0;  
    Serial.print(voltage); Serial.print(" volts  -  ");  
    Serial.print(temperatureC); Serial.print(" degrees C  -  ");  
    Serial.print(temperatureF); Serial.println(" degrees F");  
    delay(1000);  
}
```

}

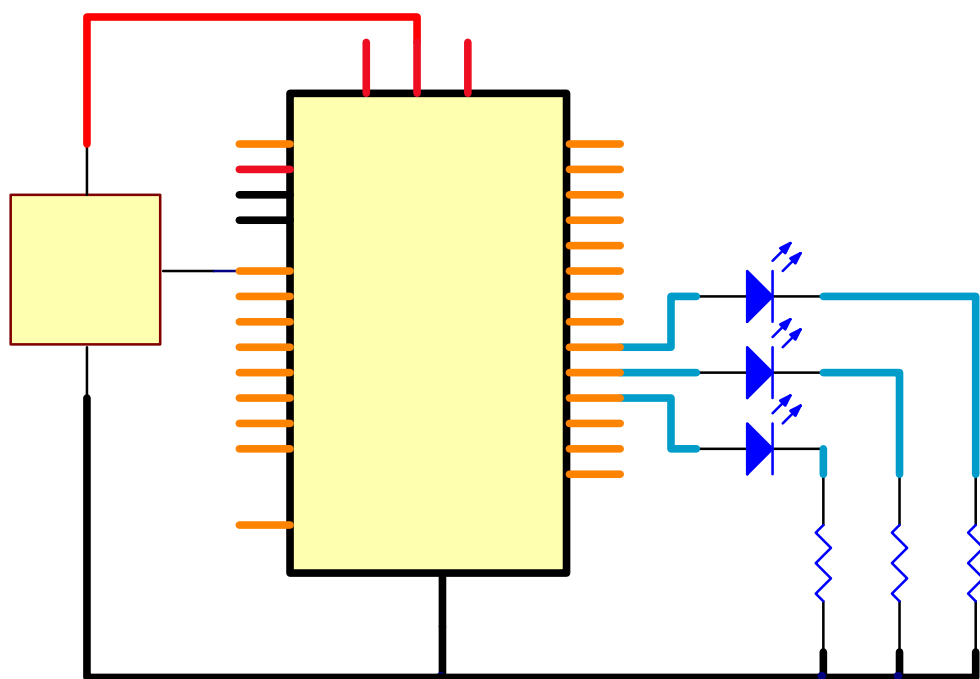
//

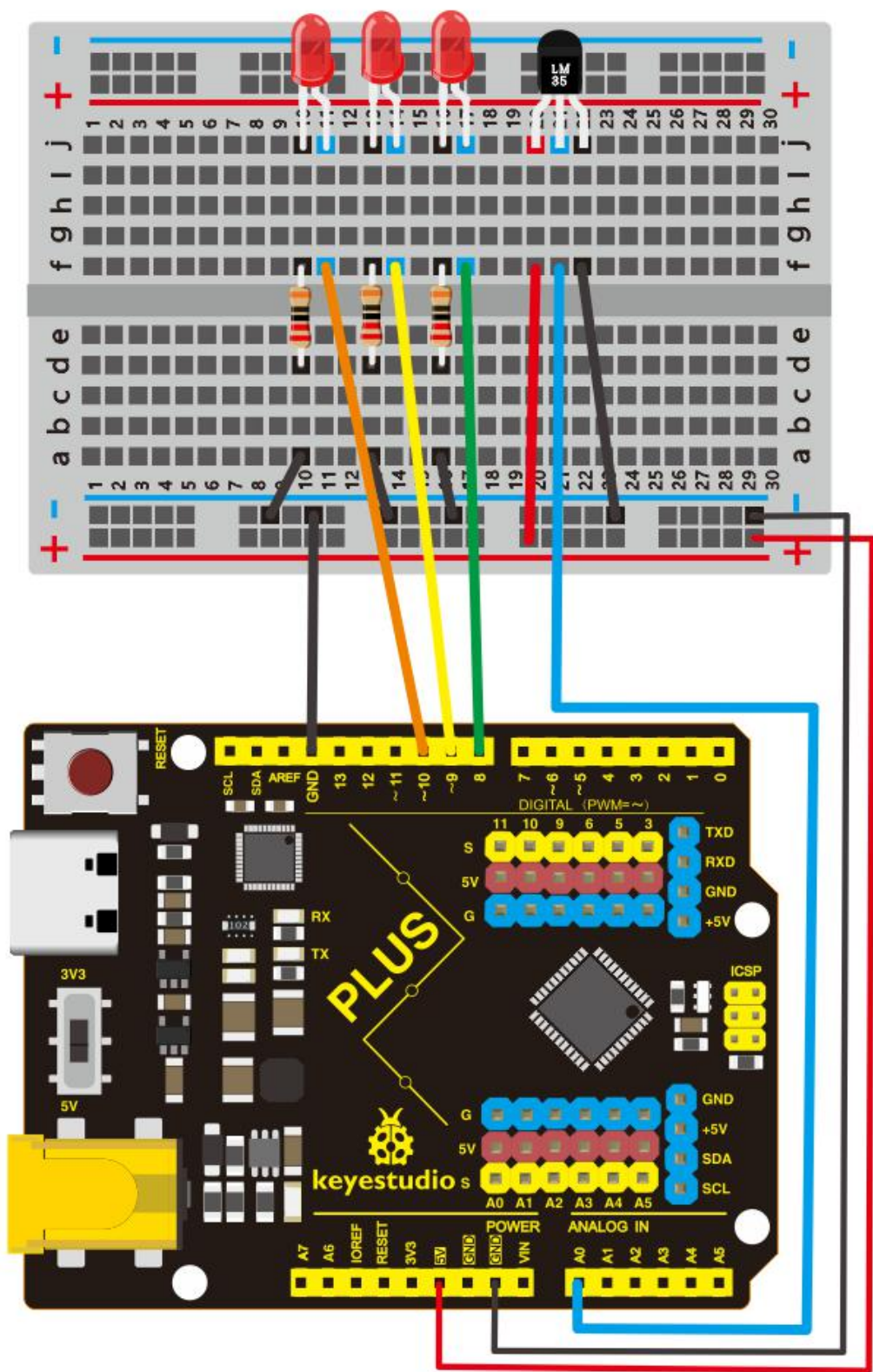
Upload the code to the Plus development board, open the serial monitor, and then you can read the current temperature value.



5. Temperature Tester Circuit Connection

Now use the LM35 temperature sensor and 3 LEDs to do a temperature tester. When the temperature tester senses different temperatures, different LEDs will light up. Follow the diagram below for wiring.





6.Project Code

