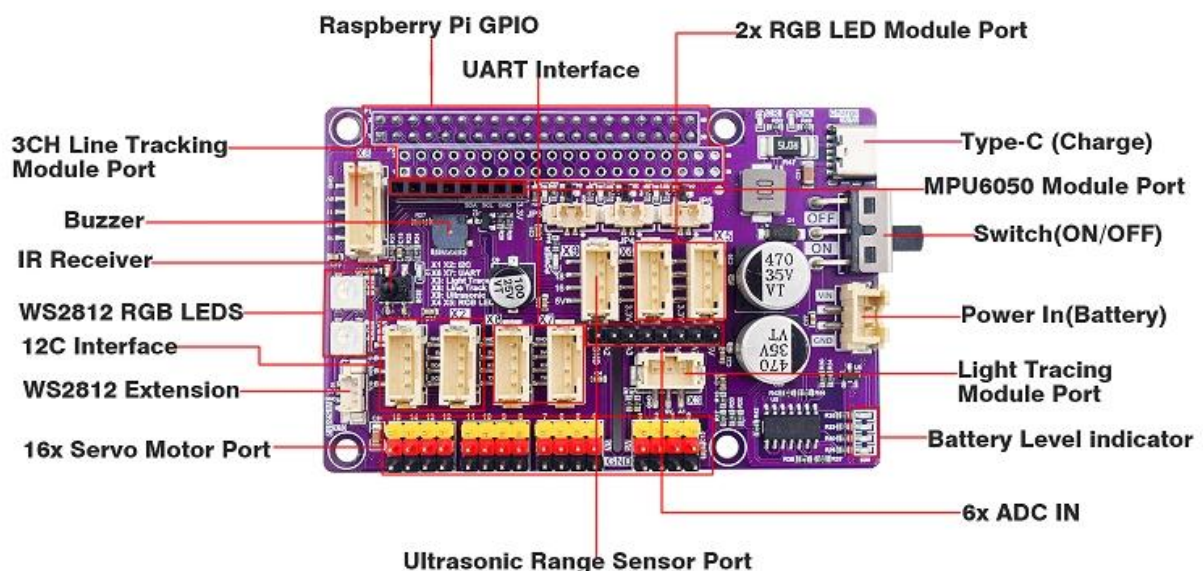
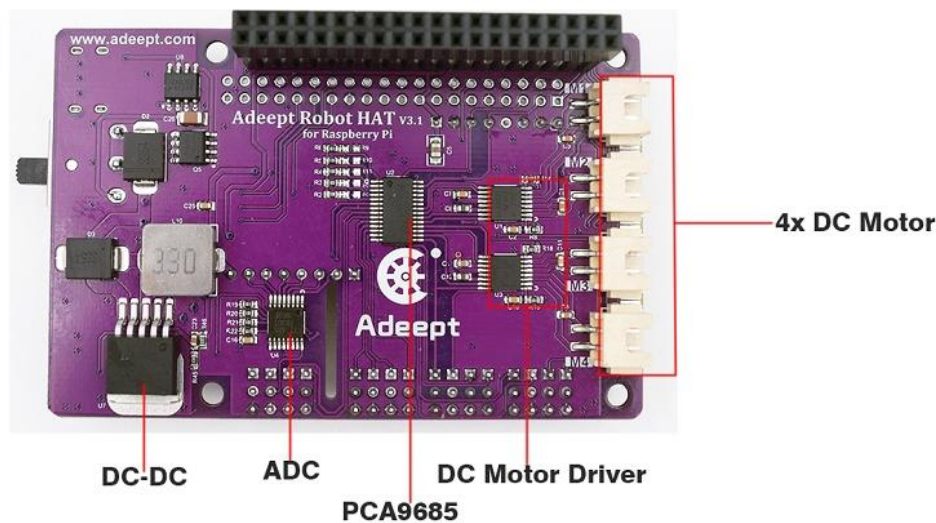


# Introduction of Robot HAT\_V3

## Robot HAT\_V3

When you get the robot product, you will see a board with its name printed inside: Adeept Robot HAT\_V3, which is an important part of the robot. There are many interfaces on the Robot HAT\_V3. You can connect sensors and electronic hardware modules to the board by those interfaces to realize more functions. This robot works on the Raspberry Pi. Let's first get to know the Robot HAT\_V3.





[Type-C]: Used to power the motherboard or charge the battery.

[Switch]: Switch is to turn the Adeept Robot HAT\_V3 ON/OFF.

[Power In]: The Power interface is an interface for external power supply.

[Raspberry Pi GPIO]: Corresponds to the Raspberry Pi 40Pin and can be used to expand the interface.

[UART Interface]: Uart interface.

[2x RGB LED,Module Port]: Connect the RGB LED module.

[3CH Line TrackingModule Port]: The pin interface of Line Tracking Module.

[Buzzer]: Onboard passive buzzer.

[IR Receiver]: Onboard IR receiver.

[WS2812 RGB LEDS]: 2 onboard WS2812 LEDs.

[WS2812 Extension]: WS2812 extension port. Used to expand the number of WS2812 LEDs.

[IIC]: I2C interface, can connect I2C devices, such as OLED.

[16x Servo Motor Port]: Servo interface.

[Ultrasonic Range Sensor Port]: Ultrasonic interface.

[MPU6050 Module Port]: I2C interface for installing MPU6050 module.

[Light Tracing Module Port]: Used to connect Light Tracking module.

[Battery Level indicator]: Battery charging indicator light, red light is on when the battery is connected and charging. Green light is on when the battery is not connected or the battery is fully charged.

[6x ADC IN]: Input pins or interfaces of analog-to-digital converters (ADCs).

[4x DC Motor]: Used to connect motors. 4 motor ports M1, M2, M3, M4.

[DC-DC]: This refers to a direct current to direct current converter, typically used to convert one voltage level of direct current to another voltage level. This type of converter is very common in power management and battery powered devices, such as converting higher battery voltage to lower voltage required by microcontrollers and other devices.

[ADC]: As mentioned earlier, this is an abbreviation for Analog to Digital Converter, which converts analog signals into digital signals so that microcontrollers or computers can process them.

