SunFounder pisloth

www.sunfounder.com

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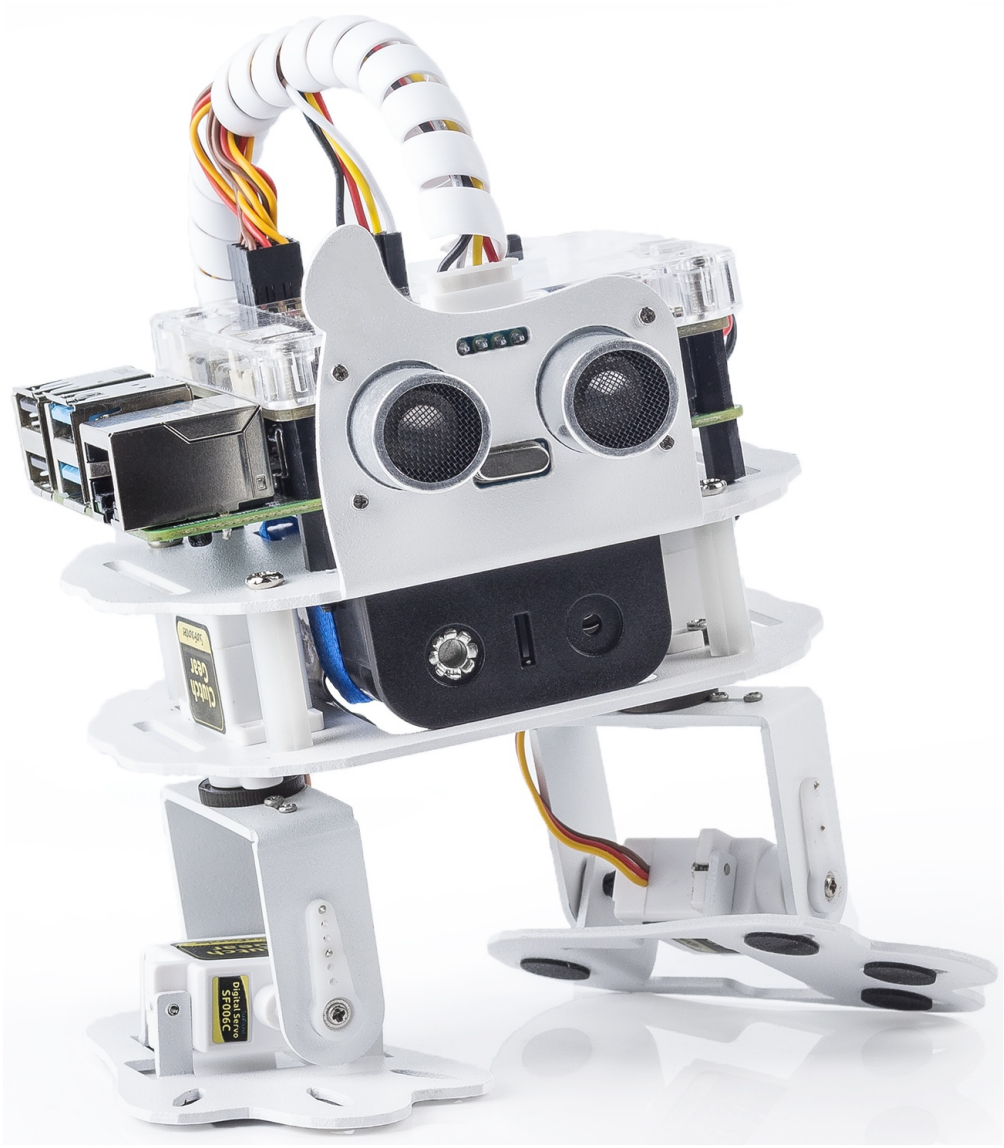
CONTENTS

Thanks for choosing our PiSloth.



PiSloth is a Raspberry Pi Bionic robot with an aluminum alloy structure. It can talk, dance, and even express emotions, such as happiness and excitement.

It has 22 different actions, such as: Stomp, Swing and MoonWalk, and you can customize the actions according to your needs. PiSloth's eyes consist of an ultrasonic sensor module that can be used to detect distance for obstacle avoidance and following functions.

In this tutorial, a list and assembly pdf, introduction to Robot HAT, and programming of PiSloth are included.

The programming part is divided into two chapters: *Play with Ezblock* & *Play with Python*, and each of them can get you stated on making PiSloth work in way you want.

EzBlock Studio is a development platform developed by SunFounder designed for beginners to lower the barriers to getting started with Raspberry Pi. It has two programming languages: Graphical and Python, and available on almost all different types of devices. With Bluetooth and Wi-Fi support, you can download code, remote control a Raspberry Pi, on Ezblock Studio.

More experienced makers can use the popular programming language - Python.

Content

CHAPTER

ONE

COMPONENT LIST AND ASSEMBLY INSTRUCTIONS

You need to check whether there are missing or damaged components according to the list first. If there are any problems, please contact us and we will solve them as soon as possible.

Please follow the steps on the PDF to assemble.

Note:

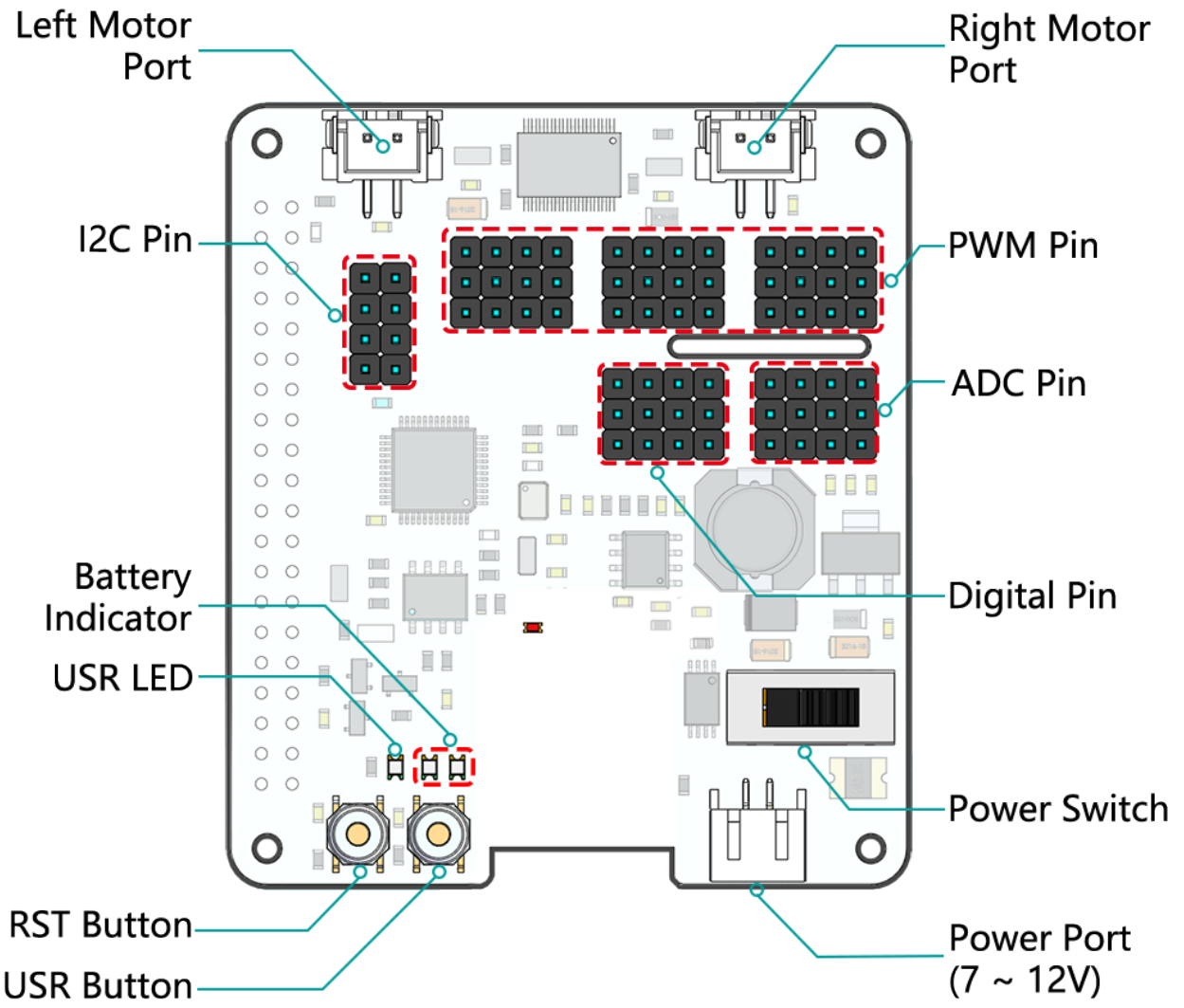
1. Before assembling, you need to buy 2 18650 batteries and fully charge them, refer to *About the Battery*.
2. Robot HAT cannot charge the battery, so you need to buy a battery charger at the same time.

- `Component List and Assembly Instructions`.

CHAPTER

TWO

ABOUT ROBOT HAT



Robot HAT is a multifunctional expansion board that allows Raspberry Pi to be quickly turned into a robot. An MCU is on board to extend the PWM output and ADC input for the Raspberry Pi, as well as a motor driver chip, Bluetooth module, I2S audio module and mono speaker. As well as the GPIOs that lead out of the Raspberry Pi itself.

It also comes with a Speaker, which can be used to play background music, sound effects and implement TTS functions to make your project more interesting.

Accepts 7-12V PH2.0 2pin power input with 2 power indicators. The board also has a user available LED and a button for you to quickly test some effects.

Note: You can see more details in the Robot HAT Documentation.

CHAPTER

THREE

PLAY WITH EZBLOCK

For beginners and novices, **EzBlock** is a software development platform offered by SunFounder for Raspberry Pi. Ezbock offers two programming environments: a graphical environment and a Python environment.

It is available for almost all types of devices, including Mac, PC, and Android.

Here is a tutorial to help you complete EzBlock installation, download, and use.

3.1 Quick Guide on EzBlock

There are 2 parts here:

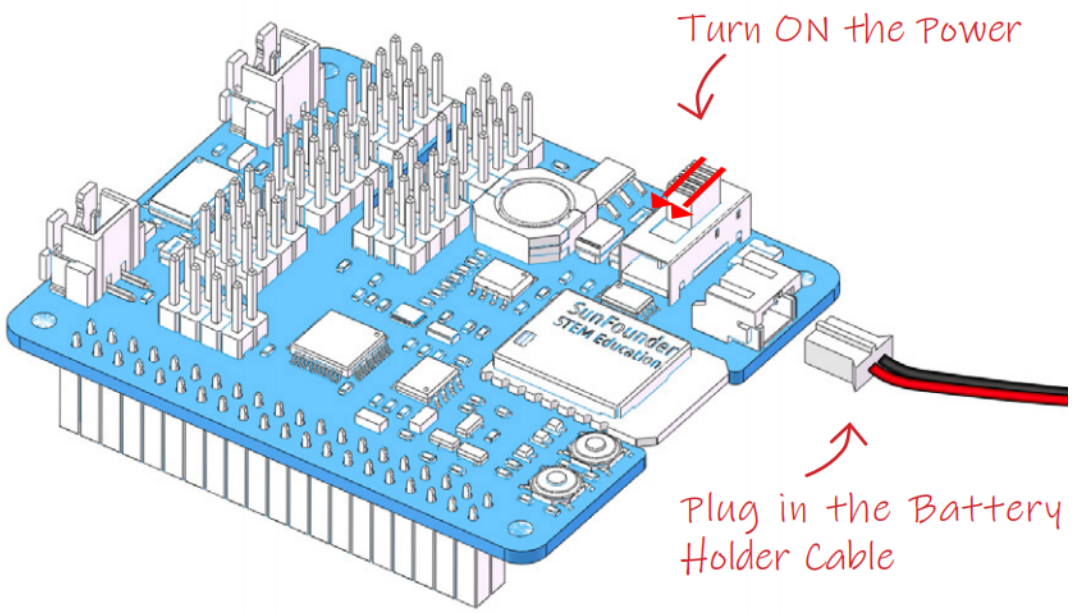
- *Servo Adjust* allows you to keep all the servos at 0 degrees to complete a proper and safe assembly (otherwise you will probably damage the servos).
- *Install and Configure EzBlock Studio* will guide you to download EzBlock Studio to play with your robot.

3.1.1 Servo Adjust

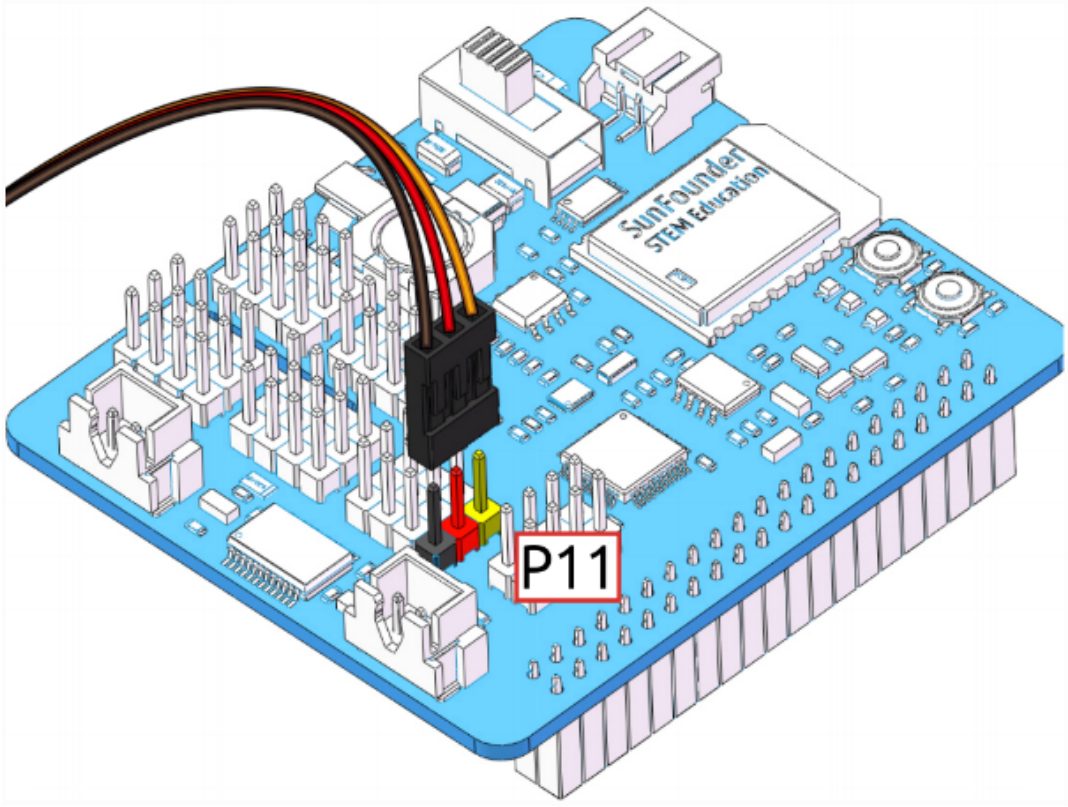
When assembling to the part with the servo, you need to keep the servo at 0° and secure it with the servo screw. Please follow the tutorial below to do this.

1. Firstly, Install EzBlock OS onto a Micro SD card, once the installation is complete, insert it into the Raspberry Pi.
2. To ensure that the servo has been properly set to 0°, first insert the rocker arm into the servo shaft and then gently rotate the rocker arm to a different angle.

3. Follow the instructions on the assembly foldout, insert the battery holder cable and turn the power switch to the ON. Wait for 1-2 minutes, there will be a sound to indicate that the Raspberry Pi boots successfully.



4. Next, plug the servo cable into the P11 port as follows.



5. At this point you will see the servo arm rotate to a specific position (0°). If the servo arm does not return to 0°, press the RST button to restart the Robot HAT.
6. Now you can continue the installation as instructed on the assembly foldout.

Note:

- Do not unplug this servo cable before fastening this servo with the servo screw, you can unplug it after fastening.
- Do not turn the servo while it is powered on to avoid damage; if the servo shaft is inserted at the wrong angle, pull out the servo and reinsert it.
- Before assembling each servo, you need to plug the servo cable into P11 and turn on the power to set its angle to 0°.
- This zeroing function will be disabled if you download a program to the robot later with the EzBlock APP.

3.1.2 Install and Configure EzBlock Studio

As soon as the robot is assembled, you will need to carry out some basic operations.

- Install EzBlock Studio: Download and install EzBlock Studio on your device or use the web-based version.
- Connect the Product and EzBlock: Configure Wi-Fi, Bluetooth and calibrate before use.
- Open and Run Examples: View or run the related example directly.

Note: After you connect the PiSloth, there will be a calibration step. This is because of possible deviations in the installation process or limitations of the servos themselves, making some servo angles slightly tilted, so you can calibrate

them in this step.

But if you think the assembly is perfect and no calibration is needed, you can also skip this step.

Projects

Here, we show you the projects of playing PiSloth on EzBlock Studio. If you are new to these, you can refer to the code images inside each project to program, and can learn the use of blocks according to TIPS.

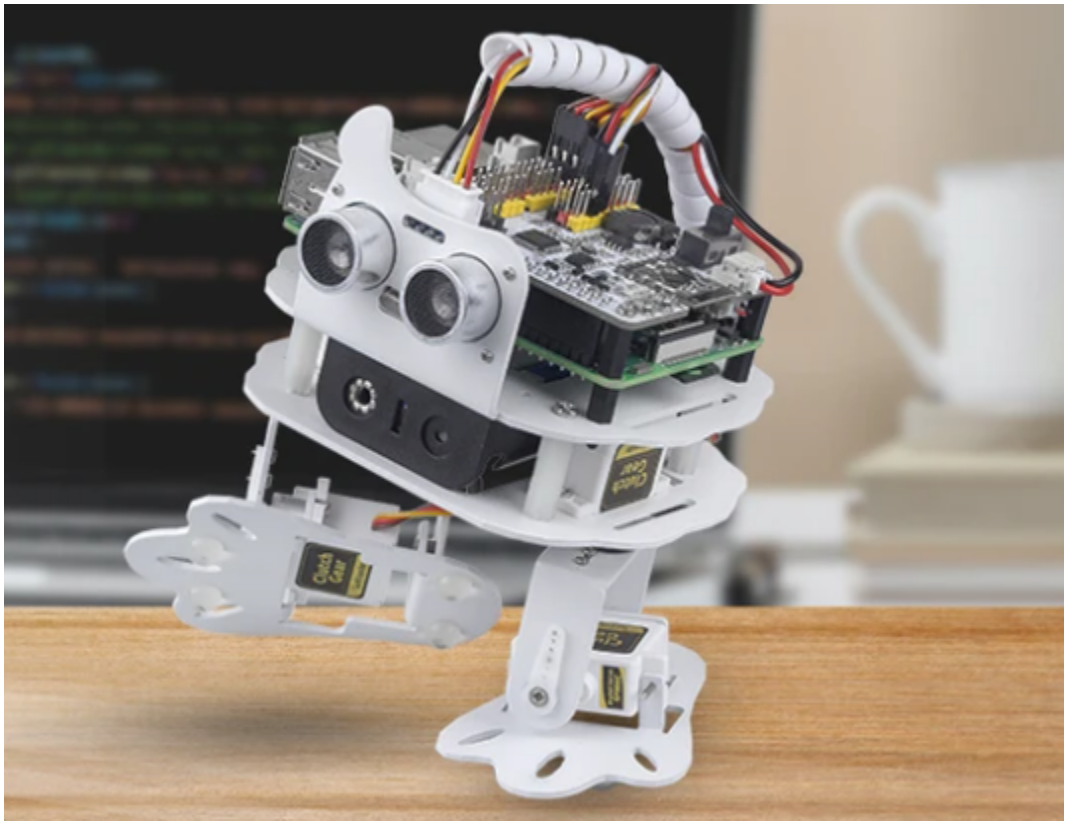
If you don't want to write these projects one by one, we have uploaded them to EzBlock Studio's Examples page and you can run them directly or edit them and run them later.

3.2 Move

This is the first project. PiSloth has woken up, and it moves freely.

Before programming, you need to learn the basic usage of EzBlock Studio from here.

- How to Create a New Project?

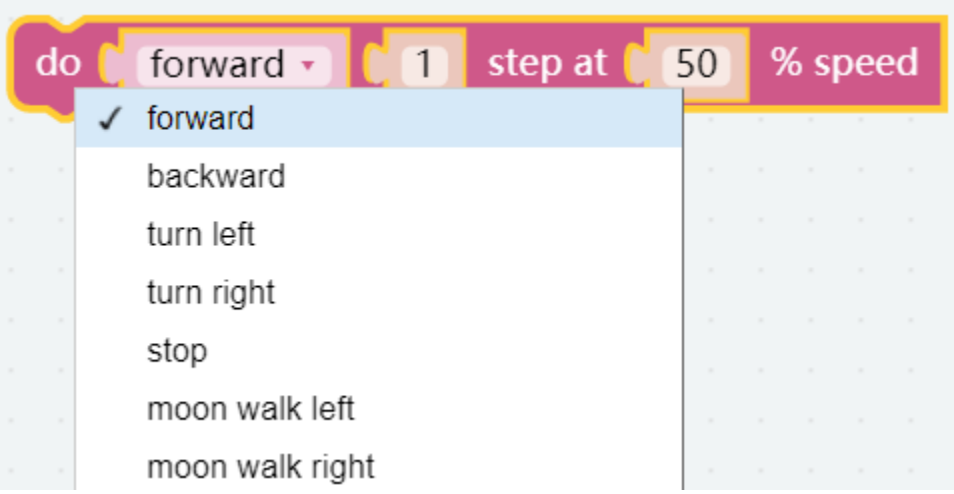


TIPS

This is the basic structure of the program, the Start block is used to do some initialization (even if no block is placed, it cannot be deleted) and the Forever block is, as the name suggests, a continuous loop that allows your program to change and respond.

This block is used to make PiSloth do a specific action several steps at a speed (%), for example, let PiSloth go forward 1 step at 50% speed.

Different actions can be selected from the drop down options, there are 22 in total.



This is a block that sets the duration of the previous block, unit: ms.

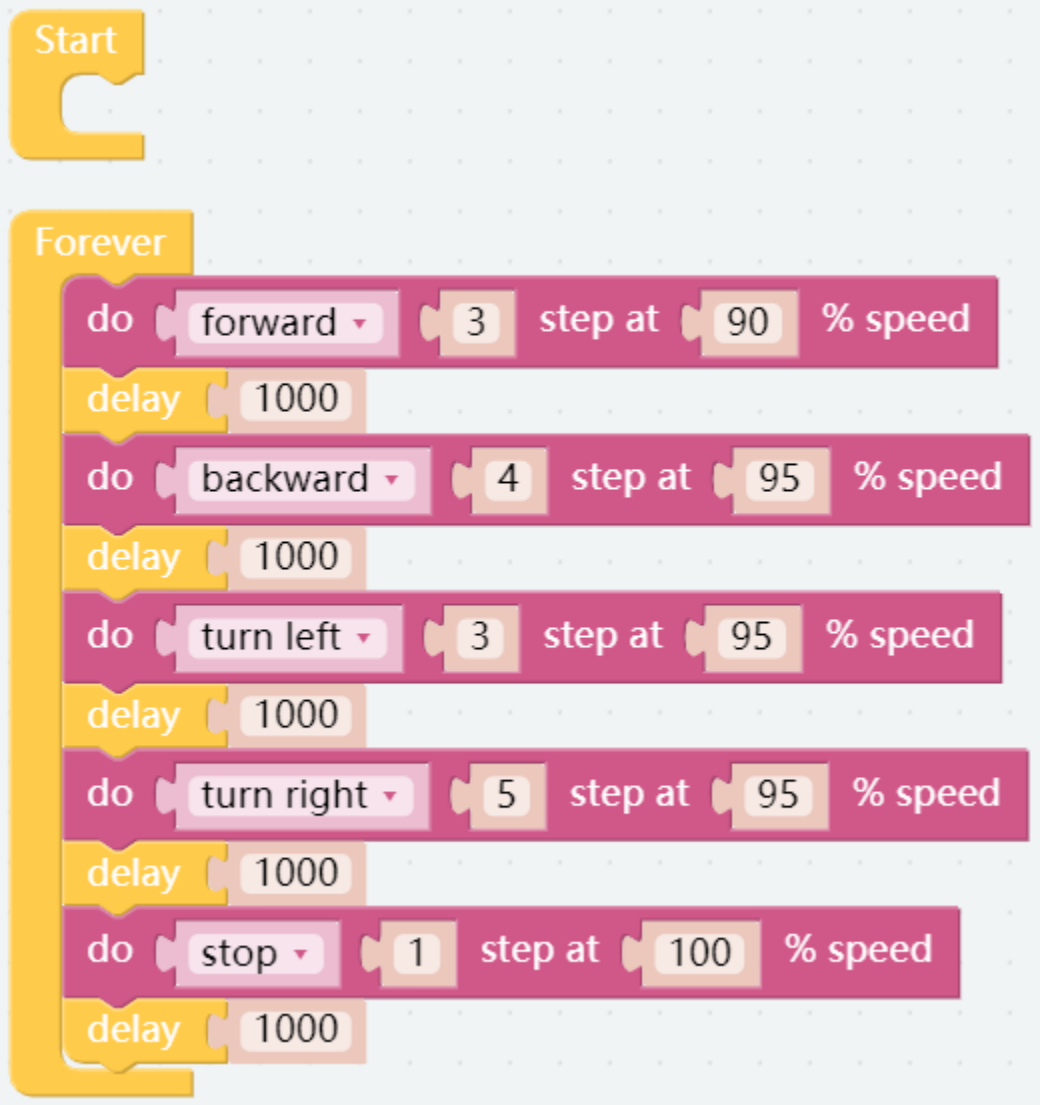
EXAMPLE

Note:

- You can write the program according to the following picture, please refer to the tutorial: How to Create a New Project?
- Or find the code with the same name on the Examples page of the EzBlock Studio and click Run or Edit directly.

After writing the code according to the following figure, click the download icon in the bottom right corner, you will see PiSloth move forward 3 steps, backward 4 steps, left 3 steps, right 5 steps, and finally stop. Since the whole code is placed inside the Forever block, PiSloth will repeat the above actions after stopping for a while.

You can try putting the code from the Forever block into the Start block and see what happens.



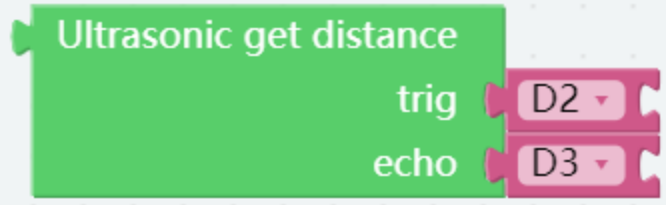
3.3 Don't Touch Me

If you don't meet PiSloth's needs, it will get angry and stay away from your touch.

TIPS

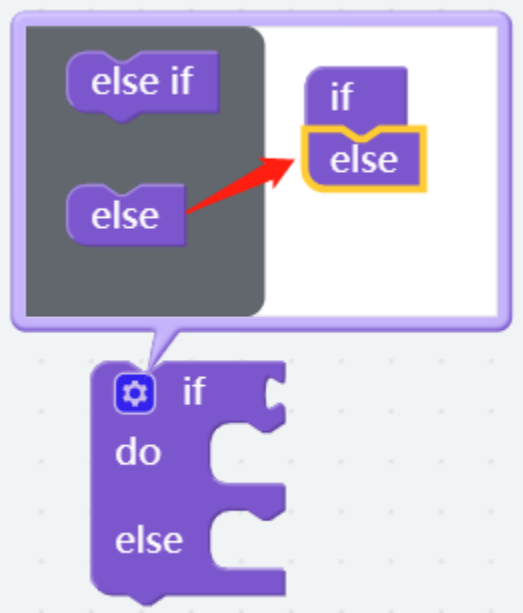
You can directly use this block to read the distance to the obstacle right ahead.

Note: When assembling, Trig and Echo are connected to D2 and D3 respectively, you also need to change them simultaneously when programming.

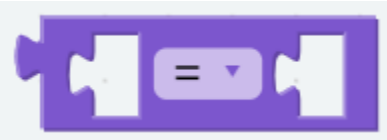


To achieve conditional judgment of "if" type, you need to use an **if do** block.

When you need to implement multiple conditional judgments, you will have to change **if do** into **if else do**. This can be achieved by clicking on the **setting** icon.

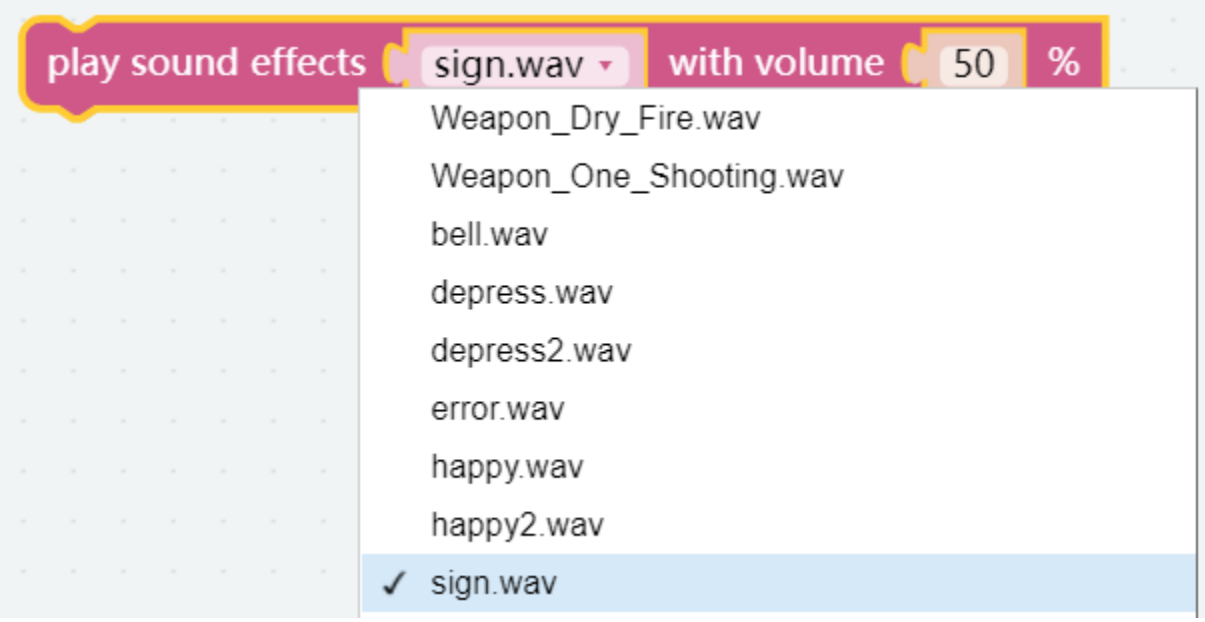


You need to use a conditional statements block in conjunction with if do. Judging conditions can be "=", ">", "<", "", "", "", "".



A number block.

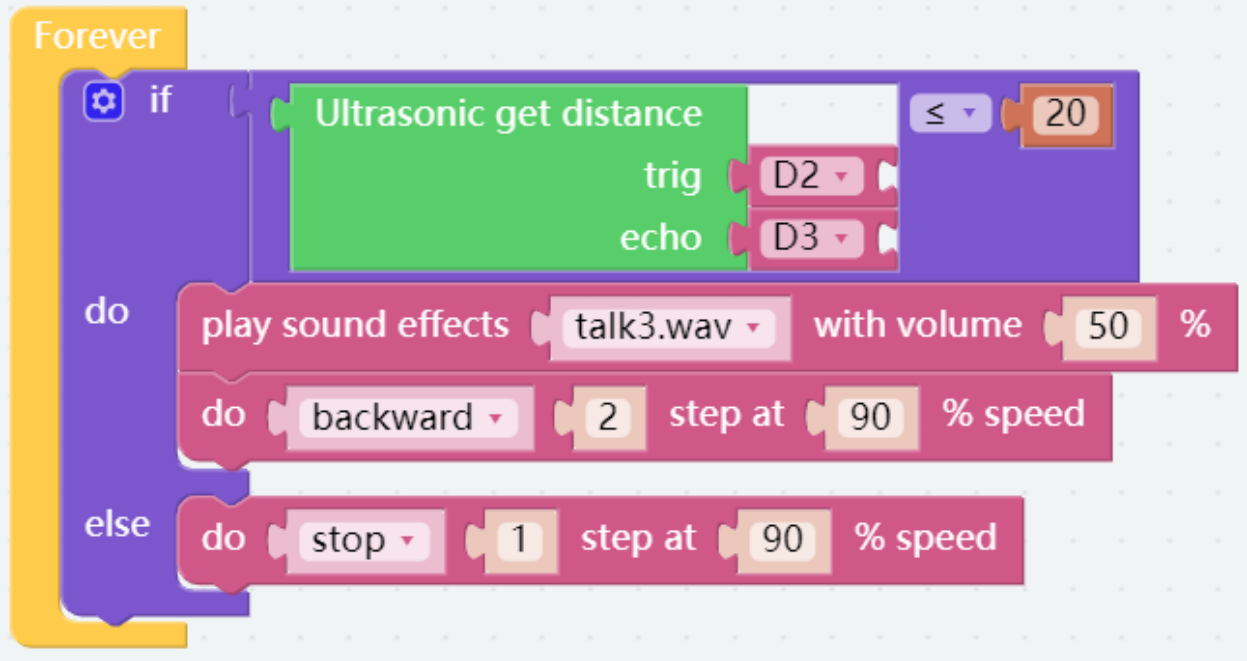
This block can emit some preset sound effects, such as siren sound, gun sound and so on. The range of volume is 1~100.



EXAMPLE

Note:

- You can write the program according to the following picture, please refer to the tutorial: How to Create a New Project?
- Or find the code with the same name on the Examples page of the EzBlock Studio and click Run or Edit directly.



3.4 Obstacle Avoidance

In this project, when PiSloth detects an obstacle, it will send a signal and look for another direction to move forward.

TIPS

This is based on the previous project *Don't Touch Me*, which adds autonomous judgment, so that PiSloth can actively avoid obstacles in front of it.

