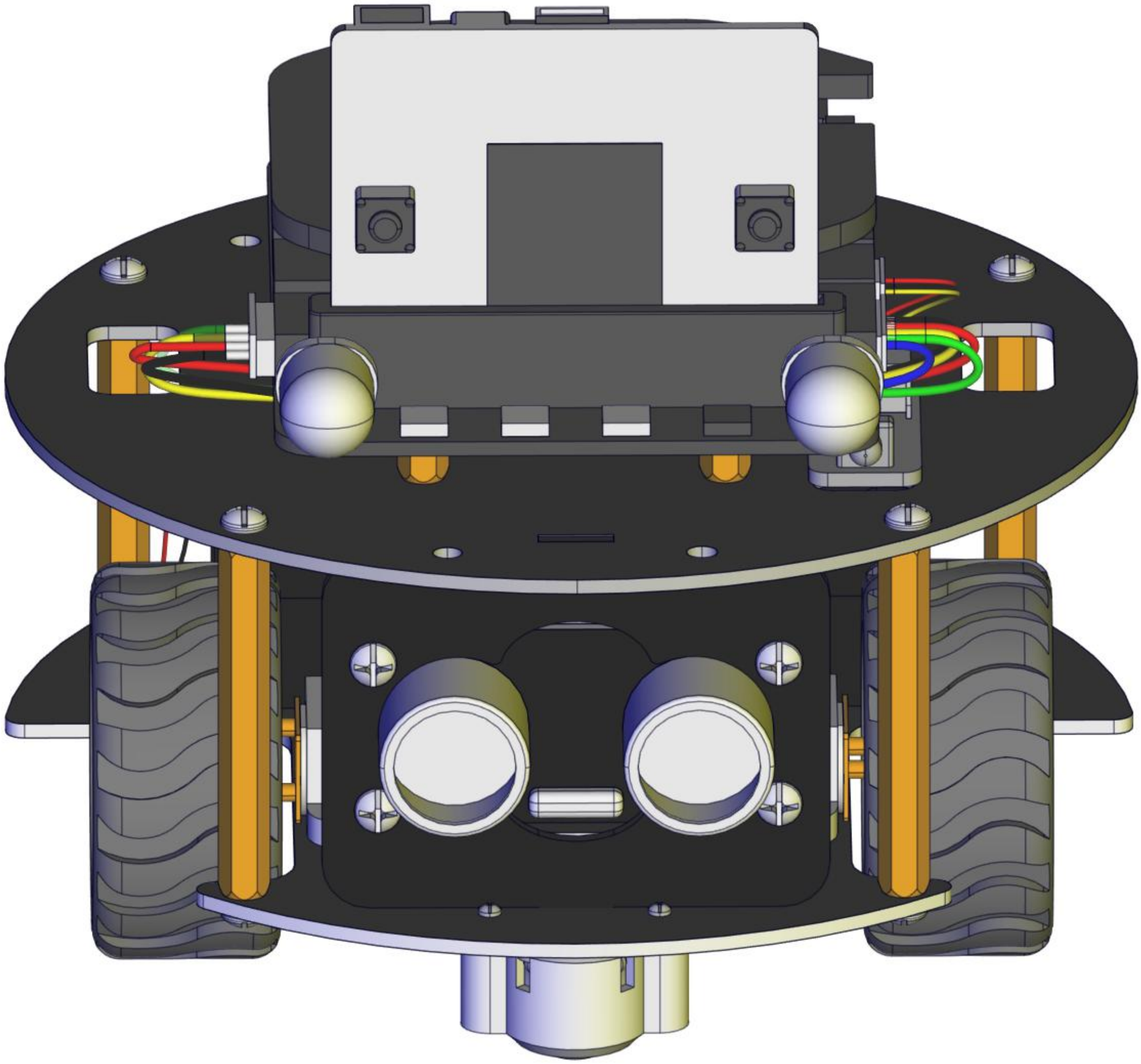
Keyestudio Micro: bit Mini Smart Turtle Car



Contents

1. Description

Micro:bit is significantly applied to STEM education for teenagers, as a small microcontroller featuring small in size, easy to carry, and powerful functions. At present, innovative technology products, like robots, wearable devices and interactive electronic games can be produced by programming and code.

In this kit, we will guide you how to control and generate a Micro:bit turtle smart car through programming in Makecode.

MakeCode is a framework for creating interactive and engaging programming experiences for those new to the world of programming.

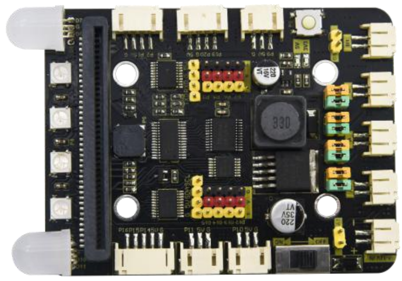
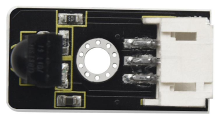
The platform provides the foundation for a tailored coding experience to create and run user programs on actual hardware or in a simulated target. What' s more, we also provide test code and projects so as to make smart car display different effects.

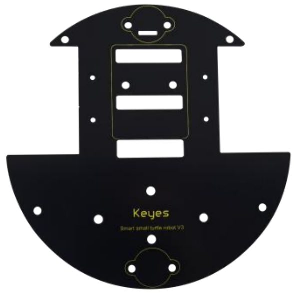
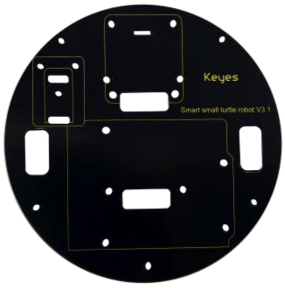
Launched by KEYES group, Keyestudio micro:bit smart car integrates obstacle avoidance, line tracking and IR and Bluetooth control. It is made up of DC geared motors, wheels , sensors and acrylic boards. In addition, it is equipped with a passive buzzer with music play function, 4 pcs WS2812RGB LEDs and 2 pcs RGB lights.

We believe that your imagination and creativity can be stimulated through assemble this smart car by yourself and acquire knowledge about how to code through Makecode, a new method to program.

2. Kit List

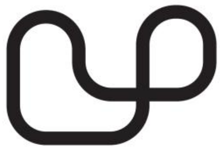
Components			
#	**Model**	**QTY**	**Picture**
0	Micro:bit main board **is Not Included** in KS4014 Kit		

0	Micro:bit main board is **Included** in KS4024 Kit	1	
1	Keyestudio Micro:bit Driver Shield	1	
2	Keyestudio Quick Connectors IR Receiver	1	
3	Keyestudio Quick Connectors Line Tracking Sensor	1	
4	Keyestudio Quick Connectors Ultrasonic Sensor	1	
5	Micro USB Cable AM/MK5P(micro)	1	
6	Keyestudio JMFP-4 17 Key	1	

1	Keyestudio Baseplate for Smart Small Turtle Robot V2.0	1	
2	Keyestudio Round Board	1	
3	Keyestudio Acrylic Top Board	1	
4	Micro:bit Fixed Mount	1	
5	Keyestudio Quick Connectors 12FN20 Motor A	1	
6	Keyestudio Quick Connectors 12FN20 Motor B	1	
7	N20 Motor White Mount	2	
8	Car Wheels	2	

9	Universal Wheel	2	
10	Dual head JST-PH2.0MM-5P Dupont Line	1	
11	Dual head JST-PH2.0MM-4P Dupont Line	1	
12	Dual head JST-PH2.0MM-3P Dupont Line	1	
13	Dual head JST-PH2.0MM-2P Dupont Line	2	
14	18650 2-Slot Battery Holder with 15cm Lead	1	
Nuts/Screws			
1	M2*12MM Round Head Screws	6	
2	M2 Nickel Plated	6	

	Nuts		
3	M3*6MM Round Head Screws	20	
4	M3*8MM Round Head Screws	8	
5	M3*10MM Flat Head Screws	4	
6	M3 Nickel Plated Nuts	12	
7	M3*15+6MM Hex Copper Bush	4	
8	Dual-pass M3*12MM Hex Copper Bush	4	
9	Dual-pass M3*40MM Hex Copper Bush	4	
	Tools		
1	3*40MM Screwdriver	1	

2	Map	1	
3	Black Ties 3*100MM	5	
4	18650 Battery (not included)	2	

3. Specifications

- Connector port input: DC 6V---9V
- Operating voltage of drive board system: 5V
- Standard operating power consumption: about 2.2W
- Maximum power: Maximum output power is 12W
- Motor speed: 100RPM/1min
- Working temperature range: 0-50℃
- Size: 120*120*120mm
- Environmental protection attributes: ROHS

Note: working voltage of micro:bit is 3.3V, driver shield integrates 3.3V/5V communication conversion circuit.

4.Introduction

4.1 What is Micro:bit?

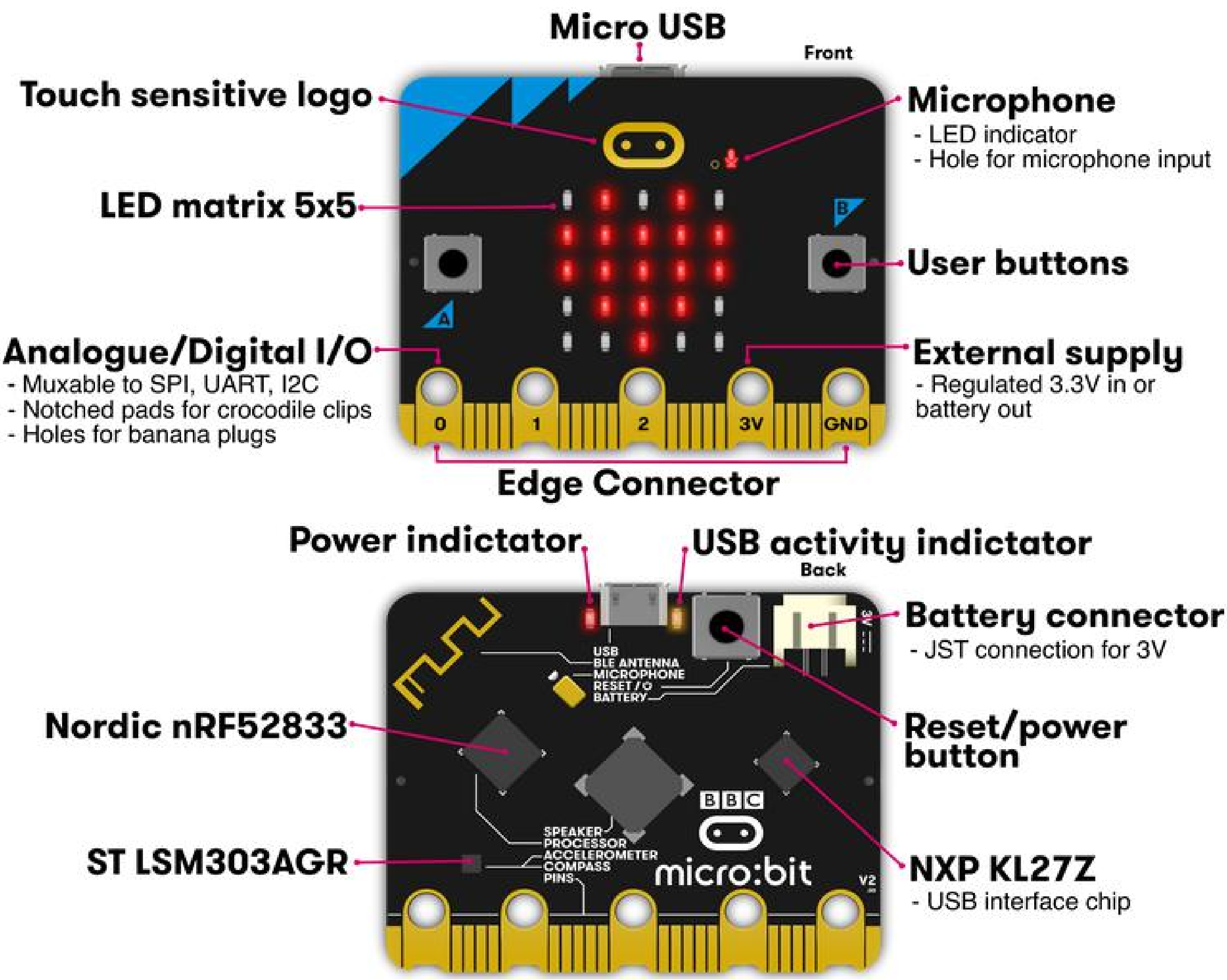
Designed by BBC, Micro:bit main board aims to help children aged above 10 years old to have a better learning of programming.

It is equipped with loads of components,including a 5*5 LED dot matrix, 2 programmable buttons, a compass, a Micro USB interface and a Bluetooth module and others. Though it is just the size of a credit card, it boasts multiple functions. To name just a few, it can be applied in programming video games, making interactions between light and sound, controlling a robot, conducting scientific experiments, developing wearable devices and make some cool inventions like robots and musical instruments, basically everything imaginable.

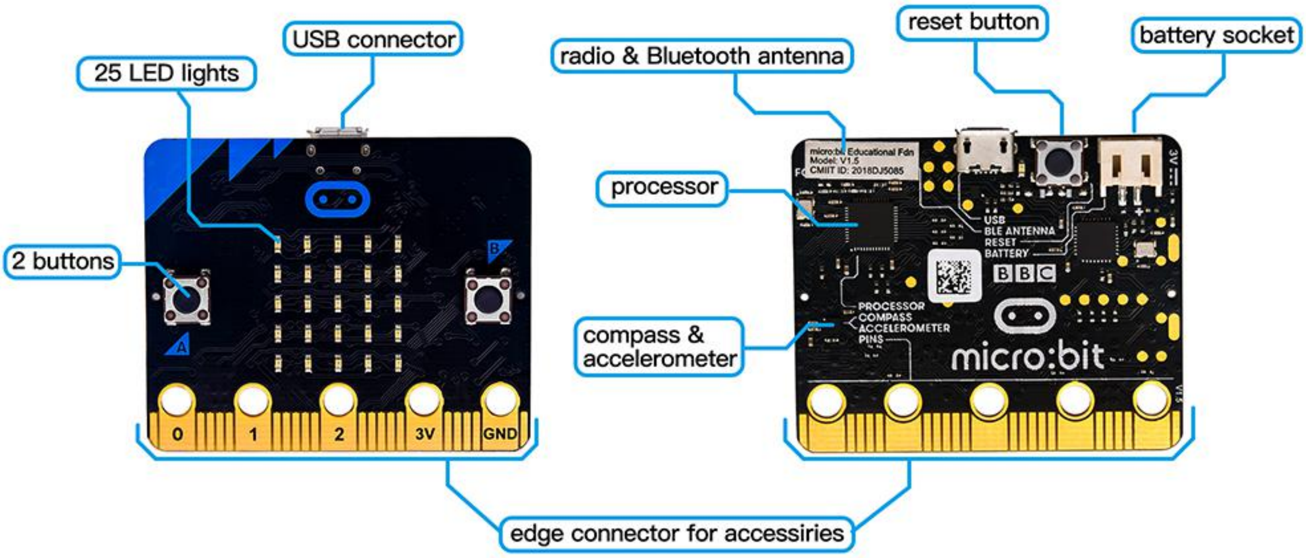
This new version, that’ s the version 2.0, of Micro:bit main board has a touch-sensitive logo and a MEMS microphone. And there is a buzzer built in the other side of the board which makes playing all kinds of sound possible without any external equipment. The golden fingers and gears added provide a better fixing of crocodile clips. Moreover, this board has a sleeping mode to lower the power consumption of battery and it can be entered if users long press the Reset & Power button on the back of it. More importantly, the CPU capacity of this version is much better than that of the V1.5 and the V2 has more RMA.

In final analysis, the V2 Micro:bit main board can allow customers to explore more functions so as to make more innovative products.

4.2 Comparison between V2.0 & V1.5



Micro:bit main board V2.0



Micro:bit main board V1.5

More details:

	V1.5	V2
PROCESSOR	Nordic Semiconductor nRF51822	Nordic Semiconductor **nRF52833**
MEMORY	256KB Flash, 16KB RAM	**512KB** Flash, **128KB** RAM
INTERFACECHIP	NXP KL26Z, 16KB RAM	NXP **KL27Z, 32KB** RAM
MICROPHONE	N/A	**MEMS microphone and LED indicator**
SPEAKER	N/A	**On board speaker**
TOUCH	N/A	**Touch sensitive logo**
EDGE CONNECTOR	25pins,PWM,I2C,SPI and Extension interface. 3 ring pins for connectin crocodile clips/banana plugs.	
	3 dedicated GPIO	**4 dedicated GPIO Notched for easier connection**
I2C	Shared (mux) I2C bus	**Dedicated I2C bus**
WIRELESS	2.4GHz Radio/BLE Blutooth 4.0	2.4GHz Radio/BLE **Blutooth 5.0**
POWER	Micro USB 5V power supply, 3V port or battery power supply	Micro USB 5V power supply, 3V port or battery power supply **LED Indicator, Power off (push and hold power button)**
CURRENT AVAILABLE	90mA	**200mA**
MOTION SENSOR	ST LSM 303	
PROGRAMMING SOFTWARE	C++, Makecode, Python, Scratch	
SIZE	5cm(W) x 4cm(H)	

For the Micro: Bit main board V2, pressing the Reset & Power button , it will reset the Micro: Bit and rerun the program.If you hold it tight, the red LED will slowly get darker.When the power indicator becomes darker, releasing the button and your Micro: Bit board will enter sleep mode for power saving .This will make your battery more durable. And you could press this button again to 'wake up' your Micro:bit.

For more information,please resort to following links :

https://tech.microbit.org/hardware/

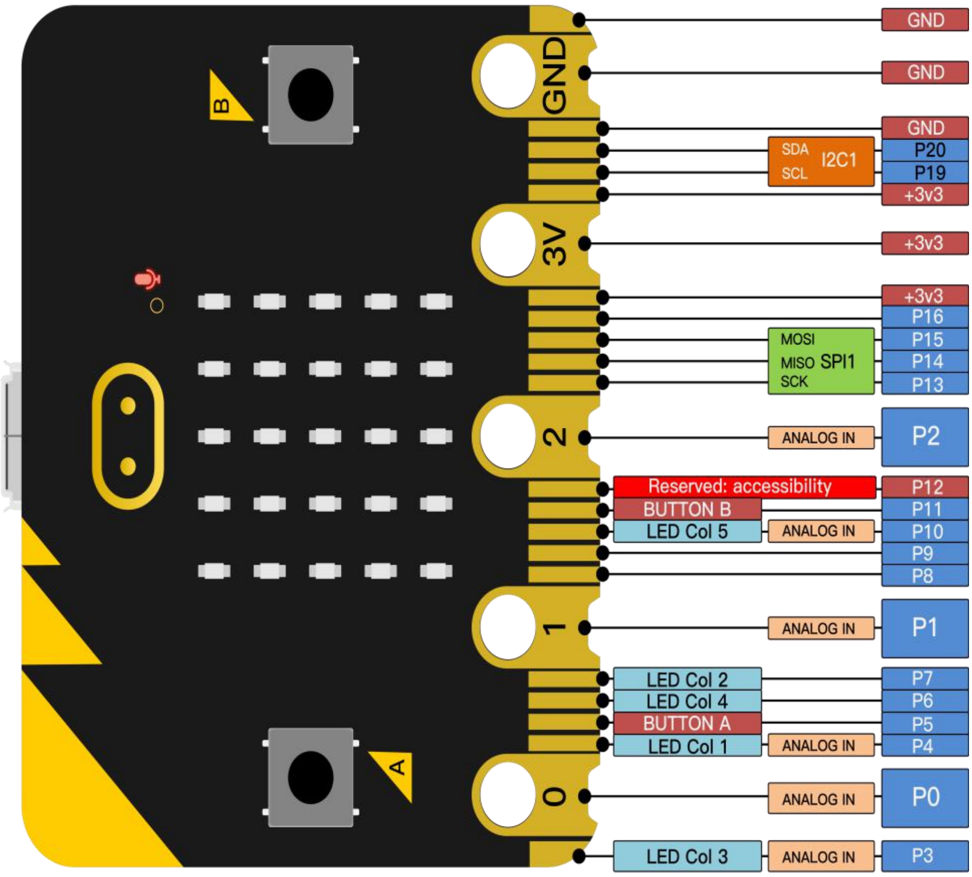
https://microbit.org/new-microbit/

https://www.microbit.org/get-started/user-guide/overview/

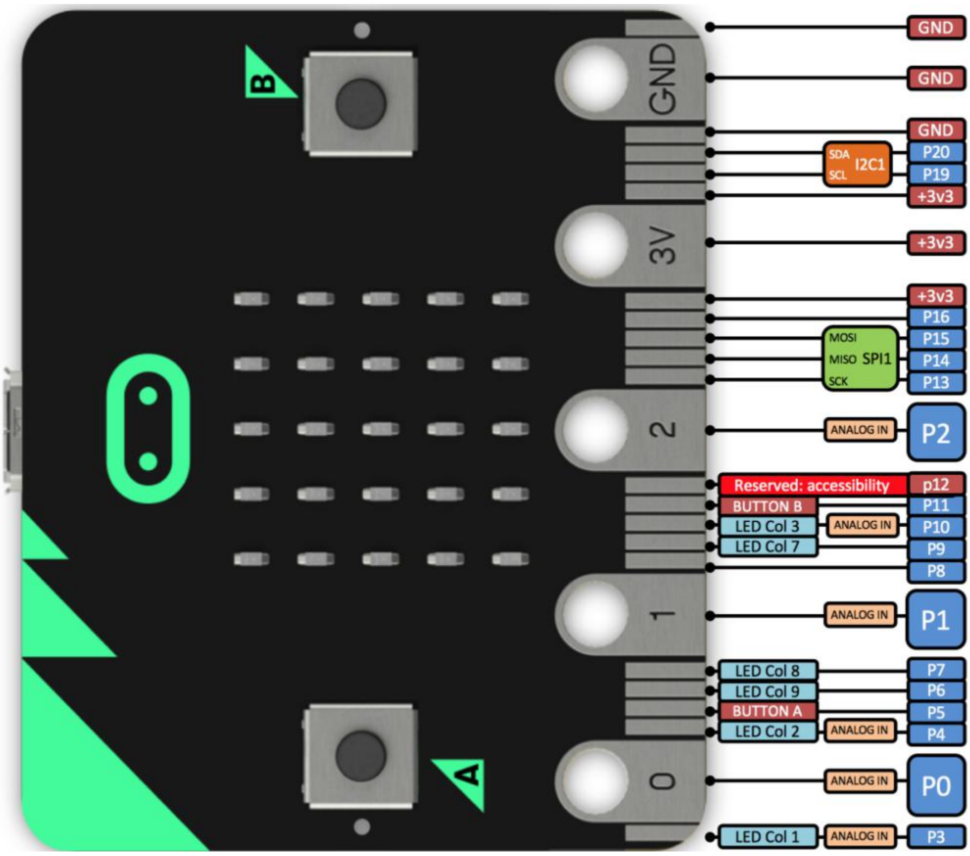
https://microbit.org/get-started/user-guide/features-in-depth/

4.3 Pinout

Micro:bit main board V2.0 VS V1.5



GND
3V
2
1
0
B
A
GND
GND
GND
P20
P19
+3v3
SDA
SCL
I2C1
+3v3
+3v3
P16
P15
P14
P13
MOSI
MISO SPI1
SCK
ANALOG IN
P2
Reserved: accessibility
P12
BUTTON B
P11
LED Col 5
ANALOG IN
P10
P9
P8
ANALOG IN
P1
LED Col 2
P7
LED Col 4
P6
BUTTON A
P5
LED Col 1
ANALOG IN
P4
ANALOG IN
P0
LED Col 3
ANALOG IN
P3



GND
3V
2
1
0
B
A
GND
GND
GND
P20
P19
+3v3
SDA
SCL
I2C1
+3v3
+3v3
P16
P15
P14
P13
MOSI
MISO SPI1
SCK
ANALOG IN
P2
Reserved: accessibility
p12
BUTTON B
P11
LED Col 3
ANALOG IN
P10
LED Col 7
P9
P8
ANALOG IN
P1
LED Col 8
P7
LED Col 9
P6
BUTTON A
P5
LED Col 2
ANALOG IN
P4
ANALOG IN
P0
LED Col 1
ANALOG IN
P3

Browse the official website for more details:

https://tech.microbit.org/hardware/edgeconnector/

https://microbit.org/guide/hardware/pins/

4.4 Notes for the application of Micro:bit main board V2.0

a. it is recommended to cover it with a silicone protector to prevent short circuit for it has a lot of sophisticated electronic components.

b. its IO port is very weak in driving since it can merely handle current less than 300mA. Therefore, do not connect it with devices operating in large current,such as servo MG995 and DC motor or it will get burnt. Furthermore, you must figure out the current requirements of the devices before you use them and it is generally recommended to use the board together with a Micro:bit shield.

c. It is recommended to power the main board via the USB interface or via the battery of 3V. The IO port of this board is 3V, so it does not support sensors of 5V. If you need to connect sensors of 5 V, a Micro: Bit expansion board is required.

d.When using pins(P3, P4, P6, P7, P10)shared with the LED dot matrix, blocking them from the matrix or the LEDs may display randomly and the data about sensors maybe wrong.

e.The battery port of 3V cannot be connected with battery more than 3.3V or the main board will be damaged.

f. Forbid to use it on metal products to avoid short circuit.

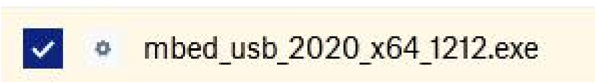
To put it simple, Micro:bit V2 main board is like a micro computer which has made programming at our fingertips and enhanced digital innovation. And about programming environment, BBC provides a website: https://microbit.org/code/, which has a graphical MakeCode program easy for use.

5.Install Micro:bit Driver

If you have downloaded micro:bit driver, then no need to download it again.

If it is you first time to use micro:bit main board, then you will have to download the driver.

You have to install the driver of micro:bit if it’ s your first time to use micro:bit.

You could enter the link: https://fs.keyestudio.com/KS4014Driver to download driver file 

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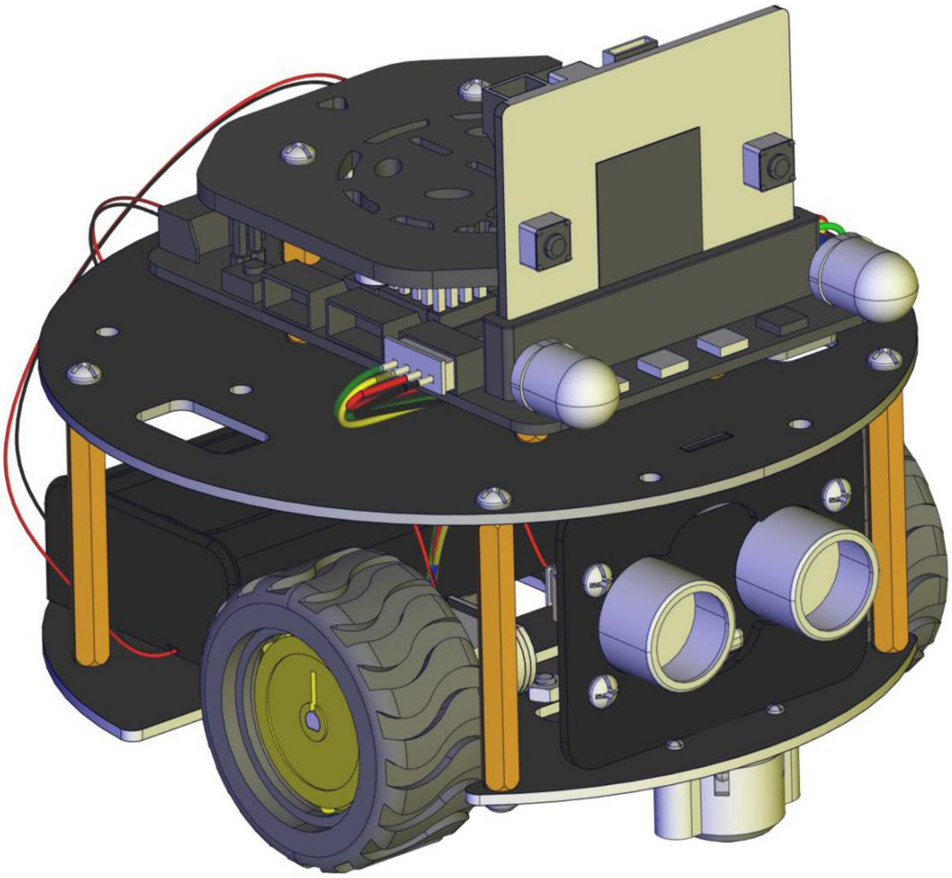
6. Keyestudio Micro:bit Mini Smart Turtle Car



Connection of Micro:bit and Turtle Smart Car

Pins of Micro:bit	Components of Keyestudio micro:bit Robot Car
P0	Passive Buzzer
P1	Trig (T) of ultrasonic sensor
P2	Echo (E) of ultrasonic sensor
P8	4 pcs WS2812RGB

P11	IR Receiver
P14	Left TCRT5000 IR tubes of line tracking sensor
P15	Middle TCRT5000 IR tubes of line tracking sensor
P16	Right TCRT5000 IR tubes of line tracking sensor

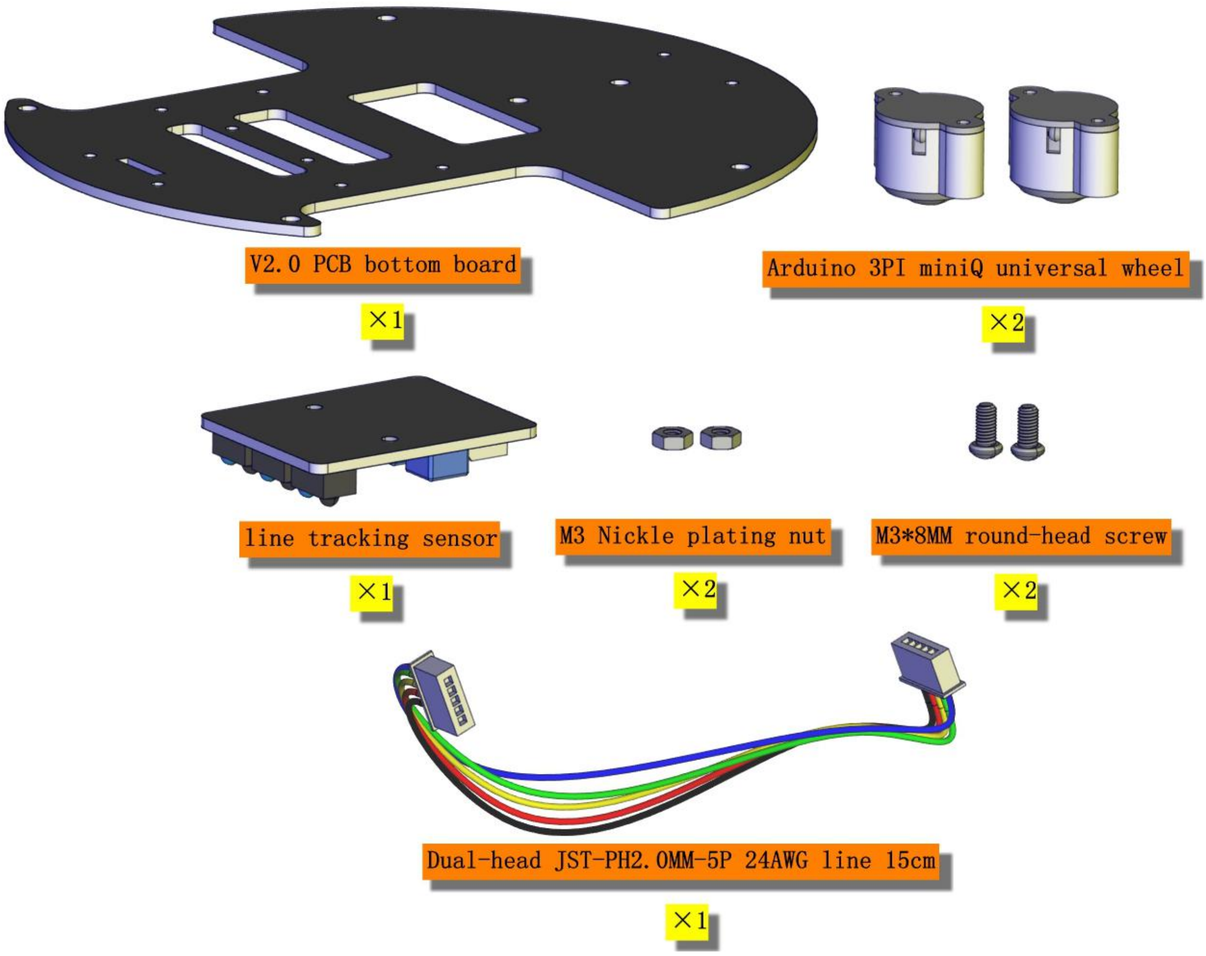
Power Supply

This smart car is powered by 2pcs 18650 batteries. And the battery holder is chargeable.

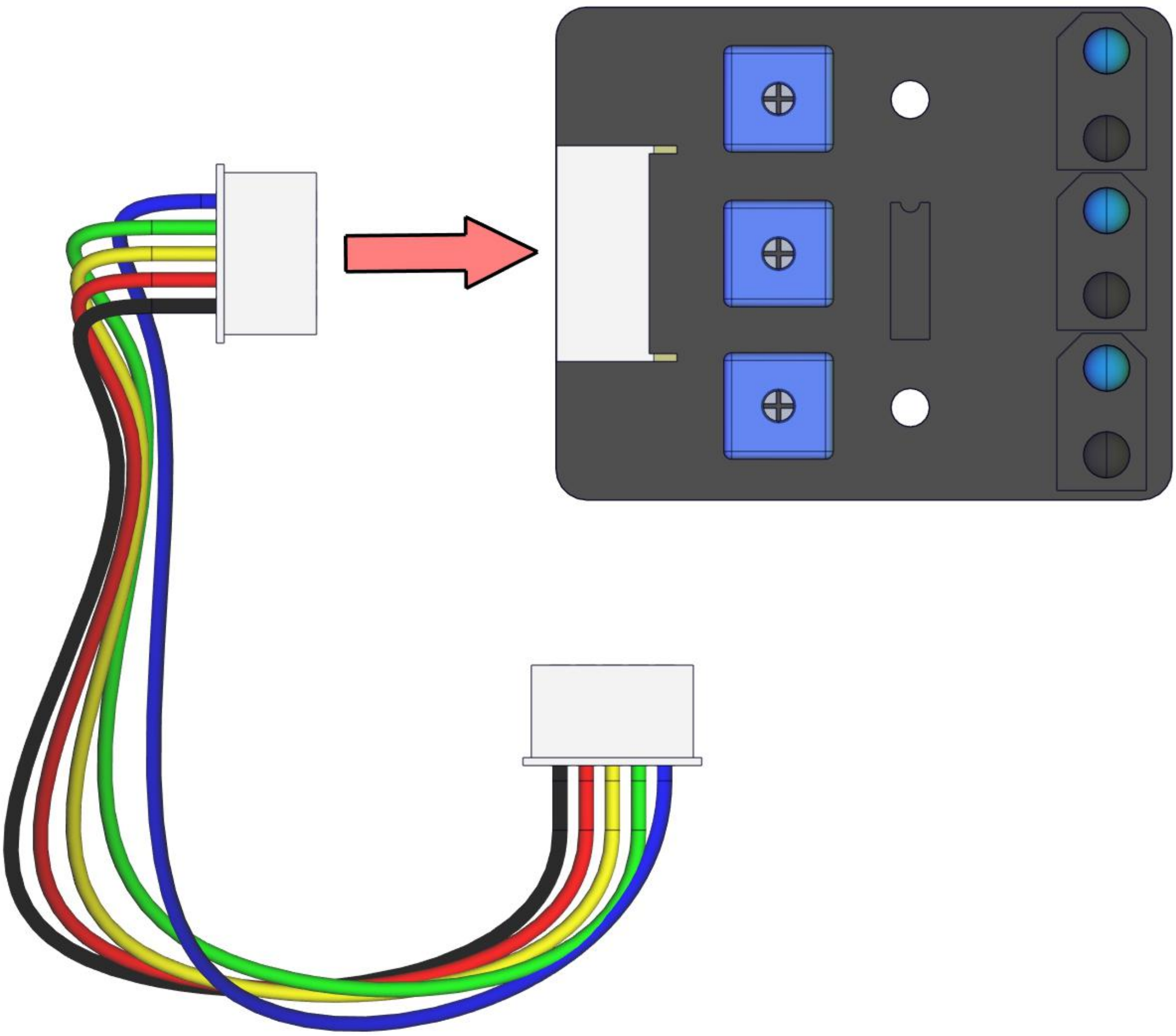
Note: battery is not included.

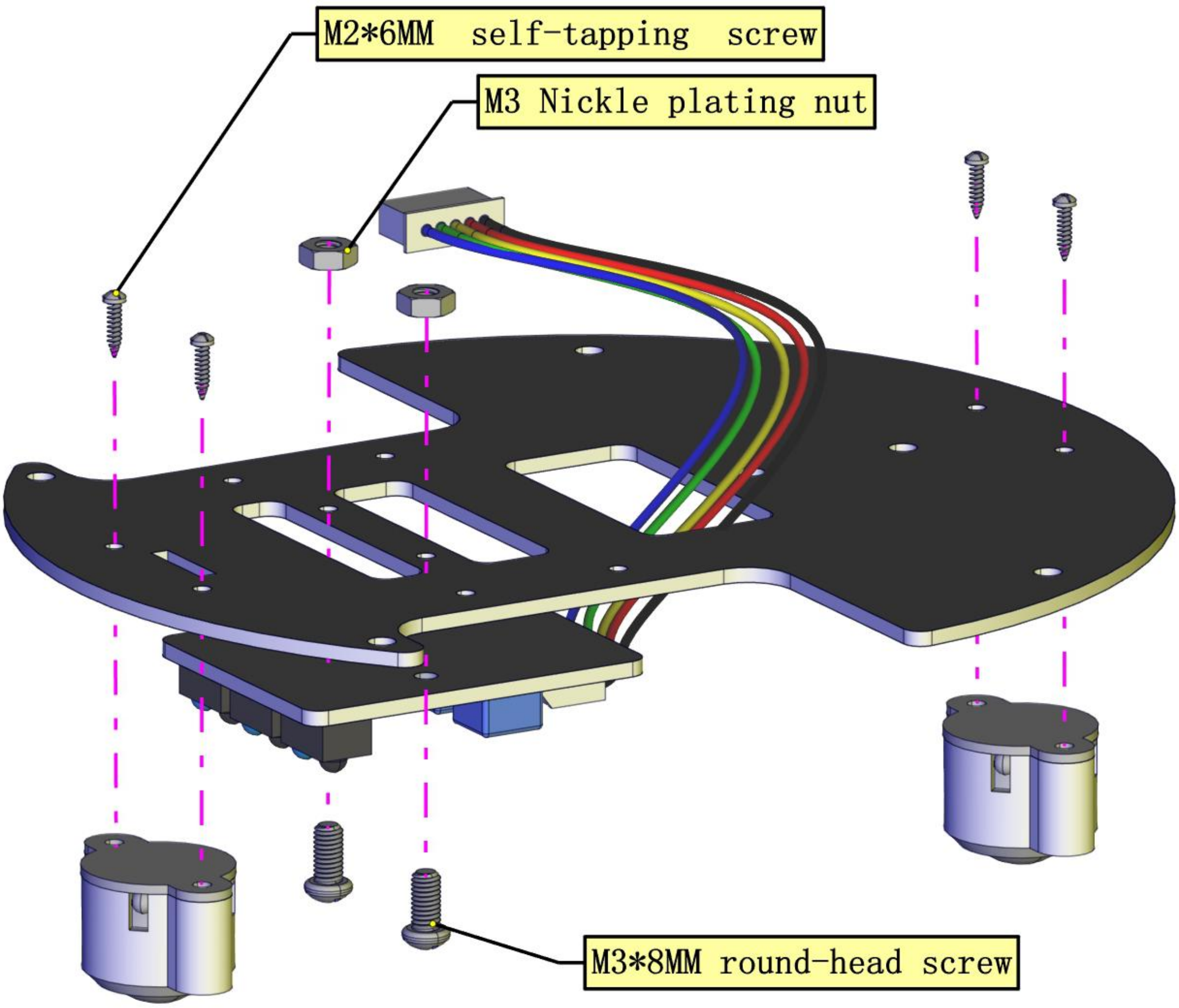
6.1. Install Micro:bit Mini Turtle Smart Car

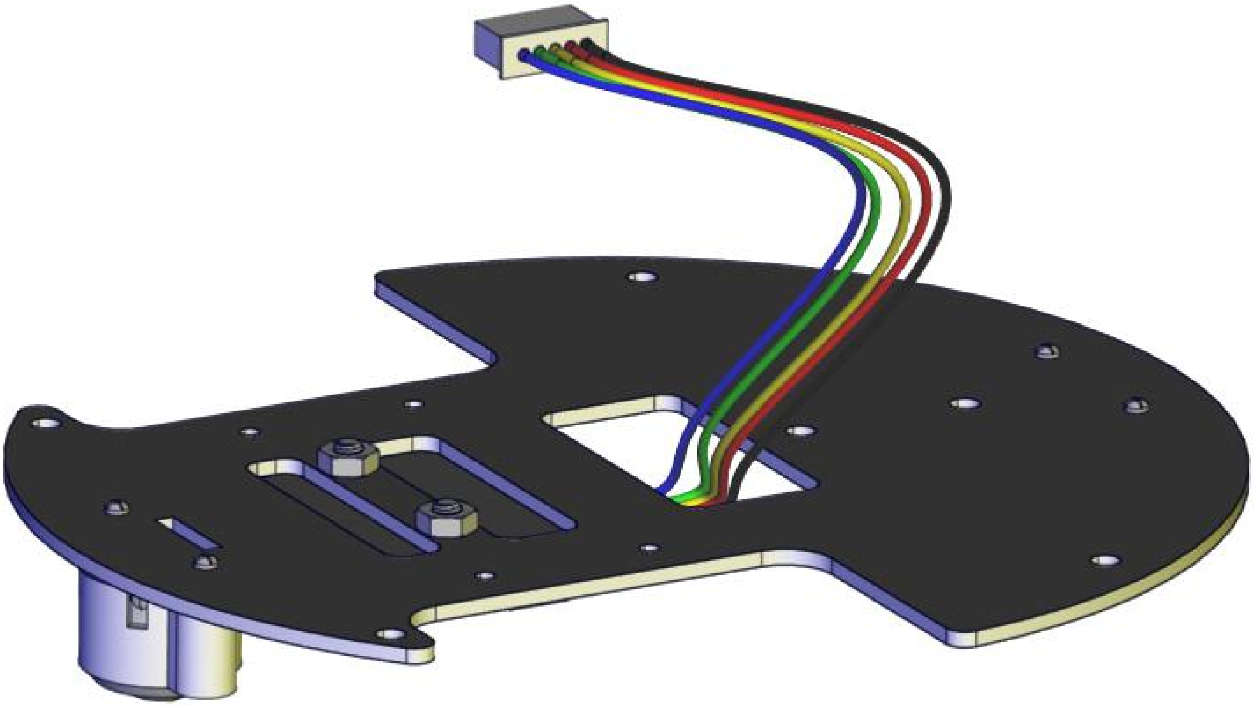
1. Install baseplate and line tracking sensor



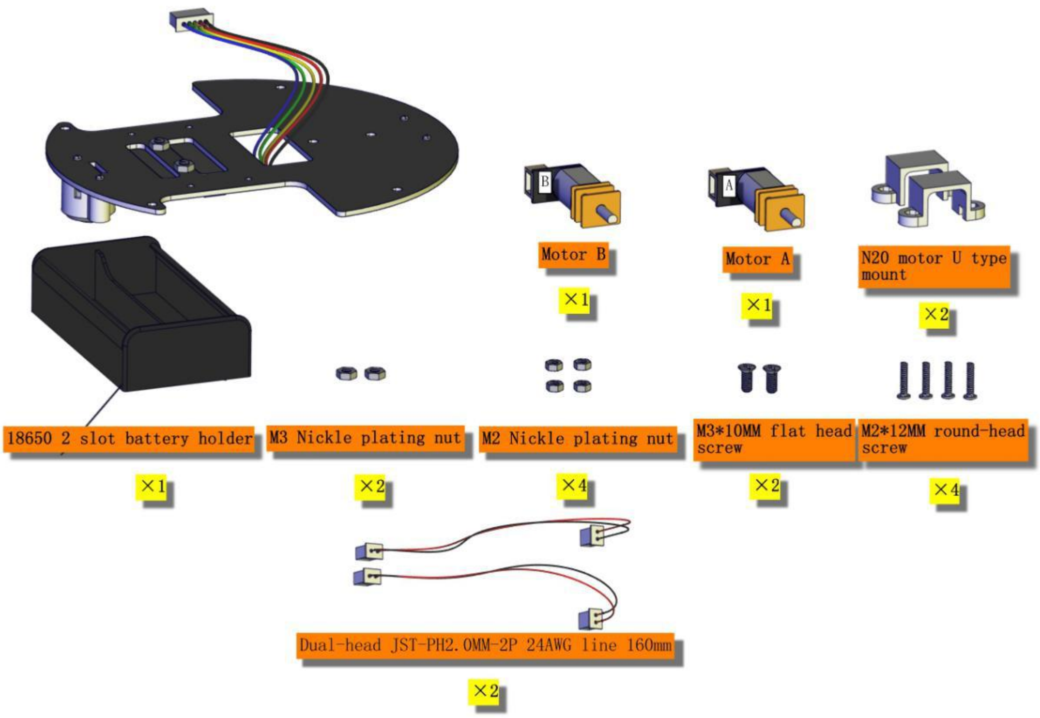
Note: we screw out the two self-locking screws first, and install universal wheel on V2.0 baseplate with these screws(don’t screw them too tightly) Make the side printed “Keyes” downward.

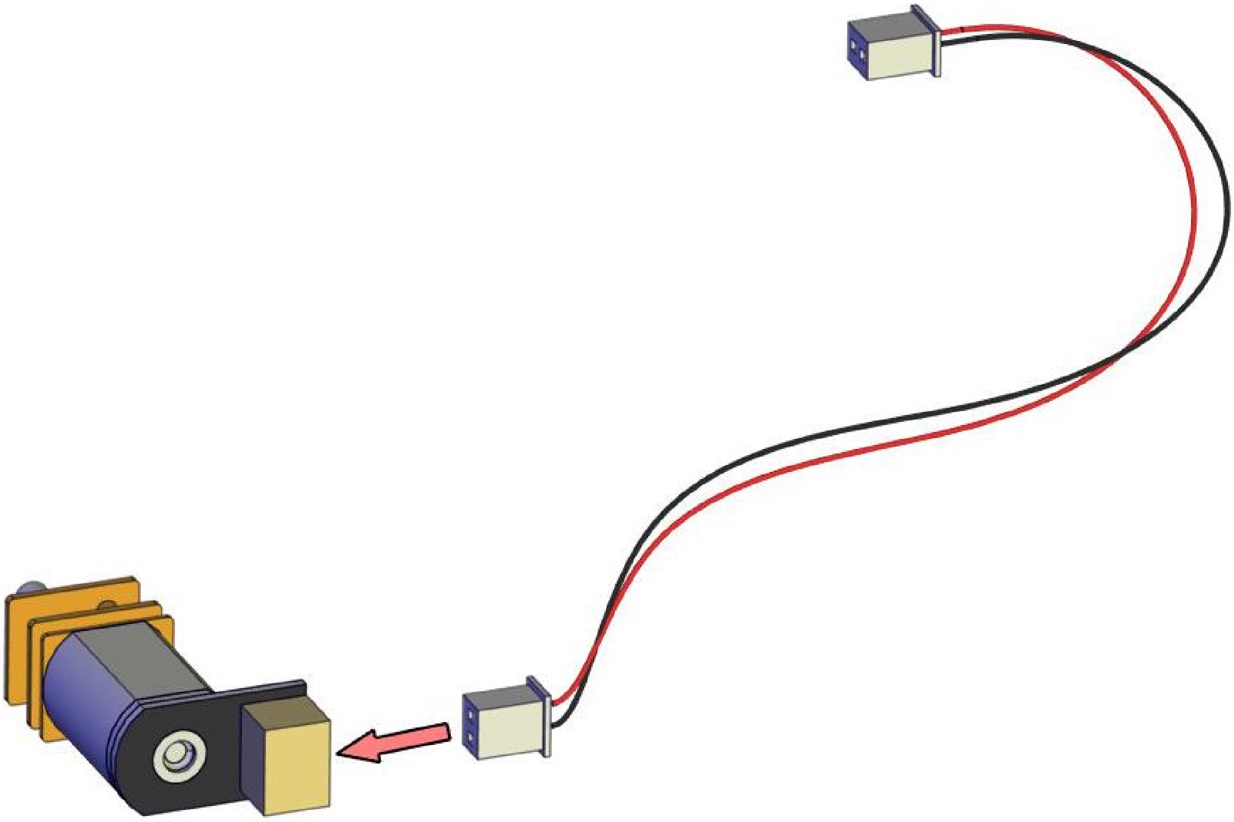


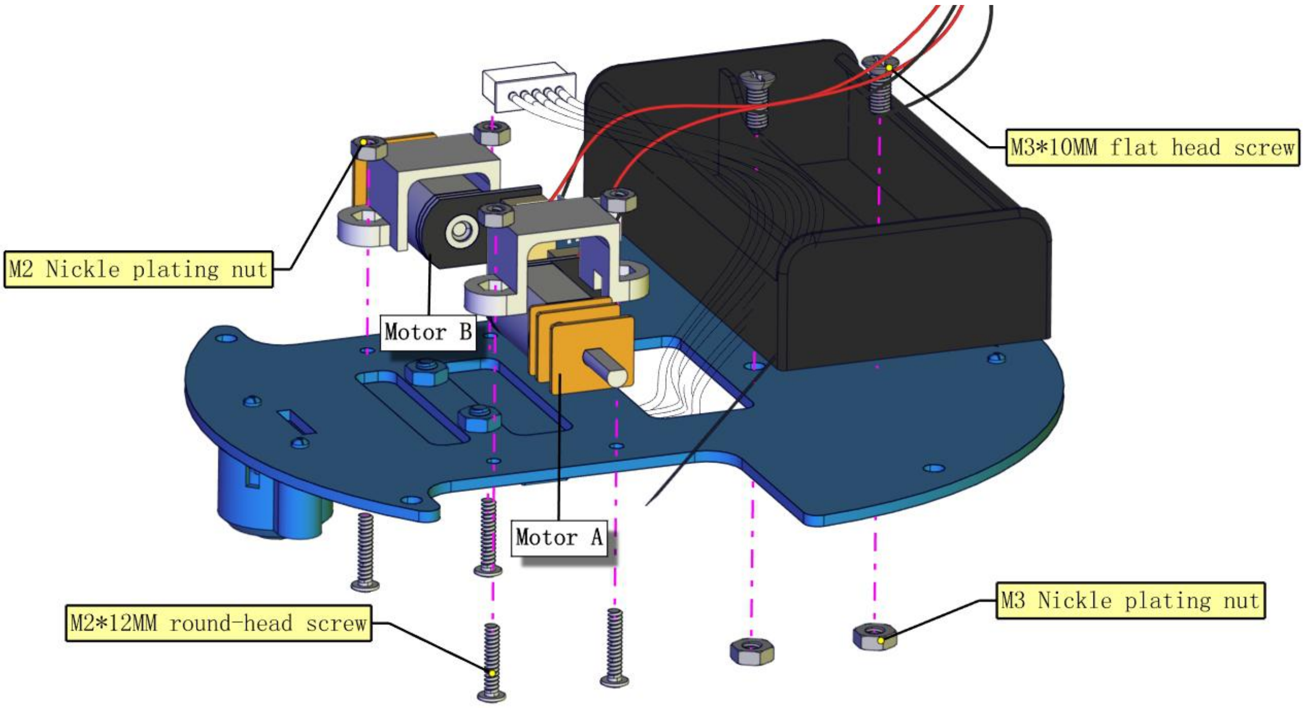

M2*6MM self-tapping screw
M3 Nickle plating nut
M3*8MM round-head screw

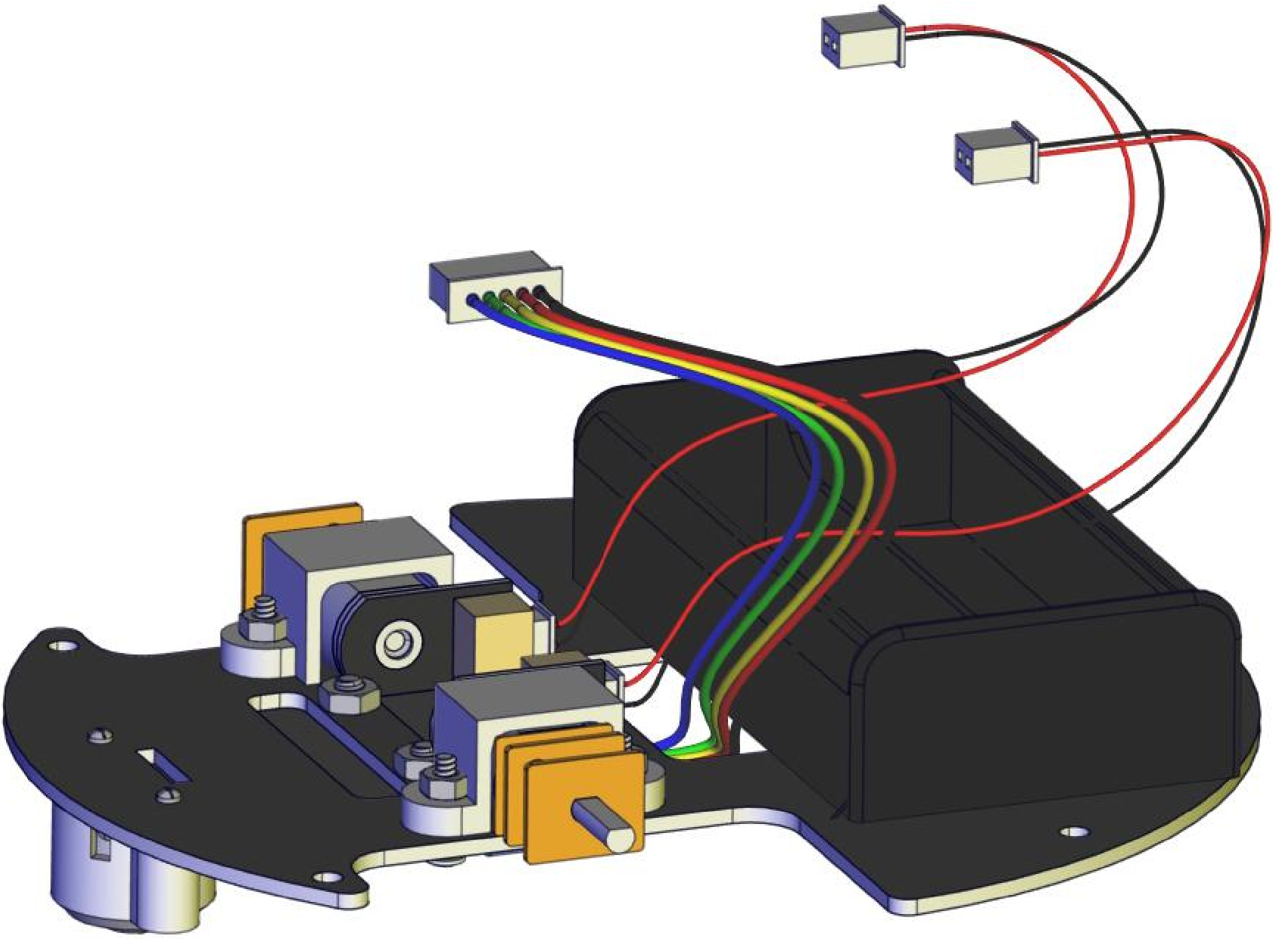


2. Mount Motor and Battery Holder

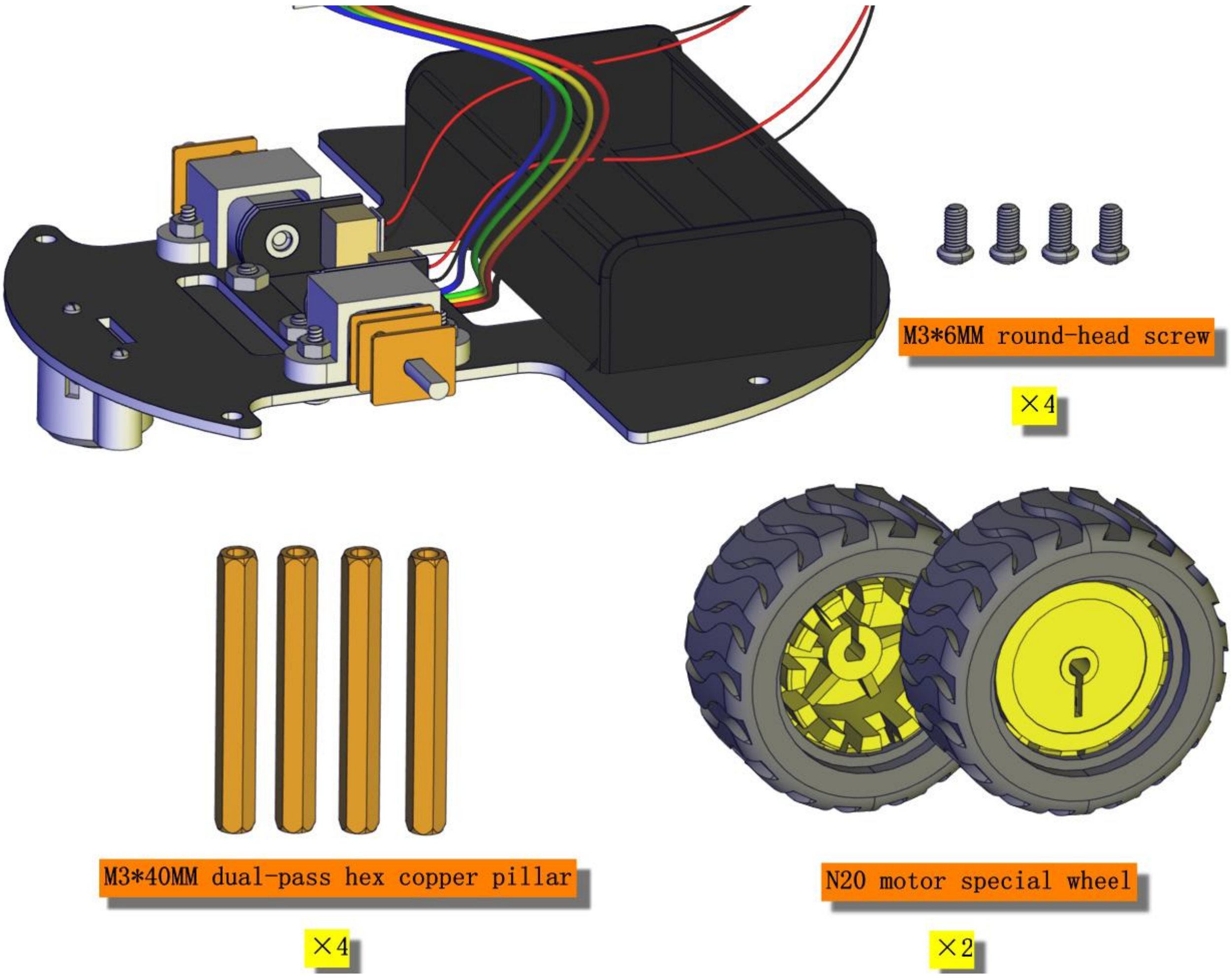


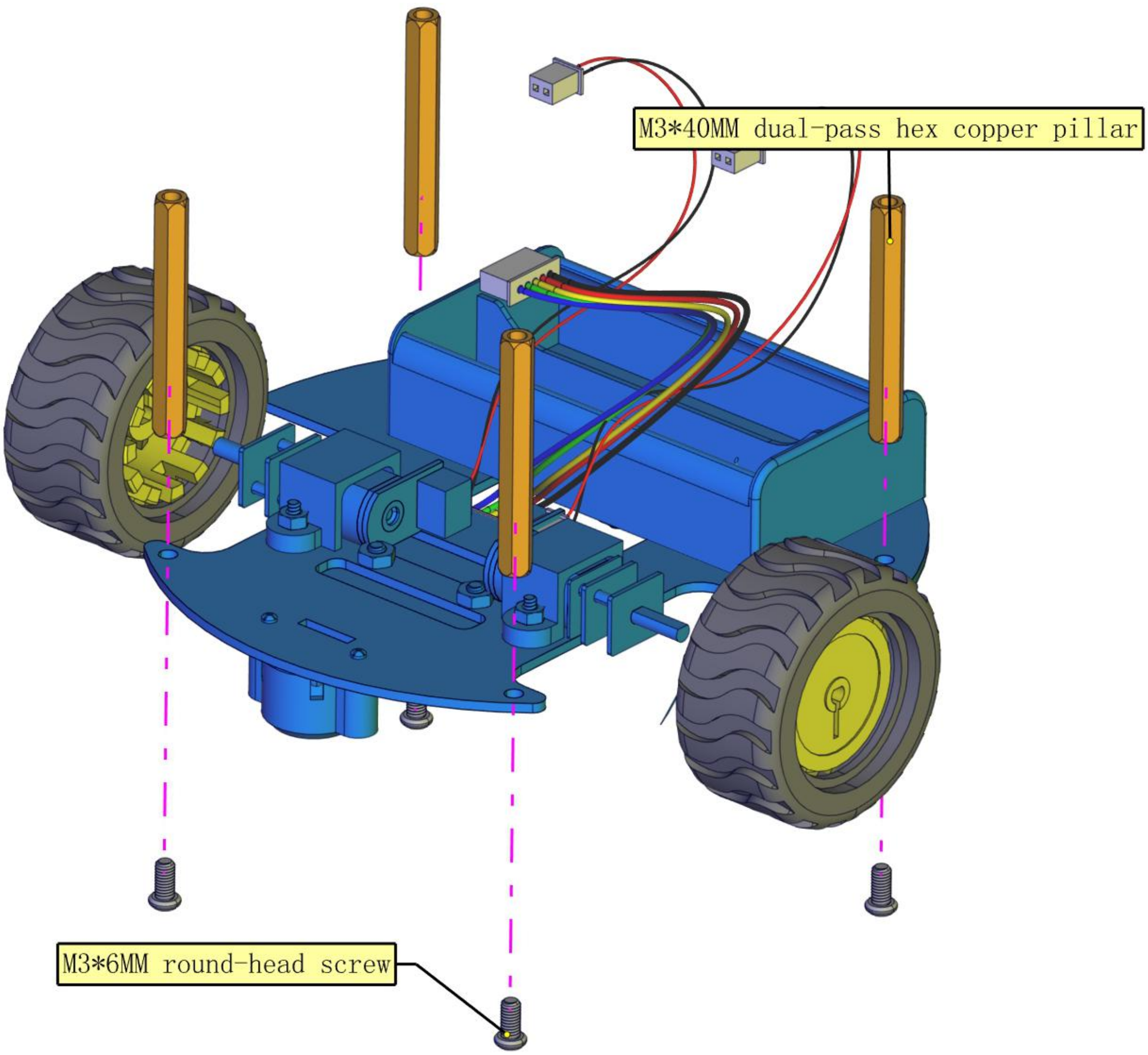


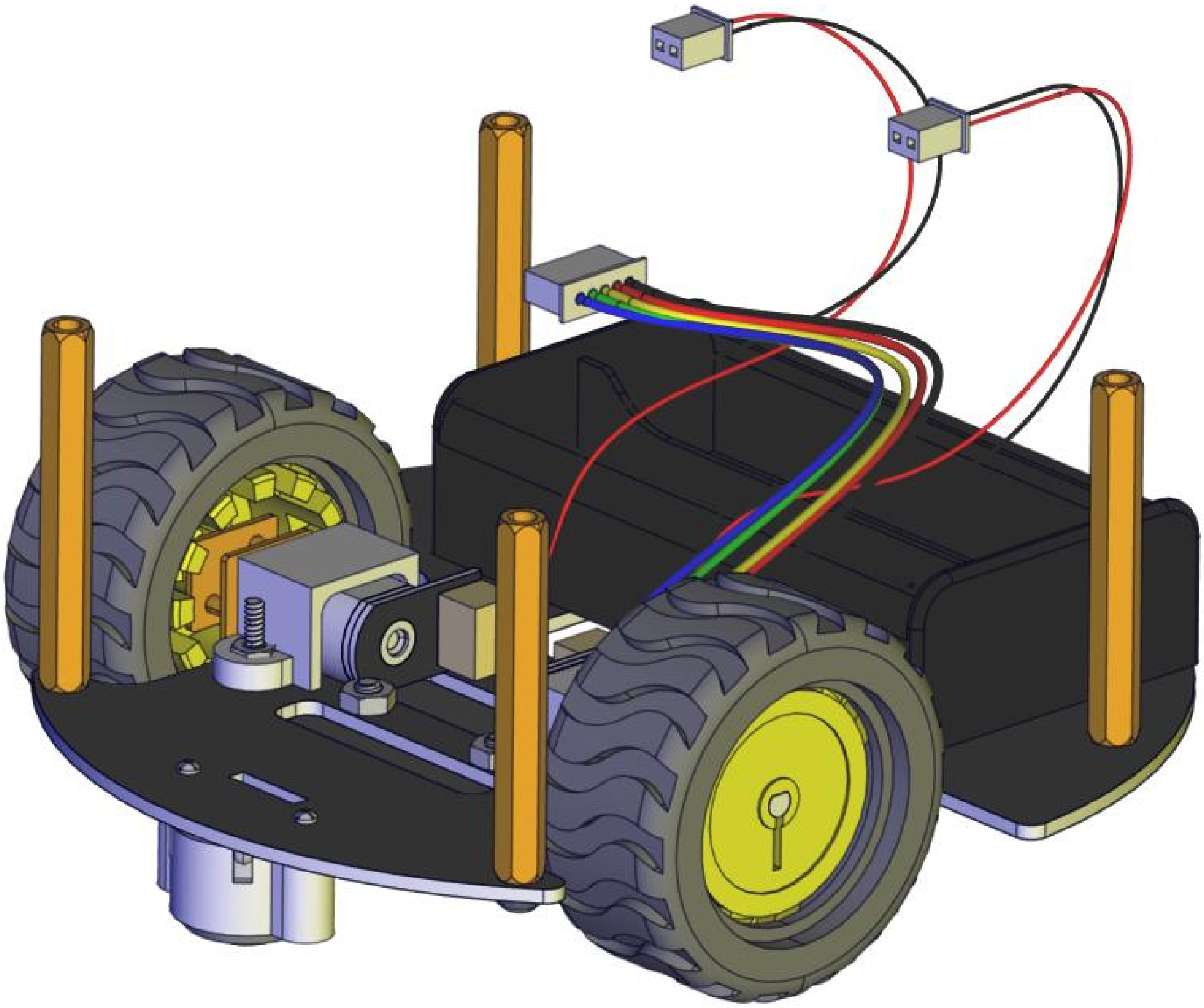

M3*10MM flat head screw
M2 Nickle plating nut
Motor B
Motor A
M2*12MM round-head screw
M3 Nickle plating nut



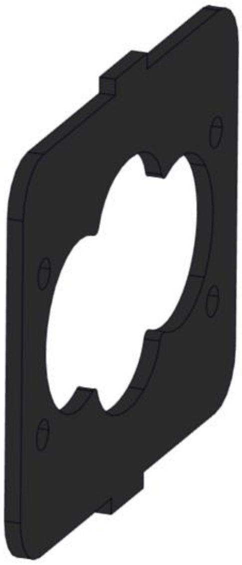
3. Assemble Car Wheels and Dual-pass Hex Copper Bushes




M3*40MM dual-pass hex copper pillar
M3*6MM round-head screw

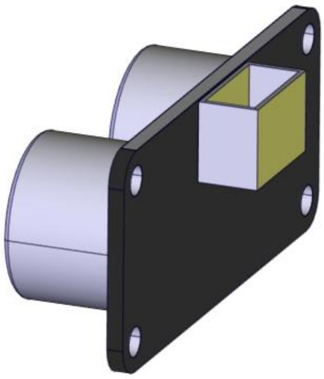


4. Install Ultrasonic Sensor



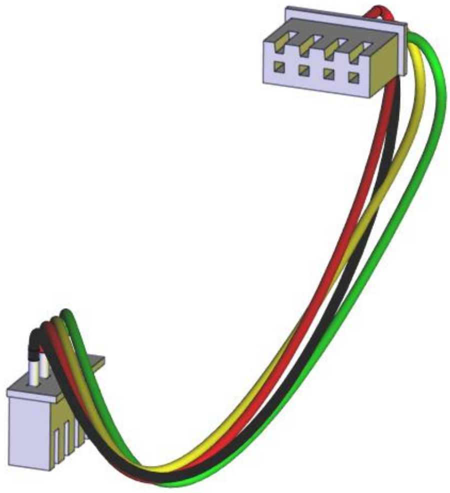
Ultrasonic fixed mount

×1



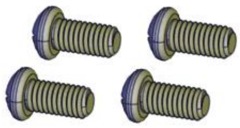
ultrasonic module

×1



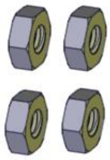
Dual-head JST-PH2.0MM-4P 24AWG line 8cm

×1



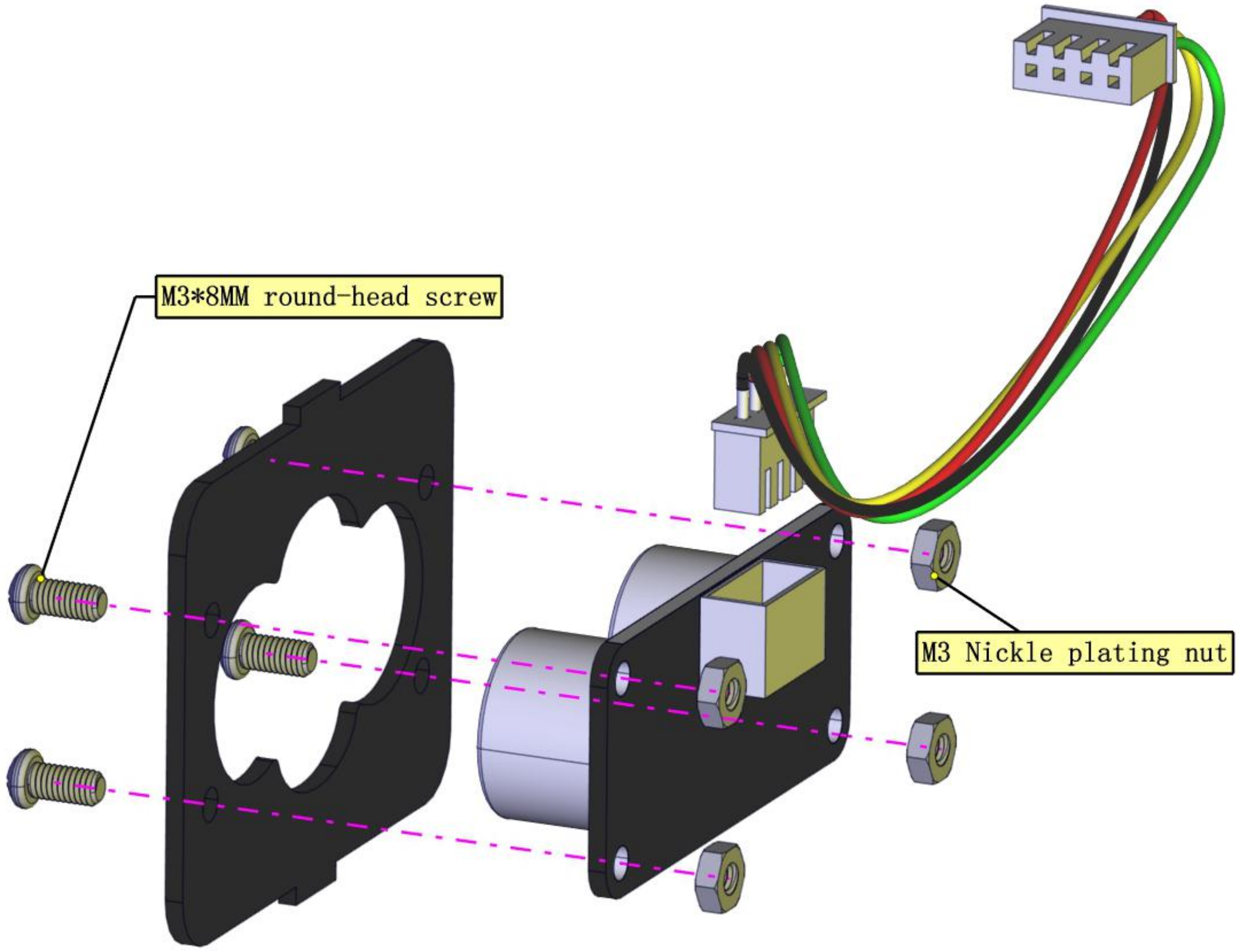
M3*8MM round-head screw

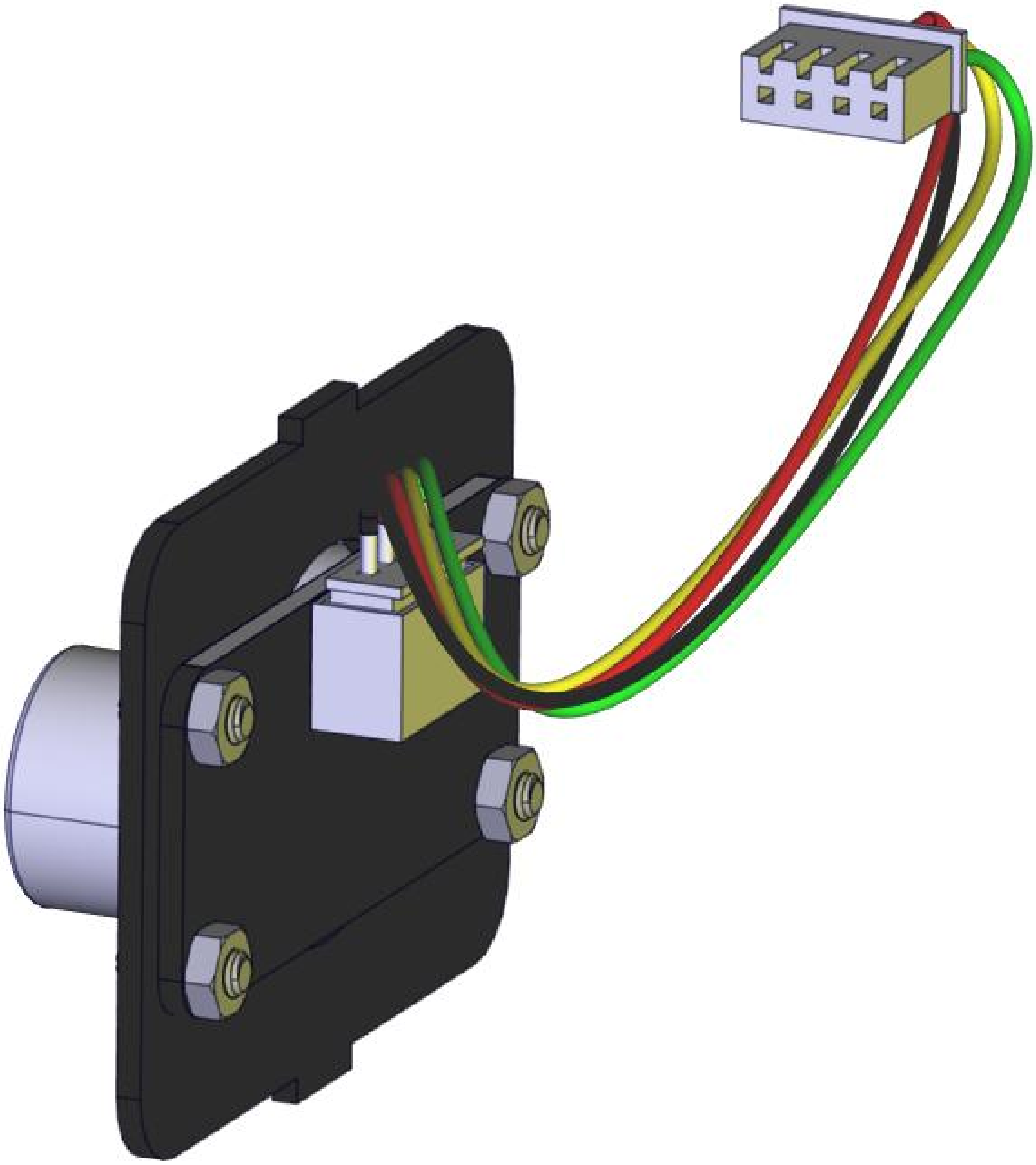
×4



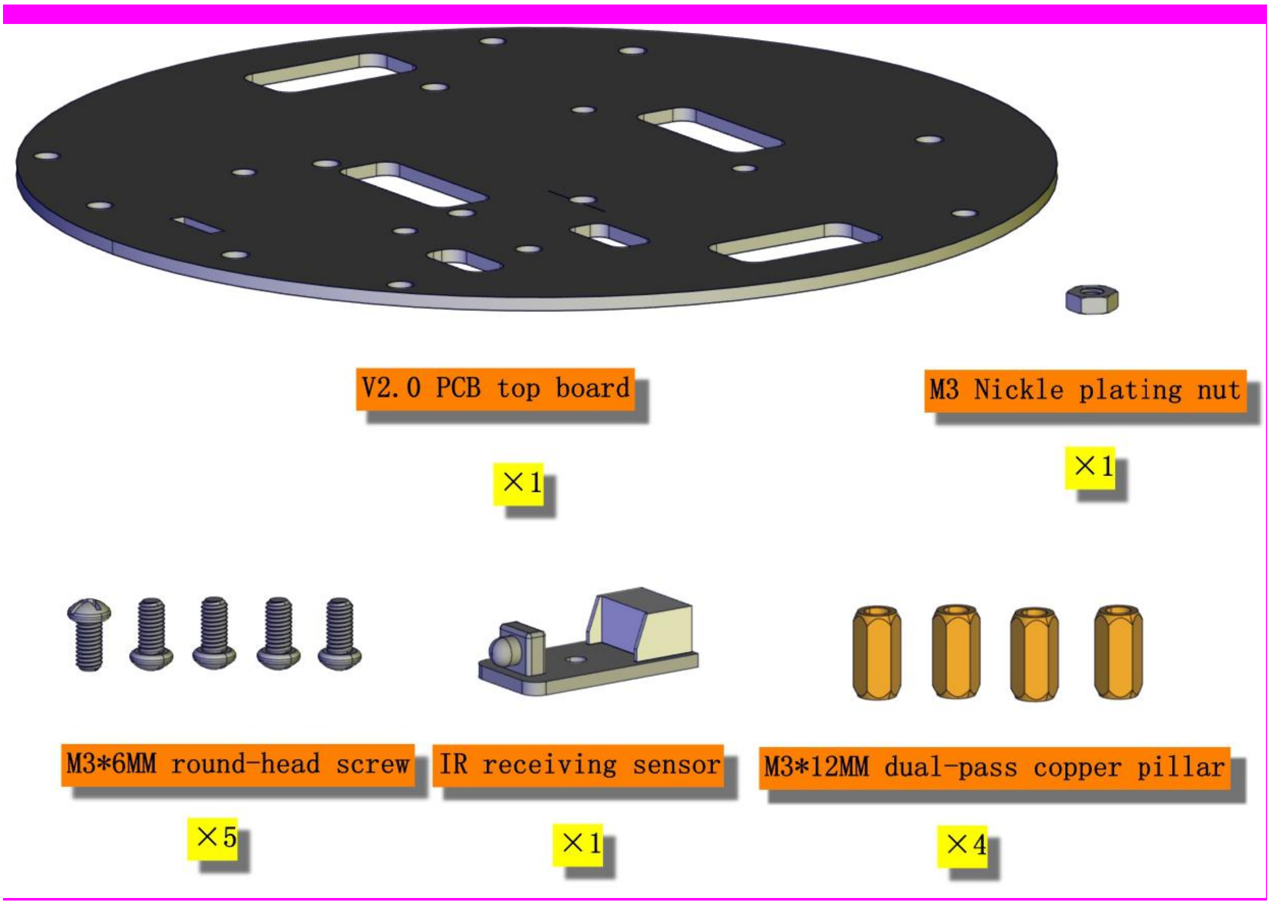
M3 Nickle plating nut

×4

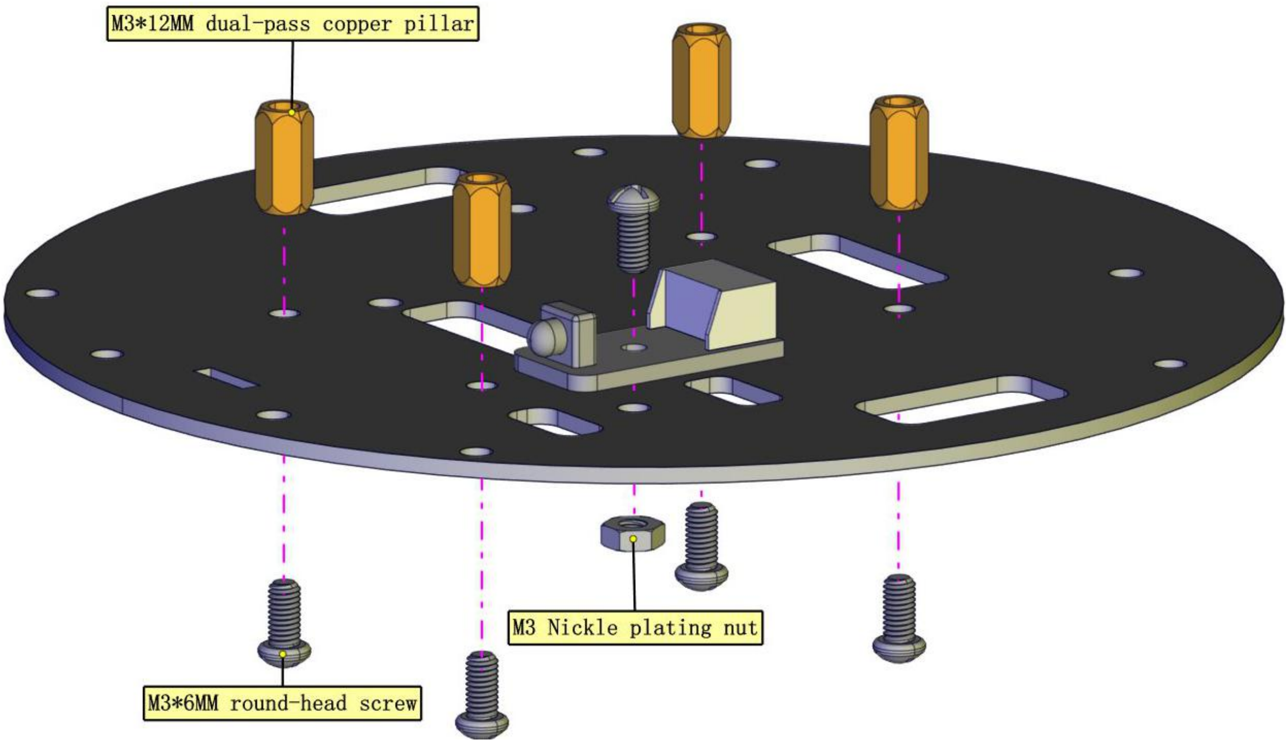

M3*8MM round-head screw
M3 Nickle plating nut

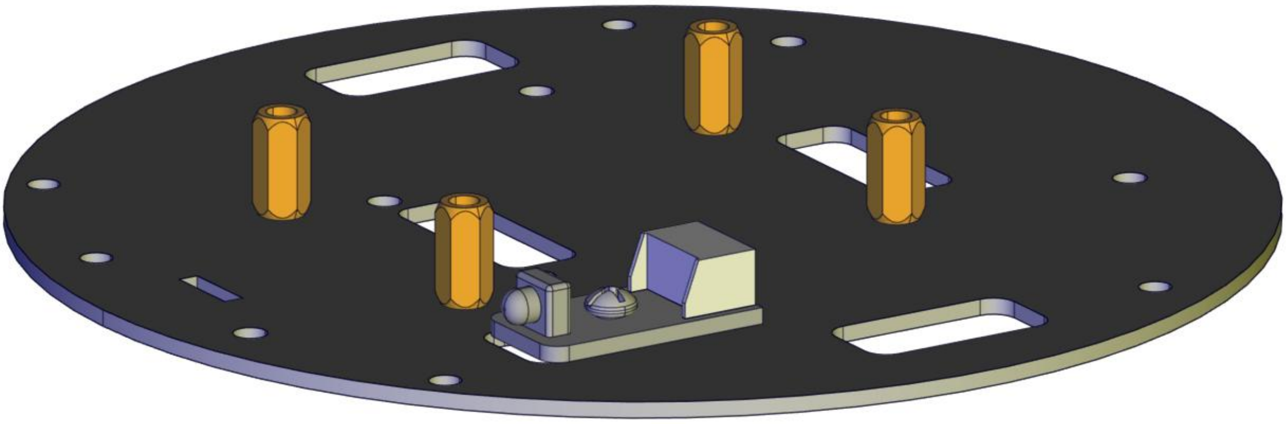


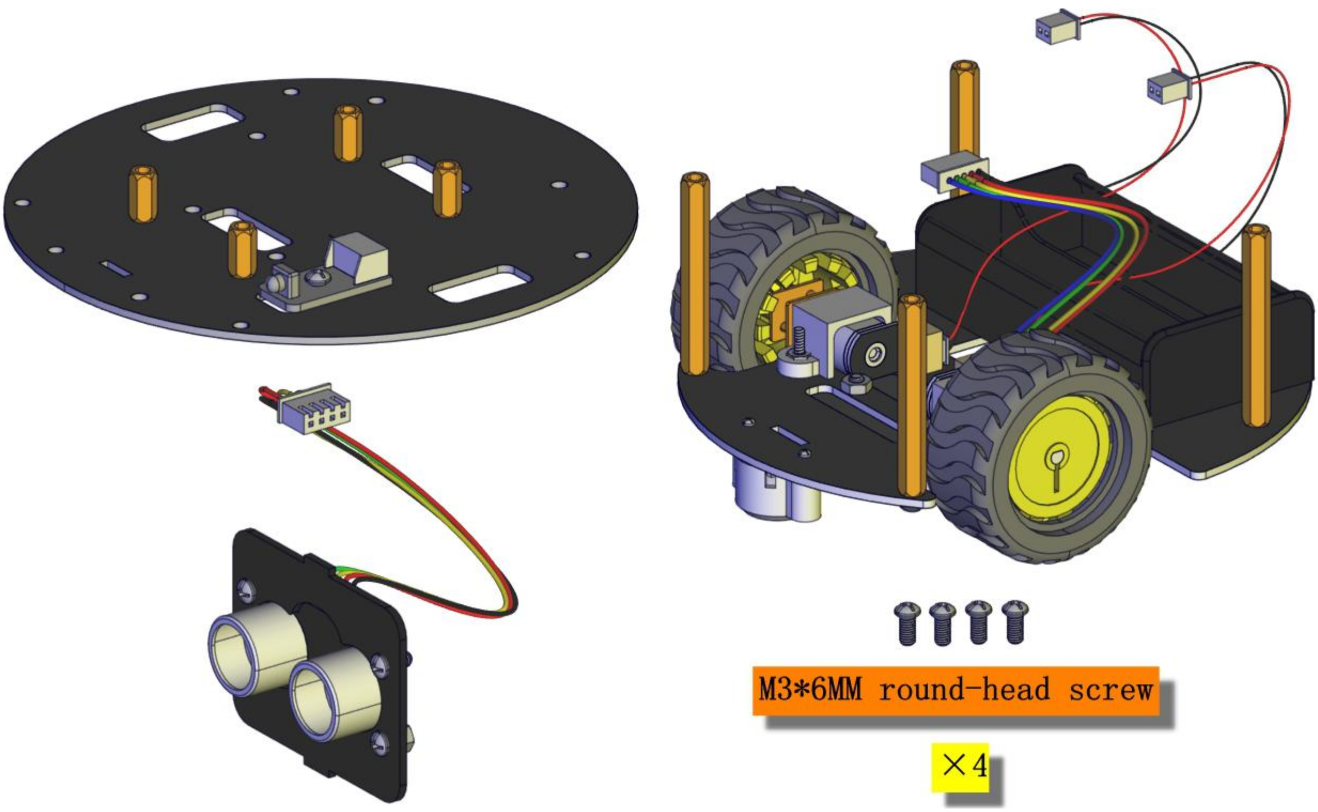
4. Mount the Middle Board and IR Receiver

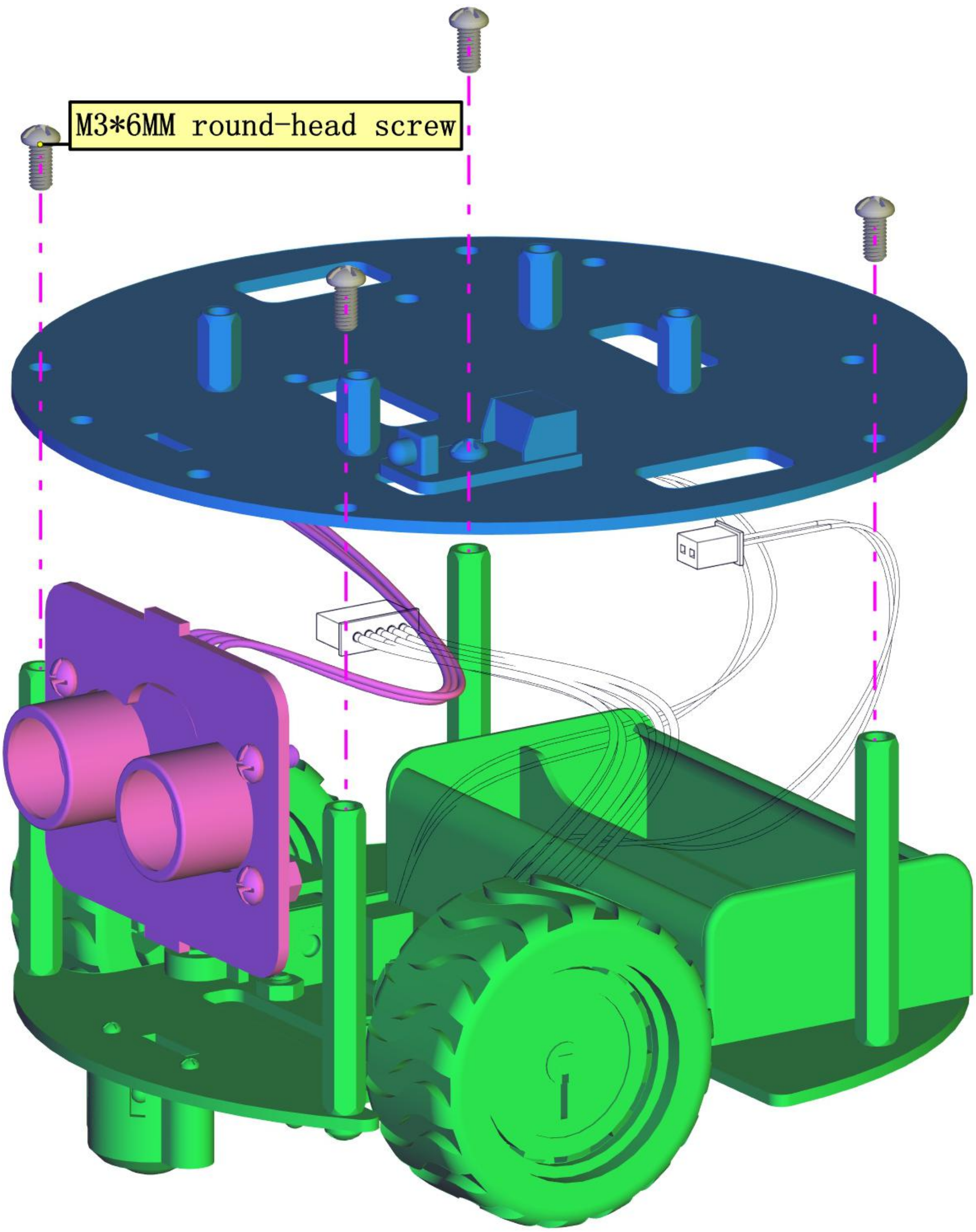


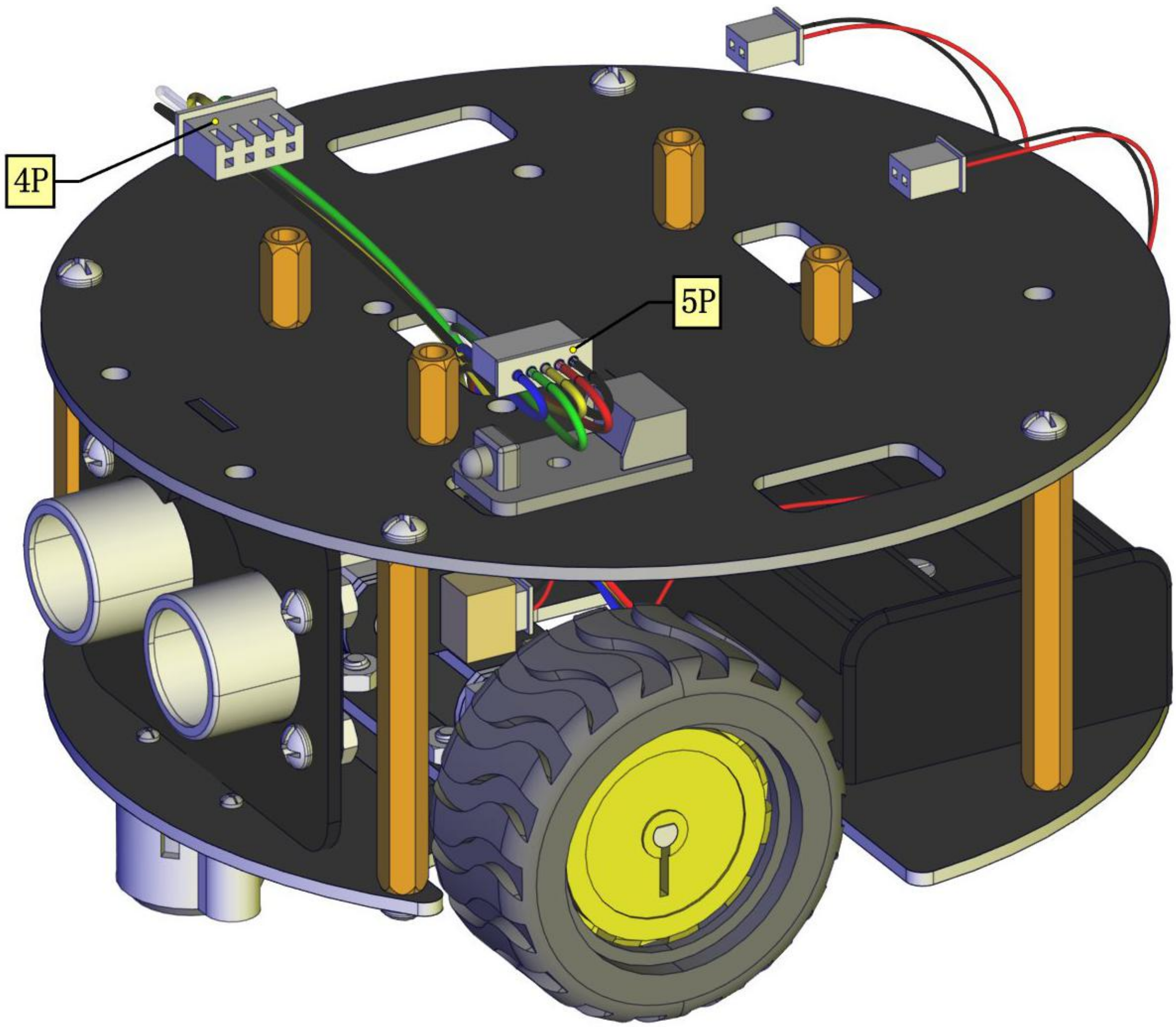
Note: make the side printed “Keyes” upward when installing the middle board.


M3*12MM dual-pass copper pillar
M3 Nickle plating nut
M3*6MM round-head screw

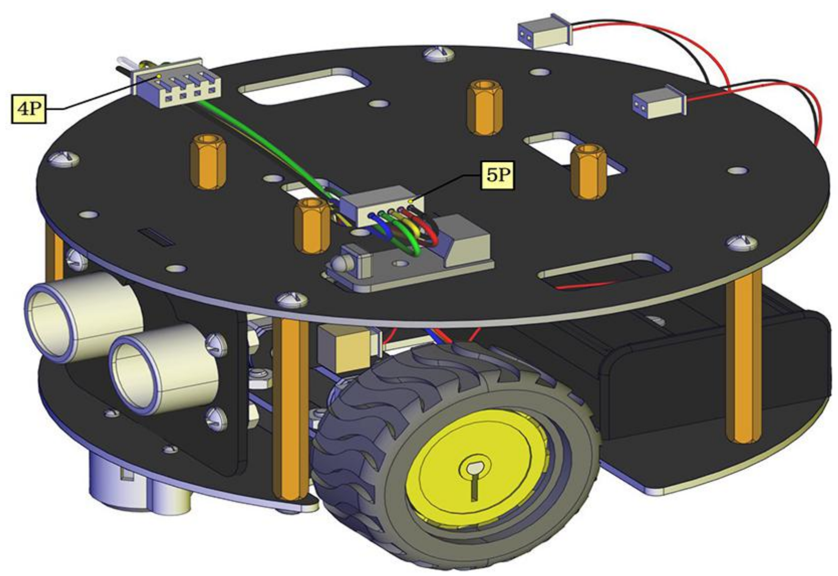


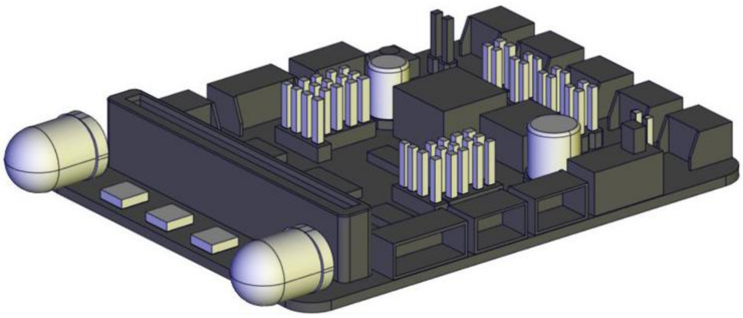

M3*6MM round-head screw
×4

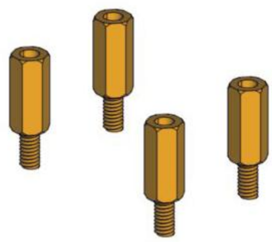

M3*6MM round-head screw


4P
5P

6. Install micro:bit TB6612 Motor Driver Shield





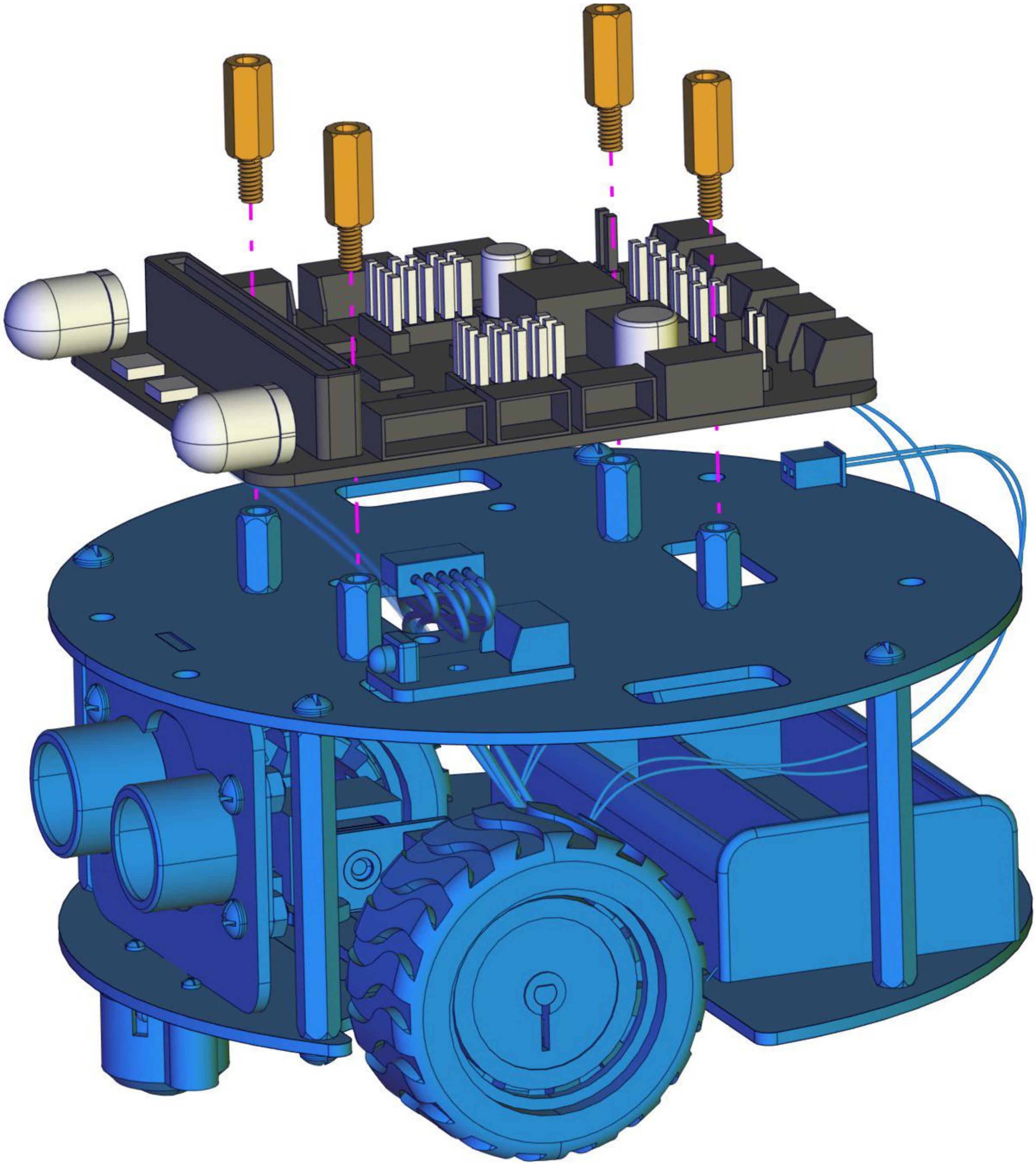


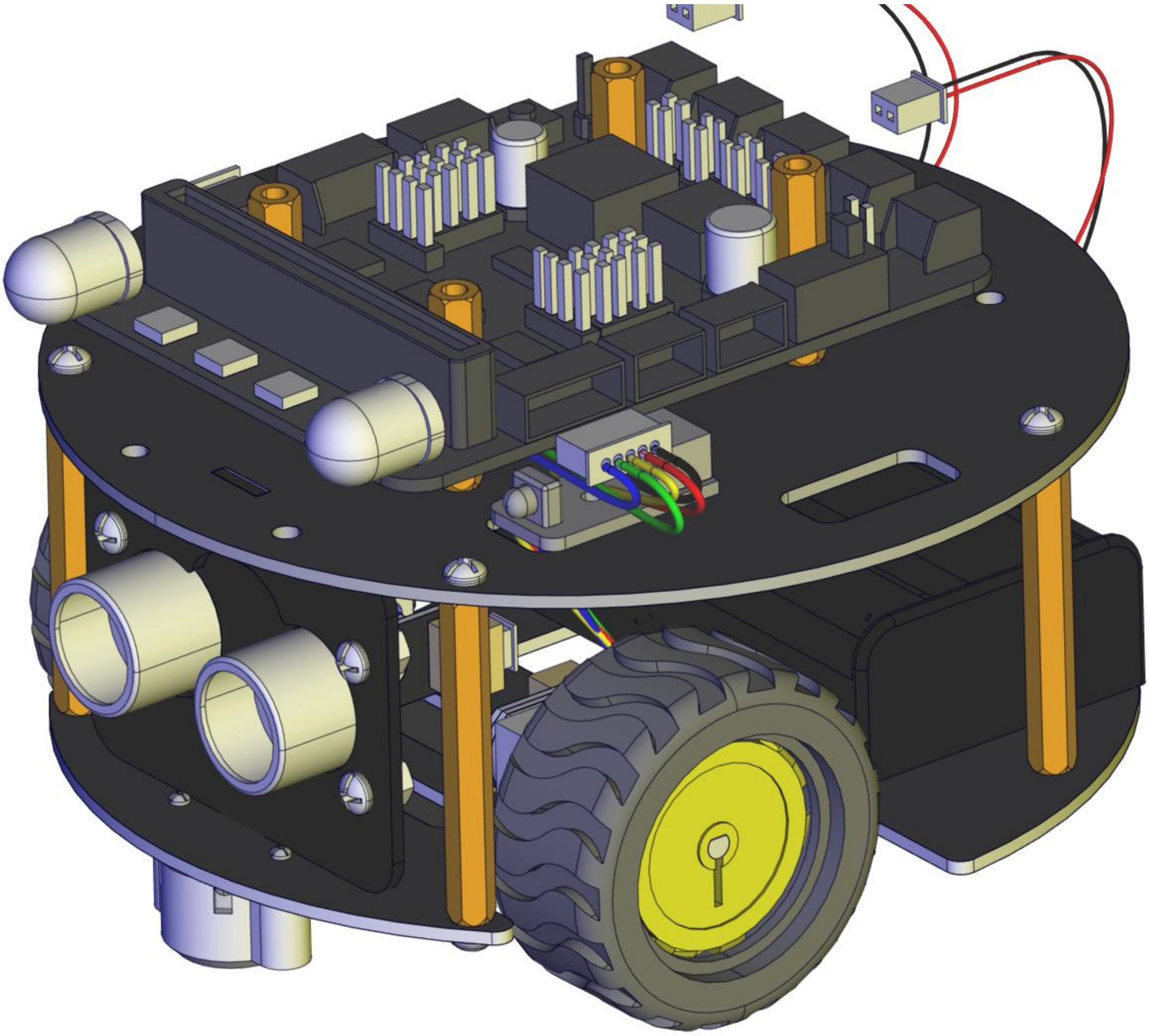
Micro:bit TB6612 Motor Driving Shield

×1

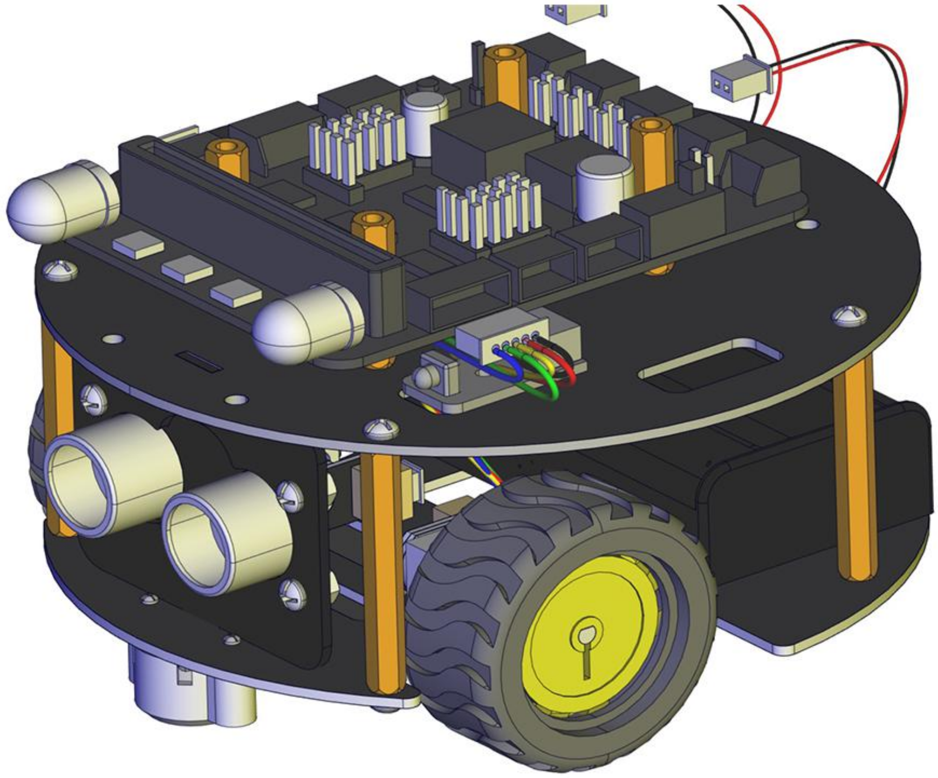
M3*15+6MM hex copper pillar

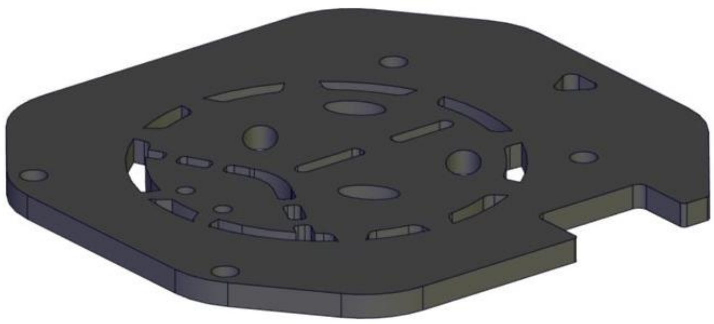
×4





7. Install Top Board



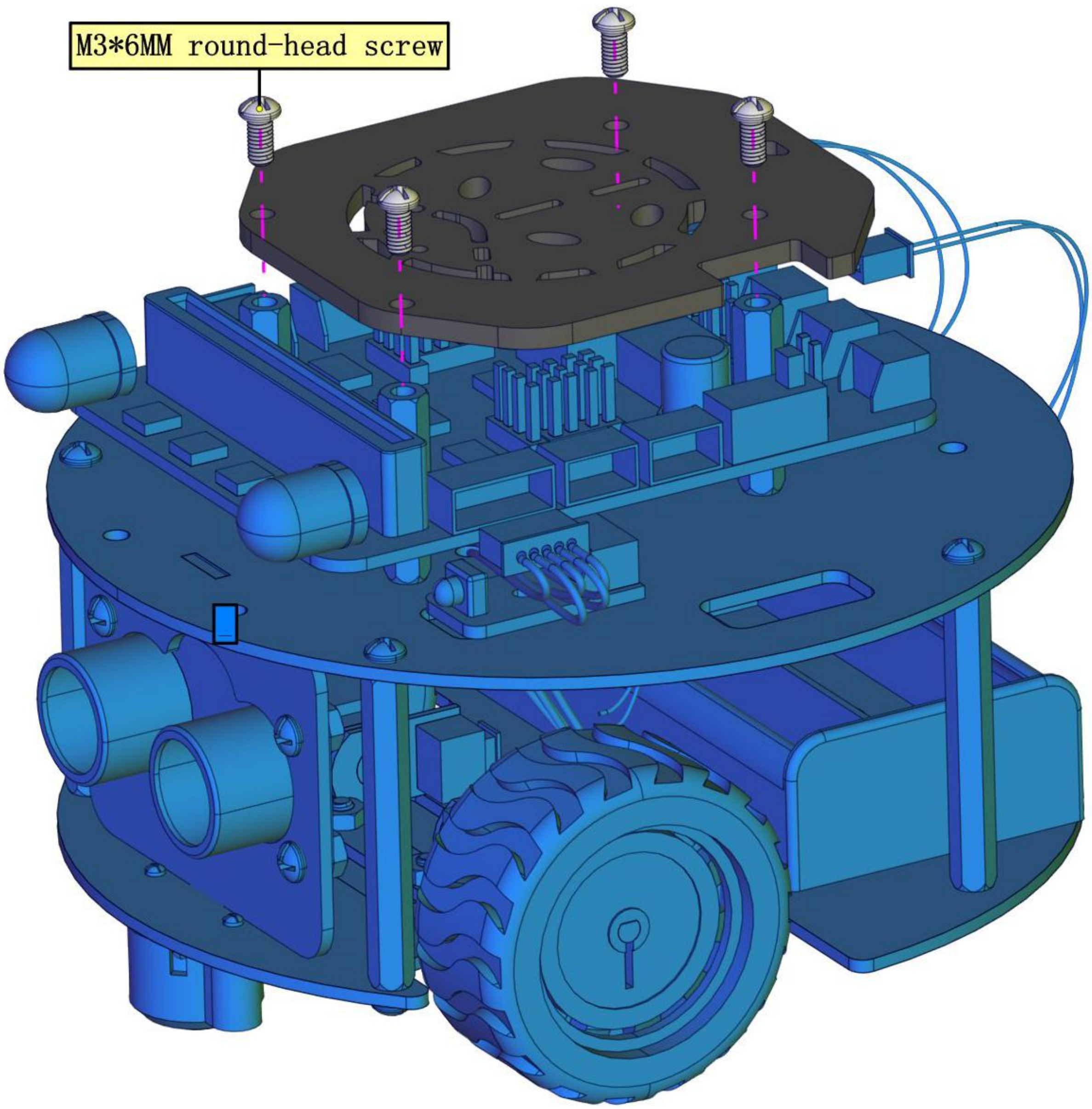


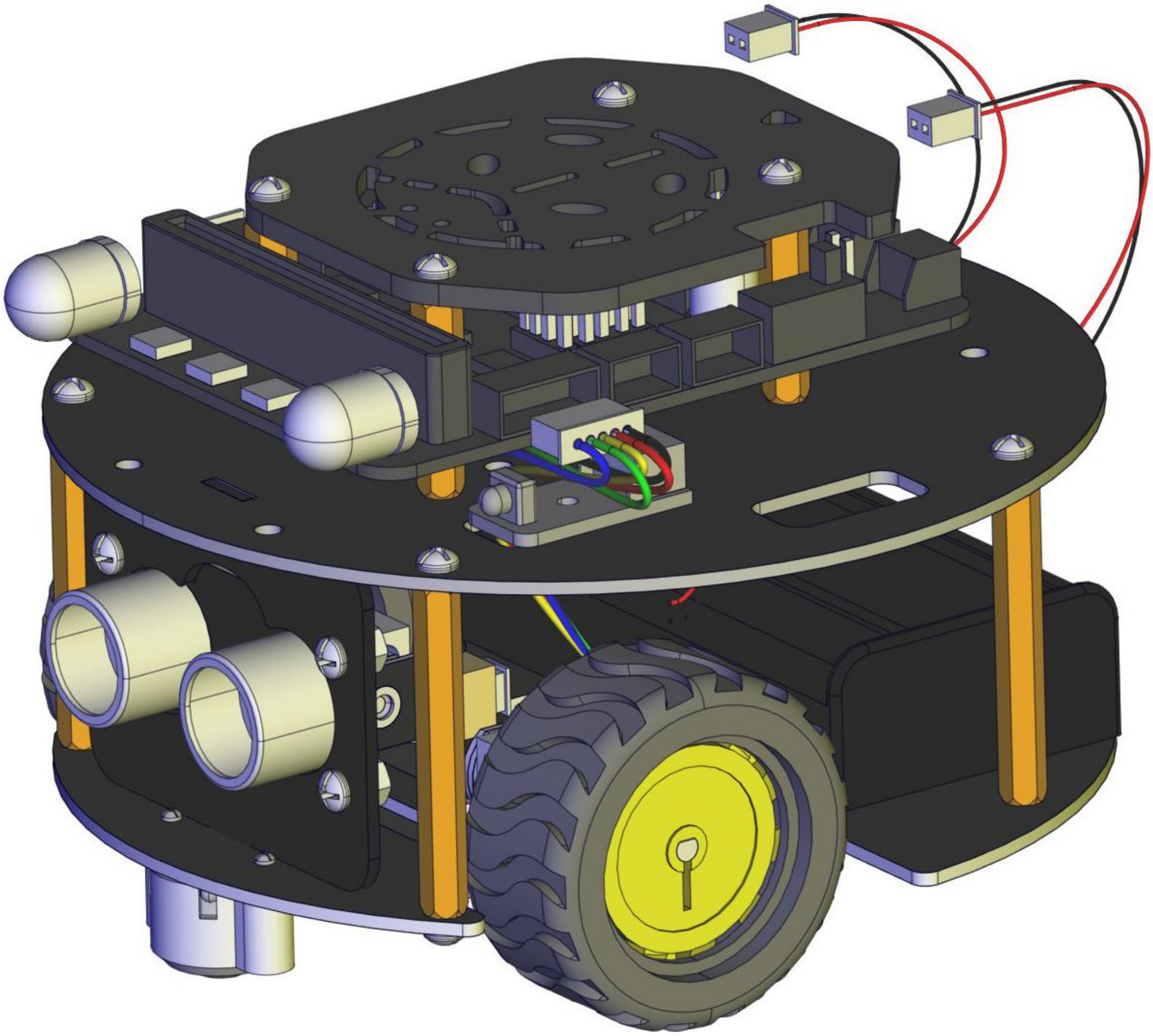
M3*6MM round-head screw

×4

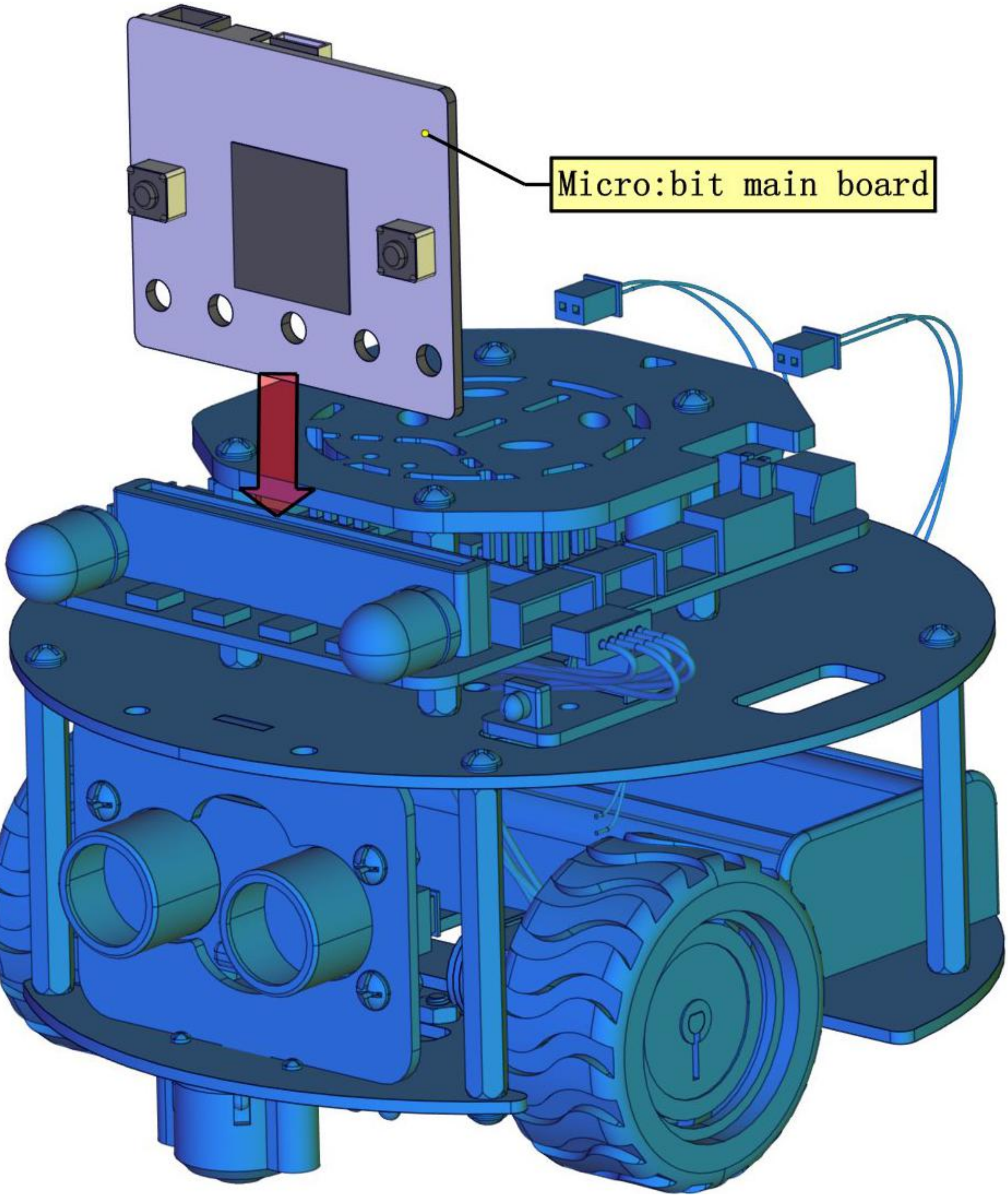
Microbit turtle Top acrylic board

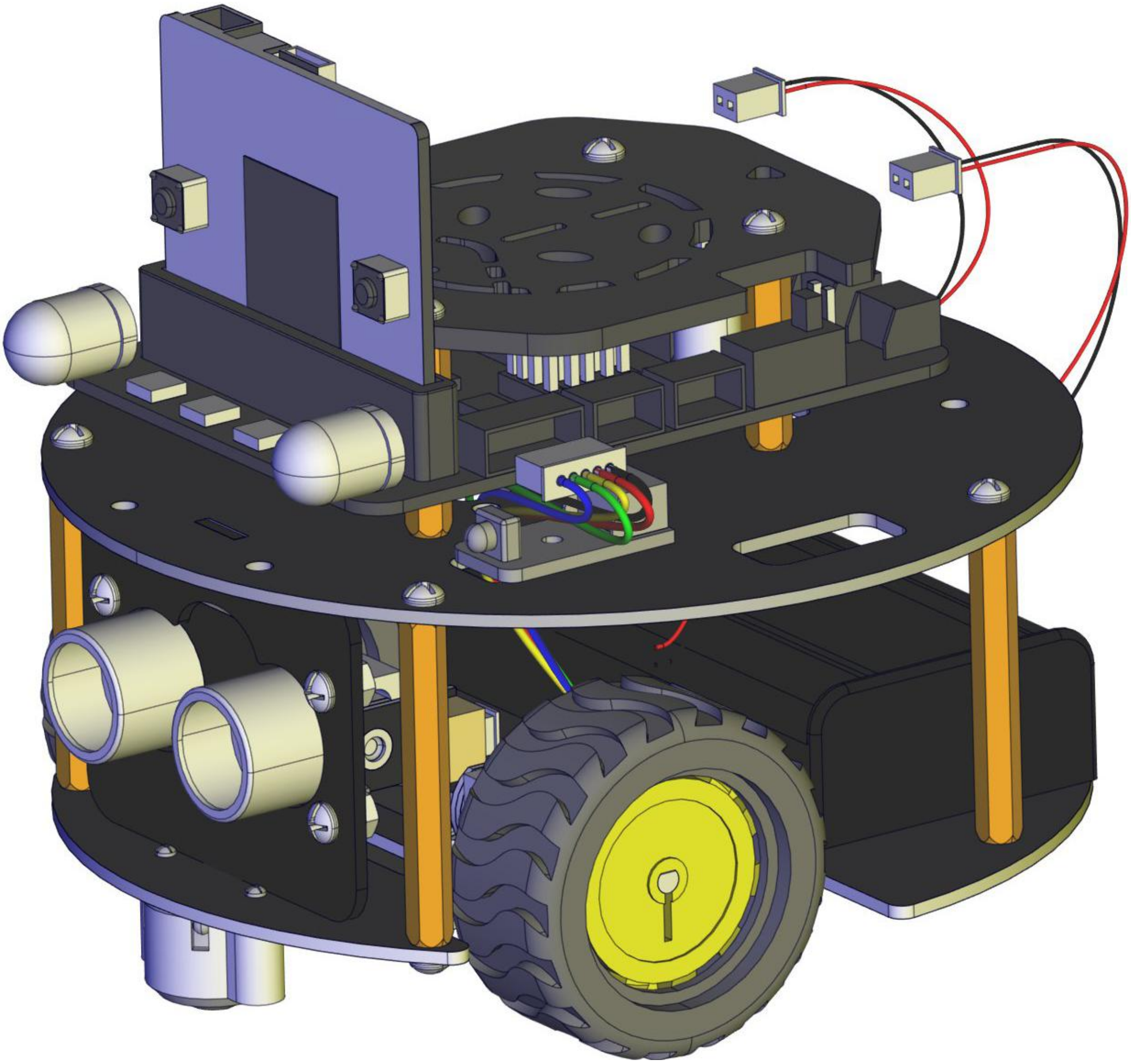
×1


M3*6MM round-head screw



8. Install Micro:bit Board





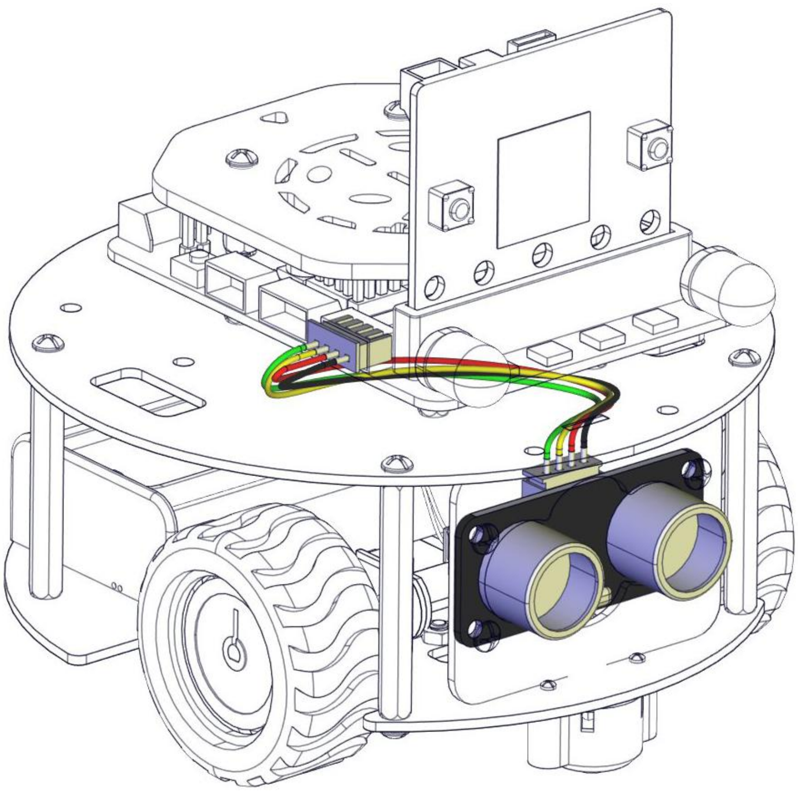
Wiring Up

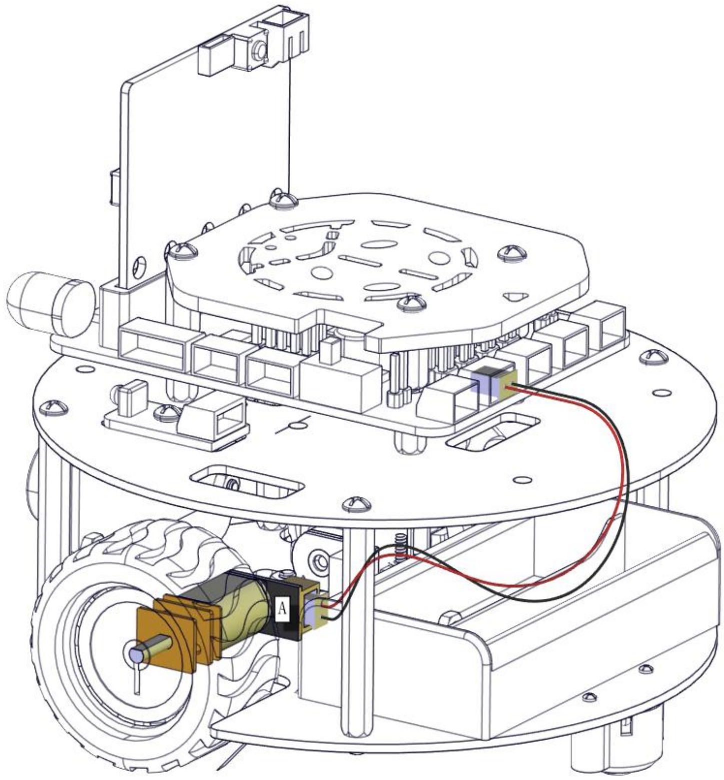
We need an additional 3P wire to connect IR receiver.

