About this Manual

Thanks for choosing our PiCrawler.

PiCrawler is an AI quadruped robot based on Raspberry Pi. It has 12 movable joints for bionics movements, including Curling up, standing, swinging etc. In addition, the camera module and ultrasonic module are equipped to support PiCrawler to complete some deep-learning-related experiments, such as image recognition, face recognition, distance judgment and so on.

Taking the SunFounder-designed Robot HAT as the driving module, it integrates the motor driving, servo driving and presets ADC, PWM, Digital pins for your function extension. A speaker has already been inserted in the Robot HAT to realize TTS (Text-to-Speech), sound effect, background music, etc.

This manual introduces lists, assembly, program, etc. The program part is divided into two chapters: To Play in Ezblock and To Play in Python and each of them can get you stated on making PiCrawler work in way you want.

★ To Play in Ezblock

If you are a programming newbie, please check this chapter for it introduces a block-based visual programming software — Ezblock Studio to guide you to grasp the programming. There are 14 examples to help you completely grasp the blockly program skill and the use of several functions of PiCrawler.

★ To Play in Python

If you give a favor to the traditional program environment — Python, skip to read this chapter directly for it introduces the RPi environment configuration and the methods of running the provided Python example codes and checking running effects. In addition, we have developed a web control page for your operation, applicable to your smart phone, tablet, desktop and so on. You can get to use PiCrawler as soon as you run a few commands.

Absorbed the application of these functions, you are expected to create your own marvellous and inspiring projects. We will be glad if you are willing to share your experience and harvest on our forum.

Thanks once again for your unremitting support for SunFounder company.

Content

Component List

M1.4 Nut
(6)

M1.4 x 6
Screw
(6)

M1.5 x 4
Self-tapping Screw
(28)

M2 x 4
Screw
(16)

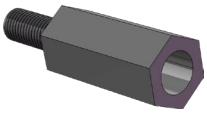
M2 x 10
Screw
(20)

M2.5 x 6
Screw
(6)

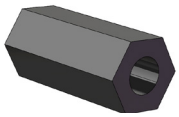
M3 x 4
Countersunk
Screw
(4)

M3 x 6
Screw
(12)

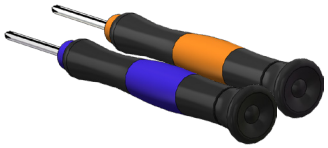
M2.5 x 8 + 6
Nylon Standoff
(6)



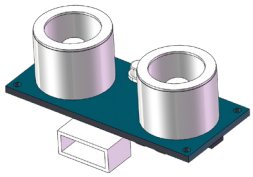
M2.5 x 11 + 6
Nylon Standoff
(6)



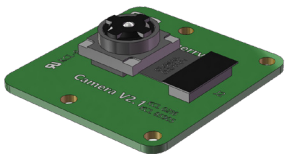
M3 x 24
Nylon Standoff
(7)



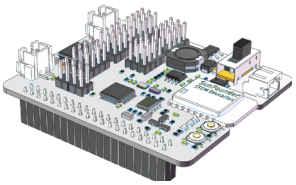
Screwdriver
(2)



Ultrasonic Module
(1)



Camera Module
(1)



Robot HAT
(1)

Battery Holder
(1)

Ultrasonic Module
Cable
(2)

FFC Cable
(2)

Spiral Cable Wrap
(1)

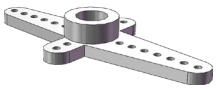
Battery Ribbon
(1)

Servo
(12)

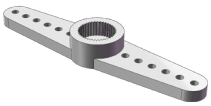
Servo
Screw A

Servo
Screw B

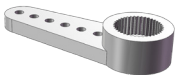
Servo
Screw B



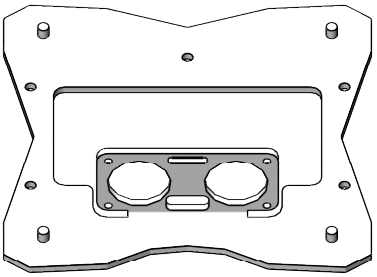
Cross Servo
Arm

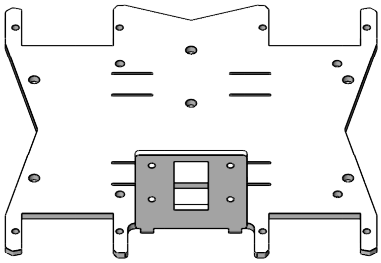


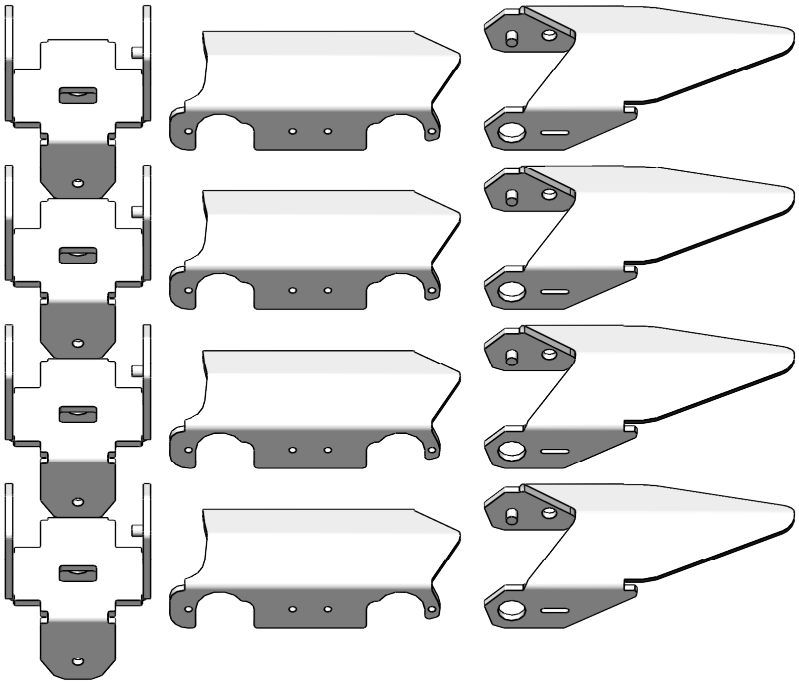
Double-Side
Servo Arm



One-Side Servo
Arm





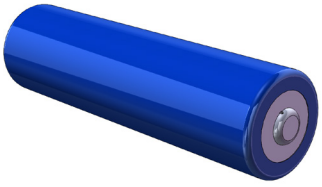


Structural Plate

Self-Provided Component

1. You are recommended to use 18650 batteries without a protective board. Otherwise, this product will be powered off and be stopped running because of the overcurrent protection of the board.

2. Please use a battery with the largest possible power to increase the duration of use.



18650 Rechargeable
Li-ion Battery
(2)

Burn System

In addition to playing this product, you ought to flash the system into the Raspberry Pi.

Required Components

Raspberry Pi	1 * Power Adapter
1 * Mirco SD Card	1 * Personal Computer

Procedures

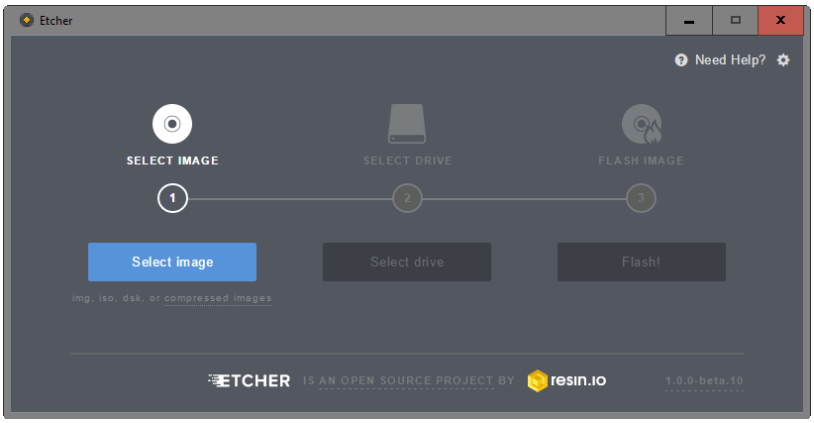
1. Prepare the tool of image burning. Here we use the **Etcher**. You can download the software here: https://www.balena.io/etcher/.

2. Download the **Ezblock for Raspberry Pi** image file here: http://ezblock.cc/download/index.html

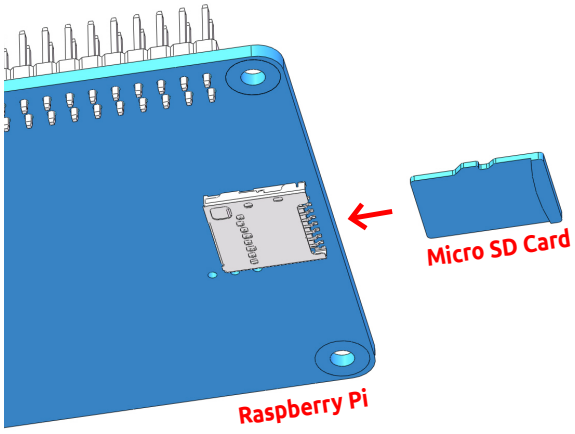
3. Unzip the package downloaded and you will see the **.img** file inside.

Note: Do not extract the .img file.

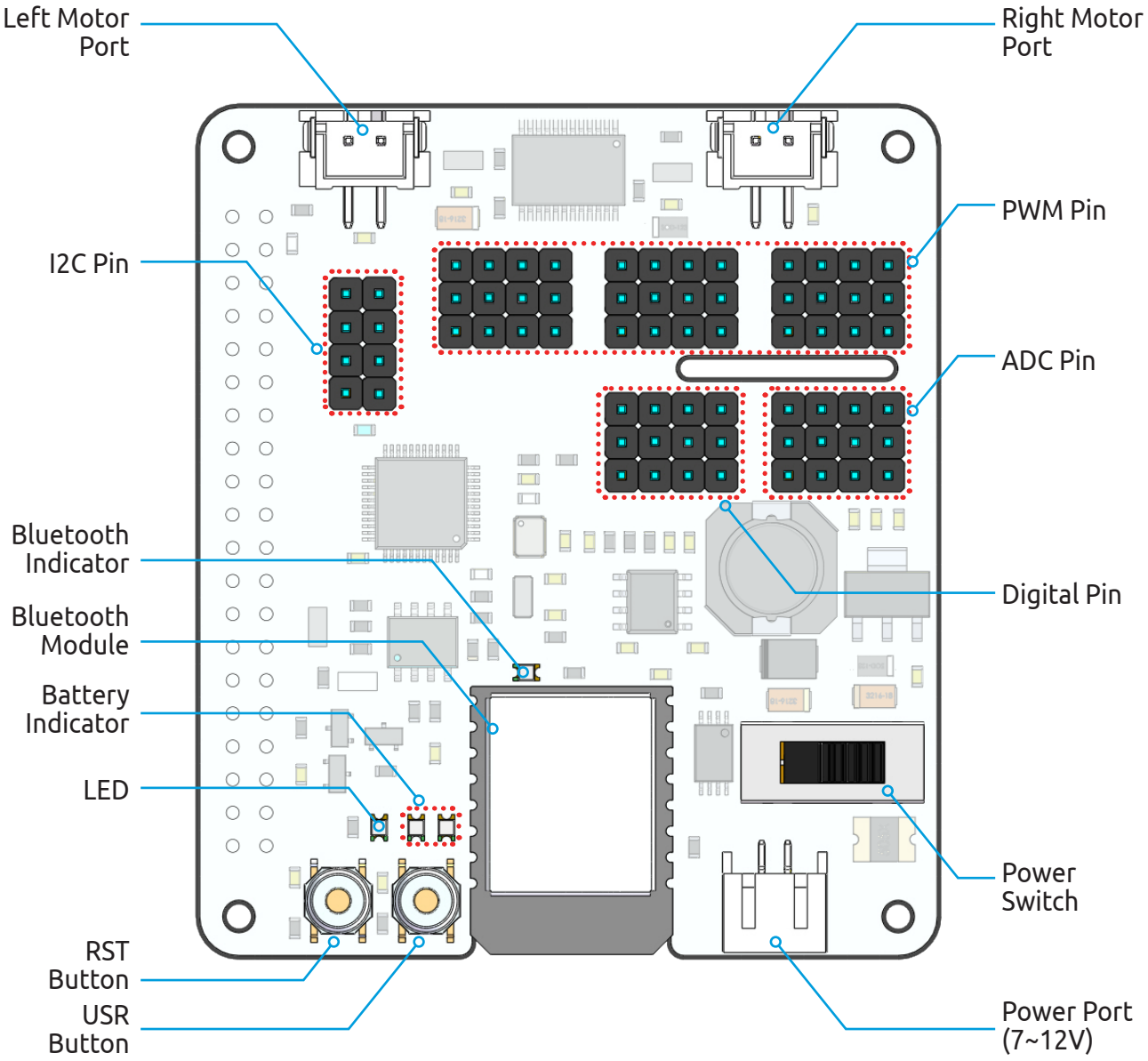
4. With Etcher, flash the image file into the SD card.



5.At this point, Ezblock for Raspberry Pi is installed. Please insert the Micro SD card into your Raspberry Pi.



About Robot HAT



RST Button:

- Short pressing RST Button causes program resetting.
- Long press RST Button till the LED lights up then release, and you will disconnect the Bluetooth.

USR Button:

- The function of USR Button can be set by your programming. (Pressing down leads to a input "0"; releasing produces a input "1".)

LED:

- Set by your program. (Outputting 1 turns the LED on. Outputting 0 turns it off.)

Battery Indicator:

- The voltage ranging above 7.8V, two LEDs light up; ranging 6.7V~7.8V, one LED turns on; ranging below 6.7V, all LEDs turn off.

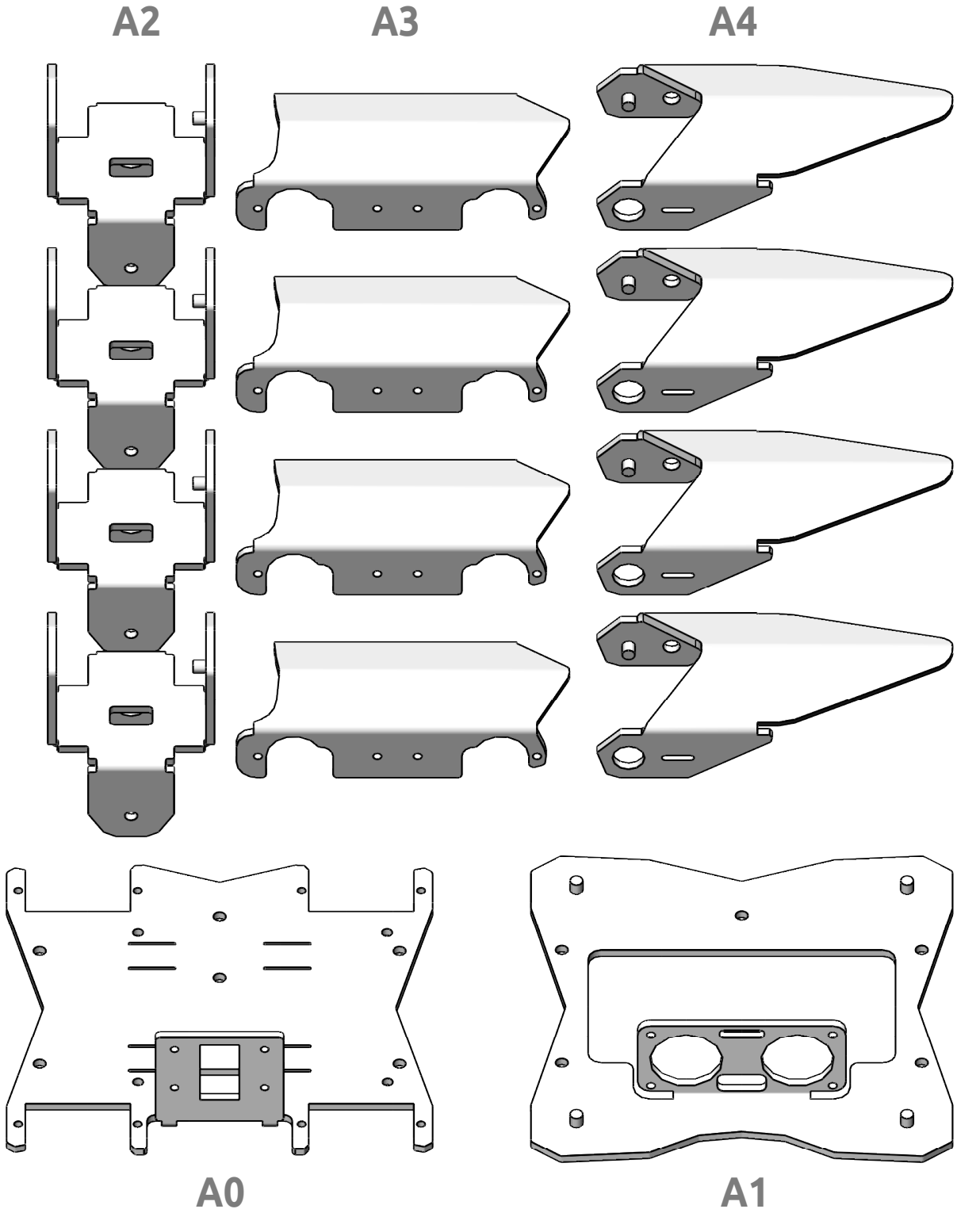
Bluetooth Indicator:

- The Bluetooth indicator keeps turning on at a well Bluetooth connection, blinks at a Bluetooth disconnection, blinks fast at a signal transmission.

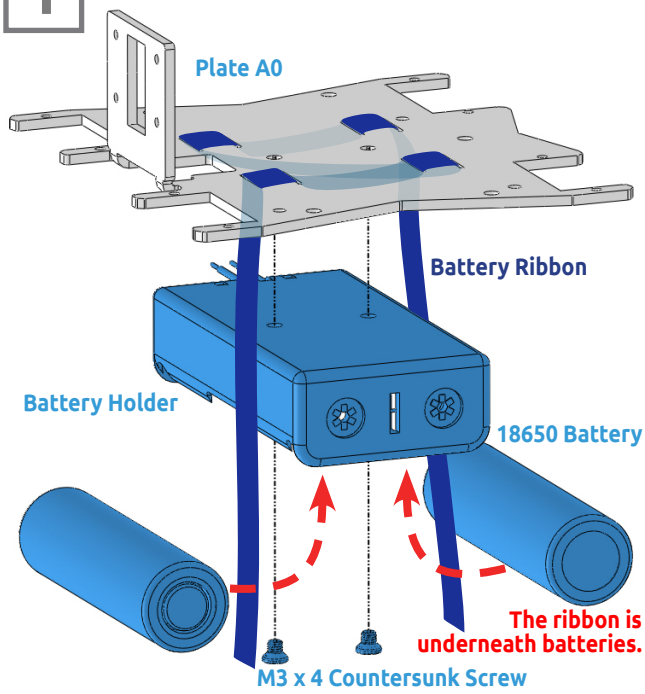
Building the PiCrawler

Now get familiar with these components in this package. In the following steps, there are so many details that you need to notice especially in the operation of calibrating the servo angle. In addition, you ought to check whether your wiring conforms to the instruction of this manual.