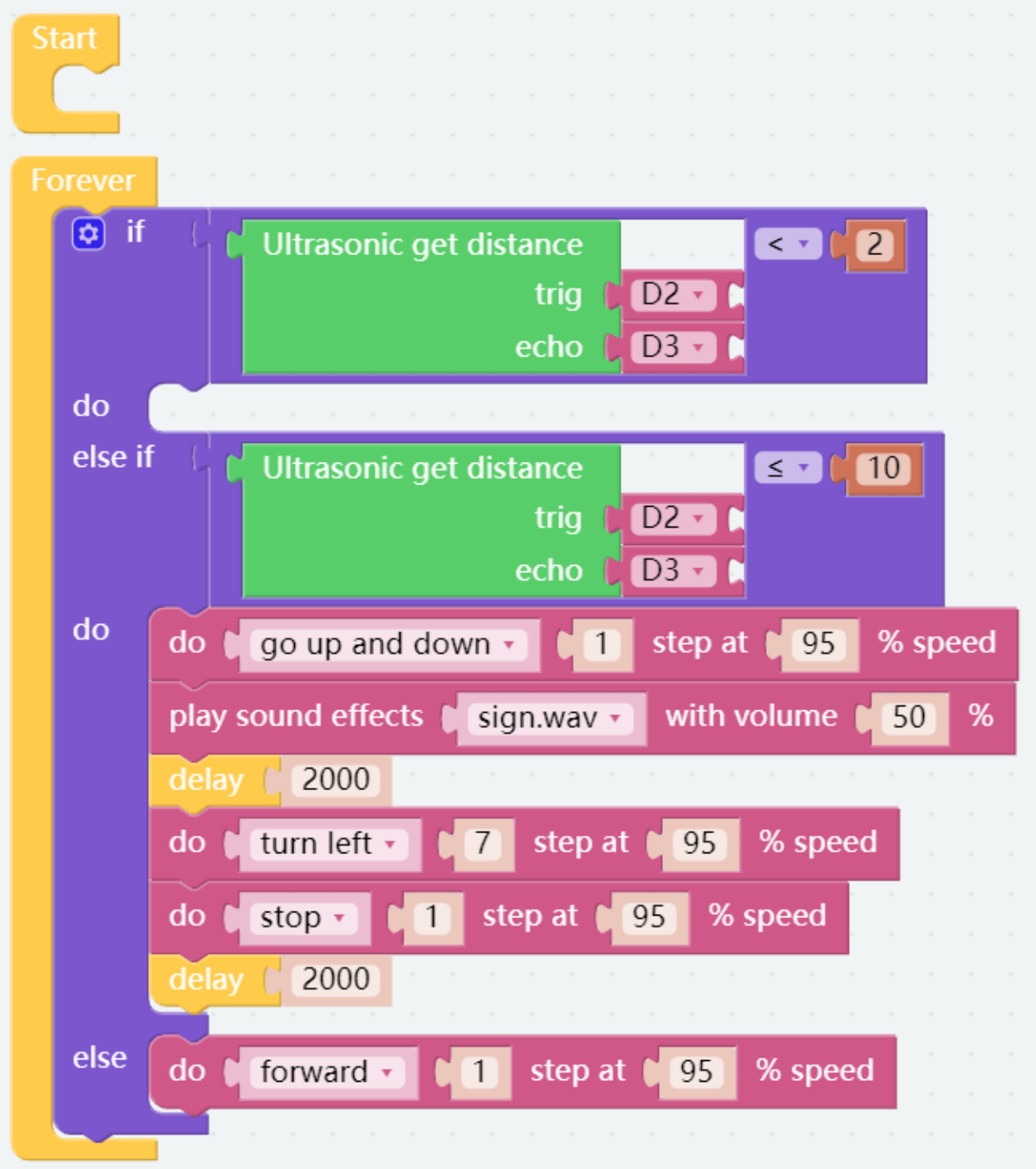
EXAMPLE

Note:

- You can write the program according to the following picture, please refer to the tutorial: How to Create a New Project?
- Or find the code with the same name on the Examples page of the EzBlock Studio and click Run or Edit directly.

After the code runs, PiSloth will walk forward. If it detects that the distance of the obstacle ahead is less than 10cm, it will stop and sound a warning, then turn left for 7 steps and stop. If there is no obstacle in the direction after turning left or the obstacle distance is greater than 10, it will continue to move forward.

Since the effective detection distance of the ultrasonic sensor module is 2-400cm, when the detection distance is less than it will do nothing.


Start
Forever
if
Ultrasonic get distance
trig
D2
echo
D3
< 2
do
else if
Ultrasonic get distance
trig
D2
echo
D3
≤ 10
do
do go up and down 1 step at 95 % speed
play sound effects sign.wav with volume 50 %
delay 2000
do turn left 7 step at 95 % speed
do stop 1 step at 95 % speed
delay 2000
else
do forward 1 step at 95 % speed

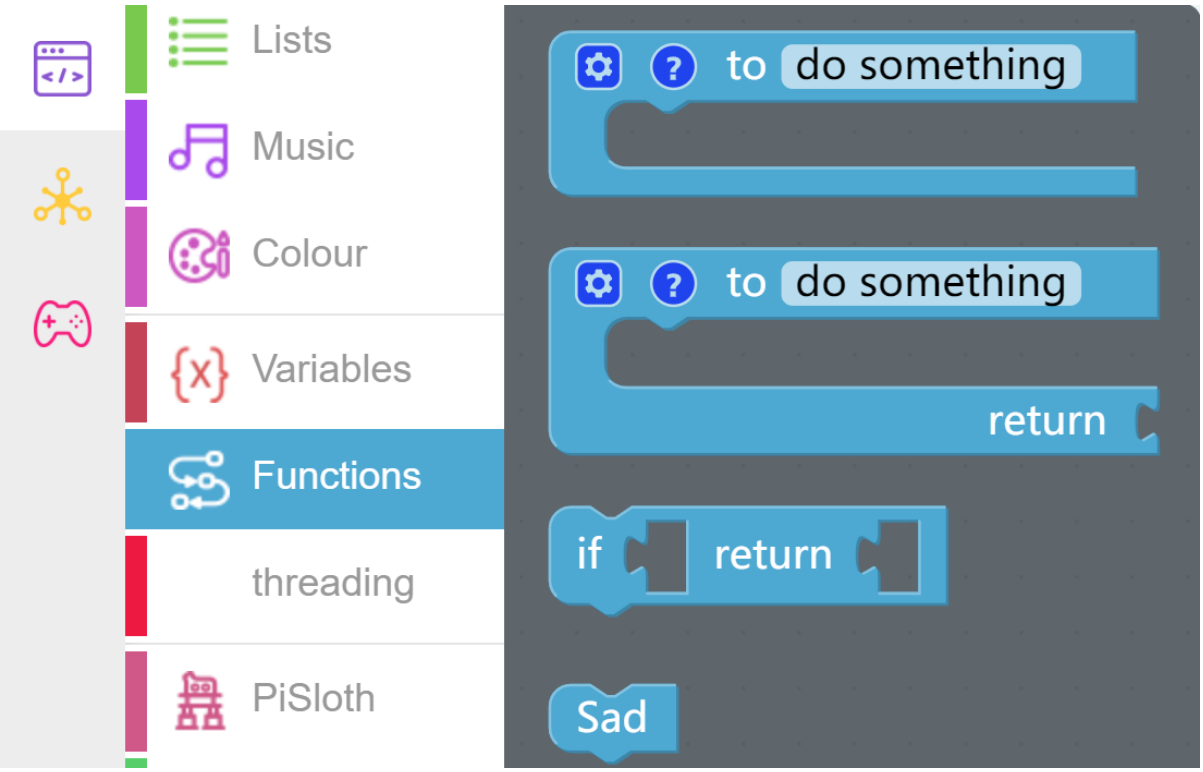
3.5 Emotional PiSloth

PiSloth is very emotional, sometimes happy, sometimes shy, sometimes confused.

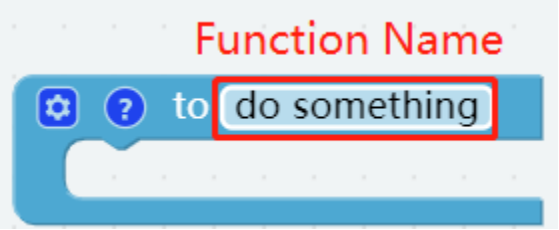
TIPS

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.

Click on the **Functions** category and select the appropriate function block, the function you created will also appear here.



The **Function** block without output is used here.

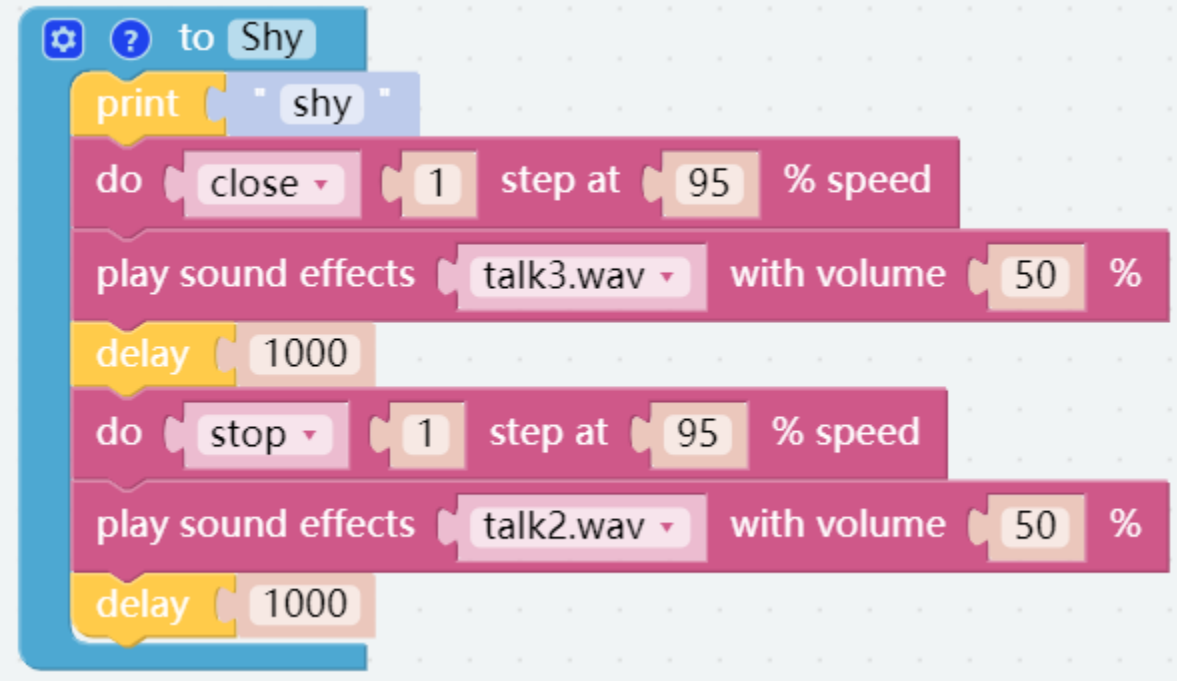


EXAMPLE

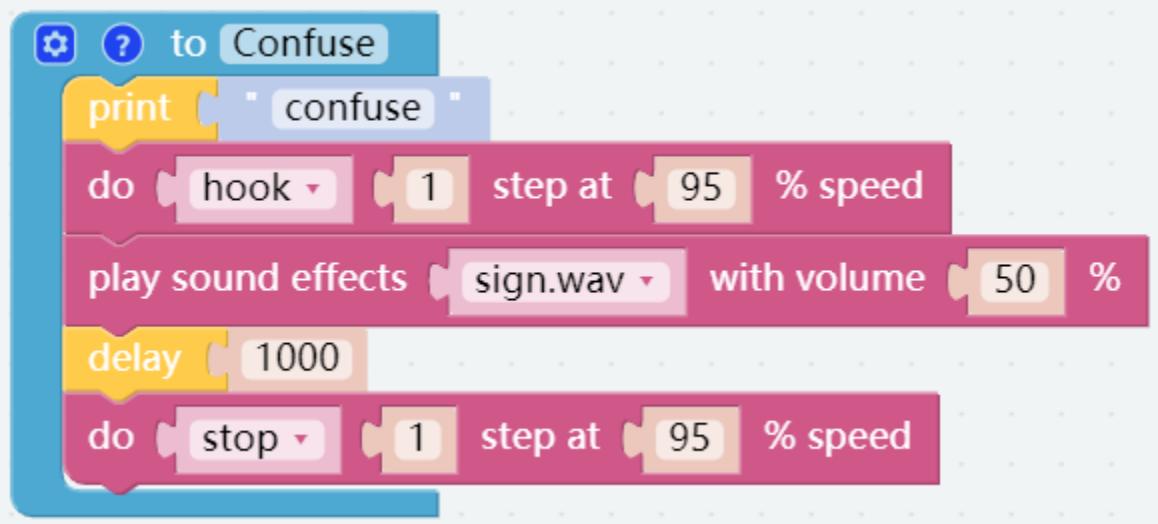
Note:

- You can write the program according to the following picture, please refer to the tutorial: How to Create a New Project?
- Or find the code with the same name on the Examples page of the EzBlock Studio and click Run or Edit directly.

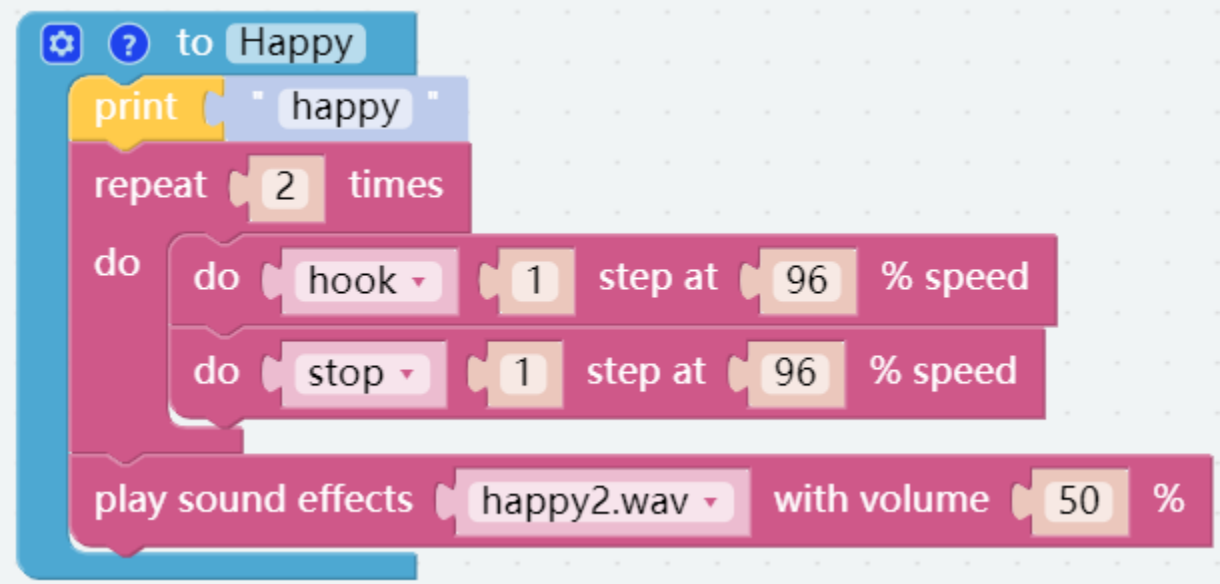
Shy



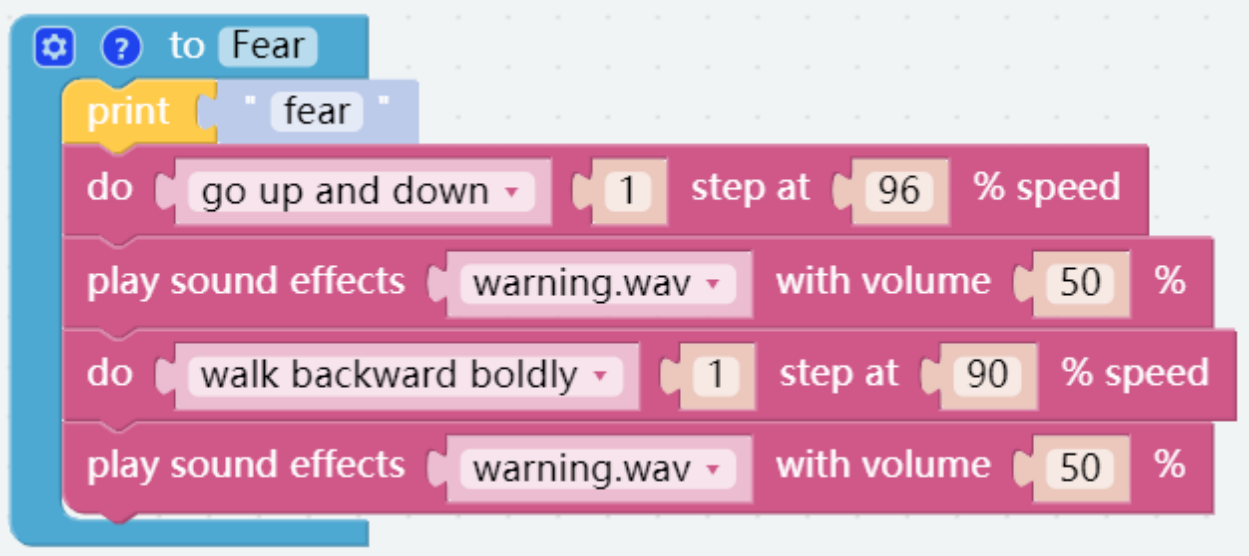
Confuse



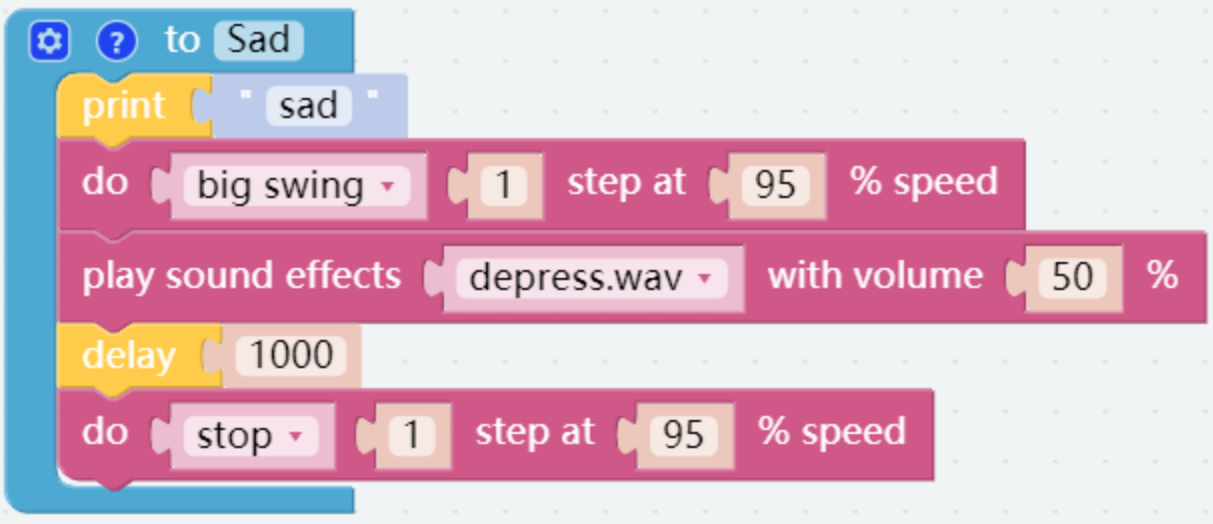
Happy


to Happy
print " happy "
repeat 2 times
do
do hook 1 step at 96 % speed
do stop 1 step at 96 % speed
play sound effects happy2.wav with volume 50 %

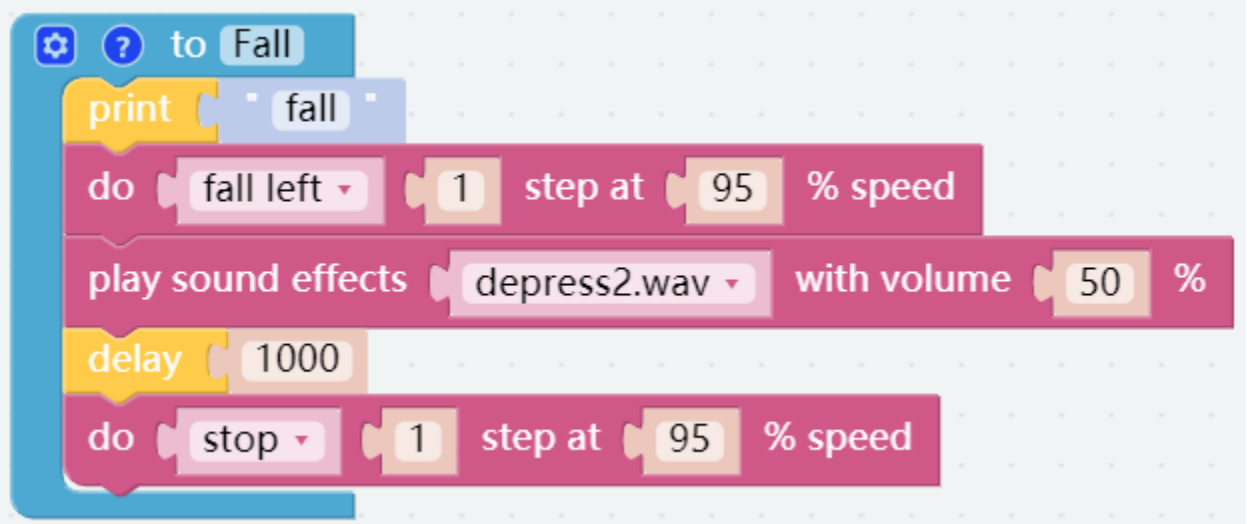
Fear


to Fear
print " fear "
do go up and down 1 step at 96 % speed
play sound effects warning.wav with volume 50 %
do walk backward boldly 1 step at 90 % speed
play sound effects warning.wav with volume 50 %

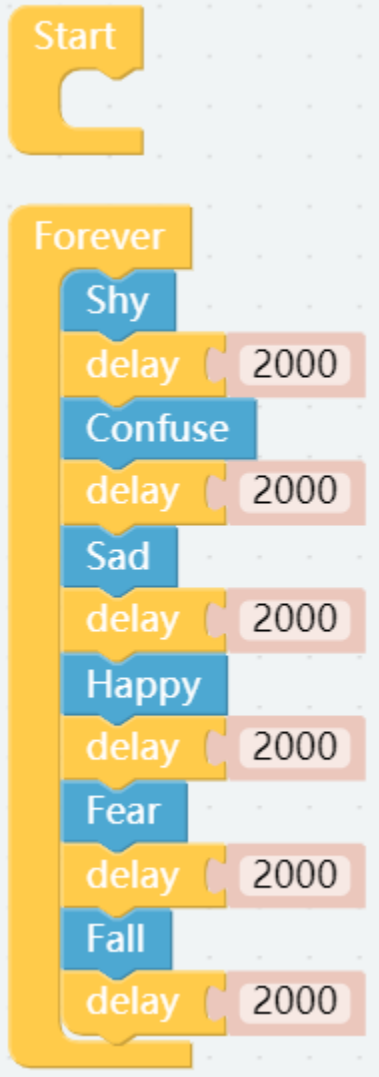
Sad



Fall



Call all custom functions in the Forever block.



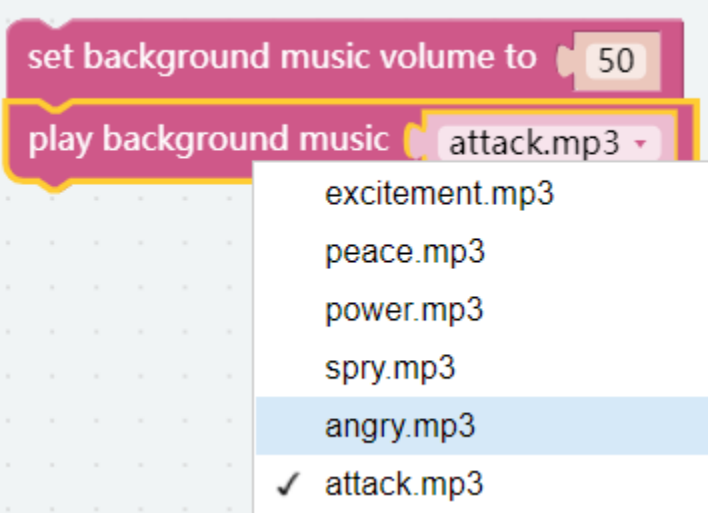
3.6 Dance

Now, PiSltoh will show you his newly learned dance.

Note: You can download and print the PDF Cartoon Mask for your PiSloth.

TIPS

In addition to having PiSloth play sound effects and speak, it can also play set background music, and the volume of the background music can be adjusted (0%-100%).



Repeat block can help you execute the same code multiple times to reduce code size.

EXAMPLE

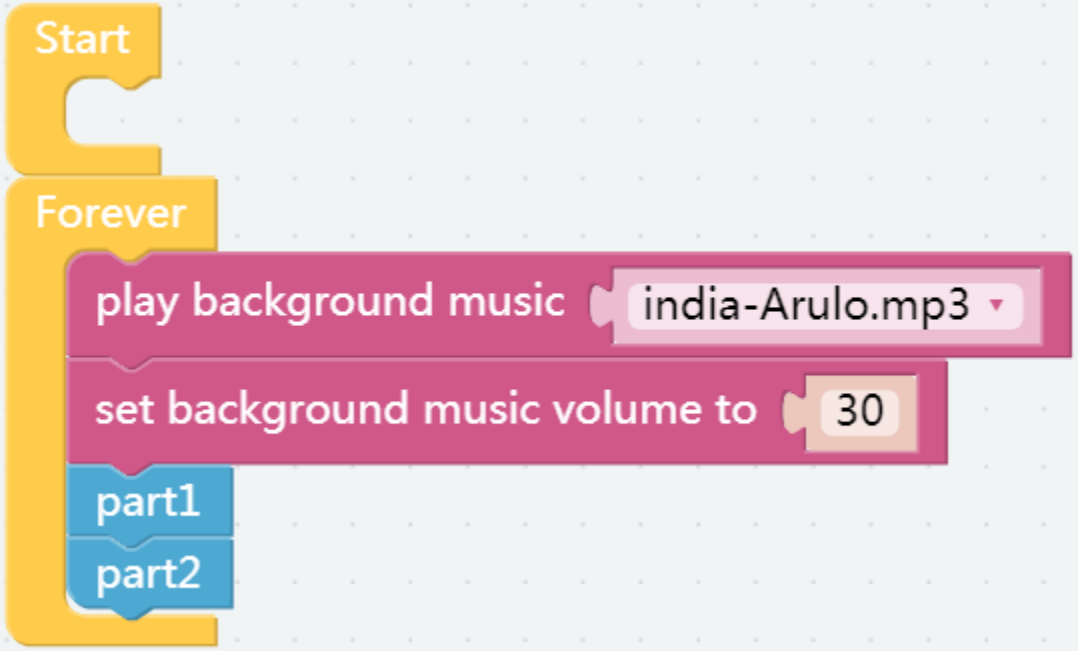
Note:

- You can write the program according to the following picture, please refer to the tutorial: How to Create a New Project?
- Or find the code with the same name on the Examples page of the EzBlock Studio and click Run or Edit directly.

The whole dance is divided into 2 parts, and PiSloth will finish these 2 parts with the music. If you don't pause the code, it will repeat the dance.

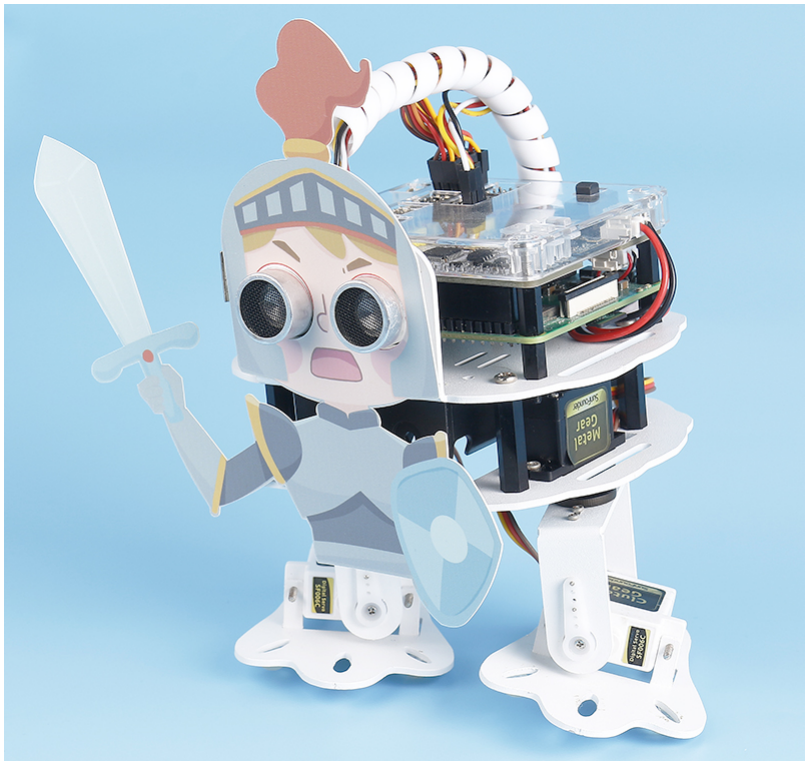

to part1
do stomp left 3 step at 90 % speed
do stomp rihgt 3 step at 90 % speed
do moon walk left 3 step at 90 % speed
do moon walk right 3 step at 90 % speed
repeat 3 times
do
do swing 1 step at 90 % speed
do stop 1 step at 90 % speed
repeat 3 times
do
do close 1 step at 90 % speed
do stop 1 step at 90 % speed
do open 1 step at 90 % speed
do stop 1 step at 90 % speed
do tiptoe left 1 step at 90 % speed
do tiptoe right 1 step at 90 % speed


to part2
do stomp left 3 step at 90 % speed
do stomp rihgt 3 step at 90 % speed
do moon walk left 3 step at 90 % speed
do moon walk right 3 step at 90 % speed
repeat 3 times
do
do hook 1 step at 90 % speed
do stop 1 step at 90 % speed
repeat 4 times
do
do swing 1 step at 90 % speed
do big swing 1 step at 90 % speed
do swing 1 step at 90 % speed
do stop 1 step at 90 % speed
do tiptoe right 2 step at 90 % speed
do stop 2 step at 90 % speed



3.7 Let's Fight! Warrior!

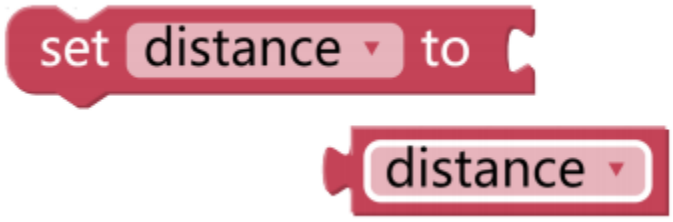
Here, PiSloth is a brave warrior, when it appears in front of the enemy, it will let out a roar and rush to the enemy.



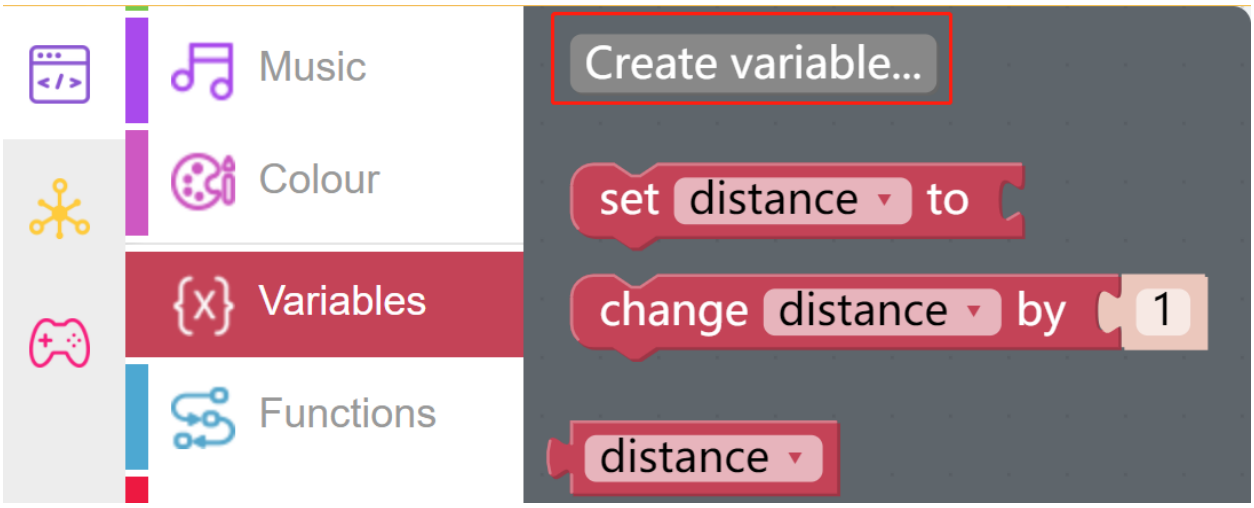
Note: You can download and print the PDF Cartoon Mask for your PiSloth.

TIPS

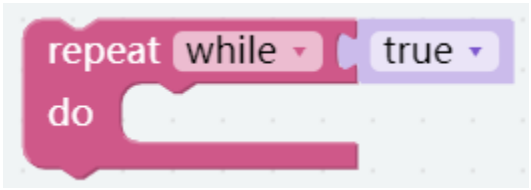
You may want to simplify your program with Variable. For example, when you have multiple functions that need to read the obstacle distance, you don't need to read the value for each function, just load the value into a variable and use it multiple times.



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

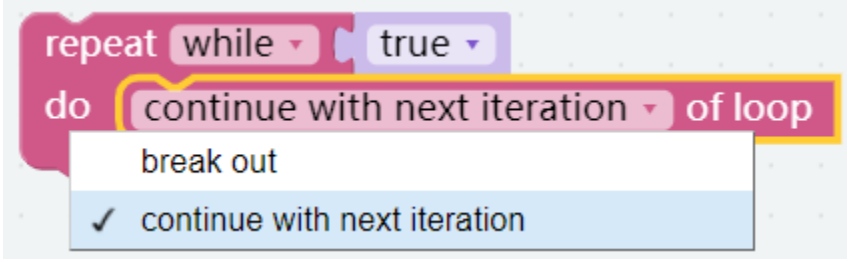


You can use this block to set up an endless loop.



This is a block that jumps out of the loop, and it has two options and can be only used within a loop.

- **break out**: Jump out of the entire loop.
- **continue with next interation**: Jump out of the current loop and enter the next loop.

