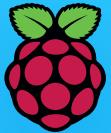


# Raspberry Pi



# QUICK START GUIDE

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makeblock



# Setting up your Raspberry Pi

## WELCOME



Congratulations on your purchase from OOB and welcome to the exciting world of the Raspberry Pi !

To setup your Raspberry Pi, you will typically need the following items:

1. MicroSD card (pre-loaded with NOOBS\*)
2. Set of heat sinks to keep the Raspberry Pi running cool
3. Case to hold and protect your Raspberry Pi. Fans will also keep the Raspberry Pi cool
4. USB MicroSD card reader for use on your PC or Mac in case you need to re-program the MicroSD card.
5. Micro-HDMI cable
6. 5V/3A DC Output MicroUSB power adapter
7. USB keyboard and mouse [Not Included]
8. HDMI monitor [Not Included]
9. Ethernet cable for connection to a wired network [Not Included\*]
  - NOOBS is designed to make it easy to select and install operating systems for the Raspberry Pi without having to worry about manually imaging your MicroSD card.
  - Raspberry Pi 4 comes with Gigabit Ethernet, along with onboard wireless networking and Bluetooth.



# Setting up your Raspberry Pi

## Step 1 Introduction

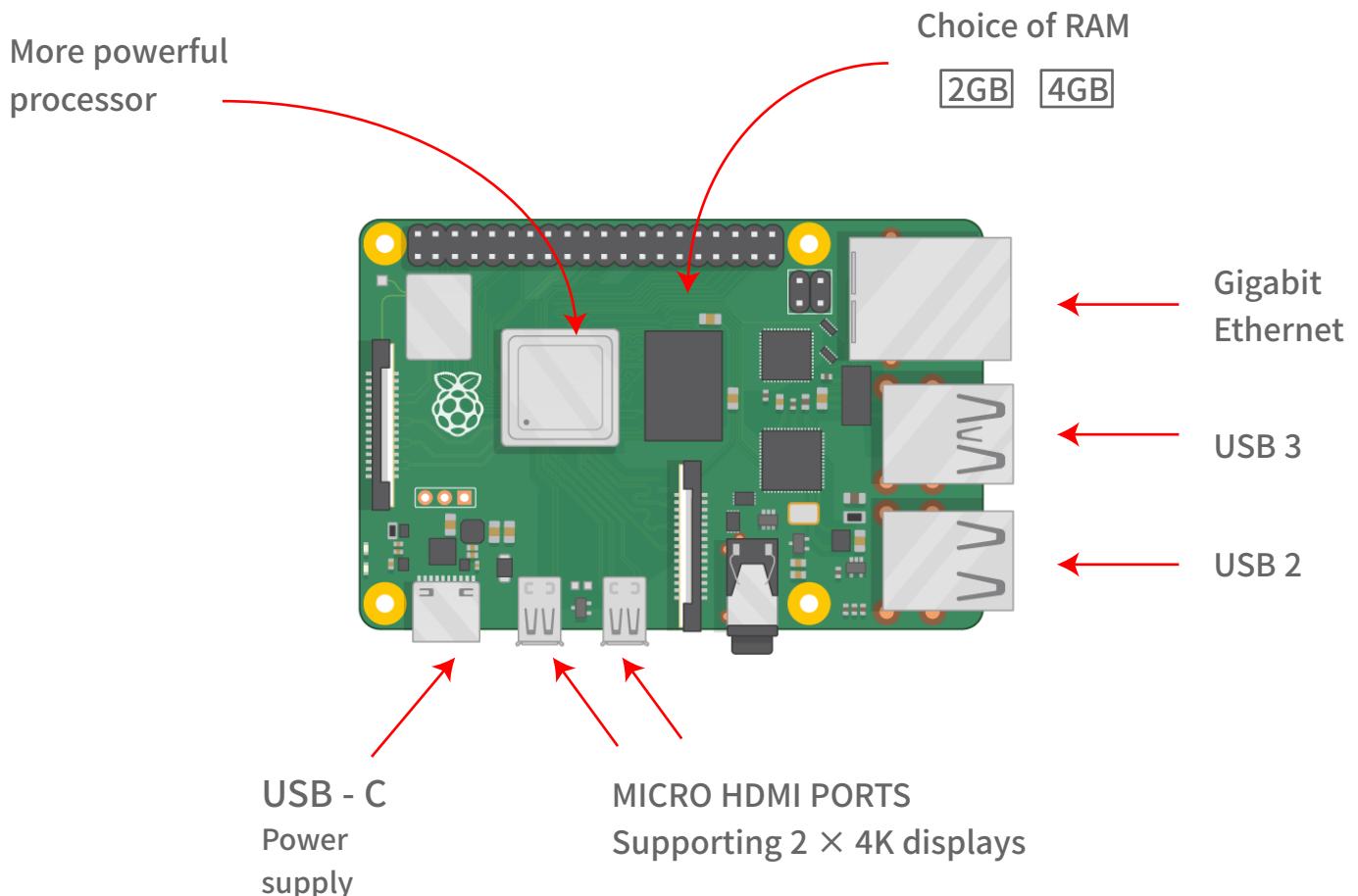
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The Raspberry Pi is a small computer – a very small computer. It consists of mostly the same parts as a standard desktop computer or laptop. A central processing unit (CPU) acts as a brain, random access memory (RAM) and long-term storage devices are used to hold data, a video display shows you what is happening, and you interact with all of this using mice, keyboards, joysticks, and other universal serial bus (USB) devices.

The Pi may be less powerful than your Windows PC or Macintosh, but it is still impressive that it fits all of this on a board only slightly larger than a credit card.

