About this Manual

Thanks for choosing our Pan-Tilt HAT.

Pan-Tilt HAT is a 2-axis Pan-Tilt kit for intelligent detection and free movement based on the Raspberry Pi. Built in a 5 megapixel camera and the Raspberry Pi extension board with 14 external interfaces, Pan-Tilt HAT can realize functions such as color detection, face detection, gesture detection and traffic sign detection, and can freely control the camera's turning around.

The free turning of the Pan-Tilt is mainly realized by two servos. The movable angle ranges 0~180° from left to right, and 0~90° from up to down.

Pan-Tilt HAT has 14 external interfaces, including 4 Analog ports, 4 PWM ports, 4 Digital ports, 2 I2C ports, 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 Pan-Tilt HAT work in a 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 10 examples to help you completely grasp the blockly program skill and the use of several functions of Pan-Tilt HAT.

★ To Play in Python

If you prefer 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.

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.

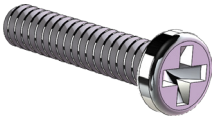
Content

Component List

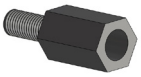
M1.5 x 4
Self Tapping Screw
(10)

M2 x 4
Screw
(6)

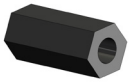
M2.5 x 6
Screw
(6)



M2 x 10
Screw
(6)

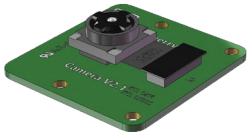


M2.5 x 8 + 6
Nylon Standoff
(6)



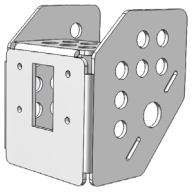
M2.5 x 11
Nylon Standoff
(6)

Washer
(2)



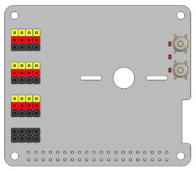
Camera Module
(1)

FFC Cable
(2)

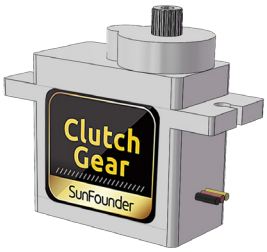


A1 Plate
(1)

A2 Plate
(1)

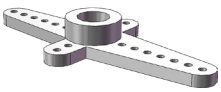


Pan-Tilt HAT
(1)



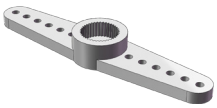
Servo
(2)

Servo
Screw A



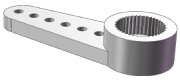
Cross Servo
Arm

Servo
Screw B

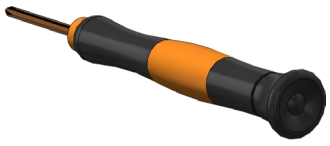


Double-Side
Servo Arm

Servo
Screw B



One-Side Servo
Arm



Screwdriver
(1)

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

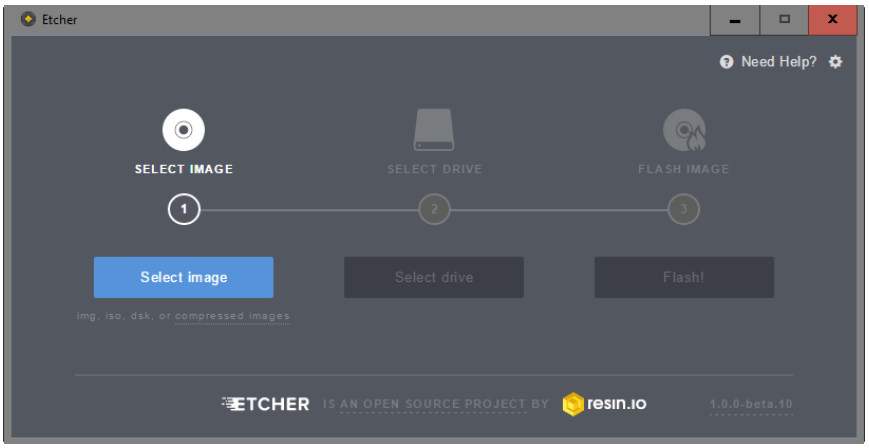
1. Prepare the tool of image burning. Here we use the **Etcher**. You can download the software here: https://www.balena.io/etcher/.

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

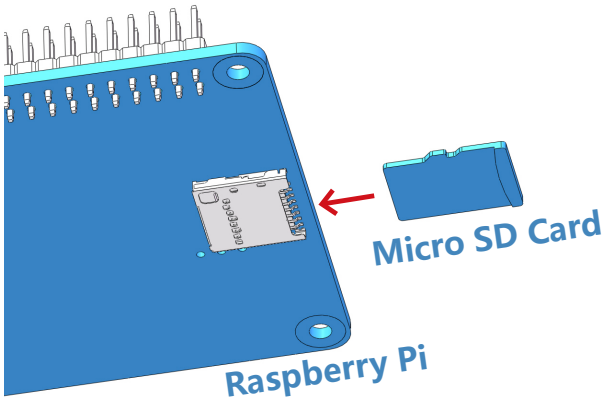
3. Unzip the package downloaded and you will see the **.img** file inside.

Note: Do not extract the .img file.

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

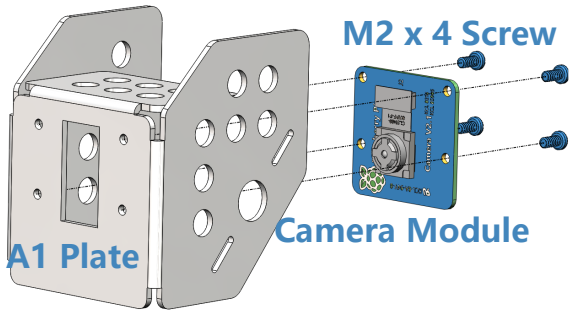


5. At this point, Ezblock for Raspberry Pi is installed. Please insert the Micro SD card into your Raspberry Pi.

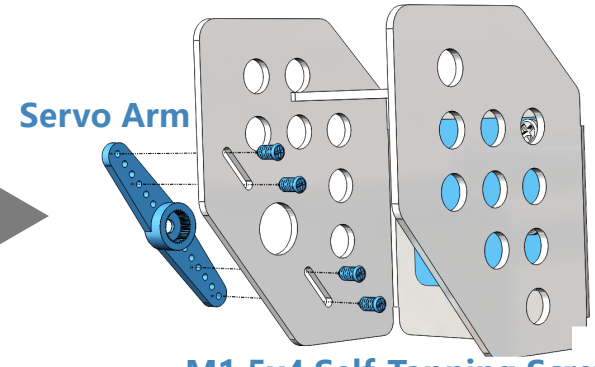


Build Pan-Tilt HAT

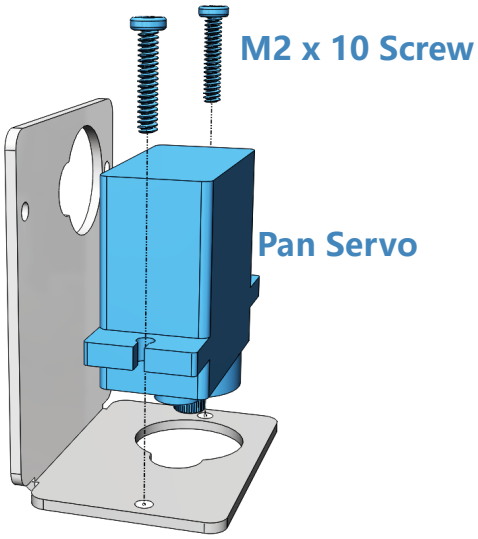
1 Assemble Camera Module

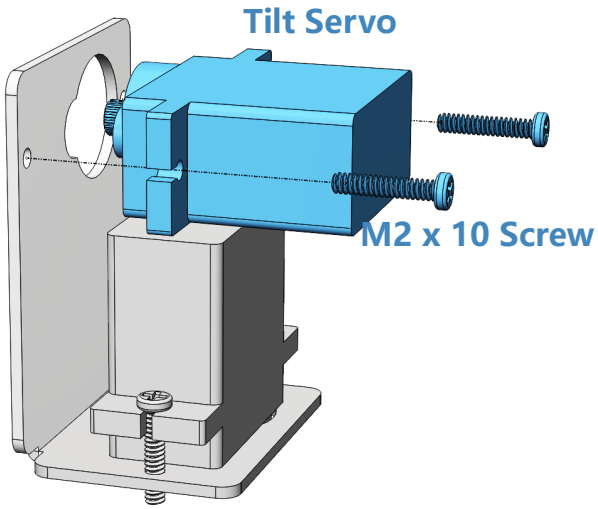


Note: There is a sticker on the camera for easy fixing.