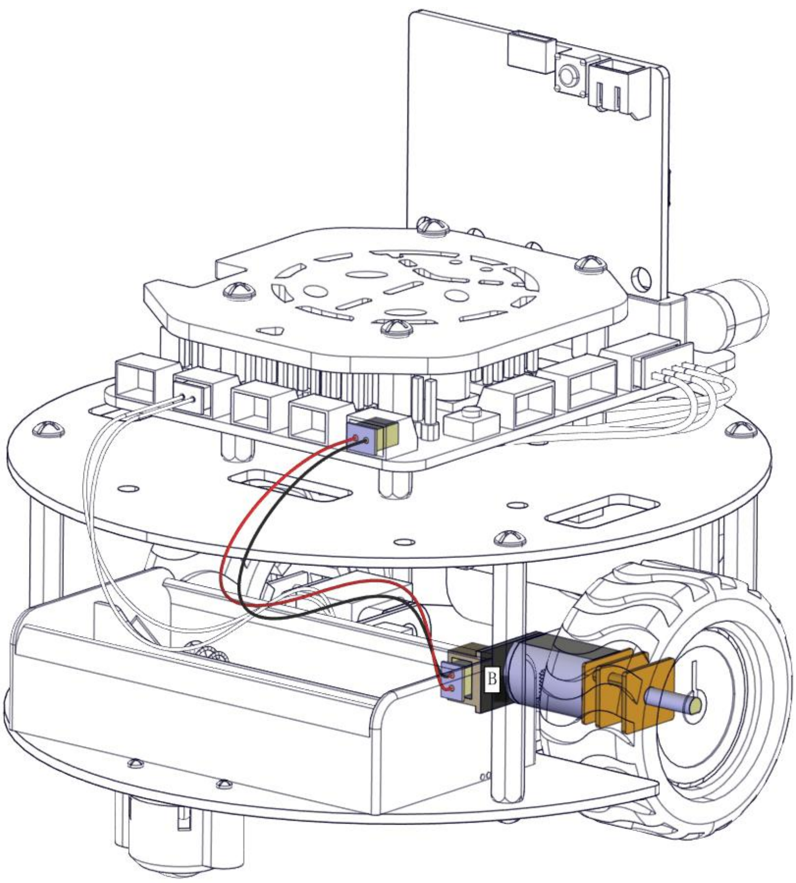
Black line is connected to G (-) , red wire is connected to 5V (+)

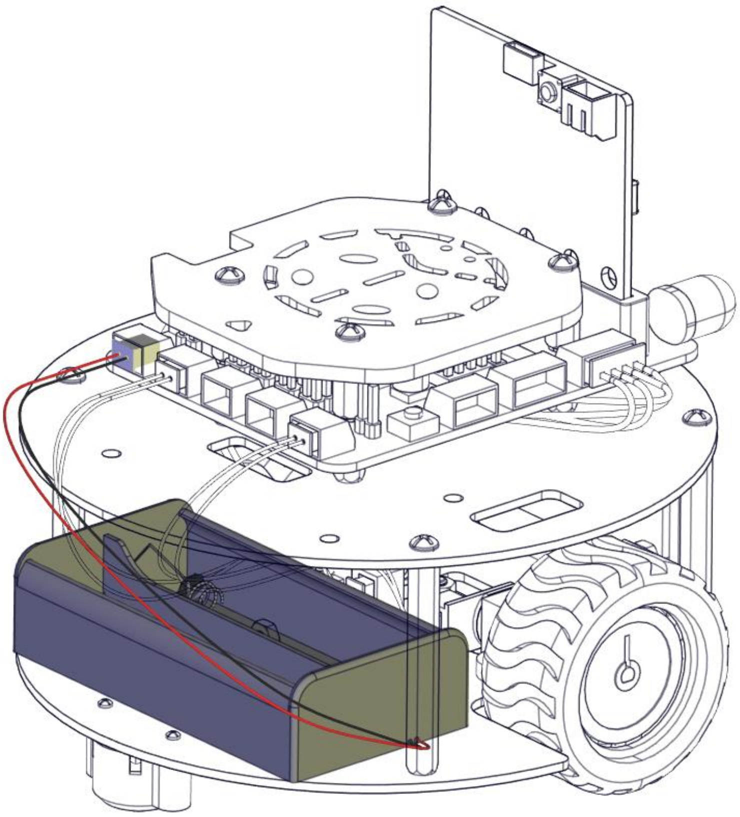
	Battery Holder	Motor A(Left)	Motor B(Right)	Line Tracking Sensor	IR Receiver	Ultrasonic Module
Driver Shield	7-12V IN (+ -)	A1	B1	P16 P15 P14 5V G	P11 5V G	P2 P1 5V G

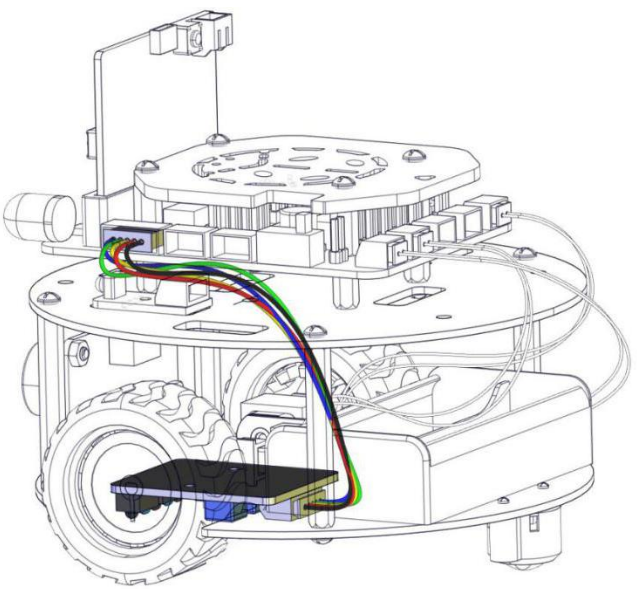
Wire up ultrasonic sensor, motors, IR receiver, line tracking sensor and battery holder

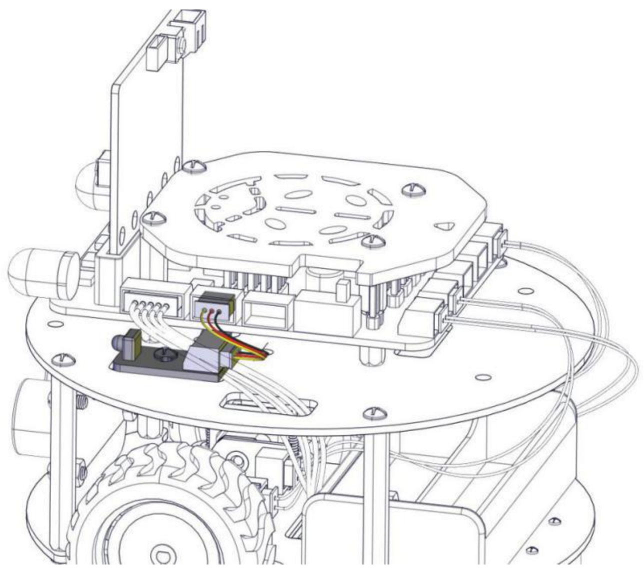


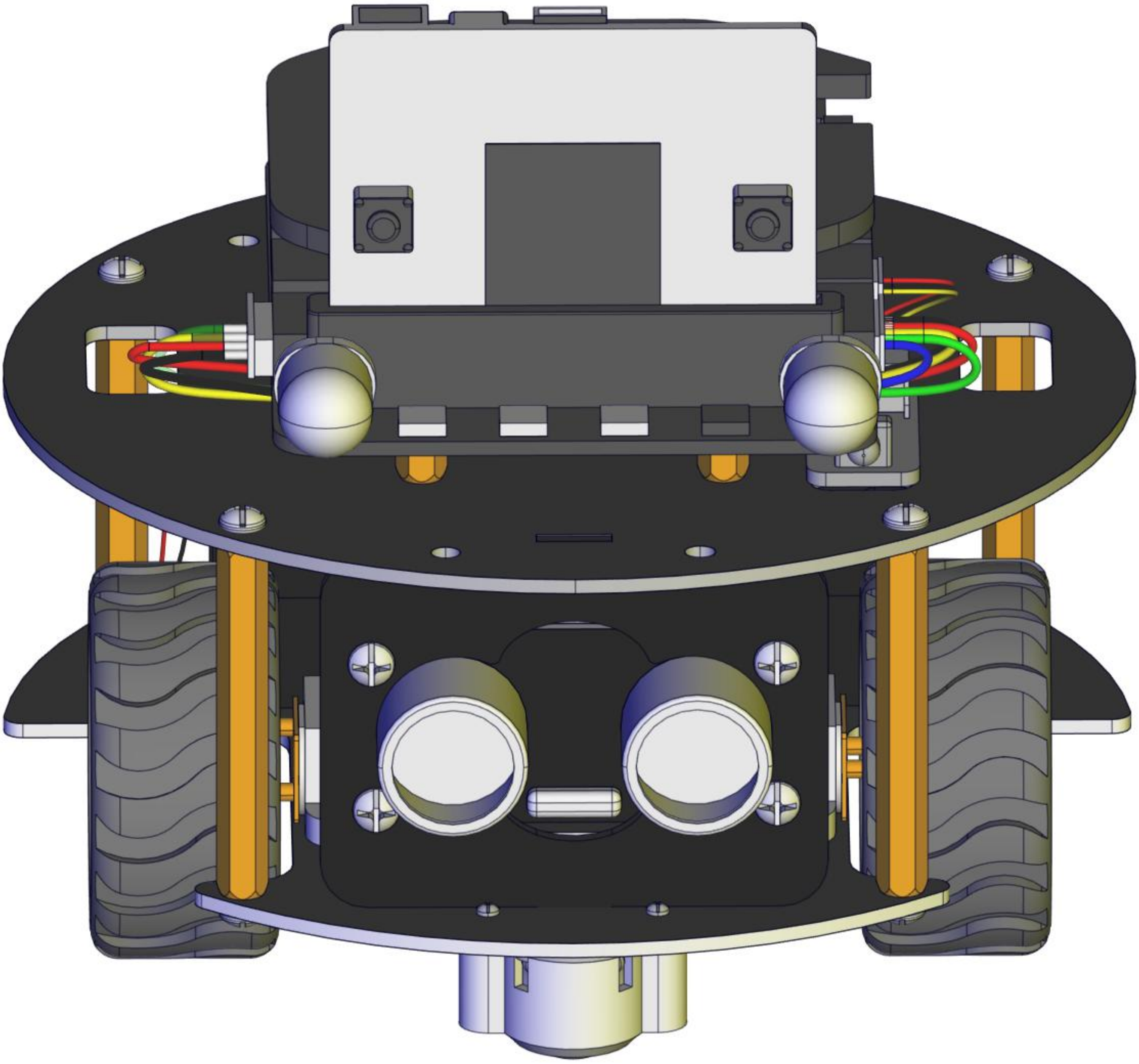

A


B









7.Code and Programming

We take Windows system as example to show you.

Get started with Micro:bit: Https://microbit.org/guide/quick/

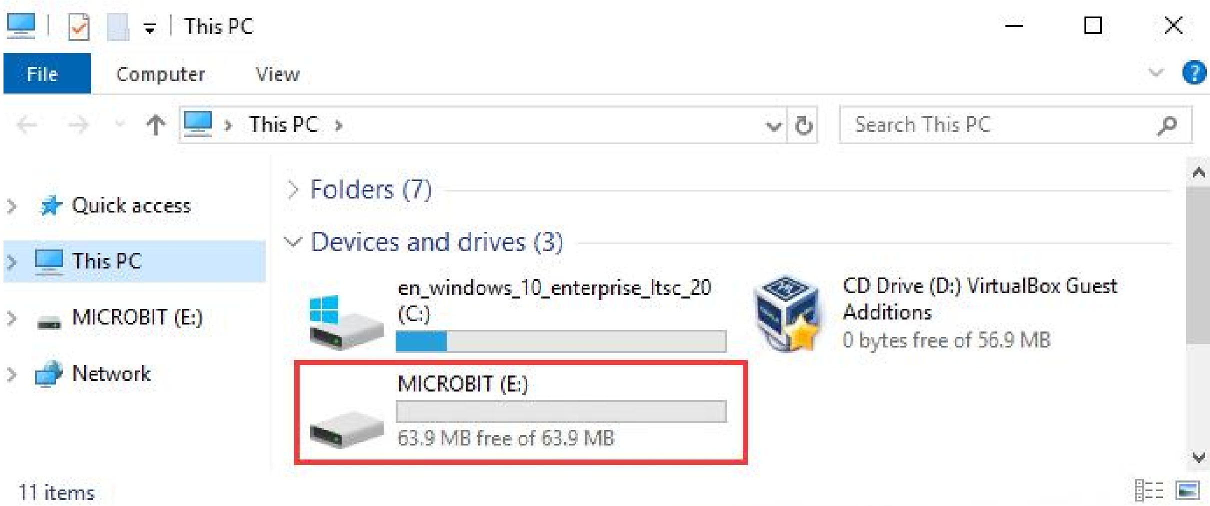
Step 1: Connect Micro：bit Board

Link micro:bit board to computer with USB cable.（Guide to mobile apps：https://microbit.org/get-started/user-guide/mobile/）

Macs ,PCs, Chromebooks and Linux system（including Raspberry Pi）support micro：bit.

The board is powered when the LED on the back of the board turns red.

There will be a MICROBIT drive in your computer, as shown below:



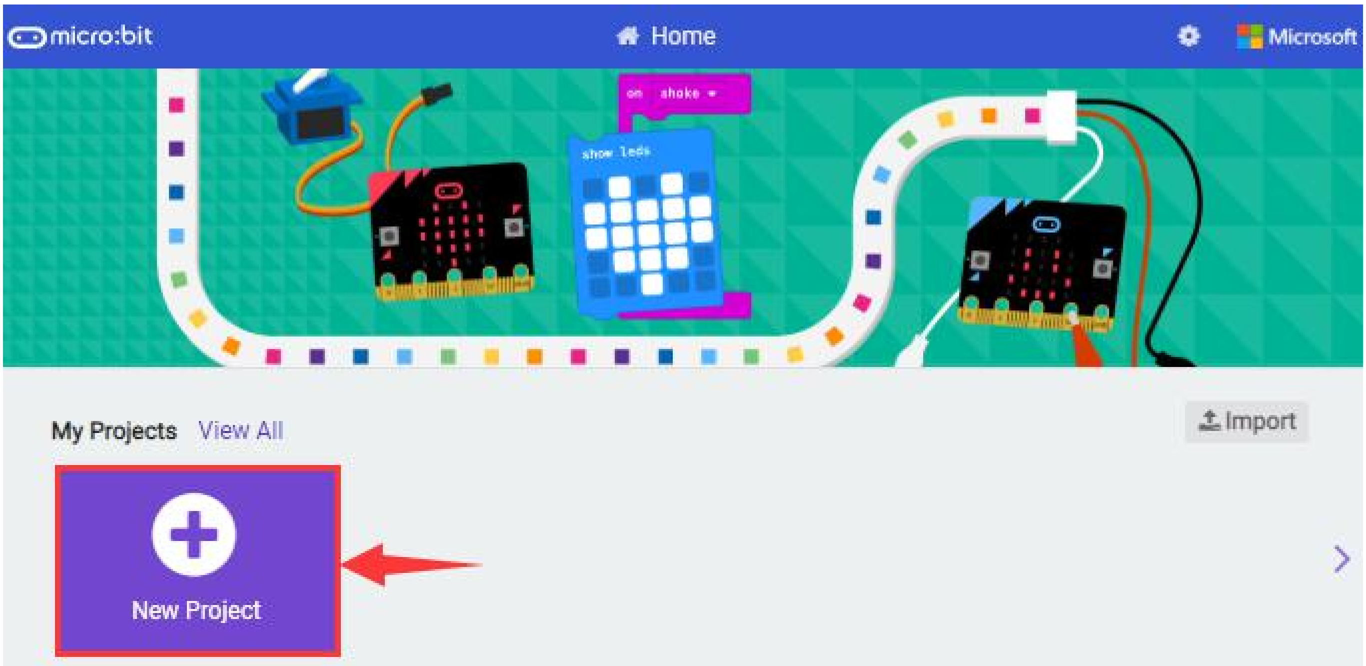
Step 2: Programming

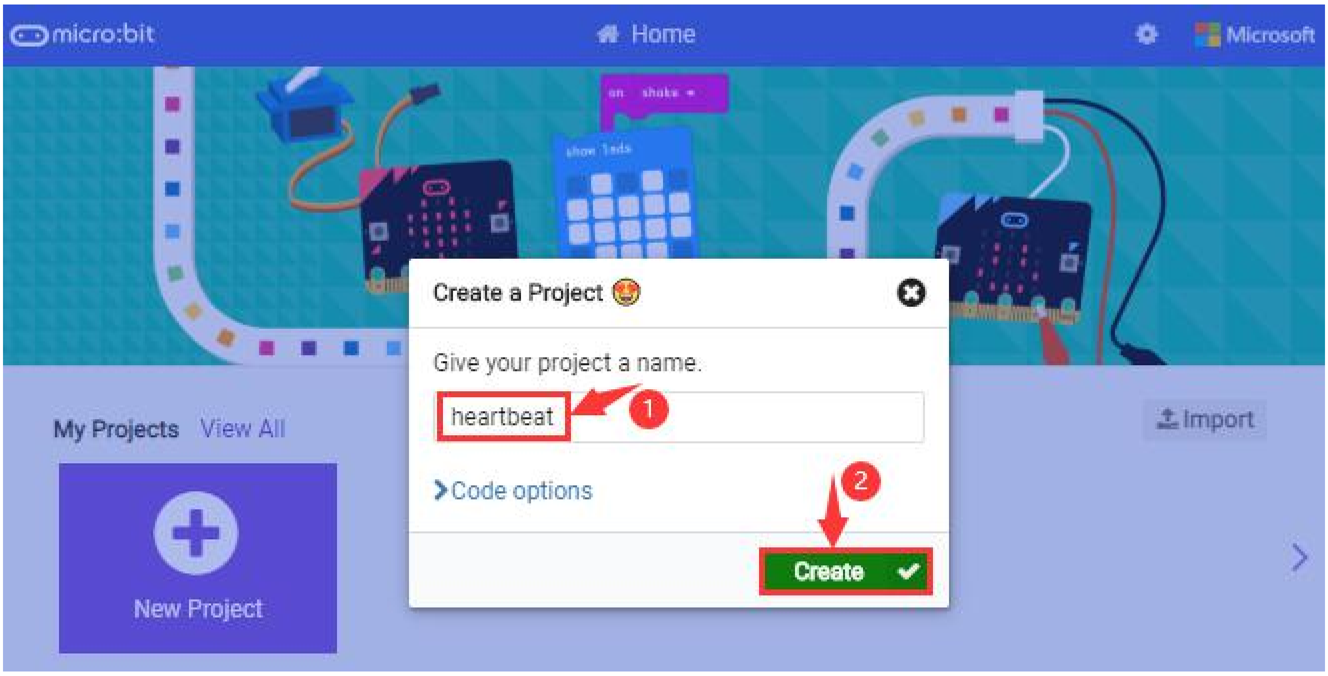
View the link https://makecode.microbit.org/ in your browser;

Click ‘New Project’;

The dialog box ‘Create a Project’ appears, fill it with ‘heartbeat’ and click ‘Create √’ to edit.

(If you are running Windows 10 system, it is also viable to edit on the APP MakeCode for micro:bit , which is exactly like editing in the website. And the link to the APP is https://www.microsoft.com/zh-cn/p/makecode-for-micro-bit/9pjc7sv48lcx?ocid=badgep&rtc=1&activetab=pivot:overviewtab)

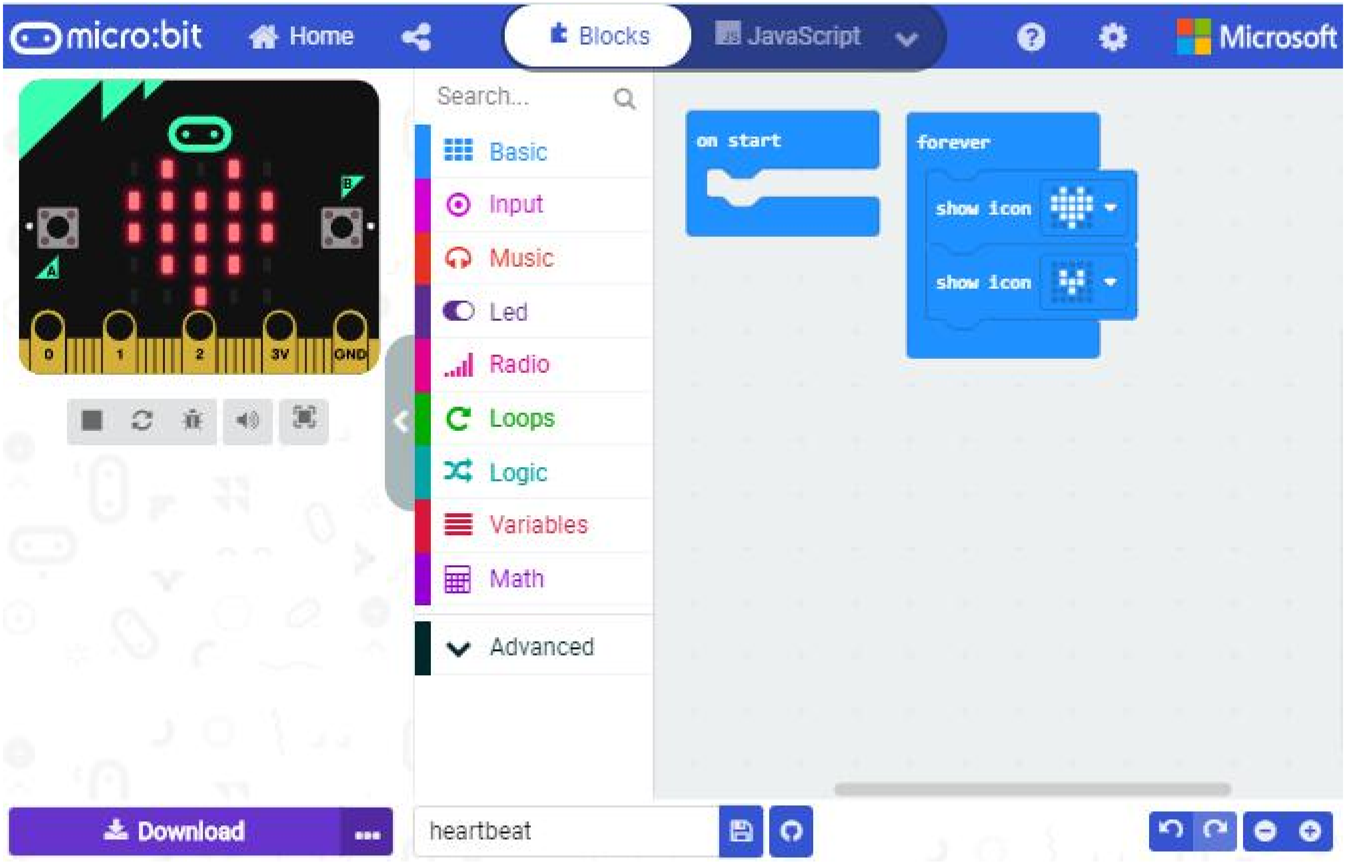




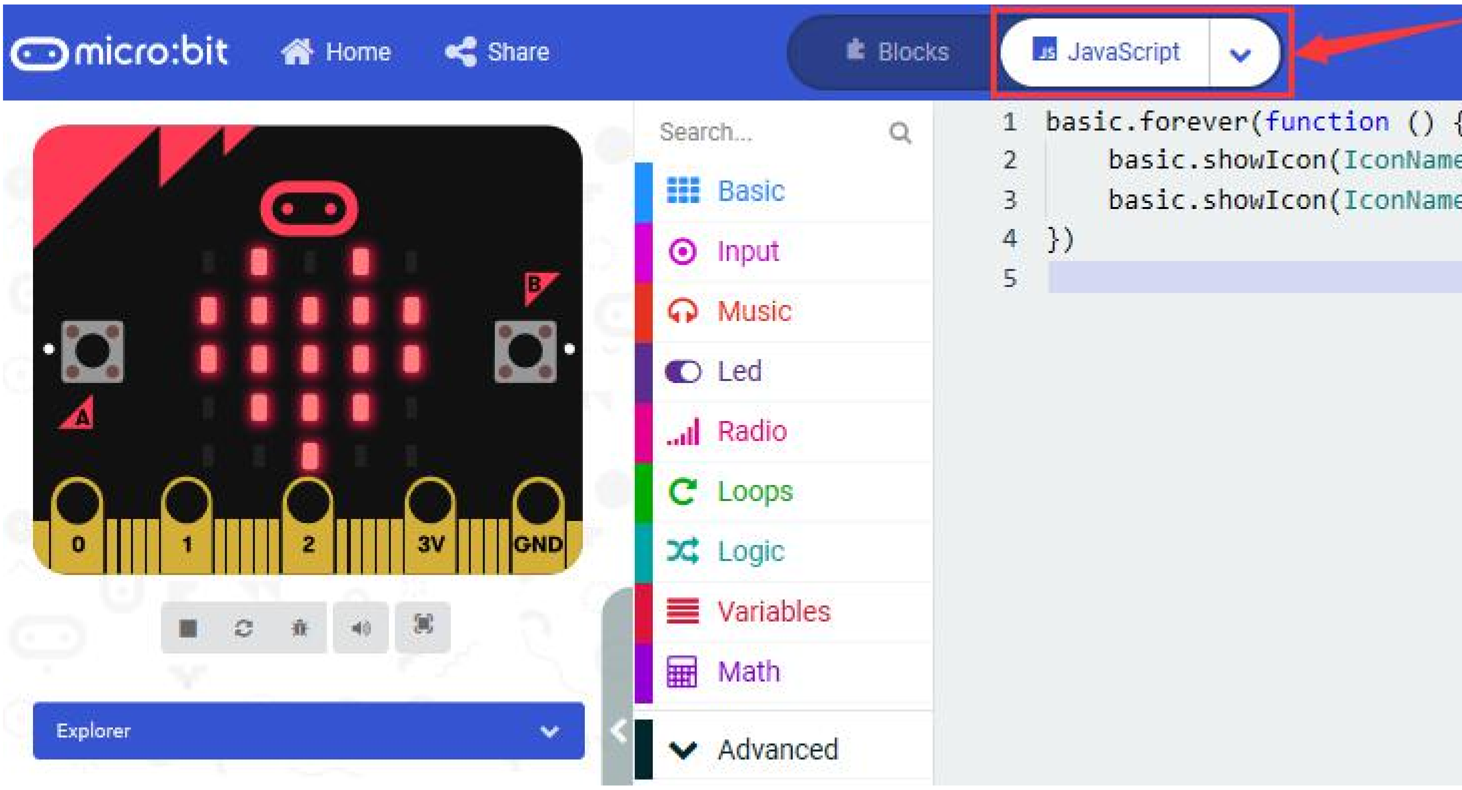
Write a set of micro:bit code. You can drag some modules in the Blocks to the editing area and then run your program in Simulator of MakeCode editor as shown in the picture below.There is a video to show you how to finish "heartbeat" pattern.

Link for the video microbit-heartbeat.mp4

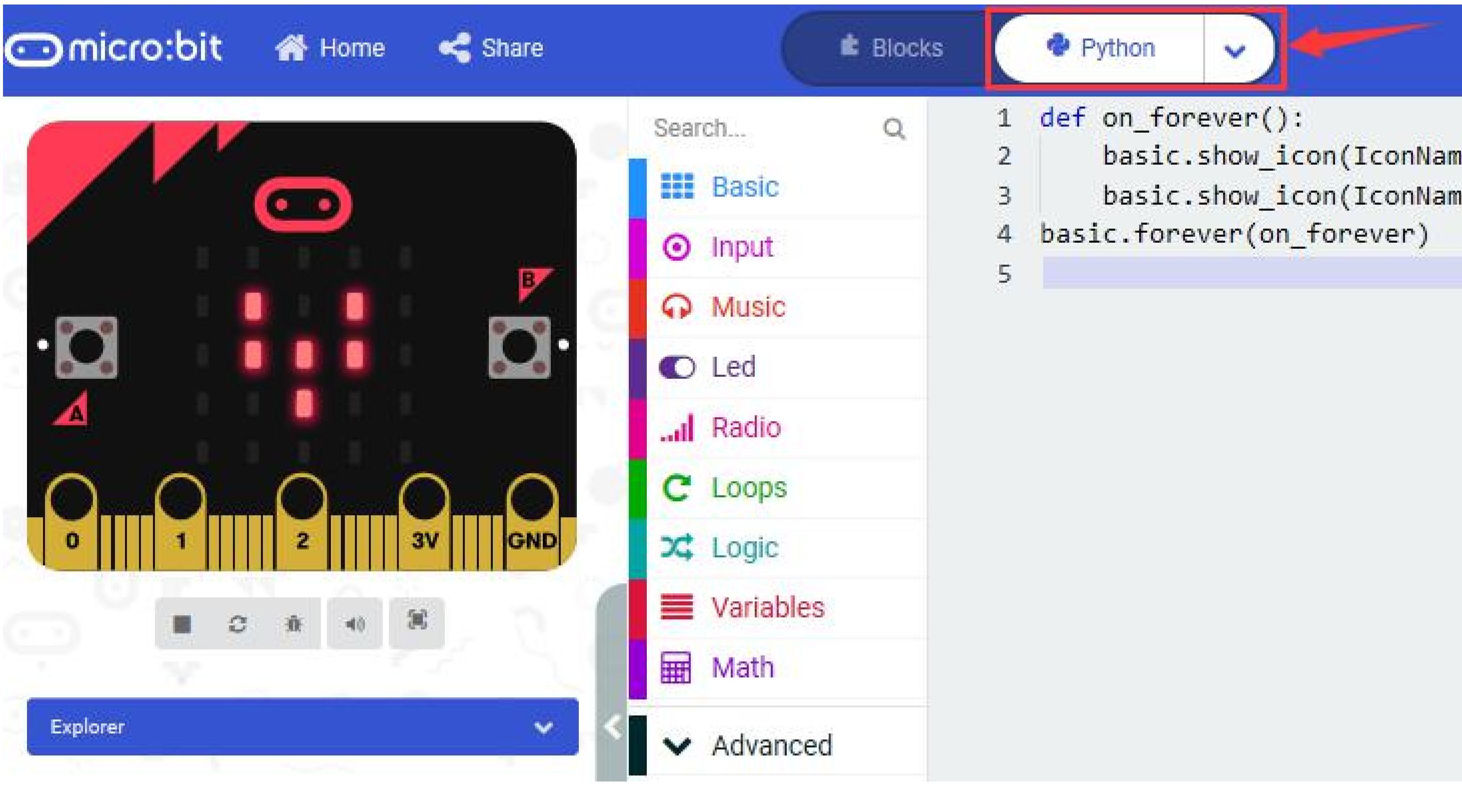
Next, we will introduce Makecode.



Click" JS JavaScript" , you will find the corresponding programming languages.



Click the little triangle" of JS JavaScript" to choose "Python", you will find the corresponding Python programming languages.

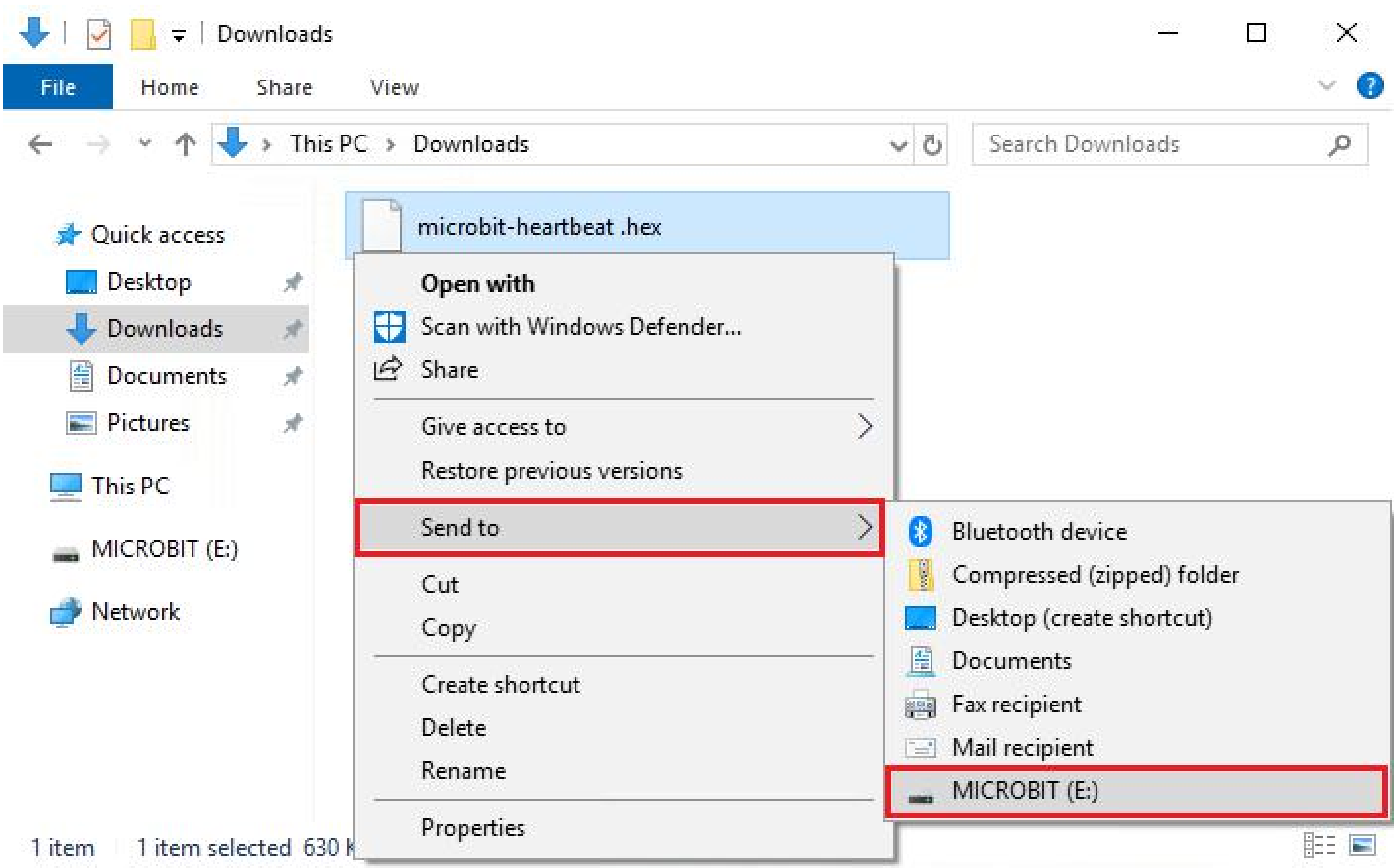


Step 3: Download Code

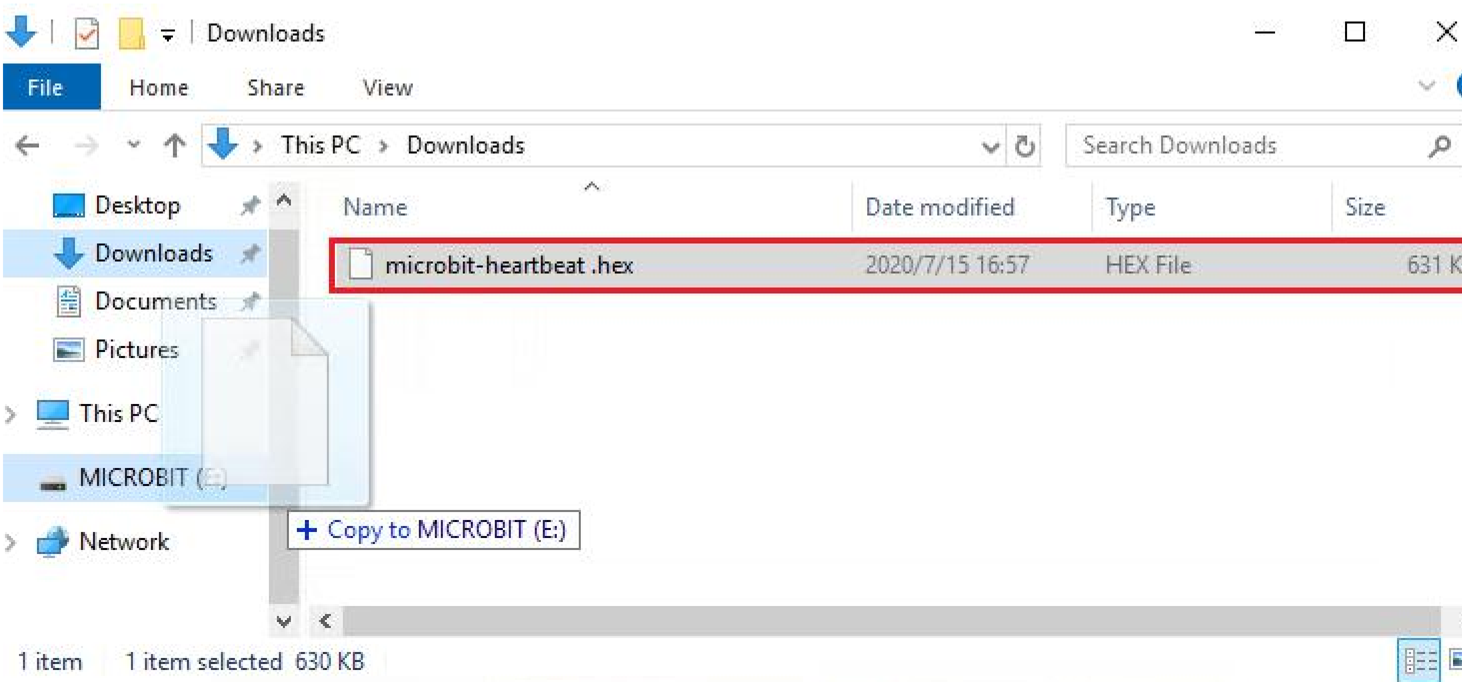
If your computer is Windows 10 and you have downloaded the APP MakeCode for micro:bit to write program, what you will have to do to download the program to your Micro: Bit main board V2 is merely clicking the ‘Download’ button, then all is done.

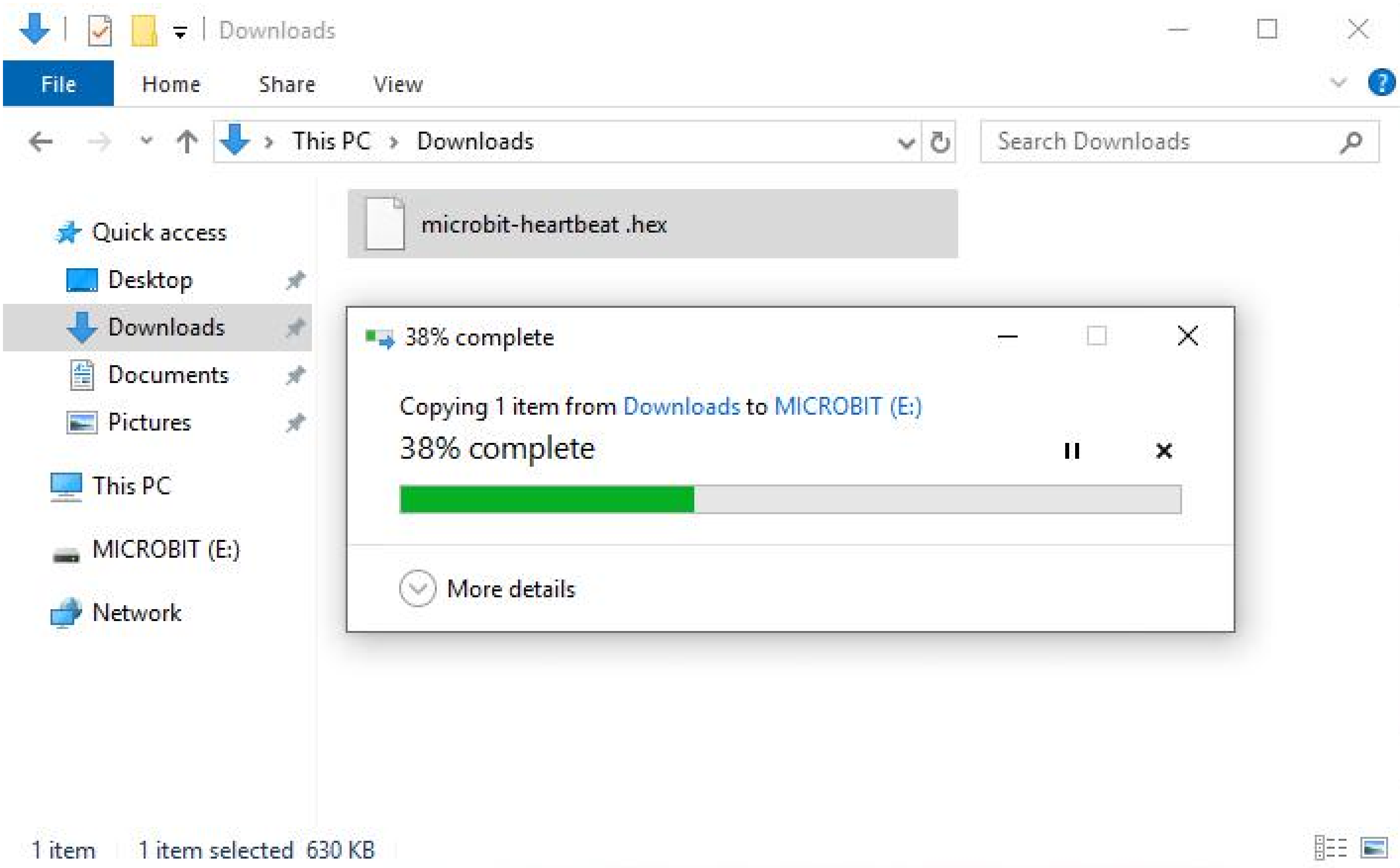
If you are writing programs through the website, following these steps:

Click the ‘Download’ in the editor to download a "hex" file, which is a compact program format that the Micro: Bit main board can read.Once the hexadecimal file is downloaded, copy it to your board V2 just like the process that you copy the file to the USB drive. If you are running Windows system, you can also right-click and select ‘Send to → Microbit (E) ‘to copy the hex file to the Micro: Bit main board V2



You can also directly drag the "hex" file onto the MICROBIT (E) disk.



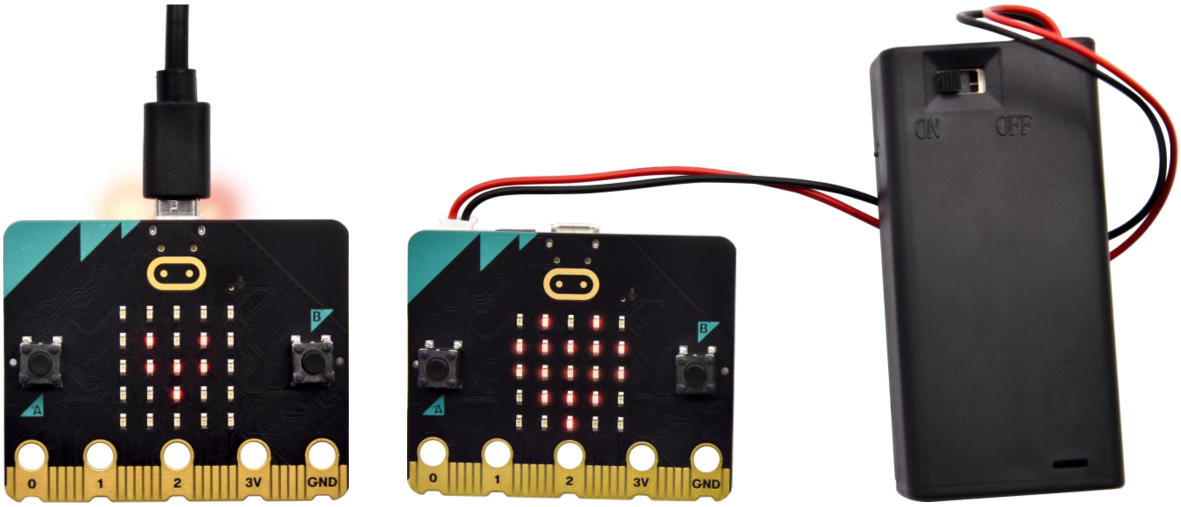


During the process of copying the downloaded hex file to the Micro: Bit main board V2, the yellow signal light on the back side of the board flashes. When the copy is completed, the yellow signal light will stop flashing and remain on.

Step 4: Run program

Upload code on micro:bit board and plug in power with USB cable.

LED dot matrix will display heartbeat pattern.



Power via micro USB & via external power supply

Programming each time, MICROBIT drive will automatically eject and return. Micro:bit only receives hex files rather than save any file.

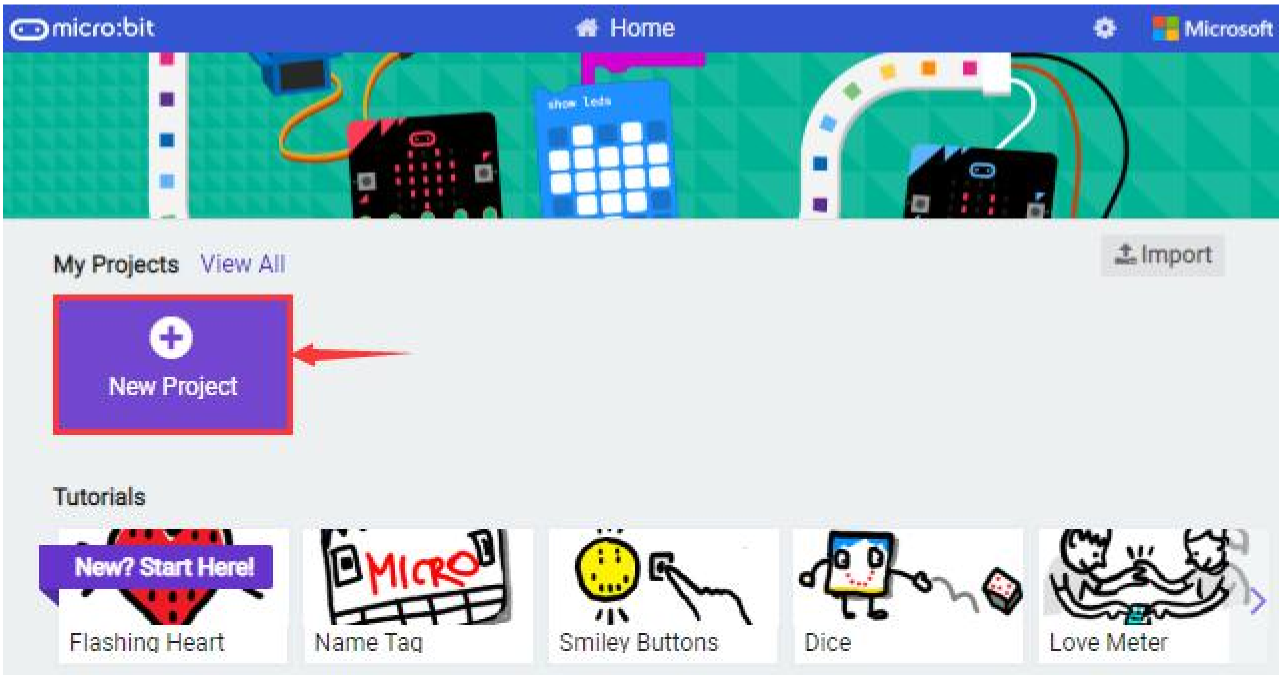
This chapter only shows you how to get started with micro:bit board. Python and JavaScript also support micro:bit board with the exception of Makecode.

https://microbit.org/code/

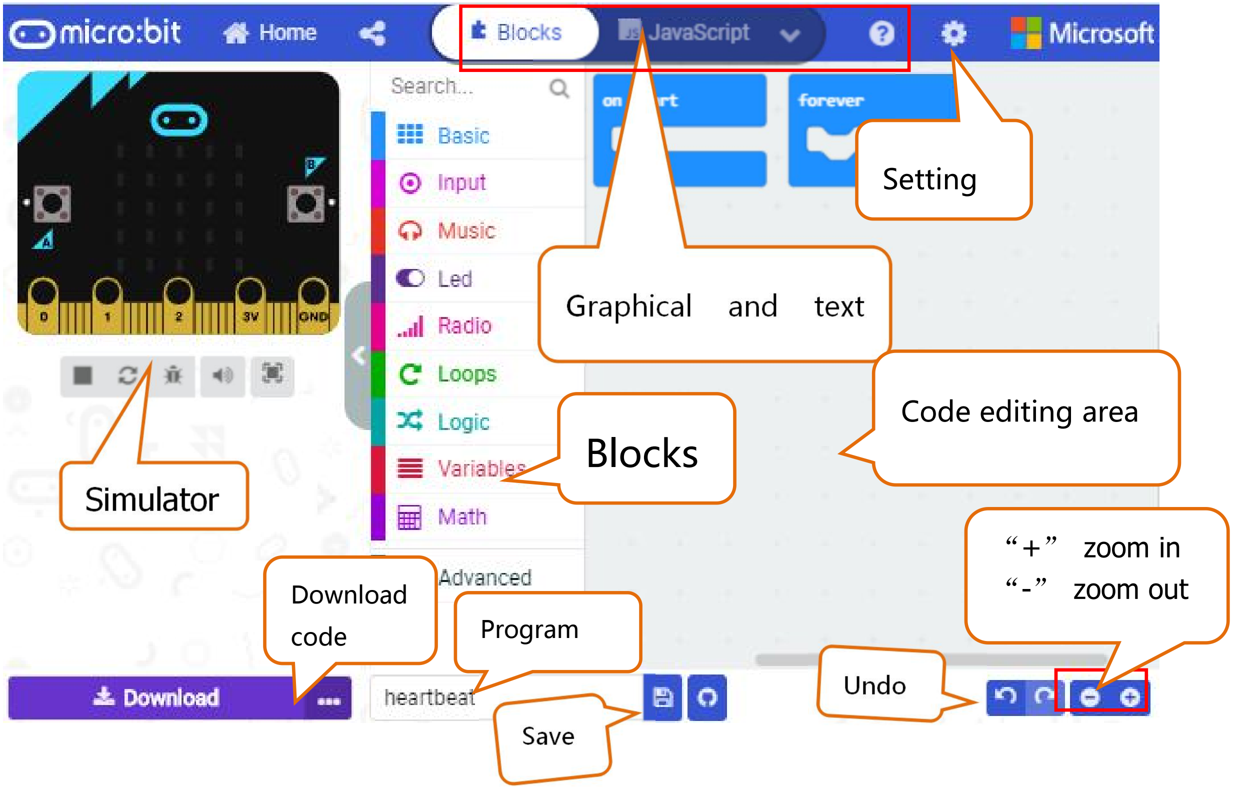
https://microbit.org/projects/

7.1 Makecode

Browse https://makecode.microbit.org/ and enter Makecode online editor.



Click “New Project”， and input “heartbeat” ，then enter Makecode editor, as shown below:



There are blocks “on start” and “forever” in the code editing area.

After power on or reset, “on start” means that the code in the block executes once while “forever” implies that the code runs cyclically.

7.2 Quick Download

As mentioned before, if your computer is Windows 10 and you have downloaded the APP MakeCode for micro:bit to write programs, the program written can be quickly downloaded to the Micro: Bit main board V2 by selecting ‘Download’.

While it is a little more trickier if you are using a browser to enter makecode. However, if you use Google Chrome, suitable for Linux , macOS and Windows 10, the process can be quicker too.

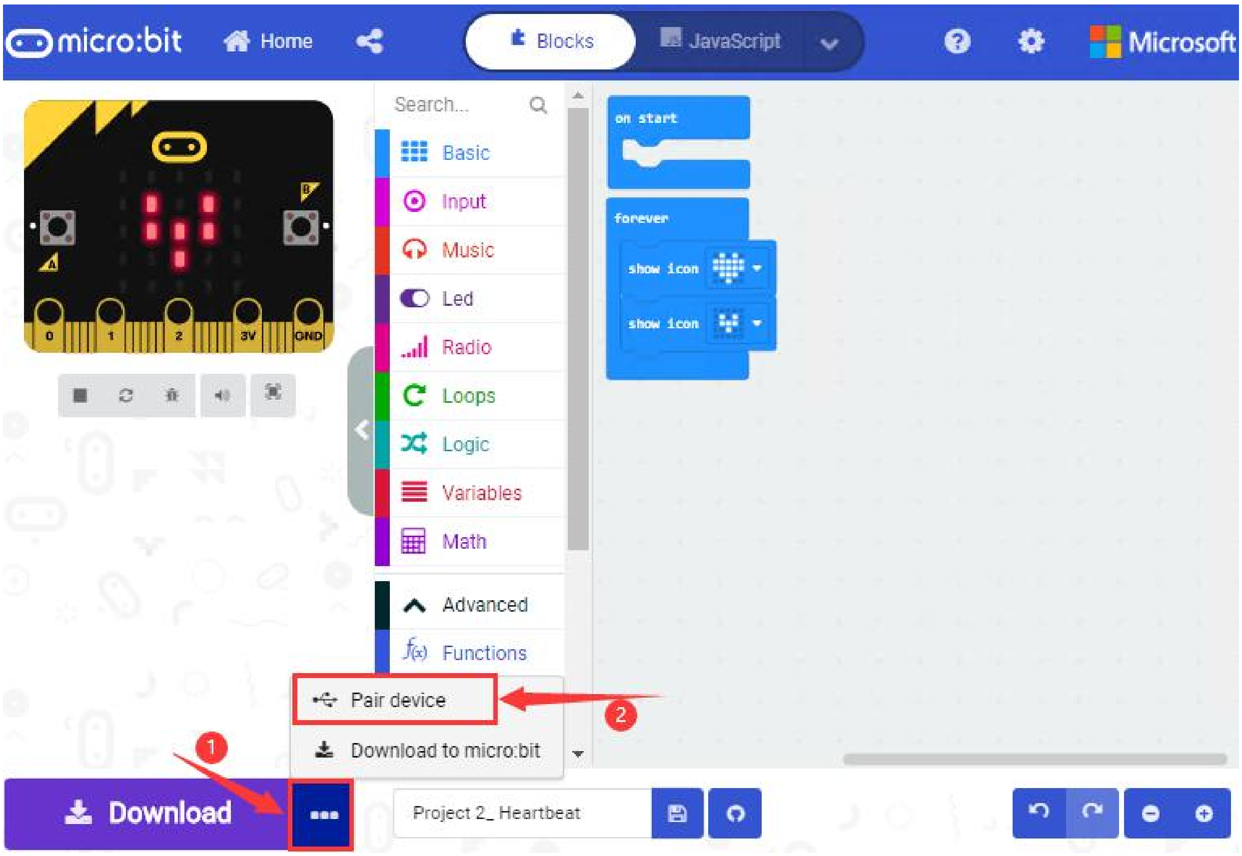
We use the webUSB function of Chrome to allow the internet page to access the hardware device connected USB.

You could refer to the following steps to connect and pair devices.

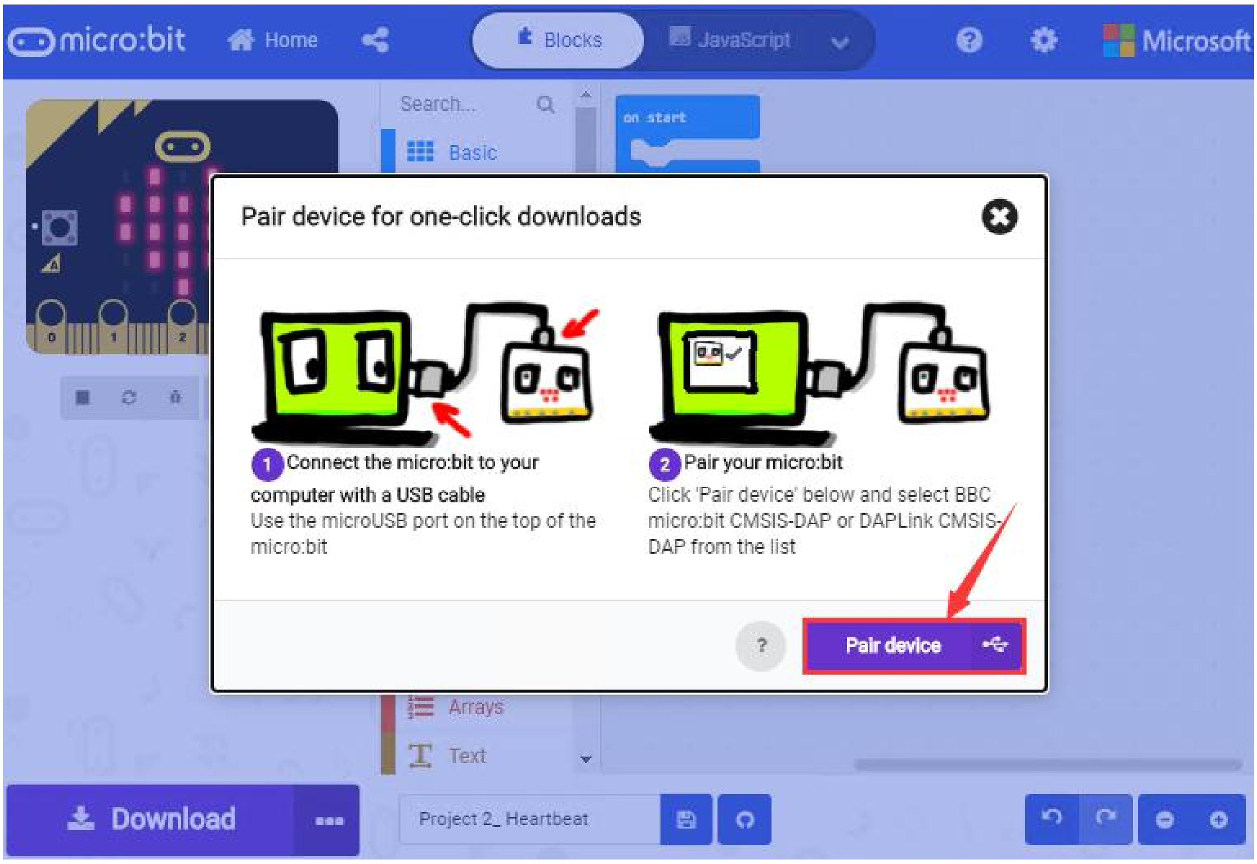
Device pairing

Interface micro:bit with computer using USB cable.

Click "..." beside "Download" and tap "Pair device" .



Continue to tap “Pair device”



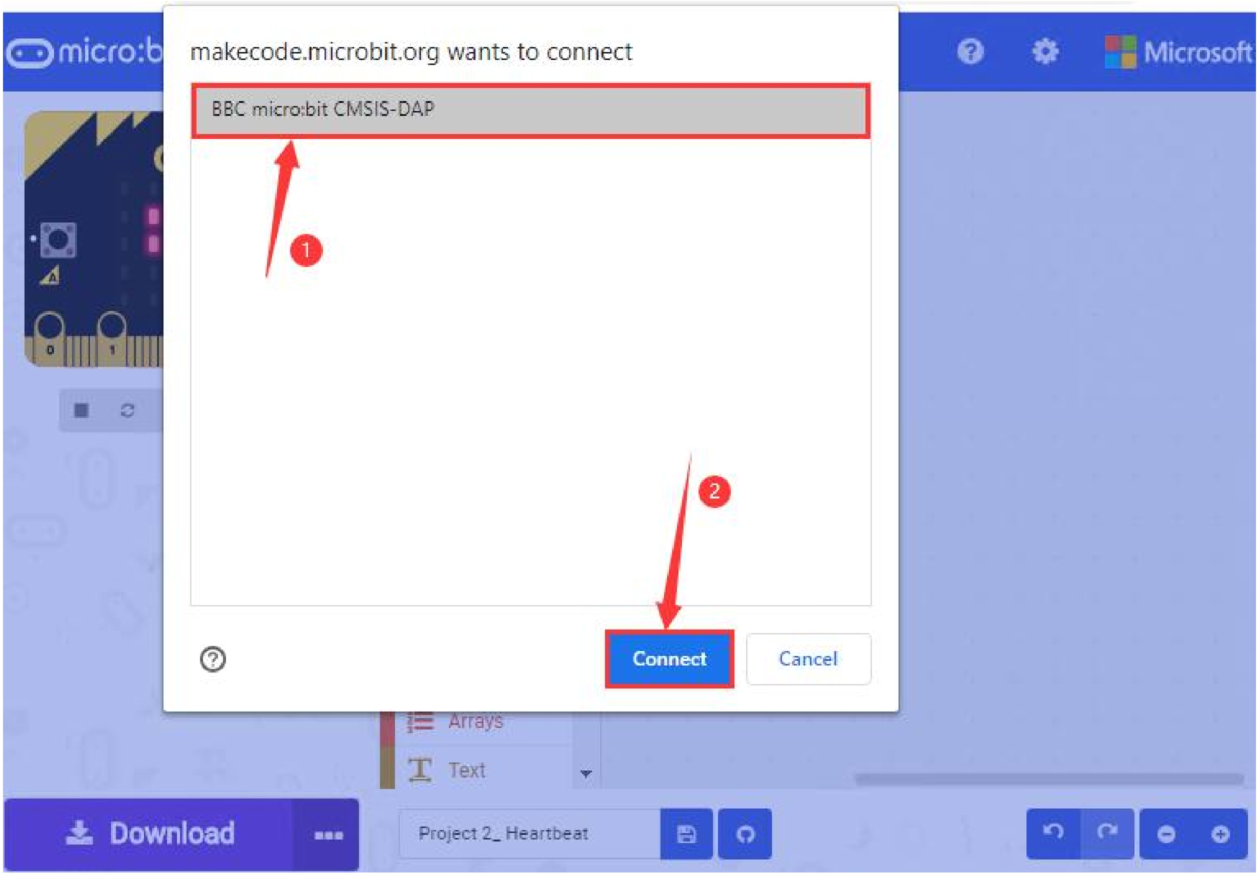
Then select the device you want to connect and tap “connect” in the window popping up.

If there is no device in the window, please refer to the following link:

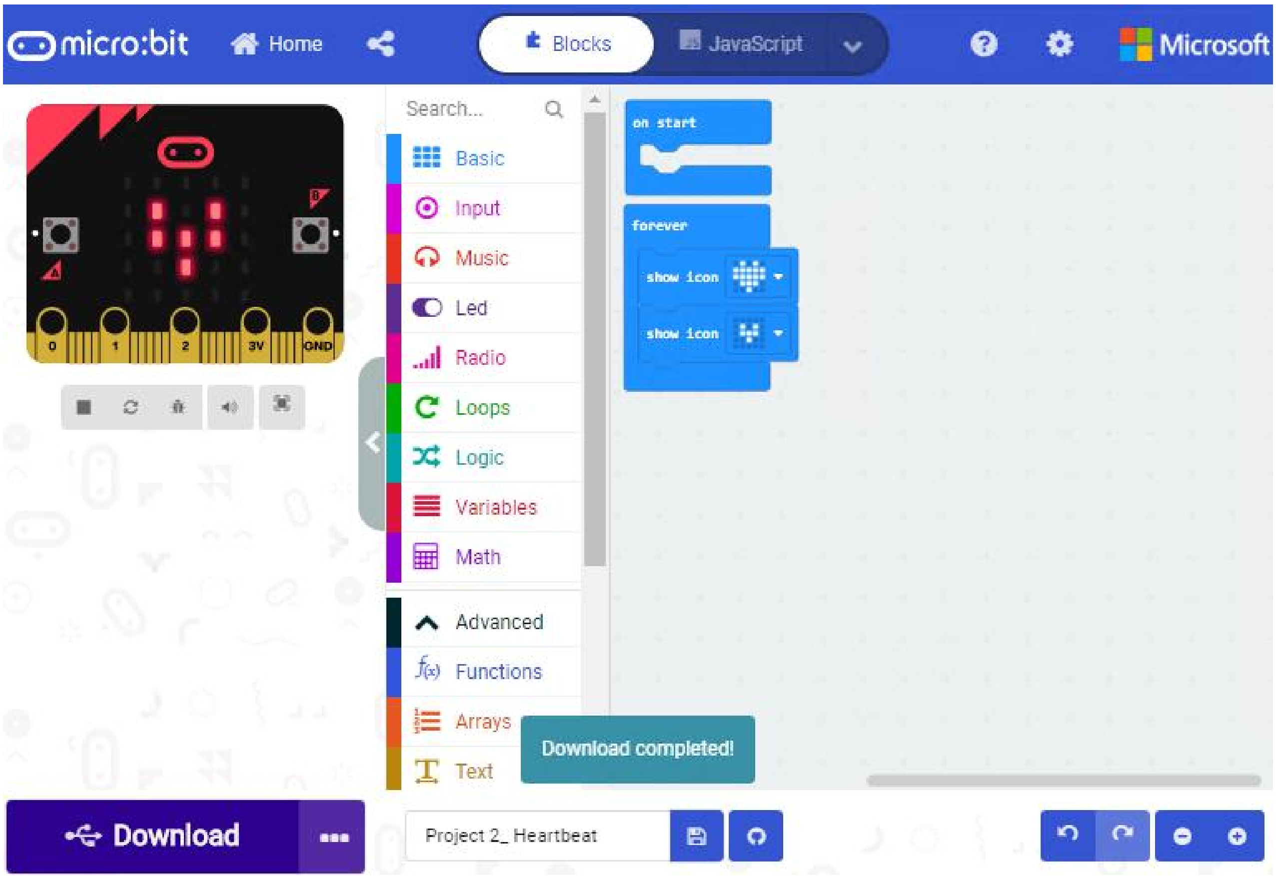
https://makecode.microbit.org/device/usb/webusb/troubleshoot

We also provide 7.Troubleshooting-WebUSB in the resource link https://fs.keyestudio.com/KS4014

What’s more, if you don’t know how to update the firmware of micro:bit, refer to the link: https://microbit.org/guide/firmware/ or browse folder 4.How to Upgrad Firmware of Micro bit board we provide.



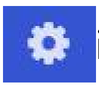
After connecting successfully, press buttons and download code to micro:bit.

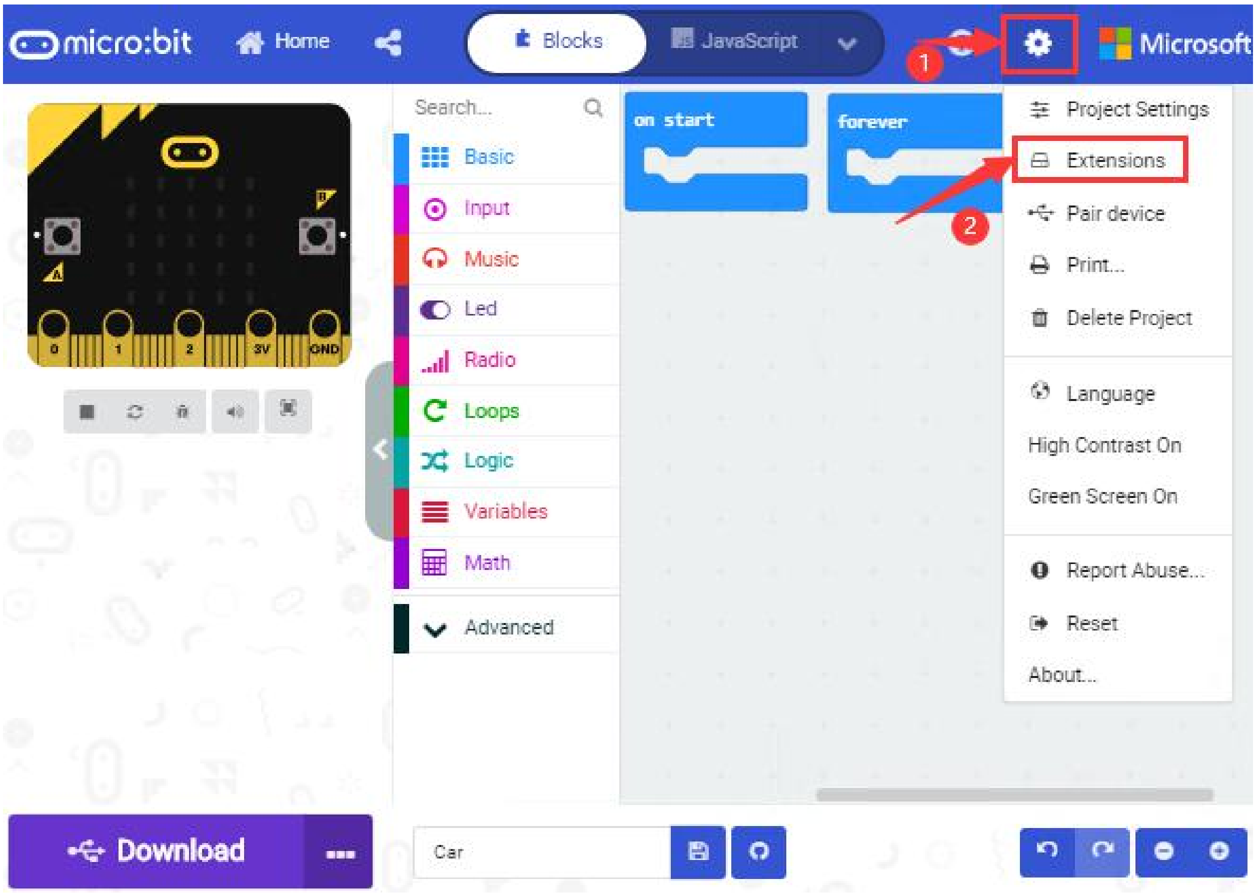


7.3 How to Import Extension Library on Makecode

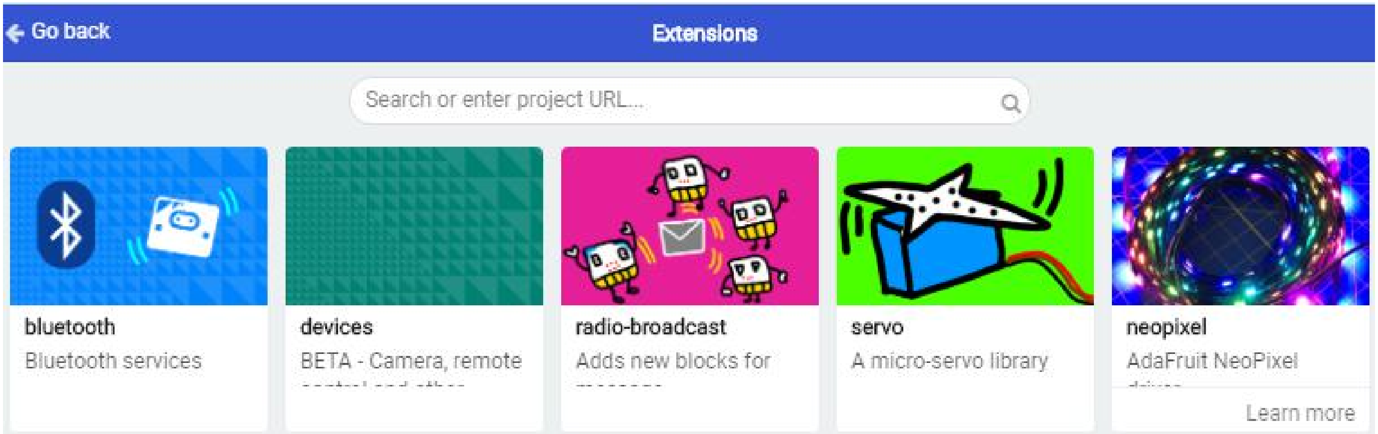
Next, we need to import turtle-bit extension library for further lessons.

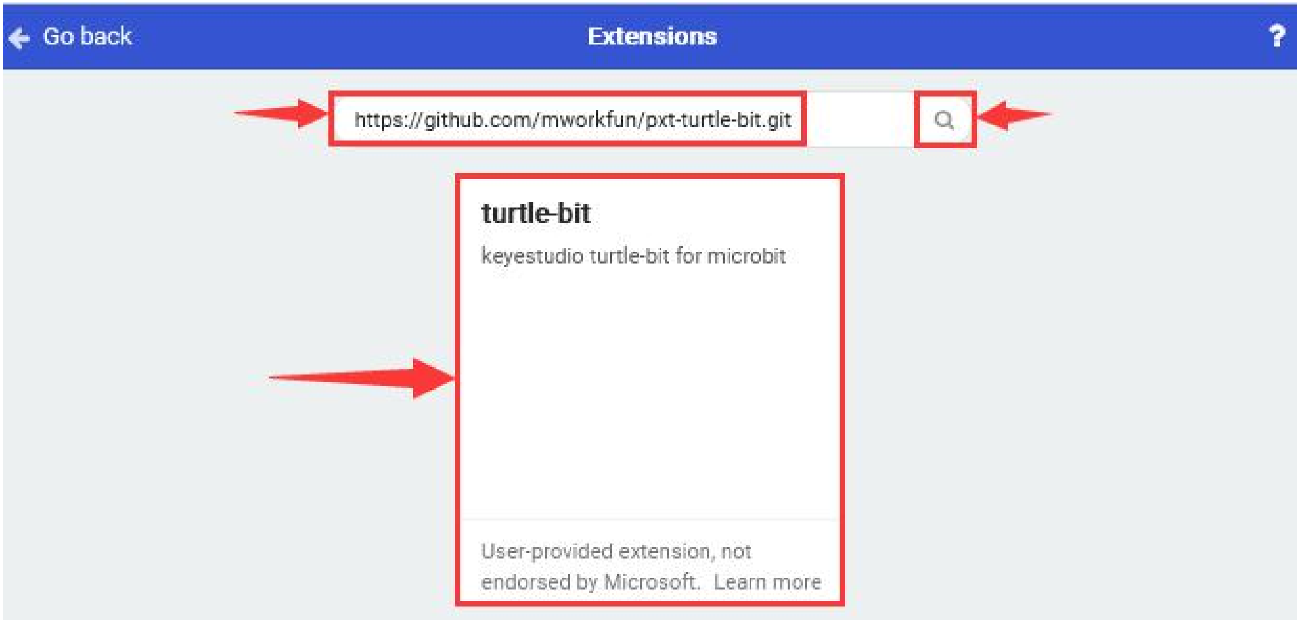
Add a Kit-bit extension library

Enter Makecode editor and click  icon and tap 

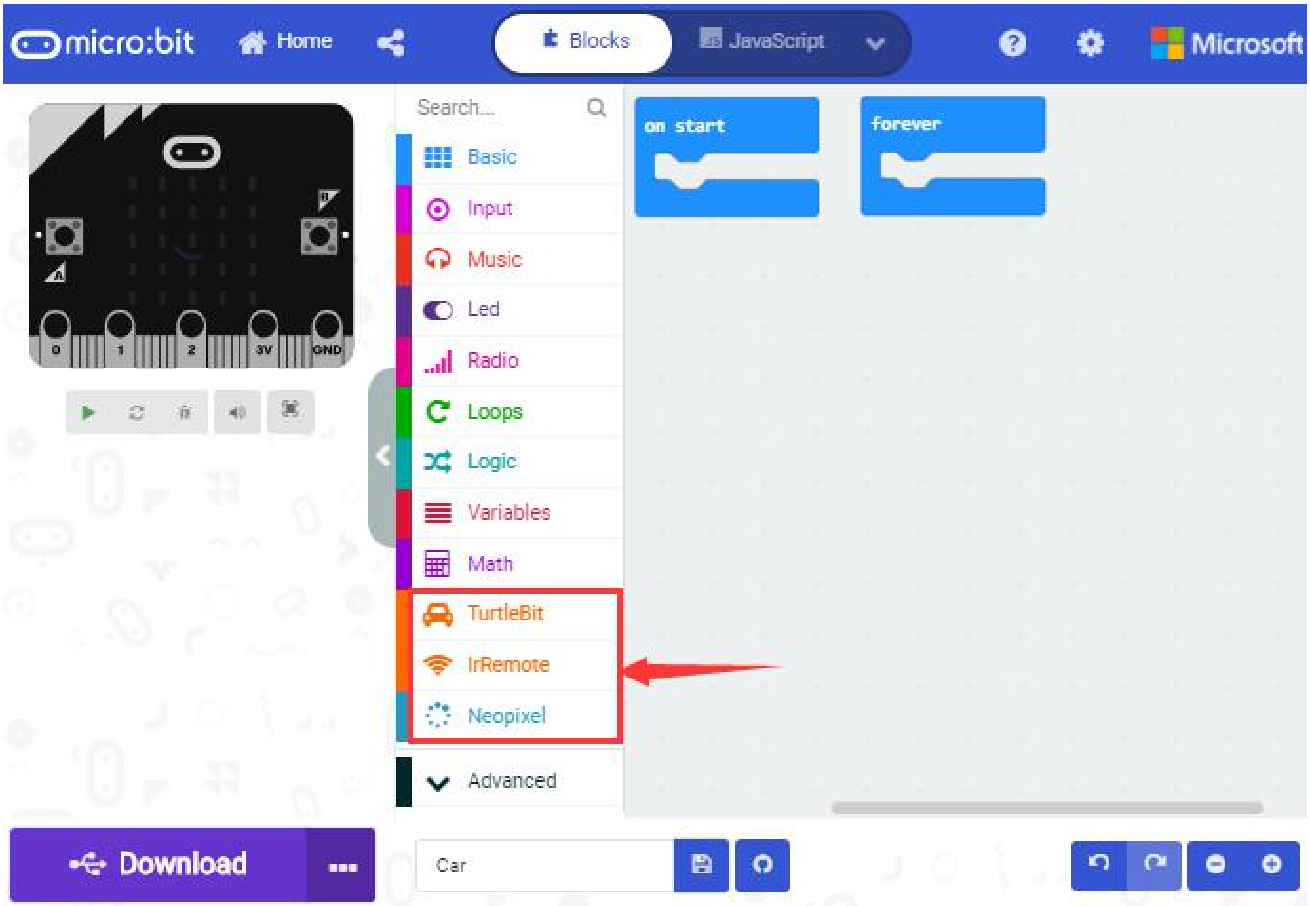


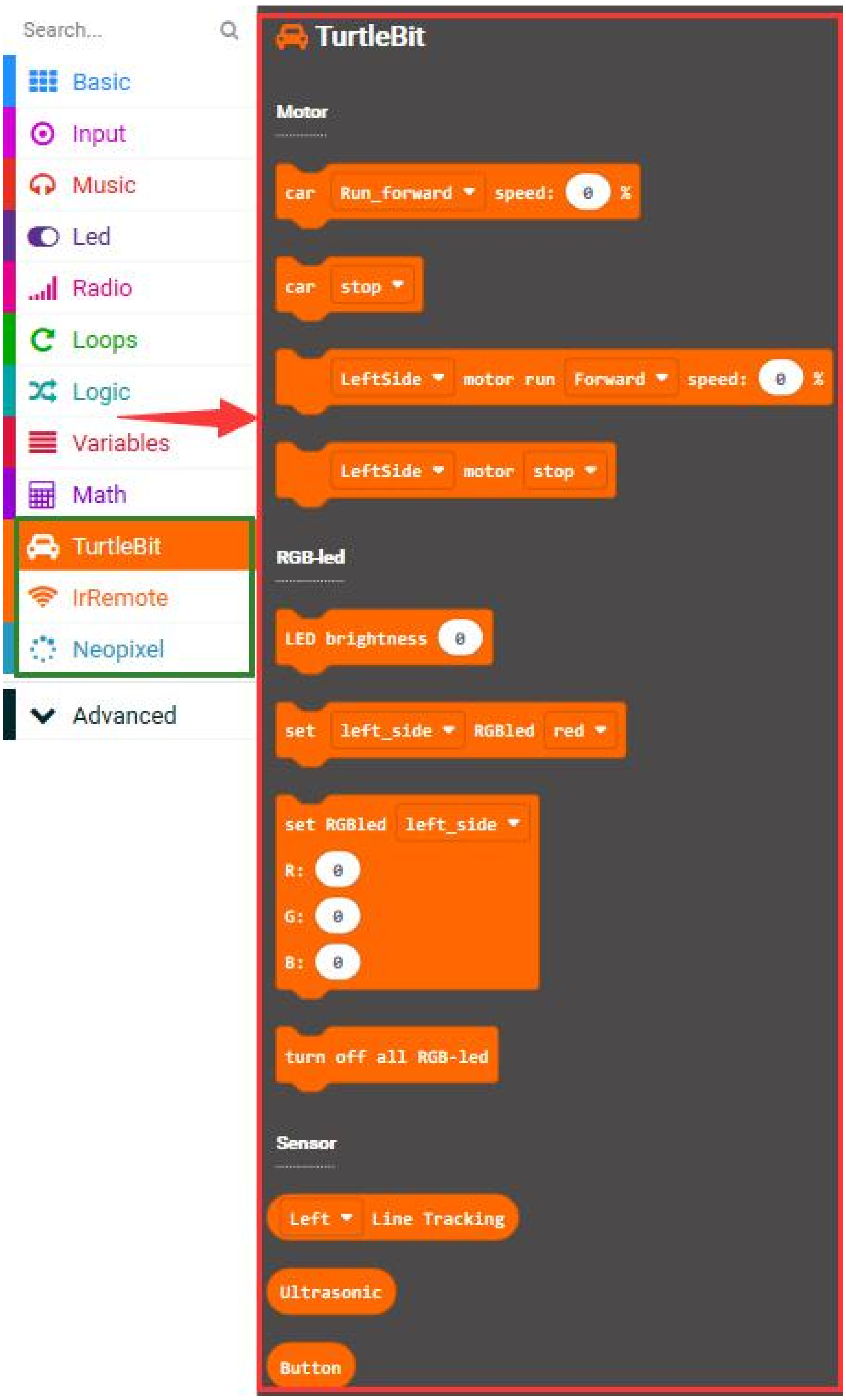
Copy https://github.com/mworkfun/pxt-turtle-bit.git in the searching box and search turtle-bit extension library.





After the installation, "turtle-bit" extension library will appear in the page





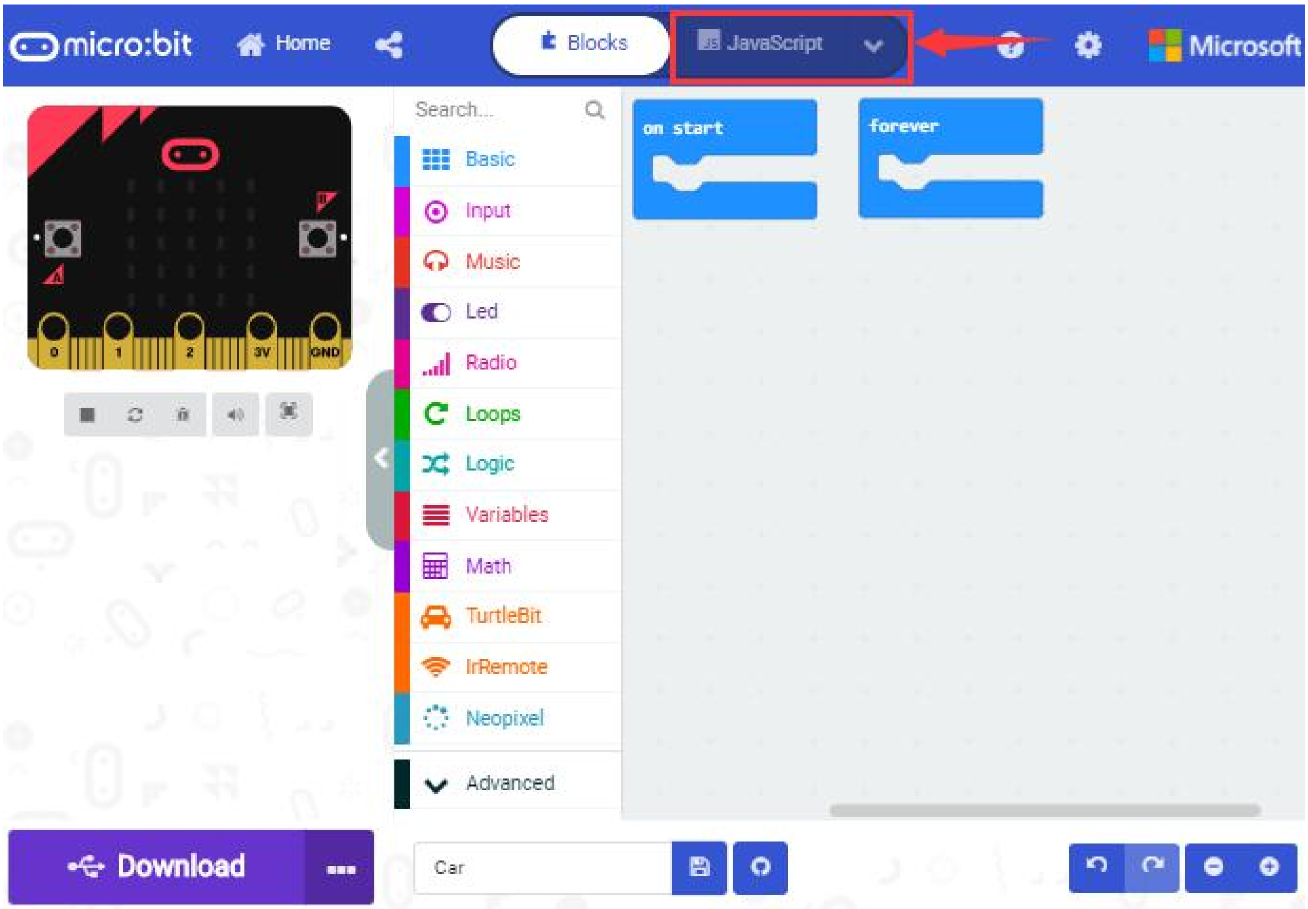
Note: the extension library added is only valid to one project. Therefore, it won’t appear in other projects.

You need to add the turtle-bit extension library again when creating new projects.

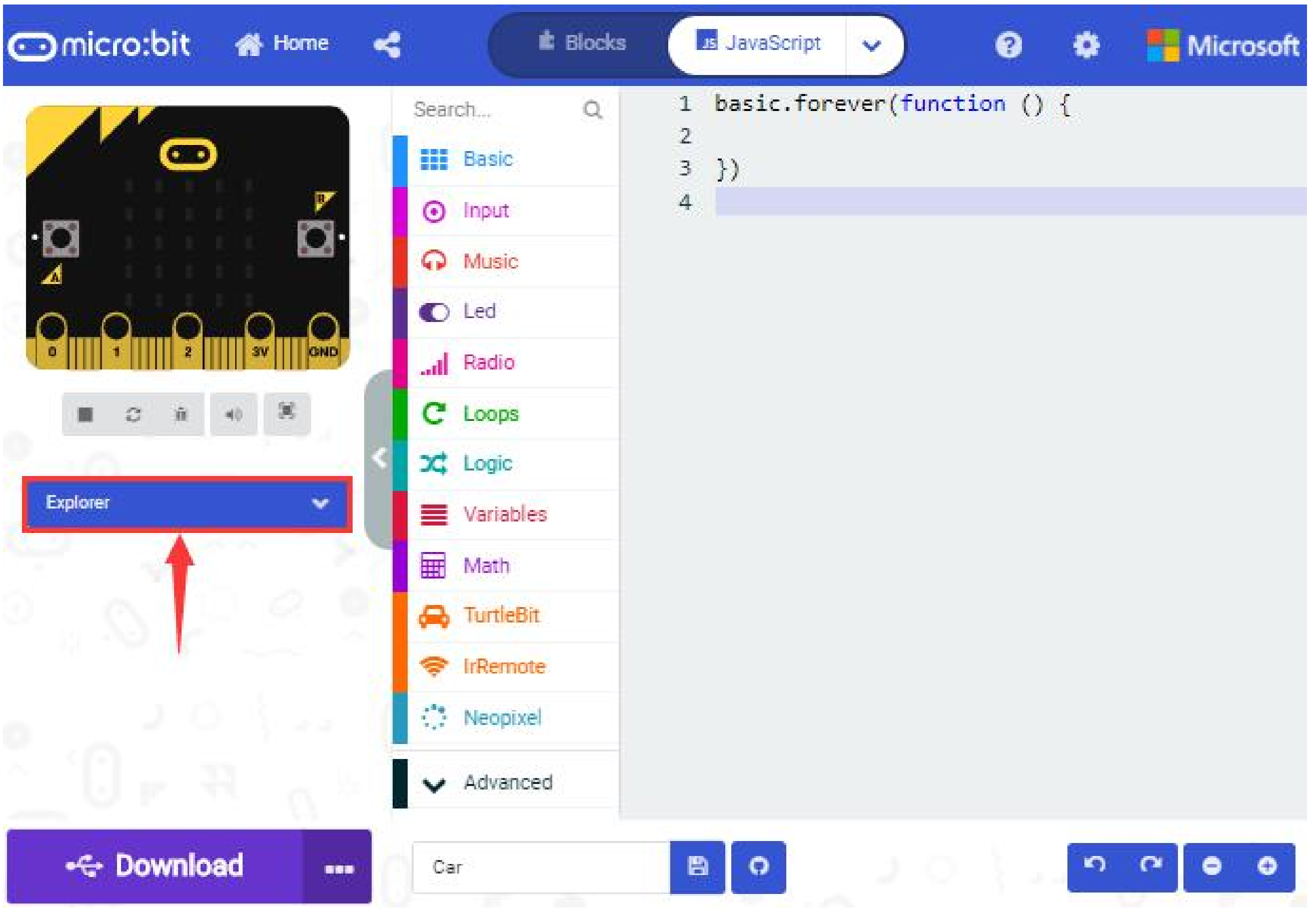
Update or Delete Turtle-bit Extension Library

Refer to the following instruction please, if you intend to update or delete turtle-bit extension library.

Click "Js JavaScript" button to switch into text code



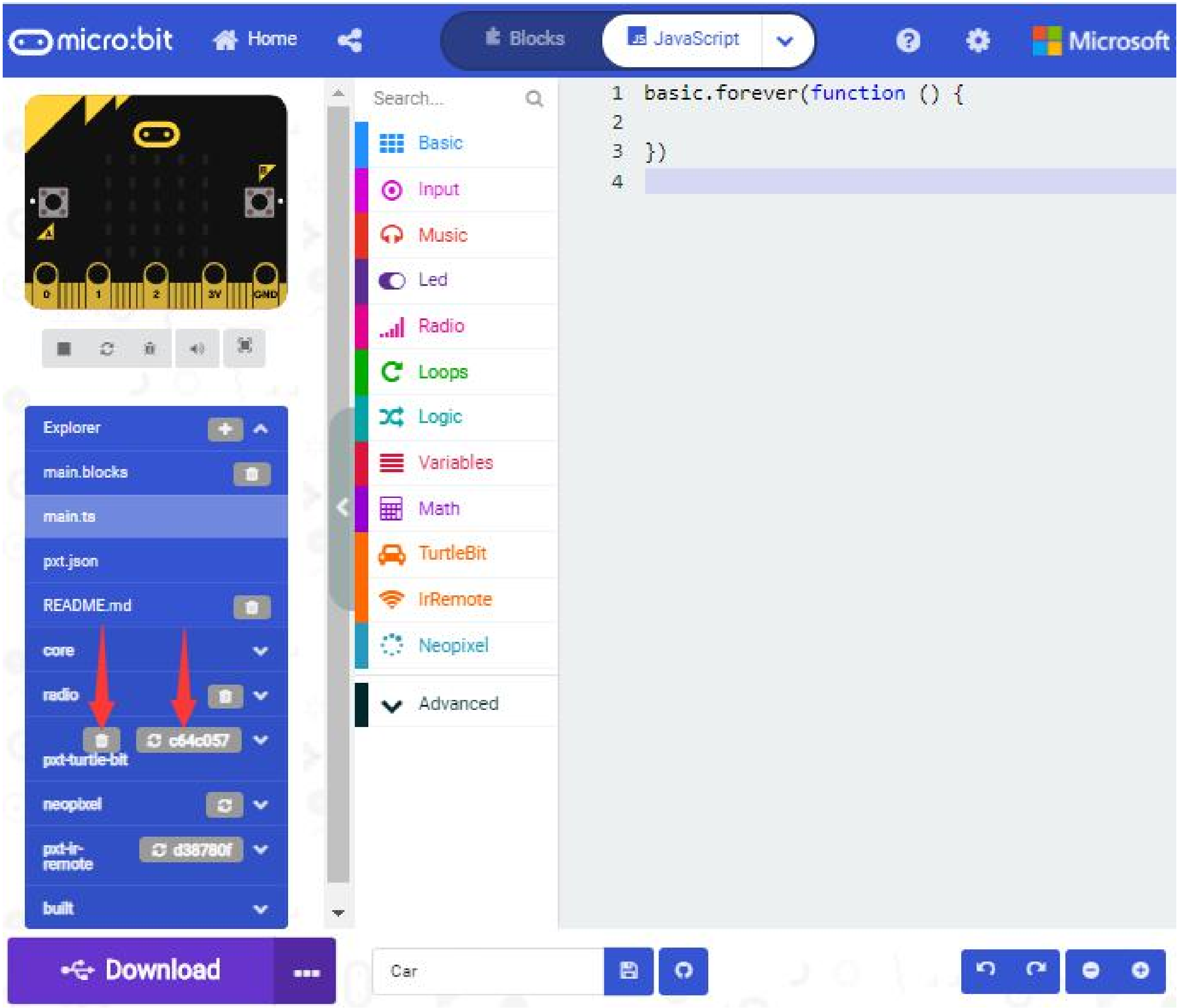
Click “Explorer” to get extension library .



Click “

” to delete turtle-bit extension program(TurtleBit IrRemote and Neopixel), next to tap “

” to update turtle-bit extension program.



7.4 Resources and Code

Download resources and code of tool package:

https://fs.keyestudio.com/KS4014 .

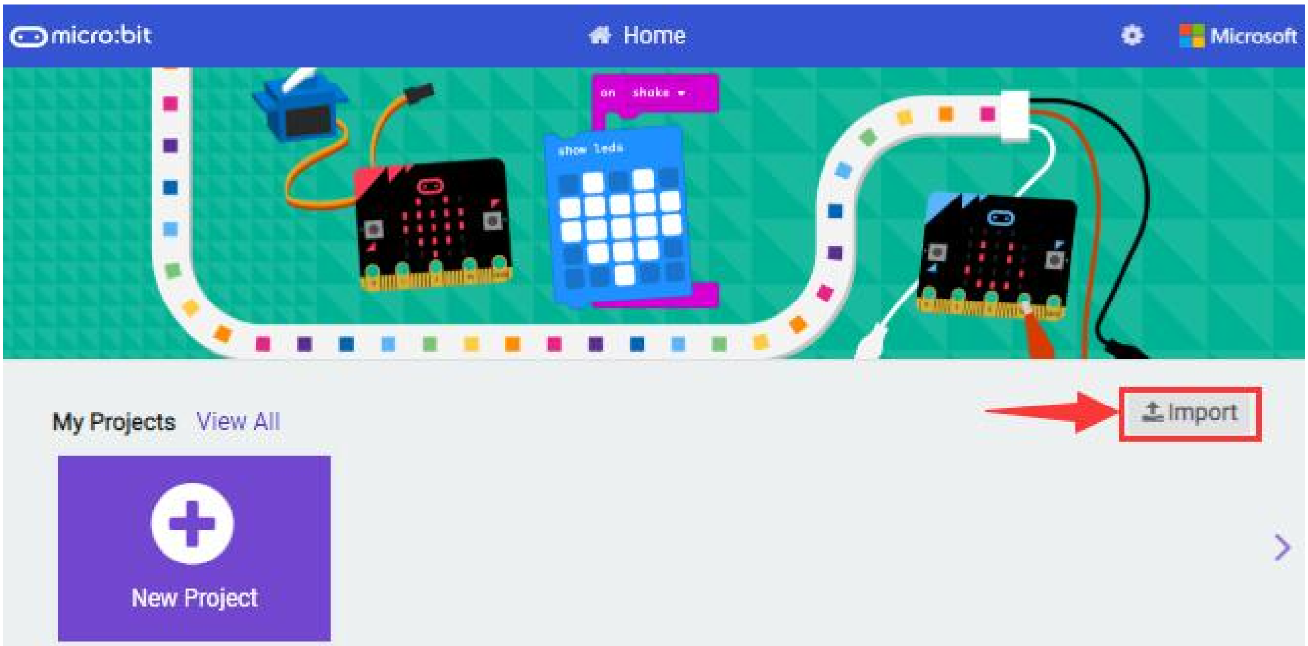
After the tool package is downloaded and unzipped, a file named KS4014 Micro Bit Mini Smart Turtle Car will be generated. It can be placed everywhere.

7.5 Import Code

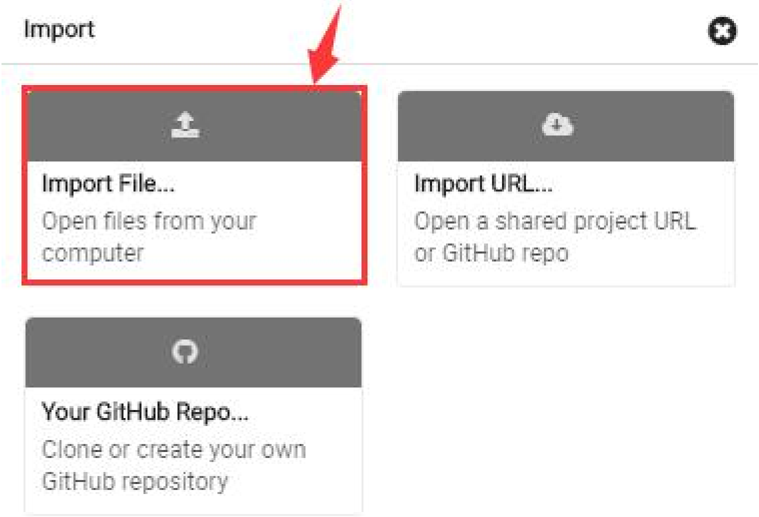
We provide every program with hex file. You could import it directly or program in Makecode blocks area, therefore, the extension library must be added.(How to add extension?)

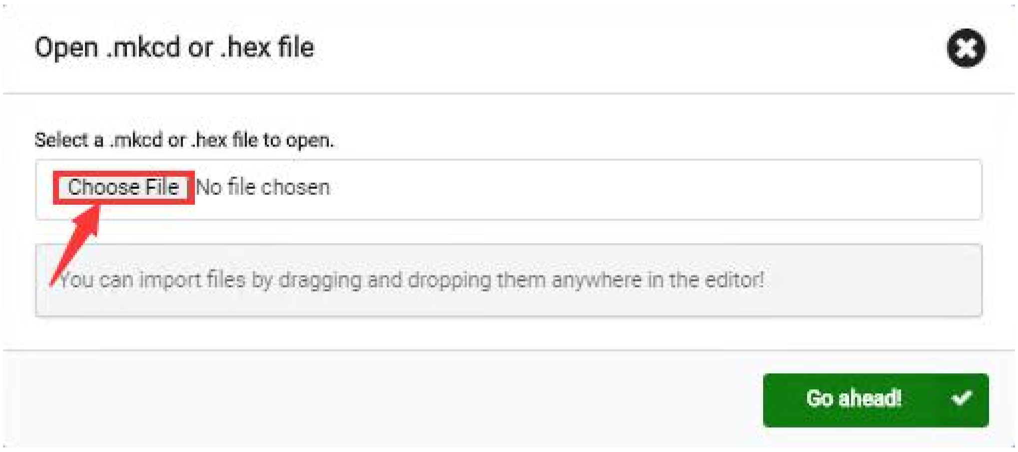
Next, we will take "heartbeat" as example to introduce how to import code

Open Makecode online editor on your computer

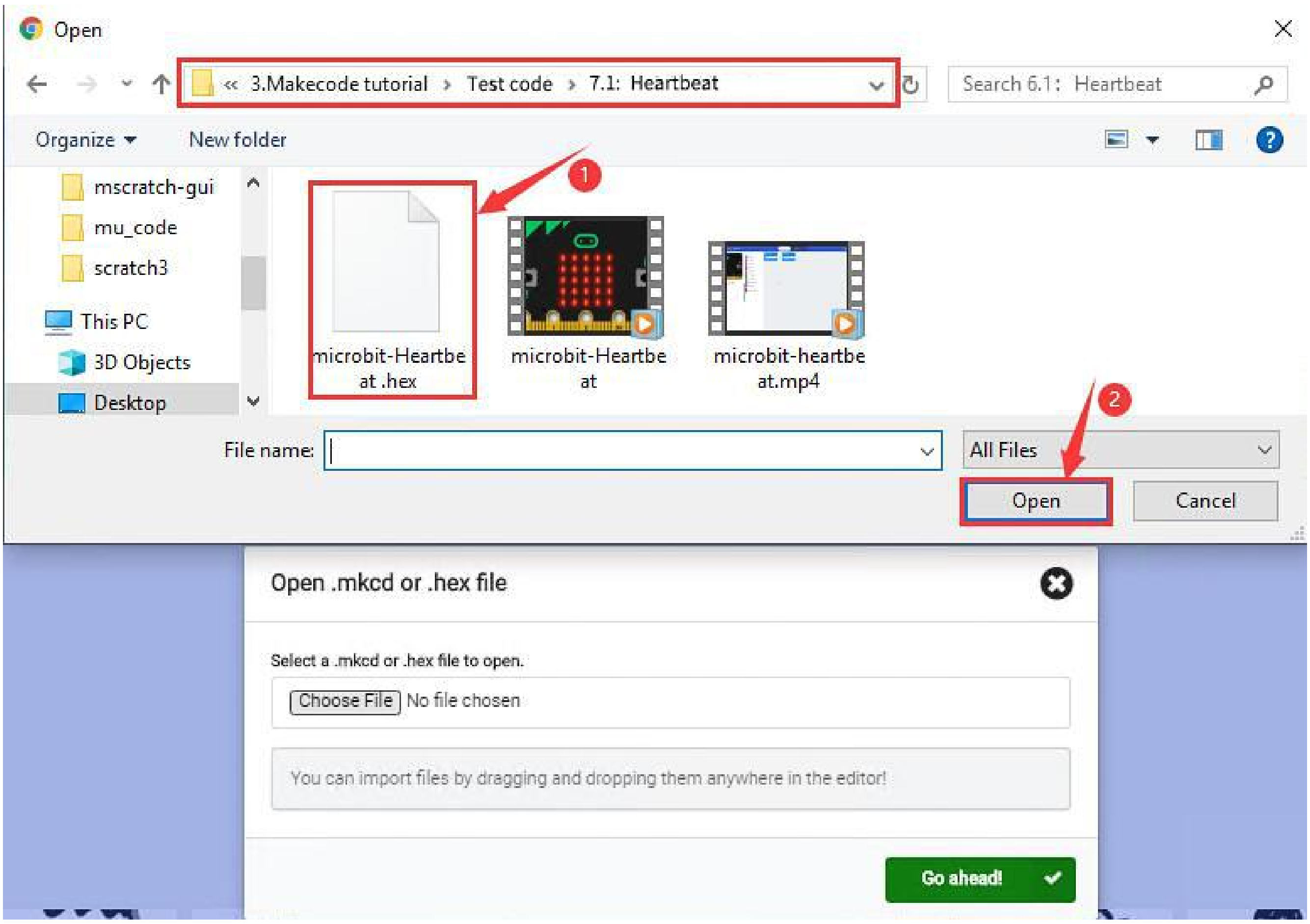


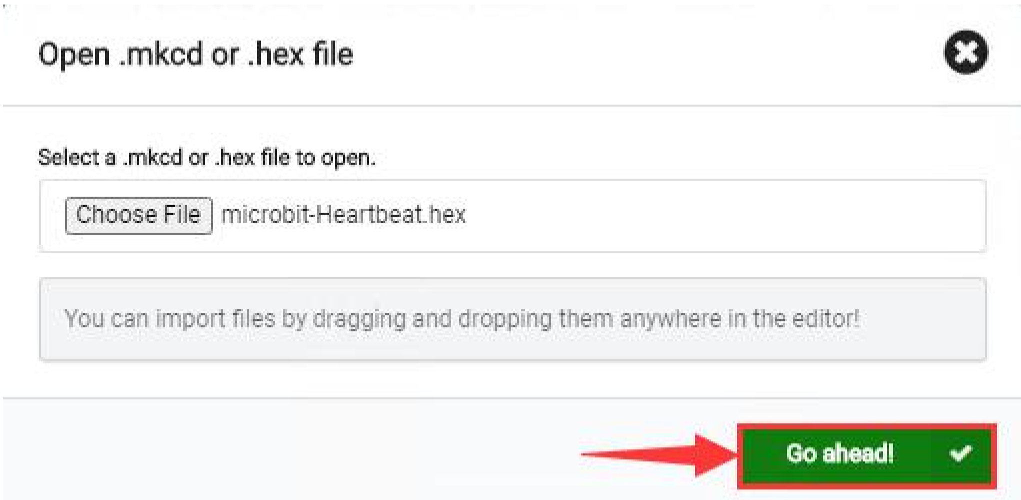
Click "Import" and "Import files"



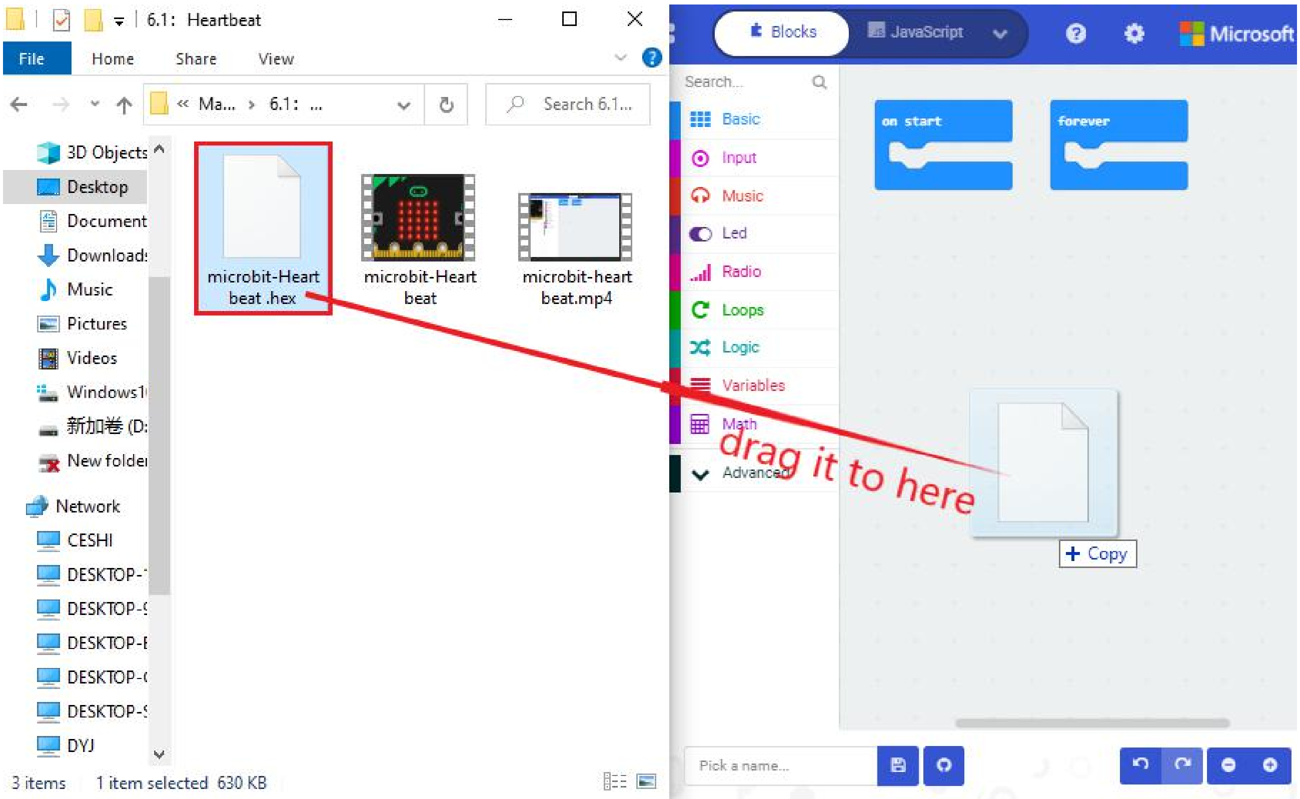


Choose file “../Test Code/7.1 :heartbeat/microbit-heartbeat.hex” , then tap “Go ahead”

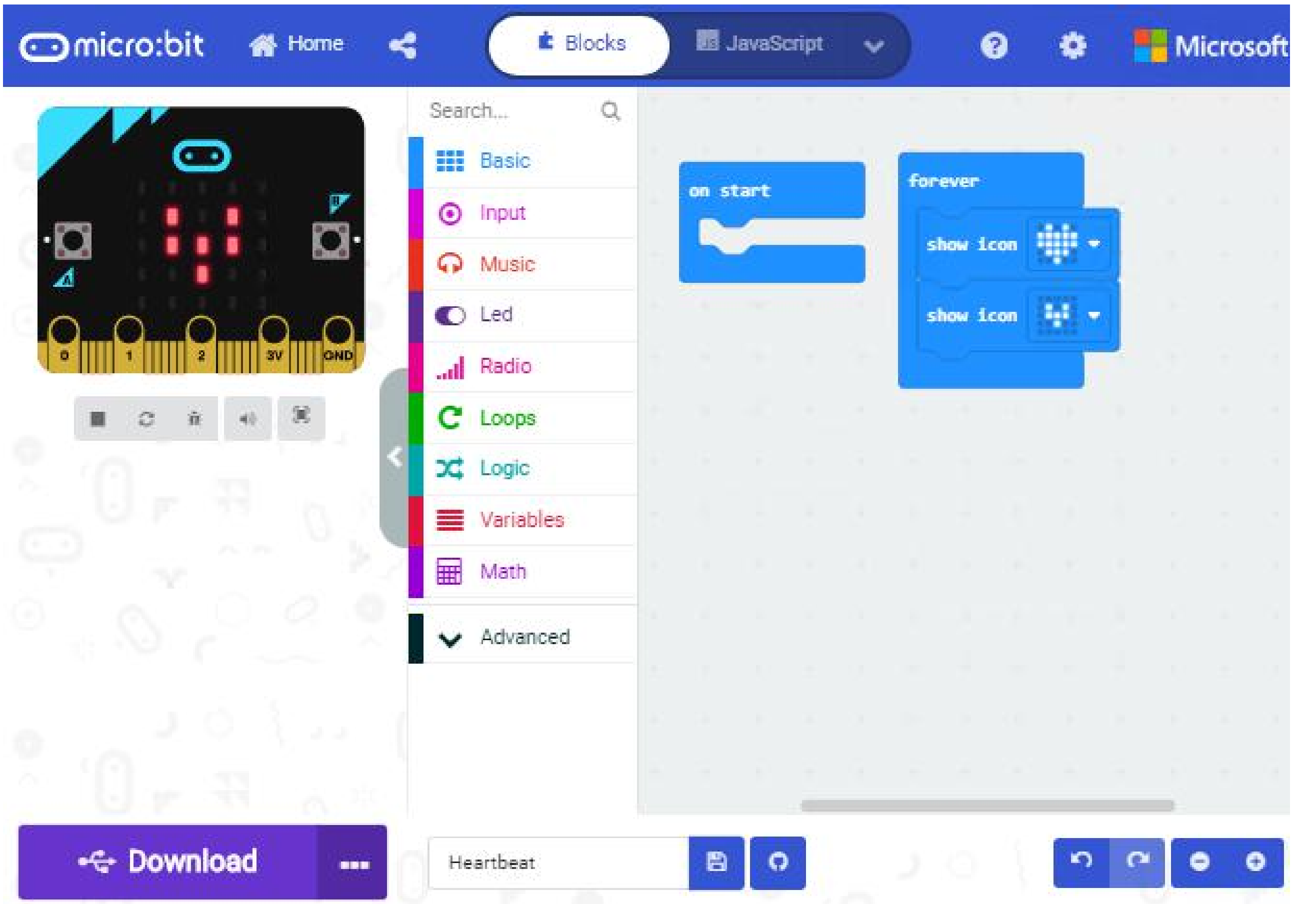




In addition to the above method of importing code , you can also directly drag cod into the Makecode compiler, as shown in the figure below:



The program is imported successfully after seconds



7.6 Install CoolTerm

If your computer system is Windows7/8 rather than Windows 10, the device can’ t be paired in Google Chrome, as a result, the digital/analog signals can’ t be read.