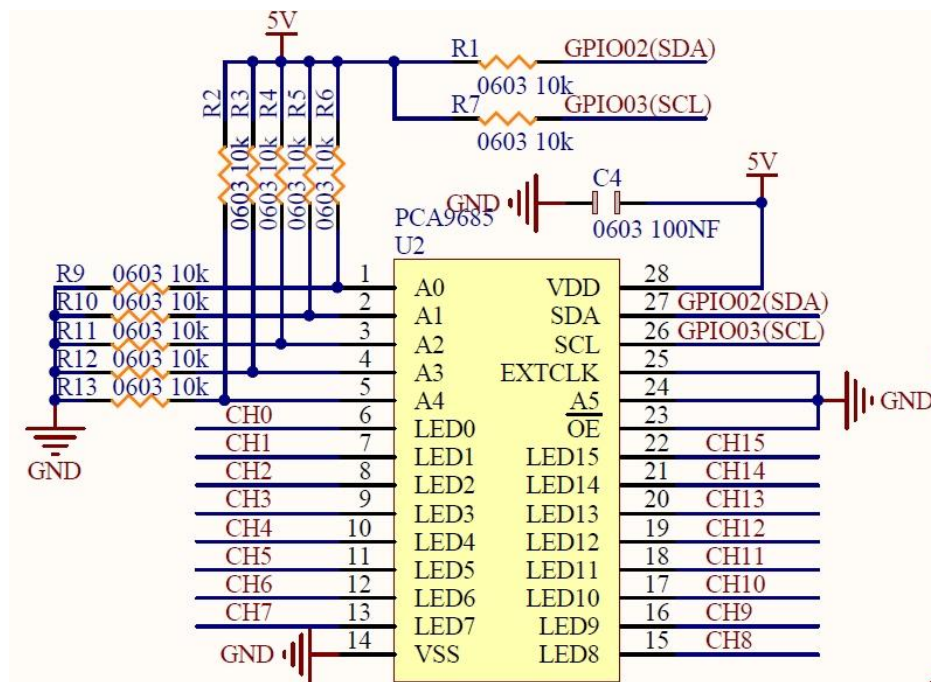
[DC Motor Driver]: This refers to a DC motor driver, which is an electronic device used to control the speed, direction, and torque of a DC motor. The driver receives signals from the microcontroller and adjusts the power of the motor accordingly.

[PCA9685]: This is a 16 channel, 12 bit PWM (Pulse Width Modulation) controller commonly used to control devices such as servos and LED light strips. It can communicate with the microcontroller through the I2C bus interface, allowing users to precisely control the PWM signal of each channel.

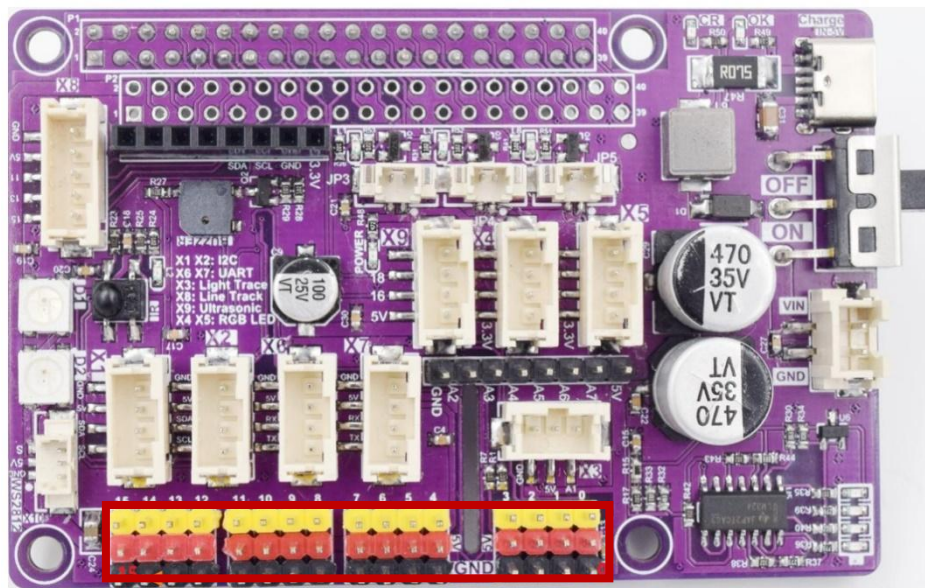
## Servo Port

PCA9685 chip, using I2C bus can control 16 steering gears.

**Circuit schematic diagram:**



### Servo port position:



Port 0 refers to the three pins in the first column, which are black GND, red 5V, and yellow signal pins. Port 1 represents the three ports in the second column. By analogy, a total of 16 servo ports can be used.

Download the test code:

```
sudo git clone https://github.com/adeept/Adeept_Robot_HAT-V3.git
```

To test the servo code,

Robot HAT_V3 Interface	Module Interface
GND	GND
5V	VCC
Signal pin	Signal pin

Run on the Raspberry Pi command line:

```
sudo python3 Adeept_Robot_HAT-V3/01_Servo.py
```

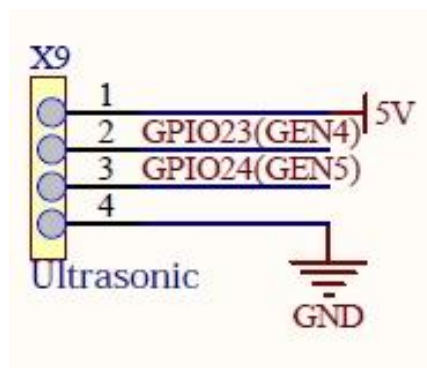
The servo cycles back and forth between 0 and 180 degrees.

```
pi@raspberrypi:~$ sudo python3 Adeept_Robot_HAT-V3/01_Servo.py
Servo on channel 0 starts to rotate 180 degrees.
```

## Ultrasonic

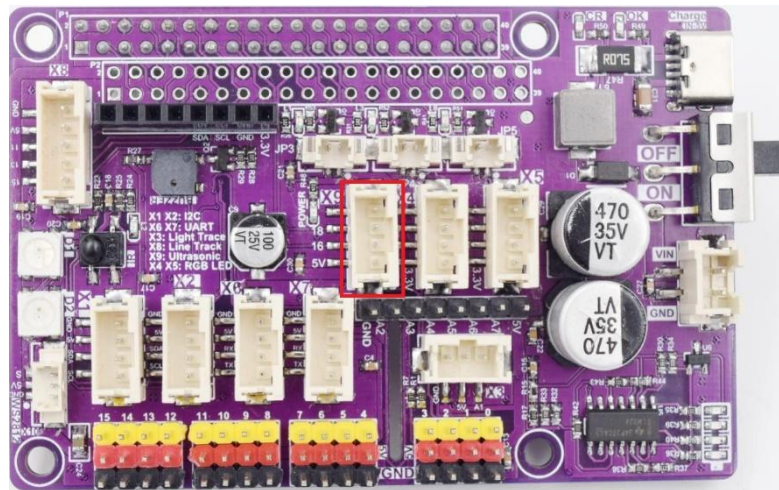
Used to control the ultrasonic module, for example: HC-SR04.

**Circuit schematic diagram:**



**Ultrasonic interface location:**





The ultrasonic interface pins from top to bottom are: **GND**, **GPIO23**, **GPIO24**, **5V**.