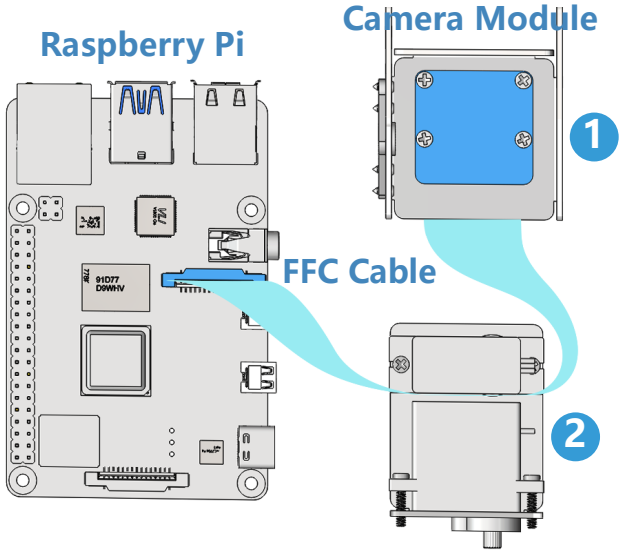


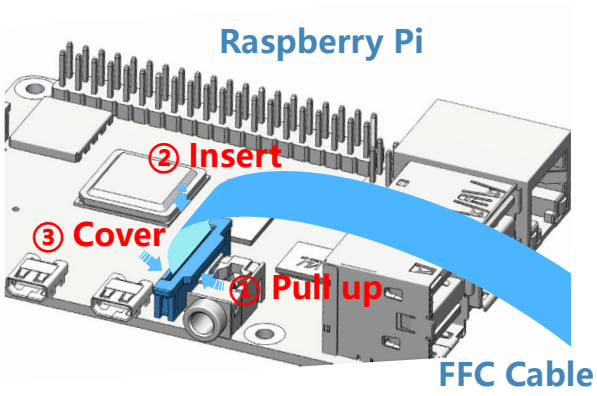
2 Assemble Pan and Tilt Servo



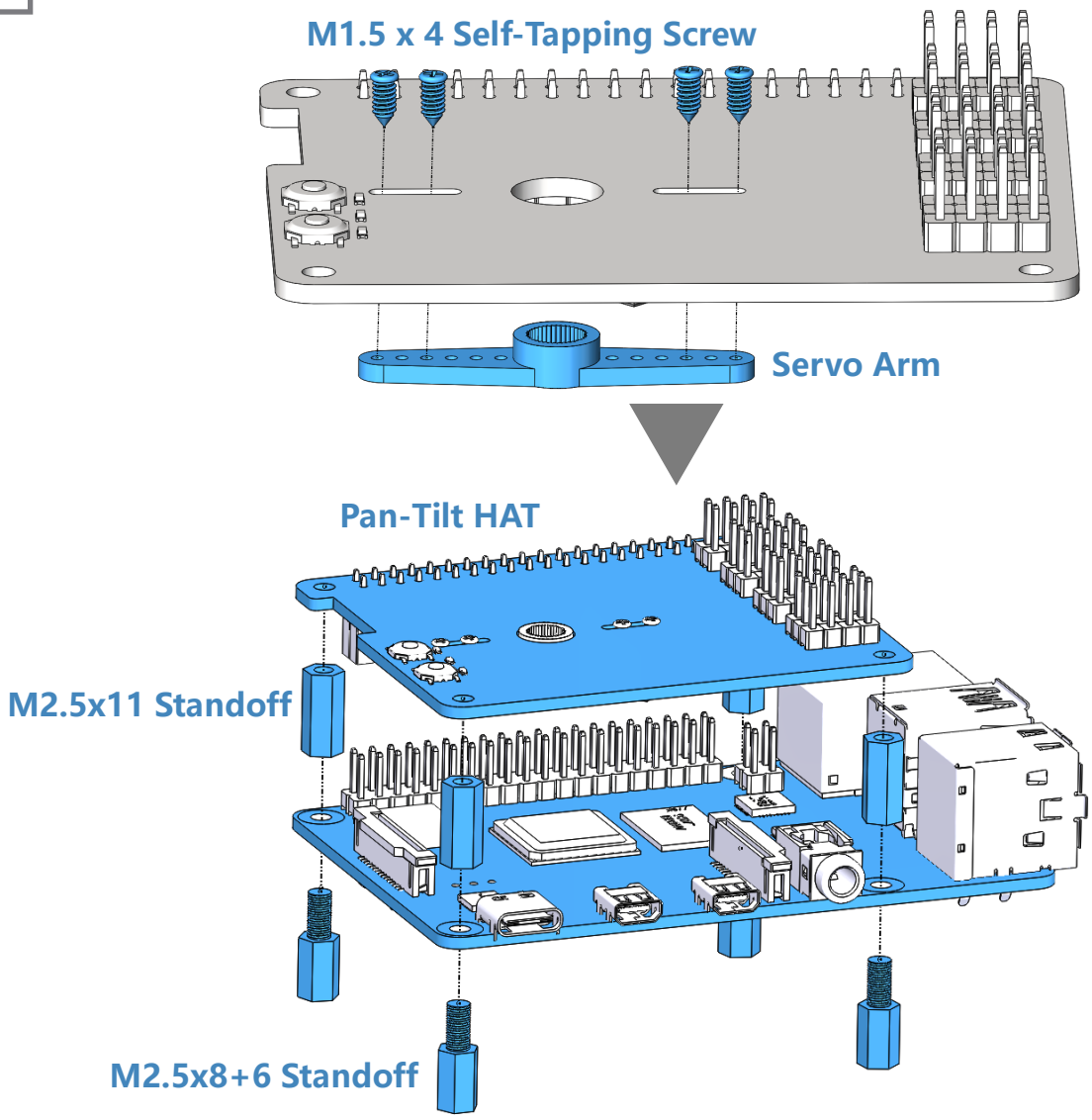


3 Connect FFC Cable

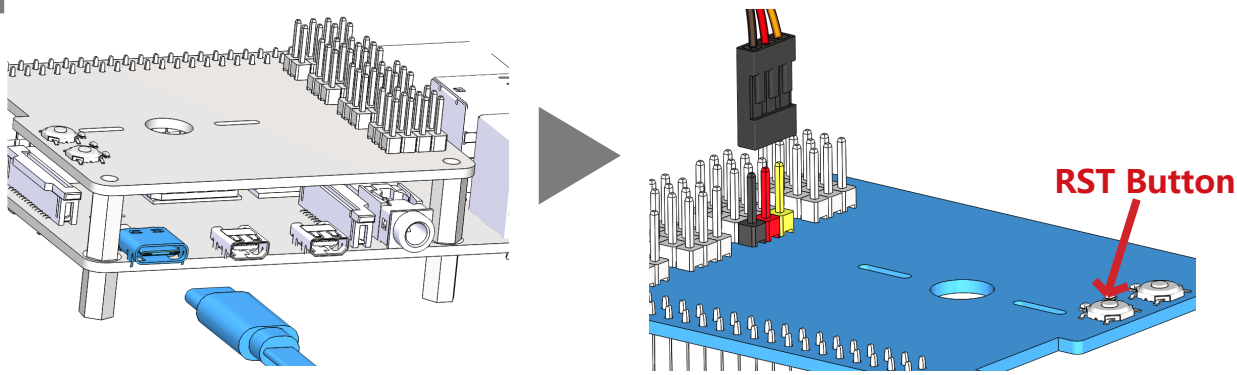




4 Assemble Pan-Tilt HAT



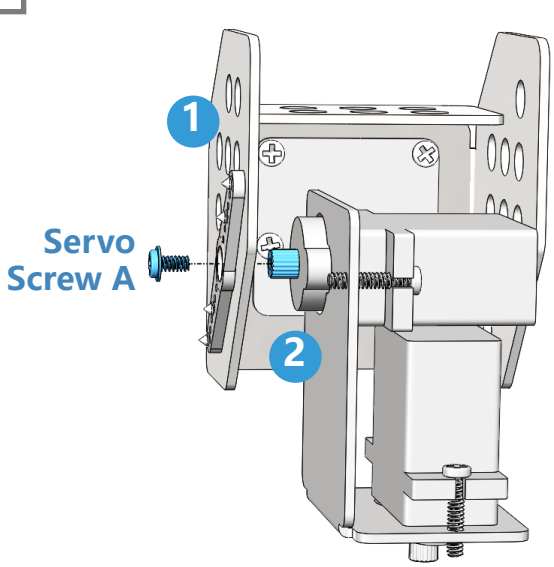
5 Servo Adjustment

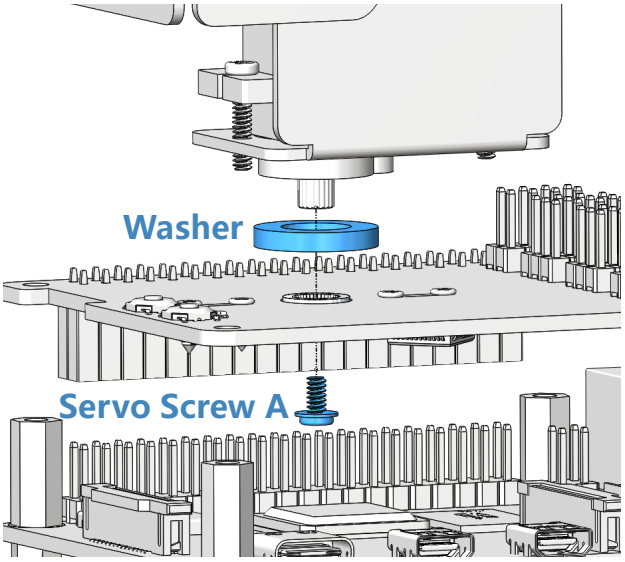


After burning the Ezblock system, P0 was set to calibrate the servo angle to 0 ° . Therefore, power on the RPi before assembling each servo, then insert the servo cable into P0, the servo will turn to 0 ° . When the P0 port fails to calibrate the servo, long press the RST button.

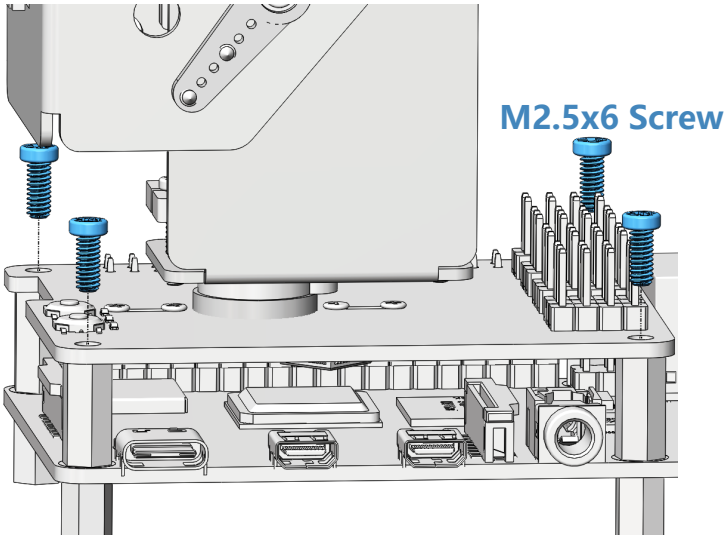
Note: This function will be invalid after you write any programs.

6 Fix Pan-and-Tilt

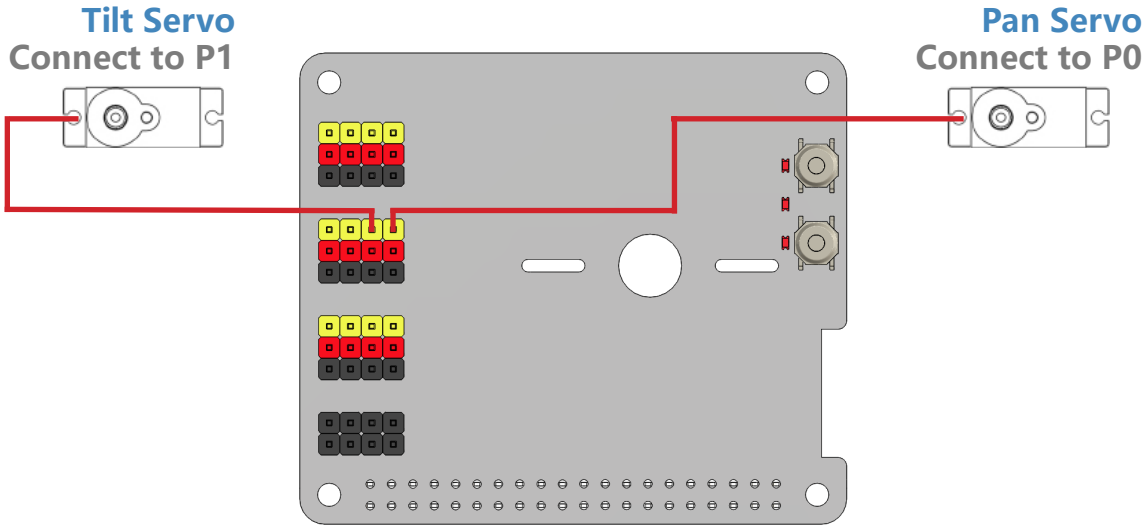




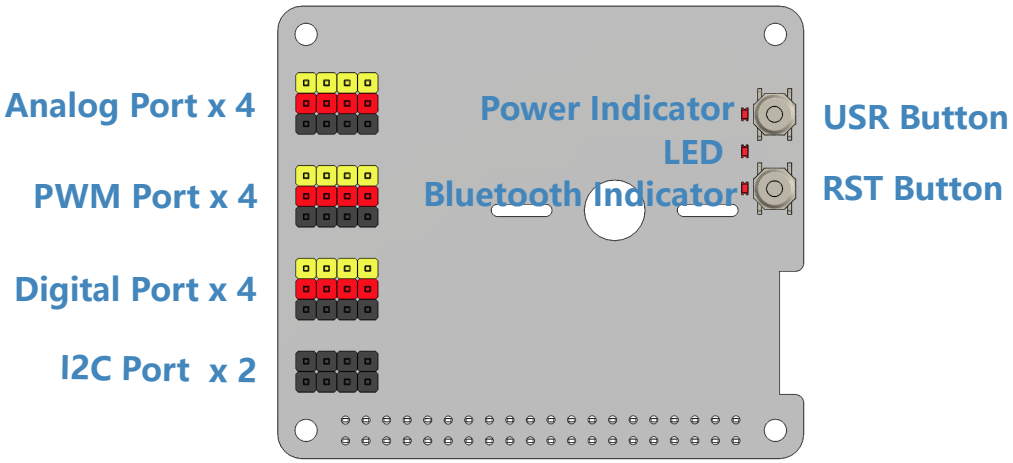
7 Screw Pan-Tilt HAT



8 Connect Servo



About Pan-Tilt 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.)

Power Indicator:

- The Power indicator keeps turning on when the Pan-Tilt HAT powers on.

Bluetooth Indicator:

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

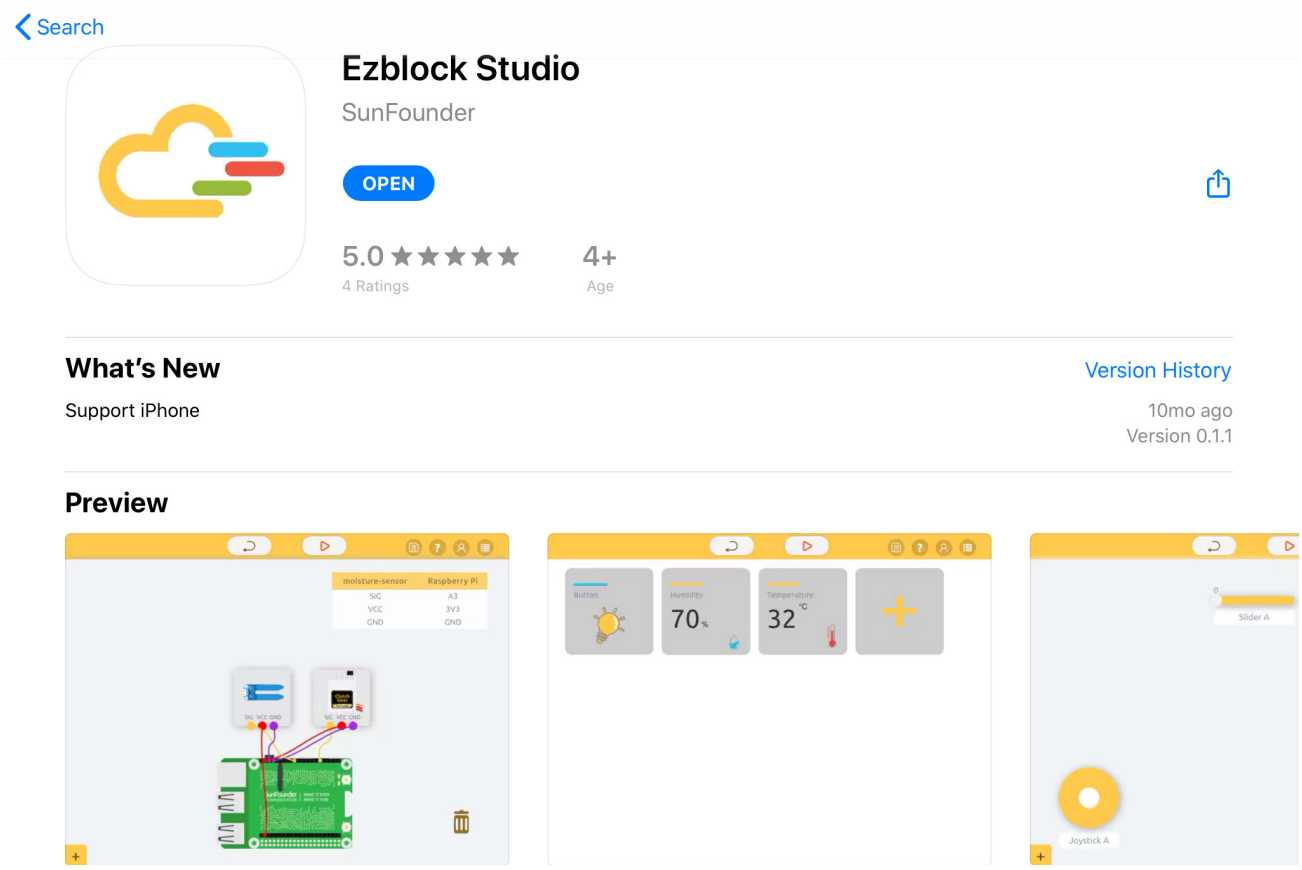
To Play in Ezblock

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.

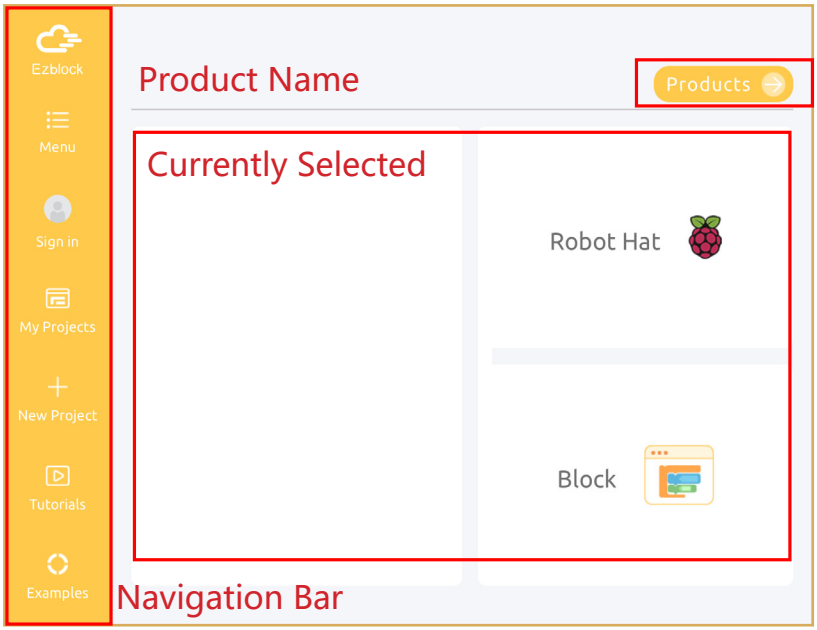


Quick Guide on Ezblock

This chapter helps to learn basic operation of Ezblock, from choosing products to flashing the project to your control board.

Home Page

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



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

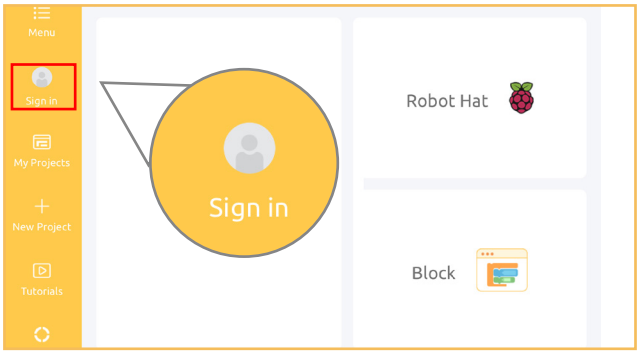
Currently Selected shows our currently selected products, control board and programming environment.

Click **Products** button, we can turn to the product selection page.

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

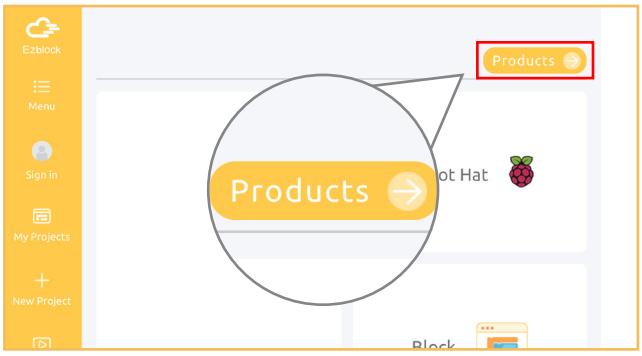
- **Menu**: Some information of the App, such as language setting and FAQ.
- **Sign in**: Sign in your account.
- **My Project**: Turn to My Project page.
- **New Project**: Create a new project.
- **Tutorials**: Teach projects step by step.
- **Examples**: Project examples.

Note: Please refer to "Appendix: Page Introduction" for more details about other pages.



