Hardware Control course--Tracking

Tip:

In order to avoid sunlight affecting the infrared sensor, the experiment needs to be carried out indoors.

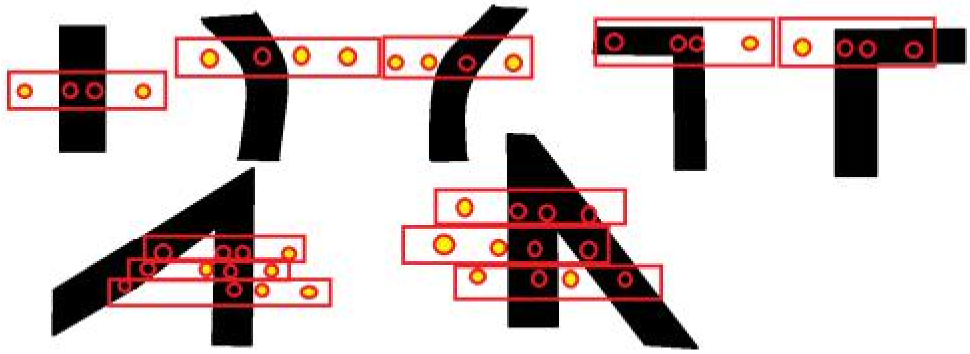
1. Learning target

In this course, we will learn how to use tracking module to make car completes tracking experiment.

2. Principle of experimental

The basic principle of the tracking sensor is to use the reflective nature of the object. Our experiment is to tracking the black line. When the infrared light is emitted to the black line, it will be absorbed by the black line. When the infrared light is emitted to the other color line, it will reflected to the infrared receiver tube.

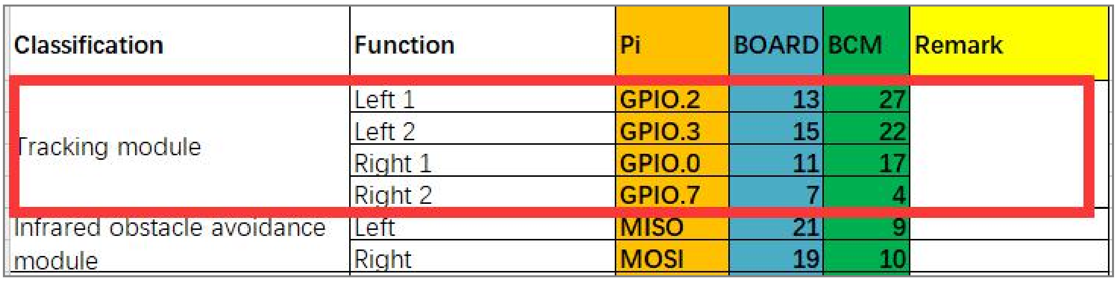
When detecting tracks of different shapes, the state of the 4-channel tracking sensor is as shown below.



For the Raspbot car, we use 4 TT DC gear motors. They are driven by the TB6612 chip. The driver chip is not directly connected to the Raspberry Pi pins.
Raspberry Pi communicates with STM8 MUC through IIC, and then STM8 MCU drives TB6612 chip to drive the motor.