Here, we need CoolTerm software to read data.

For the whole projects, we will use CoolTerm software.

Let’ s install it firstly.

CoolTerm program is used to read the serial communication.

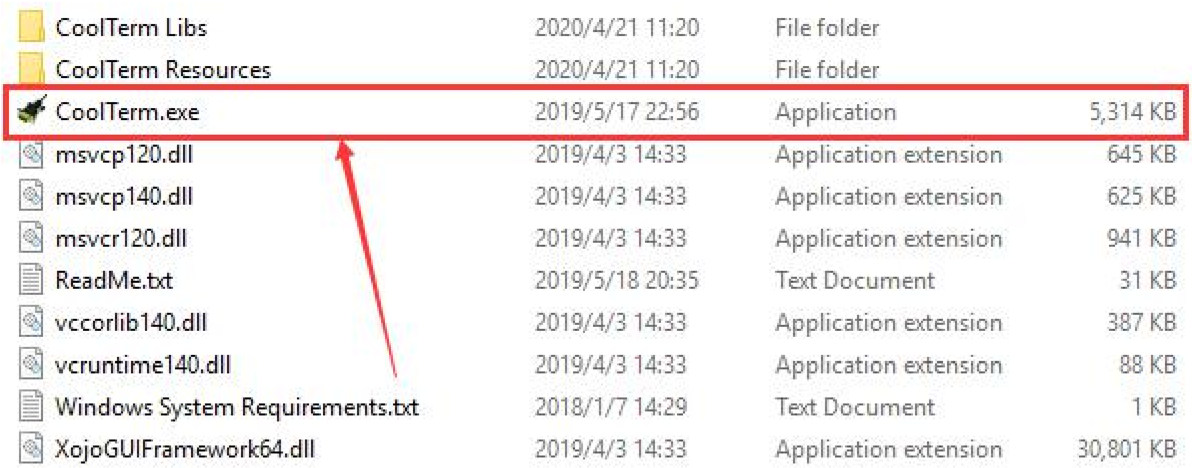
Download CoolTerm program:

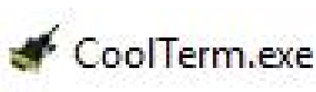
https://freeware.the-meiers.org/

(1) After the download, we need to install CoolTerm program file, the Window system is taken as an example.

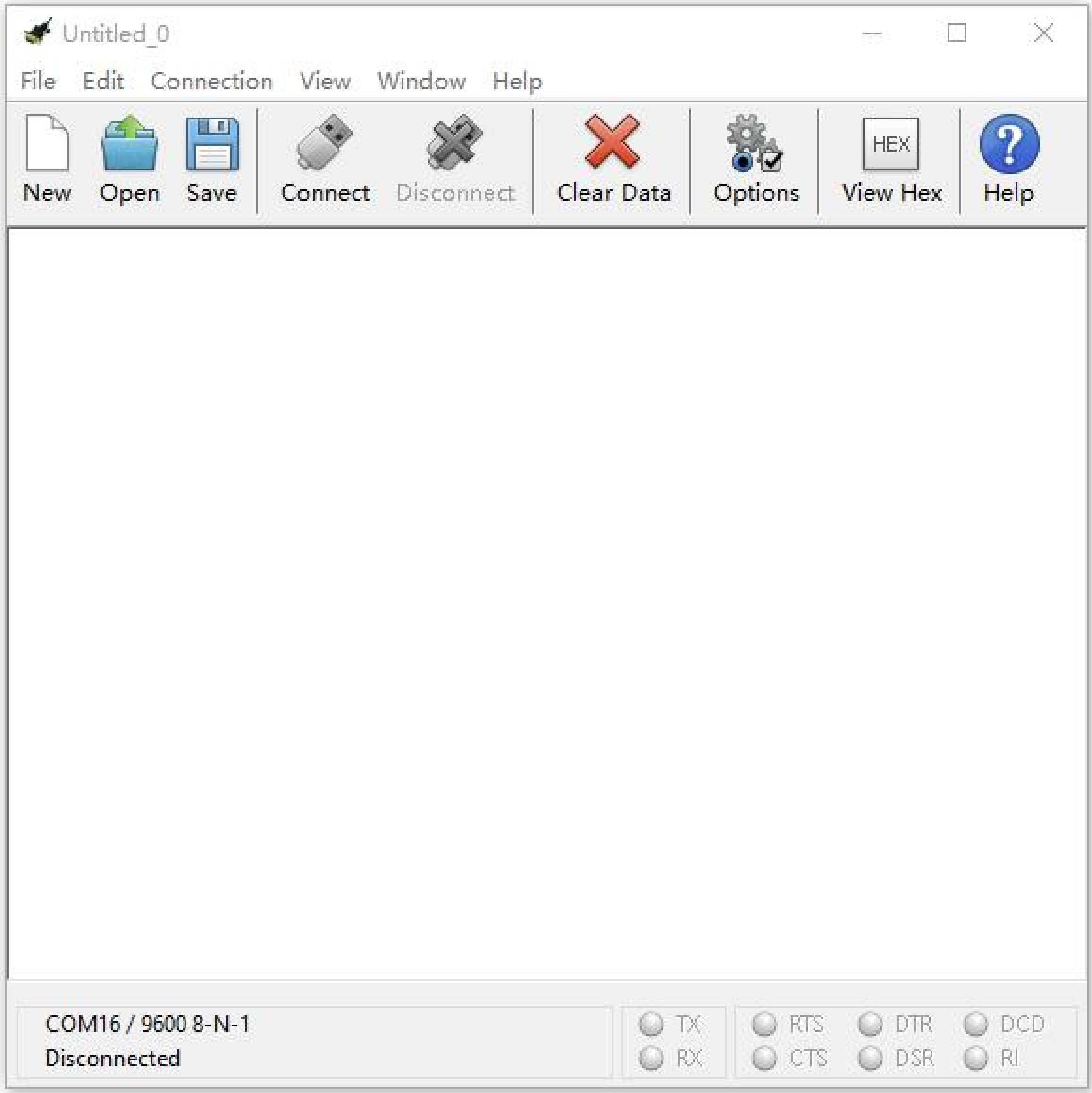
(2) Choose “win”

(3) Unzip file and open it. (also suitable for Mac and Linux system)

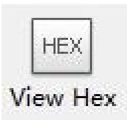


(4) Double-click 

Note: you have to install the driver of micro:bit and connect micro:bit to computer



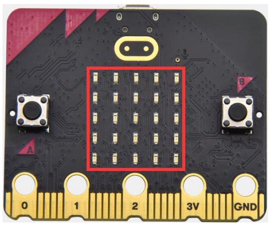
The functions of each button on the toolbar are listed below:

 New	Opens up a new Terminal
 Open	Opens a saved Connection
 Save	Saves the current Connection to disk
 Connect	Opens the Serial Connection
 Disconnect	Closes the Serial Connection
 Clear Data	Clears the Received Data
 Options	Opens the Connection Options Dialog
 HEX View Hex	Displays the Terminal Data in Hexadecimal Format
 Help	Displays the Help Window

8.Projects

(Note: project 1 to 12 will be conducted with the built-in sensors and LED dot matrix of the Micro:bit main board V2)

8.1 : Heartbeat



1. Description :

Prepare a Micro:bit board and USB cable. Next we will conduct a basic experiment that a heartbeat pattern flashes on micro:bit board.

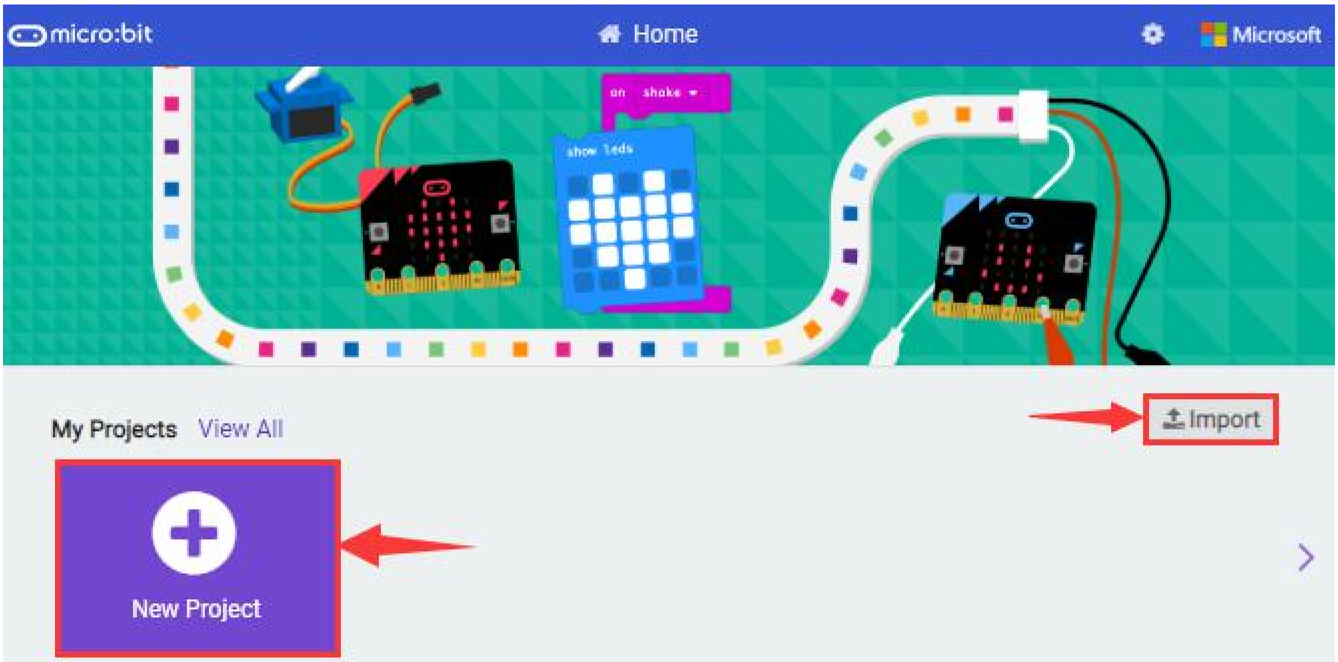
2. Experimental Preparation :

(1) Connect micro:bit to computer with USB cable

(2) Open online Makecode editor

Import Hex profile (How to import?)

Or click "New Project" and drag blocks step by step



3. Test Code :

Type	Route	File Name
Hex file	../Makecode Tutorial/Test Code/8.1 : Heart beat	microbit-Heart beat.hex

Or you could edit code step by step in the editing area.

(1) Go to “Basic” → “show icon”.

Copy it again and place into “forever” block.

Click “❤” to select “ ”.

Complete Program：

“on start”：command block runs once to start program.

The program under the block “forever” runs cyclically.

LED dot matrix displays “❤”

LED dot matrix shows “”

Click “JavaScript" to view the corresponding JavaScript code:

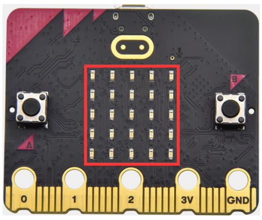
4. Test Results:

Download code to micro:bit and keep USB cable connected. The LED dot matrix will display  and  ceaselessly

(How to download?　How to quick download?)

If download unsuccessfully, disconnect micro:bit and reboot it

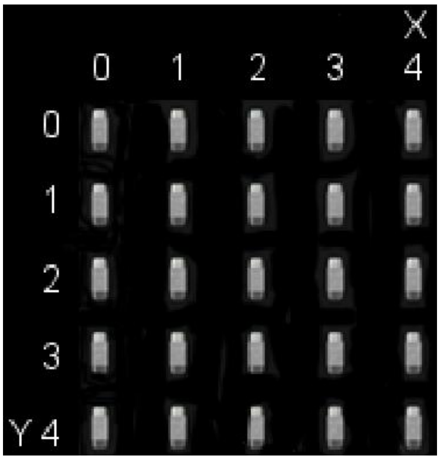
8.2 : Light Up A Single LED



1. Description :

Micro:bit motherboard consists of 25 light-emitting diodes, 5 pcs in a group. They correspond to x and y axis. Then the 5*5 matrix is formed. Moreover, every diode locates at the point of x and y axis.

Virtually, we could control an LED by setting coordinate points. For instance, set coordinate point(0 ,0)to turn on the LED at row 1 and column 1; light up LED at the row 1 and column 3, we could set （2，0) and so on.



2. Experimental Preparation：

(1) Connect micro:bit to computer with USB cable.

(2) Open online Makecode editor.

Import Hex profile (How to import?)

Or click “New Project” and drag blocks step by step

3. Test Code：

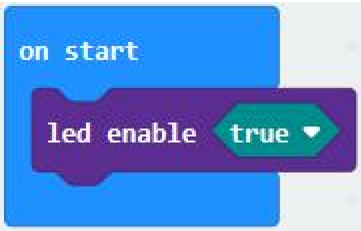
Import hex file:

Type	Route	File Name
Hex file	../Makecode Tutorial/Test Code/8.2 Light Up A Single LED	microbit-Light Up A Single LED.hex

Or you could edit code step by step in the editing area.

(1) A. Click "Led" → "more" → "led enable false"

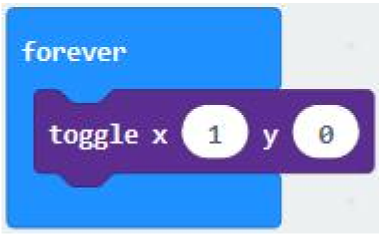
B. Put it into the "on start" block, and click the drop-down triangle button to select "true".



****

(2) A. Enter "Led" → "toggle x 0 y 0" block;

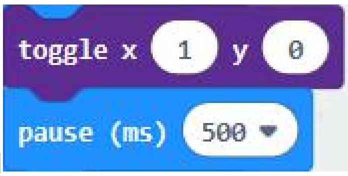
B. Combine it with "forever", alter "x 0" into "x 1".

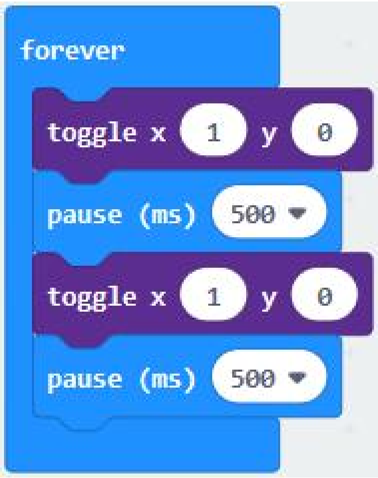


****

(3) A. Enter "Basic" → "pause (ms) 100" from "

B. Then move it below the "toggle x1 y0" block, and set to 500ms.

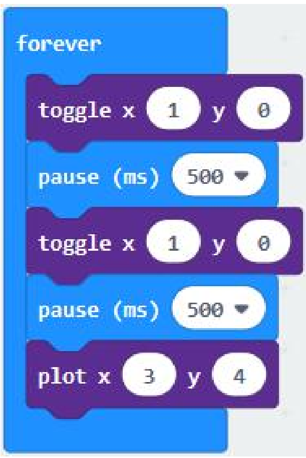
(4) Duplicate code string 

once and place it into“forever” 

block.

****

(1) A. Enter “Led” → “plot x 0 y 0”

B. Keep it beneath block “pause(ms)500”, then set to “plot x 3 y 

4”.

****

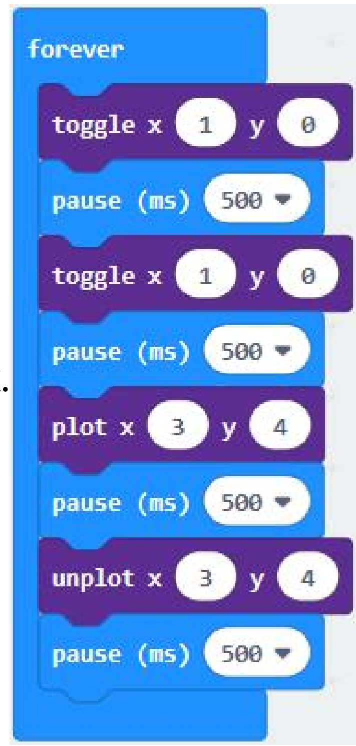
(2) Replicate “pause (ms) 500” once and keep it below the block “plot x3y4”

(3)

A. Click “Led” → “unplot x 0 y 0” and set to “unplot x3 y 4” ;

B. Lay down it beneath “pause (ms) 500” block

C. Copy “pause (ms) 500” block once, and keep it below the “unplot x3 y 4” block.



Complete Program :

"on start": command block only runs once to start program.

Turn on LED dot matrix.

The program under the block "forever" runs cyclically.

Toggle the LED brightness at coordinate point "x 1 y 0".

Toggle the LED brightness at coordinate point "x 1 y 0".

Turn on the LED at coordinate point "x3 , y4".

Delay in 500ms

Turn off the LED at coordinate point "x3 y4".

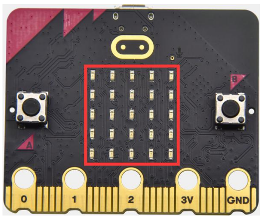
Click “JavaScript” to switch into corresponding JavaScript code:

4. Test Results：

Upload program and plug in micro:bit via USB port, the LED at coordinate point (1,0) flashes for 0.5s, then the LED at (3,4) blinks for 0.5s, alternately.

(How to download? How to quick download?)

8.3 : 5 x 5 LED Dot Matrix



1. Description :

Dot matrices are very commonplace in daily life. They have found wide applications in LED advertisement screens, elevator floor display, bus stop announcement and so on.

The LED dot matrix of Micro: Bit main board V2 contains 25 LEDs in a grid. Previously, we have succeeded in controlling a certain LED to light by integrating its position value into the test code. Supported by the same theory, we can turn on many LEDs at the same time to showcase patterns, digits and characters.

What' s more, we can also click" show icon " to choose the pattern we like to display. Last but not the least, we can our design patterns by ourselves.

2. Experimental Preparation :

(1) Connect micro:bit to computer with USB cable

(2) Open online Makecode editor

Import Hex profile (How to import?) , or click "New Project" and drag blocks step by step.

3. Test Code :

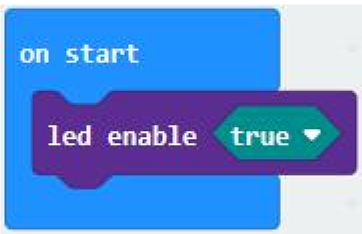
Code 1 :

Type	Route	File Name
Hex file	../Makecode Tutorial/Test Code/8.3：5 x 5 LED Dot Matrix/Code-1	microbit-Code-1.hex

Or you could edit code step by step in the editing area.

(1) A. Enter "Led" → "more" → "led enable false"

B. Click the drop-down triangle button to select " true "

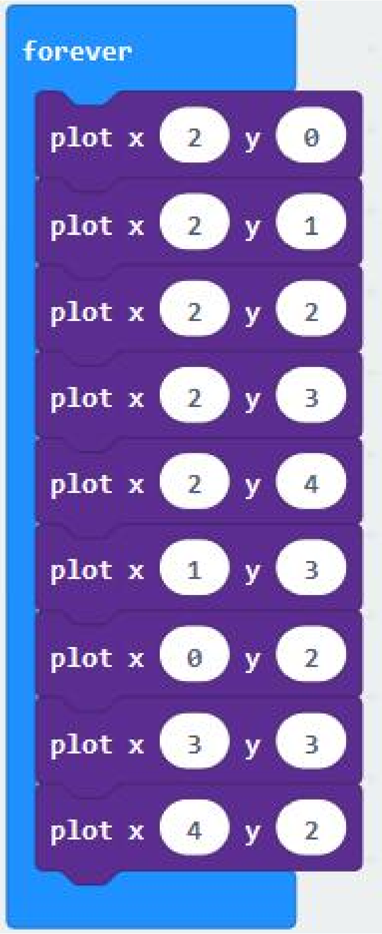


C. Combine it with "on start" block

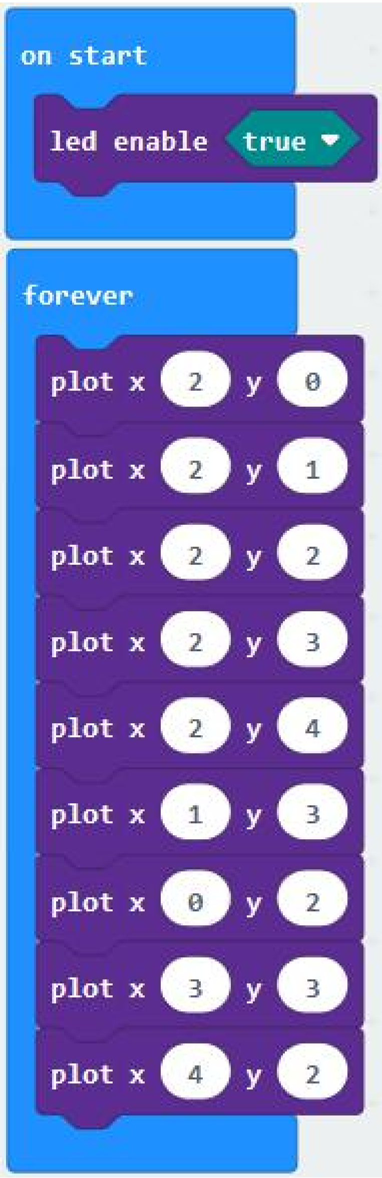
****

(2) Click "Led" to move "plot x 0 y 0" into "forever", then replicate "plot x 0 y 0" for 8 times, respectively set to "x 2" y 0", "x 2" y 1", "x 2" y 2",

“x 2” y 3” , “x 2” y 4” , “x 1” y 3” “x 0” y 2” , “x 3” y 3” , “x 4” y 2” .



Complete Program :



"on start": command block only runs once to start program.

Turn on LED dot matrix.

The program under the block "forever" runs cyclically.

Toggle the LED brightness at coordinate point "x 2 , y 0", "x 2 , y 1", "x 2 , y 2", "x 2 , y 3", "x 2 , y 4", "x 1 , y 3", "x 0 , y 2", "x 3 , y 3", "x 4 , y 2"

Click “JavaScript" to switch into the corresponding JavaScript code:

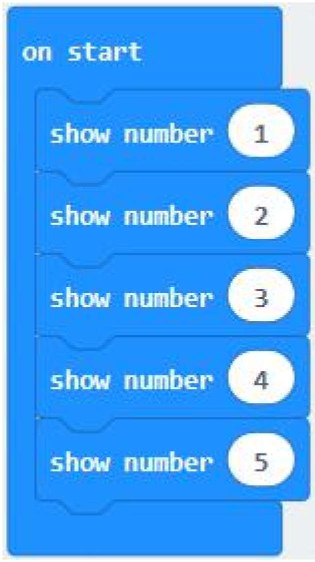
Code 2：

Type	Route	File Name
Hex file	../Makecode Tutorial/Test Code/8.3: 5 x 5 LED Dot Matrix/Code-2	microbit-Code-2.hex

Or you could edit code step by step in the editing area.

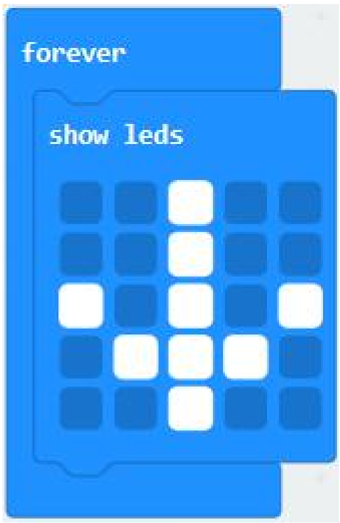
(1) A. Enter “Basic” → “show number 0” block,

B. Duplicate it for 4 times, then separately set to “show number 1”, “show number 2”, “show number 3”, “show number 4”, “show number 5”.



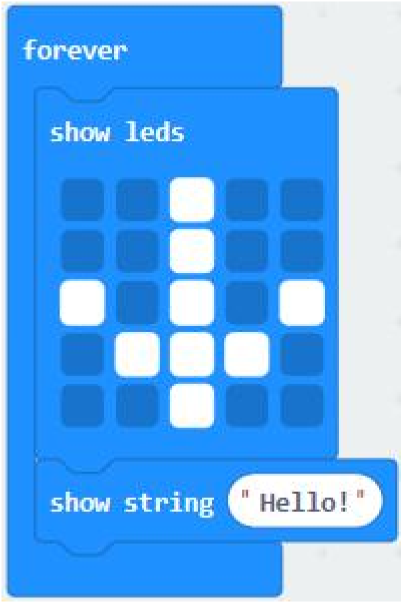
****

(2) Click “Basic” → “show leds”, then put it into “forever” block, tick blue boxes to light LED and generate “↓” pattern.

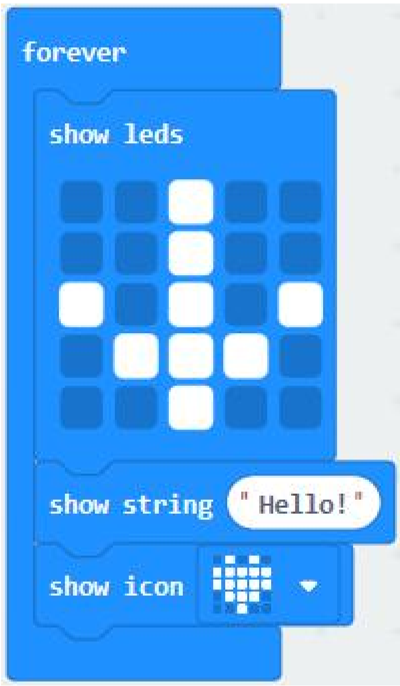


****

(3) Move out the block “show string” from “Basic” block, and leave it beneath the “show leds” block



Choose "show icon" from "Basic" block, and leave it beneath the block "show string "Hello!" block

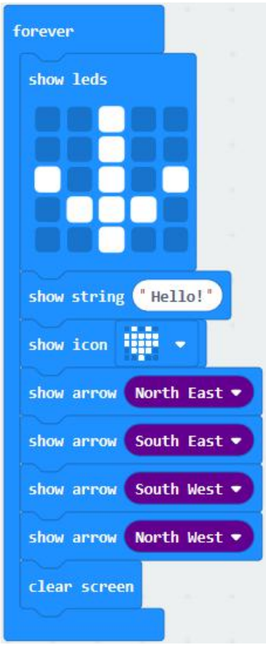


****

(4) A. Enter "Basic" → "show arrow North";

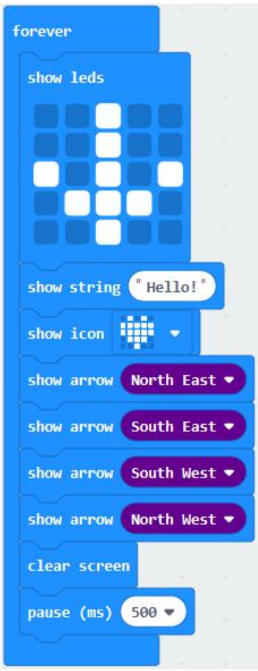
B. Leave it into “forever” block , replicate “show arrow North” for 3 times , respectively set to “North East” , “South East” , “South West” , “North West” .

(5) Click “Basic” to get block “clear screen” then remain it below the block “show arrow North West”

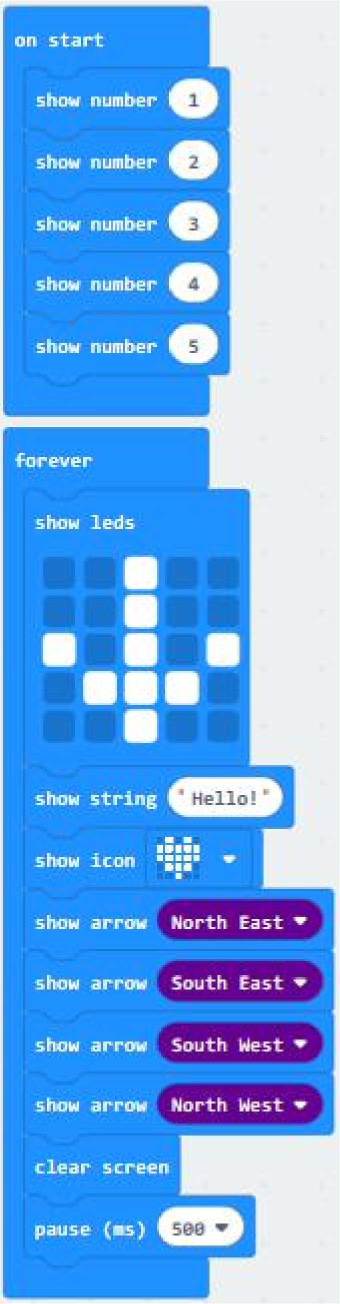


****

(6) Drag "pause (ms) 100" block from "Basic" block and set to 500ms, then leave it below "clear screen" block.



Complete Program:



"on start": command block only runs once to start program.

LED dot matrix displays 1, 2, 3, 4, 5

Under the block"forever" , program runs cyclically.

Dot matrix shows the "↓" pattern

Dot matrix displays "Hello!" in scroll way

"❤" is shown on dot matrix

LED dot matrix displays "North East" arrow.

The "South East" arrow shows up on LED dot matrix

The "South West" appears up on LED dot matrix

The "North West" is displayed on LED dot matrix

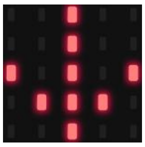
Clear the screen

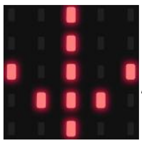
Delay in 500ms

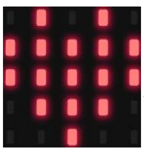
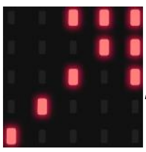
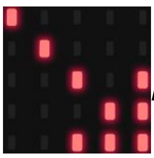
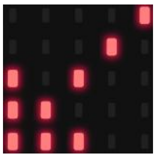
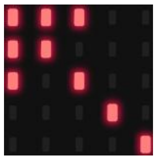
Click “JavaScript" to check the corresponding JavaScript code:

4. Test Results :

Upload code 1 and plug in micro:bit via USB cable , we will see the icon

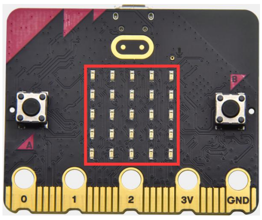
.

Upload code 2 and plug in micro:bit via USB cable. Micro: bit starts showing number 1, 2, 3, 4, and 5, then cyclically displays patterns ,

“Hello!” , , , ,  and .

(How to download? How to quick download?)

8.4 : Programmable Buttons



1. Description :

The button can control the on and off of the circuit. The button is attached to the circuit. The circuit is disconnected when the button is not pressed. The circuit is connected as soon as it is pressed, but it is disconnected after being released.

Both ends of button are like two mountains. There is a river in between. The internal metal piece connect the two sides to let the current pass, just like building a bridge to connect the two mountains.

Micro:bit board has three buttons, the reset button on the back and two programmable buttons on the front. By pressing these buttons, the corresponding characters will be displayed on dot matrix.

2. Experimental Preparation :

(1) Connect micro:bit to computer with USB cable

(2) Open online Makecode editor

Import Hex profile(How to import?) , or click "New Project" and drag blocks step by step.

3. Test Code :

Code 1 :

Press buttons on micro:bit, micro:bit will display character strings.

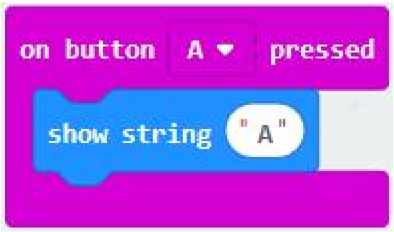
Type	Route	File Name
Hex file	../Makecode Tutorial/Test Code/8.4 : Programmable Buttons/Code-1	microbit-Code-1.hex

Or you could edit code step by step in the editing area.

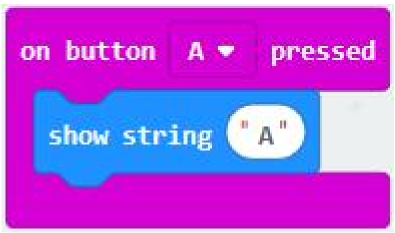
You could edit code step by step in the editing area.

(1) A. Click “Basic” → “show string” ;

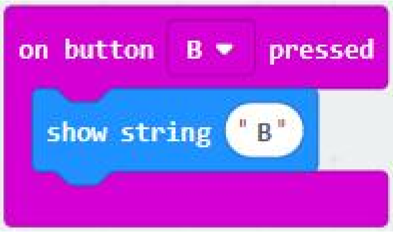
B. Then place it into “on button A pressed” block, change “Hello!” into “A” .



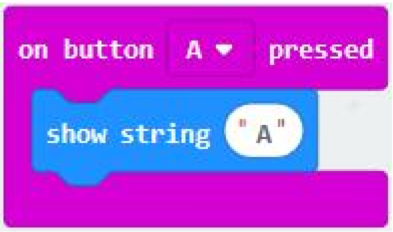
(2) Copy code string

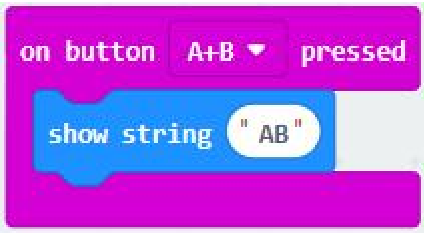


once, tap the drop-down button “A” to select “B” and modify character “A” into

“B” . 

****

(3) Copy  once , and set to “on button A+B pressed” and “show string “AB”



Complete Code:

Press button A on Micro: bit main board

Show the character “A”

Press button B on Micro: bit main board

Show the character “B”

Press button A and B at same time

Display the character “AB”

Click “JavaScript" to switch into the corresponding JavaScript code:

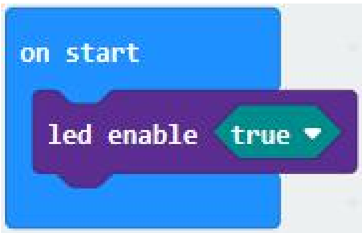
Code 2：

Type	Route	File Name
Hex file	../Makecode Tutorial/Test Code/8.4：Programmable Buttons/Code-2	microbit-Code-2.hex

Or you could edit code step by step in the editing area.

You could edit code step by step in the editing area.

(1) A. Click “Led” → “more” → “led enable false”,

B. Put it into the block “on start”，click drop-down triangle button to select “true” 

.

****

(2) A. Tap “Variables” → “Make a Variable...” → “New variable name：”

B. Enter “item” in the dialog box and click “OK”，then variable “item” is produced. And move “set item to 0” into “on start” block

(3) A. Click "Input" → "on button A pressed".

B. Go to "Variables" → " change item by 1 "

C. Place it into " on button A pressed " and 1 is modified into 5. 

****

(4) Duplicate 

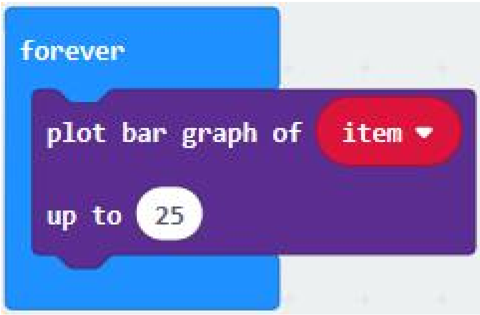
code string once , click the drop-down button to select " B " , then set " change item by -5". 

****

(5) A. Enter "Led" → "plot bar graph of 0 up to 0"

B. Keep it into "forever" block

C. Go to "Variables" to move "item" into 0 box , change 0 into 25.



****

(6) A. Go to "Logic" to move out "if...true...then..." and "=" blocks ,

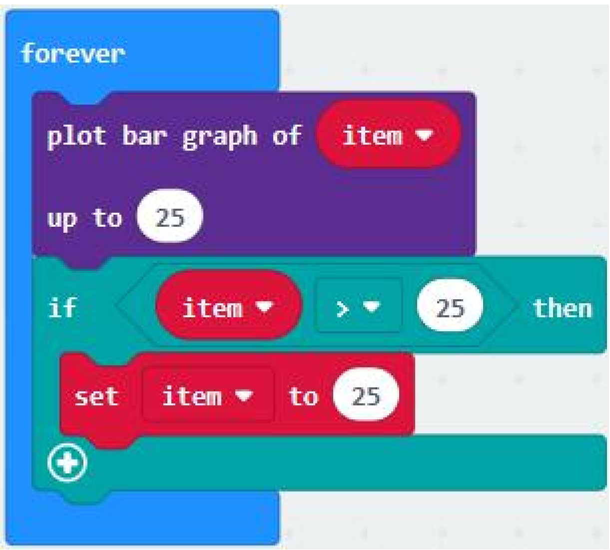
B. Keep "=" into "true" box and set to ">"

C. Select "item" in the "Variables" and lay it down at left box of ">" ,

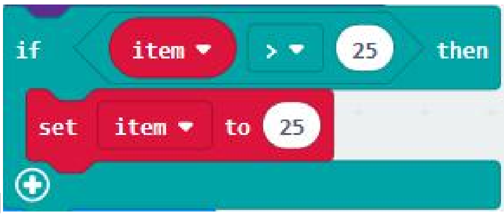
change 0 into 25 ;

D. Enter "Variables" to drag "set item to 0" block into "if...true..then..." , alter

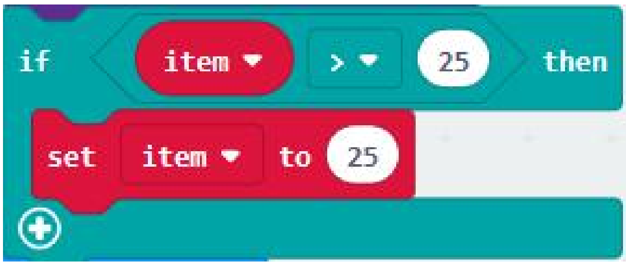
0 into 25.

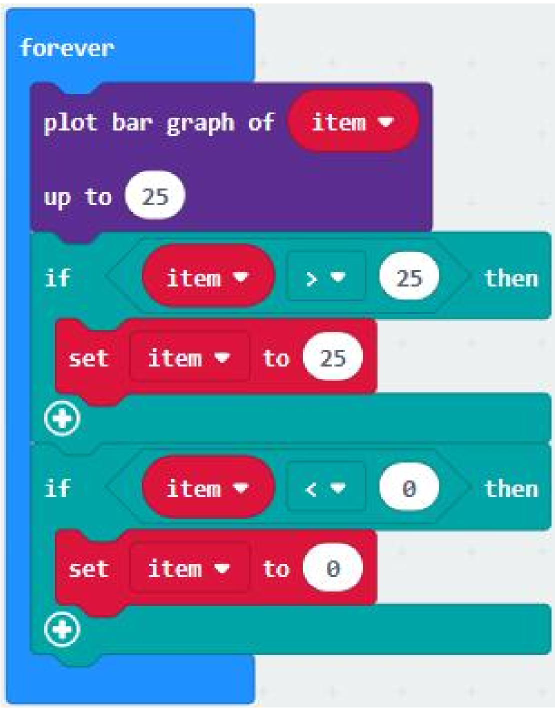


****

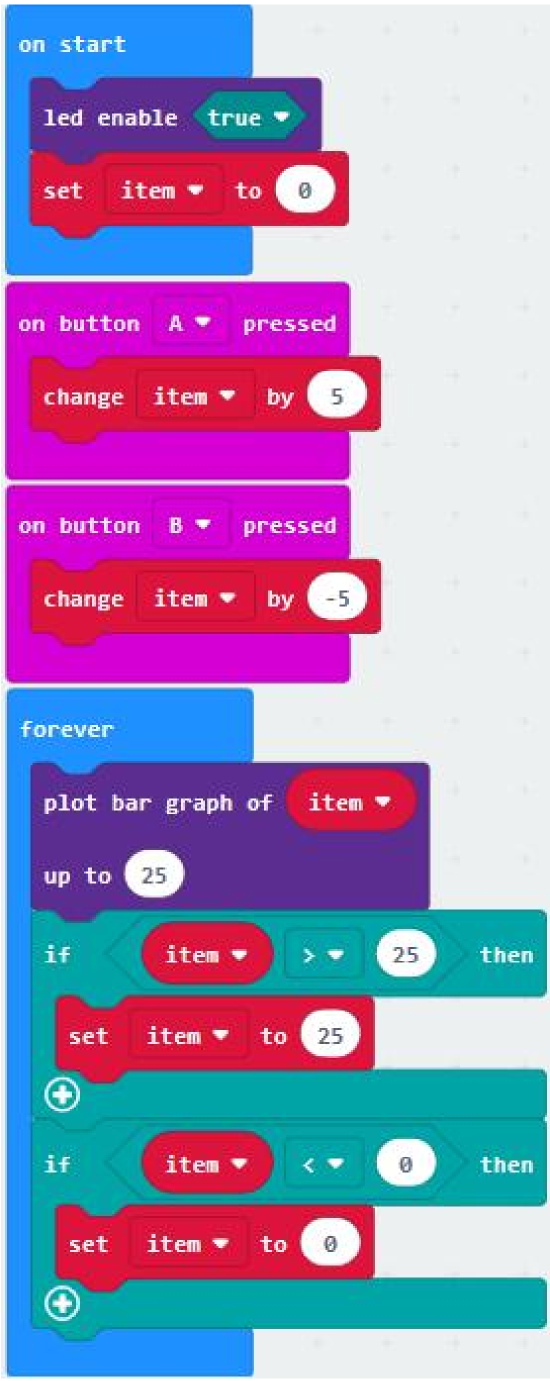
(7) A. Replicate code string  once

B. “>” is modified into “<” and 25 is changed into 0,

C. Leave it beneath  code string.



Complete Program :



"on start": command block runs once to start program.

Turn on LED dot matrix

Set the initial value of item to 0

Press button A on Micro:bit board

Change item by 5

Press button B on Micro:bit board

Change item by -5

The program under the block "forever" runs cyclically.Light on LED in dot matric to draw bar graph, light up up to 25 LEDs

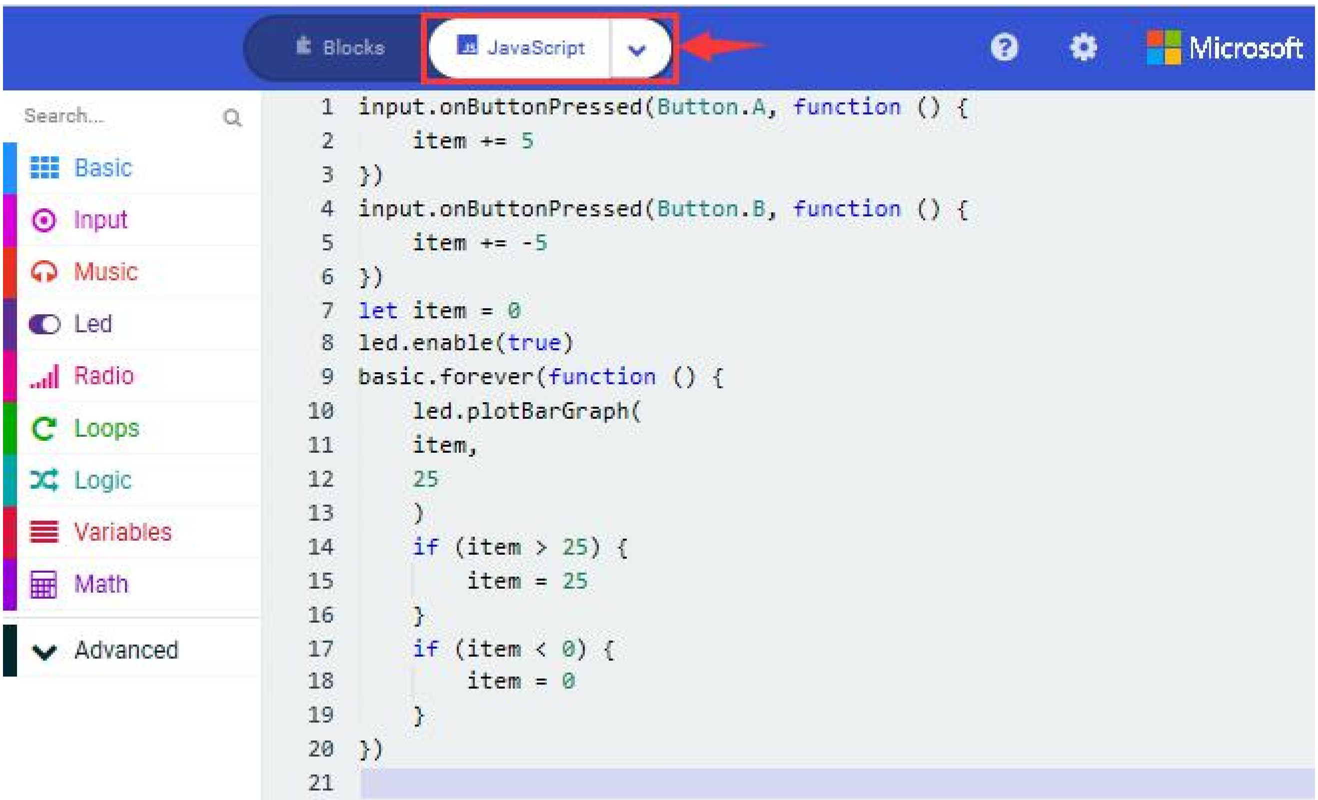
If item is greater than 25

Then set item to 25

If item is less than 0

Then set item to 0

Click “JavaScript" to switch into JavaScript code:



4. Test Results：

Upload code 1 and plug in micro:bit via USB cable, 5×5 LED dot matrix will show “A” if button A is pressed, in case that button B is pressed, “B” will appear. So will micro:bit show “AB” if you press A and B buttons simultaneously.

Upload code 2 and plug in board via USB cable. A row of luminous LEDs are added if button A is pressed, when B pressed, a row of luminous LEDs are deducted.

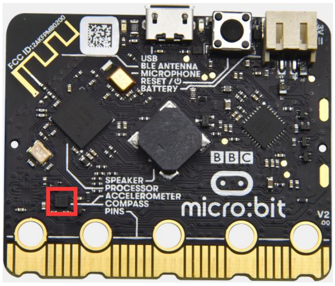
(How to download? How to quick download?)

8.5 : Temperature Measurement

1. Description :

Micro:bit main board doesn’ t come with temperature sensor actually, but detect temperature through built-in temperature of NFR51822 chip. Thereby, the detected temperature is more close to chip’ s temperature.

Note: the temperature sensor of Micro:bit main board is shown below:



2. Experimental Preparation :

(1) Connect micro:bit to computer with USB cable

(2) Open online Makecode editor.

Import Hex profile(How to import?) , or click “New Project” and drag blocks step by step

3. Test Code :

Code 1 :

Micro:bit detects temperature

Type	Route	File Name
Hex file	../Makecode Tutorial/Test Code/8.5 : Temperature Measurement /Code-1	microbit-Code-1.hex

Or you could edit code step by step in the editing area.

(1) Go to “Advanced” → “Serial” → “serial redirect to USB”

Place it into “on start”

****

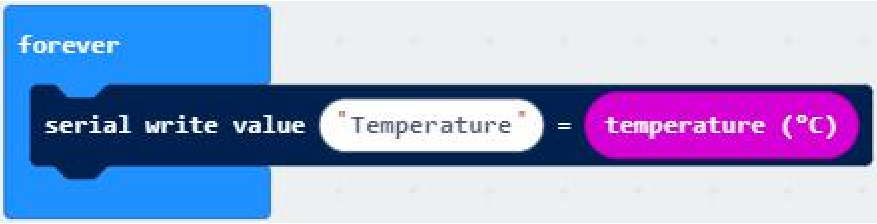
(2) Click “Serial” to drag out “serial write value x=0”

Move it into “forever” block

(3) Go to “Input” → “temperature(℃)”

Place it into 0 box

Change x into Temperature



****

(4) Move "pause (ms) 100" from "Basic" block and place it under block "serial write.....temperature(℃)"

Complete Program：

"on start" : command block runs once to start program.

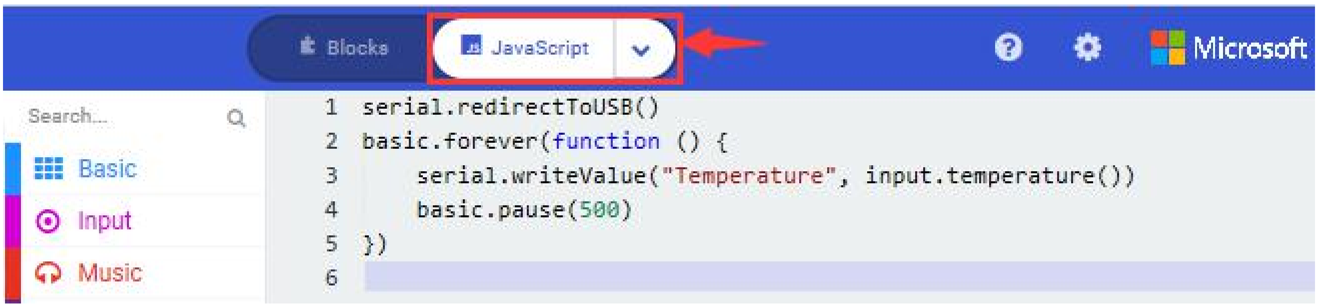
Serial redirect to USB

The program under the block "forever" runs cyclically.

Serial writes Temperature

Delay in 500ms

Click “JavaScript" to view the corresponding JavaScript code:

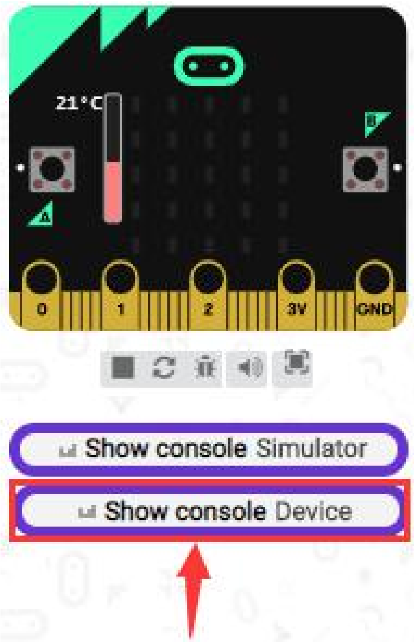


(How to quick download?)

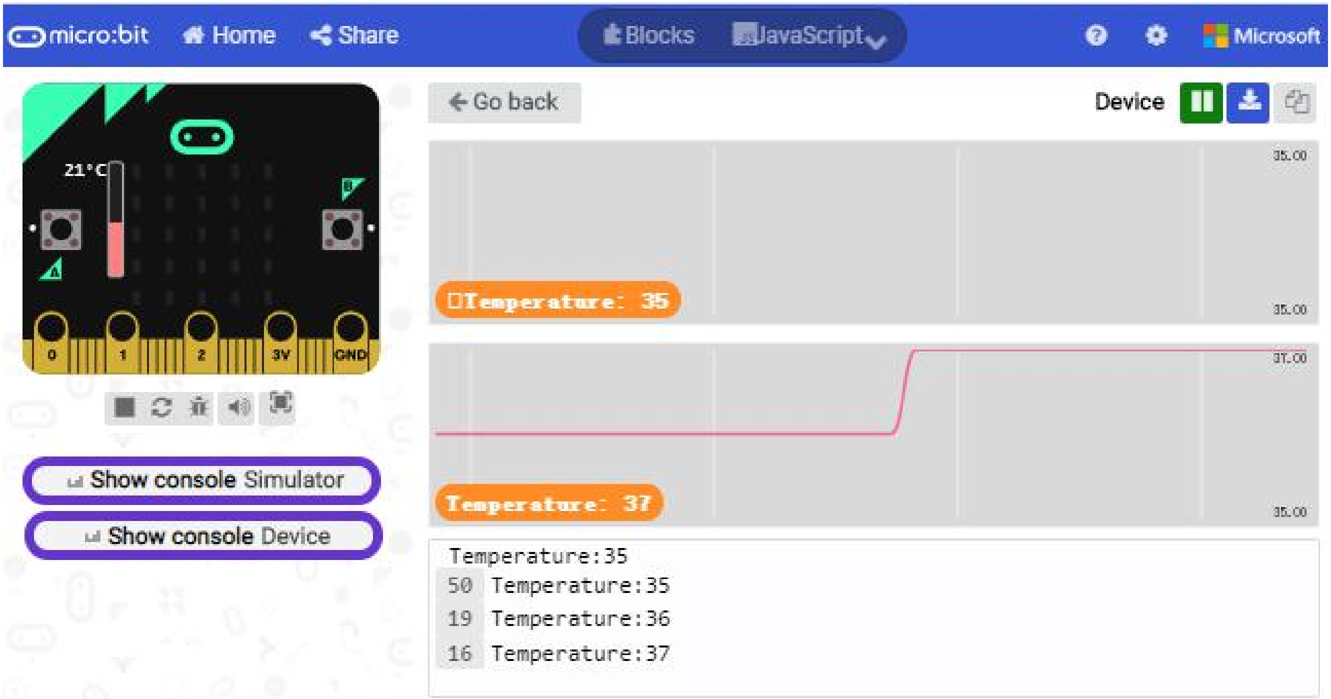
Download code 1 to micro:bit board and keep USB cable connected, then tap button 

:

(How to quick download?)



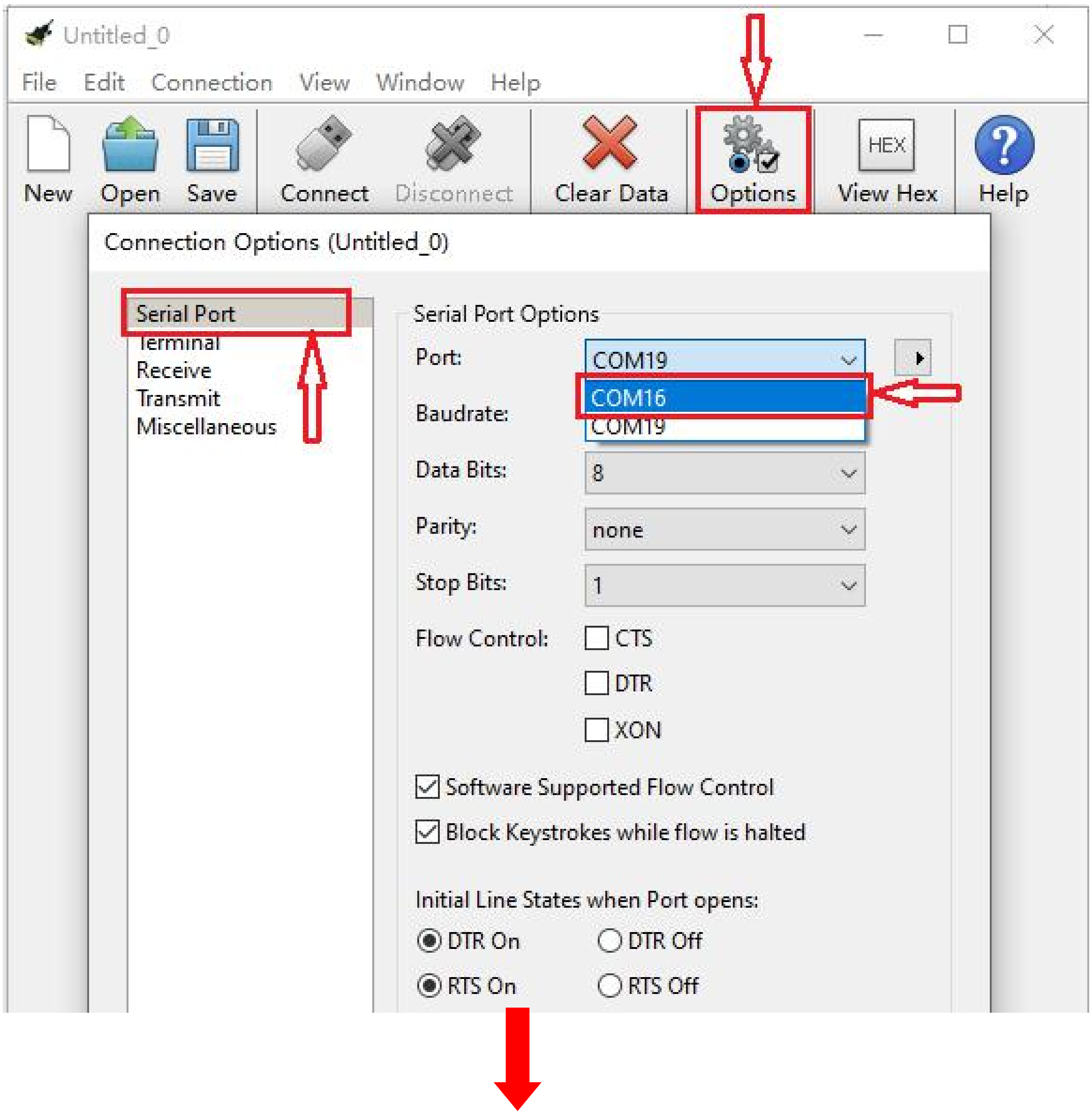
Temperature data is shown below:

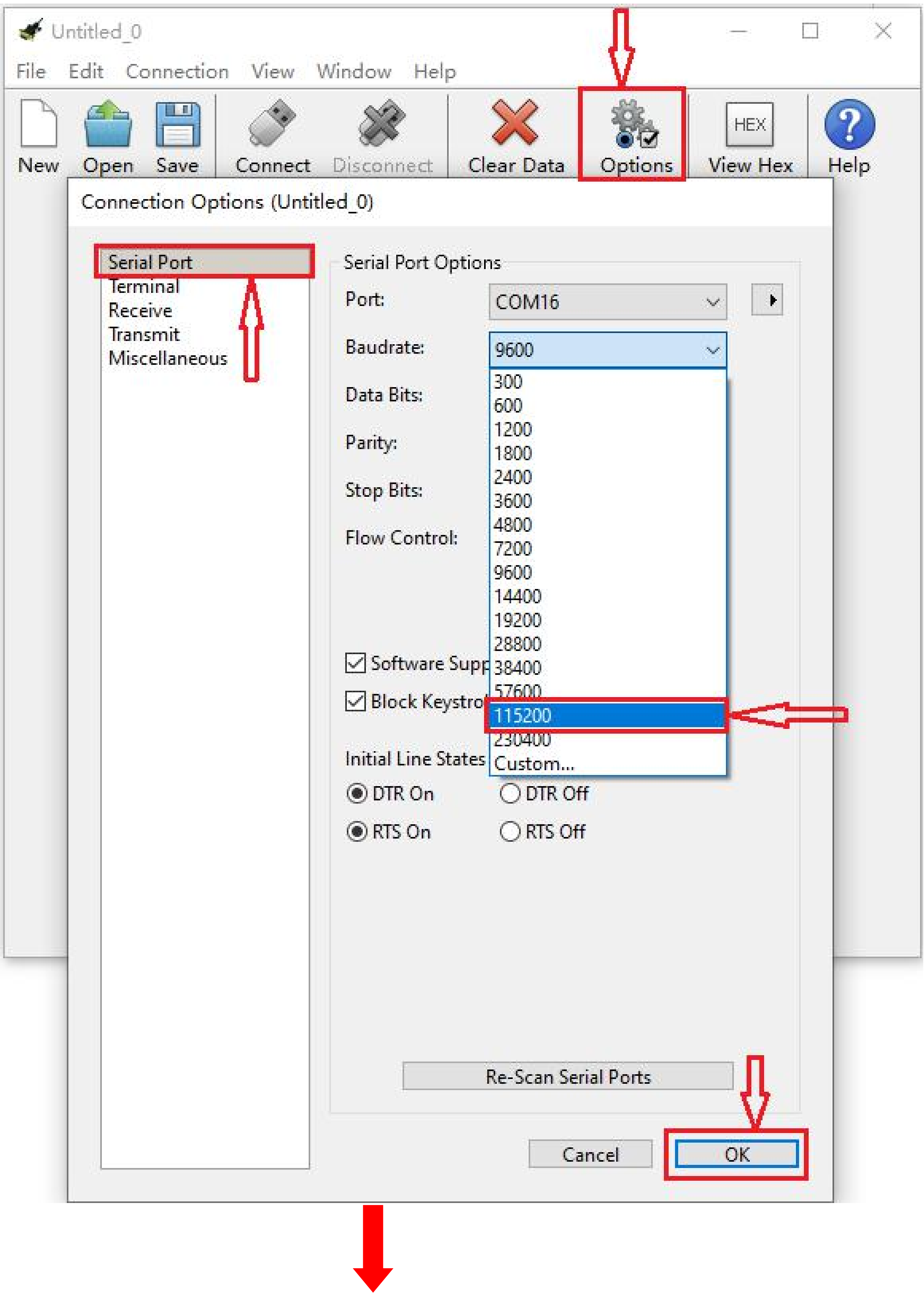


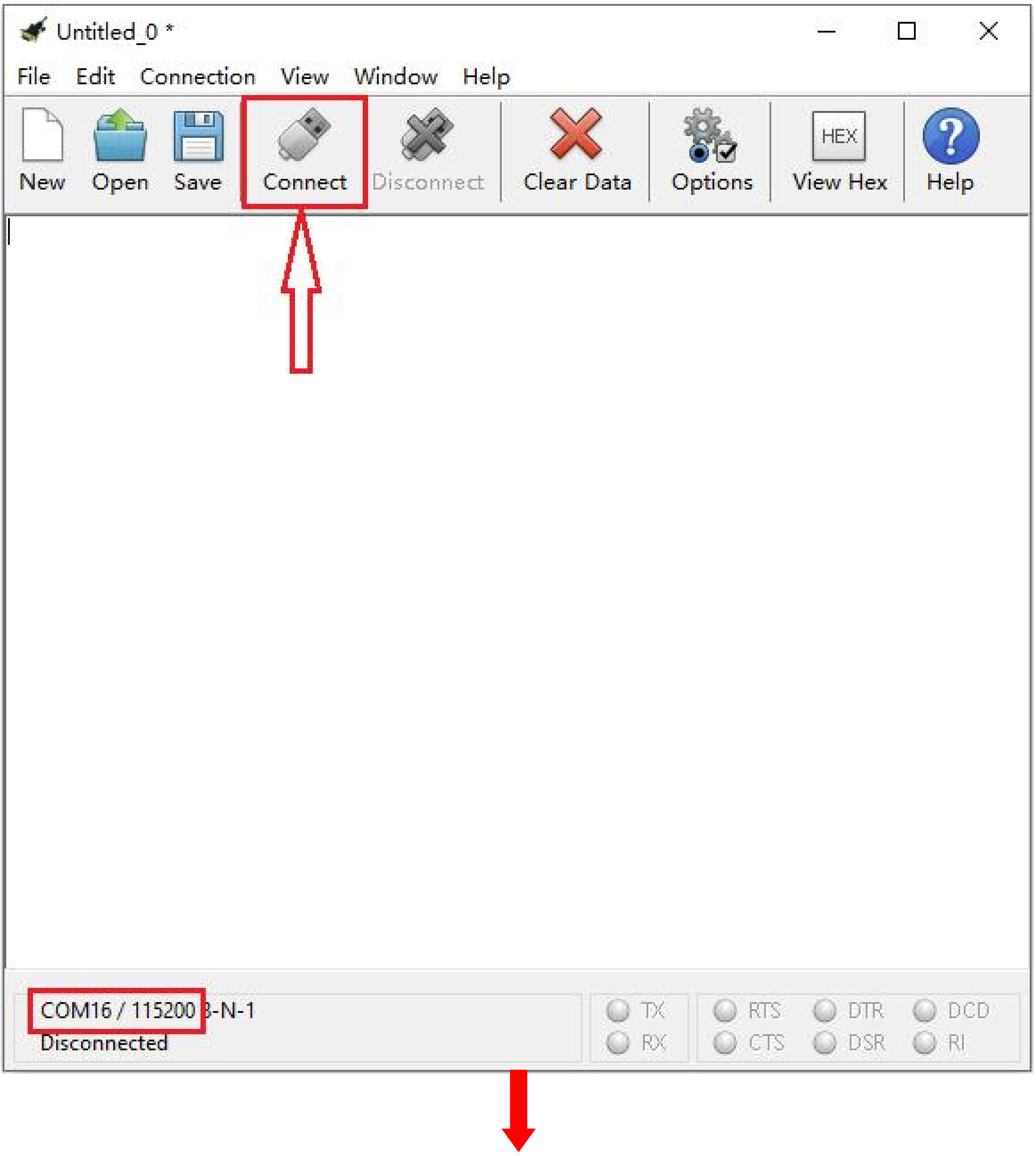
Through the test, the room temperature is 35 ℃ when touching the NFR51822 chip of micro:bit; however, the temperature rises to 37℃ when it touches water cup.

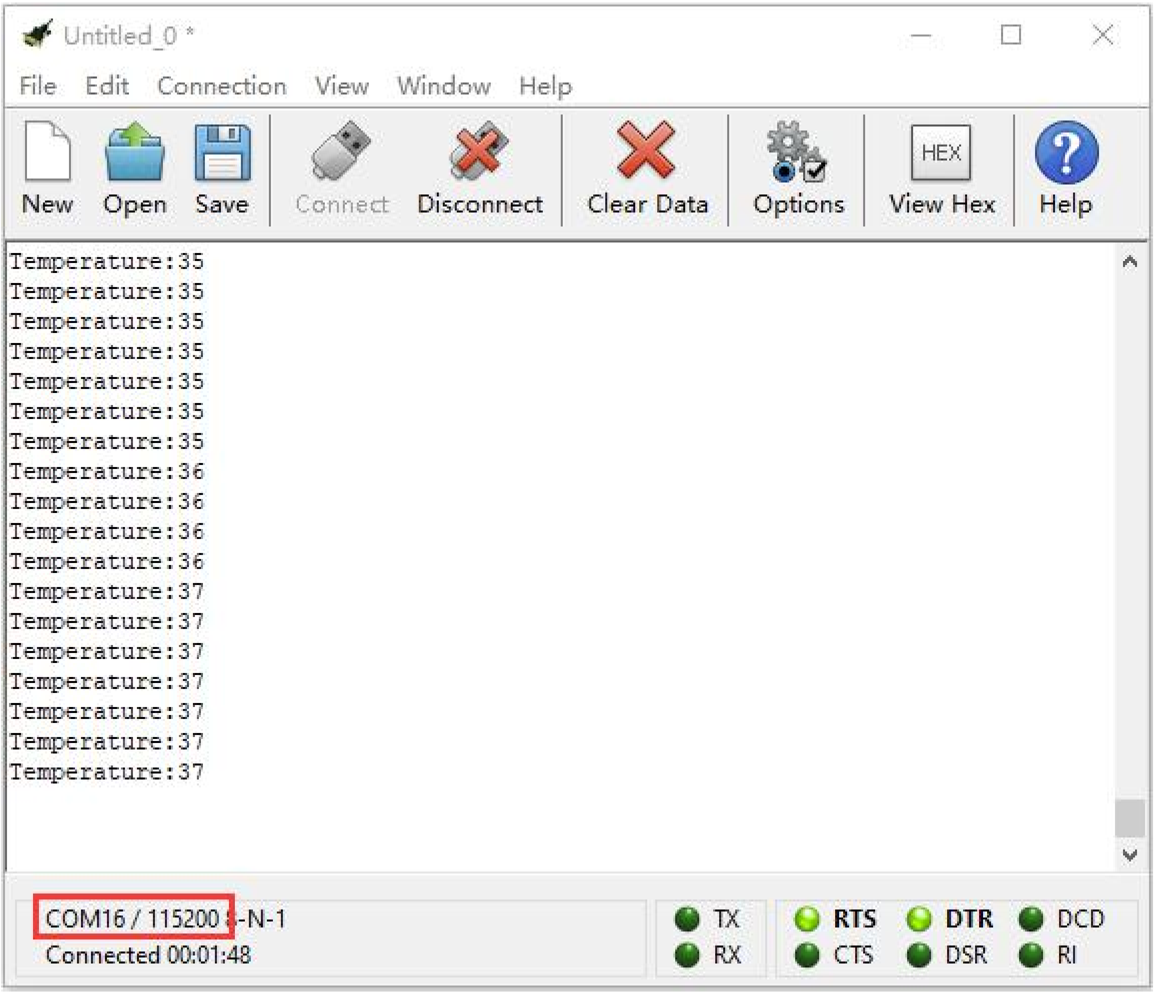
Open CoolTerm, click Options to select SerialPort. Set COM port and 115200 baud rate(the baud rate of USB serial communication of Micro:bit is 115200 through the test). Click "OK" and "Connect".

The serial monitor shows the current ambient temperature value, as shown below:


Untitled_0
File Edit Connection View Window Help
New Open Save Connect Disconnect Clear Data Options View Hex Help
HEX
Connection Options (Untitled_0)
Serial Port
Terminal
Receive
Transmit
Miscellaneous
Serial Port Options
Port:
COM19
COM16
COM19
Baudrate:
Data Bits:
8
Parity:
none
Stop Bits:
1
Flow Control:
CTS
DTR
XON
Software Supported Flow Control
Block Keystrokes while flow is halted
Initial Line States when Port opens:
DTR On
DTR Off
RTS On
RTS Off


Untitled_0
File Edit Connection View Window Help
New Open Save Connect Disconnect Clear Data Options View Hex Help
Connection Options (Untitled_0)
Serial Port
Terminal
Receive
Transmit
Miscellaneous
Serial Port Options
Port:
COM16
Baudrate:
9600
Data Bits:
Parity:
Stop Bits:
Flow Control:
300
600
1200
1800
2400
3600
4800
7200
9600
14400
19200
28800
38400
57600
115200
230400
Custom...
Software Supp
Block Keystro
Initial Line States
DTR On
DTR Off
RTS On
RTS Off
Re-Scan Serial Ports
Cancel
OK


Untitled_0 *
File Edit Connection View Window Help
New
Open
Save
Connect
Disconnect
Clear Data
Options
HEX
View Hex
Help
COM16 / 115200 8-N-1
Disconnected
TX
RX
RTS
CTS
DTR
DSR
DCD
RI



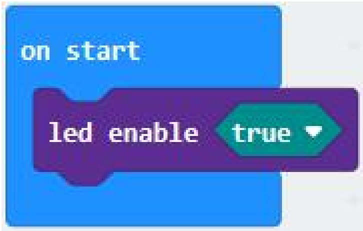
Code 2：

Micro:bit display different pictures by temperature(the temperature value in the code could be adjusted)

Type	Route	File Name
Hex file	../Makecode Tutorial/Test Code/8.5：Temperature Measurement/Code-2	microbit-Code-2.hex

Or you could edit code step by step in the editing area.

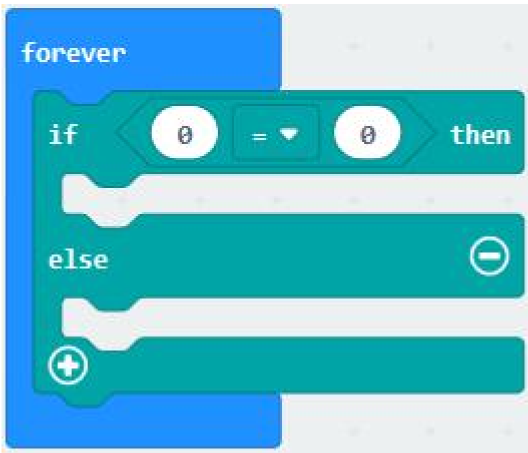
You could set temperature based on real situation.

(1) Click"Led"→"more"→"led enable false"into"on start" ,click drop-down triangle button to select "true" 

****

(2) A. Go to "Logic" → "if..true...then...else" and "=" block;

B. Move "if..true...then...else" into "forever" block , then place "=" into "true" box.



****

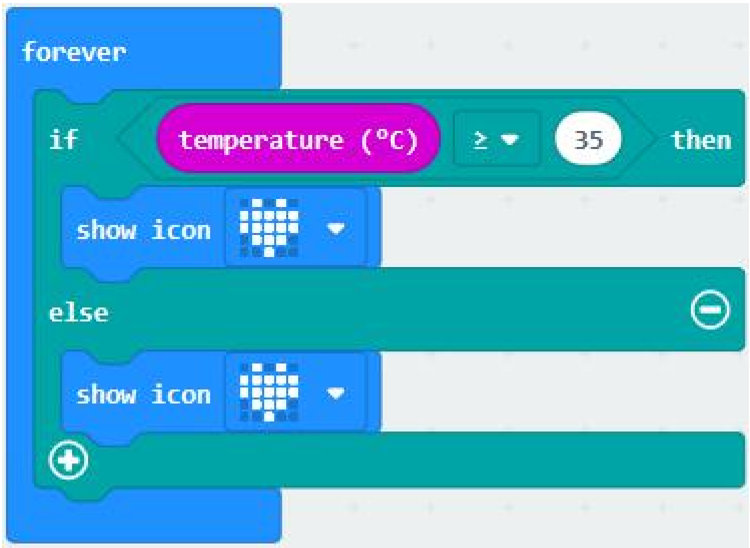
(3) A. Change "=" into "≥"

B. Go to "Input" → "temperature(℃)" and move it into left 0 box;

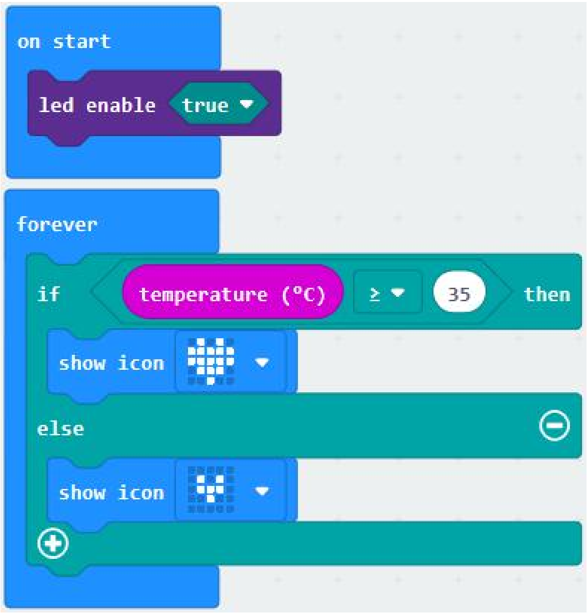
C. Change 0 into 35.

****

(4) Tap "Basic" → "show icon" , copy it once and lay down them under the "if ...then" and else blocks, then click the drop-down triangle button to select "" .



Complete Program：



"on start"：command block runs once to start program.

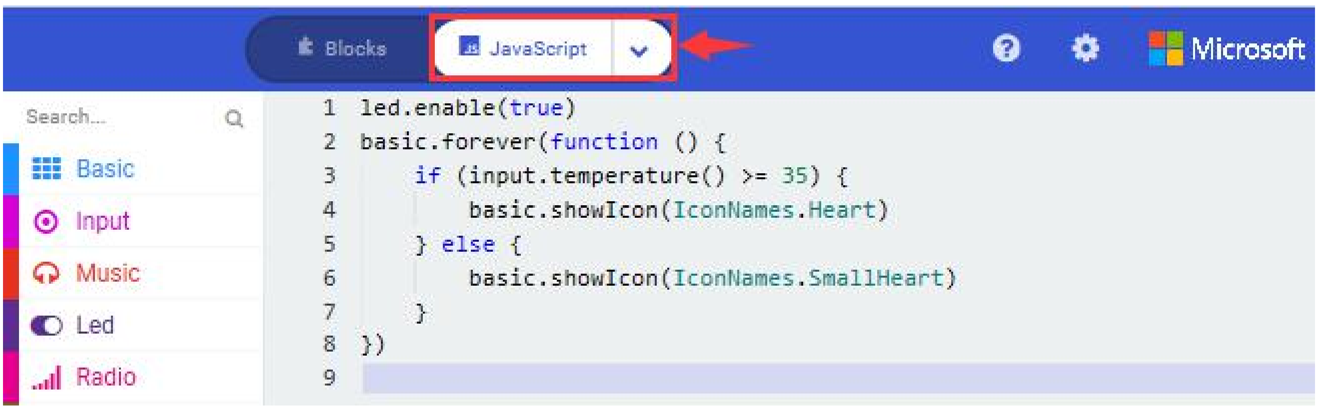
Turn on LED dot matrix

Under the block "forever" ，program runs cyclically.

If the detected temperature≥35°，the next program will be executed.

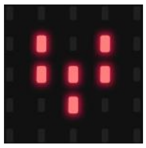
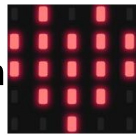
Dot matrix shows "❤"

Click "JavaScript", the corresponding JavaScript code is shown below:



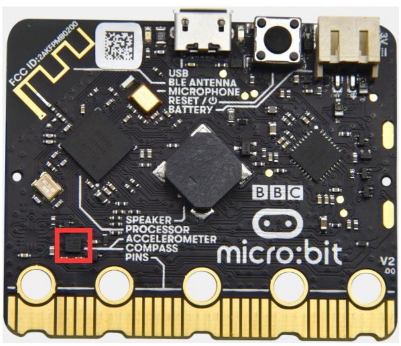
4. Test Results：

Upload the Code 1 and plug in power. And 5*5LED displays the ambient temperature. When pressing the temperature sensor, the temperature will grow on dot matrix.

Upload the code 2 plug in micro:bit via USB cable, when the ambient temperature is less than 35℃, 5*5LED will show . When the temperature is equivalent to or greater than 35℃, the pattern  will appear.

(How to download?　How to quick download?)

8.6：Micro:bit’s Compass



1. Description：

This project mainly introduces the use of the Micro:bit’s compass. In addition to detecting the strength of the magnetic field, it can also be used to determine the direction, an important part of the heading and attitude reference system (AHRS) as well.

It uses FreescaleMAG3110 three-axis magnetometer. Its I2C interface communicates with the outside, the range is ±1000μT, the maximum data update rate is 80Hz. Combined with accelerometer, it can calculate the position. Additionally, it is applied to magnetic detection and compass blocks.

Then we could read the value detected by it to determine the location. We need to calibrate the Micro:bit board when magnetic sensor works.

The correct calibration method is to rotate the Micro:bit board.

In addition, the objects nearby may affect the accuracy of readings and calibration.

2. Experimental Preparation：

(1) Connect micro:bit to computer with USB cable

(2) Open online Makecode editor

Import Hex profile(How to import?) , or click "New Project" and drag blocks step by step

3. Test Code：

Code 1：

Press A on micro:bit, the value of compass is shown.

Type	Route	File Name
Hex file	../Makecode Tutorial/Test Code/8.6：Micro:bit’s Compass/Code-1	microbit-Code-1.hex

Or you could edit code step by step in the editing area.

(1) A. Click “Input” → “more” → “calibrate compass”

B. Lay down it into block “on start”.

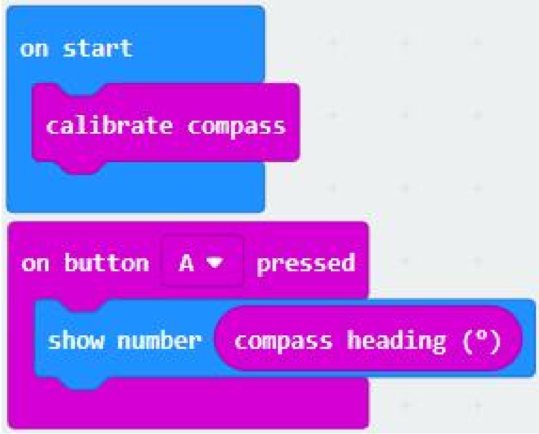
(2) A. Go to “Input” → “on button A pressed”.

B. Enter “Basic” → “show number”, put it into “on button A pressed” block;

C. Tap “Input” → “compass heading(℃)”, and place it into “show number”

****

Complete Program：



①"on start": command block only runs once to start program.

②Calibrate compass

③Press button A on Micro:bit main board

④Dot matrix shows the direction of compass heading

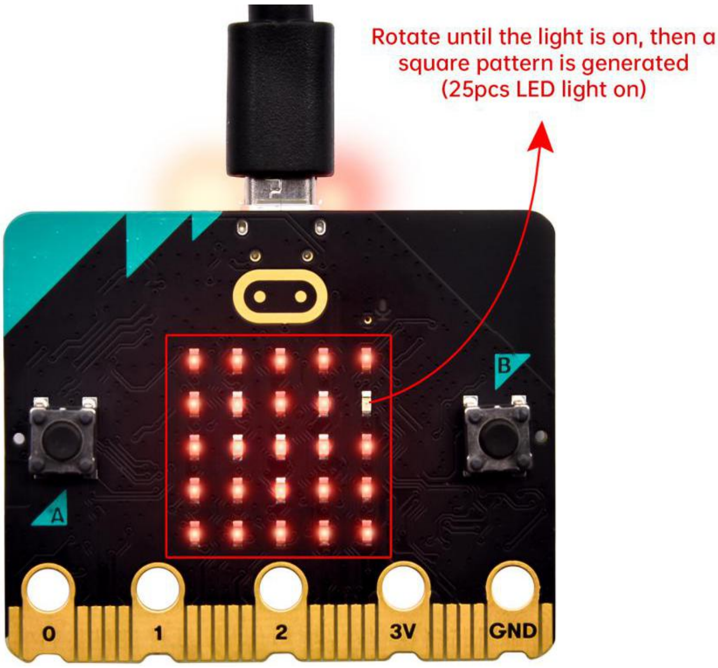
Click "JavaScript", and view the corresponding JavaScript code:

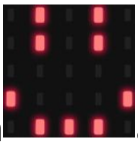
Code Description：

Upload the code 1, plug in micro:bit via USB cable.

As the button A is pressed, LED dot matrix indicates that "TILT TO FILL SCREEN" then enter the calibration interface. The calibration method: rotate the micro:bit to make LED dot matrix draw a square (25 LEDs are on), as shown in the following figure:

(How to download?   How to quick download?)



The calibration will be finished until you view the smile pattern  appear.

The serial monitor will show 0°, 90°, 180° and 270° when pressing A.

Code 2 :

Make micro: bit board point to the north, south, east and west horizontally , LED dot matrix displays the corresponding direction patterns

Type	Route	File Name
Hex file	../Makecode Tutorial/Test Code/8.6：Micro:bit’s Compass/Code-2	microbit-Code-2.hex

This code string complies that we read the value detected incessantly and determine the direction by the value range. The direction is toward North at this time.

Or you could edit code step by step in the editing area.

(1)

A. Enter “Input” → “more” → “calibrate compass”

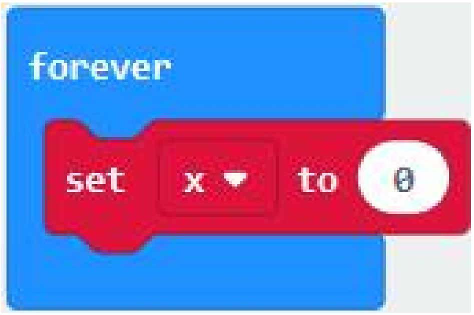
B. Move “calibrate compass” into “on start”

****

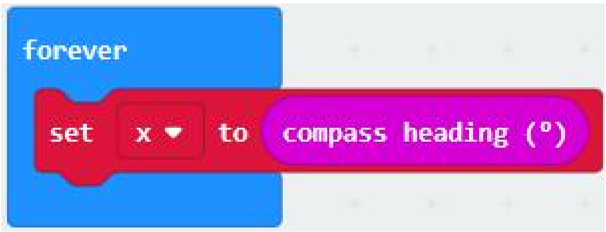
(2) A. Click "Variables" → "Make a Variable..." → "New variable name : "

B. Input "x" in the blank box and click "OK", and the variable "x" is generated.

C. Drag out "set x to" into "forever" block



(3) Go to "Input" → "compass heading(℃)" , and keep it into "0" box



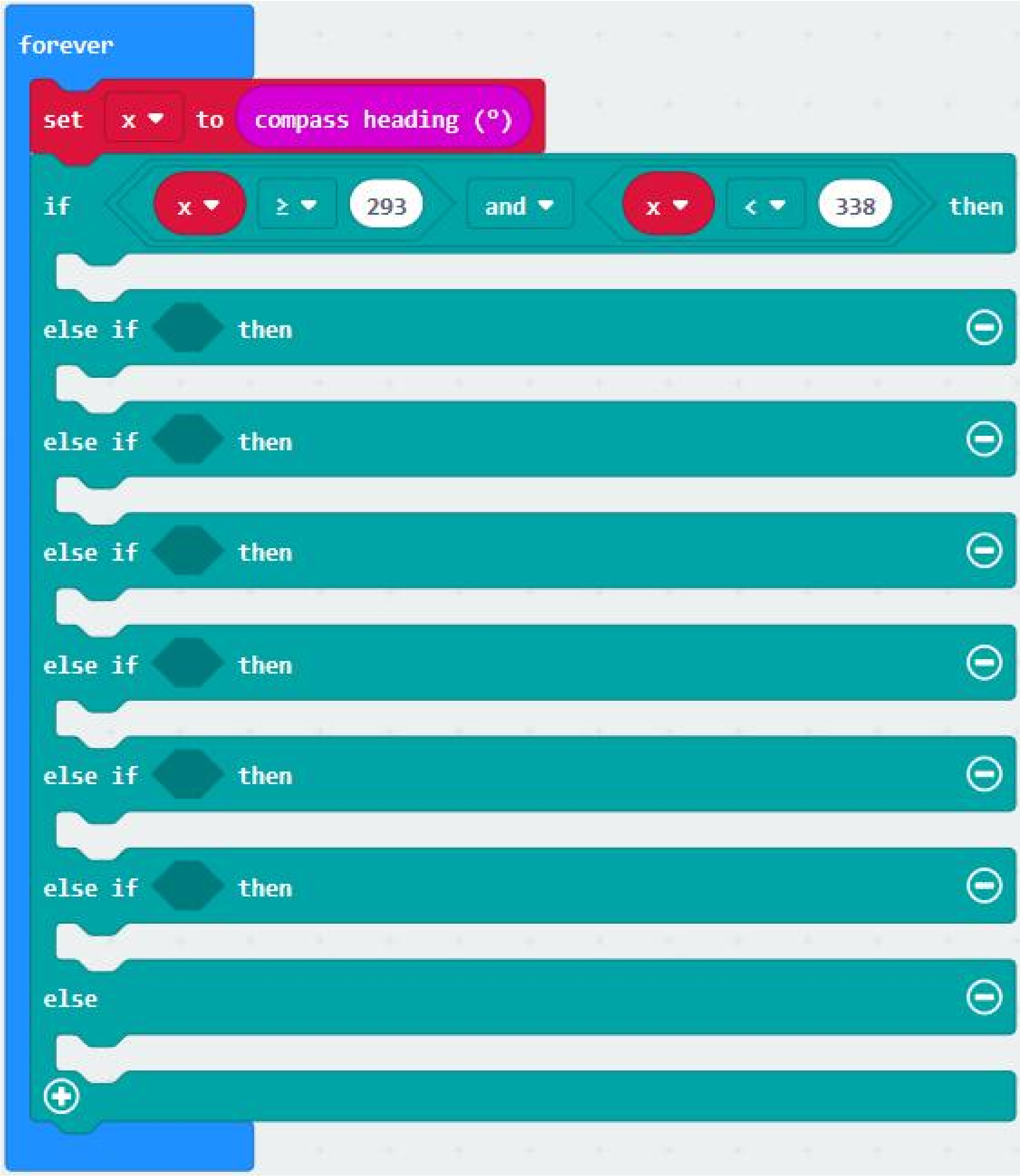
Tap "Logic" → "if...then...else" , leave it below block "sex x to compass heading" , then clickicon for 6 times.

(4) A. Place "and" into "true" block

B. Then move "=" block to the left box of "and"

C. Click “Variables” to drag “x” to the left “0” box, change 0 into 293 and set to “≥”;

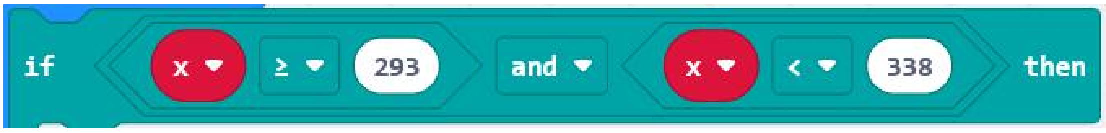
D. Then copy “x≥293” once and leave it to the right “0” box and set to “x<338”

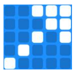


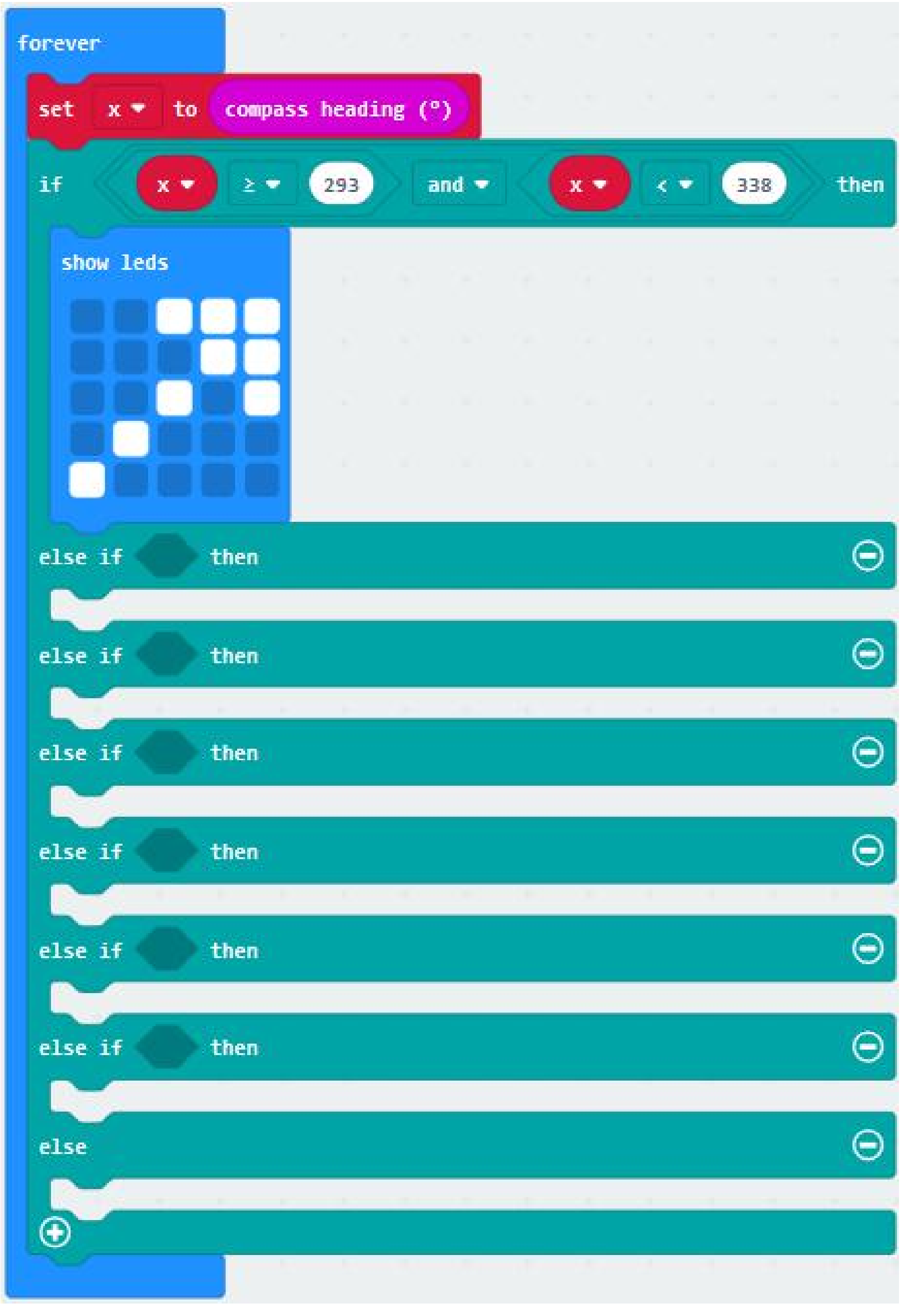
****

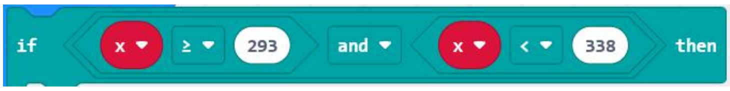
(5) A. Go to “Basic” → “show leds”

B. Lay it down beneath



block, then click “show leds” and the pattern  appears.



(6) A. Duplicate 

for 6 times.

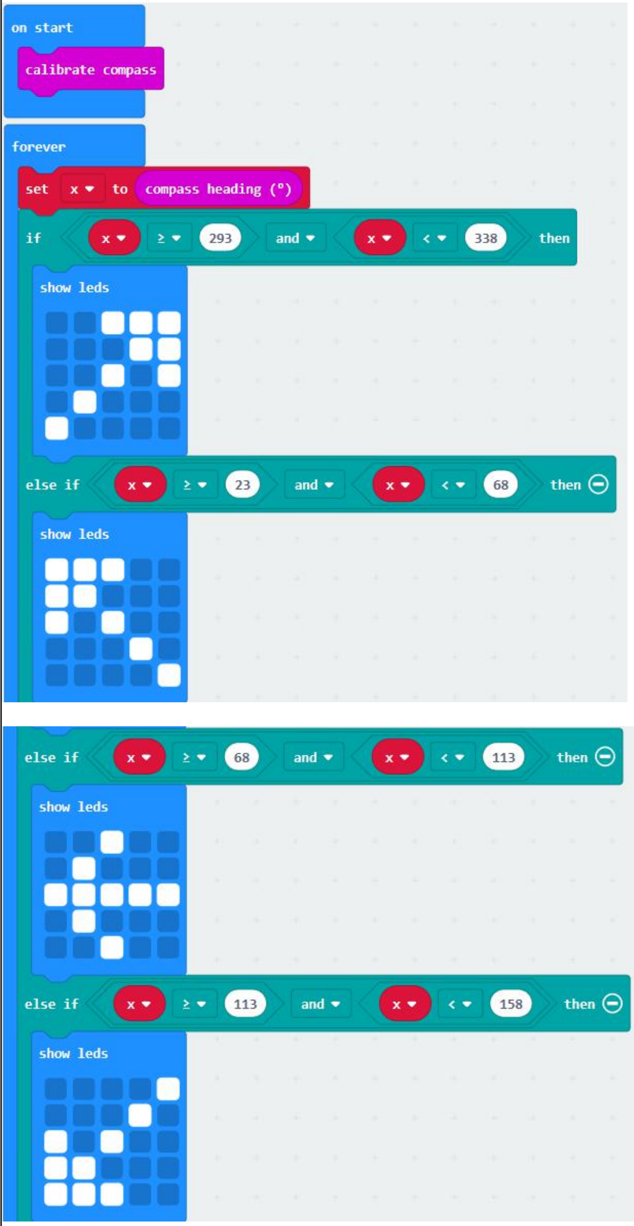
B. Separately leave them into the blank boxes behind “else if”.

C. Set to “x≥23 and x<68”, “x≥68 and x<113”, “x≥113 and x<158”, “x≥158 and x<203”, “x≥203 and x<248”, “x≥248 and x<293” respectively.

D. Then copy “show leds” for 7 times and keep them below the “else if.......then” block respectively.

E. Click the blue boxes to form the pattern “”, “”, “”, “”, “”, “” and “”.

Complete Program :



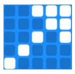
"on start": command block only runs once to start program.

Calibrate compass

The program under the block "forever" runs cyclically.

Store the angle of the compass heading into the variable x

When 293≤x<338, the next program will be executed

 appears on the dot matrix

When 23≤x<68, the next program will be executed

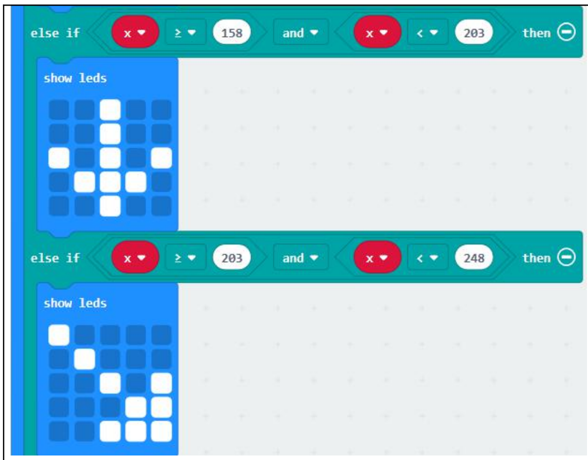
is displayed on dot matrix

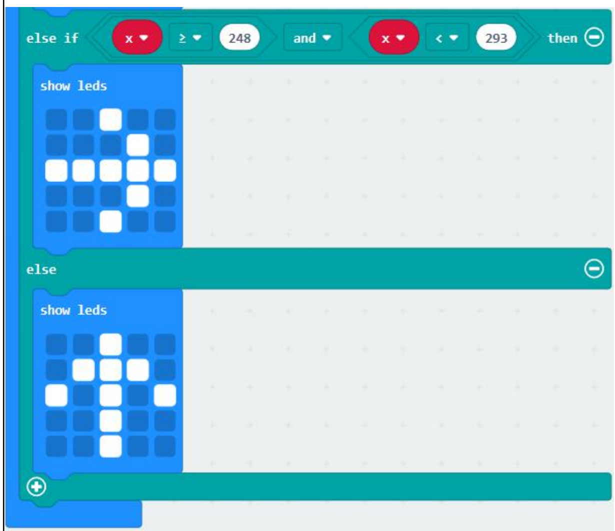
When 68≤x<113, the next program will be executed

 is shown on dot matrix

When 113≤x<158, the next program will be executed

pattern appears





When 158 ≤ x<203, the next program will be executed.

Dot matrix shows 

When 203 ≤ x<248, the next program will be executed.

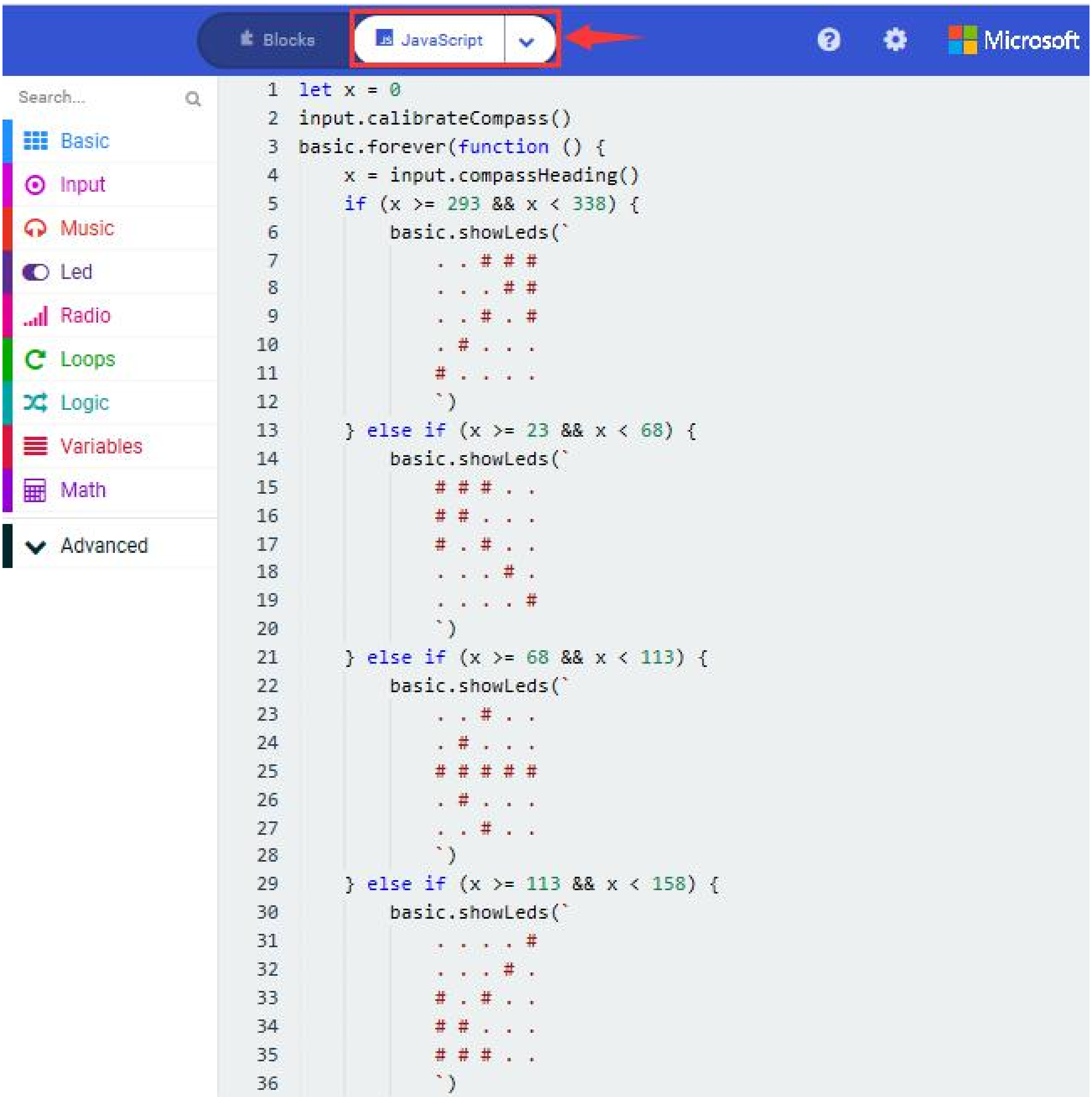
Dot matrix displays 

When 248 ≤ x<293, the next program will be executed.

Dot matrix shows 

When x is not among the above rang, the next program will be executed under else block

Click “JavaScript" to switch into the corresponding JavaScript code:



```
    } else if (x >= 158 && x < 203) {
        basic.showLeds(`
            . . # . .
            . . # . .
            # . # . #
            . # # # .
            . . # . .
            `)
    } else if (x >= 203 && x < 248) {
        basic.showLeds(`
            # . . . .
            . # . . .
            . . # . #
            . . . # #
            . . # # #
            `)
    } else if (x >= 248 && x < 293) {
        basic.showLeds(`
            . . # . .
            . . . # .
            # # # # #
            . . . # .
            . . # . .
            `)
    } else {
        basic.showLeds(`
            . . # . .
            . # # # .
            # . # . #
            . . # . .
            . . # . .
            `)
    }
})
```

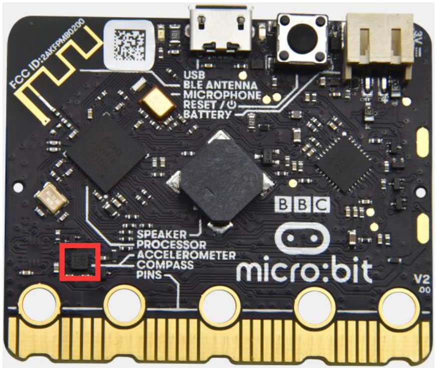
4. Test Results：

Download code 2 to micro:bit and keep USB cable connected.

After calibration, tilt Micro:bit board, micro:bit displays the direction signs.

(How to download?   How to quick download?)

8.7 : Accelerometer



1. Description :

The micro:bit board has a built-in Freescale MMA8653FC three-axis acceleration sensor (accelerometer). Its I2C interface works on external communication, the range can be set to ±2g, ±4g, and ±8g, and the maximum data update rate can reach 800Hz.

When the Micro:bit is stationary or moving at a constant speed, the accelerometer only detects the gravitational acceleration; when the Micro:bit is slightly shaken, the acceleration detected is much smaller than the gravitational acceleration and can be ignored. Therefore, in the process of using Micro:bit, the main purpose is to detect the changes of the gravitational acceleration on the x, y, and z axes when the attitude changes. For this project, we will introduce the detection of several special postures by the accelerometer.

2. Experimental Preparation :

(1) Connect micro:bit to computer with USB cable

(2) Open online Makecode editor

Import Hex profile(How to import?) , or click "New Project" and drag blocks step by step

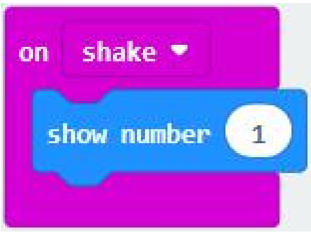
3. Test Code :

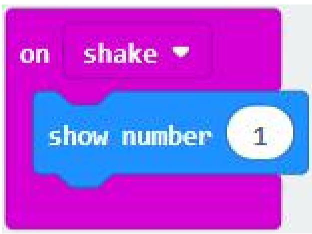
Code 1 :

Type	Route	File Name
Hex file	../Makecode Tutorial/Test Code/8.7: Accelerometer/Code-1	microbit-Code-1.hex

Or you could edit code step by step in the editing area.

(1) A. Enter "Input" → "on shake" ,

B. Click"Basic"→"show number", place it into"on shake"block, then change 0 into 1. 

(2) A. Copy code string 

for 7 times;

B. separately click the triangle button to select “logo up”, “logo down”, “screen up”, “screen down”, “tilt left”, “tilt right” and “free fall”, then respectively change 1 into 2, 3, 4, 5, 6, 7, 8.

****

Complete Program：

Shake the Micro:bit board

LED dot matrix displays 1

The log is up

LED dot matrix displays 2

The logo is down

LED dot matrix displays 3

The screen is up

LED dot matrix displays 4

The screen is down

Number 5 is shown

The Micro:bit board is tilt to the left

Number 6 is displayed

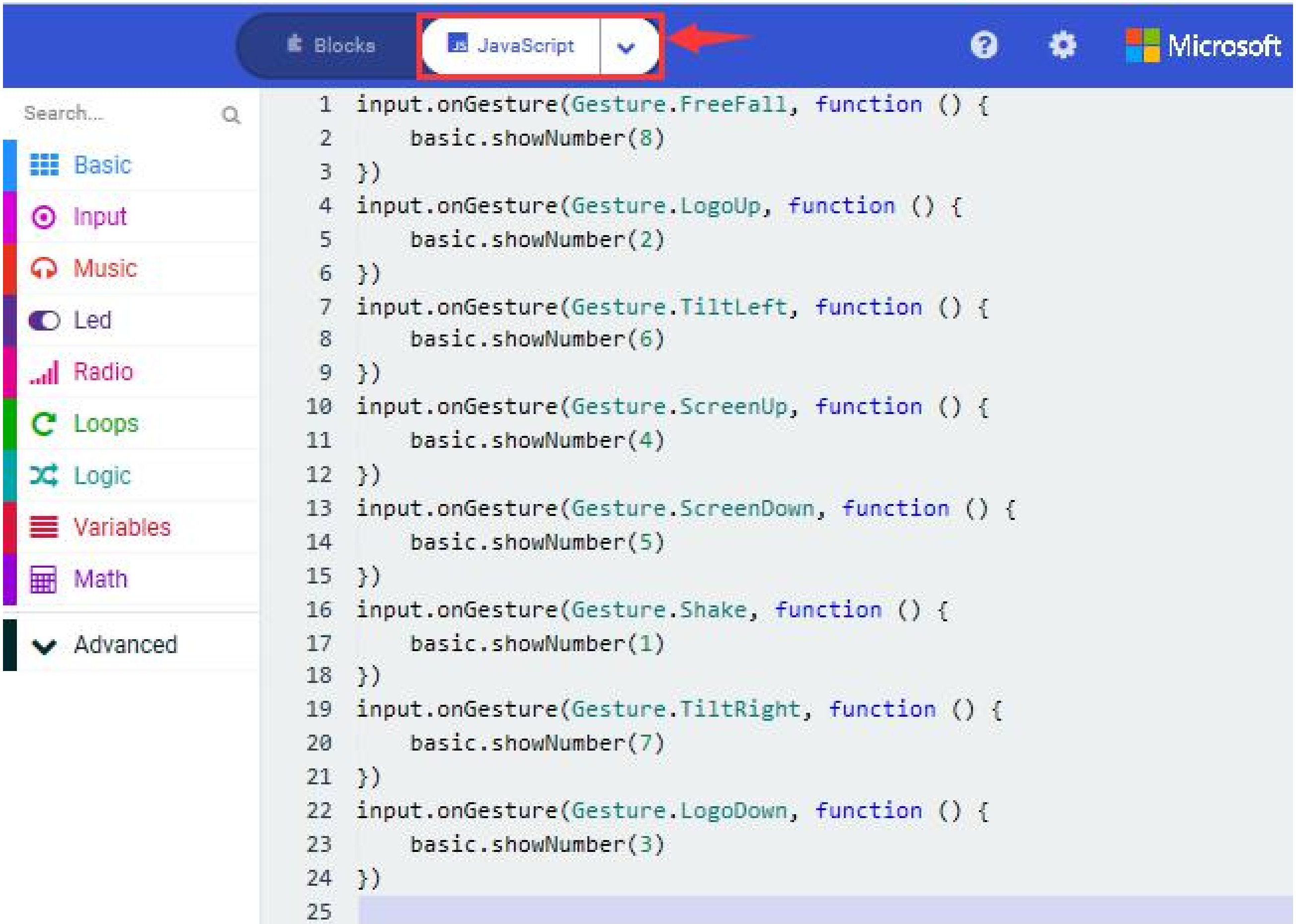
The Micro:bit board is tilt to the right

Number7 is displayed

When the Micro:bit board is free fall

LED dot matrix shows 8

Click “JavaScript", you will view the corresponding JavaScript code:



Code 2：

Detect the value of acceleration speed at x, y and z axis

Type	Route	File Name
Hex file	../Makecode Tutorial/Test Code/8.7：Accelerometer/Code-2	microbit-Code-2.hex

Or you could edit code step by step in the editing area.

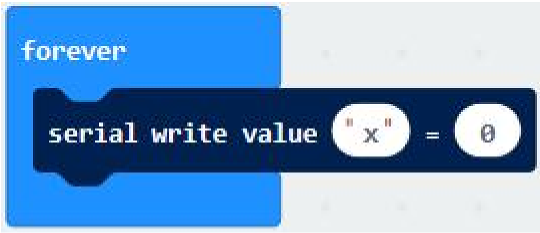
(1) A. Go to “Advanced” → “Serial” → “serial redirect to USB”

B. Drag it into “on start”

****

(2) A. Enter “Serial” → “serial write value x =0”

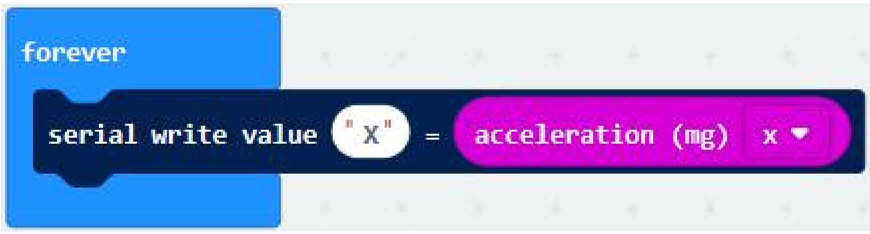
B. Leave it into “forever” block



(3) ***

A. Click “Input” → “acceleration(mg) x” ;

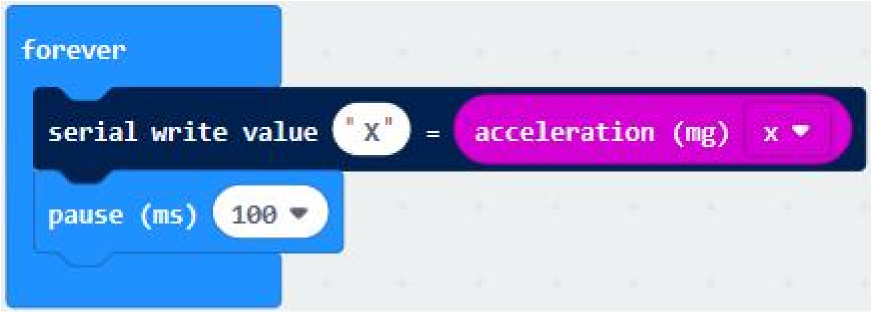
B. Keep it into “0” box and capitalize the “x”



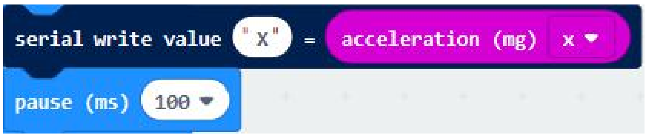
****

(4) Go to “Basic” and move out “ pause (ms) 100 ” below the block 

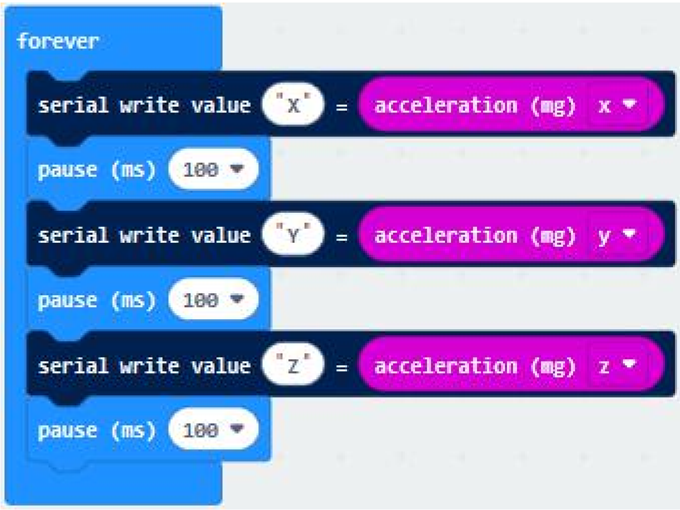
, then set to 100ms.



****

(5) Replicate code string 

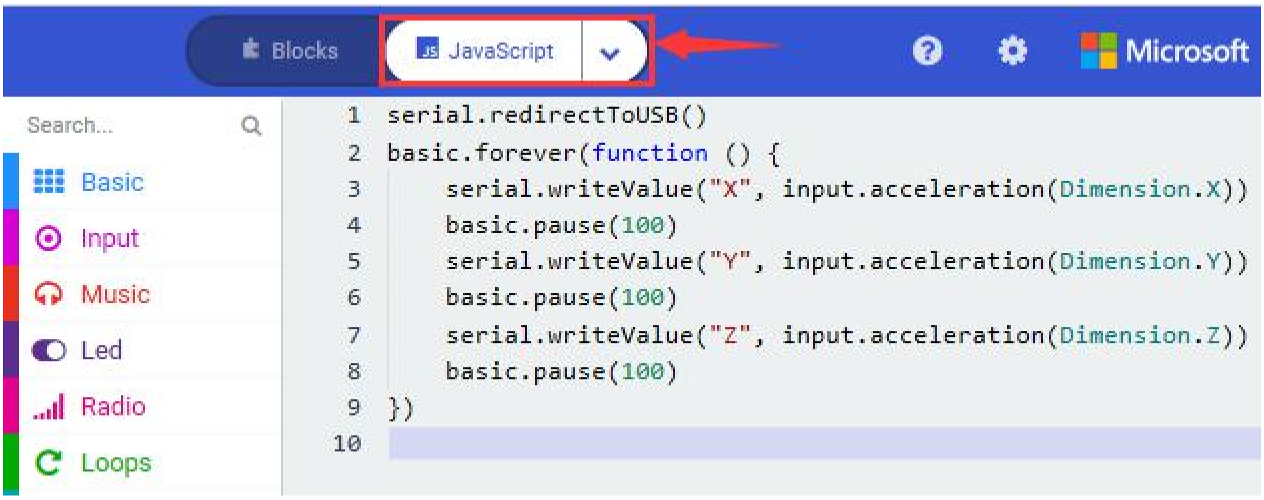
for 3 times and keep them into “forever” block, separately set the whole code string as follows:



Complete Program：

"on start": command block runs once to start program.
Serial redirects to USB
The program under the block "forever" runs cyclically.
Serial write value "X"=acceleration value on x axis
Serial write value "Y"=acceleration value on y axis
Serial write value "Z"=acceleration value on z axis

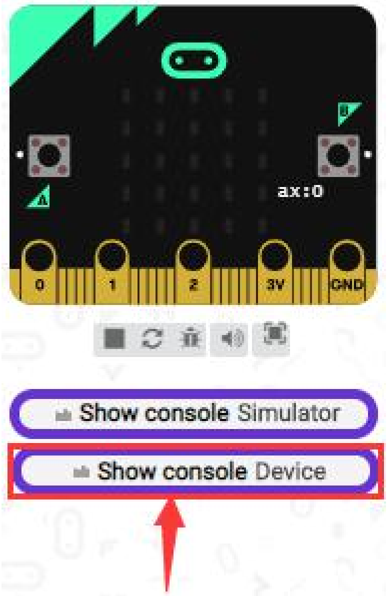
Click "JavaScript" to view the corresponding JavaScript code:



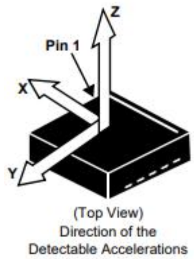
(How to quick download?)