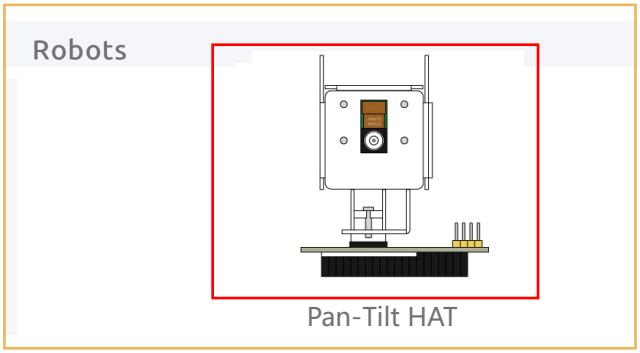
Sign in or Sign up

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



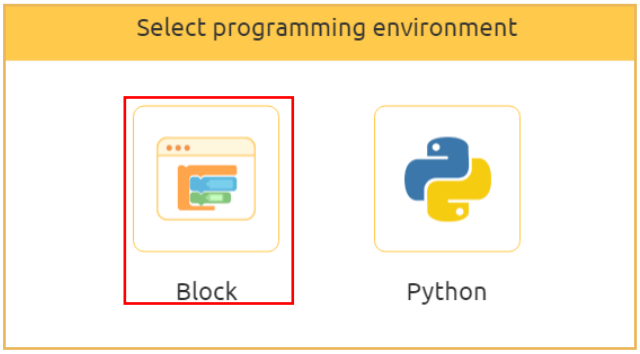
Go to Product Page

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



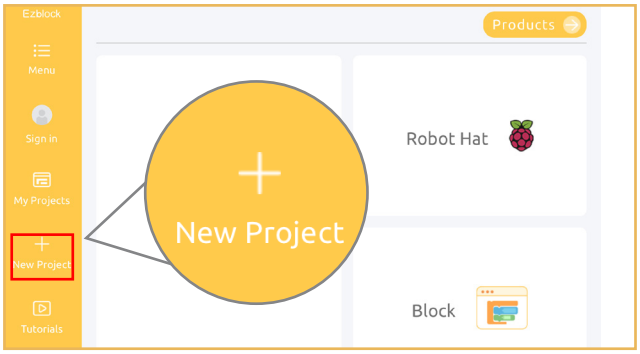
Choose Product

Choose the product, Pan-Tilt HAT under the Robots category.



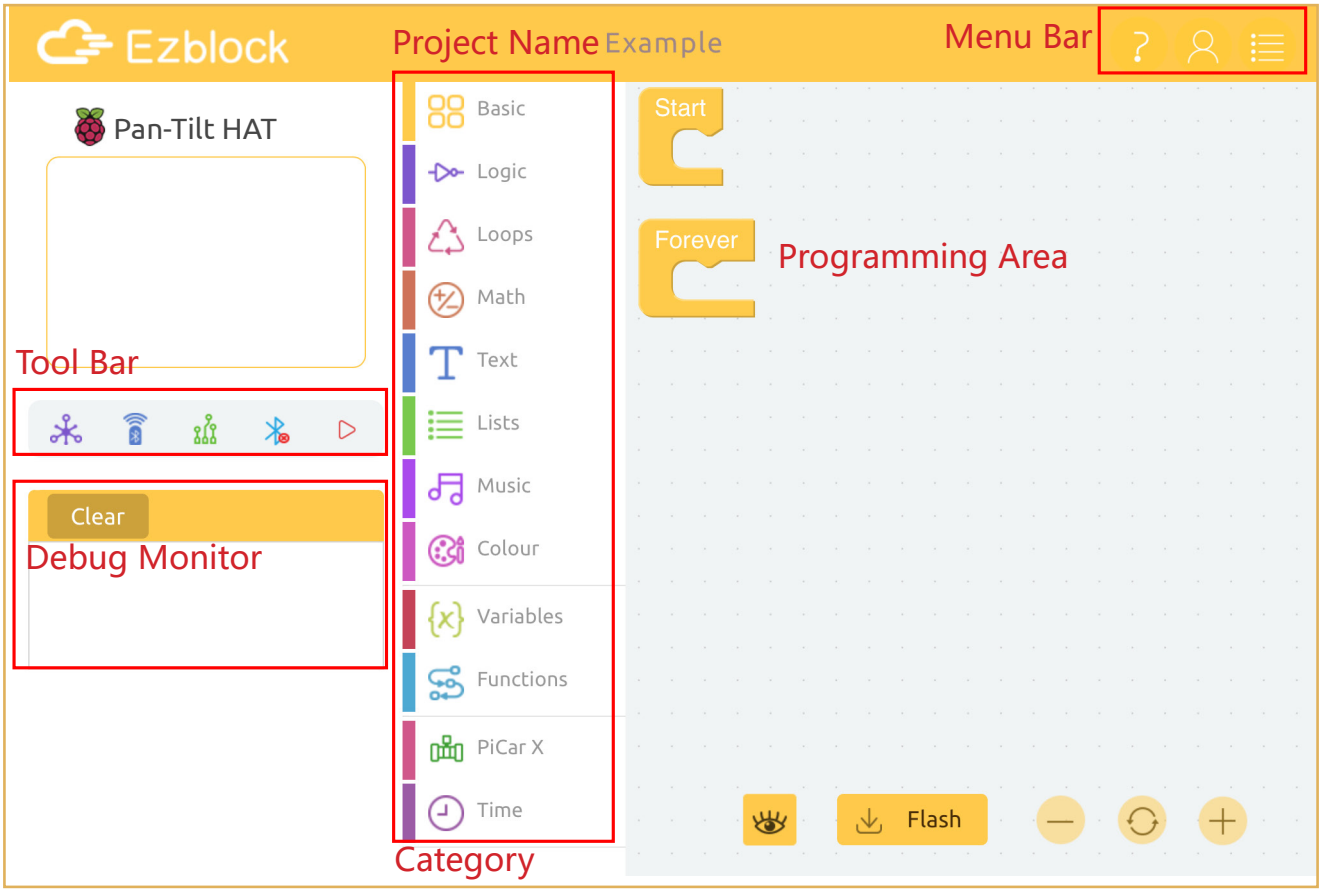
Select Environment

Select the programming environment, Block.



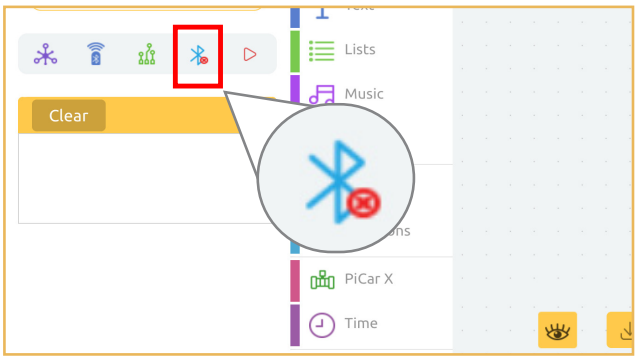
Create a New Project

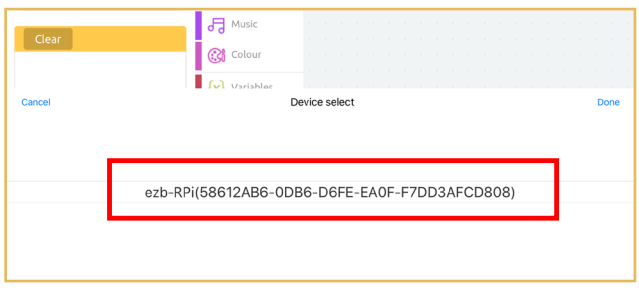
Click the button, New Project on the left side of main page to create a new project.



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.

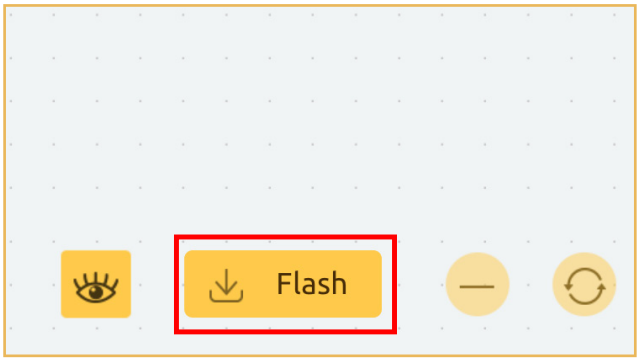




Connect Bluetooth

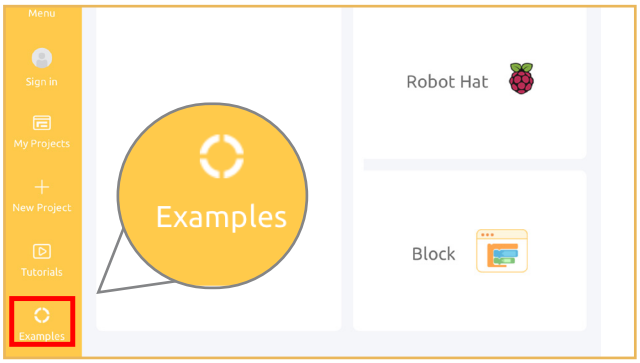
Click the Bluetooth connection button, then in device selection prompt, choose your device and click Done, and wait "Connected" to appear.

In case of cross connection between several RPi boards, the 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.



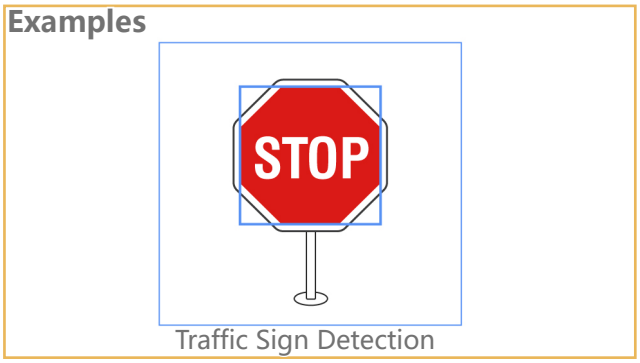
Flash Your Code

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 Examples.



Open Traffic Sign Detection

Here we open Traffic Sign Detection. This is the first code to be used later.

Elementary Project

Here, we show you the basic operation of playing Pan-Tilt HAT 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 challenges.

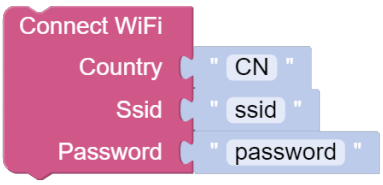
Traffic Sign Detection

Firstly, we learn how to use Pan-Tilt HAT to detect traffic signs. During this operation, we can master how to enable and use RPi camera. And an accessible WiFi is necessary for you.

TIPS

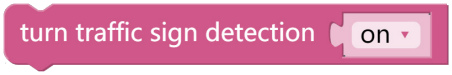
Click the  icon to enter the Bluetooth control page to enable the camera monitor.

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



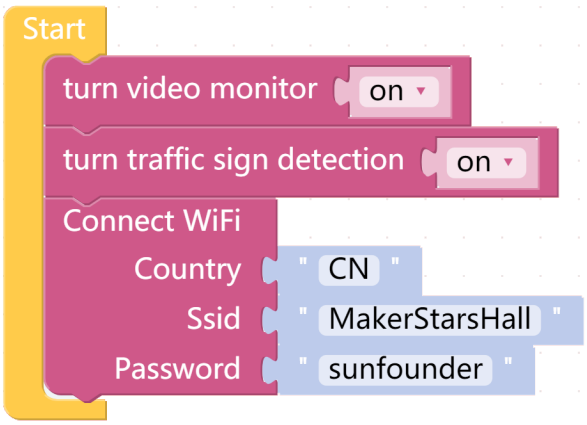
To use the Camera function, you need first to connect the Raspberry Pi to the Wi-Fi environment where the tablet is located. Put this block in Start, and type in Wi-Fi account and password.

You need to open the image in Video by turning video monitor to on. Turning it to off will close the image (but not object detection).



Turn on traffic sign detection.

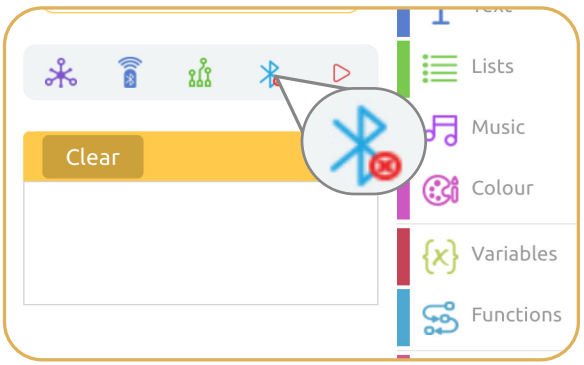
EXAMPLE



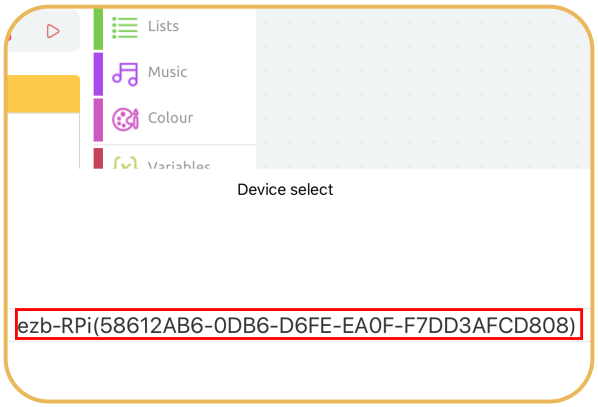
Finished the program, we show you how to use the functions of Pan-Tilt HAT via Ez-Block.

1 Connect Bluetooth

Turn on the Bluetooth on the tablet firstly



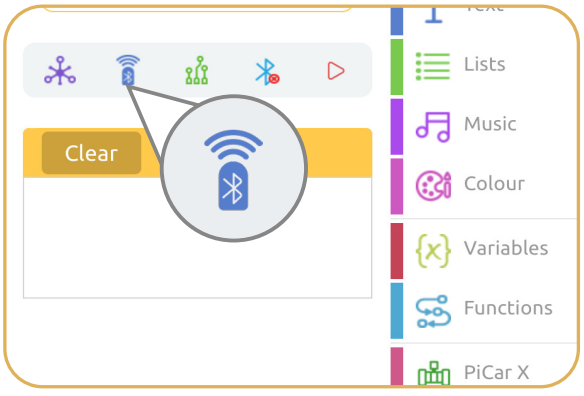
2 Select Correct Numberings



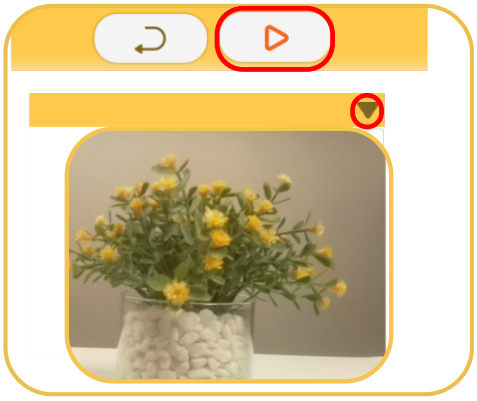
3 Download Codes

4 Update Device Information

5 Go to Bluetooth Page



6 Enable Camera Monitor



Click "Run" button, and you will see the shot pictures or videos.

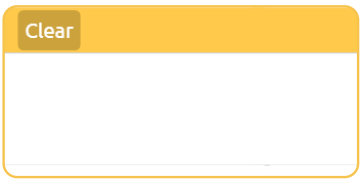
The image size can be adjusted via the inverted triangle at upper right.

Face Detection

Next, it's time to go in to learn about the face detection of Pan-Tilt HAT. The Pan-Tilt HAT can print the number of the detected faces on the debug monitor.

TIPS

A print block can be used to print data or text on the debug monitor.