To test the ultrasonic code,

Robot HAT_V3 Interface	Module Interface
GND	GND
GPIO024	Echo
GPIO23	Trig
5V	VCC

**Run on the Raspberry Pi command line:**

```
sudo python3 Adeept_Robot_HAT-V3/02_Ultra.py
```

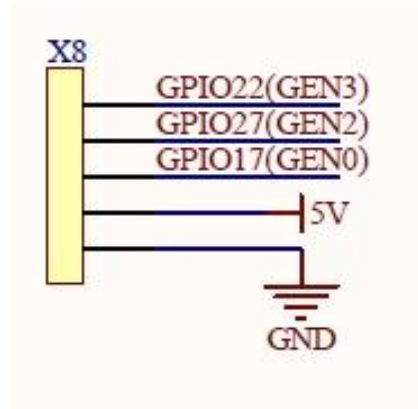
You will see the distance of the ultrasonic detection printed out.

```
pi@raspberrypi:~ $ sudo python3 Adeept_Robot_HAT-V3/02_Ultra.py
/usr/lib/python3/dist-packages/gpiozero/input_devices.py:852: PWMSoftwareFallback
k: For more accurate readings, use the pigpio pin factory. See https://gpiozero.r
eadthedocs.io/en/stable/api_input.html#distancesensor-hc-sr04 for more info
  warnings.warn(PWMSoftwareFallback(
3.70 cm
3.70 cm
3.69 cm
```

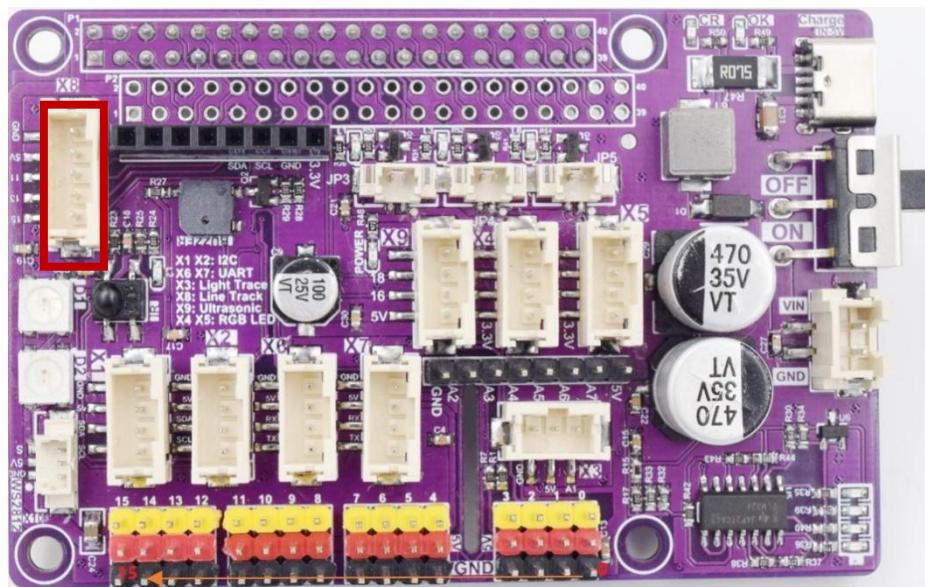
## Tracking

Used to control the 3-way line patrol module.

### Circuit schematic diagram:



### Interface location:



The pins of the three-way line inspection interface from top to bottom are: **GPIO22, GPIO27, GPIO17, 5V, GND.**

Test the Raspberry Pi line module code,

Robot HAT_V3 Interface	Module Interface
GPIO22	15
GPIO27	13
GPIO17	11
5V	VCC

GND	GND
-----	-----

run on the Raspberry Pi command line:

```
sudo python3 Adeept_Robot_HAT-V3/03_LineTracking.py
```

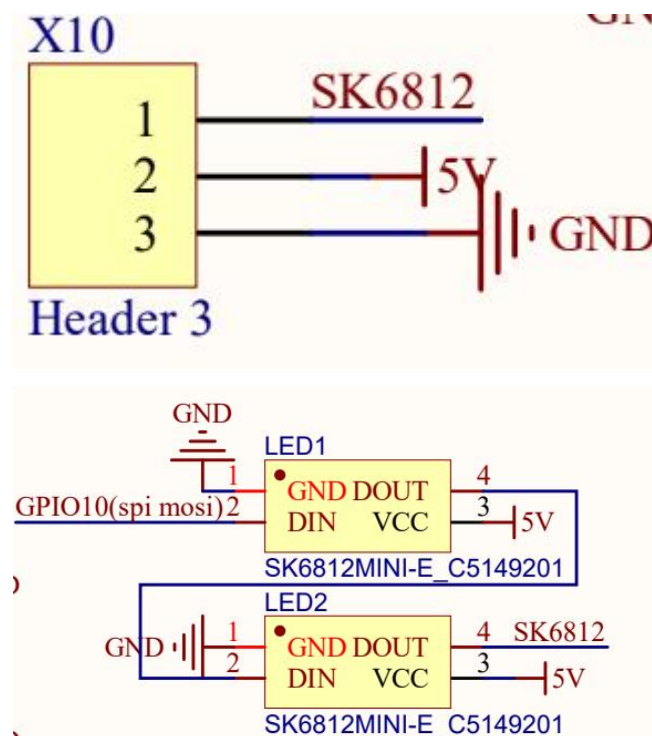
You will see the 3 test results of the line-following module printed out.

```
pi@raspberrypi:~/Aadept_Robot_HAT-V3 $ sudo python3 03_LineTracking.py
left: 0   middle: 0   right: 0
left: 0   middle: 0   right: 0
left: 0   middle: 0   right: 0
left: 0   middle: 0   right: 0
left: 0   middle: 0   right: 0
left: 0   middle: 0   right: 0
left: 0   middle: 0   right: 0
left: 0   middle: 0   right: 0
left: 0   middle: 0   right: 0
```

## WS2812

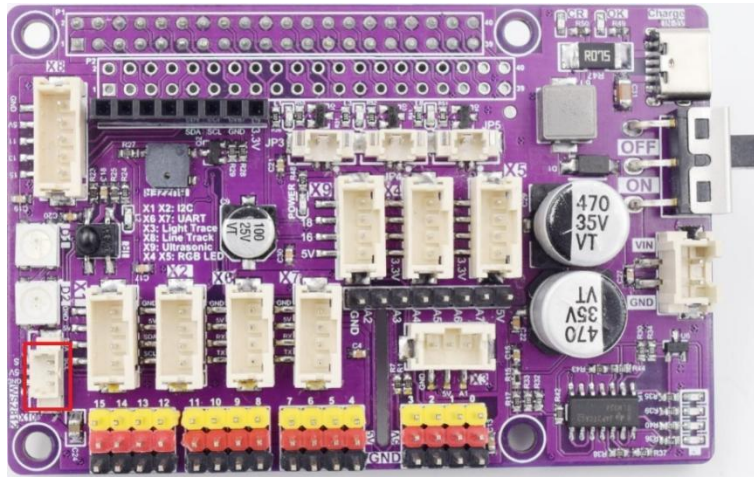
Used to control ws2812 lights.

Circuit schematic diagram:



Interface location:





The ws2812 interface pins from top to bottom are: **GND**, **5V**, and **GPIO10**.