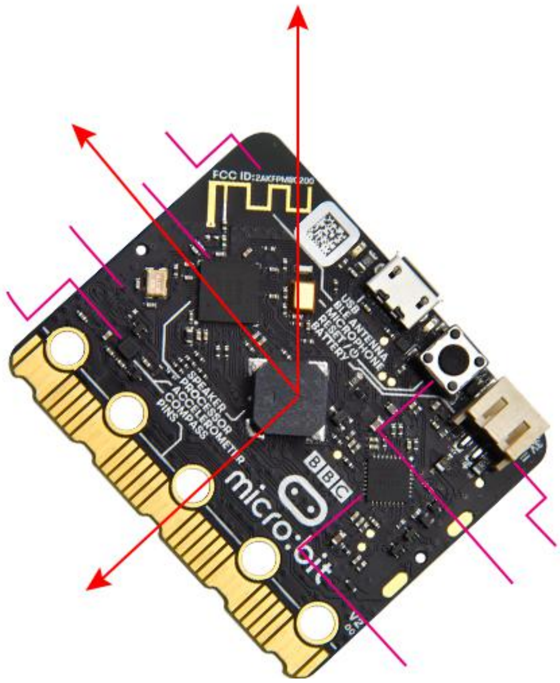
Download code 1 to micro:bit board, keep USB cable connected and click 

(How to quick download?)



The coordinates of the Micro:bit accelerometer are shown in the following figure:

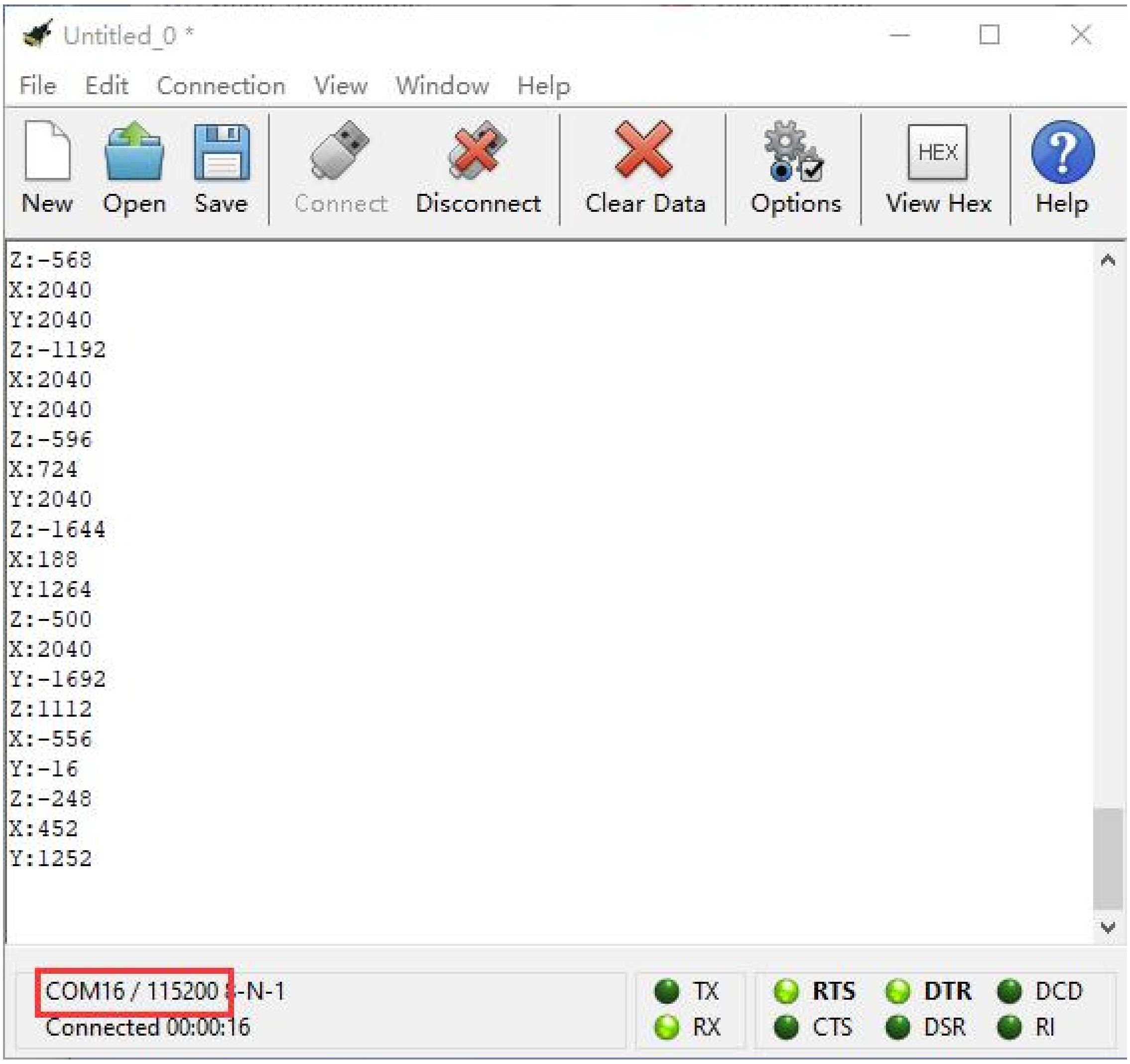




The decomposition value of acceleration on the X-axis, Y-axis, and Z-axis, as well as the synthesis of acceleration (the synthesis of gravitational acceleration and other external forces). Then flip the micro:bit board, the data is shown below:

Open CoolTerm, click Options to select SerialPort. Set COM port and 115200 baud rate(the baud rate of USB serial communication of Micro:bit is 115200 through the test). Click “OK” and “Connect” .

CoolTerm serial monitor displays the acceleration value on x, y and z axis.



4. Test Results：

Download code 1 to micro:bit board and keep USB cable connected, shake the Micro:bit board then the number 1 appears.

(How to download?   How to quick download?)

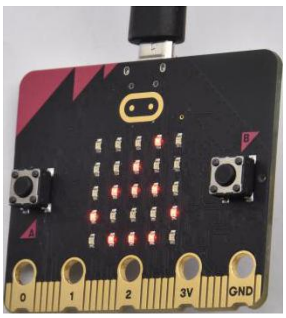
Place micro:bit vertically(logo up), then the number 2 is displayed:

Place micro:bit vertically(logo down), then the number 3 is displayed:

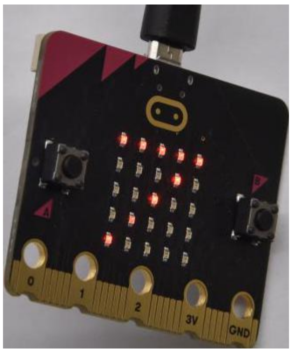
Place micro:bit horizontally (facing up), then the number 4 is displayed:

On the contrary, place micro:bit horizontally (facing down), then the number 5 is displayed:

When Micro:bit board is tilt to the left, number 6 is shown.

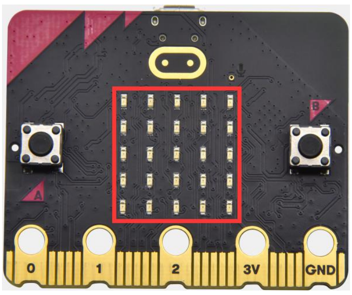


When Micro:bit board is inclined to the right, number 7 is displayed.



When it is free fall(accidentally making it fall), number 8 appears on dot matrix. (Note : we don’t recommend you to make it free fall, it will make board damage)

8.8 : Detect Light Intensity by Micro:bit



1. Description :

This project will introduce how Micro:bit detects the external light intensity. Since Micro:bit doesn’t come with a photosensitive sensor, the detection of light intensity is completed through the LED matrix. When the light irradiates the LED matrix, the voltage change will be produced. Therefore, we could determine the light intensity by voltage change.

2. Experimental Preparation :

(1) Connect micro:bit to computer with USB cable

(2) Open online Makecode editor

Import Hex profile (How to import?) , or click “New Project” and drag blocks step by step.

3. Test Code :

Type	Route	File Name
Hex file	../Makecode Tutorial/Test Code/8.8 : Detect Light Intensity by Micro:bit	microbit-Detect Light Intensity by Micro:bit .hex

Or you could edit code step by step in the editing area.

(1)A. Enter “Advanced” → “Serial” → “serial redirect to USB” ;

B. Drag it into “on start” block. 

****

(2) A. Go to “Serial” → “serial write value x =0” ;

B. Move it into “forever”

(3) A. Click “Input” → “acceleration(mg) x”

B. Put “acceleration(mg) x” in the “0” box and change “x” into “Light intensity” .

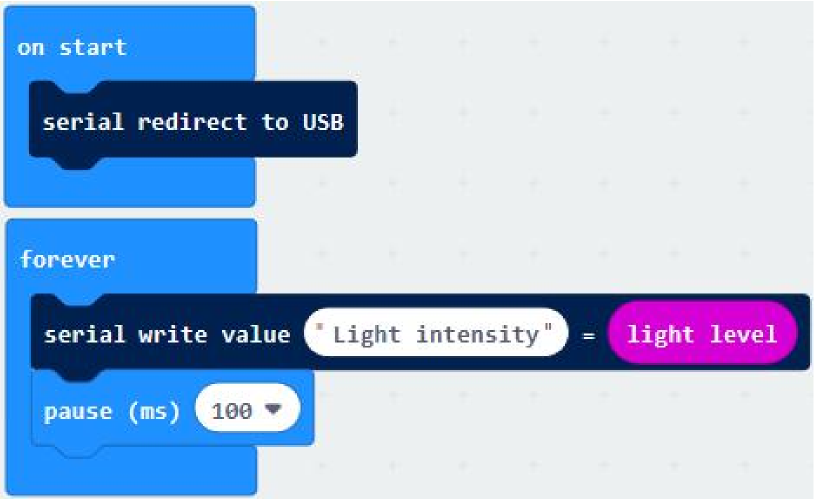
****

(4) A. Click “Basic” → “pause (ms) 100” ;

B. Lay it down into “forever” and set to 100ms.

****

3. Complete Program：



"on start": command block runs once to start program.

Serial redirects to USB

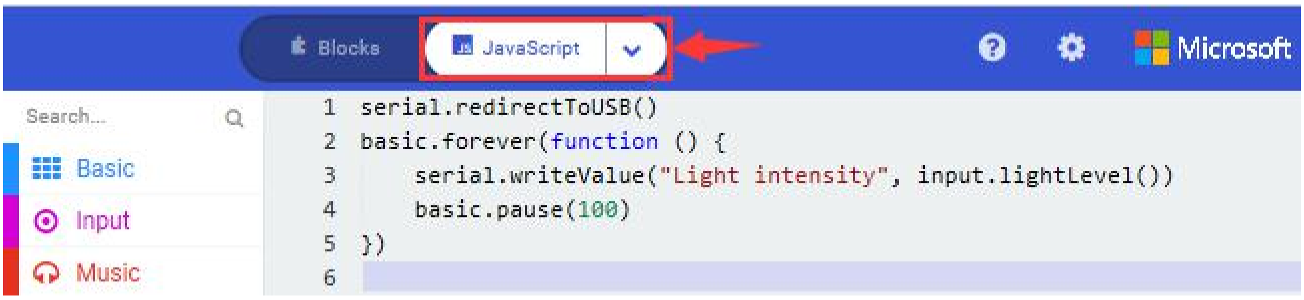
The program under the block "forever" runs cyclically.

Serial write value "Light intensity"

= light level

Delay in 100ms

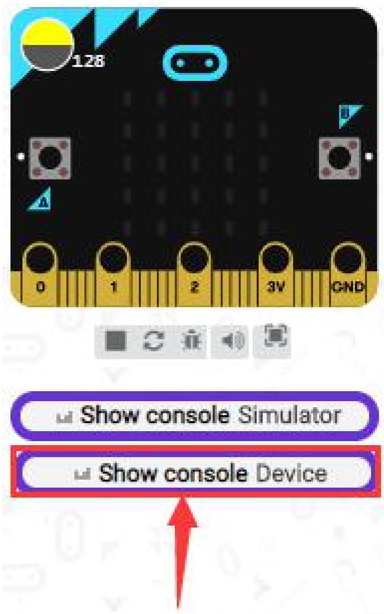
Click "JavaScript" to switch into the corresponding JavaScript code:



5. Test Results：

Download code to micro:bit board don’t plug off USB cable and click 

(How to quick download?)

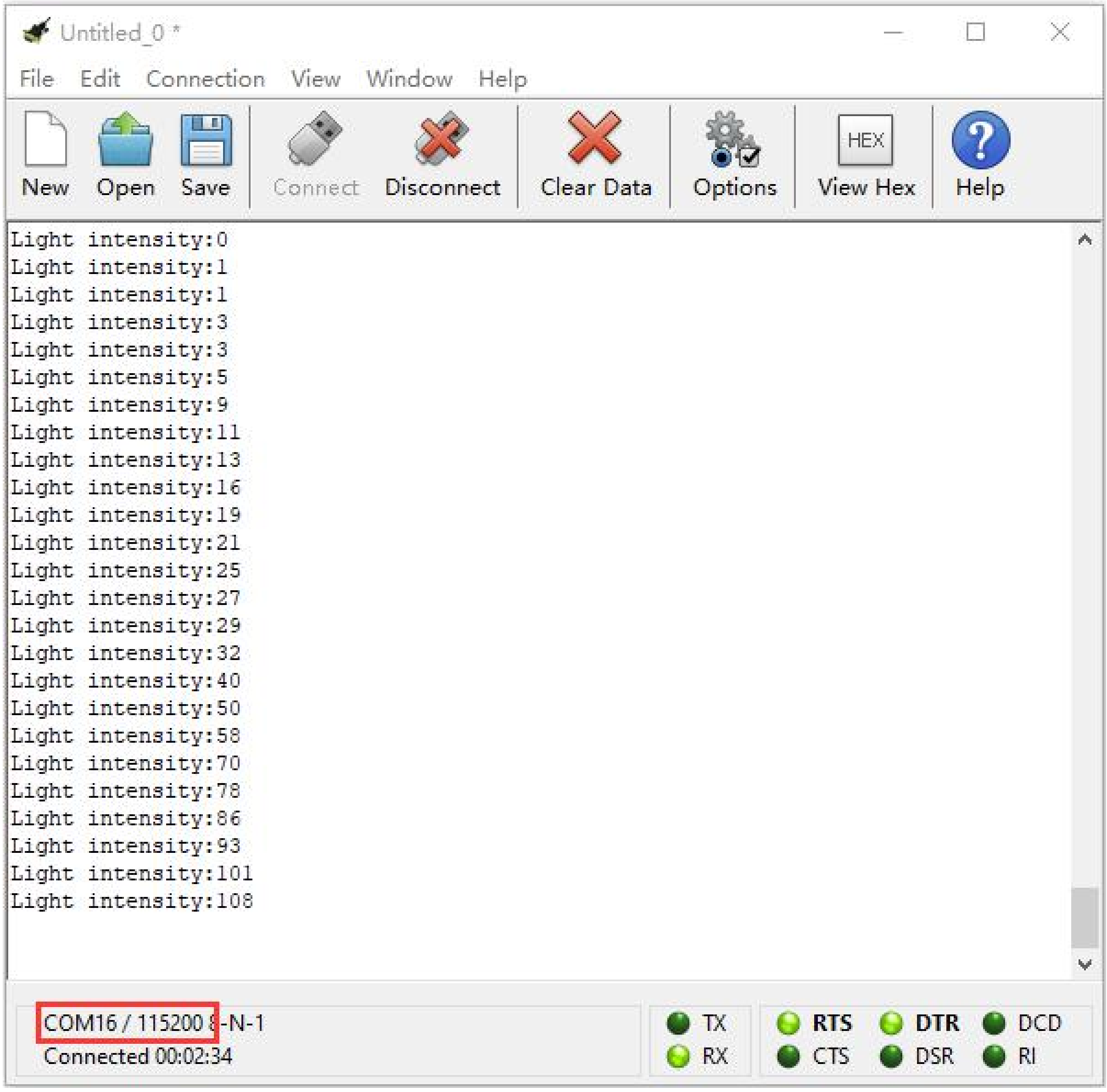


The intensity value is 0 when covering LED dot matrix. And the value varies with the light intensity. When placing micro:bit under the sunlight, the stronger the light is, the larger the intensity value is. As shown below:

Open “CoolTerm”, click “Options” to select “SerialPort”, and set “COM” port and 115200 baud rate(the baud rate of USB serial communication of micro:bit is 115200 through the test).

Then click “OK” and “Connect”.

The light intensity value is shown below:


Untitled_0 *
File Edit Connection View Window Help
New Open Save Connect Disconnect Clear Data Options View Hex Help
Light intensity:0
Light intensity:1
Light intensity:1
Light intensity:3
Light intensity:3
Light intensity:5
Light intensity:9
Light intensity:11
Light intensity:13
Light intensity:16
Light intensity:19
Light intensity:21
Light intensity:25
Light intensity:27
Light intensity:29
Light intensity:32
Light intensity:40
Light intensity:50
Light intensity:58
Light intensity:70
Light intensity:78
Light intensity:86
Light intensity:93
Light intensity:101
Light intensity:108
COM16 / 115200 8-N-1
Connected 00:02:34
TX RX RTS CTS DTR DSR DCD RI

8.9: Speaker


BBC
micro:bit

1. Description:

The Micro: Bit main board V2 has an built-in speaker, which makes adding sound to the programs easier. We can program the speaker to air all kinds of tones ,such as playing the song, "Ode to Joy" .

2.Experimental Preparation :

Connect micro:bit to computer with USB cable

Open online Makecode editor

Import Hex profile (How to import?) , or click "New Project" and drag blocks step by step.

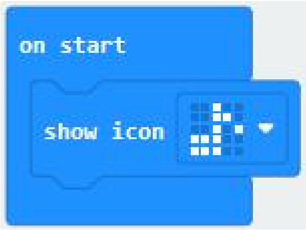
3. Test Code :

Type	Route	File Name
Hex file	../Makecode Tutorial/Test Code/8.9 : Speaker by Micro:bit	microbit-Speaker by Micro:bit .hex

Or you could edit code step by step in the editing area.

(1) Enter "Basic" module to find "show icon" and drag it into "on start" block;

Click the little triangle to find ""

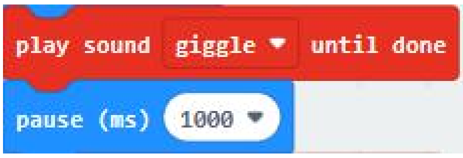


****

(2) Enter "Music" module to find and drug "play sound giggle until done" into "forever" block;

Enter "Basic" module to find and drug "pause(ms) 100" into "forever" block ;

Change 100 into 1000;

(3) Copy 

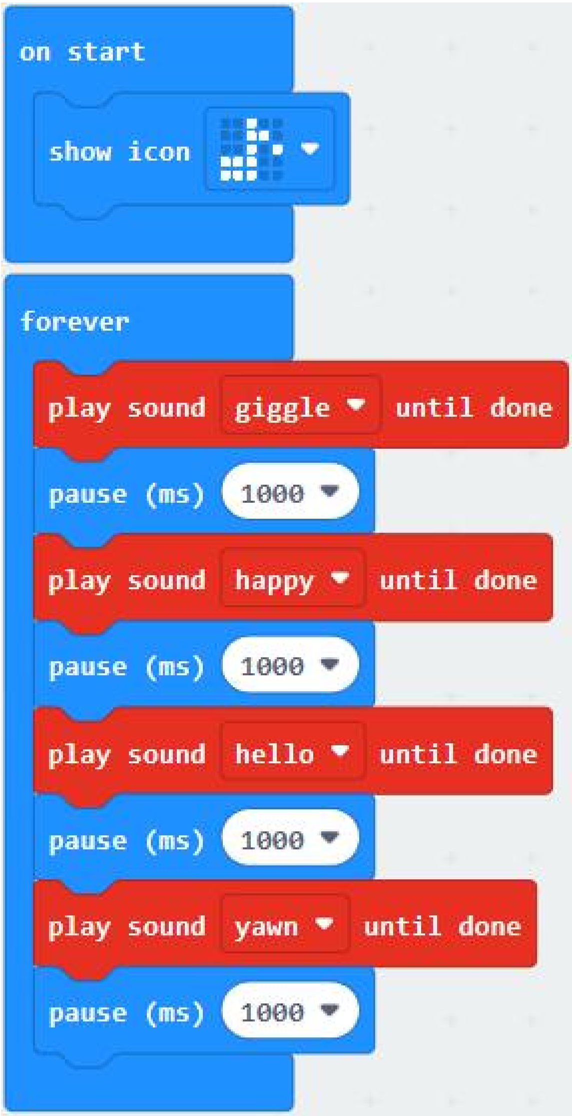
three times and place it into "forever" block ;

Click the little triangle to select "happy" ," hello" ," yawn" ;

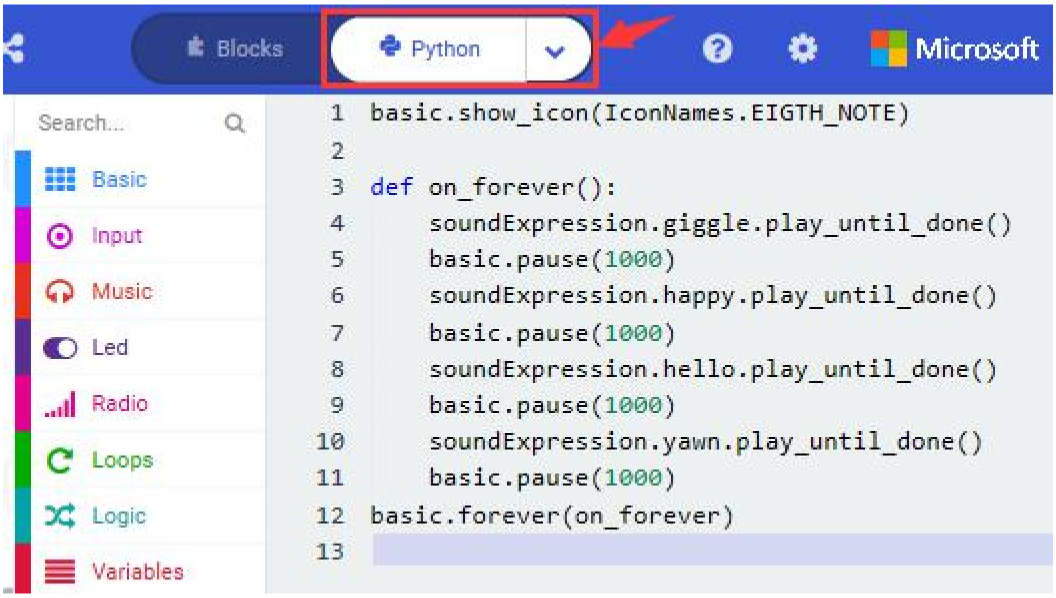

forever
play sound giggle until done
pause (ms) 1000
play sound happy until done
pause (ms) 1000
play sound hello until done
pause (ms) 1000
play sound yawn until done
pause (ms) 1000

****

Complete Program：



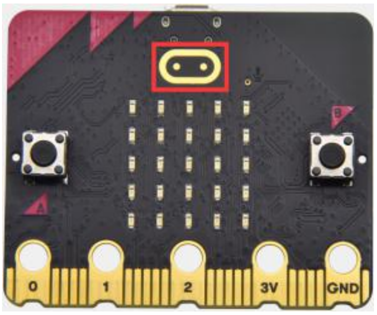
Select “JavaScript" and “Python” to switch into JavaScript and Python language code:



4.Test Results:

After uploading the test code to micro:bit main board V2 and powering the board via the USB cable, the speaker utters sound and the LED dot matrix shows the logo of music.

8.10: Touch-sensitive Logo



1. Description:

The Micro: Bit main board V2 is equipped with a golden touch-sensitive logo, which can act as an input component and function like an extra button.

It contains a capacitive touch sensor that senses small changes in the electric field when pressed (or touched), just like your phone or tablet screen do.When you press it , you can activate the program.

2.Experimental Preparation :

Connect micro:bit to computer with USB cable

Open online Makecode editor

Import Hex profile (How to import?) , or click “New Project” and drag blocks step by step.

3. Test Code：

Type	Route	File Name
Hex file	../Makecode Tutorial/Test Code/8.10：Touch-sensitive logo by Micro:bit	microbit-Touch-sensitive logo by Micro:bit .hex

Or you could edit code step by step in the editing area.

(1) Delete block “on start” and “forever”；

(2)Enter “Input” module to find and drag “on logo pressed” ；

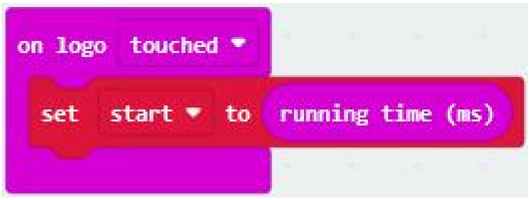
Click the little triangle to find “touched”；

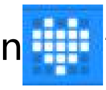
(3) Enter module “Variables” →choose “Make a Variable” →input “start” →click “OK”

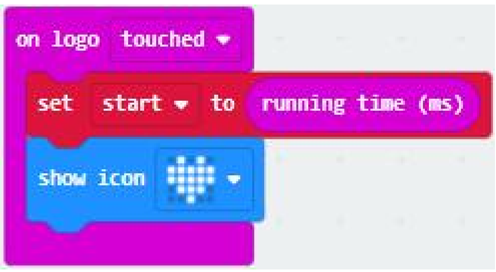
The variable “start” is established;

Enter “Variables” module to find and drag “set start to 0” into “on logo touched” block;

(4)Enter "Input" module →click "more" → find and drag "running time(ms)" into the "0" of "set start to 0" block;



(5)Enter "Basic" module to find and drag "show icon " into "on logo touched" block;



(6)Enter "Input" module to find and drag "on logo pressed" →choose "released" → establish variable "time" ;

Enter "Variables" module to find and drag "set time to 0" into "on logo pressed" block;

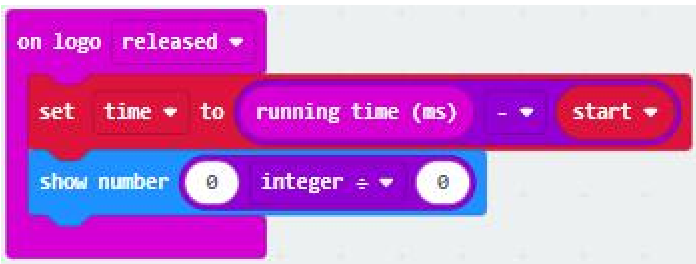
Enter "Math" module to find and drag "0-0" into the "0" of "set start to 0" block;

(7)Enter “Input” module→ “more” → find and drag “running time(ms)” into “0” on the left side of “0-0” ;

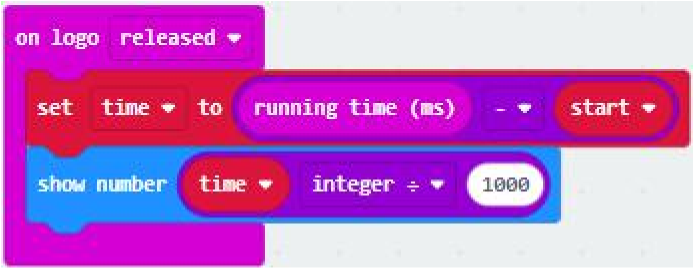
Enter “Variables” module to find and drag “start” into “0” on the right side of “0-0” ;

(8)Enter “Basic” module to find and drag “show number” into “on logo released” block;

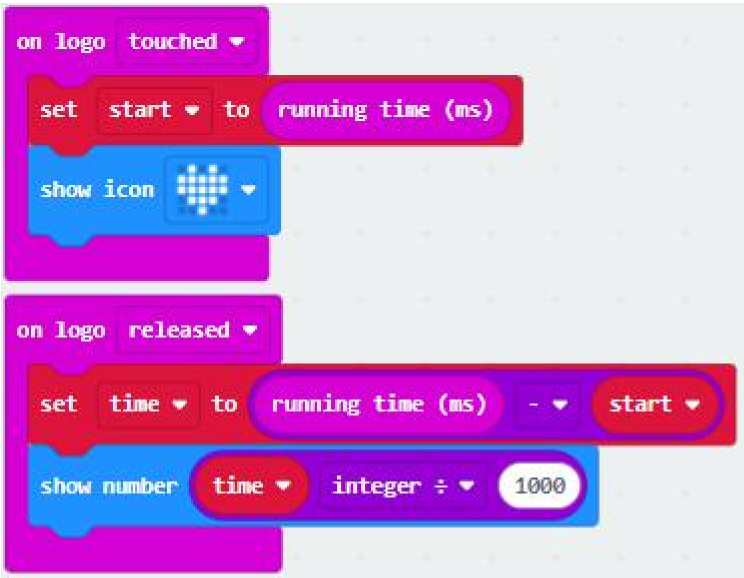
Enter “Math” module to find and drag “square root 0” into “0” ; Click the little triangle to find” integer÷” ;



(9) Enter “Variables” module to find and drag “time” into “0” on the left side of “0-0” and change the “0” on the right side to” 1000” ;



Complete Program：

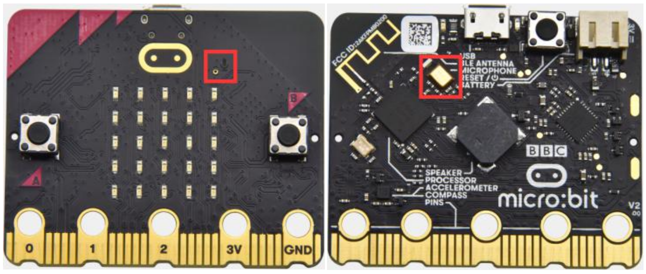


Select “JavaScript" and “Python” to switch into JavaScript and Python language code:

4.Test Results:

After uploading the test code to micro:bit main board V2 and powering the board via the USB cable, the LED dot matrix exhibits the heart pattern when the touch-sensitive logo is pressed or touched and displays digit when the logo is released.

8.11: Microphone



1.Description:

The Micro: Bit main board V2 is built with a microphone which can test the volume of ambient environment. When you clap, the microphone LED indicator will turn on. Since it can measure the intensity of sound, you can make a noise scale or disco lighting changing with music. The microphone is placed on the opposite side of the microphone LED indicator and in proximity with holes that lets sound pass.When the board detects sound, the LED indicator lights up.

2.Experimental Preparation：

Connect micro:bit to computer with USB cable

Open online Makecode editor

Import Hex profile (How to import?) , or click "New Project" and drag blocks step by step.

3. Test Code :

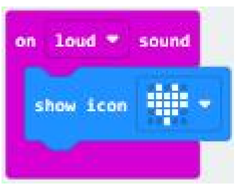
Type	Route	File Name
Hex file	../Makecode Tutorial/Test Code/8.11 : Microphone by Micro:bit	microbit-Microphone logo by Micro:bit .hex

Or you could edit code step by step in the editing area.

(1) Delete block "on start" and "forever" ;

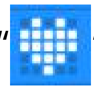
(2) Enter "Input" module to find and drag "on loud sound" ;

Enter "Basic" module to find and drag "show number" into "on loud sound" block ;

(3)Copy 

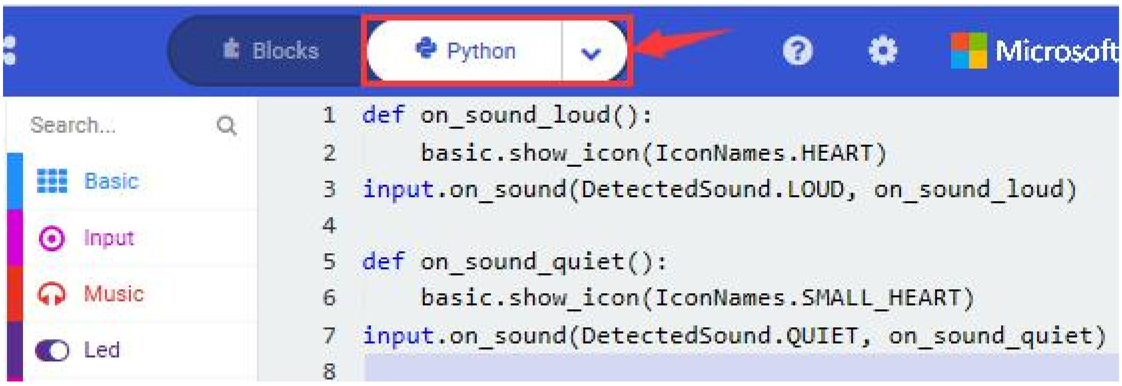
once;

Click the little triangle of "lond" to choose" quiet" ;

Click the little triangle of “” to choose” ” ;

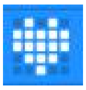
Complete Program：

Select “JavaScript" and “Python” to switch into JavaScript and Python language code:



4.Test Results 1:

After uploading test code to micro:bit main board V2 and powering the board via the USB cable.

The LED light will display “  ” when you clap your hands and  will appear when the environment is quiet

5.Test Code 2:

Link computer with micro:bit board by micro USB cable, and program in MakeCode editor,

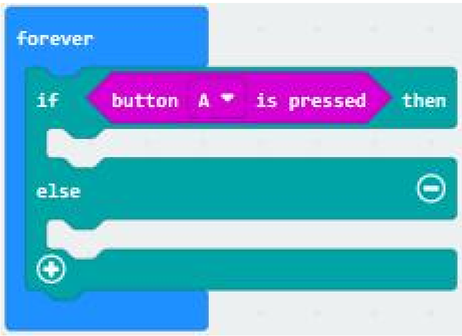
(1)Enter “Advanced” module→ choose “Serial” to find and drag “serial redirect to USB” into “on start” block ;

(2)Enter “Variables” module→ choose “Make a Variable” → input “maxSound” →click “OK” ,variable ” maxSound” is established;

Enter “Variables” module to find and drag “set maxSound to 0” into “on start” block ;

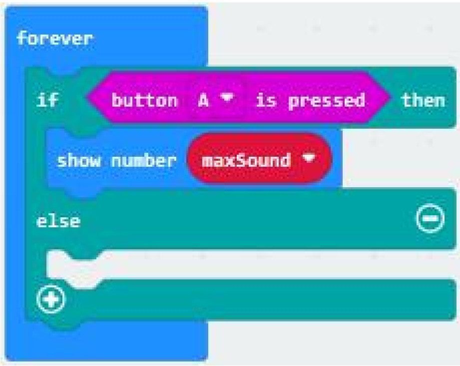
(3)Enter “Logic” module to find and drag “if true then...else” into “forever” block ;

Enter “Input” module to find and dragbutton A is pressed” into “then” ;



(4)Enter “Basic” module to find and drag “show number” into “then” ;

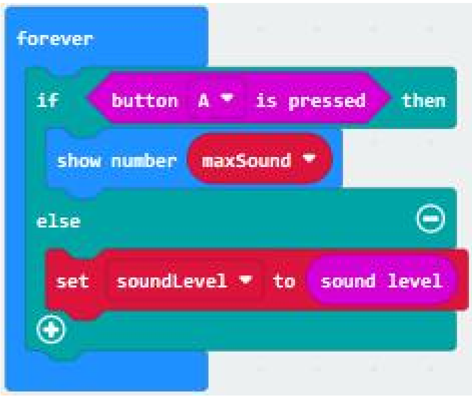
Enter “Variables” module to find and drag “maxSound” into “0” ;



(5) Establish variable “soundLevel” ;

Enter “Variables” module to find and drag “set soundLevel to 0” into “else” ;

Enter “Input” module to find and drag “sound level” into “0” ;



(6)Enter “Led” module to find and drag “plot bar graph of 0 up to 0” into “else” ;

Enter “Variables” module to find and drag “soundLevel” into the “0” behind “of” ;

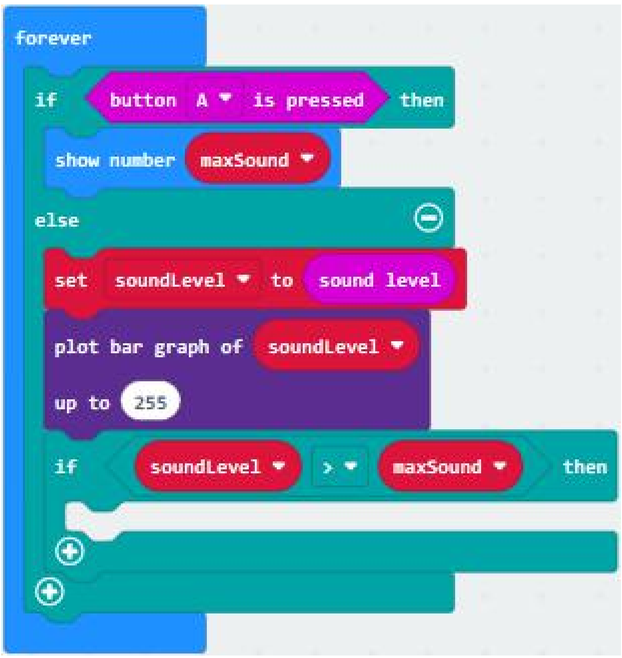
Change the “0” behind “up” to “255” ;

(7)Enter "Logic" module to find and drag "if true then" into "else" block;

Enter "Logic" module to find and drag "0 > 0" into "then" ;

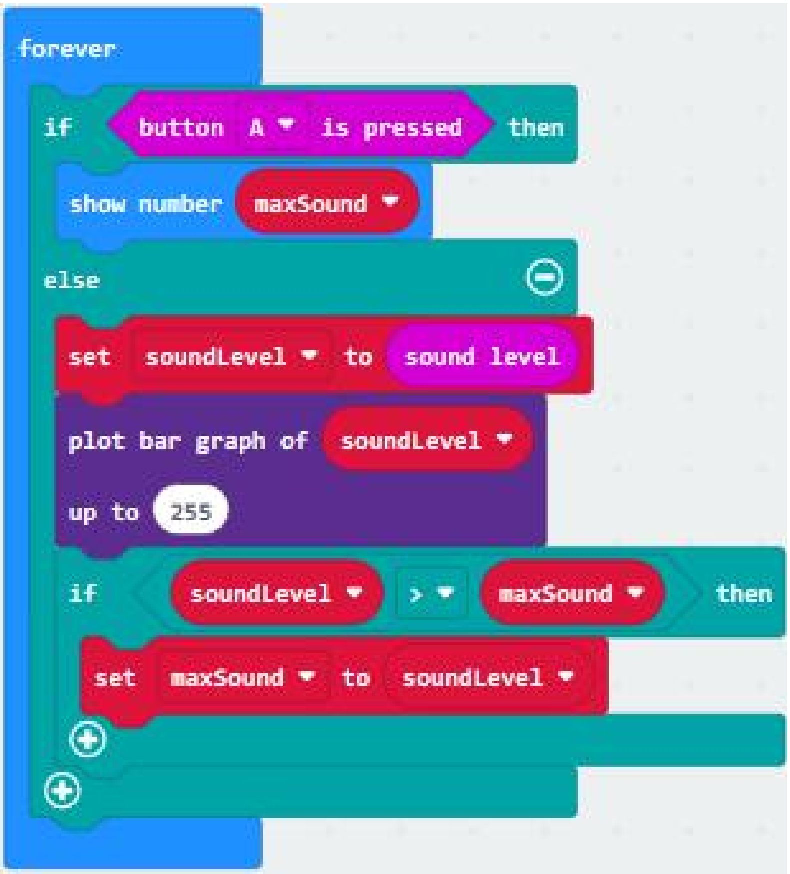
Enter "Variables" module to find and drag "soundLevel" into "0" on the left side of "0-0" ;

Enter "Variables" module to find and drag "maxSound" into "0" on the right side;

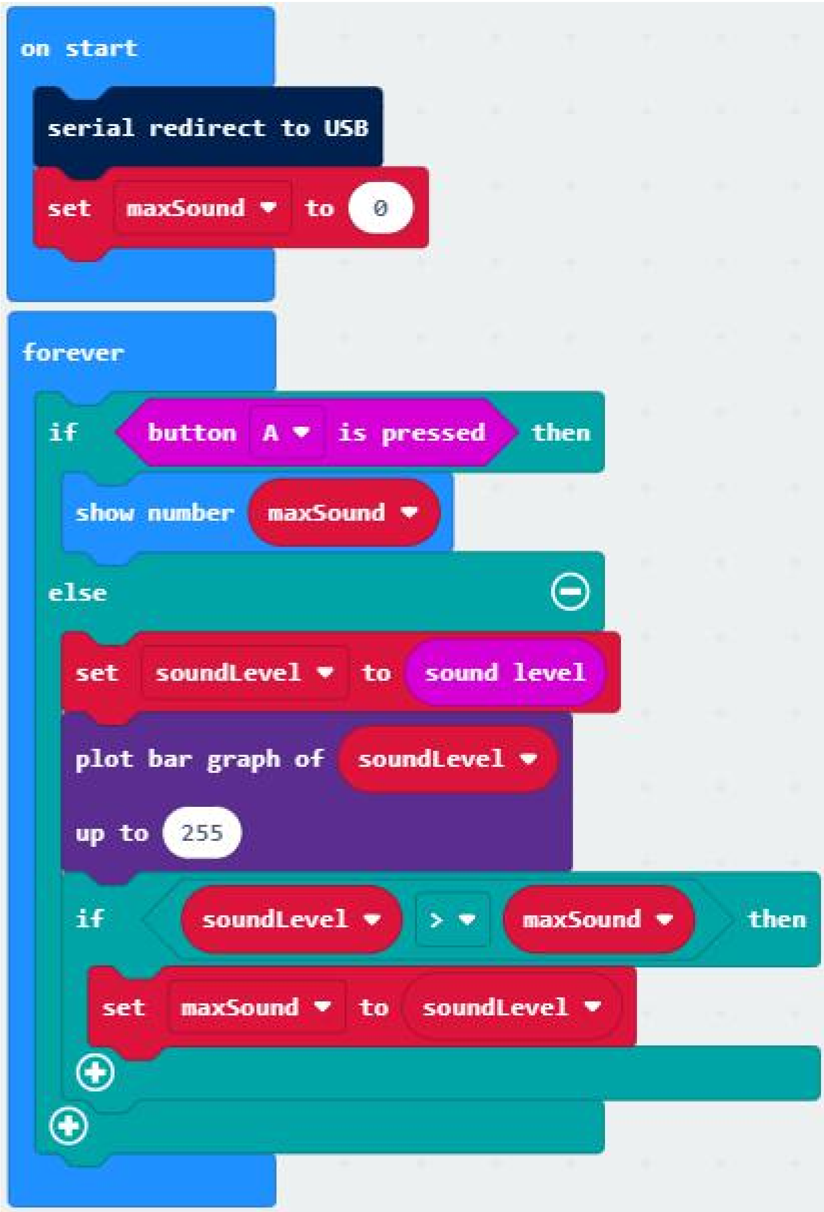


(8)Enter “Variables” module to find and drag “set maxSound to 0” into the second “then” ;

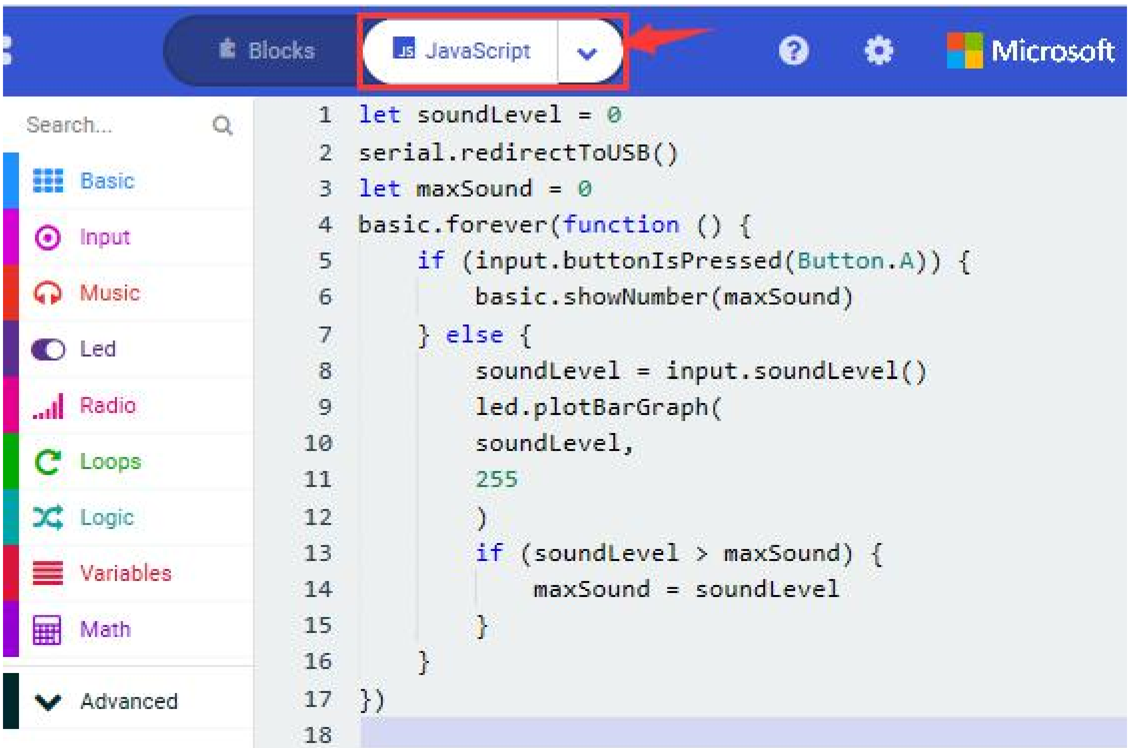
Enter “Variables” module to find and drag “soundLevel” into the “0” ;

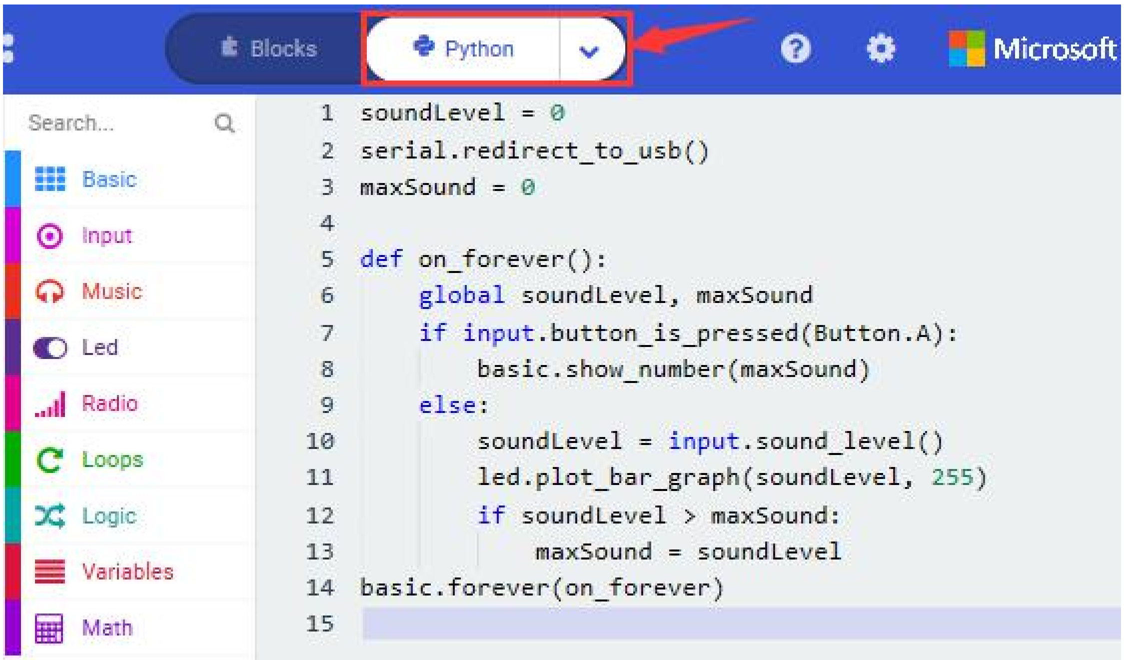


Complete Program：



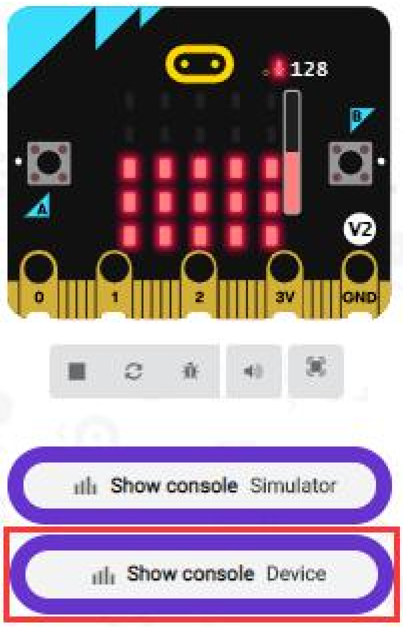
Select "JavaScript" and "Python" to switch into JavaScript and Python language code:



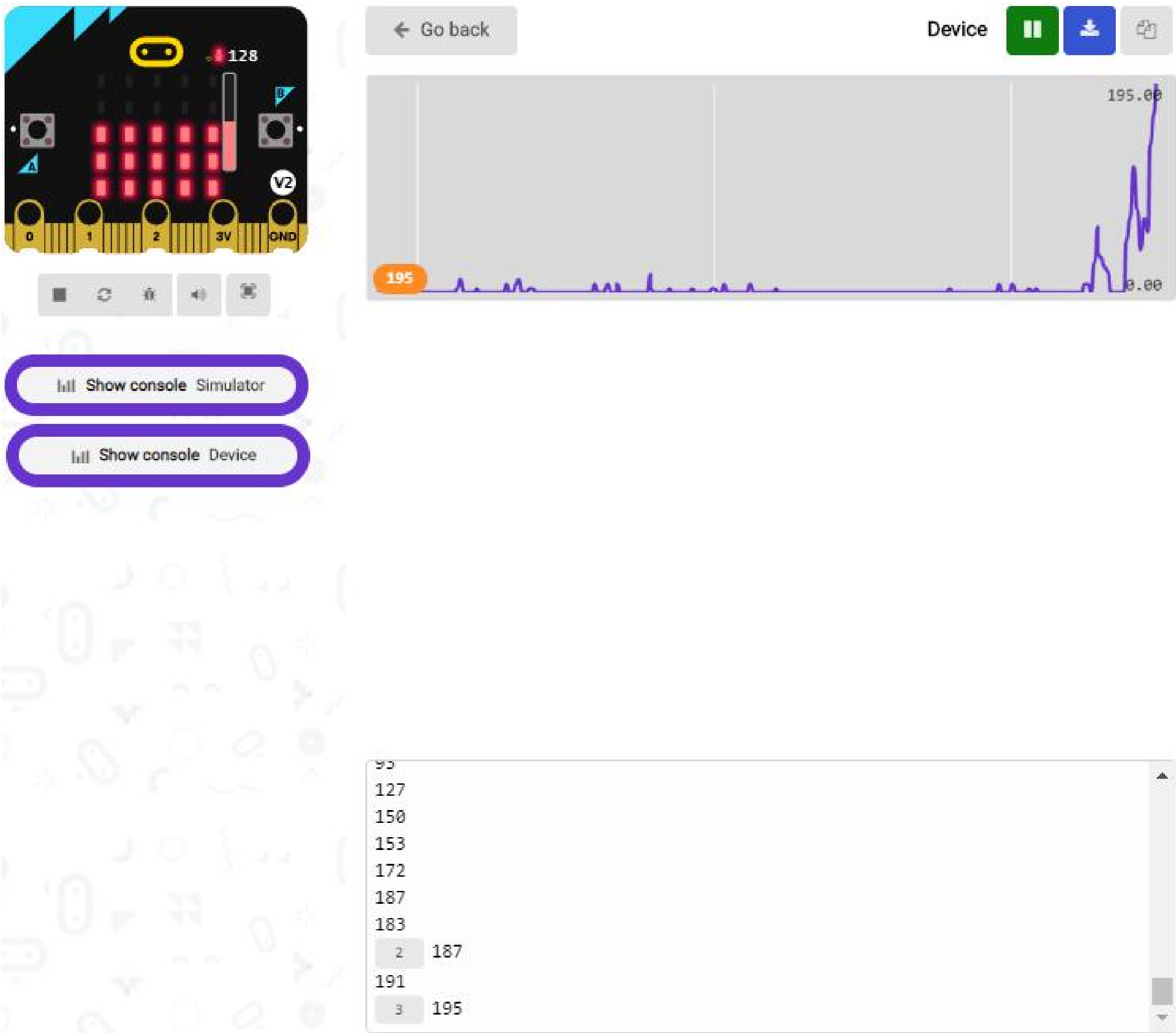


5. Test Results 2:

Upload test code to micro:bit main board V2, power the board via the USB cable and click Show console Device” as shown below.

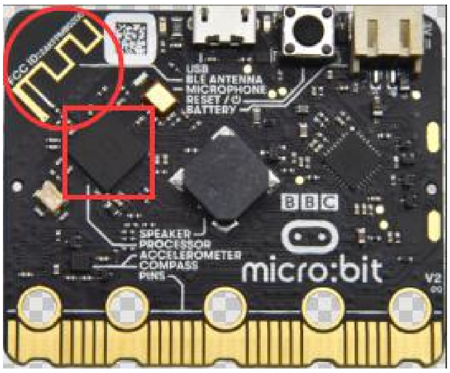


When the sound is louder around, the sound value shows in the serial port is bigger as shown below.



What’ s more, when pressing the button A, the LED dot matrix displays the value of the biggest volume(please note that the biggest volume can be reset via the Reset button on the other side of the board) while when clapping, the LED dot matrix shows the pattern of the sound.

8.12: Bluetooth Wireless Communication



1.Project Description:

The Micro: Bit main board V2 comes with a nRF52833 processor (with built-in Bluetooth 5.1 BLE(Bluetooth Low Energy) device) and a 2.4GHz antenna for Bluetooth wireless communication and 2.4GHz wireless communication. With the help of them, the board is able to communicate with a variety of Bluetooth devices, including smart phones and tablets.

In this project, we mainly concentrate on the Bluetooth wireless communication function of this main board. Linked with Bluetooth, it can transmit code or signals. To this end, we should connect an Apple device (a phone or an iPad) to the board.

Since setting up Android phones to achieve wireless transmission is similar to that of Apple devices, no need to illustrate again.

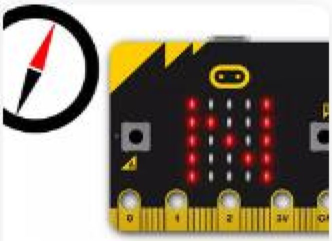
2. Preparation

*Attach the Micro:bit main board V2 to your computer via the Micro USB cable.

*An Apple device (a phone or an iPad) or an Android device;

3. Procedures:

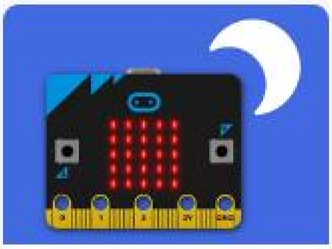
For Apple devices, enter this link: https://www.microbit.org/get-started/user-guide/ble-ios/ with your computer first, and then click "Download pairing HEX file" to download the Micro: Bit firmware to a folder or desk, and upload the downloaded firmware to the Micro: Bit main board V2.



Compass North

Create a simple compass to show...

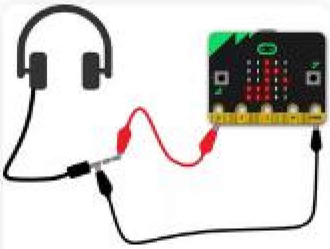
Intermediate



Nightlight

Create a light that turns on when it's...

Intermediate



Make some noise

Connect headphones or speakers to make...

Intermediate

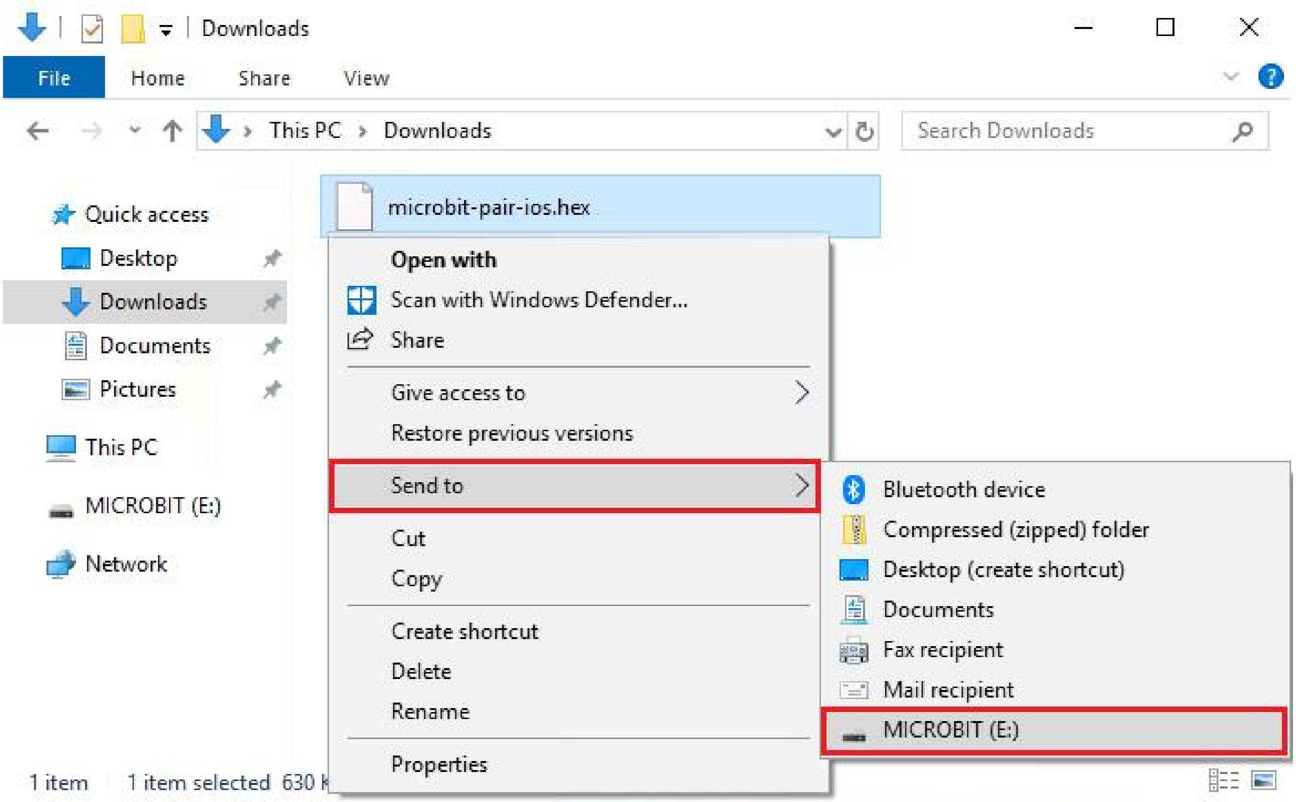
If you need help

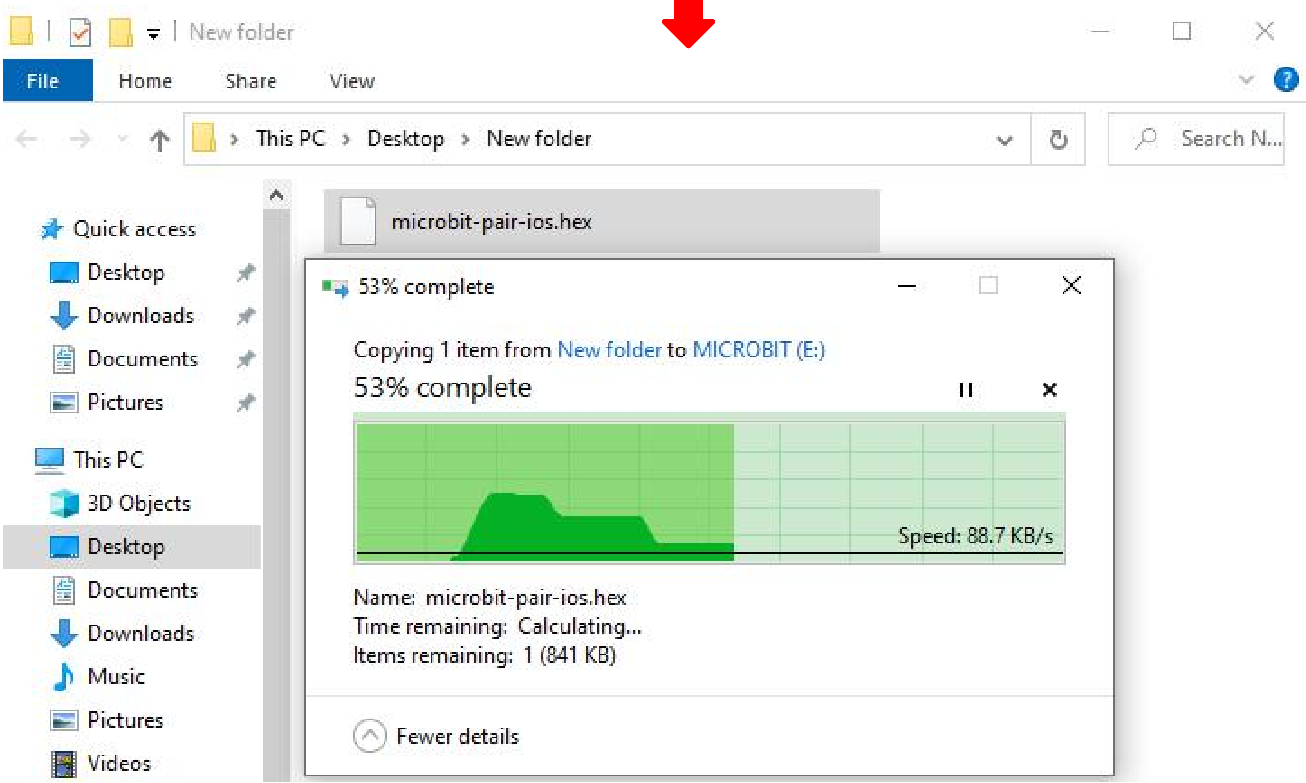
If you're having problems flashing code from your iOS device to your micro:bit, download this HEX file and transfer it to your micro:bit from a computer, or visit our support site.

Download pairing HEX file **iOS app support**

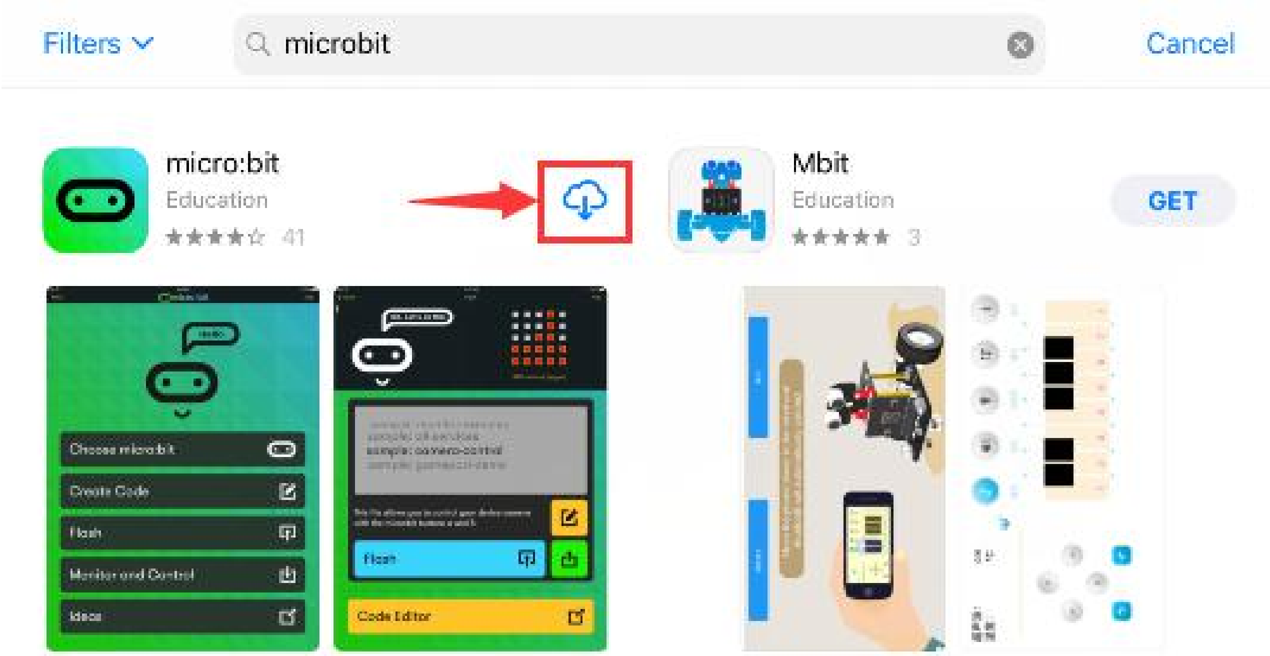
Monitor and control

The 'Monitor and control' section of the iOS app allows you to observe real-time data from the micro:bit sensors, send messages directly to the LEDs and control the micro:bit buttons and pins from your iPad or iPhone.


Downloads
File
Home
Share
View
This PC › Downloads
Search Downloads
Quick access
Desktop
Downloads
Documents
Pictures
This PC
MICROBIT (E:)
Network
microbit-pair-ios.hex
Open with
Scan with Windows Defender...
Share
Give access to
Restore previous versions
Send to
Cut
Copy
Create shortcut
Delete
Rename
Properties
Bluetooth device
Compressed (zipped) folder
Desktop (create shortcut)
Documents
Fax recipient
Mail recipient
MICROBIT (E:)
1 item
1 item selected 630 K


New folder
File
Home
Share
View
This PC › Desktop › New folder
Search N...
Quick access
Desktop
Downloads
Documents
Pictures
This PC
3D Objects
Desktop
Documents
Downloads
Music
Pictures
Videos
microbit-pair-ios.hex
53% complete
Copying 1 item from New folder to MICROBIT (E:)
53% complete
Speed: 88.7 KB/s
Name: microbit-pair-ios.hex
Time remaining: Calculating...
Items remaining: 1 (841 KB)
Fewer details

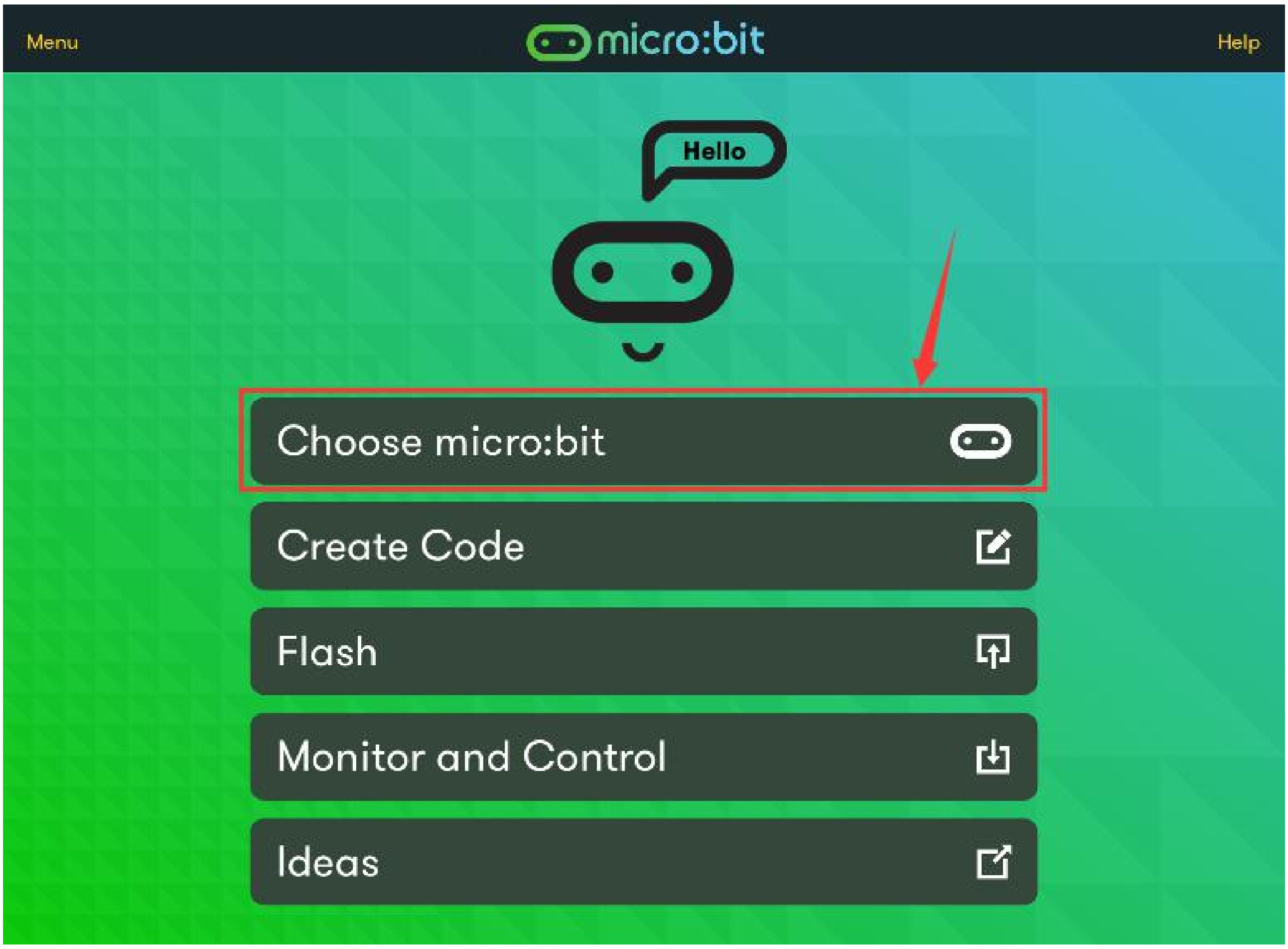
Search “micro bit” in your App Store to download the APP micro:bit.



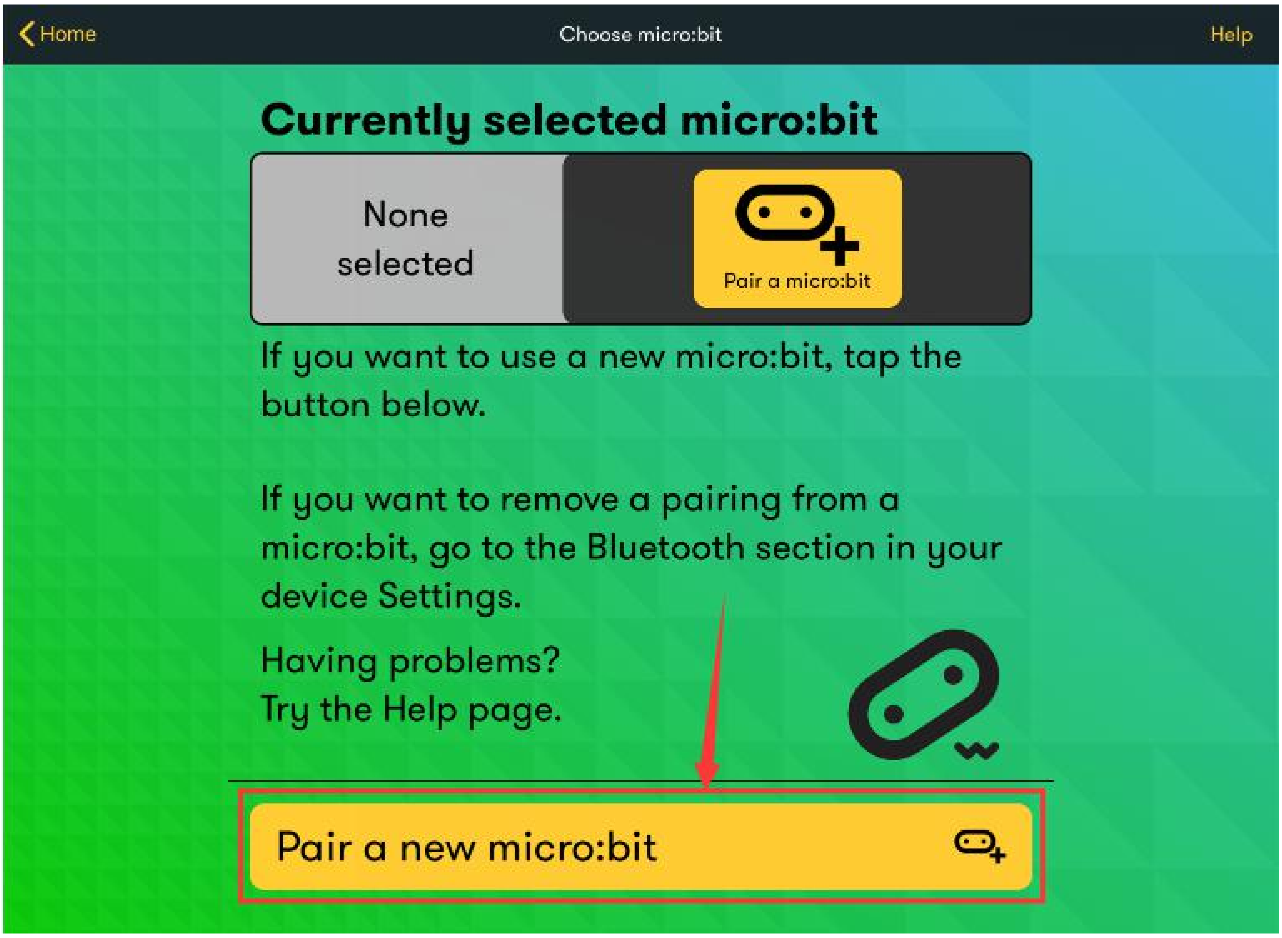
Connect your Apple device with Micro: Bit main board V2:

Firstly, turn on the Bluetooth of your Apple device and open the APP micro:bit to select item “Choose micro:bit” to start pairing Bluetooth.

Please make sure that the Micro: Bit main board V2 and your computer are still linked via the USB cable.

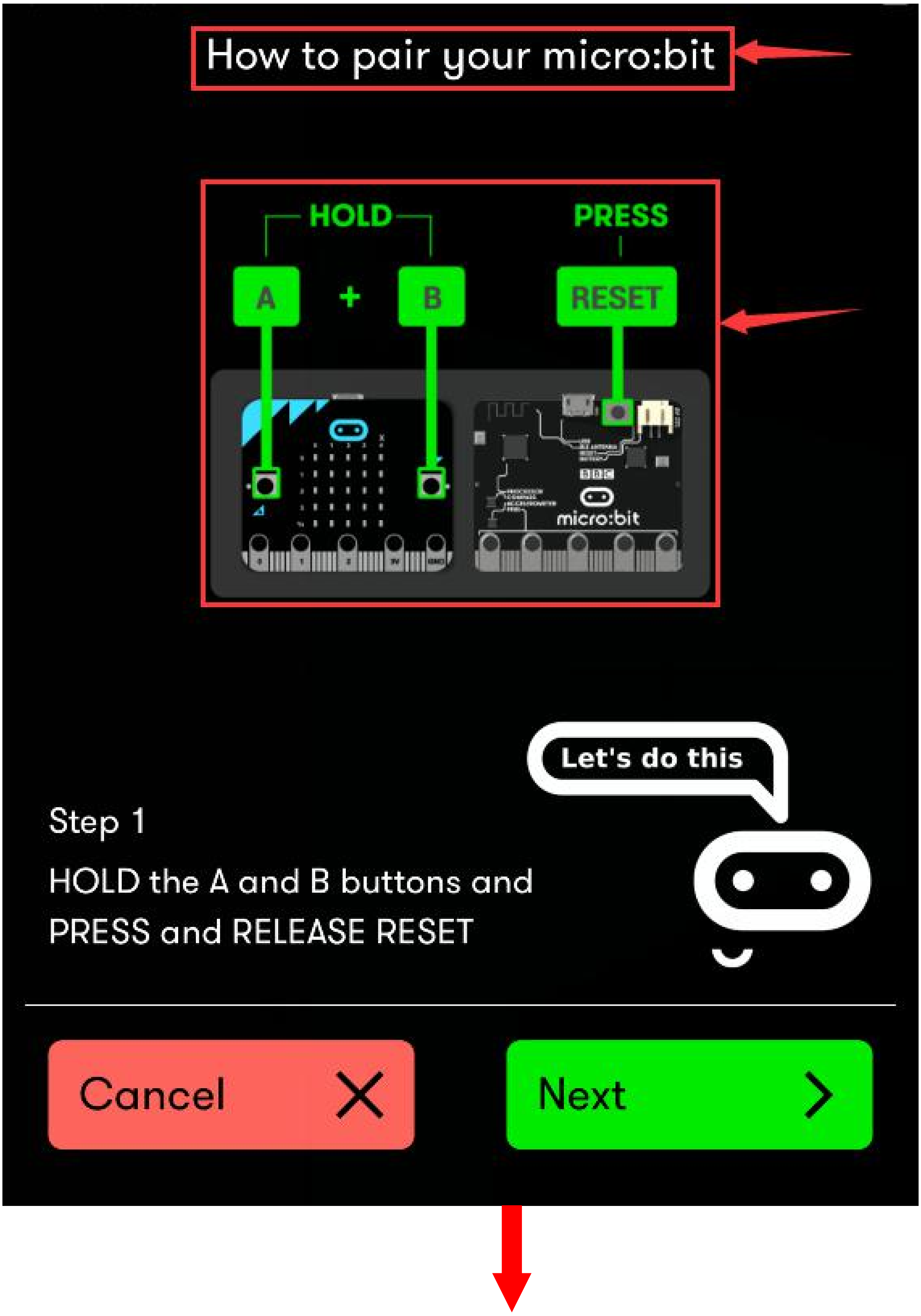


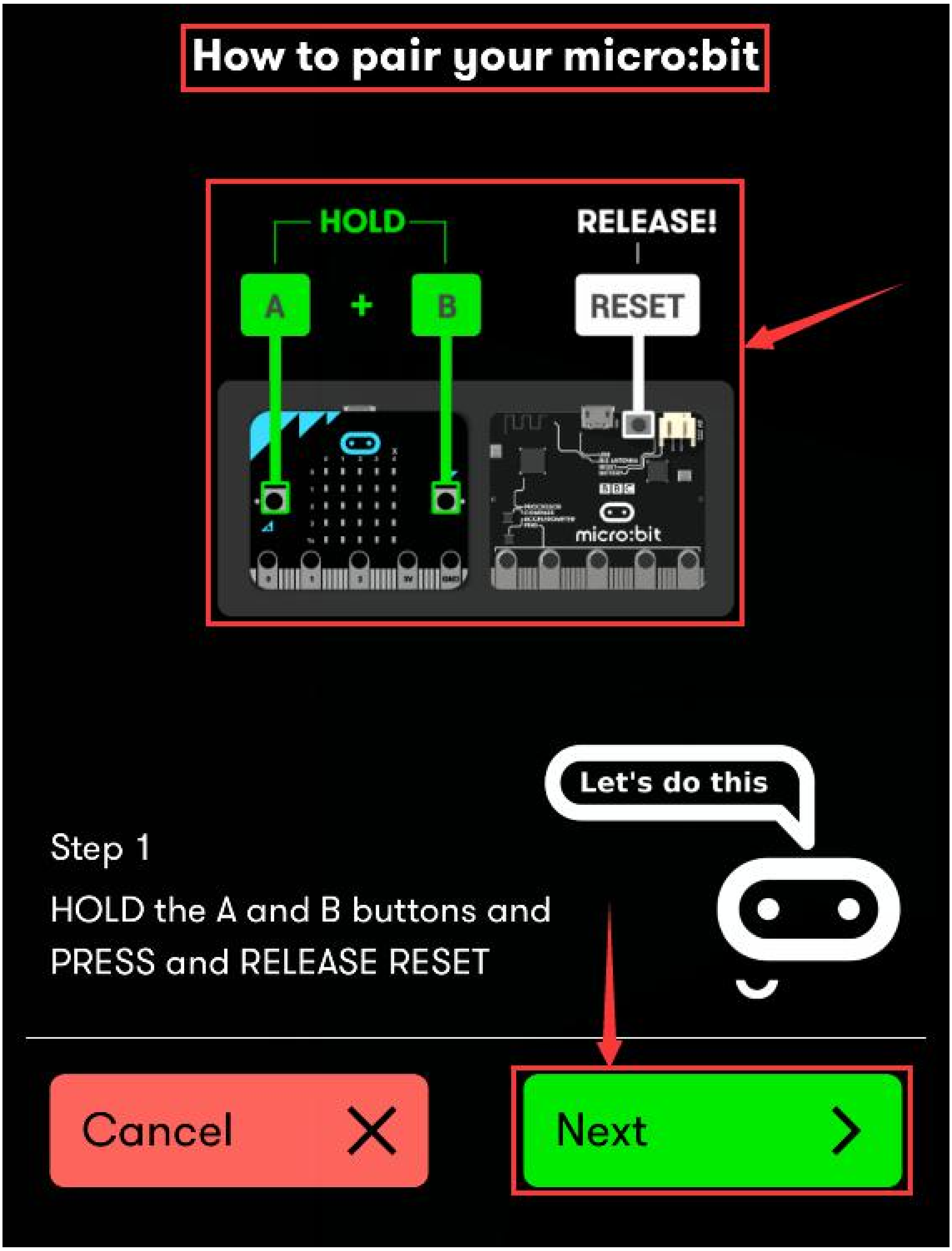
Secondly, click “Pair a new micro:bit”;



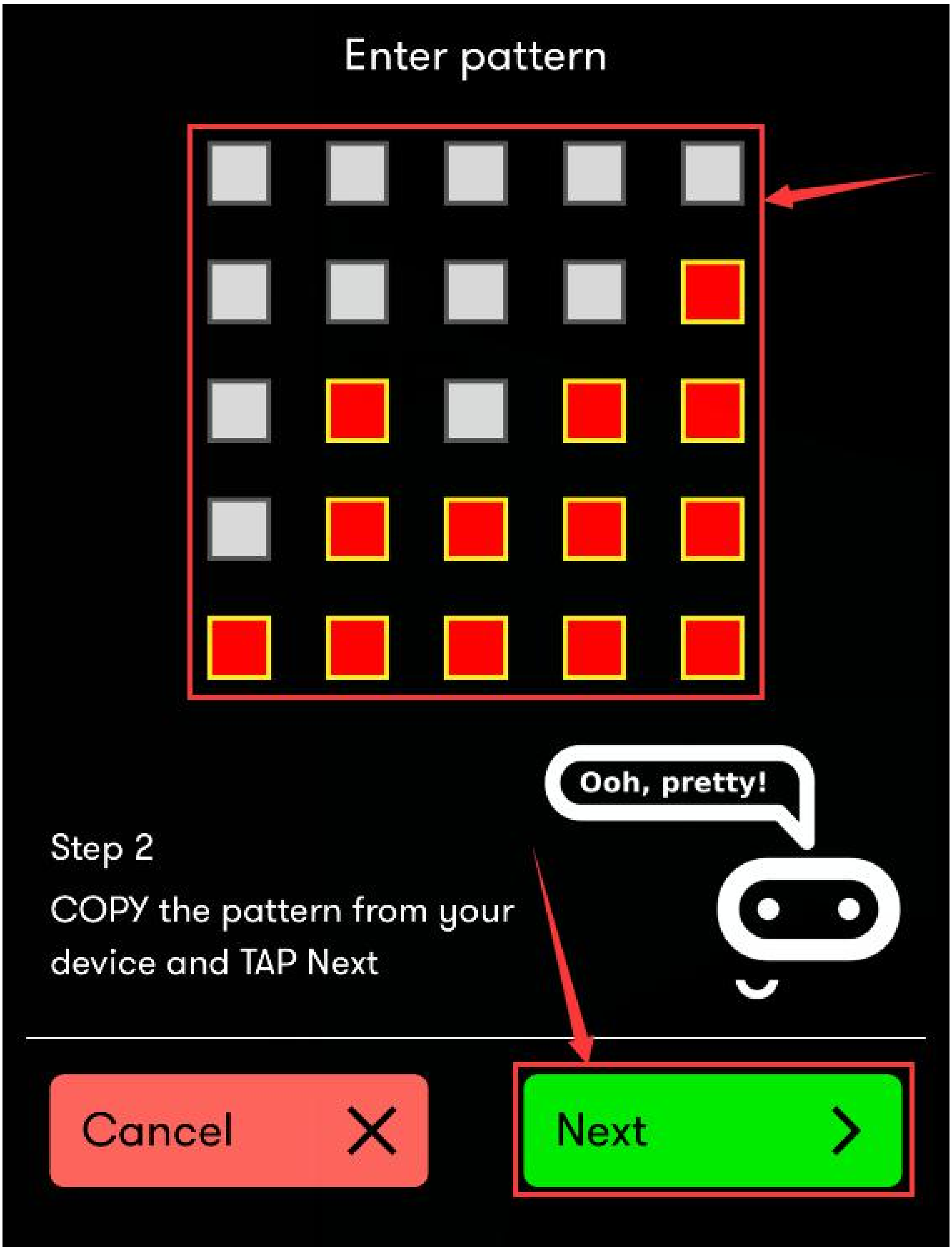
Following the instructions to press button A and B at the same time(do not release them until you are told to) and press Reset & Power button for a few seconds.

Release the Reset & Power button, you will see a password pattern shows on the LED dot matrix. Now , release buttons A and B and click Next.

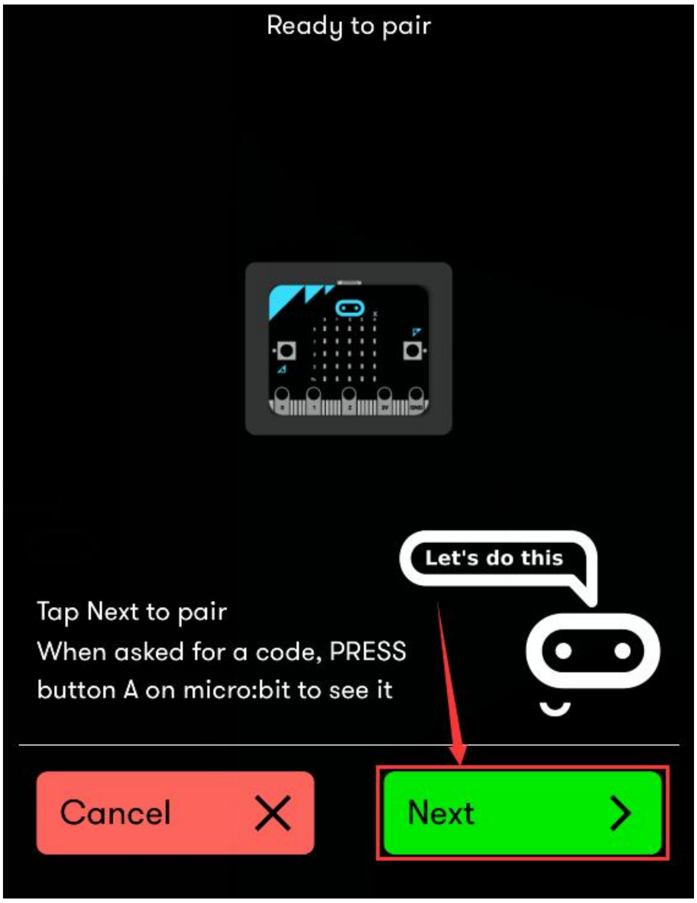

How to pair your micro:bit
HOLD
PRESS
A
+
B
RESET
micro:bit
Let's do this
Step 1
HOLD the A and B buttons and
PRESS and RELEASE RESET
Cancel
Next

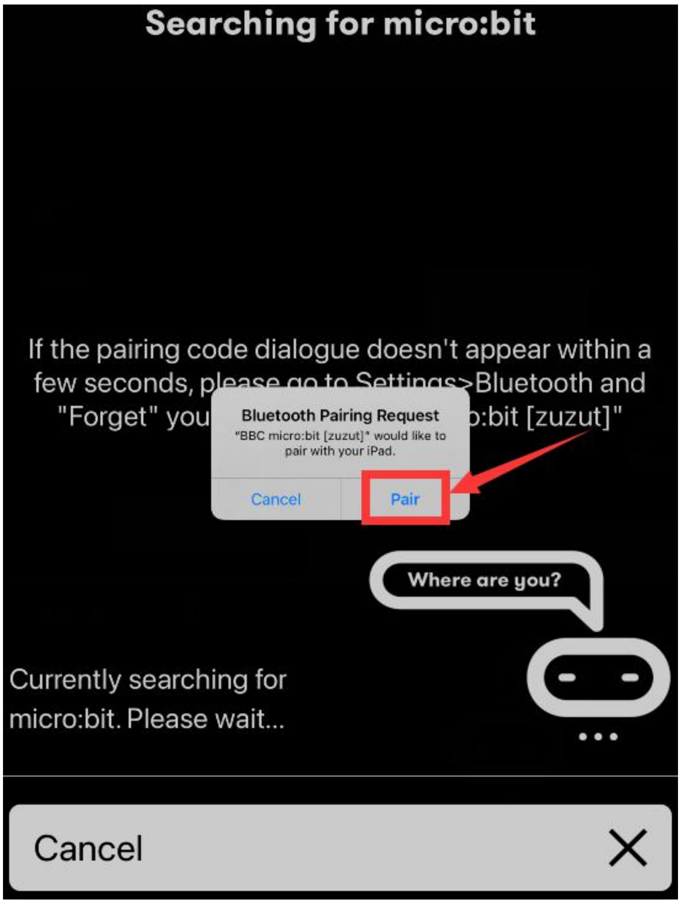

How to pair your micro:bit
HOLD
A
+
B
RELEASE!
RESET
micro:bit
Let's do this
Step 1
HOLD the A and B buttons and
PRESS and RELEASE RESET
Cancel
Next

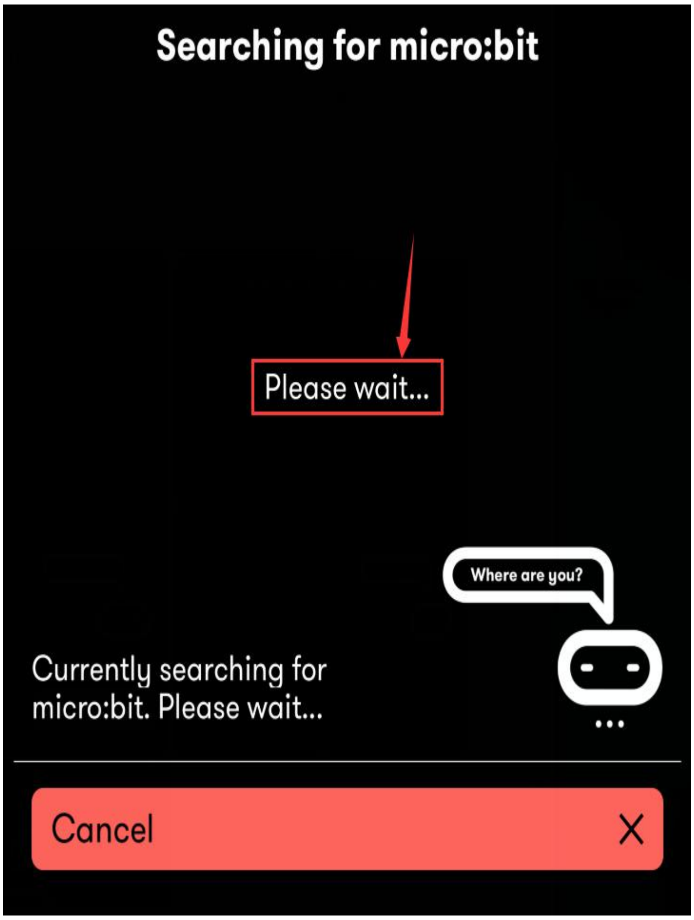
Set the password pattern on your Apple device as the same pattern showed on the matrix and click Next.

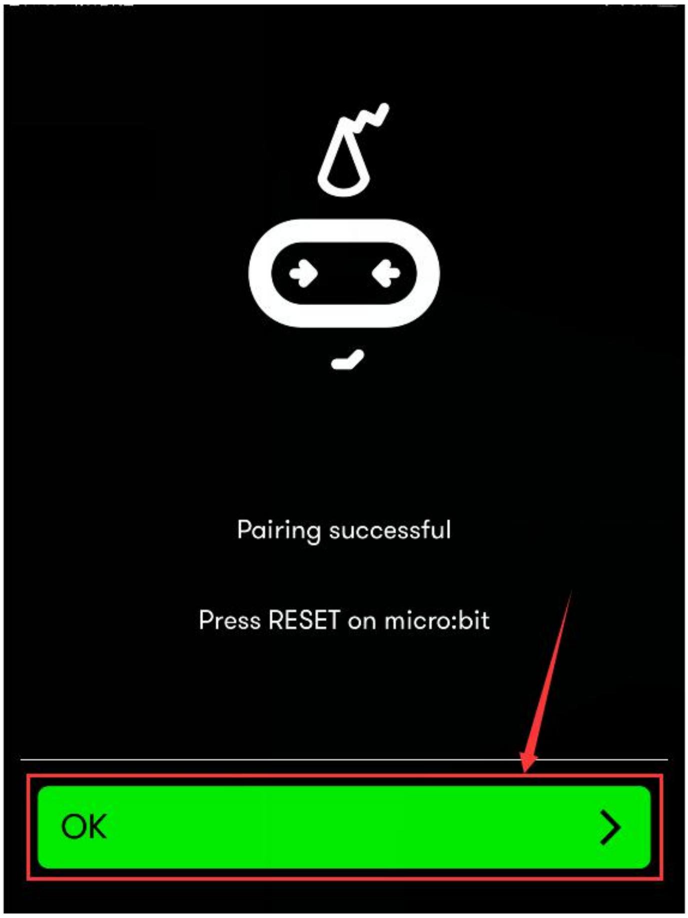


Still click Next and a dialog box props up as shown below. Then click "Pair". A few seconds later, the match is done and the LED dot matrix displays the "√" pattern.




Searching for micro:bit
If the pairing code dialogue doesn't appear within a few seconds, please go to Settings>Bluetooth and "Forget" you
:bit [zuzut]"
Bluetooth Pairing Request
"BBC micro:bit [zuzut]" would like to pair with your iPad.
Cancel
Pair
Where are you?
Currently searching for micro:bit. Please wait...
Cancel

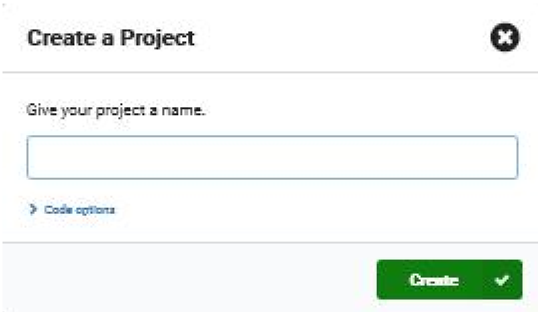

Searching for micro:bit
Please wait...
Where are you?
Currently searching for micro:bit. Please wait...
Cancel



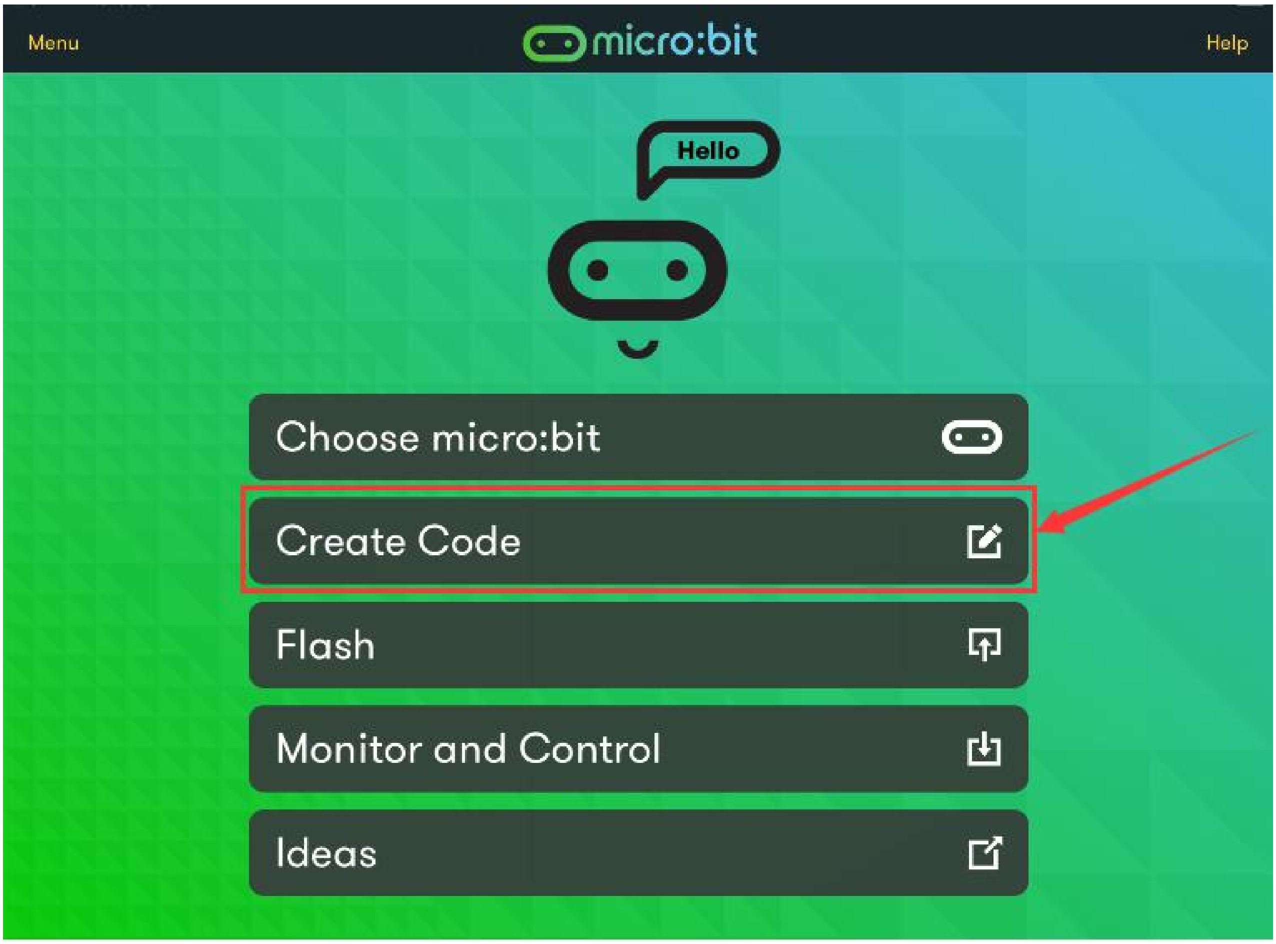
After the match with Bluetooth, write and upload code with the App.

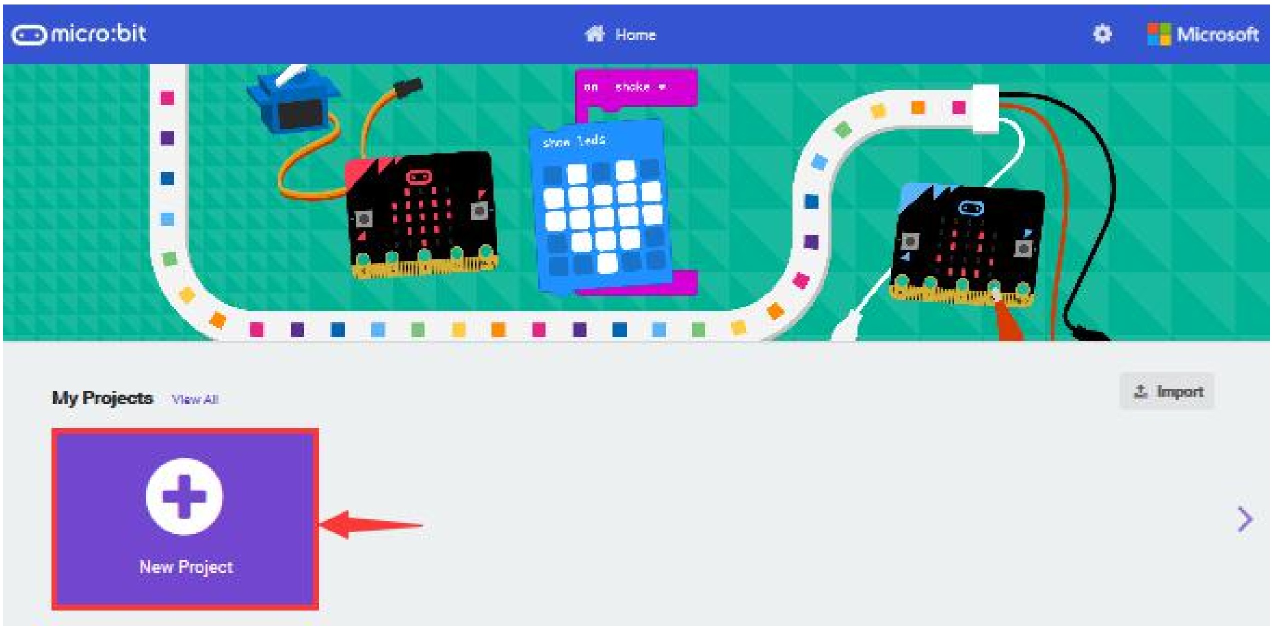
Click “Create Code” to enter the programming page and write code.

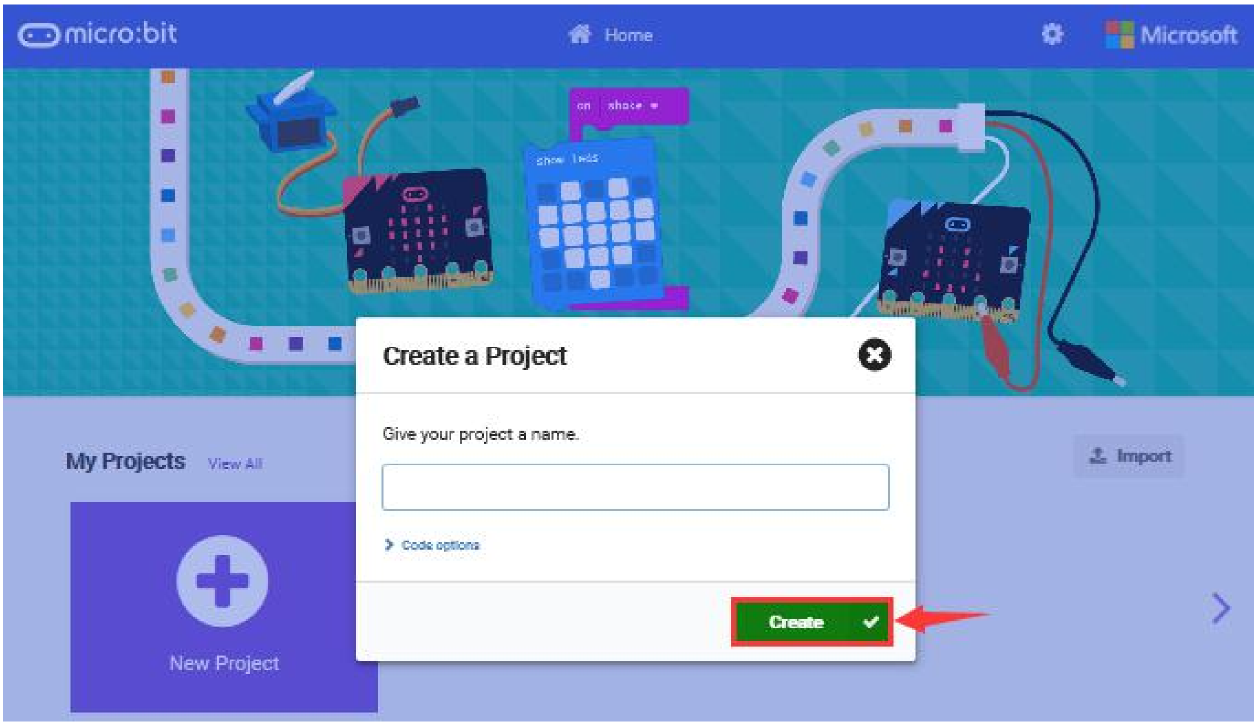
Click 

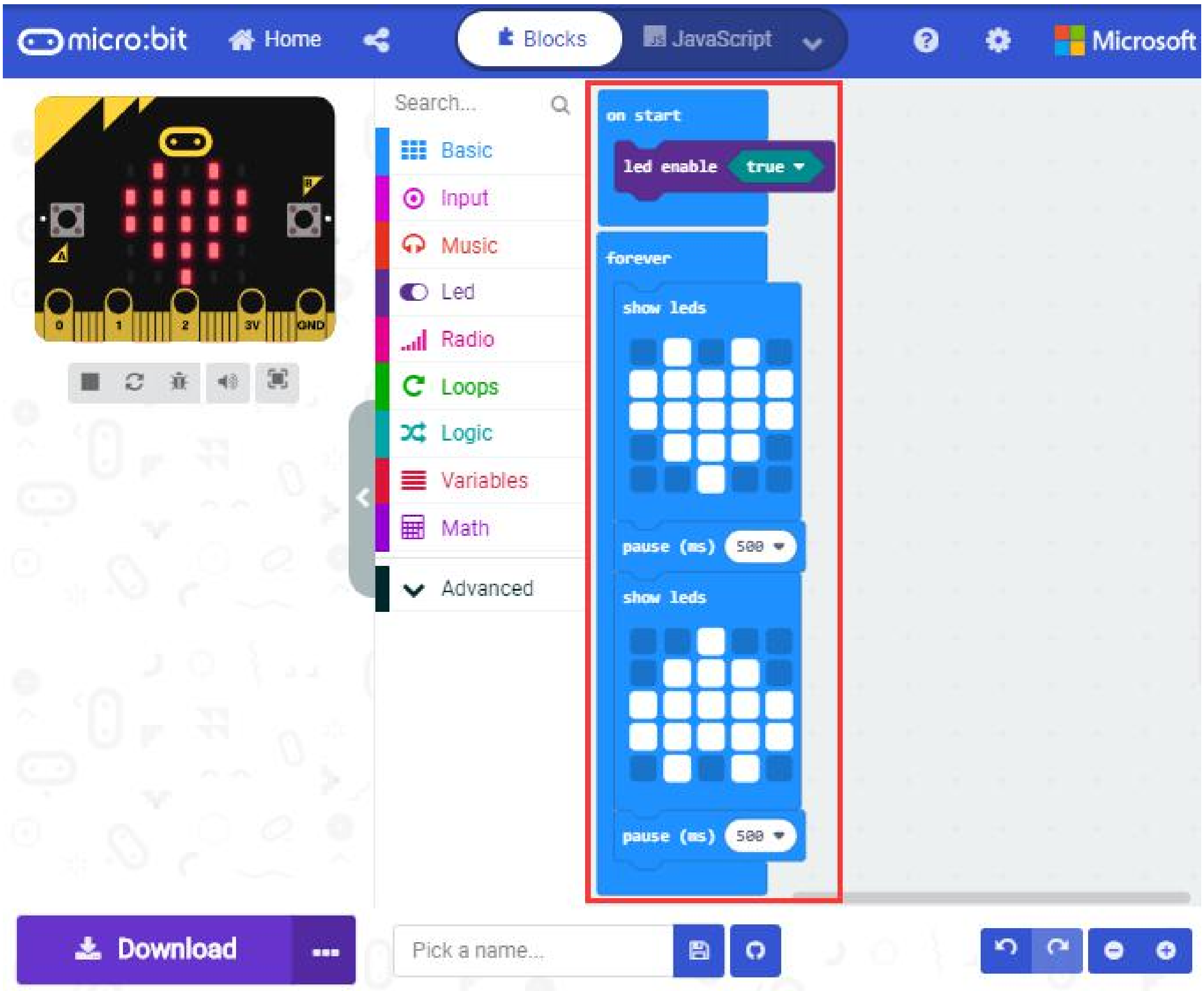
and the box 

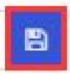
appears, and then select “Create √”.

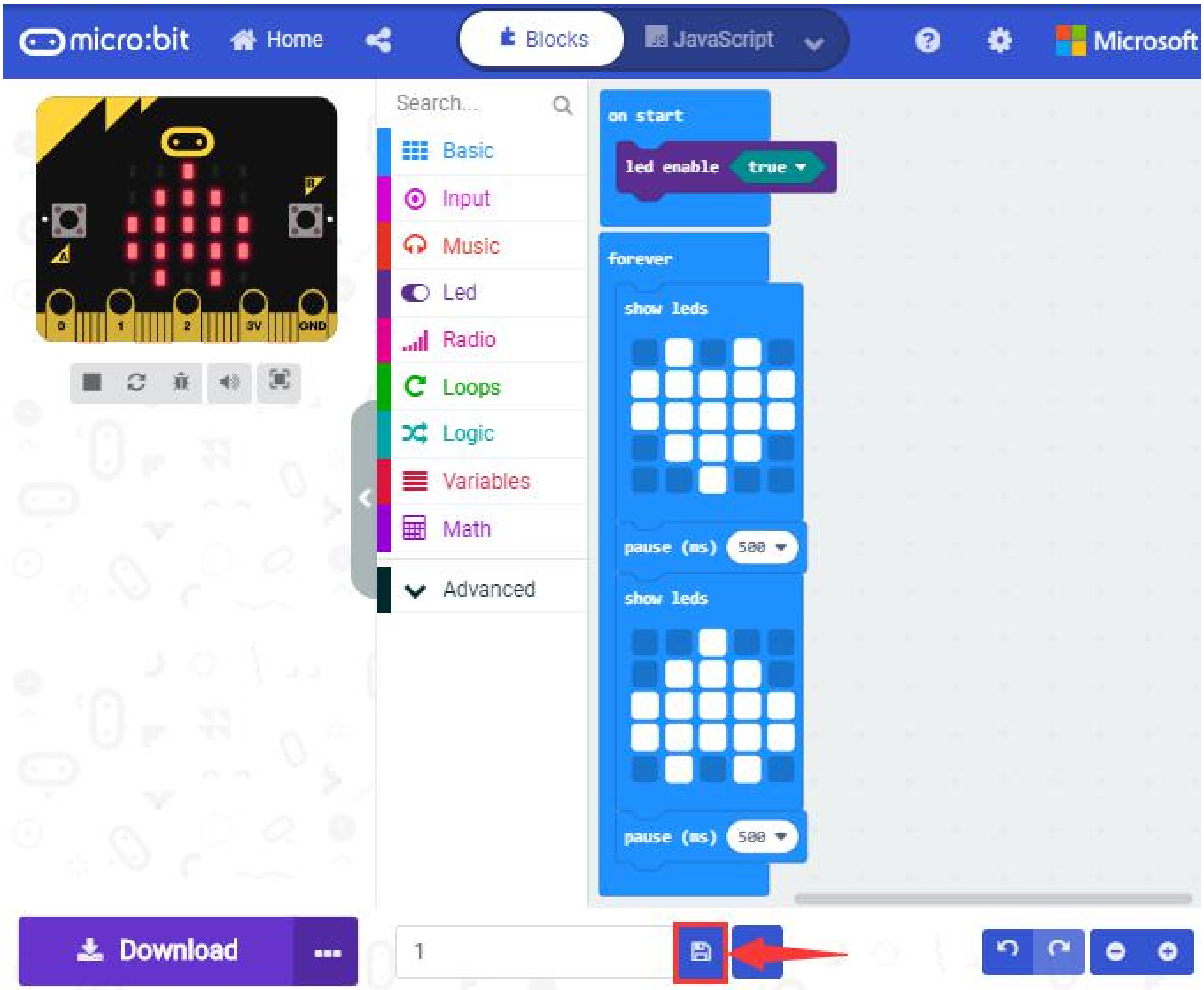

Menu
micro:bit
Help
Hello
Choose micro:bit
Create Code
Flash
Monitor and Control
Ideas


micro:bit
Home
Microsoft
on shake
show leds
My Projects
View All
Import
New Project

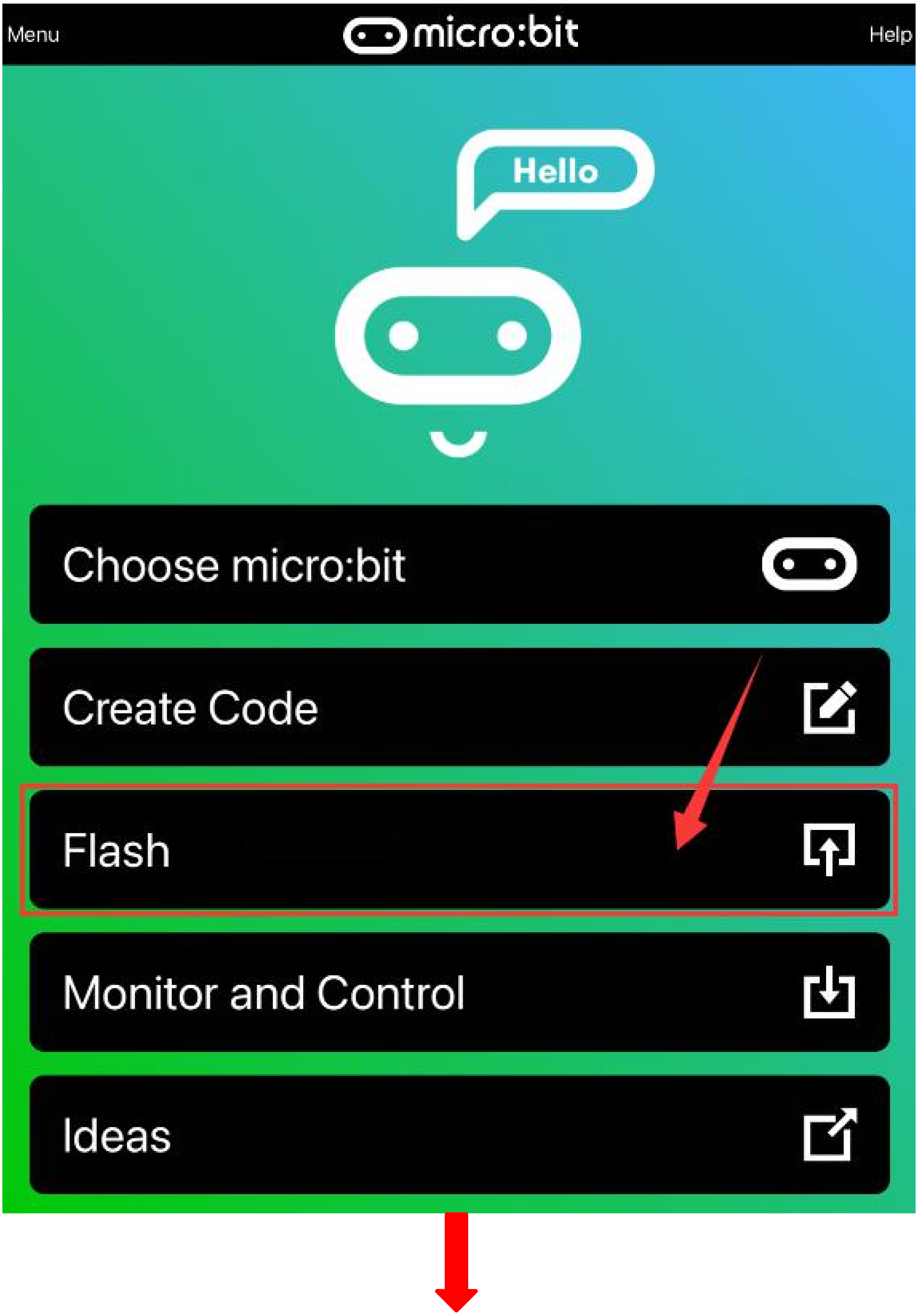

micro:bit
Home
Microsoft
Create a Project
Give your project a name.
Code options
Create
My Projects
View All
Import
New Project

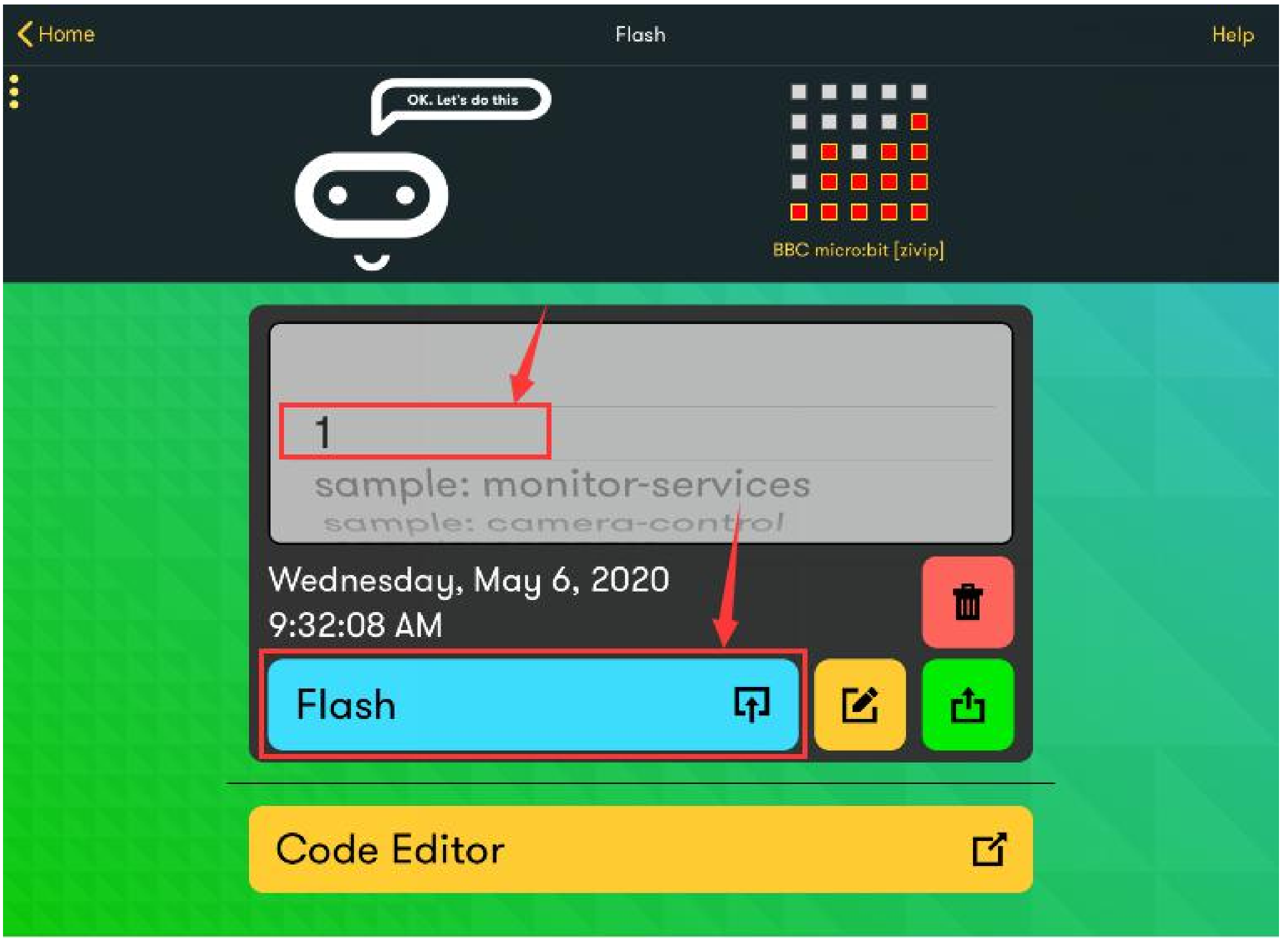


Name the code as “1” and click  to save it.