3. Coding method

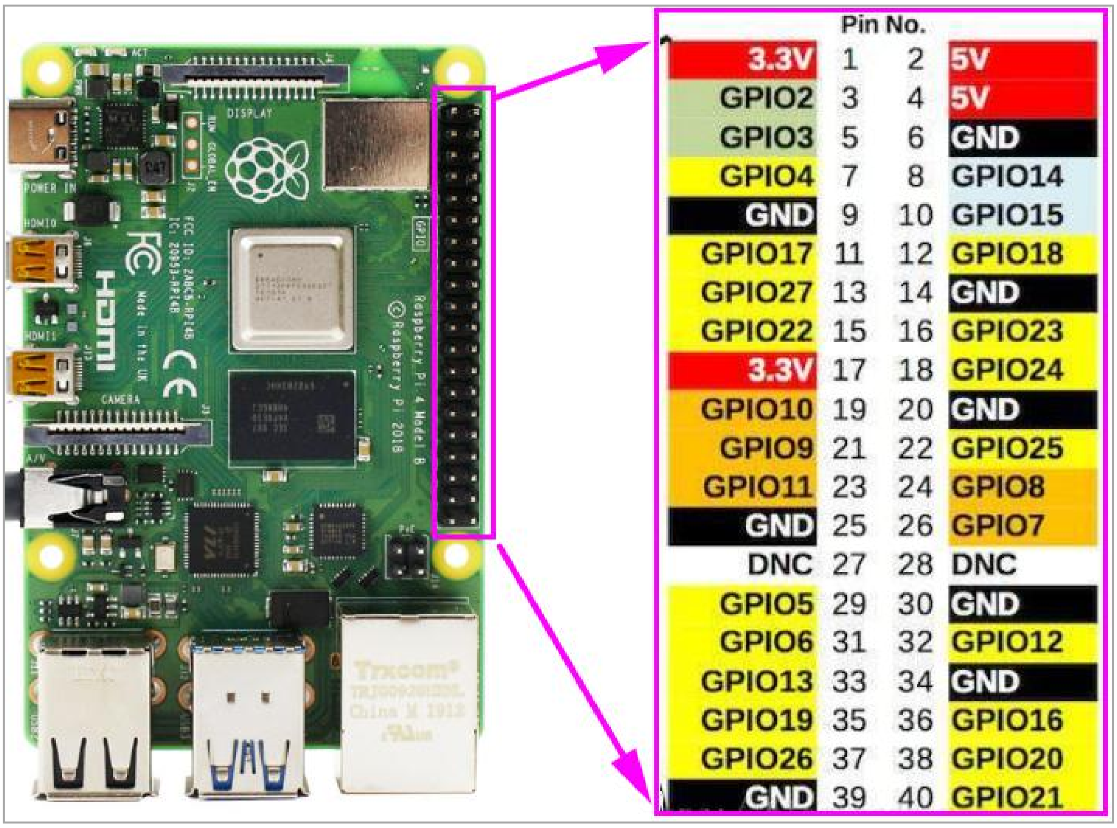
In this course, we use BOARD coding method.
According to the hardware interface manual, we see that the tracking module pins are connected to the 11,7,13,15 pin of the Raspberry Pi board.



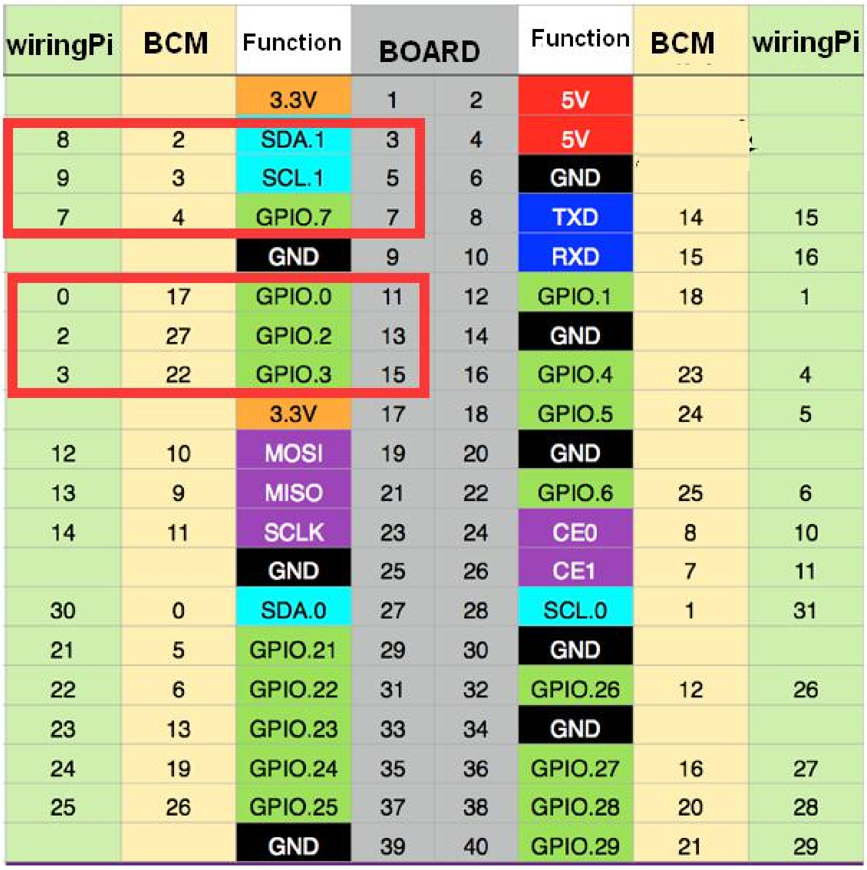
Classification	Function	Pi	BOARD	BCM	Remark
Tracking module	Left 1	GPIO.2	13	27	
	Left 2	GPIO.3	15	22	
	Right 1	GPIO.0	11	17	
	Right 2	GPIO.7	7	4	
Infrared obstacle avoidance module	Left	MISO	21	9	
	Right	MOSI	19	10	