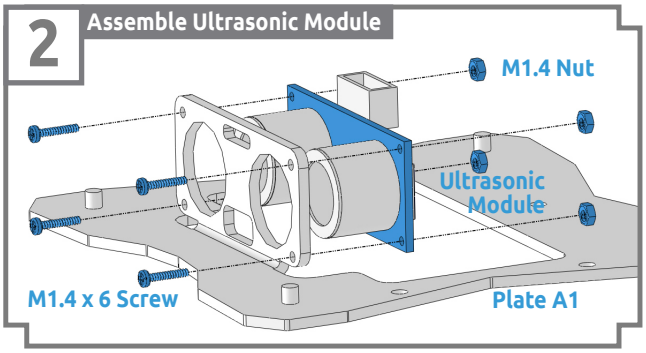
Structural Plate



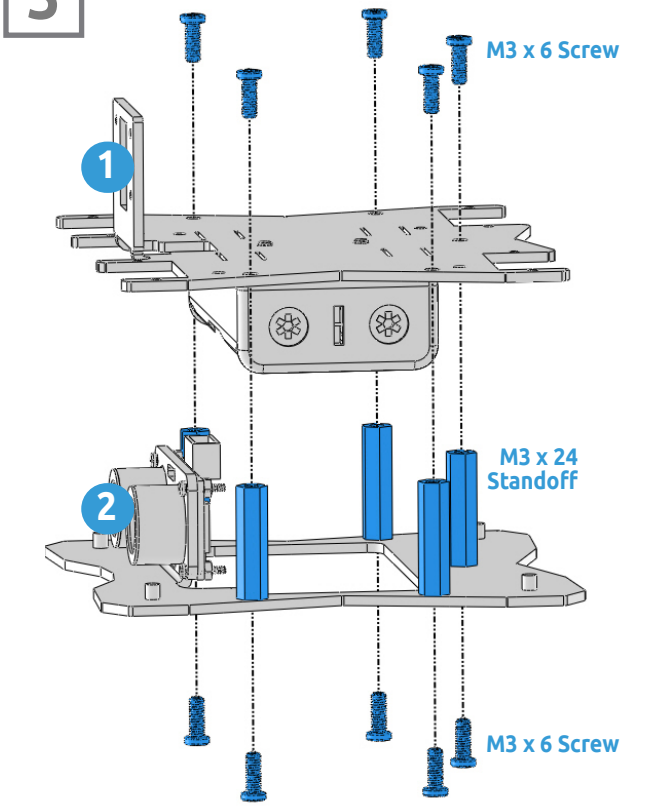
1 Assemble Battery Holder



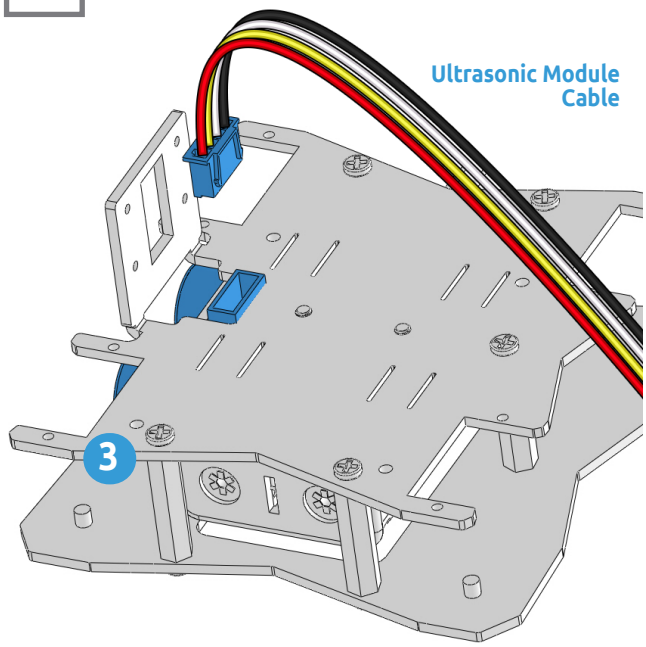
2 Assemble Ultrasonic Module



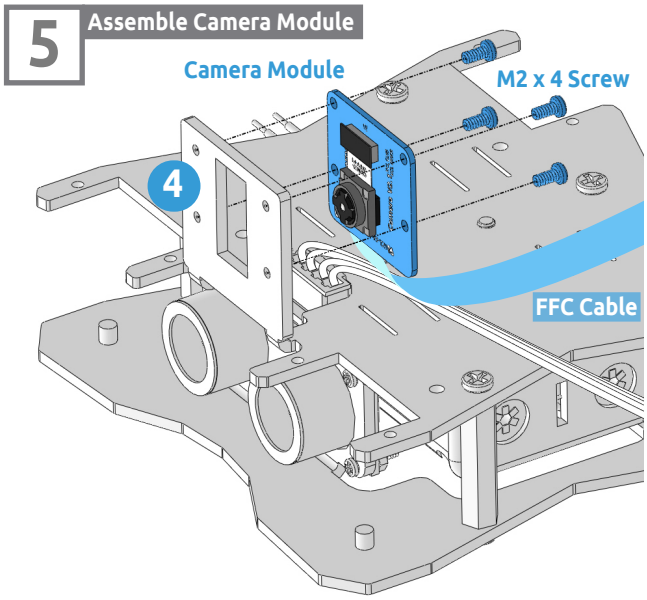
3 Assemble Body Part



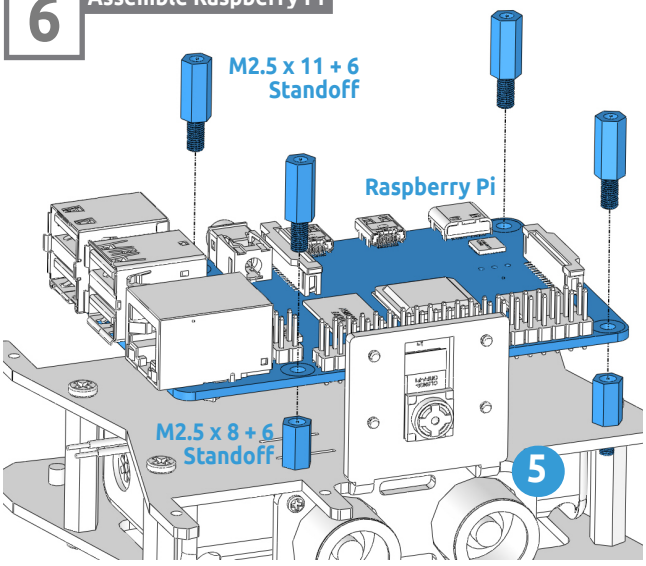
4 Insert the Ultrasonic Cable



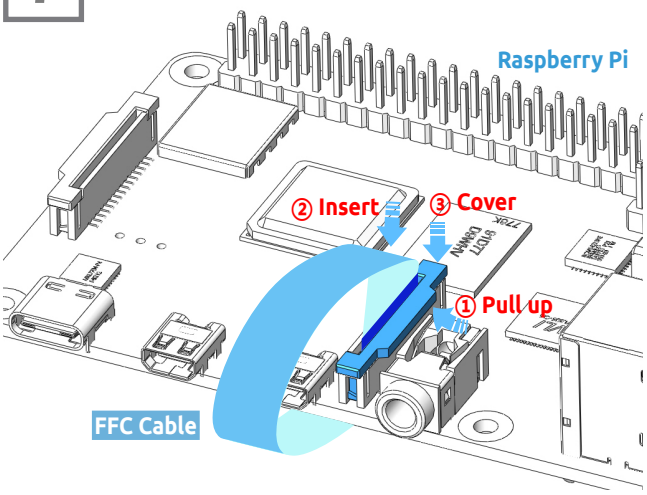
5 Assemble Camera Module



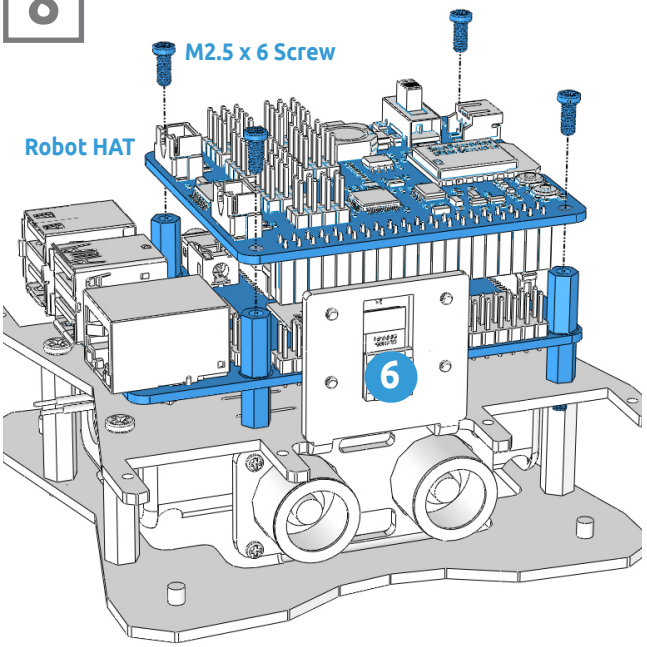
6 Assemble Raspberry Pi



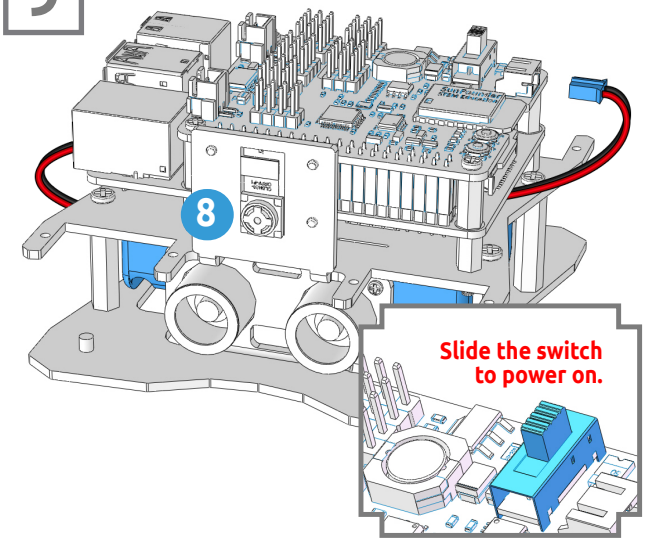
7 Connect Camera FFC



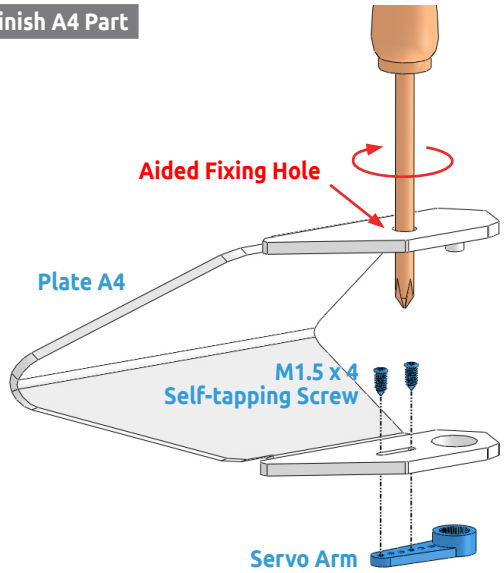
8 Assemble Robot HAT



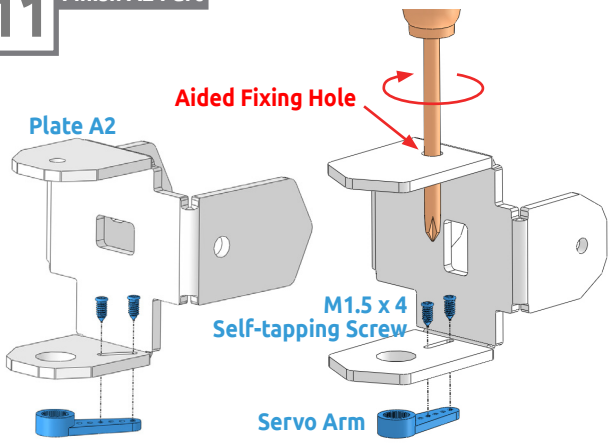
9 Power on



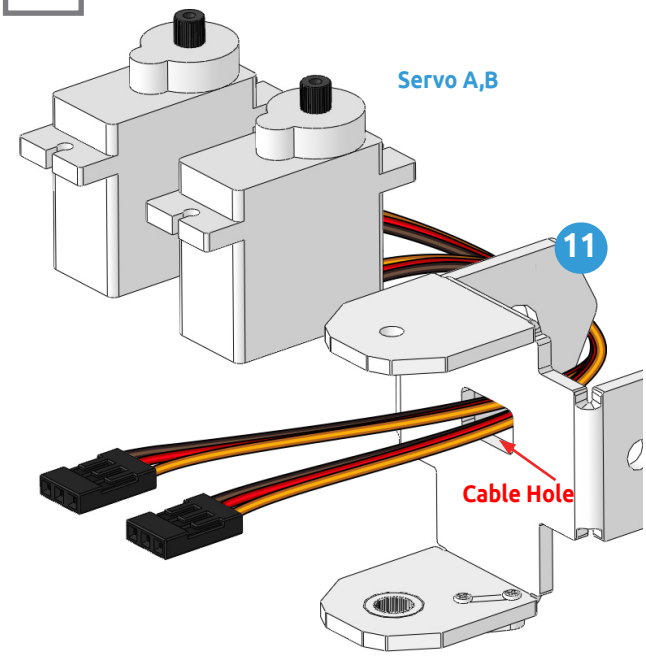
10 Finish A4 Part



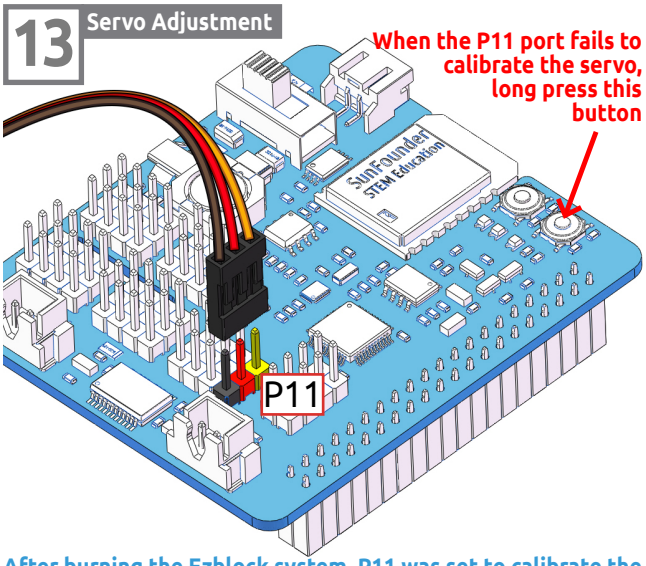
11 Finish A2 Part



12 Through the Cable Hole



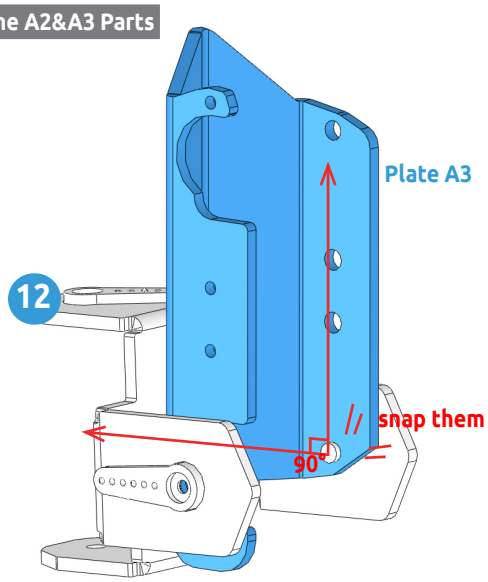
13 Servo Adjustment



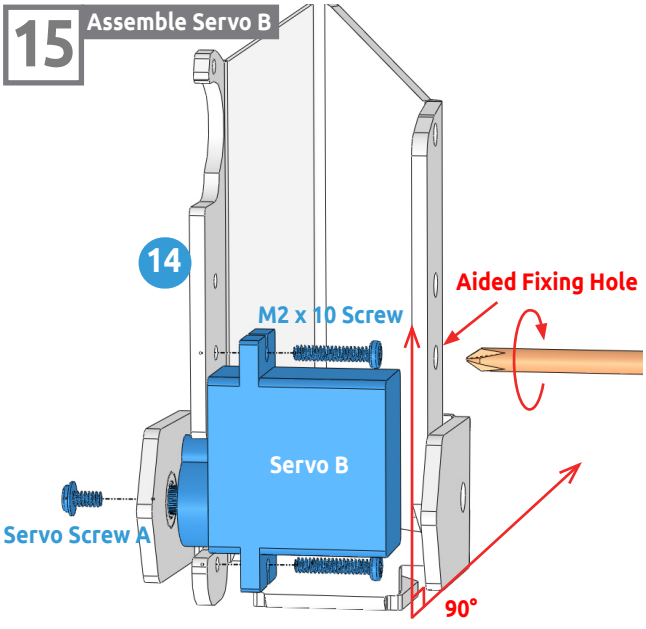
After burning the Ezblock system, P11 was set to calibrate the servo angle to 0 °. Therefore, before assembling each servo, you need to plug the servo pin into P11 and keep power on.

NOTE: This function will be invalid after writing any programs.

14 Combine A2&A3 Parts

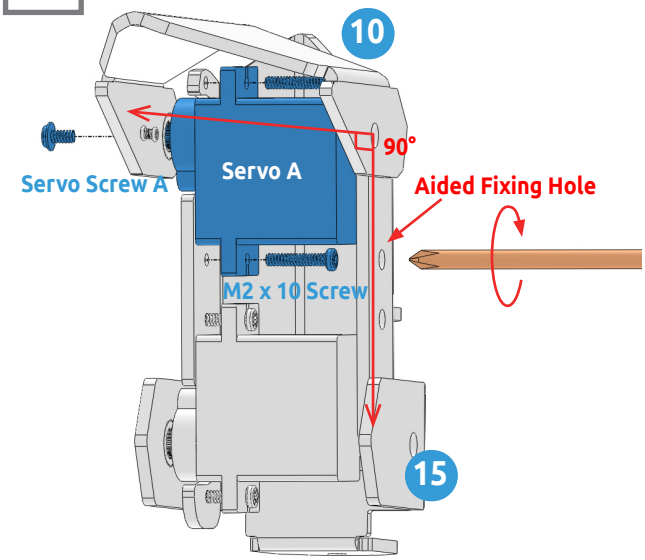


15 Assemble Servo B



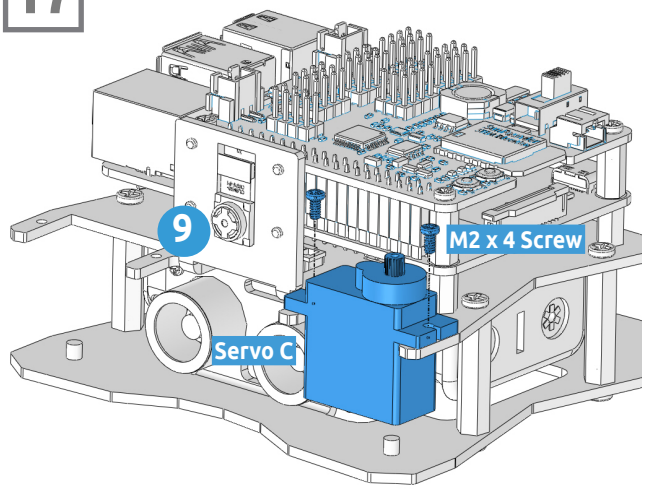
The Servo B should be driven by P11 port here.

16 Assemble Servo A

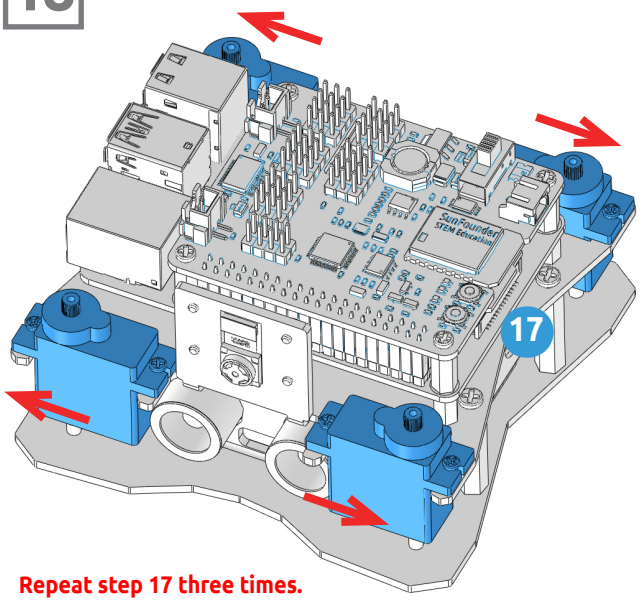


The Servo A should be driven by P11 port here.

17 Assemble Servo C



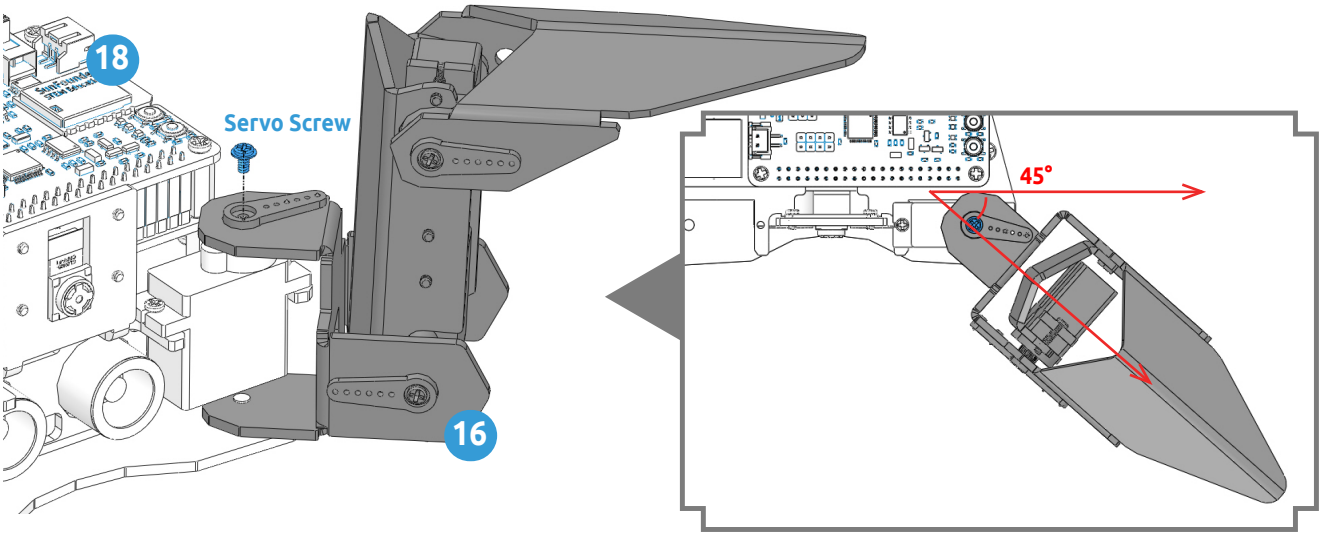
18 Assemble All Servo C



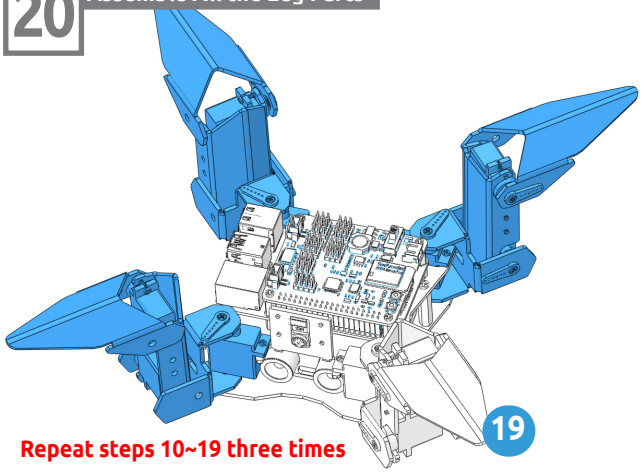
Repeat step 17 three times.

19 Assemble the Leg Part

The Servo C should be driven by P11 port here.