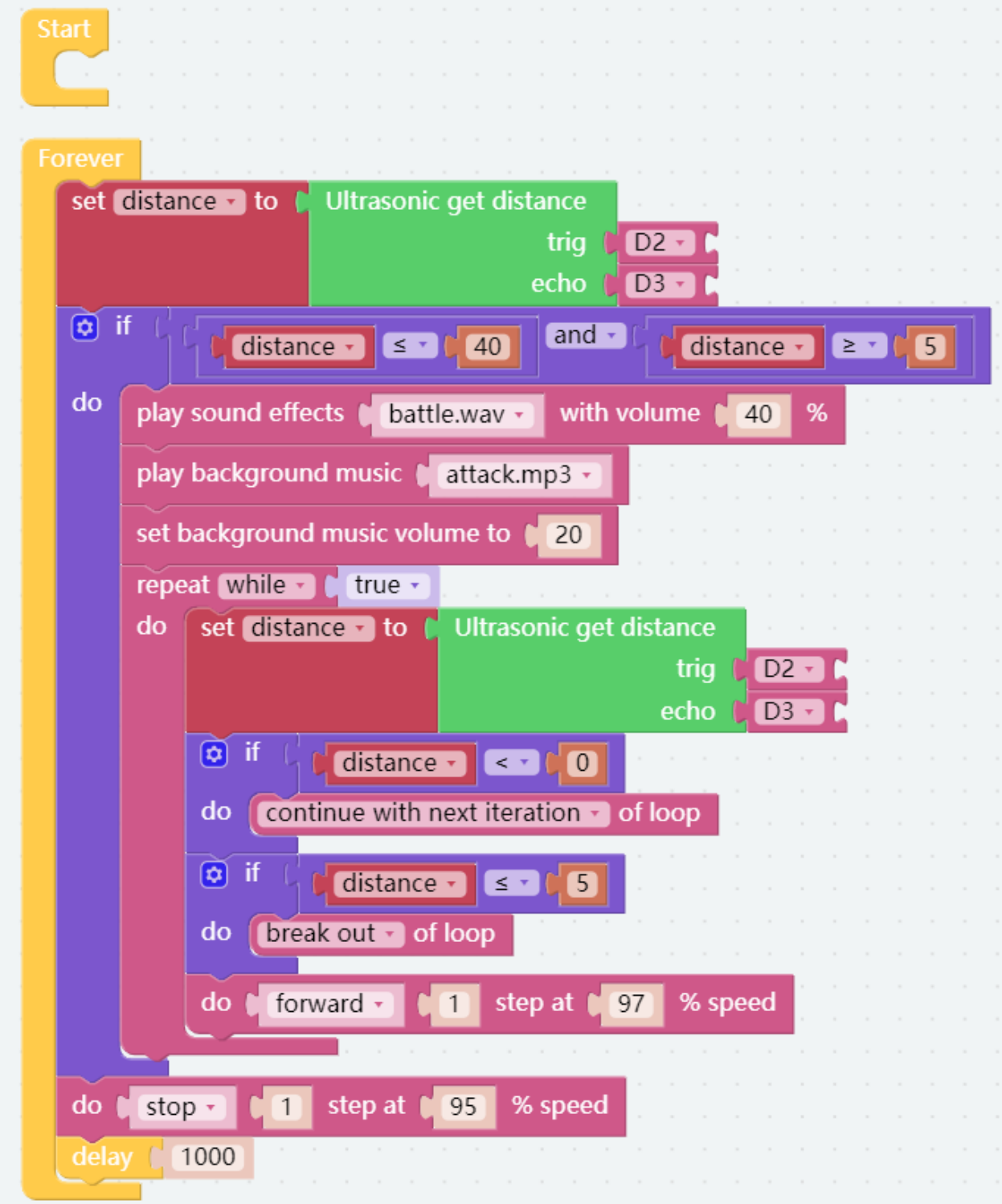


EXAMPLE

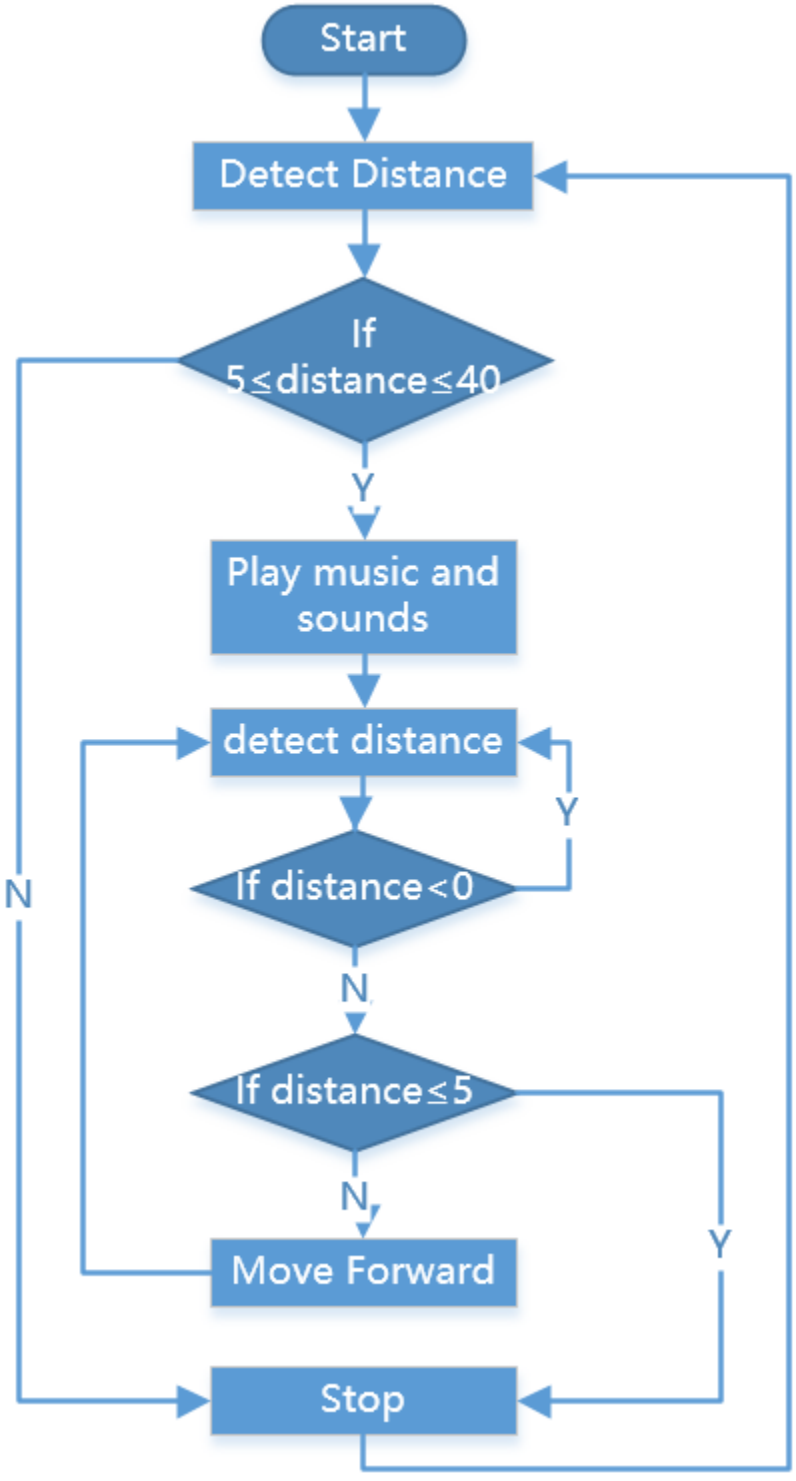
Note:

- You can write the program according to the following picture, please refer to the tutorial: How to Create a New Project?
- Or find the code with the same name on the Examples page of the EzBlock Studio and click Run or Edit directly.

After the code is run, PiSloth will continuously detect the distance of the obstacle, when the distance is between 5 and 40, PiSloth will make a roaring sound and rush forward; when the distance of the obstacle is less than 5, PiSloth will stop.


Start
Forever
set distance to Ultrasonic get distance
trig D2
echo D3
if distance ≤ 40 and distance ≥ 5
do play sound effects battle.wav with volume 40 %
play background music attack.mp3
set background music volume to 20
repeat while true
do set distance to Ultrasonic get distance
trig D2
echo D3
if distance < 0
do continue with next iteration of loop
if distance ≤ 5
do break out of loop
do forward 1 step at 97 % speed
do stop 1 step at 95 % speed
delay 1000

Flow Chart


Start
Detect Distance
If
5≤distance≤40
Y
Play music and
sounds
detect distance
Y
If distance<0
N
N
If distance≤5
N
Y
Move Forward
Stop

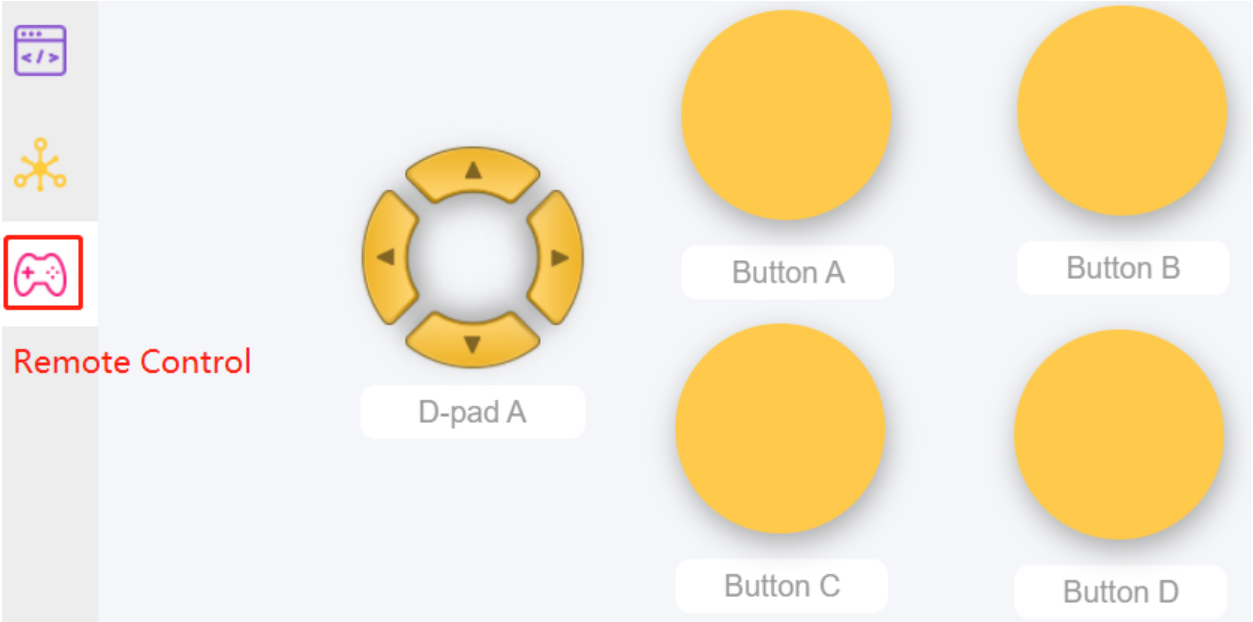
3.8 Remote Control

You can also use the widgets on EzBlock Studio to make PiSloth move.

- How to Use the Remote Control Function?

TIPS

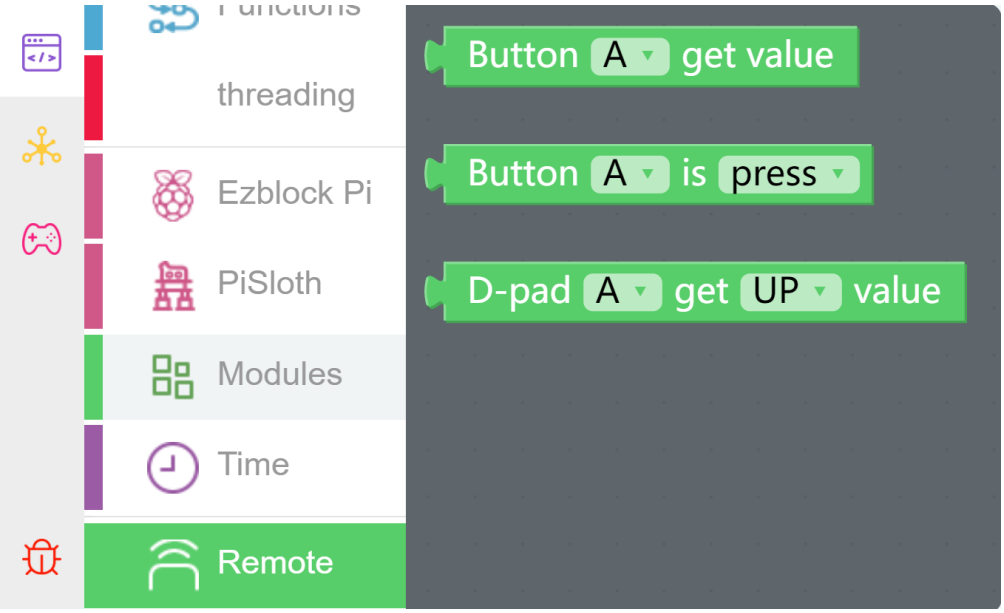
To use the remote control function, you need to enter the **Remote Control** page from the left side of main page, and then drag one D-pad and 4 buttons to the central area.



Back in the programming page, you will see an additional Remote category, and the D-pad and Button block appear in

it.

- **Button () get value**: This block is used to read the value of the buttons, if the button is pressed, the value is 1, otherwise it is 0.
- **Button () is (press/release)**: This block and `Button () get value = (0/1)` have the same effect and can be used directly to determine whether a button is pressed or not.
- **D-pad () get () value**: This block is used to read the up/down/left/right (selected through the drop-down menu) pad values, press for 1 and release for 0.



EXAMPLE

Note:

- You can write the program according to the following picture, please refer to the tutorial: How to Create a New Project?
- Or find the code with the same name on the Examples page of the EzBlock Studio and click Run or Edit directly.


Start
Forever
if
D-pad A get UP value = 1
do
do forward 1 step at 95 % speed
else if
D-pad A get DOWN value = 1
do
do backward 1 step at 95 % speed
else if
D-pad A get LEFT value = 1
do
do turn left 1 step at 95 % speed
else if
D-pad A get RIGHT value = 1
do
do turn right 1 step at 95 % speed
else if
Button A is press
do
play sound effects talk2.wav with volume 50 %
else if
Button B is press
do
play sound effects depress.wav with volume 50 %
else if
Button C is press
do
say " Oh hello there "
else if
Button D is press
do
say " Bye "

3.9 Custom Step

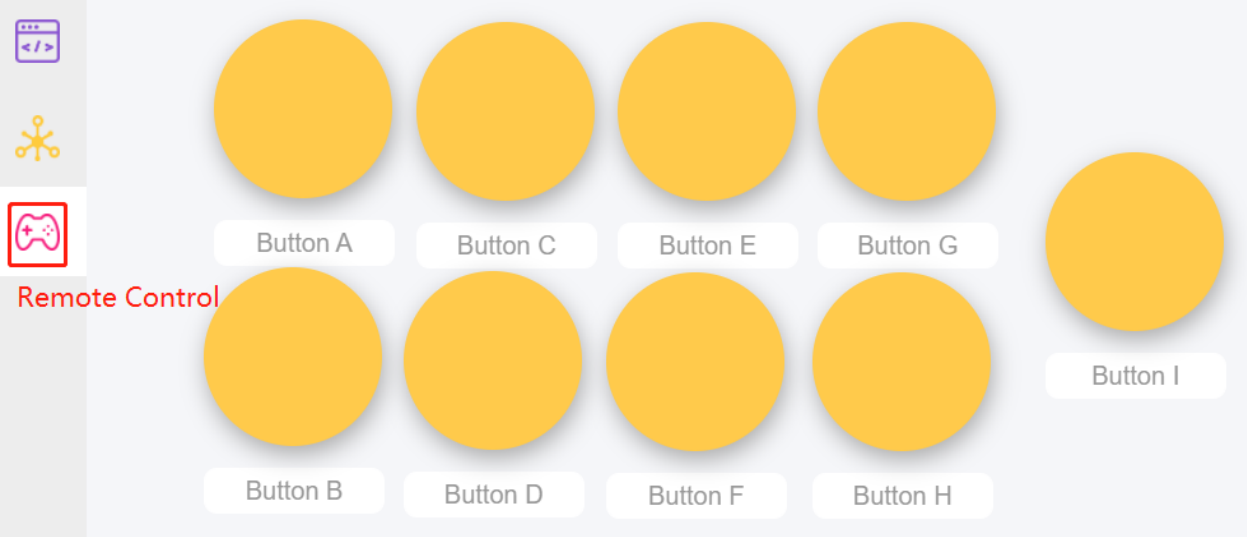
In the previous projects, we used a lot of actions that we wrote, so how are these actions composed and done? Generally speaking, an action is composed of one or more steps.

In this project, we will learn how to customize PiSloth's step.

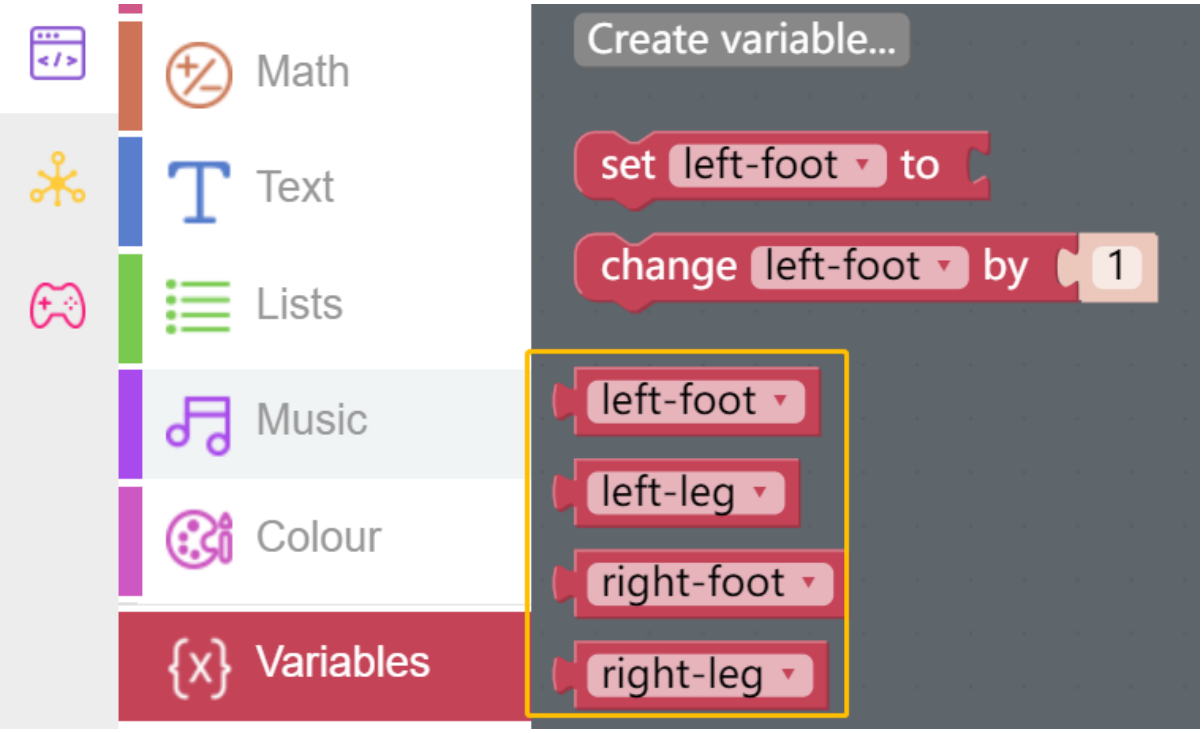
All we have to do is to use the buttons in the remote control page to make PiSloth complete the step shown in the figure below, and then get the angles of the 4 Servos at that time.

Note: You can download and print the PDF Cartoon Mask for your PiSloth.

Step 1: Drag out 9 buttons in the Remote Control to control the rotation angles of the 4 Servos on the PiSloth.



Step 2: Create 4 variables to store the angles of the 4 Servos.



Then initialize the angle to 0.

Step 3: Reads the values of the different buttons that are used to control the angles of the Servos.

- **button AB** control the **left-leg**.
- **button CD** control the **left-foot**.
- **button EF** control the **right-leg**.
- **button GH** control the **right-foot**.
- Press **button I** and the angles of the 4 Servos will be printed in the Debug Monitor.

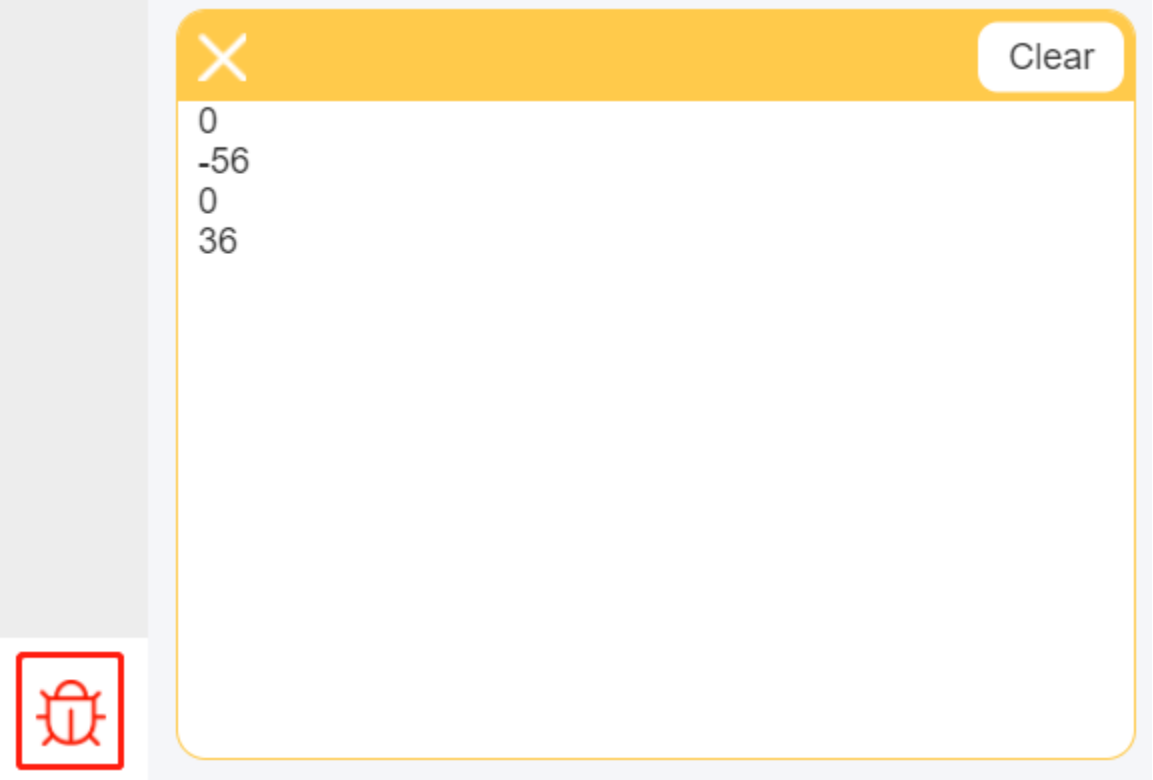

Forever
if Button A is press
do set left-leg to left-leg + 1
else if Button B is press
do set left-leg to left-leg - 1
else if Button C is press
do set left-foot to left-foot + 1
else if Button D is press
do set left-foot to left-foot - 1
else if Button E is press
do set right-leg to right-leg + 1
else if Button F is press
do set right-leg to right-leg - 1
else if Button G is press
do set right-foot to right-foot + 1
else if Button H is press
do set right-foot to right-foot - 1
else if Button I is press
do print left-leg
print left-foot
print right-leg
print right-foot

Step 4: At the end of the Forever block, fill in the angle values read into the 4 servos and use the **do action** block to make PiSloth do this step.

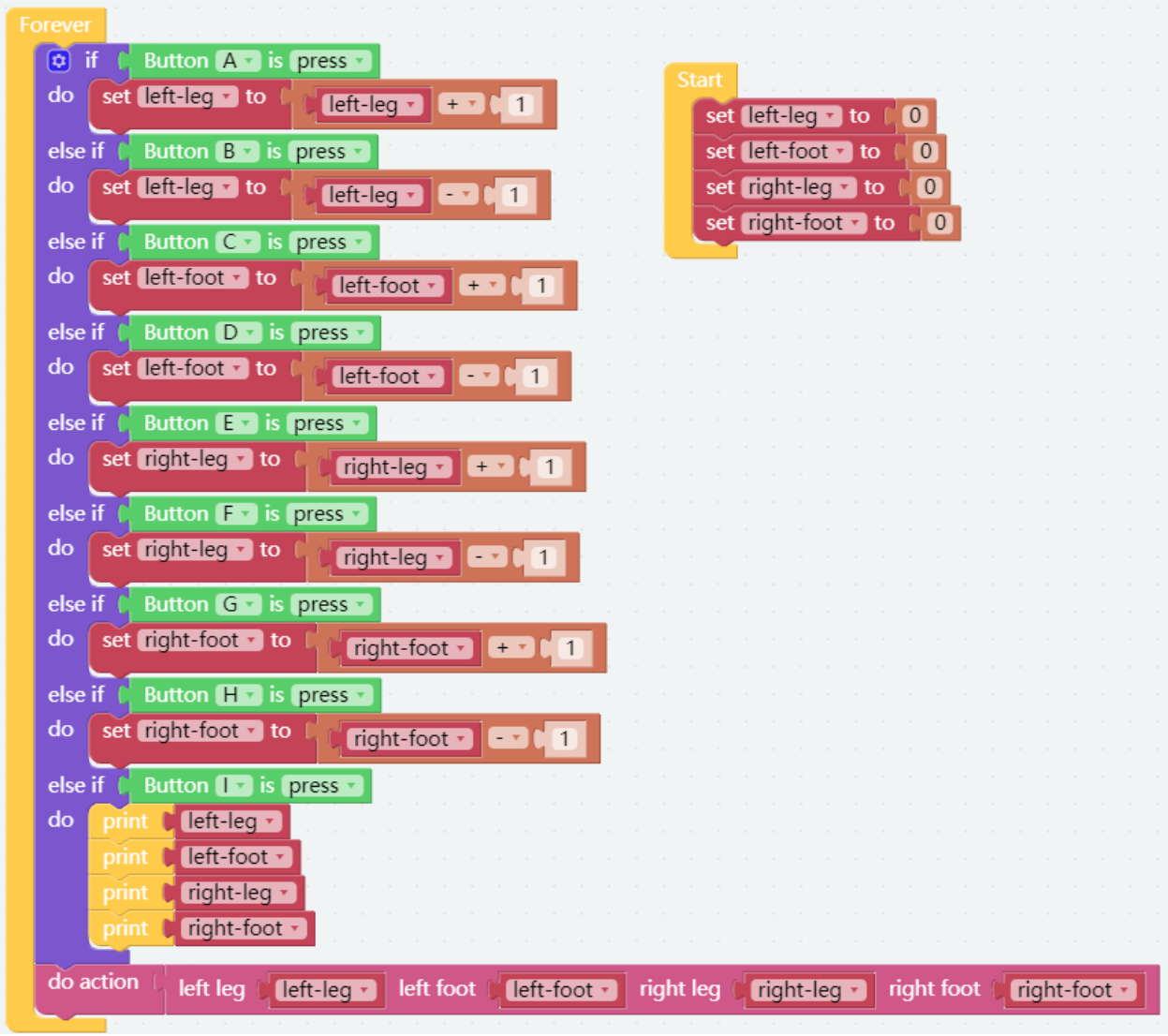
Step 5: Once the code is complete, click the **download** icon in the bottom right corner to download and run the code. Now we can click **button CD** and **button GH** (according to the actual code) to make PiSloth pose like this, you can also make it do other steps.

Step 6: Click on the Debug Monitor icon in the bottom left corner, and you will see the angle of the 4 servos in the Debug Monitor at that moment when you press **button I**.

Note: Some times more than 2 sets of data may appear because if you click **button I** for a little longer, EzBlock will think **button I** was clicked 2 times. You can clear the data and click button I again.



The complete code is as follows:



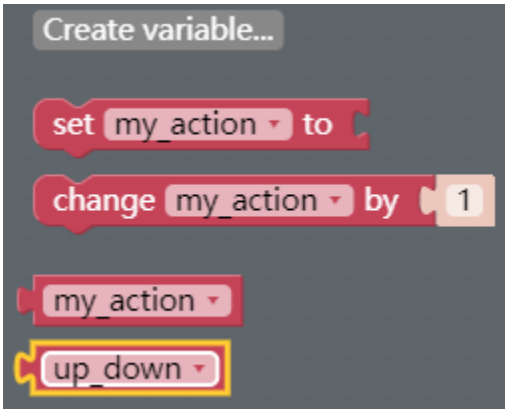
3.10 Custom Action

In the previous project, we were able to give PiSloth custom steps, so how do we combine these steps into actions? For example, have PiSloth make the step from the previous project and then return to the initial position.

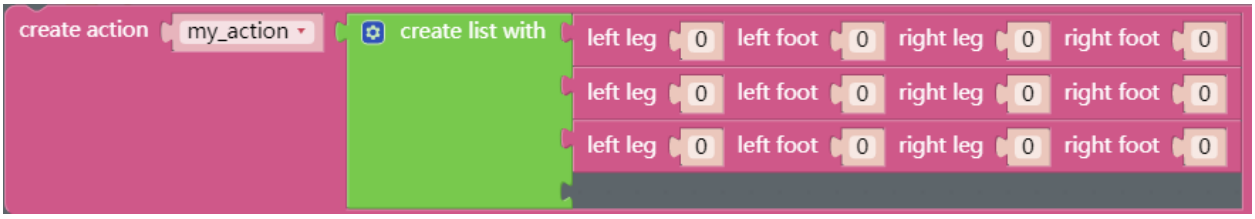
Note: You can download and print the PDF Cartoon Mask for your PiSloth.

TIPS

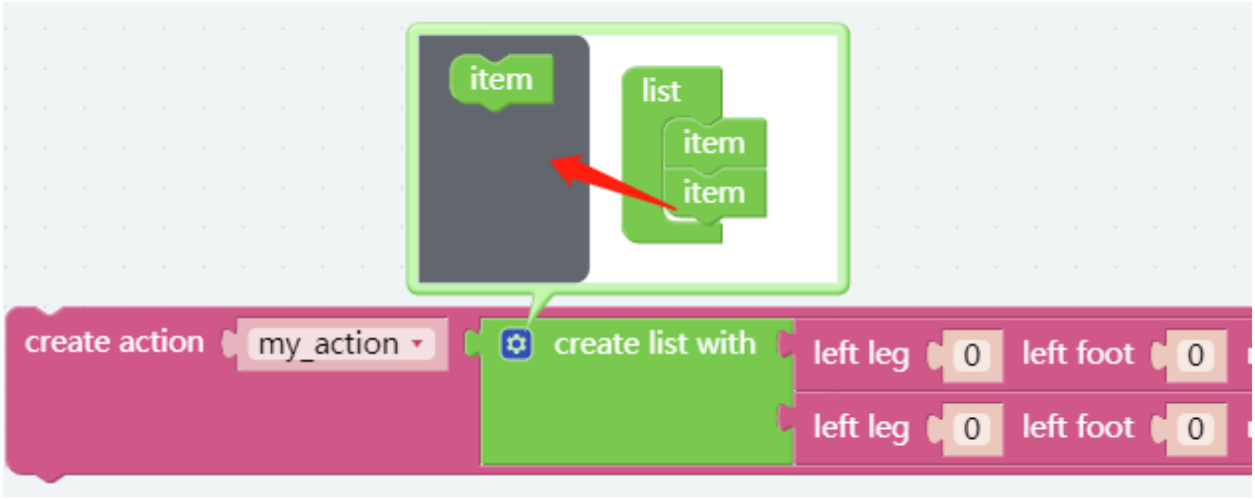
Create a variable **up_down** to store this action.



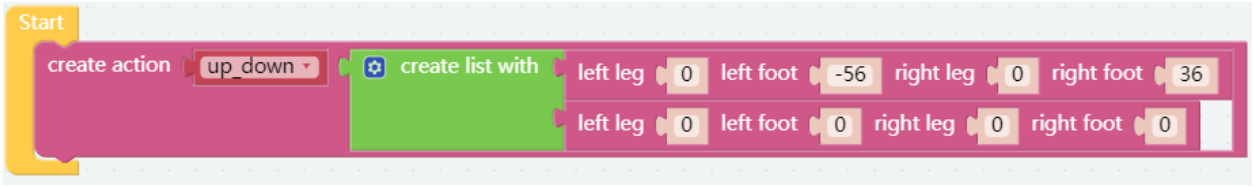
You can use the **create action** block to make PiSloth do this action. These values represent the angles of the 4 Servos on the PiSloth. The range is (-90~90).



Here you can increase or decrease the number of items by dragging it.



Fill in the angle obtained in the previous project and name this action **up_down** (drag it from **Variables** category).

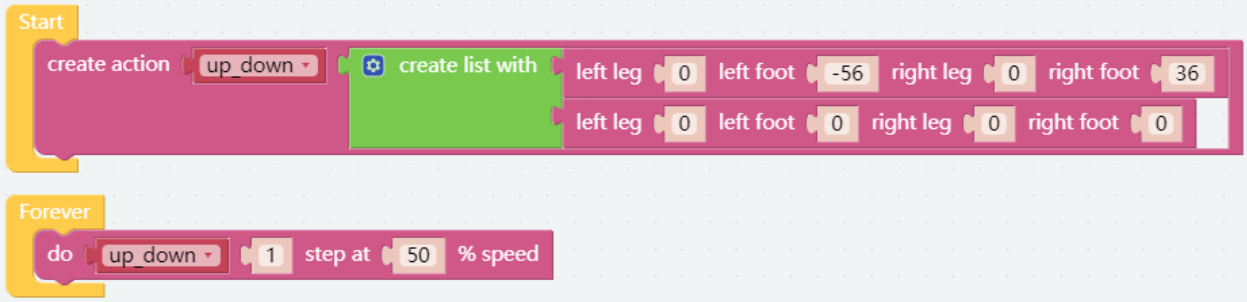


Use the **do** block to make PiSloth do this action once at 50% speed.

EXAMPLE

Note:

- You can write the program according to the following picture, please refer to the tutorial: How to Create a New Project?
- Or find the code with the same name on the Examples page of the EzBlock Studio and click Run or Edit directly.


Start
create action
up_down
create list with
left leg 0 left foot -56 right leg 0 right foot 36
left leg 0 left foot 0 right leg 0 right foot 0
Forever
do
up_down
1
step at
50
% speed

CHAPTER

FOUR

PLAY WITH PYTHON

If you want to program in python, then you will need to learn some basic Python programming skills and basic knowledge of Raspberry Pi, please configure the Raspberry Pi first according to *Quick Guide on Python*.

4.1 Quick Guide on Python

This section is to teach you how to install Raspberry Pi OS, configure wifi to Raspberry Pi, remote access to Raspberry Pi to run the corresponding code.

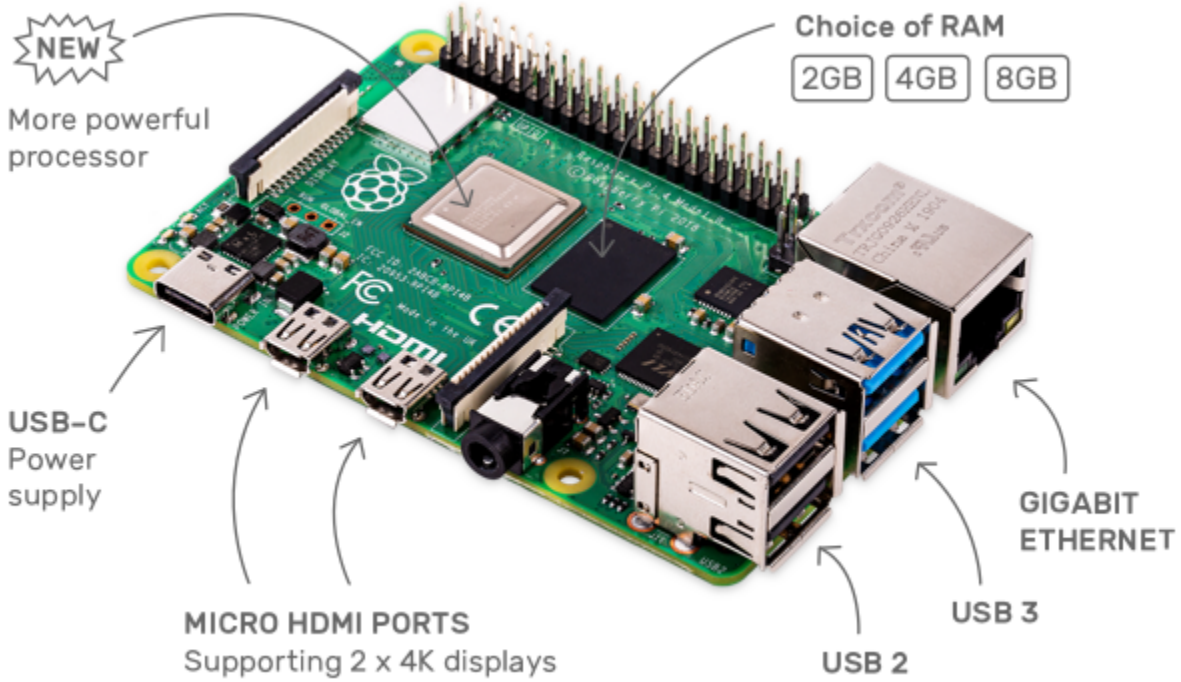
If you are familiar with Raspberry Pi and can open the command line successfully, then you can skip the first 3 parts and then complete the last part.

4.1.1 What Do We Need?

Required Components

Raspberry Pi

The Raspberry Pi is a low cost, credit-card sized computer that plugs into a computer monitor or TV, and uses a standard keyboard and mouse. It is a capable little device that enables people of all ages to explore computing, and to learn how to program in languages like Scratch and Python.