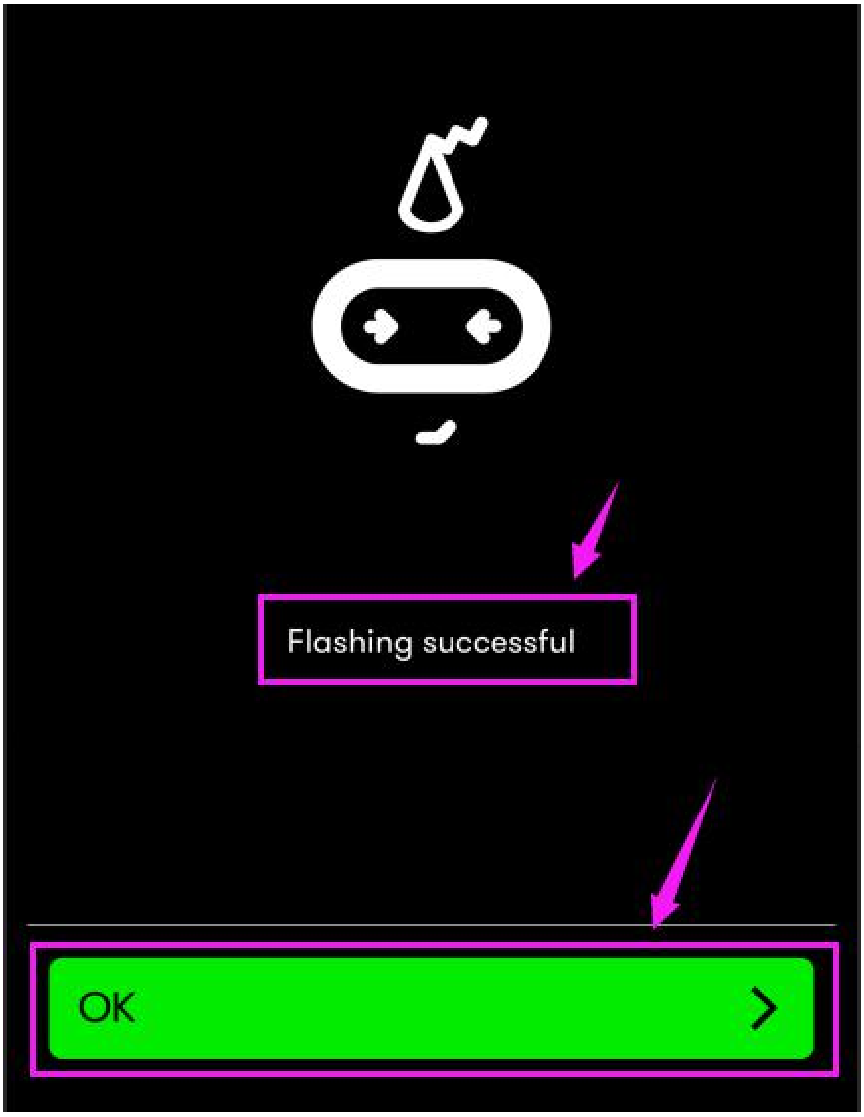


Click the third item “Flash” to enter the uploading page. The default code program for uploading is the one saved just now and named "1" and then click the other "Flash" to upload the code program "1".


Menu
micro:bit
Help
Hello
Choose micro:bit
Create Code
Flash
Monitor and Control
Ideas


Home
Flash
Help
OK. Let's do this
BBC micro:bit [zivip]
1
sample: monitor-services
sample: camera-control
Wednesday, May 6, 2020
9:32:08 AM
Flash
Code Editor

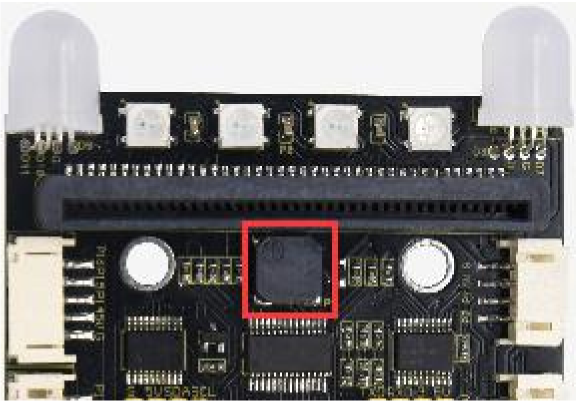
If the code is uploaded successfully a few seconds later, the App will emerge as below and the LED dot matrix of the Micro: Bit main board V2 will exhibit a heart pattern.



Projects above all conduct with the built-in sensors and the LED dot matrix of the main board while the following ones will carry out with the help of external sensors of this turtle car.

（Attention：to avoid burning the the Micro:bit main board V2, please remove the USB cable and the external power from the board before fix it with the shield of the car; likewise, the USB cable and the external power should be cut from the main board before disconnect the shield from the board.)

8.13: Passive Buzzer



1. Description :

We can use Micro:bit board to make many interactive works of which the most commonly used is acoustic-optic display. The previous lessons are related to LED. However, we will elaborate the Sound in this lesson.

Buzzer is inclusive of active buzzer and passive buzzer.

The passive buzzer doesn’t carry with vibrator inside, so it need external sine or square wave to drive. It can produce slight sound when connecting directly to power supply. It features controlling sound frequency and producing the sound of “do re mi fa so la si”.

A diode should be connected in reverse when driving by the square wave signal source, which will hinder the high-voltage generated to damage other components or service life when the power breaks down.

Frequency is made of a series of pitch names in English letters and Numbers. You can choose different frequencies, that is, tone. The frequency of sound is called pitch.

It involves music knowledge. In music lesson, our teacher taught “1 (Do) , 2 (Re) , 3(Mi), 4(Fa) , 5(Sol), 6(La), 7(Si)”

1(Do)	2 (Re)	3(Mi)	4(Fa)	5(Sol)	6(La)	7(Si)
C	D	E	F	G	A	B

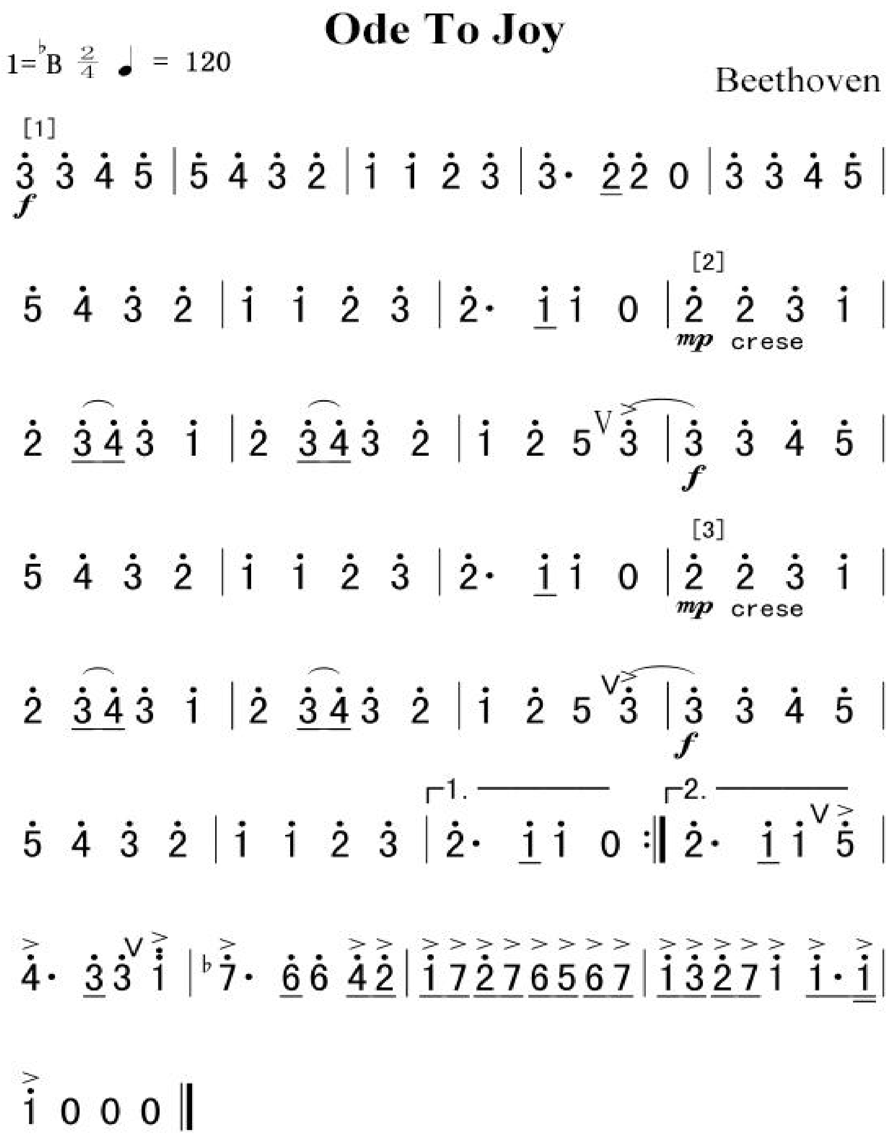
The number depends on high or low tone. The larger the number, the higher the tone. When the number is the same, the frequency (tone) is getting higher and higher from C to _B.

Beats are the time delay for each note. The larger the number, the longer the delay time. A note without a line in the spectrum is a beat, with a delay of 1000 milliseconds. while a beat with an underline is 1/2 of a beat without a line, and a beat with two underlines is 1/4 of a beat without a line.

(

)

Here is the notation of Ode to Joy.



2. Experimental Preparation：

(1) Insert micro:bit board into slot of V2 shield.

(2) Place batteries into battery holder.

(3) Dial POWER switch to ON end

(4) Connect micro:bit to computer by USB cable and open online Makecode editor.

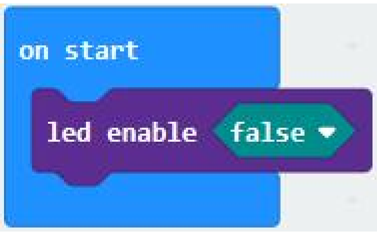
Import Hex profile **(How to import?)** , or click “New Project” and drag blocks step by step(add turtle-bit extension library first)

(How to add turtle-bit extension?)

1. Test Code :

Type	Route	File Name
Hex file	../Makecode Tutorial/Test Code/8.13：Passive Buzzer	microbit-Passive Buzzer.hex

Or you could edit code step by step in the editing area.

(1) Click “Led” →” more” → “led enable false” , combine it with “on start” .

****

(2) Enter “Music” → “play tone Middle C for 1 beat” , leave it into “forever” block , then tap “Middle C” , then

appear 

code.

Choose “High E” and set to “1 beat” .

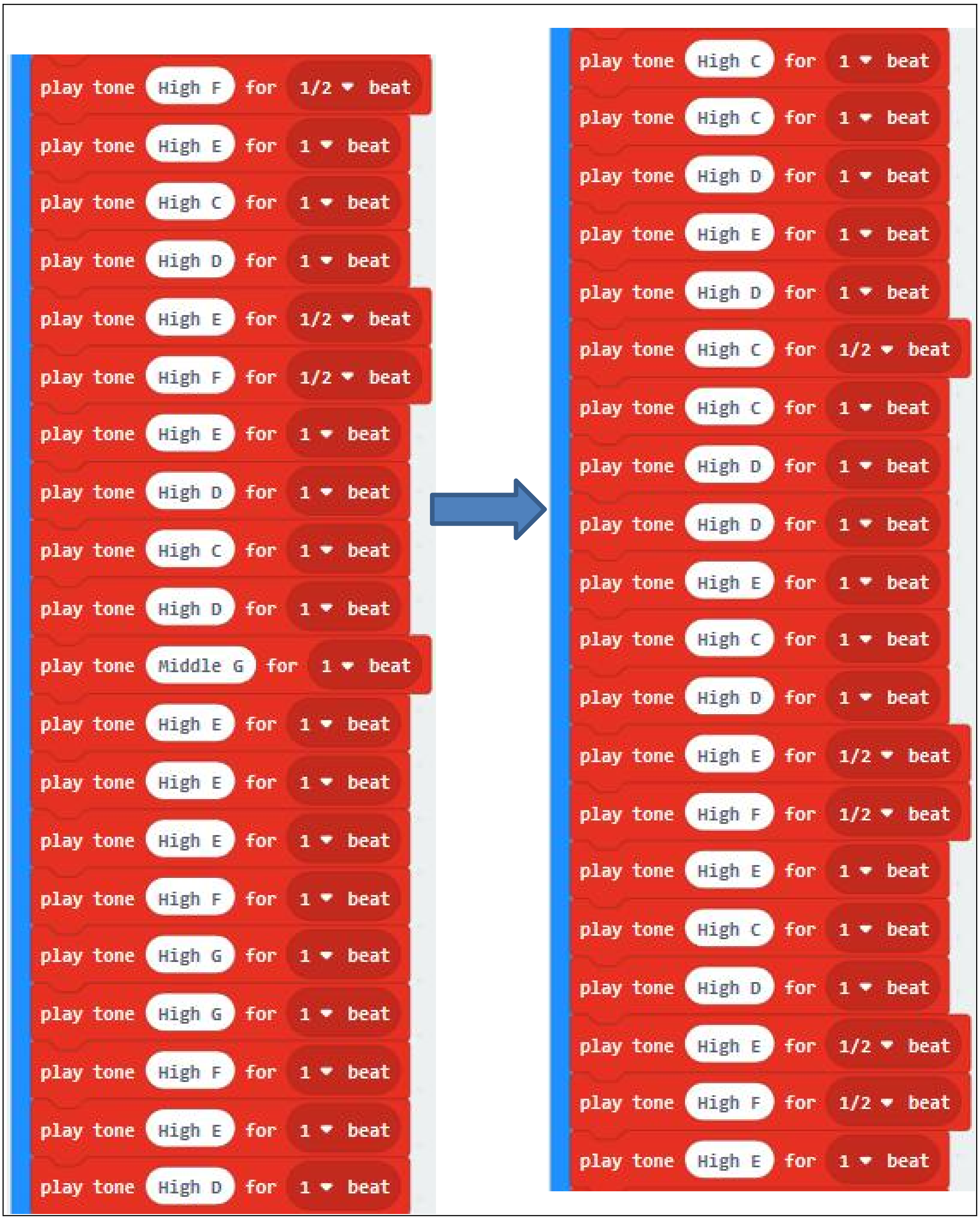
.

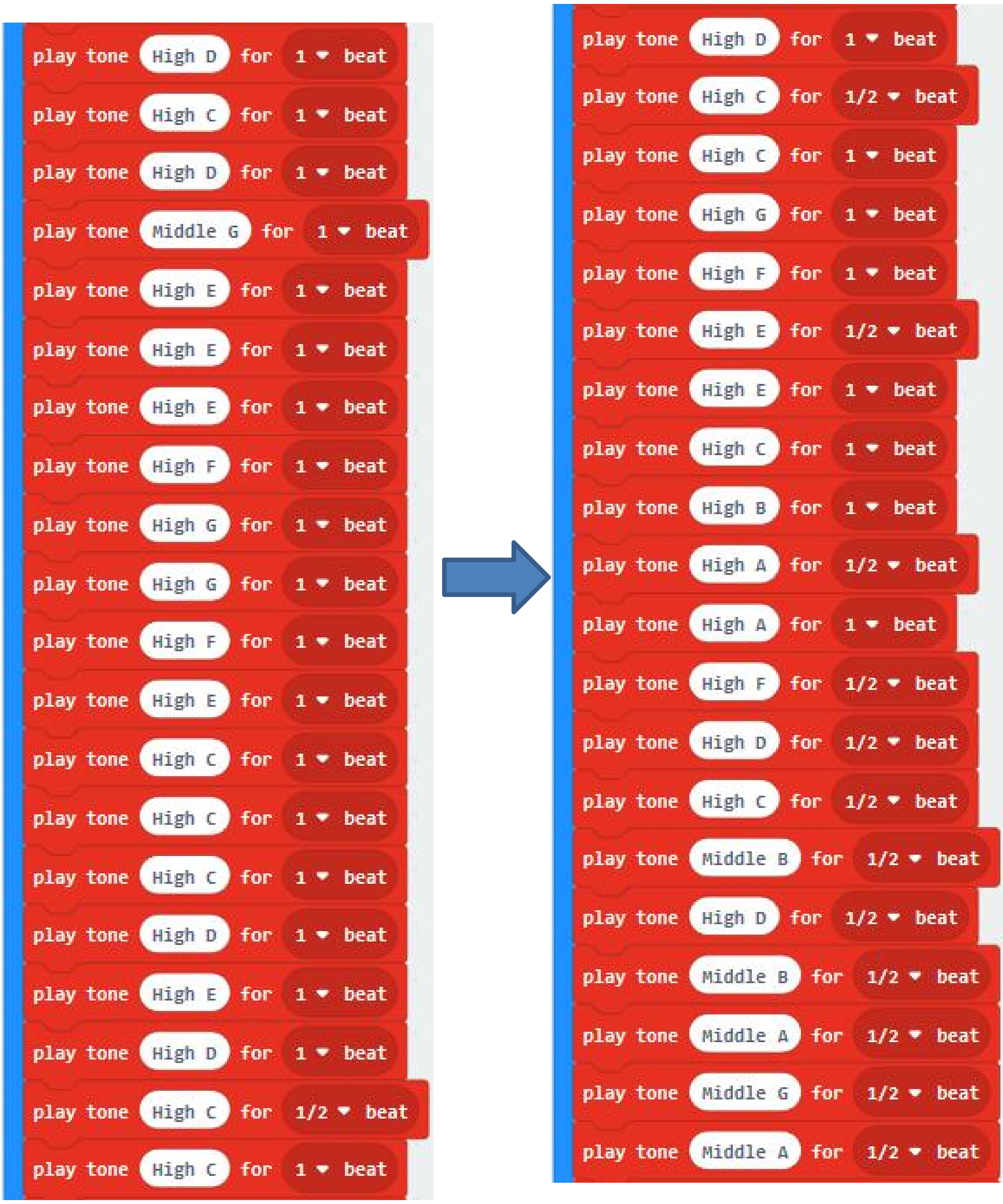
(3) According to the above music score. Copy “play tone High E for 1 beat” 124 times , separately change “High E” of “play tone High E for 1 beat” into “High E” , “High F” , “High G” , “High G” , “High F” , “High E” , “High D” , “High C” , “High C” , “High D” , “High E” , “High E” , “High D” , “High D” , “High E” , “High E” , “High F” , “High G” , “High G” , “High F” , “High E” , “High D” , “High C” , “High C” , “High D” , “High E” , “High D” , “High C” , “High C” , “High D” , “High D” , “High E” , “High C” , “High D” , “High E” , “High F” , “High E” , “High C” , “High D” , “High E” , “High F” , “High

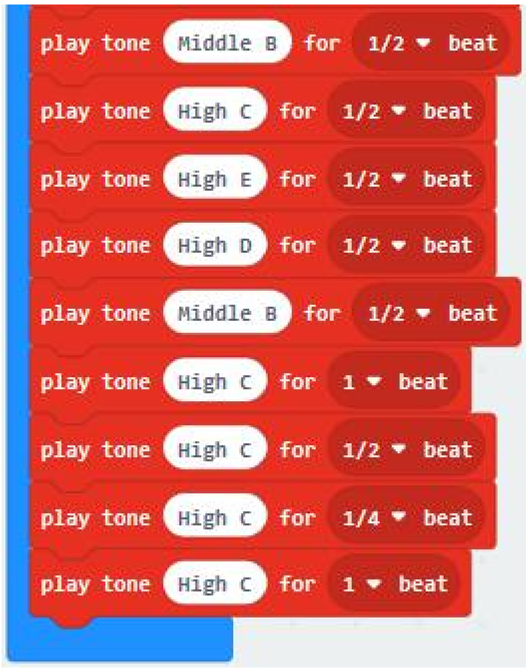
E” , “High D” , “High C” , “High D” , “Middle G ” , “High E” , “High E” , “High E” , “High F” , “High G” , “High G” , “High F” , “High E” , “High D”, “High C” , “High C” , “High D” , “High E” , “High D” , “High C” , “High C” , “High D” , “High D” , “High E” , “High C” , “High D” , “High E” , “High F” , “High E” , “High C” , “High D” , “High E” , “High F” , “High E” , “High D” , “High C” , “High D” , “Middle G” , “High E” , “High E” , “High E” , “High F” , “High G” , “High G” , “High F” , “High E” , “High C” , “High C”, “High C” , “High D” , “High E” , “High D” , “High C” , “High C” , “High D” , “High C” , “High C” , “High G” , “High F” , “High E” , “High E” , “High C” , “High B” , “High A” , “High A” , “High F” , “High D” , “High C” , “Middle B” , “High D” , “Middle B” , “Middle A” , “Middle G” , “Middle A” , “Middle B” , “High C” , “High E” , “High D” , “Middle B” , “High C” , “High C” , “High C” , “High C” .

Then set beat to “1” , “1” , “1” , “1” , “1” , “1” , “1” , “1” , “1” , “1” , “1” , “1” , “1/2” , “1” , “1” , “1” , “1” , “1” , “1” , “1” , “1” , “1” , “1”, “1” , “1” , “1” , “1” , “1/2” , “1” , “1” , “1” , “1” , “1” , “1” , “1/2” , “1/2”, “1” , “1” , “1” , “1/2” , “1/2” , “1” , “1” , “1” , “1” , “1” , “1” , “1” , “1”, “1” , “1” , “1” , “1” , “1” , “1” , “1” , “1” , “1” , “1” , “1” , “1/2” , “1”, “1” , “1” , “1” , “1” , “1” , “1/2” , “1/2” , “1” , “1” , “1” , “1/2” , “1/2”, “1” , “1” , “1” , “1” , “1” , “1” , “1” , “1” , “1” , “1” , “1” , “1” , “1” , “1” , “1” , “1” , “1” , “1” , “1” , “1/2” , “1” , “1” , “1/2” , “1” , “1” , “1”, “1/2” , “1” , “1” , “1” , “1/2” , “1” , “1/2” , “1/2” , “1/2” , “1/2” , “1/2”, “1/2” , “1/2” , “1/2” , “1/2” , “1/2” , “1/2” , “1/2” , “1/2” , “1/2” , “1”, “1/2” , “1/4” , “1” .

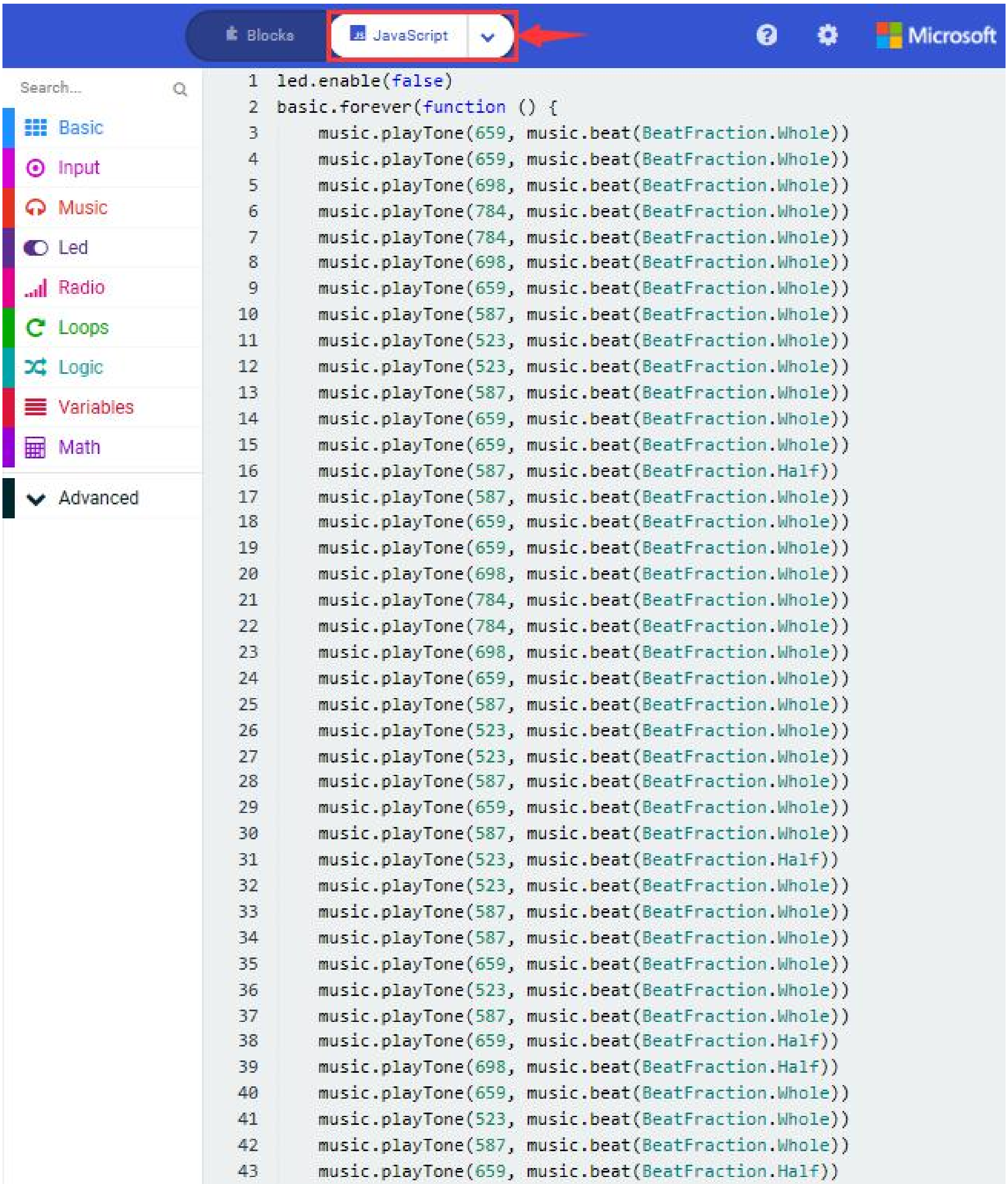
Complete Program：


play tone High F for 1/2 beat
play tone High E for 1 beat
play tone High C for 1 beat
play tone High D for 1 beat
play tone High E for 1/2 beat
play tone High F for 1/2 beat
play tone High E for 1 beat
play tone High D for 1 beat
play tone High C for 1 beat
play tone High D for 1 beat
play tone Middle G for 1 beat
play tone High E for 1 beat
play tone High E for 1 beat
play tone High E for 1 beat
play tone High F for 1 beat
play tone High G for 1 beat
play tone High G for 1 beat
play tone High F for 1 beat
play tone High E for 1 beat
play tone High D for 1 beat
play tone High C for 1 beat
play tone High C for 1 beat
play tone High D for 1 beat
play tone High E for 1 beat
play tone High D for 1 beat
play tone High C for 1/2 beat
play tone High C for 1 beat
play tone High D for 1 beat
play tone High D for 1 beat
play tone High E for 1 beat
play tone High C for 1 beat
play tone High D for 1 beat
play tone High E for 1/2 beat
play tone High F for 1/2 beat
play tone High E for 1 beat
play tone High C for 1 beat
play tone High D for 1 beat
play tone High E for 1/2 beat
play tone High F for 1/2 beat
play tone High E for 1 beat


play tone High D for 1 beat
play tone High C for 1 beat
play tone High D for 1 beat
play tone Middle G for 1 beat
play tone High E for 1 beat
play tone High E for 1 beat
play tone High E for 1 beat
play tone High F for 1 beat
play tone High G for 1 beat
play tone High G for 1 beat
play tone High F for 1 beat
play tone High E for 1 beat
play tone High C for 1 beat
play tone High C for 1 beat
play tone High C for 1 beat
play tone High D for 1 beat
play tone High E for 1 beat
play tone High D for 1 beat
play tone High C for 1/2 beat
play tone High C for 1 beat
play tone High D for 1 beat
play tone High C for 1/2 beat
play tone High C for 1 beat
play tone High G for 1 beat
play tone High F for 1 beat
play tone High E for 1/2 beat
play tone High E for 1 beat
play tone High C for 1 beat
play tone High B for 1 beat
play tone High A for 1/2 beat
play tone High A for 1 beat
play tone High F for 1/2 beat
play tone High D for 1/2 beat
play tone High C for 1/2 beat
play tone Middle B for 1/2 beat
play tone High D for 1/2 beat
play tone Middle B for 1/2 beat
play tone Middle A for 1/2 beat
play tone Middle G for 1/2 beat
play tone Middle A for 1/2 beat


play tone Middle B for 1/2 beat
play tone High C for 1/2 beat
play tone High E for 1/2 beat
play tone High D for 1/2 beat
play tone Middle B for 1/2 beat
play tone High C for 1 beat
play tone High C for 1/2 beat
play tone High C for 1/4 beat
play tone High C for 1 beat

Click “JavaScript", you will view the corresponding JavaScript code:



```
    music.playTone(698, music.beat(BeatFraction.Half))
    music.playTone(659, music.beat(BeatFraction.Whole))
    music.playTone(587, music.beat(BeatFraction.Whole))
    music.playTone(523, music.beat(BeatFraction.Whole))
    music.playTone(587, music.beat(BeatFraction.Whole))
    music.playTone(392, music.beat(BeatFraction.Whole))
    music.playTone(659, music.beat(BeatFraction.Whole))
    music.playTone(659, music.beat(BeatFraction.Whole))
    music.playTone(659, music.beat(BeatFraction.Whole))
    music.playTone(698, music.beat(BeatFraction.Whole))
    music.playTone(784, music.beat(BeatFraction.Whole))
    music.playTone(784, music.beat(BeatFraction.Whole))
    music.playTone(698, music.beat(BeatFraction.Whole))
    music.playTone(659, music.beat(BeatFraction.Whole))
    music.playTone(587, music.beat(BeatFraction.Whole))
    music.playTone(523, music.beat(BeatFraction.Whole))
    music.playTone(523, music.beat(BeatFraction.Whole))
    music.playTone(587, music.beat(BeatFraction.Whole))
    music.playTone(659, music.beat(BeatFraction.Whole))
    music.playTone(587, music.beat(BeatFraction.Whole))
    music.playTone(523, music.beat(BeatFraction.Half))
    music.playTone(523, music.beat(BeatFraction.Whole))
    music.playTone(587, music.beat(BeatFraction.Whole))
    music.playTone(587, music.beat(BeatFraction.Whole))
    music.playTone(659, music.beat(BeatFraction.Whole))
    music.playTone(523, music.beat(BeatFraction.Whole))
    music.playTone(587, music.beat(BeatFraction.Whole))
    music.playTone(659, music.beat(BeatFraction.Half))
    music.playTone(698, music.beat(BeatFraction.Half))
    music.playTone(659, music.beat(BeatFraction.Whole))
    music.playTone(523, music.beat(BeatFraction.Whole))
    music.playTone(587, music.beat(BeatFraction.Whole))
    music.playTone(659, music.beat(BeatFraction.Half))
    music.playTone(698, music.beat(BeatFraction.Half))
    music.playTone(659, music.beat(BeatFraction.Whole))
    music.playTone(587, music.beat(BeatFraction.Whole))
    music.playTone(523, music.beat(BeatFraction.Whole))
    music.playTone(587, music.beat(BeatFraction.Whole))
    music.playTone(392, music.beat(BeatFraction.Whole))
    music.playTone(659, music.beat(BeatFraction.Whole))
    music.playTone(659, music.beat(BeatFraction.Whole))
    music.playTone(659, music.beat(BeatFraction.Whole))
    music.playTone(698, music.beat(BeatFraction.Whole))
```

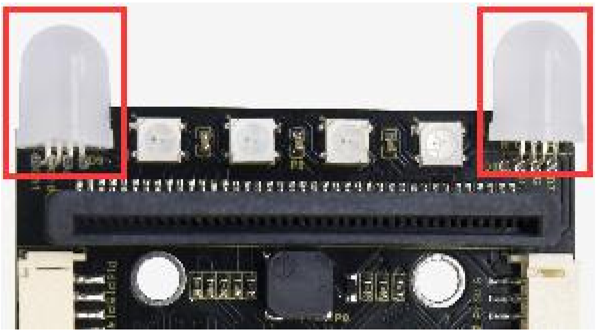
```
    music.playTone(784, music.beat(BeatFraction.Whole))
    music.playTone(784, music.beat(BeatFraction.Whole))
    music.playTone(698, music.beat(BeatFraction.Whole))
    music.playTone(659, music.beat(BeatFraction.Whole))
    music.playTone(523, music.beat(BeatFraction.Whole))
    music.playTone(523, music.beat(BeatFraction.Whole))
    music.playTone(523, music.beat(BeatFraction.Whole))
    music.playTone(587, music.beat(BeatFraction.Whole))
    music.playTone(659, music.beat(BeatFraction.Whole))
    music.playTone(587, music.beat(BeatFraction.Whole))
    music.playTone(523, music.beat(BeatFraction.Half))
    music.playTone(523, music.beat(BeatFraction.Whole))
    music.playTone(587, music.beat(BeatFraction.Whole))
    music.playTone(523, music.beat(BeatFraction.Half))
    music.playTone(523, music.beat(BeatFraction.Whole))
    music.playTone(784, music.beat(BeatFraction.Whole))
    music.playTone(698, music.beat(BeatFraction.Whole))
    music.playTone(659, music.beat(BeatFraction.Half))
    music.playTone(659, music.beat(BeatFraction.Whole))
    music.playTone(523, music.beat(BeatFraction.Whole))
    music.playTone(988, music.beat(BeatFraction.Whole))
    music.playTone(880, music.beat(BeatFraction.Half))
    music.playTone(880, music.beat(BeatFraction.Whole))
    music.playTone(698, music.beat(BeatFraction.Half))
    music.playTone(587, music.beat(BeatFraction.Half))
    music.playTone(523, music.beat(BeatFraction.Half))
    music.playTone(494, music.beat(BeatFraction.Half))
    music.playTone(587, music.beat(BeatFraction.Half))
    music.playTone(494, music.beat(BeatFraction.Half))
    music.playTone(440, music.beat(BeatFraction.Half))
    music.playTone(392, music.beat(BeatFraction.Half))
    music.playTone(440, music.beat(BeatFraction.Half))
    music.playTone(494, music.beat(BeatFraction.Half))
    music.playTone(523, music.beat(BeatFraction.Half))
    music.playTone(659, music.beat(BeatFraction.Half))
    music.playTone(587, music.beat(BeatFraction.Half))
    music.playTone(494, music.beat(BeatFraction.Half))
    music.playTone(523, music.beat(BeatFraction.Whole))
    music.playTone(523, music.beat(BeatFraction.Half))
    music.playTone(523, music.beat(BeatFraction.Quarter))
    music.playTone(523, music.beat(BeatFraction.Whole))
})
```

4 .Test Results：

Download code to micro:bit board and dial POWER switch to ON end. The "Ode to Joy" is played by passive buzzer

(How to download? How to quick download?)

8.14: RGB Experiments



1. Description：

The RGB color mode is a color standard in the industry. It obtains various colors by changing the three color channels of red (R), green (G), and blue (B) and integrating them. RGB denotes the three colors of red, green and blue.

The monitors mostly adopt the RGB color standard, and all the colors on the computer screen are composed of the three colors of red, green and blue mixed in different proportions. A group of red, green and blue is the smallest display unit. Any color on the screen can be recorded and expressed by a set of RGB values.

Each of the three color channels of red, green, and blue is divided into 256 levels of brightness. At 0, the "light" is the weakest-it is turned off, and at 255, the "light" is the brightest. When the three-color gray values are the same, the gray tones with different gray values are produced, that is, when the three-color gray is 0, the darkest black is generated; when the three-color gray is 255, it is the brightest white tone .

Color	RGB value (R,G,B)	Color code	Color	RGB value (R,G,B)	Color code
Black	0,0,0	#000000	Red	255,0,0	#FF0000
Green	0,255,0	#00FF00	Blue	0,0,255	#0000FF
indigo	0,255,255	#00FFFF	Dark red	255,0,255	#FF00FF
Yellow	255,255,0	#FFFF00	White	255,255,255	#FFFFFF
……	…….	……	……	……	……
Adjust the numbers to get gradient colors					

RGB colors are called additive colors since the adding of R, G, and B together (that is, all light reflect back to the eye) produces white color. Additive colors are used for lighting, television and computer displays. For example, displays produce color by emitting red, green, and blue rays.

Most visible spectra can be expressed as a mixture of red, green and blue (RGB) light in different proportions and intensities. If these colors overlap, they produce cyan, magenta and yellow.

We will make two experiments, one is that two RGB LEDs light up red, green, blue, indigo, dark red, yellow and white color, another one is that RGB lights display color in gradient way.

2. Experimental Preparation :

(1) Insert micro:bit board into slot of V2 shield.

(2) Place batteries into battery holder.

(3) Dial power switch to ON end

(4) Connect micro:bit to computer by USB cable and open online Makecode editor.

Import Hex profile **(How to import?)** , or click “New Project” and drag blocks step by step(add turtle-bit extension library first)

(How to add turtle-bit extension?)

3. Test Code：

Code 1

RGB lights show seven colors

Type	Route	File Name
Hex file	../Makecode Tutorial/Test Code/8.14：RGB Experiments/Code-1	microbit-Code-1.hex

Or you could edit code step by step in the editing area.

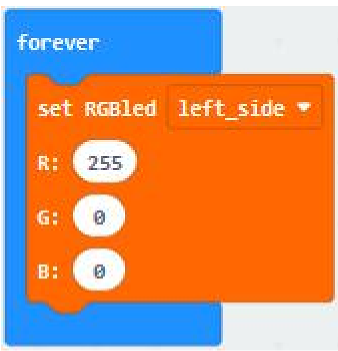
(1) Click “TurtleBit” to drag “LED brightness 0” into “on start” block

The larger the number you set, the brighter the RGB gets

Here, we set to 70

(2) Click “TurtleBit” to drag “set RGBled left_side R：0 G：0 B：0” block into “forever”

Set R:255 G:0 B:0



(3)Click “TurtleBit” to move “set RGBled left_side R：0 G：0 B：0” into “forever” block.

Tap left_side to choose right_side, change R:0 into R:255

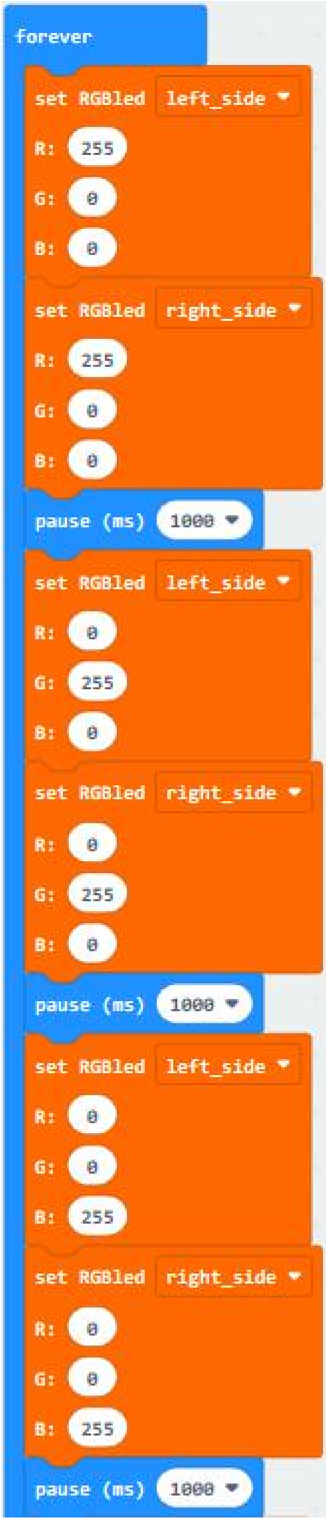
(4) Click “Basic” to drag “pause (ms) 100” block into “forever”

Delay in 1000ms

(5) Copy code string 

for six times and separately place them into “forever” block.

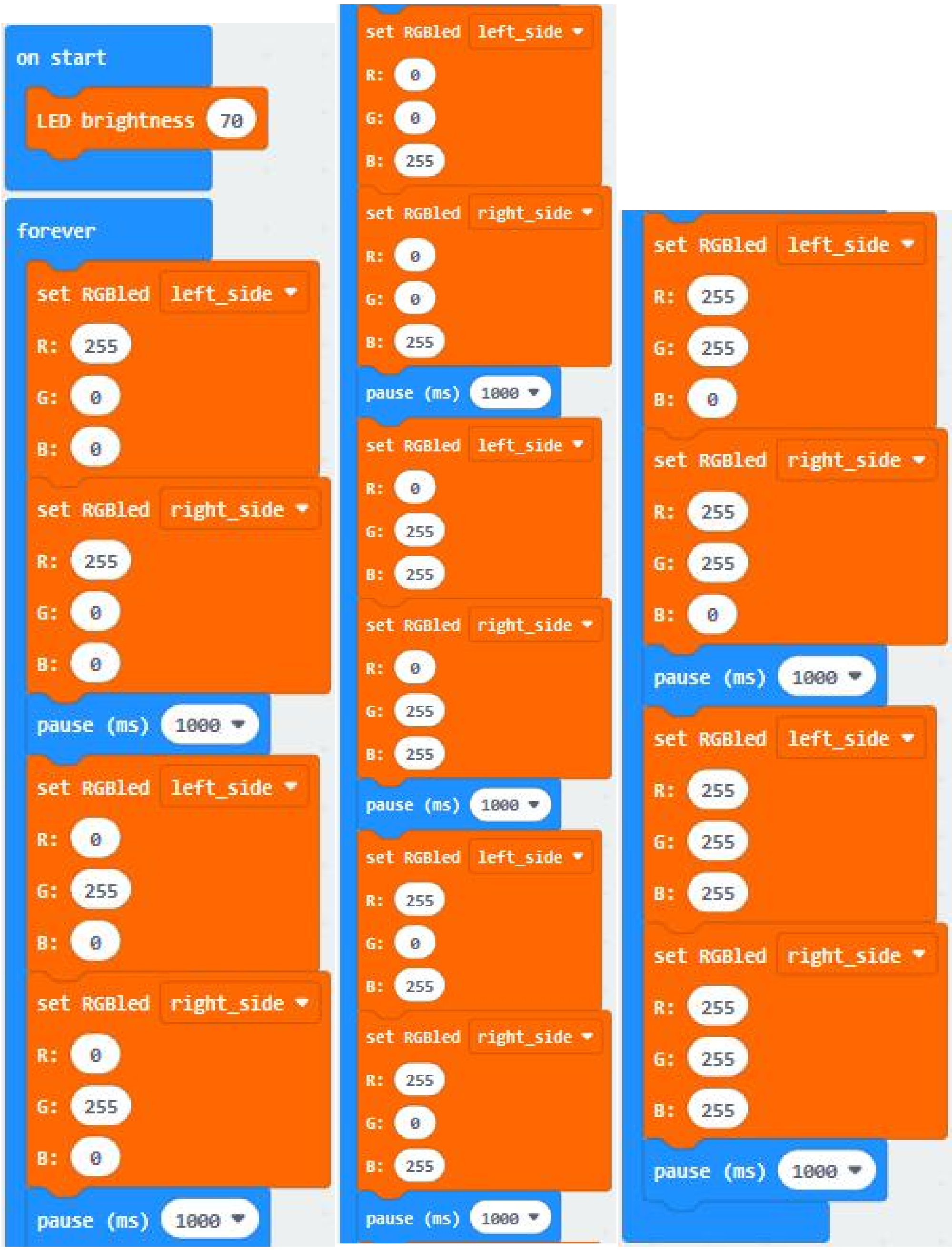
Respectively set to “R : 0 G : 255 B : 0” , “ R : 0 G : 0 B : 255” , “ R : 0 G : 255 B : 255” , “ R : 255 G : 0 B : 255” , “ R : 255 G : 255 B : 0” and “ R : 255 G : 0 B : 255” .


forever
set RGBled left_side
R: 255
G: 0
B: 0
set RGBled right_side
R: 255
G: 0
B: 0
pause (ms) 1000
set RGBled left_side
R: 0
G: 255
B: 0
set RGBled right_side
R: 0
G: 255
B: 0
pause (ms) 1000
set RGBled left_side
R: 0
G: 0
B: 255
set RGBled right_side
R: 0
G: 0
B: 255
pause (ms) 1000


set RGBled left_side
R: 0
G: 255
B: 255
set RGBled right_side
R: 0
G: 255
B: 255
pause (ms) 1000
set RGBled left_side
R: 255
G: 0
B: 255
set RGBled right_side
R: 255
G: 0
B: 255
pause (ms) 1000
set RGBled left_side
R: 255
G: 255
B: 0
set RGBled right_side
R: 255
G: 255
B: 0
pause (ms) 1000


set RGBled left_side
R: 255
G: 255
B: 255
set RGBled right_side
R: 255
G: 255
B: 255
pause (ms) 1000

Complete Code



“on start” : command block runs once to start program.

Set the brightness of two RGB lights on car to 70

The program under the block “forever” runs cyclically.

Set R : 255 G : 0 B : 0 to make left RGB light display red color

Set R : 255 G : 0 B : 0 to make right RGB light display red color

Delay in 1000ms

Set R : 0 G : 255 B : 0 to make left RGB light display green color

Set R : 0 G : 255 B : 0 to make right RGB light display green color

Delay in 1000ms

Set R : 0 G : 0 B : 255 to make the left RGB light display blue color

Set R : 0 G : 0 B : 255 to make the right RGB light display blue color

Delay in 1000m

Set R : 0 G : 255 B : 255 to make the left RGB light display indigo color

Set R : 0 G : 255 B : 255 to make the right RGB light display indigo color

Delay in 1000ms

Set R : 255 G : 0 B : 255 to make the left RGB light display dark red color

Set R : 255 G : 0 B : 255 to make the right RGB light display dark red color

Delay in 1000ms

Set R : 255 G : 255 B : 0 to make the left RGB light display yellow color

Set R : 255 G : 255 B : 0 to make the right RGB light display yellow color

Delay in 1000ms

Set R : 255 G : 255 B : 255 to make the left RGB light display white color

Set R : 255 G : 255 B : 255 to make the right RGB light display white color

Delay in 1000ms

Click "JavaScript" to switch into the corresponding JavaScript code:

```
turtleBit.SetLed(
RGBLED.left_side,
0,
255,
255
)
turtleBit.SetLed(
RGBLED.right_side,
0,
255,
255
)
basic.pause(1000)
turtleBit.SetLed(
RGBLED.left_side,
255,
0,
255
)
turtleBit.SetLed(
RGBLED.right_side,
255,
0,
255
)
basic.pause(1000)
turtleBit.SetLed(
RGBLED.left_side,
255,
255,
0
)
turtleBit.SetLed(
RGBLED.right_side,
255,
255,
0
)
basic.pause(1000)
```

```
    turtleBit.SetLed(
    RGBLED.left_side,
    255,
    255,
    255
    )
    turtleBit.SetLed(
    RGBLED.right_side,
    255,
    255,
    255
    )
    basic.pause(1000)
})

```

Code 2：

Type	Route	File Name
Hex file	../Makecode Tutorial/Test Code/8.14：RGB Experiments/Code-2	microbit-Code-2.hex

Or you could edit code step by step in the editing area.

(1) Go to “TurtleBit” to move block “LED brightness 0” into “on start” Change 0 into 200

(2) Go to “Variables” → “Make a Variable...” → “New variable name：” dialog box，

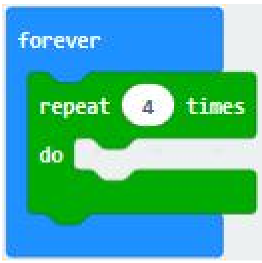
(3) Input “led-r” and click “OK” to produce variable “led-r” ,

Then set variable “led-g” and “led-b” in same way.

Move block “set led-b to 0” into “on start”

Copy “set led-b to 0” block twice and set to led-r, led_g and led_b

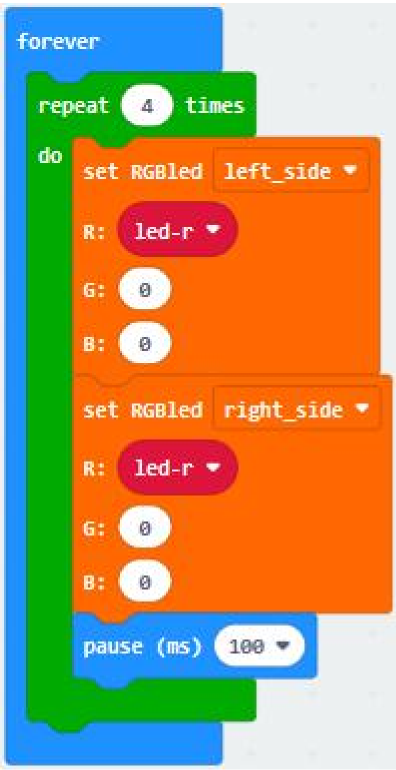
(4) Go to “Loops” to drag block “repeat 4 times do” into “forever”



(5) Tap “TurtleBit” to drag block “set RGBled left_side R : 0 G : 0 B : 0” into “repeat 4 times do” block.

Copy it once, and change blocks as follows:

(6) Move block “pause (ms) 100” from “Basic” and place it into “repeat 4 times do”.

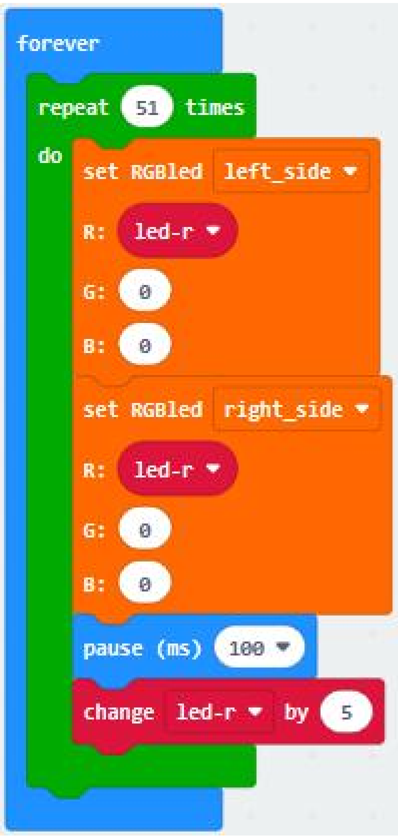


(7) Enter “Variables” to move block “change led-b by 1” under block “pause (ms) 100” .

Click triangle to change led-b into led-r.

The R value is in the range of 0-255, and we make variable “led-r” increases by 5 every time. Therefore, 51 times in total.

Set “repeat 51 times” and “by 5” .

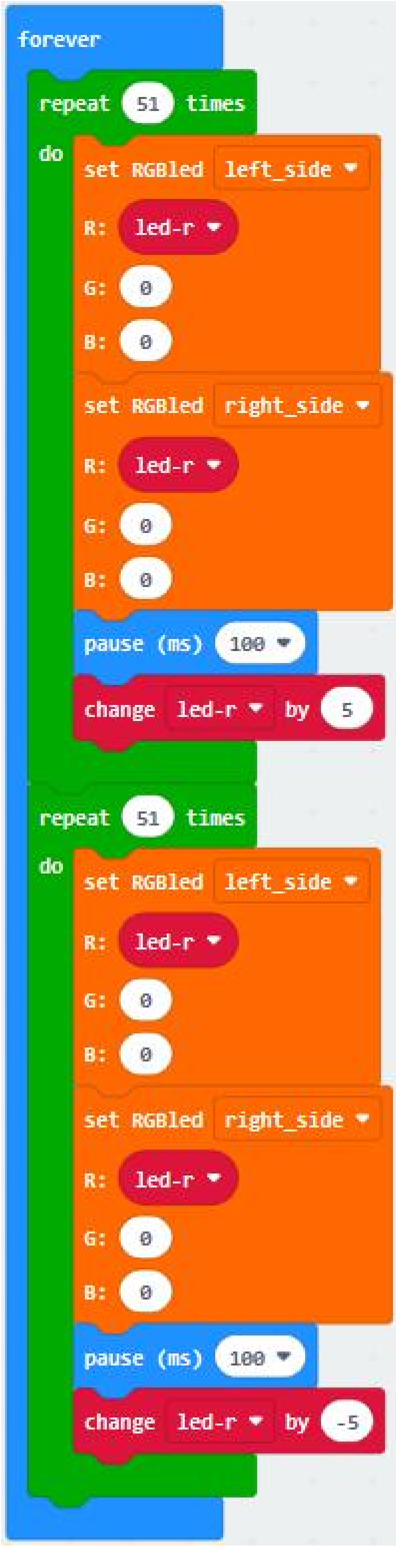


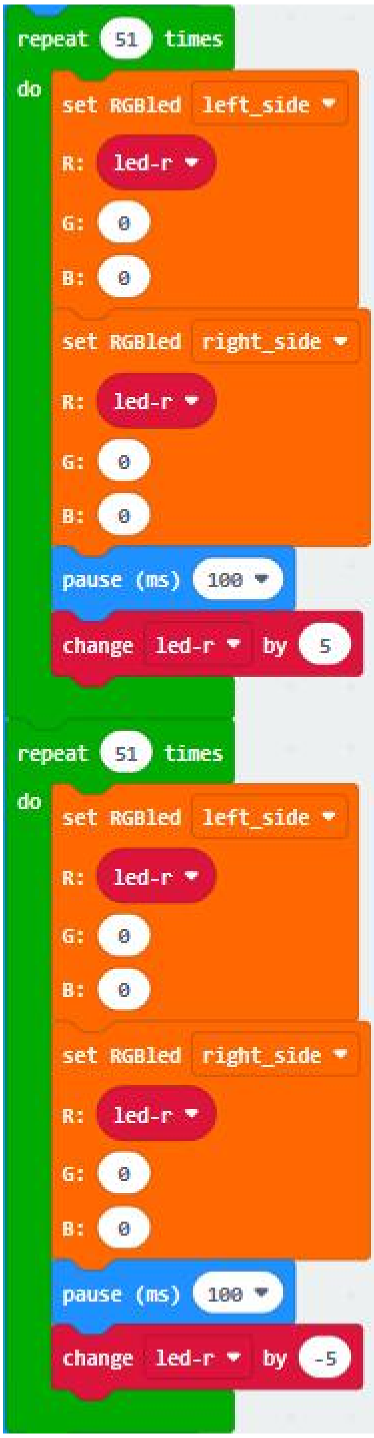
(8) Copy code string 

once and leave it into “forever”.

To make RGB get darker gradually, we set “led-r by -5”, 51 times in total

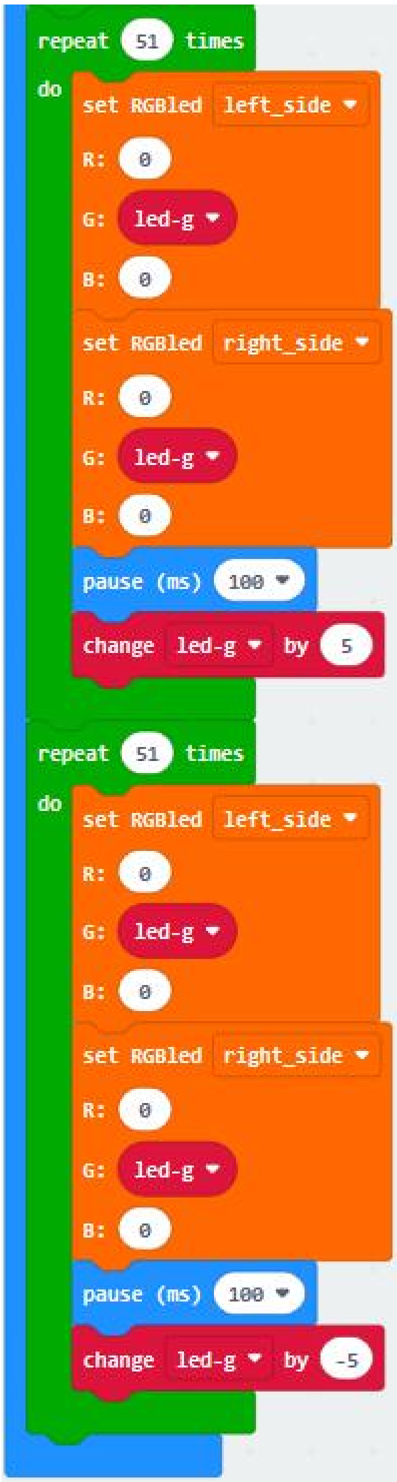
So we change 5 into -5.


forever
repeat 51 times
do
set RGBled left_side
R: led-r
G: 0
B: 0
set RGBled right_side
R: led-r
G: 0
B: 0
pause (ms) 100
change led-r by 5
repeat 51 times
do
set RGBled left_side
R: led-r
G: 0
B: 0
set RGBled right_side
R: led-r
G: 0
B: 0
pause (ms) 100
change led-r by -5

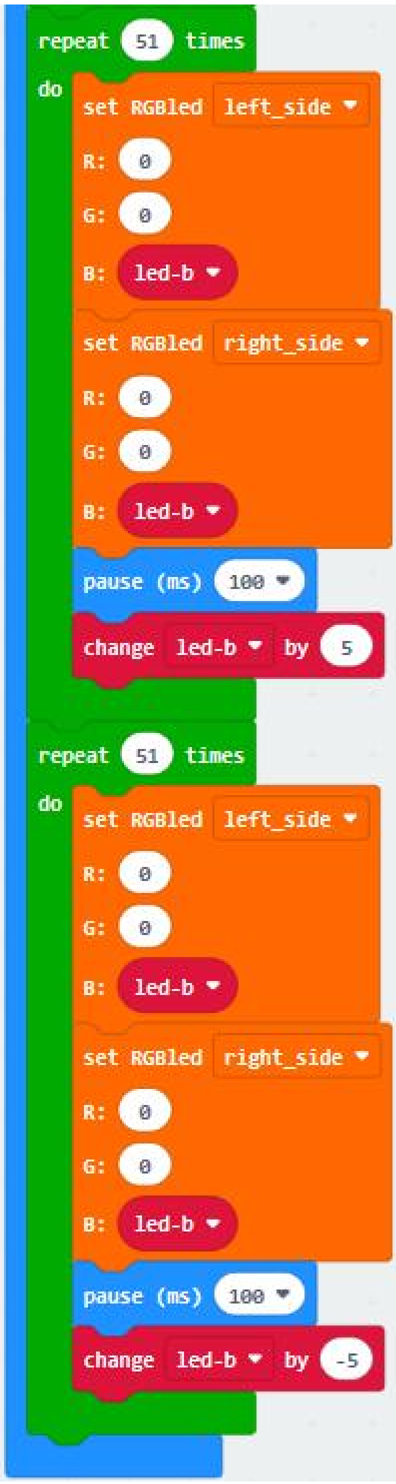
(9) Replicate 

once and keep them into “forever” block.

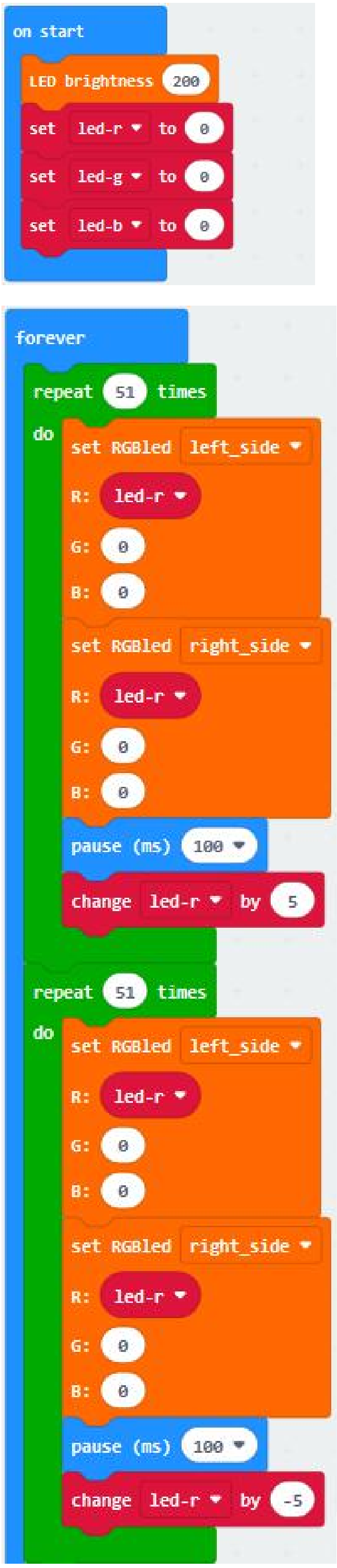
Set R:0 and G: led-g, as shown below:


repeat 51 times
do
set RGBled left_side
R: 0
G: led-g
B: 0
set RGBled right_side
R: 0
G: led-g
B: 0
pause (ms) 100
change led-g by 5
repeat 51 times
do
set RGBled left_side
R: 0
G: led-g
B: 0
set RGBled right_side
R: 0
G: led-g
B: 0
pause (ms) 100
change led-g by -5

(10) Copy again, and set code string as follows:


repeat 51 times
do
set RGBled left_side
R: 0
G: 0
B: led-b
set RGBled right_side
R: 0
G: 0
B: led-b
pause (ms) 100
change led-b by 5
repeat 51 times
do
set RGBled left_side
R: 0
G: 0
B: led-b
set RGBled right_side
R: 0
G: 0
B: led-b
pause (ms) 100
change led-b by -5

Complete Code



"on start" : command block runs once to start program.

Set the light intensity of 2 RGB to 200

Set led-r to 0

Set led-g to 0

Set led-b to 0

The program under the block "forever" runs cyclically.

The program in the do block repeats 51 times

Set left RGB: R : led-r G : 0 B : 0

Set right RGB : R : led-r G : 0 B : 0

Delay in 100ms

Change led-r by 5

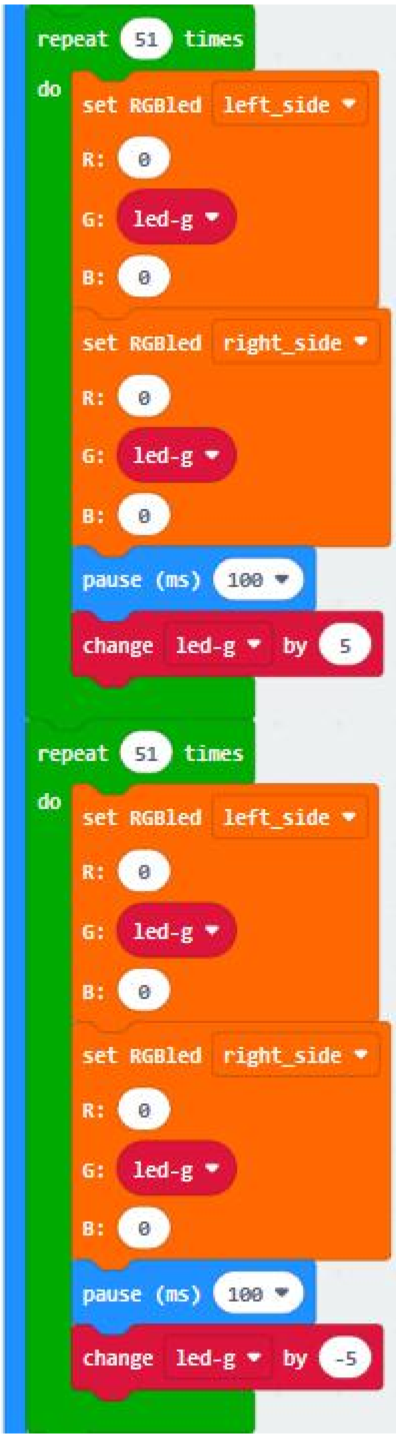
The program in the do block repeats 51 times

Set left RGB : R : led-r G : 0 B : 0

Set right RGB : R : led-r G : 0 B : 0

Delay in 100ms

Change led-r by -5



The program in the do block repeats 51 times

Set left RGB: R : 0 G : led-g B : 0

Set right RGB: R : 0 G : led-g B : 0

Delay in 100ms

Change led-g by 5

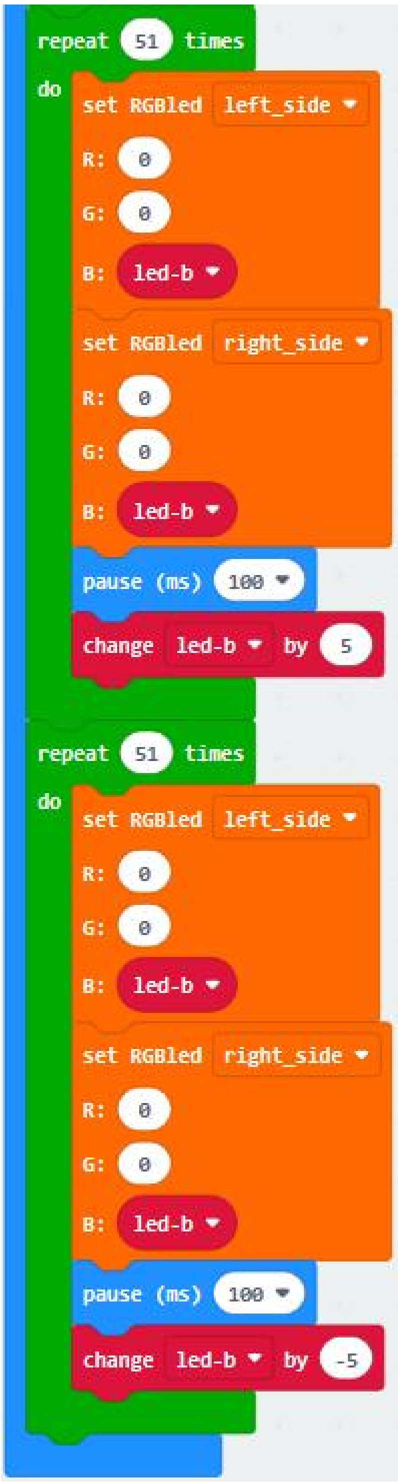
The program in the do block repeats 51 times

Set left RGB: R : 0 G : led-g B : 0

Set right RGB: R : 0 G : led-g B : 0

Delay in 100ms

Change led-g by -5



The program in the do block repeats 51 times

Set right RGB: R : 0 G : 0 B : led-b

Set right RGB: R : 0 G : 0 B : led-b

Delay in 100ms

Change led-b by 5

The program in the do block repeats 51 times

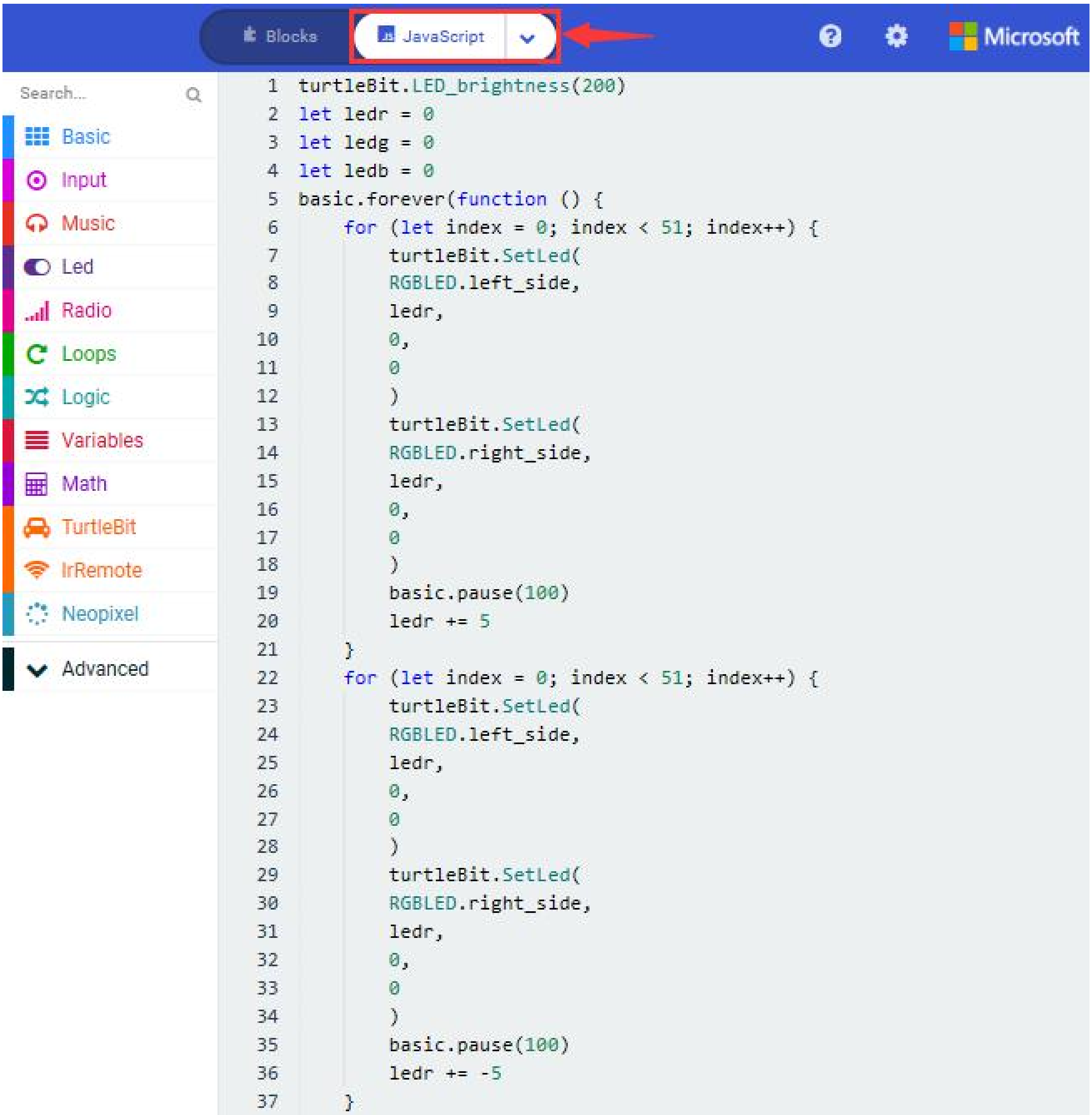
Set right RGB: R : 0 G : 0 B : led-b

Set right RGB: R : 0 G : 0 B : led-b

Delay in 100ms

Change led-g by -5

Click “JavaScript" to switch into the corresponding JavaScript code:



```
    for (let index = 0; index < 51; index++) {
        turtleBit.SetLed(
        RGBLED.left_side,
        0,
        ledg,
        0
        )
        turtleBit.SetLed(
        RGBLED.right_side,
        0,
        ledg,
        0
        )
        basic.pause(100)
        ledg += 5
    }
    for (let index = 0; index < 51; index++) {
        turtleBit.SetLed(
        RGBLED.left_side,
        0,
        ledg,
        0
        )
        turtleBit.SetLed(
        RGBLED.right_side,
        0,
        ledg,
        0
        )
        basic.pause(100)
        ledg += -5
    }
```

```
    for (let index = 0; index < 51; index++) {
        turtleBit.SetLed(
        RGBLED.left_side,
        0,
        0,
        ledb
        )
        turtleBit.SetLed(
        RGBLED.right_side,
        0,
        0,
        ledb
        )
        basic.pause(100)
        ledb += 5
    }
    for (let index = 0; index < 51; index++) {
        turtleBit.SetLed(
        RGBLED.left_side,
        0,
        0,
        ledb
        )
        turtleBit.SetLed(
        RGBLED.right_side,
        0,
        0,
        ledb
        )
        basic.pause(100)
        ledb += -5
    }
})

```

4.Test Results：

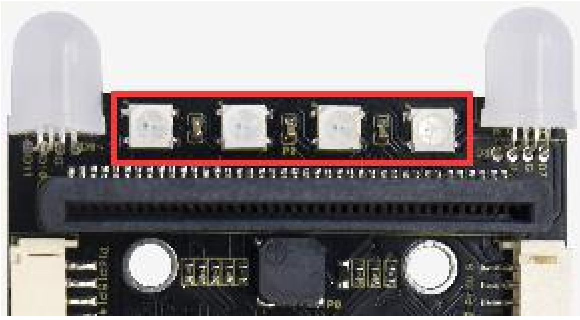
(How to download?   How to quick download?)

Download code 1 to micro:bit board and dial POWER switch to ON end, 2 RGB lights of smart car emit red, green, blue, indigo, dark red, yellow and white color cyclically.

Download code 2 to micro:bit board, 2 RGB lights show different color cyclically.

(How to download?   How to quick download?)

8.15: WS2812 RGB



1.Description：

The driver shield cooperates 4 pcs WS2812 RGB LEDs, compatible with micro:bit board and controlled by P8. In this lesson, we will make RGB LEDs display different colors by P8

2. Experimental Preparation：

(1) Insert micro:bit board into slot of V2 shield.

(2) Place batteries into battery holder.

(3) Dial power switch to ON end

(4) Connect micro:bit to computer by USB cable and open online Makecode editor.

Import Hex profile **(How to import?)**, or click "New Project" and drag blocks step by step(add turtle-bit extension library first)

(How to add turtle-bit extension?)

3. Test Code：

Code 1：

Type	Route	File Name
Hex file	../Makecode Tutorial/Test Code/8.15：WS2812 RGB/Code-1	microbit-Code-1.hex

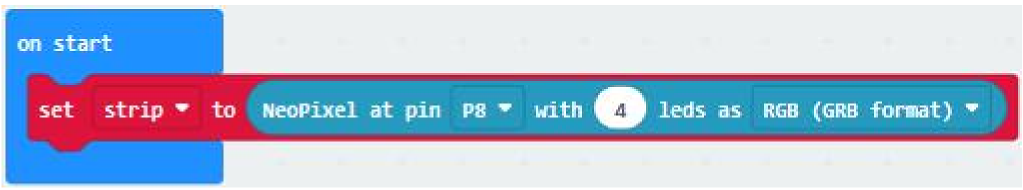
Or you could edit code step by step in the editing area.

(1) a. Enter “Neopixel” → “set strip to Neopixel at pin P0 with 24 leds as RGB (GRB format)”

b. Place it into “on start” block ,

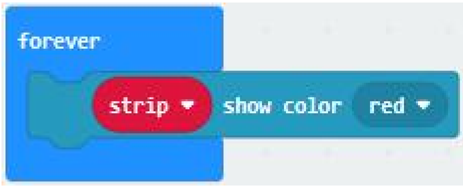
c. Signal end P8 of WS2812 RGB is controlled by P8 of micro:bit . So we set to P8.

d. Smart car has 4 pcs WS2812 RGB lights, so set to 4 leads

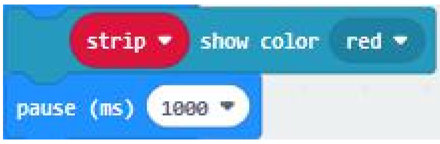


(2) Click “Neopixel” to move block “strip clear” into “on start” block.

(3) Enter “Neopixel” to move block “strip show color red” into “forever” block

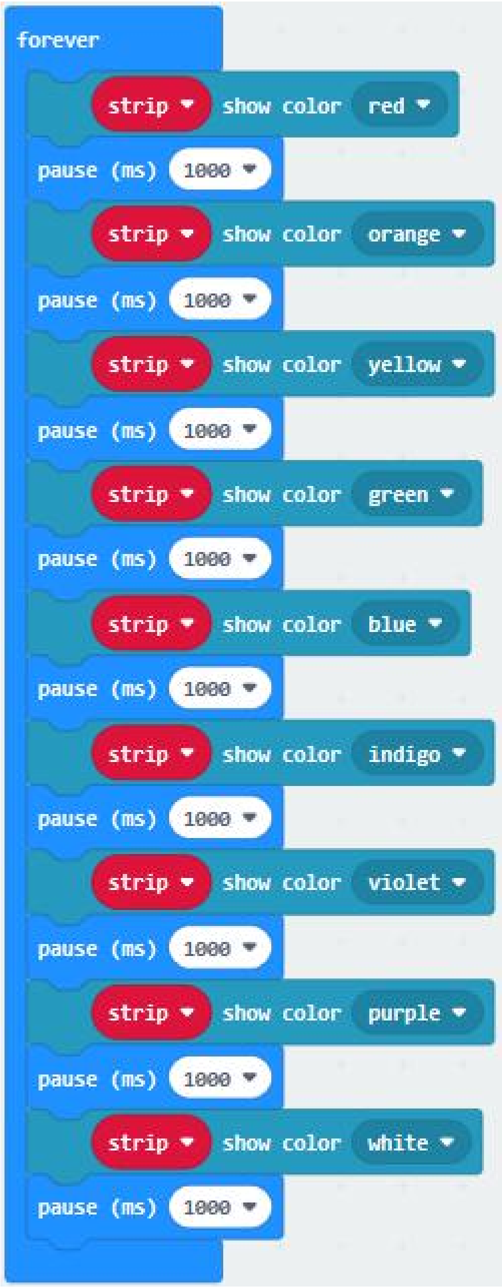


(4) Click “Basic” to move “pause (ms) 100” block into “forever” block Then set to 1000ms

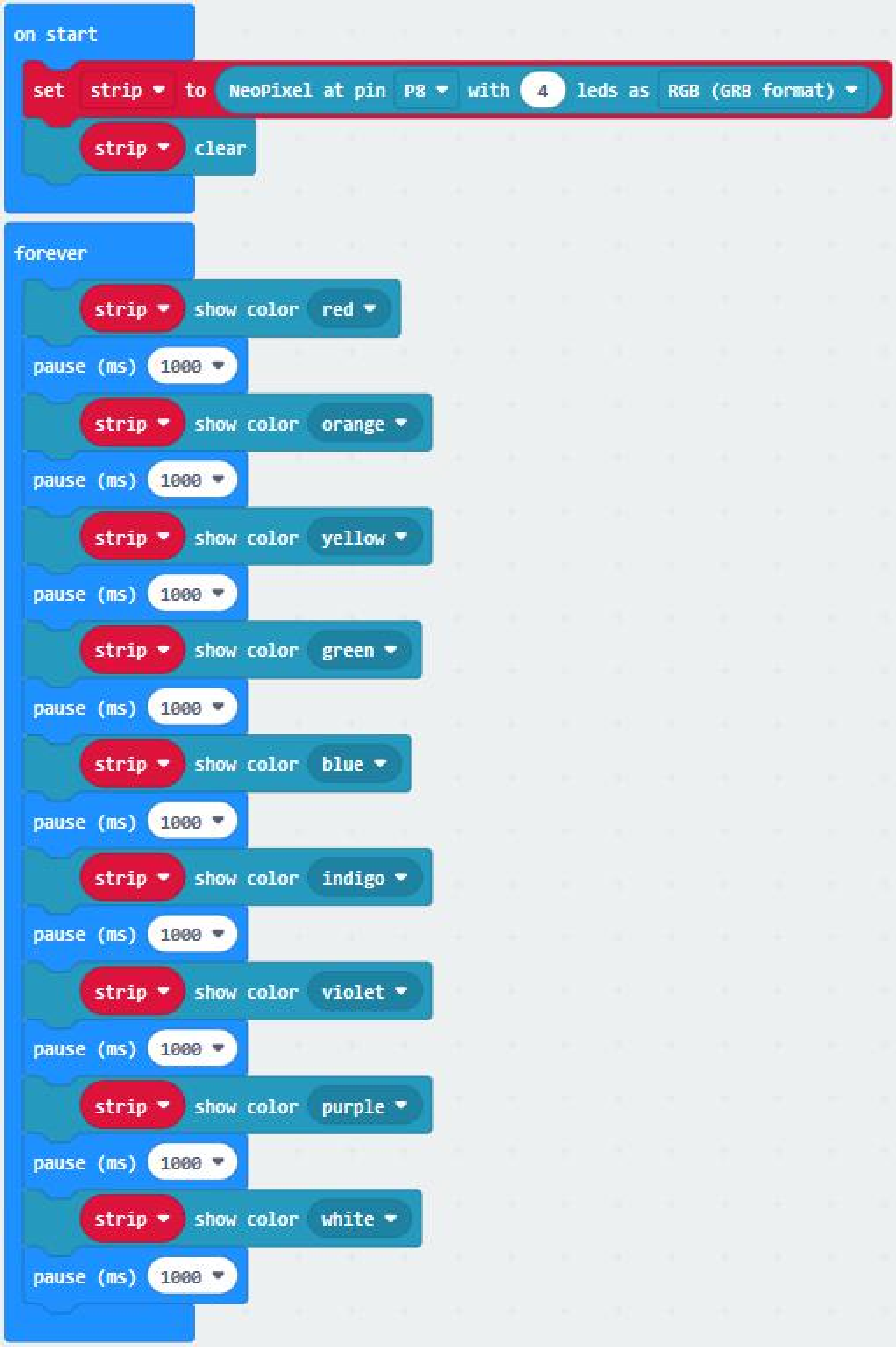
(5) Copy code string 

for eight times, and click red to respectively set to orange, yellow, green, blue, indigo, violet, purple and white.

(6) Tap the triangle icon to select orange, yellow, green, blue, indigo, violet, purple and white.

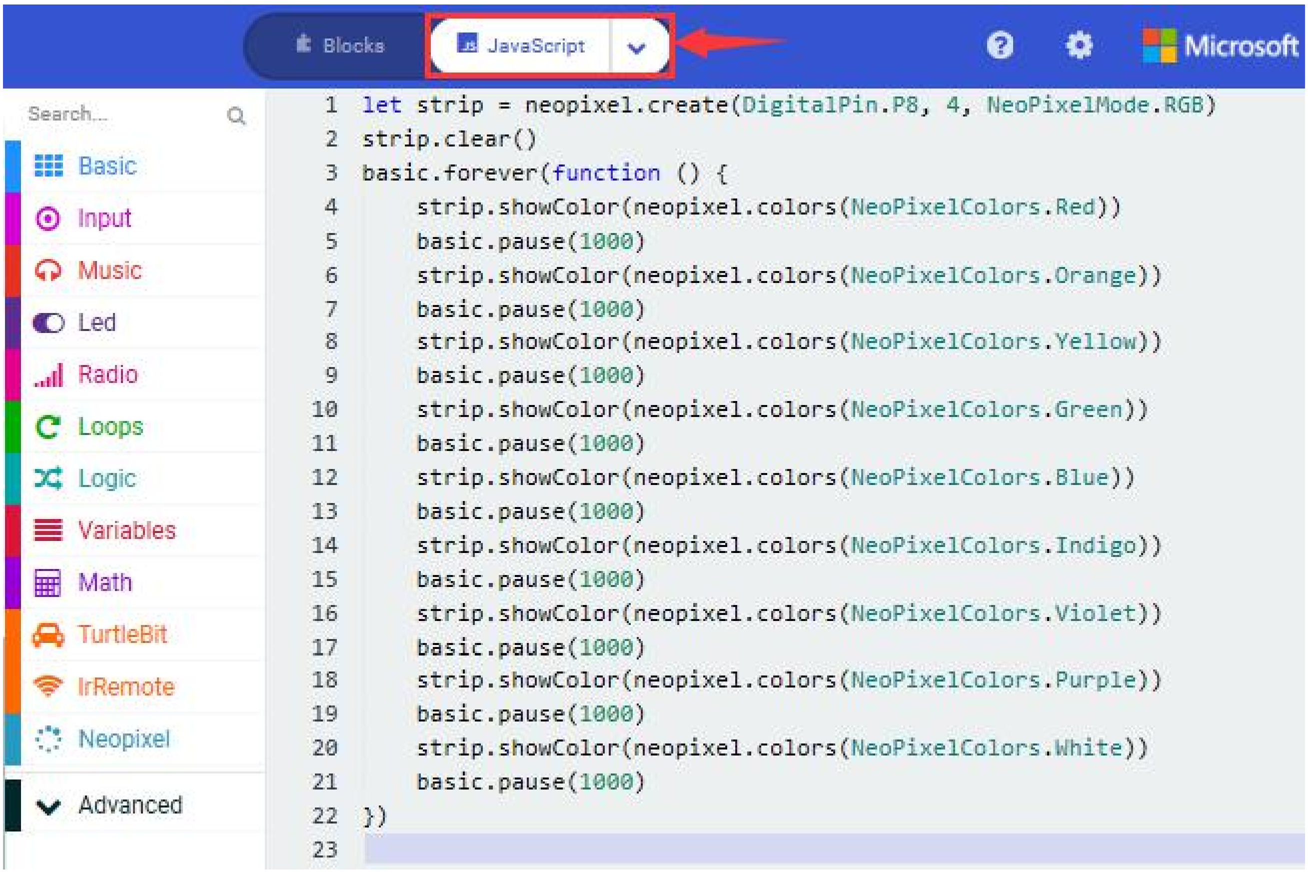


Complete Code


on start
set strip to NeoPixel at pin P8 with 4 leds as RGB (GRB format)
strip clear
forever
strip show color red
pause (ms) 1000
strip show color orange
pause (ms) 1000
strip show color yellow
pause (ms) 1000
strip show color green
pause (ms) 1000
strip show color blue
pause (ms) 1000
strip show color indigo
pause (ms) 1000
strip show color violet
pause (ms) 1000
strip show color purple
pause (ms) 1000
strip show color white
pause (ms) 1000

. “on start” : command block runs once to start program.
Set strip to Neopixel at pin P8 with 4 leads as RGB
Turn off 4pcs WS2812 RGB lights
The program under the block “forever” runs cyclically.
All RGB lights show red color
Delay in 1000ms
All RGB lights show orange color
Delay in 1000ms
All RGB lights show yellow color
Delay in 1000ms
All RGB lights show green color
Delay in 1000ms
All RGB lights show blue color
Delay in 1000ms
All RGB lights show indigo color
Delay in 1000ms
All RGB lights show violet color
Delay in 1000ms
All RGB lights show purple color
Delay in 1000ms
All RGB lights show white color
Delay in 1000ms

Click “JavaScript" to switch into the corresponding JavaScript code:



Code 2：

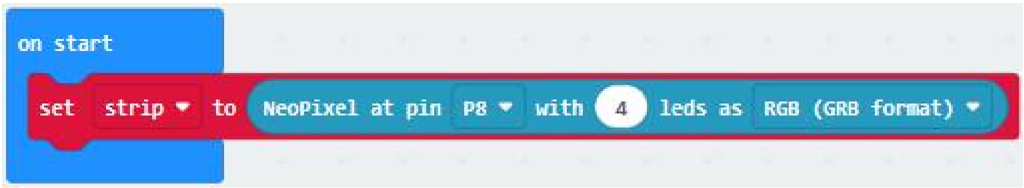
Type	Route	File Name
Hex file	../Makecode Tutorial/Test Code/8.15：WS2812 RGB/Code-2	microbit-Code-2.hex

(1) a. Enter "Neopixel" → "set strip to Neopixel at pin P0 with 24 leds as RGB (GRB format)"

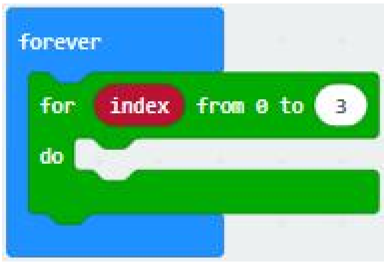
b. Place it into "on start" block，

c. Signal end P8 of WS2812 RGB is controlled by P8 of micro:bit . So we set to P8.

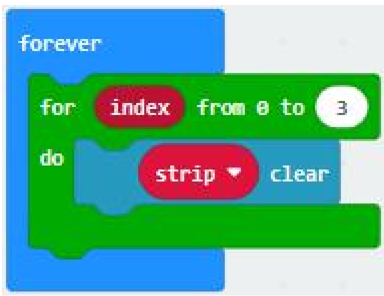
d. Smart car has 4 pcs WS2812 RGB lights, so set to 4 leads



(2) Click "Loops" to drag "for index from 0 to 4...do" into "forever" block Change 4 into 3

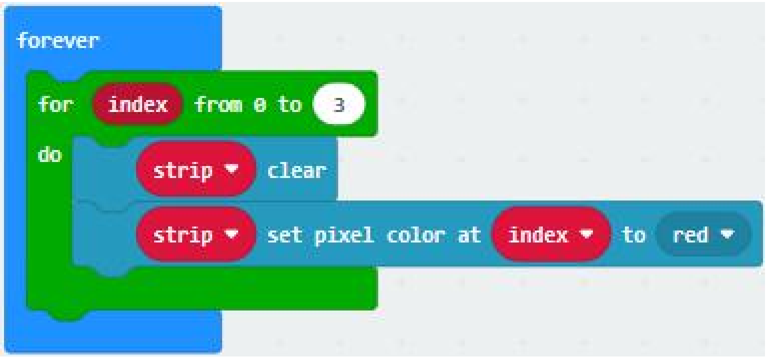


(3) Click "Neopixel" to move block "strip clear" into block "for index from 0 to 3...do"

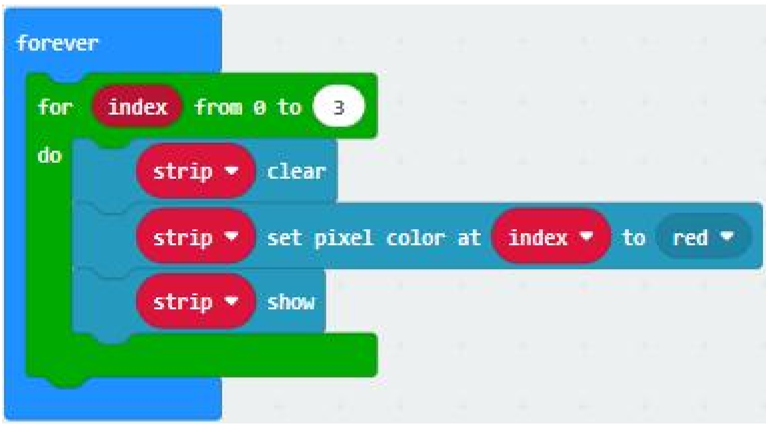


(4) Tap "Neopixel" → "more" → "strip set pixel color at 0 to red" Place it into "for index from 0 to 3...do" block

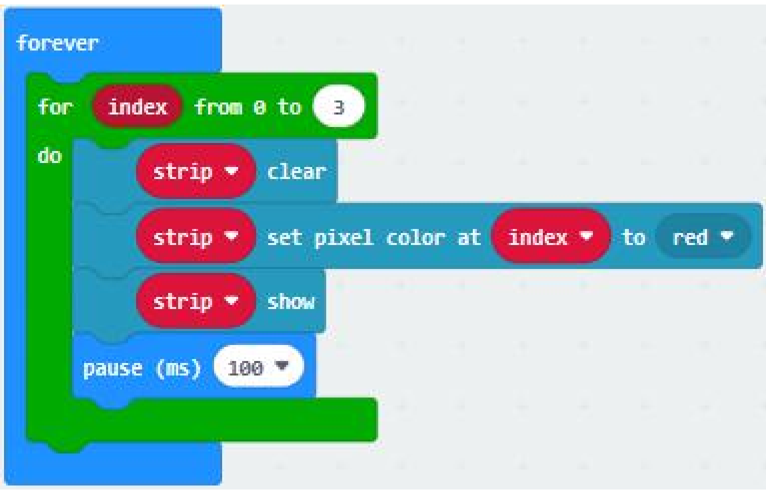
Click “Variables” to move “index” into 0 box

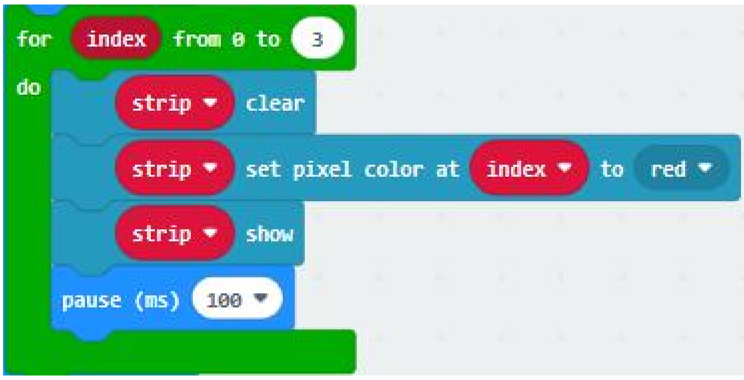


(5) Click “Neopixel” to move “strip show” into “for index from 0 to 3...do” block



(6) Tap“Basic”to move “pause (ms) 100”block into “index from 0 to 3...do”

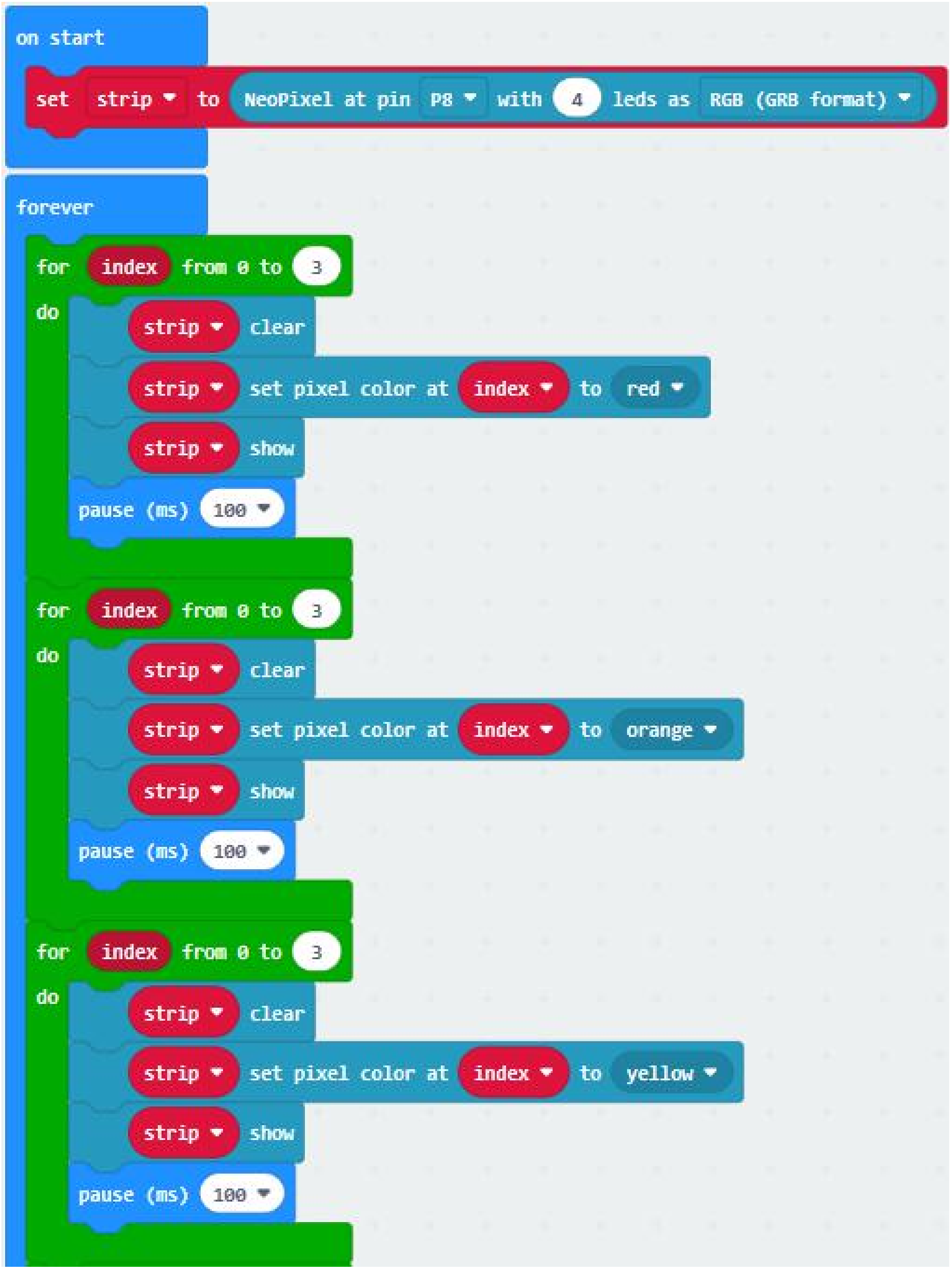


(7) Replicate code string 

for eight times and place them into “forever” block

Click red to respectively choose orange, yellow, green, blue, indigo, violet, purple and white

Complete Code :


on start
set strip to NeoPixel at pin P8 with 4 leds as RGB (GRB format)
forever
for index from 0 to 3
do
strip clear
strip set pixel color at index to red
strip show
pause (ms) 100
for index from 0 to 3
do
strip clear
strip set pixel color at index to orange
strip show
pause (ms) 100
for index from 0 to 3
do
strip clear
strip set pixel color at index to yellow
strip show
pause (ms) 100

“on start” : command block runs once to start program.

Set strip to Neopixel at pin p8 with 4 leads as RGB

The program under the block “forever” runs cyclically.

For index from 0 to 3, execute the program under do block

Turn off 4 pcs WS2812 RGB lights

Set index of WS2812 RGB lights to red color

Strip shows

Delay in 100ms

For index from 0 to 3, execute the program under do block

Turn off 4 pcs WS2812 RGB lights

Set index of WS2812 RGB lights to orange color

Strip shows

Delay in 100ms

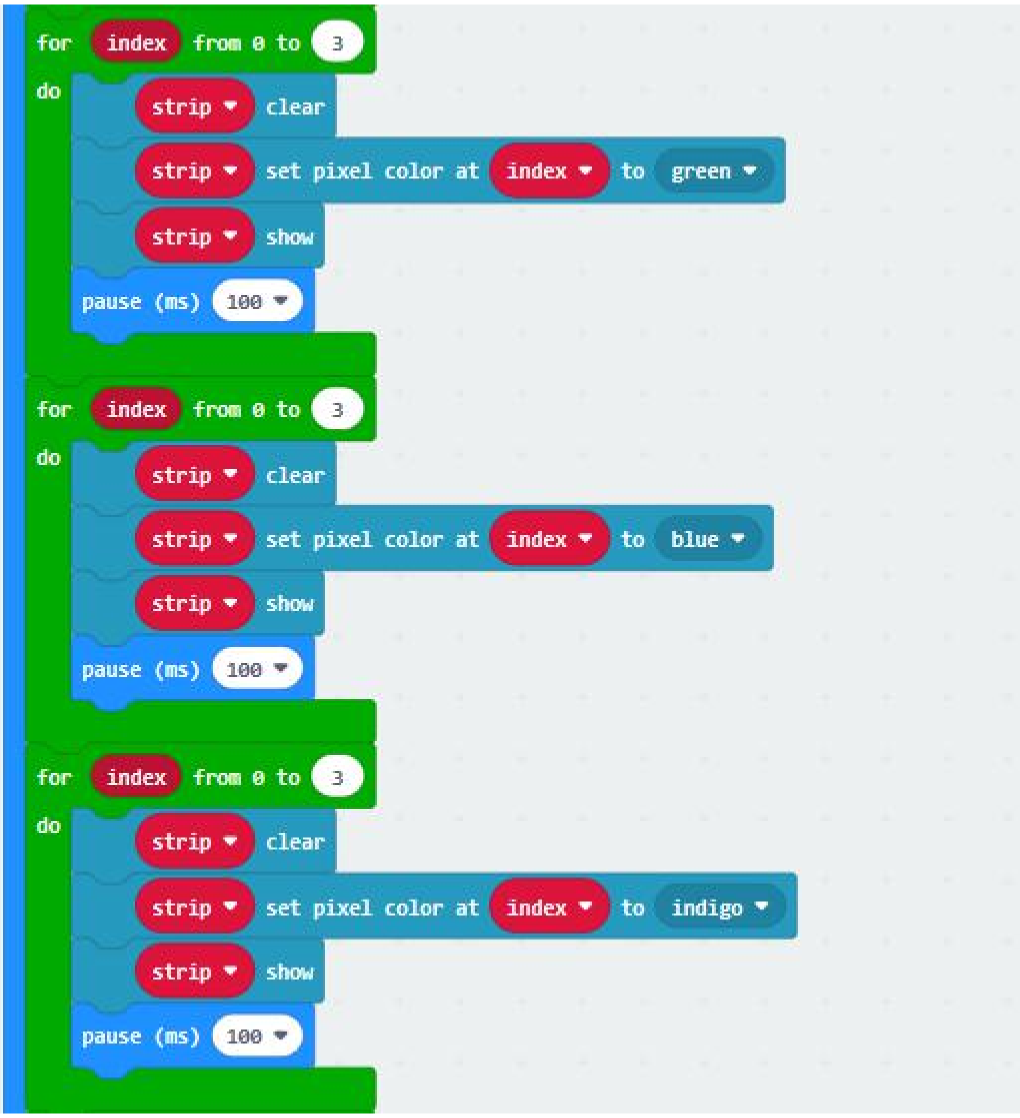
For index from 0 to 3, execute the program under do block

Turn off 4 pcs WS2812 RGB lights

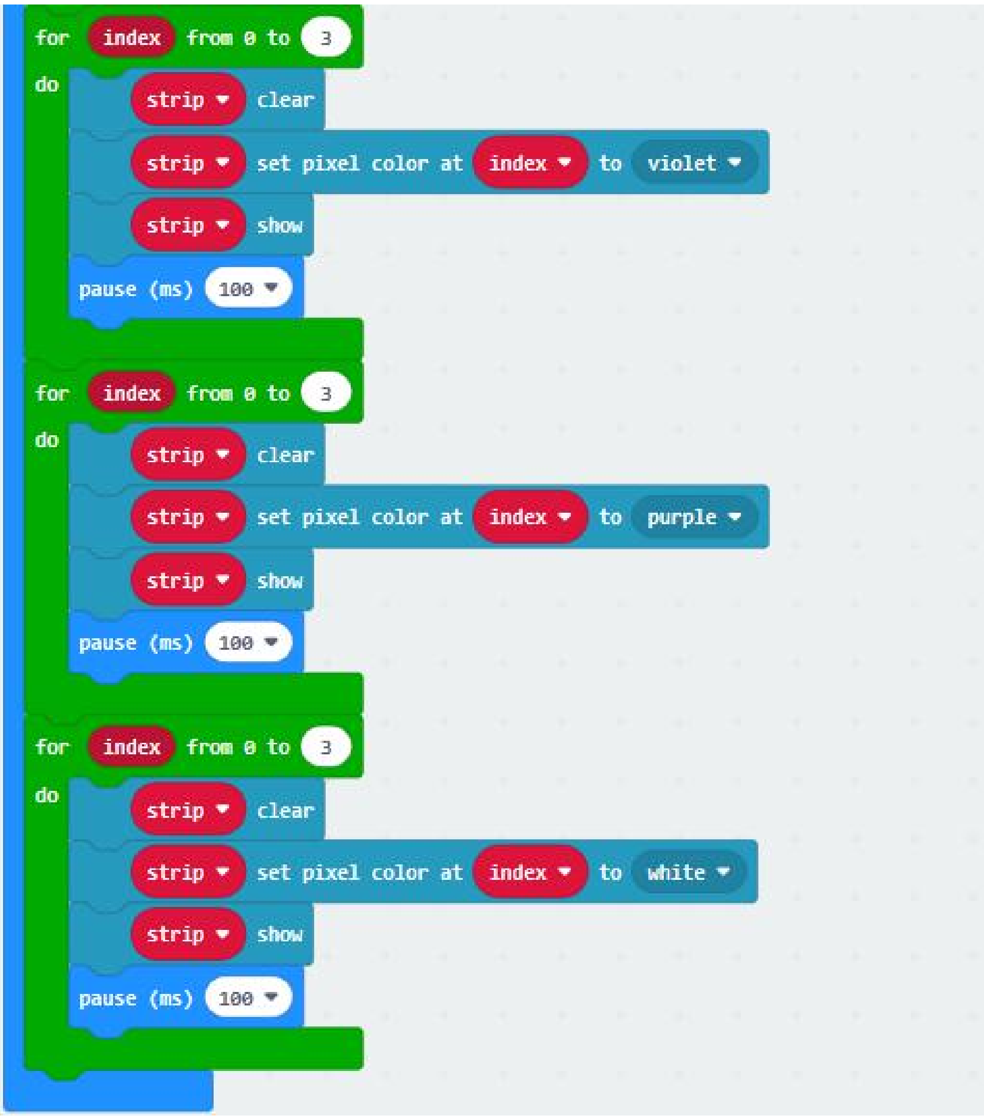
Set index of WS2812 RGB lights to yellow color

Strip shows

Delay in 100ms


for index from 0 to 3
do
strip clear
strip set pixel color at index to green
strip show
pause (ms) 100
for index from 0 to 3
do
strip clear
strip set pixel color at index to blue
strip show
pause (ms) 100
for index from 0 to 3
do
strip clear
strip set pixel color at index to indigo
strip show
pause (ms) 100

.For index from 0 to 3, execute the program under do block
Turn off 4 pcs WS2812 RGB lights
Set the index of WS2812 RGB lights to green color
Strip shows
Delay in 100ms
For index from 0 to 3, execute the program under do block
Turn off 4 pcs WS2812 RGB lights
Set the index of WS2812 RGB lights to blue color
strip shows
Delay in 100ms
For index from 0 to 3, execute the program under do block
Turn off 4 pcs WS2812 RGB lights
Set the index of WS2812 RGB lights to indigo color
Strip shows
Delay in 100ms
For index from 0 to 17, execute the program under do block
Turn off all RGB on strip
Set the index of WS2812 RGB lights to violet color
Set all RGB lights to show violet color
Strip displays all changes
Delay in 100ms
For index from 0 to 17, execute the program under do block
Turn off all RGB on strip
Set the index of WS2812 RGB lights to purple color
Strip displays all changes
Delay in 100ms
For index from 0 to 17, execute the program under do block
Turn off all RGB on strip
Set the index of WS2812 RGB lights to white color
Strip displays all changes
Delay in 100ms



For index from 0 to 3, execute the program under do block

Turn off 4 pcs WS2812 RGB lights

Set the index of WS2812 RGB lights to violet color

Strip shows

Delay in 100ms

For index from 0 to 3, execute the program under do block

Turn off 4 pcs WS2812 RGB lights

Set the index of WS2812 RGB lights to purple color

Strip shows

Delay in 100ms

For index from 0 to 3, execute the program under do block

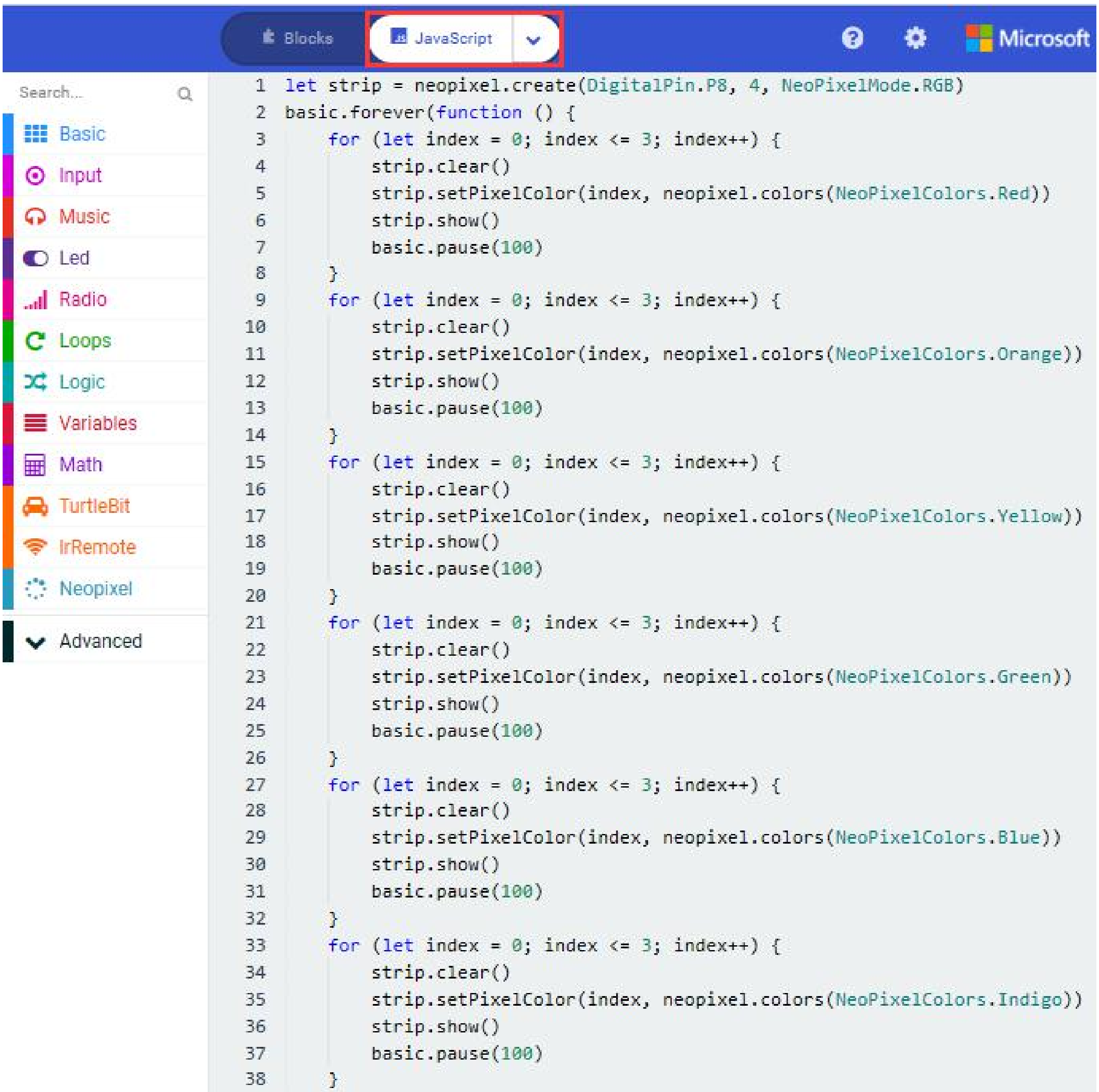
Turn off 4 pcs WS2812 RGB lights

Set the index of WS2812 RGB lights to white color

Strip shows

Delay in 100ms

Click “JavaScript" to switch into the corresponding JavaScript code:



```
    for (let index = 0; index <= 3; index++) {
        strip.clear()
        strip.setPixelColor(index, neopixel.colors(NeoPixelColors.Violet))
        strip.show()
        basic.pause(100)
    }
    for (let index = 0; index <= 3; index++) {
        strip.clear()
        strip.setPixelColor(index, neopixel.colors(NeoPixelColors.Purple))
        strip.show()
        basic.pause(100)
    }
    for (let index = 0; index <= 3; index++) {
        strip.clear()
        strip.setPixelColor(index, neopixel.colors(NeoPixelColors.White))
        strip.show()
        basic.pause(100)
    }
})
```

Code 3：

Type	Route	File Name
Hex file	../Makecode Tutorial/Test Code/8.15：WS2812 RGB/Code-3	microbit-Code-3.hex

Or you could edit code step by step in the editing area.

(1) a. Enter “Neopixel” → “set strip to Neopixel at pin P0 with 24 leds as RGB (GRB format)”

b. Place it into “on start” block，

c. Signal end P8 of WS2812 RGB is controlled by P8 of micro:bit . So we set to P8.

d. Smart car has 4 pcs WS2812 RGB lights, set to 4 leads

(2) Click “Variables” → “Make a Variable...”

Input R to build up variable R

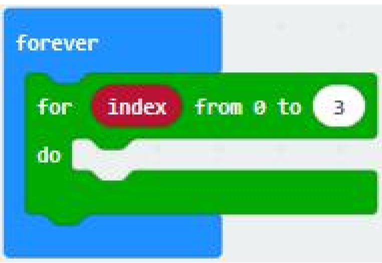
We create variable “G” and “B” in same way

Drag “set B to 0” into “on start” block

Copy “set B to 0” twice and click triangle button to choose G and B

(3) Click “Loops” to get block “for index from 0 to 4...do”

Leave it into “forever” and change 4 into 3

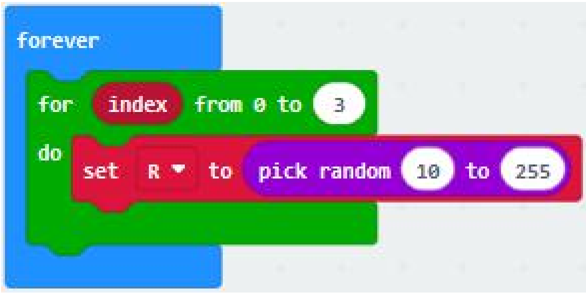


(4) Move block "set B to 0" into "for index from 0 to 3...do" block,

Click B to choose R

Go to "Math" to drag block "pick random 0 to 10" into 0 box

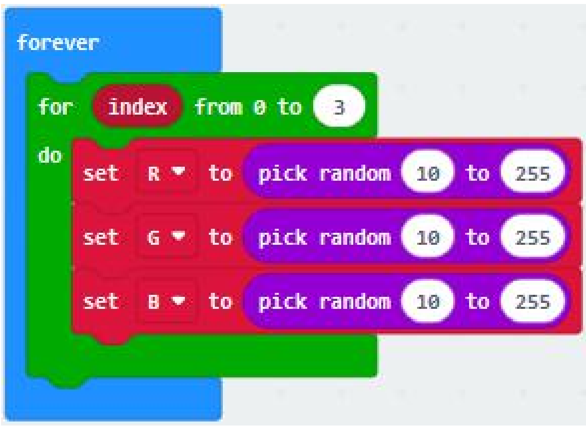
Change 0 into 10, 10 into 255



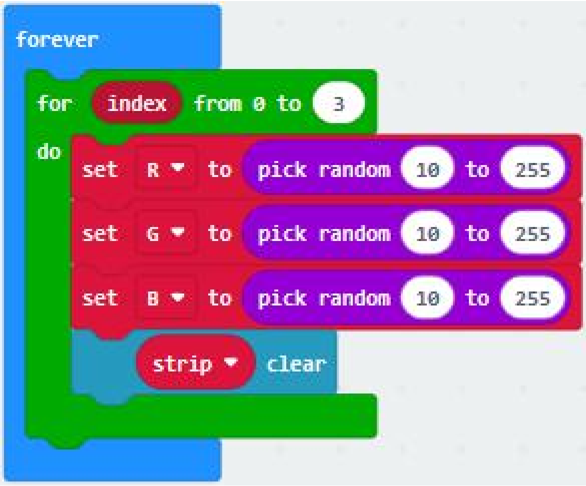
(5) Replicate block 

twice and place them into "for index from 0 to 3...do" block.

Click R to select G and B



(6) Tap "Neopixel" and move "strip clear" into "for index from 0 to 3...do" block.