To test the ws2812 code,

Robot HAT_V3 Interface	Module Interface
GND	GND
5V	VCC
GPIO10	Signal pin

run on the Raspberry Pi command line:

```
sudo python3 Adeept_Robot_HAT-V3/04_WS2812.py
```

You can see that the WS2812 light is breathing normally.

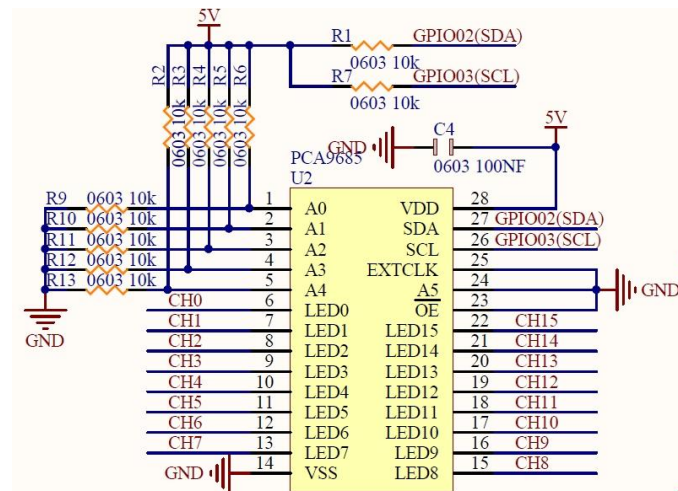
```
pi@raspberrypi:~$ sudo python3 Adeept_Robot_HAT-V3/04_WS2812.py
spidev version is 3.5
spidev device as show:
/dev/spidev0.0 /dev/spidev0.1 /dev/spidev10.0
```

## Motor

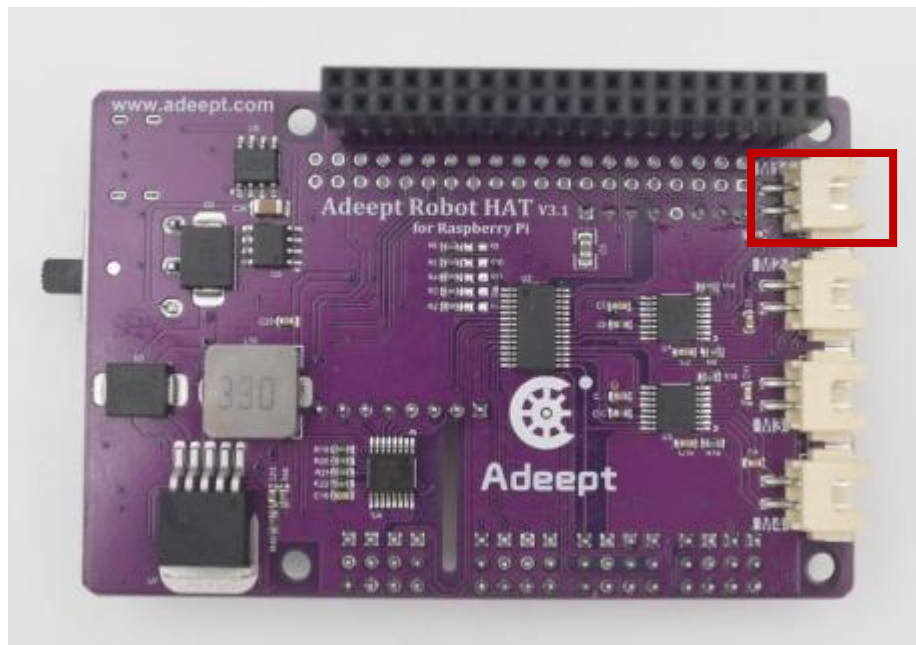
PCA9685 chip, using I2C bus can control 16 steering gears.

When using a motor, pins **8-15** can be selected. When you have a need to control both the motor and servo system simultaneously, to ensure stable system operation, it is recommended to use pins 0-7 to control the servo system and pins 8-15 to control the motor.

**Circuit schematic diagram:**



**Interface location:**



For the motor interface pins, the upper end is connected to the positive pole of the motor, and the lower end is connected to the negative pole of the motor.

To test the motor interface code, run on the Raspberry Pi command line:

```
sudo python3 Adept_Robot_HAT-V3/05_Motor.py
```

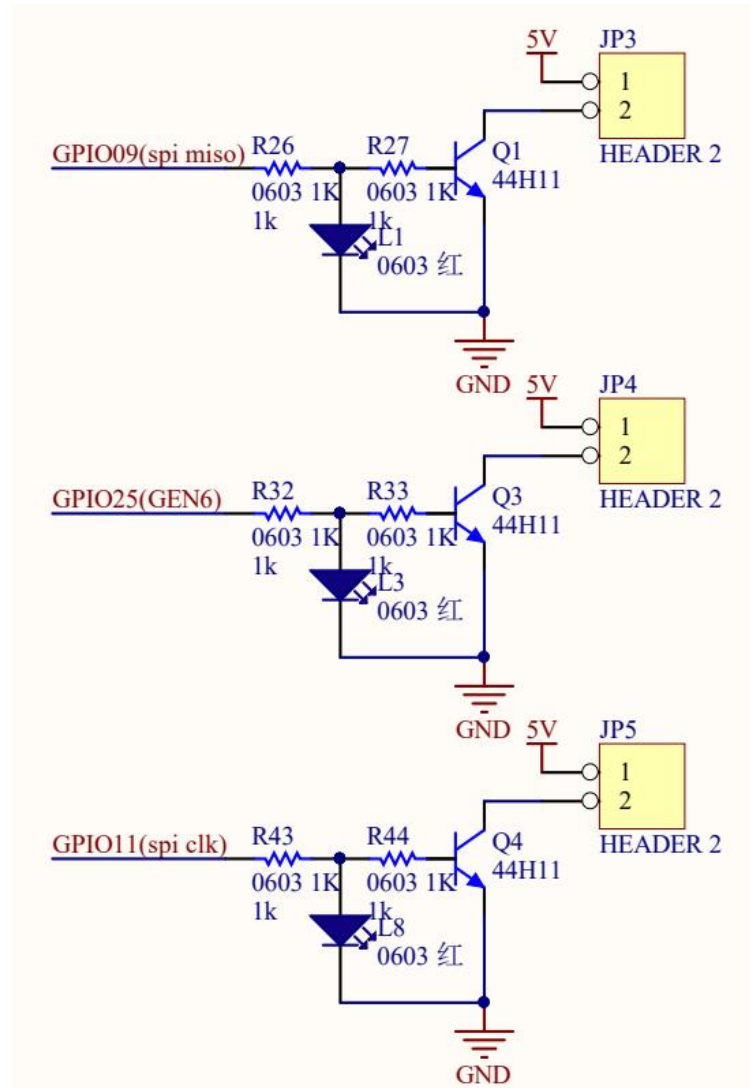
You can see that the motor rotates forward for 2 seconds , then reverses for 2 seconds.

```
pi@raspberrypi:~ $ sudo python3 Adept_Robot_HAT-V3/05_Motor.py
Forward
Backward
```