## Step 2 Technical Specifications

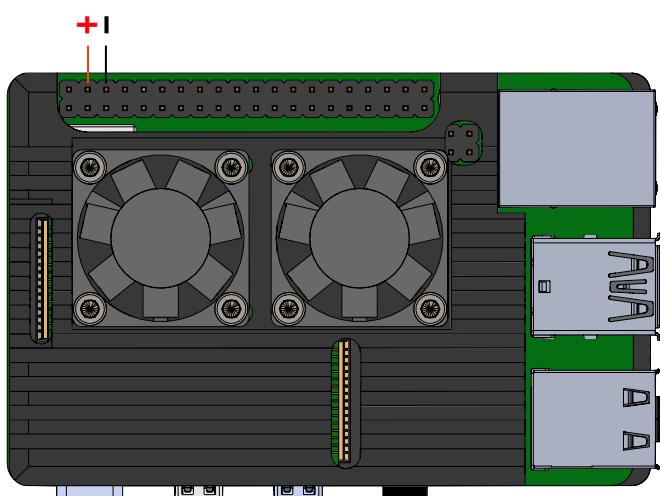
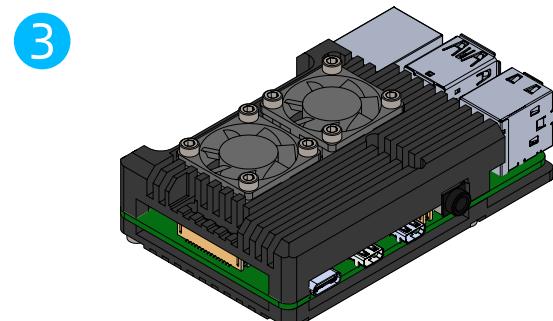
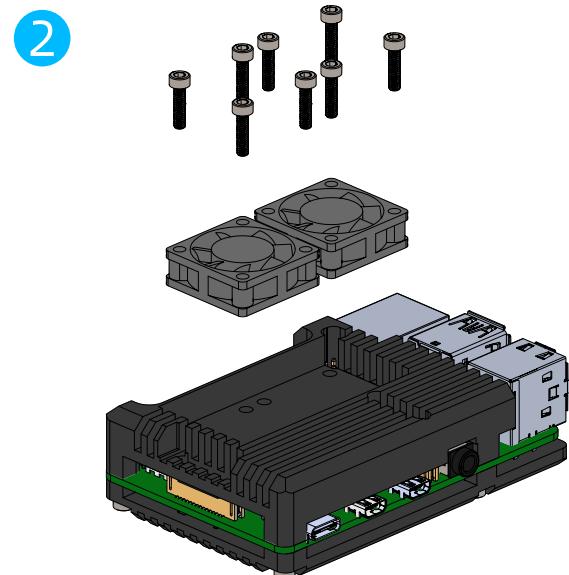
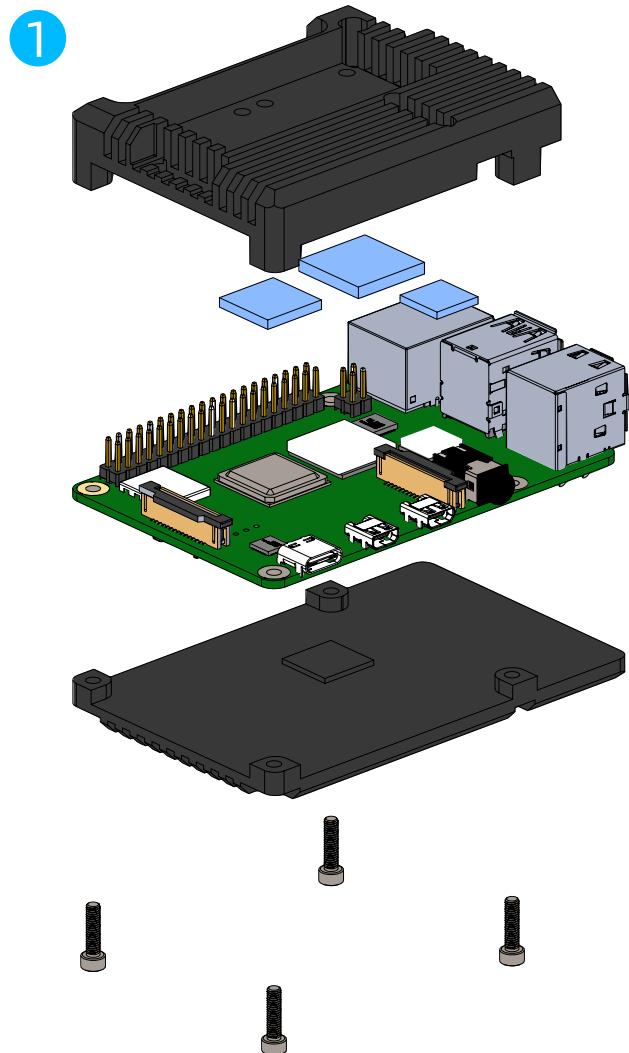
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# Setting up your Raspberry Pi

## Step 3 Basic Setup



### Fitting a Heat Sink

When the components in a computer system work hard, they generate heat. And above a certain level, this heat can reduce the lifespan of the components or even break them altogether.

A Heatsink Armor Case is a carefully designed block of metal that takes the heat away from the electronic component and then passes it into the air surrounding the device.

There are three chips on a Raspberry Pi that can get very hot if the device is working hard. Using 3 pieces thermal pads to touch the shell body for dissipating heat.



# Setting up your Raspberry Pi

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## Connecting Power

Power is fed to the Pi through the Type-C socket or, if you have a suitable connector, through the general purpose input output pins. However, providing power through the GPIO header pins bypasses the on-board protection circuitry that is designed to prevent damage to the device. For this reason, it should only be attempted by people who are experienced in building electronic circuits.

## Connecting a Display

HDMI offers a high-quality video and audio signal, and is the preferred way of connecting all models of Raspberry Pi to a modern television. To connect a high-definition television: Plug one end of an HDMI cable into the Raspberry Pi's HDMI socket, and the other end into an HDMI input on your TV.

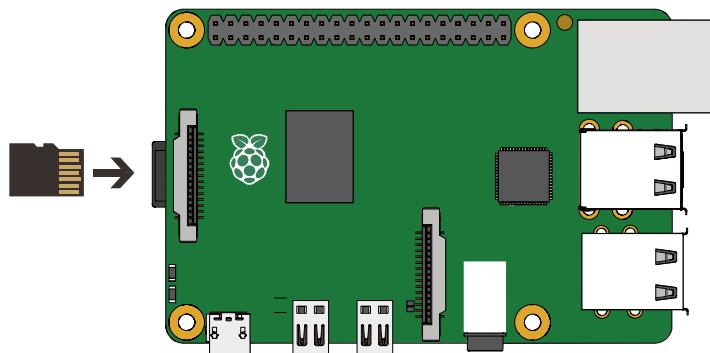
## Step 4 SD Cards

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In the next chapter, you will learn about Raspberry Pi operating systems (in particular, Raspbian Linux) and how to install them onto an SD card. This will complete the set-up of the Pi. Inserting and Removing SD Cards It is likely that you will need a memory card with more than 2 GB capacity, if you are intending to run an operating system on the Pi. MicroSD cards are widely available and generally very cost-effective.

To insert an SD card:

1. Shut down the Raspberry Pi from the button on the power cable.
2. Locate the SD card socket on the underside of the Pi's board.
3. When looking from above, the SD card's contacts should be facing up.
4. Gently, push the SD card into the socket.



To remove the SD card: Gently pull the card out.

When inserting and removing SD cards in other computers, it is not always necessary to turn off the device. However, as the memory card contains its operating system, the Pi may access it at any time. Removing the card while the Pi is accessing it can corrupt data and, in extreme cases, may stop the card working at all.