Power Adapter

To connect to a power socket, the Raspberry Pi has a micro USB port (the same found on many mobile phones). You will need a power supply which provides at least 2.5 amps.

Micro SD Card

Your Raspberry Pi needs an Micro SD card to store all its files and the Raspberry Pi OS. You will need a micro SD card with a capacity of at least 8 GB

Optional Components

Screen

To view the desktop environment of Raspberry Pi, you need to use the screen that can be a TV screen or a computer monitor. If the screen has built-in speakers, the Pi plays sounds via them.

Mouse & Keyboard

When you use a screen , a USB keyboard and a USB mouse are also needed.

HDMI

The Raspberry Pi has a HDMI output port that is compatible with the HDMI ports of most modern TV and computer monitors. If your screen has only DVI or VGA ports, you will need to use the appropriate conversion line.

Case

You can put the Raspberry Pi in a case; by this means, you can protect your device.

Sound or Earphone

The Raspberry Pi is equipped with an audio port about 3.5 mm that can be used when your screen has no built-in speakers or when there is no screen operation.

4.1.2 Installing the OS

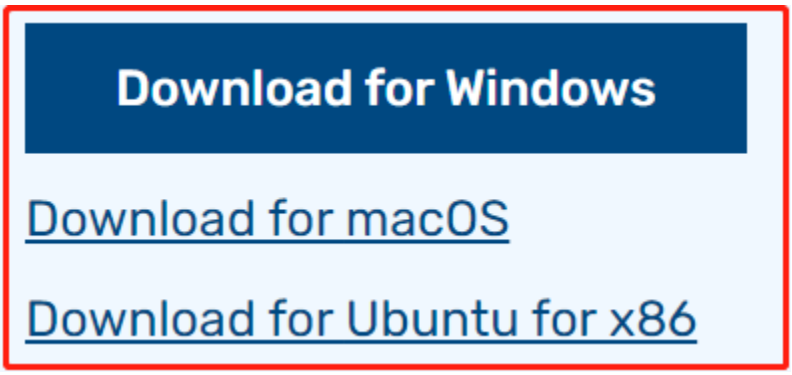
Required Components

Any Raspberry Pi	1 * Personal Computer
1 * Micro SD card	

Step 1

Raspberry Pi have developed a graphical SD card writing tool that works on Mac OS, Ubuntu 18.04 and Windows, and is the easiest option for most users as it will download the image and install it automatically to the SD card.

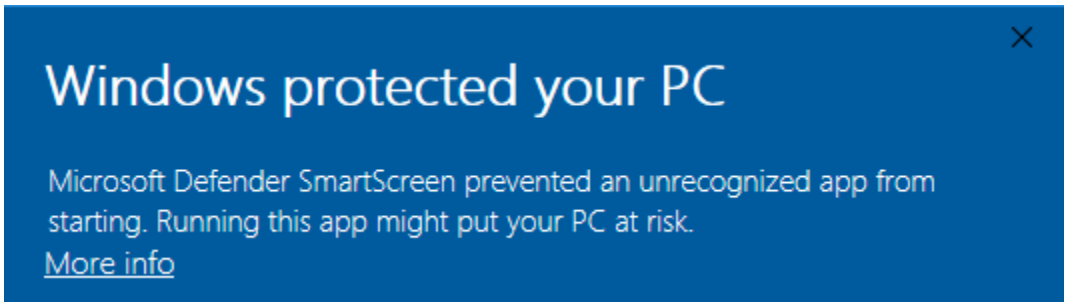
Visit the download page: https://www.raspberrypi.org/software/. Click on the link for the Raspberry Pi Imager that matches your operating system, when the download finishes, click it to launch the installer.



Step 2

When you launch the installer, your operating system may try to block you from running it. For example, on Windows I receive the following message:

If this pops up, click on **More info** and then **Run anyway**, then follow the instructions to install the Raspberry Pi Imager.



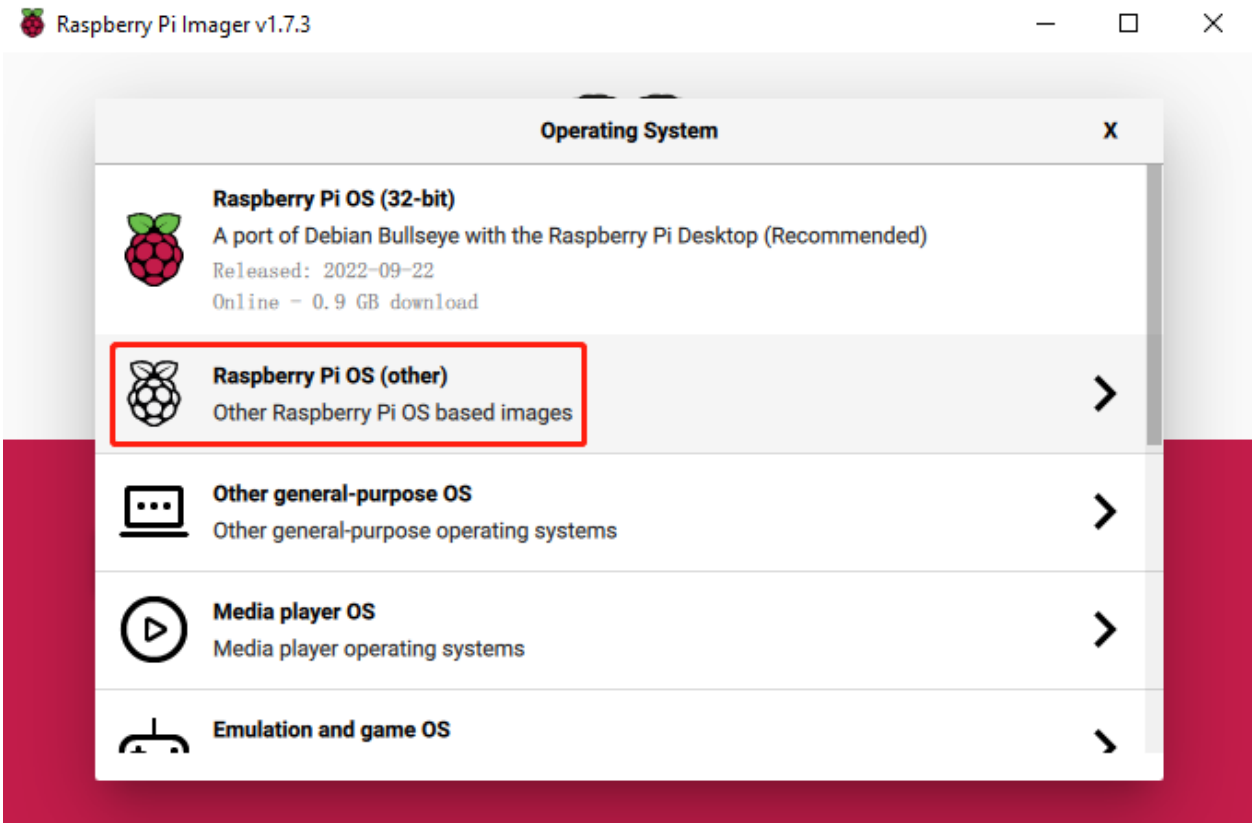
Step 3

Insert your SD card into the computer or laptop SD card slot.

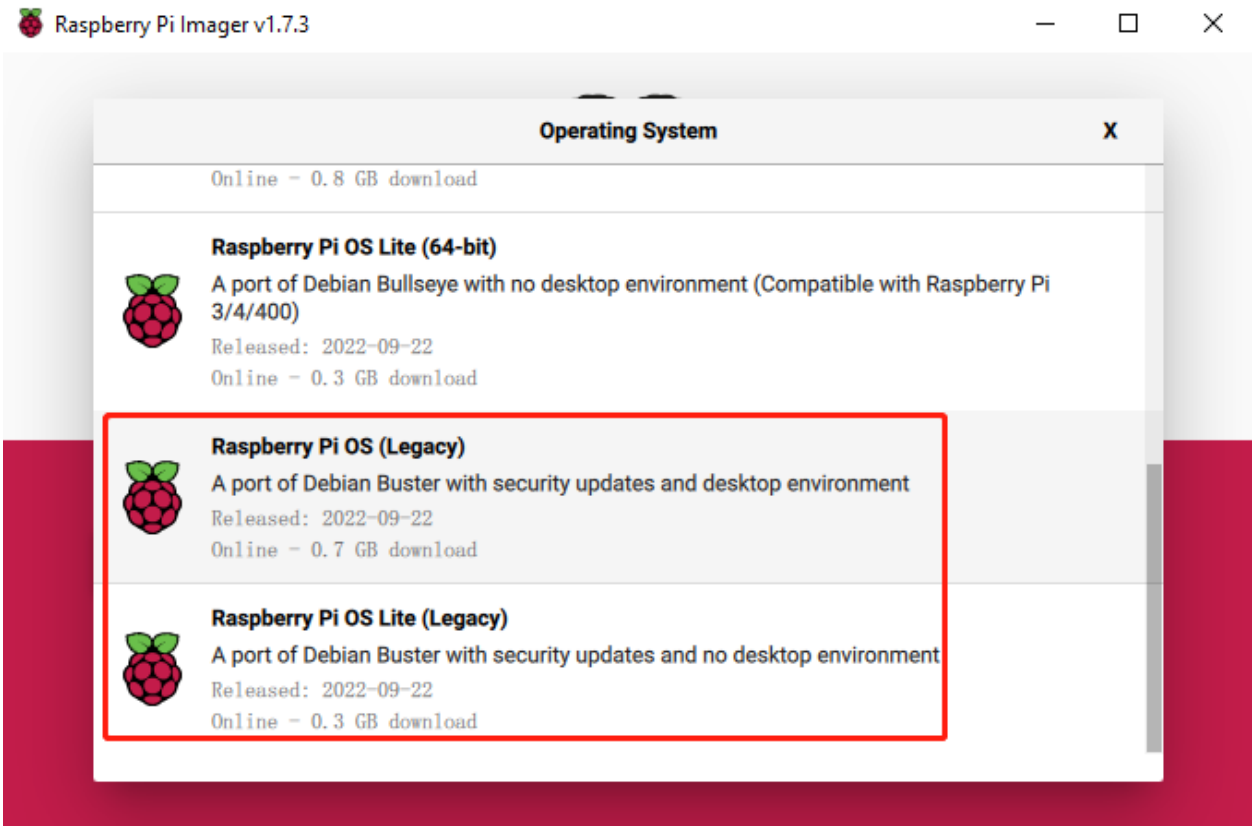
Step 4

> **Warning:** Upgrading the Raspberry Pi OS to **Debian Bullseye** will cause some features to not work, so it is recommended to continue using the **Debian Buster** version.

In the Raspberry Pi Imager, click **CHOOSE OS -> Raspberry Pi OS(other)**.

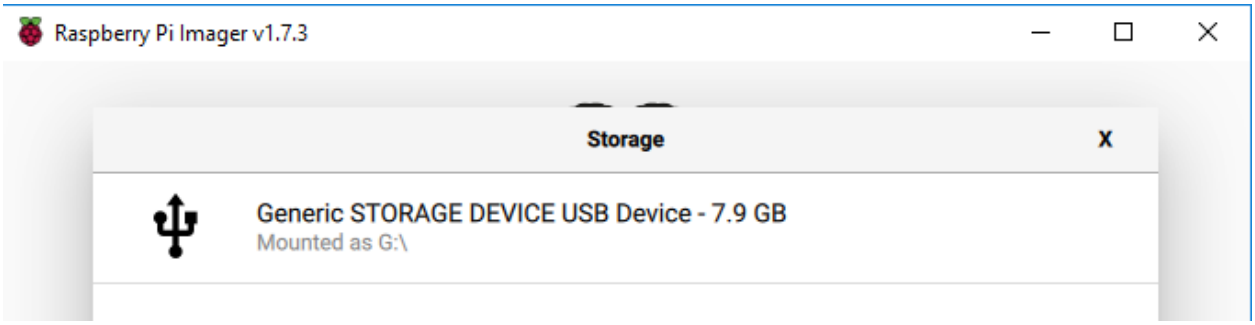


Scroll down to the end of the newly opened page and you will see **Raspberry Pi OS(Legacy)** and **Raspberry Pi OS Lite(Legacy)**.



Step 5

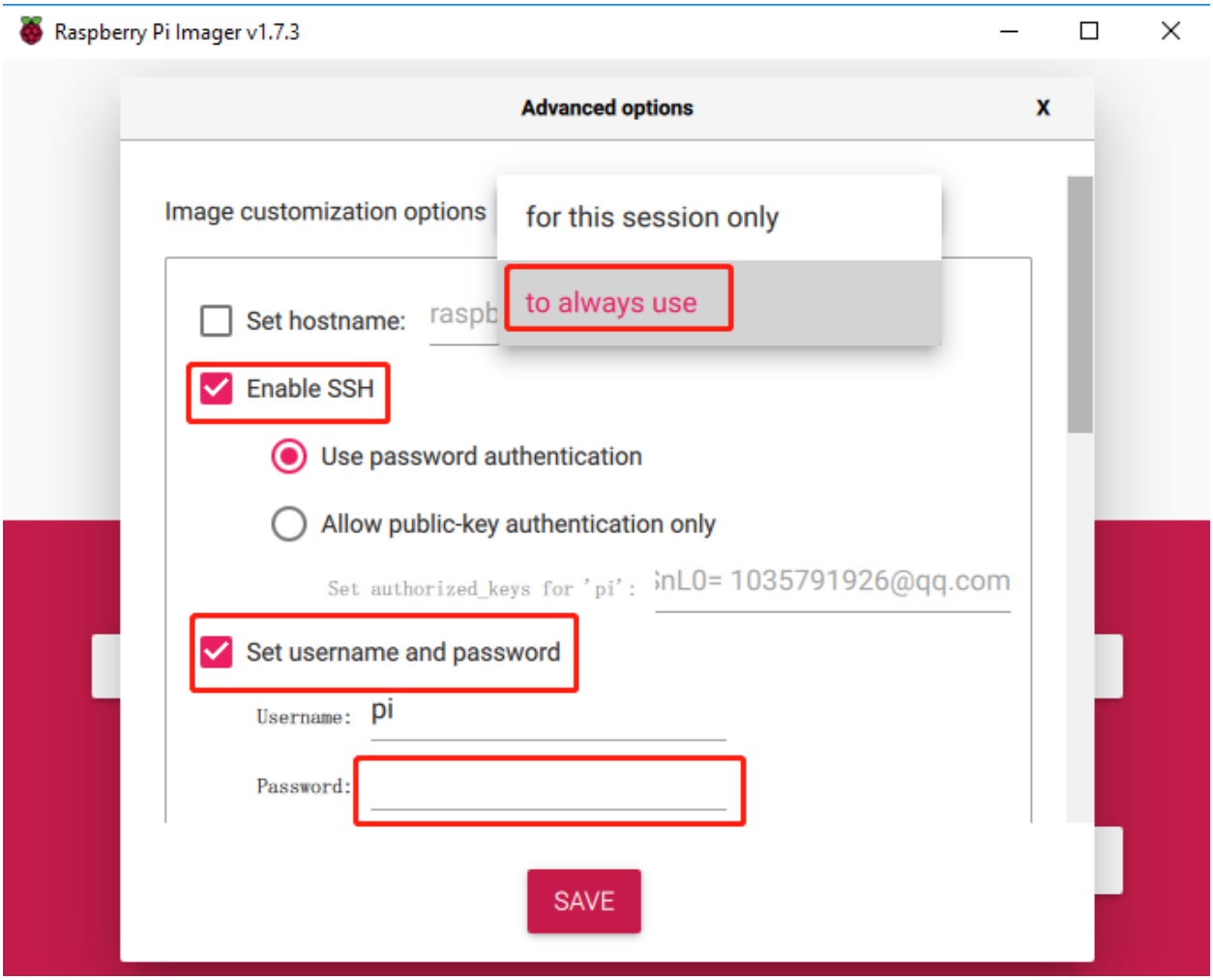
Select the SD card you are using.



Step 6

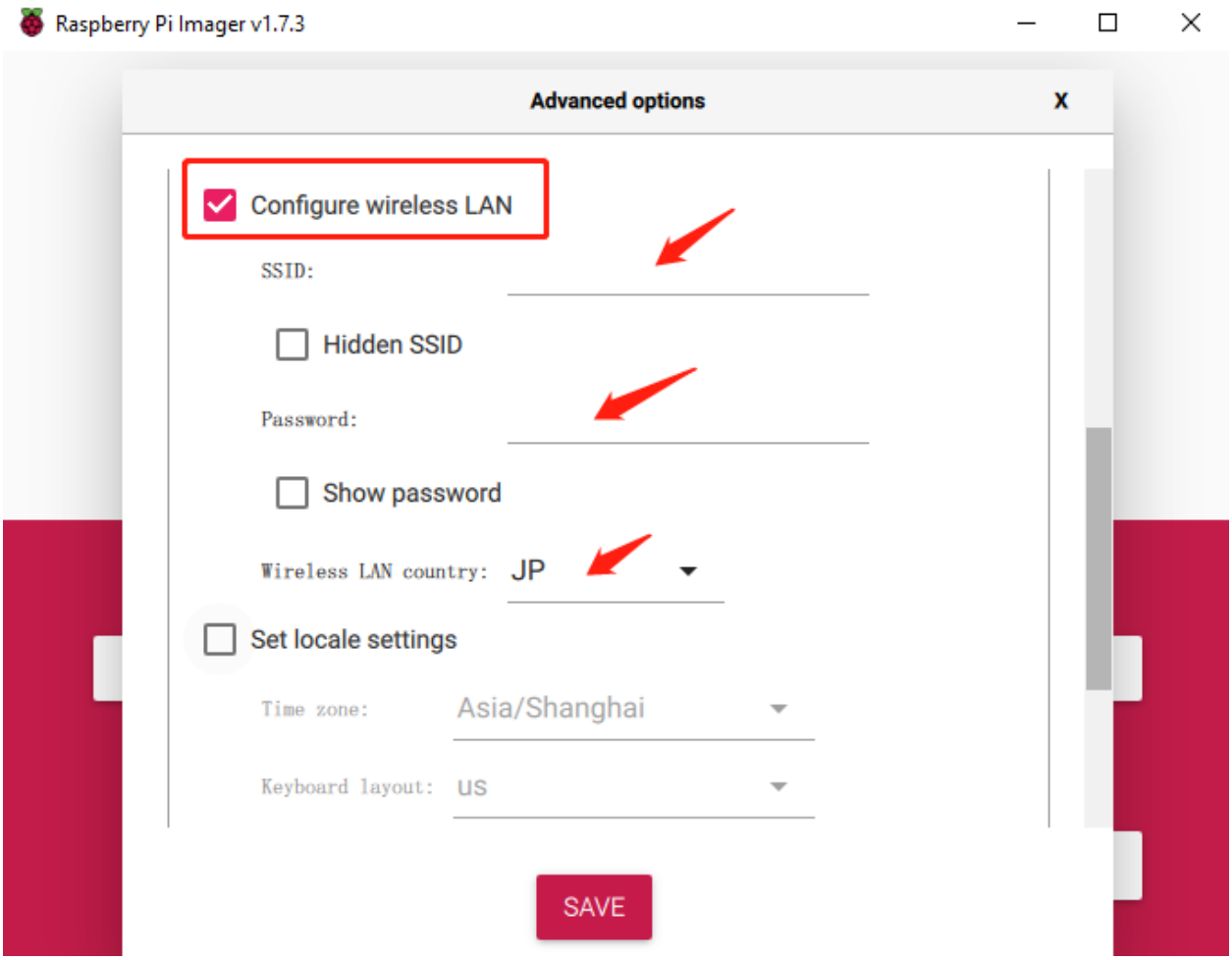
To open the advanced options page, click the setting button (appears after selecting operating system) or press Ctrl+Shift+X. Enable ssh and set the username and name. You can choose to always use this image customization options.

Note: When the Set hostname box is not checked, the default hostname will still be `raspberrypi`, and we will use this hostname to access the Raspberry Pi remotely.



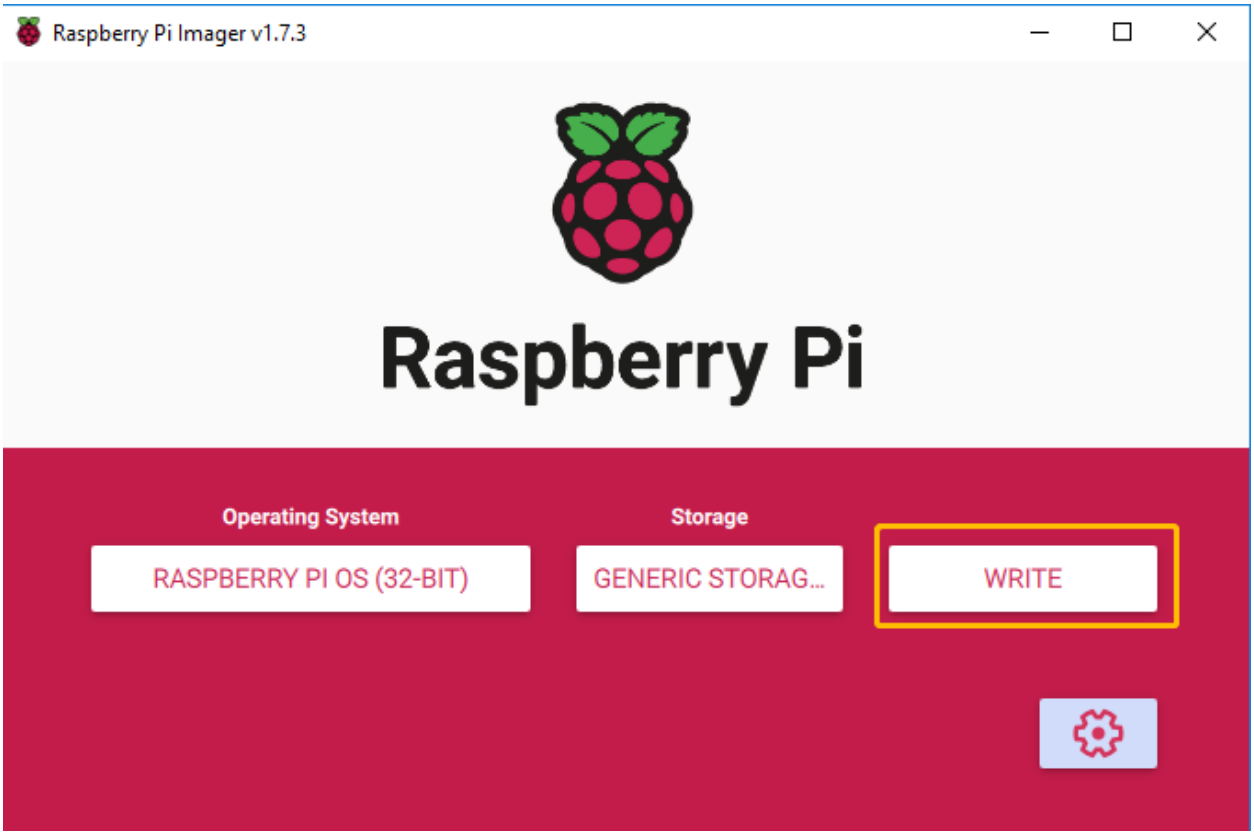
Then scroll down to complete the wifi configuration and click **SAVE**.

Note: **wifi country** should be set the two-letter ISO/IEC alpha2 code for the country in which you are using your Raspberry Pi, please refer to the following link: https://en.wikipedia.org/wiki/ISO_3166-1_alpha-2#Officially_assigned_code_elements



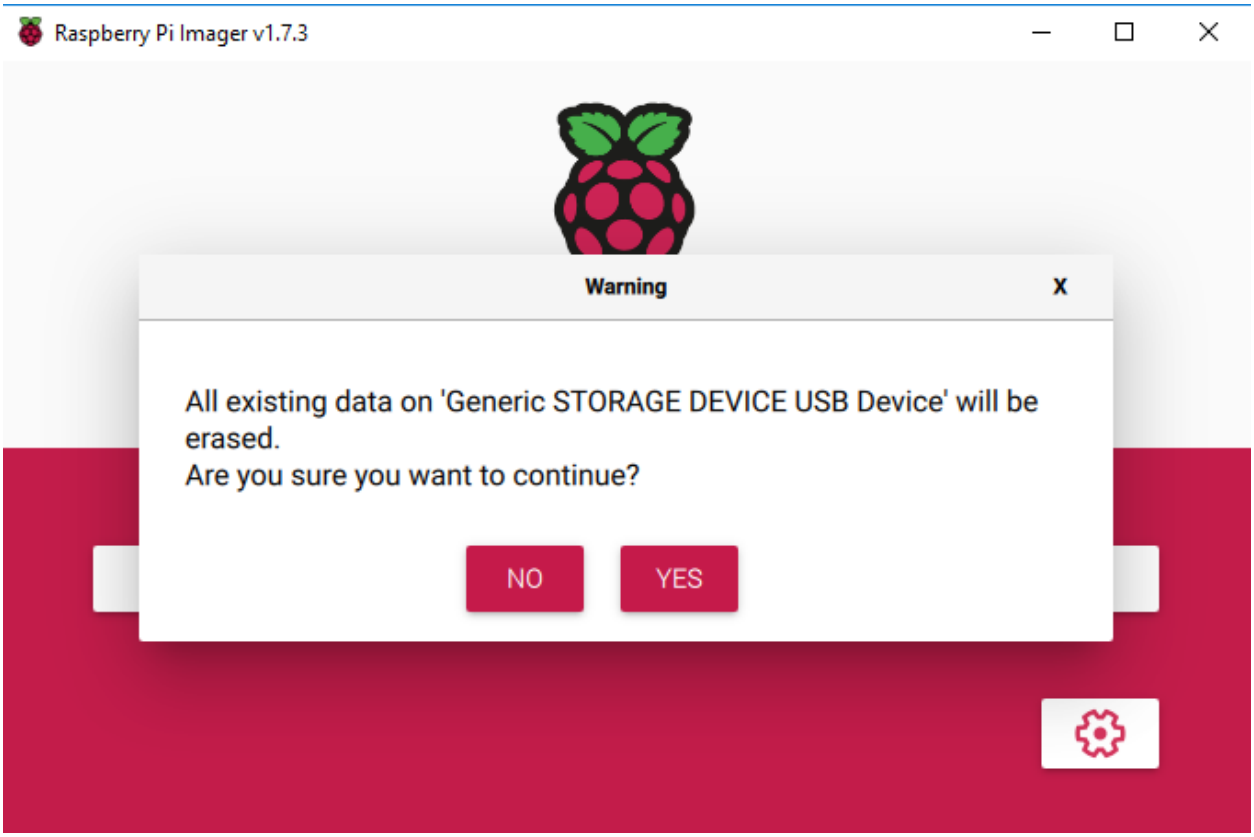
Step 7

Click the **WRITE** button.



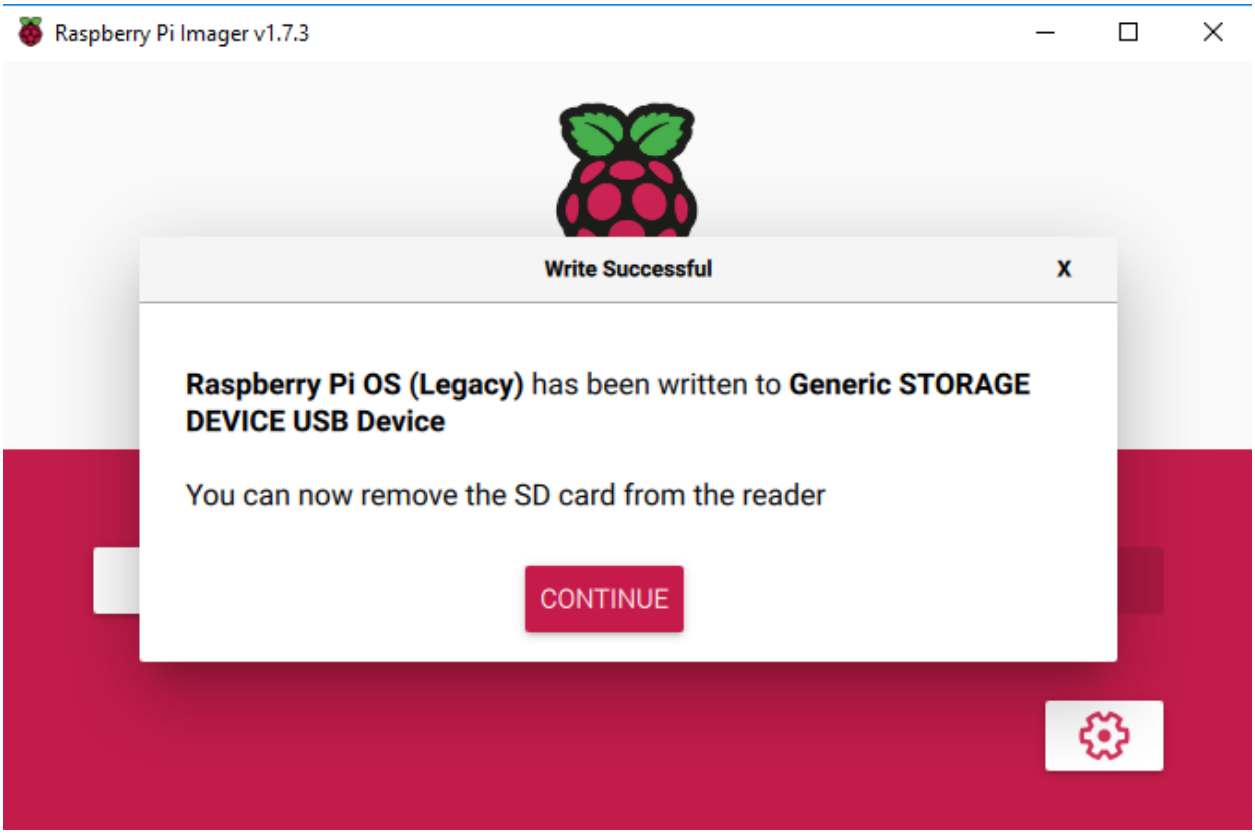
Step 8

If your SD card currently has any files on it, you may wish to back up these files first to prevent you from permanently losing them. If there is no file to be backed up, click **Yes**.



Step 9

After waiting for a period of time, the following window will appear to represent the completion of writing.



4.1.3 Set up Your Raspberry Pi

If You Have a Screen

If you have a screen, it will be easy for you to operate on the Raspberry Pi.

Required Components

- Any Raspberry Pi
- 1 * Power Adapter
- 1 * Micro SD card
- 1 * Screen Power Adapter
- 1 * HDMI cable
- 1 * Screen
- 1 * Mouse
- 1 * Keyboard

1. Insert the SD card you've set up with Raspberry Pi OS into the micro SD card slot on the underside of your Raspberry Pi.
2. Plug in the Mouse and Keyboard.
3. Connect the screen to Raspberry Pi's HDMI port and make sure your screen is plugged into a wall socket and switched on.

Note: If you use a Raspberry Pi 4, you need to connect the screen to the HDMI0 (nearest the power in port).

4. Use the power adapter to power the Raspberry Pi. After a few seconds, the Raspberry Pi OS desktop will be displayed.

If You Have No Screen

If you don't have a monitor, you can remotely log into your Raspberry Pi.

You can apply the SSH command to open the Raspberry Pi's Bash shell. Bash is the standard default shell for Linux. The shell itself is a command (instruction) when the user uses Unix/Linux. Most of what you need to do can be done through the shell.

If you're not satisfied with using the command window to access your Raspberry Pi, you can also use the remote desktop feature to easily manage files on your Raspberry Pi using a GUI.

See below for detailed tutorials for each system.

Mac OS X user

For Mac users, accessing the Raspberry Pi desktop directly via VNC is more convenient than from the command line. You can access it via Finder by entering the set account password after enabling VNC on the Raspberry Pi side.

Note that this method does not encrypt communication between the Mac and Raspberry Pi. The communication will take place within your home or business network, so even if it's unprotected, it won't be an issue. However, if you are concerned about it, you can install a VNC application such as VNC® Viewer.

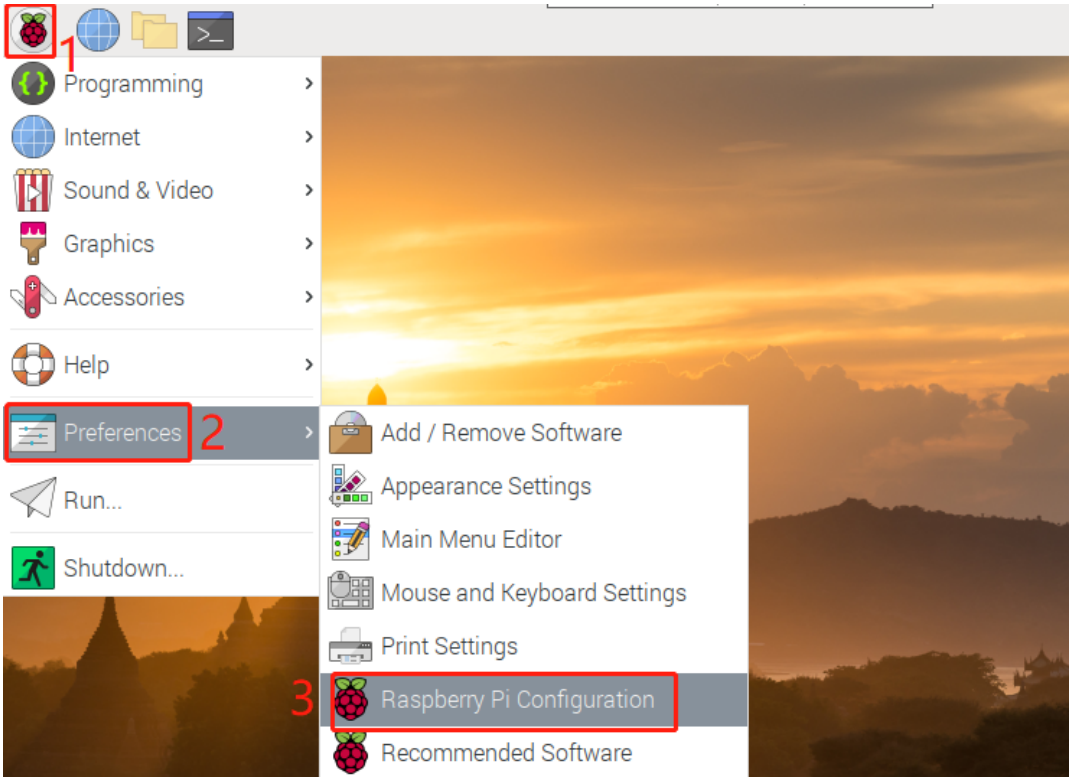
Alternatively it would be handy if you could use a temporary monitor (TV), mouse and keyboard to open the Raspberry Pi desktop directly to set up VNC. If not, it doesn't matter, you can also use the SSH command to open the Raspberry Pi's Bash shell and then using the command to set up the VNC.

