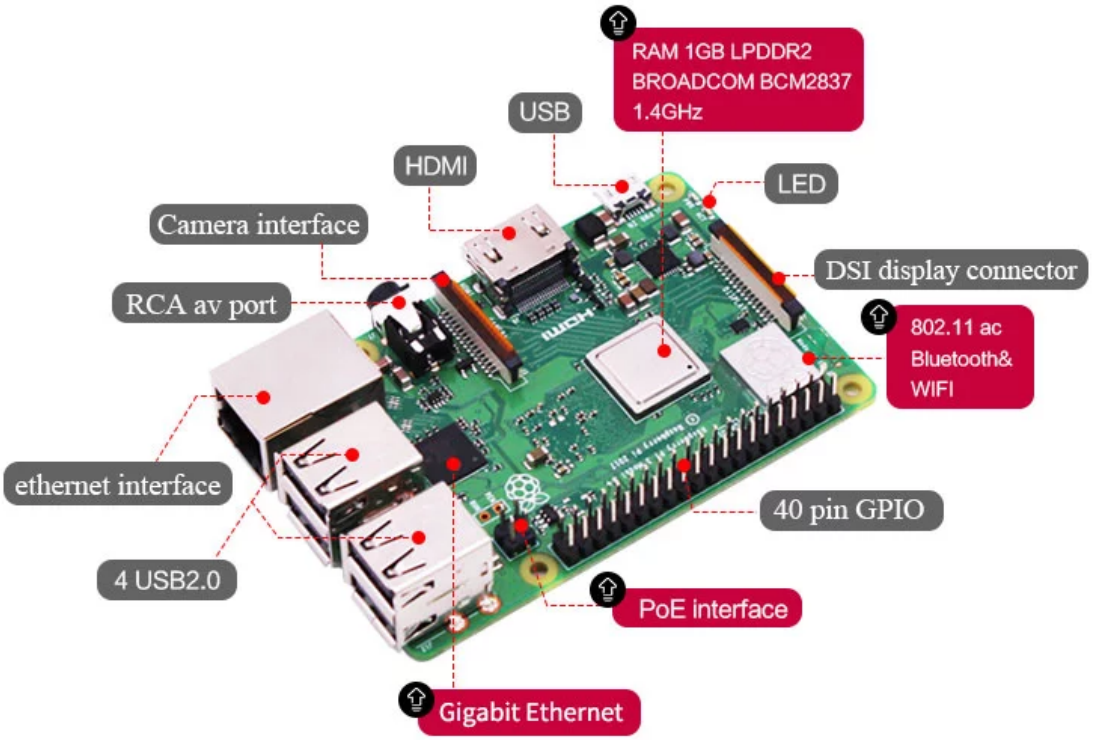
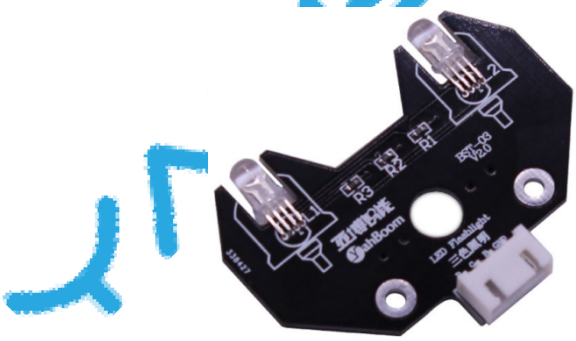
1.Raspberry Pi platform-------Color_LED

1) Preparation



1-1 Raspberry Pi board



1-2 RGB module

2) Purpose of Experimental

After running the Color_LED executable in the Raspberry Pi system and you can see the lights in 7 different colors.

