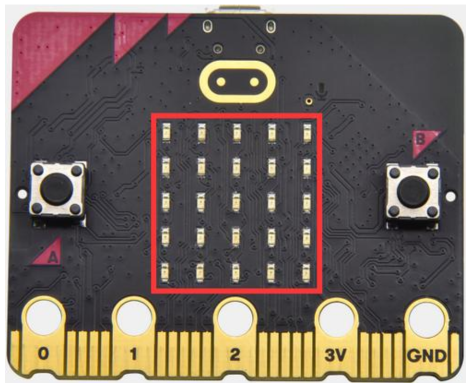
Micro:bit Basic Tutorial

Micro:bit Basic Projects

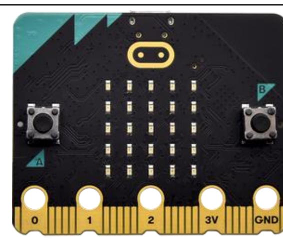
Project 1: Heartbeat



1. Introduction

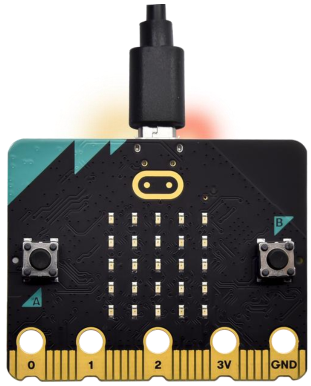
This project is easy to conduct with a micro:bit main board, a Micro USB cable and a computer. The micro:bit LED dot matrix will display a beating heart. It serves as a start for your entry to the programming world!

2. Components

Micro:bit mainboard*1	
Micro USB cable*1	

3. Connection

Connect the board to your computer via micro USB cable.



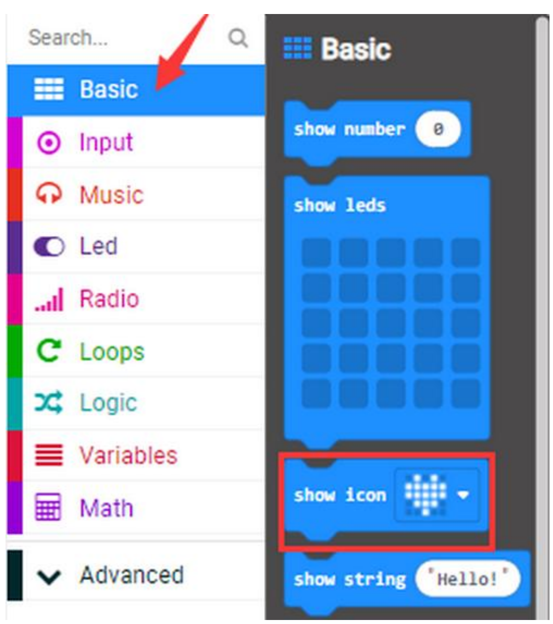
4. Test Code

Please check code in Project 1 file.

Visit https://makecode.micro:bit.org/reference to find more information about micro: bit blocks.

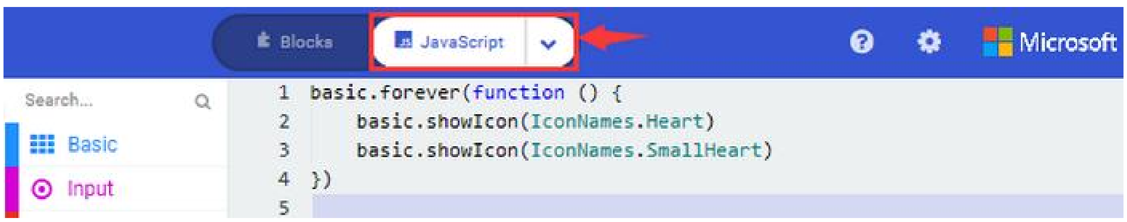
Visit https://makecode.micro:bit.org/ for programming helps.

Find code blocks:

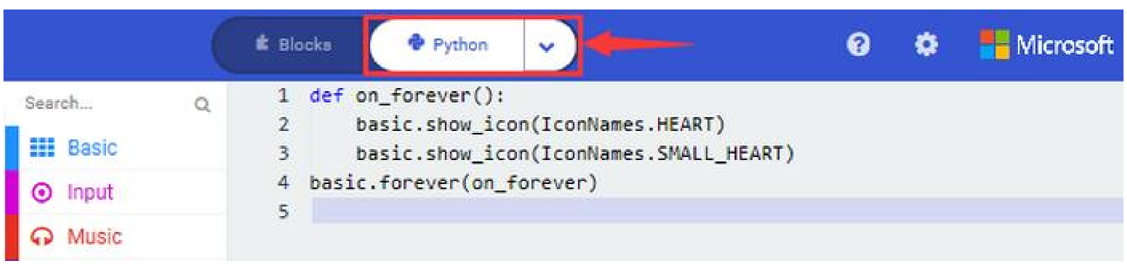


Build blocks:

Click “JSJavaScript” to see Java code:



Pull down to click “Python” to see Python code:



