Study Notes of Iteaduino Part VII

- Track Sensor

Iteaduino can sense the environment with various sensors. In last note, I introduced how to use Iteaduino pin input to receive information transmitted from temperature sensor DS18B20 and to display the temperature value detected by DS18B20 on 1602 LCD screen. In the following test, I’ d like to use track sensor.

To do this test, we will need：

- Iteaduino board x 1
- Track sensor electronic brick x 1
- LED electronic brick x 1

Introduction of materials

Track sensor can be used in infrared detection applications such as smart tracking car, robots, etc., in which a sensing probe is consisted of a pair of infrared transmitting and receiving tubes TCRT5000, using SGM358 as a comparator to process the acquired signals to let them output TTL level signals (built-in hysteresis circuit for more stable output signal). There are also a potentiometer and an LED indicator in track sensor module.

The actual track sensor electronic brick is shown in figure 1 and 2:

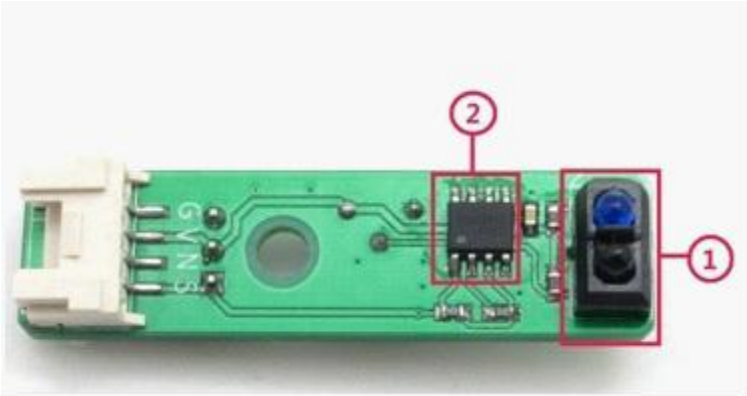

Figure 1

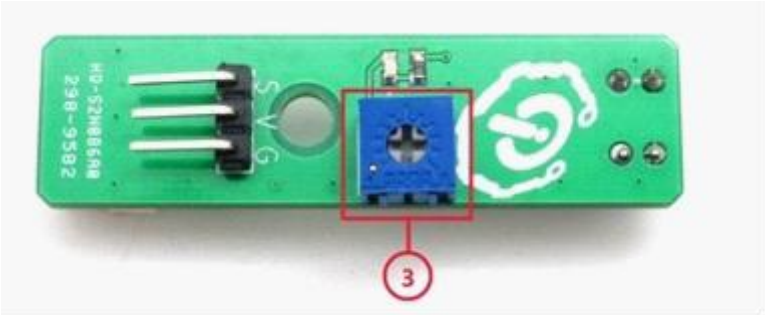

Figure 2

①Sensing probe TCRT5000 is consisted of a pair of infrared transmitting and receiving tube, the schematic of which is shown in figure 3. After the infrared receiving tube receives a signal, it will reflect different voltage output value depending on the distance. When there are no objects blocking, interface 1 of TCRT5000 will output supply voltage; when there are foreign matters approaching, the receiving tube of TCRT5000 will receive infrared signal. The shorter the distance, the stronger the signal, the lower the voltage output from terminal 1. The smart tracking car with TCRT5000 probe makes use of the feature of infrared that it has different reflective properties on surfaces of different colors, it emits infrared constantly to the ground in the process of moving. The infrared light reflects when it encounters white road, then the reflected light will be received by the receiving tube of TCRT5000, the LED indicator on the module will not be illuminated; If it encounter a black line, the infrared light will be absorbed which cannot be received by the receiving tube of

TCRT5000, the LED indicator on the module will be illuminated. Micro-controller determines the location of the black lines and car route according to whether the reflected infrared is received or not. Under condition of same distances, TCRT5000 outputs higher voltage when it encounters black objects.

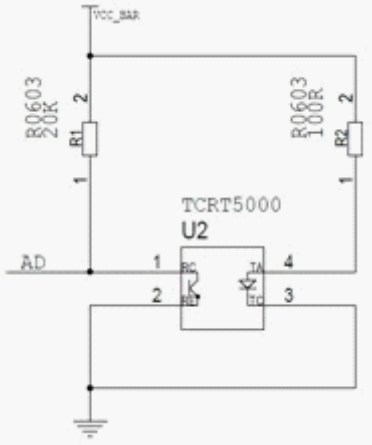

Figure 3

②SGM358 operational amplifier. When the analog signal output from TCRT5000 is accessed by comparator with hysteresis composed of SGM358, the analog signal will be transformed into a digital signal. SGM358 supports rail-to-rail input and output voltage, rail-to-rail operational amplifier allows the input potential to change from the negative supply to the positive supply in the entire interval, even slightly above the positive supply or slightly below the negative supply will also be allowed. The output characteristics of circuit SGM358 is shown in figure 4.