- *Have Temporarily Monitor (or TV)?*

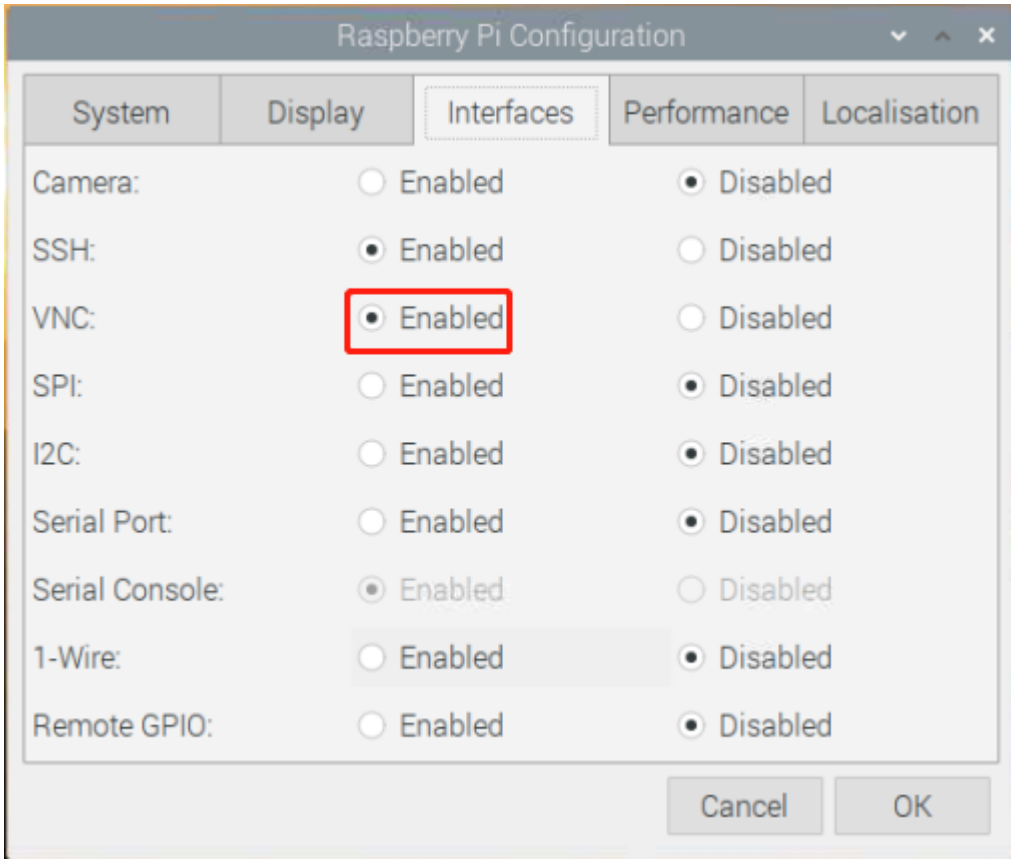
- *Don't Have Temporarily Monitor (or TV)?*

Have Temporarily Monitor (or TV)?

1. Connect a monitor (or TV), mouse and keyboard to the Raspberry Pi and power it on. Select the menu according to the numbers in the figure.

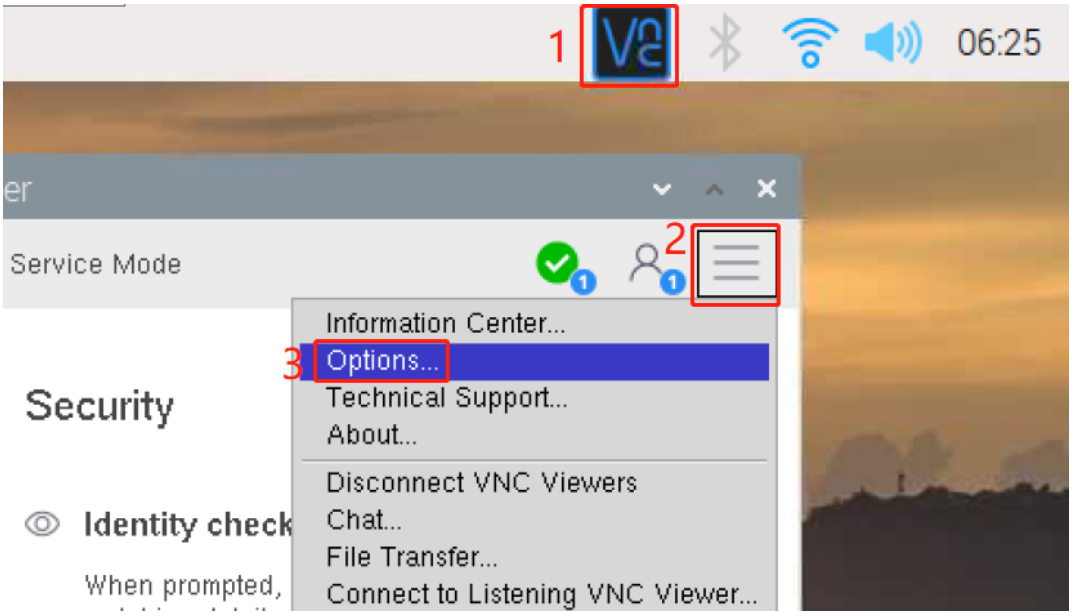


2. The following screen will be displayed. Set **VNC** to **Enabled** on the **Interfaces** tab, and click **OK**.

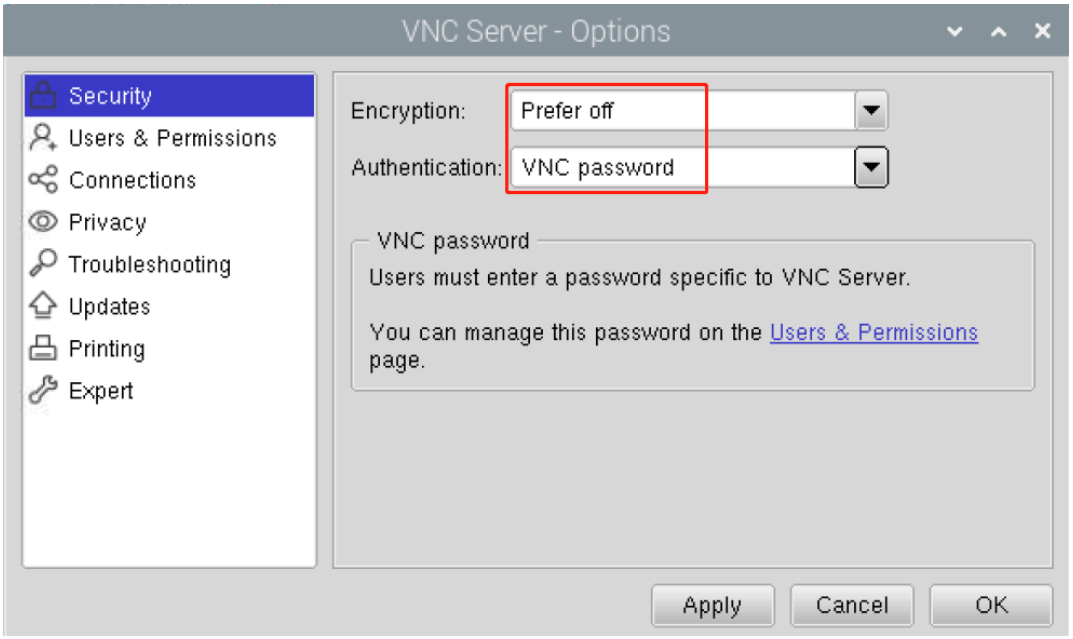


3. A VNC icon appears on the upper right of the screen and the VNC server starts.

4. Open the VNC server window by clicking on the **VNC** icon, then click on the **Menu** button in the top right corner and select **Options**.

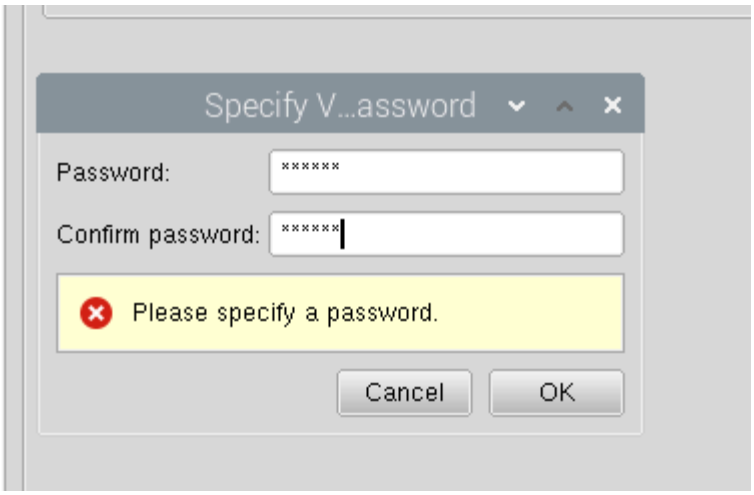


5. You will be presented with the following screen where you can change the options.



Set **Encryption** to **Prefer off** and **Authentication** to **VNC password**.

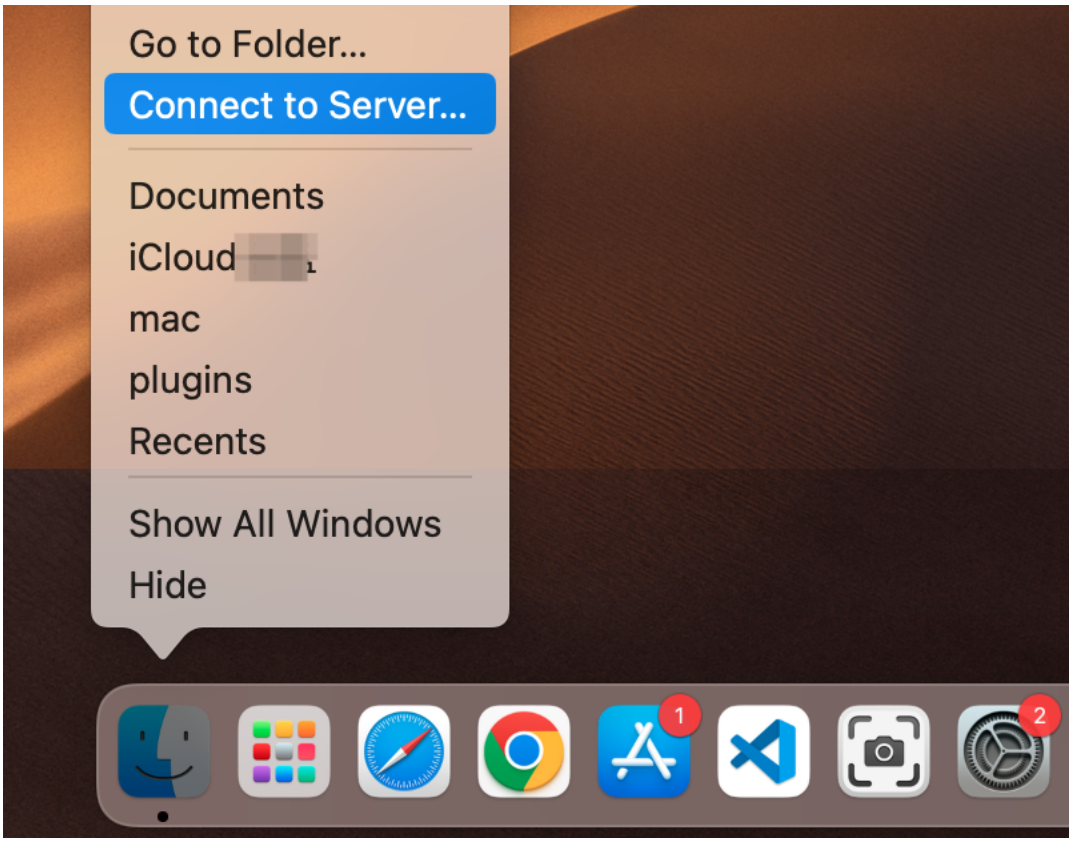
6. When you click the **OK** button, the password input screen is displayed. You can use the same password as the Raspberry pi password or a different password, so enter it and click **OK**.



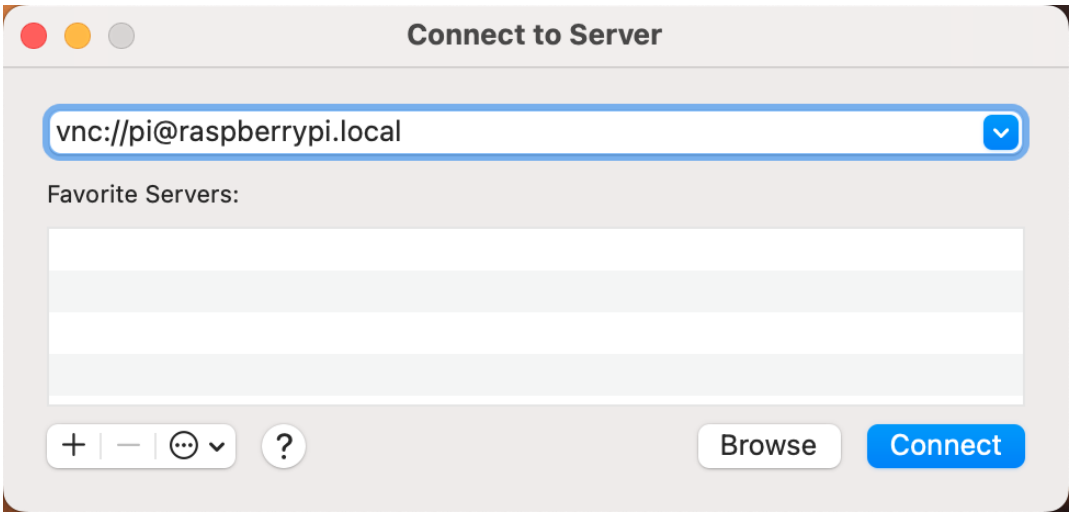
You are now ready to connect from your Mac. It's okay to disconnect the monitor.

From here, it will be the operation on the Mac side.

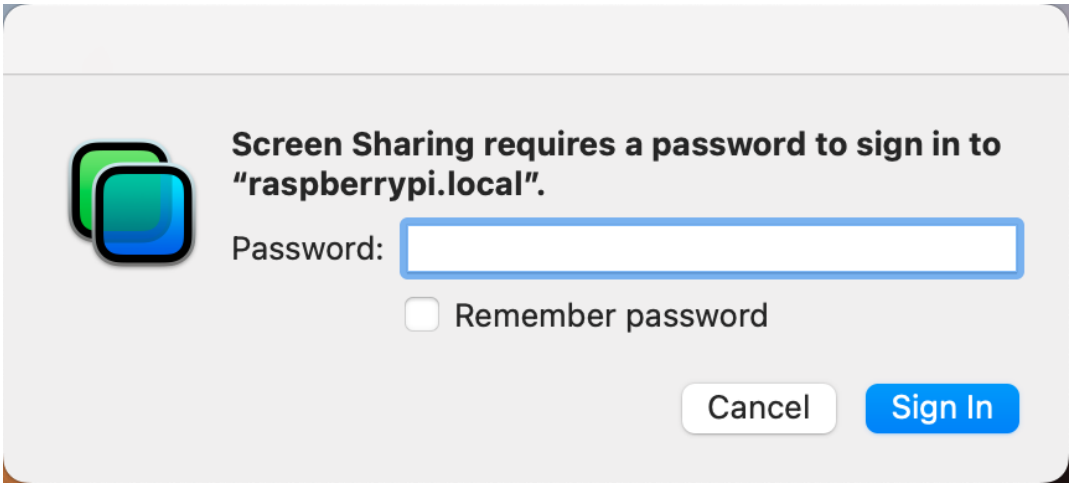
1. Now, select **Connect to Server** from the Finder's menu, which you can open by right-clicking.



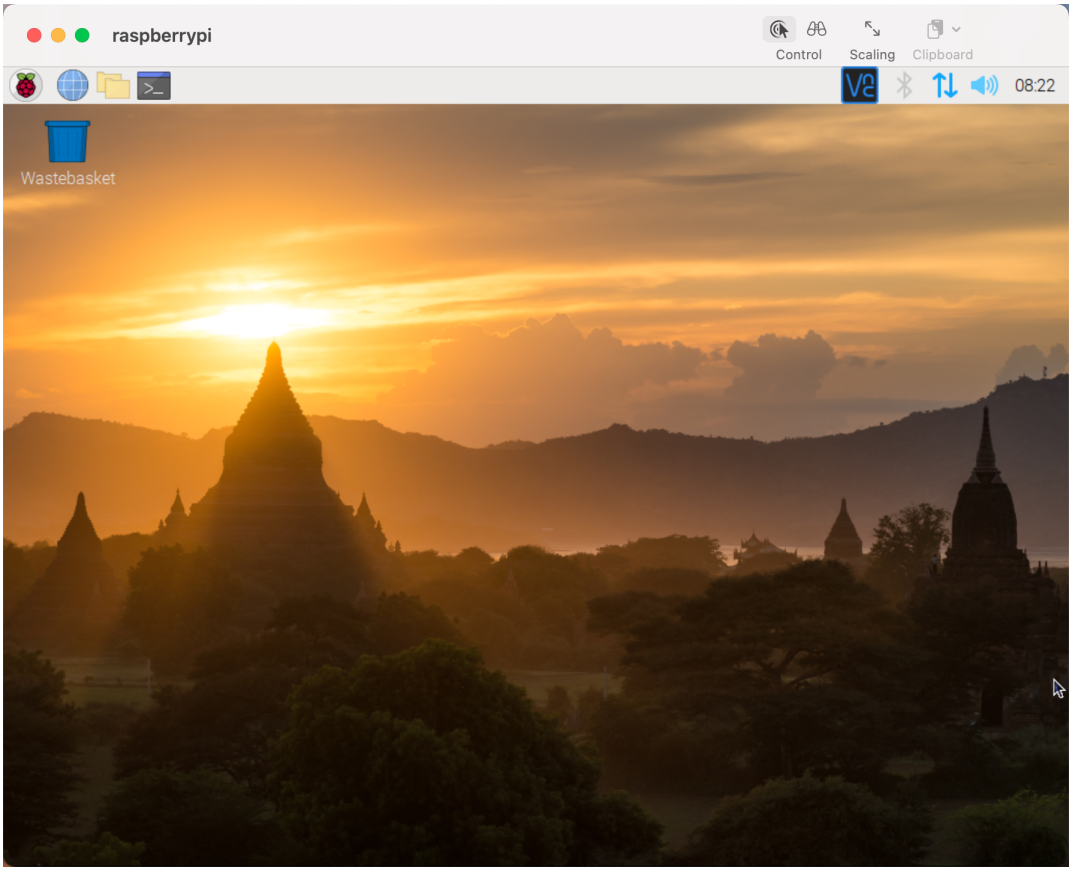
2. Type in `vnc://<username>@<hostname>.local` (or `vnc://<username>@<IP address>`). After entering, click **Connect**.



3. You will be asked for a password, so please enter it.



4. The desktop of the Raspberry pi will be displayed, and you will be able to operate it from the Mac as it is.

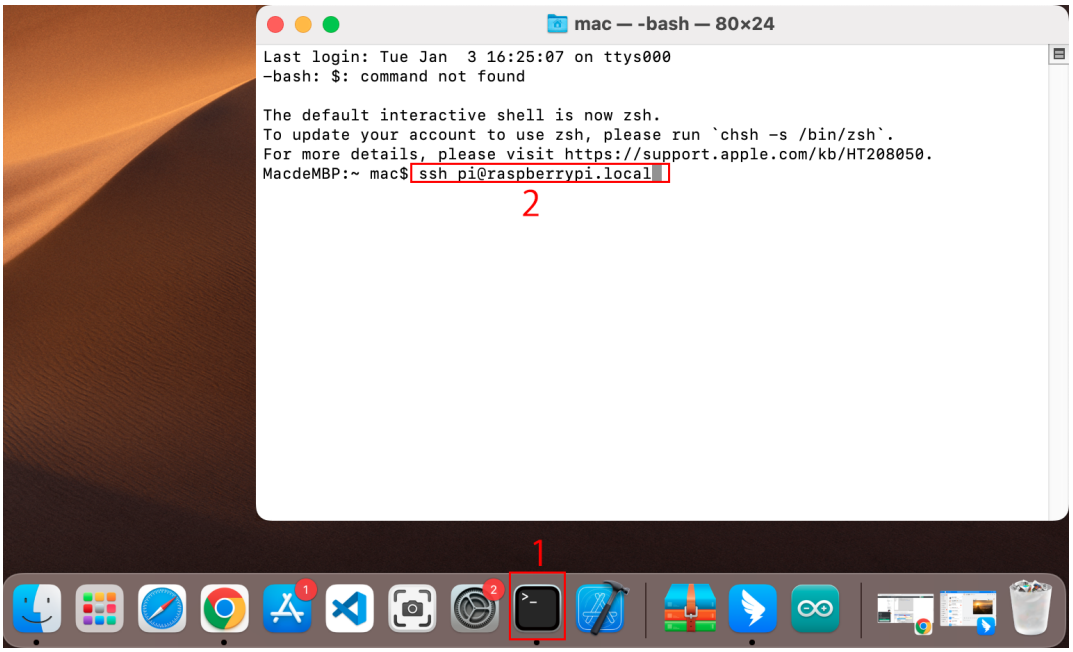


Don't Have Temporarily Monitor (or TV)?

- You can apply the SSH command to open the Raspberry Pi's Bash shell.
- Bash is the standard default shell for Linux.
- The shell is a command line interpreter (CLI) when the user uses Unix/Linux.
- Most of what you need to do can be done through the shell.
- After setting up the Raspberry pi side, you can access the desktop of the Raspberry Pi using the **Finder** from the Mac.

1. Type `ssh <username>@<hostname>.local` to connect to the Raspberry Pi.

```
ssh pi@raspberrypi.local
```



2. The following message will be displayed only when you log in for the first time, so enter **yes**.

```
The authenticity of host 'raspberrypi.local␣
↪(2400:2410:2101:5800:635b:f0b6:2662:8cba)' can't be established.
ED25519 key fingerprint is SHA256:oo7x3ZSgAo032wD1tE8eW0fFM/
↪kmewIvRwkBys6XRwg.
This key is not known by any other names
Are you sure you want to continue connecting (yes/no/[fingerprint])?
```

3. Enter the password for the Raspberry pi. The password you enter will not be displayed, so be careful not to make a mistake.

```
pi@raspberrypi.local's password:
Linux raspberrypi 5.15.61-v8+ #1579 SMP PREEMPT Fri Aug 26 11:16:44 BST␣
↪2022 aarch64

The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
Last login: Thu Sep 22 12:18:22 2022
pi@raspberrypi:~ $
```

4. Set up your Raspberry Pi so that you can log in via VNC from your Mac once you have successfully logged into it. The first step is to update your operating system by running the following commands.

```
sudo apt update
sudo apt upgrade
```

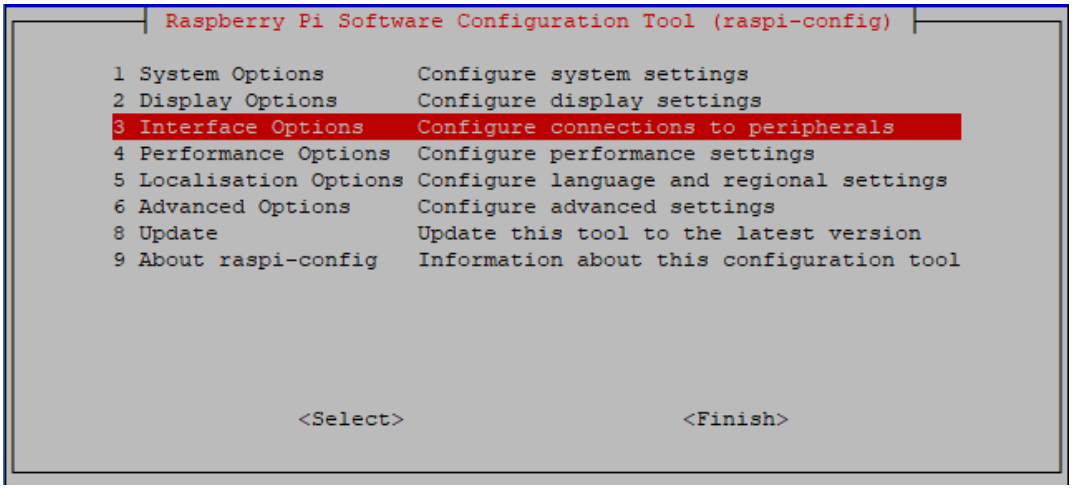
`Do you want to continue? [Y/n]`, Enter `Y` when prompted.

It may take some time for the update to finish. (It depends on the amount of updates at that time.)

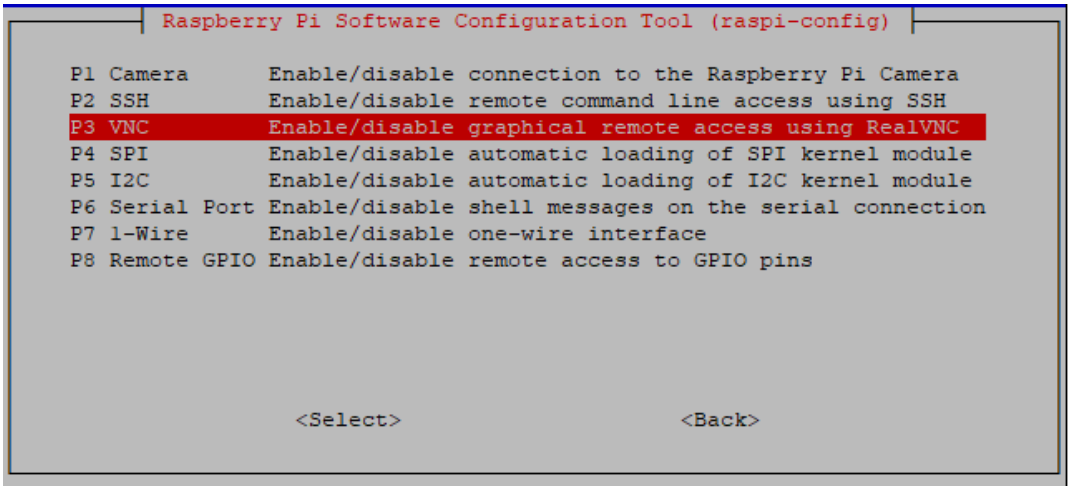
5. Enter the following command to enable the **VNC Server**.

```
sudo raspi-config
```

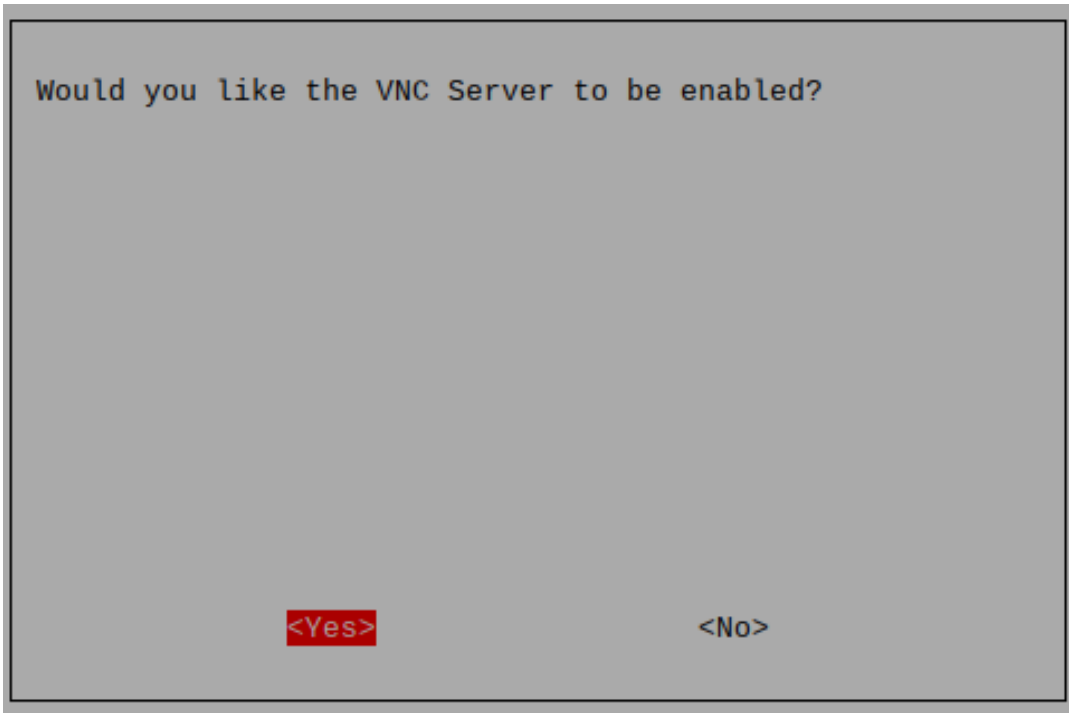
6. The following screen will be displayed. Select **3 Interface Options** with the arrow keys on the keyboard and press the **Enter** key.



7. Then select **P3 VNC**.



8. Use the arrow keys on the keyboard to select **<Yes>** -> **<OK>** -> **<Finish>** to complete the setup.

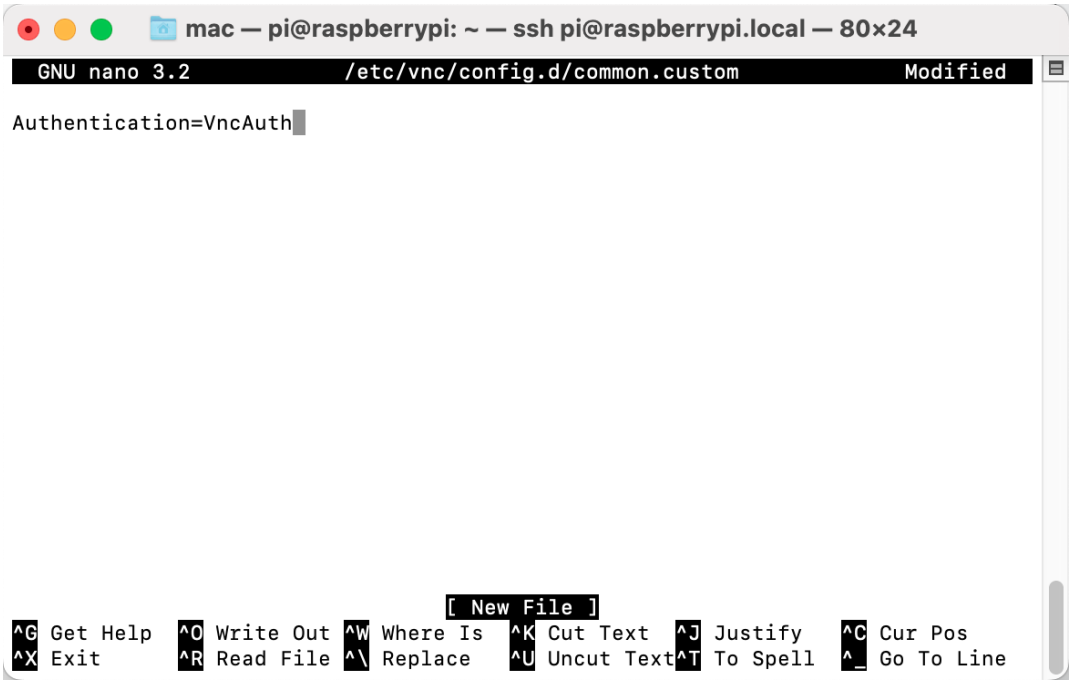


9. Now that the VNC server has started, let's change the settings for connecting from a Mac.

   To specify parameters for all programs for all user accounts on the computer, create `/etc/vnc/config.d/common.custom`.

   ```
   sudo nano /etc/vnc/config.d/common.custom
   ```

   After entering `Authentication=VncAuthenter`, press `Ctrl+X` -> `Y` -> `Enter` to save and exit.



10. In addition, set a password for logging in via VNC from a Mac. You can use the same password as the Raspberry

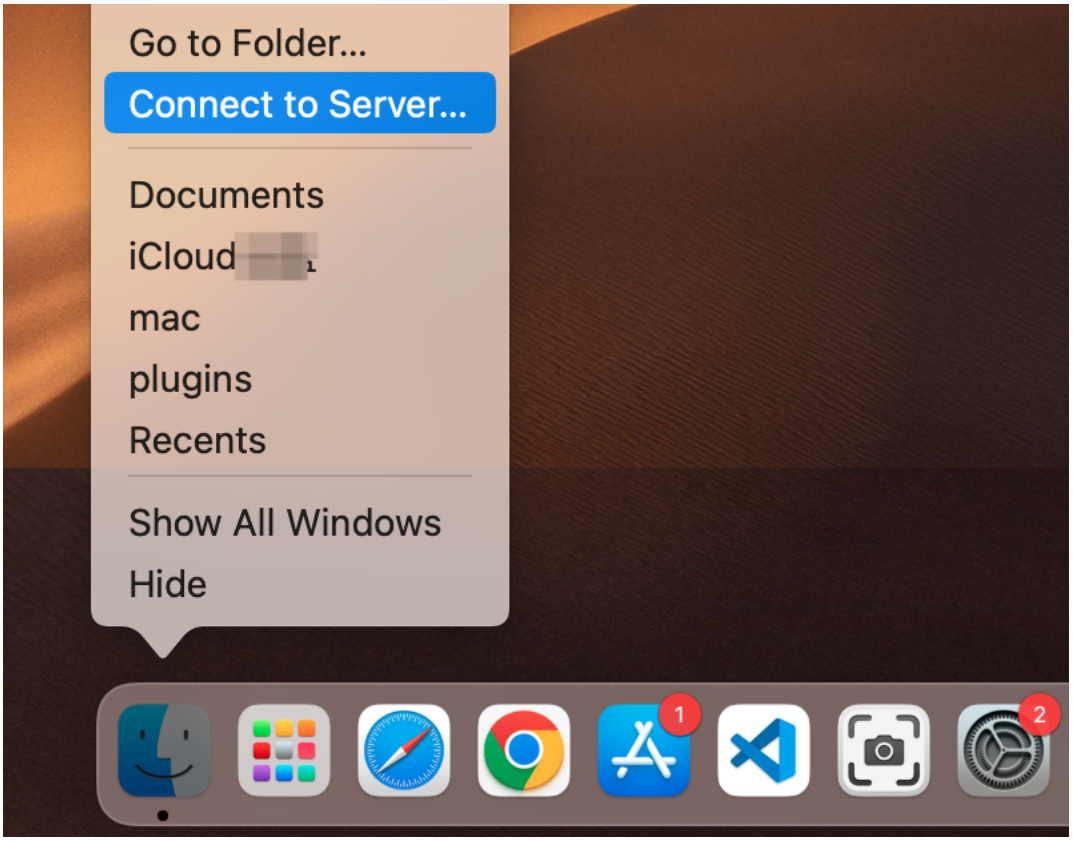
pi password or a different password.

```
sudo vncpasswd -service
```

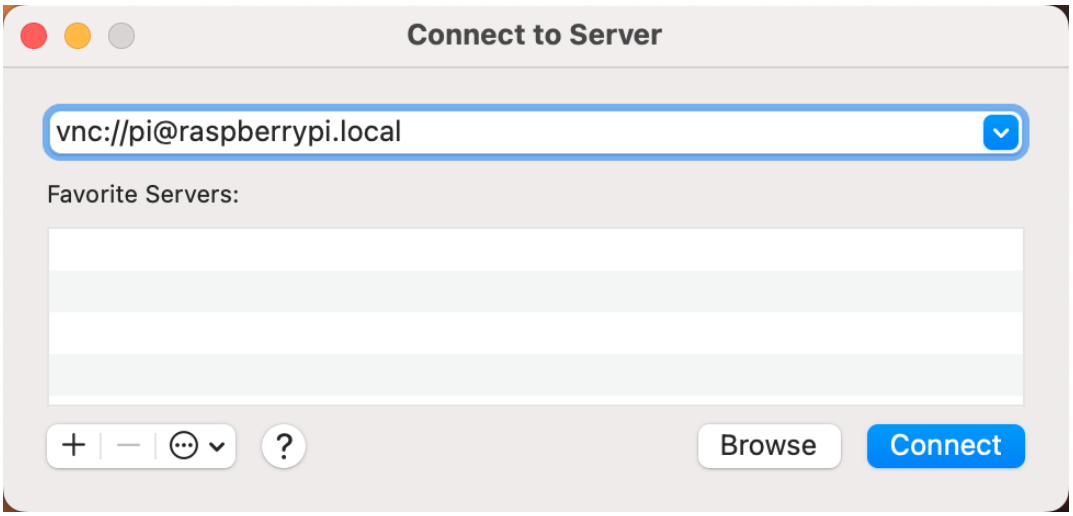
11. Once the setup is complete, restart the Raspberry Pi to apply the changes.

```
sudo sudo reboot
```

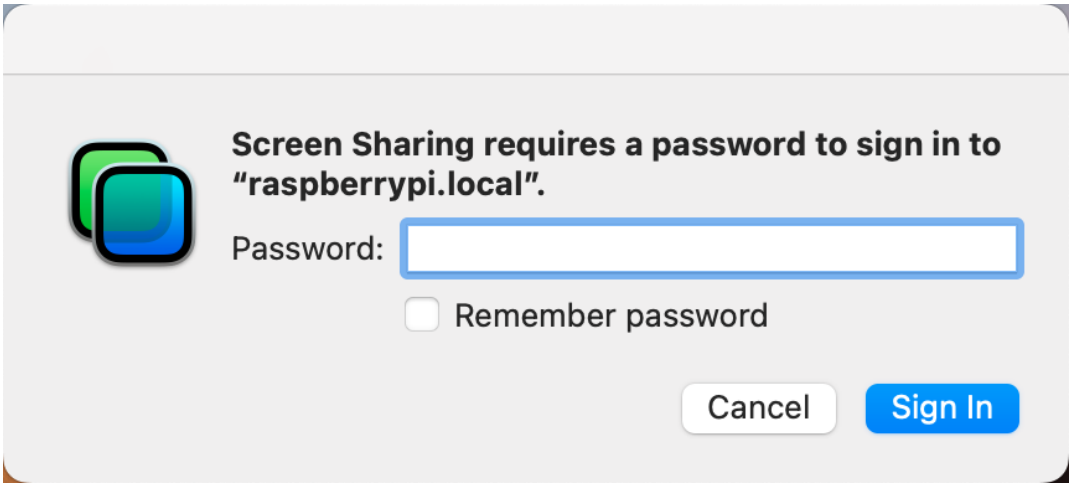
12. Now, select **Connect to Server** from the **Finder**'s menu, which you can open by right-clicking.