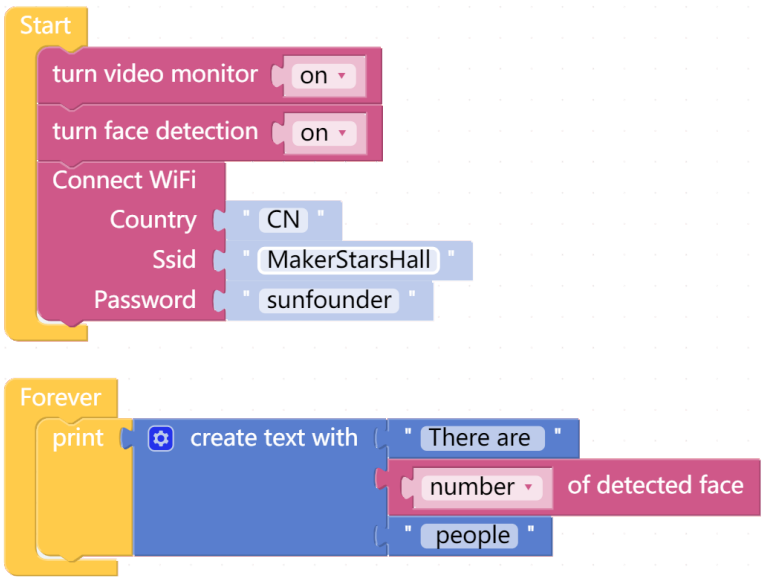
The data printed by the Print block will appear in the Debug Monitor on the left. In other pages, you can also click on the Debug Monitor in the upper right corner.

You may want to use text block to print the combination of texts and data at once.

You need to turn on face detection.

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

EXAMPLE



Note: After the code is uploaded, don't forget to update the device information to enable Wi-Fi config.

Gesture Calibration

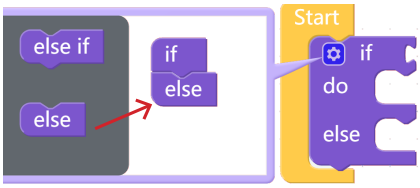
Gesture detection is easily influenced by environmental factors, so we need first to calibrate gestures then enable gesture detection.

TIPS

Here we drag a Switch from the page. After that a **Remote** category will appear.

To use Switch on the page, you need to add a **read from remote** block from the **Remote** category to the Forever block.

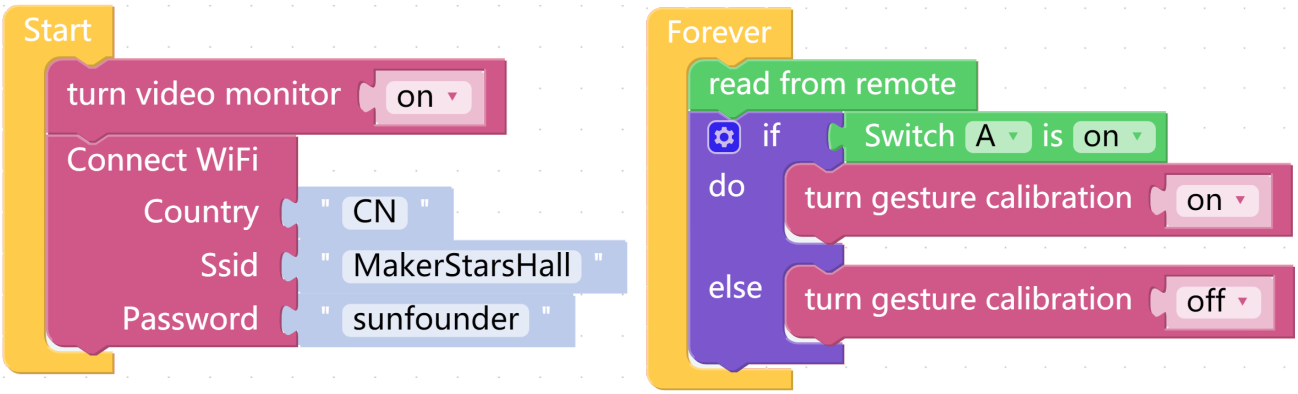
This block reads the switch state in the Bluetooth control page.

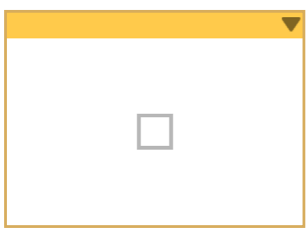


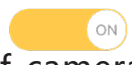
To achieve conditional judgment of "if" type, you need to use an if do block.

Calibrate your gesture by using this block. In the drop-down menu, choose on, the calibration will be on; otherwise, the calibration will be off.

EXAMPLE





After the code is uploaded, click the icon and let 

, there will appear a white square in the center of camera monitor. Put out your hand and place the palm in the square. Let

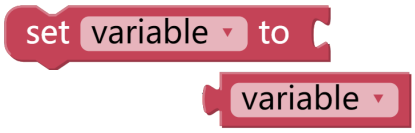
and finish the calibration.

When the gesture is being calibrated, the camera should avoid being directly radiated by light. After calibration is complete, you need to press the reset key on the Pan-Tilt HAT to take effect.

Gesture Detection

Completed the gesture calibration, we can start using Pan-Tilt HAT to detect our gestures. Now, what can be detected by our Pan-Tilt HAT includes rock, scissor, paper.

TIPS



You may want to simplify your program with Variable. For example, when you need to use the values of the type of gesture repeatedly, just assign them to variables for repeated use instead of reading repeatedly.

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

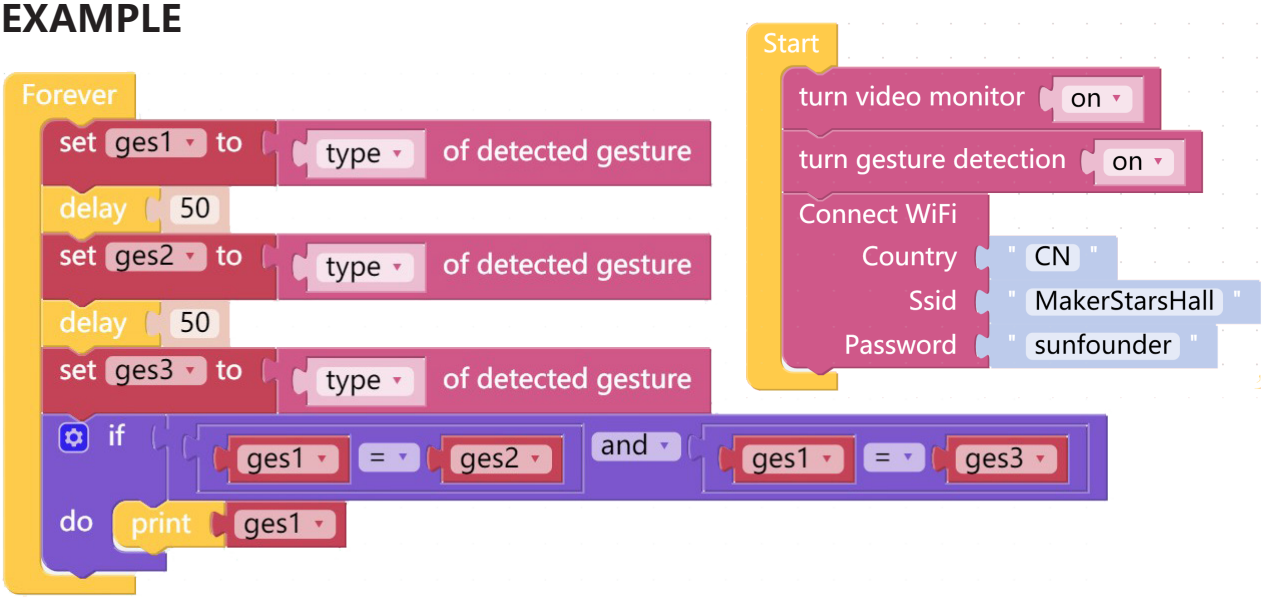
This block is used to do conditional judgement. Judging conditions can be "=", ">", "<", " ≥ ", " ≤ ", " ≠ ".

This block is used to do "logical judgment" and judging conditions can be "and", "or" etc.

You need to turn on gesture detection.

You can read the results of the detected gesture through this block. In the drop-down menu, choose to read the coordinates, size, type or accuracy of the detected gesture.

EXAMPLE

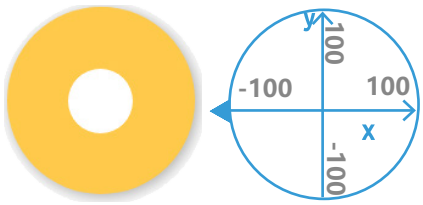


1. The environmental difference between calibration and detection cannot be too large, otherwise you need to retry your calibration.
2. Avoid putting other things in the same color as the palm (ex. arm or neck) on the camera interface for your precise detection.

Color Detection

We continue to learn the color detection of Pan-Tilt HAT. Let's adjust the direction of camera via joystick and see the results of color detection displaying on camera monitor.

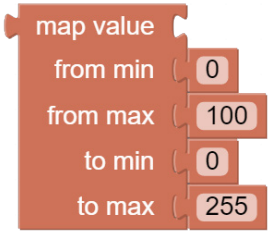
TIPS



Click the icon, drag a Joystick to the central area. Toggle the white point in it to produce a coodinate (-100~100).

This block reads the Joystick value in the Bluetooth control page. You can click the drop-down menu to switch to the Y-axis reading.

This block is used to drive the servo arm to rotate in a certain direction.

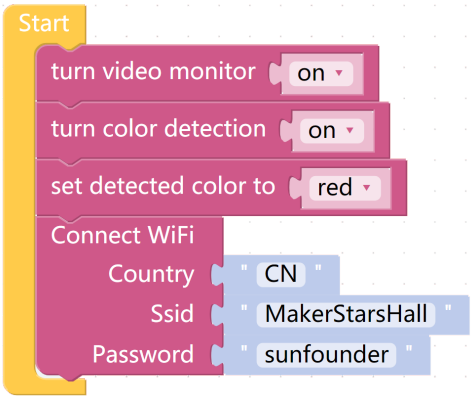


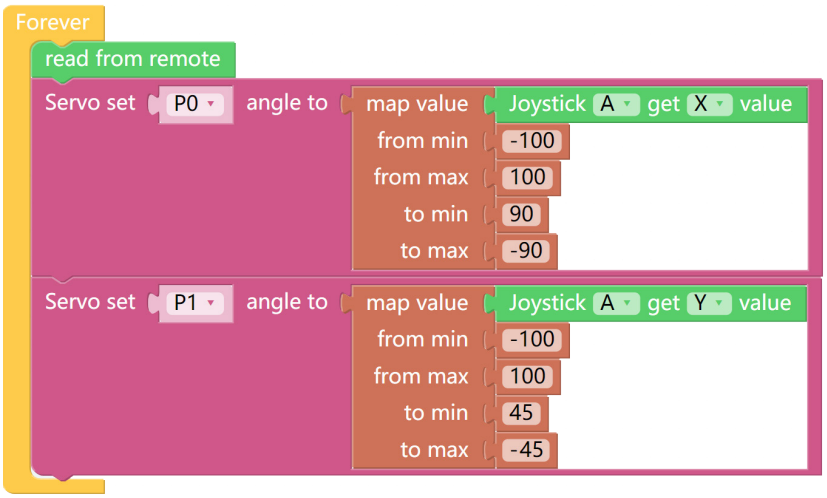
The map block can remap a number from one range to another. If a number is 50， it is at 50% position of the range of 0~100; then if we map it to the range 0~255 via the map block, the number will be 127.5.

You need to turn on color detection.

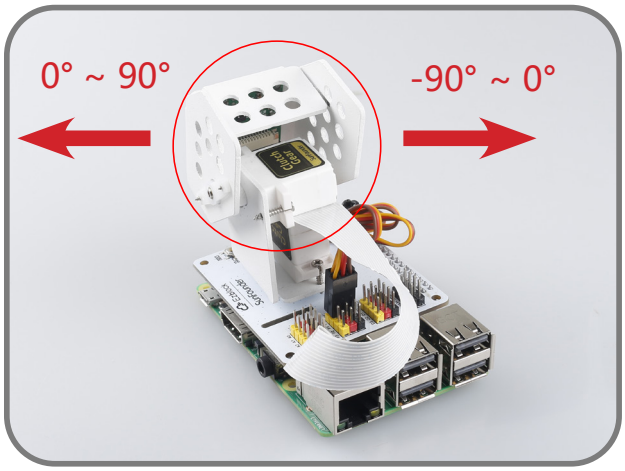
You can use this block to choose the detected color. Only one color can be detected for each detection.

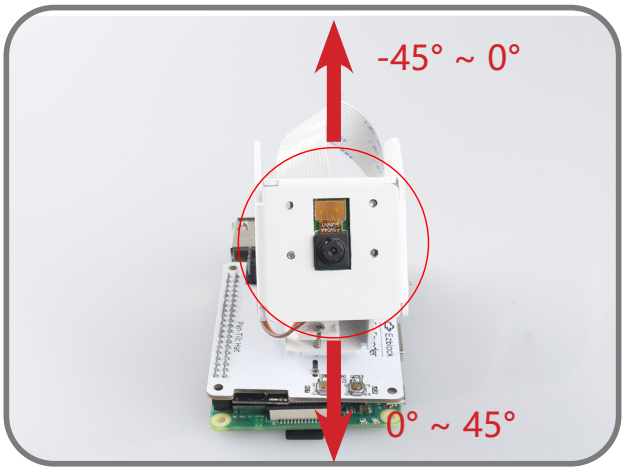
EXAMPLE





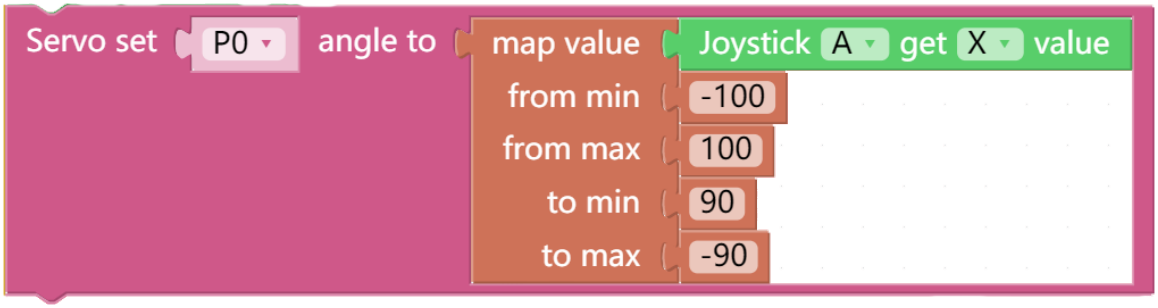
The angle ranges of Pan servo and Tilt servo are shown as below.

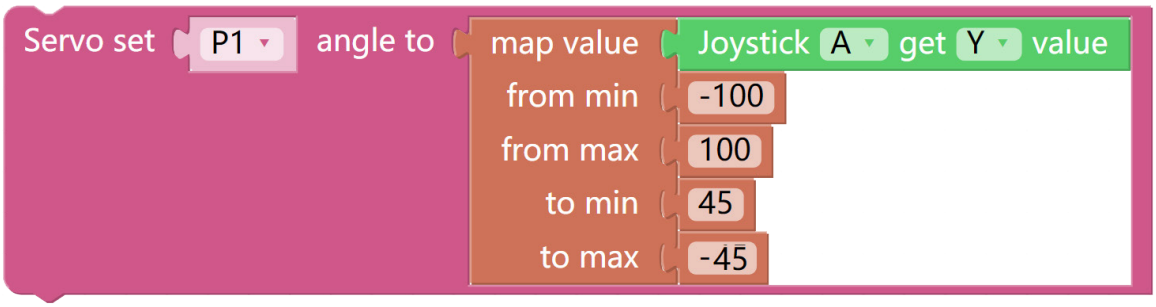




For Example: If you want Pan servo turn 25° to the right, just type in -25 in Servo set P0 angle to block; to turn down 45° , please type in 25 in Servo set P1 angle to block.

In this example, use the Joystick to control the angle of Pan and Tilt servo. But the rangle of Joystick is -100~100, here use the map block to map -100~100 to 90~-90 or 45~-45.