STM8 is connected to SDA.1, SCL.1 on the Raspberry Pi board.
We have provided a library text dedicated to driving motors and servos --YB_Pcb_Car.py.
It is located in the same directory as the motor driver.

The pin comparison table of Raspberry Pi as shown below.



	Pin No.		
3.3V	1	2	5V
GPIO2	3	4	5V
GPIO3	5	6	GND
GPIO4	7	8	GPIO14
GND	9	10	GPIO15
GPIO17	11	12	GPIO18
GPIO27	13	14	GND
GPIO22	15	16	GPIO23
3.3V	17	18	GPIO24
GPIO10	19	20	GND
GPIO9	21	22	GPIO25
GPIO11	23	24	GPIO8
GND	25	26	GPIO7
DNC	27	28	DNC
GPIO5	29	30	GND
GPIO6	31	32	GPIO12
GPIO13	33	34	GND
GPIO19	35	36	GPIO16
GPIO26	37	38	GPIO20
GND	39	40	GPIO21

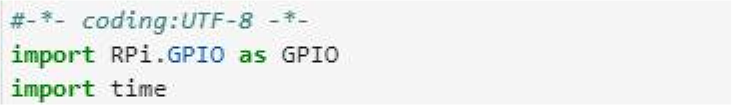


wiringPi	BCM	Function	BOARD		Function	BCM	wiringPi
		3.3V	1	2	5V		
8	2	SDA.1	3	4	5V		
9	3	SCL.1	5	6	GND		
7	4	GPIO.7	7	8	TXD	14	15
		GND	9	10	RXD	15	16
0	17	GPIO.0	11	12	GPIO.1	18	1
2	27	GPIO.2	13	14	GND		
3	22	GPIO.3	15	16	GPIO.4	23	4
		3.3V	17	18	GPIO.5	24	5
12	10	MOSI	19	20	GND		
13	9	MISO	21	22	GPIO.6	25	6
14	11	SCLK	23	24	CE0	8	10
		GND	25	26	CE1	7	11
30	0	SDA.0	27	28	SCL.0	1	31
21	5	GPIO.21	29	30	GND		
22	6	GPIO.22	31	32	GPIO.26	12	26
23	13	GPIO.23	33	34	GND		
24	19	GPIO.24	35	36	GPIO.27	16	27
25	26	GPIO.25	37	38	GPIO.28	20	28
		GND	39	40	GPIO.29	21	29