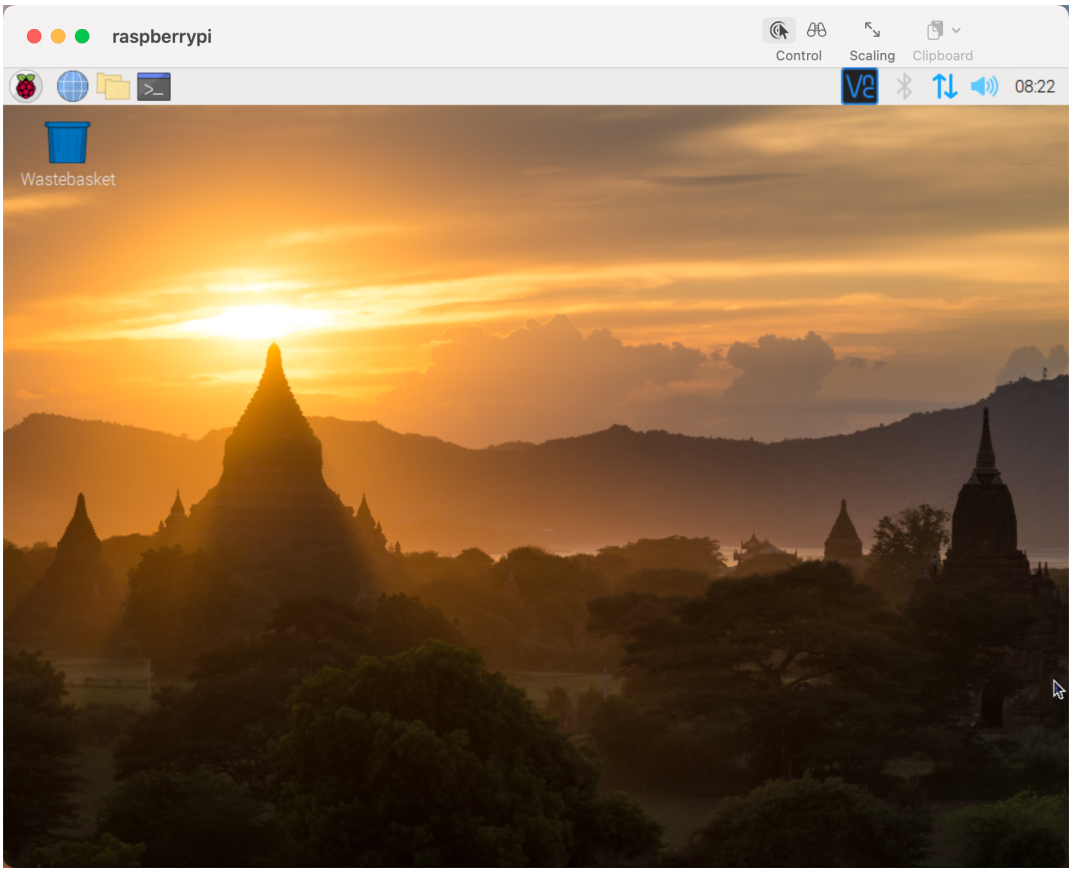
13. Type in `vnc://<username>@<hostname>.local` (or `vnc://<username>@<IP address>`). After entering, click **Connect**.



14. You will be asked for a password, so please enter it.



15. The desktop of the Raspberry pi will be displayed, and you will be able to operate it from the Mac as it is.

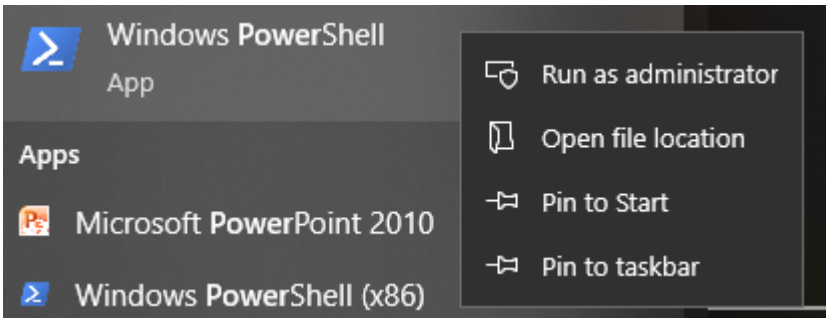


Windows Users

Login Raspberry Pi Remotely

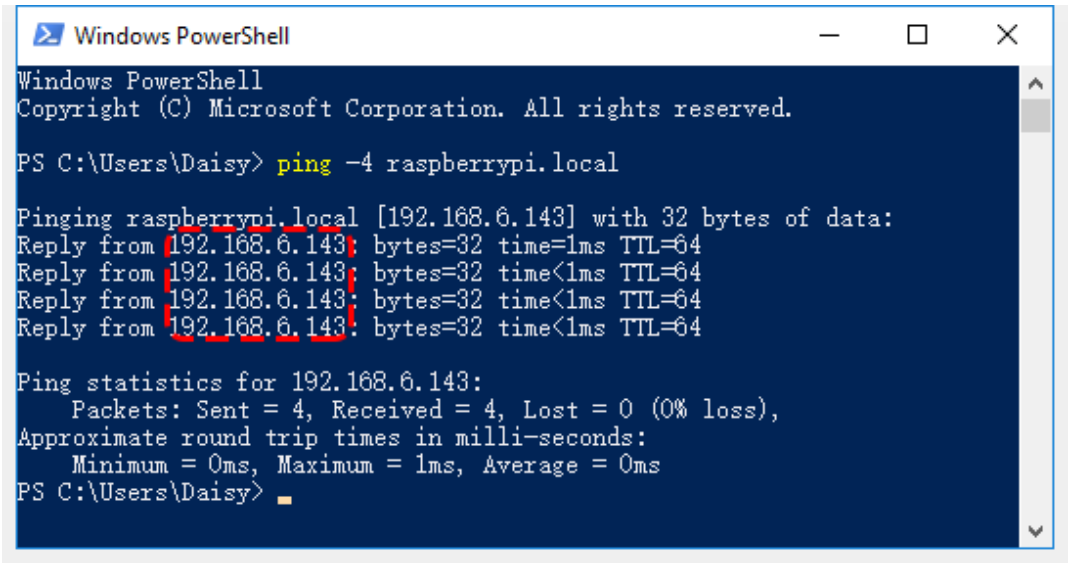
If you are using win10, you can use follow way to login Raspberry Pi remotely.

1. Type `powershell` in the search box of your Windows desktop, right click on the `Windows PowerShell`, and select `Run as administrator` from the menu that appears.



2. Then, check the IP address of your Raspberry Pi by typing in `ping -4 <hostname>.local`.

```
ping -4 raspberrypi.local
```



As shown above, you can see the Raspberry Pi's IP address after it has been connected to the network.

- If terminal prompts `Ping request could not find host pi.local. Please check the name and try again.`. Please follow the prompts to make sure the hostname you fill in is correct.
- Still can't get the IP? Check your network or WiFi configuration on the Raspberry Pi.

3. At this point you will be able to log in to your Raspberry Pi using the `ssh <username>@<hostname>.local` (or `ssh <username>@<IP address>`).

```
ssh pi@raspberrypi.local
```

> **Warning:** If a prompt appears `The term 'ssh' is not recognized as the name of a cmdlet...`.
>
> It means your system is too old and does not have ssh tools pre-installed, you need to manually *Install OpenSSH via Powershell*.
>
> Or use a third party tool like *PuTTY*.

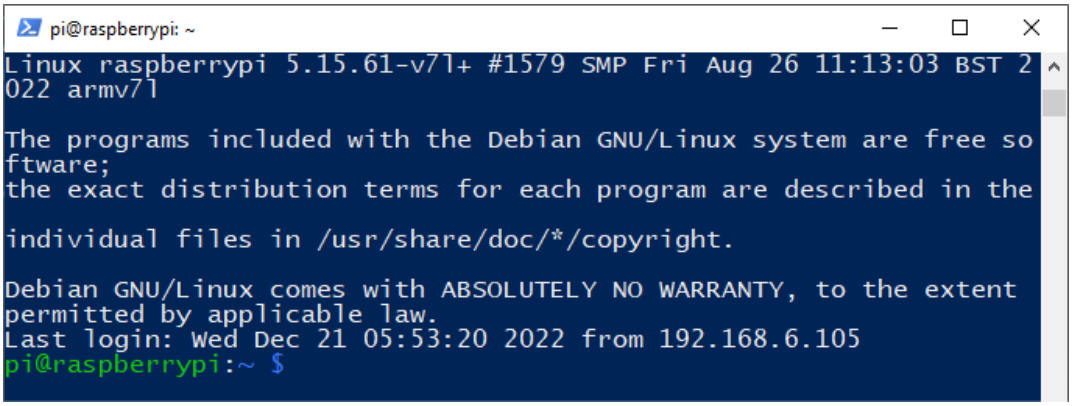
4. The following message will be displayed only when you log in for the first time, so enter `yes`.

```
The authenticity of host 'raspberrypi.local␣
↪(2400:2410:2101:5800:635b:f0b6:2662:8cba)' can't be established.
ED25519 key fingerprint is SHA256:oo7x3ZSgAo032wD1tE8eW0fFM/
↪kmewIvRwkBys6XRwg.
This key is not known by any other names
Are you sure you want to continue connecting (yes/no/[fingerprint])?
```

5. Input the password you set before. (Mine is `raspberry`.)

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

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



Remote Desktop

If you're not satisfied with using the command window to access your Raspberry Pi, you can also use the remote desktop feature to easily manage files on your Raspberry Pi using a GUI.

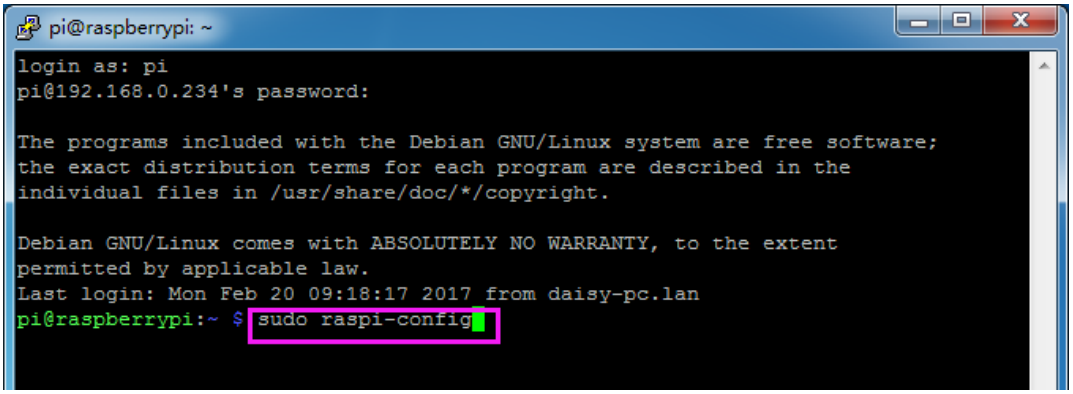
Here we use VNC® Viewer.

Enable VNC service

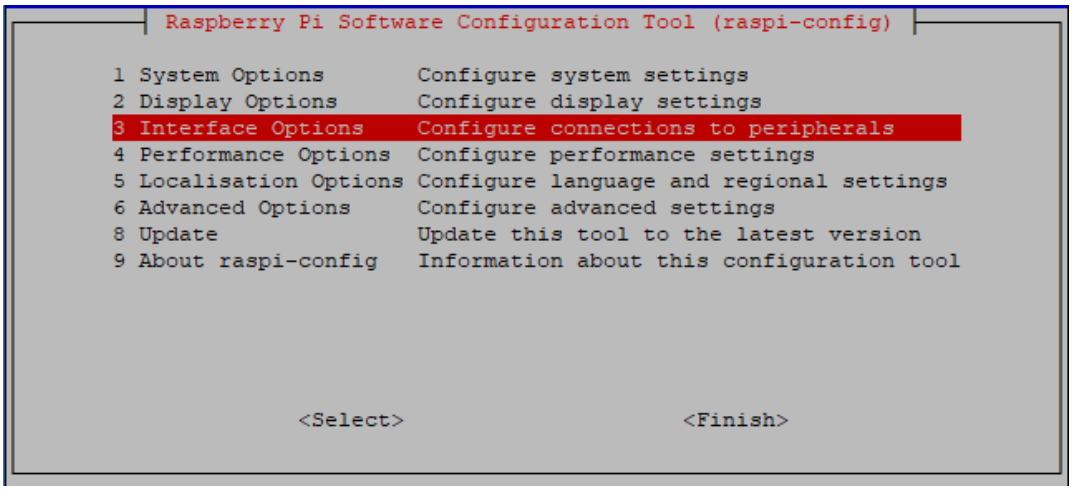
The VNC service has been installed in the system. By default, VNC is disabled. You need to enable it in config.

1. Input the following command:

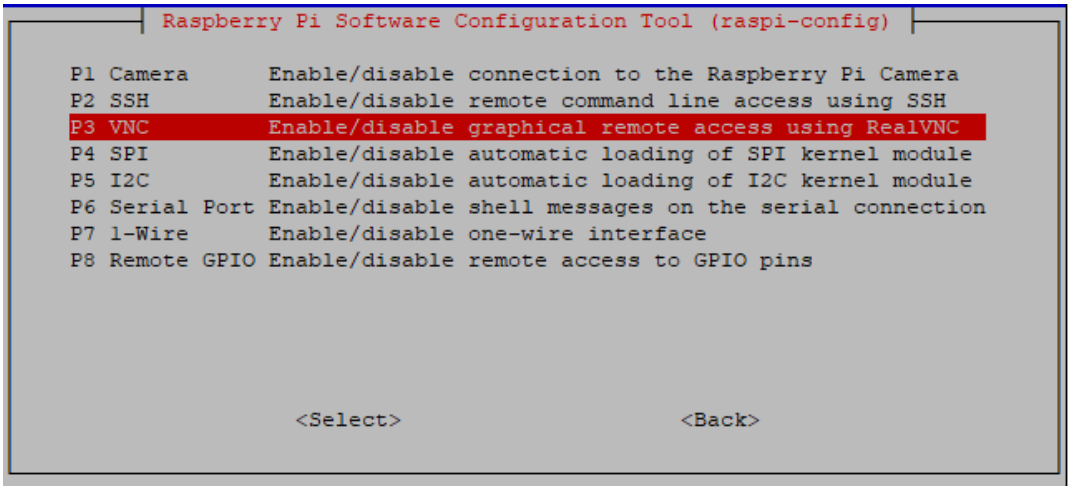
```
sudo raspi-config
```



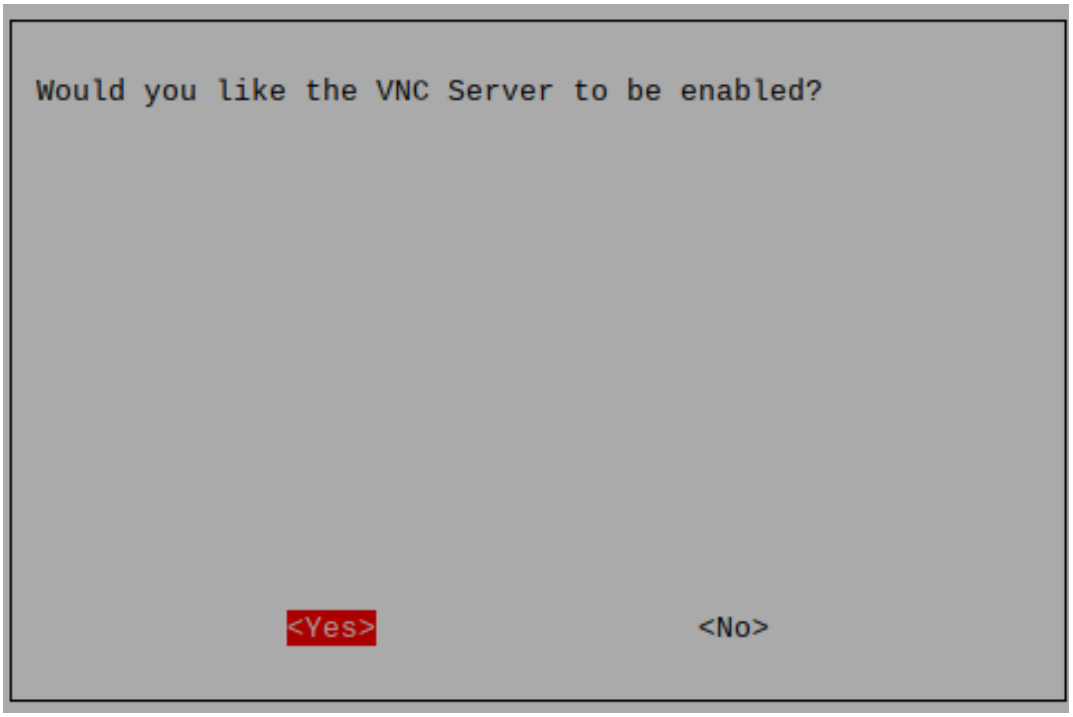
2. Choose **3 Interfacing Options** by press the down arrow key on your keyboard, then press the **Enter** key.



3. Then **P3 VNC**.

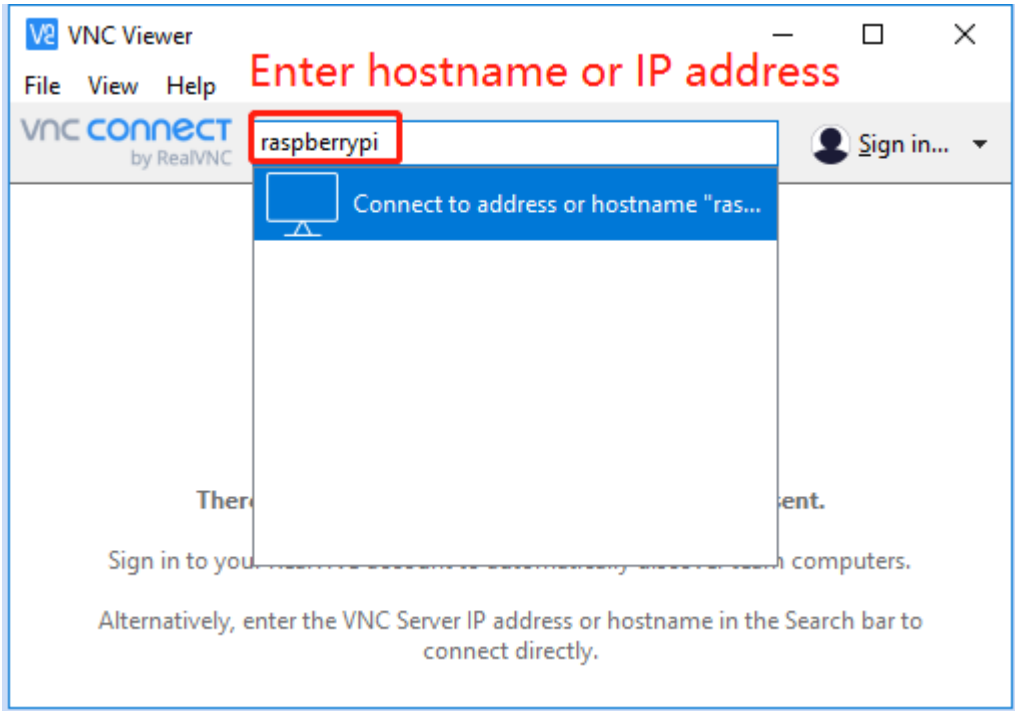


4. Use the arrow keys on the keyboard to select **<Yes>** -> **<OK>** -> **<Finish>** to complete the setup.

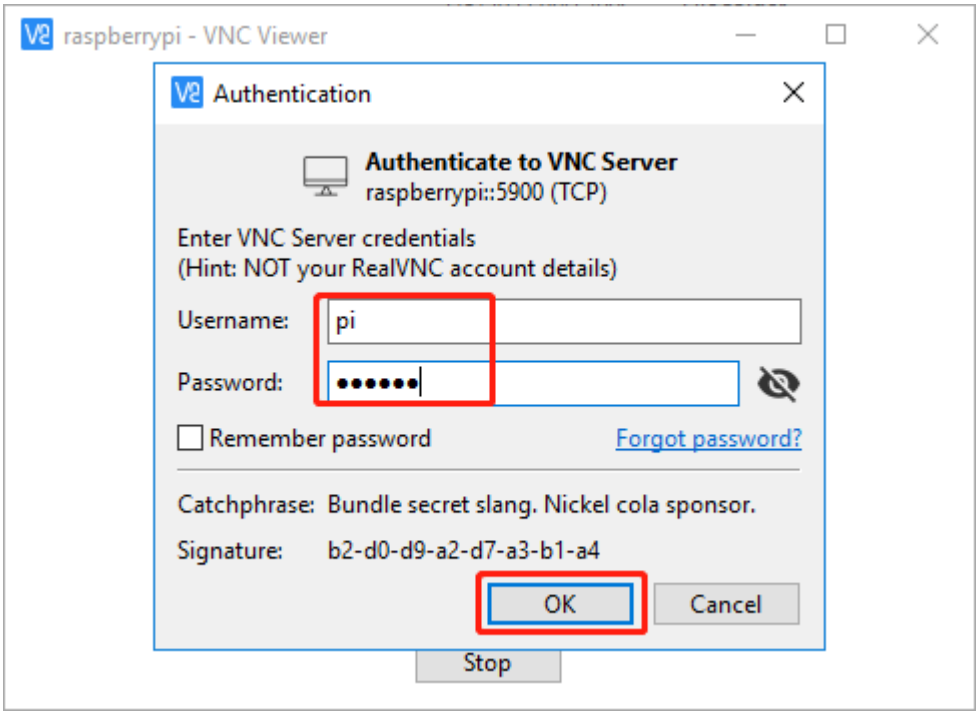


Login to VNC

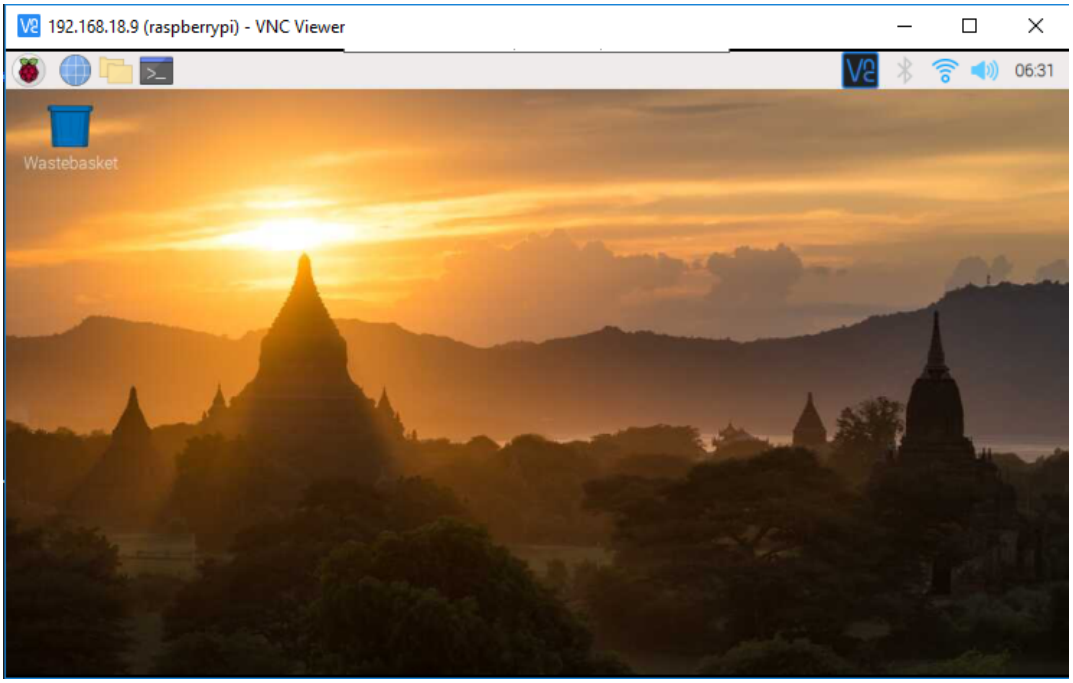
1. You need to download and install the VNC Viewer on personal computer.
2. Open it once the installation is complete. Then, enter the host name or IP address and press Enter.



3. After entering your Raspberry Pi name and password, click **OK**.

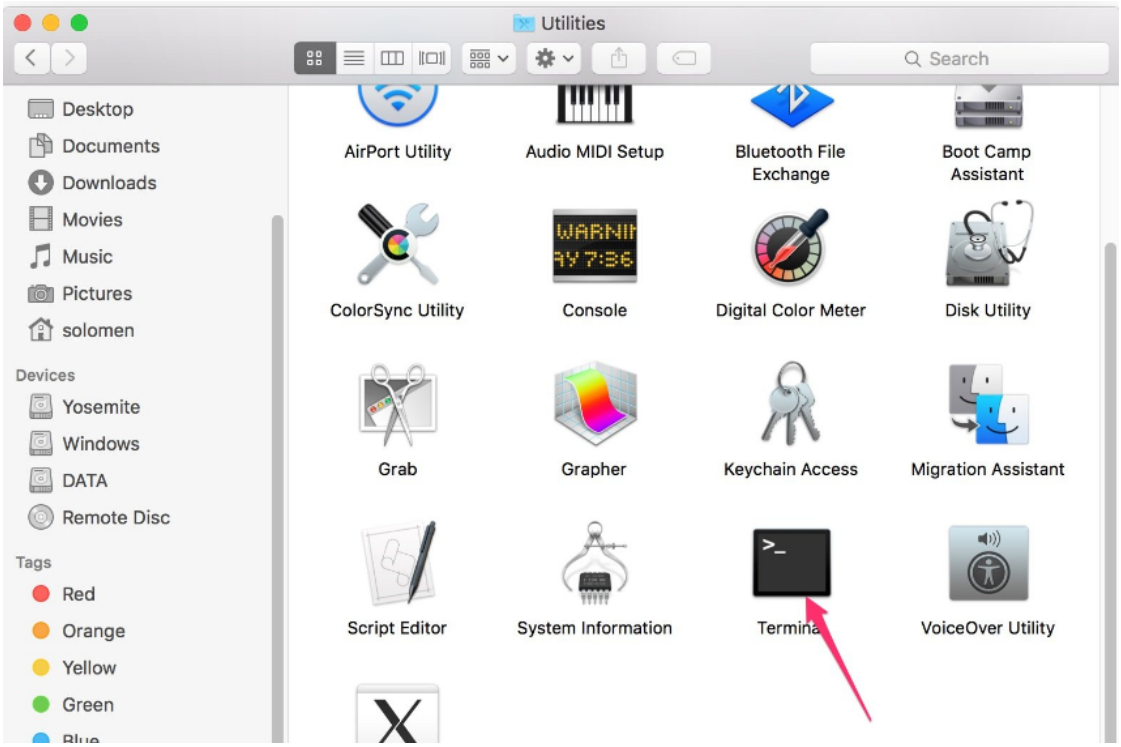


4. Now you can see the desktop of the Raspberry Pi.



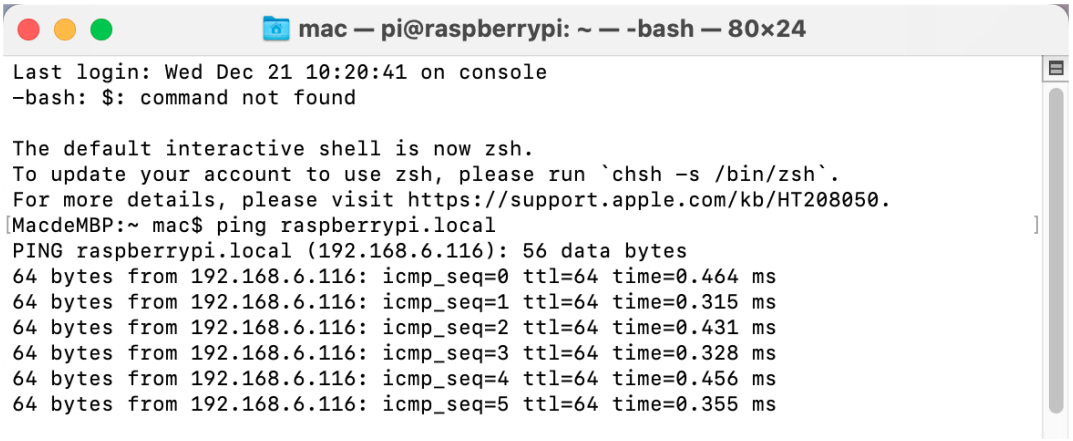
Linux /Unix Users

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



1. Check if your Raspberry Pi is on the same network by type in `ping <hostname>.local`.

```
ping raspberrypi.local
```



As shown above, you can see the Raspberry Pi's IP address after it has been connected to the network.

- If terminal prompts `Ping request could not find host pi.local. Please check the name and try again.`. Please follow the prompts to make sure the hostname you fill in is correct.
- Still can't get the IP? Check your network or WiFi configuration on the Raspberry Pi.

2. Type in `ssh <username>@<hostname>.local` (or `ssh <username>@<IP address>`).

```
ssh pi@raspberrypi.local
```

Note: If a prompt appears `The term 'ssh' is not recognized as the name of a cmdlet...`.

It means your system is too old and does not have ssh tools pre-installed, you need to manually *Install OpenSSH via Powershell*.

Or use a third party tool like *PuTTY*.

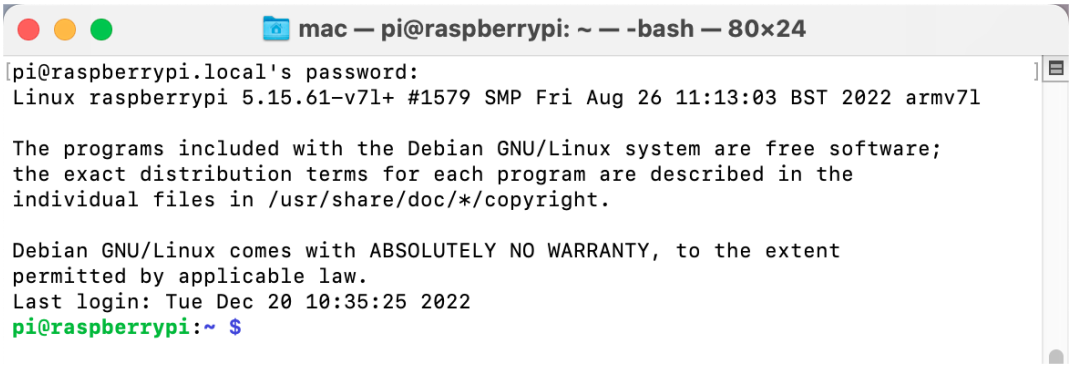
3. The following message will be displayed only when you log in for the first time, so enter `yes`.

```
The authenticity of host 'raspberrypi.local␣
↪(2400:2410:2101:5800:635b:f0b6:2662:8cba)' can't be established.
ED25519 key fingerprint is SHA256:oo7x3ZSgAo032wD1tE8eW0fFM/
↪kmewIvRwkBys6XRwg.
This key is not known by any other names
Are you sure you want to continue connecting (yes/no/[fingerprint])?
```

4. Input the password you set before. (Mine is `raspberry`.)

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

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



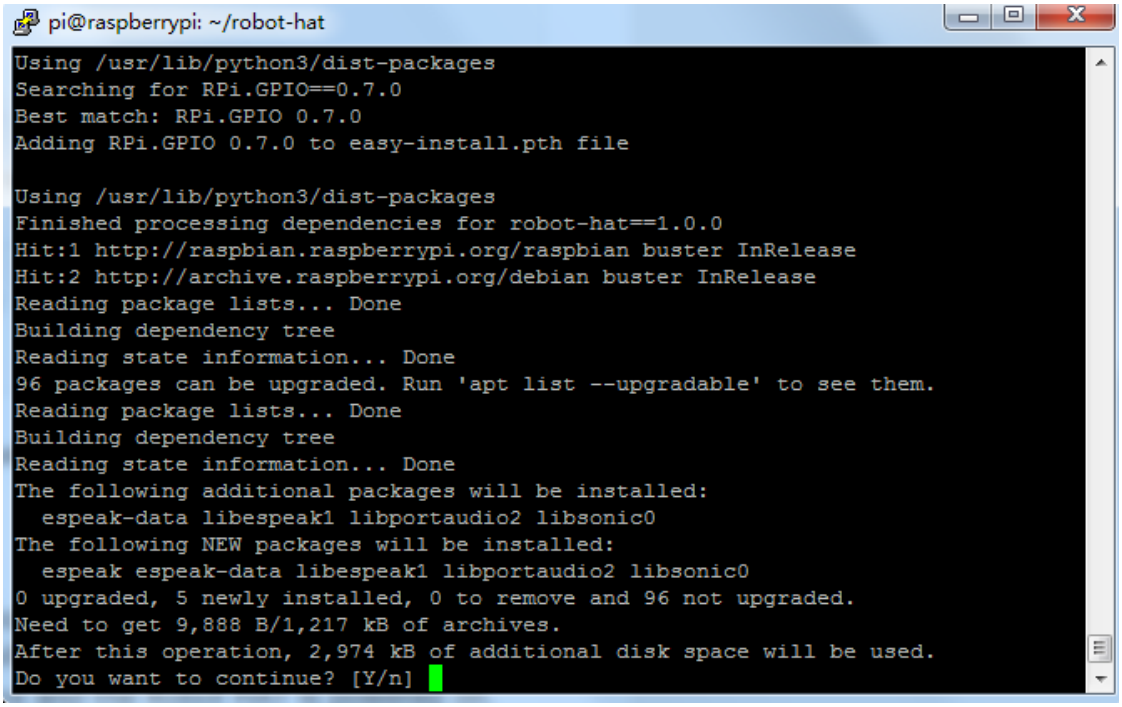
4.1.4 Download and Run the Code

We can download the files by using `git clone` in the command line.