Take a Photo

Pan-Tilt HAT can take a photo. We use button to simulate a shutter, and once you press it, you can get a photo.

TIPS

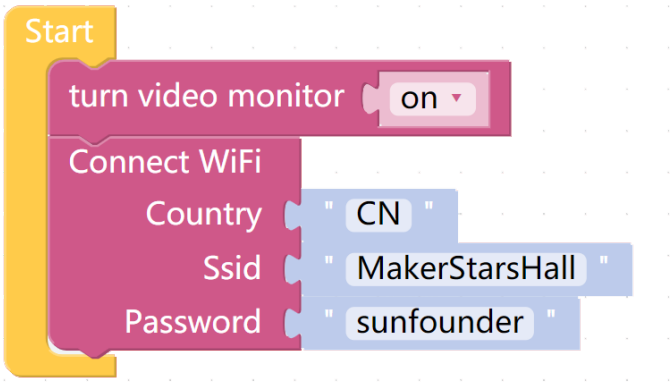
click the icon, and drag a Button to the central area.

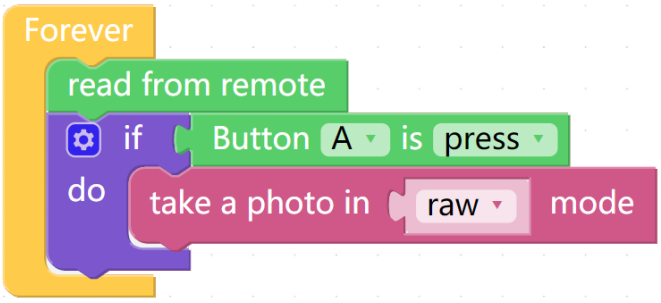
Judge if the button is pressed.

Use this block to take a photo. In the drop-down menu, choose raw or opencv.

Before you choose opencv, enable at least one kind of detection (color/face/ gesture/traffic sign detection). During your shooting, the information of detected objects appears with a frame; for example, if the color detection (red) is enabled, on the photo, the red area will be marked with a frame and the information "red" will be indicated.

EXAMPLE





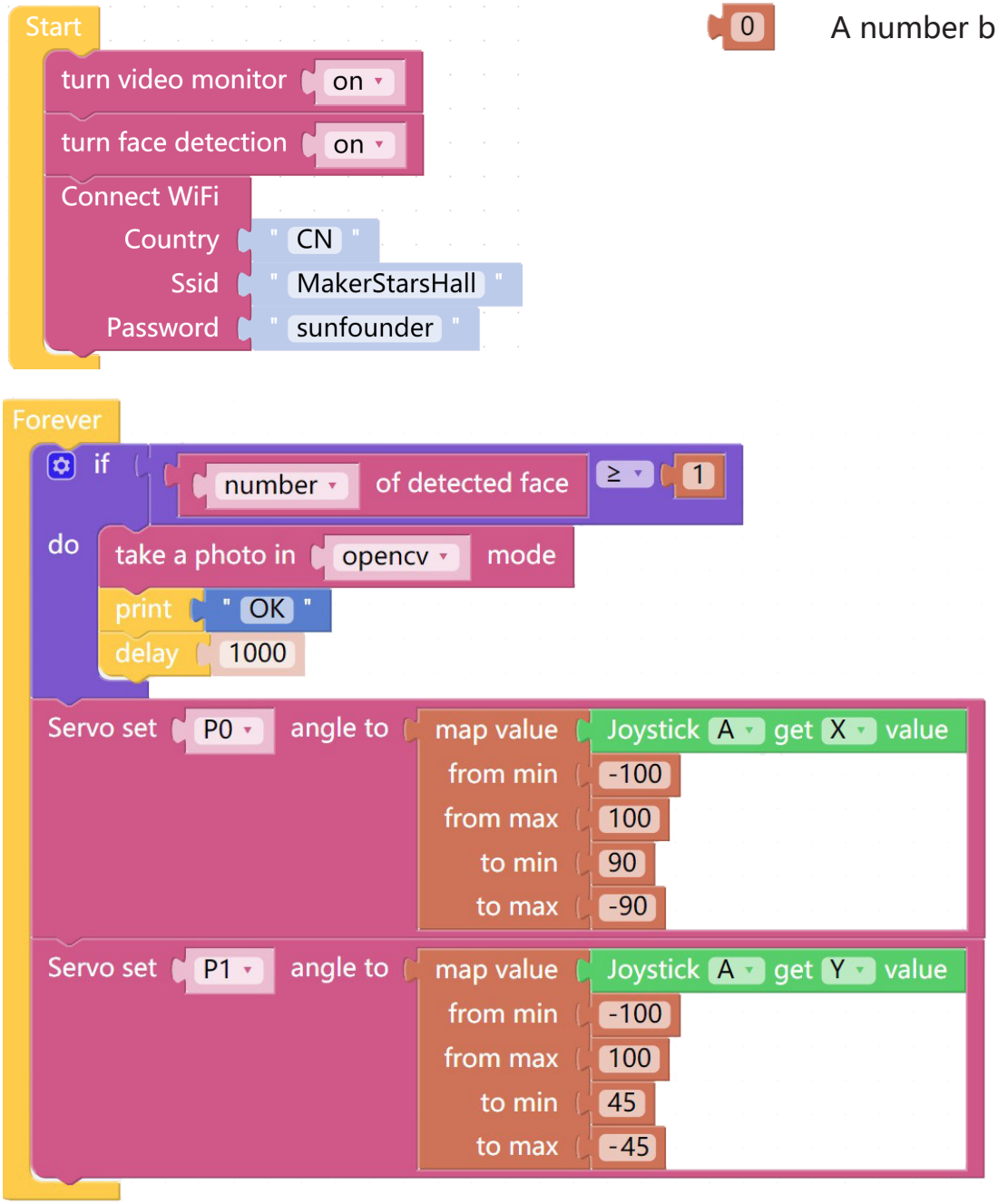
Advanced Project

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

Say Cheese

Let's try to implement a simple project with Pan-Tilt HAT: remotely control Pan-Tilt HAT's movement. When Pan-Tilt HAT sees people, it will take a photo then print "OK".

EXAMPLE



TIPS

A number block.

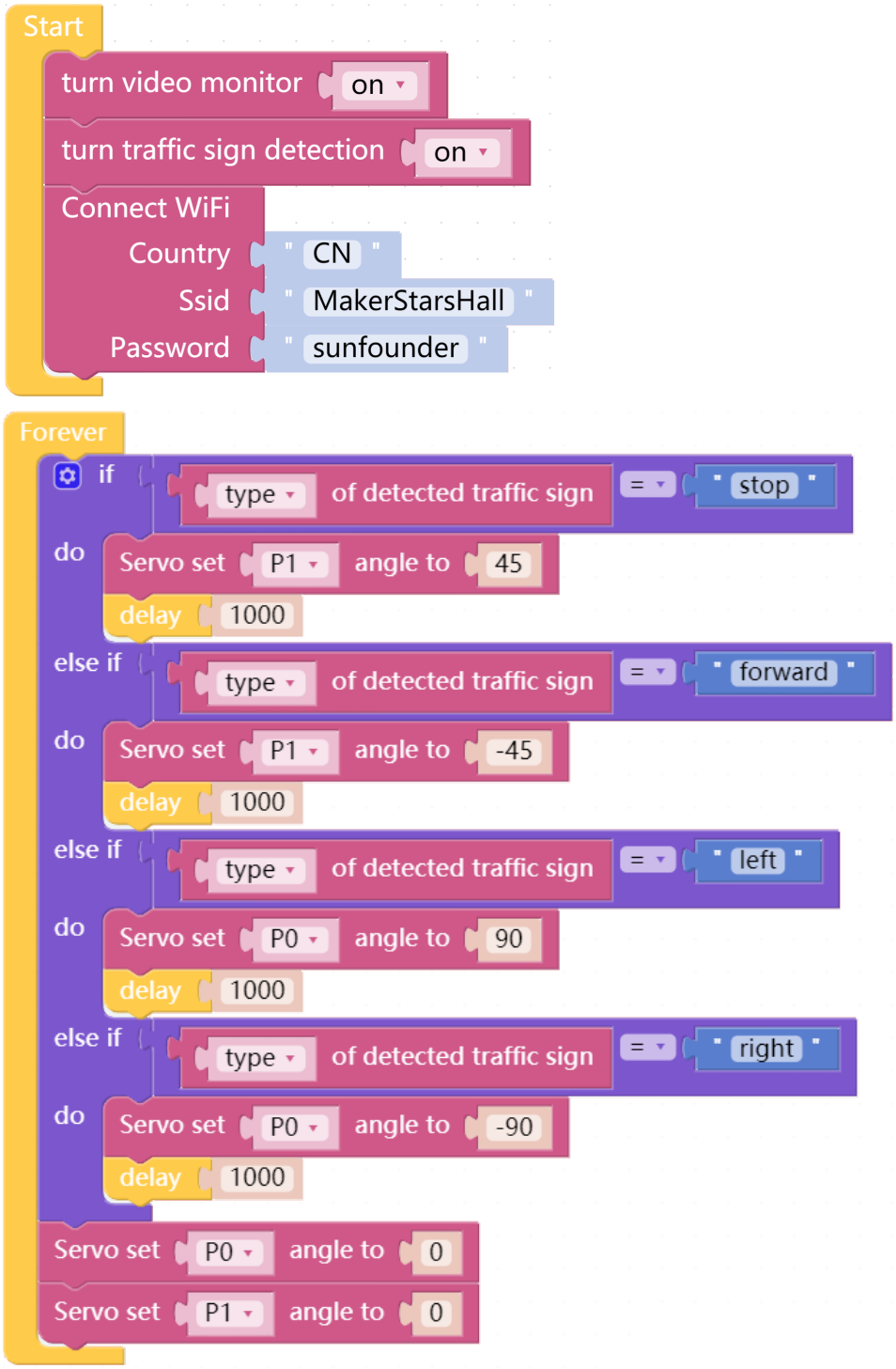
Get Order

Now Pan-Tilt HAT gets orders from traffic signs. when getting order "left", it turns left.

TIPS

You can detect the traffic signs through this block, modify the drop-down menu options, and choose to read the coordinates, size, type or accuracy of the detected traffic signs.

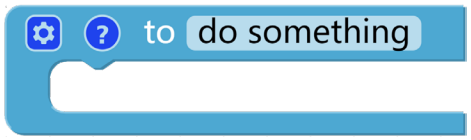
EXAMPLE



Play Rock-Paper-Scissor

Let's play Rock-Paper-Scissor with Pan-Tilt HAT. Pan-Tilt HAT can judge who is the winner according to your gestures and print the result.

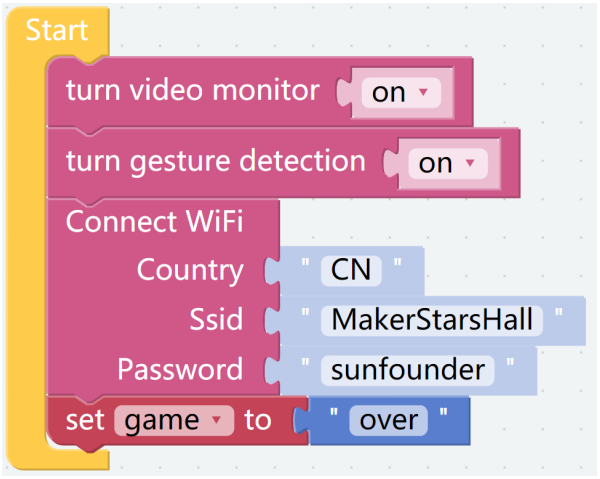
TIPS

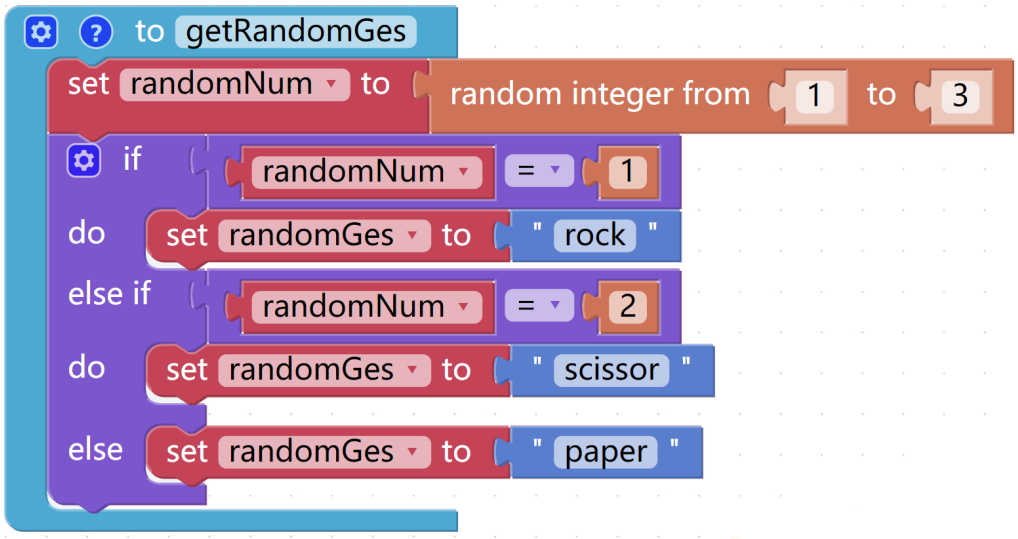


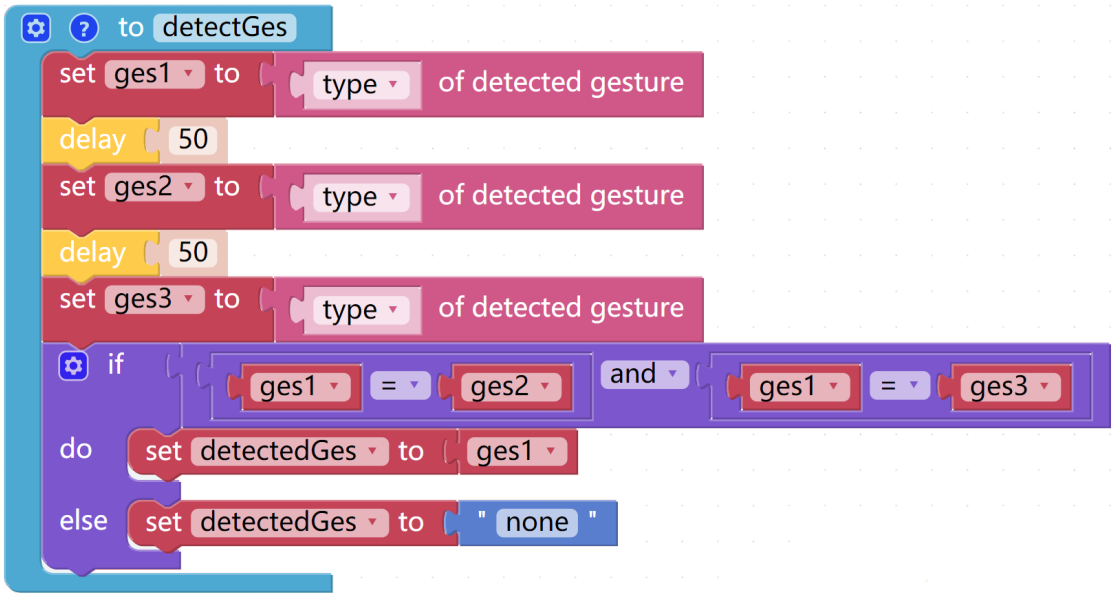
You may want to simplify the program with Functions, especially when you perform the same operation multiple times. Putting these operations into a newly declared function can greatly facilitate your use.