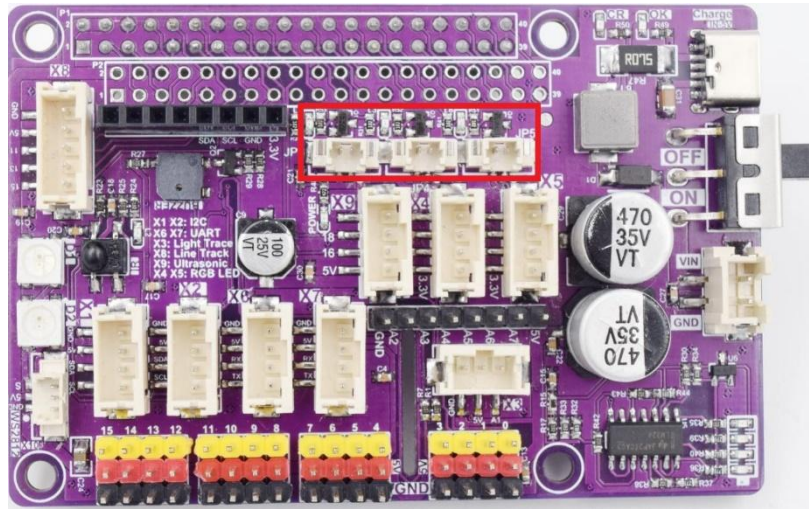
## LED Port

Used to control single color LED or switch.

**Circuit schematic diagram:**



**Interface location:**



There are 2 pins in each interface, the upper part is 5V, and the lower part is the signal pin. The signal pins from left to right are **GPIO09**, **GPIO11**, **GPIO25**.

To test the LED interface code,

Robot HAT_V3 Interface	Module Interface
5V	VCC
GPIO09/GPIO011/GPIO25	GND

run on the Raspberry Pi command line:

```
sudo python3 Adeept_Robot_HAT-V3/06_LED.py
```

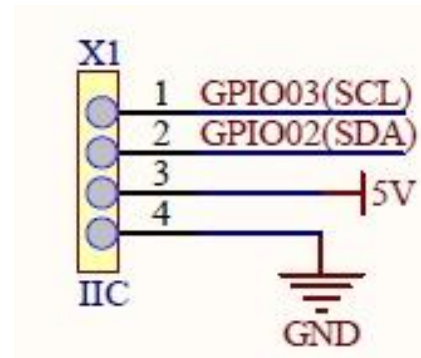
You can see that the three LEDs on Adeept Robot HAT\_V3 turn on and off regularly.

```
pi@raspberrypi:~ $ sudo python3 Adeept_Robot_HAT-V3/06_LED.py
LED1 on
LED2 on
LED3 on
All LED off
```

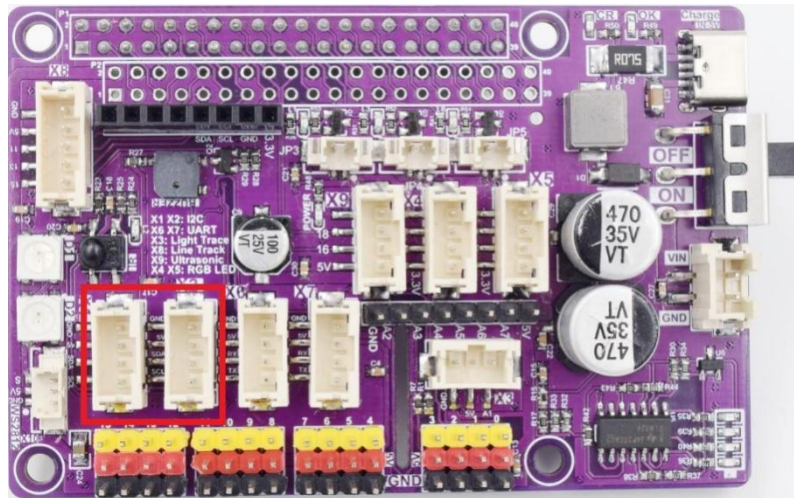
## IIC

Used to control some modules that require IIC driver. For example: OLED screen.

**Circuit schematic diagram:**



**Interface location:**



IIC interface pins from top to bottom are: **5V**, **GND**, **GPIO03(SCL)** , **GPIO02(SDA)**.

Test the IIC interface code, take the OLED screen as an example, the OLED screen occupies the I2C address **0x3C**.

Robot HAT_V3 Interface	Module Interface
5V	VCC
GND	GND
GPIO03(SCL)	SCL
GPIO02(SDA)	SDA

Run in the Raspberry Pi command line:

```
sudo python3 Adeept_Robot_HAT-V3/07_OLED.py
```

If an OLED screen is installed, you can see the Raspberry Pi's system time on the screen.

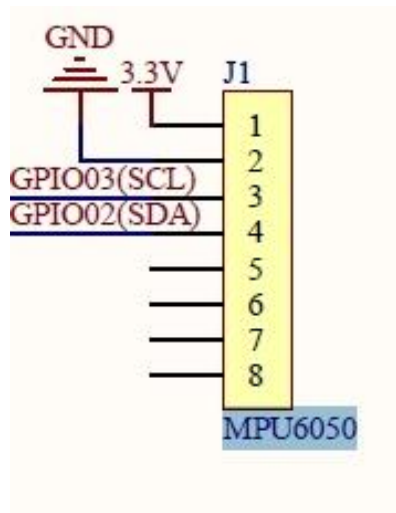


```
pi@raspberrypi:~ $ sudo python3 Adeept_Robot_HAT-V3/07_OLED.py
```

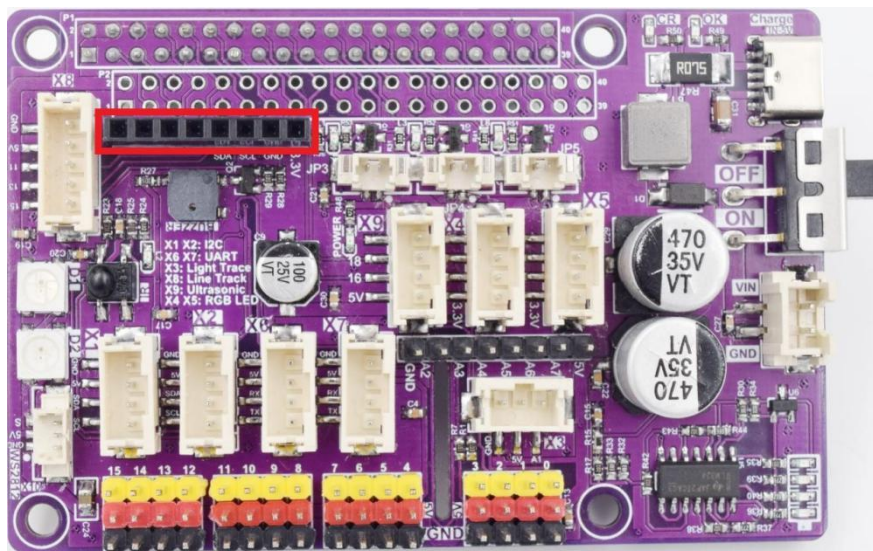
## MPU6050

Used to control the MPU6050 acceleration sensor.