Install `robot-hat` library first.

```
cd /home/pi/
git clone https://github.com/sunfounder/robot-hat.git
cd robot-hat
sudo python3 setup.py install
```

Note: Running setup.py will download some necessary components. You may fail to download due to network problems. You may need to download again at this time. In the following cases, enter Y and press Enter.



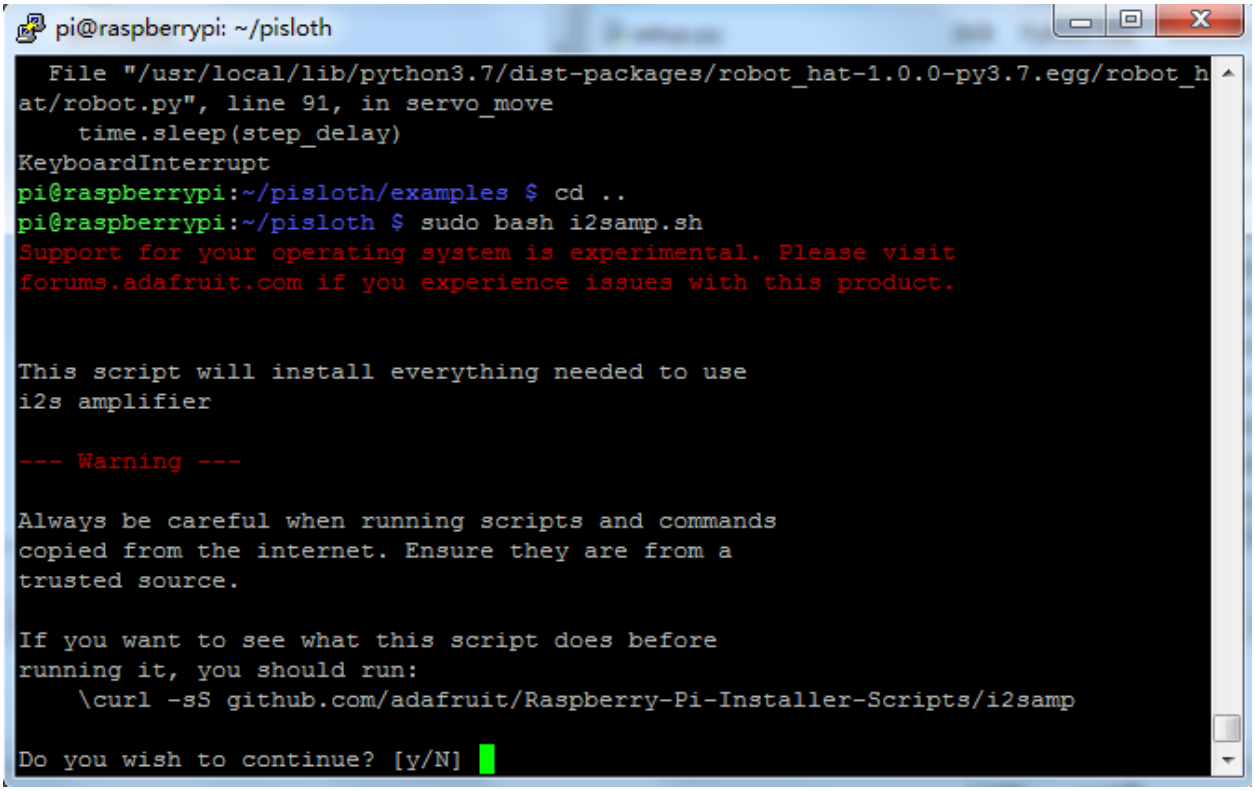
Then download the code and install `pisloth` library.

```
cd /home/pi/
git clone -b v2.0 https://github.com/sunfounder/pisloth.git
cd pisloth
sudo python3 setup.py install
```

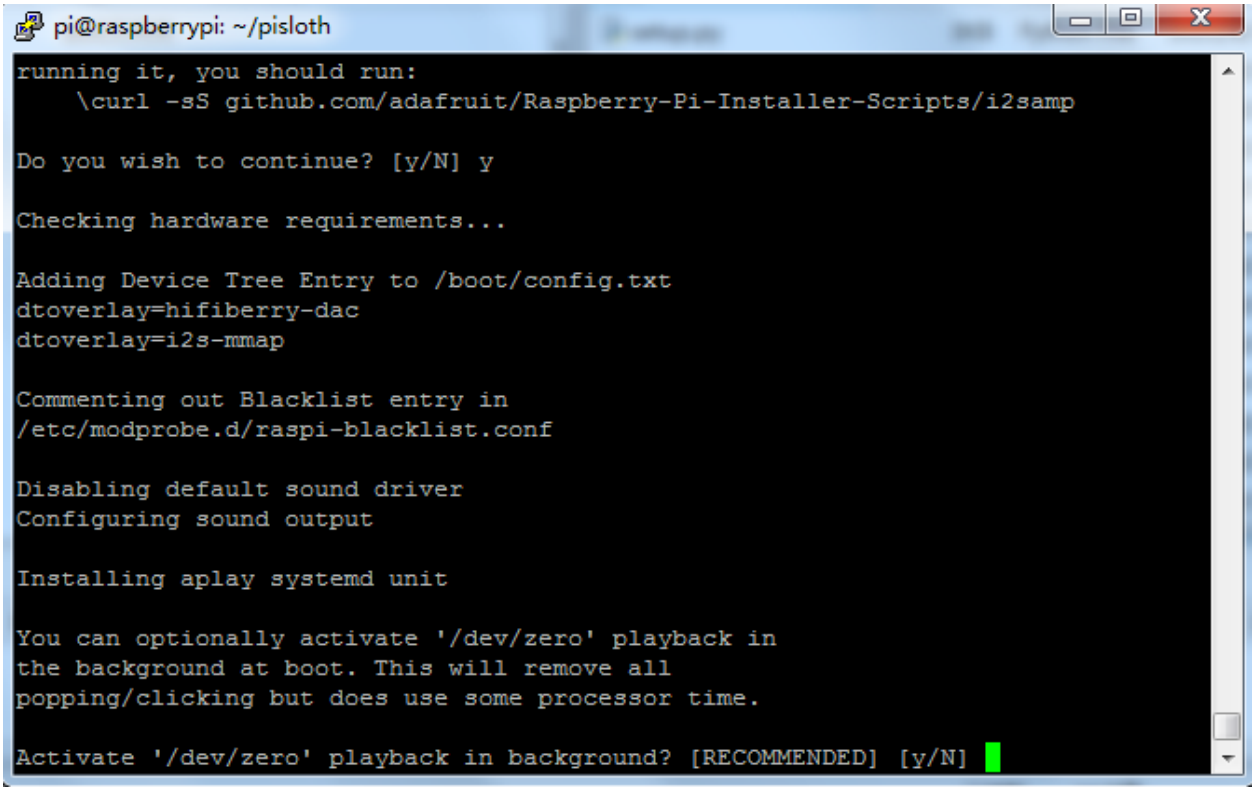
This step will take a little time, so please be patient.

Finally, you need to run the script `i2samp.sh` to install the components required by the i2s amplifier, otherwise the pislot will have no sound.

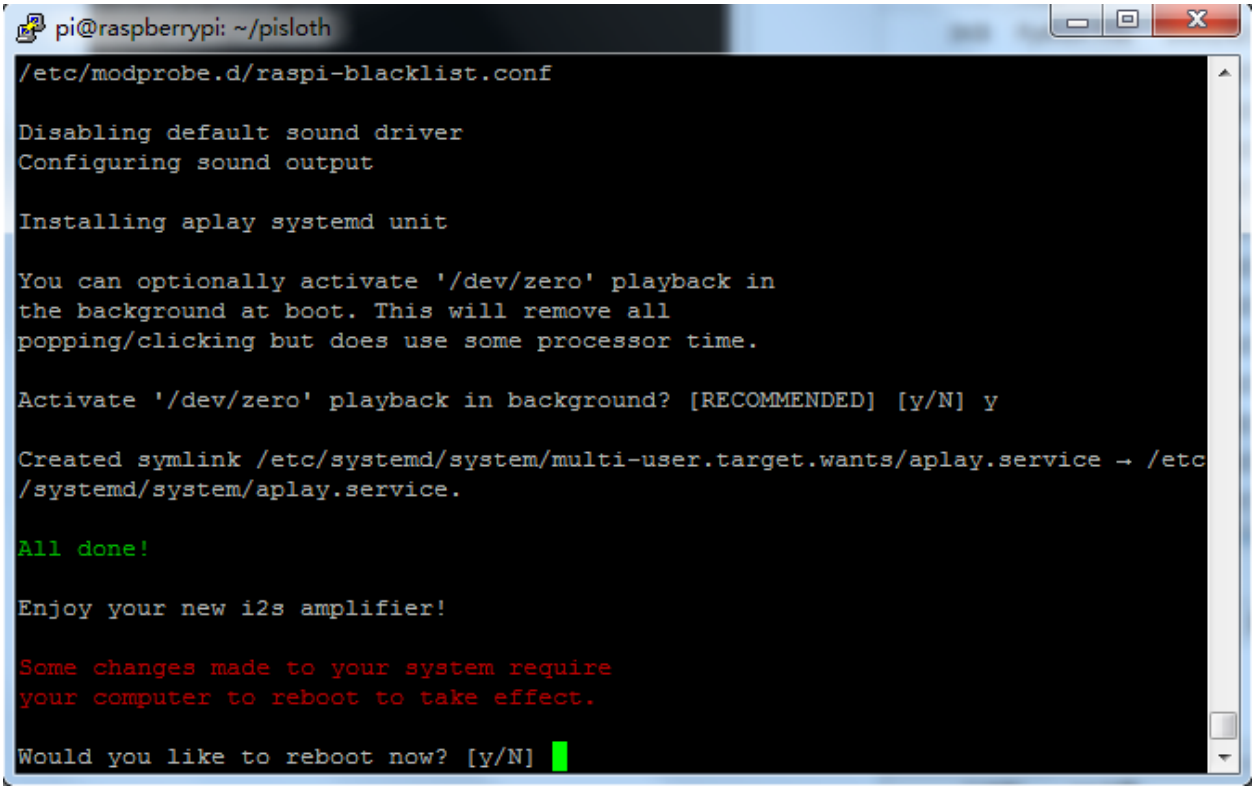
```
cd /home/pi/pisloth
sudo bash i2samp.sh
```



Type y and press Enter to continue running the script.



Type y and press Enter to run `/dev/zero` in the background.

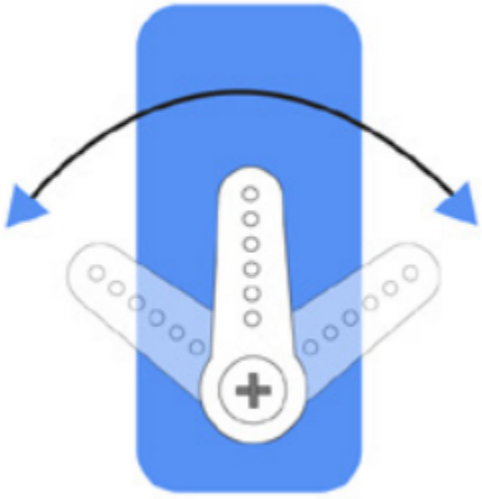


Type y and press Enter to restart the machine.

Note: If there is no sound after restarting, you may need to run the i2samp.sh script multiple times.

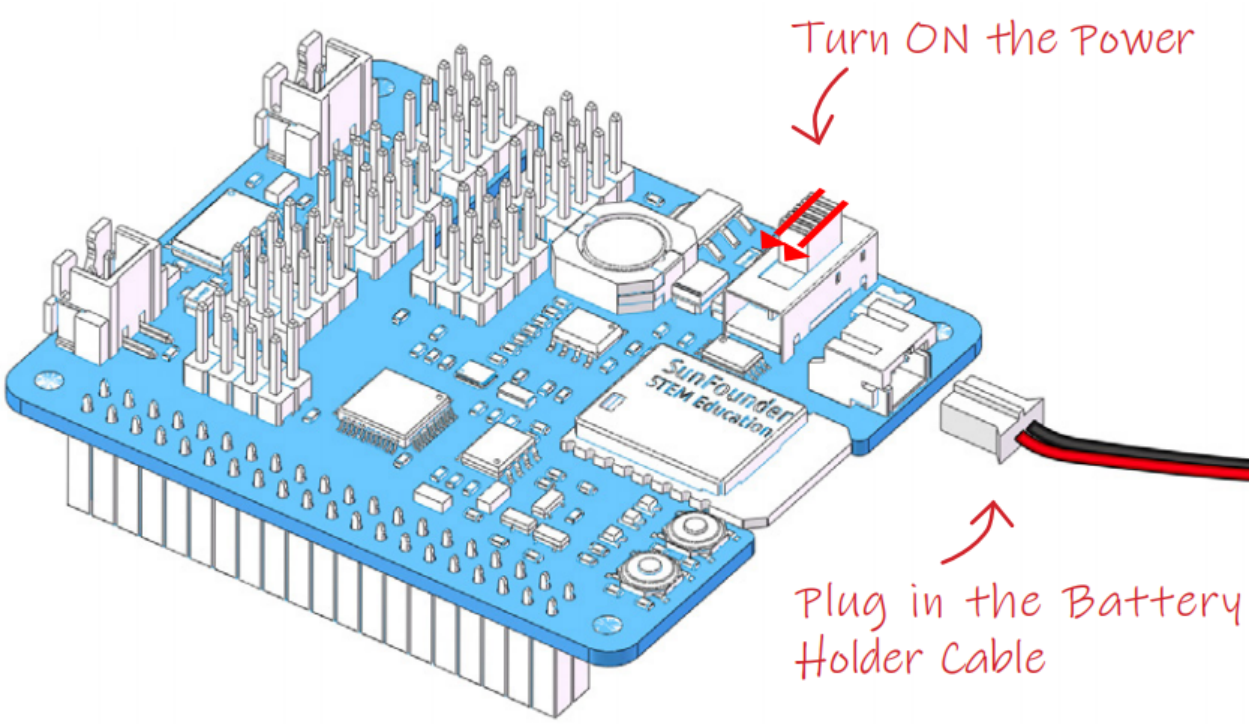
4.1.5 Servo Adjust

To ensure that the servo has been properly set to 0°, first insert the rocker arm into the servo shaft and then gently rotate the rocker arm to a different angle.



Follow the instructions on the assembly foldout, insert the battery holder cable and turn the power switch to the ON.

Wait for 1-2 minutes, there will be a sound to indicate that the Raspberry Pi boots successfully.

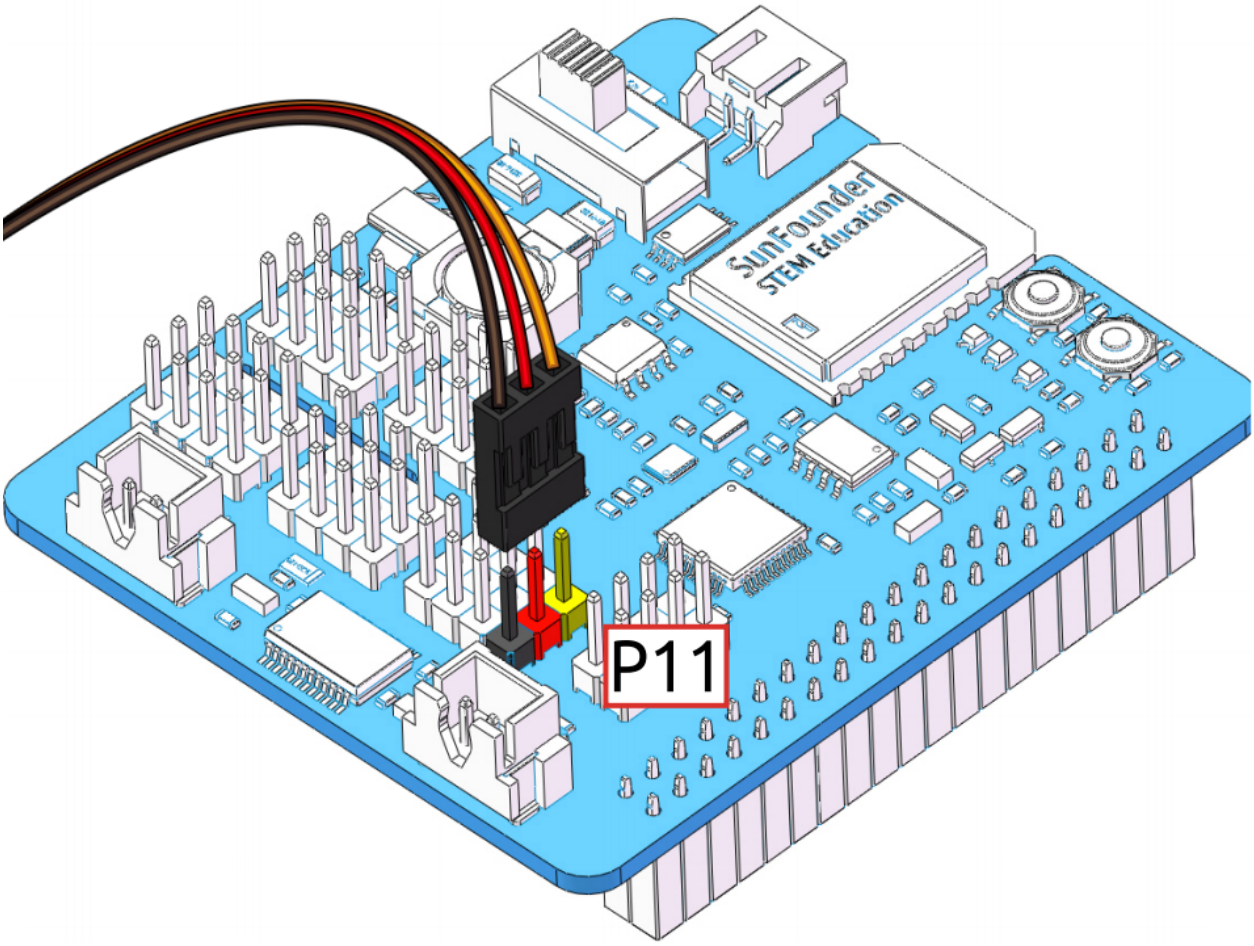


Now, run `servo_zeroing.py` in the `examples/` folder.

```
cd /home/pi/piarm/examples
sudo python3 servo_zeroing.py
```

Note: If you get an error, try re-enabling the Raspberry Pi's I2C port, see: i2c_config.

Next, plug the servo cable into the P11 port as follows.



At this point you will see the servo arm rotate to a specific position (0°). If the servo arm does not return to 0°, press the RST button to restart the Robot HAT.

Now you can continue the installation as instructed on the assembly foldout.

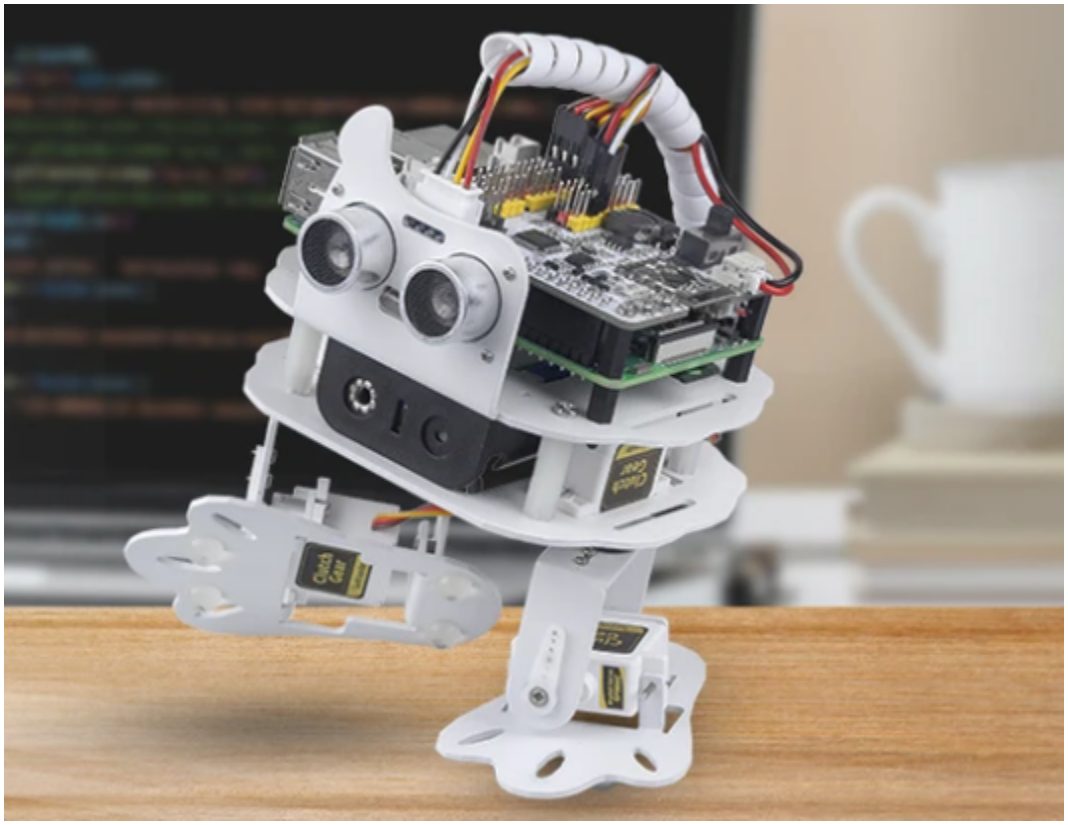
Note:

- Do not unplug this servo cable before fixing it with the servo screw, you can unplug it after fixing it.
- Do not rotate the servo while it is powered on to avoid damage; if the servo shaft is not inserted at the right angle, pull the servo out and reinsert it.
- Before assembling each servo, you need to plug the servo cable into P11 and turn on the power to set its angle to 0°.

After the assembly is complete, you can try to run the projects below.

4.2 Move

This is the first project. PiSloth has woken up, and it moves freely.



Run the Code

```
cd ~/pisloth/examples
sudo python3 move.py
```

After running the code, you will see PiSloth move left 7 steps, forward 5 steps, right 7 steps, and forward 5 steps.

Code

Note: You can **Modify/Reset/Copy/Run/Stop** the code below. But before that, you need to go to source code path like `pisloth\examples`. After modifying the code, you can run it directly to see the effect.

```
from pisloth import Sloth

sloth = Sloth([1,2,3,4])
sloth.set_offset([0,0,0,0])

def main():
    sloth.do_action('turn left', 7, 90)
    sloth.do_action('forward', 5, 90)
    sloth.do_action('turn right', 7, 90)
    sloth.do_action('forward', 5, 90)
```

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```
if __name__ == "__main__":
    while True:
        main()
```

How it works?

First, import the `Sloth` class from the `pisloth` library you have installed, which contains all of PiSloth's actions and the functions that implement them.

```
from pisloth import Sloth
```

Then instantiate the `Sloth` class.

```
sloth = Sloth([1,2,3,4])
sloth.set_offset([0,0,0,0])
```

Finally use the `sloth.do_action()` function to make PiSloth move.

```
sloth.do_action('turn left', 7, 90)
sloth.do_action('forward', 5, 90)
sloth.do_action('turn right', 7, 90)
sloth.do_action('forward', 5, 90)
```

In general, all actions of PiSloth can be implemented with the `sloth.do_action()` function. It has four parameters:

- `motion_name` is the name of specific actions, including: `forward`, `turn right`, `turn left`, `backward`, `stand`, `moon walk left`, `moon walk right`, `hook`, `big swing`, `swing`, `walk boldly`, `walk backward boldly`, `walk shyly`, `walk backward shyly`, `stomp rihgt`, `stomp left`, `close`, `open`, `tiptoe left`, `tiptoe right`, `fall left`, `fall right`.
- `step` represents the number of each action is done, the default is 1.
- `speed` indicates the speed of the action, the default is 50 and the range is 0~100.
- `bpm` means rhythm, we will use it later in the *Dance* project.

Note: You can add different sound effects or music to `musics` or `sounds` folder via *Filezilla Software*.

4.3 Dance

Now, PiSltoh will show you its newly learned dance.

Note: You can download and print the PDF Cartoon Mask for your PiSloth.

Run the Code

```
cd ~/pisloth/examples
sudo python3 dancing.py
```

The whole dance is divided into 2 parts, and PiSloth will finish these 2 parts with the music. If you don't stop the code, it will repeat the dance.

Code

Note: You can **Modify/Reset/Copy/Run/Stop** the code below. But before that, you need to go to source code path like `pisloth\examples`. After modifying the code, you can run it directly to see the effect.

```
from pisloth import Sloth
from robot_hat import Music
from robot_hat import Ultrasonic
from robot_hat import Pin
import time
import os

music = Music()
```

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```
sloth = Sloth([1,2,3,4])
sloth.set_offset([0,0,0,0])


def main():

    music.background_music('./musics/india-Arulo.mp3')
    music.music_set_volume(20)
    sloth.do_action('stomp left',3,bpm=129)
    sloth.do_action('stomp right',3,bpm=129)
    sloth.do_action('moon walk left',3,bpm=129)
    sloth.do_action('moon walk right',3,bpm=129)
    for i in range(3):
        sloth.do_action('swing',1,bpm=129)
        sloth.do_action('stand',1,bpm=129)
    for i in range(3):
        sloth.do_action('close',1,bpm=129)
        sloth.do_action('stand',1,bpm=129)
        sloth.do_action('open',1,bpm=129)
        sloth.do_action('stand',1,bpm=129)
    sloth.do_action('tiptoe left',2,bpm=129)
    sloth.do_action('tiptoe right',2,bpm=129)

    sloth.do_action('stomp left',3,bpm=129)
    sloth.do_action('stomp rihgt',3,bpm=129)
    sloth.do_action('moon walk left',3,bpm=129)
    sloth.do_action('moon walk right',3,bpm=129)
    for i in range(3):
        sloth.do_action('hook',1,bpm=129)
        sloth.do_action('stand',1,bpm=129)
    for i in range(4):
        sloth.do_action('swing',1,bpm=129)
        sloth.do_action('big swing',1,bpm=129)
        sloth.do_action('swing',1,bpm=129)
        sloth.do_action('stand',1,bpm=129)

    sloth.do_action('tiptoe right',2,bpm=129)
    sloth.do_action('stand',2,bpm=129)



    music.music_stop()
    time.sleep(10)



if __name__ == "__main__":
    while True:
        main()
```

How it works?

You can make PiSloth play music by importing the following libraries.

```
from robot_hat import TTS, Music
```

Play the background music in the `pisloth/examples/musics` directory and set the volume to 20. You can also add music to the `musics` folder via *Filezilla Software*.

```
music.background_music('./musics/india-Arulo.mp3')
music.music_set_volume(20)
```

In general, all actions of PiSloth can be implemented with the `sloth.do_action()` function. It has four parameters:

- `motion_name` is the name of specific actions, including: `forward`, `turn right`, `turn left`, `backward`, `stand`, `moon walk left`, `moon walk right`, `hook`, `big swing`, `swing`, `walk boldly`, `walk backward boldly`, `walk shyly`, `walk backward shyly`, `stomp rihgt`, `stomp left`, `close`, `open`, `tiptoe left`, `tiptoe right`, `fall left`, `fall right`.
- `step` represents the number of each action is done, the default is 1.
- `speed` indicates the speed of the action, the default is 50 and the range is 0~100.
- `bpm` means rhythm, the bpm parameter here affects the interval time of PiSloth movement. The higher the value, the shorter the interval time. When we know the beat of a song through the **bpm calculator**, we can make PiSloth dance to the music.

For music bmp, if you want to know more, you can refer to: https://en.wikipedia.org/wiki/Tempo

Note: You can add different sound effects or music to `musics` or `sounds` folder via *Filezilla Software*.

4.4 Obstacle Avoidance

In this project, PiSloth will use an ultrasonic module to detect obstacles in front. When PiSloth detects an obstacle, it will send a signal and look for another direction to move forward.

Run the Code

```
cd ~/pisloth/examples
sudo python3 avoid.py
```

After the code runs, PiSloth will walk forward. If it detects that the distance of the obstacle ahead is less than 10cm, it will stop and sound a warning, then turn left and stop. If there is no obstacle in the direction after turning left or the obstacle distance is greater than 10, it will continue to move forward.

Code

Note: You can **Modify/Reset/Copy/Run/Stop** the code below. But before that, you need to go to source code path like `pisloth\examples`. After modifying the code, you can run it directly to see the effect.

```
from pisloth import Sloth
from robot_hat import TTS, Music
from robot_hat import Ultrasonic
from robot_hat import Pin
import time
import os
```

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```
tts = TTS()
music = Music()

sloth = Sloth([1,2,3,4])
sloth.set_offset([0,0,0,0])
sonar = Ultrasonic(Pin("D2") ,Pin("D3"))

alert_distance = 10

def main():
    distance = sonar.read()
    if distance < 0:
        pass
    elif distance <= alert_distance:
        try:
            music.sound_effect_threading('./sounds/sign.wav')
        except Exception as e:
            print(e)
        sloth.do_action('hook', 1,95)
        time.sleep(0.5)
        sloth.do_action('stand', 1,95)
        time.sleep(0.5)
        sloth.do_action('turn left',7,90)
        sloth.do_action('stand', 1,95)
        time.sleep(0.2)
    else :
        sloth.do_action('forward', 1,90)


if __name__ == "__main__":
    while True:
        main()
```

How it works?

You can get the distance by importing the `Ultrasonic` class.

```
from robot_hat import Ultrasonic
```

Then initialize the ultrasonic pins.

```
sonar = Ultrasonic(Pin("D2") ,Pin("D3"))
```

Here is the main program.

- Read the `distance` detected by ultrasonic module and filter out the values less than 0 (When the ultrasonic module is too far from the obstacle or cannot read the data correctly, `distance<0` will appear).
- When the `distance` is less than or equal to `alert_distance` (the threshold value set earlier, which is 10), play the sound effect `sign.wav`. PiSloth does `hook`, `stand`, `left turn` and `stand` in sequence.
- When the `distance` is greater than `alert_distance`, PiSloth will move `forward`.

```
distance = sonar.read()
if distance < 0:
    pass
elif distance <= alert_distance:
    try:
        music.sound_effect_threading('./sounds/sign.wav')
    except Exception as e:
        print(e)
    sloth.do_action('hook', 1,95)
    time.sleep(0.5)
    sloth.do_action('stand', 1,95)
    time.sleep(0.5)
    sloth.do_action('turn left',7,90)
    sloth.do_action('stand', 1,95)
    time.sleep(0.2)
else :
    sloth.do_action('forward', 1,90)
```

Note: You can add different sound effects or music to `musics` or `sounds` folder via *Filezilla Software*.

4.5 Don't Touch Me

If you don't meet PiSloth's needs, it will get angry and stay away from your touch.

Run the Code

```
cd ~/pisloth/examples
sudo python3 dont_touch_me.py
```

Code

Note: You can **Modify/Reset/Copy/Run/Stop** the code below. But before that, you need to go to source code path like `pisloth\examples`. After modifying the code, you can run it directly to see the effect.

```
from pisloth import Sloth
from robot_hat import Music
from robot_hat import Ultrasonic
from robot_hat import Pin
import time
import os


music = Music()

sloth = Sloth([1,2,3,4])
sloth.set_offset([0,0,0,0])
sonar = Ultrasonic(Pin("D2") ,Pin("D3"))
```

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```
alert_distance = 20

def main():
    distance = sonar.read()
    print(distance)
    if distance <= alert_distance :
        try:
            music.sound_effect_threading('./sounds/talk3.wav')
        except Exception as e:
            print(e)
        sloth.do_action('backward', 2, 90)
    else:
        sloth.do_action('stand', 1, 90)
        time.sleep(1)


if __name__ == "__main__":
    while True:
        main()
```

How it works?

Instantiate various classes of `Music`, `Sloth` and `Ultrasonic` to be used.

```
music = Music()

sloth = Sloth([1,2,3,4])
sloth.set_offset([0,0,0,0])
sonar = Ultrasonic(Pin("D2") ,Pin("D3"))
```

Here is the main program.

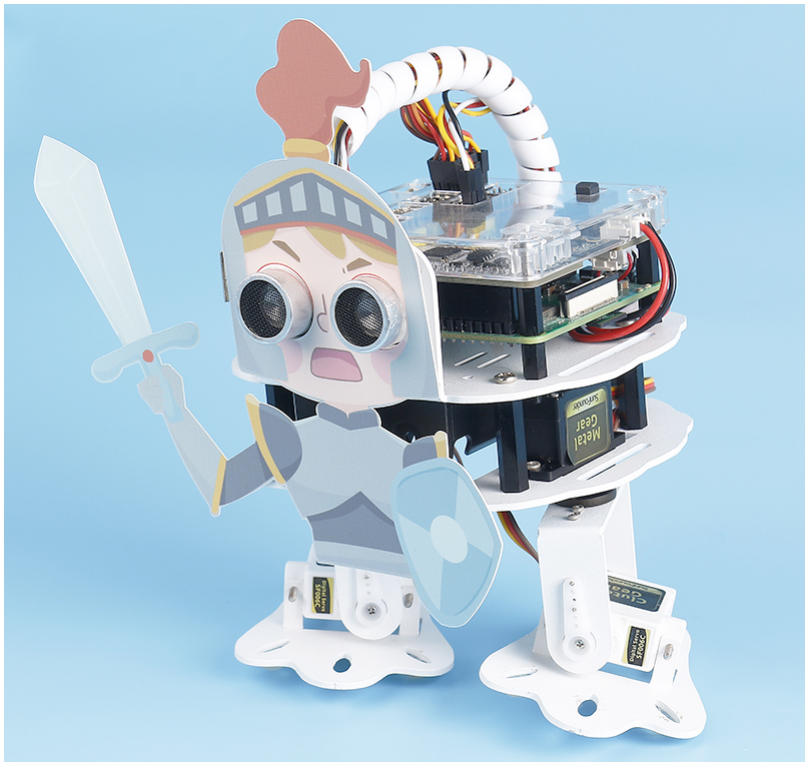
- Read the `distance` detected by the ultrasonic module and print it.
- When the `distance` is less than or equal to `alert_distance` (the threshold value set earlier, which is 20), play the sound effect `talk3.wav` and move `backward`.
- When the `distance` is greater than `alert_distance`, PiSloth will Stand.

```
distance = sonar.read()
print(distance)
if distance <= alert_distance :
    try:
        music.sound_effect_threading('./sounds/talk3.wav')
    except Exception as e:
        print(e)
    sloth.do_action('backward', 2, 90)
else:
    sloth.do_action('stand', 1, 90)
    time.sleep(1)
```

Note: You can add different sound effects or music to `musics` or `sounds` folder via *Filezilla Software*.

4.6 Let's Fight! Warrior!

Here, PiSloth is a brave warrior, when it appears in front of the enemy, it will let out a roar and rush to the enemy.



Note: You can download and print the PDF Cartoon Mask for your PiSloth.

Run the Code

```
cd ~/pisloth/examples
sudo python3 lets_fight.py
```

After the code is run, PiSloth will continuously detect the distance of the obstacle, when the distance is between 5 and 40, PiSloth will make a roaring sound and rush forward; when the distance of the obstacle is less than 5, PiSloth will stop.