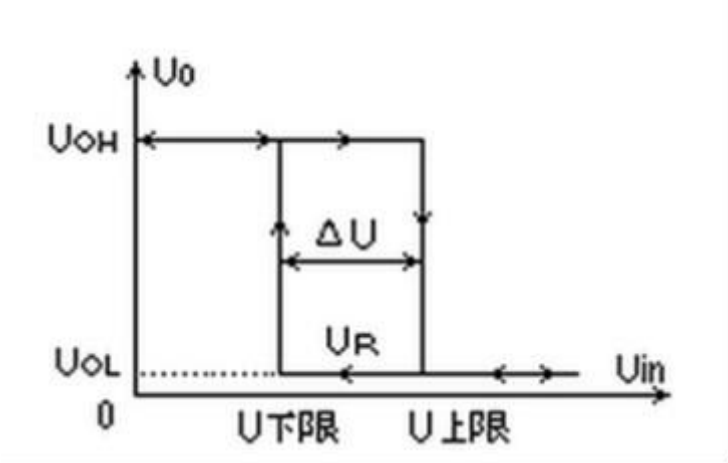

Figure 4

In the common comparator circuit, if there is a slight interference to input signal in the vicinity of threshold, the output voltage will be fluctuated accordingly. Therefore, we introduce a hysteresis comparator in the circuit. Once the output state is converted, as long as the interference near the leaping voltage value does not exceed the threshold, the output voltage value will be stable.

③ Potentiometer. Adjust the potentiometer to control the reference voltage within the appropriate range, the schematic of potentiometer is shown in Figure 5, each small grid represents 0.5V. Rotating to left will increase the reference voltage, while rotating to right will decrease the reference voltage. The reference voltage of the comparator can be changed by adjusting height of the black line on the module, the higher the reference voltage, the longer the detecting distance. It needs to be noted that the potentiometer knob cannot be turned to the left-most nor to the rightmost ends. As output voltage value range of TCRT5000 is from 0V to 5V, if the potentiometer knob is turned to the rightmost, the reference voltage will be 0V, while the output voltage value of TCRT5000 is more than 0V, so it cannot be used for comparison. It is the same reason for not turning to the leftmost.

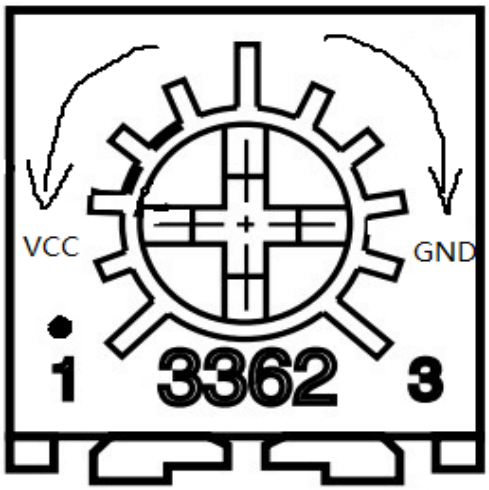

Figure 5

Construction of hardware circuit

First, connect LED electronic brick module to D5 pin of Iteaduino with connection cable, then the cathode of LED indicator is linked to GND terminal of Iteaduino board, anode to +5 V terminal of Iteaduino board and S pin to D5 pin of Iteaduino board.

Connect track sensor electronic brick to D4 pin of Iteaduino board with the connection cable, then the cathode of the track sensor electronic brick is connected to GND terminal of Iteaduino board, anode to +5 V terminal of Iteaduino board and S pin to D4 pin of Iteaduino board.

The actual circuit schematic is shown in Figure 6:

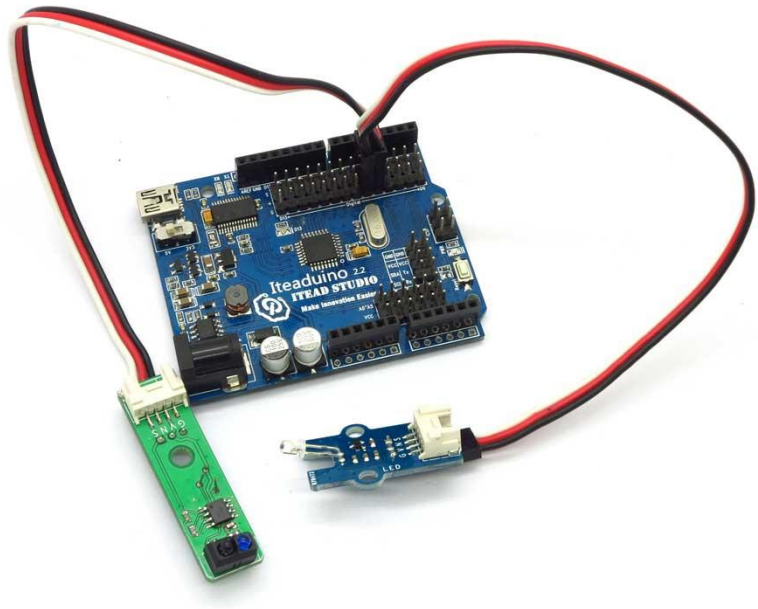

Figure 6

Writing of control program

The complete program used in the test is as below:

```
int SIGNAL=4; //巡线传感器连接到数字端口 D4
int ledpin=5;   //LED 连接到数字端口 D5
void setup()
{
  Serial.begin(9600);   //设置波特率为9600
  pinMode(SIGNAL, INPUT);   //设置 D4为输入端口
  pinMode(ledpin, OUTPUT);   //设置 D5为输出端口
}
void loop()
{
  if(digitalRead(SIGNAL)==LOW)     //如果读取 D4的值为低电平，即没有遮挡住巡线传感器
  {
  digitalWrite(ledpin,LOW);              //D5输出低电平，LED 灯不亮
```

```
  }
  else                                  //如果读取 D4的值为高电平，即遮挡住巡线传感器
  {
  digitalWrite(ledpin,HIGH);            //D5输出高电平，LED 灯亮
  }
}
```

Compiling and uploading of program

Then compile and download the above program onto Iteaduino, the operation of which is the same with that in last tests.

After downloading the program, when there is nothing blocking the track sensor, LED indicator will not illuminate; when there are objects blocking the track sensor, LED indicator will illuminate.

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