**Circuit schematic diagram:**



**Interface location:**



Only use the 4 pins below, from bottom to top: **3.3V**, **GND**, **GPIO03 (SCL)**, **GPIO02 (SDA)**.

Test the MPU6050 interface code

Robot HAT_V3 Interface	Module Interface
------------------------	------------------

3.3V	VCC
GND	GND
GPIO03(SCL)	SCL
GPIO02(SDA)	SDA

run it on the Raspberry Pi command line:

```
sudo python3 Adeept_Robot_HAT-V3/08_Mpu6050.py
```

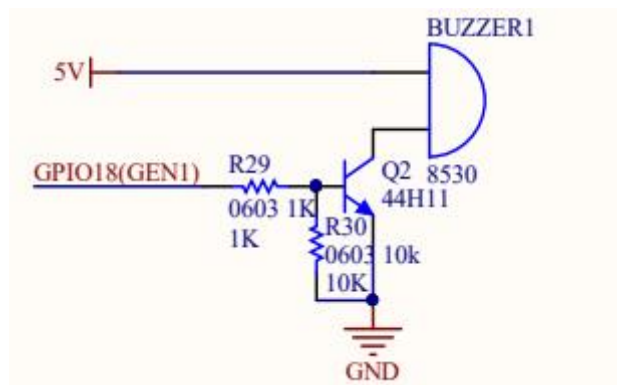
If MPU6050 is installed, you can see that the acceleration values in the X, Y, and Z directions are printed.

```
pi@raspberrypi:~ $ sudo python3 Adeept_Robot_HAT-V3/08_Mpu6050.py
X=-0.371, Y=0.229, Z=9.545
X=-0.390, Y=0.203, Z=9.536
X=-0.385, Y=0.216, Z=9.546
X=-0.397, Y=0.222, Z=9.493
```

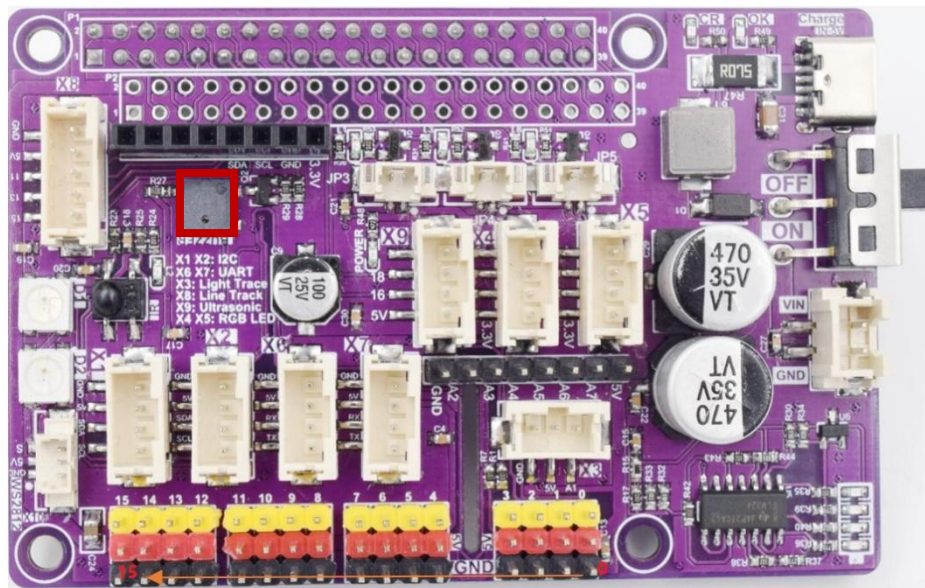
## Buzzer

Used to control the buzzer.

**Circuit schematic diagram:**



**Interface location:**



Only use the 3 pins below, from bottom to top: **5V**, **GPIO18**.

Test the Buzzer interface code

Robot HAT_V3 Interface	Module Interface
5V	VCC
GPIO18	GND

run it on the Raspberry Pi command line:

```
sudo python3 Adeept_Robot_HAT-V3/09_Buzzer.py
```

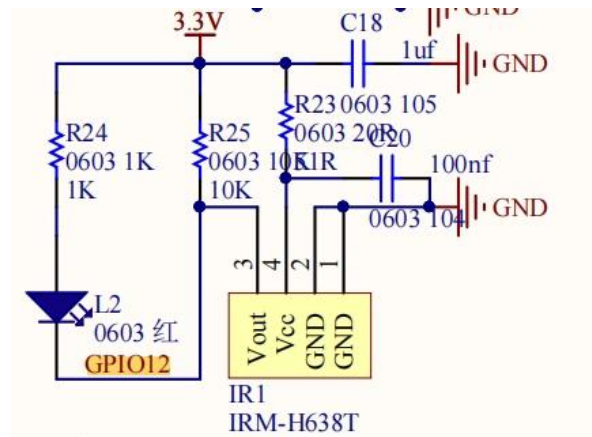
The buzzer will play a piece of music.

```
pi@raspberrypi:~ $ sudo python3 Adeept_Robot_HAT-V3/09_Buzzer.py
Demo: Playing the Happy Birthday song
G4
G4
A4
G4
C5
```

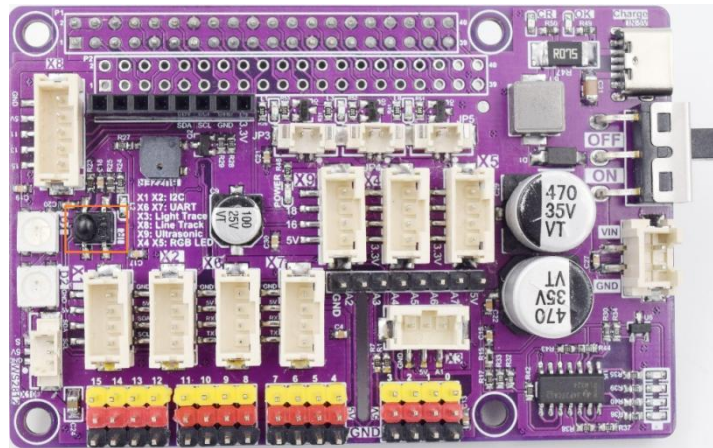
## IR Receiver

Used to control the IR Receiver.

**Circuit schematic diagram:**



Interface location:



Only use the 3 pins below, from bottom to top: **3.3V, GND, GND,GPIO12.**

Test the IR Receiver interface code

Robot HAT_V3 Interface	Module Interface
3.3V	VCC
GND	GND
GPIO12	V out
GND	GND

run it on the Raspberry Pi command line:

```
sudo python3 Adeept_Robot_HAT-V3/10_IR_Receiver.py
```

After running, clicking on the infrared remote control will print the "Received signal".