3) Principle of experimental

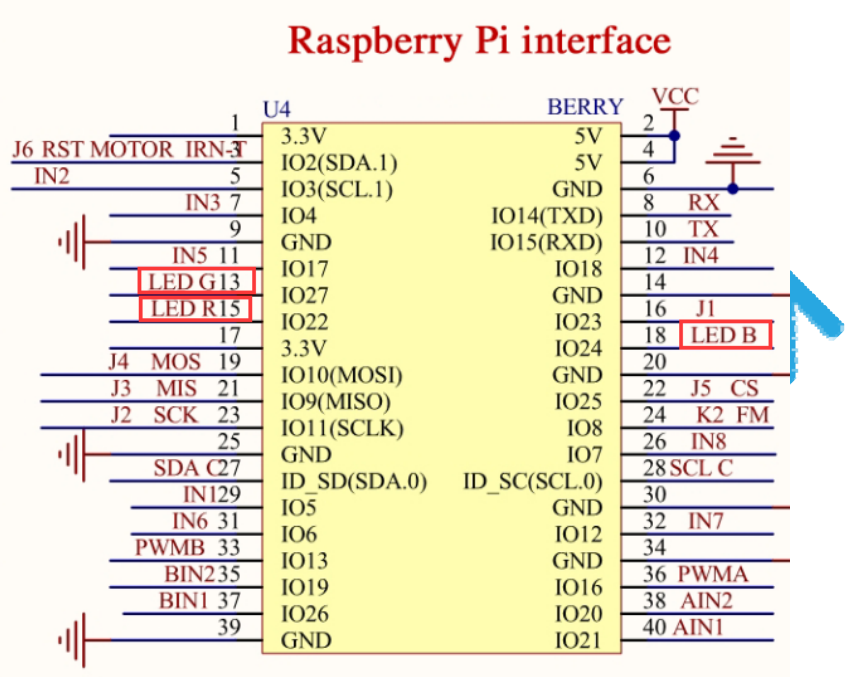
3 LEDs (red, green, blue) are packaged in the RGB lamp module. We can mix different colors(256*256*256) by controlling the brightness of the three LEDs.

According to the circuit schematic, the RGB lamp is a common cathode LED, one pin is connect to GND, and the remaining three pins are respectively connected to the wiringPi port 3, 2, 5 on the

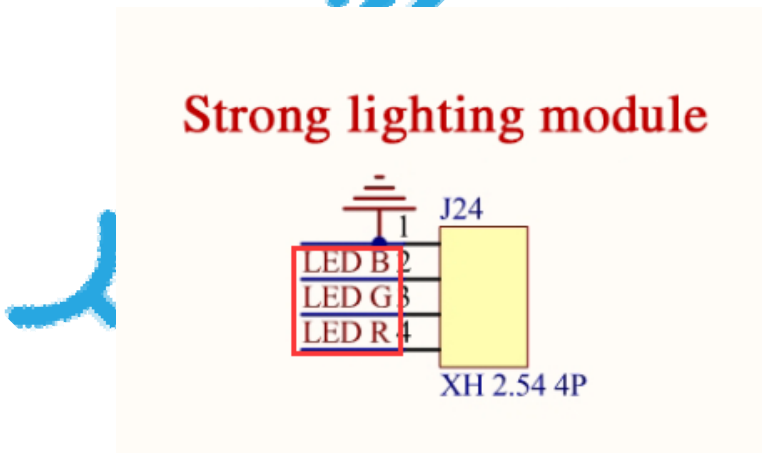
Raspberry Pi board. Each LED needs to be connected in series with a 220Ω resistor as the current limiting resistor. We can control the LED by controlling the corresponding pin to be high level of Raspberry Pi board.

4) Experimental Steps

4-1 About the schematic



4-1 Raspberry Pi interface circuit diagram



4-2 RGB module interface circuit diagram

wiringPi	BCM	Funtion	Physical pin		Funtion	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

4-3 Raspberry Pi 40 pins comparison table

4-2 According to the circuit schematic:

LED_R-----15(Physical pin)----- 3(wiringPi)

LED_G-----13(Physical pin)----- 2(wiringPi)

LED_B-----18(Physical pin)----- 5(wiringPi)

(Note: We use the wiringPi library to write code.)