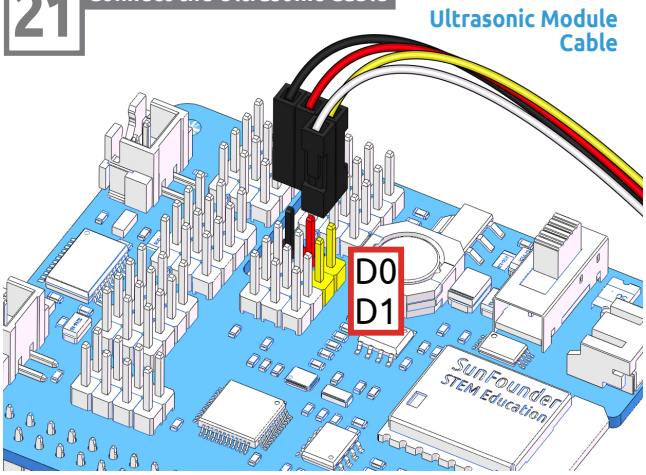


20 Assemble All the Leg Parts

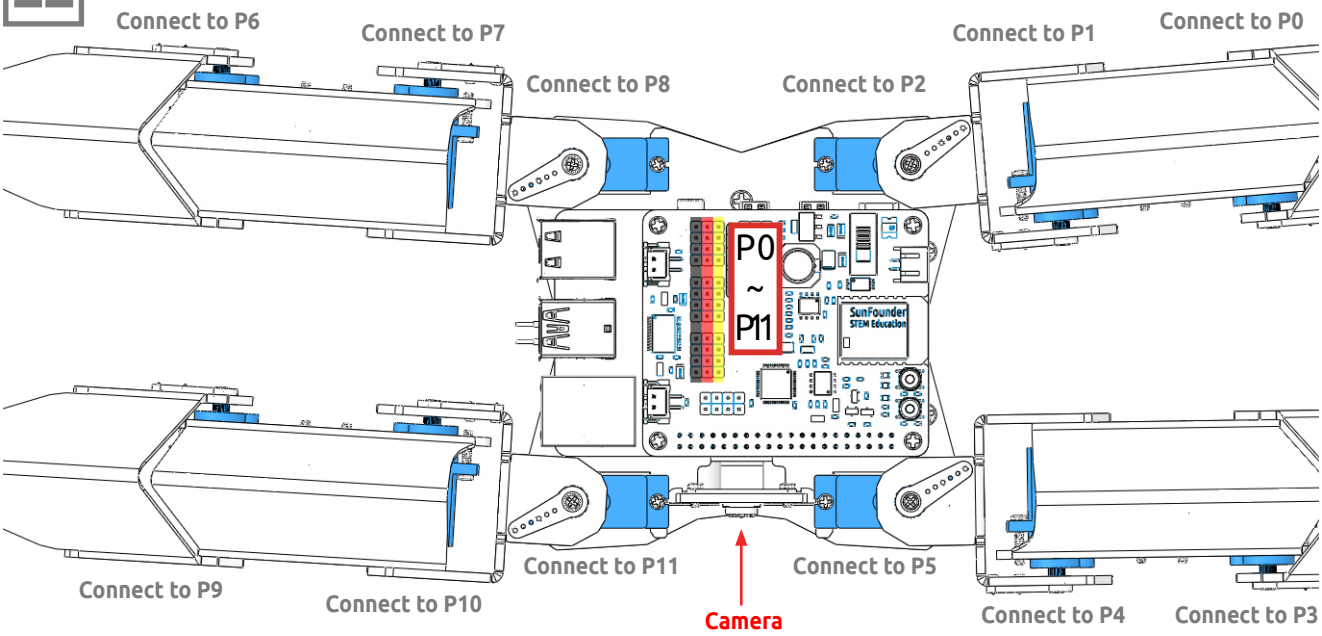


Repeat steps 10~19 three times

21 Connect the Ultrasonic Cable



22 Connect All the Servo Cables



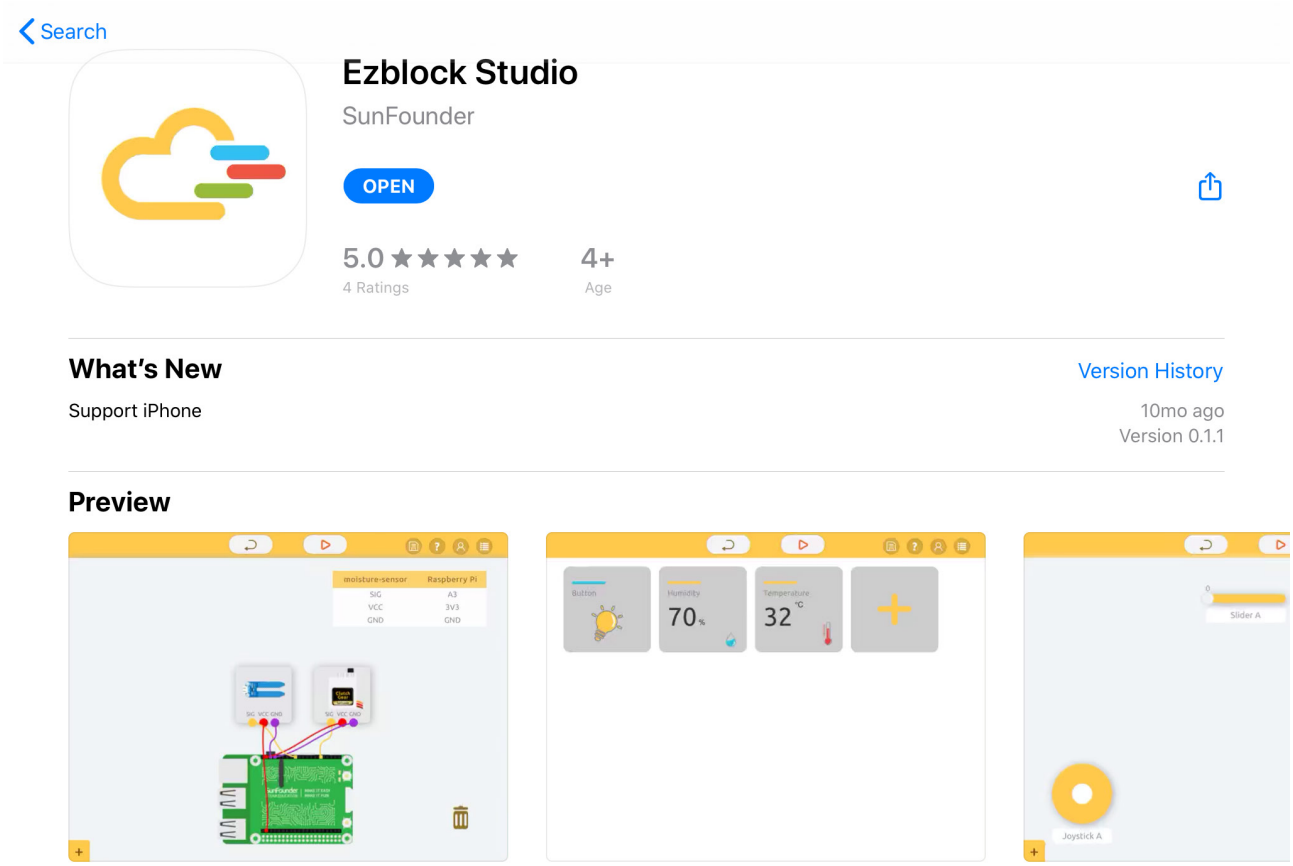
To Play in Ezblock

Introduce Ezblock Studio

Ezblock Studio is a new open-source platform for building electronic projects and graphical programming.

Ezblock Studio also serves as a coding platform that runs on your phone, tablet and computer. In addition, the Ezblock Studio applies Blocks and Python, making it easier to learn programming. By and large, Ezblock Studio integrates Hardware Simulator, Bluetooth Debugger, IoT Panel and Customizable Remote Controller, which are conducive to the operation of prototyping, debugging, and so on.

Open App Store (iOS/Mac OS X system) or Play Store (Android/Windows/Linux system), then search and download Ezblock Studio.

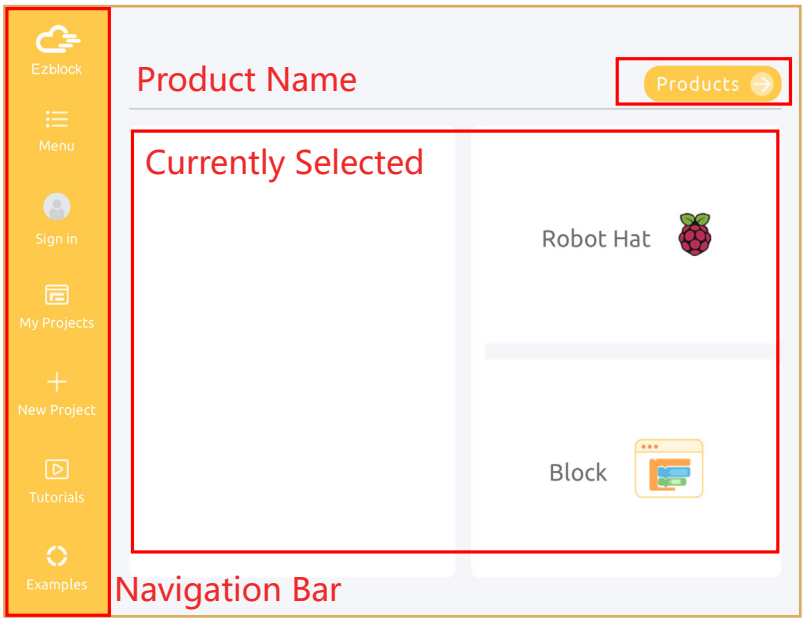


Quick Guide on Ezblock

This chapter is used to help learning basic operation of Ezblock, from choosing products to flashing the project to your control board.

Home Page

When enter the Ezblock Studio, we can see the main page as shown below. The Main page consists of three parts:



1. Currently Selected
2. Products.
3. Navigation Bar

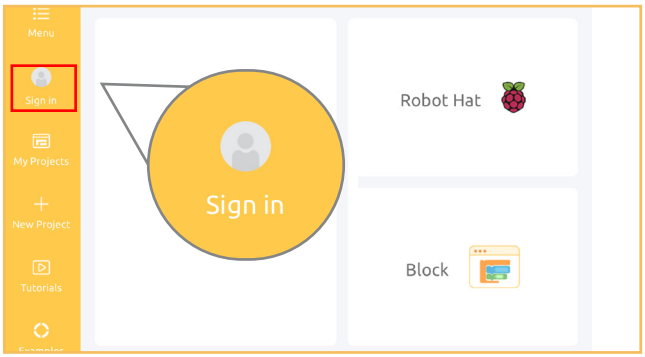
Currently Selected shows our currently selected products, control board and programming environment.

Click **Products** button, we can turn to the products selecting page.

Navigation bar is composed of some sub menus designed for leading in different pages of the App.

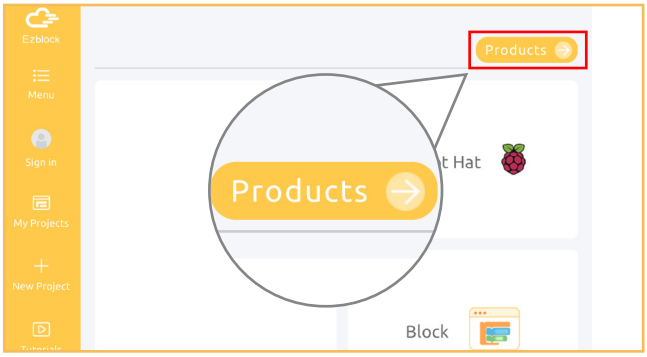
- **Menu**: Some information of the App, such as language setting and FAQ.
- **Sign in**: Sign in your account.
- **My Project**: Turn to My Project page.
- **New Project**: Create a new project.
- **Tutorials**: Teach projects step by step.
- **Examples**: Project examples.

NOTE: Please refer to appendix 1 for more details about other pages.



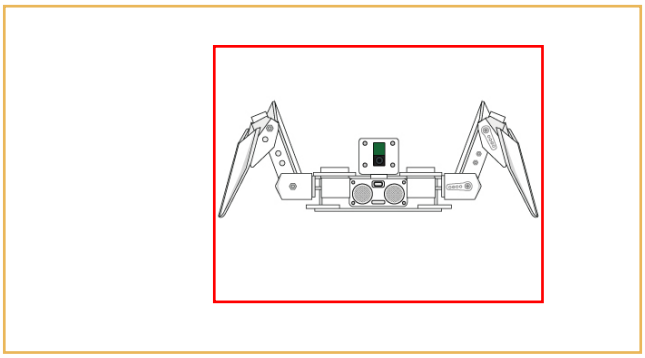
Sign in or Sign up

We suggest you create a new account at the first time you use it so as to save your projects in the cloud.



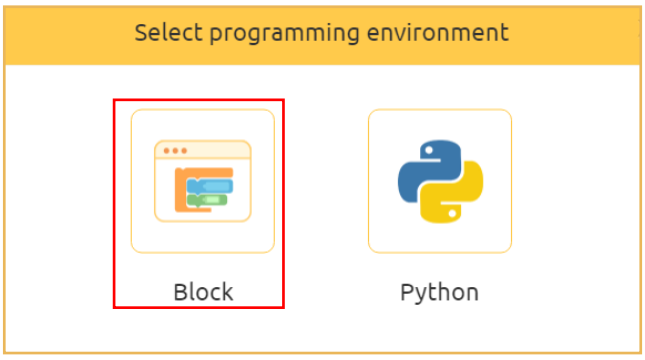
Go to Product Page

Go to the home page of Ezblock Studio and click the word, Product in the top right corner to enter the product selection page.



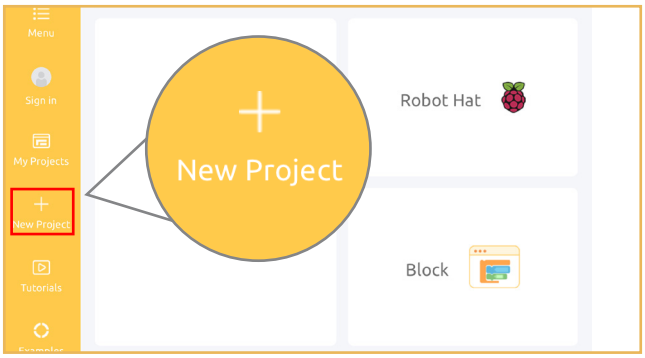
Choose Product

Choose the product, **PiCrawler** under the Robots category.



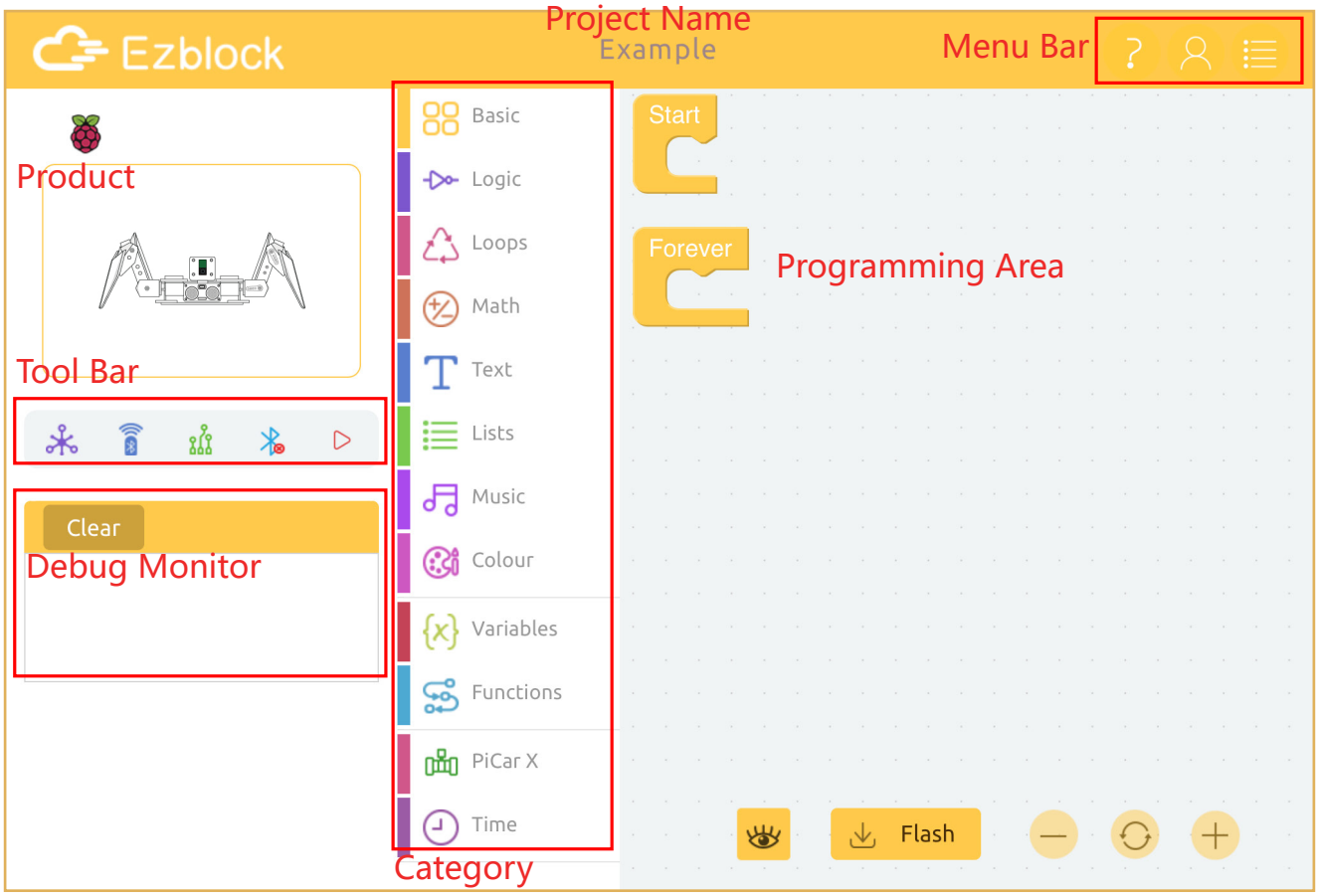
Select Environment

Select the programming environment, Block.



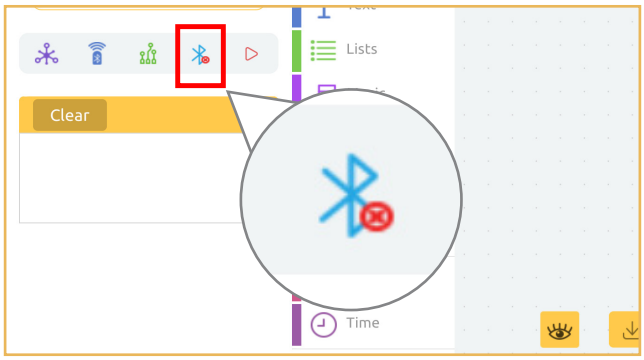
Create a New Project

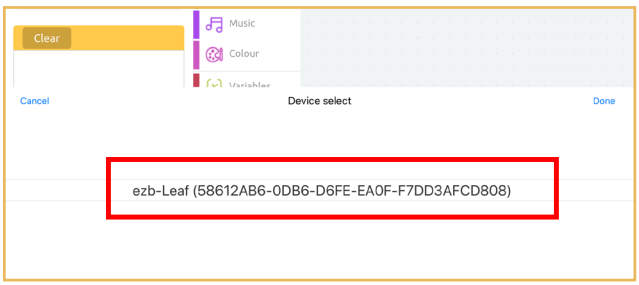
Click the button, New Project on the left side of main page to create a new project.



Programming Page

We can program by dragging the blocks from Category to Programming Area. Click the icons on Tool Bar and Menu Bar to perform some functions. Please refer to the appendix for more details.

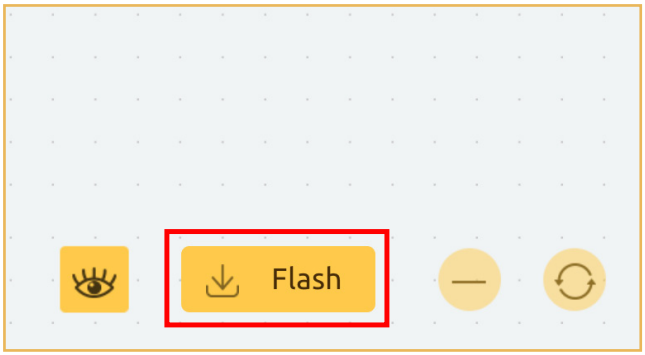




Connect Bluetooth

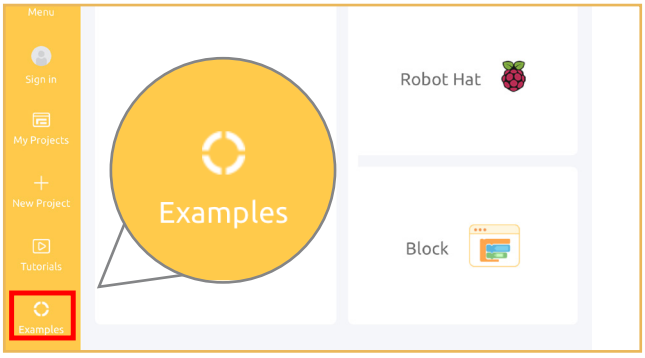
Click the Bluetooth connection button, then in device selection prompt, choose your device and click Done, and wait "Connected" to appear.

In case of cross connection between several RPi boards, Robot HAT decrease its Bluetooth signal strength while being connected. You need to put it as close as possible to your device. As long as they are connected, the signal strength will return to normal.



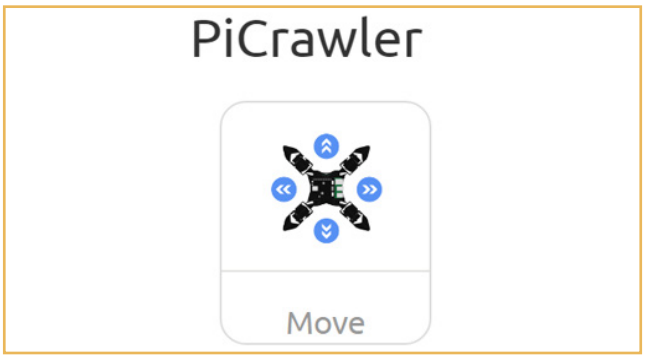
Flash Your Code

After the connection is done, click the Flash button to compile and download the code to the Raspberry Pi.



Enter Example Page

In addition to creating new projects, you can also directly open ready-made programs in Example.



Open an Example Project

Here we open Example-Move. This is the first code that we will use later.

Elmentary Project

Here we show you the basic operation of playing PiCrawler with Ezblock. If you are new to these, you can try to write the corresponding function according to TIPS, or directly use the reference code in Example. We suggest you do it yourself and experience the fun of challenge.

Move

First we need to know how to make PiCrawler move. Here, we let it perform the six actions of "forward", "backward", "turn left", "turn right", "sit", and "stand" in order.

TIPS

The Start block is called when a program starts. Use it to initialize variables, module setting, etc. It will only run once, after each flash or reset of the program.

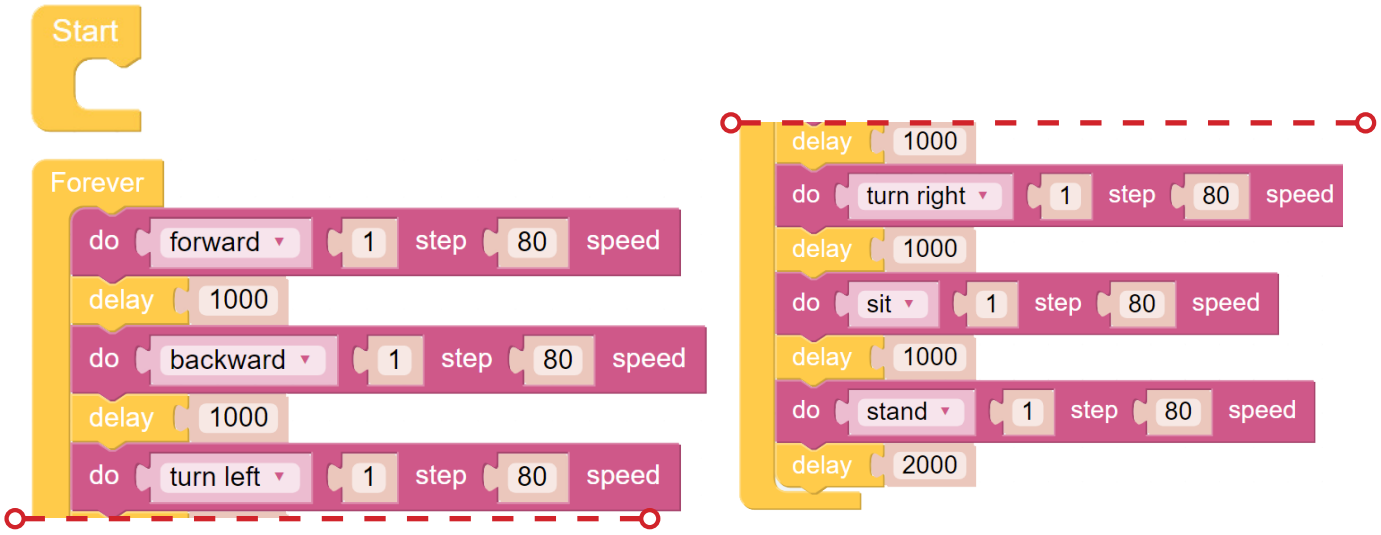
After creating a Start block, the Forever block does precisely what its name suggests, and loops consecutively, allowing your program to change and respond. Use it to actively control the Picrawler.