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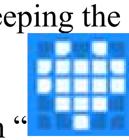
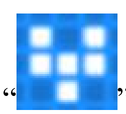
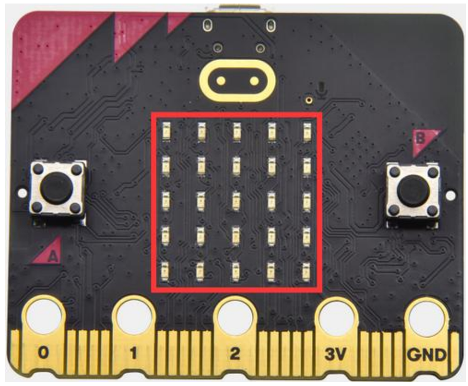
5. Test Result

After uploading test code to micro:bit main board and keeping the connection with the computer to power the main board, the LED dot matrix shows pattern “” and “” , alternately.

If the downloading is not smooth, please remove the USB cable from the main board and then reconnect them and reopen Makecode to try again.

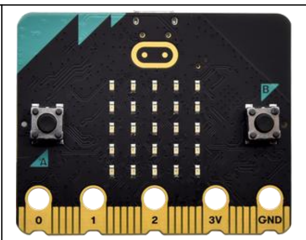
Project 2: Single LED Blinking



1. Introduction

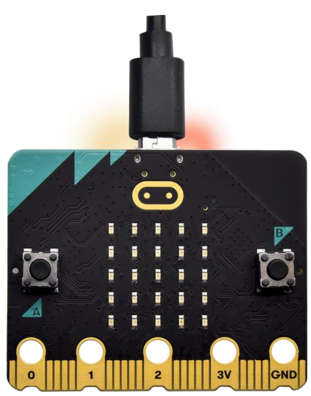
In this project, we intend to control a certain LED of the micro:bit main board to light up.

2. Components

Micro:bit mainboard*1	
Micro USB cable*1	

3. Connection

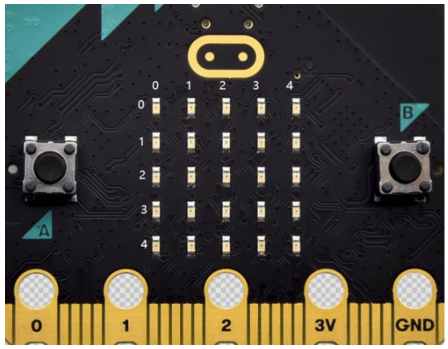
Connect the board to your computer via micro USB cable.



4. Knowledge

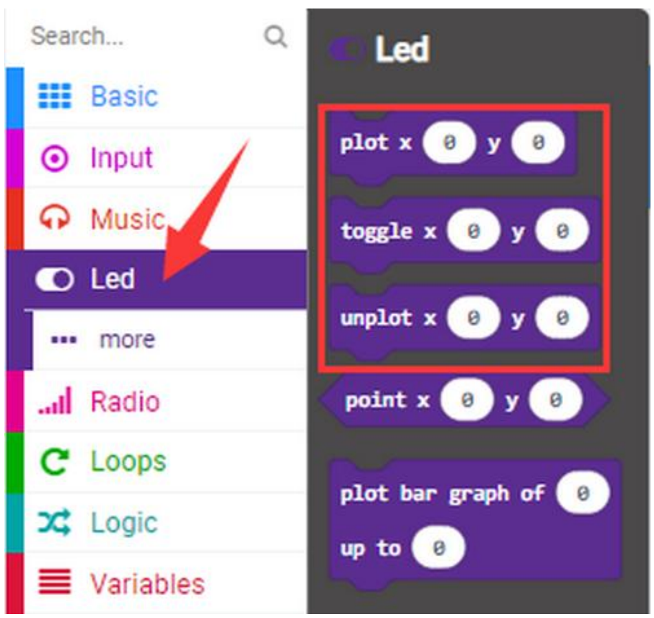
The LED dot matrix consists of 25 LEDs arranged in a 5 by 5 square.

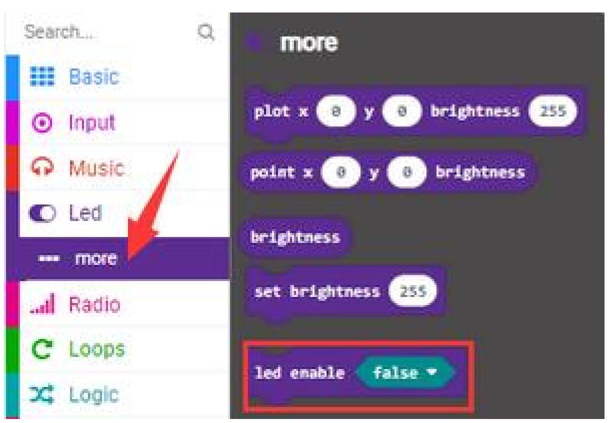
In order to locate these LEDs quickly, as the figure shown below, we can regarded this matrix as a coordinate system by marking 0~4 from top to bottom and from left to right. Therefore, the LED sat in the first of the first line is (0,0) and the LED positioned in the fifth of the first column is (0,4), and others likewise.