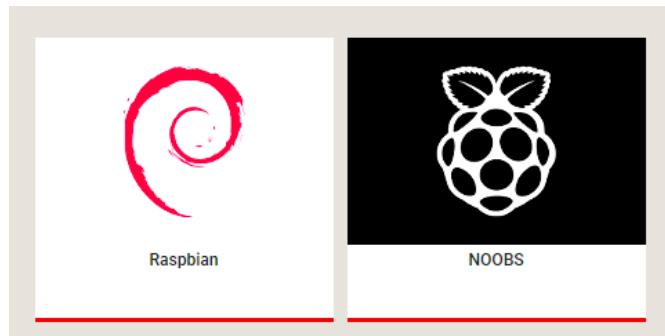
## Installing Raspbian

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### Raspbian and linux

An operating system (OS) is a unique type of application that you run on your computer. It is an environment in which many other applications can run at the same time, with a consistent user interface and sharing the same resources. Microsoft Windows and Apple's Mac OS X are probably the two most well-known operating systems, but there are others.

Raspbian is a Linux distribution that is based on Debian, another popular version of Linux. It is designed for the Raspberry Pi and is the OS recommended by the Raspberry Pi Foundation. Once you are familiar with Raspbian, you will find that you are able to use other varieties of Linux without much help.

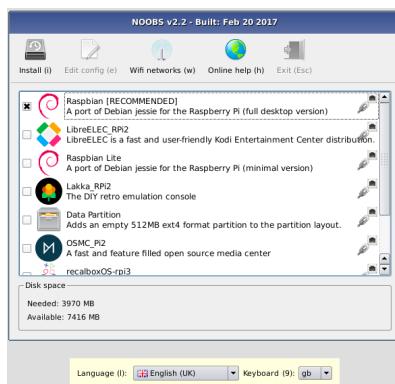


## Installation of Raspbian with NOOBS

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New out of Box Software (NOOBS) is a tool that you can run on your Raspberry Pi, and it will help you install an OS. It stays on the SD card, even after the OS installed, and you can also use it to edit the Pi's main configuration file or replace the installed OS. The SD card supplied with your Pi already contains NOOBS.

## Installing Raspbian



To install Raspbian, you will need to connect a keyboard, mouse, and display to your Pi. First, ensure the Pi is completely off and unplugged, and then insert the SD card into the Pi's memory card socket. Reconnect the power to your Pi. The Pi will start and load the NOOBS tool.

To install Raspbian:

1. Click the box next to Raspbian.
2. On the toolbar, click Install. When the installation is complete, the Raspberry Pi restarts and loads the raspi-config tool.

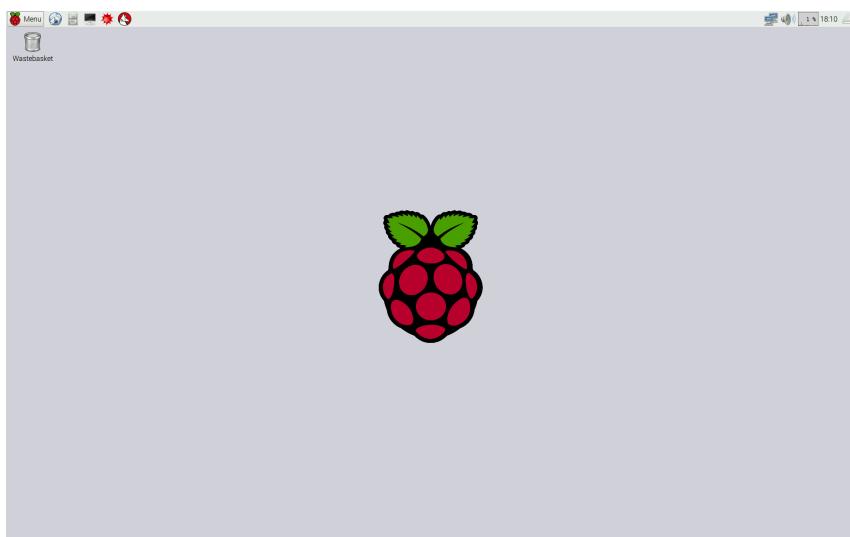


## Raspbian's Desktop Environment

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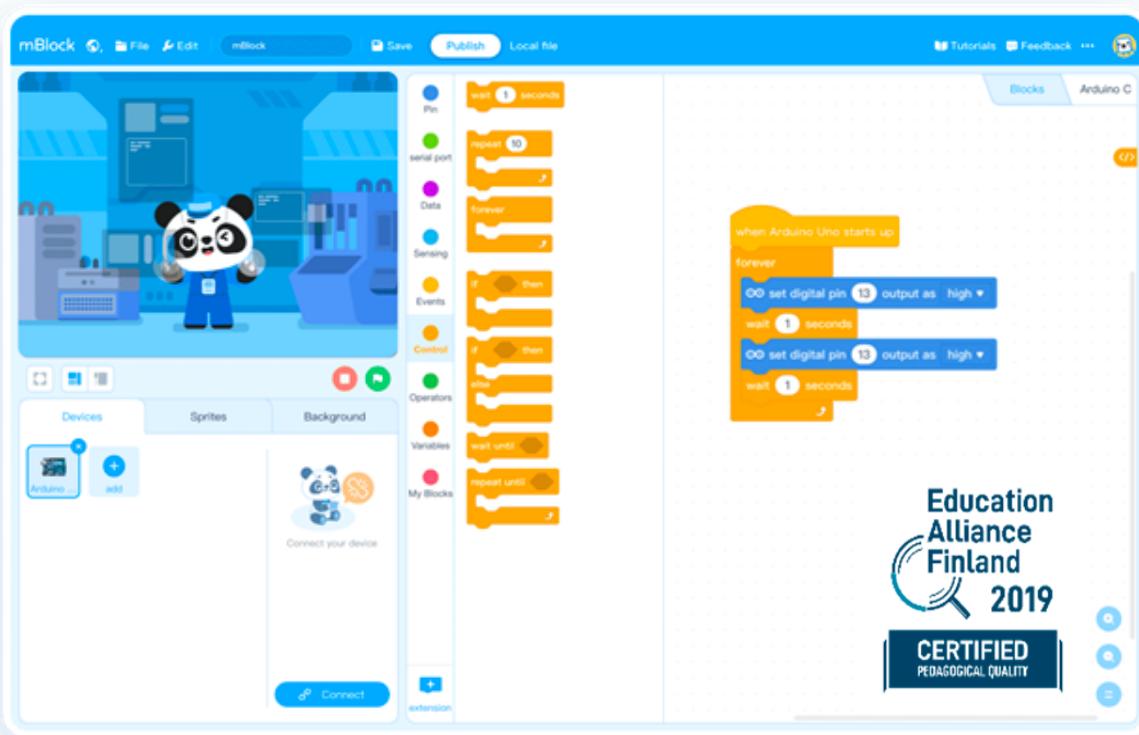
Raspbian's desktop is similar to Microsoft Windows and many of the ways that you use it are the same. To interact with icons and buttons, click them with the mouse. If you right-click an icon, Raspbian displays a context menu. The options in a context menu only apply to the item that you clicked.