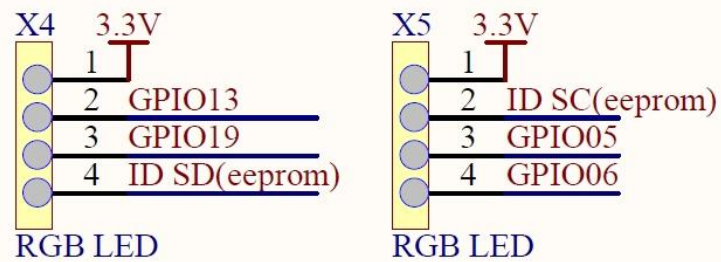


```
pi@raspberrypi:~ $ sudo python3 Adeept_Robot_HAT-V3/10_IR_Receiver.py
```

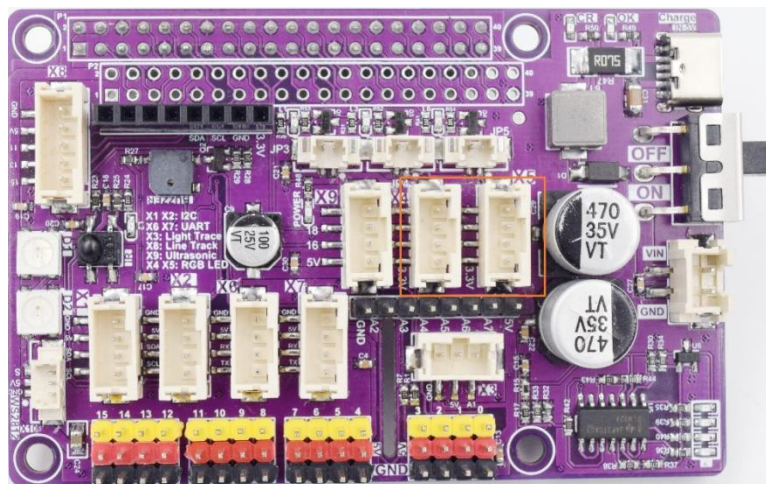
## RGB LED

Using RGB LEDs.

**Circuit schematic diagram:**



**Interface location:**



**X4:**use the 4 pins below, from bottom to top: **3.3V**, **ID\_SD**, **GPIO13** , **GPIO19**.

Test the RGB LED interface code

Robot HAT_V3 Interface	Module Interface
3.3V	VCC
GPIO13	R
GPIO19	G



ID_SD	B
-------	---

**X5:**use the 4 pins below, from bottom to top: **3.3V**, **ID\_SC**, **GPIO05** , **GPIO06**

Test the RGB LED interface code

Robot HAT_V3 Interface	Module Interface
3.3V	VCC
ID_SC	R
GPIO05	G
GPIO06	B

run it on the Raspberry Pi command line:

```
sudo python3 Adeept_Robot_HAT-V3/11_RGB.py
```

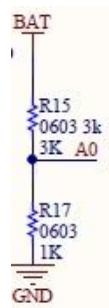
After successfully running the program, you can observe that the RGB led will light up in different colors.

```
pi@raspberrypi:~ $ sudo python3 Adeept_Robot_HAT-V3/11_RGB.py
```

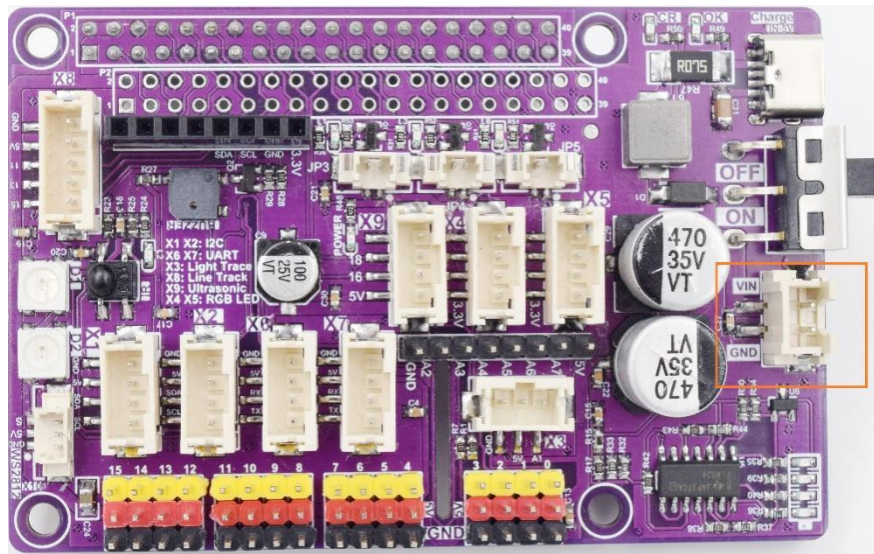
## Battery Level Detection

Check battery level.

**Circuit schematic diagram:**



**Interface location:**



Test the Battery level detection interface code

Robot HAT_V3 Interface	Module Interface
5V	VCC
GND	GND
ADC: A0	Signal pin

run it on the Raspberry Pi command line:

```
sudo python3 Adeept_Robot_HAT-V3/12_Battrey_Level.py
```

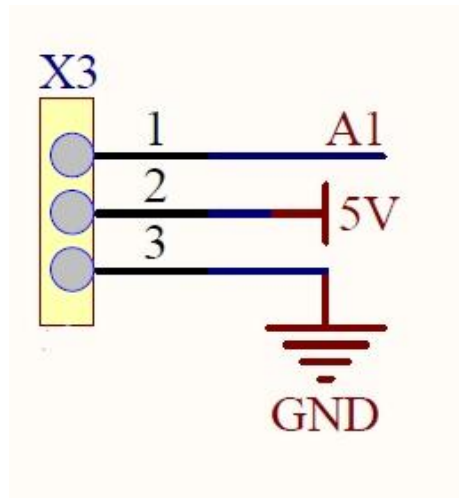
After running the ADC code below, the value corresponding to the battery level can be obtained.

```
pi@raspberrypi:~ $ sudo python3 Adeept_Robot_HAT-V3/12_Battrey_Level.py
Current battery level: 31.05 %
Current battery level: 34.31 %
Current battery level: 31.05 %
```