4-3 About the code

(1) Before compiling the code, we can see the mode and level state changes of the pins by inputting gpio readall. As shown in the figure below.

```
root@raspberrypi:/home/pi/SmartCar# ls
ColorLED  ColorLED.c  initpin.sh
root@raspberrypi:/home/pi/SmartCar# gpio readall
 +-----+-----+---------+------+---+---Pi 3---+---+------+---------+-----+-----+
 | BCM | wPi |   Name  | Mode | V | Physical | V | Mode | Name    | wPi | BCM |
 +-----+-----+---------+------+---+----++----+---+------+---------+-----+-----+
 |     |     |    3.3v |      |   |  1 || 2  |   |      | 5v      |     |     |
 |   2 |   8 |   SDA.1 |   IN | 1 |  3 || 4  |   |      | 5v      |     |     |
 |   3 |   9 |   SCL.1 |   IN | 1 |  5 || 6  |   |      | 0v      |     |     |
 |   4 |   7 | GPIO. 7 |   IN | 1 |  7 || 8  | 1 | IN   | TxD     | 15  | 14  |
 |     |     |      0v |      |   |  9 || 10 | 1 | IN   | RxD     | 16  | 15  |
 |  17 |   0 | GPIO. 0 |   IN | 0 | 11 || 12 | 1 | IN   | GPIO. 1 | 1   | 18  |
 |  27 |   2 | GPIO. 2 |   IN | 0 | 13 || 14 |   |      | 0v      |     |     |
 |  22 |   3 | GPIO. 3 |   IN | 0 | 15 || 16 | 0 | IN   | GPIO. 4 | 4   | 23  |
 |     |     |    3.3v |      |   | 17 || 18 | 0 | IN   | GPIO. 5 | 5   | 24  |
 |  10 |  12 |    MOSI |   IN | 1 | 19 || 20 |   |      | 0v      |     |     |
 |   9 |  13 |    MISO |   IN | 1 | 21 || 22 | 1 | IN   | GPIO. 6 | 6   | 25  |
 |  11 |  14 |    SCLK |   IN | 1 | 23 || 24 | 1 | IN   | CE0     | 10  | 8   |
 |     |     |      0v |      |   | 25 || 26 | 1 | IN   | CE1     | 11  | 7   |
 |   0 |  30 |   SDA.0 |   IN | 1 | 27 || 28 | 1 | IN   | SCL.0   | 31  | 1   |
 |   5 |  21 | GPIO.21 |   IN | 1 | 29 || 30 |   |      | 0v      |     |     |
 |   6 |  22 | GPIO.22 |   IN | 1 | 31 || 32 | 0 | IN   | GPIO.26 | 26  | 12  |
 |  13 |  23 | GPIO.23 |   IN | 0 | 33 || 34 |   |      | 0v      |     |     |
 |  19 |  24 | GPIO.24 |   IN | 0 | 35 || 36 | 0 | IN   | GPIO.27 | 27  | 16  |
 |  26 |  25 | GPIO.25 |   IN | 0 | 37 || 38 | 0 | IN   | GPIO.28 | 28  | 20  |
 |     |     |      0v |      |   | 39 || 40 | 0 | IN   | GPIO.29 | 29  | 21  |
 +-----+-----+---------+------+---+----++----+---+------+---------+-----+-----+
 | BCM | wPi |   Name  | Mode | V | Physical | V | Mode | Name    | wPi | BCM |
 +-----+-----+---------+------+---+---Pi 3---+---+------+---------+-----+-----+
```

(2) We need to compile this file in the Raspberry Pi system. (Note: we need to add -lwiringPi to the library file.)