The desktop takes up most of the screen. This is where your programs will appear when you start them. And if you save files to the /home/pi/Desktop directory then you can see links to these files appear on the desktop.





## Using Raspberry Pi to learn Python Robotics Programming AI & IoT with mBlock



mBlock is an all-in-one coding platform tailored to coding education.

With mBlock, you may easily create games, animations and program robots by dragging and dropping blocks, or through writing Python. Moreover, mBlock comes with AI, IoT, data science features for cutting-edge computer science learning, making it the perfect helper for coding educators and learners.

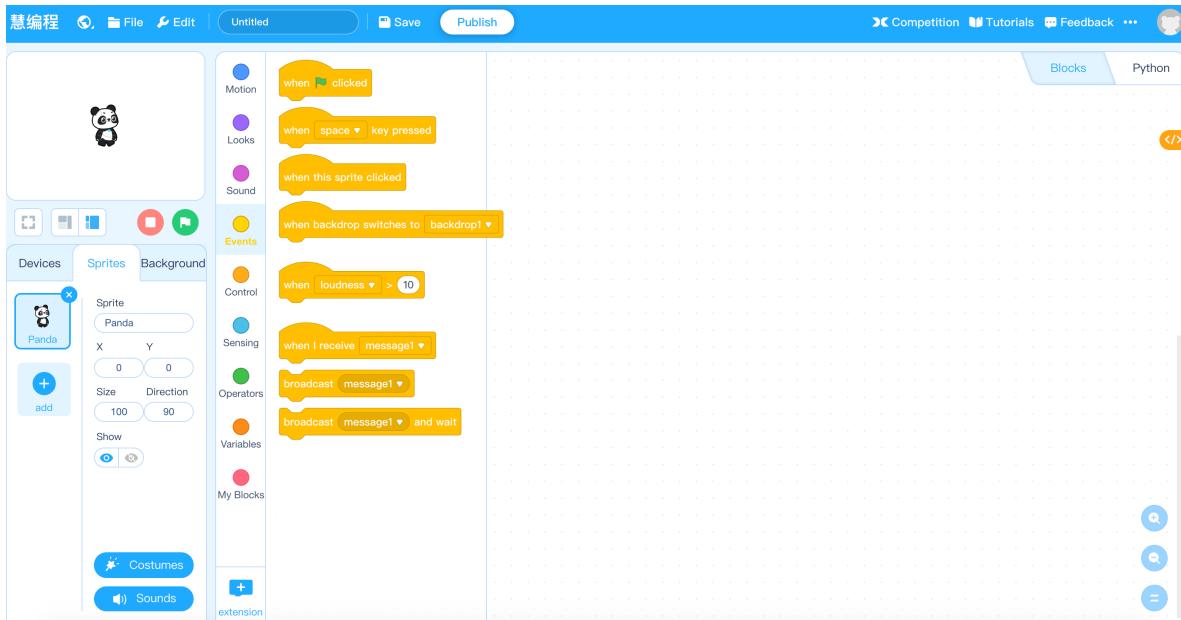
mBlock is available in Raspbian.

Using Chromium to open <https://ide.mblock.cc/#/en-raspberry> to program online.

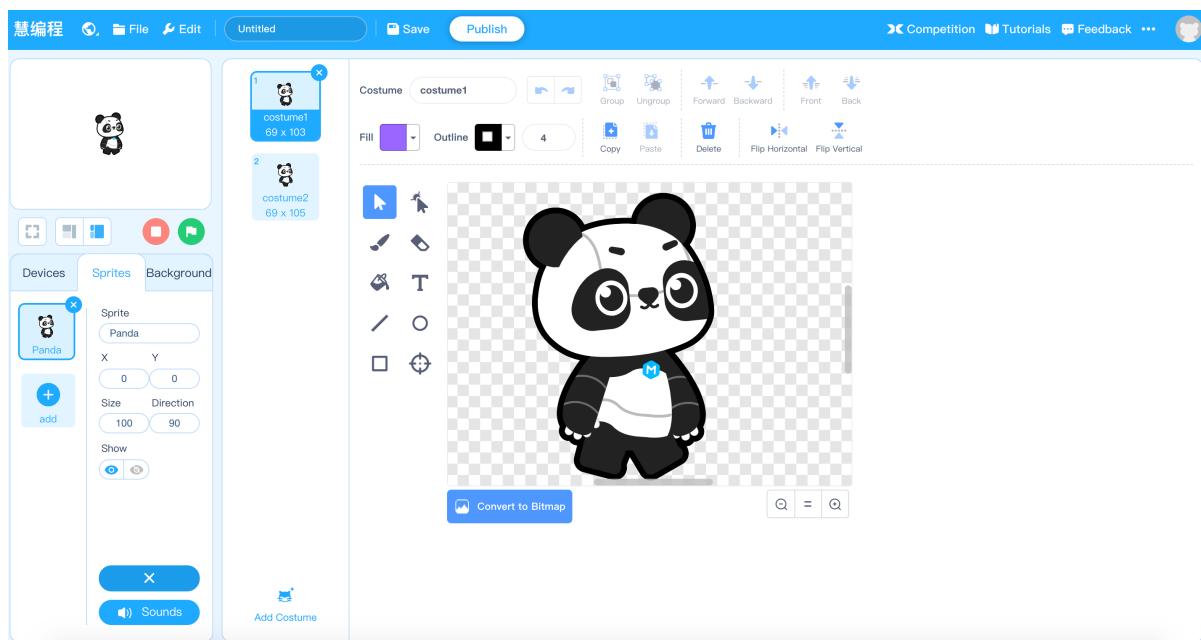


## Scratch 3.0 based and enhanced

Program by dragging and dropping blocks.



Center a costume



- Import and edit Scratch 2.0 and Scratch 3.0 projects.
- Compatible with Scratch teaching resources.
- Enhanced with practical features like “Centering a costume”.
- More clear user interface by separating "Device" and "Sprite" coding section.