(7) Go to "Neopixel" → "more" → "strip set pixel color at 0 to red"

Leave it in the block "for index from 0 to 3...do" block

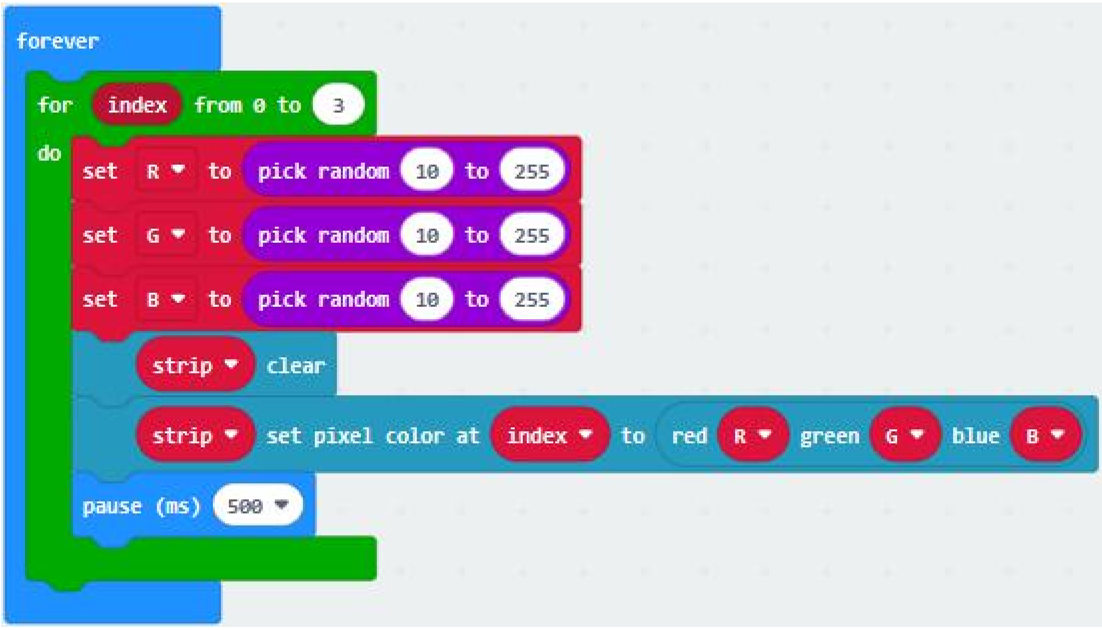
Drag block "red 255 green 255 blue 255" into "red" box

Tap "Variables" to move "index" block into 0 box

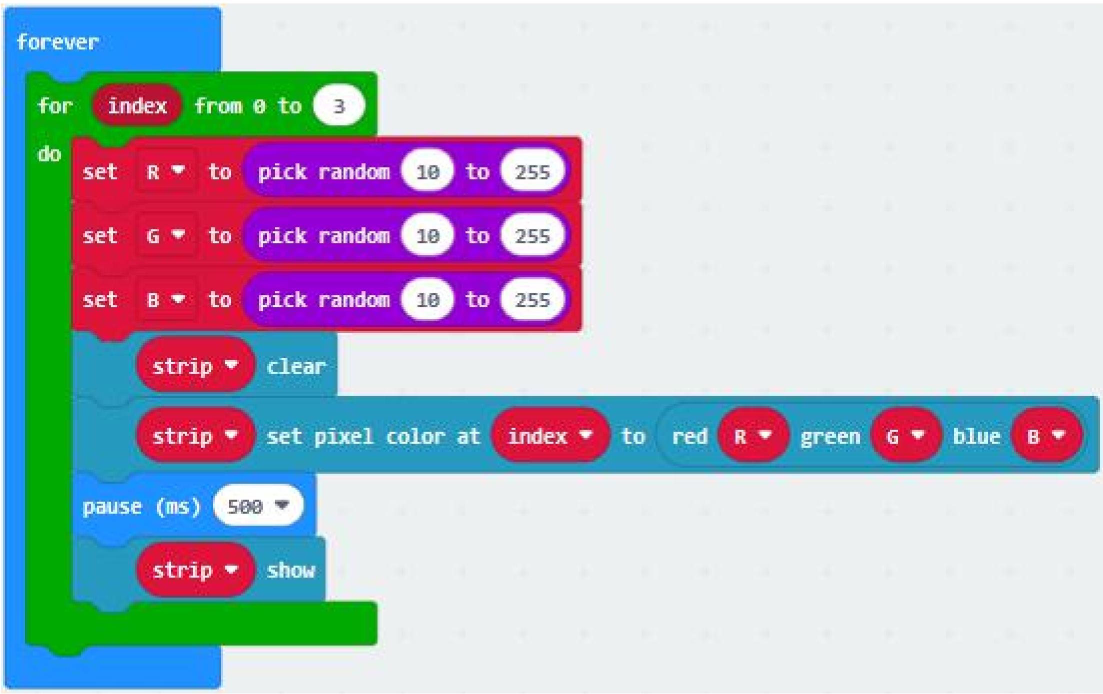
Separately drag R , G and B into 255 box, as shown below:

(8) Click "Basic" to drag "pause (ms) 100" under block "strip.....B"

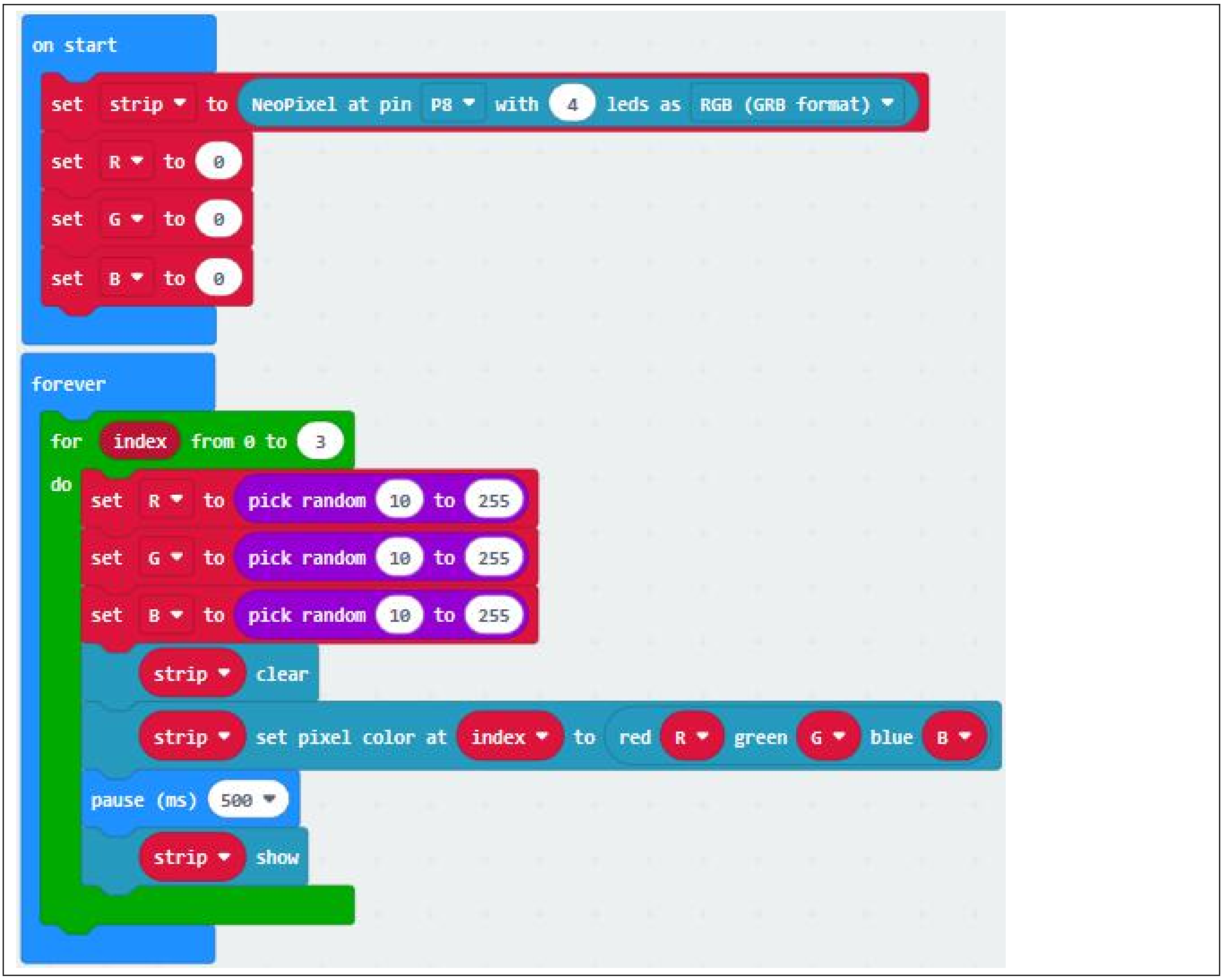
Set to 500ms.



(9) Click “Neopixel” to move “strip show” block under “pause(as) 500”



Complete Code:



"on start" : command block runs once to start program.
Set strip to Neopixel at pin p8 with 4 leads as RGB(GRB format)
Set variable R to 0
Set variable G to 0
Set variable B to 0
The program under the block "forever" runs cyclically.
When the value of index is in 0-3, execute the program under do block
Set variable R to random number in 10-255
Set variable G to random number in 10-255
Set variable B to random number in 10-255
Turn off all RGB on strip
Set index of 4 pcs WS2812 RGB lights to RGB(red, green, blue)
Delay in 500ms
Strip shows

Click "JavaScript" to switch into the corresponding JavaScript code:

4.Test Results：

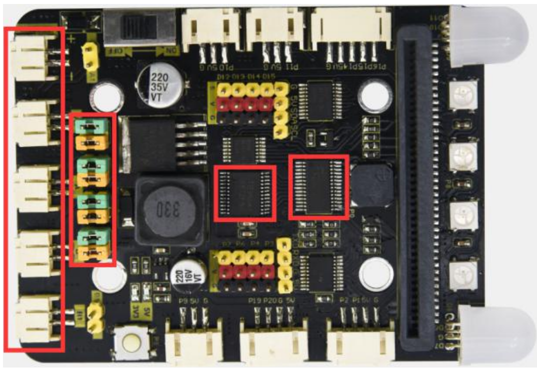
Download code 1 to micro：bit, and dial POWER to ON end. WS2812RGB LEDs light up different colors cyclically.

Download code 2 to micro：bit, WS2812RGB LEDs display like flow light.

Download code 3 to micro：bit, every WS2812RGB light shows random color one by one.

(How to download?　How to quick download?)

8.16: Motor Driving

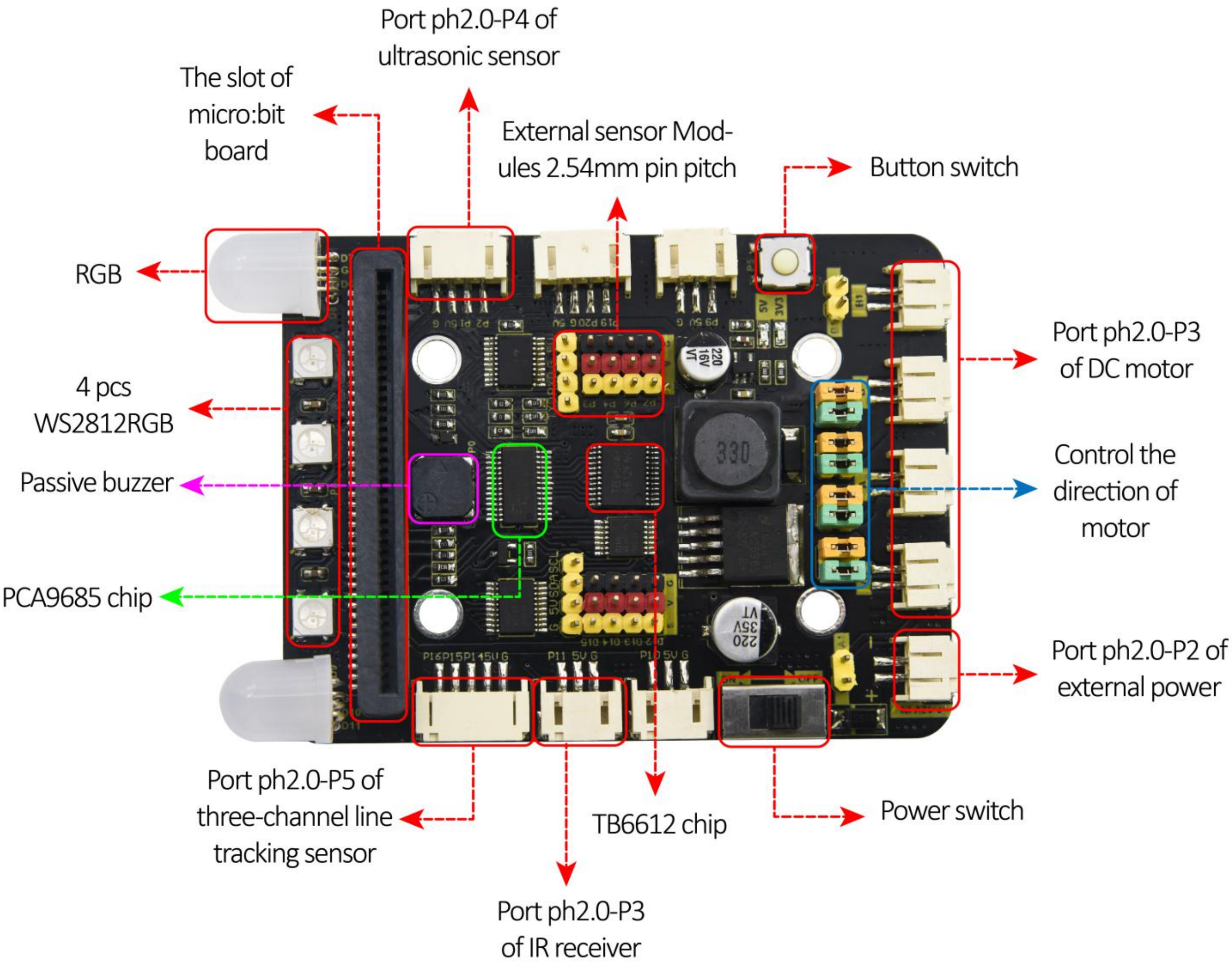


1. Description :

Keyestudio micro : bit smart car is equipped with two DC geared motors which are added a gearbox based on regular DC motors.

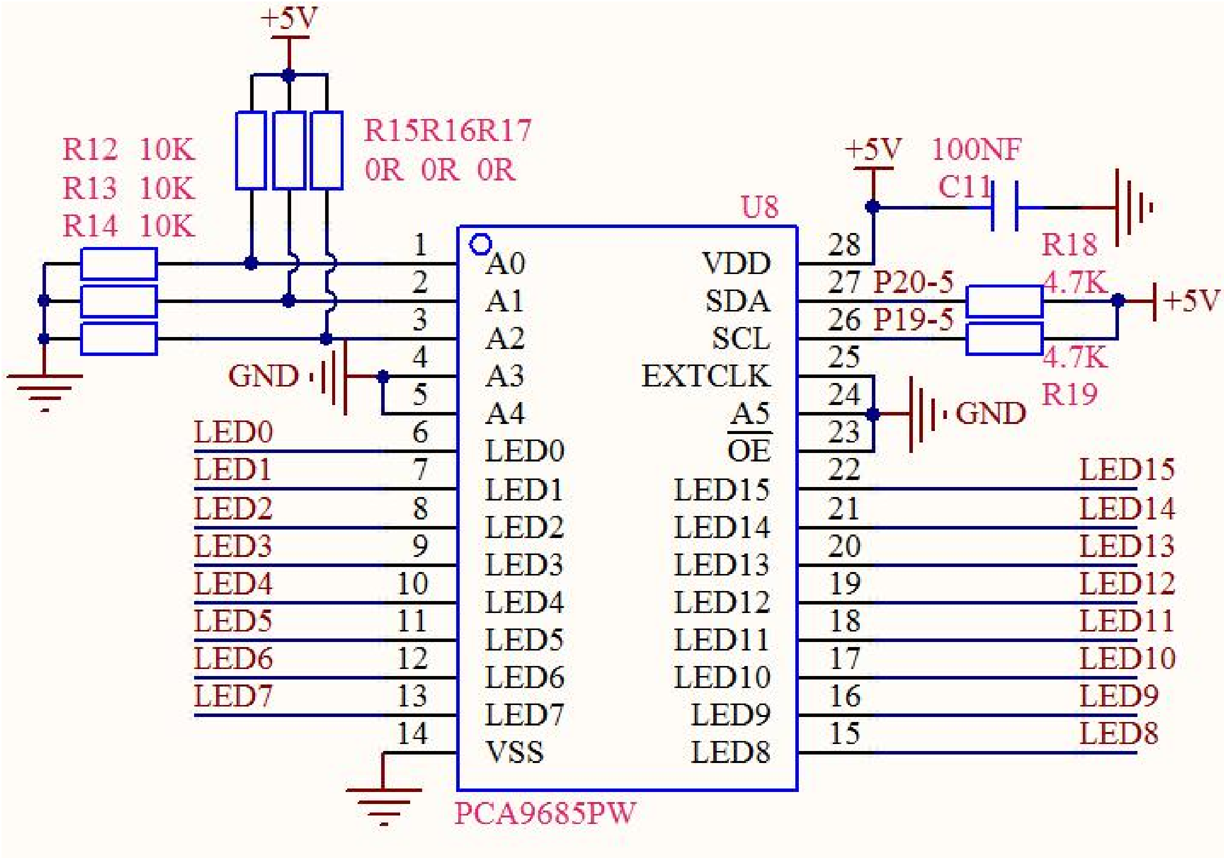
Gear motor is the integration of gearmotor and motor, which is applied widely in steel and machine industry

Micro:bit motor driver shield comes with PCA9685PW and TB6612FNG chip , to save the IO port resource , we control the rotation direction and speed of two DC gear motors with TB6612FNG chip.

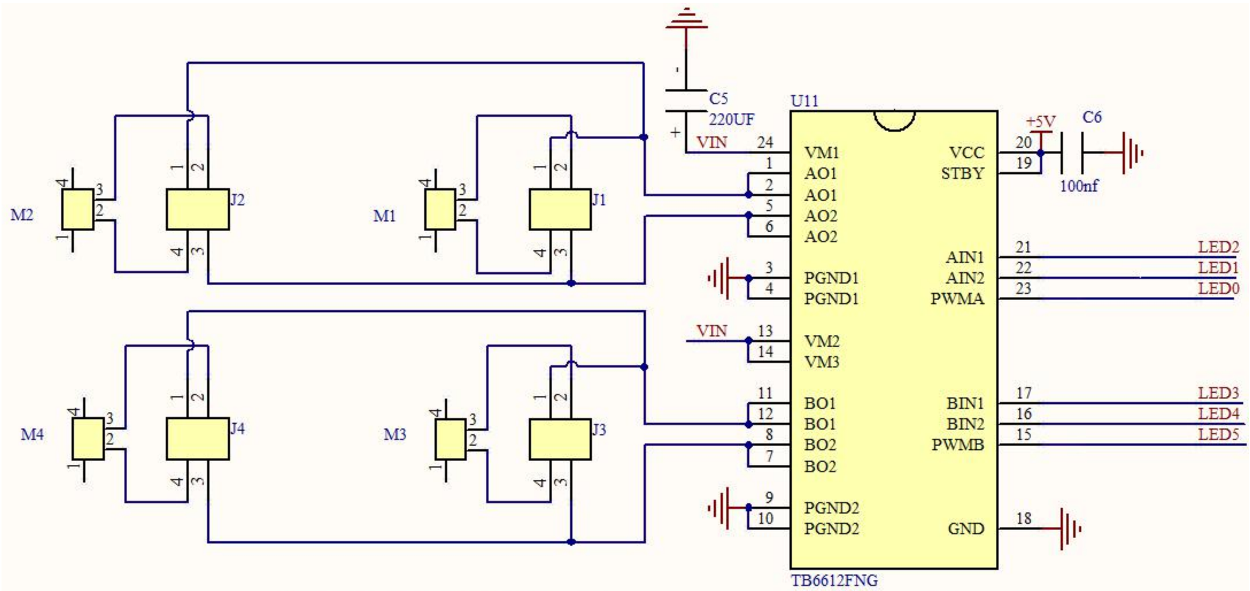


PCA9685 chip is controlled by IIC port of micro:bit board and used to be output port and expand the IO ports of micro:bit board.

TB6612 chip is controlled by LEDx pin of PCA9685 chip(pin LED1 and LED2 control the direction of left motor, speed is LED0 pin; LED3 and LED4 pin control direction of right motor, speed is LED5



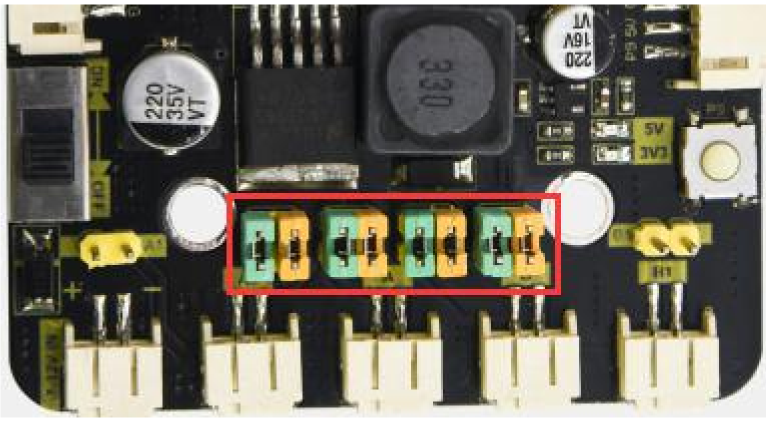
PCA9685PW IC



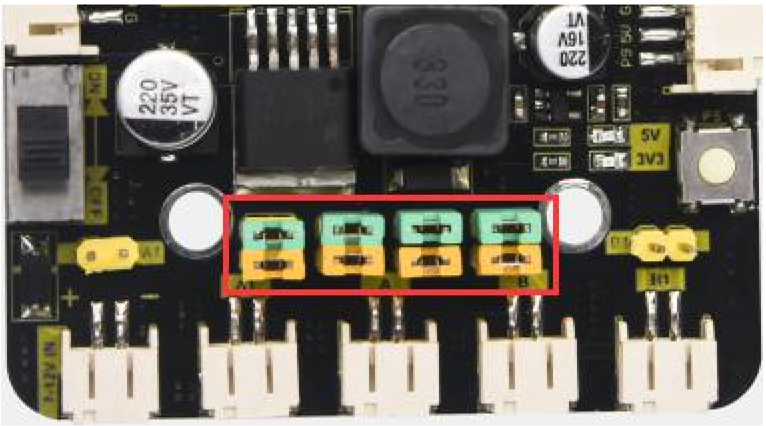
TB6612FNG Motor control chip

Note: please follow the direction of eight jumper caps inserted.

In this way, the rotation direction is as same as the set rotation orientation in the code



The picture below is wrong inserted direction of jumper caps



2. Experimental Preparation：

(1) Insert micro:bit board into slot of V2 shield.

(2) Place batteries into battery holder.

(3) Dial power switch to ON end

(4) Connect micro:bit to computer by USB cable and open online Makecode editor.

Import Hex profile **(How to import?)** , or click “New Project” and drag blocks step by step(add turtle-bit extension library first)

(How to add turtle-bit extension?)

3. Test Code :

Code 1 :

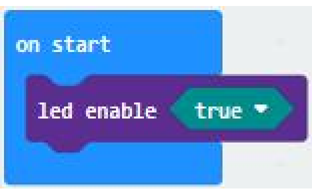
Type	Route	File Name
Hex file	../Makecode Tutorial/Test Code/8.16: Motor Driving/Code-1	microbit-Code-1.hex

Or you could edit code step by step in the editing area.

(1) Click “Led” → “more” → “led enable fasle”

Leave it into “on start”

Tap “false” to select “true”



(2) Click “Basic” to get block “show arrow North”

Leave it into “forever” block

Click North to select South

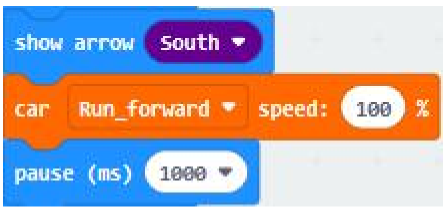
(3) Click “TurtleBit” to drag “car Run_forward speed : 0 %” block

Place it into “forever” block

Change 0 into 100.

(4) Tap “Basic” to move “pause (ms) 100” block into “forever” block

Delay in 100ms

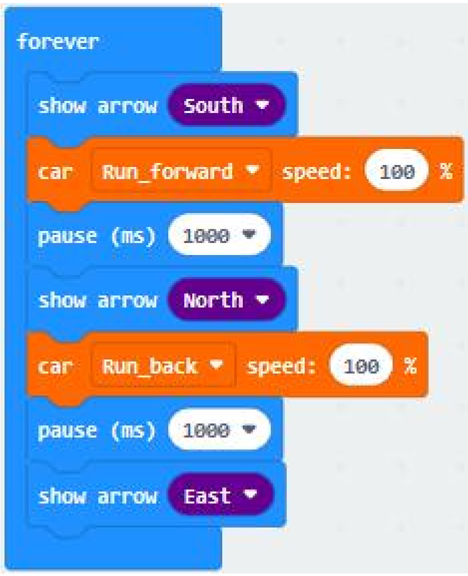
(5) Replicate code string 

once and leave it under “pause (ms) 100” block

Change South into North and Run_forward into Run_back

(6) Copy "show arrow South" once and keep it under block "pause (ms) 100" .

(7) Change South into East.



(8) Click "TurtleBit" to move "LeftSide motor run Forward speed : 0 %" and copy it once

(9) Place them under "show arrow East" block

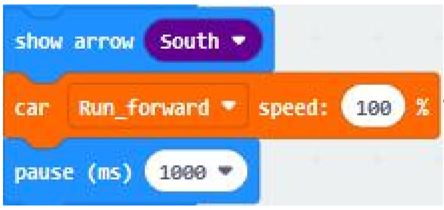
(10) And copy "pause (ms) 1000" block once

(11) Set the code string as follows:

(12) Duplicate code string  once and

keep it under "pause (ms) 1000" block

Change East into West, 50 into 100 and 100 into 50

(13) Copy code string 

twice,

Place them into “forever” block

Click South to select East and West

Tap Run_forward to select Turn_Left and Turn_Right

(14) Tap "Basic" to drag block "show leds" into "forever"

Tick blue boxes to generate "❤" pattern

(15) Tap "TurtleBit" to drag "car stop" into "forever" block

Copy "pause (ms) 1000" once and leave it under "car stop" block

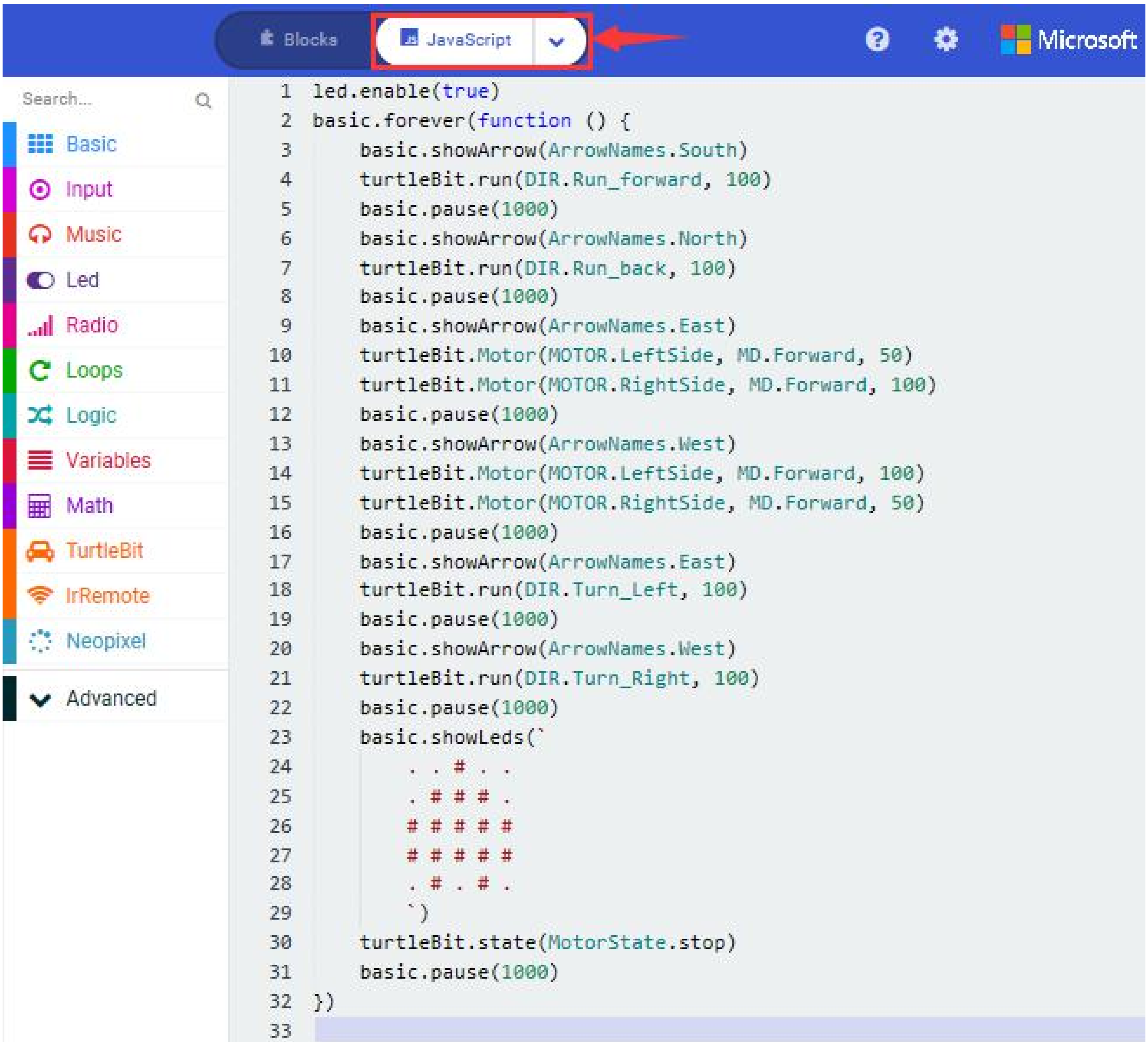

forever
show arrow South
car Run_forward speed: 100 %
pause (ms) 1000
show arrow North
car Run_back speed: 100 %
pause (ms) 1000
show arrow East
LeftSide motor run Forward speed: 50 %
RightSide motor run Forward speed: 100 %
pause (ms) 1000
show arrow West
LeftSide motor run Forward speed: 100 %
RightSide motor run Forward speed: 50 %
pause (ms) 1000
show arrow East
car Turn_Left speed: 100 %
pause (ms) 1000
show arrow West
car Turn_Right speed: 100 %
pause (ms) 1000
show leds
car stop
pause (ms) 1000

Complete Code:

"on start": command block runs once to start program.
Turn on LED dot matrix
The program under the block "forever" runs cyclically.
Micro:bit shows the southward arrow
Car goes forward at 100% speed
Delay in 1000ms
Micro:bit shows the northward arrow
Car goes back at 100% speed
Delay in 1000ms
Micro:bit shows the eastward arrow
The left car wheels go forward at 50% speed
The right car wheels go forward at 100% speed
Delay in 1000ms
Micro:bit shows the westward arrow
The left car wheels go forward at 100% speed
The right car wheels go forward at 50% speed
Delay in 1000ms
Micro:bit shows the eastward arrow
Car rotates anticlockwise at 100% speed
Delay in 1000ms
Micro:bit shows the westward arrow
Car rotates anticlockwise at 100% speed
Delay in 1000ms
Micro:bit shows the eastward arrow
Car stops
Delay in 1000ms


show arrow East
car Turn_Left speed: 100 %
pause (ms) 1000
show arrow West
car Turn_Right speed: 100 %
pause (ms) 1000
show leds
car stop
pause (ms) 1000

Click “JavaScript" to switch into the corresponding JavaScript code:



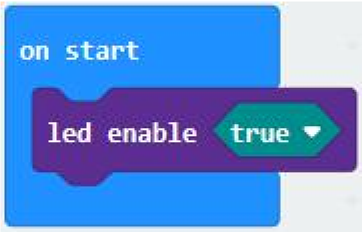
Code 2：

Type	Route	File Name
Hex file	../Makecode Tutorial/Test Code/8.16：Motor Driving/Code-2	microbit-Code-2.hex

Or you could edit code step by step in the editing area.

(1) Click “Led” → “more” → “led enable false”,

Put it into block “on start”,click drop-down triangle button to select “true”



.

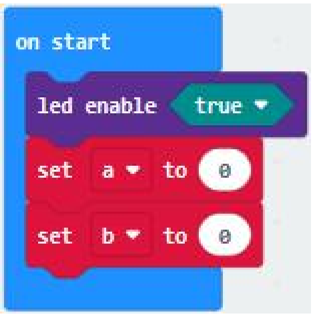
(2) Click “Variables” → “Make a Variable...”

Input “a” and click “OK”, variable “a” is built

Then create the variable “b” in same way

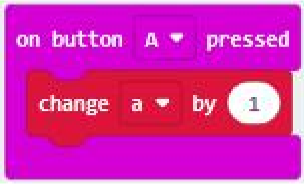
Drag “set b to 0” into “on start” block, change b into a

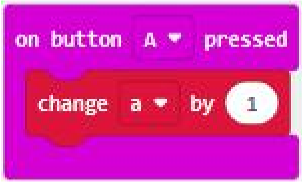
Copy “set b to 0” once and leave it under “set a to 0”



(3) Click “Input” to drag out “on button A pressed”

Tap “Variables” to move “change b by 1” into “on button A pressed” block, and change b into a.



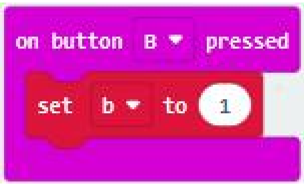
(4) Copy code string 

once, delete “change a by 1” block

Change A into B

Tap “Variables” to drag “set b to 0” into “on button B pressed”

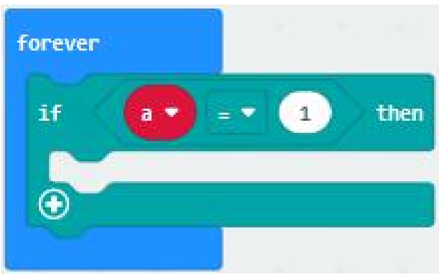
Alter 0 into 1



(5) Click “Logic” to move “if true then...” into “forever” block

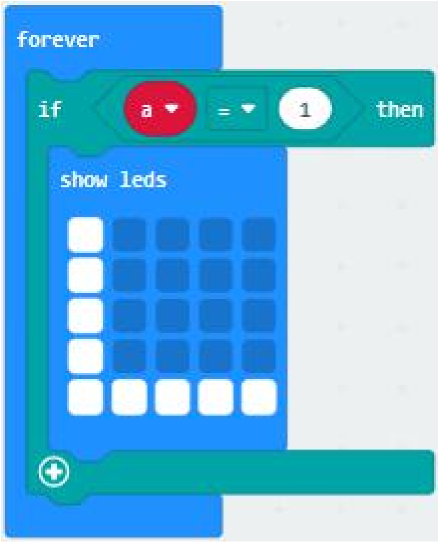
Drag “=” block into “true” box

Tap “Variables” to move variable “a” to left box of “=”, and change 0 into 1.



(6) Click “Basic” to drag “show leds” under then block

Tick blue box to generate “L”

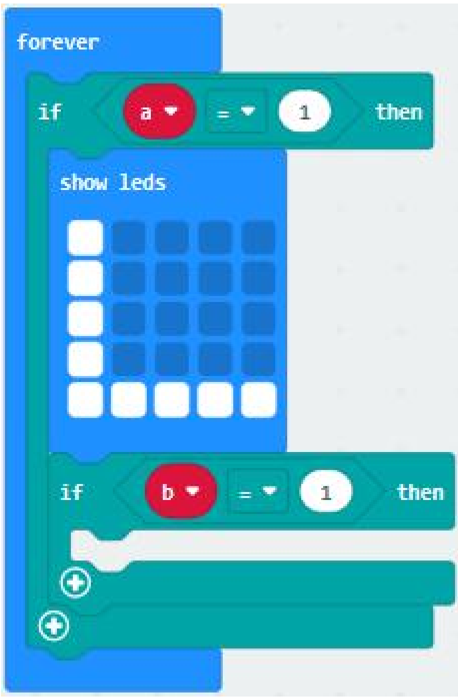


(7) Click “Logic” to get “if true then...” block

Leave it under block “if..then” block

Go to “Variables” to move block “b” to left box of “=” block

Change 0 into 1

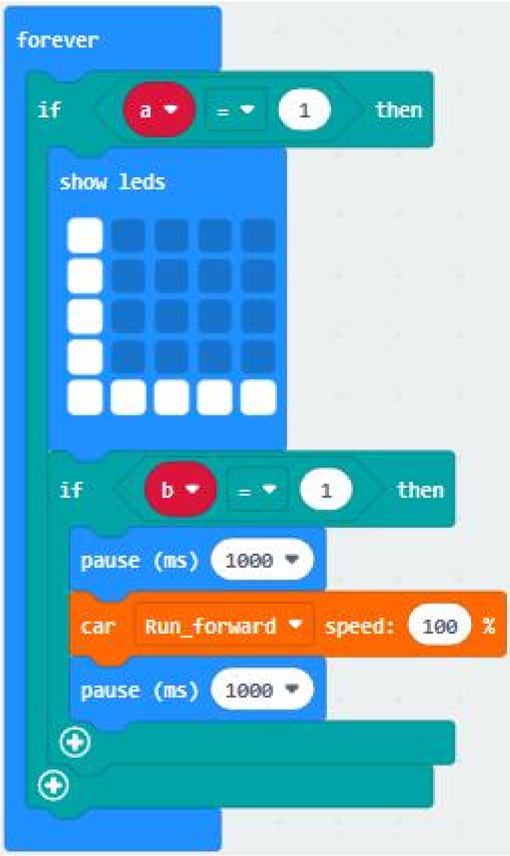


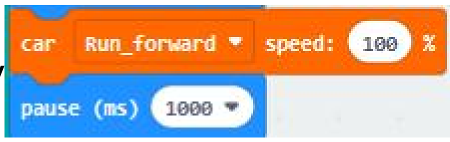
(8) Click “Basic” to get block “pause (ms) 100”

Leave it into “if..then” block

Click “TurtleBit” to move “car Run_forward speed: 0 %” under block “pause (ms) 100” and change 0 into 100

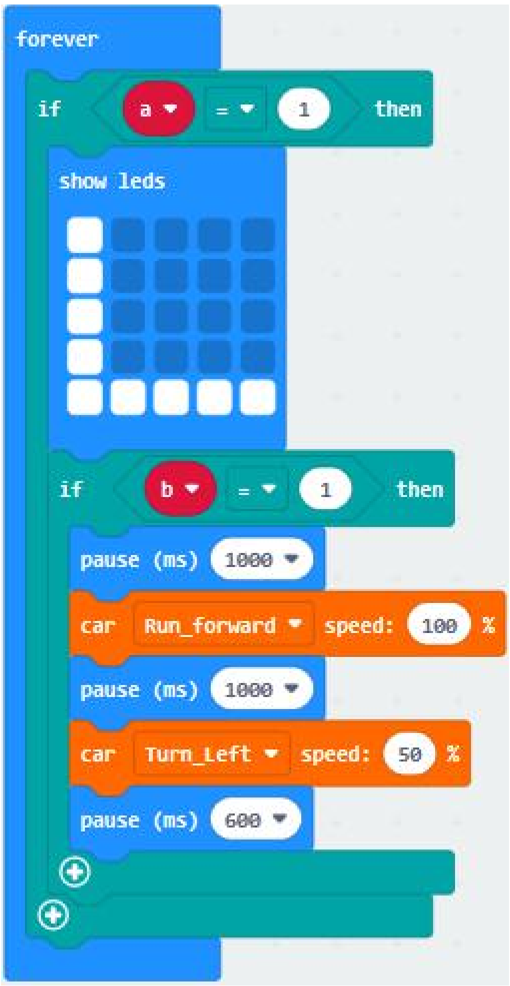
Copy “pause (ms) 1000” block and leave it under “car...100%” block.

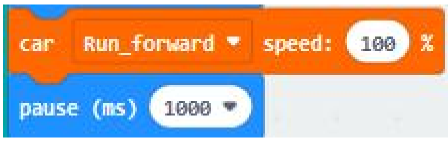


(9) Copy 

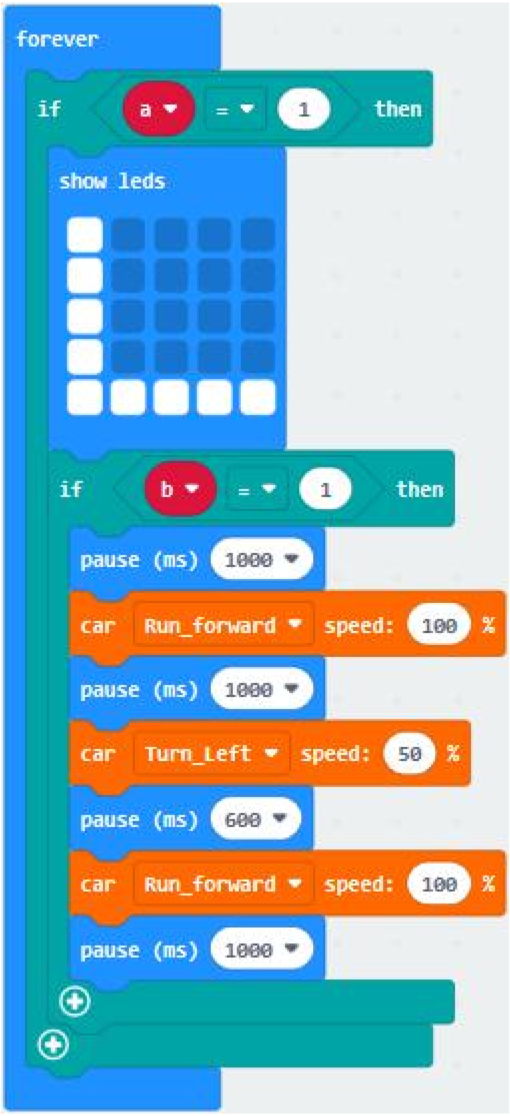
once and leave it under “pause (ms) 100” block

Change Run_Forward into Turn_Left, 100 into 50 and delay in 600ms



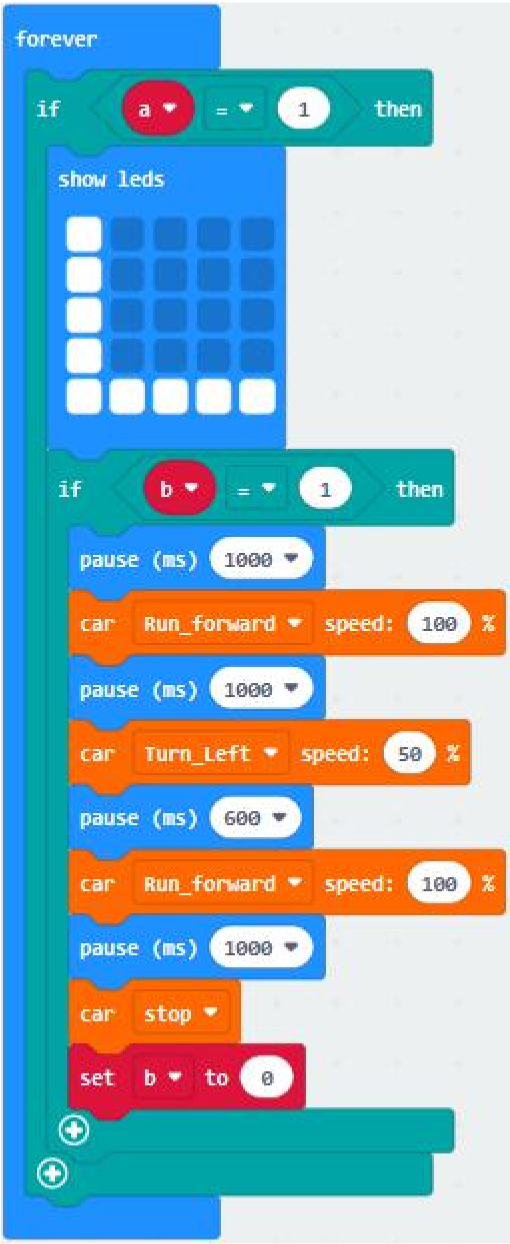
(10) Duplicate code string 

once, keep it under "pause (ms) 600" block



(11) Tap "TurtleBit" to drag "car stop" block under block "pause (ms) 1000"

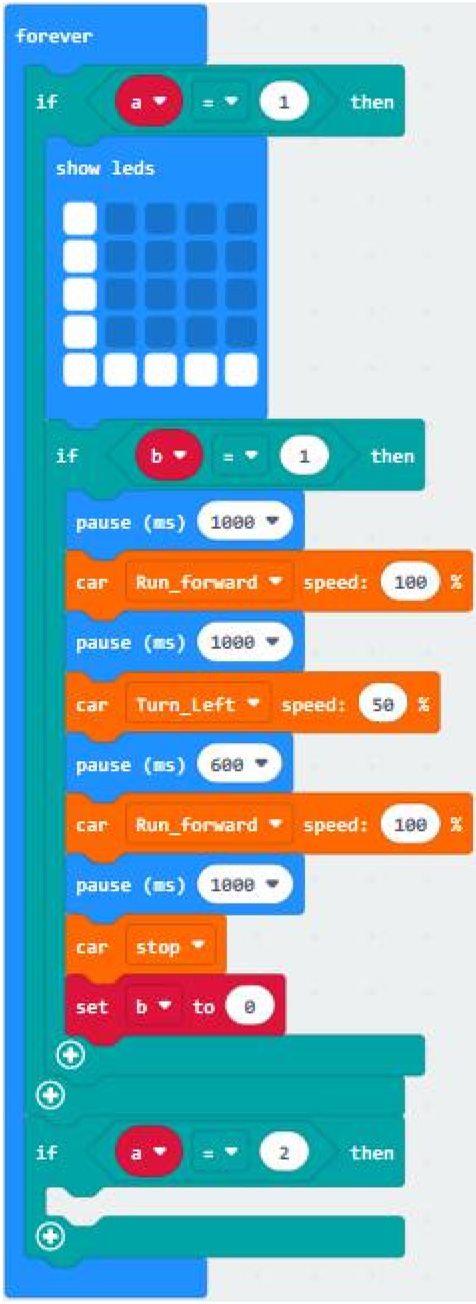
Tap "Variables" to move "set b to 0" block under "car stop" block



(12) Click "Logic" to drag "if true then…" into "forever"

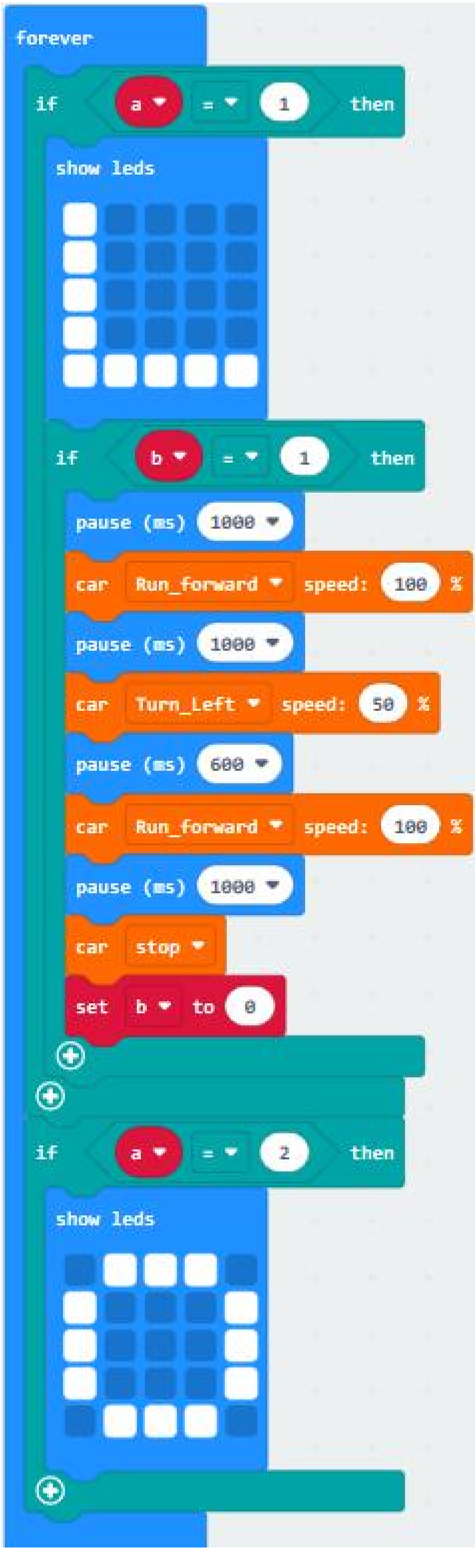
Move "=" block into "true" box

Click "Variables" to move "a" to left box of "=" and change 0 into 20



(13) Click “Basic” to drag “show leds” into the third “if..then” block

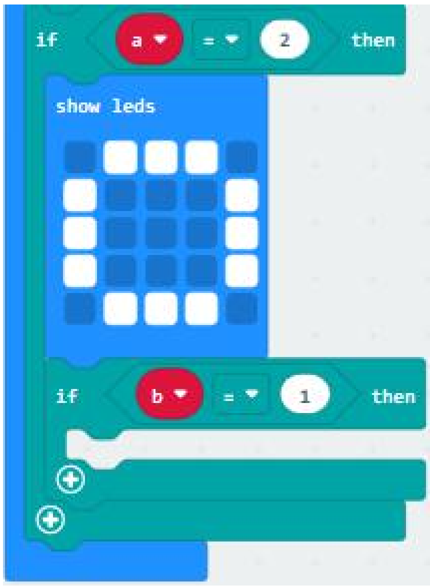
Tick blue boxes to produce “口”



(14) Go to “Logic” to drag “if true then...” block

Keep it under “show leds □” block

Move variable b into left box of “=” block and change 0 into 1



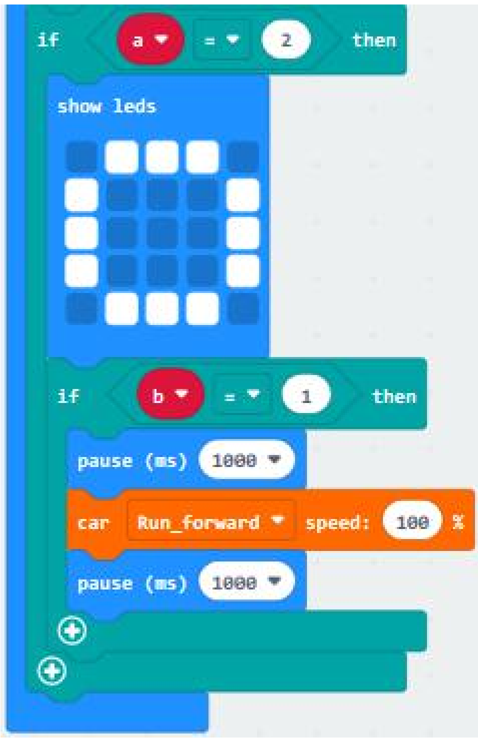
(15) Tap “Basic” to drag “pause (ms) 100” and copy it once

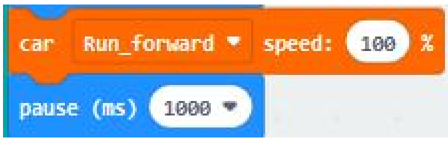
Set to 1000ms

Tap “TurtleBit” block to drag out “car Run_forward speed: 0 %” block

Change 0 into 100

Then set the code string as follows:

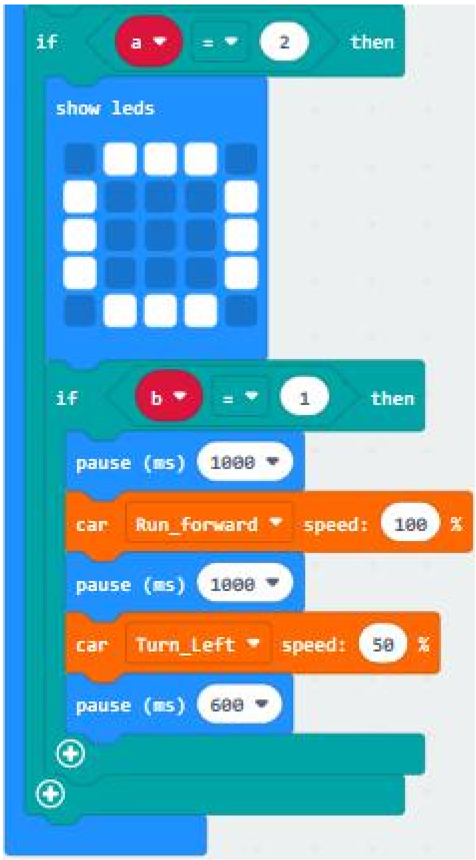


(16) Duplicate code string 

once

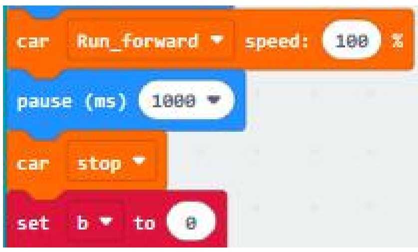
Change Run_Forward into Turn_Left, 100 into 50 and 1000 into 600

Place it into code sting, as shown below



(17) Replicate code string 

twice and keep them in the code string as follows:

(18) Copy code string 

once, and leave it under "pause(as) 600" block

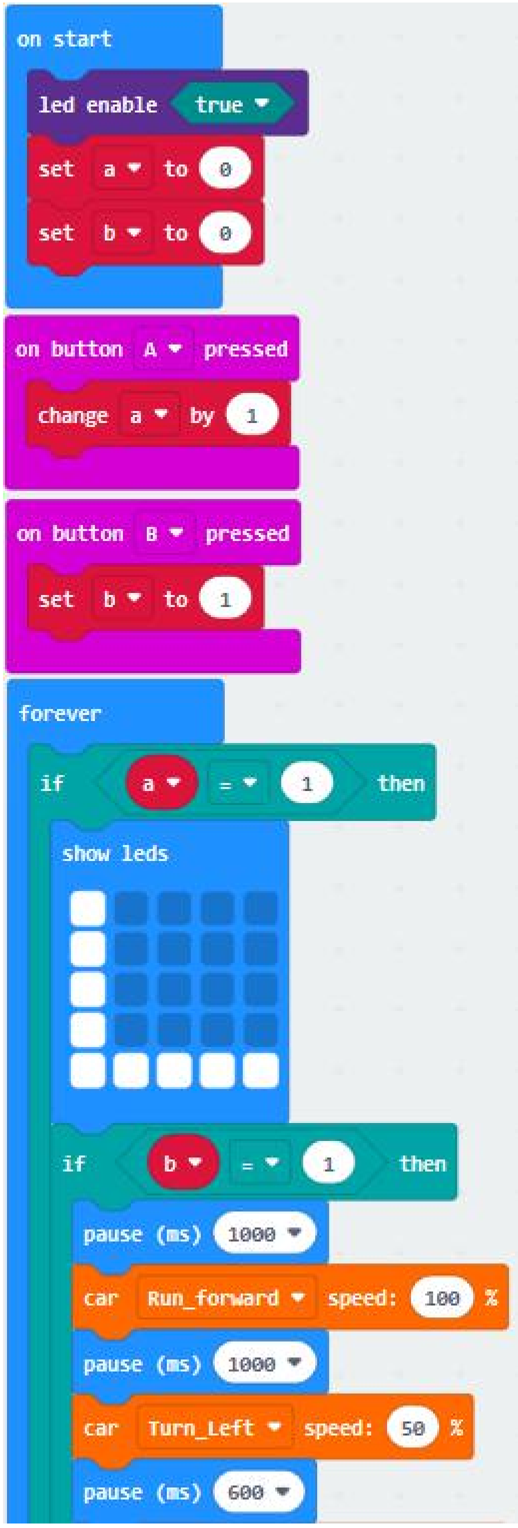
(20) Copy “if a=2 then” block once and change 2 into 3

Tap “Variables” to move “set b to 0” into “if a=3 then” block

Alter b into a and 0 into 1


if b = 1 then
pause (ms) 1000
car Run_forward speed: 100 %
pause (ms) 1000
car Turn_Left speed: 50 %
pause (ms) 600
car Run_forward speed: 100 %
pause (ms) 1000
car Turn_Left speed: 50 %
pause (ms) 600
car Run_forward speed: 100 %
pause (ms) 1000
car Turn_Left speed: 50 %
pause (ms) 600
car Run_forward speed: 100 %
pause (ms) 1000
car stop
set b to 0
if a = 3 then
set a to 1

Complete Code:



"on start" : command block runs once to start program.

Turn on LED dot matrix

Set variable a to 0

Set variable b to 0

When button A is pressed

Change variable a by 1

When A is pressed

Set variable b to 1

The program under the block "forever" runs cyclically.

When variable a=1, run the program under then block

Micro:bit shows "L"

When variable b=1, run the program under then block

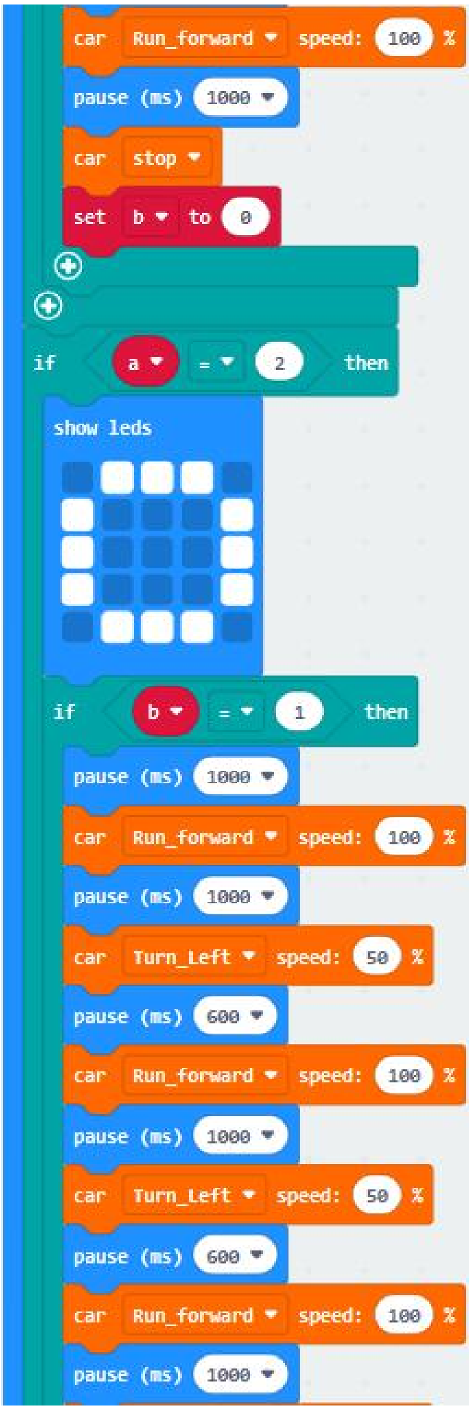
Delay in 1000ms

Go forward at 100% speed

Delay in 1000ms

Turn anticlockwise at 50% speed

Delay in 600ms



Car goes forward at 100% speed

Delay in 1000ms

Car stops

Set variable b to 0

When variable a=2, run the program under then block

Matrix shows “□”

When variable b=1, execute the program under then block

Delay in 1000ms

Car goes forward at 100% speed

Delay in 1000ms

Car turns anticlockwise at 50% speed

Car turns anticlockwise at 50% speed

Delay in 600ms

Car goes forward at 100% speed

Delay in 1000ms

Car turns anticlockwise at 50% speed

Delay in 600ms

Car goes forward at 100% speed

Delay in 1000ms

Car turns anticlockwise at 50% speed

Delay in 600ms

Car goes forward at 100% speed

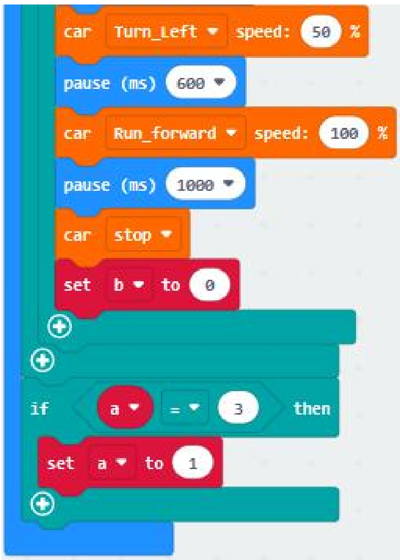
Delay in 1000ms

Car stops

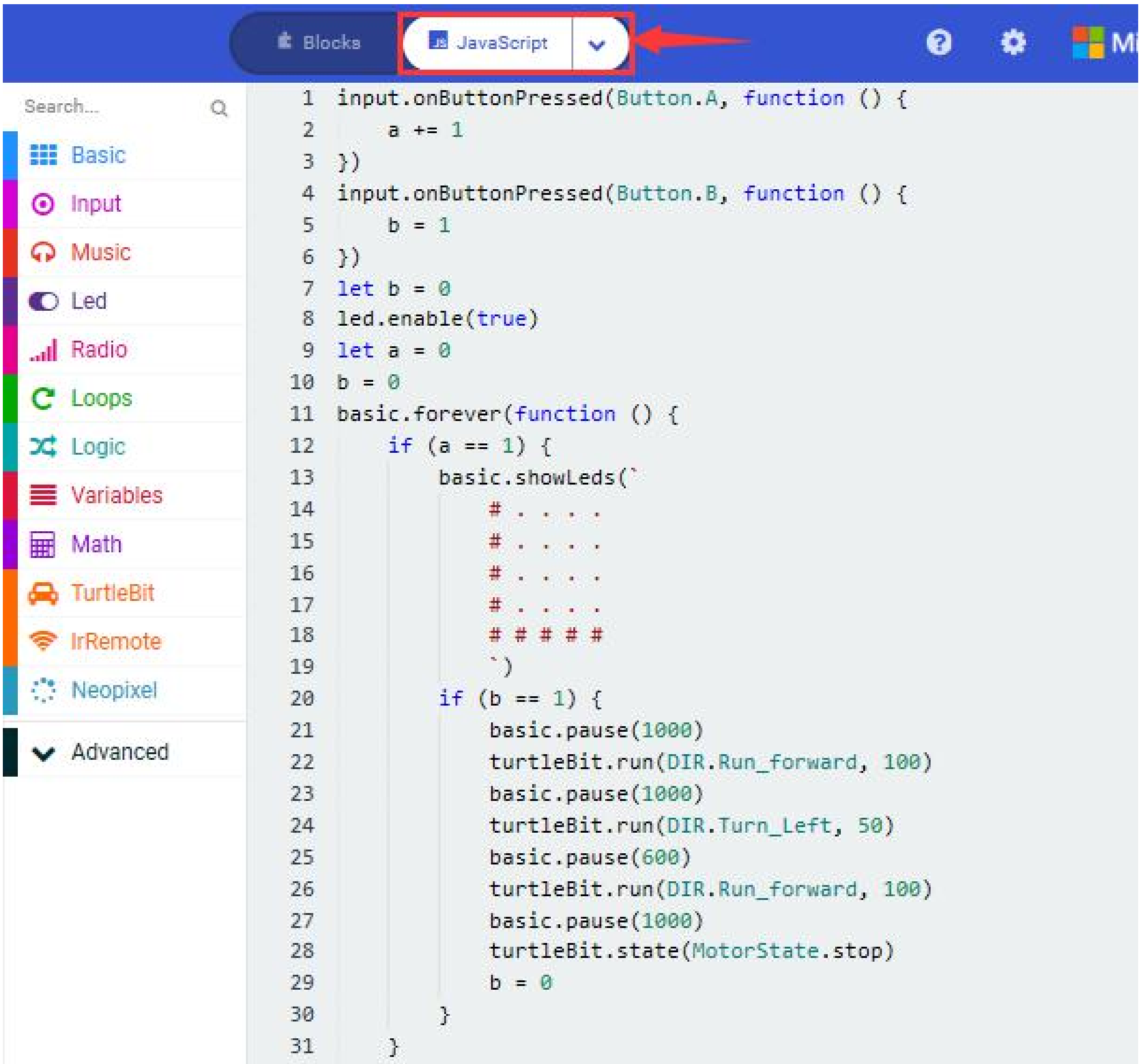
Set variable b to 0

When variable a=3, execute the program under then block

Set variable a to 1



Click “JavaScript" to view the corresponding JavaScript code:


Blocks
JavaScript
Search...
Basic
Input
Music
Led
Radio
Loops
Logic
Variables
Math
TurtleBit
IrRemote
Neopixel
Advanced
input.onButtonPressed(Button.A, function () {
    a += 1
})
input.onButtonPressed(Button.B, function () {
    b = 1
})
let b = 0
led.enable(true)
let a = 0
b = 0
basic.forever(function () {
    if (a == 1) {
        basic.showLeds(`
            # . . . .
            # . . . .
            # . . . .
            # . . . .
            # # # # #
            `)
        if (b == 1) {
            basic.pause(1000)
            turtleBit.run(DIR.Run_forward, 100)
            basic.pause(1000)
            turtleBit.run(DIR.Turn_Left, 50)
            basic.pause(600)
            turtleBit.run(DIR.Run_forward, 100)
            basic.pause(1000)
            turtleBit.state(MotorState.stop)
            b = 0
        }
    }

```
    if (a == 2) {
        basic.showLeds(`
            . # # # .
            # . . . #
            # . . . #
            # . . . #
            . # # # .
            `)
        if (b == 1) {
            basic.pause(1000)
            turtleBit.run(DIR.Run_forward, 100)
            basic.pause(1000)
            turtleBit.run(DIR.Turn_Left, 50)
            basic.pause(600)
            turtleBit.run(DIR.Run_forward, 100)
            basic.pause(1000)
            turtleBit.run(DIR.Turn_Left, 50)
            basic.pause(600)
            turtleBit.run(DIR.Run_forward, 100)
            basic.pause(1000)
            turtleBit.run(DIR.Turn_Left, 50)
            basic.pause(600)
            turtleBit.run(DIR.Run_forward, 100)
            basic.pause(1000)
            turtleBit.state(MotorState.stop)
            b = 0
        }
    }
    if (a == 3) {
        a = 1
    }
})
```

4.Test Results：

Download code 1 to micro:bit board, dial POWER switch to ON end. Smart car goes forward for 1s, backward for 1s, turns left for 1s, turns right for 1s, rotates anticlockwise for 1s, clockwise for 1 and stops for 1s. And dot matrix displays the corresponding patterns

Download code 2 to micro:bit board, “L” will be shown on dot matrix when A button is pressed, then press B, the route of smart car is “L” type. “口” will be displayed when the Button A is pressed again, then press B, the route of smart car is “口” type.

(How to download? How to quick download?)

8.17: Line Tracking Smart Car

8.17.1: Detect Line Tracking Sensor

1. Description :

The V2 expansion board of keyestudio micro : bit mini smart robot car comes with two line tracking sensors which adopt TCRT5000 IR tubes.

TCRT5000 IR tube has an IR emitting tube and a receiving tube.

Low level(0) is output when IR transmitting tube emits IR signals to receiving tube; high level(1) will be output when smart car runs along black line.

When smart car drives on the white ground, TCRT5000 IR tube will emit IR signals which will be reflected by white ground and received by receiving tube, consequently output low level(0); on the contrary, when driving on the black surface, the high level is output.

The left and right line tracking sensors are respectively controlled by P12 and P13.

Put a paper under the bottom of car, adjust the potentiometers on shield to adjust sensitivity. When D2 and D6 are on, then pull up the universal wheels for 0.5cm off the paper. The sensitivity is set well if D2 and D6 are off

2. Experimental Preparation：

(1) Insert micro:bit board into slot of V2 shield.

(2) Place batteries into battery holder.

(3) Dial power switch to ON end

(4) Connect micro:bit to computer by USB cable and open online Makecode editor.

(5) Import Hex profile **(How to import?)** , or click “New Project” and drag blocks step by step(add turtle-bit extension library first)

(How to add turtle-bit extension?)

3. Test Code :

Code 1 :

Type	Route	File Name
Hex file	../Makecode Tutorial/Test Code/8.17: Line Tracking Smart Car/8.17.1:Detect Line Tracking Sensor/Code-1	microbit-Code-1.hex

Or you could edit code step by step in the editing area.

(1) Click "Advanced" → "Serial" → "serial redirect to USB"

Place it into "on start"

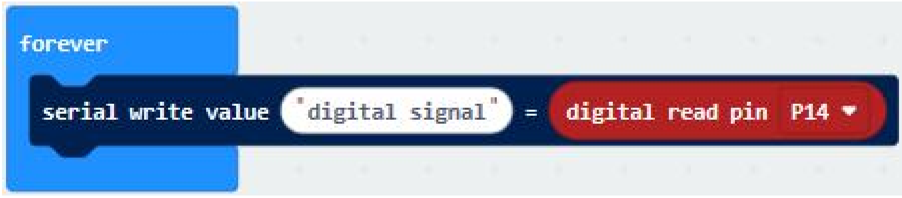
(2) Enter "Advanced" → "Serial" → "serial write value "x" =0"

Leave it into "forever" block.

Go to "Pins" → "digital read pin P0 "

Move "digital read pin P0" into 0 box

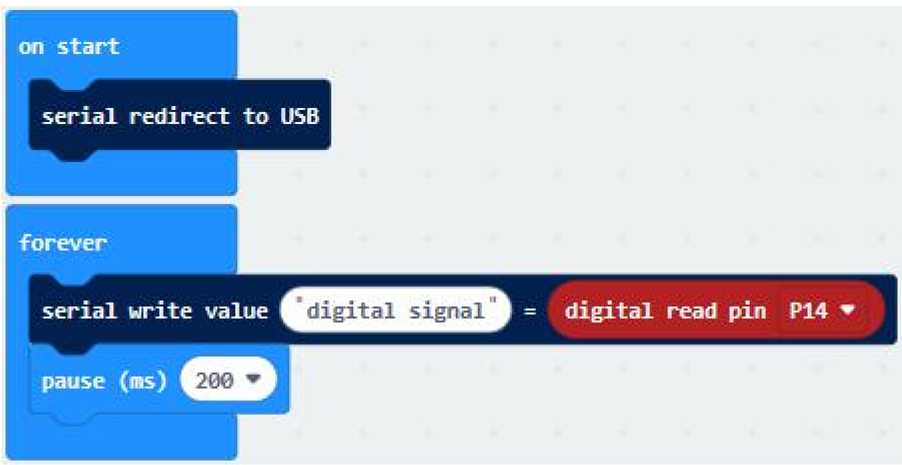
The right tracking sensor is controlled by P14. Then change P0 into P14 and "x" into "digital signal" .



(3) Go to “Basic” → “pause (ms) 100”

Keep it into “forever” block and set to 200ms.

Complete Program：

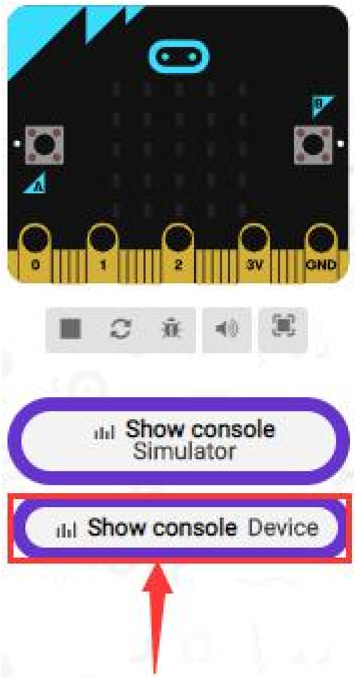


"on start": command block runs once to start program.
Serial redirect to USB
The program under the block "forever" runs cyclically.
Serial write value "digital signal"=digital red pin P14
Delay in 200ms

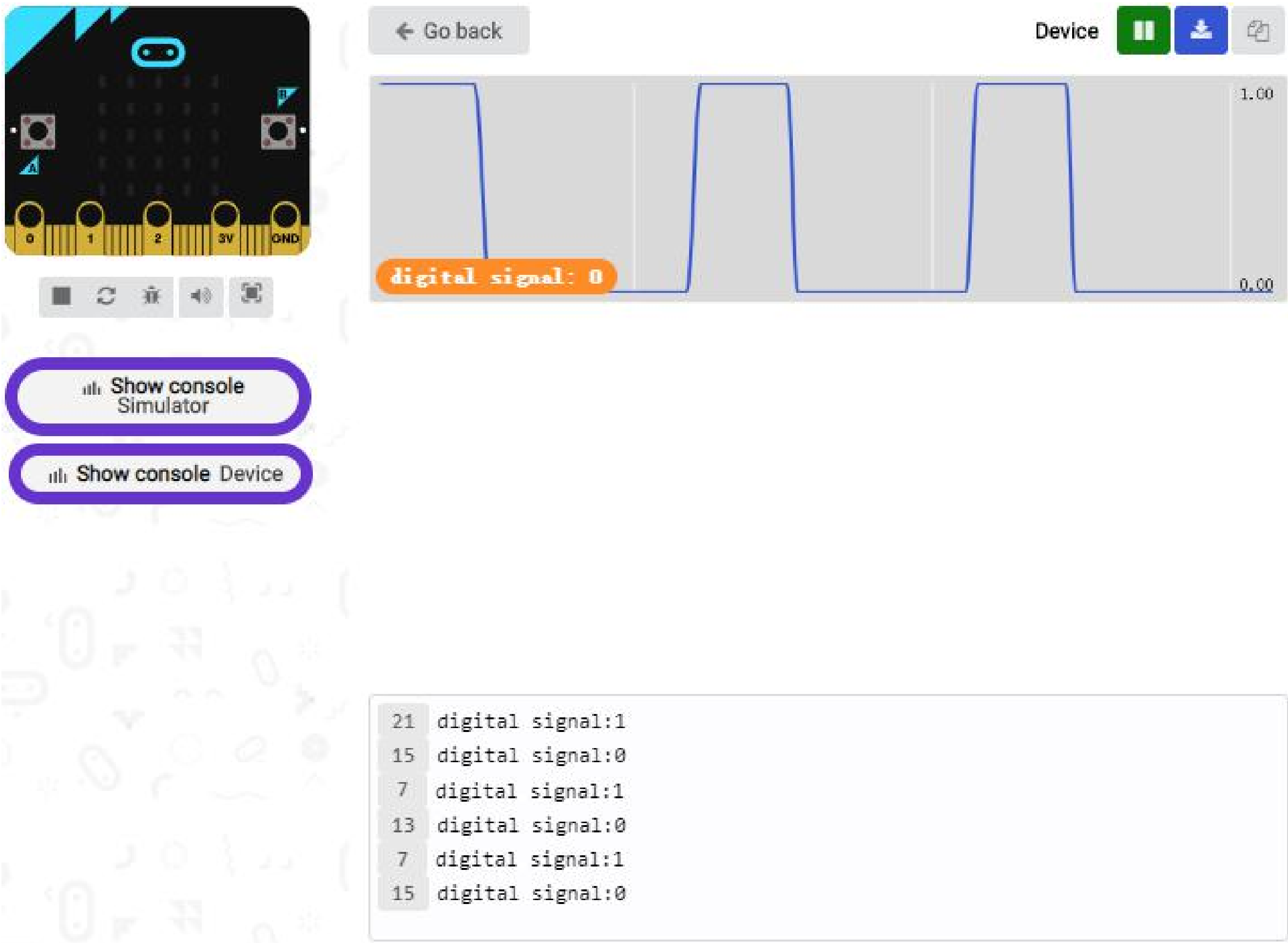
Click "JavaScript" to view the corresponding JavaScript code:

Download code 1 to micro:bit board, don't plug off USB cable and click 

(How to quick download?)

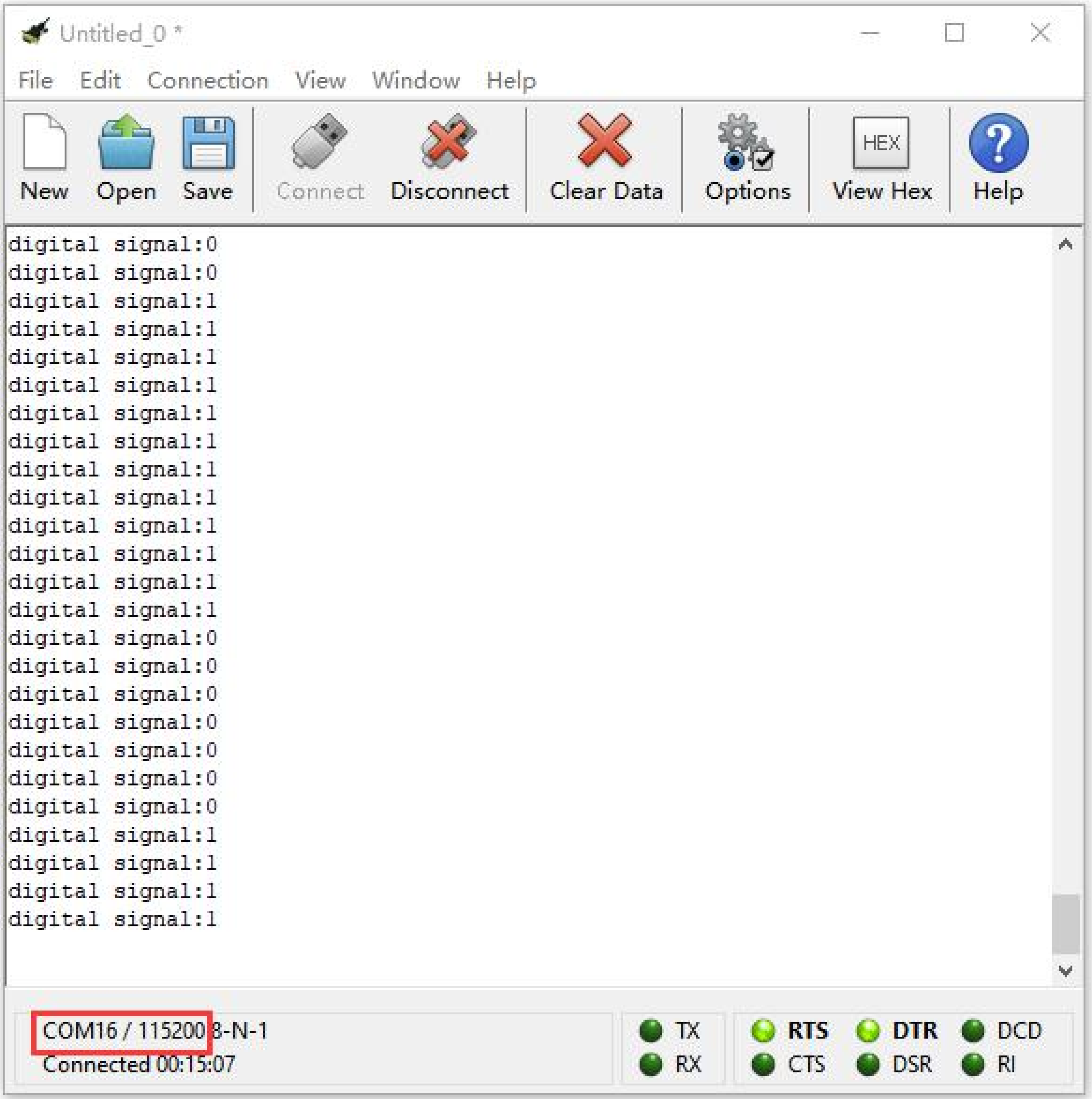


Serial monitor will display low level(0) and left indicator will be on when the left TCRT5000 IR tube detects white objects, black objects or no object are detected by left TCRT5000 IR tube, 1(high level) will be shown on serial monitor and indicator will be off, as shown below:



Open CoolTerm, click Options to select SerialPort. Set COM port and 115200 baud rate. Click “OK” and “Connect” .

The CoolTerm serial monitor displays the digital signals read by right line tracking sensor.

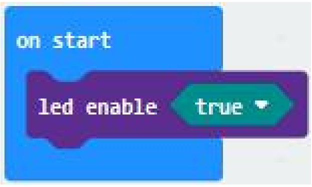


Code 2：

Type	Route	File Name
Hex file	../Makecode Tutorial/Test Code/8.17: Line Tracking Smart Car/8.17.1:Detect Line Tracking Sensor/Code-2	microbit-Code-2.hex

(1) Click “Led” → “more” → “led enable false”,

Put it into block “on start” ,click drop-down triangle button to select “true”



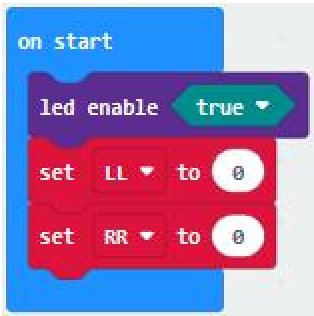
****

(2) Go to “Variables” → “Make a Variable...” → “New variable name : ” dialog box.

Enter LL and click “OK” to create variable “LL” .

Next to produce variable “RR” in same way.

Drag block “set RR to 0” into “on start” block and copy it once. Then set code string:



(3) Click “Variables” to drag block “set RR to 0” into block “forever”

Tap RR to select LL

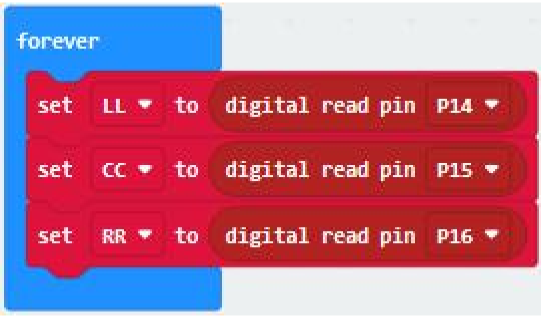
Tap “Advanced” → “Pins” → “digital read pin P0”

Place “digital read pin P0” into 0 box

Copy “set LL to digital read pin P0” twice and keep them into “forever” block.

Separately change into CC and RR

The three TCRT5000 IR tubes of line tracking sensor are controlled by P14, P15 and P16, therefore we set to code string as follows:

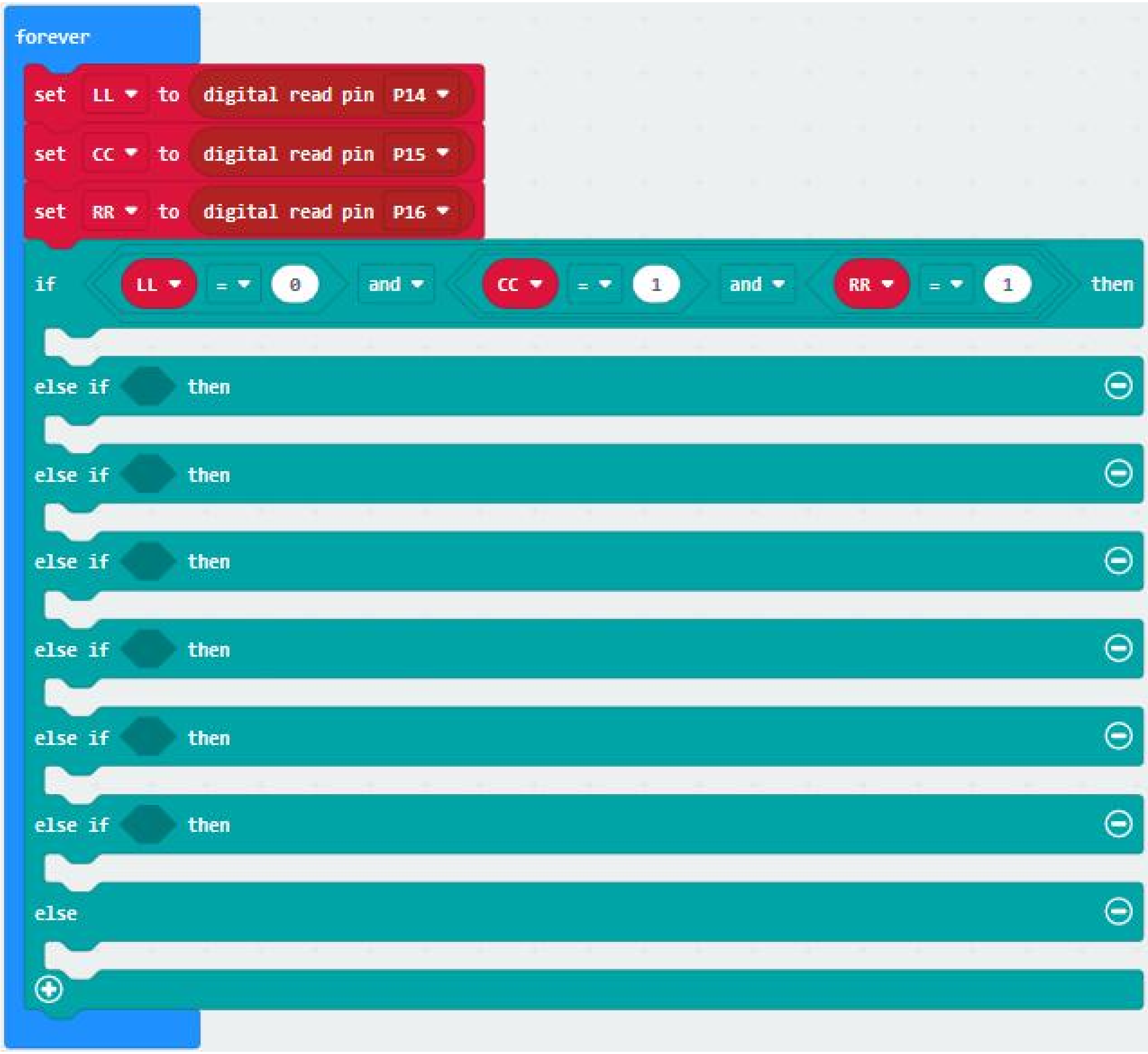


(4) Click "Logic" to drag "if true then...else" block into "forever" block Tap "" for six times and move "and" block twice and place them into true boxes, as shown below:

(5) Go to "Logic" to move block "=" into left box of the first and block

Click "Variables" to drag "LL" into left box of "=" block

Copy "LL=0" twice and respectively leave them into boxes of the second and block and change 0 into 1, as shown below



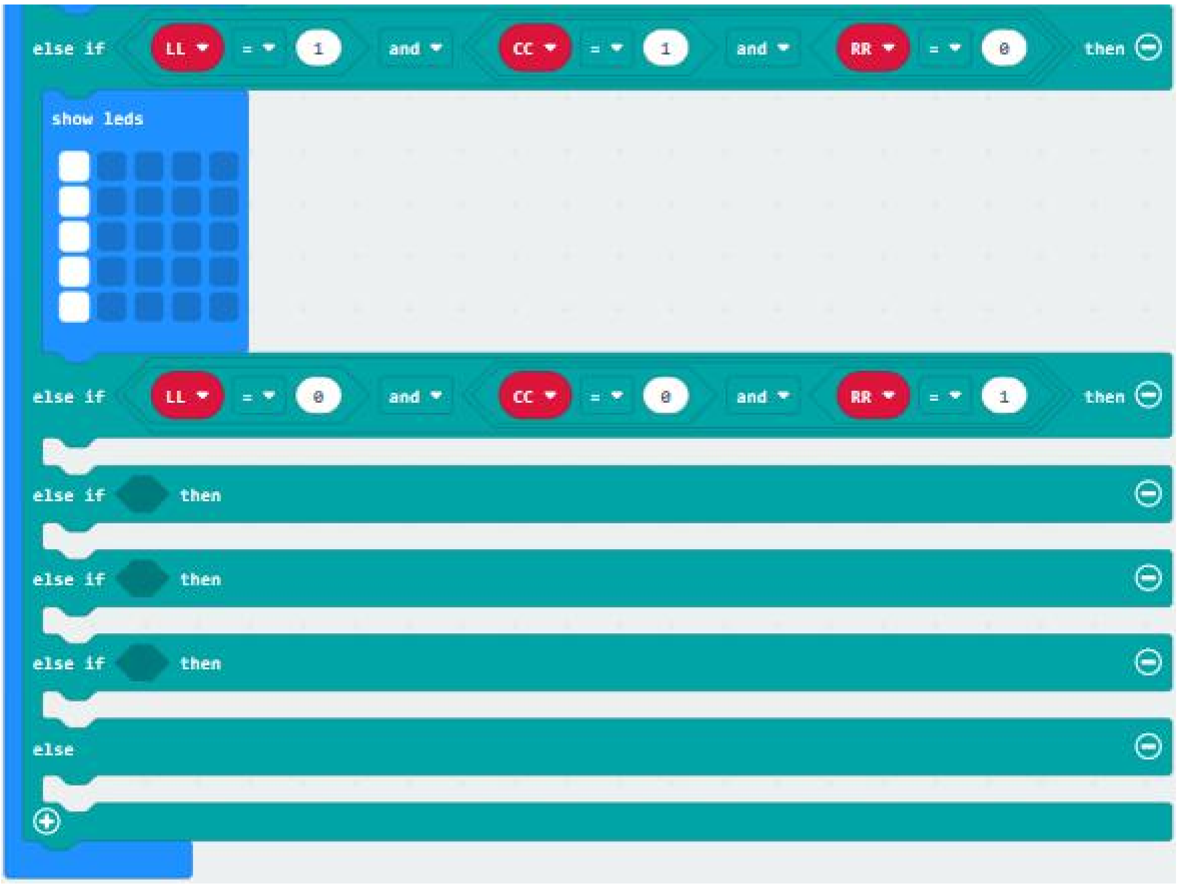
(6) Click “Basic” to move block “show leds” under “if....then” block

Copy it twice and respectively leave them under the first and second “else if....then” block

Replicate “LL=0 and CC=1 and RR=1” twice and edit code string as follows:

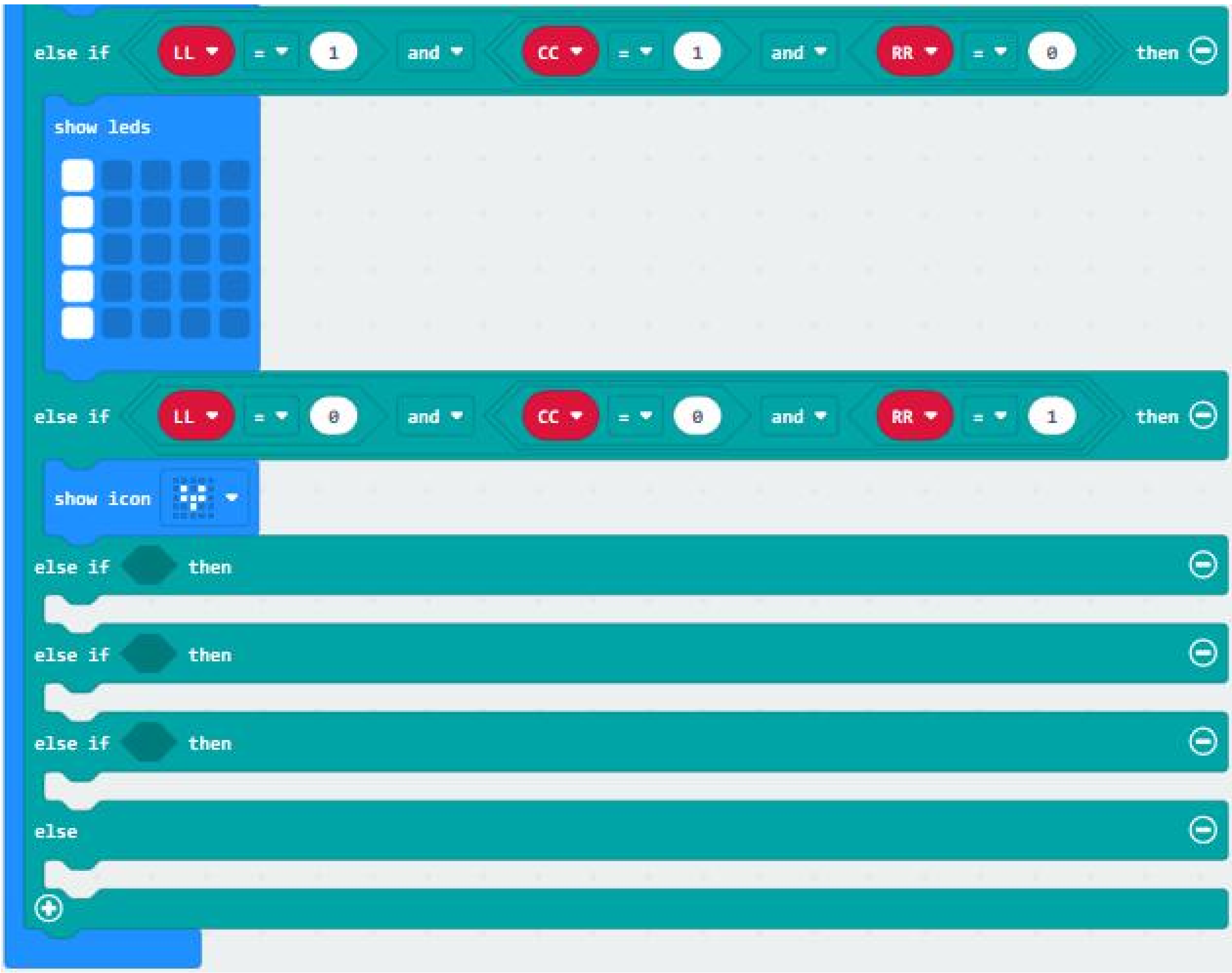
(7) Duplicate "LL=1 and CC=1 and RR=0" again and leave it into box behind the third else if block

Set "LL=0 and CC=0 and RR=1"



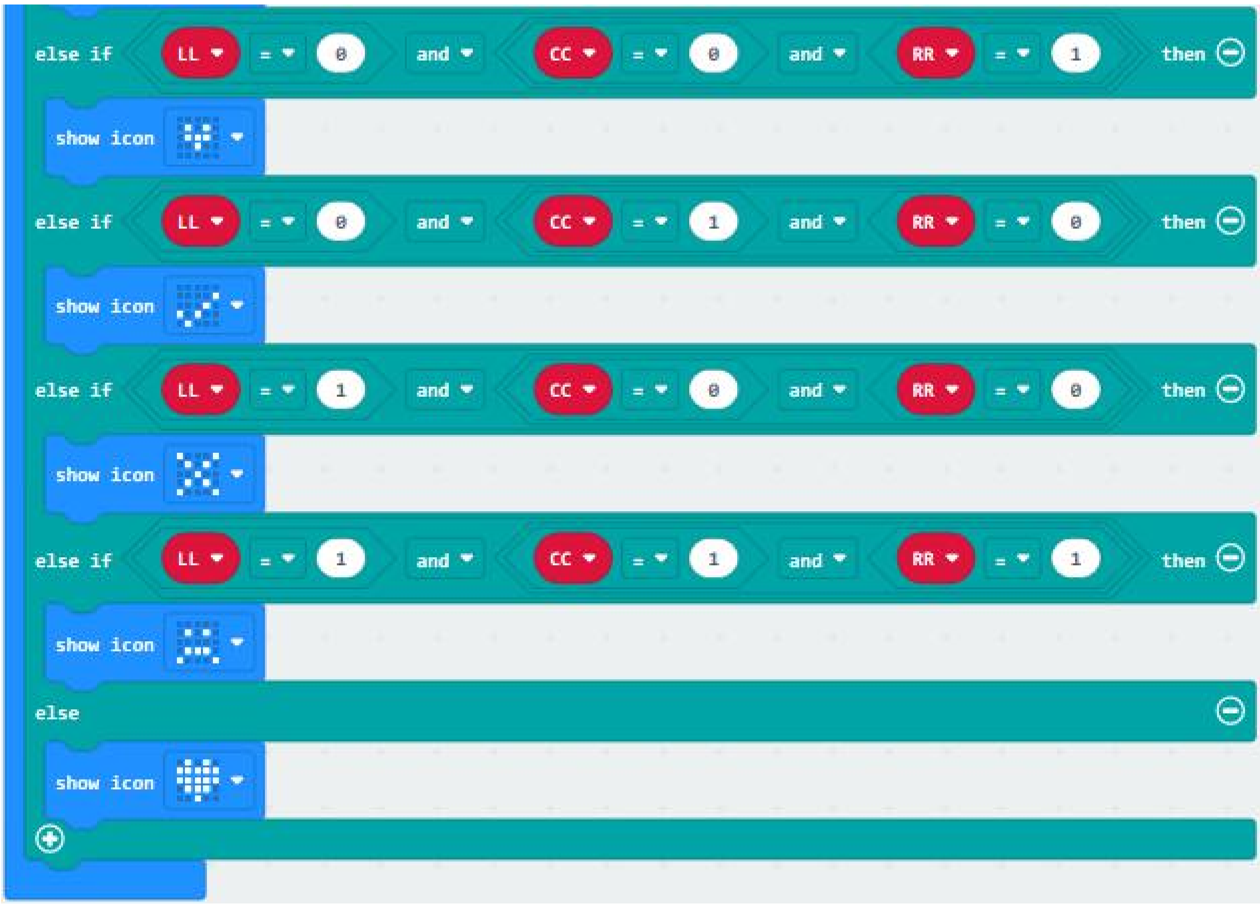
(8) Click "Basic" to move block "show icon" under the fourth "else if...then" block

Click the triangle button to select ""

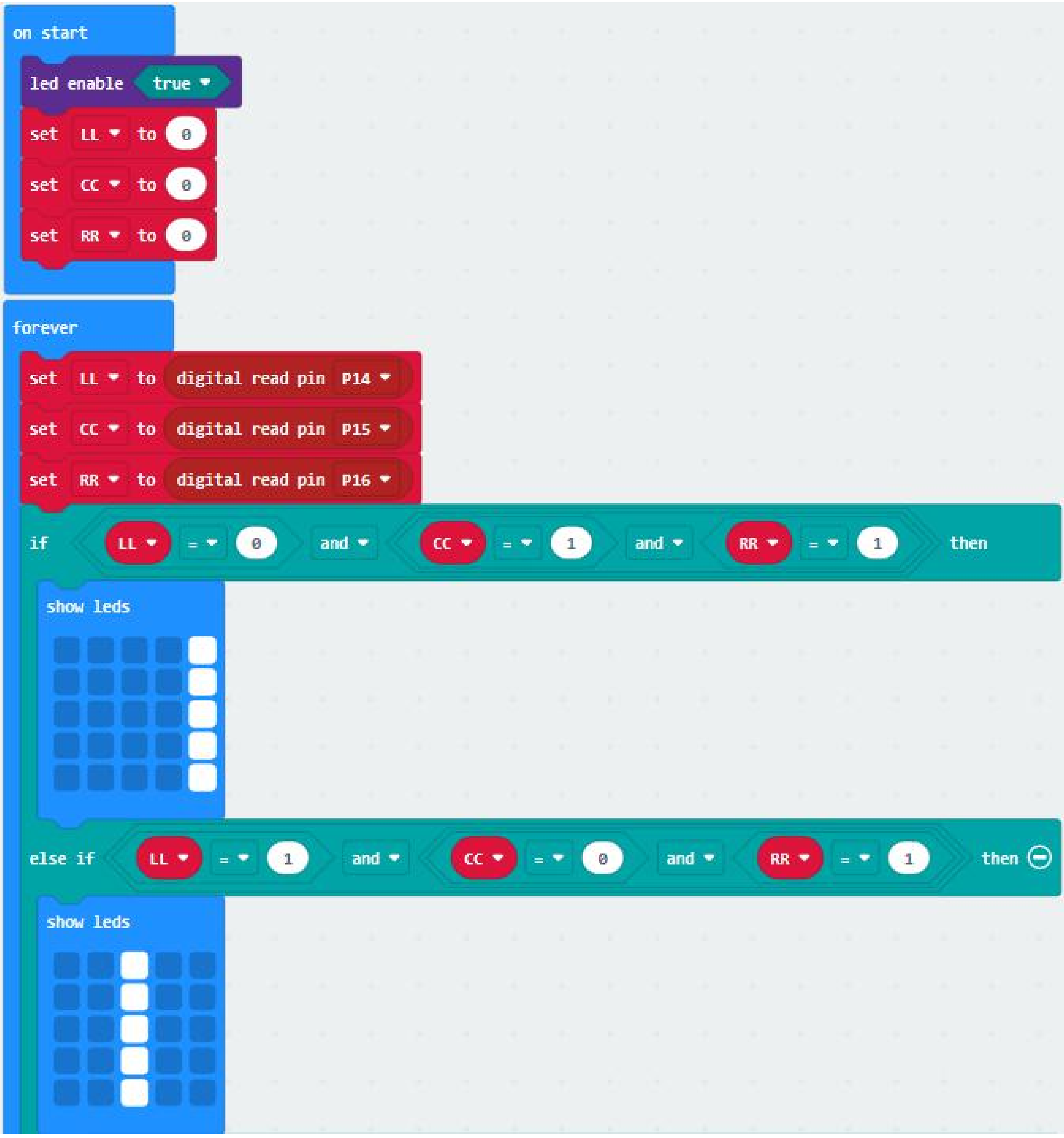


(9) Copy "LL=0 and CC=0 and RR=1" for three times and block "show icon" for four times

(10) Edit the code string as follows:



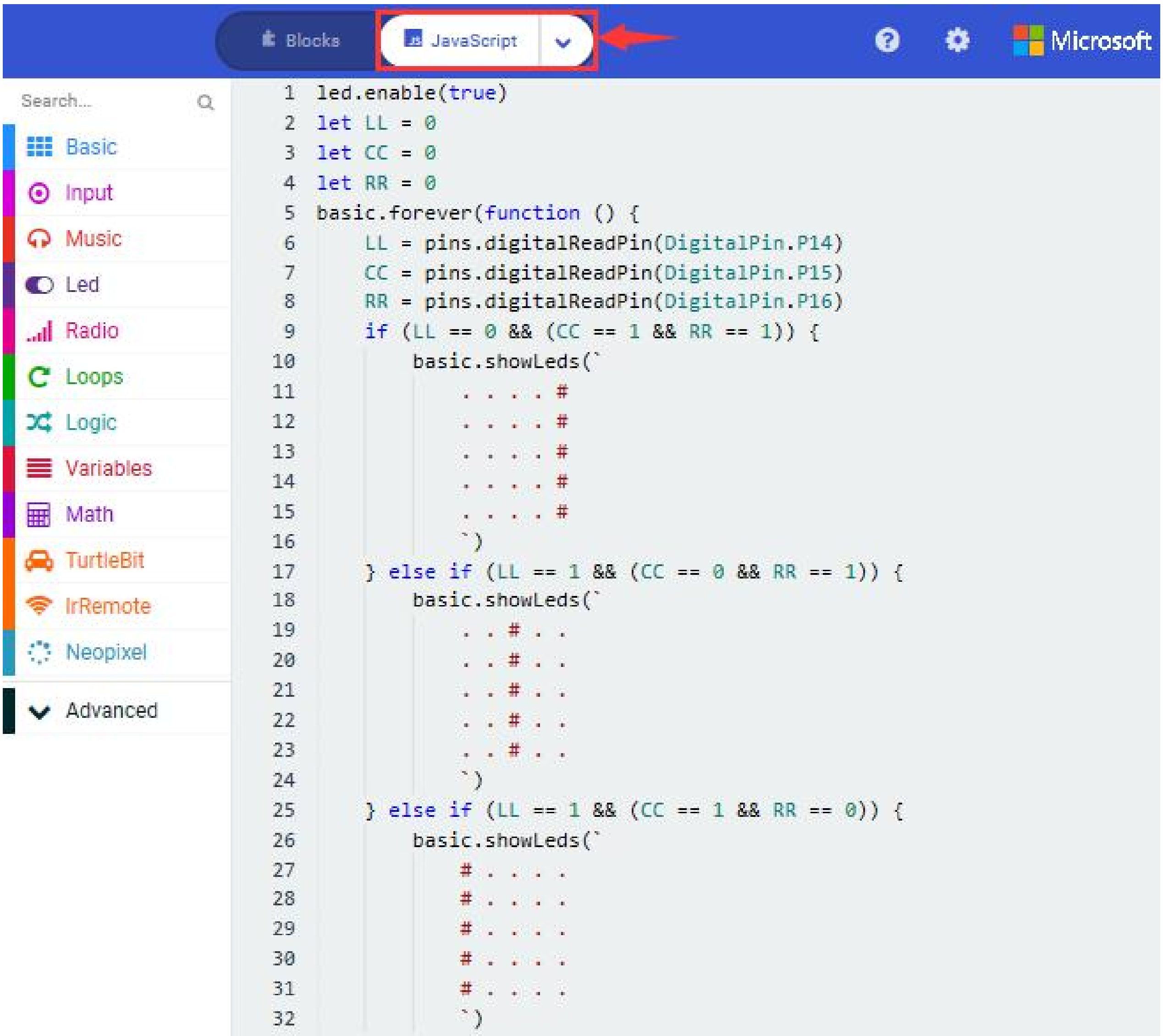
Complete Code：


on start
led enable true
set LL to 0
set CC to 0
set RR to 0
forever
set LL to digital read pin P14
set CC to digital read pin P15
set RR to digital read pin P16
if LL = 0 and CC = 1 and RR = 1 then
show leds
else if LL = 1 and CC = 0 and RR = 1 then
show leds


else if LL = 1 and CC = 1 and RR = 0 then
show leds
else if LL = 0 and CC = 0 and RR = 1 then
show icon
else if LL = 0 and CC = 1 and RR = 0 then
show icon
else if LL = 1 and CC = 0 and RR = 0 then
show icon
else if LL = 1 and CC = 1 and RR = 1 then
show icon
else
show icon

"on start" : command block runs once to start program.
Turn on dot matrix
Set variable LL to 0
Set variable CC to 0
Set variable RR to 0
The program under the block "forever" runs cyclically.
Set LL to the digital signals read by P14
Set CC to the digital signals read byP15
Set RR to the digital signals read by P16
When LL=0, CC=1and RR=1, execute the program under then block
Set to display "I"
When LL=1, CC=0 and RR=1, execute the program under then block
Micro:bit shows "I"
When LL=1, CC=1 and RR=0, execute the program under then block
Micro:bit shows "I"
When LL=1, CC=0 and RR=1, execute the program under then block
Micro:bit shows ""
When LL=1, CC=1 and RR=0, execute the program under then block
Micro:bit shows ""
When LL=1, CC=0 and RR=0, execute the program under then block
Micro:bit shows ""
When LL=1, CC=1 and RR=1, execute the program under then block
Micro:bit shows ""
When the above condition is not met, execute the program under else block
Micro:bit shows "❤"

Click "JavaScript" to switch into the corresponding JavaScript code:




```
led.enable(true)
let LL = 0
let CC = 0
let RR = 0
basic.forever(function () {
    LL = pins.digitalReadPin(DigitalPin.P14)
    CC = pins.digitalReadPin(DigitalPin.P15)
    RR = pins.digitalReadPin(DigitalPin.P16)
    if (LL == 0 && (CC == 1 && RR == 1)) {
        basic.showLeds(`
            . . . . #
            . . . . #
            . . . . #
            . . . . #
            . . . . #
            `)
    } else if (LL == 1 && (CC == 0 && RR == 1)) {
        basic.showLeds(`
            . . # . .
            . . # . .
            . . # . .
            . . # . .
            . . # . .
            `)
    } else if (LL == 1 && (CC == 1 && RR == 0)) {
        basic.showLeds(`
            # . . . .
            # . . . .
            # . . . .
            # . . . .
            # . . . .
            `)
    } else if (LL == 0 && (CC == 0 && RR == 1)) {
        basic.showIcon(IconNames.SmallHeart)
    } else if (LL == 0 && (CC == 1 && RR == 0)) {
        basic.showIcon(IconNames.Yes)
    } else if (LL == 1 && (CC == 0 && RR == 0)) {
        basic.showIcon(IconNames.No)
    } else if (LL == 1 && (CC == 1 && RR == 1)) {
        basic.showIcon(IconNames.Sad)
    } else {
        basic.showIcon(IconNames.Heart)
    }
})
```

Code 3：

We could use block “Line Tracking” to simplify code 2. The digital signal read by line tracking sensor is 0(low level) and 1(high level).

Then we transfer the digital signals from line tracking sensor into binary and decimal system, as shown below:

Level of left, middle and right TCRT5000 IR Tube			Binary	Decimal system
Low (0)	Low (0)	High (1)	001	1
Low (0)	High (1)	Low (0)	010	2
Low (0)	High (1)	High (1)	011	3
High (1)	Low (0)	Low (0)	100	4
High (1)	Low (0)	High (1)	101	5
High (1)	High (1)	Low (0)	110	6
High (1)	High (1)	High (1)	111	7
Low (0)	Low (0)	Low (0)	000	0

Type	Route	File Name
Hex file	../Makecode Tutorial/Test Code/8.17 :Line Tracking Smart Car/8.17.1：Detect Line Tracking Sensor/Code-3	microbit-Code-3.hex

Or you could edit code step by step in the editing area.

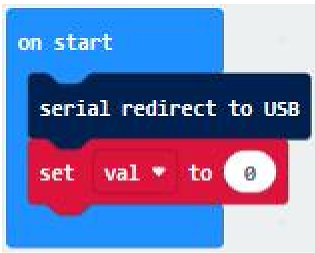
(1) Click “Advanced” → “Serial” → “serial redirect to USB”

Place it into “on start” block.

(2) Click “Variables” → “Make a Variable...” → “New variable name :” dialog box;

Input val and click “OK” to generate variable “val”

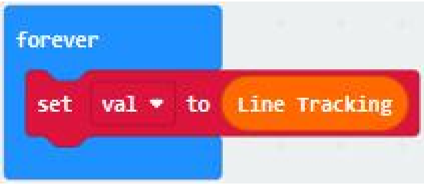
Move out “set val to 0” and keep it into block “on start”



(3) Enter “Variables” → “set val to 0”

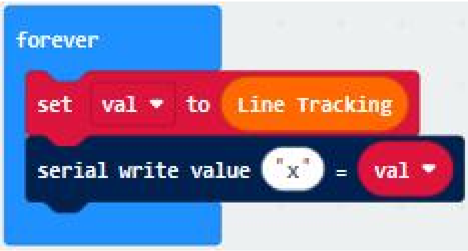
Keep it into “forever” block

Move “Line Tracking” from “TurtleBit” and place it into 0 box



(4) Click “Advanced” → “Serial” → “serial write value “x” =0”

Put it into “forever” , and move variable “val” into 0 box.



****

(5) Click “Logic” → “if true then...else”

Move it into “forever” , tap “ ” six times and move out “=” block into “true” block.

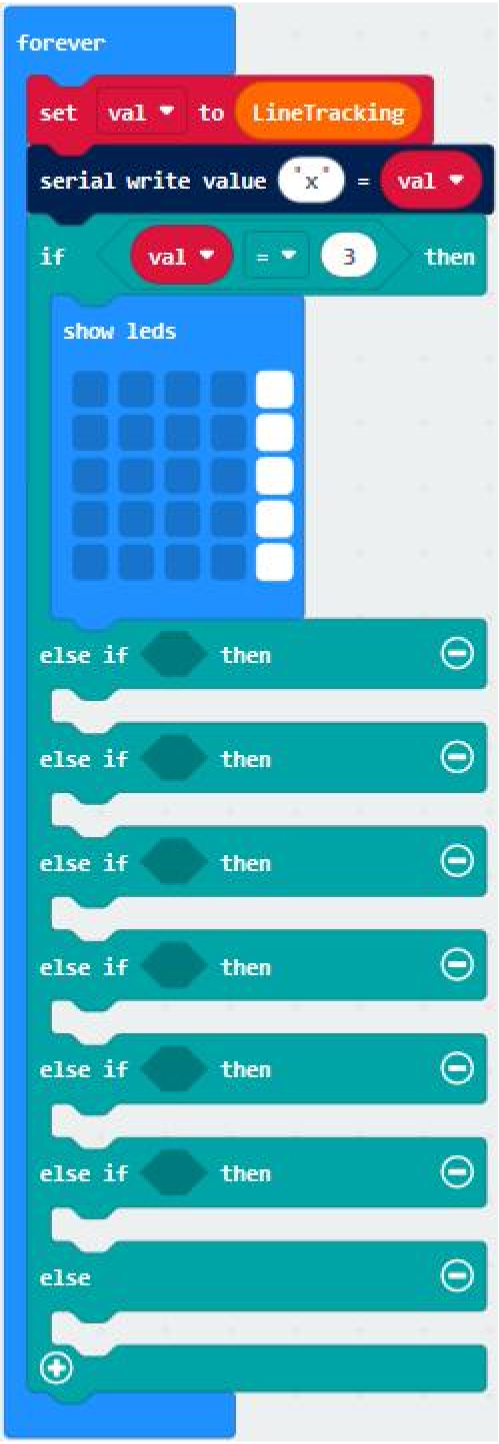
(6) Enter “Variables” to move block “val” into left box of “=” block

And change 0 into 3.

(7) Enter “Basic” → “show leds”

Place it under the first block “if..val...then” block

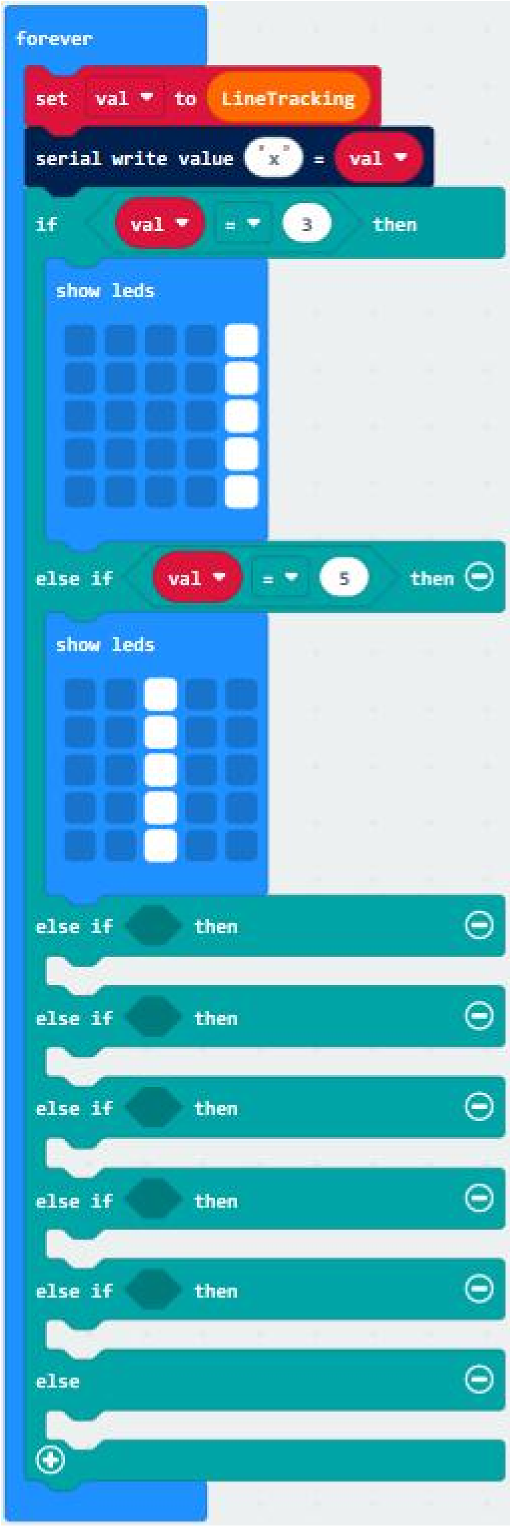
Tick dark blue boxes to generate “I” pattern.



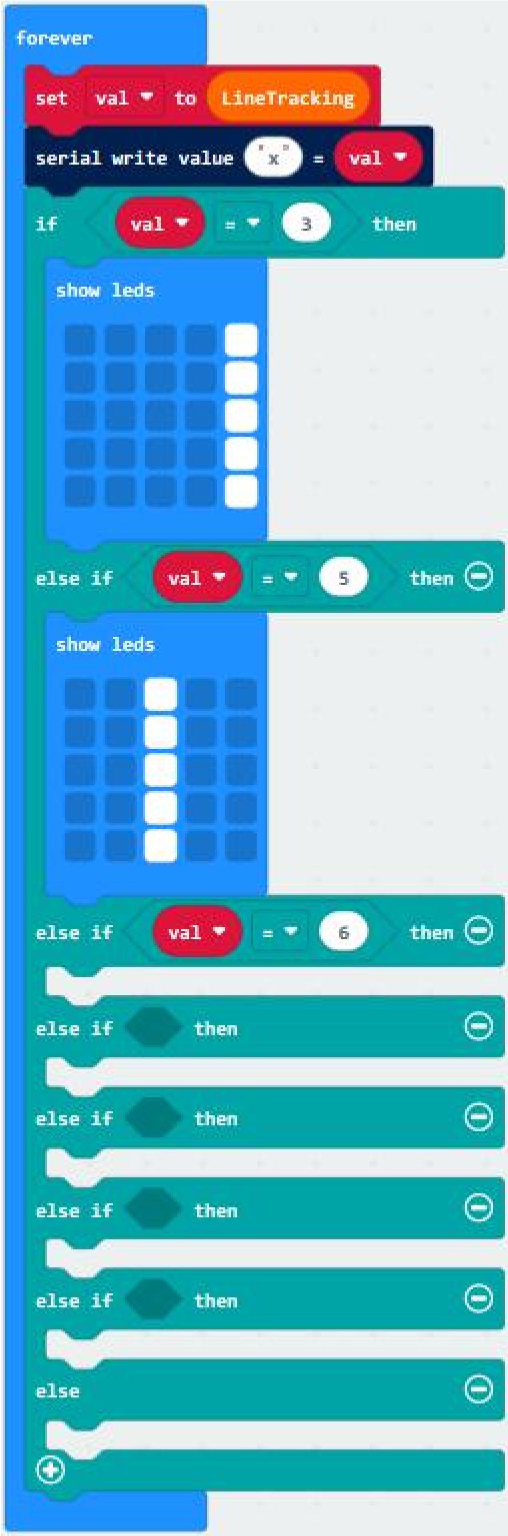
(8) Copy block "val=3 " once and place it into box behind the first "else of ... then" block and change 3 into 5

(9) Replicate "show leds" block and leave it under the first "else of ... then" block.

Tick blue boxes to produce "I"

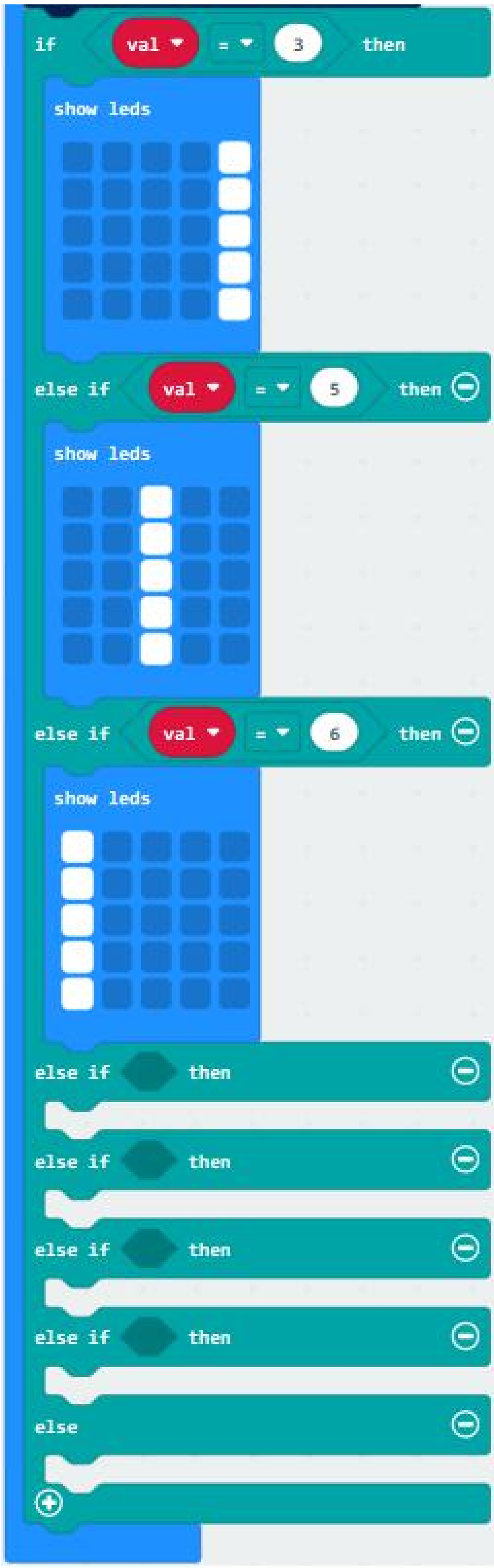


(4) Duplicate block “val=5 ” and place it into the second box behind the second “else if...then” block, change 5 into 6



(5) Duplicate "show leds" once and leave it into box behind the second "else if...then" block

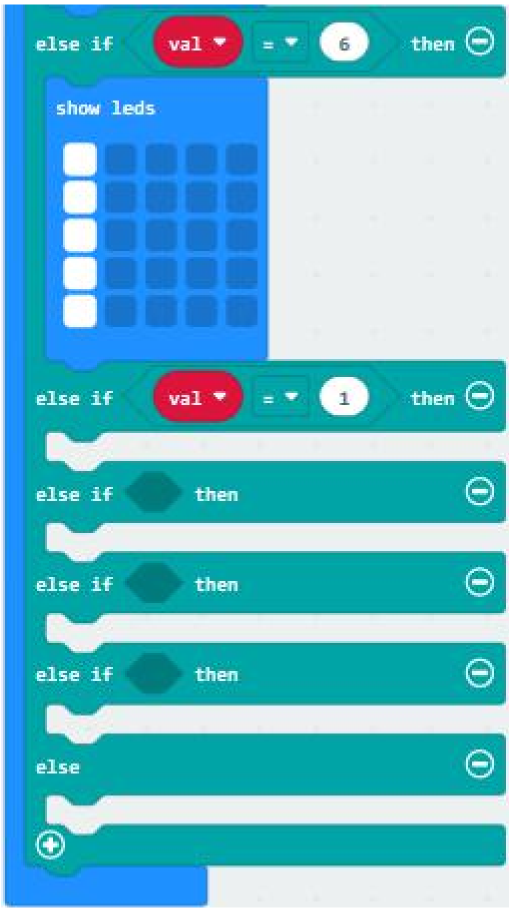
Tick blue box to create "I"



(6) Copy “val=6” block once and leave it into box behind the third “else

if...then” block

Change 6 into 1

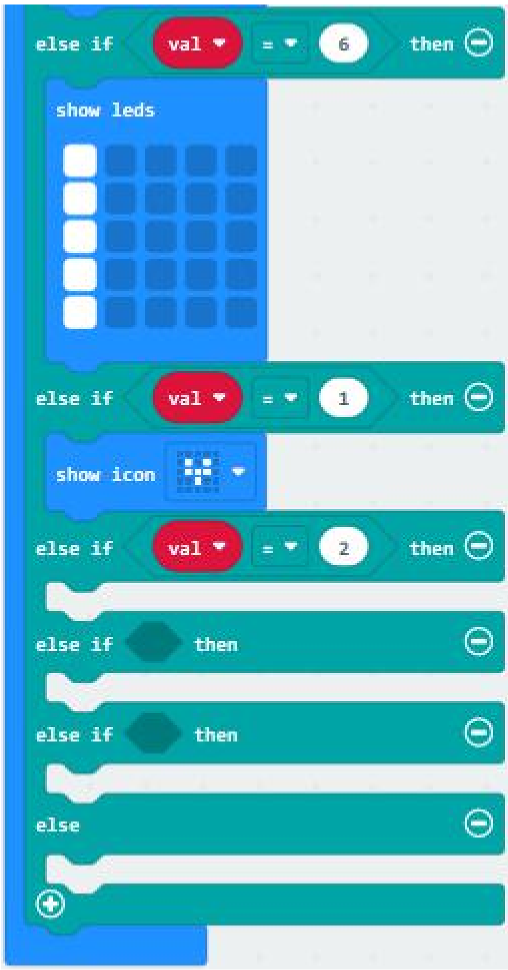


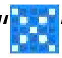
(7) Drag out “show icon” under the third “else if...then” block

Click “❤” to set “▦”

(8) Copy "val=1" once and leave it into box behind the the fourth "else if ..then" block.