4. About code

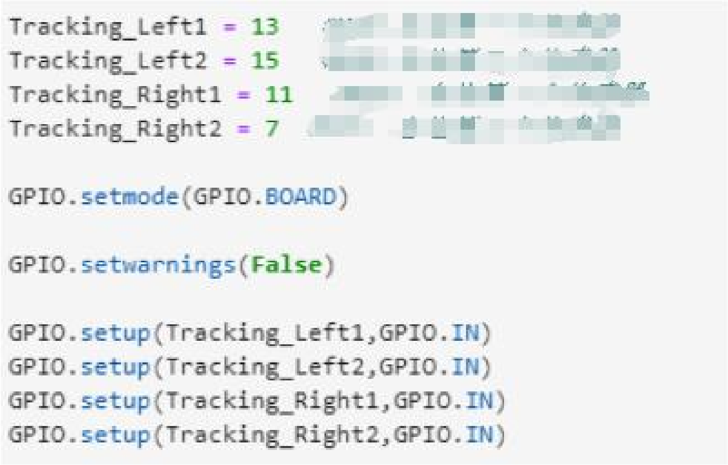
Path: /home/pi/Yahboom_project/Raspbot/2.Hardware Control course/7.Ultrasonic avoid/Tracking test.ipynb

1) Import time and GPIO library



```
#-*- coding:UTF-8 -*-
import RPi.GPIO as GPIO
import time
```

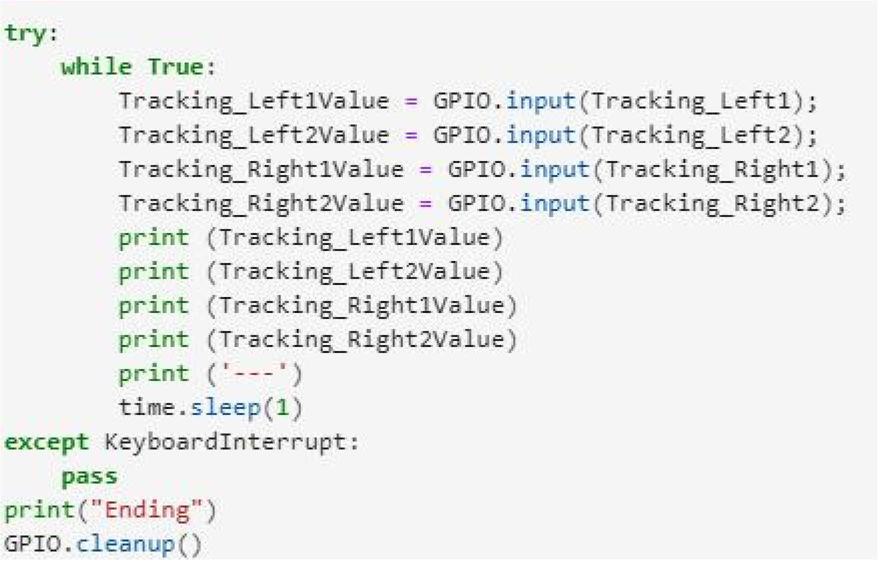
2)Set the GPIO coding mode, define tracking module pin and define the car class is used to drive motors or servos.



```
Tracking_Left1 = 13     [illegible]
Tracking_Left2 = 15     [illegible]
Tracking_Right1 = 11    [illegible]
Tracking_Right2 = 7     [illegible]

GPIO.setmode(GPIO.BOARD)

GPIO.setwarnings(False)

GPIO.setup(Tracking_Left1,GPIO.IN)
GPIO.setup(Tracking_Left2,GPIO.IN)
GPIO.setup(Tracking_Right1,GPIO.IN)
GPIO.setup(Tracking_Right2,GPIO.IN)
```

3) Read the value of the tracking module and print it out.