## Progress from block- to text-based coding



Block-based Coding

### Python

```
1 # generated by mBlock5 for codey & rocky
2 # codes make you happy
3 import rocky, codey, time, event
4
5 @event.start
6 def on_start():
7     while True:
8         if rocky.color_ir_sensor.is_obsta
9             codey.display.show_image("000")
10            rocky.turn_right(50, 1)
11
12     else:
13         codey.display.show_image("000")
14         rocky.forward(50)
15
```

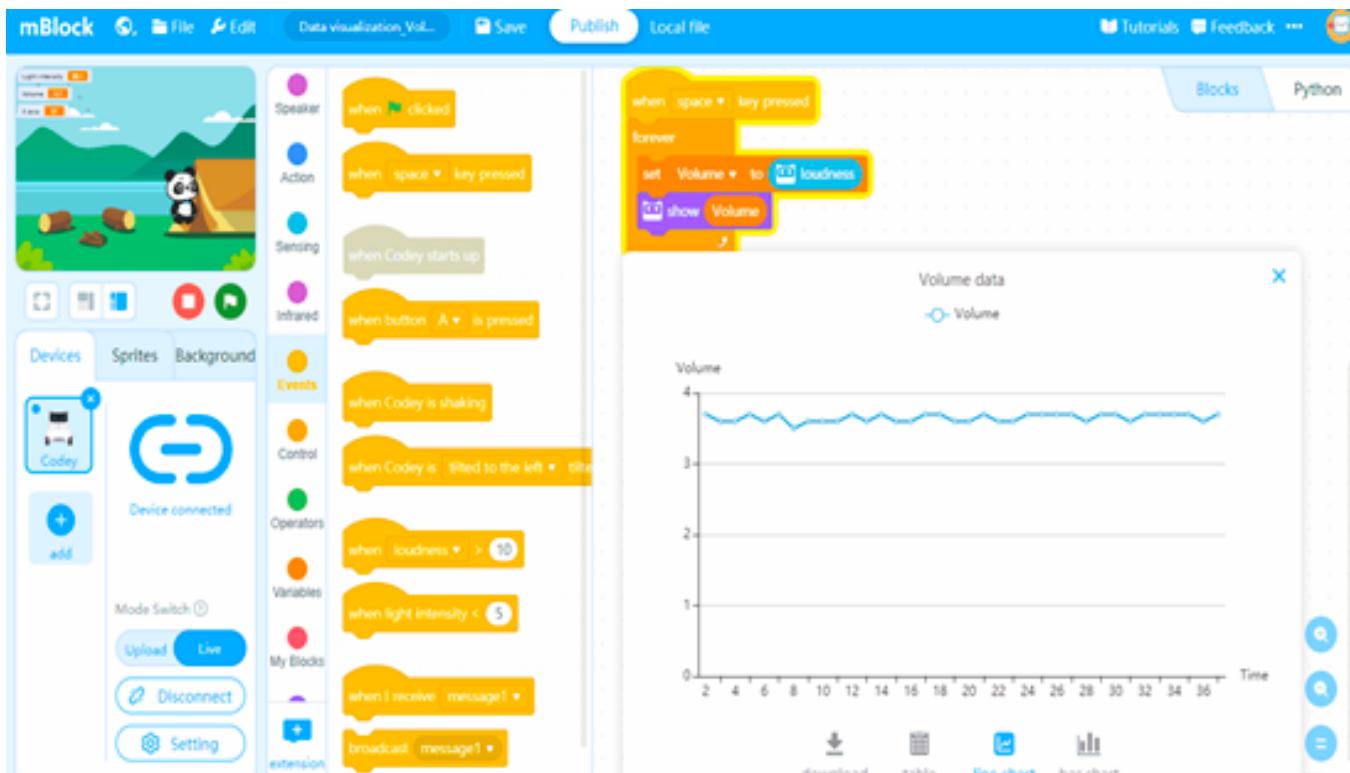
Code with Python

- Compare code and blocks side-by-side, making the transition from block- to text-based programming intuitive and straightforward.
- Code with Python or Arduino C.
- Drive hardware with Python.

User Share: <https://bit.ly/rpipython>



## Practical AI and IoT features for data science education



### Gather data via Codey

- Recognize speech, printed and written text; analyze age and emotion from people's faces.
- Help students create interactive projects with the data models trained via machine learning.

User Share: <https://bit.ly/rpidata1>

Official Guide: <https://bit.ly/rpidata2>

- Gather data via Codey Rocky and visual volume data. Work with Google Sheet or data chart for data science education. Collect and visualize data on the Internet.

Codey Rocky user case: <https://bit.ly/rpidata3>

Data chart user case: <https://bit.ly/rpidata4>



# Raspberry Pi - AI & IoT

## Code for robots and devices

Device Library



Halocode  
Developers: mBlock



Codey  
Developers: mBlock



mBot  
Developers: mBlock



mBot Ranger  
Developers: mBlock



Ultimate 2.0  
Developers: mBlock



mBuild  
Developers: mBlock



NovaPi  
Developers: mBlock



MegaPi Pro  
Developers: mBlock



Orion  
Developers: mBlock



Bluetooth Controller  
Developers: mBlock



Neuron  
Developers: mBlock



MotionBlock  
Developers: mBlock



micro:bit  
Developers: mBlock

Become a developer of mBlock to unlock more potential.