Pauses the program for the amount of time (in milliseconds) specified as parameter. (There are 1000 ms in a second.)

This block makes PiCrawler act in a certain step and speed. The speed ranges 0~100.

Tap ▼ next to **forward**. In addition to "forward", "backward", "turn left", "turn right", "sit" and "stand", the actions "look up" and "dance" are also included.

EXAMPLE

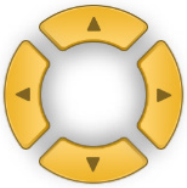


Remote Control 1

Next we control the PiCrawler with a tablet. You will need to use the D-Pad at the Bluetooth control page. In addition, you also need to use if judgment statement to respond to D-Pad.

TIPS

To use the remote control function, you need to enter the Bluetooth control page .



Drag a D-pad to the central area, then a Remote category appears. There are 4 buttons that control the going forward, back, left and right.

Once you press a button, you get a value 1. Release the button, and you'll get a value 0.

To enable the remote control, please add this block from the Remote category to the **Forever** block.

This block reads the D-Pad value in the Bluetooth control page. You can tap ▼ next to UP to switch options.

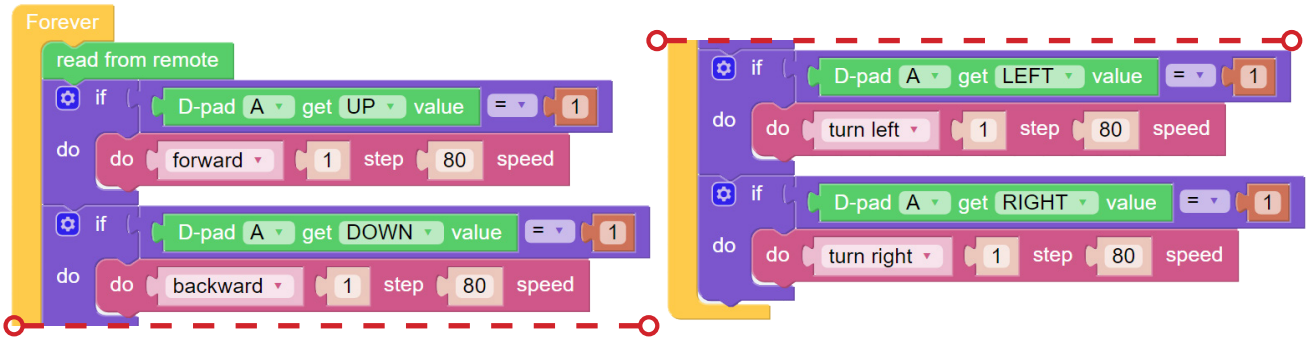
To achieve conditional judgment of "if" type, you need to use an if do block.

You need to use a conditional statements block in conjunction with if do. Judging conditions can be "=", ">", "<", "≥", "≤", "≠".

A number block can be used in comparison in the conditional judgment block.

EXAMPLE

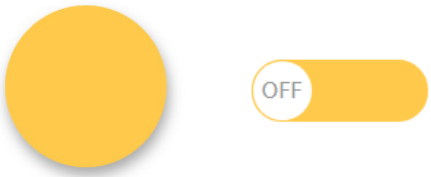
NOTE: After you upload, click the icon again, then click the icon in the upper right corner to start the remote control.



Remote Control 2

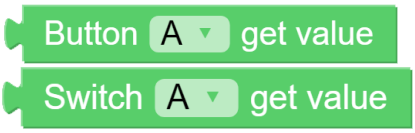
Next, enable PiCrawler via Button & Switch to get more actions: crouch, stand up, dance and so on.

TIPS



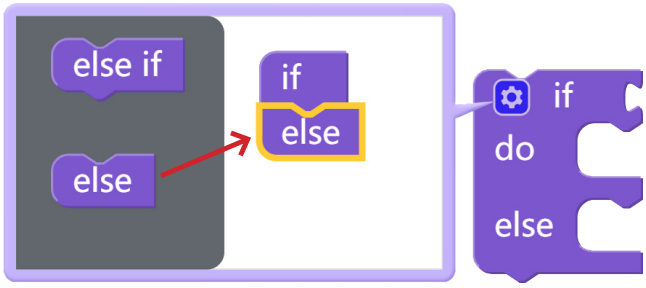
Here we drag a Button from the page to enable PiCrawler to dance. Use Switch to switch to sit or stand up.

If press the Button, you'll get a 1; release it, you'll get a 0. Toggle the Switch to ON, and you'll get 1; to OFF, and you'll get 0.



We use Button in the same way as that of Switch and use the same block "get value" to get the current value of them.

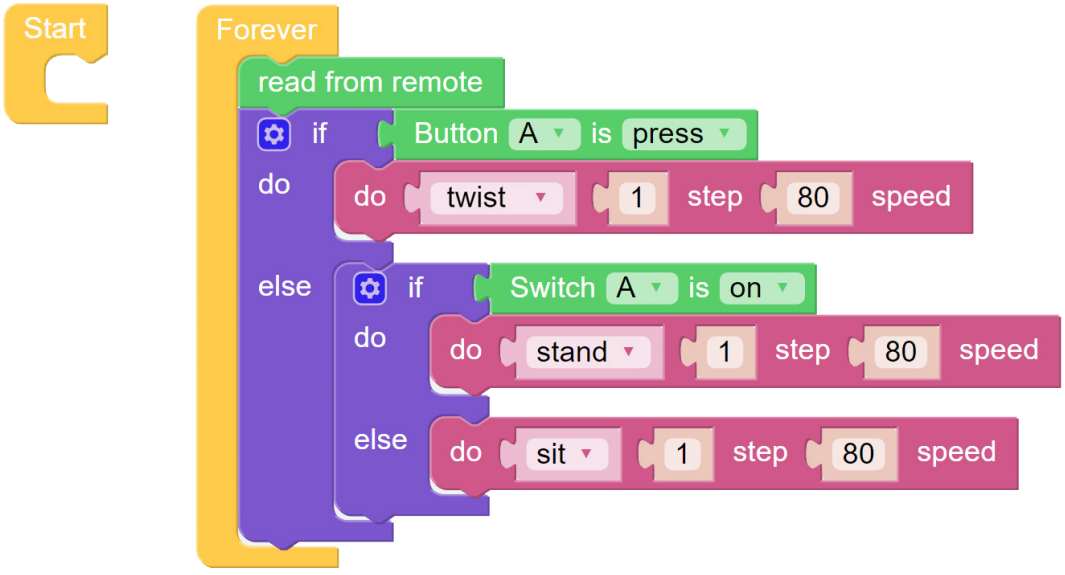
Both Button and Switch have easier conditional judgment blocks to be placed in **if** block.



When you need to implement multiple conditional judgments, you will have to change if do into if else do or else if do.

This can be achieved by clicking on the icon.

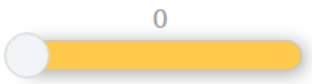
EXAMPLE



Remote Control 3

Combine the key points of the previous two lessons and use a slider to control the speed of all actions.

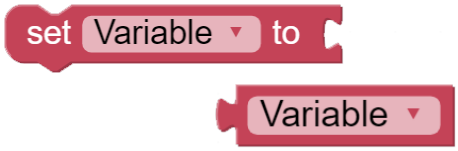
TIPS



Here we drag a Slider from the page to adjust speed.

The value range of slider is 0 ~ 100.

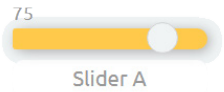
This block reads the Slider value in the Bluetooth control page.



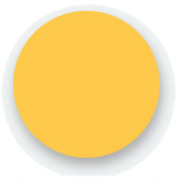
You may want to simplify your program with Variable. For example, when you have multiple functions that need to read the obstacle distance, you don't need to read the value for each function, but load the value into a variable and use it multiple times.

Click the **Create variable** button on the Variables category to create a variable named **speed**.

EXAMPLE



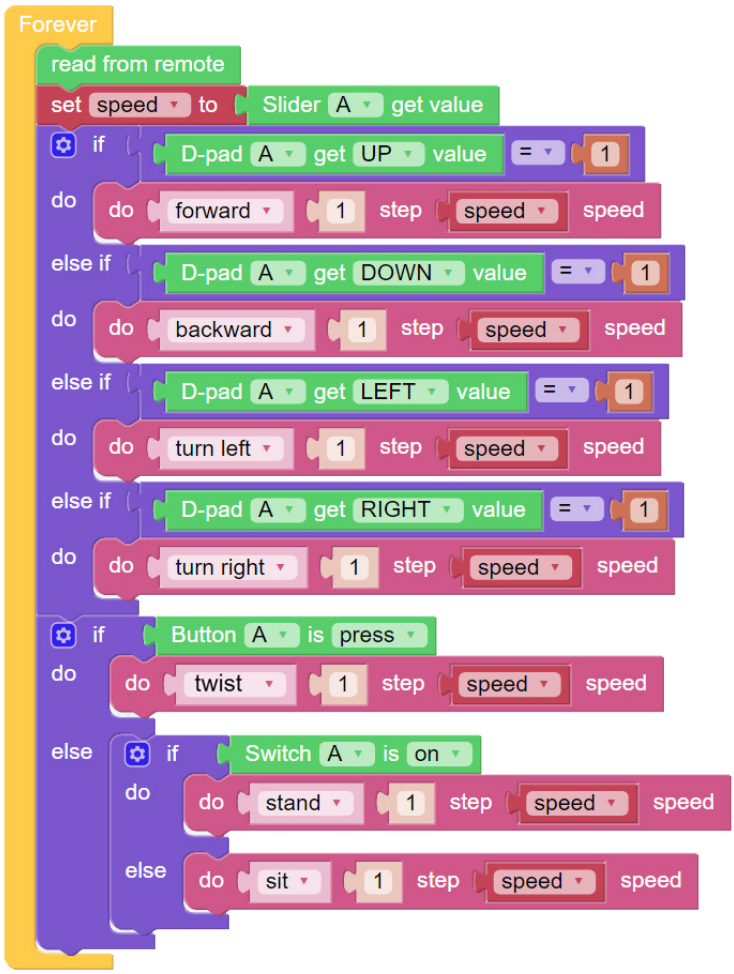
Slider A



Button A

D-pad A

Switch A



Ultrasonic Sensor Test

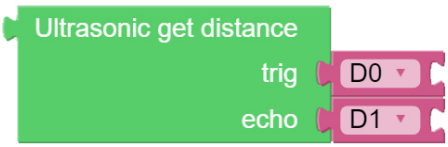
PiCrawler has Ultrasonic Sensor that can be used for experiments such as obstacle avoidance and automatic follow. Here we will try to use Ultrasonic to read the distance (unit: cm).

TIPS

To use the ultrasonic or grayscale module, you need to enter the simulation page from the left side of main page.

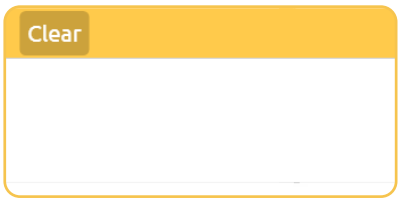
Drag the ultrasonic module to the blank area. There will appear 4 colored dots under the module.

Connect the colored dots on this interface according to the physical wiring. Here we connect Trig to D0 and Echo to D1.



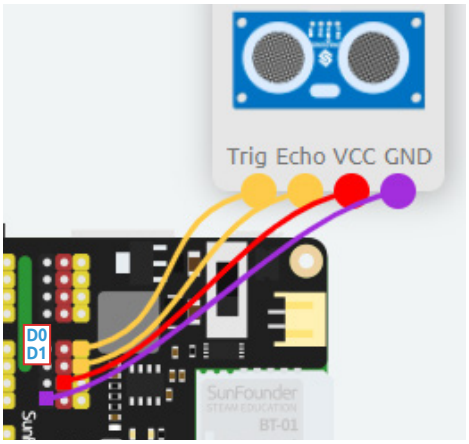
The Modules category will appear and the Ultrasonic block in it after your connection on the simulation page. You can directly use this block to read the distance to the obstacle right ahead.

The Print function can print data such as variables and text for easy debugging.

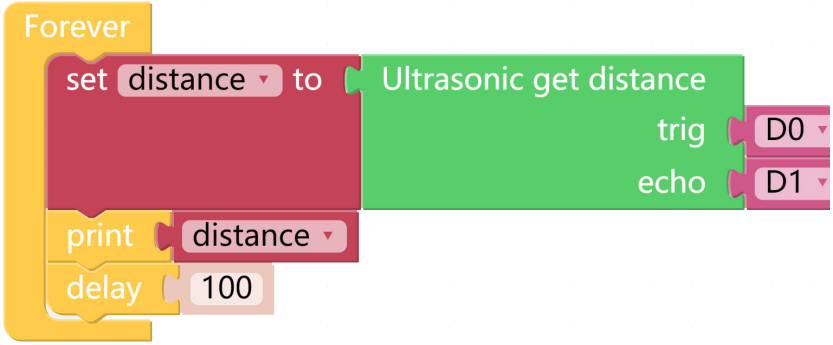


The data printed by the Print function will appear in the Debug Monitor on the left. In other interfaces, you can also click on the Debug Monitor in the upper right corner.

WIRING



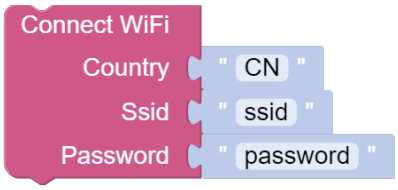
EXAMPLE



Color Detection

PiCrawler is a Robot with Camera. Ezblock also provides some object detection functions. Here we try color detection. Prior to this, you must ensure that the Pi Camera FFC cable is properly and securely connected.

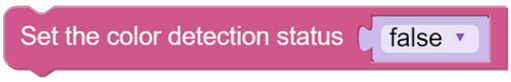
TIPS



To use the Camera function, you need first to connect the Raspberry Pi to the Wi-Fi environment where the tablet is located. Put this block in Start, type in Wi-Fi account and password.

Here we drag a Video from the page, and it will generate a video monitor.

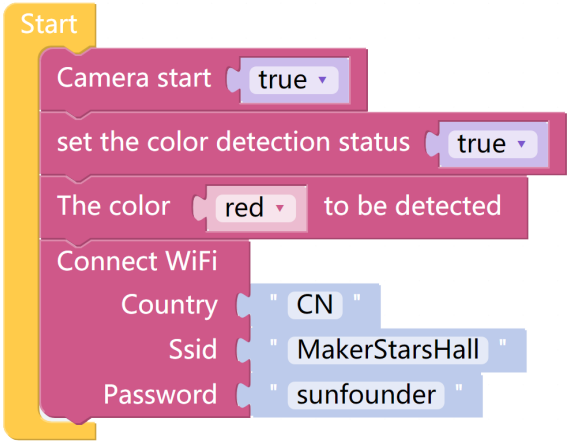
You need to open the image in Video by setting Camera start to true. Setting it to false will close the image (but not object detection).



You need to set Color detection status to true to enable the color detection.

You can use this block to switch the color detected by the color detection. Only one color can be detected at a time.

EXAMPLE



After the code is uploaded, Wi-Fi configuration requires you to click the upper left button of Ezblock to update the device information to take effect.

Then clicking the icon again, you click the icon in the upper right corner, and you can see the captured image and the detected color position.

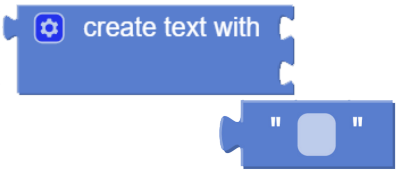
Face Detection

In addition to color detection, PiCrawler also provides face detection. Here we have the faces number be displayed in the debug monitor.

TIPS

You need to set face detection status to true to enable face detection.

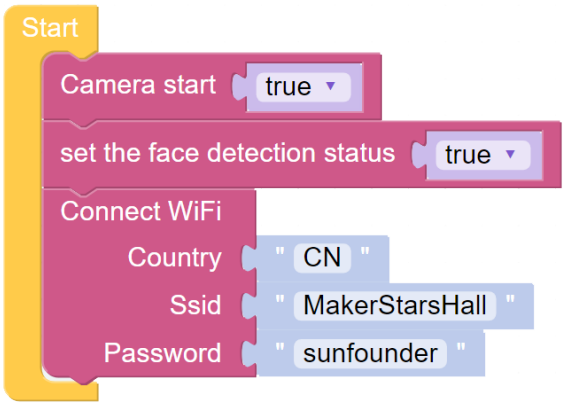
You can read the image detection results through this block, modify the drop-down menu options, and choose to read the coordinates, size or number of the image detection results.



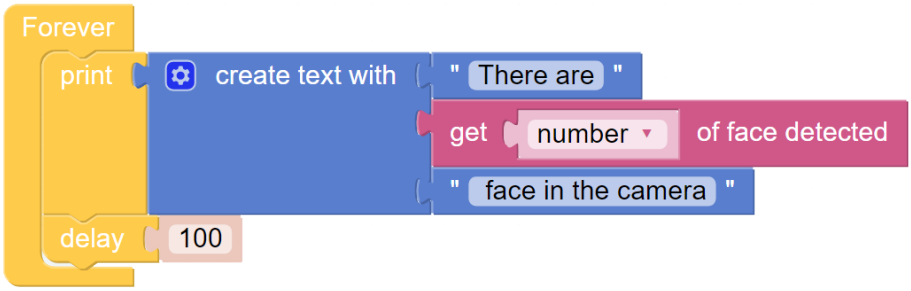
you may want to use text block to print the combination of texts & data at once.

EXAMPLE

After the code is uploaded, Wi-Fi configuration requires you to click the upper left button of Ezblock to update the device information to take effect.



Then clicking the icon again, you click the icon in the upper right corner, and you can see the captured image and the detected color position.

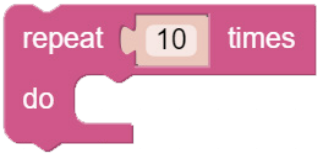


Sound Effect

PiCrawler can make voice. You can enter text to make it speak, or make specific sound effects. Let us fire a gun as soon as a 3s countdown stops.

TIPS

Write the sentence in this block, and PiCrawler will say it. It can be used with Text.

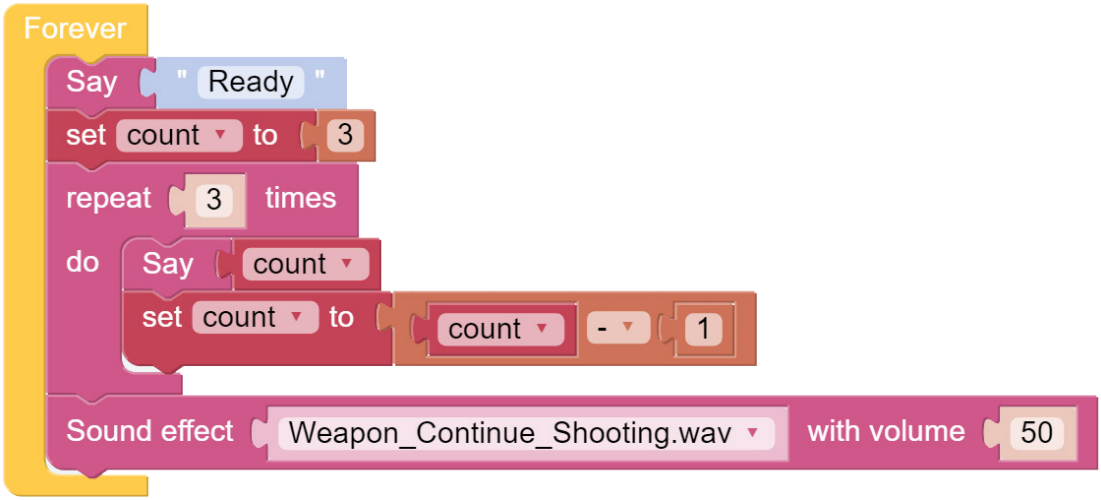


You may want to use repeat which can help you repeatedly execute the same statement and reduce code size.

Mathematical operation block can perform " + , - , x , ÷ ".

This block can emit some preset sound effects, such as siren sound, gun sound and so on. The range of volume is 1~100.

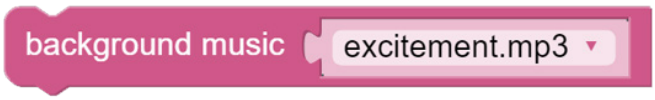
EXAMPLE



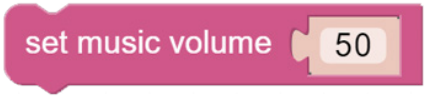
Background Music

In addition to having PiCrawler play sound effects or speak on specific occasions, you can also add background music to it. Use a Slider here to control the adjust music volume.

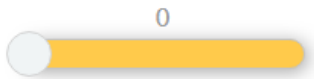
TIPS



You can choose different background music in the block drop-down menu to let PiCrawler play.



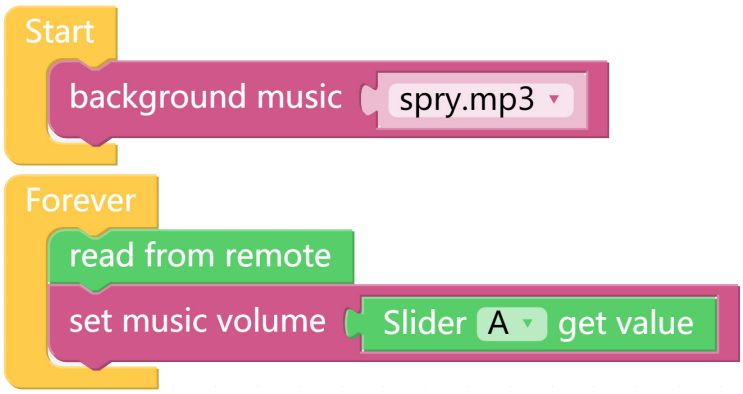
Adjust the volume in the range of “0” ~ “100”.



Here we drag a Slider from the page to adjust music volume.

This block reads the Slider value in the Bluetooth control page.

EXAMPLE



NOTE: After you upload, click the icon again, then click the icon in the upper right corner to start the remote control.

Calibration

When you need to provide higher precision for the action of PiCrawler, please use this calibration block which needs to be used together with the back cover of the manual.