When we click the stop button, we exit the loop, stop the car, and clear the car class and GPIO.



```
try:
    while True:
        Tracking_Left1Value = GPIO.input(Tracking_Left1);
        Tracking_Left2Value = GPIO.input(Tracking_Left2);
        Tracking_Right1Value = GPIO.input(Tracking_Right1);
        Tracking_Right2Value = GPIO.input(Tracking_Right2);
        print (Tracking_Left1Value)
        print (Tracking_Left2Value)
        print (Tracking_Right1Value)
        print (Tracking_Right2Value)
        print ('---')
        time.sleep(1)
except KeyboardInterrupt:
    pass
print("Ending")
GPIO.cleanup()
```

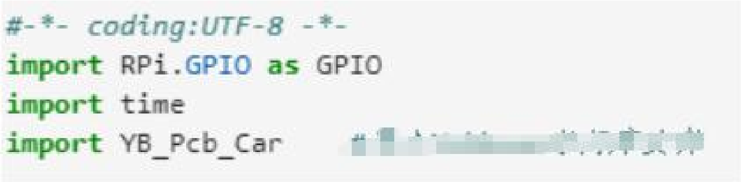
5. Experimental phenomenon

After the program runs. Place the car on a dedicated black and white tracking map, adjust the knob of the tracking module to make indicator light is on when the sensor detects black, and indicator light is off when it detects white.

We can see that when black is detected, 0 is printed, and when white is detected, 1 is printed.

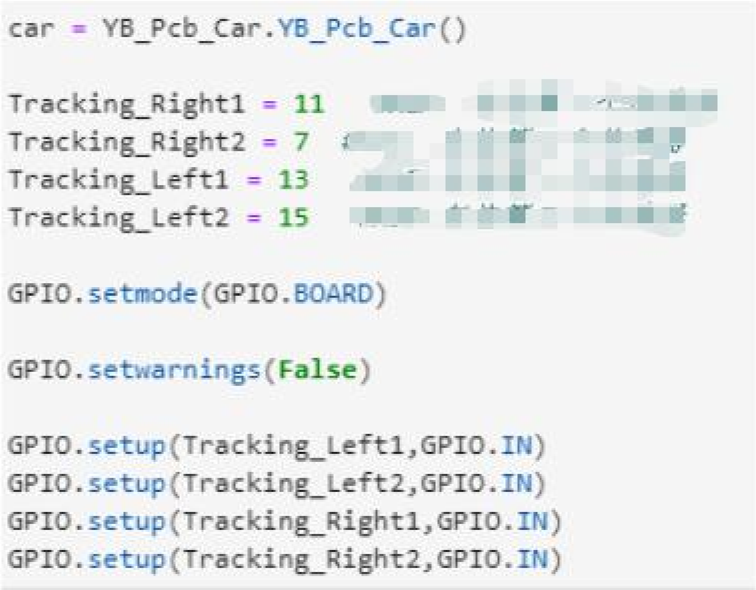
Path: /home/pi/Yahboom_project/Raspbot/2.Hardware Control course/7.Ultrasonic avoid/Tracking.ipynb