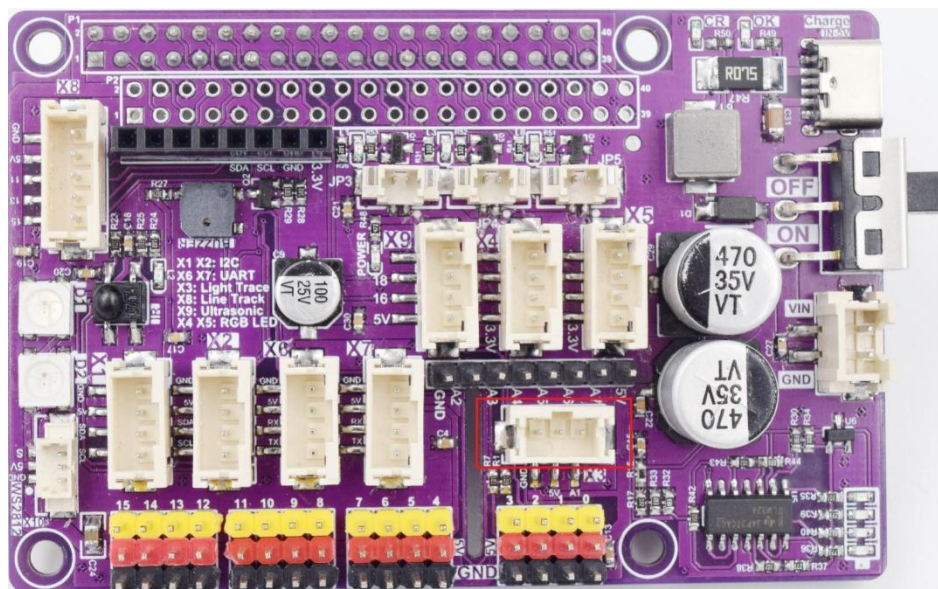
## Light Tracking

use the Light Tracking Module.

**Circuit schematic diagram:**



**Interface location:**



Test the LightTracking interface code

Robot HAT_V3 Interface	Module Interface
5V	VCC
GND	GND
ADC: A1	Signal pin

run it on the Raspberry Pi command line:

```
sudo python3 Adeept_Robot_HAT-V3/13_LightTracking.py
```

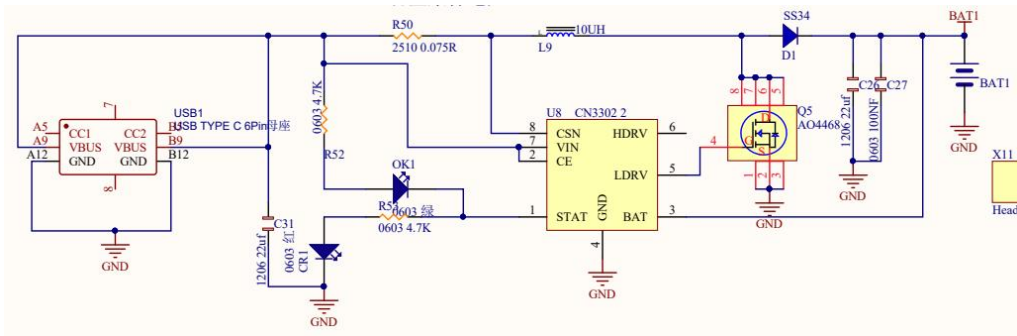
After running the program successfully, Use light to shine on "LDR1" or "LDR2" at both ends of the light tracking module, and the value on the screen will show the maximum value (close to 65535), or the value will decrease, with the minimum value being 0 (close to 0).

[www.adeept.com](http://www.adeept.com)

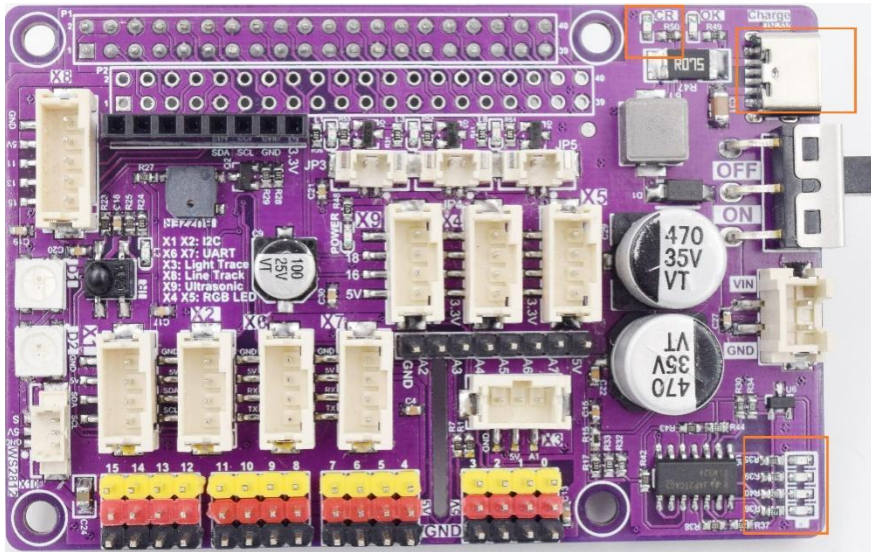
```
pi@raspberrypi:~ $ sudo python3 Adept_Robot_HAT-V3/l3_LightTracking.py
ADC channel 1 = 64768
-----
ADC channel 1 = 64768
```

## Battery charging

**Circuit schematic diagram:**



Interface location:



When the Type-C interface is connected to a USB cable and the Power IN is connected to an external power source, the indicator light in the picture will light up. If the indicator light displays red, it indicates that the device is charging; When the indicator light turns green, it indicates that the battery is fully charged.

## Precautions for Using the Robot HAT\_V3

When you are performing software installation, structural assembly, or program debugging, you can use a USB cable to power the Raspberry Pi. If the Raspberry Pi is equipped with Robot HAT\_V3, you can connect the USB cable to the USB port on the Robot HAT\_V3. The Robot HAT\_V3 will supply power to the Raspberry Pi through the GPIO interface.

Different models of Raspberry Pi have specific requirements for current. For example, the Raspberry Pi 3B requires at least 2A of current to boot up, the Raspberry Pi 4 needs 3A of current to boot up normally, and the Raspberry Pi 5 requires 4A of current to boot up normally. When you use a power adapter to power the Raspberry Pi, you can check the specifications on the power adapter.

When the Robot HAT\_V3 is connected to a load, such as a motor or several servos, a high-current power source needs to be connected to the Vin interface on the Robot HAT\_V3. You can use two high-current 18650 batteries for power supply.

When using the USB port on the Robot HAT\_V3 as a power source, the switch of the Robot HAT\_V3 does not control whether to turn on or off the power, but only controls the power supply on the Vin interface side. Please do not use both the USB port and the Vin interface on the Robot HAT\_V3 to supply power simultaneously.

If you need to debug the program for a long time and don't want to remove the battery, you can set the switch on the Robot HAT\_V3 to "OFF". In this way, when you connect the Robot HAT\_V3 with a USB cable, the Robot HAT\_V3 will be powered by the USB.

If your robot restarts automatically after booting up, or disconnects and restarts at the moment it starts to move after a normal boot, it is likely that the power supply you are using does not provide enough current.

It is recommended to choose an 18650 battery with a maximum continuous discharge current exceeding 4A, or an 18650 battery with the characteristic of "high-rate discharge".

You can also use a high-energy lithium-ion battery to power the Robot HAT\_V3; the Robot HAT\_V3 can be powered by a power source with a voltage not exceeding 15V.