TIPS

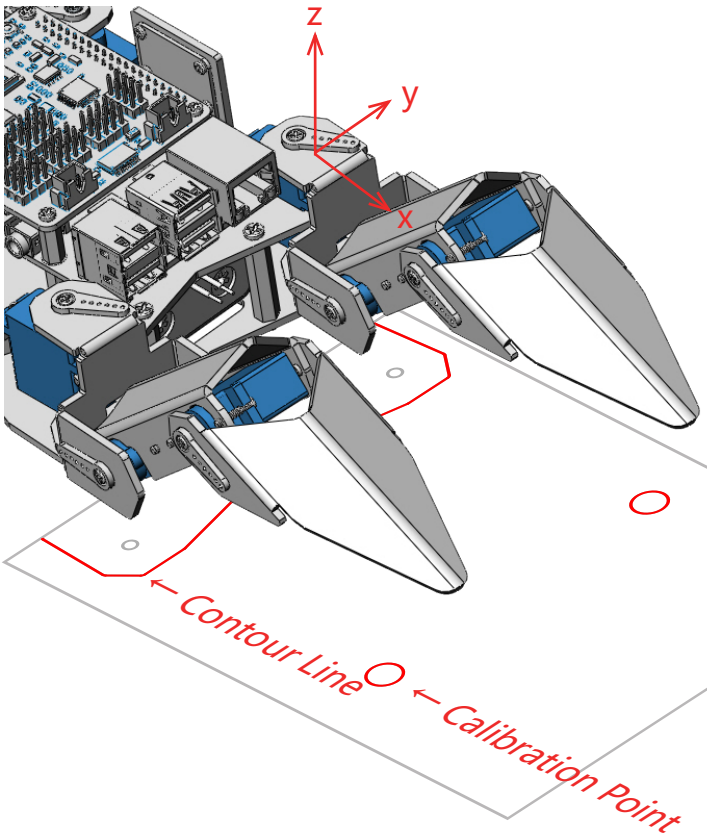
This block writes the compensation values of each pin of PiCrawler into the config file to automatically correct the coordinate deviation at each startup. The parameters of this block are as follows:

leg: To start the calibration, select these legs: right front, left front, left rear, right rear by writting 1, 2, 3, 4.

up, down, left, right, high, low: The toe moves along the axes x, y, z when 1 is received by these slots.

During calibration, please lift the toe first to avoid stroking on the back cover.

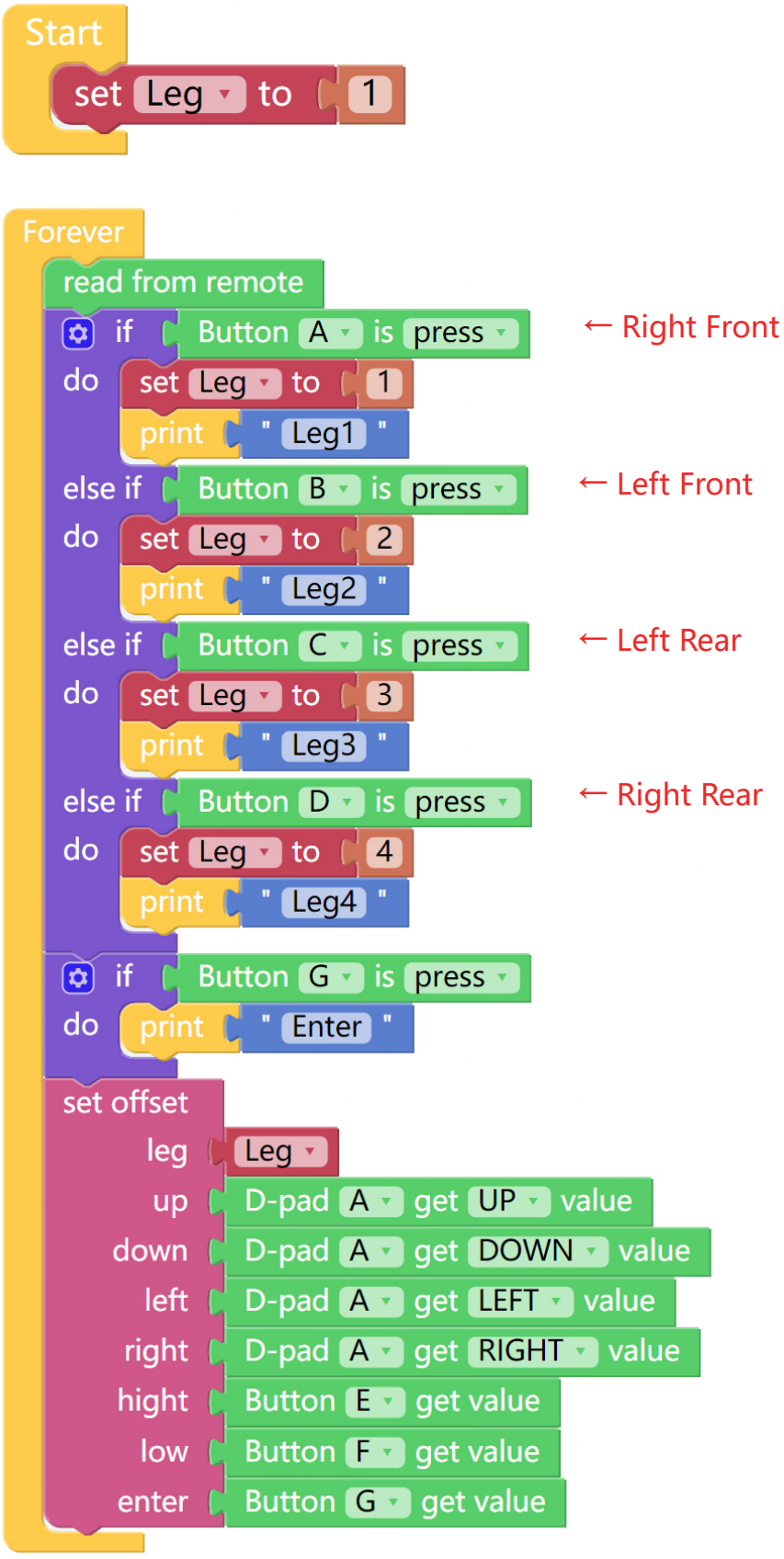
enter: Write the current compensation value to the config file when 1 is received. Please switch the leg after writing the compensation value to avoid writing errors .

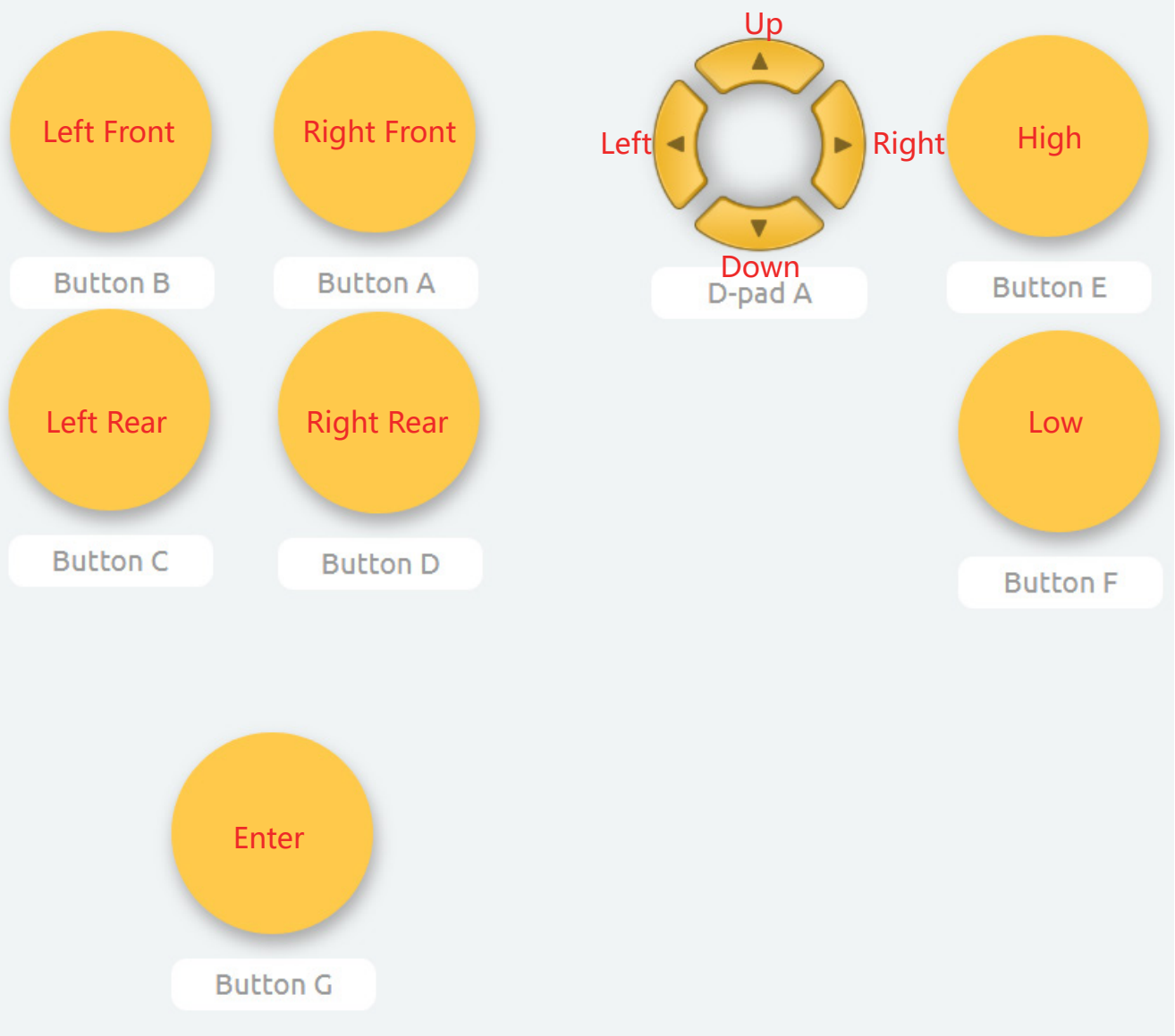


The calibration picture on the back cover can be used as follows:

1. Let the camera face forward.
2. Place the back cover under one side of PiCrawler.
3. Make the contour line coincide with that of PiCrawler base plate.
4. Connect the Raspberry Pi and burn calibration example.
5. Use D-pad and button on the Bluetooth control page to let the two toes of this side step onto the calibration points, and tap enter.
6. Rotate the back cover and calibrate the other two legs in the same way.
7. After confirming, restart PiCrawler.

EXAMPLE


Start
set Leg to 1
Forever
read from remote
if Button A is press
do set Leg to 1
print " Leg1 "
else if Button B is press
do set Leg to 2
print " Leg2 "
else if Button C is press
do set Leg to 3
print " Leg3 "
else if Button D is press
do set Leg to 4
print " Leg4 "
if Button G is press
do print " Enter "
set offset
leg Leg
up D-pad A get UP value
down D-pad A get DOWN value
left D-pad A get LEFT value
right D-pad A get RIGHT value
hight Button E get value
low Button F get value
enter Button G get value
← Right Front
← Left Front
← Left Rear
← Right Rear


Left Front
Right Front
Up
Left
Right
High
Down
Button B
Button A
D-pad A
Button E
Left Rear
Right Rear
Low
Button C
Button D
Button F
Enter
Button G

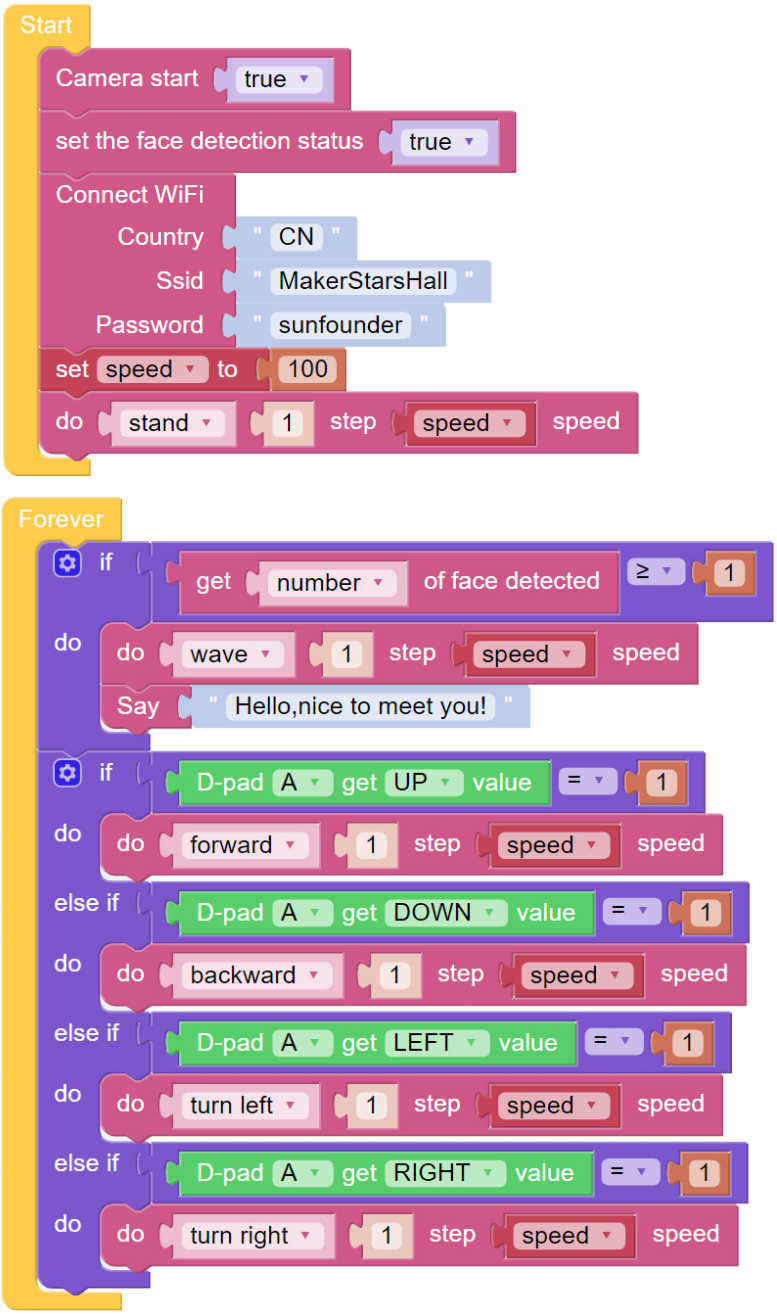
Advanced Project

The next four are extended experiments that allow you to integrate the functions described in Basic. The code is a bit long. You can click Example in Ezblock to view these codes directly.

Say Hello

Let's try to implement a simple project with PiCrawler: remotely control PiCrawler's movement, and it will always look ahead. When it sees people, it will wave and say "Hello".

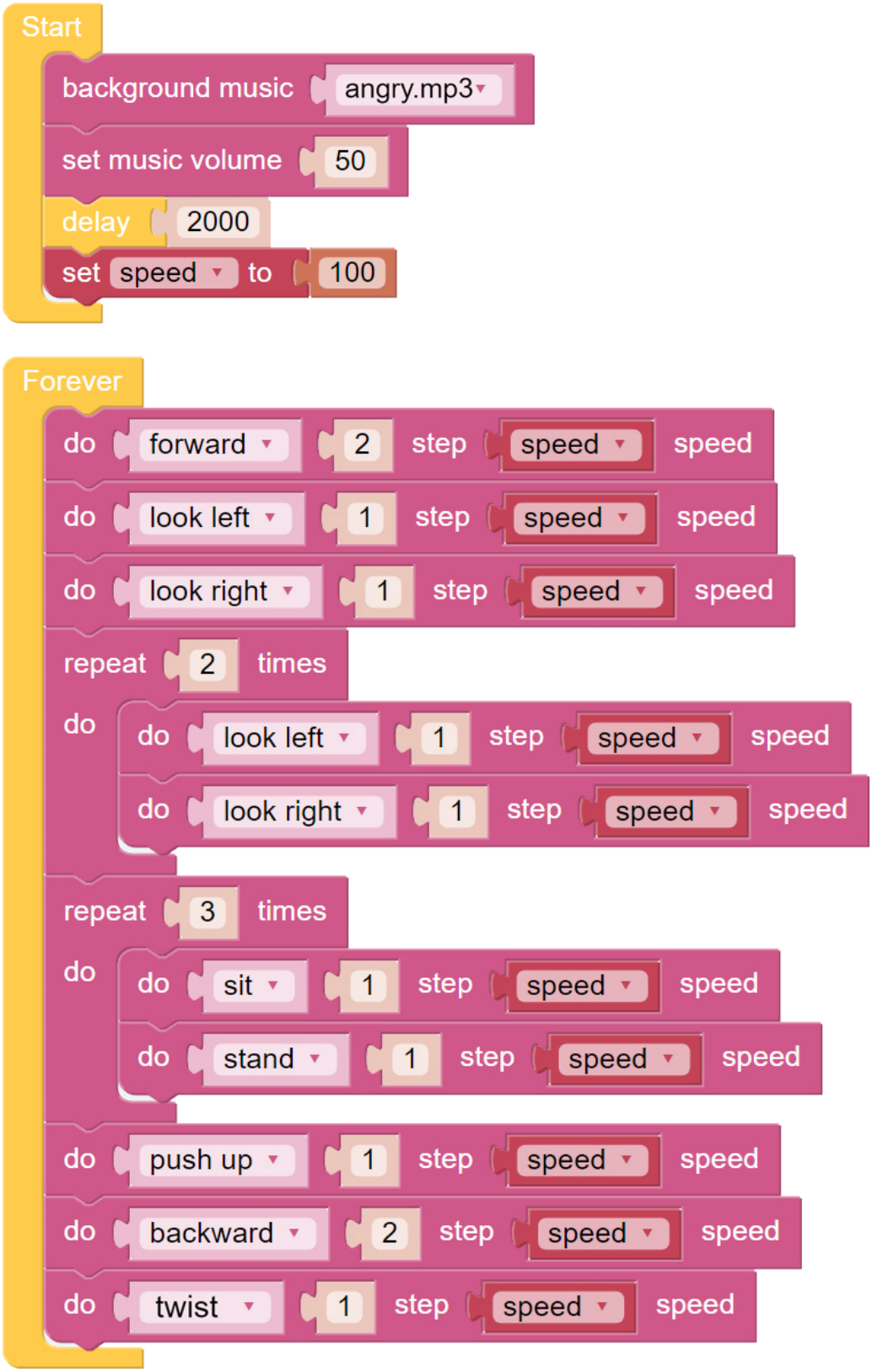
EXAMPLE



Dance

PiCrawler has been set a series of actions we can combine to compose music for the PiCrawler to dance.

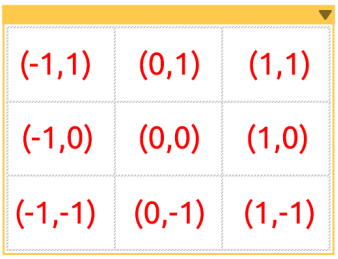
EXAMPLE

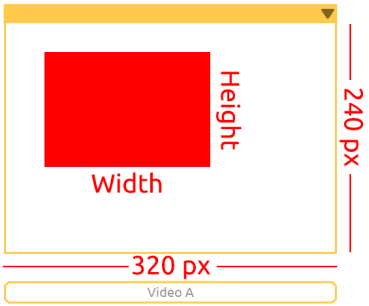


Bullfight

Turn PiCrawler into an angry bull! Prepare a red cloth. When PiCrawler chases after the red cloth, be careful not to be hit by it. You need to use the color detection function to make the camera always face the red cloth.

TIPS





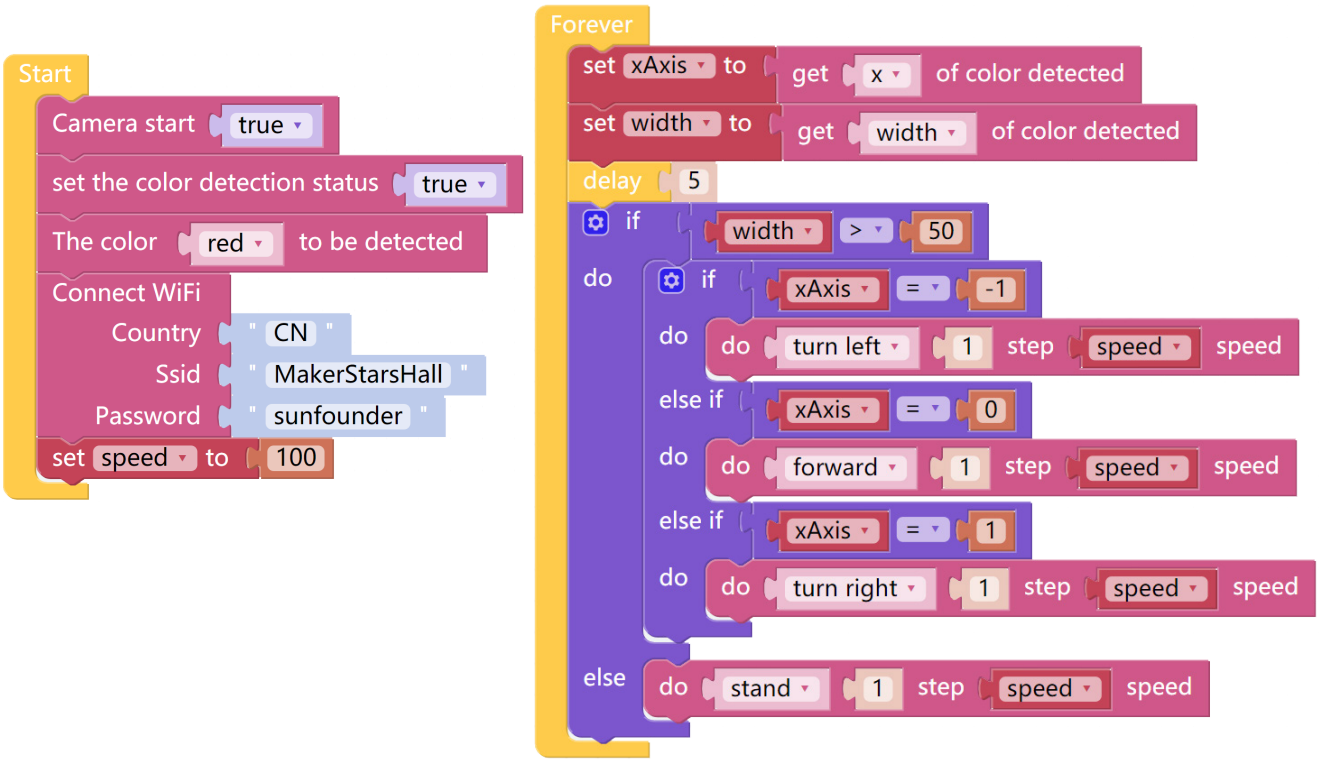
Here we need to use "object detection" which is used to detect the quantity in "Face Detection". Now we know more about its usage.

The "object detection" can output the detected coordinate value (x, y) based on the center point of the graphic. The screen is divided into a 3x3 grid, as shown on the left.