Change 1 into 2.

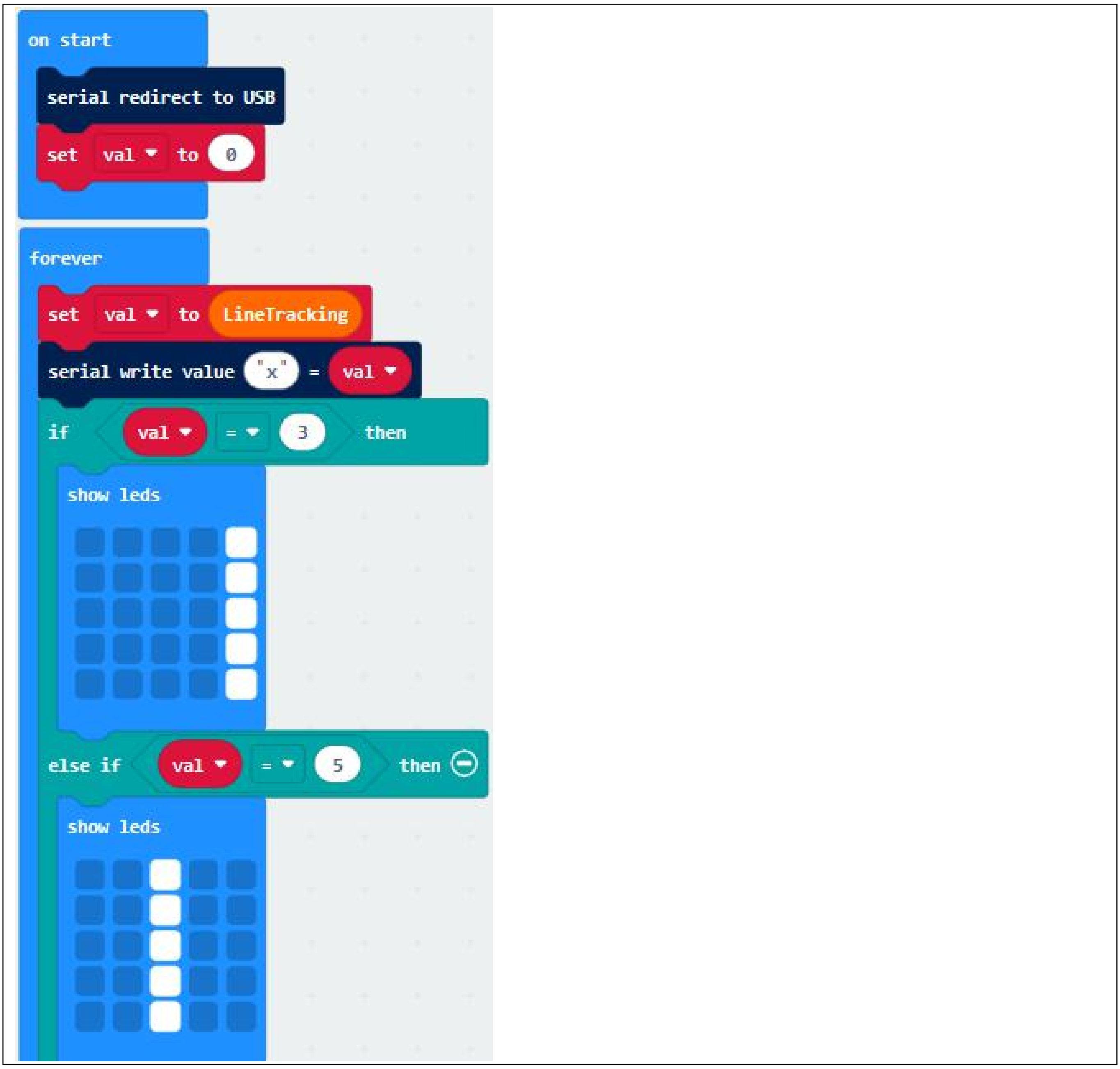


(9) Copy block “show icon” for four times and click the triangle button to select “”, “”, “” and “”.

Set to val=1, 2, 4 and 7


else if val = 1 then
show icon
else if val = 2 then
show icon
else if val = 4 then
show icon
else if val = 7 then
show icon
else
show icon

Complete Code



"on start" : command block runs once to start program.

Serial redirects to USB

Set variable val to 0

The program under the block "forever" runs cyclically.

Set val to Line Tracking

Serial redirects x=val

When val=3, execute the program under then block

Micro:bit shows "I" at right

When val=5, execute the program under then block

Micro:bit shows "I" in the middle

When val=6, execute the program under then block

Micro:bit shows "I" at left

When val=1, execute the program under then block

Micro:bit shows " "

When val=2, execute the program under then block

Micro:bit shows " "

When val=4, execute the program under then block

Micro:bit shows " "

When val=7, execute the program under then block

Micro:bit shows " "

When the above condition is not met, execute the program under else block

Micro:bit shows "❤"

Click “JavaScript" to switch into the corresponding JavaScript code:

3.Test Results：

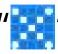
Download code 2 to micro:bit board, “I” will be shown at left and indicator will be on when only left TCRT5000 IR tube on line tracking sensor detects white objects.

“I” will be shown in the middle and indicator will be on when only middle TCRT5000 IR tube on line tracking sensor detects white objects.

“I” will be shown at right and indicator will be on when only right TCRT5000 IR tube on line tracking sensor detects white objects.

As only left and middle TCRT5000 IR tubes detect white objects, micro:bit shows “” and indicators at left and middle are on.

Micro:bit shows “” and indicators at left and right are on when only left and right TCRT5000 IR tubes detect white objects.

Micro:bit shows “” and indicators at right and middle are on when only middle and right TCRT5000 IR tubes detect white objects.

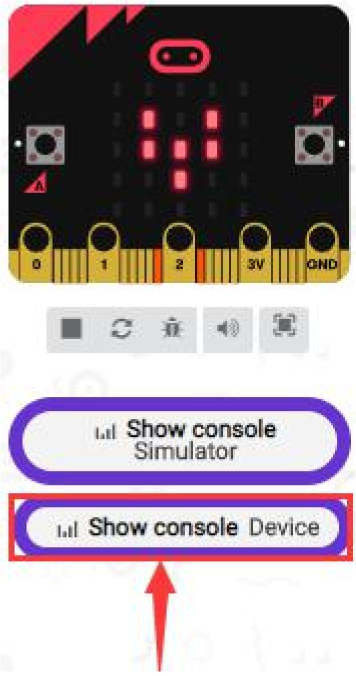
Micro:bit displays “” and none of indicator is on when both of them detect black objects or no object is detected.

Both of them detect white objects, micro:bit shows “❤” and indicators are on.

(How to download? How to quick download?)

Download code 3 to micro:bit, and keep micro : bit connected and click 

(How to quick download?)



Number 3 will be displayed when only left TCRT5000 IR tube detects white objects.

Number 5 will be displayed when only middle TCRT5000 IR tube detects white objects.

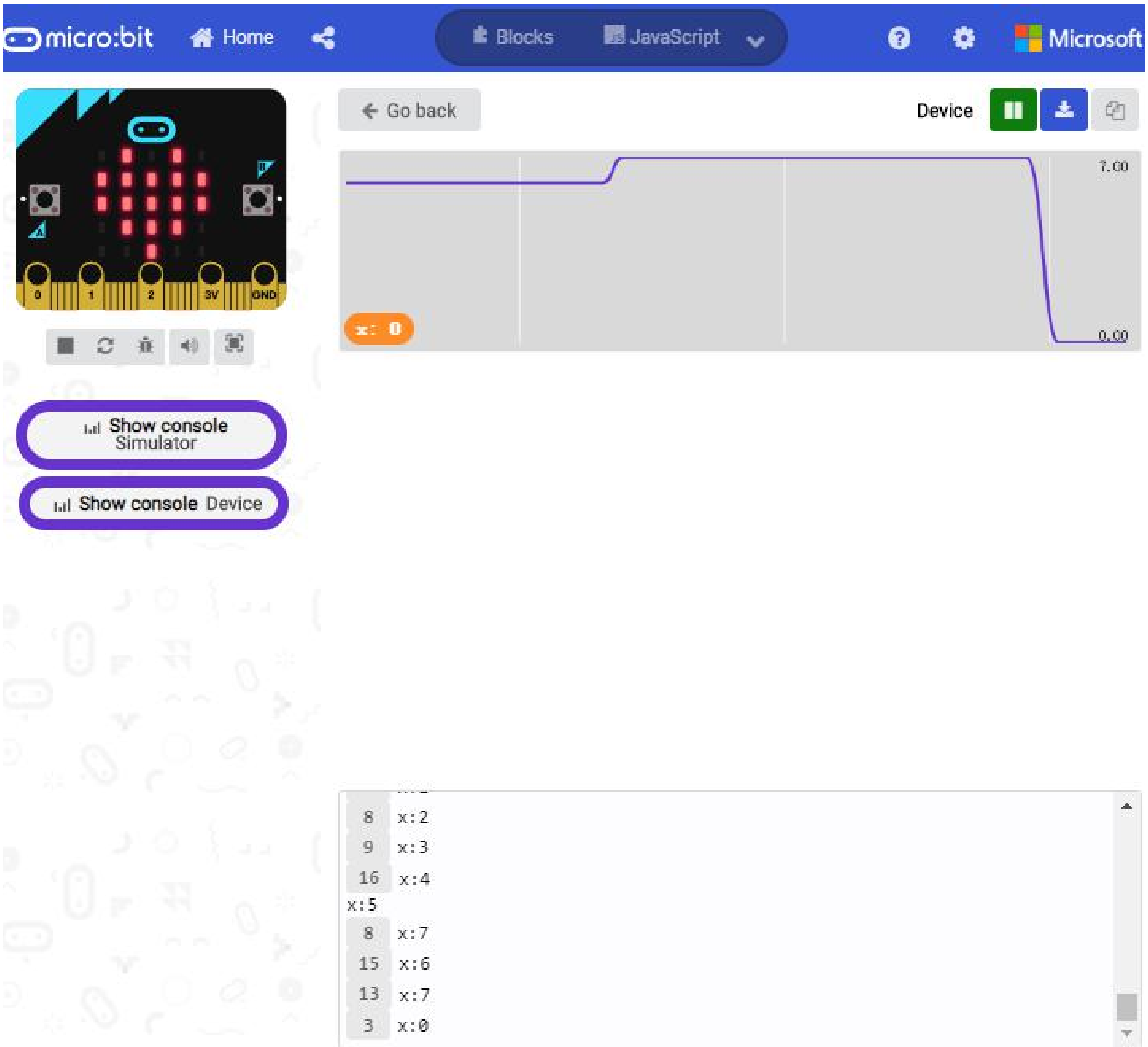
Number 6 will be displayed when only right TCRT5000 IR tube detects white objects.

Number 1 will be displayed when only left and middle TCRT5000 IR tubes detect white objects.

Number 2 will be displayed when only left and right TCRT5000 IR tubes detect white objects.

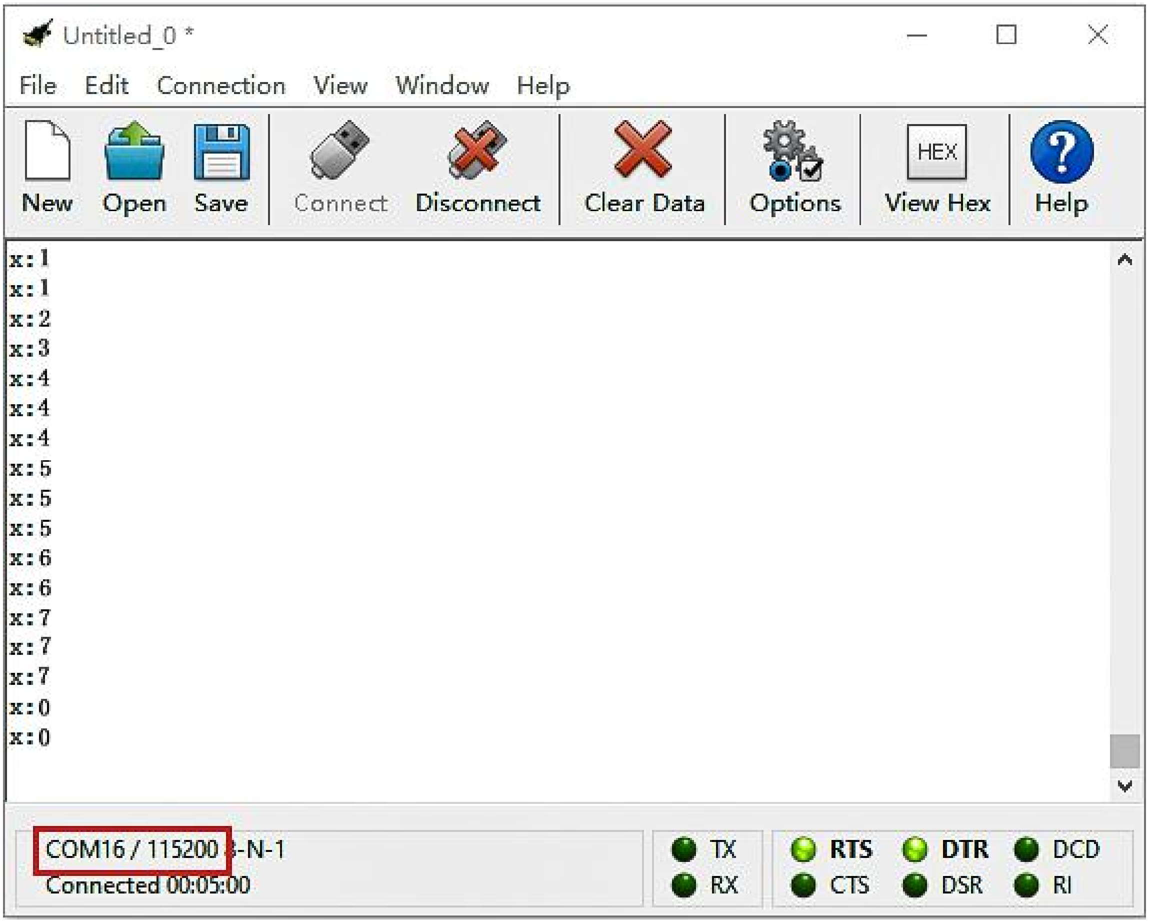
Number 4 will be displayed when only right and middle TCRT5000 IR tubes detect white objects.

Number 7 will be displayed when all TCRT5000 IR tubes detect black objects or not object is detected.

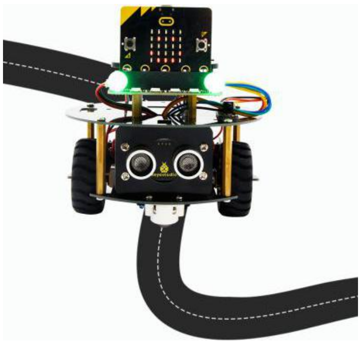


Open CoolTerm, click Options to select SerialPort. Set COM port and 115200 baud rate(the baud rate of USB serial communication of Micro:bit is 115200 through the test). Click "OK" and "Connect" ,

CoolTerm serial monitor display the value of decimal system.



8.17.2: Line Tracking Smart Car

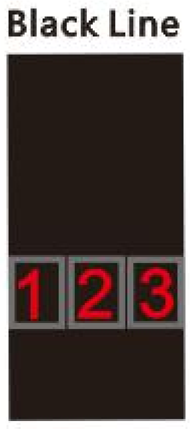


1.Description：

In this lesson we will combine line tracking sensors with a motor to make a line tracking smart car.

The micro:bit board will analyze the signals and control smart car to show line tracking function.

Left/Middle/Right TCRT5000 IR Tunes (Level)			binary	Decimal system (a)	Turtle Smart Car
LOW (0)	LOW (0)	HIGH (1)	001	1	Turn Right
LOW (0)	HIGH (1)	LOW (0)	010	2	Go forward
LOW (0)	HIGH (1)	HIGH (1)	011	3	Go forward
HIGH (1)	LOW (0)	LOW (0)	100	4	Turn Left
HIGH (1)	LOW (0)	HIGH (1)	101	5	Go forward
HIGH (1)	HIGH (1)	LOW (0)	110	6	Go forward
HIGH (1)	HIGH (1)	HIGH (1)	111	7	Go forward
LOW (0)	LOW (0)	LOW (0)	000	0	Stop



The three-channel line tracking sensor is connected to integrated pin(G,5V P14, P15, P16) and controlled by P14, P15 and P16.

2. Experimental Preparation :

(1) Insert micro:bit board into slot of V2 shield.

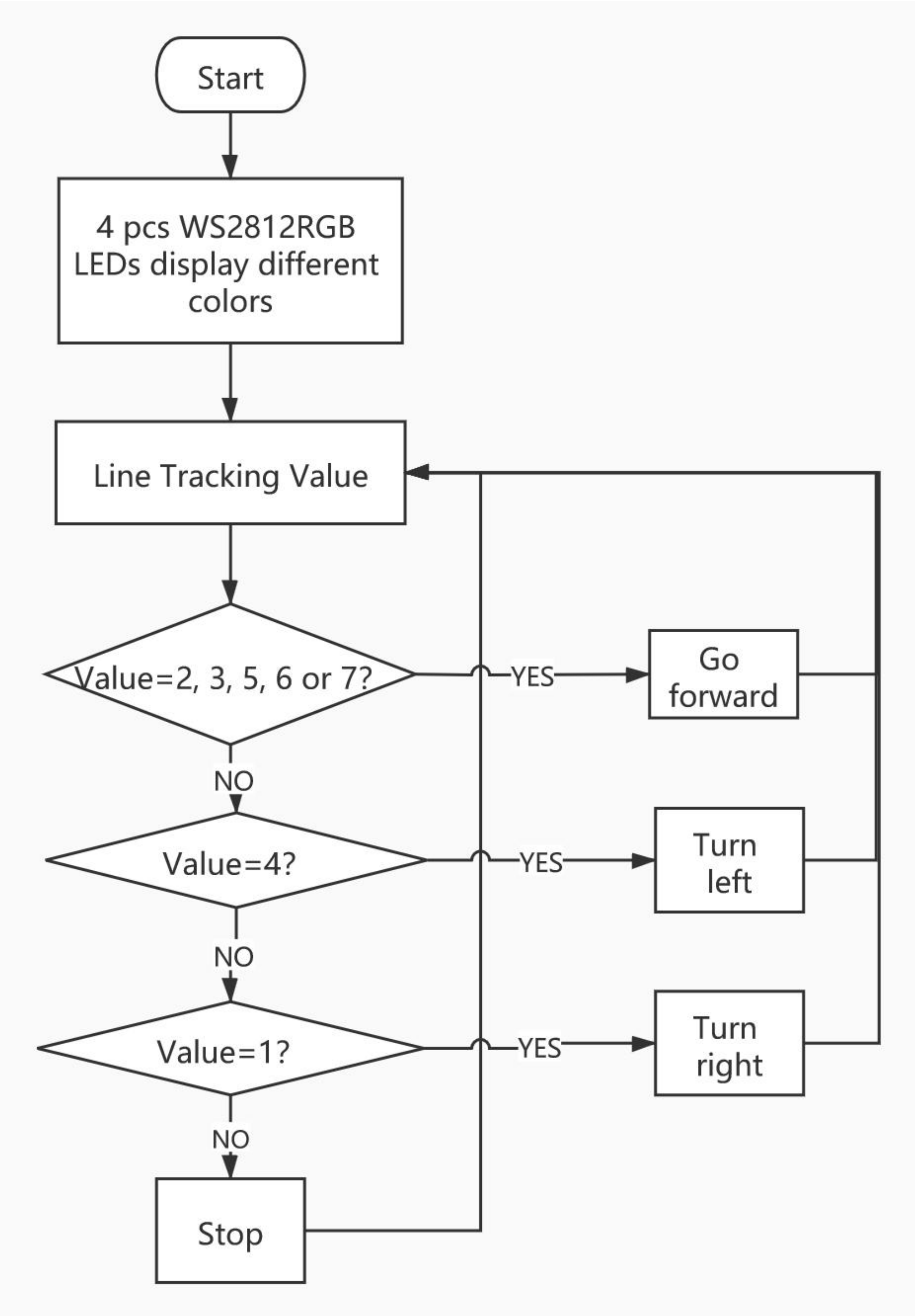
(2) Place batteries into battery holder.

(3) Dial power switch to ON end

(4) Connect micro:bit to computer by USB cable and open online Makecode editor.

Warning: the line tracking sensor can't work normally under strong light because there is a mountain of invisible light including IR and ultraviolet rays.

3. Flow Chart


Start
4 pcs WS2812RGB LEDs display different colors
Line Tracking Value
Value=2, 3, 5, 6 or 7?
YES
Go forward
NO
Value=4?
YES
Turn left
NO
Value=1?
YES
Turn right
NO
Stop

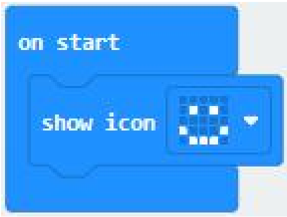
4. Test Code :

Type	Route	File Name
Hex file	../Test Code/8.17 :Line Tracking Smart Car/8.17.2 : Line Tracking Smart Car	microbit-Line Tracking Smart Car.hex

Or you could edit code step by step in the editing area.

(1) Enter "Basic" → "show icon ♥"

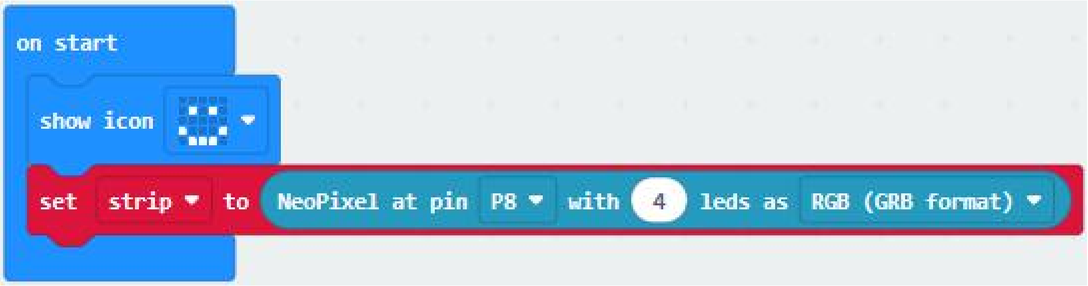
Combine it with "on start" block ,and click triangle button to select "".



(2) Click "Neopixel" →"set strip to Neopixel at pin P0 with 24 leds as RGB (GRB format)"

Put it into "on start" block , P8 of 4pcs WS2812RGB lights is connected by P8 of micro:bit.

Click the triangle button to set to P8 and set to 4 leads



(3) Enter “Neopixel” → “strip clear”

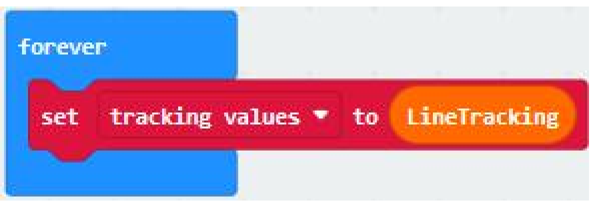
Place it into “on start”

(4) Go to “Variables” → “Make a Variable...” → “New variable name : ”

Enter “tracking values” and click “OK” , then variable “tracking values” is set up.

Drag “set tracking values to 0” into forever block.

Tap turtle-bit to move “Line Tracking” block into 0 box.



(5) Click “Logic” and drag “if true then...else” under the block “set...tracking”.

Tap “⊕” twice, move “or” block into true box, then copy “or” block for three times and leave them into right box of “or” block.

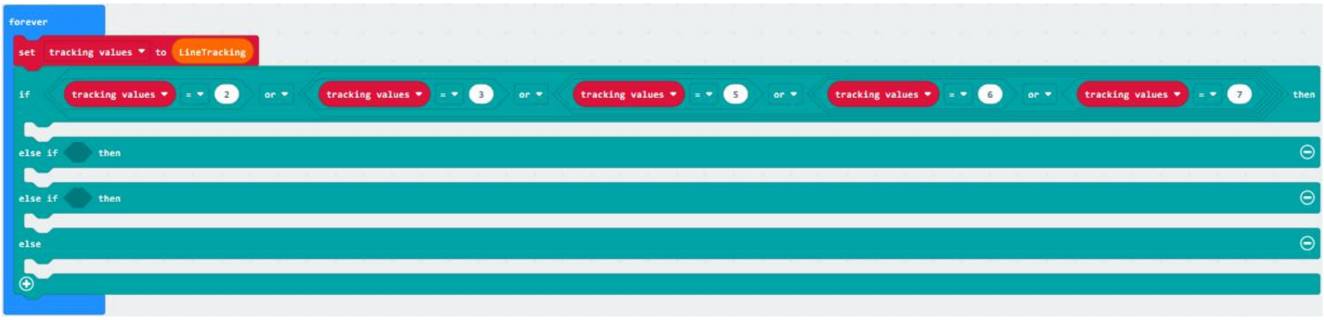
(6) Tap “Logic” to drag out “=” and leave it at left box of “or” block

Click “Variables” to move “tracking values” into right box of “=” block.

Change 0 into 2

Copy “tracking values=2” for four times, and separately leave them into boxes as follows:

Change 2 into 3, 5, 6 and 7



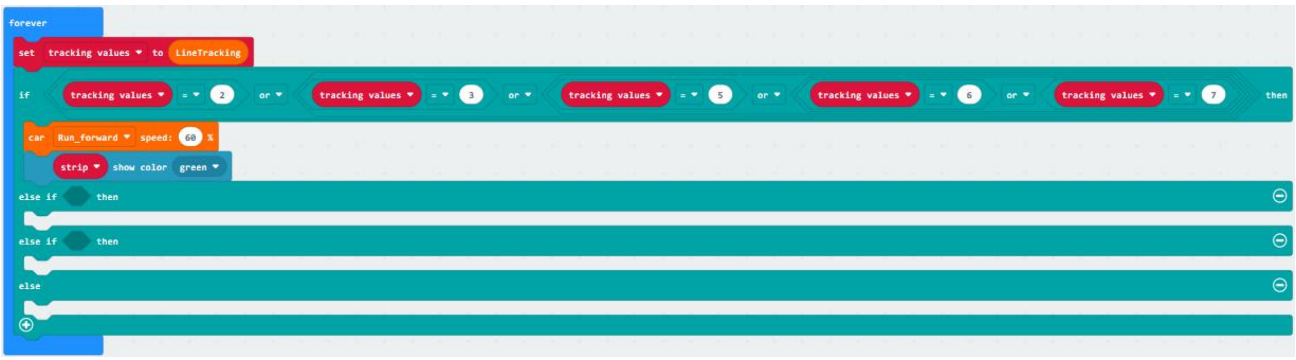
(7) Click "TurtleBit" to drag "car Run_forward speed: 0 %" under "if....then" block

Change 0 into 60

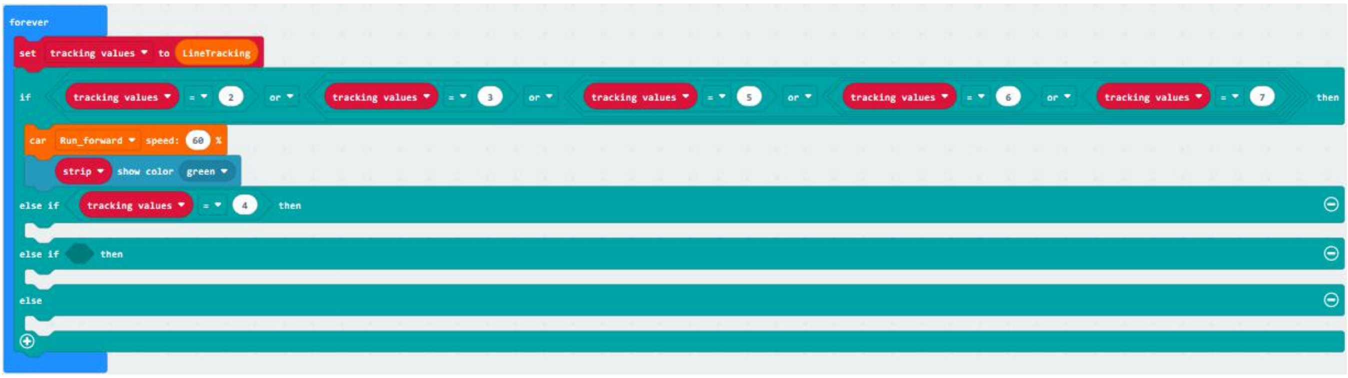
Tap "Neopixel" to get block "strip show color red"

Change red into green

Leave "strip show color green" under "car....68%" block



(8) Duplicate block "tracking values=2" once and place it into box behind the first "else if" block, change 2 into 4.

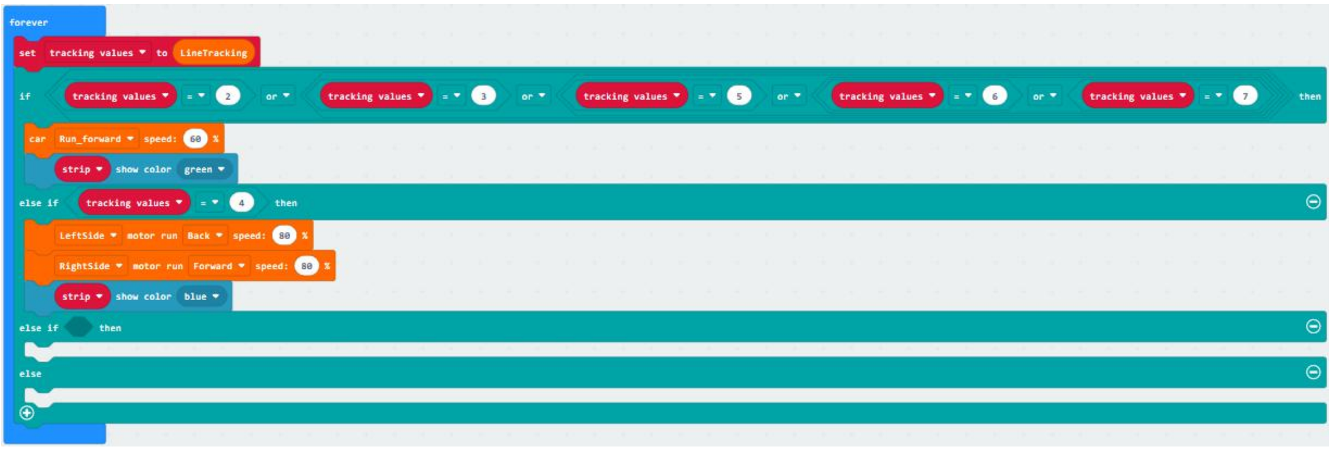


(9) Click “TurtleBit” to drag “LeftSide motor run Forward speed: 0 %”

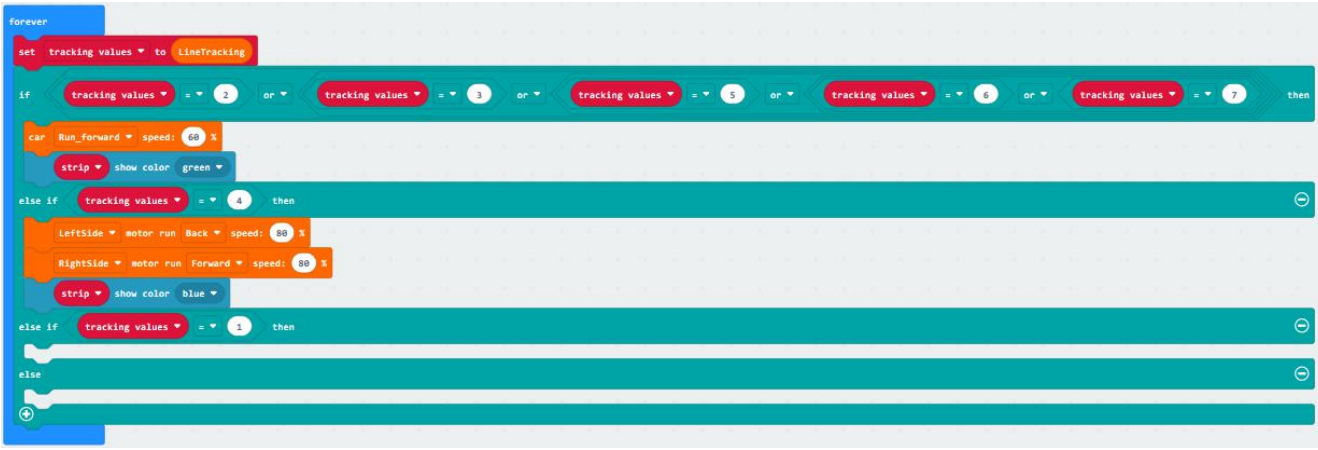
Copy it once and leave them under the “else if....then” block

Then set blocks as follows:

Copy “strip show color green” once and change green into blue.



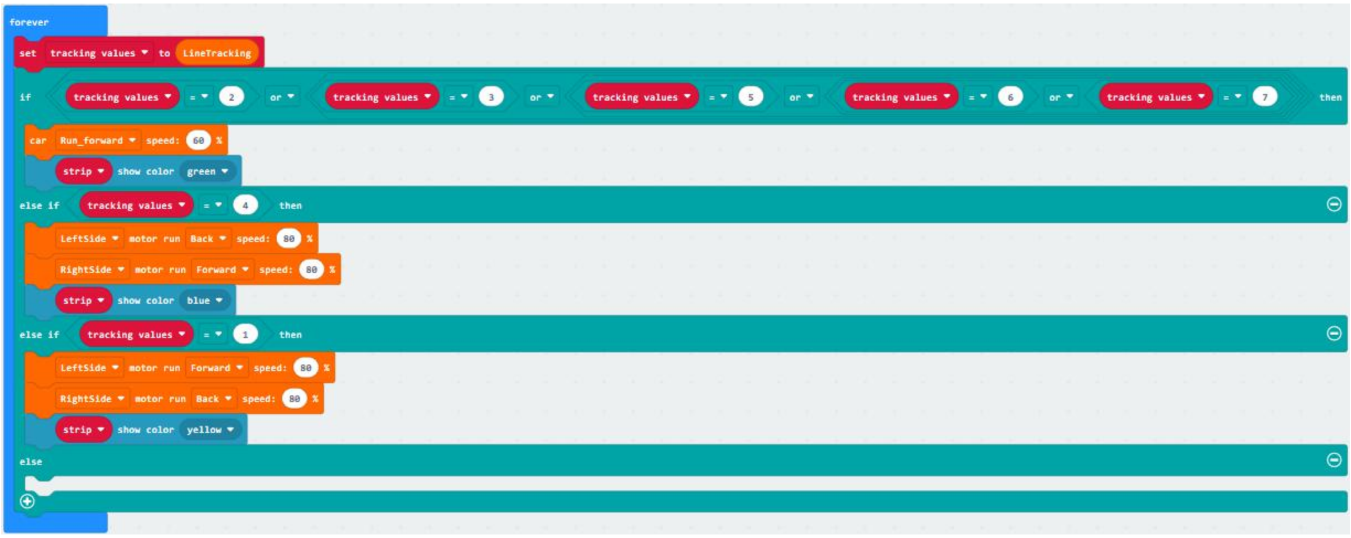
(10) Copy“tracking values=4”once and place it into box behind the second “else if”, change 4 into 1.



(11) Copy 

once,and place it under the "second else if..then" block

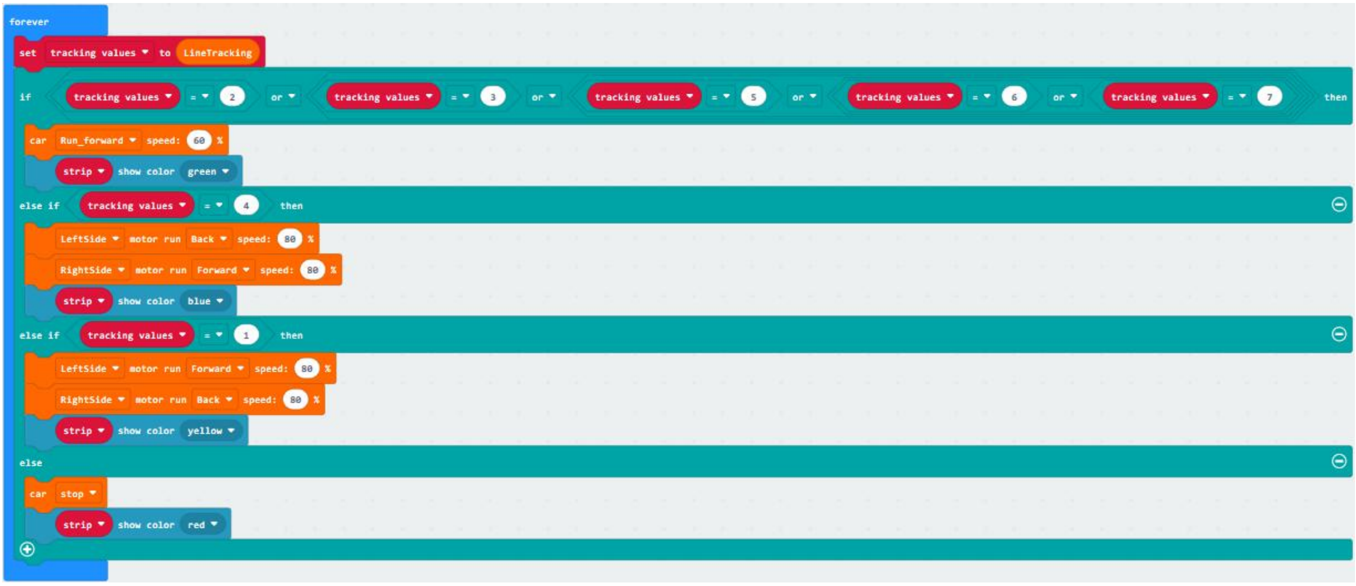
Set the code string as follows:



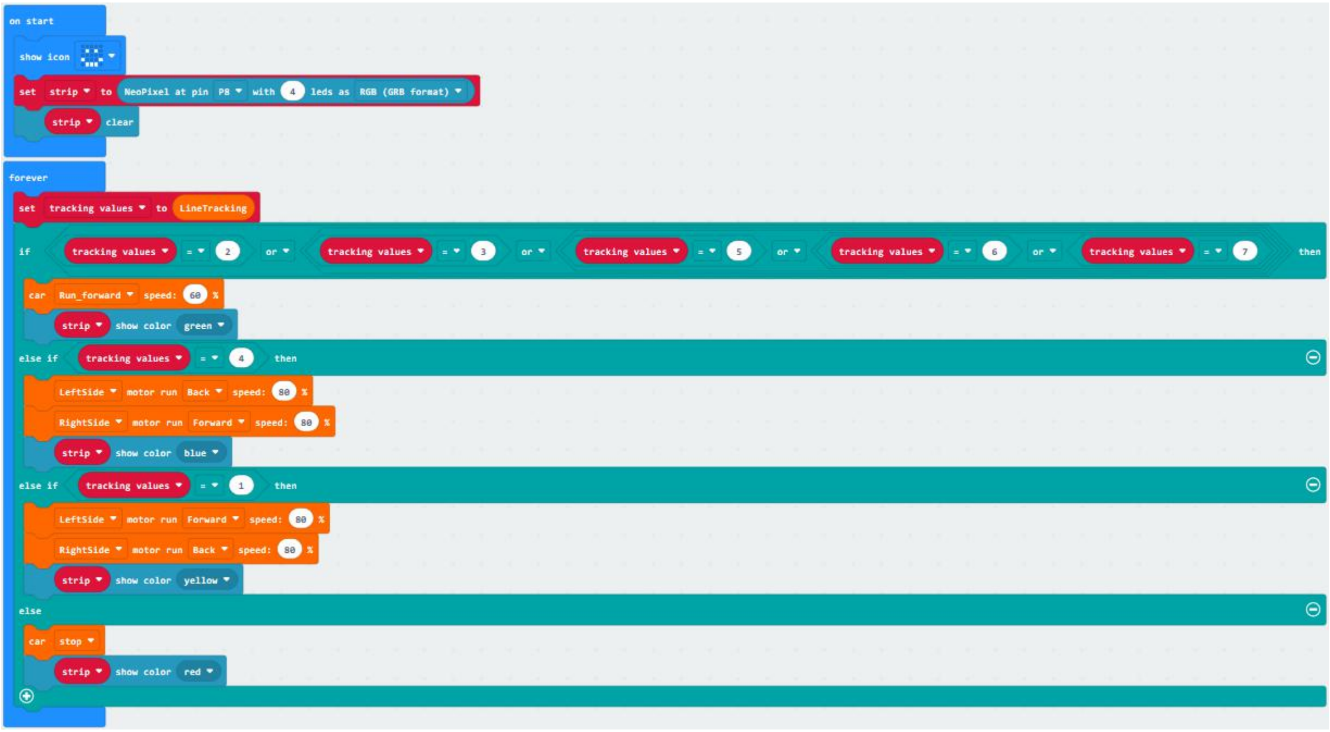
(12) Click "TurtleBit" to move "car stop" under the else block

Copy "strip show color yellow" once and alter yellow into red.

Place blocks as follows:



Complete Code



“on start” : command block runs once to start program.

Micro:bit shows “”

Set strip to Neopixel pin 8 with 4 leads(RGB format)

Turn off all RGB on strip

The program under the block “forever” runs cyclically.

Set tracking values to the value read by line tracking sensor

When tracking values=2, 3, 5, 6 or 7, execute the program under then block

Go forward at the 60% speed

4pcs WS2812RGB display green color

When tracking values=4, execute the program under then block.

The left car wheels go back at 80% speed

The right car wheels go forward at 80% speed

4pcs WS2812RGB display blue color

When tracking values=1, execute the program under then block

The left car wheels go backward at 80% speed

The right car wheels go backward at 80% speed

4pcs WS2812RGB display yellow color

When tracking values is not met, execute the program under else block

turtle car stops

4pcs WS2812RGB display red color

Click “JavaScript"to view the corresponding JavaScript code:

```
let tracking_values = 0
basic.showIcon(IconNames.Happy)
let strip = neopixel.create(DigitalPin.P8, 4, NeoPixelMode.RGB)
strip.clear()
basic.forever(function () {
    tracking_values = turtleBit.LineTracking()
    if (tracking_values == 2 || (tracking_values == 3 || (tracking_values == 5 || (tracking_values == 6 || tracking_values == 7)))) {
        turtleBit.run(DIR.Run_forward, 60)
        strip.showColor(neopixel.colors(NeoPixelColors.Green))
    } else if (tracking_values == 4) {
        turtleBit.Motor(MOTOR.LeftSide, MD.Back, 80)
        turtleBit.Motor(MOTOR.RightSide, MD.Forward, 80)
        strip.showColor(neopixel.colors(NeoPixelColors.Blue))
    } else if (tracking_values == 1) {
        turtleBit.Motor(MOTOR.LeftSide, MD.Forward, 80)
        turtleBit.Motor(MOTOR.RightSide, MD.Back, 80)
        strip.showColor(neopixel.colors(NeoPixelColors.Yellow))
    } else {
        turtleBit.state(MotorState.stop)
        strip.showColor(neopixel.colors(NeoPixelColors.Red))
    }
})
```

6. Test Results :

Download code to micro:bit and dial POWER to ON end, line tacking car goes forward along black line and turn on WS2812 RGB lights

(How to download? How to quick download?)

Note: turn on the switch at the back of micro:bit car.

the width of black line should be larger than the width of line tracking sensor.

Avoid to test smart car under the strong light.

8.18: Ultrasonic Follow Smart Car

8.18.1: Ultrasonic Ranging

1. Description :

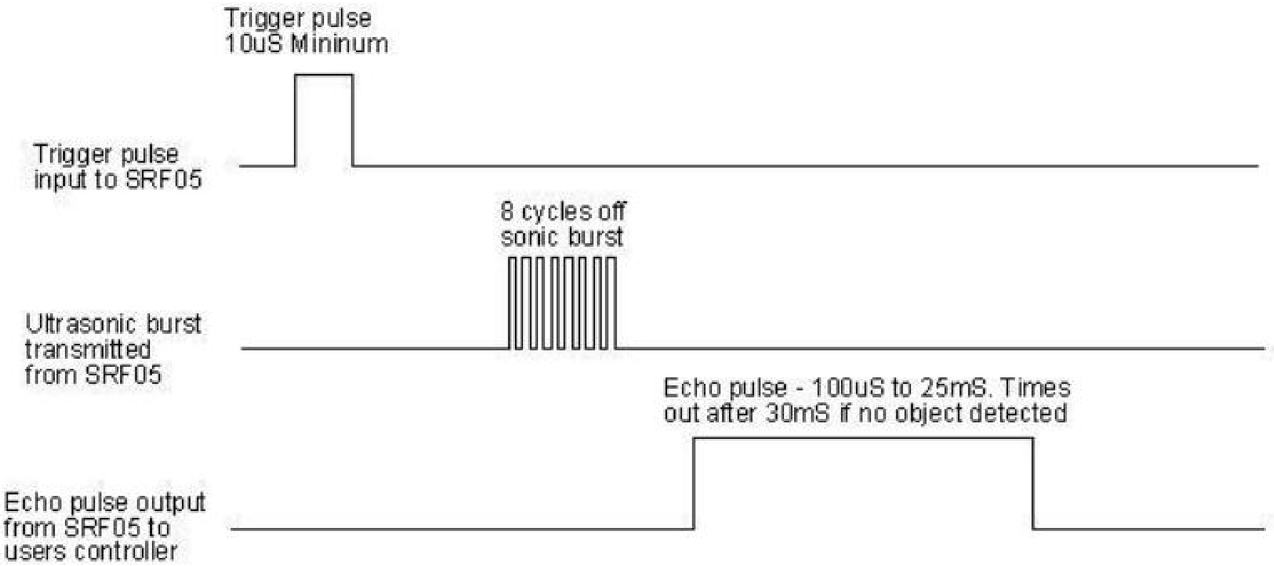
The HC-SR04 ultrasonic sensor uses sonar to determine distance to an object like bats do. It offers excellent non-contact range detection with high accuracy and stable readings in an easy-to-use package. It comes complete with ultrasonic transmitter and receiver modules.

The HC-SR04 or the ultrasonic sensor is being used in a wide range of electronics projects for creating obstacle detection and distance measuring application as well as various other applications.

As the above picture shown, it is like two eyes. One is transmitting end, the other is receiving end.

The ultrasonic module will emit the ultrasonic waves after trigger signal. When the ultrasonic waves encounter the object and are reflected back, the module outputs an echo signal, so it can determine the distance of object from the time difference between trigger signal and echo signal.

2. Working Principle :



1. Pull down TRIG then trigger high level signals with least 10us

2. After triggering, the module will automatically send eight 40KHz ultrasonic pulses and detect whether there is a signal return.

3. The propagation speed of sound in the air is about 343m/s, therefore, distance = speed * time, because the ultrasonic wave emits and comes back, which is 2 times of distance, so it needs to be divided by 2, the distance measured by ultrasonic wave = (speed * time)/2

3. Specifications :

- Working voltage：3-5.5V（DC）
- Power Supply :+5V DC
- Working Current: 15mA
- Working frequency: 40khz
- Maximum Ranging Distance : around 3m

- Minimum Ranging Distance: 2-3cm
- Resolution : 0.3 cm
- Measuring Angle: ≤15 degree
- Trigger Input Pulse width: 10uS
- Accuracy: up to 0.2cm
- Output echo signal : output TTL level signal(high), which is proportion to range.

4. Experimental Preparation :

Insert micro:bit board into slot of V2 shield.

Place batteries into battery holder.

Dial power switch to ON end

Connect micro:bit to computer by USB cable and open online Makecode editor.

Import Hex profile **(How to import?)** , or click “New Project” and drag blocks step by step(add turtle-bit extension library first)

(How to add turtle-bit extension?)

5. Test Code：

Type	Route	File Name
Hex file	../Makecode Tutorial/Test Code/8.18: Ultrasonic Follow Smart Car/8.18.1: Ultrasonic Ranging	microbit-Ultrasonic Ranging.hex

Or you could edit code step by step in the editing area.

(1) Tap “Advanced” → “Serial” → “serial redirect to USB”

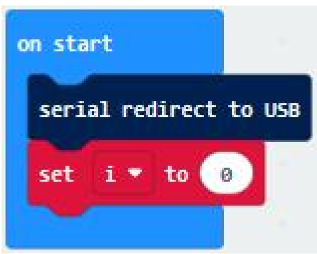
Combine it with “on start” block

****

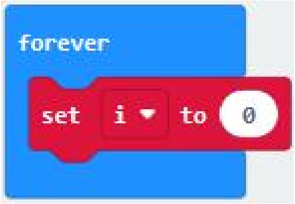
(2) Go to “Variables”→“Make a Variable...”→“New variable name :” dialog box，

Input i and click “OK” to produce variable “i” ，

Move “set i to 0” from “Variables” and integrate with “on start” block



****

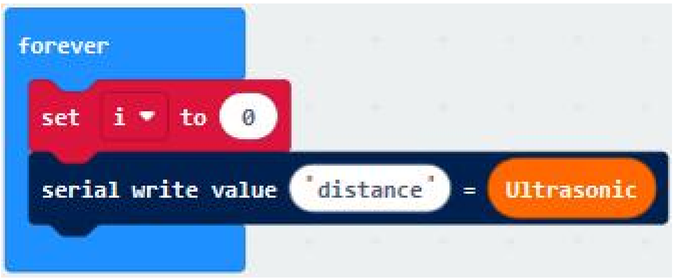


(3) Tap “Advanced” → “Serial” → “serial write value x=0”

Place it under “set i to 0” block

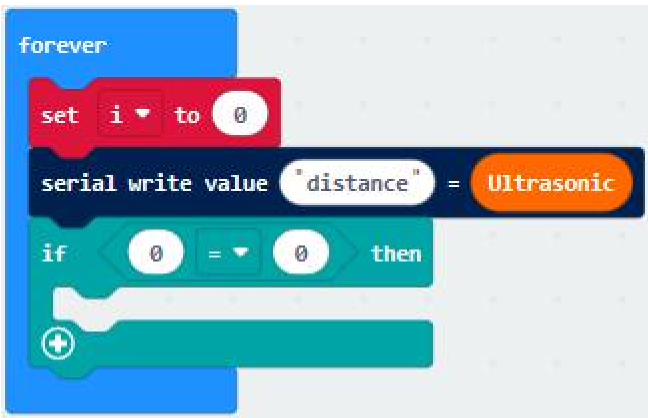
Click “TurtleBit” to move “Ultrasonic” into 0 box of “=” block

Change X into distance



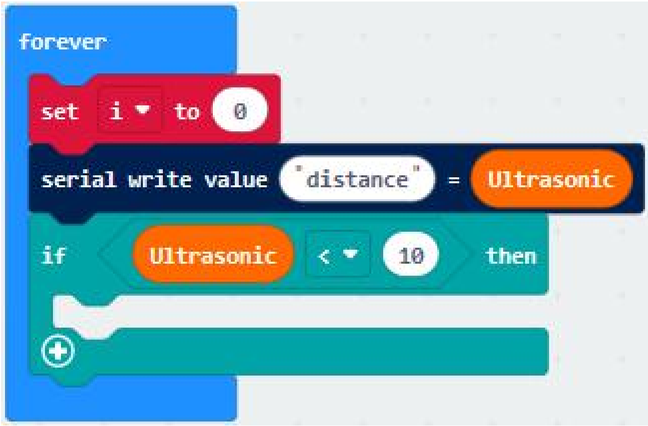
(4) Click “Logic” to drag “if true then” block into “forever” block.

Move “=” into true box



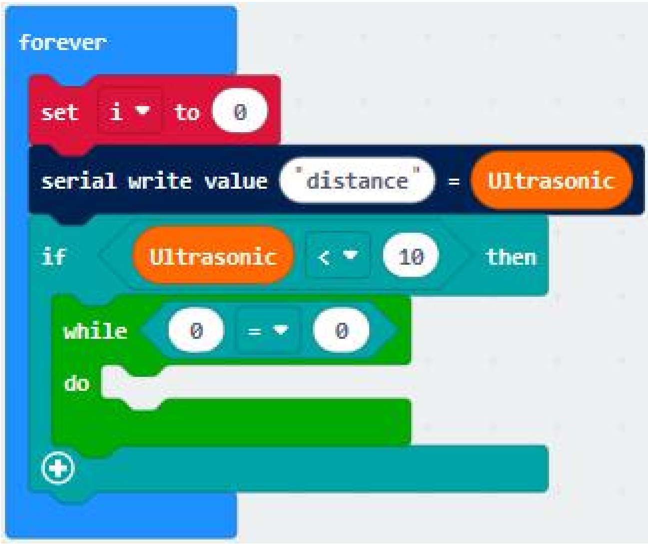
(5) Click “TurtleBit” to drag “Ultrasonic” to left box of “=”

Change “=” into “<”, 0 into 10.



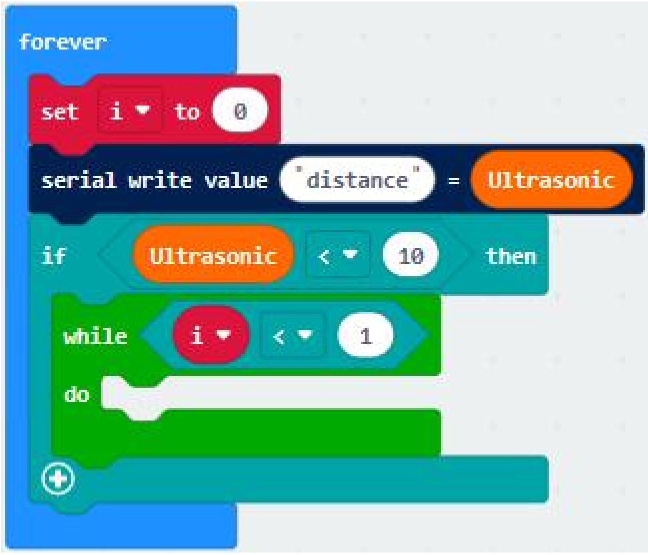
(6) Tap “Loops” to get block “while true do” and place it into forever block

Click “Logic” to move “=” block into true box



(7) Click “Variables” to move variable “i” to left box of “=” block

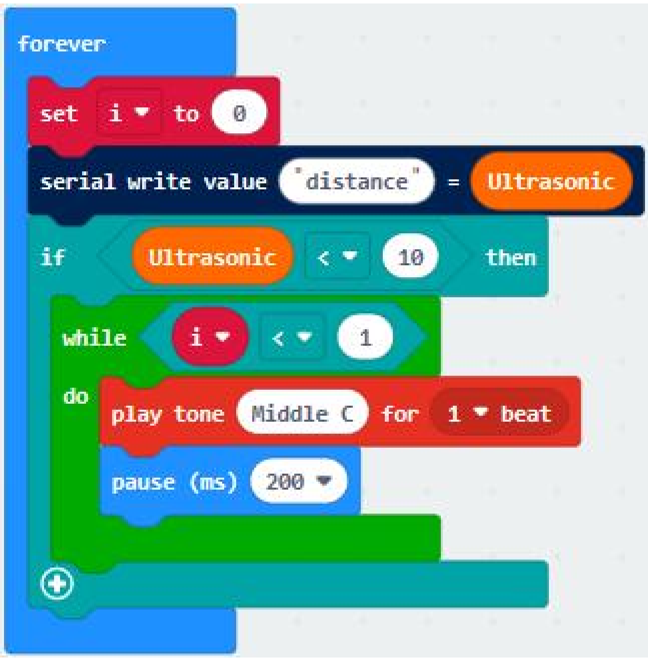
Change “=” into “<” and 0 into 1



(8) Click "Music" and move "play tone Middle C for 1 beat" block into do block

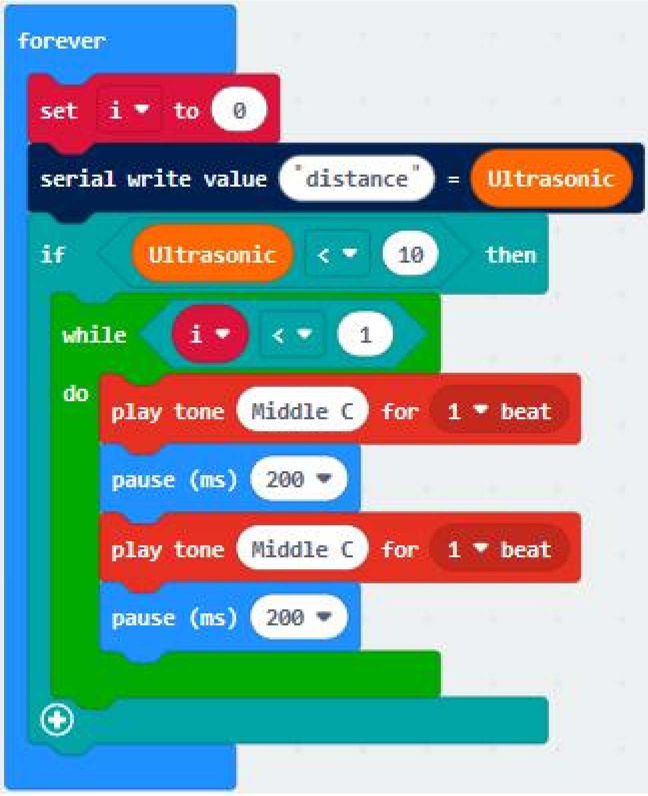
Tap "Basic" to move "pause(ms)100" under "play...beat" block

Change 100 into 200

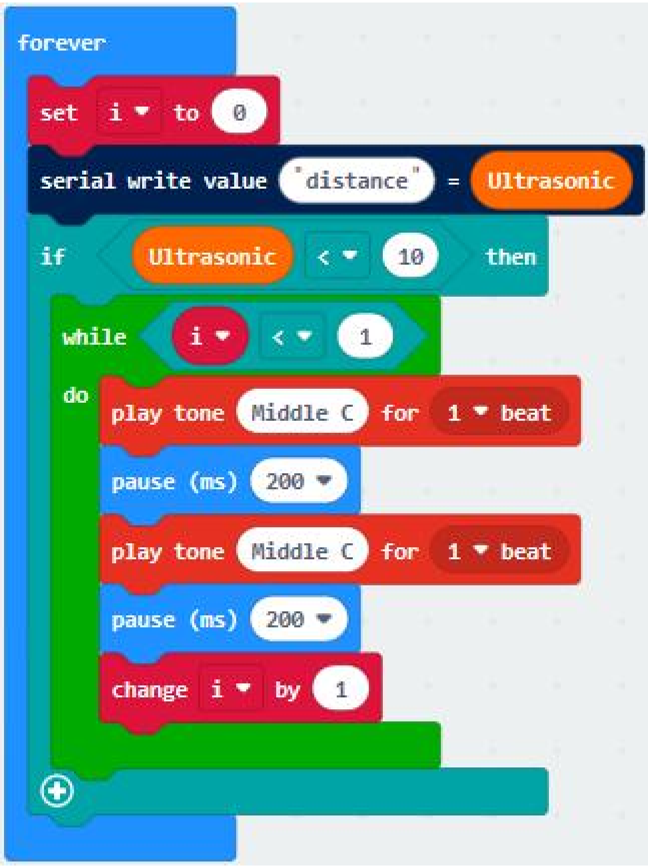


Copy 

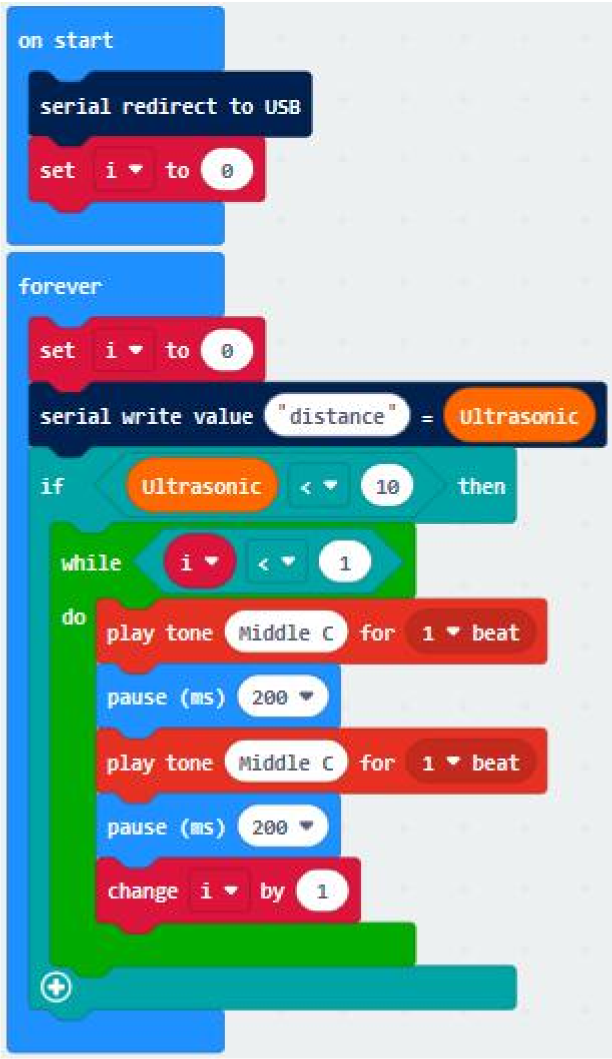
once and place it into do block



Click “Variables” to drag “change i by 1” into do block

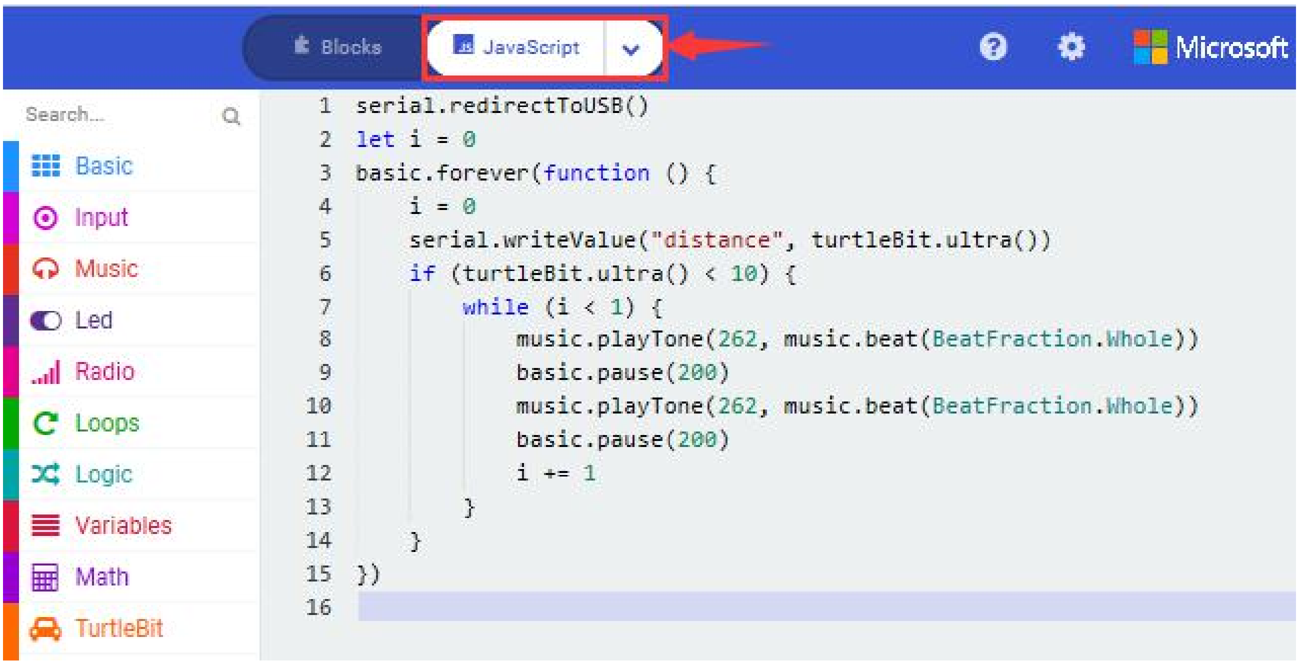


Complete Code



“on start” : command block runs once to start program.
Serial redirect to USB
Set variable i to 0
The program under the block “forever” runs cyclically.
Set variable i to 0
Serial writes distance=Ultrasonic
When Ultrasonic<10, execute the program under then block
When variable i <1, execute the program under do block
Play tone C for 1 beat
Delay in 200ms
Play tone C for 1 beat
Delay in 200ms
Change i by 1

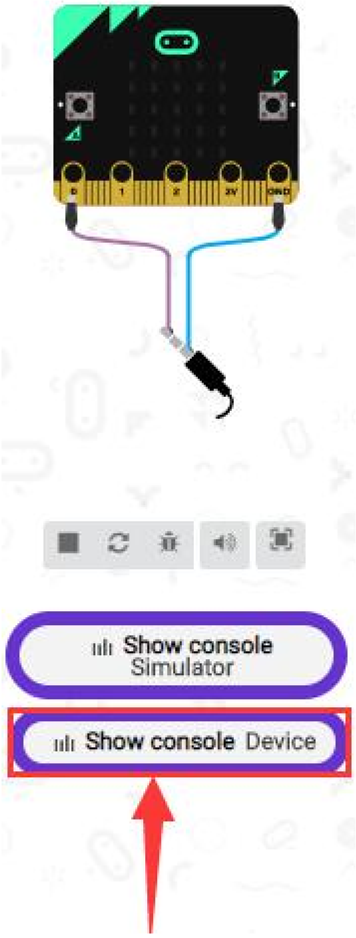
Click “JavaScript" to view the corresponding JavaScript code:



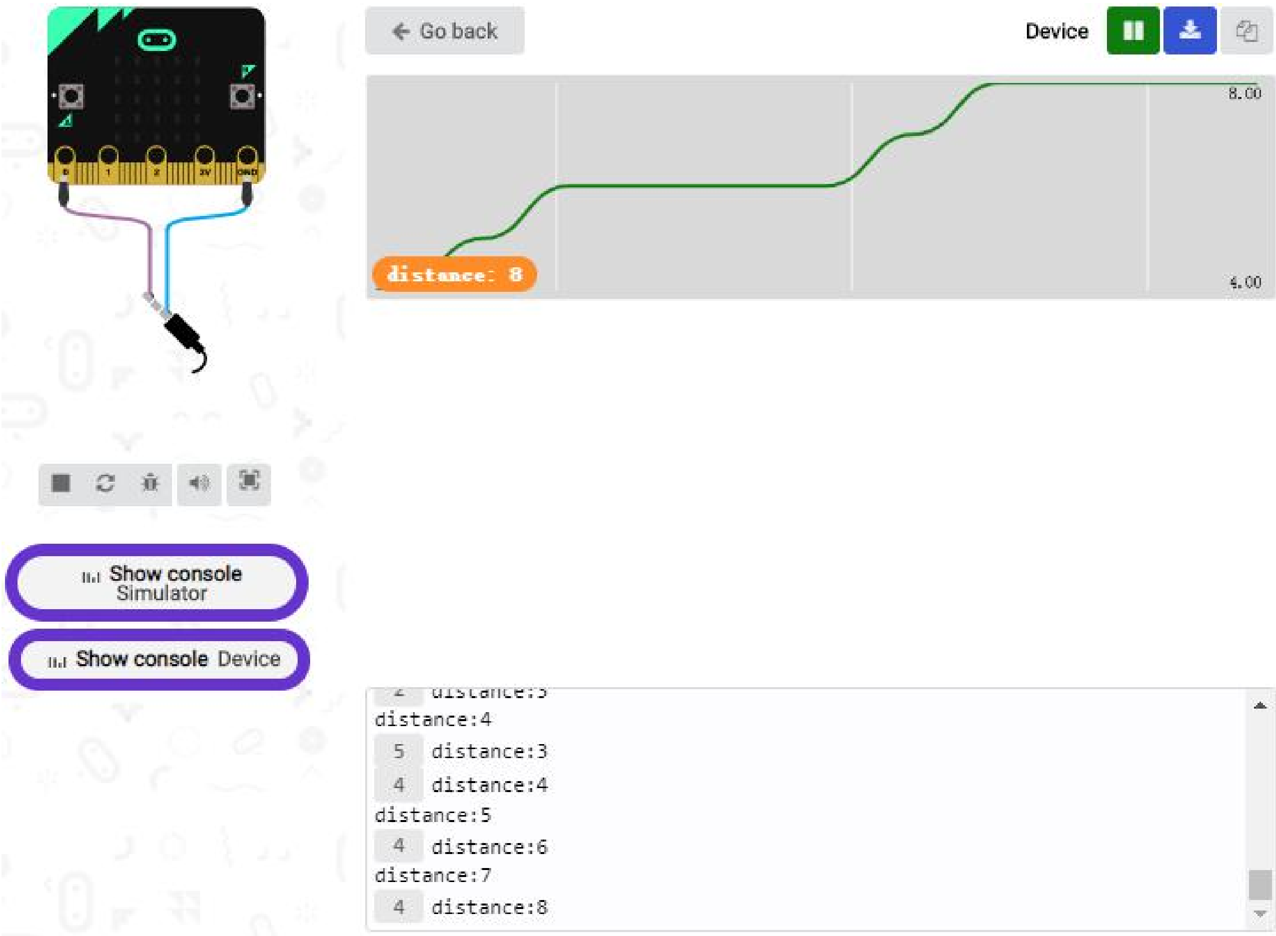
6. Test Results：

Download code to micro:bit, keep USB cable connected, dial POWER switch to ON end. The distance value will be displayed on monitor.

(How to quick download?)

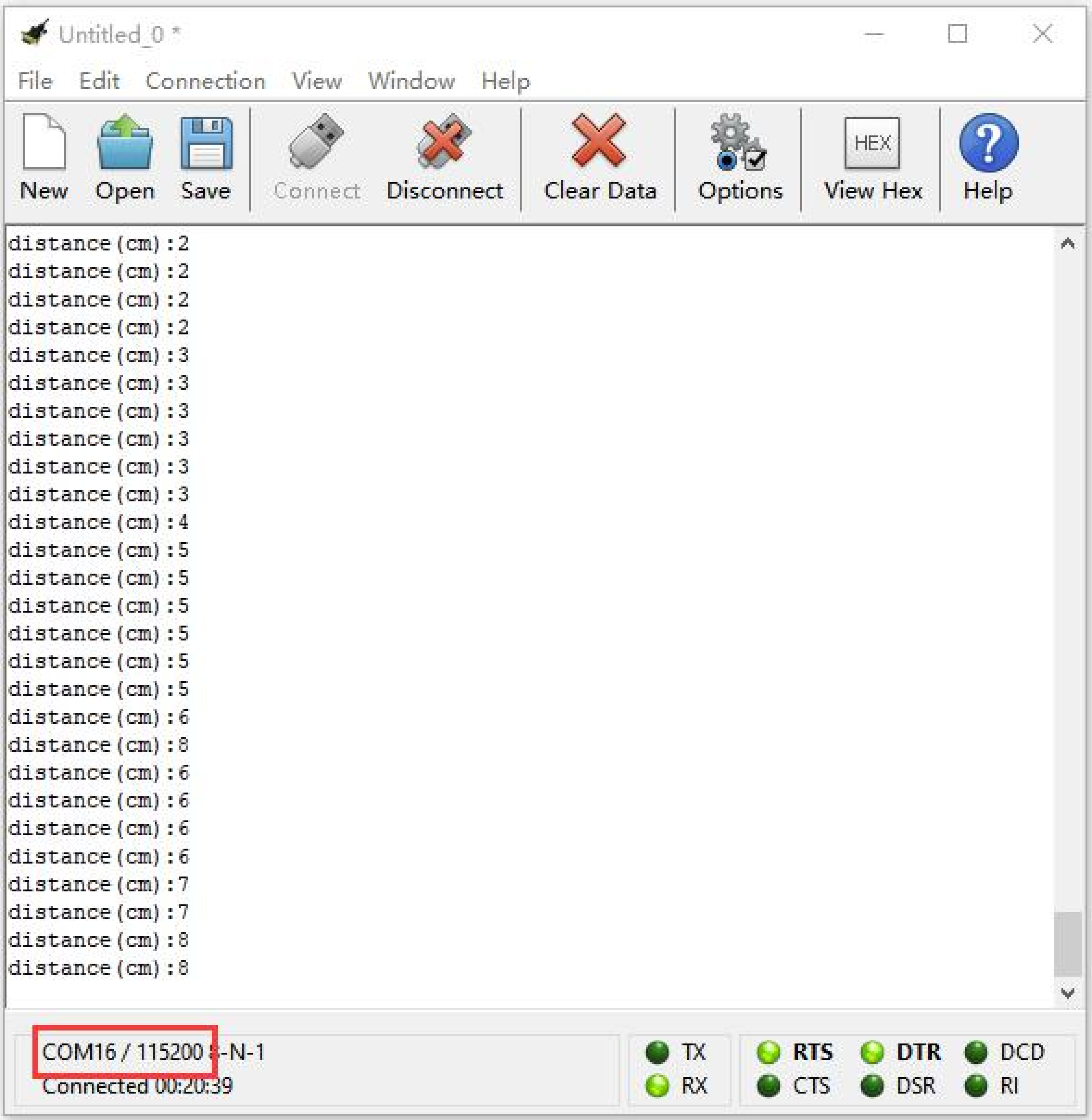


The monitor shows the distance between the obstacle and ultrasonic sensor(as shown below). When the distance is less than 10cm, the passive buzzer of smart car emits sound.

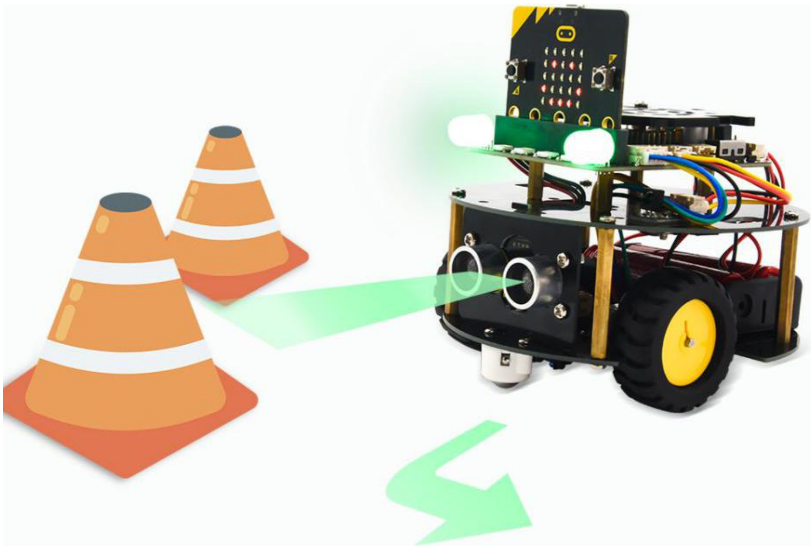


Open CoolTerm, click Options to select SerialPort. Set COM port and 115200 baud rate(the baud rate of USB serial communication of Micro:bit is 115200 through the test). Click “OK” and “Connect”.

CoolTerm serial monitor displays the distance value as follows:


Untitled_0 *
File Edit Connection View Window Help
New Open Save Connect Disconnect Clear Data Options View Hex Help
HEX
distance(cm):2
distance(cm):2
distance(cm):2
distance(cm):2
distance(cm):3
distance(cm):3
distance(cm):3
distance(cm):3
distance(cm):3
distance(cm):3
distance(cm):4
distance(cm):5
distance(cm):5
distance(cm):5
distance(cm):5
distance(cm):5
distance(cm):5
distance(cm):6
distance(cm):8
distance(cm):6
distance(cm):6
distance(cm):6
distance(cm):6
distance(cm):7
distance(cm):7
distance(cm):8
distance(cm):8
COM16 / 115200 8-N-1
Connected 00:20:39
TX
RX
RTS
CTS
DTR
DSR
DCD
RI

8.18.2: Ultrasonic Avoidance Car



1. Description :

We’ ve learned the knowledge of obstacle avoidance sensor. In this project, we will integrate ultrasonic sensor, and car expansion board to make an ultrasonic avoidance car.

Its principle is to detect the distance between the car and obstacle by ultrasonic sensor and control the motion of smart car.

2. Experimental Preparation :

(1) Insert micro:bit board into slot of V2 shield.

(2) Place batteries into battery holder.

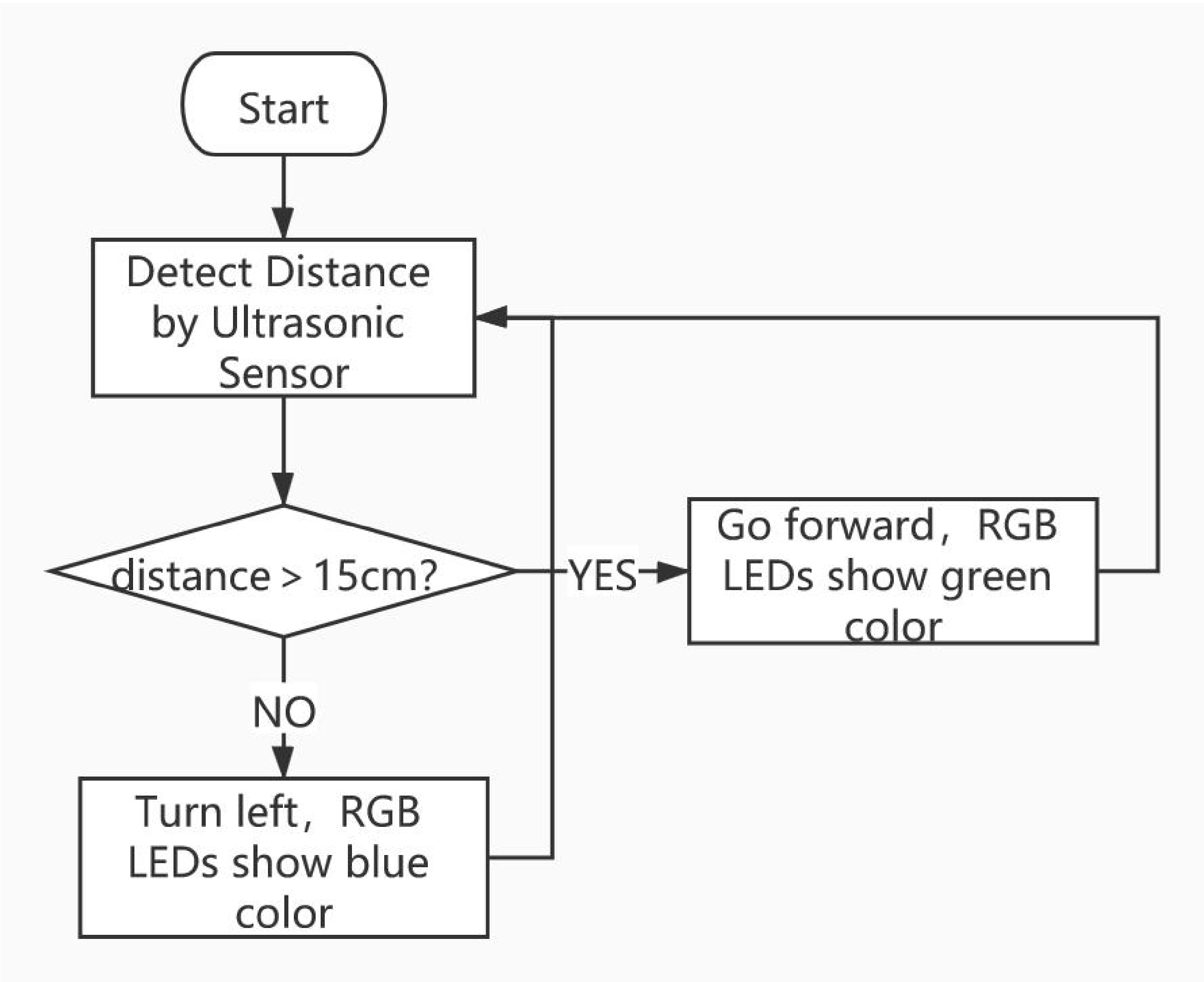
(3) Dial power switch to ON end

(4) Connect micro:bit to computer by USB cable and open online Makecode editor.

(5) Import Hex profile **(How to import?)** , or click "New Project" and drag blocks step by step(add turtle-bit extension library first)

(How to add turtle-bit extension?)

3. Flow Chart



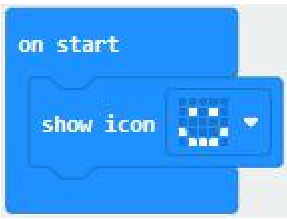
4. Test Code :

Type	Route	File Name
Hex file	../Makecode Tutorial/Test Code/8.12: Ultrasonic Follow Smart Car/8.12.2 : Ultrasonic Avoidance Car	microbit-Ultrasonic Avoidance Car.hex

Or you could edit code step by step in the editing area.

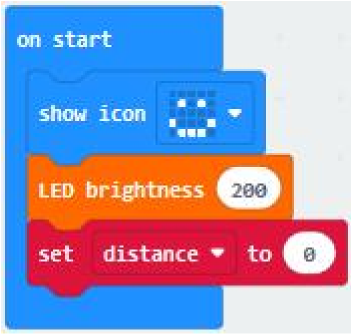
(1) Enter "Basic" → "show icon ♥"

Place it into "on start" and click the triangle button to select "" pattern.



(2) Click "TurtleBit" to move "LED brightness 0" into "on start" block

Change 0 into 200



(3) Tap “Variables” → “Make a Variable...”

Put “distance” in the search bar

Click “OK” to set up variable “distance”

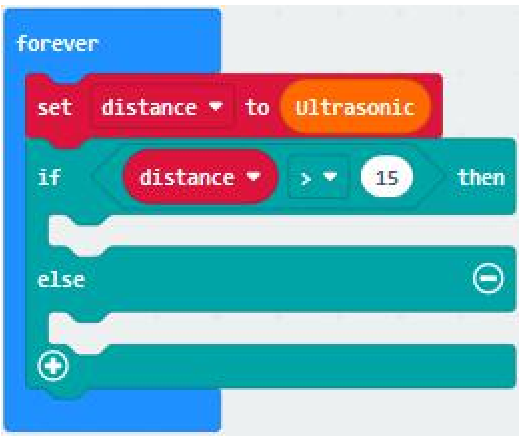
Place it under “LED brightness 2000” block

(4) Go to “Logic” to move “if true then...else” under “set...ultrasonic” block

Drag “=” block into true box

Click “Variables” to move variable “distance” into left box of “=” block

Change “=” into “>”, 0 into 15.



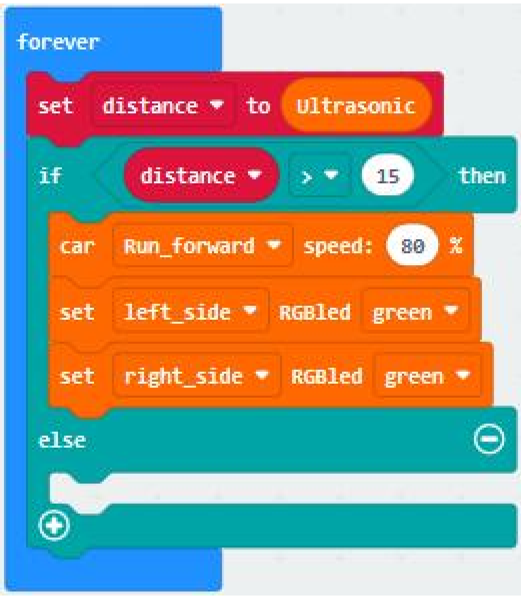
(5) Tap "TurtleBit" to move "car Run_forward speed: 0%" block under "if...then" block

Change 0 into 80

Drag "set left_side RGBled red" and place it under "car...80%" block

Copy it once and change red into green

Set code string as follows

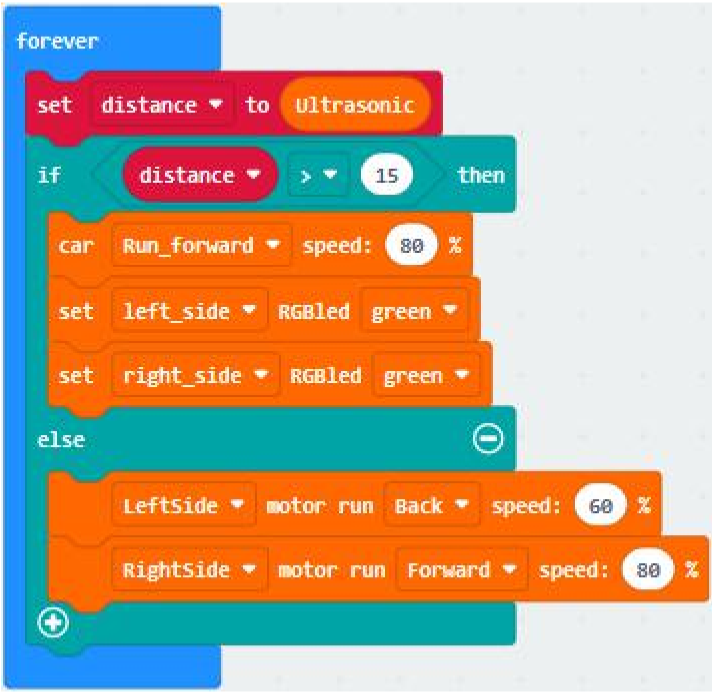


(6) Click "TurtleBit" to drag "LeftSide motor run forward speed: 0%" block into else block

Chang "forward" into back,0 into 60

Copy "LeftSide motor run back speed: 60%" again

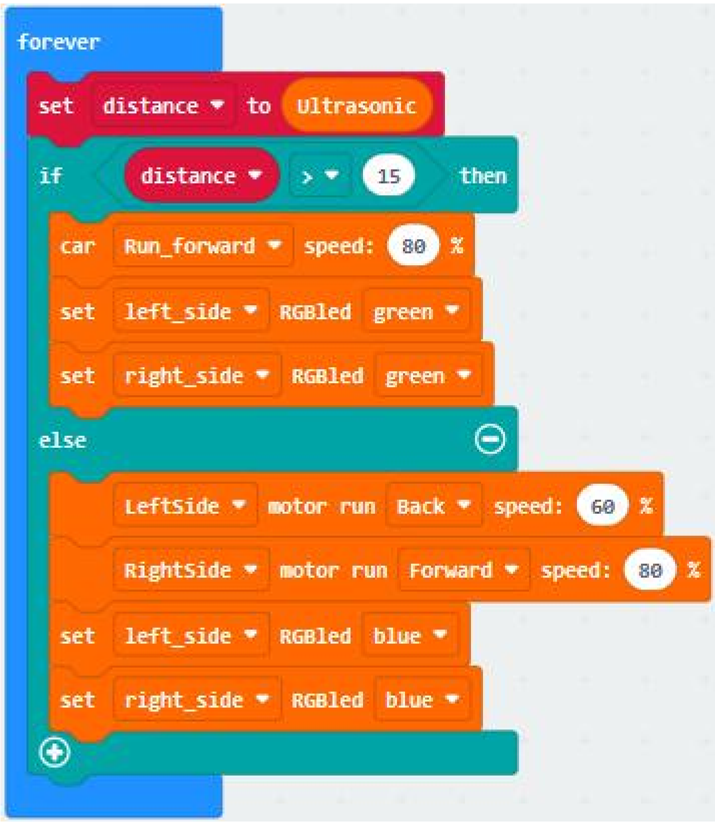
Set the code string as follows:



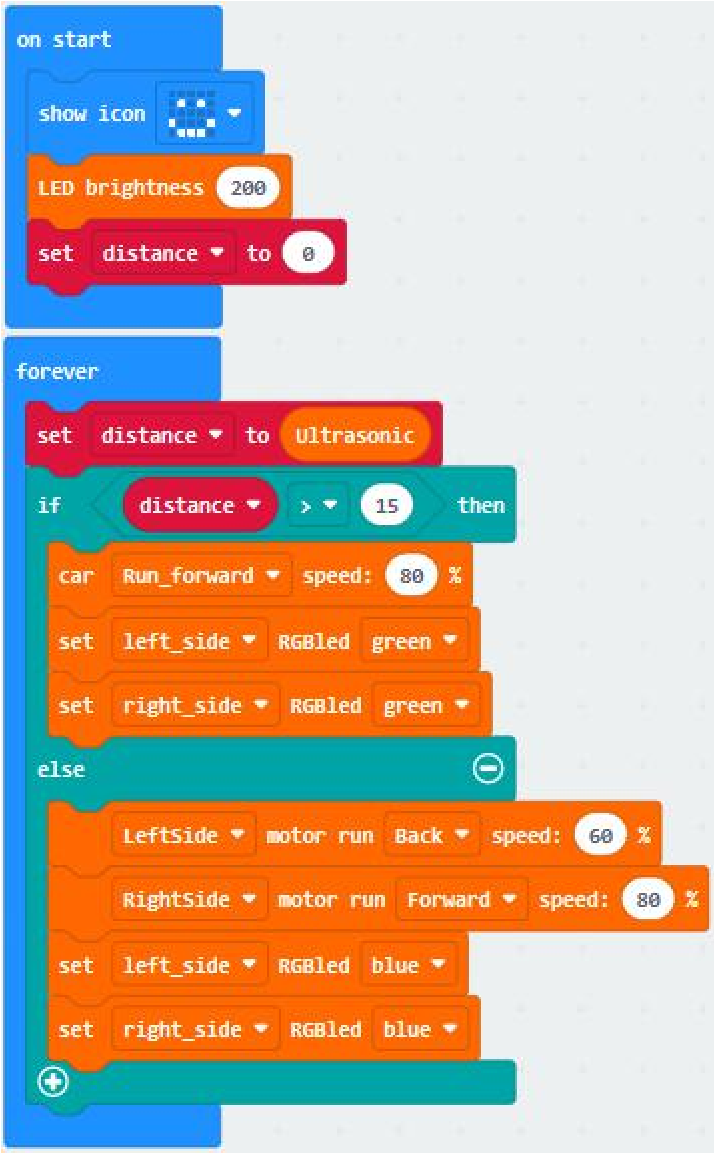
(7) Duplicate 

once and leave it under else block

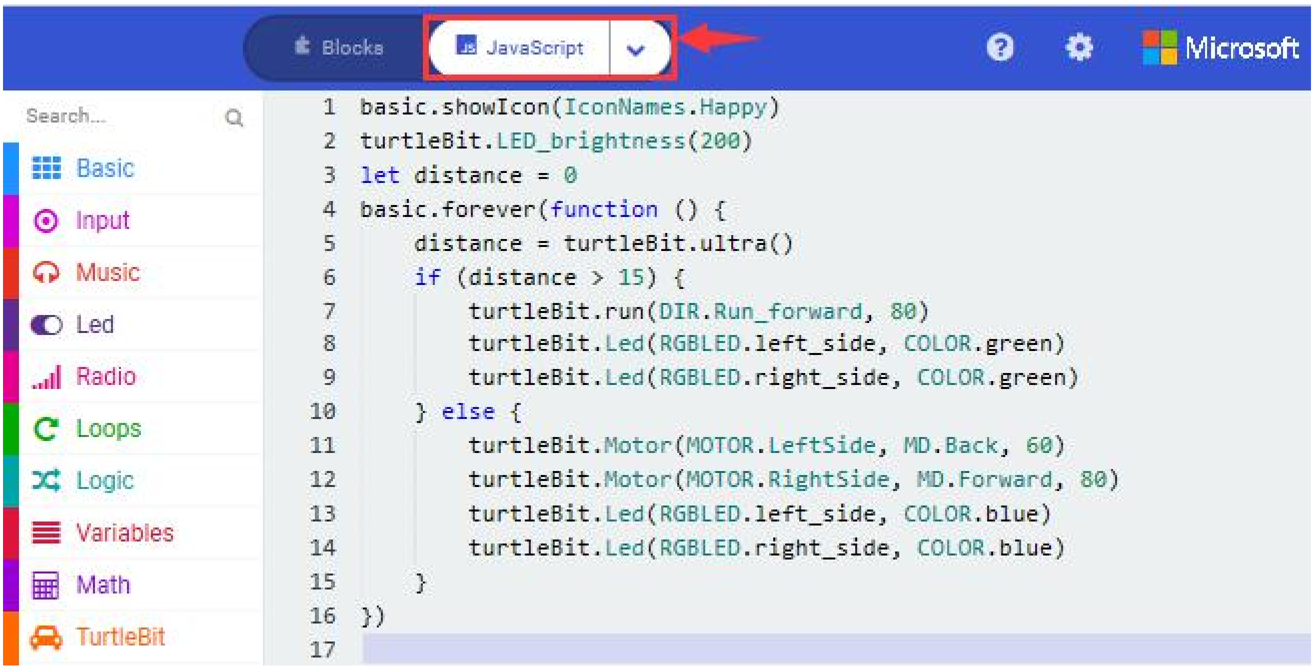
Click green to select blue



Complete Code



Click “JavaScript" to switch into the corresponding JavaScript code:




```
basic.showIcon(IconNames.Happy)
turtleBit.LED_brightness(200)
let distance = 0
basic.forever(function () {
    distance = turtleBit.ultra()
    if (distance > 15) {
        turtleBit.run(DIR.Run_forward, 80)
        turtleBit.Led(RGBLED.left_side, COLOR.green)
        turtleBit.Led(RGBLED.right_side, COLOR.green)
    } else {
        turtleBit.Motor(MOTOR.LeftSide, MD.Back, 60)
        turtleBit.Motor(MOTOR.RightSide, MD.Forward, 80)
        turtleBit.Led(RGBLED.left_side, COLOR.blue)
        turtleBit.Led(RGBLED.right_side, COLOR.blue)
    }
})
```

5. Test Results :

Download code to micro:bit, dial to ON end, and dial POWER to ON end. When the obstacle distance is greater than 15cm, turtle car goes forward and 2 RGB lights show green color; on the contrary, smart car turns left and 2 RGB lights show blue color.

(How to download?   How to quick download?)

8.18.3: Ultrasonic Follow Smart Car

1. Description：

In previous lesson, we've learned the basic principle of line tracking sensor. Next, we will combine ultrasonic sensor with car shield to make an ultrasonic follow car.

The ultrasonic sensor detects the obstacle distance and control the motion status of car.

2. Experimental Preparation：

(1) Insert micro:bit board into slot of V2 shield.

(2) Place batteries into battery holder.

(3) Dial power switch to ON end

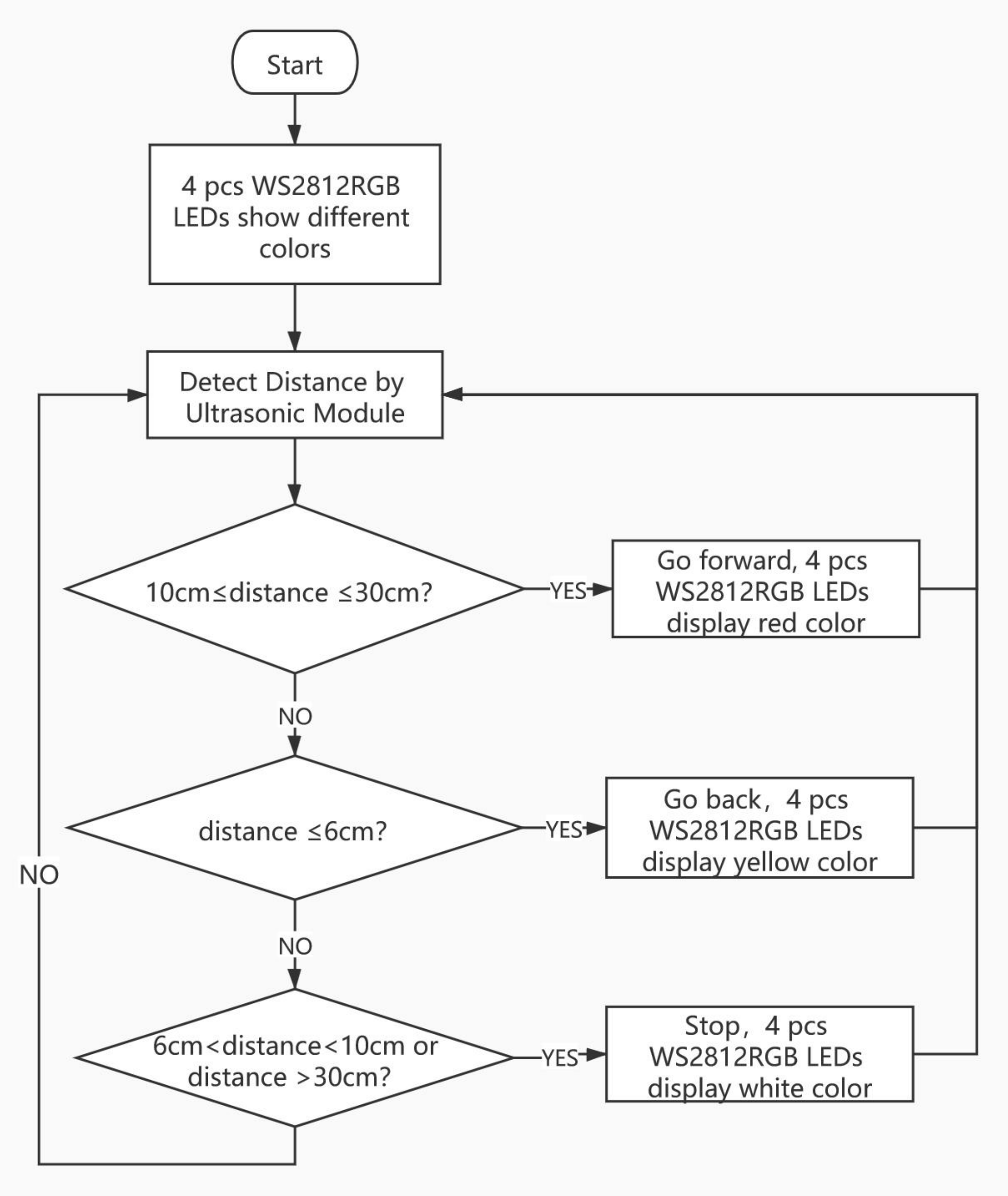
(4) Connect micro:bit to computer by USB cable and open online Makecode editor.

(5) Import Hex profile **(How to import?)** , or click "New Project" and drag

blocks step by step(add turtle-bit extension library first)

(How to add turtle-bit extension?)

3. Flow Chart



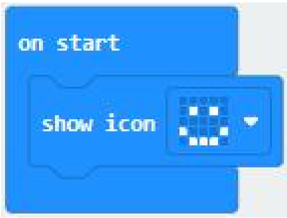
4. Test Code :

Type	Route	File Name
Hex file	../Makecode Tutorial/Test Code/8.18 Ultrasonic Follow Smart Car/8.18.3 : Ultrasonic Follow Smart Car	microbit-Ultrasonic Follow Smart Car.hex

Or you could edit code step by step in the editing area.

(1) Enter "Basic" → "show icon ♥"

Place it into "on start" and click the triangle button to select "" pattern.

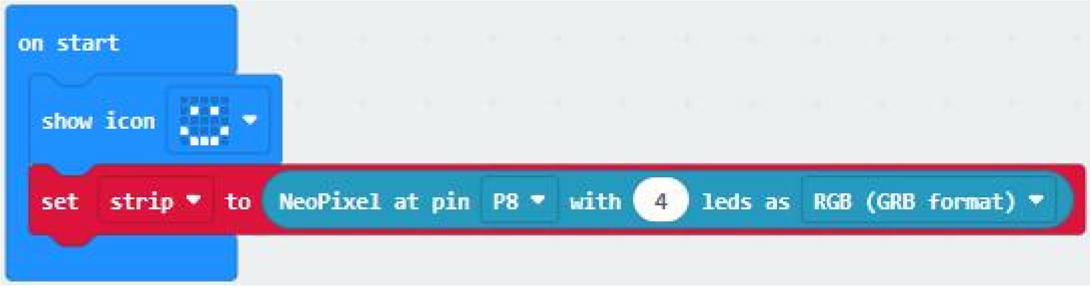


****

(2) a. Enter "Neopixel" → "set strip to Neopixel at pin P0 with 24 leds as RGB (GRB format)"

b. Place it into "on start" block ,

c. 4 pcs WS2812 RGB lights are controlled by P8 of micro:bit board . So we set to P8 and 4 leads



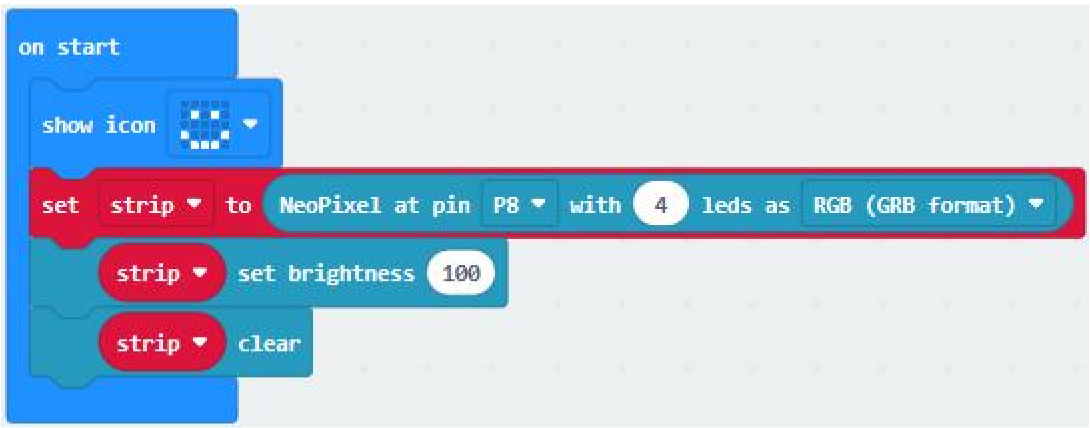
(3)Tap "Neopixel" → "more" → "strip set brightness 255"

Leave it under the block "set....(RGB format)

To reduce the brightness of WS2812 RGB lights, change 255 into 100.

(4) Click "Neopixel" to find "strip clear"

Keep it into "on start" block.

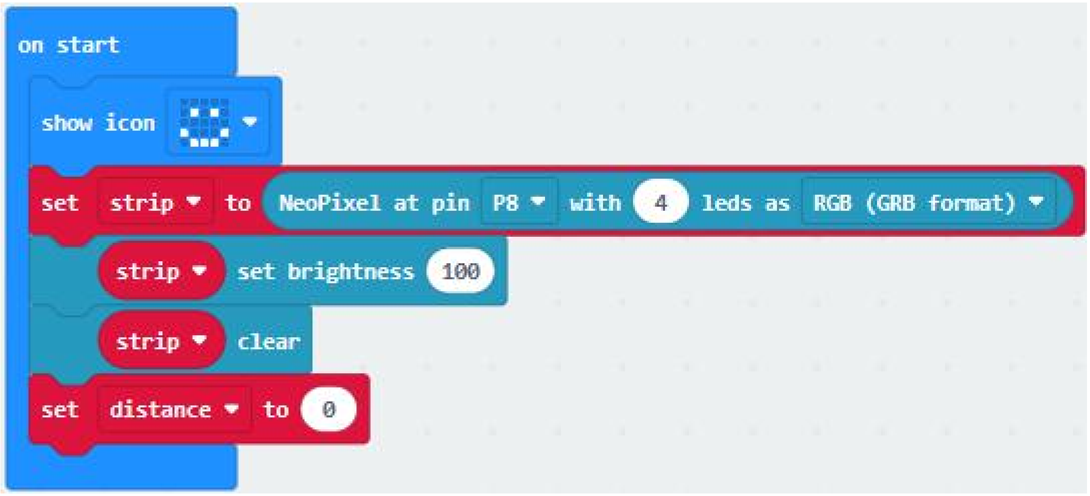


(5) Go to "Variables" → "Make a Variable..." → "New variable name :" dialog

box ,

Input distance and click “OK” to produce variable “distance” ,

Drag out “set distance to 0” into “on start”

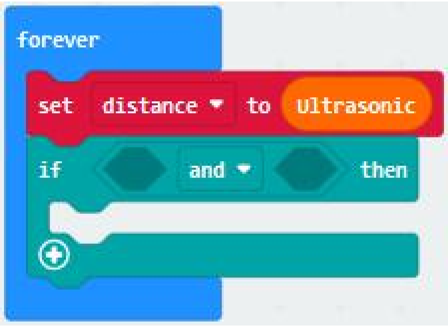


(6) Click “Variables” to move “set distance to 0” into forever block

Click “TurtleBit” to drag block “Ultrasonic” into 0 box.

(7) Enter “Logic” to move out “if true then” into “forever” ,

Then place “and” block into true box.



(8) Click “Logic” to move out “=” into left box of “and” block

Move out variable “distance” into left box of “=” block

Change “=” into “≥” and 0 into 10.

Replicate “distance≥10” once and leave it into right box of “and” block.

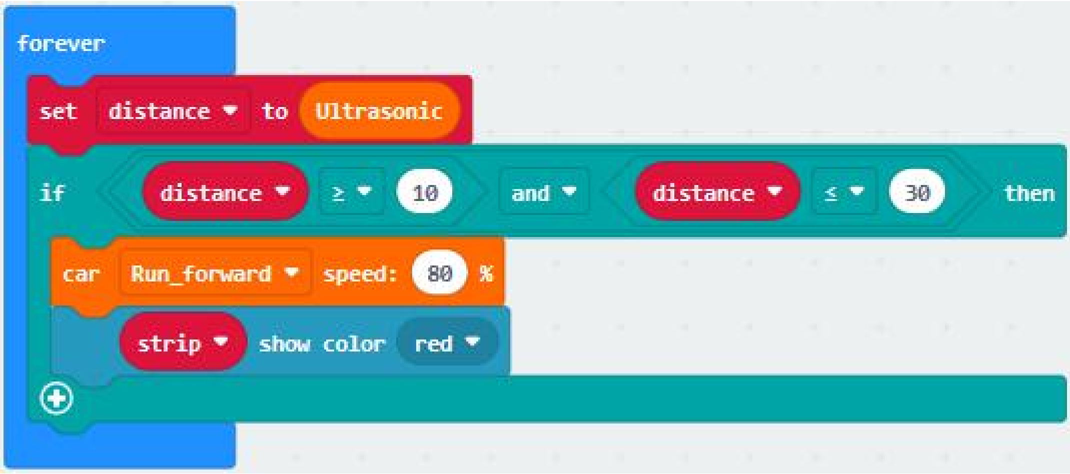
Then we set distance ≤30

(5) Click “TurtleBit” → “car Run_Forward speed: 0 %”

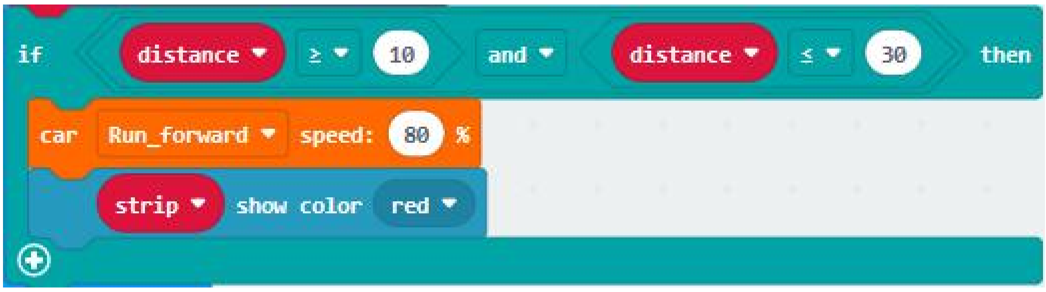
Leave it under “if...30 then” block. Then change 0 into 80.

Go to “Neopixel” → “strip show color red”

Place it under “car Run_Forward speed: 80 %” block.



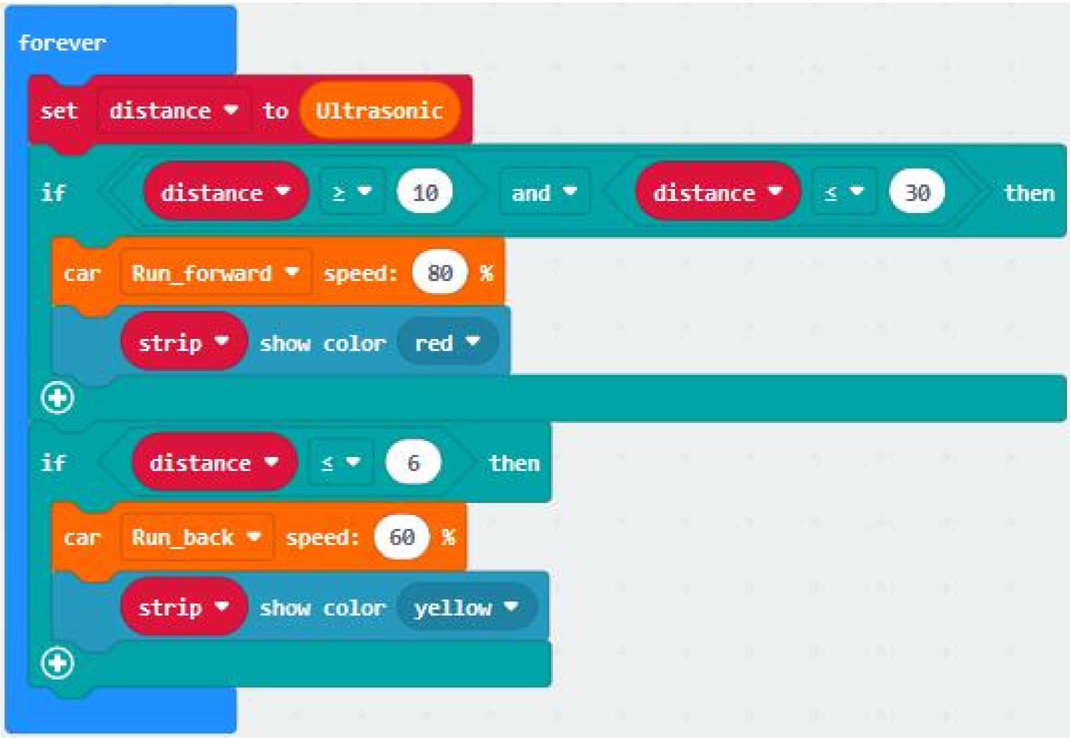
(6) Duplicate code string

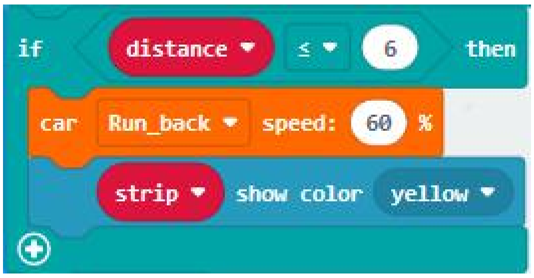


once and keep it into "forever" ,

Delete block "distance≥10" and "and" block ,

Change 30 into 6, Run_Forward into Run_Back , 80 into 60 and red into yellow.



(7) Copy code string 

once and place it into "forever" ,

Delete block "distance≤6" and "car RunBack speed: 60 %"

Go to "Logic" to drag out block "or" into true box ,

Move block "and" into left box of "or" block ,

Replicate block "distance≤6" once and place it into left box of "and" block ,

Change "≤" into ">" , and duplicate block "distance≥10" once and move into right box of “and” ,

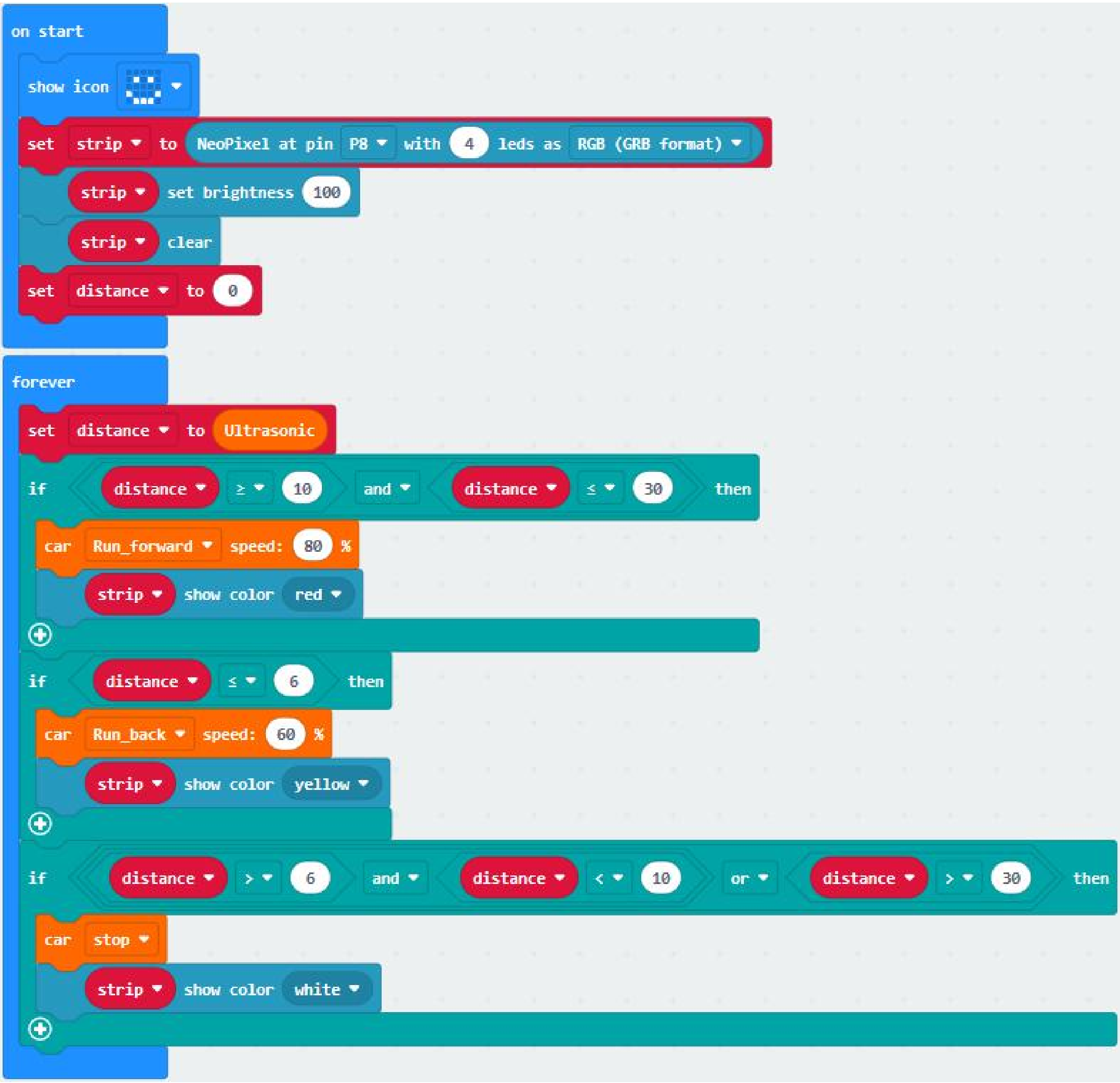
Change “≥” into “<” , and copy block “distance≤30” once and drag into right box of “or” ,

Change “≤” into “>” , and move block “car stop” from “TurtleBit”

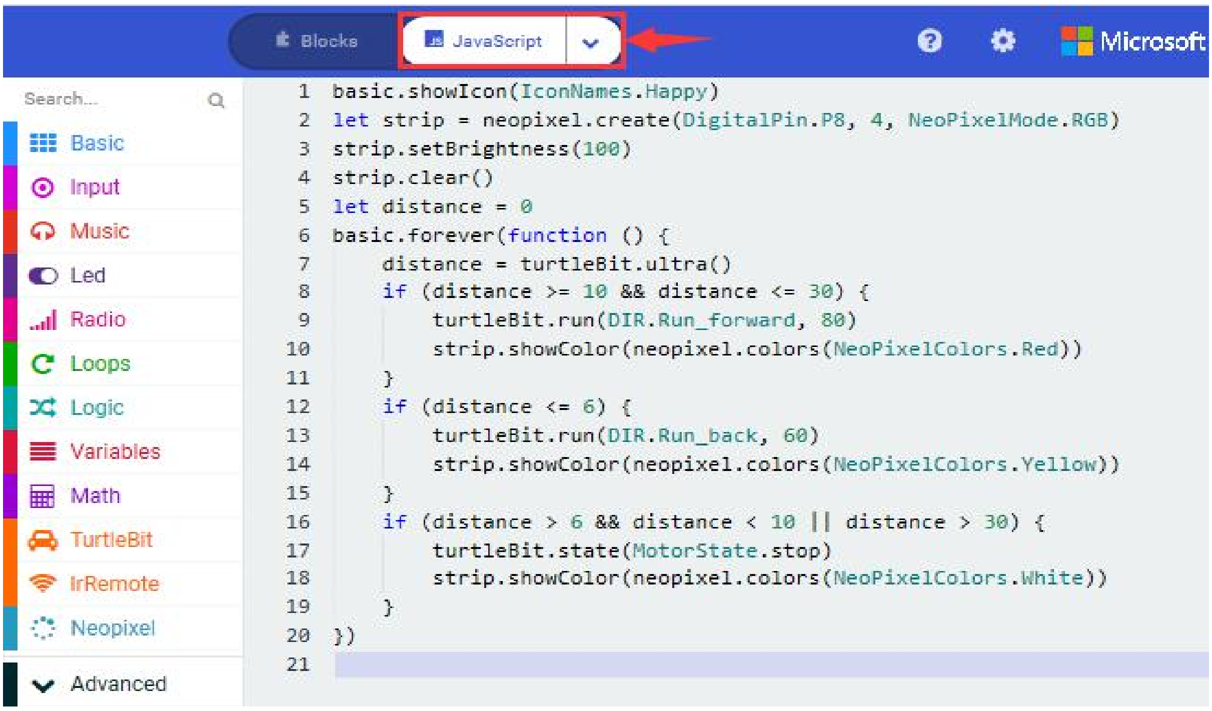
Keep “car stop” block under “if...then” block

Alter yellow into white.