Code

Note: You can **Modify/Reset/Copy/Run/Stop** the code below. But before that, you need to go to source code path like `pisloth\examples`. After modifying the code, you can run it directly to see the effect.

```
from pisloth import Sloth
from robot_hat import Music
from robot_hat import Ultrasonic
from robot_hat import Pin
import time
import os
```

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```
music = Music()

sloth = Sloth([1,2,3,4])
sloth.set_offset([0,0,0,0])
sonar = Ultrasonic(Pin("D2") ,Pin("D3"))

alert_distance = 40
contact_distance = 5

def main():
    distance = sonar.read()
    if distance <= alert_distance and distance >= contact_distance :
        try:
            music.sound_effect_play('./sounds/battle.wav')
            music.background_music('./musics/attack.mp3')
            music.music_set_volume(20)
        except Exception as e:
            print(e)
        while True:
            distance = sonar.read()
            print(distance)
            if distance < 0:
                continue
            if distance <= contact_distance:
                break
            sloth.do_action('forward', 1,90)
    sloth.do_action('stand', 1, 90)
    time.sleep(1)


if __name__ == "__main__":
    while True:
        main()
```

How it works?

Here is the main program.

- Read the `distance` detected by ultrasonic module and filter out the values less than 0 (When the ultrasonic module is too far from the obstacle or cannot read the data correctly, `distance<0` will appear).
- When the `distance` is between 5 and 40, PiSloth will play `warning.wav` and `attack.mp3` and move `forward`.
- When the `distance` is less than 5, PiSloth will keep the `stand` position.

```
distance = sonar.read()
if distance <= alert_distance and distance >= contact_distance :
    try:
        music.sound_effect_play('./sounds/battle.wav')
        music.background_music('./musics/attack.mp3')
        music.music_set_volume(20)
    except Exception as e:
```

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```
        print(e)
    while True:
        distance = sonar.read()
        print(distance)
        if distance< 0:
            continue
        if distance<=contact_distance:
            break
        sloth.do_action('forward', 1,95)
sloth.do_action('stand', 1, 90)
time.sleep(1)
```

Note: You can add different sound effects or music to `musics` or `sounds` folder via *Filezilla Software*.

4.7 Emotional PiSloth

PiSloth is very emotional, sometimes happy, sometimes shy, sometimes confused.

Run the Code

```
cd ~/pisloth/examples
sudo python3 emotional_pisloth.py
```

Code

Note: You can **Modify/Reset/Copy/Run/Stop** the code below. But before that, you need to go to source code path like `pisloth\examples`. After modifying the code, you can run it directly to see the effect.

```
from pisloth import Sloth
from robot_hat import TTS, Music
import time

tts = TTS()
music = Music()

sloth = Sloth([1,2,3,4])
sloth.set_offset([0,0,0,0])

def confuse():
    try:
        music.sound_effect_threading('./sounds/sign.wav')
    except Exception as e:
        print(e)
    sloth.do_action('hook', 1, 90)

def happy():
    try:
        music.sound_effect_threading('./sounds/happy2.wav')
```

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```
    except Exception as e:
        print(e)
    for i in range(3):
        sloth.do_action('hook', 1, 90)
        sloth.do_action('stand', 1, 90)

def fear():
    try:
        music.sound_effect_threading('./sounds/warning.wav')
    except Exception as e:
        print(e)
    sloth.do_action('hook', 1, 90)
    sloth.do_action('stand', 1, 90)
    try:
        music.sound_effect_threading('./sounds/warning.wav')
    except Exception as e:
        print(e)
    sloth.do_action('walk backward boldly', 1, 90)
    sloth.do_action('stand', 1, 90)

def sad():
    try:
        music.sound_effect_threading('./sounds/depress.wav')
    except Exception as e:
        print(e)
    sloth.do_action('big swing', 1, 90)

def angry():
    try:
        music.sound_effect_threading('./sounds/error.wav')
    except Exception as e:
        print(e)
    sloth.do_action('walk backward boldly', 1, 90)
    sloth.do_action('stand', 1, 90)

def fail():
    try:
        music.sound_effect_threading('./sounds/depress2.wav')
    except Exception as e:
        print(e)
    sloth.do_action('fall left', 1, 90)

def shy():
    try:
        music.sound_effect_threading('./sounds/talk3.wav')
    except Exception as e:
        print(e)
    sloth.do_action('close', 1, 90)
    time.sleep(1)
    try:
        music.sound_effect_threading('./sounds/talk2.wav')
    except Exception as e:
```

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```
        print(e)
    sloth.do_action('stand', 1, 90)

def main():

    print("shy")
    shy()
    time.sleep(1)
    sloth.do_action('stand', 1, 90)
    time.sleep(2)

    print("confuse")
    confuse()
    time.sleep(1)
    sloth.do_action('stand', 1, 90)
    time.sleep(2)

    print("happy")
    happy()
    time.sleep(1)
    sloth.do_action('stand', 1, 90)
    time.sleep(2)

    print("fear")
    fear()
    time.sleep(1)
    sloth.do_action('stand', 1, 90)
    time.sleep(2)

    print("sad")
    sad()
    time.sleep(1)
    sloth.do_action('stand', 1, 90)
    time.sleep(2)

    print("angry")
    angry()
    time.sleep(1)
    sloth.do_action('stand', 1, 90)
    time.sleep(2)

    print("fail")
    fail()
    time.sleep(1)
    sloth.do_action('stand', 1, 90)
    time.sleep(2)


if __name__ == "__main__":
    while True:
        main()
```

How it works?

In this project, actions + sound effects are combined into different emotional actions, and you can also modify them yourself.

Note: This `fail` action will make the PiSloth fall, be careful not to let it fall off the table and break it.

You can add different sound effects or music to `musics` or `sounds` folder via *Filezilla Software*.

4.8 Remote Control

In this project, we will learn how to use the keyboard to remotely control the PiSloth. You can control the PiSloth to move up, down, left, and right and speak through specific keys.

Run the Code

```
cd ~/pisloth/examples
sudo python3 keyboard_control.py
```

Once the code runs, you can control PiSloth by pressing `wasd`, play different sound effects by pressing `1234`, and make PiSloth talk by pressing `qe`.

Press `esc` to exit.

- w: Go Forward
- a: Turn Left
- s: Backward
- d: Turn Right
- 1: Sound effect: talk1
- 2: Sound effect: talk2
- 3: Sound effect: talk3
- 4: Sound effect: depress2
- q: Say: “Oh hello there”
- e: Say: “bye”
- esc: Quit

Code

Note: You can **Modify/Reset/Copy/Run/Stop** the code below. But before that, you need to go to source code path like `pisloth\examples`. After modifying the code, you can run it directly to see the effect.

```
from pisloth import Sloth
from robot_hat import Music
from robot_hat import TTS
import sys
import tty
import termios
import time
```

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```
sloth = Sloth([1,2,3,4])
tts = TTS()
music = Music()
sloth.set_offset([0,0,0,0])

def readchar():
    fd = sys.stdin.fileno()
    old_settings = termios.tcgetattr(fd)
    try:
        tty.setraw(sys.stdin.fileno())
        ch = sys.stdin.read(1)
    finally:
        termios.tcsetattr(fd, termios.TCSADRAIN, old_settings)
    return ch

manual = '''
Press keys on keyboard to control PiSloth!

    w: Forward
    a: Turn left
    s: Backward
    d: Turn right
    1: Sound effect: talk1
    2: Sound effect: talk2
    3: Sound effect: talk3
    4: Sound effect: depress2
    q: Say: "Oh hello there"
    e: Say: "bye"
    esc: Quit
'''

def main():
    print(manual)
    while True:
        key = readchar().lower()
        # print(key)
        if key == "w":
            sloth.do_action('forward', 1, 90)
        elif key == "a":
            sloth.do_action('turn left', 1, 90)
        elif key == "s":
            sloth.do_action('backward', 1, 90)
        elif key == "d":
            sloth.do_action('turn right', 1, 90)
        elif key == "1":
            music.sound_effect_play('./sounds/talk1.wav')
        elif key == "2":
            music.sound_effect_play('./sounds/talk2.wav')
        elif key == "3":
            music.sound_effect_play('./sounds/talk3.wav')
        elif key == "4":
```

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```
            music.sound_effect_play('./sounds/depress.wav')
        elif key == "q":
            tts.say("Oh hello there")
        elif key == "e":
            tts.say("bye")
        elif key == chr(27): # 27 for ESC
            break
        time.sleep(0.05)
    print("\nQuit")

if __name__ == "__main__":
    main()
```

How it works?

This function refers to the standard input stream and returns the first character of the data stream read.

- `tty.setraw(sys.stdin.fileno)` is to change the standard input stream to raw mode, that is, all characters will not be escaped during transmission, including special characters. Before changing the mode, back up the original mode, and restore it after the change.
- `old_settings = termios.tcgetattr(fd)` and `termios.tcsetattr(fd, termios.TCSADRAIN, old_settings)` plays the role of backup and restore.

```
def readchar():
            fd = sys.stdin.fileno()
            old_settings = termios.tcgetattr(fd)
            try:
                    tty.setraw(sys.stdin.fileno())
                    ch = sys.stdin.read(1)
            finally:
                    termios.tcsetattr(fd, termios.TCSADRAIN, old_settings)
            return ch
```

Finally, according to the read keyboard characters, let PiSloth do the actions we set, call the `tts.say()` function to speak or play the sound effects prepared in advance.

```
key = readchar().lower()
    # print(key)
    if key == "w":
        sloth.do_action('forward', 1, 90)
    elif key == "a":
        sloth.do_action('turn left', 1, 90)
    elif key == "s":
        sloth.do_action('backward', 1, 90)
    elif key == "d":
        sloth.do_action('turn right', 1, 90)
    elif key == "1":
        music.sound_effect_play('./sounds/talk1.wav')
    elif key == "2":
        music.sound_effect_play('./sounds/talk2.wav')
    elif key == "3":
        music.sound_effect_play('./sounds/talk3.wav')
    elif key == "4":
```

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```
        music.sound_effect_play('./sounds/depress.wav')
    elif key == "q":
        tts.say("Oh hello there")
    elif key == "e":
        tts.say("bye")
    elif key == chr(27): # 27 for ESC
        break
```

Note: You can add different sound effects or music to `musics` or `sounds` folder via *Filezilla Software*.

4.9 Custom Step

In the previous projects, we used a lot of actions that we wrote, so how are these actions composed and done? Generally speaking, an action is composed of one or more steps.

In this project, we will learn how to customize PiSloth's step.

Note: You can download and print the PDF Cartoon Mask for your PiSloth.

Run the Code

```
cd ~/pisloth/examples
sudo python3 custom_step.py
```

Once the code has been run, press the following keys to adjust the angle of each servo of PiSloth.

- q: Increase the angle of the left leg
- w: Decrease the angle of the left leg
- z: Increase the angle of the left foot
- x: Decreases the angle of the left foot
- i: Increase the angle of the right leg
- o: decreases the angle of the right leg
- n: increases the angle of the right foot
- m: decreases the angle of the right foot
- SPACE: Print all angle
- ESC: exit

For example, by pressing the `zx` and `nm` keys, we make PiSloth do the pose shown in the figure.

Press the **key SPACE** to print the angle of the 4 servos at this time. You need to record these angle values, which will be used in the next project *Custom Action*.

```
pi@raspberrypi:~/pisloth/examples $ sudo python3 custom_step.py

Press keys on keyboard to control PiSloth!
    Q: Increase left-up servo angle
    W: Decrease left-up servo angle
    Z: Increase left-down servo angle
    X: Decrease left-down servo angle
    I: Increase right-up servo angle
    O: Decrease right-up servo angle
    N: Increase right-down servo angle
    M: Decrease right-down servo angle
    SPACE: Print all servo angle
    ESC: Quit

0 -45 0 40
```

Code

Note: You can **Modify/Reset/Copy/Run/Stop** the code below. But before that, you need to go to source code path like `pisloth\examples`. After modifying the code, you can run it directly to see the effect.

```
from pisloth import Sloth
# from robot_hat import Music
```

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```
# from robot_hat import TTS
from robot_hat import PWM
from robot_hat import Servo

import sys
import tty
import termios
import time

sloth = Sloth([1,2,3,4])
# tts = TTS()
# music = Music()
sloth.set_offset([0,0,0,0])

right_leg_servo = Servo(PWM('P0'))
right_foot_servo = Servo(PWM('P1'))
left_leg_servo = Servo(PWM('P2'))
left_foot_servo = Servo(PWM('P3'))


def readchar():
    fd = sys.stdin.fileno()
    old_settings = termios.tcgetattr(fd)
    try:
        tty.setraw(sys.stdin.fileno())
        ch = sys.stdin.read(1)
    finally:
        termios.tcsetattr(fd, termios.TCSADRAIN, old_settings)
    return ch

manual = '''
Press keys on keyboard to control PiSloth!
    q: Increase the servo angle of the left leg
    w: Decrease the servo angle of the left leg
    z: Increase the servo angle of the left foot
    x: Decrease the servo angle of the left foot
    i: Increase the servo angle of the right leg
    o: Decrease the servo angle of the right leg
    n: Increase the servo angle of the right foot
    m: Decrease the servo angle of the right foot
    SPACE: Print all angle
    ESC: Quit
'''

def main():
    print(manual)

    left_leg=0
    left_foot=0
    right_leg=0
    right_foot=0
    while True:
```

(continues on next page)

(continued from previous page)

```
        key = readchar().lower()
        # print(key)
        if key == "q":
            left_leg = left_leg+5
        elif key == "w":
            left_leg = left_leg-5
        elif key == "z":
            left_foot = left_foot+5
        elif key == "x":
            left_foot = left_foot-5
        elif key == "i":
            right_leg = right_leg+5
        elif key == "o":
            right_leg = right_leg-5
        elif key == "n":
            right_foot = right_foot+5
        elif key == "m":
            right_foot = right_foot-5
        elif key == chr(32): # 32 for space
            print(right_leg,right_foot,left_leg,left_foot)
        elif key == chr(27): # 27 for ESC
            break

        right_leg_servo.angle(right_leg)
        right_foot_servo.angle(right_foot)
        left_leg_servo.angle(left_leg)
        left_foot_servo.angle(left_foot)
        # time.sleep(0.05)

    print("\nQuit")

if __name__ == "__main__":
    main()
```

4.10 Custom Action

In the previous project, we were able to give PiSloth custom steps, so how do we combine these steps into actions?

For example, have PiSloth make the step from the previous project and then return to the initial position.

Note: You can download and print the PDF Cartoon Mask for your PiSloth.

Step 1: Go to the `~/pisloth/examples` path.

```
cd ~/pisloth/examples
```

Step 2: Open `custom_action.py` with the following command.

```
nano custom_action.py
```

Step 3: Modify the angle in `sloth.add_action()`, each group represents a step, and only 2 steps are set here. You can set multiple steps as needed.

```
sloth.add_action("my_action", [
    [ 0,-45  ,0, 40],
    [0,   0, 0,   0]
    ])
```

Step 4: Run this code.

```
sudo python3 custom_action.py
```

Code

Note: You can **Modify/Reset/Copy/Run/Stop** the code below. But before that, you need to go to source code path

like `pisloth\examples`. After modifying the code, you can run it directly to see the effect.

```
from pisloth import Sloth
import time

sloth = Sloth([1,2,3,4])
sloth.add_action("my_action", [
    [ 0,-45  ,0, 40],
    [0,   0, 0,   0]
    ])

def main():
    sloth.do_action("my_action", 1, 80)
    time.sleep(1)

if __name__ == "__main__":
    while True:
        main()
```

CHAPTER

FIVE

APPENDIX

5.1 About the Battery

Applicable Parameters

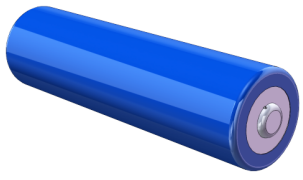
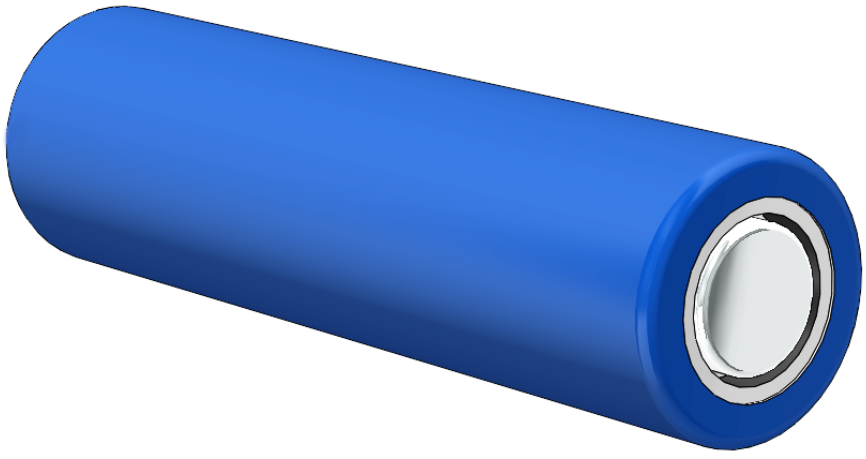
- 3.7V
- 18650
- Rechargeable
- Li-ion Battery
- Button Top
- No Protective Board

Note:

- Robot HAT cannot charge the battery, so you need to buy a battery charger.
- When the two power indicators on the Robot HAT are off, it means the power is too low and the batteries need to be charged.

Button Top vs Flat Top?

Please choose battery with button top to ensure a good connection between the battery and the battery holder.

Button Top	Flat Top
	

No protective board?

You are recommend to use 18650 batteries without a protective board. Otherwise, the robot may be cut power and stop running because of the overcurrent protection of the protective board.

Battery capacity?

In order to keep the robot working for a long time, use large-capacity batteries as much as possible. It is recommended to purchase batteries with a capacity of 3000mAh and above.

5.2 Filezilla Software

The File Transfer Protocol (FTP) is a standard communication protocol used for the transfer of computer files from a server to a client on a computer network.

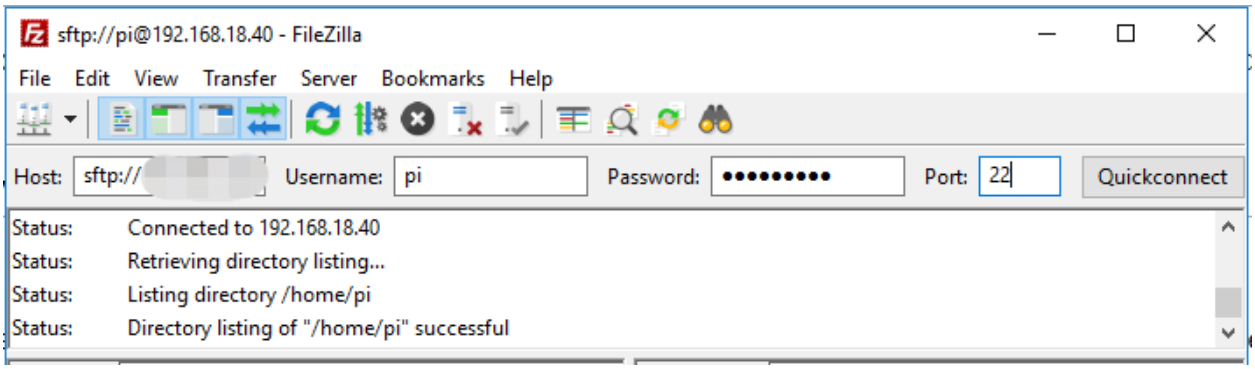
Filezilla is an open source software that not only supports FTP, but also FTP over TLS (FTPS) and SFTP. We can use Filezilla to upload local files (such as pictures and audio, etc.) to the Raspberry Pi, or download files from the Raspberry Pi to the local.

Step 1: Download Filezilla.

Download the client from Filezilla's official website, Filezilla has a very good tutorial, please refer to: Documentation - Filezilla.

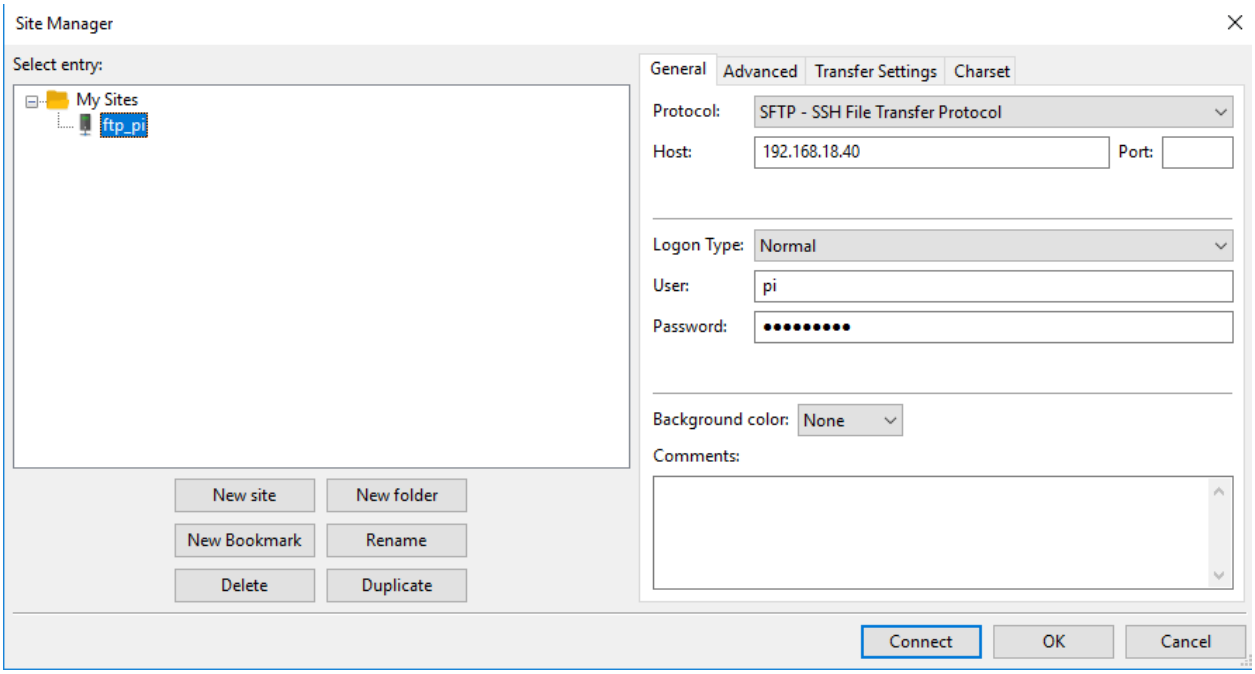
Step 2: Connect to Raspberry Pi

After a quick install open it up and now connect it to an FTP server. It has 3 ways to connect, here we use the **Quick Connect** bar. Enter the **hostname/IP**, **username**, **password** and **port (22)**, then click **Quick Connect** or press **Enter** to connect to the server.



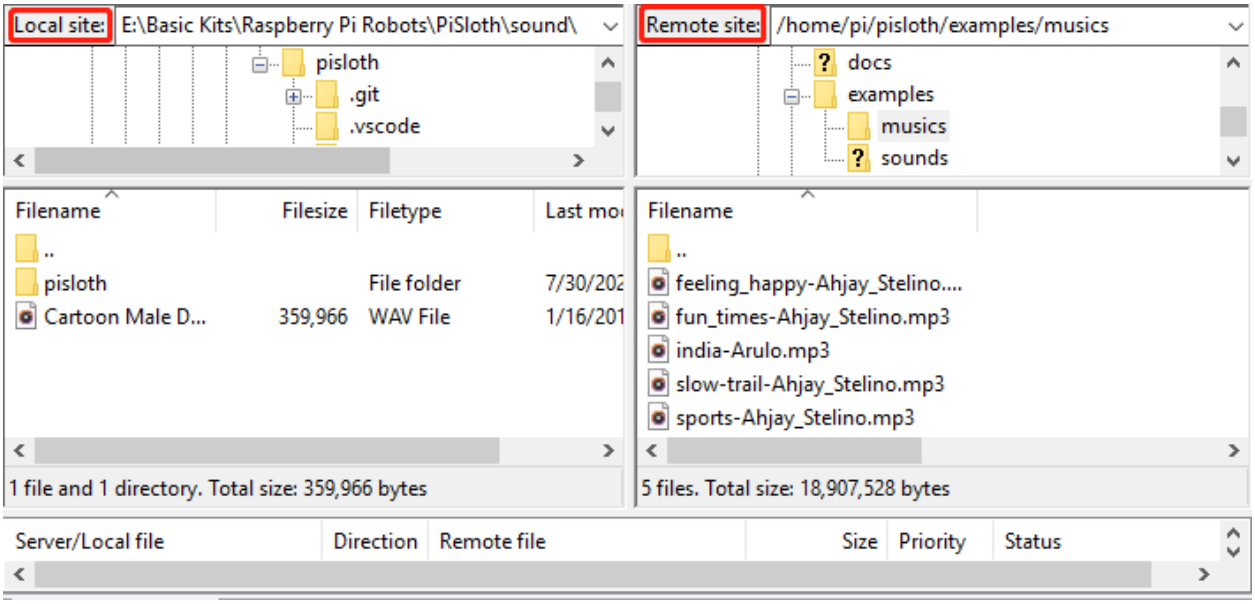
Note: Quick Connect is a good way to test your login information. If you want to create a permanent entry, you can

select **File-> Copy Current Connection to Site Manager** after a successful Quick Connect, enter the name and click **OK**. Next time you will be able to connect by selecting the previously saved site inside **File -> Site Manager**.



Step 3: Upload/download files.

You can upload local files to Raspberry Pi by dragging and dropping them, or download the files inside Raspberry Pi files locally.



5.3 PuTTY

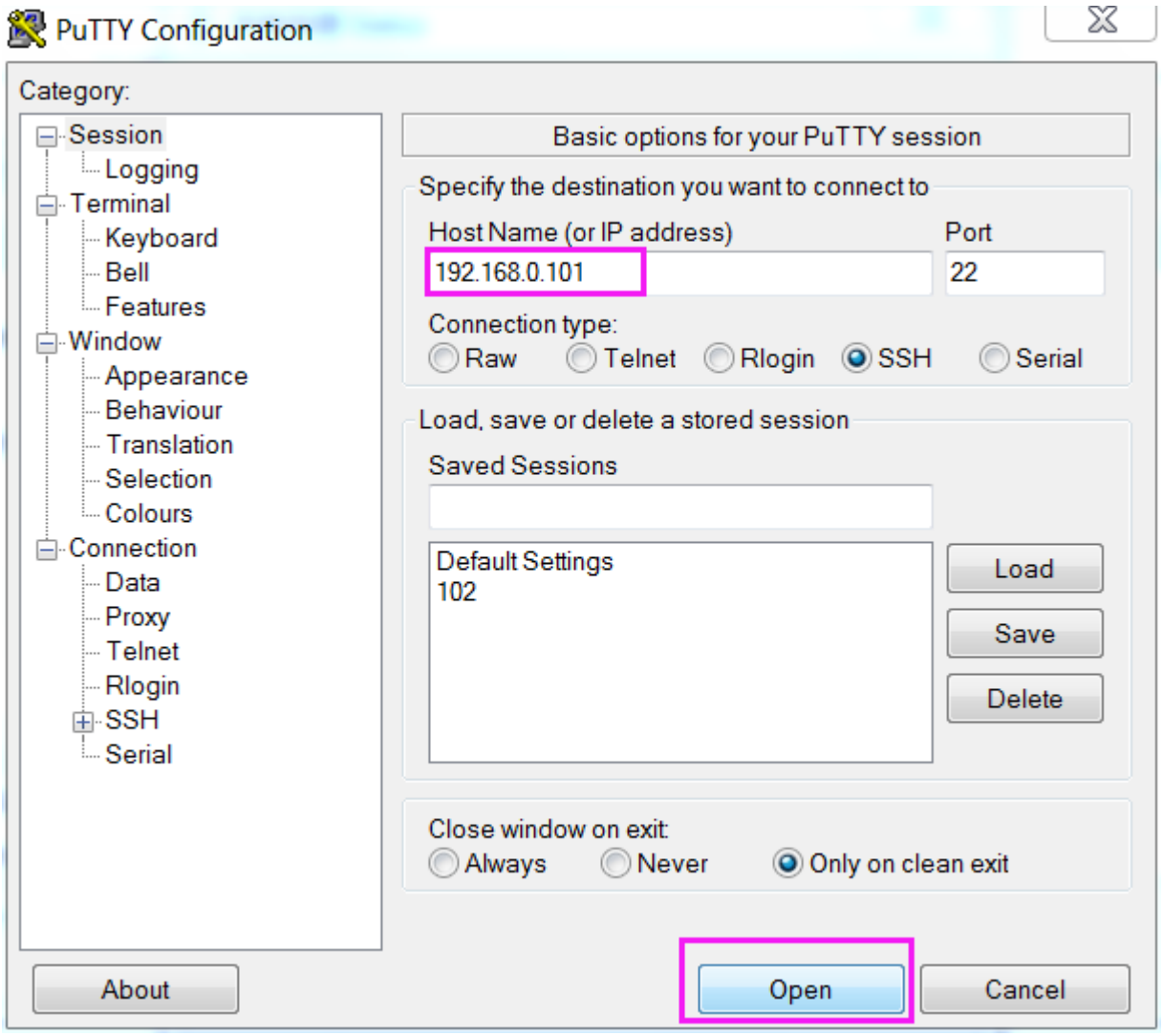
If you are a Windows user, you can use some applications of SSH. Here, we recommend PuTTY.

Step 1

Download PuTTY.

Step 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).



Step 3

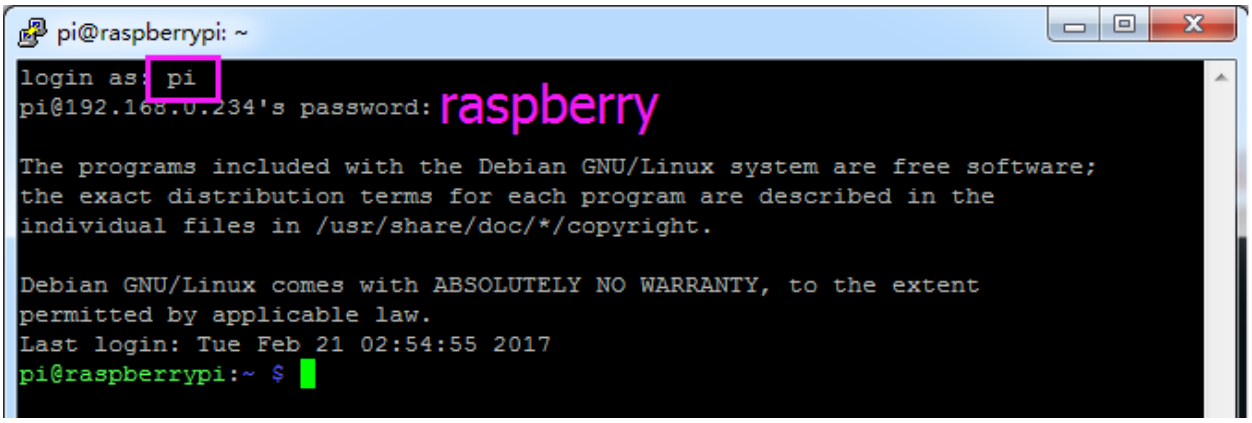
Click **Open**. Note that when you first log in to the Raspberry Pi with the IP address, there prompts a security reminder. Just click **Yes**.

Step 4

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).

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

If inactive appears next to PuTTY, it means that the connection has been broken and needs to be reconnected.



Step 5

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

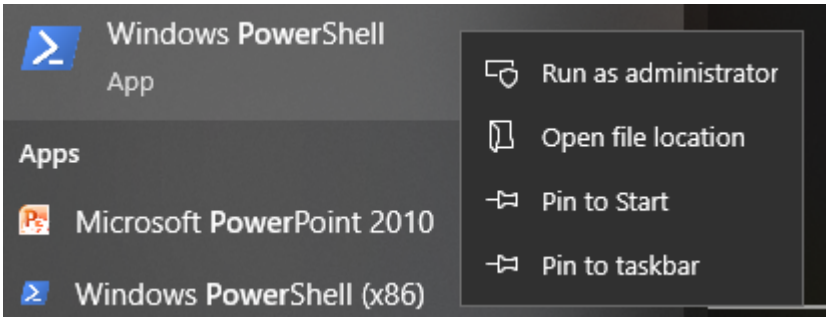
5.4 Install OpenSSH via Powershell

When you use `ssh <username>@<hostname>.local` (or `ssh <username>@<IP address>`) to connect to your Raspberry Pi, but the following error message appears.

```
ssh: The term 'ssh' is not recognized as the name of a cmdlet, function,␣
↪script file, or operable program. Check the
spelling of the name, or if a path was included, verify that the path is␣
↪correct and try again.
```

It means your computer system is too old and does not have OpenSSH pre-installed, you need to follow the tutorial below to install it manually.

1. Type `powershell` in the search box of your Windows desktop, right click on the `Windows PowerShell`, and select `Run as administrator` from the menu that appears.



2. Use the following command to install `OpenSSH.Client`.

```
Add-WindowsCapability -Online -Name OpenSSH.Client~~~~0.0.1.0
```

3. After installation, the following output will be returned.

```
Path          :
Online        : True
RestartNeeded : False
```

4. Verify the installation by using the following command.

```
Get-WindowsCapability -Online | Where-Object Name -like 'OpenSSH*'
```

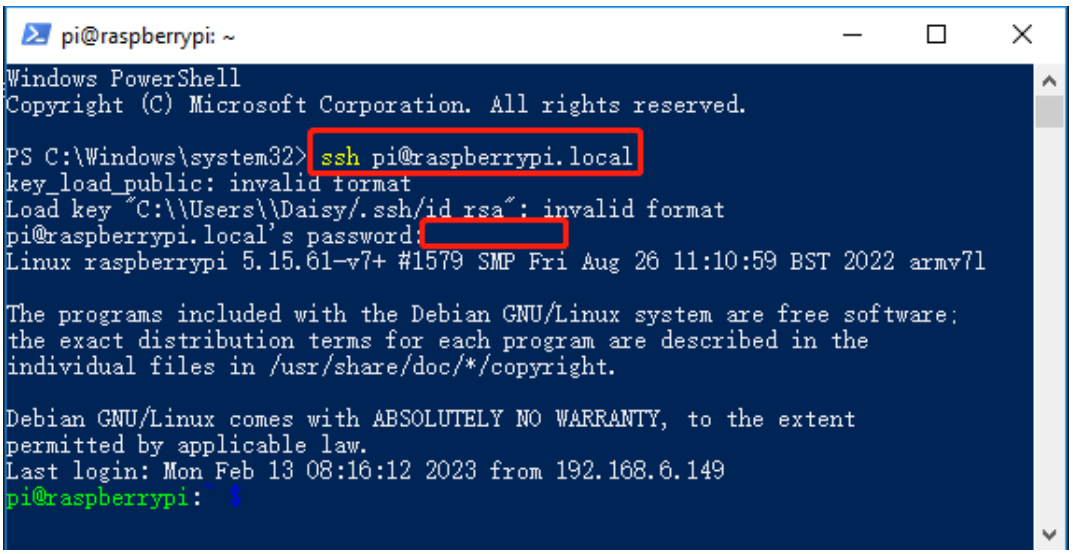
5. It now tells you that `OpenSSH.Client` has been successfully installed.

```
Name  : OpenSSH.Client~~~~0.0.1.0
State : Installed

Name  : OpenSSH.Server~~~~0.0.1.0
State : NotPresent
```

> **Warning:** If the above prompt does not appear, it means that your Windows system is still too old, and you are advised to install a third-party SSH tool, like *PuTTY*.

6. Now restart PowerShell and continue to run it as administrator. At this point you will be able to log in to your Raspberry Pi using the `ssh` command, where you will be prompted to enter the password you set up earlier.



CHAPTER

SIX

THANK YOU

Thanks to the evaluators who evaluated our products, the veterans who provided suggestions for the tutorial, and the users who have been following and supporting us. Your valuable suggestions to us are our motivation to provide better products!

Particular Thanks

- Len Davisson
- Kalen Daniel
- Juan Delacosta

Now, could you spare a little time to fill out this questionnaire?

Note: After submitting the questionnaire, please go back to the top to view the results.

CHAPTER

SEVEN

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