The “object detection” can detect the size (Width & Height) of the graphic.

In the above two usages, if multiple targets are identified, the largest target will be the sole result.

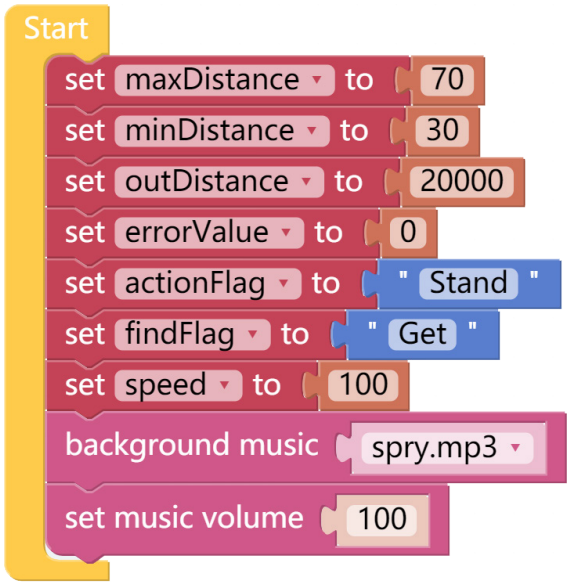
EXAMPLE

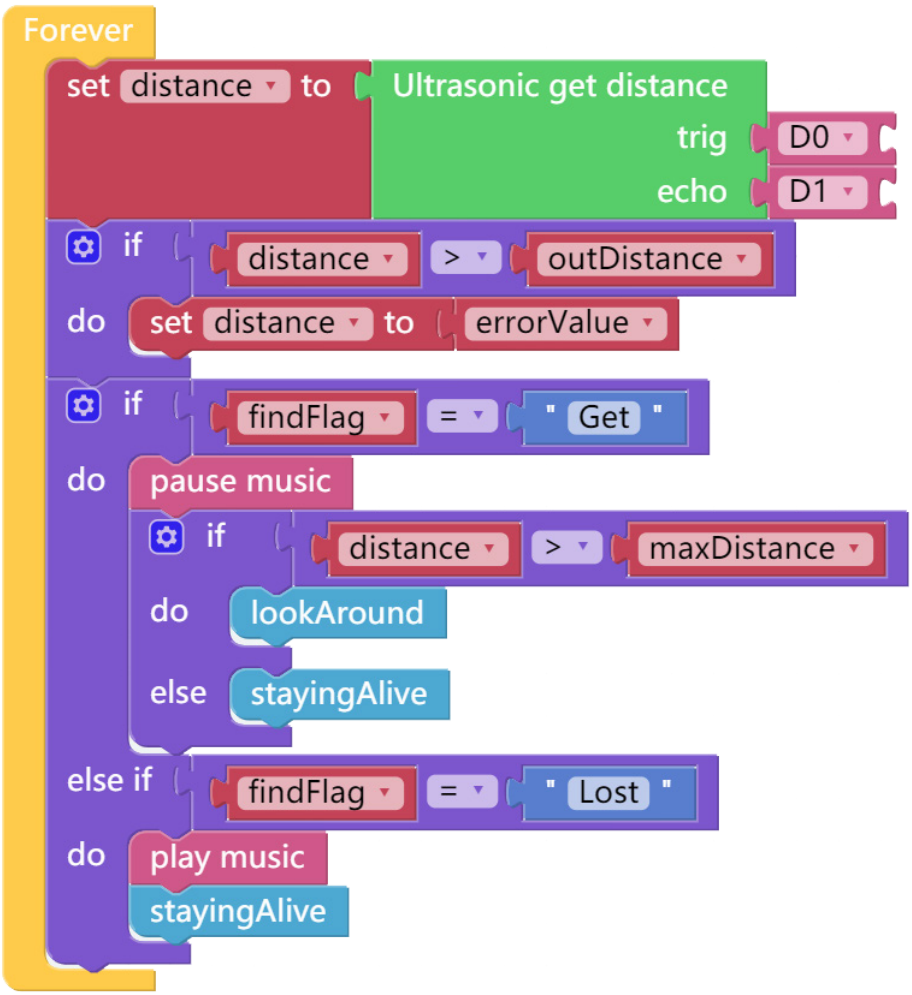


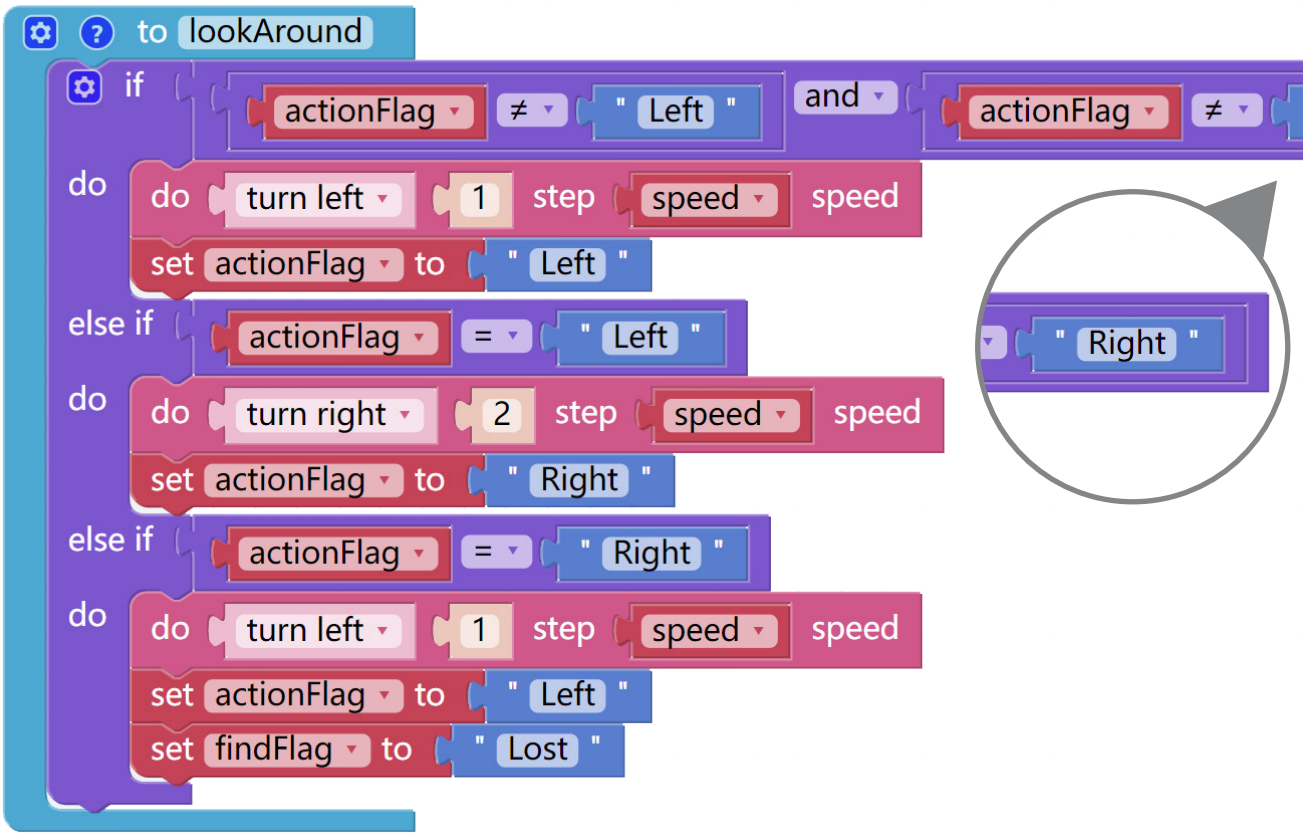
Pet

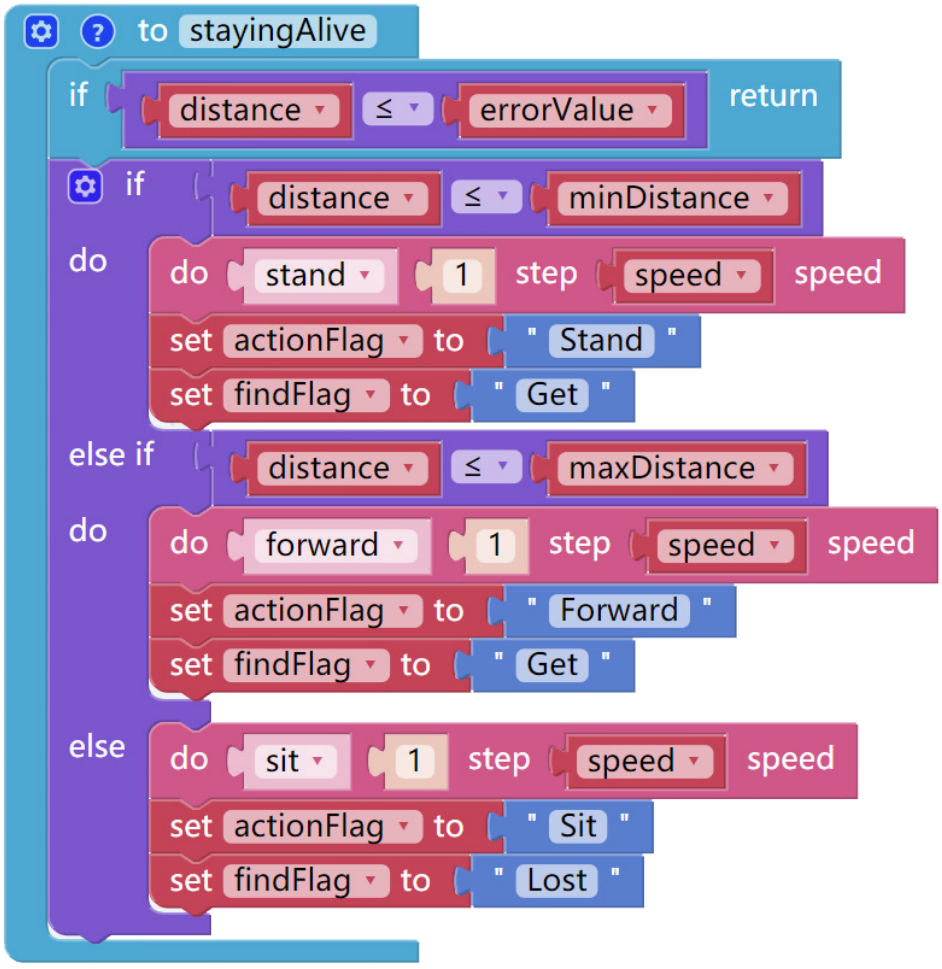
Let's assign PiCrawler some pet behavior! As a little rascal, it will follow you behind; if gets lost, it will look around, then sit down to sing until you show up; after that, it will follow you with glee.

EXAMPLE






to lookAround
if
actionFlag ≠ " Left " and actionFlag ≠
do
do turn left 1 step speed speed
set actionFlag to " Left "
else if
actionFlag = " Left "
do
do turn right 2 step speed speed
set actionFlag to " Right "
else if
actionFlag = " Right "
do
do turn left 1 step speed speed
set actionFlag to " Left "
set findFlag to " Lost "
" Right "


to stayingAlive
if distance ≤ errorValue return
if distance ≤ minDistance
do
do stand 1 step speed speed
set actionFlag to " Stand "
set findFlag to " Get "
else if
distance ≤ maxDistance
do
do forward 1 step speed speed
set actionFlag to " Forward "
set findFlag to " Get "
else
do sit 1 step speed speed
set actionFlag to " Sit "
set findFlag to " Lost "

Appendix: Page Introduction

Tool Bar

Some basic functions available for the product are displayed on Tool Bar.

NOTE: Compared with other products, Raspberry Pi reflects its uniqueness by the application of IoT.

1. **IoT Control:** Click this icon to go to the IoT Control page in which you can execute operation of sensor monitoring and apply IoT. Refer to the introduction of IoT Control page for more details.

2. **Remote Control:** When this icon is pressed, you can enter the Remote Control page so as to add virtual controls to the project to control the device remotely. Refer to the introduction of IoT Control page for more details.

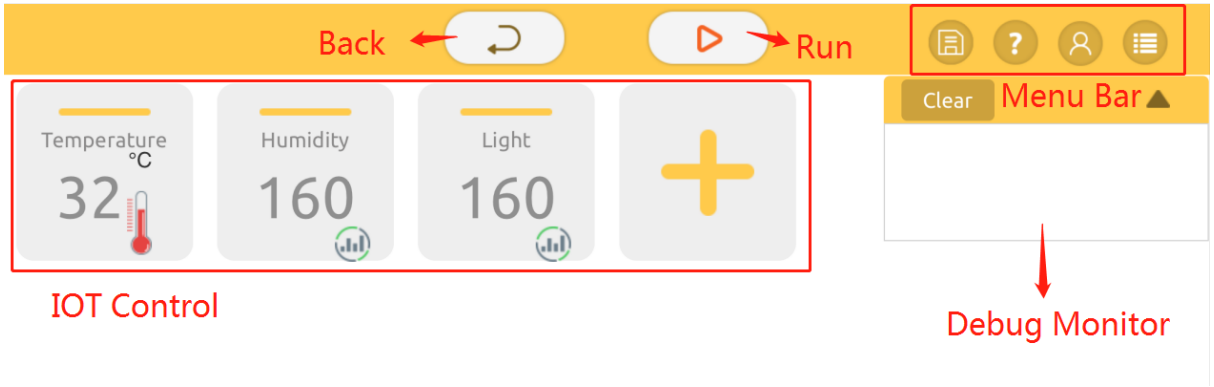
3. **Simulation Page:** Click this icon, you can access the Simulation Page and program by adding some simulation blocks. From the kit of Sloth, you may use the ultrasonic sensor module.

4. **Bluetooth Connection:** This operation ought to be executed before flashing code.

5. **Run:** This icon is to bring you to the page of simulation and then you can check the simulation effect.

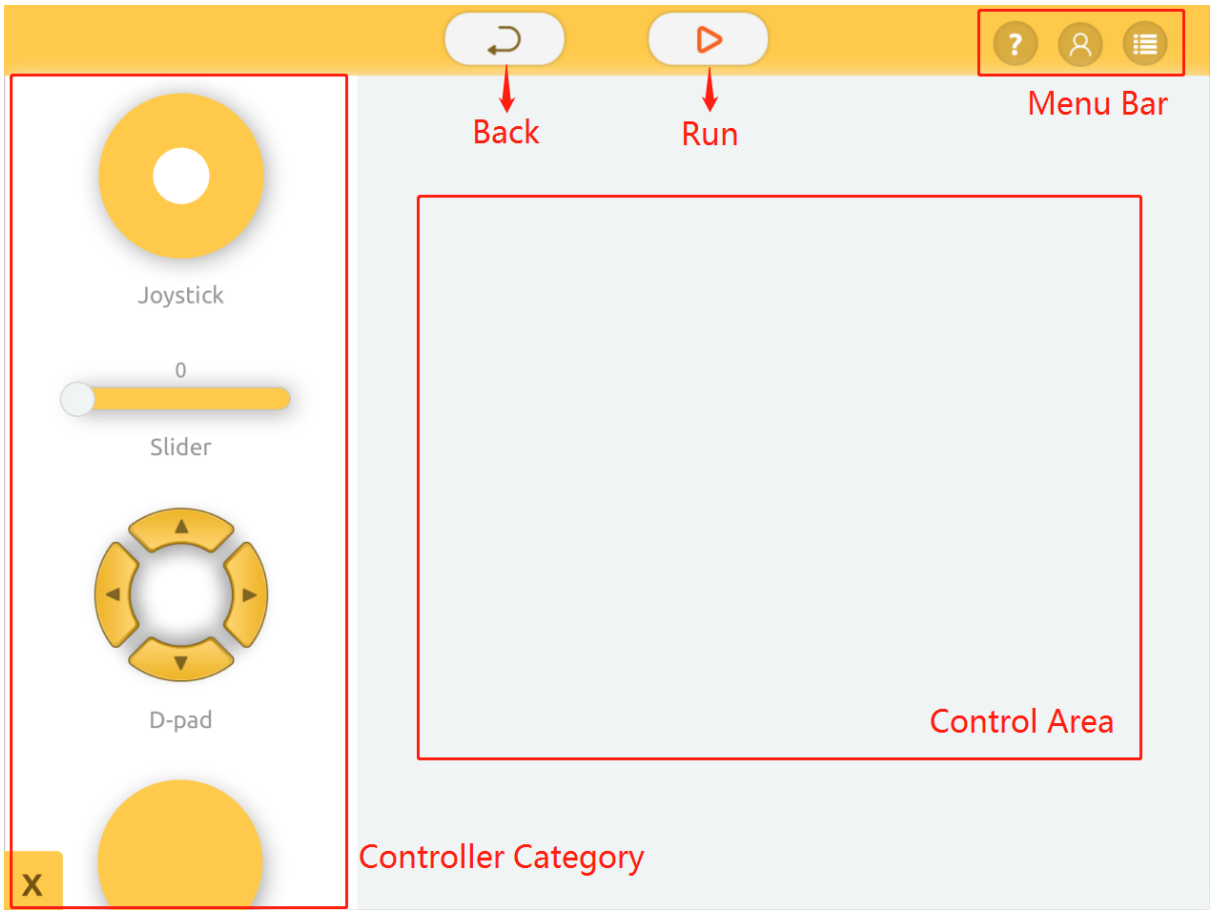
IoT Control Page

IoT Control page contains Sensors/Actuators, Add button, Debug Monitor and Menu Bar. To add Sensors and Actuators, we should click on the Add button. In addition, when we press the Run button on the top of the page, we can control relevant components and notice the data of sensor are changing.



Remote Control Page

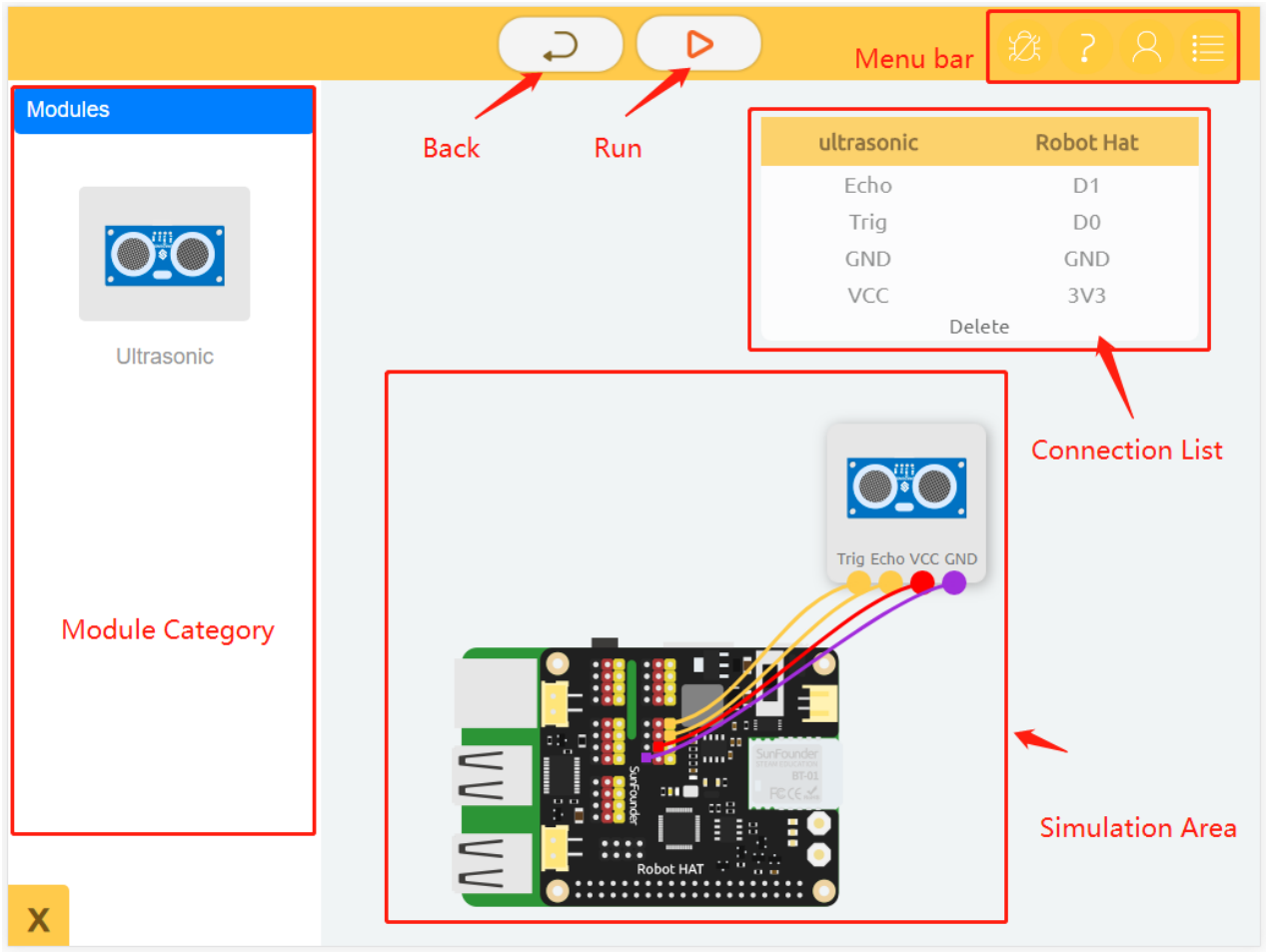
In some projects, we control the components by the remote controller on the Ez-block Studio. Create some virtual control components to the right area in order to add something to the project.



Simulation Page

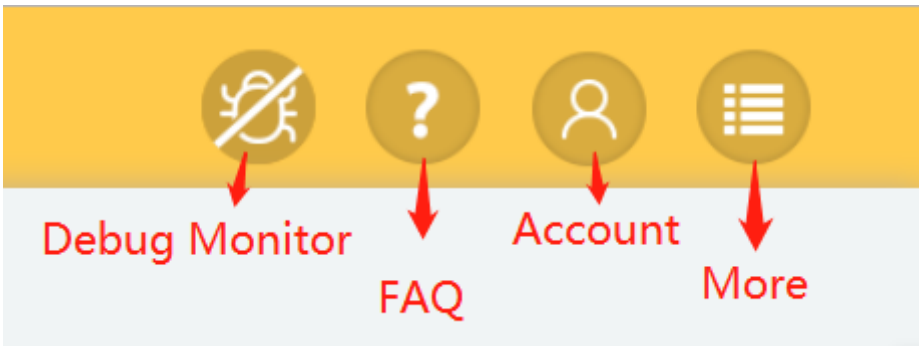
In some projects, we need some external equipment to get some certain effects, such as applying ultrasonic sensor module to detect the distance.

Now what we need to do is dragging some modules from Module Category and then wire them up according to the prompt.