1) Import time, GPIO and YB_Pcb_Car library



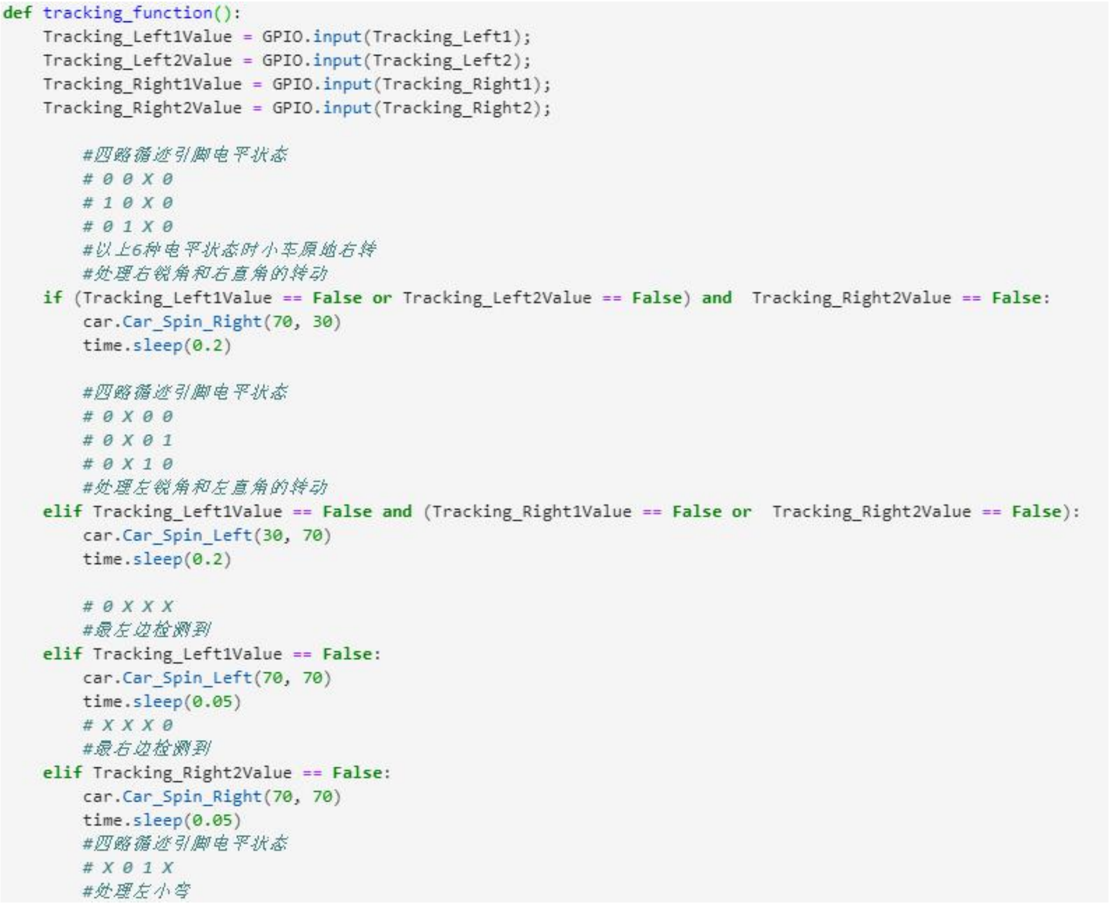
```
#-*- coding:UTF-8 -*-
import RPi.GPIO as GPIO
import time
import YB_Pcb_Car    [illegible]
```

2)Set the GPIO coding mode, define tracking module pin and define the car class is used to drive motors or servos.

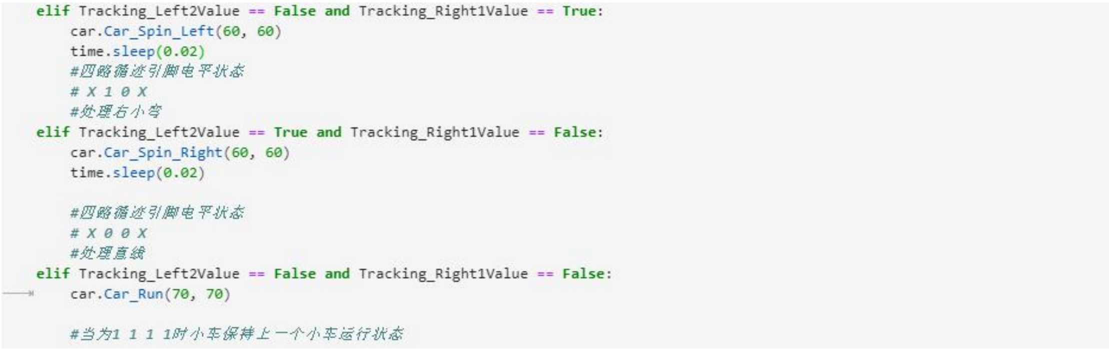


```
car = YB_Pcb_Car.YB_Pcb_Car()

Tracking_Right1 = 11   [redacted]
Tracking_Right2 = 7
Tracking_Left1 = 13
Tracking_Left2 = 15

GPIO.setmode(GPIO.BOARD)

GPIO.setwarnings(False)

GPIO.setup(Tracking_Left1,GPIO.IN)
GPIO.setup(Tracking_Left2,GPIO.IN)
GPIO.setup(Tracking_Right1,GPIO.IN)
GPIO.setup(Tracking_Right2,GPIO.IN)
```