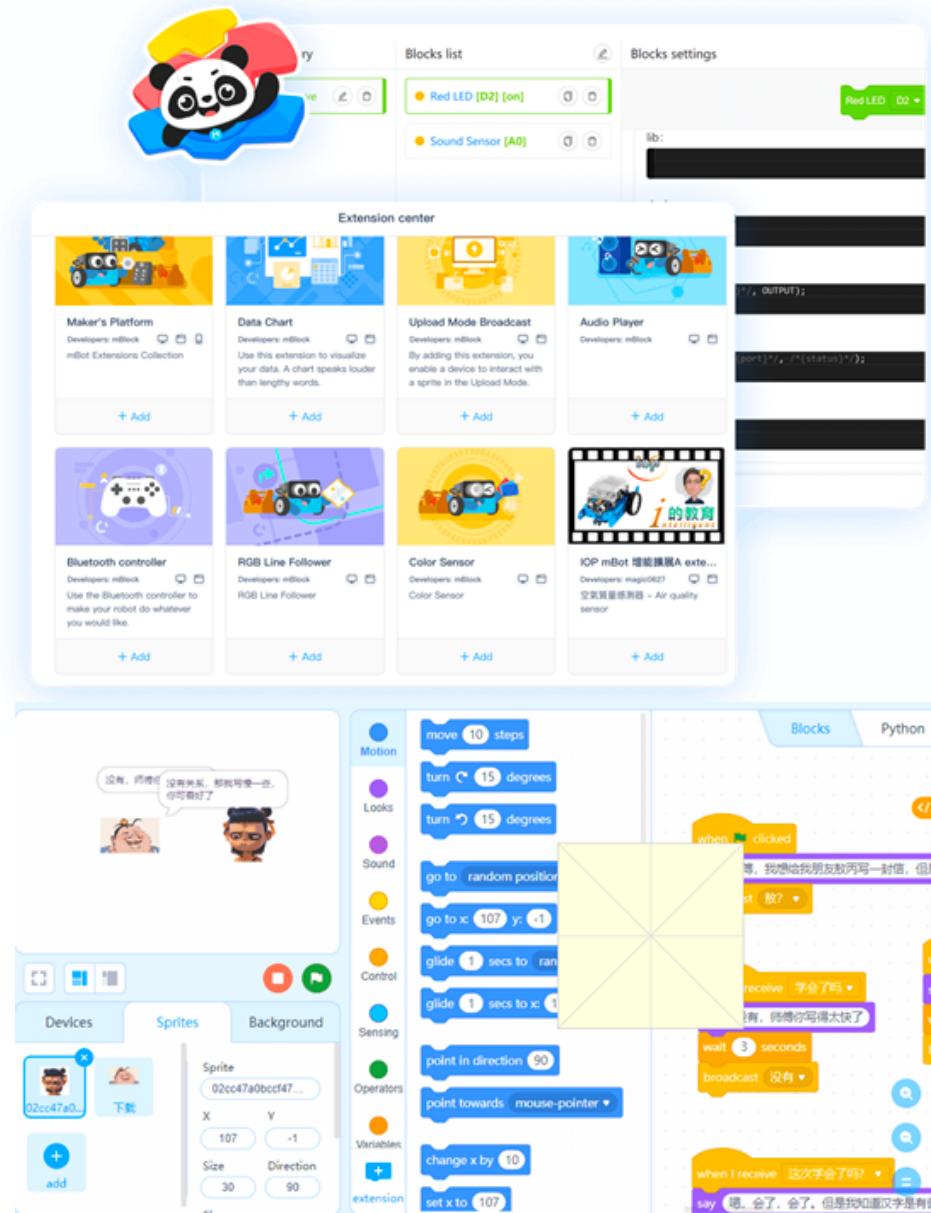
Cancel

OK

- Code for all the Makeblock robots.
- Connect and code for open-source hardware, including Arduino and micro:bit, and over 500 sensors.
- Bridge robots and the Internet through broadcasting in the cloud.
- Visualize the learning outcome via connecting code to real-life.



## Customize mBlock with Extension Builder



- More than 500 ready-to-use block extensions (Over 400 extensions are contributed by users).
- Customize coding blocks for existing devices or add new device to mBlock.
- Parameter settings and graphical UI reduce development efforts.
- Detailed developer documentation and rich case studies.
- <https://bit.ly/rpimblockext>

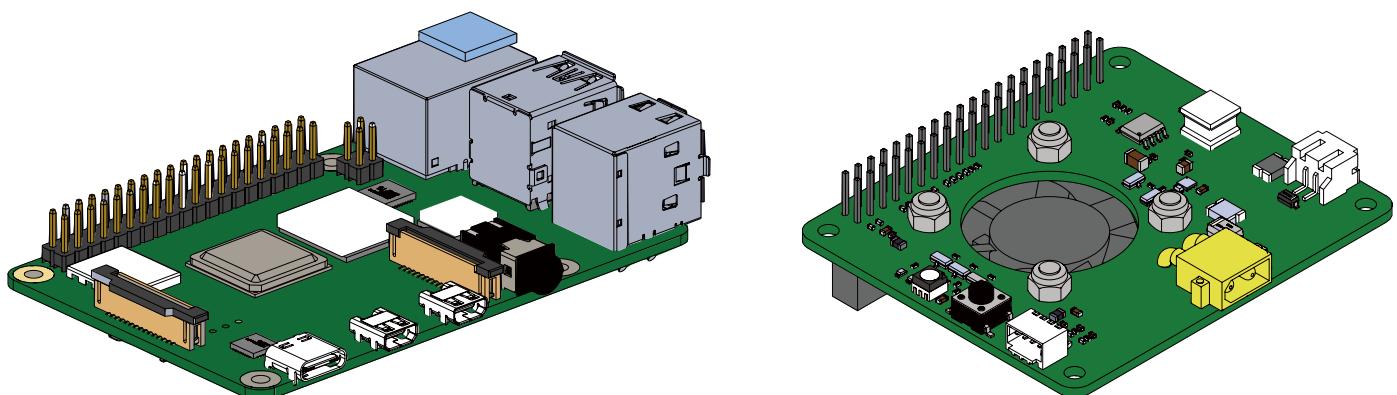
Help Document:

<https://bit.ly/rpihelp>



## Raspberry Pi Camera

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### 1. Overview

**Raspberry Pi Camera uses Raspberry Pi 4 Model B and a camera to capture, process and recognize images.**

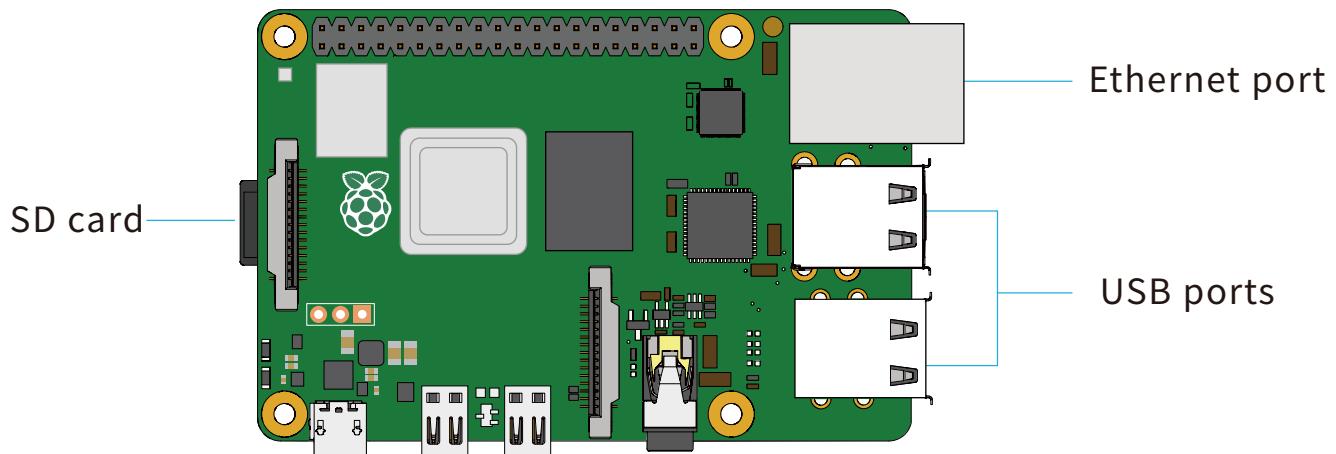
It allows you to obtain the geometric information of letters, like position, size, and distance. Combined with NovaPi, the Raspberry Pi Camera can be used to build a robot that can automatically recognize objects.