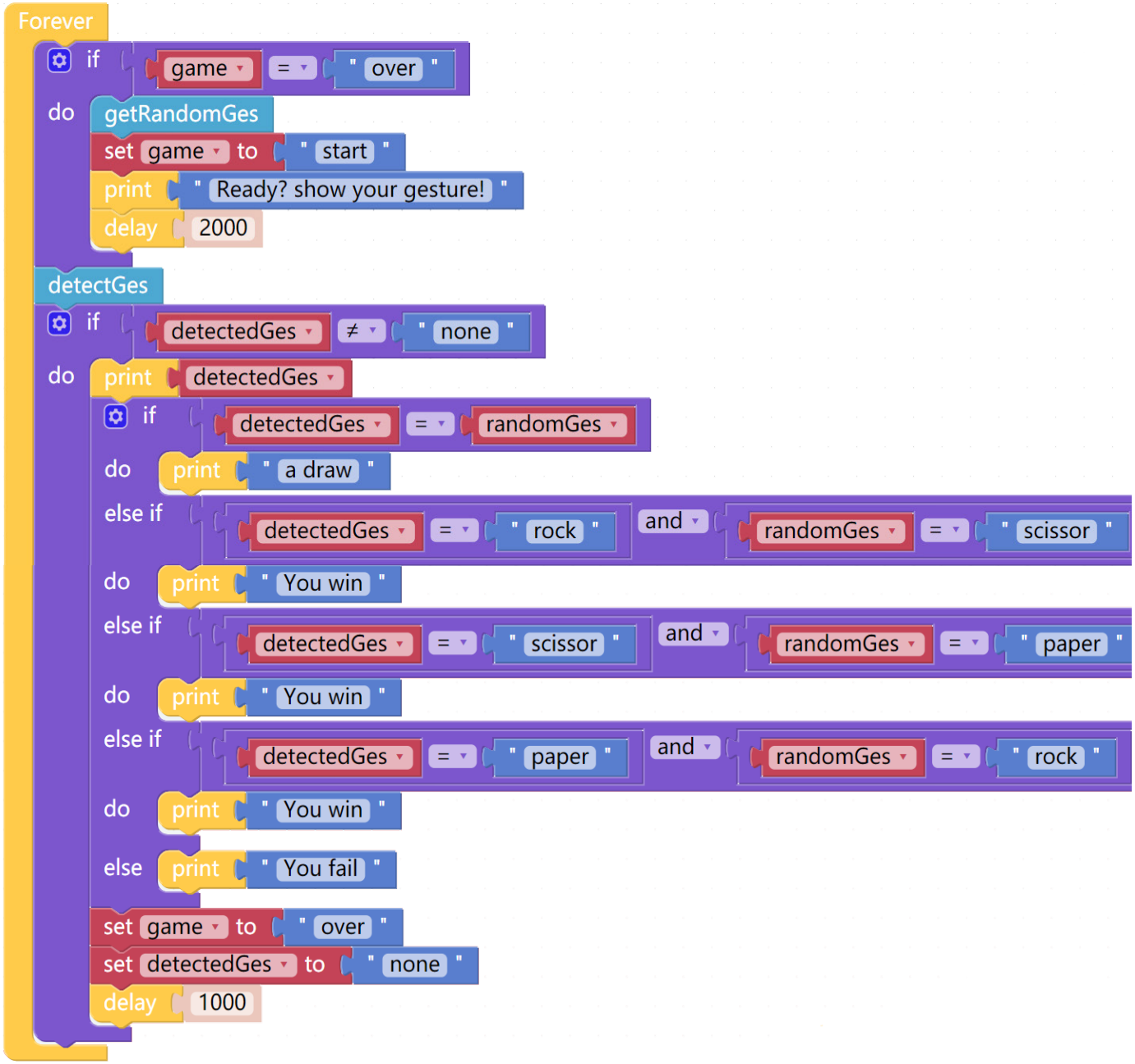
This block produces a random integer in a certain range and you can modify the upper and lower limits.

EXAMPLE






to detectGes
set ges1 to type of detected gesture
delay 50
set ges2 to type of detected gesture
delay 50
set ges3 to type of detected gesture
if ges1 = ges2 and ges1 = ges3
do set detectedGes to ges1
else set detectedGes to " none "


Forever
if game = " over "
do getRandomGes
set game to " start "
print " Ready? show your gesture! "
delay 2000
detectGes
if detectedGes ≠ " none "
do print detectedGes
if detectedGes = randomGes
do print " a draw "
else if detectedGes = " rock " and randomGes = " scissor "
do print " You win "
else if detectedGes = " scissor " and randomGes = " paper "
do print " You win "
else if detectedGes = " paper " and randomGes = " rock "
do print " You win "
else print " You fail "
set game to " over "
set detectedGes to " none "
delay 1000

Color Tracking

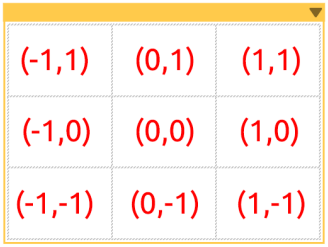
Prepare a small red ball and place it directly in front of the camera of Pan-Tilt HAT. The camera can consistently track the ball. This project may be little harder than the previous projects.

TIPS

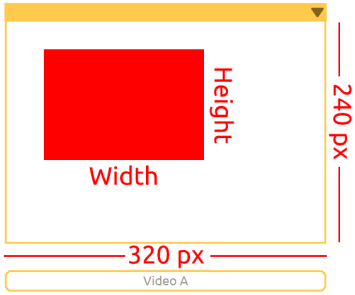
Mathematical operation block can perform " + , - , x , ÷ ".

This block is often used together with variables to limit their ranges.

You can get the information of detected color through this block. Modify the drop-down menu options, and choose to read the coordinates, size or number.



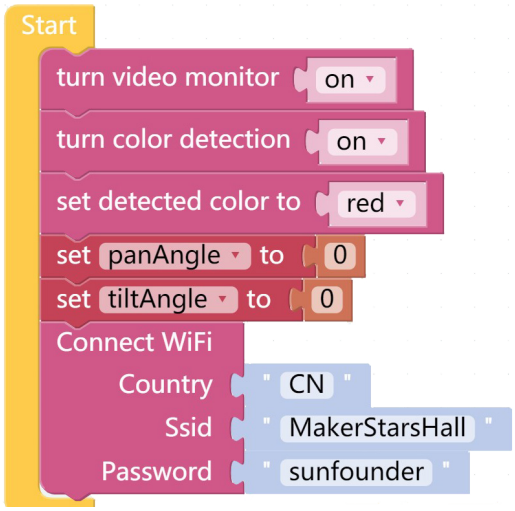
The "object detection" can output the detected co-ordinate value (x, y) based on the center point of the graphic. The screen is divided into a 3x3 grid, as shown on the left.

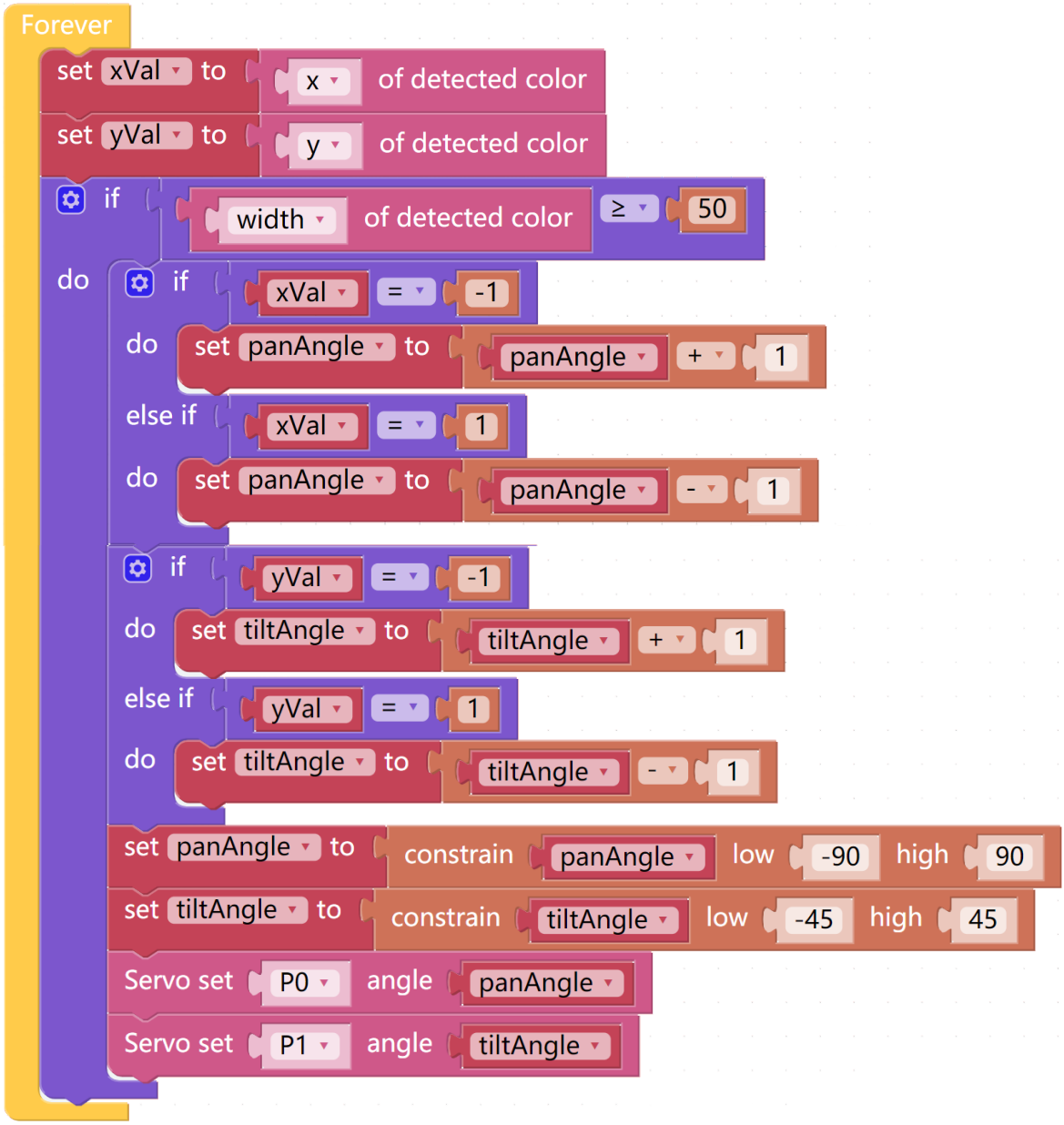


The "object detection" can detect the size (Width & Height) of the graphic.

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

EXAMPLE




Forever
set xVal to x of detected color
set yVal to y of detected color
if width of detected color ≥ 50
do if xVal = -1
do set panAngle to panAngle + 1
else if xVal = 1
do set panAngle to panAngle - 1
if yVal = -1
do set tiltAngle to tiltAngle + 1
else if yVal = 1
do set tiltAngle to tiltAngle - 1
set panAngle to constrain panAngle low -90 high 90
set tiltAngle to constrain tiltAngle low -45 high 45
Servo set P0 angle panAngle
Servo set P1 angle tiltAngle

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.

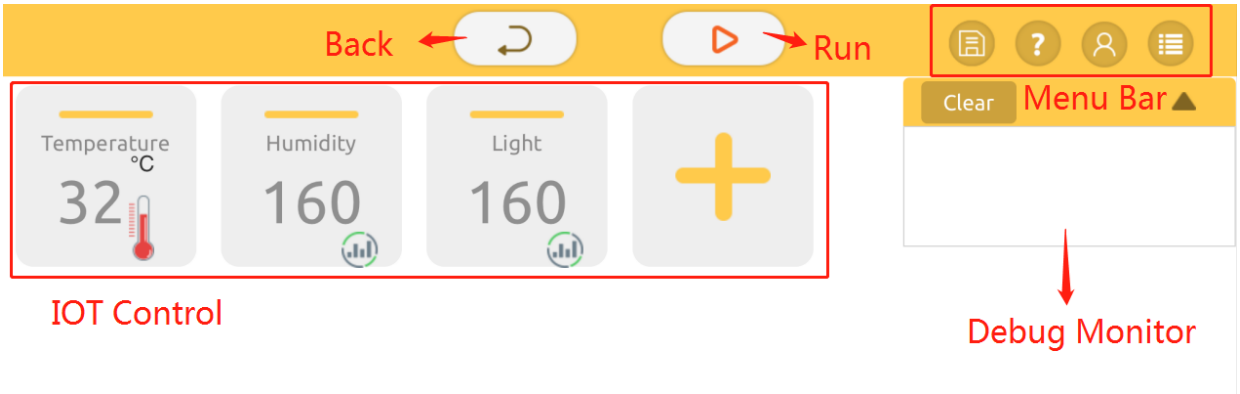
3. **Simulation Page:** Click this icon, you can access the Simulation Page and program by adding some simulation blocks. From the kit of Sloth, you may use the ultra-sonic sensor module.

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.