Complete Code:


on start
show icon
set strip to NeoPixel at pin P8 with 4 leds as RGB (GRB format)
strip set brightness 100
strip clear
set distance to 0
forever
set distance to Ultrasonic
if distance ≥ 10 and distance ≤ 30 then
car Run_forward speed: 80 %
strip show color red
if distance ≤ 6 then
car Run_back speed: 60 %
strip show color yellow
if distance > 6 and distance < 10 or distance > 30 then
car stop
strip show color white

Click "JavaScript" to switch into the corresponding JavaScript code:



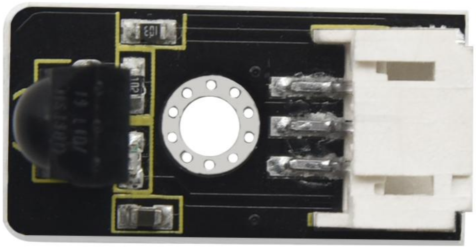
5. Test Results :

Download code to micro:bit, dial POWER switch to ON end on shield, smart can could follow the obstacle to move and WS2812 RGB lights show different color

Note: the obstacle only moves in front of smart car, not turning

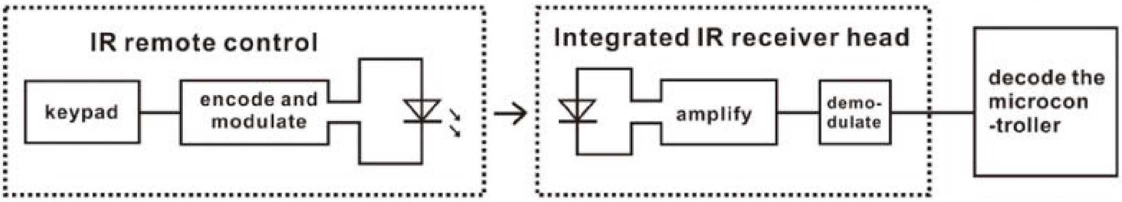
8.19: IR Remote Control Smart Car

8.19.1: Decode IR Remote Control



1. Description：

There is no doubt that infrared remote control is ubiquitous in daily life. It is used to control various household appliances, such as TVs, stereos, video recorders and satellite signal receivers. Infrared remote control is composed of infrared transmitting and infrared receiving systems, that is, an infrared remote control and infrared receiving module and a single-chip microcomputer capable of decoding.



The 38K infrared carrier signal emitted by remote controller is encoded by the encoding chip in the remote controller. It is composed of a section of pilot code, user code, user inverse code, data code, and data inverse code. The time interval of the pulse is used to distinguish whether it is a 0 or 1 signal and the encoding is made up of these 0, 1 signals.

The user code of the same remote control is unchanged. The data code can distinguish the key.

When the remote control button is pressed, the remote control sends out an infrared carrier signal. When the IR receiver receives the signal, the program will decode the carrier signal and determines which key is pressed. The MCU decodes the received 01 signal, thereby judging what key is pressed by the remote control.

Infrared receiver we use is an infrared receiver module. Mainly composed of an infrared receiver head, it is a device that integrates reception, amplification, and demodulation. Its internal IC has completed demodulation, and can achieve from infrared reception to output and be compatible with TTL signals. Additionally, it is suitable for infrared remote control and infrared data transmission. The infrared receiving module made by the receiver has only three pins, signal line, VCC and GND.

2. Specifications：

- Operating Voltage: 3.3-5V（DC）
- Interface: 3PIN
- Output Signal: Digital signal
- Receiving Angle: 90 degrees
- Frequency: 38khz
- Receiving Distance: about 5m

3. Experimental Preparation：

(1) Insert micro:bit board into slot of V2 shield.

(2) Place batteries into battery holder.

(3) Dial power switch to ON end

(4) Connect micro:bit to computer by USB cable and open online Makecode editor.

(5) Import Hex profile **(How to import?)** , or click "New Project" and drag blocks step by step(add turtle-bit extension library first)

(How to add turtle-bit extension?)

4. Test Code：

Type	Route	File Name
Hex file	../Makecode Tutorial/Test Code/8.19：IR Remote Control Smart Car/8.19.1：Decode IR Remote Control	microbit-Decode IR Remote Control.hex

(1) Click "Advanced" → "Serial" → "serial redirect to USB"

Place it into "on start" block.

(2) Enter “IrRemote” → “connect IR receiver at P0”

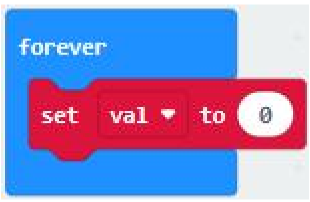
Put it into “on start” block

IR receiving module is controlled by P11 of micro:bit board, so click P0 to select P11.

(3) Go to “Variables” → “Make a Variable...” → “New variable name : ” dialog box ,

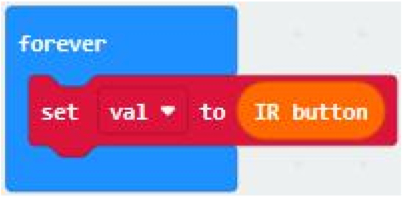
Enter “val” and click “OK” to create variable “val”

Then drag out “set val to 0” block into “forever” block.



(4) Go to “Ir Remote” → “IR button”

Place it into 0 box

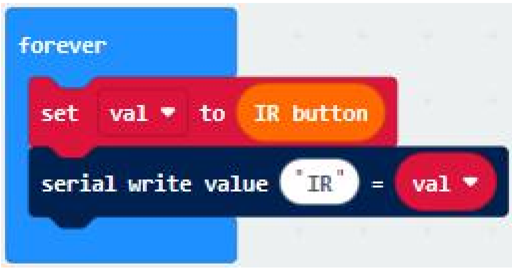


(5) Click “Advanced” → “Serial” → “serial write value “x” =0”

Put it into “forever” block

Change “x” into “IR”

Enter “Variables” to move block “val” into 0 box behind “=”



(6) Drag out block “pause (ms) 100” from “Basic” and delay in 1000ms

Leave it into “forever” block

Complete Program：

"on start" : command block runs once to start program.

Serial redirect to USB

Connect IR receiver to P11

The program under the block "forever" runs cyclically.

Set val to IR button

Serial port prints IR=val

Delay in 1000ms

Click "JavaScript" to switch into the corresponding JavaScript code:

Code explanation: when the buttons are not pressed, the serial monitor constantly shows 0; when pressed, the corresponding key values are displayed.

Notes :

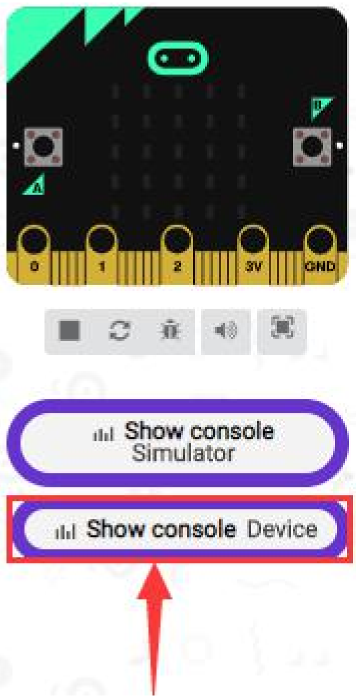
The remote control in this kit is not inclusive of batteries. We recommend you to purchase them online.(battery type:CR2025).

Make sure IR remote is good before test. There is a tip for you to check it. Open the cellphone camera , make IR remote control point at camera and press button. The remote control is good if you see the purple flashing light in the camera.

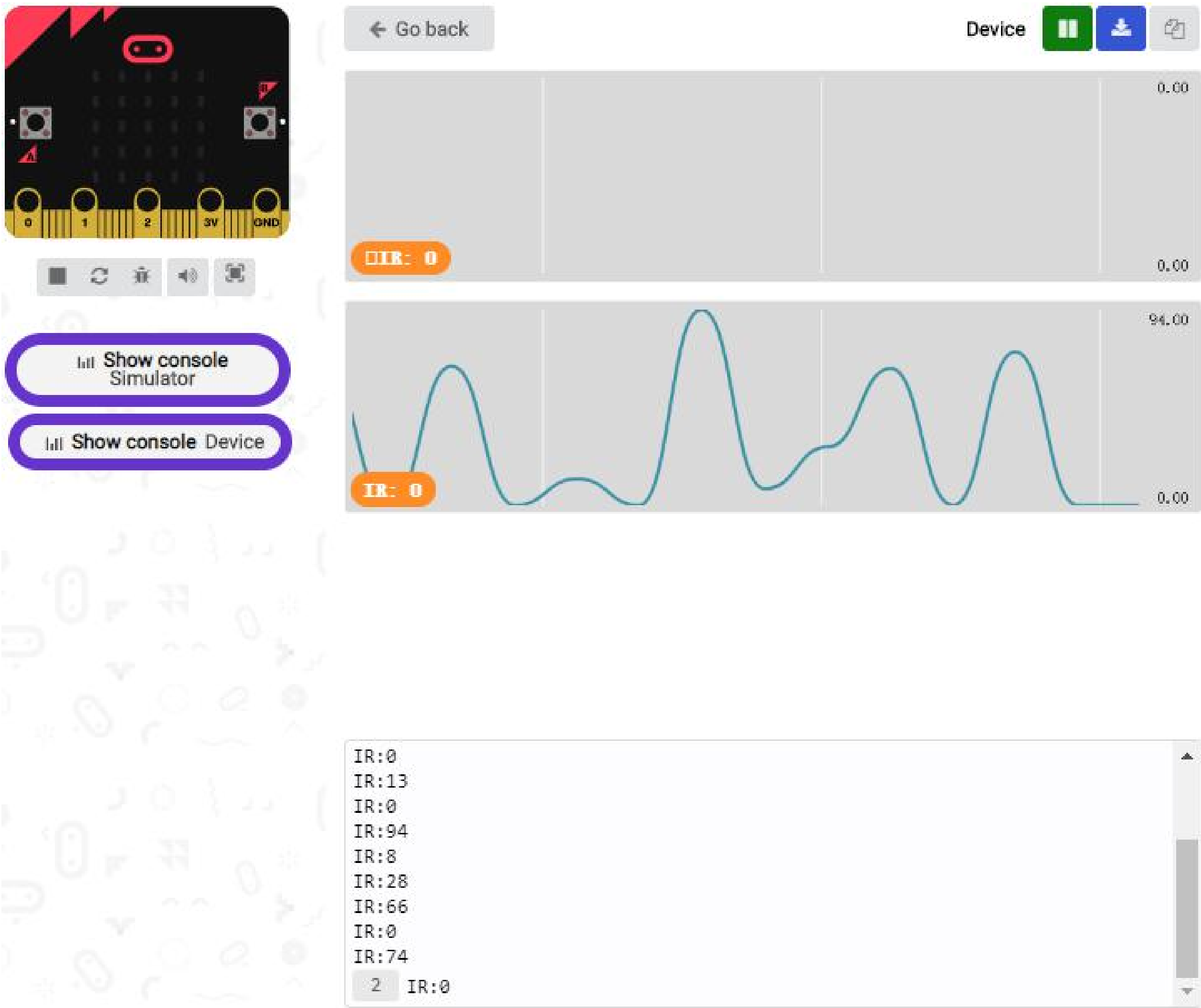
Download code to micro: bit board and don’ t plug off USB cable

Click 

(How to quick download?)

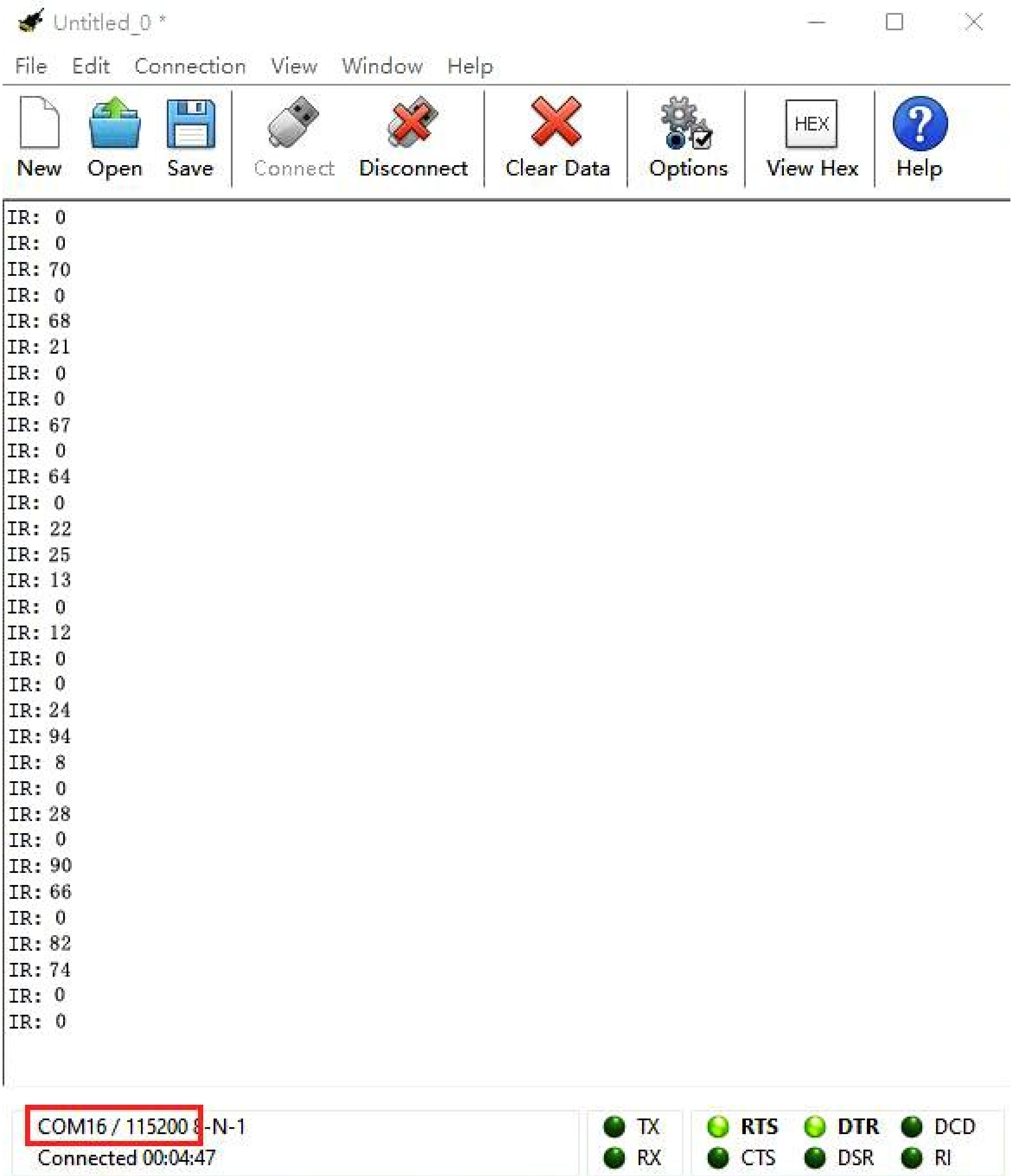


Make IR remote control point at IR receiver and press the button, the serial monitor will display the corresponding key values, as shown below :

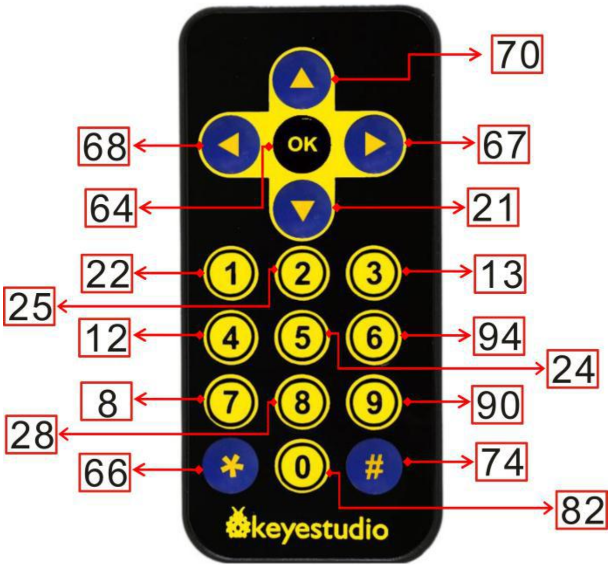


Open CoolTerm, click Options to select SerialPort. Set COM port and 115200 baud rate. Click “OK” and “Connect” .

CoolTerm serial monitor shows the key value as follows:


Untitled_0 *
File Edit Connection View Window Help
New
Open
Save
Connect
Disconnect
Clear Data
Options
HEX
View Hex
Help
IR: 0
IR: 0
IR: 70
IR: 0
IR: 68
IR: 21
IR: 0
IR: 0
IR: 67
IR: 0
IR: 64
IR: 0
IR: 22
IR: 25
IR: 13
IR: 0
IR: 12
IR: 0
IR: 0
IR: 24
IR: 94
IR: 8
IR: 0
IR: 28
IR: 0
IR: 90
IR: 66
IR: 0
IR: 82
IR: 74
IR: 0
IR: 0
COM16 / 115200 8-N-1
Connected 00:04:47
TX
RX
RTS
CTS
DTR
DSR
DCD
RI

The key value is displayed as for your reference:



8.19.2: IR Remote Control

1. Description :

In this project, we combine IR remote control with car shield to make an IR remote smart car. Its principle is to control the motion of car by sending key signals from IR remote control to IR receiving module of car shield.

2. Experimental Preparation :

(1) Insert micro:bit board into slot of V2 shield.

(2) Place batteries into battery holder.

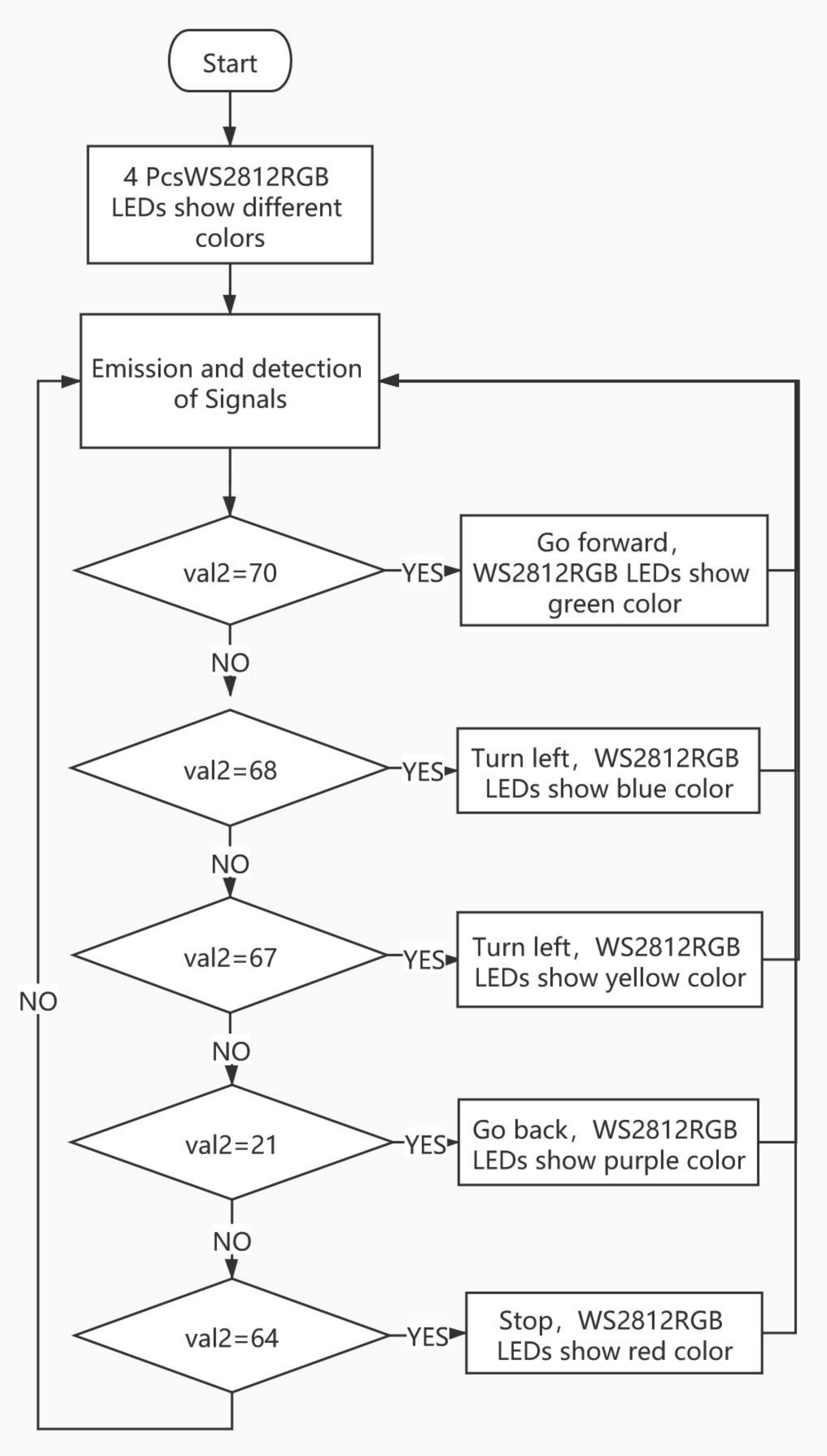
(3) Dial power switch to ON end

(4) Connect micro:bit to computer by USB cable and open online Makecode editor.

(5) Import Hex profile **(How to import?)** , or click “New Project” and drag blocks step by step(add turtle-bit extension library first)

(How to add turtle-bit extension?)

3. Flow Chart


Start
4 PcsWS2812RGB LEDs show different colors
Emission and detection of Signals
val2=70
YES
Go forward, WS2812RGB LEDs show green color
NO
val2=68
YES
Turn left，WS2812RGB LEDs show blue color
NO
val2=67
YES
Turn left，WS2812RGB LEDs show yellow color
NO
val2=21
YES
Go back，WS2812RGB LEDs show purple color
NO
val2=64
YES
Stop，WS2812RGB LEDs show red color
NO

4. Test Code:

Type	Route	File Name
Hex file	../Makecode Tutorial/Test Code/8.19：IR Remote Control Smart Car/8.19.2：IR Remote Control	microbit-IR Remote Control .hex

Or you could edit code step by step in the editing area.

(1) Enter “IrRemote” to get block “connect IR receiver at P0”

Put it into “on start” block

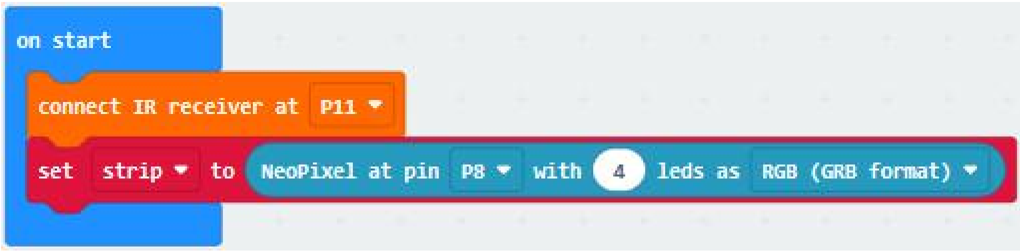
IR receiving module is controlled by P11 of micro:bit board, so click P0 to select P11.

(2) a. Enter “Neopixel” → “set strip to Neopixel at pin P0 with 24 leds as RGB (GRB format)”

b. Place it into “on start” block，

c. Signal end of WS2812 RGB is connected to P8 of micro:bit board . So we set to P8.

d. The robot has 4 pcs WS2812 RGB lights, therefore, change 24 into 4.



(3) Go to “Variables” → “Make a Variable...” → “New variable name : ” dialog box.

Enter “val” and click “OK” to produce variable “val”

Move “set val to 0” under “set strip...RGB(RGB format)” block

Then create variable “val2” in same way

Drag “set val2 to 0” into “on start”

Edit the code as follows:

(4) Copy “set val2 to 0” once and move it into “forever” block.

Click the triangle button to select “val”

Go to “IrRemote” to drag block “IR button” into 0 box.

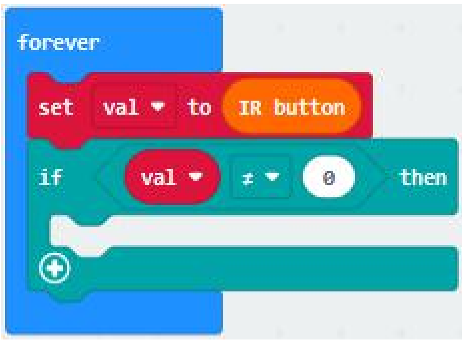
****

(5) Enter “Logic” → “if true then” and place it into “forever”

Drag block “=” block into “true” box

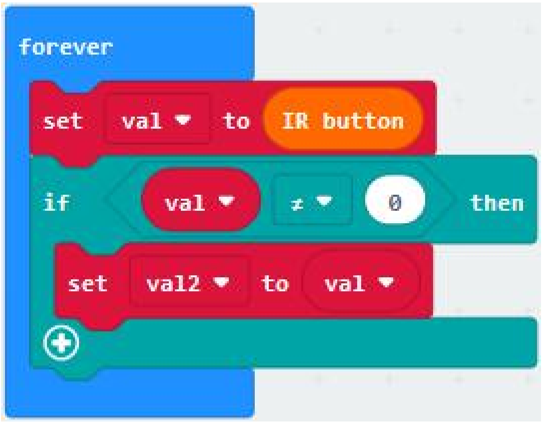
Go to “Variables” and move “val” block into left box of “=” .

Then click “=” to set “≠”



(6) Duplicate “set val2 to 0” block again and leave it under the block “if...val...then” block.

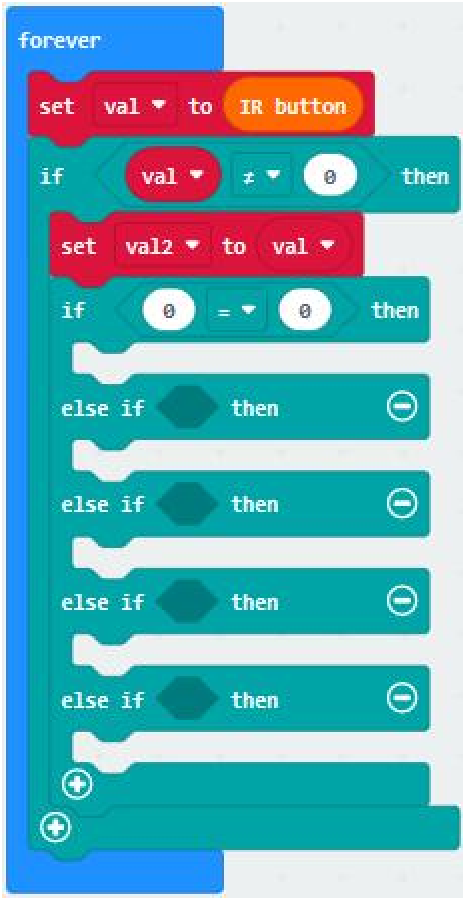
Then drag out variable “val” into 0 box.



(7) Go to “Logic” to drag block “if. true..then...else” under block “set val2 to val” block.

Then tap “ ” four times and delete “ ” behind “else”

Move “=” block into “true” box.



(8) Go to “Variables” to move block “val2” into left box of “=”

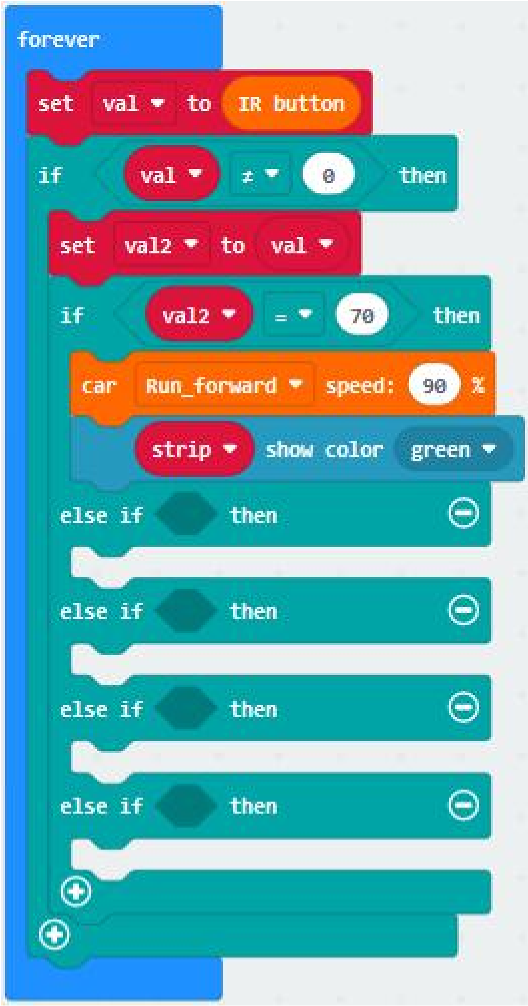
Change 0 into 70.

(9) Enter “TurtleBit” → “car Run_Forward speed: 0%”

Leave it under the second block “if...val2..then” block and change 0 into 90.

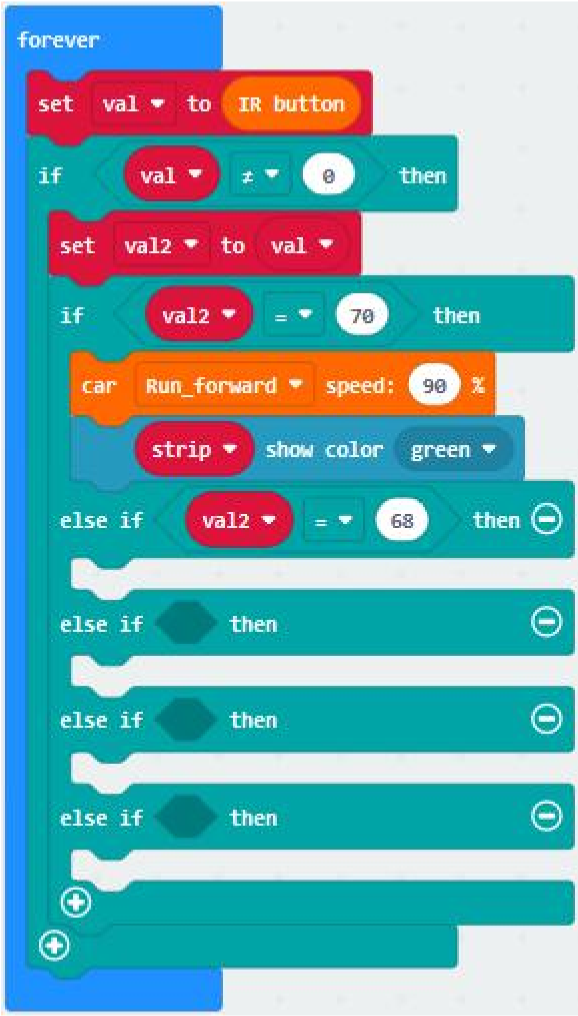
Go to “Neopixel” to move block “strip show color red” under block “car Run_Forward speed: 90%”

Change red into green.



(10) Replicate code “val2=70” once and leave it into box behind “else if...then”.

Change 70 into 68

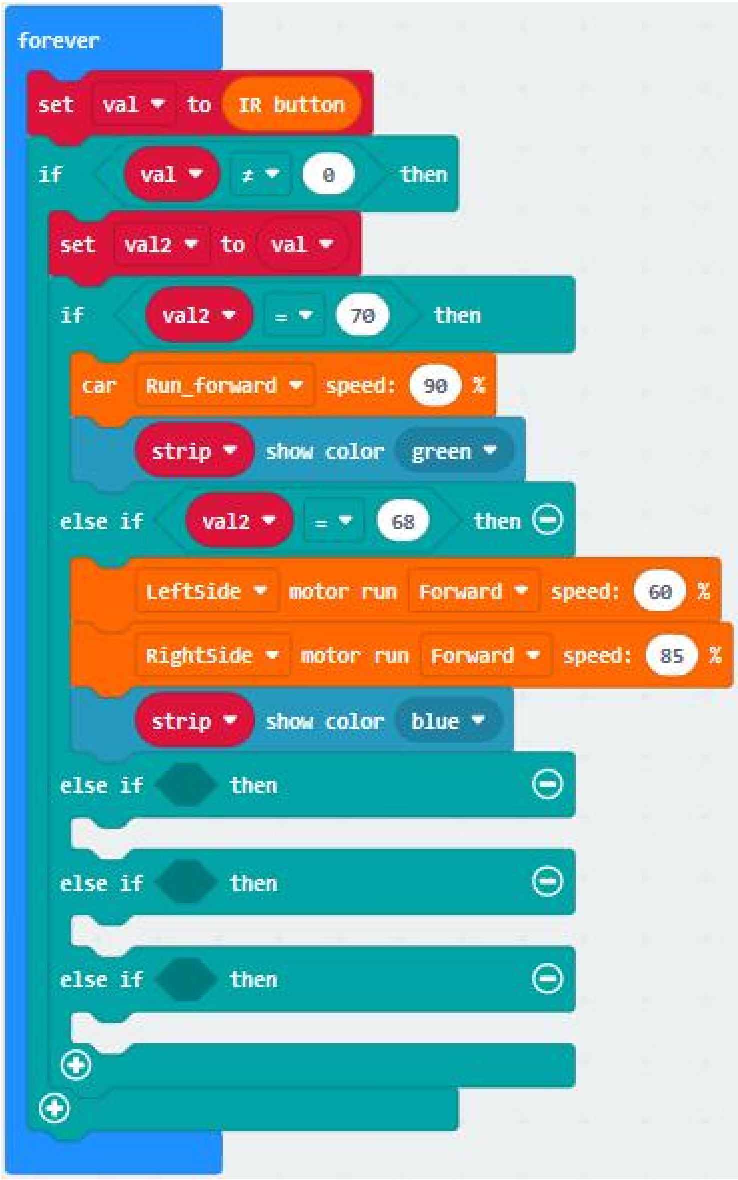


(11) Click “TurtleBit” to drag “LeftSide motor run Forward speed: 0%” block under the first “else if ....then” block. And alter 0 into 60

Duplicate “LeftSide motor run Forward speed: 60%” once and alter LeftSide into RightSide and 60 into 85.

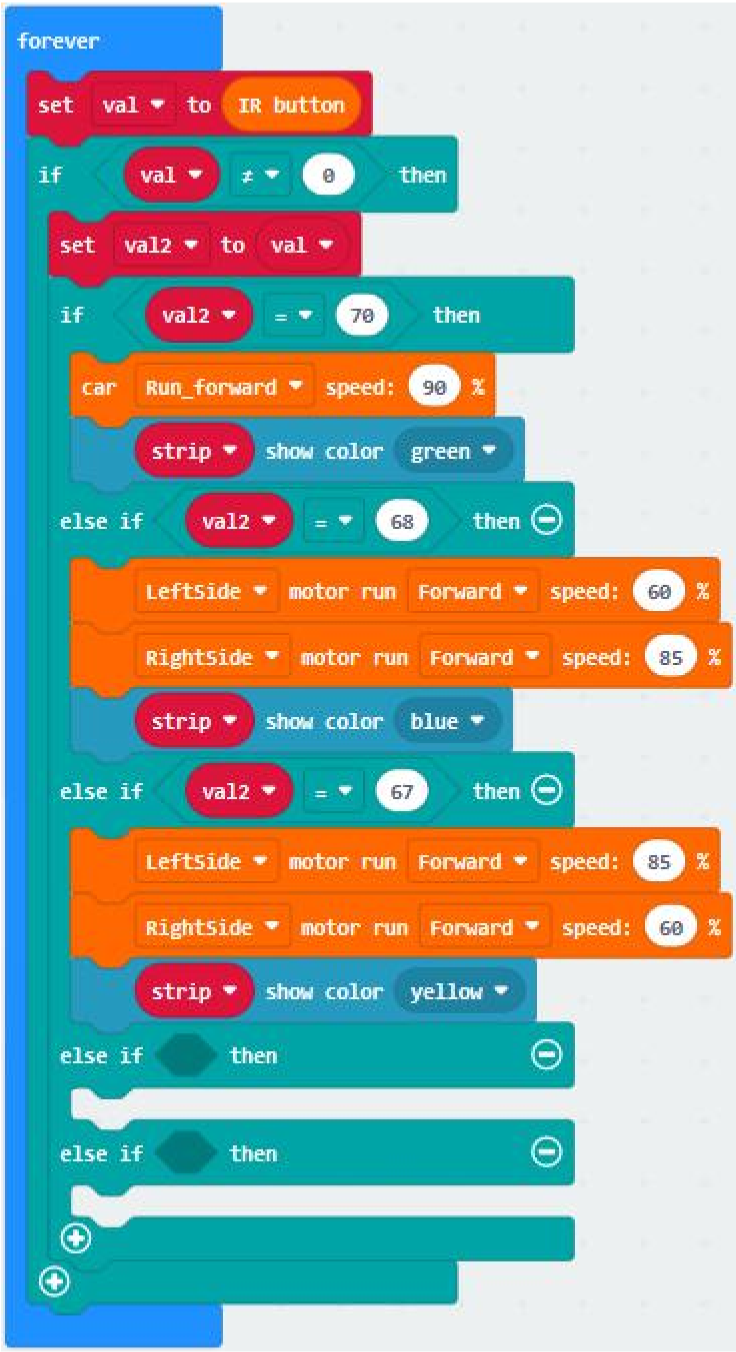
Drag “strip show color red” block under the block “RightSide motor run Forward speed: 85%”

Change red into blue.



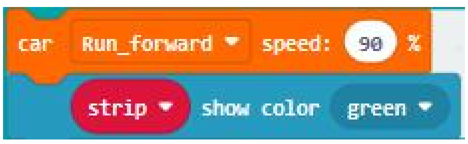
(12) Replicate “val2=68” block and code string

Then edit the code string as follows:



(13) Copy "val2=67" again and keep it into the third box behind "else if....then" block

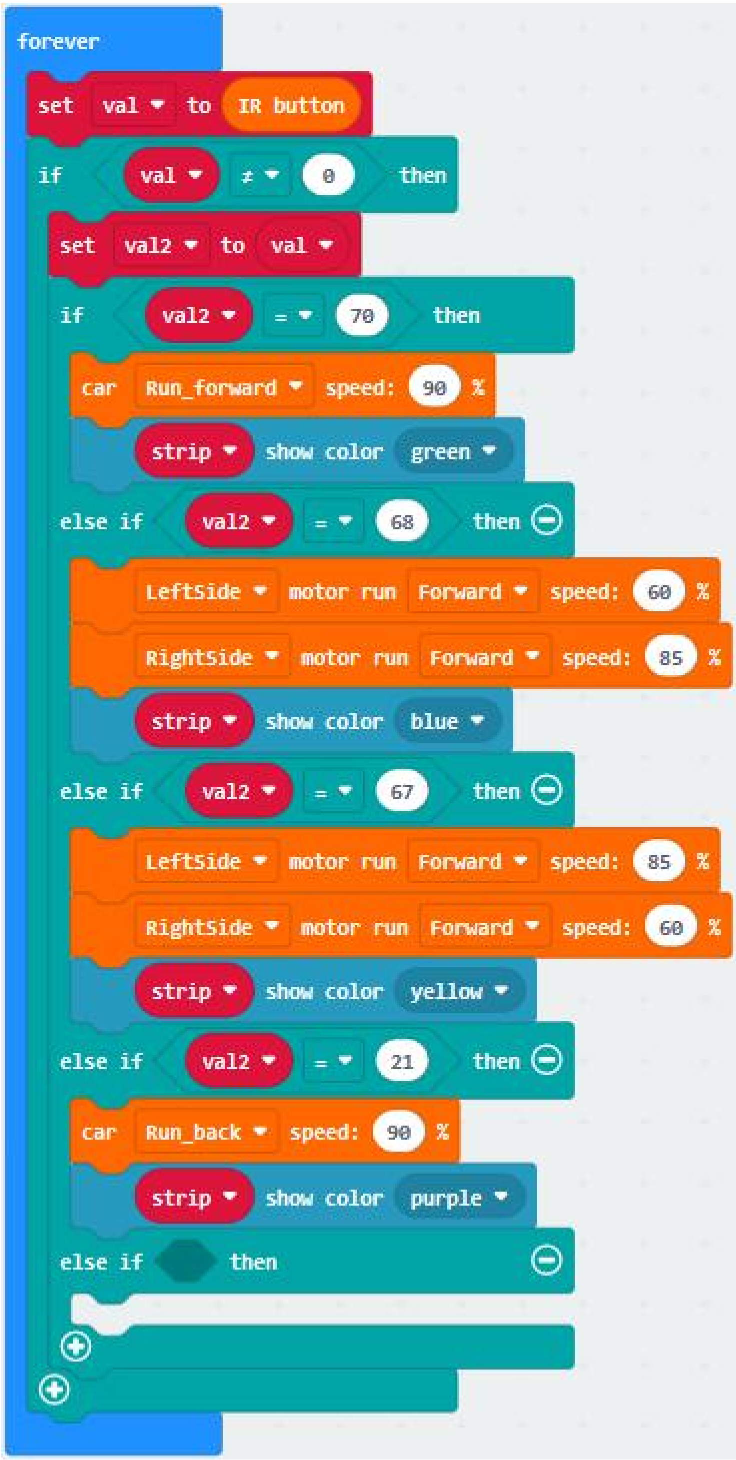
Change 67 into 21.

Replicate code string 

and place it under the

third “else if….then” block.

Change Run_Forward into RunBack and green into purple

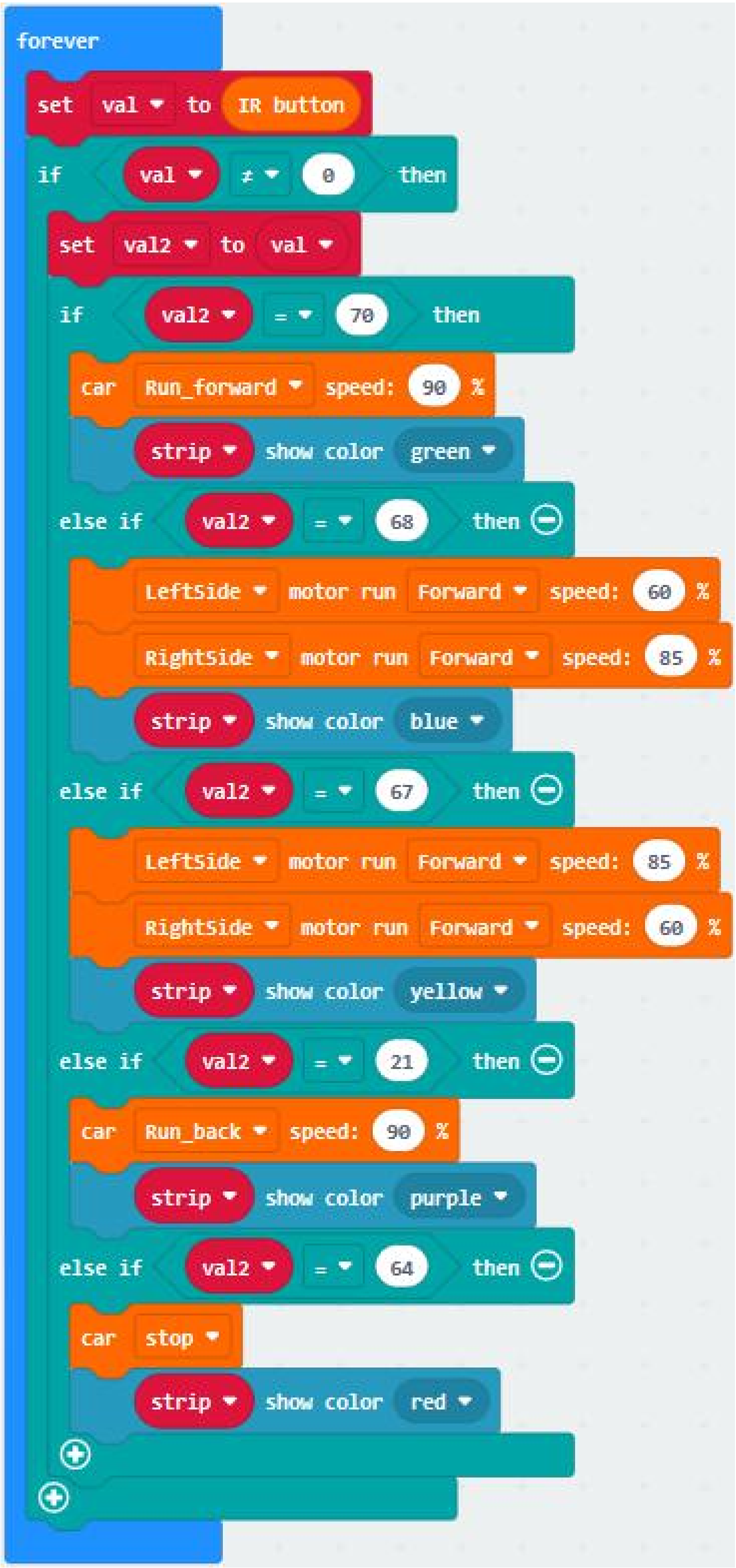


(14) Then replicate “val2=21” once and “strip show color purple” block again

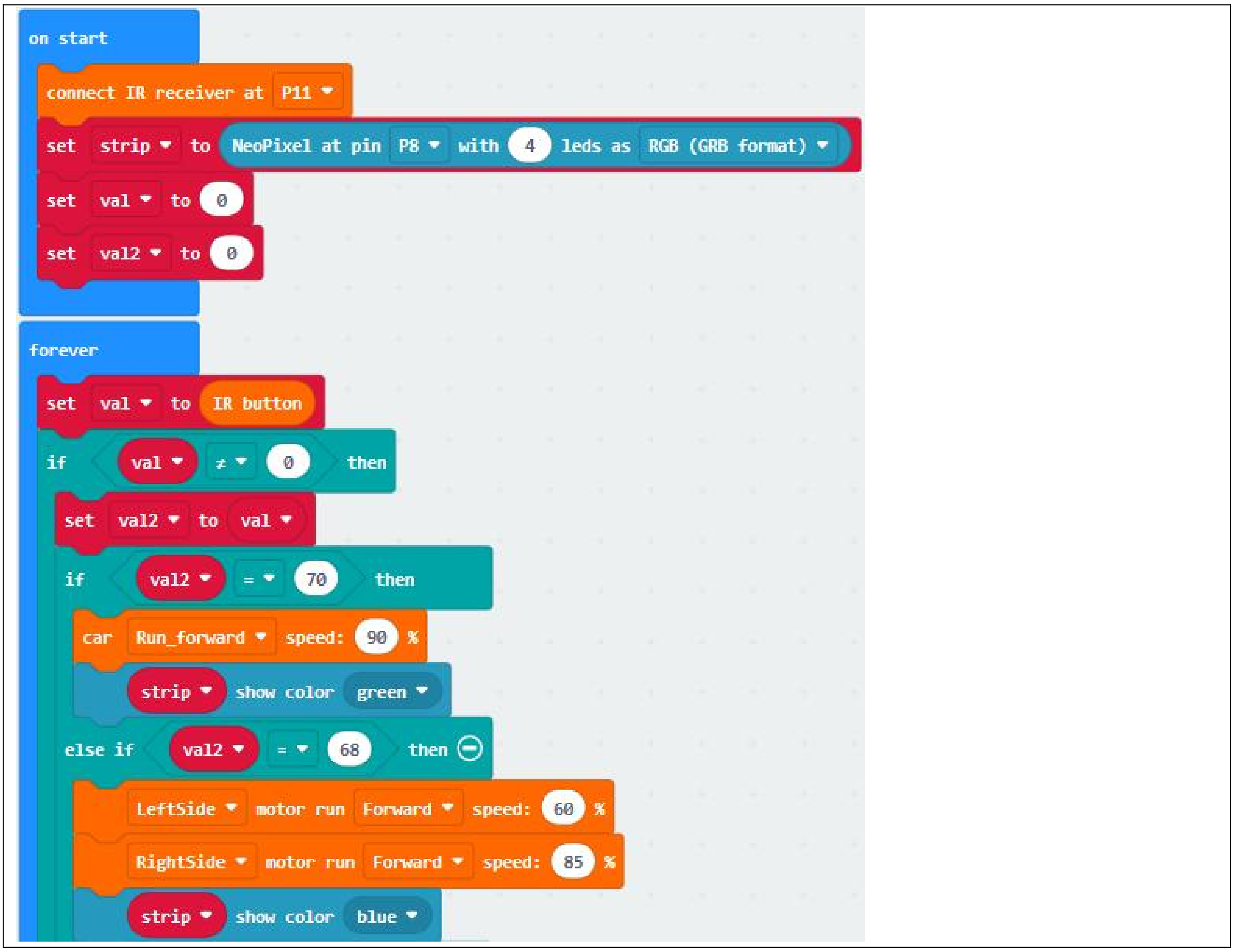
Change 21 into 64 and purple into red

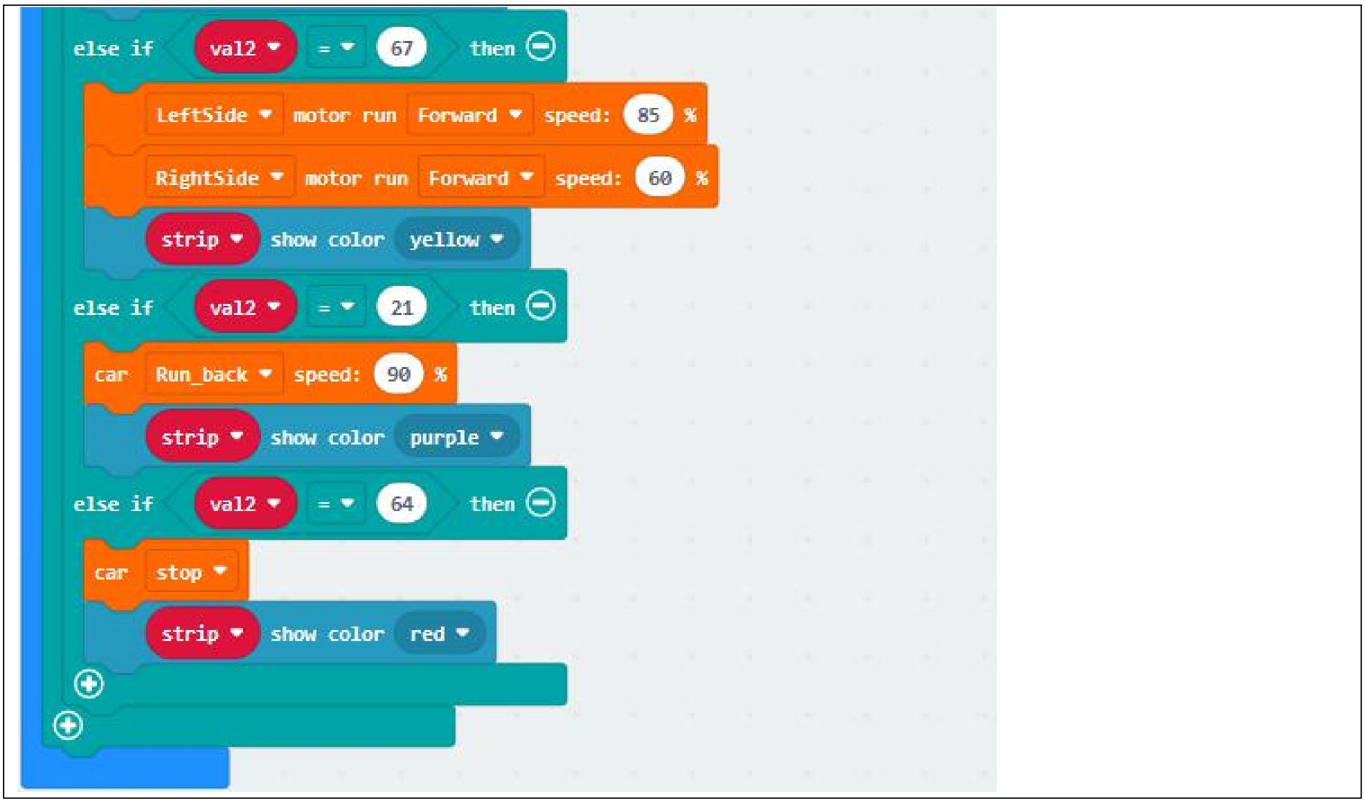
Click “TurtleBit” to move out block “car stop”

Edit the code string as follows:


forever
set val to IR button
if val ≠ 0 then
set val2 to val
if val2 = 70 then
car Run_forward speed: 90 %
strip show color green
else if val2 = 68 then
LeftSide motor run Forward speed: 60 %
RightSide motor run Forward speed: 85 %
strip show color blue
else if val2 = 67 then
LeftSide motor run Forward speed: 85 %
RightSide motor run Forward speed: 60 %
strip show color yellow
else if val2 = 21 then
car Run_back speed: 90 %
strip show color purple
else if val2 = 64 then
car stop
strip show color red

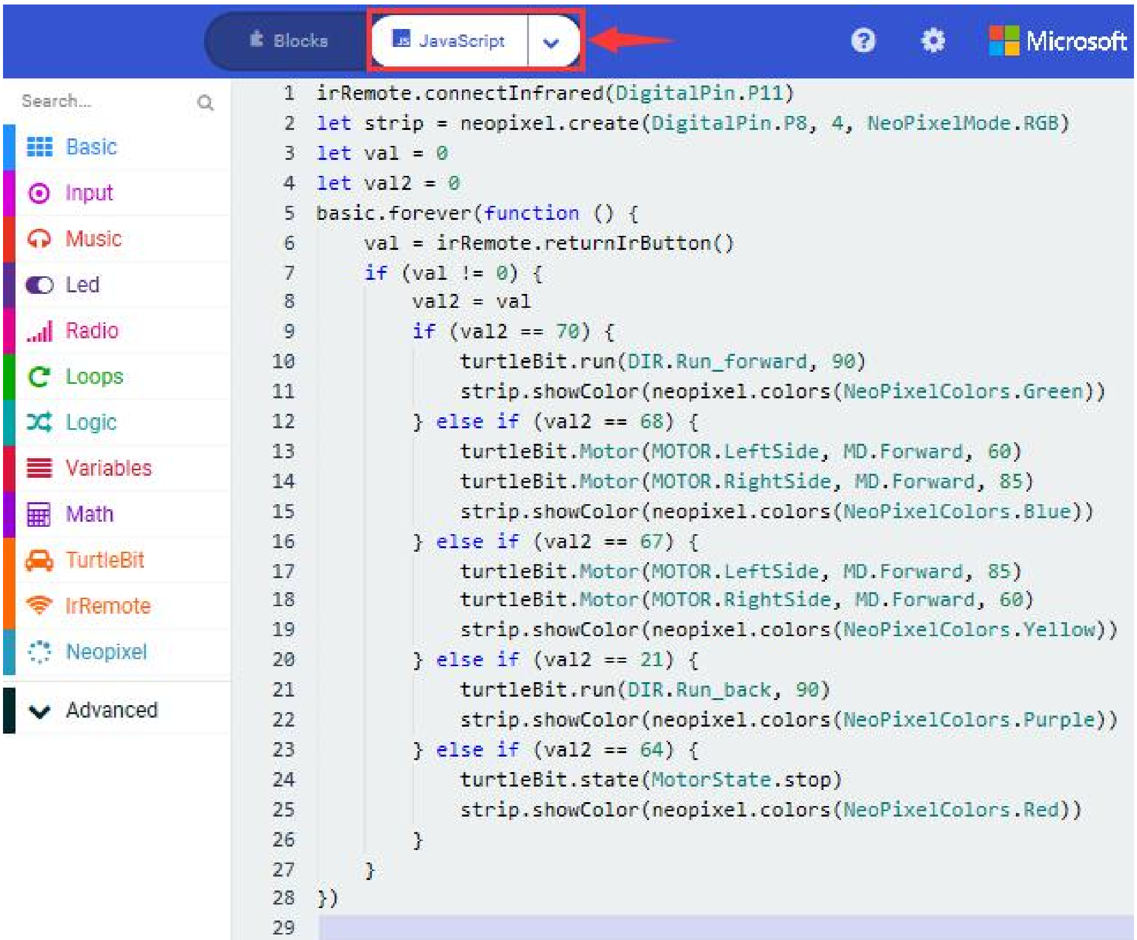
Complete Code




else if val2 = 67 then
LeftSide motor run Forward speed: 85 %
RightSide motor run Forward speed: 60 %
strip show color yellow
else if val2 = 21 then
car Run_back speed: 90 %
strip show color purple
else if val2 = 64 then
car stop
strip show color red

"on start" : command block runs once to start program.
Connect IR receiver to P16
Set strip to Neopixel at pin P8 with 4 leads as RGB
Set val to 0
Set val2 to 0
The program under the block "forever" runs cyclically.
Set val to IR button
If val≠0, execute the program under then block
Set val2 to val
When val2=70, execute the program under then block
Smart car goes forward at 40% speed
18 pcs RGB lights show green color
When val2=68, execute the program under then block
The left car wheels go forward at 15% speed
The right car wheels go forward at 35% speed
18 pcs RGB lights show blue color on strip
When val2=67, execute the program under then block
The left wheel go forward at 35% speed
The right wheels go forward at 15% speed
18 pcs RGB show yellow color on strip
When val2=21, execute the program under then block
When val2=21
Car goes back at 40% speed
18 pcs RGB lights show purple color on strip
When val2=64, execute the program under then block
Car stops
18 pcs RGB lights show red color on strip

Click “JavaScript" to switch into the corresponding JavaScript code:

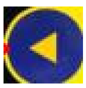


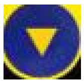
5. Test Results :

(How to download? How to quick download?)

Download code to micro:bit board, and dial POWER to ON end.

Make IR remote control point at micro:bit and press the button to control smart car to move.

 button makes smart car move forward ,  stands for turning left ,

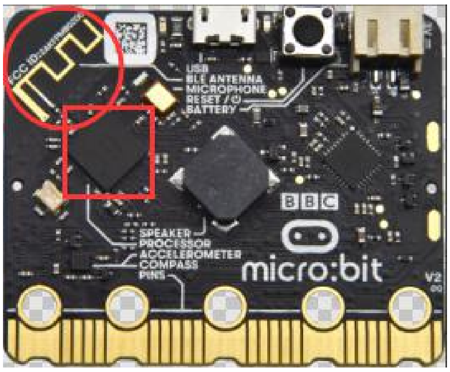
 implies rightward turning,  indicates moving backward ,  stops car , and 4pcs WS2812RGB light up the corresponding color.

(How to download?   How to quick download?)

Note: the distance between IR remote control and IR receiving head of smart car are supposed less than 5m, during the test.

8.20: Bluetooth Multi-purpose Smart Car

8.20.1: Read Bluetooth Data



1. Description :

In this lesson, we will control smart car to perform different functions by Bluetooth of micro:bit board. We provide you with an App.

Let’ s know its interface and function of every icon first

2. Experimental Preparation :

(1) Insert micro:bit board into slot of V2 shield.

(2) Place batteries into battery holder.

(3) Dial power switch to ON end

(4) Connect micro:bit to computer by USB cable and open online Makecode editor.

(5) Import Hex profile **(How to import?)** , or click "New Project" and drag blocks step by step(add turtle-bit extension library first)

(How to add turtle-bit extension?)

As the Bluetooth and extension radio can't work together, therefore, their extension libraries are not compatible.

Therefore, remove extension(s) and add Bluetooth please if you see the following prompt box pop up.

3. Test Code：

Type	Route	File Name
Hex file	../Makecode Tutorial/Test Code/8.20：Bluetooth Multi-purpose Smart Car/8.20.1：Read Bluetooth Data	microbit-Read Bluetooth Data.hex

Or you could edit code step by step in the editing area.

(1) Enter “Advanced” → “Serial” → “serial redirect to USB”

Place it into “on start”

****

(2) Click “Bluetooth” → “on bluetooth connected”

Go to “Basic” to move “show icon” block into “on bluetooth connected” block.

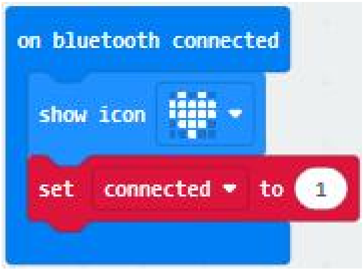
****

(3) Click “Variables” → “Make a Variable...” → “New variable name：”

dialog box.

Input “connected” and click “OK” to create variable “connected” .

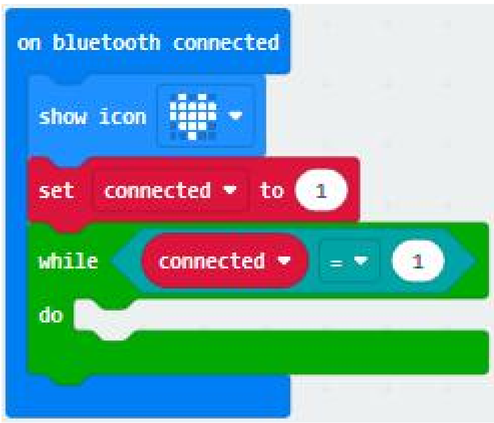
Drag “set connected to 0” under block “show icon” and change 0 into 1.



(4) Go to “Loops” to move block “while true do...” into “on bluetooth connected” block.

Enter “Logic” to drag out “=” block.

Click “Variables” to drag “connected” into left box of “=” block and change 0 into 1.



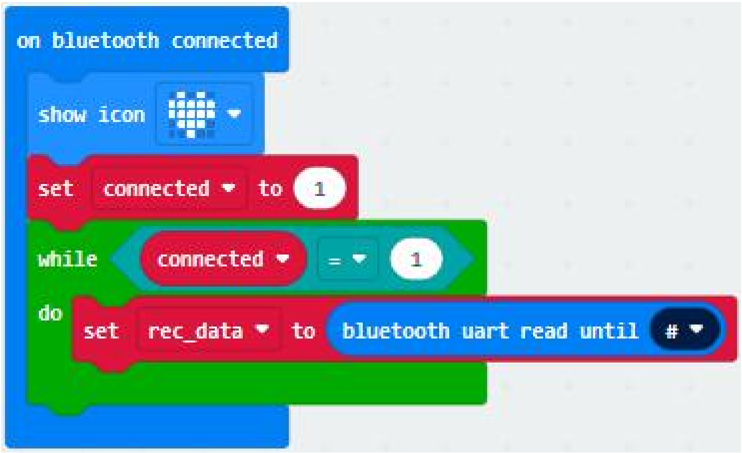
****

(5) Then we generate variable “rec_data” in same way.

Then drag out “set rec_data to 0” and place it into block “while connected=1 do…” block.

Click “Bluetooth” → “more” → “bluetooth uart read until new line( )”

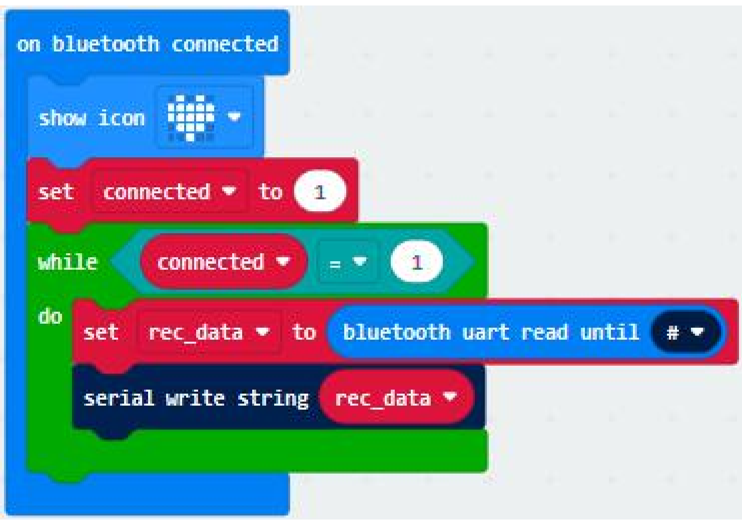
Keep it into 0 box and click triangle button to select #.



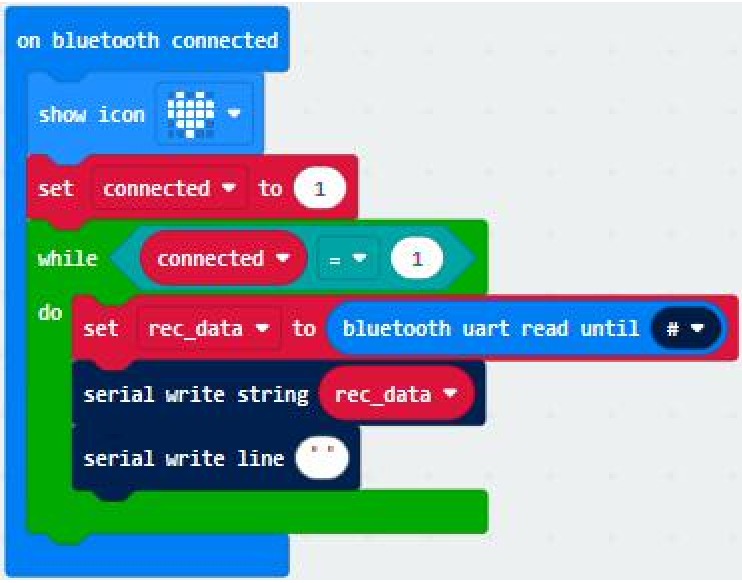
(6) Go to “Advanced” → “Serial” → “serial write string”

Move it below “set rec_data…until#” block

And combine variable “rec_data” with “serial write string” block.



(7) Click “Advanced” → “Serial” → “serial write line” and edit code string as follows:

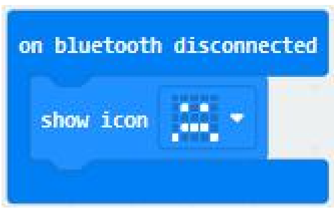


(8) Click “Bluetooth” to drag out “on bluetooth disconnected” .

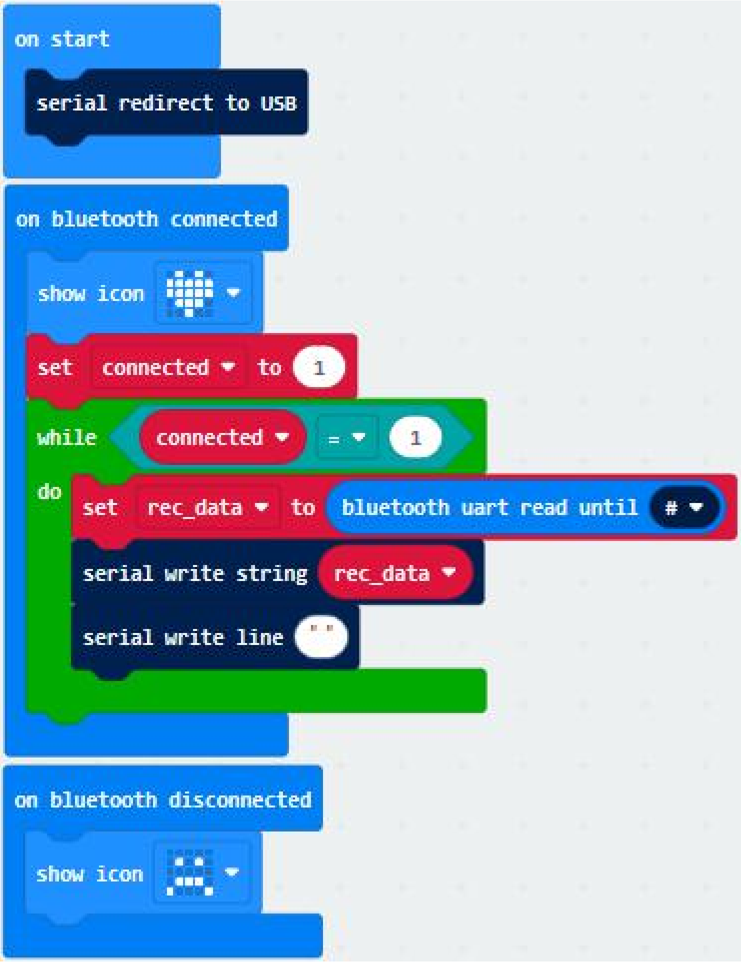
(9) Go to “Bluetooth” → “on bluetooth disconnected”

Copy “show icon” block and keep it into block “on bluetooth disconnected”

Click triangle button to select “” pattern.



Complete Program



"on start" : command block runs once to start program.

Serial redirect to USB

Connect Bluetooth

LED dot matrix shows "❤" pattern

Set variable connected to 1

When connected=1, the code under do block will be executed.

Set rec_data to bluetooth uart read until #

Serial port prints rec_data

Print a blank space

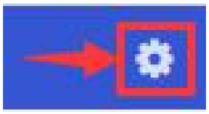
Disconnect Bluetooth

LED dot matrix displays "" pattern.

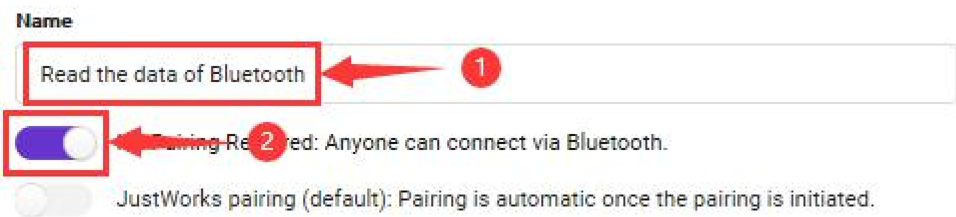
Click “JavaScript" to view the corresponding JavaScript code:

2. Test Results：

If you drag blocks step by step, you need to set as follows after finishing test code.

Click  → 

→



However, you could skip this step if you directly import test code.

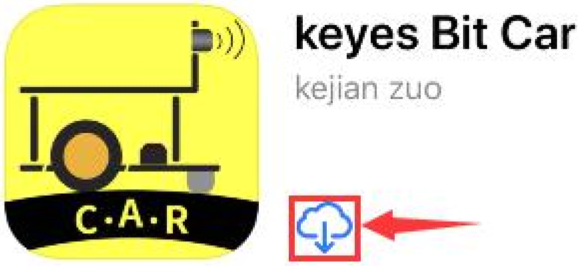
After setting, download code to micro:bit board, don’t plug off USB cable(How to download? How to quick download?)

Next to download App.

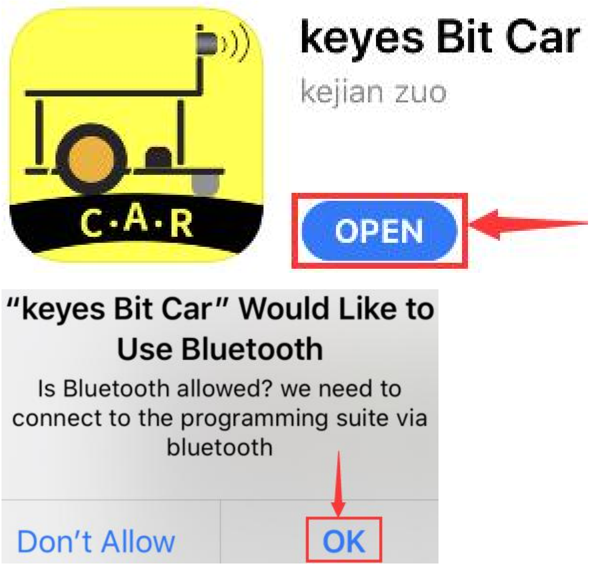
For IOS system

a. Open App Store

b. Search keyes Bit Car and click “” icon to download keyes Bit Car



c. After the download, tap “OK” when a dialog box appears up.



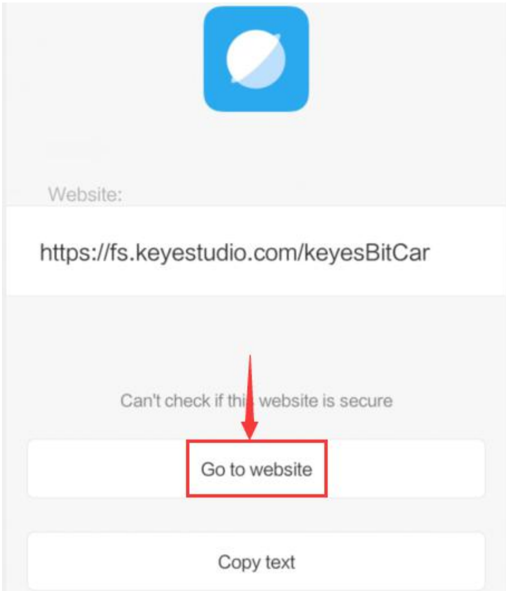
d. Enable Bluetooth of cellphone or iPad.

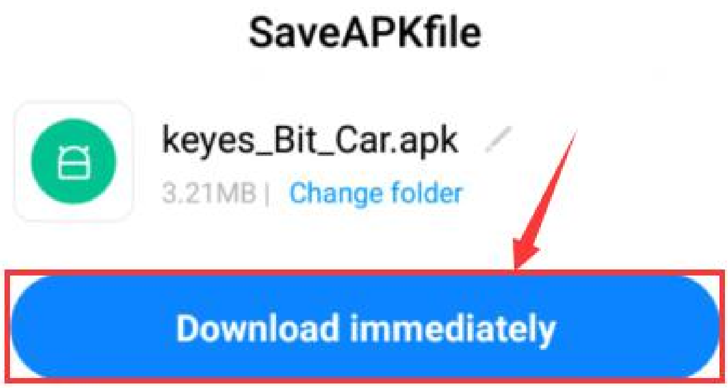
Click “connect” button to search Bluetooth.

Then select “BCC micro:bit” to connect Bluetooth.

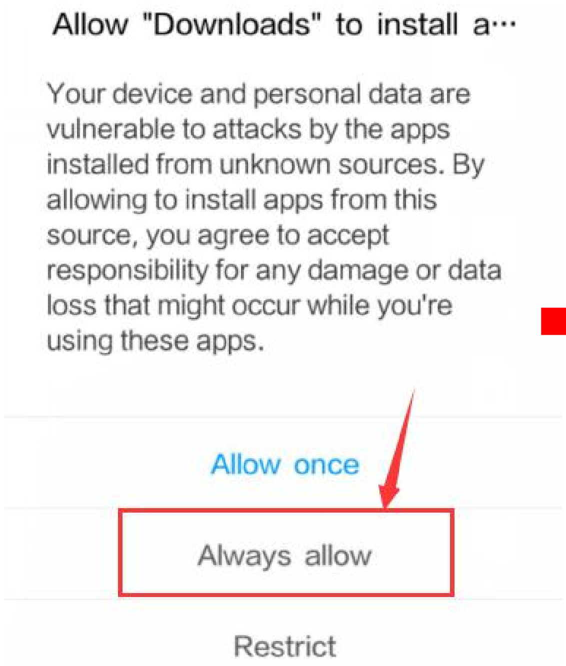
For Android system

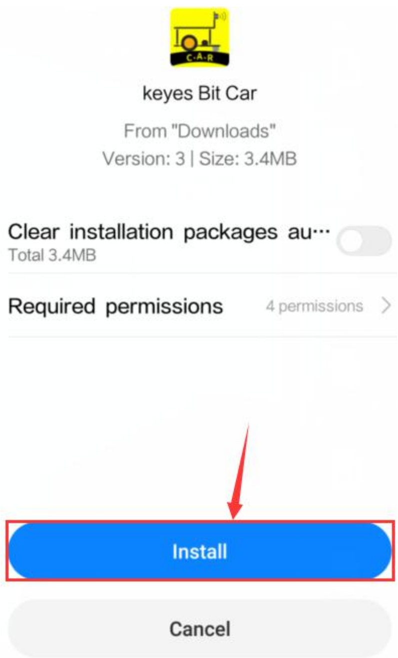
Scan the QR code and enter website to download keyes_Bit_Car.apk





Then click "Always allow" and tap "install"

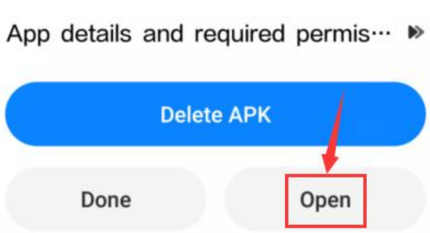


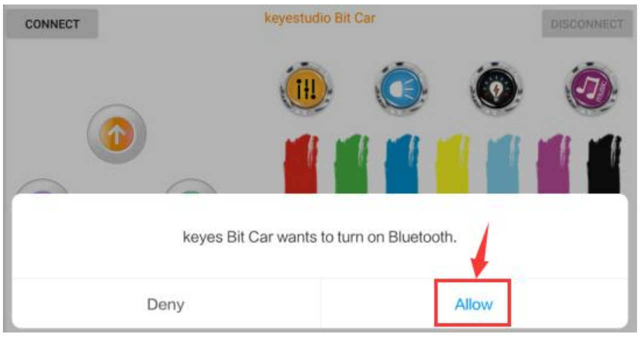


e. Tap "Open" or click "keyes Bit Car" icon to enter app.

A dialog box appears, then click "Allow" to turn on Bluetooth.

You also enable Bluetooth firstly.



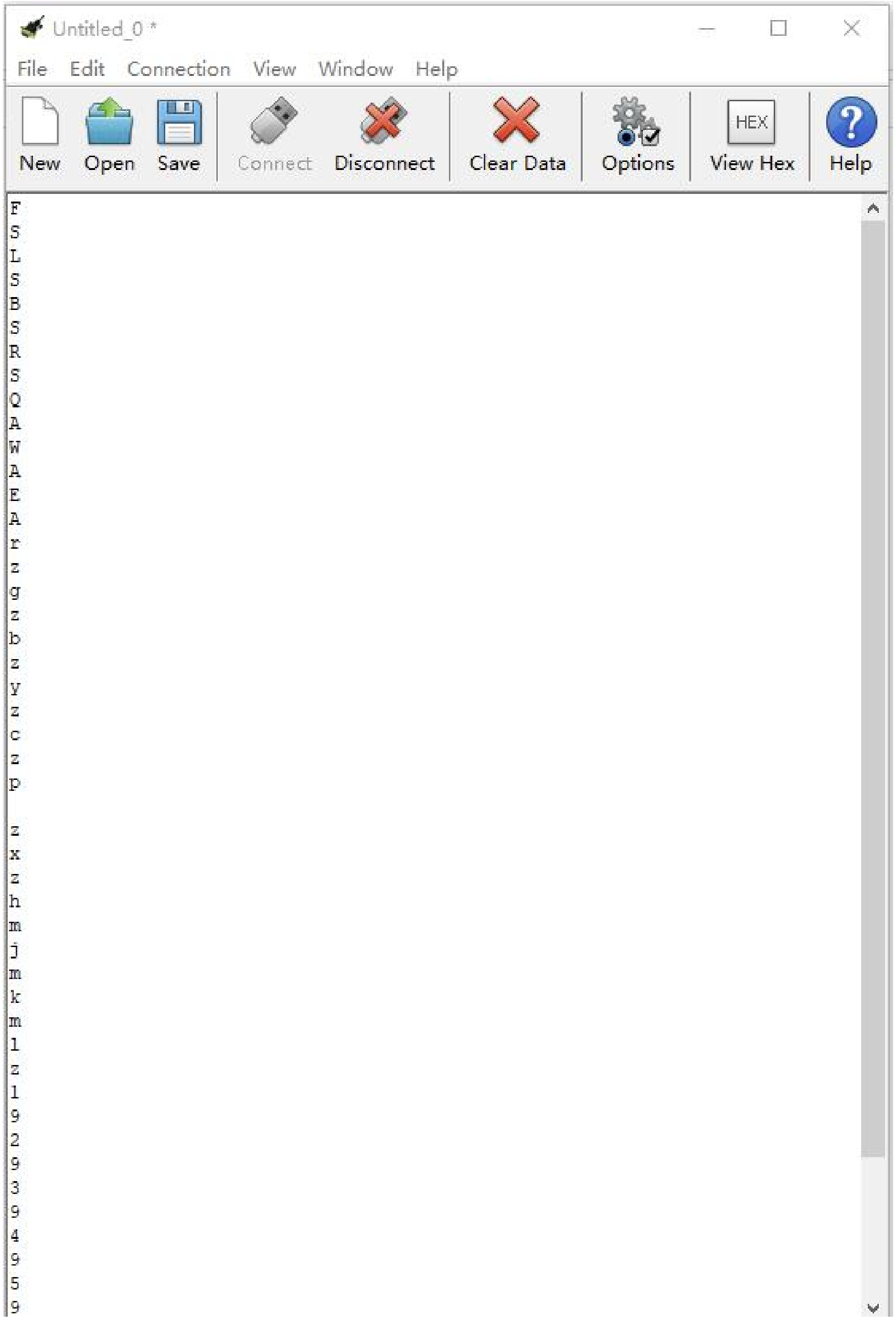


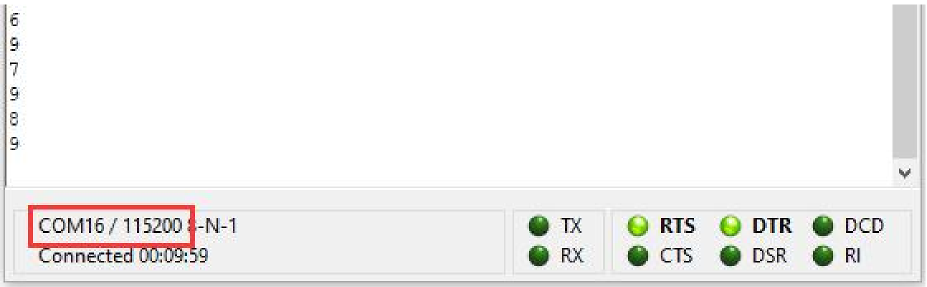
Click "CONNECT" to search and link with Bluetooth.

Open CoolTerm, click Options to select SerialPort. Set COM port and

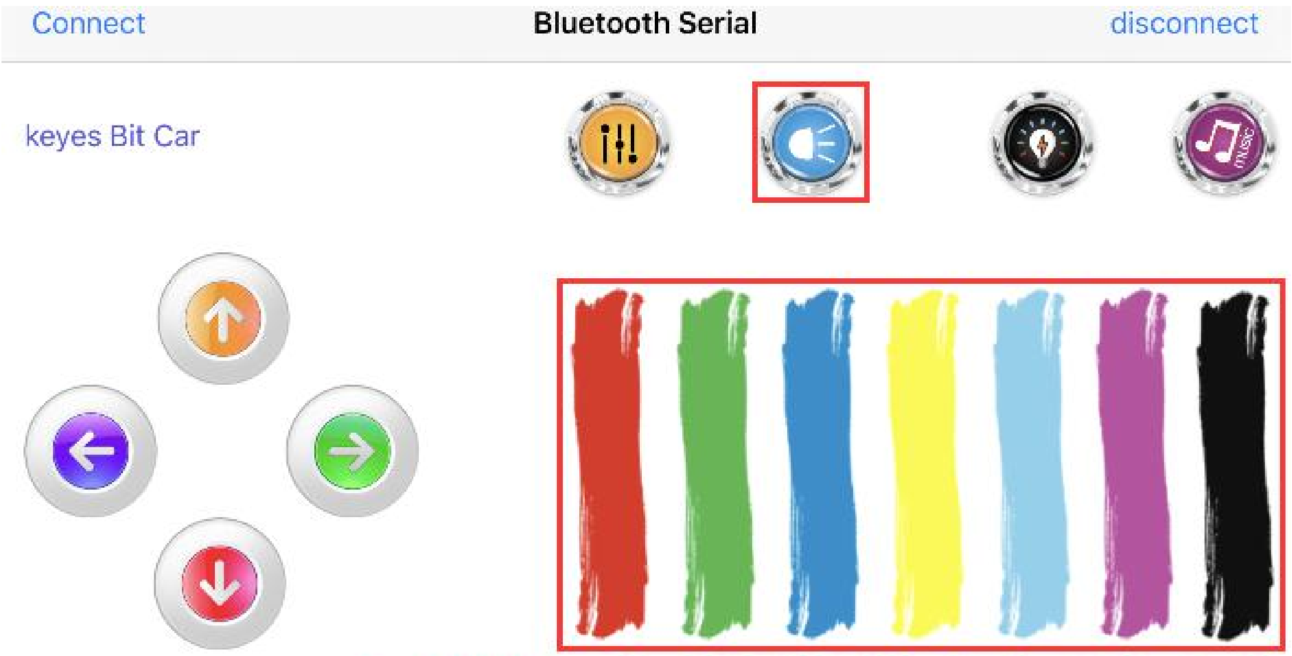
115200 baud rate. Click “OK” and “Connect” .

Point at micro:bit board and press the icons on APP, the corresponding characters are shown on CoolTerm monitor.

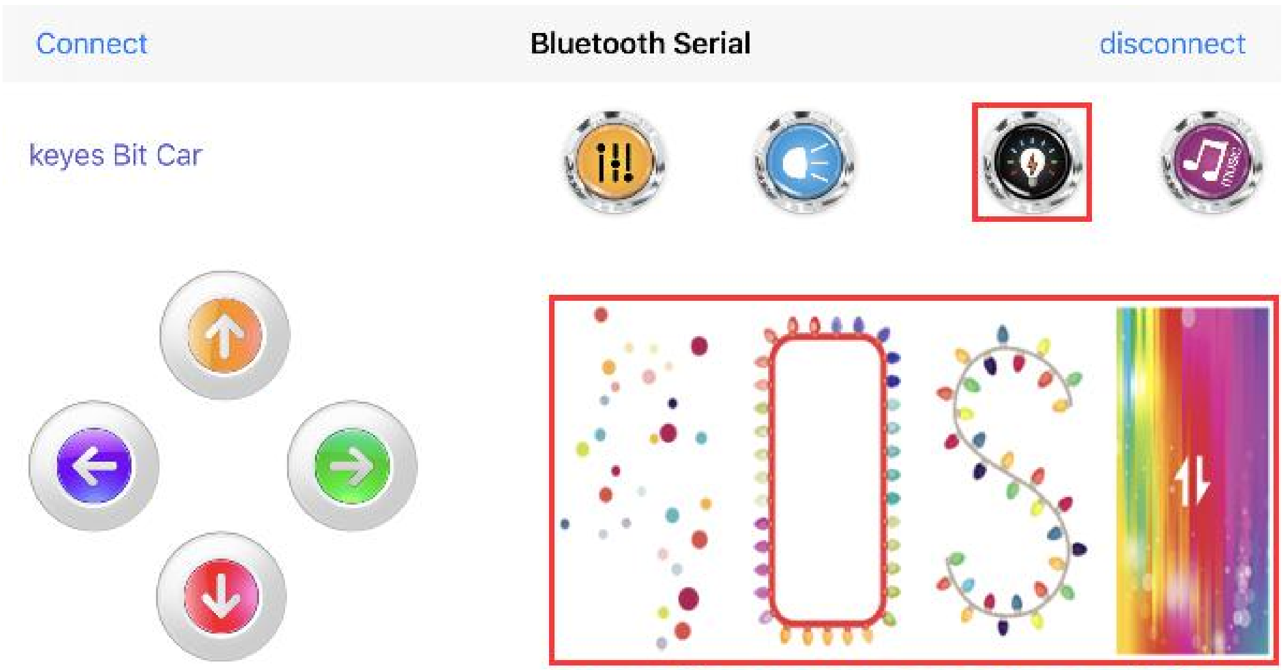




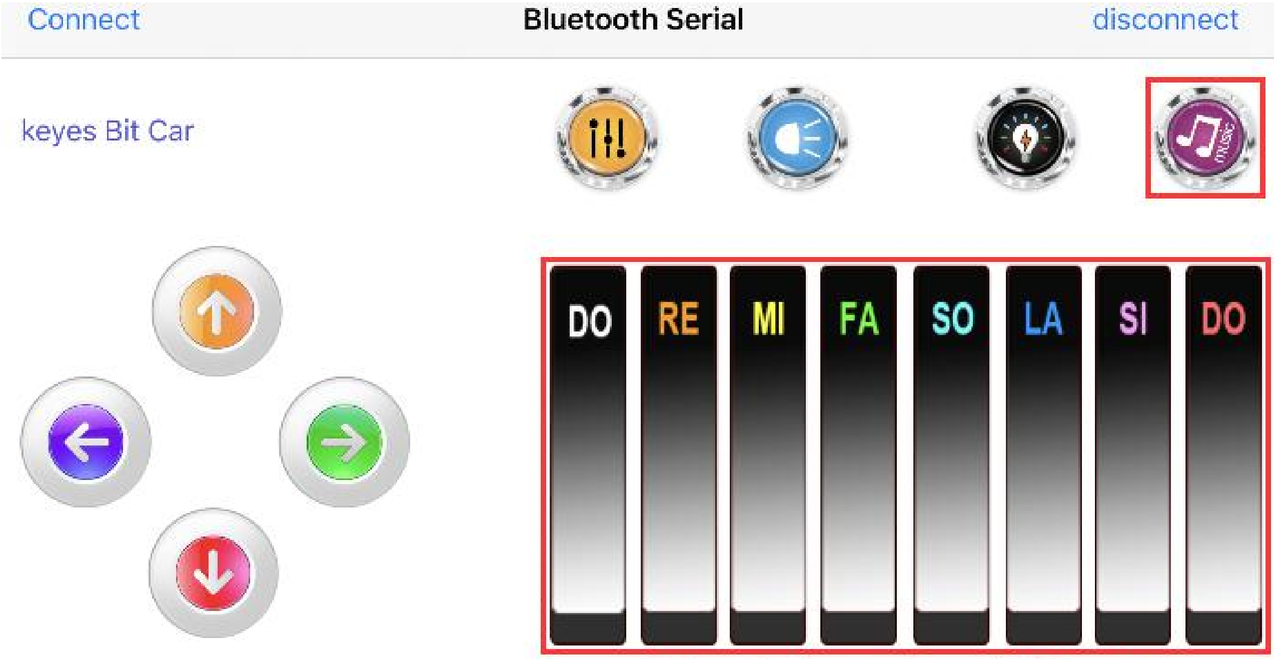
Through the test, we get the function of every icon, as shown below:



Control the two front RGB lights to display distinct color



control 4 pcs WS2812 RGB to light up



control passive buzzer to emit different tones

8.20.2: Multi-purpose Smart Car

1. Description :

In this lesson, we will control the smart car to perform multipurpose function.

2. Experimental Preparation :

(1) Insert micro:bit board into slot of V2 shield.

(2) Place batteries into battery holder.

(3) Dial power switch to ON end

(4) Connect micro:bit to computer by USB cable and open online Makecode editor.

(5) Import Hex profile **(How to import?)** , or click “New Project” and drag blocks step by step(add turtle-bit extension library first)

(How to add turtle-bit extension?)

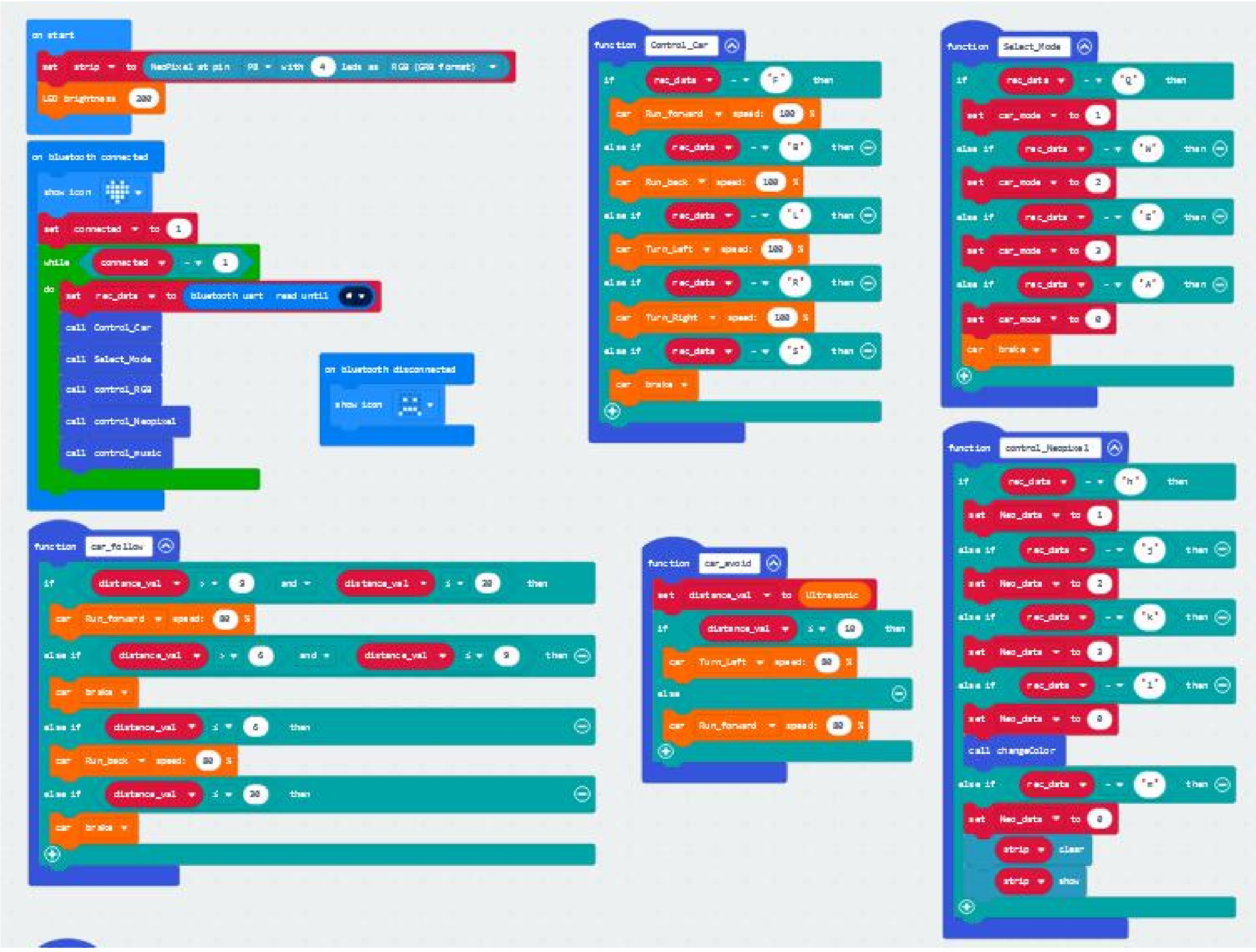
As the Bluetooth and extension radio can’t work together, therefore, their extension libraries are not compatible.

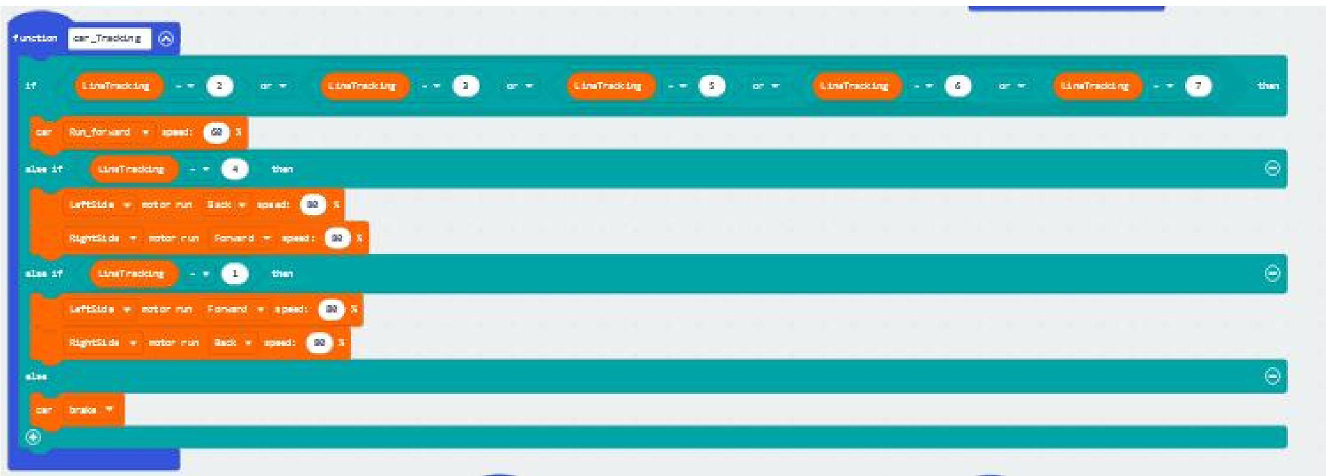
Therefore, remove extension(s) and add Bluetooth please if you see the following prompt box pop up.

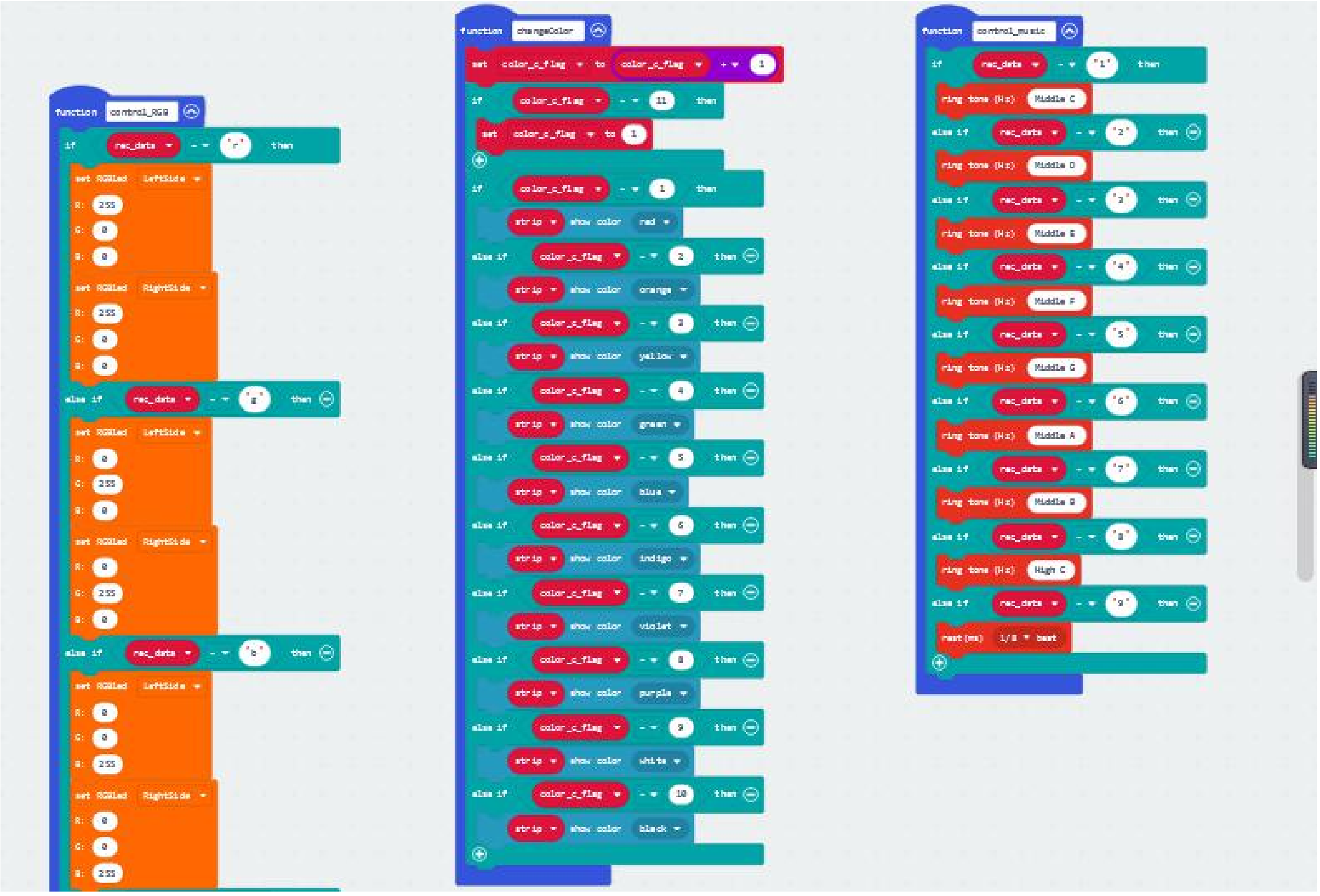
3. Test Code :

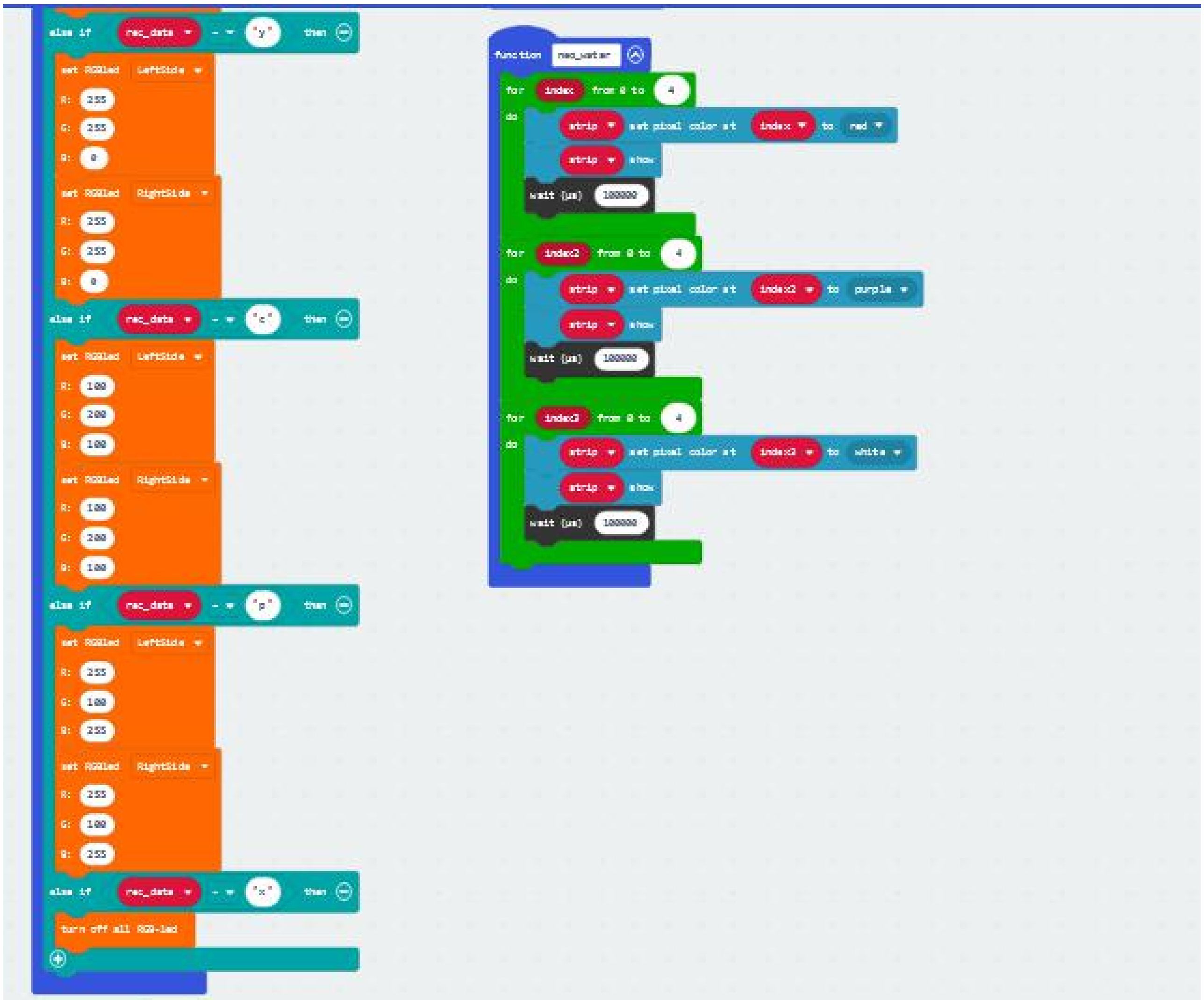
Type	Route	File Name
Hex file	../Makecode Tutorial/Test Code/8.20 : Bluetooth Multi-purpose Smart Car /8.20.2 : Multi-purpose Smart Car	microbit-Multi-purpose Smart Car.hex

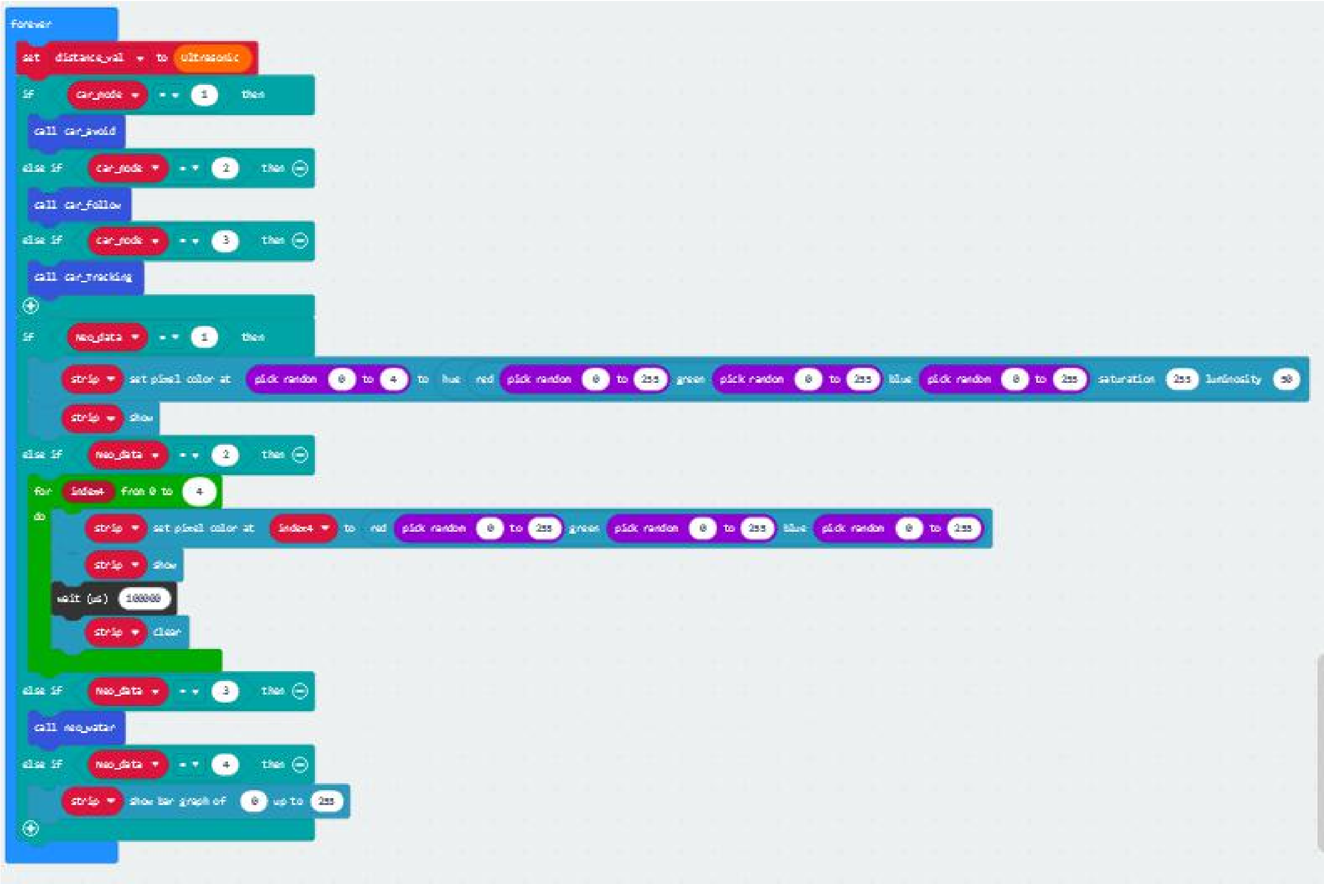
Complete Code






function control_RGB
function changeColor
function control_music


else if rec_data = "y" then
set RGBled LeftSide
R: 255
G: 255
B: 0
set RGBled RightSide
R: 255
G: 255
B: 0
else if rec_data = "c" then
set RGBled LeftSide
R: 100
G: 200
B: 100
set RGBled RightSide
R: 100
G: 200
B: 100
else if rec_data = "p" then
set RGBled LeftSide
R: 255
G: 100
B: 255
set RGBled RightSide
R: 255
G: 100
B: 255
else if rec_data = "x" then
turn off all RGB-led
function rec_water
for index from 0 to 4
do
strip set pixel color at index to red
strip show
wait (µs) 100000
for index2 from 0 to 4
do
strip set pixel color at index2 to purple
strip show
wait (µs) 100000
for index3 from 0 to 4
do
strip set pixel color at index3 to white
strip show
wait (µs) 100000


forever
set distance_val to ultrasonic
if car_mode = 1 then
call car_avoid
else if car_mode = 2 then
call car_follow
else if car_mode = 3 then
call car_tracking
if neo_data = 1 then
strip set pixel color at pick random 0 to 4 to hue red pick random 0 to 255 green pick random 0 to 255 blue pick random 0 to 255 saturation 255 luminosity 50
strip show
else if neo_data = 2 then
for index4 from 0 to 4
do
strip set pixel color at index4 to red pick random 0 to 255 green pick random 0 to 255 blue pick random 0 to 255
strip show
wait (µs) 100000
strip clear
else if neo_data = 3 then
call neo_water
else if neo_data = 4 then
strip show bar graph of 0 up to 255

Click “JavaScript" to switch into the corresponding JavaScript code:

```
function Select_Mode () {
    if (rec_data == "Q") {
        car_mode = 1
    } else if (rec_data == "W") {
        car_mode = 2
    } else if (rec_data == "E") {
        car_mode = 3
    } else if (rec_data == "A") {
        car_mode = 0
        turtleBit.state(MotorState.brake)
    }
}
bluetooth.onBluetoothConnected(function () {
    basic.showIcon(IconNames.Heart)
    connected = 1
    while (connected == 1) {
        rec_data = bluetooth.uartReadUntil(serial.delimiters(Delimiters.Hash))
        Control_Car()
        Select_Mode()
        control_RGB()
        control_Neopixel()
        control_music()
    }
})
bluetooth.onBluetoothDisconnected(function () {
    basic.showIcon(IconNames.Sad)
})
function control_RGB () {
    if (rec_data == "r") {
        turtleBit.SetLed(
        LR.LeftSide,
        255,
        0,
        0
        )
        turtleBit.SetLed(
        LR.RightSide,
        255,
        0,
        0
        )
    } else if (rec_data == "g") {
        turtleBit.SetLed(
        LR.LeftSide,
```

```
        0,
        255,
        0
        )
        turtleBit.SetLed(
        LR.RightSide,
        0,
        255,
        0
        )
    } else if (rec_data == "b") {
        turtleBit.SetLed(
        LR.LeftSide,
        0,
        0,
        255
        )
        turtleBit.SetLed(
        LR.RightSide,
        0,
        0,
        255
        )
    } else if (rec_data == "y") {
        turtleBit.SetLed(
        LR.LeftSide,
        255,
        255,
        0
        )
        turtleBit.SetLed(
        LR.RightSide,
        255,
        255,
        0
        )
    } else if (rec_data == "c") {
        turtleBit.SetLed(
        LR.LeftSide,
        100,
        200,
        100
        )
```

```
        turtleBit.SetLed(
        LR.RightSide,
        100,
        200,
        100
        )
    } else if (rec_data == "p") {
        turtleBit.SetLed(
        LR.LeftSide,
        255,
        100,
        255
        )
        turtleBit.SetLed(
        LR.RightSide,
        255,
        100,
        255
        )
    } else if (rec_data == "x") {
        turtleBit.OFFLed()
    }
}
function car_avoid () {
    distance_val = turtleBit.ultra()
    if (distance_val <= 10) {
        turtleBit.run(DIR.Turn_Left, 80)
    } else {
        turtleBit.run(DIR.Run_forward, 80)
    }
}
function Control_Car () {
    if (rec_data == "F") {
        turtleBit.run(DIR.Run_forward, 100)
    } else if (rec_data == "B") {
        turtleBit.run(DIR.Run_back, 100)
    } else if (rec_data == "L") {
        turtleBit.run(DIR.Turn_Left, 100)
    } else if (rec_data == "R") {
        turtleBit.run(DIR.Turn_Right, 100)
    } else if (rec_data == "S") {
        turtleBit.state(MotorState.brake)
    }
```

```
}
function control_Neopixel () {
    if (rec_data == "h") {
        Neo_data = 1
    } else if (rec_data == "j") {
        Neo_data = 2
    } else if (rec_data == "k") {
        Neo_data = 3
    } else if (rec_data == "l") {
        Neo_data = 0
        changeColor()
    } else if (rec_data == "m") {
        Neo_data = 0
        strip.clear()
        strip.show()
    }
}
function neo_watar () {
    for (let index = 0; index <= 4; index++) {
        strip.setPixelColor(index, neopixel.colors(NeoPixelColors.Red))
        strip.show()
        control.waitMicros(100000)
    }
    for (let index2 = 0; index2 <= 4; index2++) {
        strip.setPixelColor(index2, neopixel.colors(NeoPixelColors.Purple))
        strip.show()
        control.waitMicros(100000)
    }
    for (let index3 = 0; index3 <= 4; index3++) {
        strip.setPixelColor(index3, neopixel.colors(NeoPixelColors.White))
        strip.show()
        control.waitMicros(100000)
    }
}
function car_follow () {
    if (distance_val > 9 && distance_val <= 30) {
        turtleBit.run(DIR.Run_forward, 80)
    } else if (distance_val > 6 && distance_val <= 9) {
        turtleBit.state(MotorState.brake)
    } else if (distance_val <= 6) {
        turtleBit.run(DIR.Run_back, 80)
    } else if (distance_val <= 30) {
        turtleBit.state(MotorState.brake)
```

```
    }
}
function changeColor () {
    color_c_flag = color_c_flag + 1
    if (color_c_flag == 11) {
        color_c_flag = 1
    }
    if (color_c_flag == 1) {
        strip.showColor(neopixel.colors(NeoPixelColors.Red))
    } else if (color_c_flag == 2) {
        strip.showColor(neopixel.colors(NeoPixelColors.Orange))
    } else if (color_c_flag == 3) {
        strip.showColor(neopixel.colors(NeoPixelColors.Yellow))
    } else if (color_c_flag == 4) {
        strip.showColor(neopixel.colors(NeoPixelColors.Green))
    } else if (color_c_flag == 5) {
        strip.showColor(neopixel.colors(NeoPixelColors.Blue))
    } else if (color_c_flag == 6) {
        strip.showColor(neopixel.colors(NeoPixelColors.Indigo))
    } else if (color_c_flag == 7) {
        strip.showColor(neopixel.colors(NeoPixelColors.Violet))
    } else if (color_c_flag == 8) {
        strip.showColor(neopixel.colors(NeoPixelColors.Purple))
    } else if (color_c_flag == 9) {
        strip.showColor(neopixel.colors(NeoPixelColors.White))
    } else if (color_c_flag == 10) {
        strip.showColor(neopixel.colors(NeoPixelColors.Black))
    }
}
function control_music () {
    if (rec_data == "1") {
        music.ringTone(262)
    } else if (rec_data == "2") {
        music.ringTone(294)
    } else if (rec_data == "3") {
        music.ringTone(330)
    } else if (rec_data == "4") {
        music.ringTone(349)
    } else if (rec_data == "5") {
        music.ringTone(392)
    } else if (rec_data == "6") {
        music.ringTone(440)
```

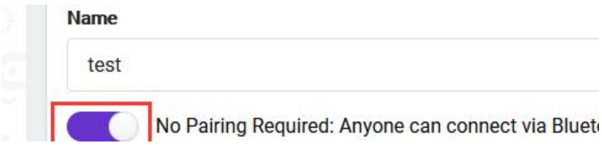
```
    } else if (rec_data == "7") {
        music.ringTone(494)
    } else if (rec_data == "8") {
        music.ringTone(523)
    } else if (rec_data == "9") {
        music.rest(music.beat(BeatFraction.Eighth))
    }
}
function car_Tracking () {
    if (turtleBit.LineTracking() == 2 || (turtleBit.LineTracking() == 3 || (turtleBit.LineTracking() == 5 || (turtleBit.LineTracking() == 6 || turtleBit.LineTracking() == 7)))) {
        turtleBit.run(DIR.Run_forward, 60)
    } else if (turtleBit.LineTracking() == 4) {
        turtleBit.Motor(LR.LeftSide, MD.Back, 80)
        turtleBit.Motor(LR.RightSide, MD.Forward, 80)
    } else if (turtleBit.LineTracking() == 1) {
        turtleBit.Motor(LR.LeftSide, MD.Forward, 80)
        turtleBit.Motor(LR.RightSide, MD.Back, 80)
    } else {
        turtleBit.state(MotorState.brake)
    }
}
let color_c_flag = 0
let Neo_data = 0
let distance_val = 0
let connected = 0
let car_mode = 0
let rec_data = ""
let strip: neopixel.Strip = null
strip = neopixel.create(DigitalPin.P8, 4, NeoPixelMode.RGB)
turtleBit.LED_brightness(200)
basic.forever(function () {
    distance_val = turtleBit.ultra()
    if (car_mode == 1) {
        car_avoid()
    } else if (car_mode == 2) {
        car_follow()
    } else if (car_mode == 3) {
        car_Tracking()
    }
    if (Neo_data == 1) {
        strip.setPixelColor(randint(0, 4), neopixel.hsl(neopixel.rgb(randint(0, 255), randint(0, 255), randint(0, 255)), 255, 50))
        strip.show()
    } else if (Neo_data == 2) {
```

```
        for (let index4 = 0; index4 <= 4; index4++) {
            strip.setPixelColor(index4, neopixel.rgb(randint(0, 255), randint(0, 255), randint(0, 255)))
            strip.show()
            control.waitMicros(100000)
            strip.clear()
        }
    } else if (Neo_data == 3) {
        neo_watar()
    } else if (Neo_data == 4) {
        strip.showBarGraph(0, 255)
    }
})
```

4. Test Results：

We will control micro:bit smart car to move via app.

Enter Makecode online editor → Projecting Settings →



, enable "No Pairing...." (you could skip this step if you import test code directly)

Download code and turn on the switch at the back of micro:bit car. Then control smart car via "keyes Bit Car" app

(How to download? How to quick download?)

9. Resources

https://fs.keyestudio.com/KS4014

Wiki page: https://wiki.keyestudio.com/Main_Page

Official website: https://keyestudio.com/