Raspberry Pi is powered by Power Shield, which has a Bluetooth Module port and a cooler to draw heat away from the Raspberry Pi.

### 2. Components

Raspberry Pi

Model: Raspberry Pi 4 Model B





## Raspberry Pi Camera

Ethernetport

SDcard

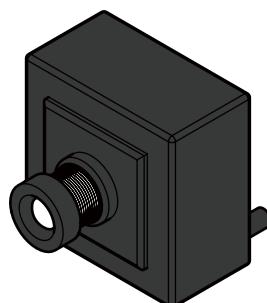
USBports

Output formats: MJPEG/YUV2 (YUYV)

Operating voltage: 5V

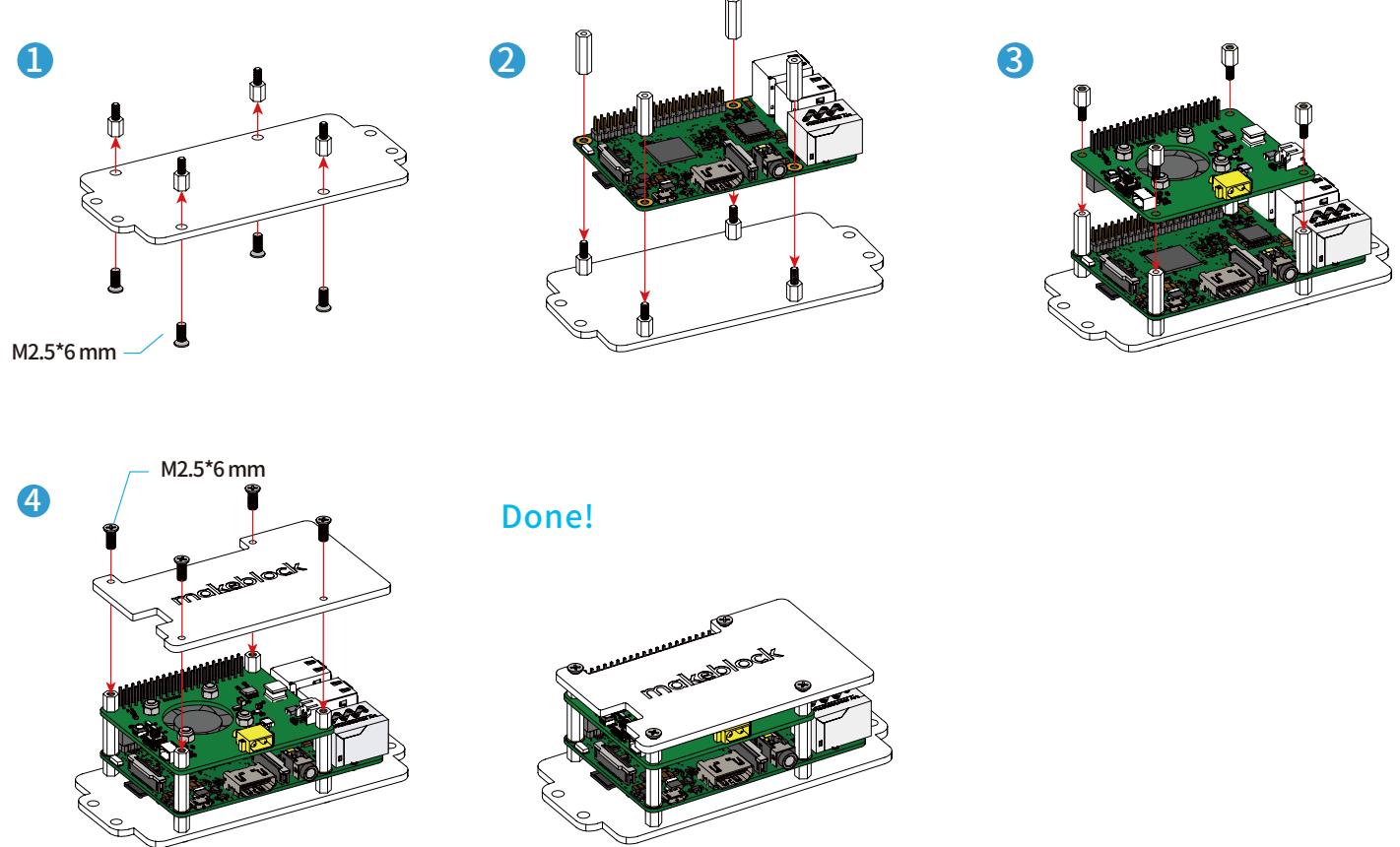
Lens: 6mm

Adjustable parameters: brightness, contrast, color saturation, brilliance, gamma, white balance, backlight, exposure, flip