3) Define the function of the tracking module

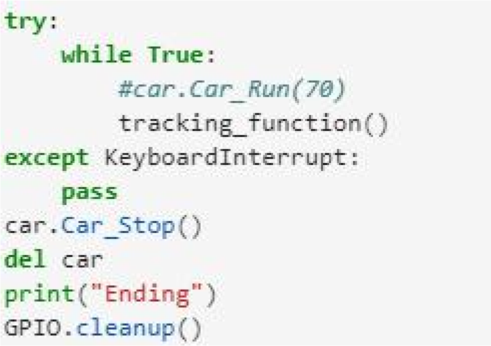


```
def tracking_function():
    Tracking_Left1Value = GPIO.input(Tracking_Left1);
    Tracking_Left2Value = GPIO.input(Tracking_Left2);
    Tracking_Right1Value = GPIO.input(Tracking_Right1);
    Tracking_Right2Value = GPIO.input(Tracking_Right2);

        #四路循迹引脚电平状态
        # 0 0 X 0
        # 1 0 X 0
        # 0 1 X 0
        #以上6种电平状态时小车原地右转
        #处理右锐角和右直角的转动
    if (Tracking_Left1Value == False or Tracking_Left2Value == False) and  Tracking_Right2Value == False:
        car.Car_Spin_Right(70, 30)
        time.sleep(0.2)

        #四路循迹引脚电平状态
        # 0 X 0 0
        # 0 X 0 1
        # 0 X 1 0
        #处理左锐角和左直角的转动
    elif Tracking_Left1Value == False and (Tracking_Right1Value == False or  Tracking_Right2Value == False):
        car.Car_Spin_Left(30, 70)
        time.sleep(0.2)

        # 0 X X X
        #最左边检测到
    elif Tracking_Left1Value == False:
        car.Car_Spin_Left(70, 70)
        time.sleep(0.05)
        # X X X 0
        #最右边检测到
    elif Tracking_Right2Value == False:
        car.Car_Spin_Right(70, 70)
        time.sleep(0.05)
        #四路循迹引脚电平状态
        # X 0 1 X
        #处理左小弯
```



```
    elif Tracking_Left2Value == False and Tracking_Right1Value == True:
        car.Car_Spin_Left(60, 60)
        time.sleep(0.02)
        #四路循迹引脚电平状态
        # X 1 0 X
        #处理右小弯
    elif Tracking_Left2Value == True and Tracking_Right1Value == False:
        car.Car_Spin_Right(60, 60)
        time.sleep(0.02)

        #四路循迹引脚电平状态
        # X 0 0 X
        #处理直线
    elif Tracking_Left2Value == False and Tracking_Right1Value == False:
        car.Car_Run(70, 70)

        #当为1 1 1 1时小车保持上一个小车运行状态
```

4) Call the tracking function in loop to complete the obstacle avoidance experiment. When we click the stop button, we exit the loop, stop the car, and clear the car class and GPIO.



```
try:
    while True:
        #car.Car_Run(70)
        tracking_function()
except KeyboardInterrupt:
    pass
car.Car_Stop()
del car
print("Ending")
GPIO.cleanup()
```

6. Experimental phenomenon

Before running the tracking experiment.

We need to adjust the sensitivity of the tracking module. The indicator light is off when white is detected, and the indicator light is on when black is detected.

After the program runs, place the car on the dedicated black and white tracking map, and the car will move along the black line.