```
/*  
keyestudio STEM Starter Kit  
Project 24.2  
Temperature tester  
http://www.keyestudio.com  
*/  
  
#define sensorPin  A0  
  
#define greenLED 8  
  
#define yellowLED 9  
  
#define redLED 10  
  
void setup()  
{  
  pinMode(greenLED, OUTPUT);  
  pinMode(yellowLED, OUTPUT);  
  pinMode(redLED, OUTPUT);  
  Serial.begin(9600);  
}  
  
void loop()  
{  
  int reading = analogRead(sensorPin);  
  float voltage = reading * 5.0;
```

```
voltage /= 1024.0;

float temperatureC = (500 * reading) /1024 ;

float temperatureF = (temperatureC * 9.0 / 5.0) + 32.0;

Serial.print(voltage); Serial.print(" volts  -  ");

Serial.print(temperatureC); Serial.print(" degrees C  -  ");

Serial.print(temperatureF); Serial.println(" degrees F");


if (temperatureF >= 75) {
    digitalWrite(greenLED, LOW);
    digitalWrite(yellowLED, LOW);
    digitalWrite(redLED, HIGH);
}

else if (temperatureF >= 70 && temperatureF < 75) {
    digitalWrite(greenLED, LOW);
    digitalWrite(yellowLED, HIGH);
    digitalWrite(redLED, LOW);
}

else {
    digitalWrite(greenLED, HIGH);
    digitalWrite(yellowLED, LOW);
    digitalWrite(redLED, LOW);
}
```

```

    delay(3000);
}

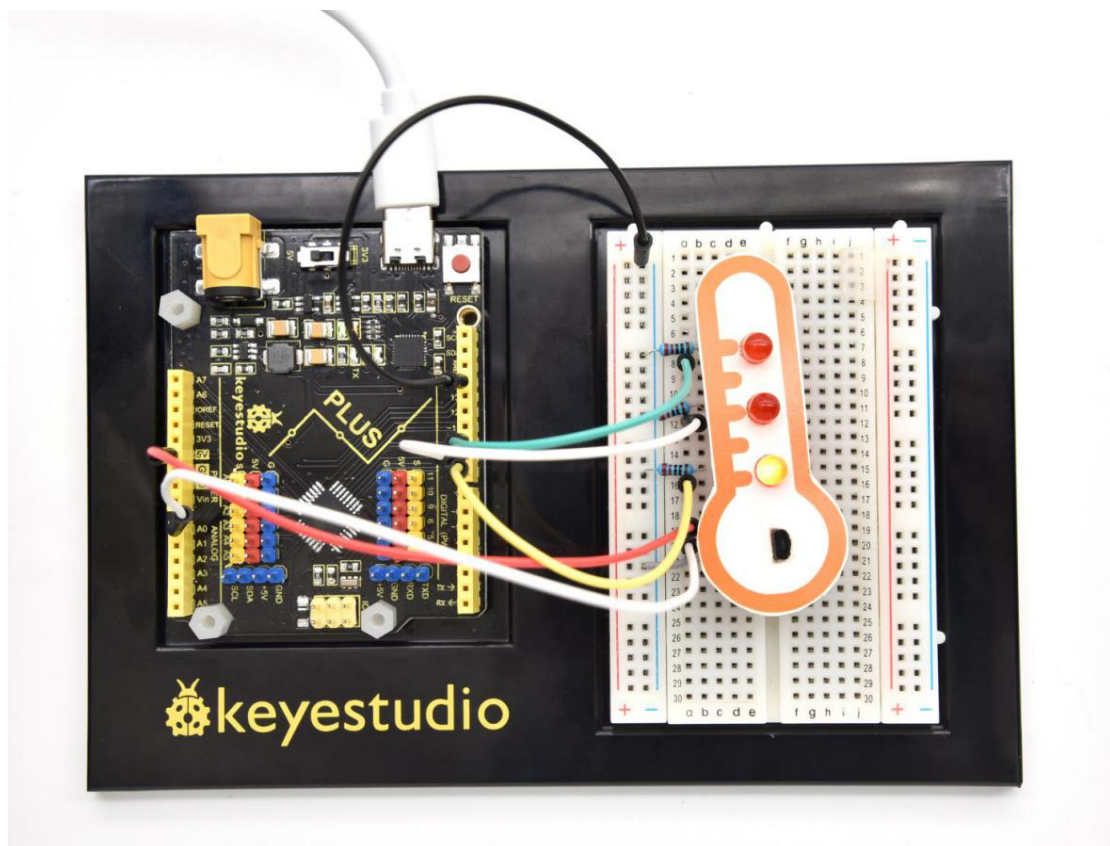
////////////////////////////////////////////////////////////////

```

7.Project Result

Upload the code to the PLUS development board, open the serial monitor and set the baud rate to 9600. The monitor displays the current temperature value.

We wire up components as below. When temperature sensor works, LED will light up.



*****next

project*****