We need to input:gcc ColorLED.c -o ColorLED -lwiringPi

(3)We need to run the compiled executable file in the Raspberry Pi system.We need to input: ./ColorLED

As shown in the figure below.

```
root@raspberrypi:/home/pi/SmartCar# vi ColorLED.c
root@raspberrypi:/home/pi/SmartCar# gcc ColorLED.c -o ColorLED -lwiringPi
root@raspberrypi:/home/pi/SmartCar# ./ColorLED
^C
```

(4)We can input: gpio readall to see the mode and level state changes of the pins. You will find that the level and mode of the corresponding pin has changed.

```
root@raspberrypi:/home/pi# gpio readall
 +-----+-----+---------+------+---+---Pi 3---+---+------+---------+-----+-----+
 | BCM | wPi |   Name  | Mode | V | Physical | V | Mode | Name    | wPi | BCM |
 +-----+-----+---------+------+---+----++----+---+------+---------+-----+-----+
 |     |     |    3.3v |      |   |  1 || 2  |   |      | 5v      |     |     |
 |   2 |   8 |   SDA.1 |   IN | 1 |  3 || 4  |   |      | 5v      |     |     |
 |   3 |   9 |   SCL.1 |   IN | 1 |  5 || 6  |   |      | 0v      |     |     |
 |   4 |   7 | GPIO. 7 |   IN | 1 |  7 || 8  | 1 | IN   | TxD     | 15  | 14  |
 |     |     |      0v |      |   |  9 || 10 | 1 | IN   | RxD     | 16  | 15  |
 |  17 |   0 | GPIO. 0 |   IN | 0 | 11 || 12 | 1 | IN   | GPIO. 1 | 1   | 18  |
 |  27 |   2 | GPIO. 2 |  OUT | 1 | 13 || 14 |   |      | 0v      |     |     |
 |  22 |   3 | GPIO. 3 |  OUT | 0 | 15 || 16 | 0 | IN   | GPIO. 4 | 4   | 23  |
 |     |     |    3.3v |      |   | 17 || 18 | 0 | OUT  | GPIO. 5 | 5   | 24  |
 |  10 |  12 |    MOSI |   IN | 1 | 19 || 20 |   |      | 0v      |     |     |
 |   9 |  13 |    MISO |   IN | 1 | 21 || 22 | 1 | IN   | GPIO. 6 | 6   | 25  |
 |  11 |  14 |    SCLK |   IN | 1 | 23 || 24 | 1 | IN   | CE0     | 10  | 8   |
 |     |     |      0v |      |   | 25 || 26 | 1 | IN   | CE1     | 11  | 7   |
 |   0 |  30 |   SDA.0 |   IN | 1 | 27 || 28 | 1 | IN   | SCL.0   | 31  | 1   |
 |   5 |  21 | GPIO.21 |   IN | 1 | 29 || 30 |   |      | 0v      |     |     |
 |   6 |  22 | GPIO.22 |   IN | 1 | 31 || 32 | 0 | IN   | GPIO.26 | 26  | 12  |
 |  13 |  23 | GPIO.23 |   IN | 0 | 33 || 34 |   |      | 0v      |     |     |
 |  19 |  24 | GPIO.24 |   IN | 0 | 35 || 36 | 0 | IN   | GPIO.27 | 27  | 16  |
 |  26 |  25 | GPIO.25 |   IN | 0 | 37 || 38 | 0 | IN   | GPIO.28 | 28  | 20  |
 |     |     |      0v |      |   | 39 || 40 | 0 | IN   | GPIO.29 | 29  | 21  |
 +-----+-----+---------+------+---+----++----+---+------+---------+-----+-----+
 | BCM | wPi |   Name  | Mode | V | Physical | V | Mode | Name    | wPi | BCM |
 +-----+-----+---------+------+---+---Pi 3---+---+------+---------+-----+-----+
```

(5) We can input: ctrl+c to stop this process, which mean is send a signal to the linux kernel to terminate the current process, but the state of the relevant pin is uncertain at this time, we also need to run a script to initialize all pins.

(Note:The initpin.sh script file is included in the SmartCar directory.)

You need to input: chmod 777 initpin.sh

./initpin.sh

```
root@raspberrypi:/home/pi/SmartCar# chmod 777 initpin.sh
root@raspberrypi:/home/pi/SmartCar# ./initpin.sh
root@raspberrypi:/home/pi/SmartCar#
```

After completing the above steps, the experiment is over.