Max current: 4A

### 3. How to install



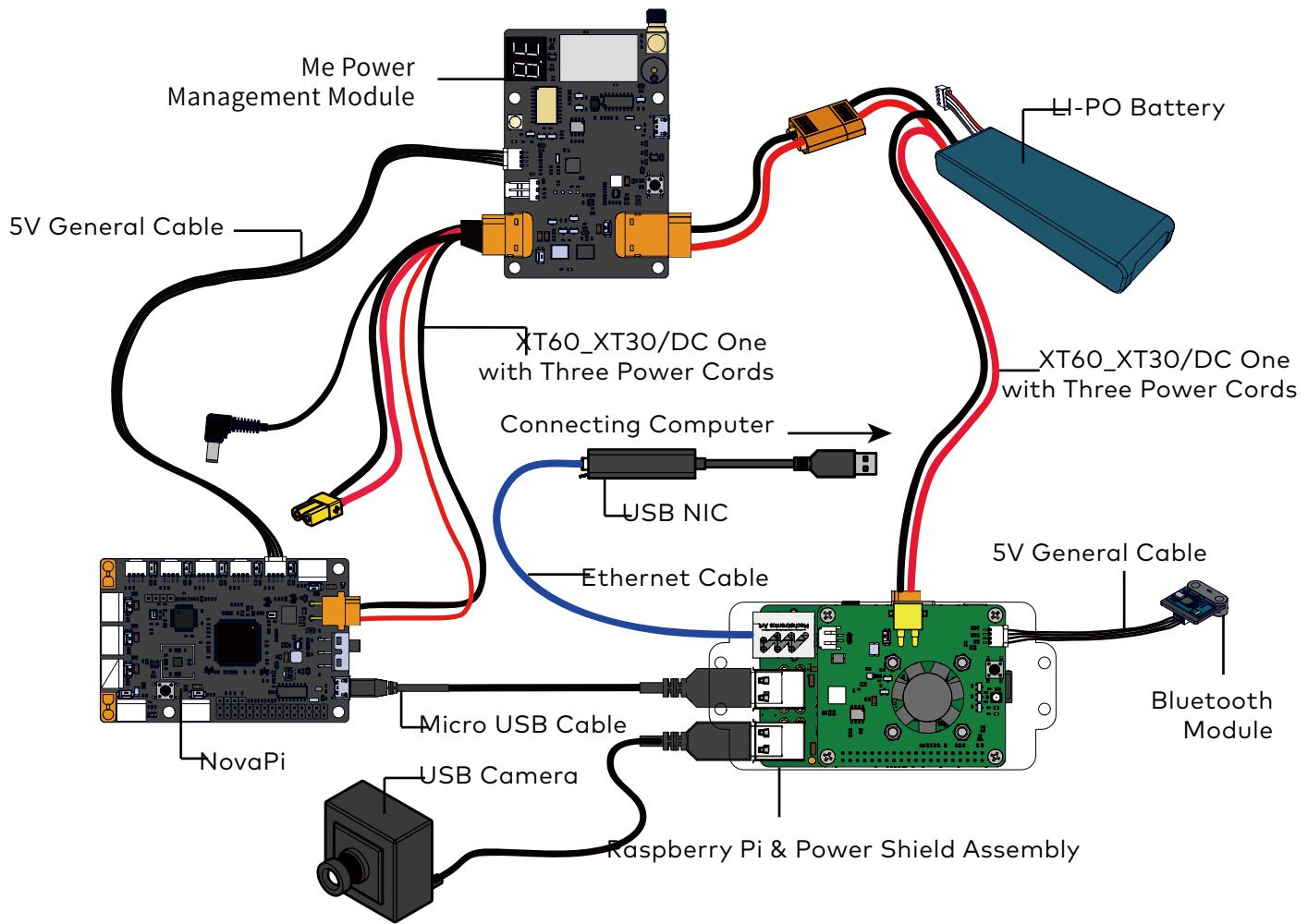


## Raspberry Pi Camera

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### 4. Set up the hardware

Note: Make sure the accompanying SD card is well inserted into the Raspberry Pi.



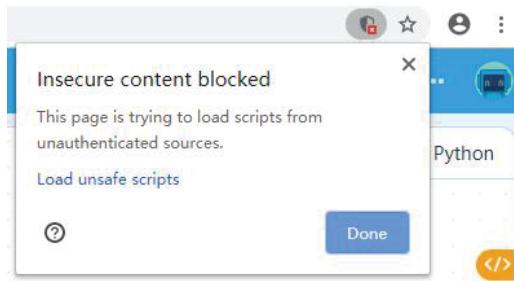
### 5. Connect to mBlock

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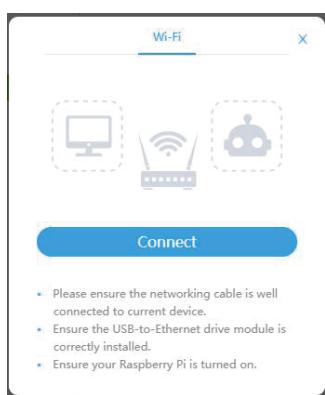
- (1) Open mBlock and add "Raspberry Pi Camera" from the Device Library.



(2) Check whether the browser blocks some content. If it does, click Load unsafe scripts.



(3) Click Connect at the lower left to connect the device to mBlock.



(4) Test the Raspberry Pi Camera with the program below. Click Upload when you finish the program.



(5) If a real-time camera preview appears on the stage, that means the Raspberry Pi Camera is working.



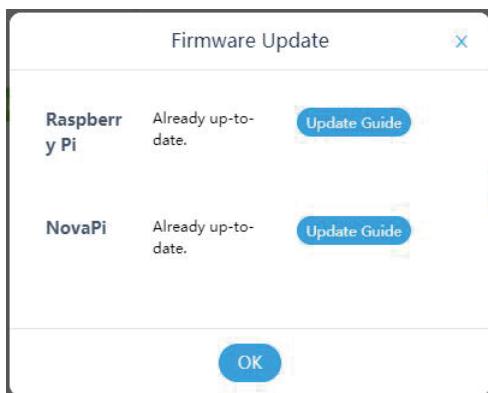


## 6. Coding blocks

Category	Coding block	Description
Event		This event is generated when the main program of the Raspberry Pi Camera is executed. Place this block at the beginning of a script.
Image		This block turns on the camera.
		This block turns off the camera.
		This block detects a specified letter of a specified size. It also gathers geometric information about the letter, such as center coordinate X/Y, external rectangle width/height, area, distance to the camera, and deflection angle.

## 7. Firmware updates

Click Setting → Update Firmware. In the pop-up window, click Update Guide. Then follow the instructions to complete the firmware updates.



## 8. Example programs

### Switch between modes

Description:

(1) Auto mode: the system first detects its distance to the letter "M"; if it's far from the letter, it approaches the letter at a higher speed; if it's close to the letter, it approaches the letter at a lower speed.

(2) Manual mode: the motor rotates only when you press button 1 on the Bluetooth Controller.



# Raspberry Pi - AI & IoT

The Scratch script consists of two main programs:

- Automatic program:** Triggers when the competition starts in automatic mode. It checks the distance to the camera. If the distance is greater than 1000 mm, the encoder motor M1 rotates at 100 r/min. Otherwise, it rotates at 50 r/min.
- Manual program:** Triggers when a Bluetooth controller's button 1 is pressed. The encoder motor M1 rotates at -80 r/min. If the button is not pressed, the motor rotates at 0 r/min.

## Center the letter

Description: the camera keeps moving left and right until the letter "M" appears within the range of  $\pm 30$  pixels around the center of the frame.

Note: The resolution is 640 x 480 pixels.

The Scratch script uses the camera to find the center coordinate of a letter 'M'. It then moves a motor to center the letter relative to the video frame.

- Initial setup: Set center coordinate x of video to 320 and center coordinate x of letter to 0.
- Loop:** Continuously updates the center coordinate of the letter and compares it to the center coordinate of the video frame.
- If the letter is positioned to the right of the center ( $> 30$  pixels), the motor rotates at 50 r/min.
- If the letter is positioned to the left of the center ( $< -30$  pixels), the motor rotates at -50 r/min.
- If the letter is centered ( $= 0$  pixels), the motor rotates at 0 r/min.



## Identify another letter

Description: the system first detects the position of the letter "M" and then that of "A".

Note: When you change the letter to be recognized, the system may fail to recognize the new target immediately. So, allow the system to capture the coordinate of the new target twice with an interval of 0.1 seconds.