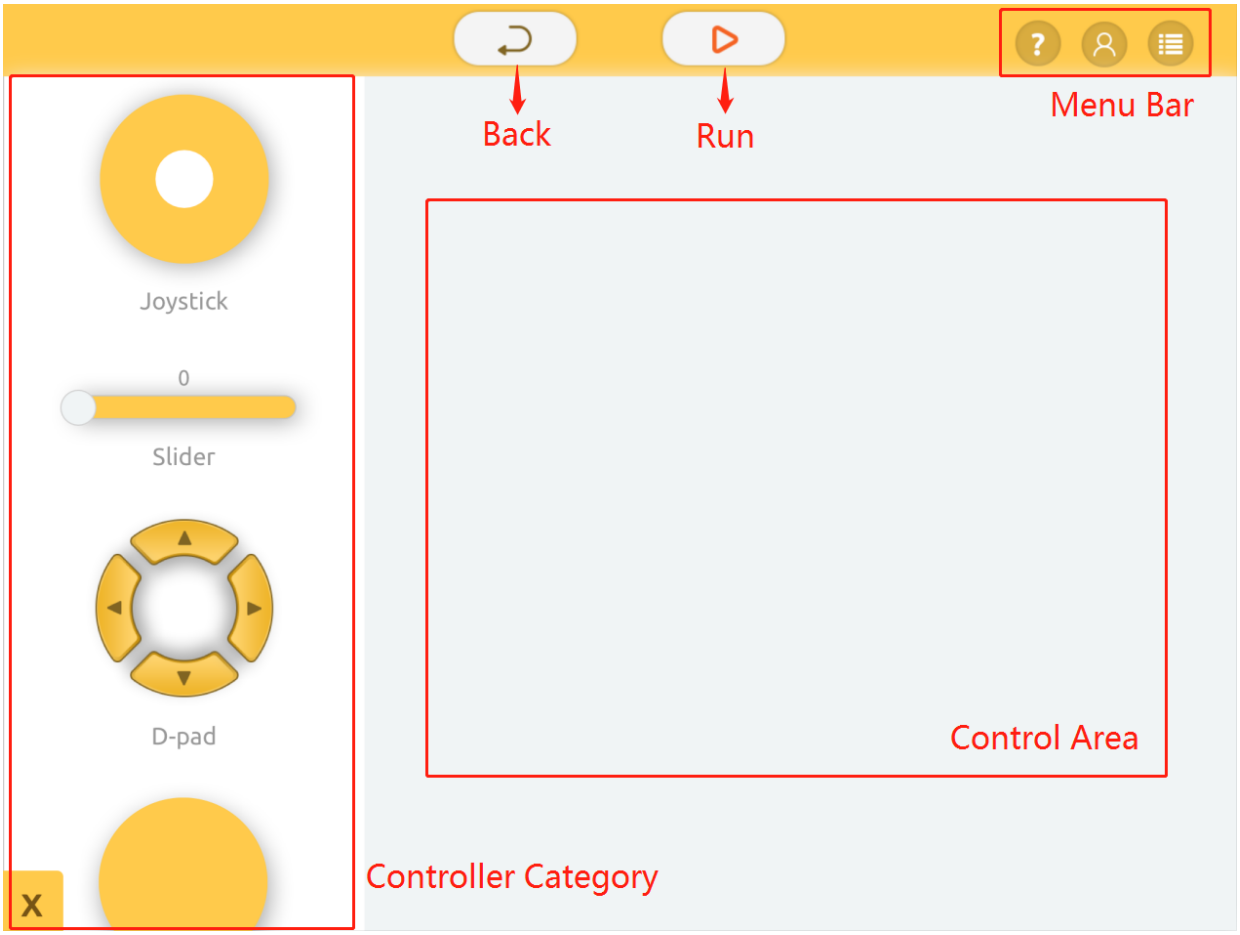
IoT Control Page

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

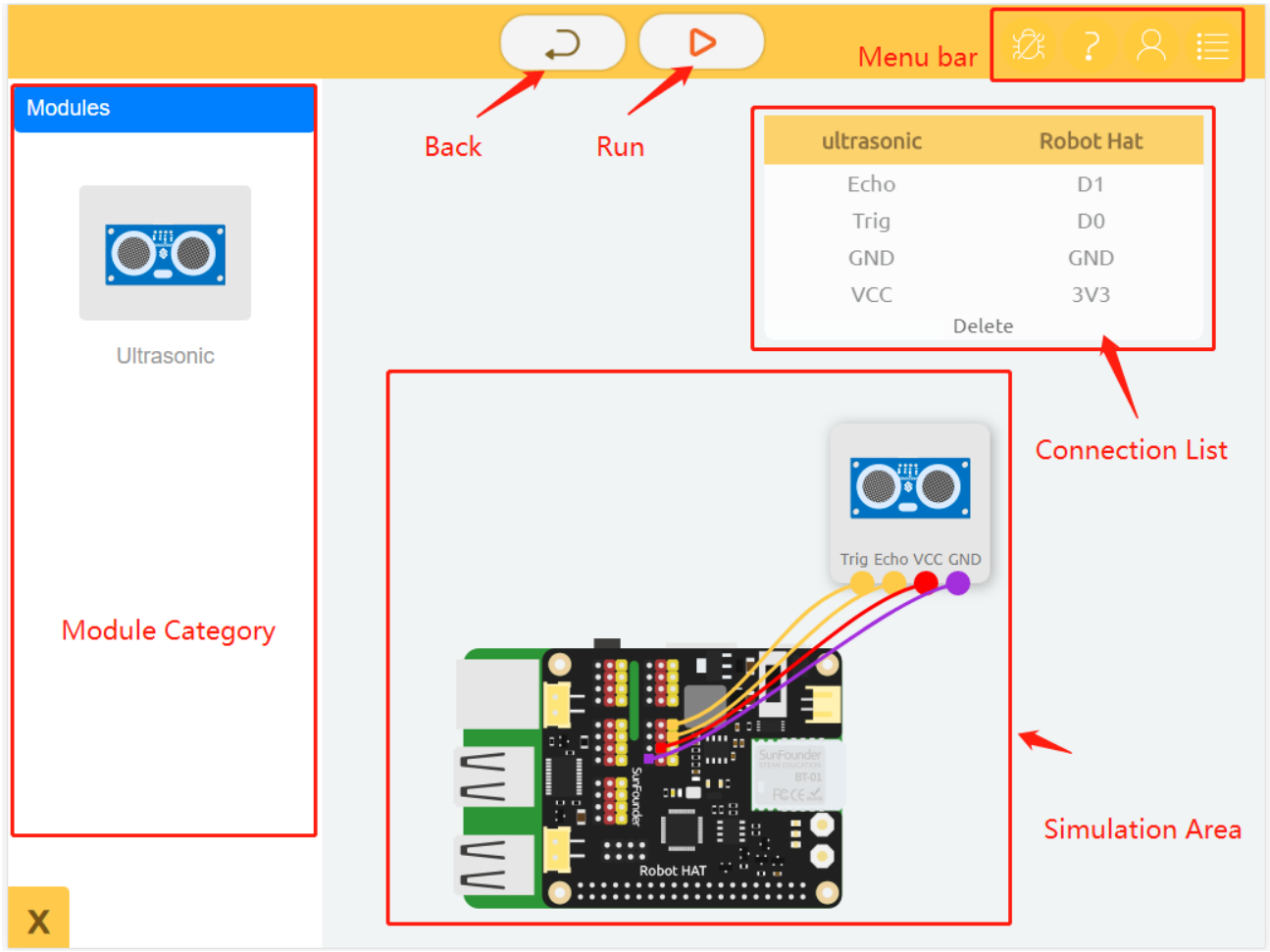
In some projects, we control the components by the remote controller on the Ezblock Studio. Create some virtual control components to the right area in order to add something to the project.



Simulation Page

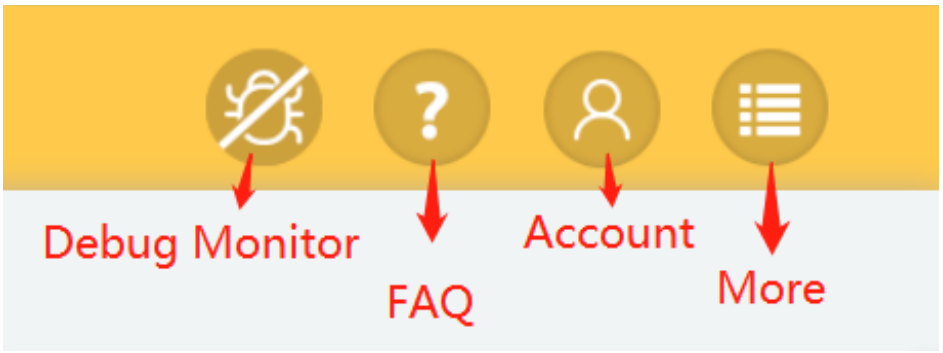
In some projects, we need some external equipment to get some certain effects, such as applying ultrasonic sensor module to detect the distance.

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



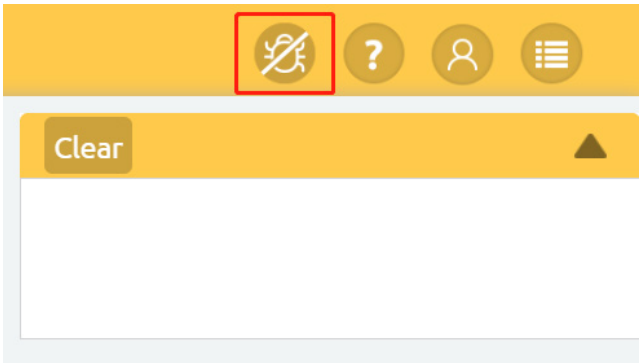
Menu Bar

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



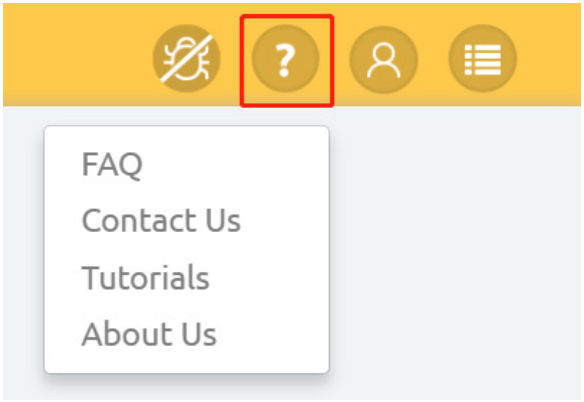
Debug Monitor

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



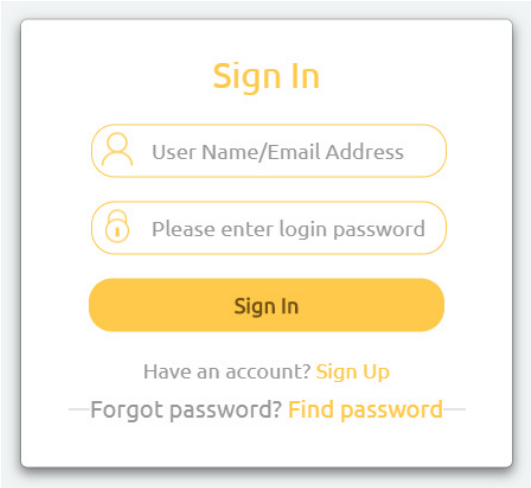
FAQ

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



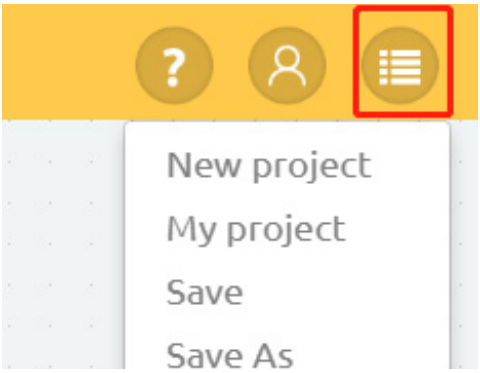
Account

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

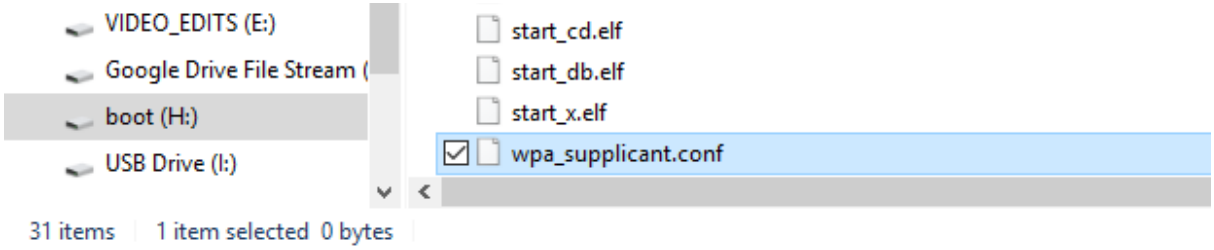
This chapter is used to set up Raspberry Pi, from configure the Raspberry Pi environment to download the sample python code of Pan-Tilt HAT.

Note: First, you must burn the Ezblock system. If you use the Raspian system, the sample python we provide 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
}
```

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.

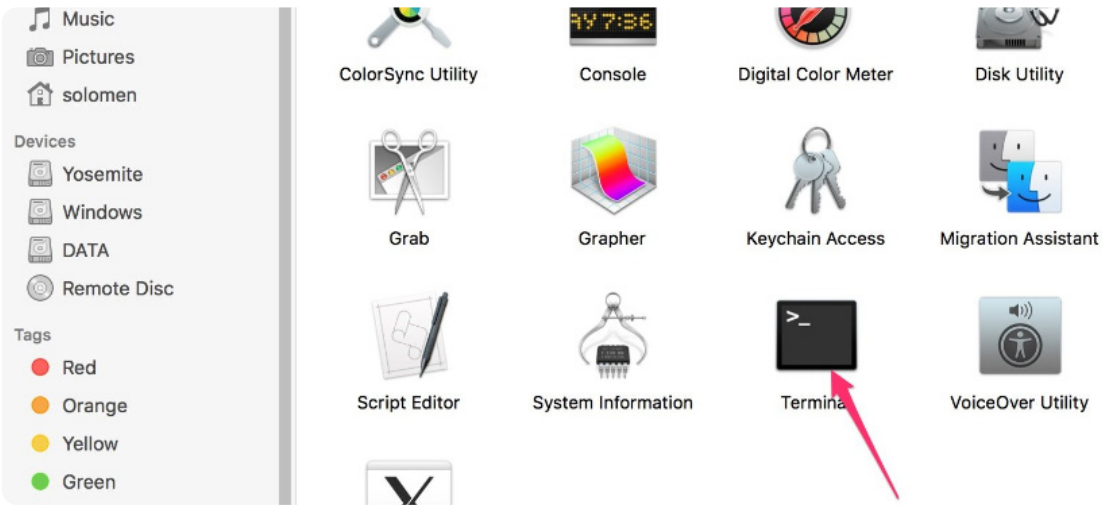
Scan the IP range set, and the name of all connected devices will be displayed. Similarly, the default hostname of the Raspbian system is raspberrypi, now you need to find the hostname.

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

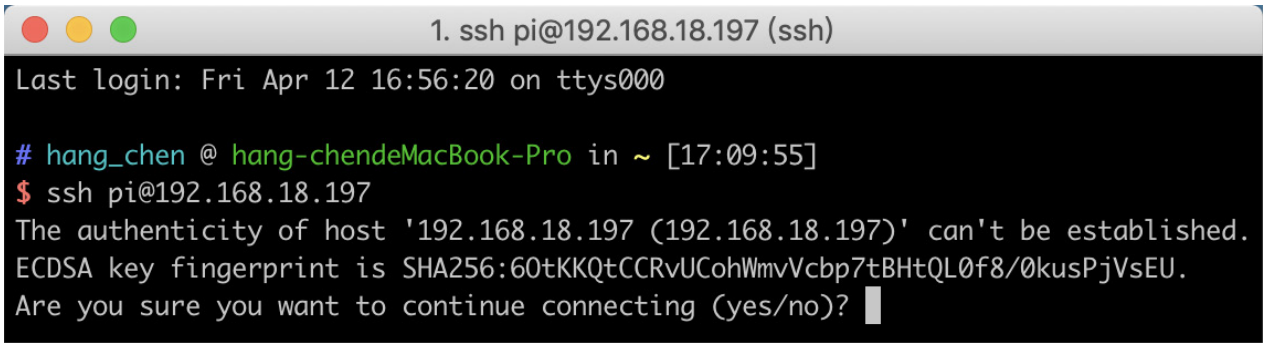
1. Go to Applications->Utilities, find the Terminal, and open it.



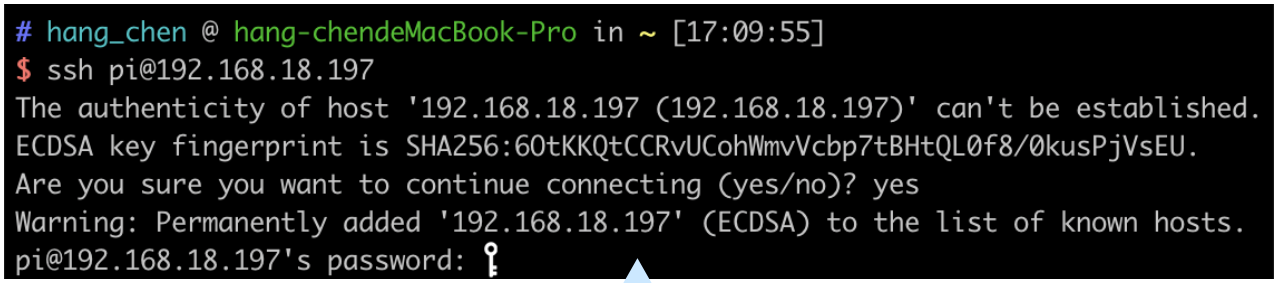
2. Type in ssh pi@ip_address. “pi” is your username and “ip_address” is your IP address. For example:

```
ssh pi@192.168.18.197
```

3. Input “yes”.

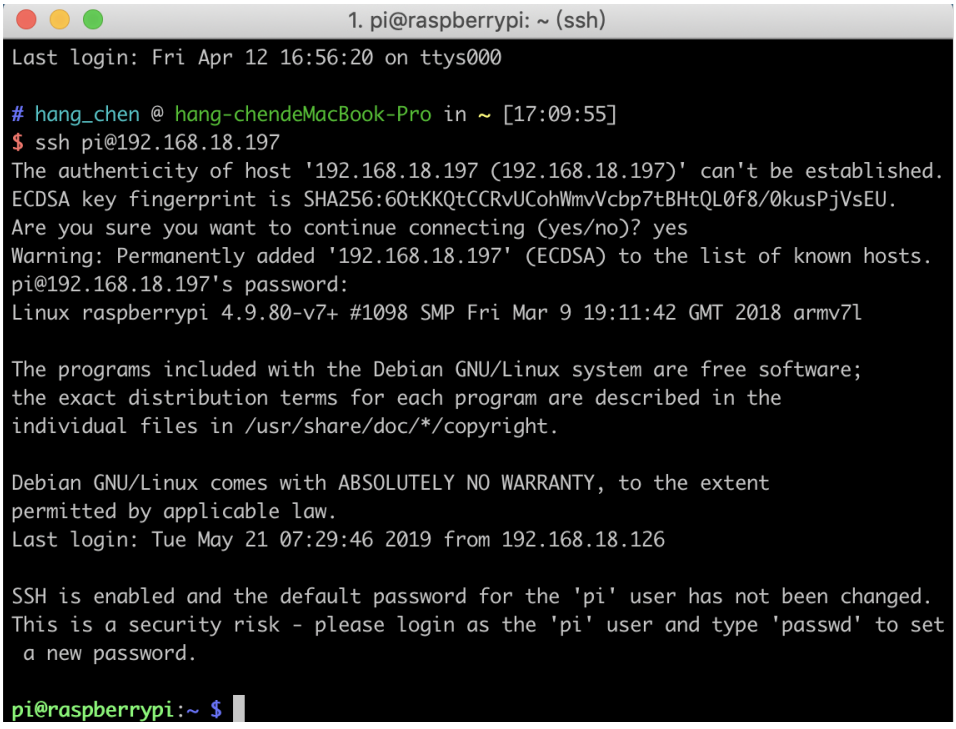


4. Input the passcode and the default password is “raspberry”.



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.

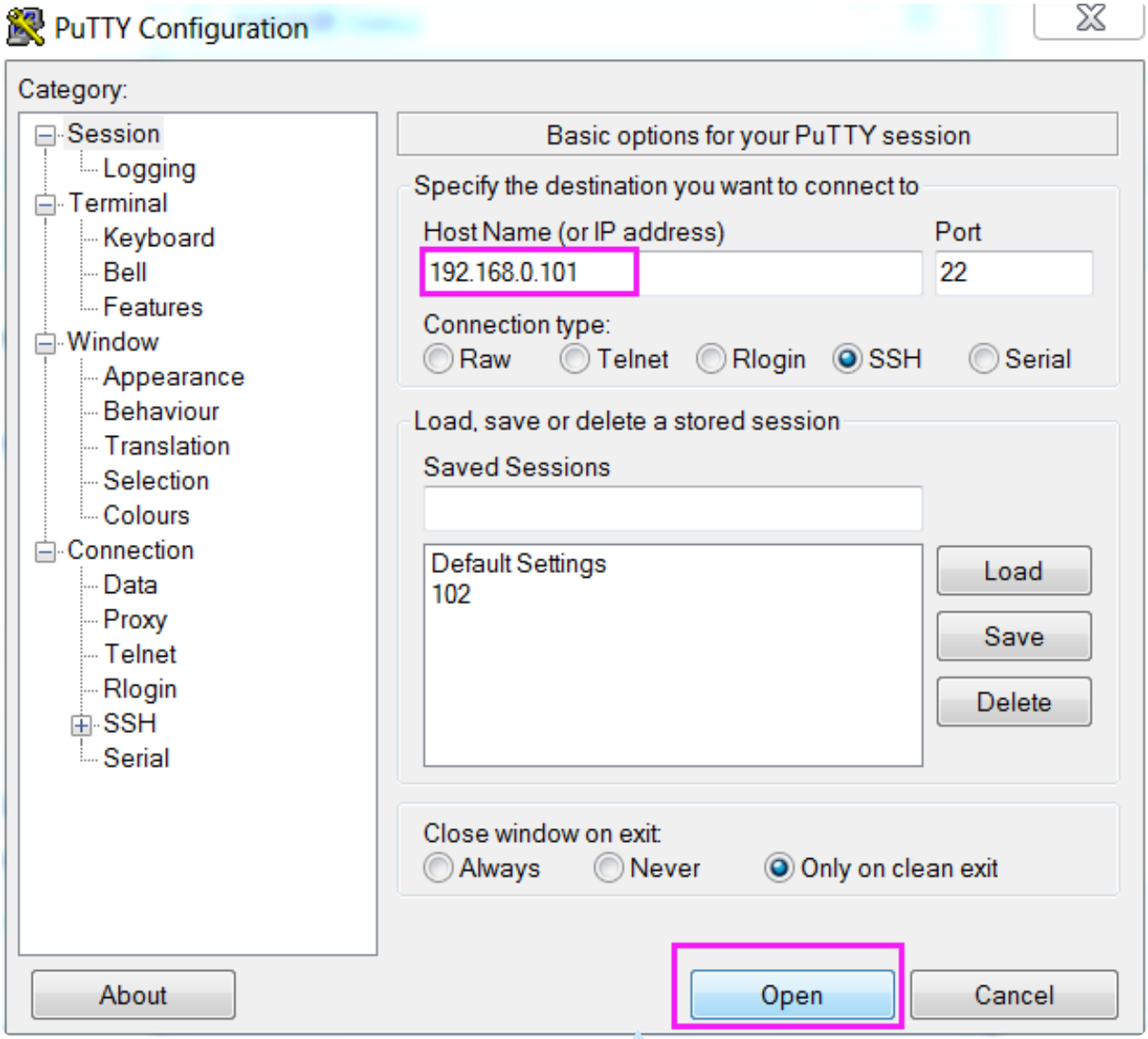


★ For Windows Users

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

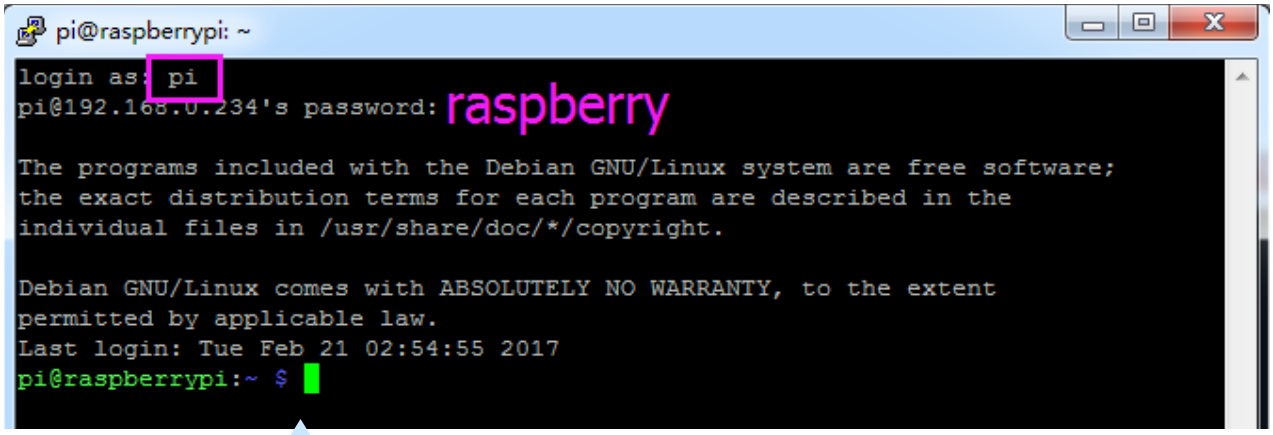
1) Download PuTTY.

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.



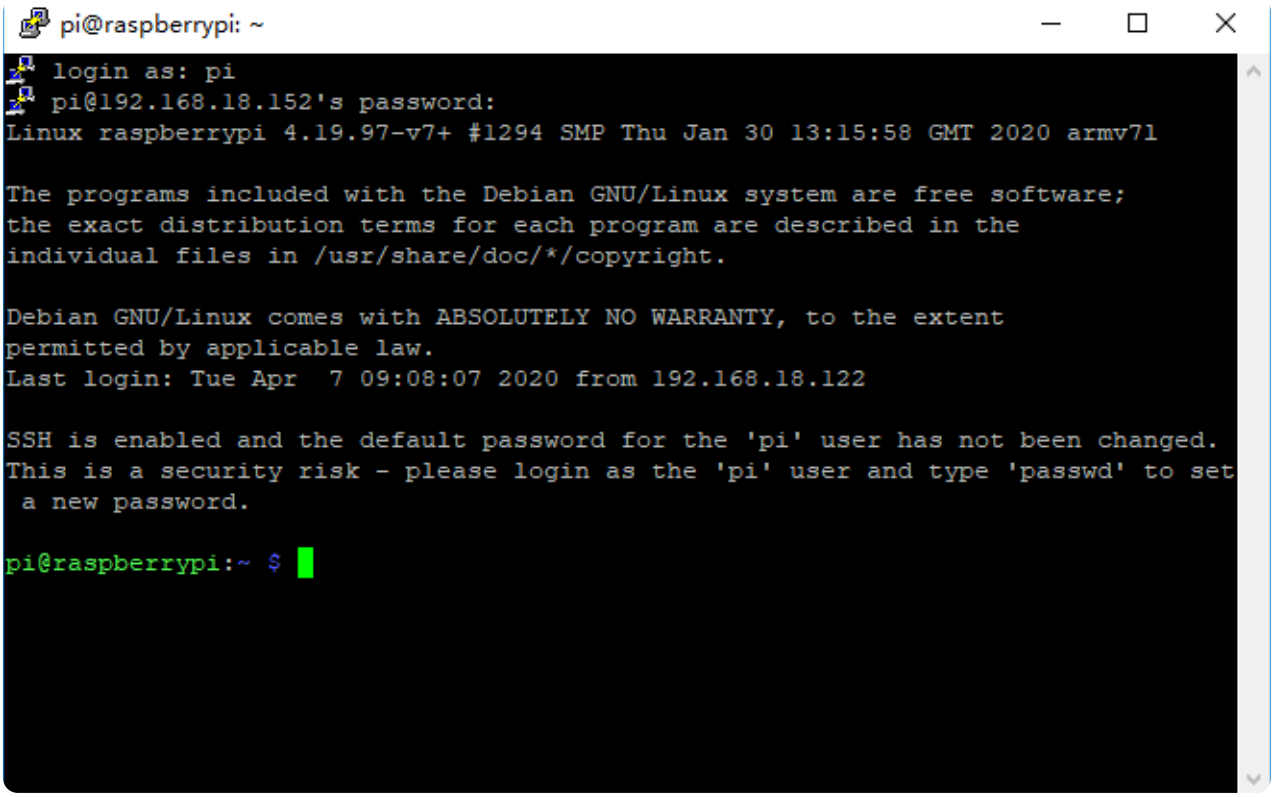
When you first log in to the Raspberry Pi with the IP address, there prompts a security reminder. Just click Yes.

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/pan-tilt-hat
```

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 Pan-Tilt HAT: **python code control**.

Input the command to open the **examples** folder, and you will see there are 9 python codes.

```
cd /home/pi/pan-tilt-hat/examples
```

You can run the python codes by the following command:

```
sudo python3 1.traffic_sign_detection.py
```

Before you run any examples, you need to open the file by the following command and change the "MakerStarsHall" and "sunfounder" into your WLAN on the WiFi(). write() function.

```
sudo nano 1.traffic_sign_detection.py
```

As the program is running, on the browser, type in **192.168.18.152:9000/mjpg**, then you can enter the interface to view the video.

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.

Press "Ctrl + C" to stop running python codes.

★ 1.traffic_sign_detection.py

Pan-Tilt HAT is a 2-axis Pan-Tilt kit with traffic sign detection. Its camera can detect "stop", "forward", "left", "right" and mark them with boxes.

★ 2.face_detection.py

Pan-Tilt HAT 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).

★ 3.gesture_calibration.py

Gesture detection is easily influenced by environmental factors, so we need first to calibrate gestures then enable gesture detection.

Run the python code, please wait the tips of print and check the video, at the center of which exists a white square. Now, reach out your palm and keep it at the center of the square till the square disappears. Then stop running python code, and the calibration done. You have 15 seconds to finish calibration and save the calibrating results gotten before the disappearance of square.

Note: When calibrating gestures, avoid your camera being directly radiated by light.

★ 4.gesture_detection.py

Finished the gesture calibration, we start to use the gesture detection of Pan-Tilt HAT. The detectable gestures can be rock, scissor, paper.

After running the code, the camera detects then selects the gesture with a box and prints the gesture type (other options: x, y, accuracy, height, width).

Note:

1. The environmental difference between calibration and detection cannot be too large, otherwise you need to retry your calibration.
2. Avoid putting other things in the same color as the palm (ex. arm or neck) on the camera interface for your precise detection.

★ 5.color_detection.py

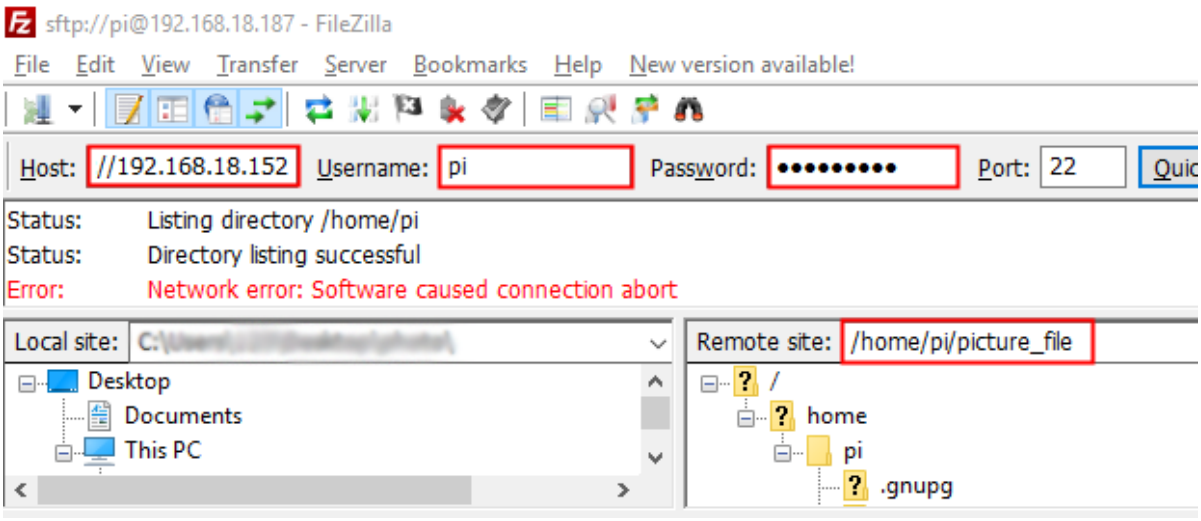
Pan-Tilt HAT has color detection. Here we set the detected color as red in codes (other options: orange, yellow, green, blue, purple), and the camera will detect then select with a box.

★ 6.say_cheese.py

Let's get the Pan-Tilt HAT to take a photo. Without a shutter, the automatic shooting is enabled once the camera detects your face. Then it will take a photo and print "OK". You can download the taken photos from this path /home/pi/picture_file/ via FTP.

1) Download a FileZilla and run it.

2) **Enter Host**: 192.168.18.152, **Usename**: pi, **Password**: raspberry, **Port**: 22 and click Quickconnect. Download photos from /home/pi/picture_file/.



★ 7.get_order.py

Now Pan-Tilt HAT gets orders from traffic signs. when getting order "left", it turns left.

★ 8.play_rock_paper_scissor.py

Play rock paper scissors with Pan-Tilt HAT. It can detect and print your gestures and tell you the game results.

★ 9.color_tracking.py

Get a red ball and place it in front of the camera of Pan-Tilt HAT. When you move the ball, the pan-tilt moves as well.

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