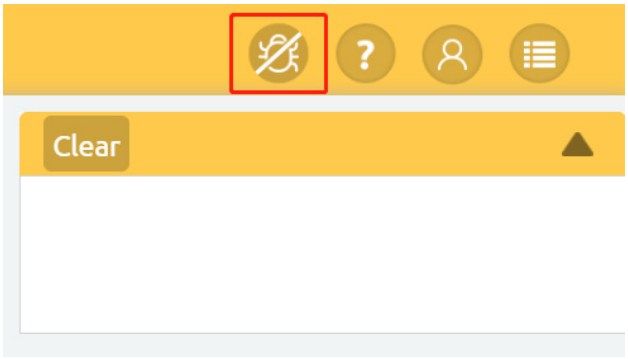
Menu Bar

On many pages, you can see the similar Bar as shown, with which you can log into your account conveniently.



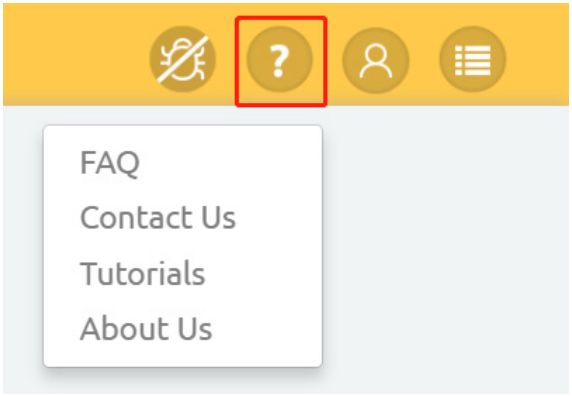
Debug Monitor

You can open or close the window of Debug Monitor by clicking this button marked.



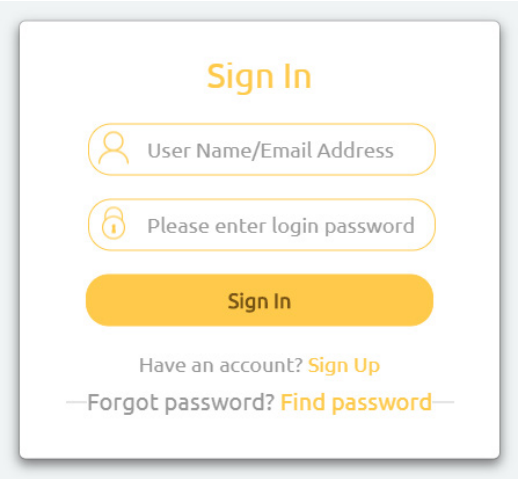
FAQ

You can find FAQ, Contact Us, Tutorials, and About Us after clicking the question mark.



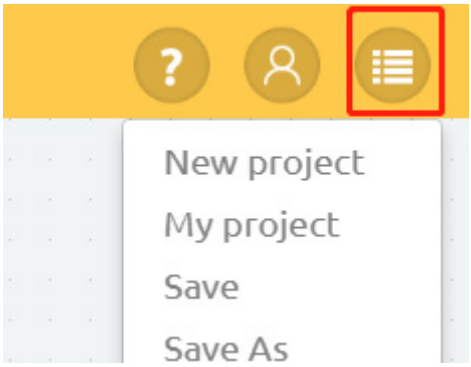
Account

By clicking the Account icon as marked in the previous picture, you can go to the following page on which you can log into or log out your account.

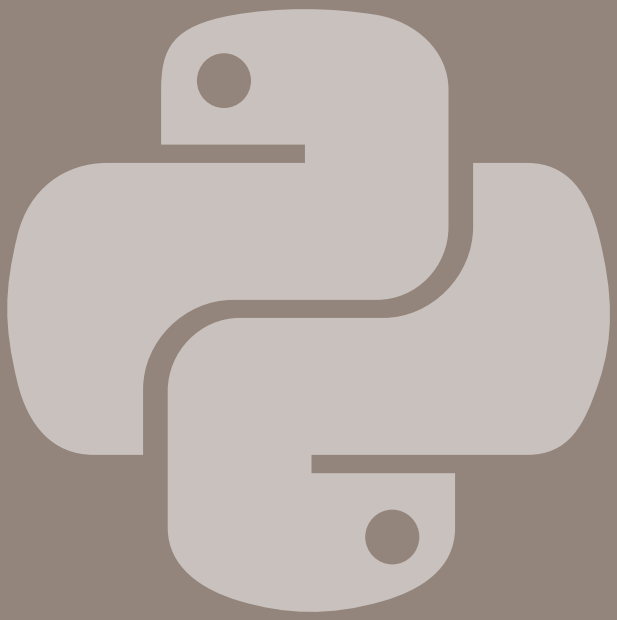


More

To execute more operation, press the button as shown so as to get the list in which you can see these options, including New project, Save and so on.



To Play in Python



Quick Guide on Python

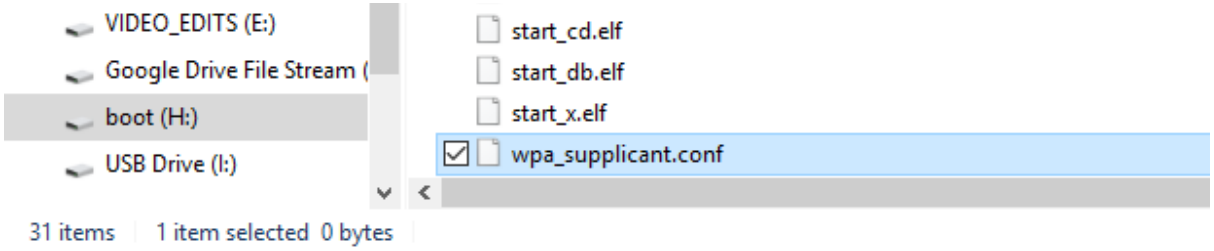
This chapter is used to set up Raspberry Pi, from configure the Raspberry Pi environment to download the sample python code of PiCrawler.

NOTE: First, you must burn the Ezblock system. If you use the Raspian system, the sample python we provide for PiCrawler will not be available.

Connect the Raspberry Pi to the Internet.

You need to modify a Wi-Fi configuration file wpa_supplicant.conf in the Micro SD card by your PC that is located in the directory /etc/wpa_supplicant/.

If your personal computer is working on a linux system, you can access the directory directly to modify the configuration file; however, if your PC use Windows system, then you can't access the directory and what you need next is to go to the directory, /boot/ to create a new file with the same name, wpa_supplicant.conf.



Input the following content in the file:

```
ctrl_interface=DIR=/var/run/wpa_supplicant GROUP=netdev
update_config=1
country=GB
network={
ssid="Wi-Fi-A"
psk="Sunfounder"
key_mgmt=WPA-PSK
priority=1
}
```

You need to replace "Wi-Fi-A" with your custom name of Wi-Fi and "Sunfounder" with your password.

By doing these, the Raspbian system will move this file to the target directory automatically to overwrite the original Wi-Fi configuration file when it runs next time.

Now, the Raspbian system is configured. When the Micro SD card is inserted into the Raspberry Pi, you can use it immediately.

Get the IP Address

After the Raspberry Pi is connected to Wi-Fi, we need to get the IP address of it. There are many ways to know the IP address, and two of them are listed as follows.

★ Checking via Router

If you have permission to log in the router (such as a home network), you can check the addresses assigned to Raspberry Pi on the admin interface of router.

The default hostname of the system, Raspbian is raspberrypi, and you need to find it. (If you are using ArchLinuxARM system, please find alarmpi.)

★ Network Segment Scanning

You can also use network scanning to look up the IP address of Raspberry Pi. You can apply the software, Advanced IP scanner and so on.

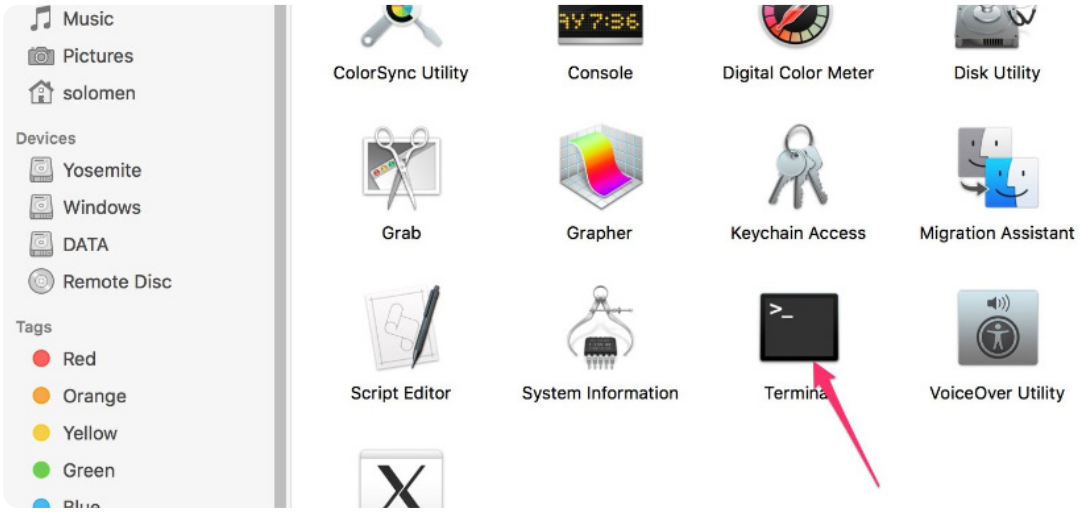
Scan the IP range set, and the name of all connected devices will be displayed. Similarly, the default hostname of the Raspbian system is raspberrypi, now you need to find the hostname.

Remote Control

We can open the Bash Shell of Raspberry Pi by applying SSH. Bash is the standard default shell of Linux. The Shell itself is a program written in C that is the bridge linking the customers and Unix/Linux. Moreover, it can help to complete most of the work needed.

★ For Linux or/Mac OS X Users

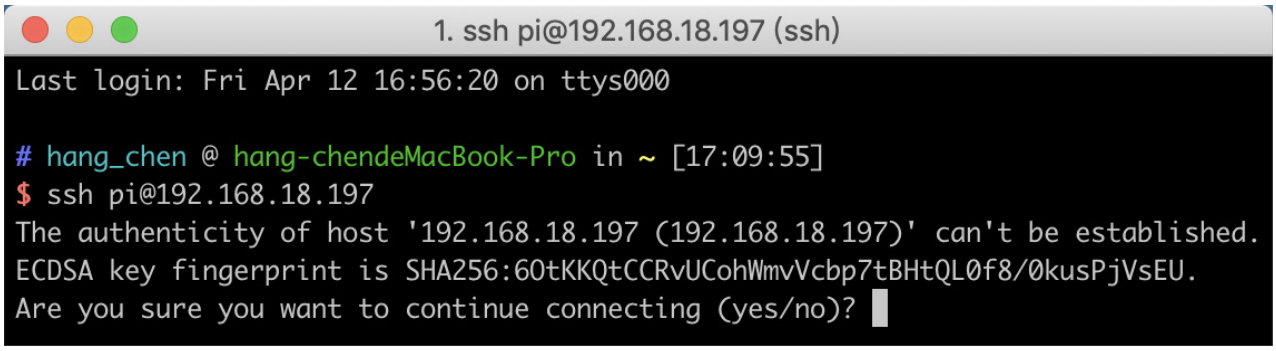
1. Go to Applications->Utilities, find the Terminal, and open it.



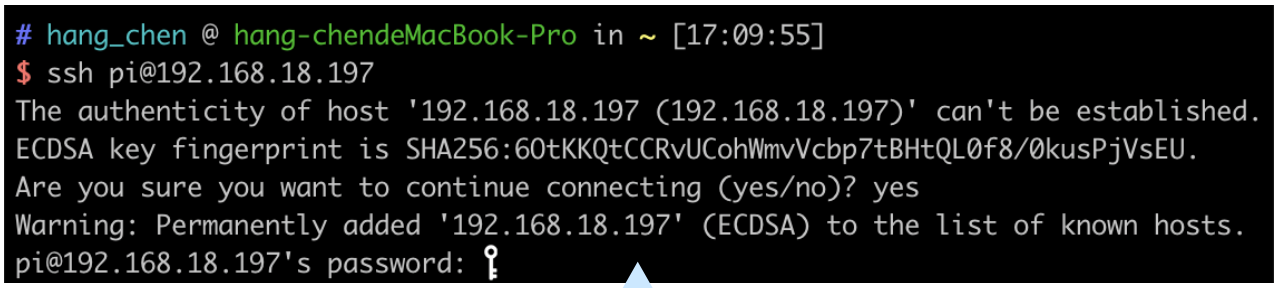
2. Type in ssh pi@ip_address. “pi” is your username and “ip_address” is your IP address. For example:

```
ssh pi@192.168.18.197
```

3. Input “yes”.

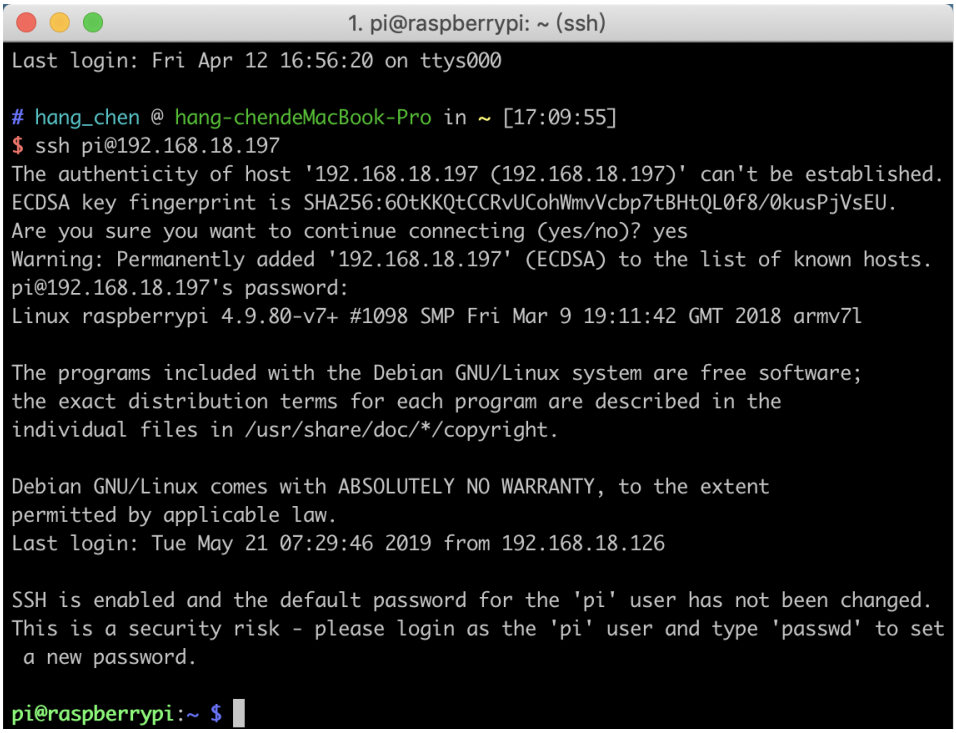


4. Input the passcode and the default password is “raspberry”.



When you input the password, the characters do not display on window accordingly, which is normal. What you need is to input the correct passcode.

5. We now get the Raspberry Pi connected and are ready to go to the next step.

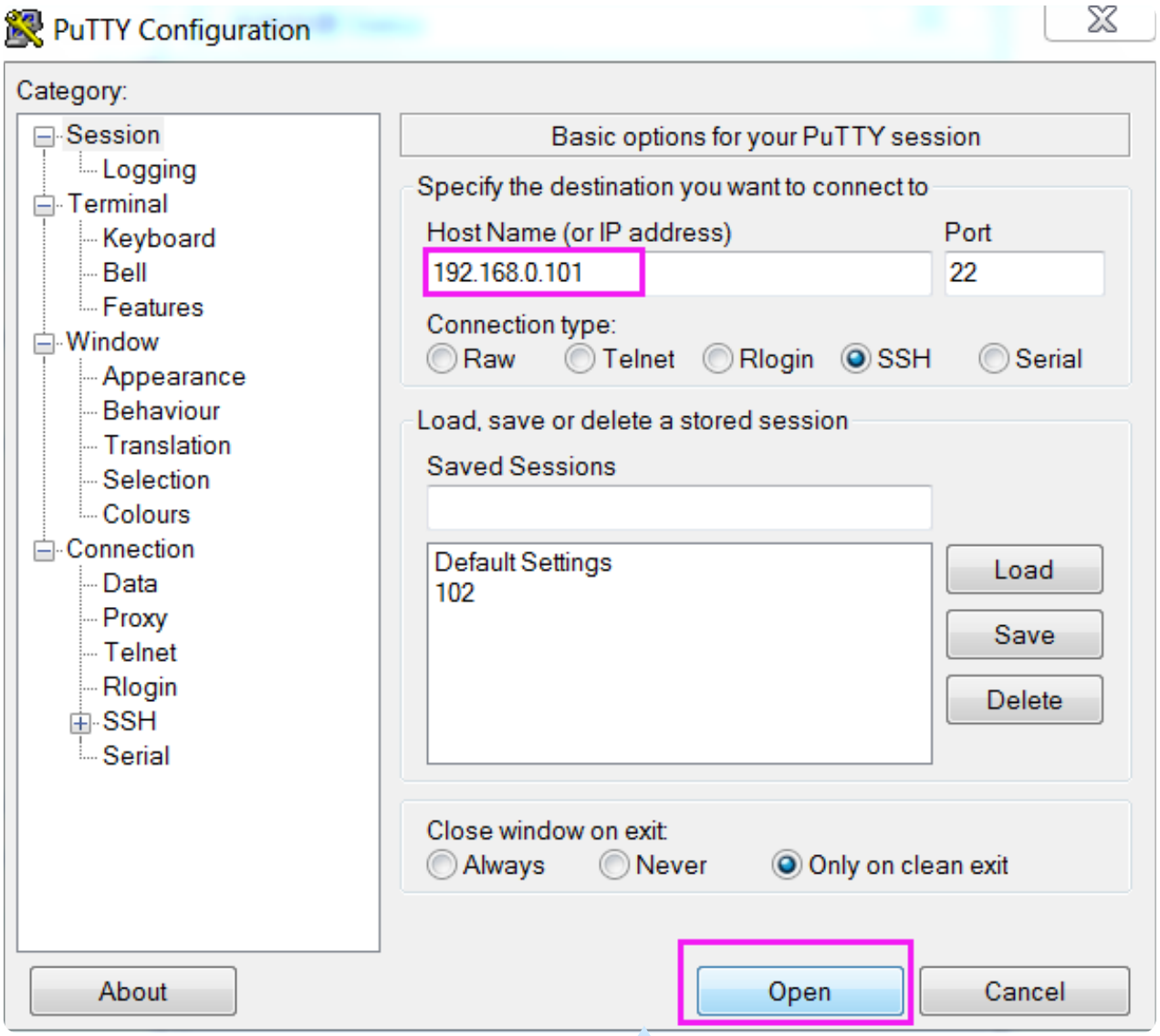


★ For Windows Users

If you're a Windows user, you can use SSH with the application of some software. Here, we recommend PuTTY.

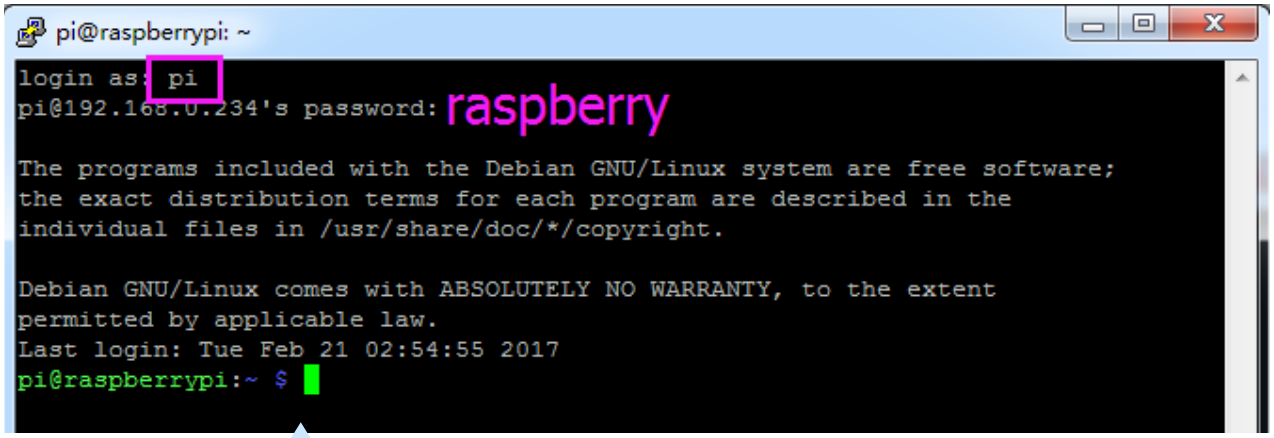
1) Download PuTTY.

2) Open PuTTY and click Session on the left tree-alike structure. Enter the IP address of the RPi in the text box under Host Name (or IP address) and 22 under Port (by default it is 22). Click Open.



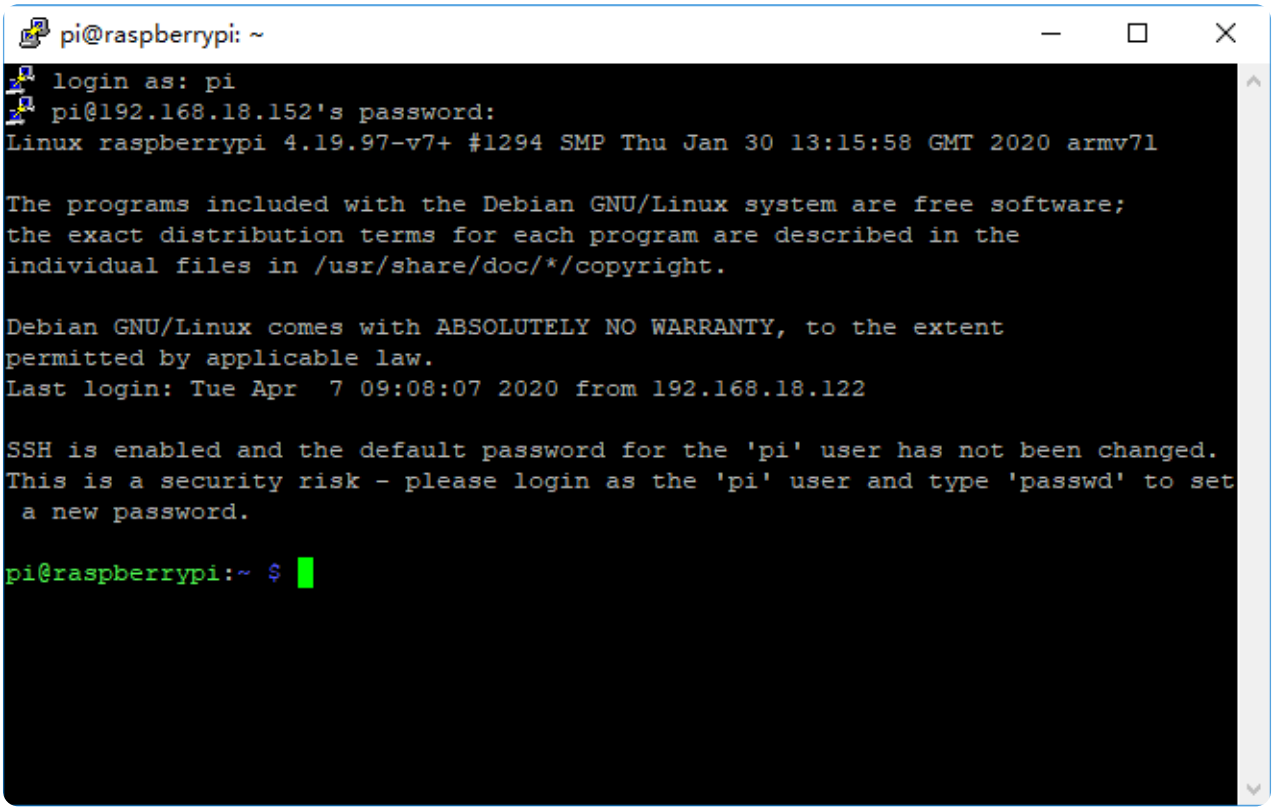
When you first log in to the Raspberry Pi with the IP address, there prompts a security reminder. Just click Yes.

3) When the PuTTY window prompts “login as:”, type in “pi” (the user name of the RPi), and password: “raspberry” (the default one, if you haven’t changed it).



When you input the password, the characters do not display on window accordingly, which is normal. What you need is to input the correct passcode.

4) Here, we get the Raspberry Pi connected and it is time to conduct the next steps.



Download the Code

We can download the example codes by using git clone in the Raspberry Pi.

① Change directory to /home/pi

```
cd /home/pi/
```

cd, short for change directory is to change from the current path to the intended directory. Informally, here is to go to the path /home/pi/.

② Clone the repository from github.

```
git clone https://github.com/sunfounder/picrawler.git
```

Stop Ezblock Service

The running of codes is based on Ezblock Studio. Please stop Ezblock at first.

```
sudo service ezblock stop
```

If you want to restart Ezblock, please run:

```
sudo service ezblock start
```

Ezblock is a startup program, and you can select the different commands to decide whether the program runs at startup or not:

```
sudo service ezblock-rest stop
```

```
sudo service ezblock-rest start
```

Python Code Control

In this kit, two different kinds of python methods are provided for you to play PiCrawler: **python code control** and **web control**.

Input the command to open the example folder, and you will see there are 11 python codes and a web_control folder in it.

```
cd /home/pi/picrawler/examples
```

You can run the python codes by the following command:

```
sudo python3 1.move.py
```

Before you run the 3/4/7/9 example, you need to open the file (e.g. run the command "nano 3.color_detection.py") and change the "MakerStarsHall" and "sunfounder" into your WLAN on the WiFi().write() function.

★ 1.move.py

Here, we let it perform the six actions: "forward", "backward", "turn left", "turn right", "sit" and "stand" in order.

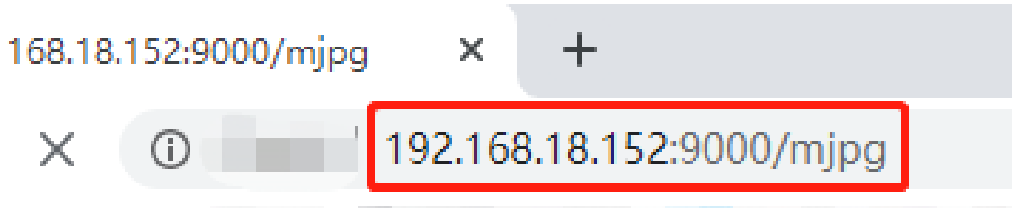
★ 2.ultrasonic_sensor_test.py

The code reads the distance value via ultrasonic module and prints the value on the screen. (unit: cm)

★ 3.color_detection.py

PiCrawler is a camera robot with color and face detection. Here we set the detected color as red in codes (other options: orange, yellow, green, blue, purple), and the camera will detect then select with a box.

As the program is running, on the browser, type the IP of the Raspberry Pi, and you can enter the interface to view the video.



NOTE:

1) Replace 192.168.18.152 with your own RPi IP.

2) Enlarge the image frame by zooming in the webpage display.

3) Repeat this step every time you need to check the video.

★ 4.face_detection.py

In addition to color detection, PiCrawler also has face detection. The camera can detect then select the face with a box and print the face **numbers** (other options: x, y, height, width).

★ 5.sound_effect.py

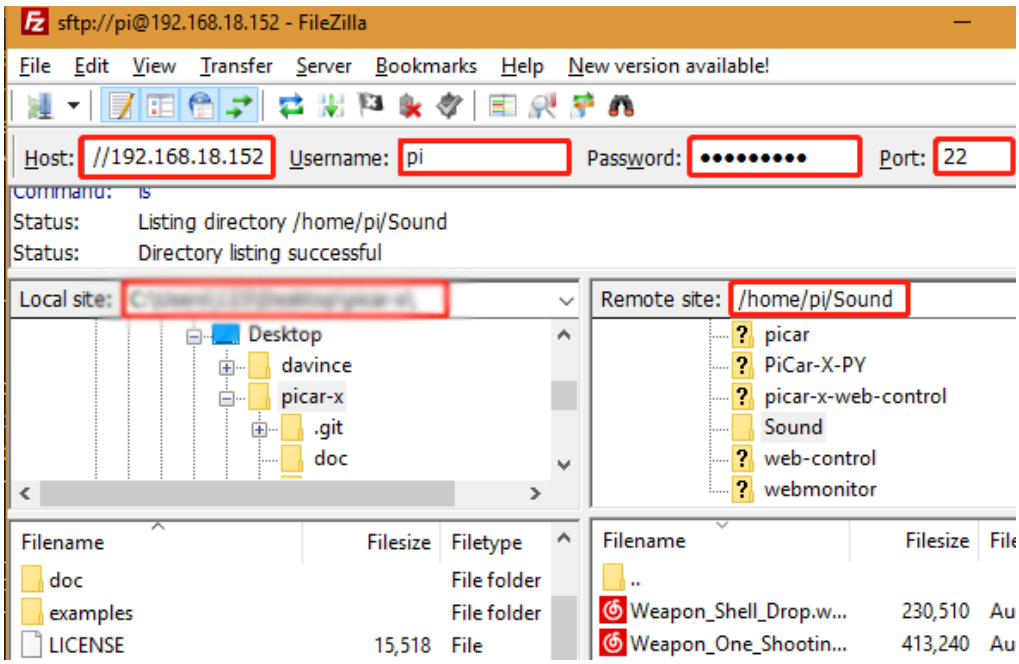
PiCrawler can make voice. You can enter text to make it speak, or make specific sound effects. Let us fire a gun after the last 3 countdowns.

If you want to manually add some sound effects, you can upload your sound effects to the path /home/pi/Sound/ via FTP. Steps are:

1) Download desired sound effects to your PC and then download a **FileZilla** software.

2) Start FileZilla then enter **Host**: 192.168.18.152, **Usename**: pi, **Password**: raspberry, **Port**: 22 and click **Quickconnect**. Copy the desired sound effects to /home/pi/Sound/.

3) Rename the sound effect file in the function: sound_effect_play('**Weapon_Continue_Shooting**.wav',50)



★ 6.background_music.py

In addition to having PiCrawler play sound effects or speak on specific occasions, you can also add background music to it.

To add music, you can try to upload your music to the path /home/pi/Music/ via FTP. Rename the music file in the function background_music('spry.mp3').

★ 7.say_hello.py

Let PiCrawler to move forward, and it will always look ahead. When it sees people, it will nod and say "Hello，nice to meet you".

★ 8.dance.py

PiCrawler has been set a series of actions we can combine to compose music for the crawler to dance.

★ 9.bullfight.py

Turn PiCrawler into an angry bull! Prepare a red cloth. When PiCrawler chases after the red cloth, be careful not to be hit by it. You need to use the color detection function to make the camera always face the red cloth.

★ 10.pet.py

Let's assign PiCrawler some pet behavior! As a little rascal, it will follow you behind; if gets lost, it will look around, then sit down to sing until you show up; after that, it will follow you with glee.

★ calibration.py

```
cd /home/pi/picrawler/examples/calibration/
```

```
sudo python3 calibration.py
```

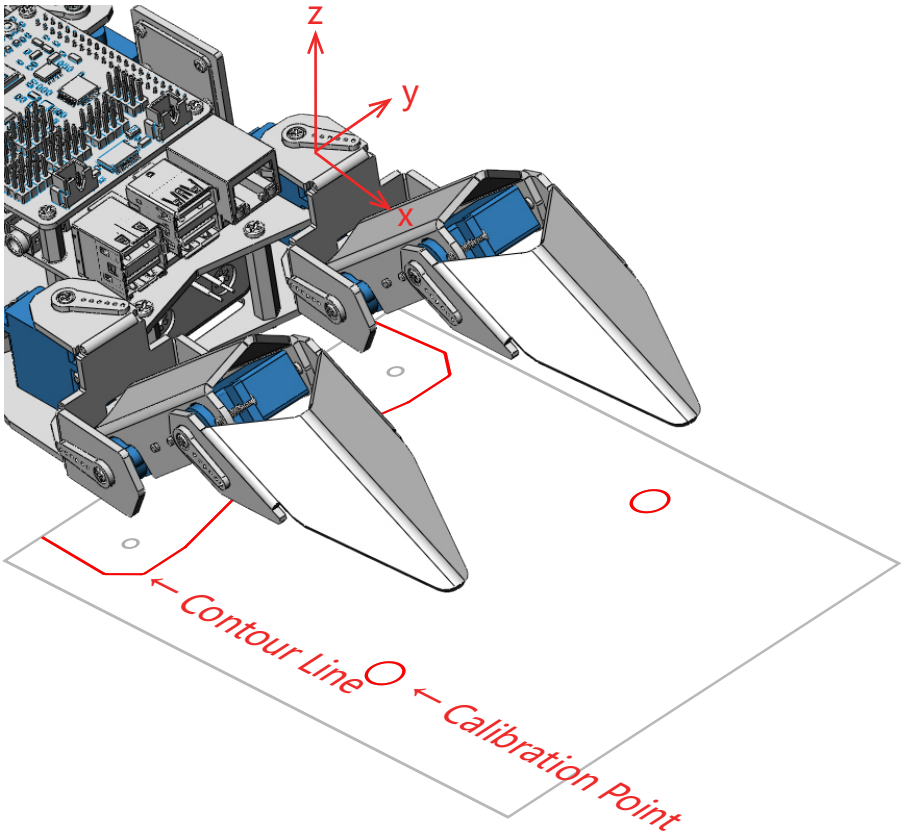
When you need to provide higher precision for the action of PiCrawler, please use this example which needs to be used together with the back cover of the manual.

To start the calibration, select these legs: right front, left front, left rear, right rear by pressing keys "1, 2, 3, 4".

The toe moves along the axes x, y, z when keys "W, S, A, D, I, K" are pressed. During calibration, please lift the toe first to avoid stroking on the back cover.

The calibration picture on the back cover can be used as follows:

1. Let the camera face forward.
2. Place the back cover under one side of PiCrawler.
3. Make the contour line coincide with that of PiCrawler base plate.
4. Use keyboard to let the two toes of this side step onto the calibration points, and press "enter". Write the current compensation value to the config file when “enter“ is pressed. Please switch the leg after writing the compensation value to avoid writing errors.
5. Rotate the back cover and calibrate the other two legs in the same way.
6. After confirming, restart PiCrawler.



Web Control

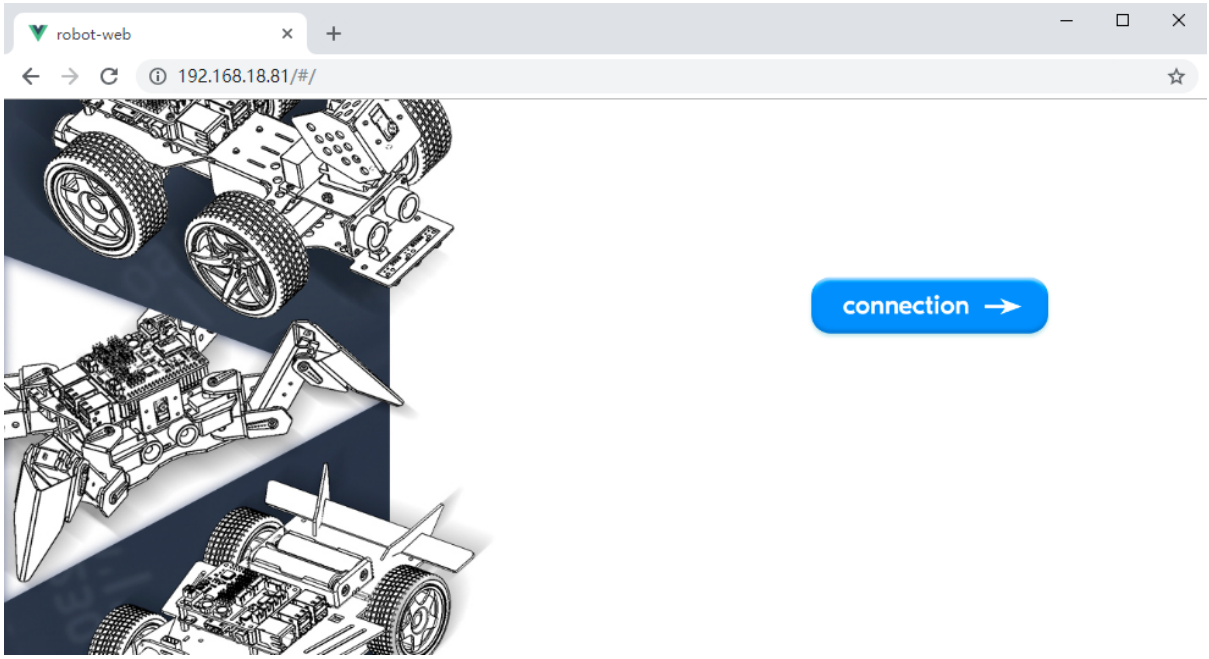
In the examples, we are provided with method of web control. So you can open the browser on different terminal equipments, including computer, cellphone, tablet and so on. You can use most functions of PiCrawler, such as obstacle avoidance, line-following, face tracking and color tracking.

1) Input the command and start up the web control program.

```
cd /home/pi/picrawler/examples/web_control/
```

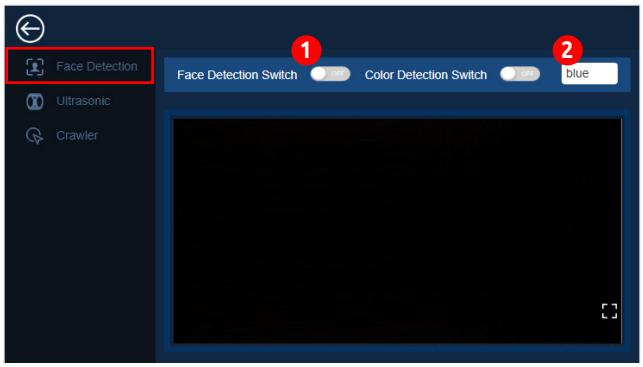
```
sudo python3 start_server.py
```

2) As the program is running, on the browser, type the IP of the Raspberry Pi, and you can enter the Web interface.



Interface Introduction

1. Direction Controller 1: Go forward and back.
2. Direction Controller 2: Go left and right.
3. Obstacle Monitor: Read the real-time distance value.
4. Power Bar: Set the action speed of the PiCrawler.
5. Music Player: Play the music, audio and convert words to voice.
6. Camera Monitor: Display the image of camera.
7. Navigation Bar: Switch the certain functions on or off.
   A. Ultrasonic: Activate the Ultrasonic module and display the results in Obstacle Monitor.
   B. Obstacle: Avoid hitting obstacles and continue to go ahead.
   C. Colortracking: Track the certain color to move forward.
   D. Color: Display the detected color in Camera Monitor.
   E. Tracking: Follow the detected face to go forward.
   F. Face: Display the detected face in Camera Monitor.
   G. Setting: Test each function respectively.



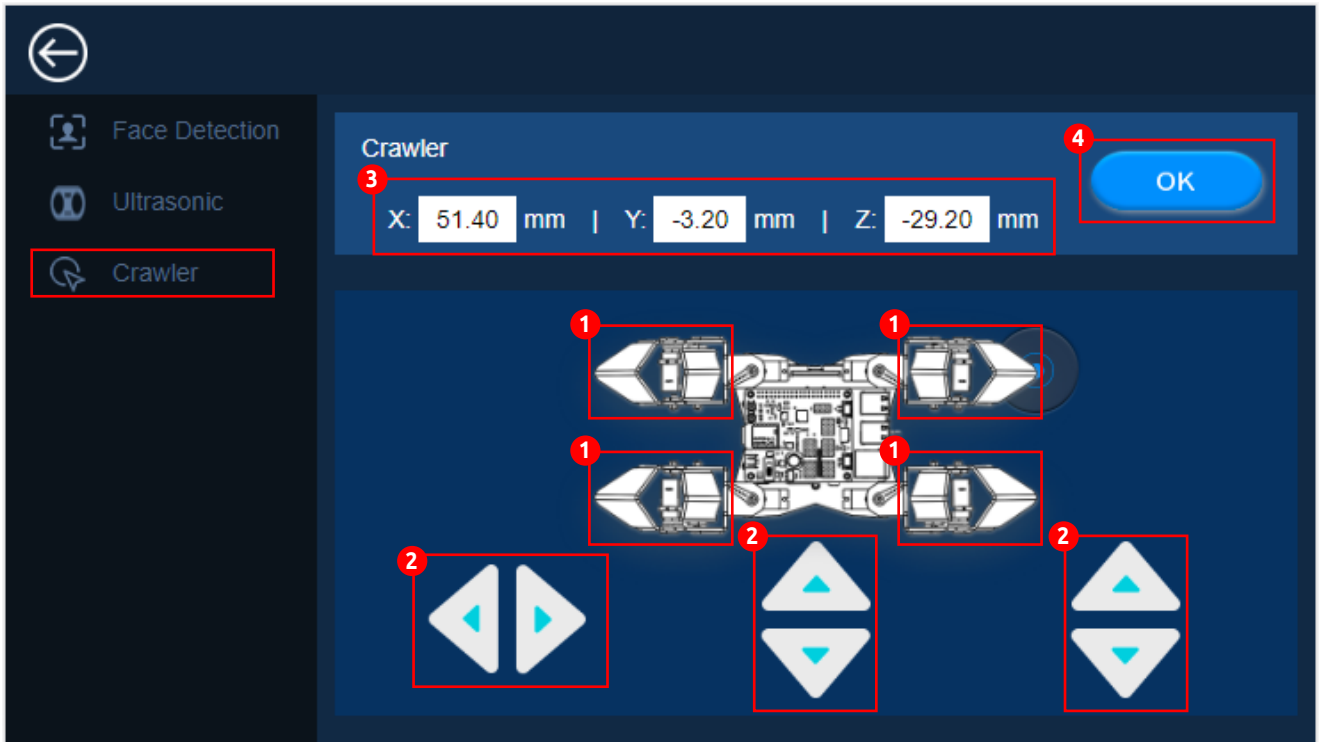
1. Switch on/off the Face detection.

2. Switch on/off Color detection and test by modifying the detected options: red, blue, green, yellow, orange, purple.

Ultrasonic options for setting the distance detection.

1. The detected distance is displayed.

2. Switch on/off the Ultrasonic distance detection.



This option for calibrating the angle of the servo. The function is to be used in accordance with the back cover— place the PiCrawler around the contour to let the toes step on the two remarked circles.

1. Tap any toe on the picture to select the to-be-adjusted toe.

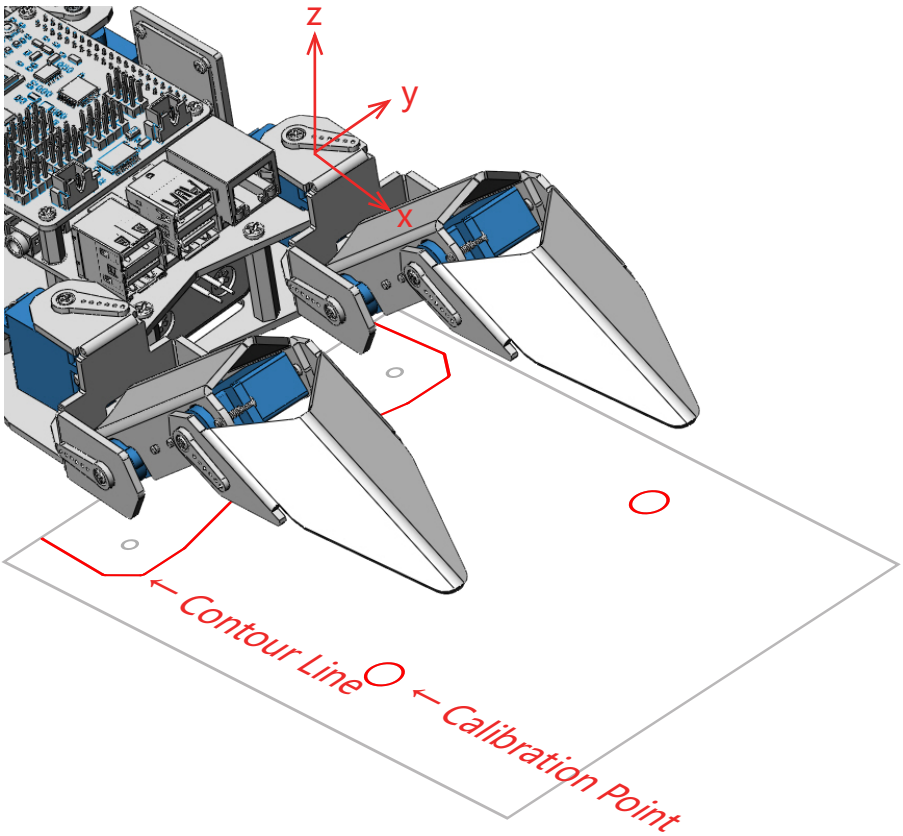
2. Tap the direction buttons (the three buttons correspond to the axes x, y, z).

3. Check the coordinate of the currently selected leg.

4.Tap "OK" after calibration. Write the calibrated coordinate value into the configuration file. "OK" must be tapped before calibrating a new leg.

The calibration picture on the back cover can be used as follows:

1. Let the camera face forward.
2. Place the back cover under one side of PiCrawler.
3. Make the contour line coincide with that of PiCrawler base plate.
4. Use direction buttons to let the two toes of this side step onto the calibration points, and tap "OK". Write the current compensation value to the config file when “OK“ is pressed. Please switch the leg after writing the compensation value to avoid writing errors.
5. Rotate the back cover and calibrate the other two legs in the same way.
6. After confirming, restart PiCrawler.



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For **NON-TECH questions** like order and shipment issues, please **send an email to service@sunfounder.com**. You're also welcomed to share your projects on.