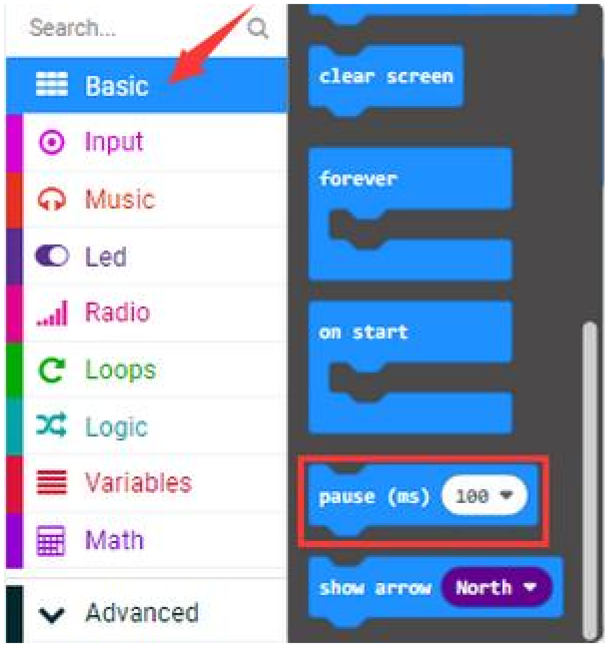


5. Test Code

Find code blocks:





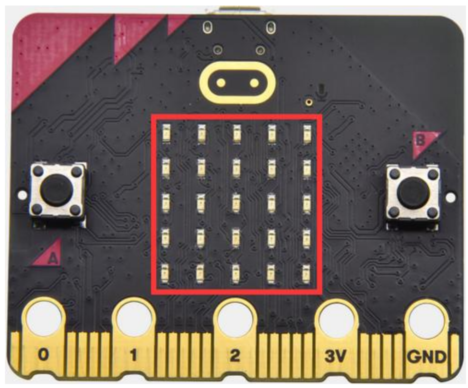


Build blocks:

6. Test Result

After uploading test code to micro:bit main board and powering the main board via the USB cable, the LED in (1,0) lights up for 1s and the one in (3,4) shines for 1s and this sequence will repeat.

Project 3: LED Dot Matrix



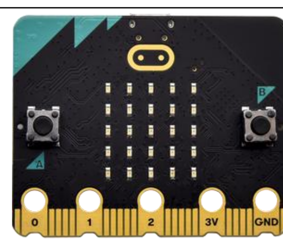
1. Introduction

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 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. Theoretically, we can turn on many LEDs at the same time to show patterns, digits and characters.

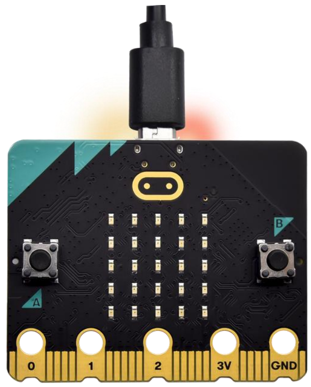
What’s more, we can also click ”show icon“ to choose the pattern we like to display. Last but not the least, we can design patterns by ourselves as well.

2. Components

Micro:bit mainboard*1	
Micro USB cable*1	

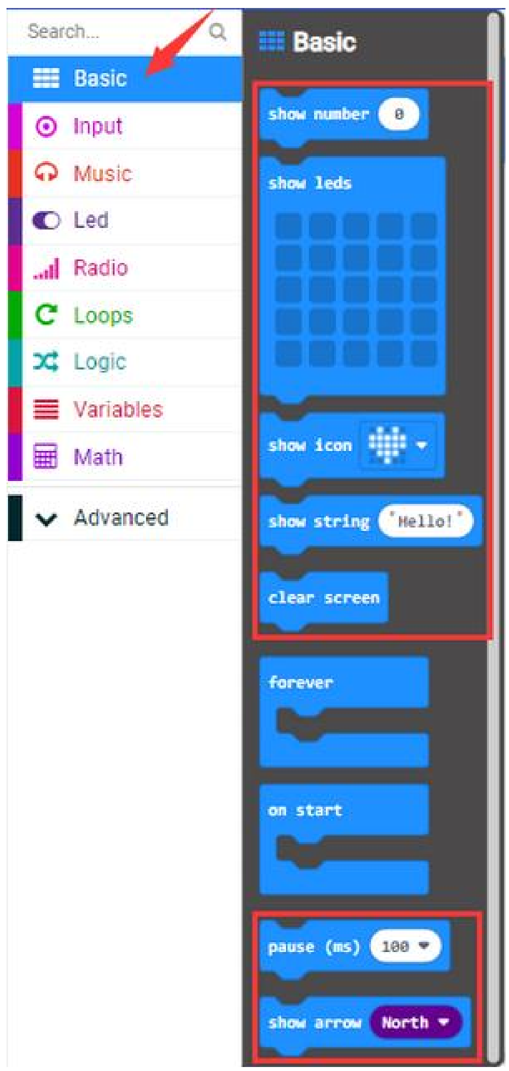
3. Connection

Connect the board to your computer via micro USB cable.

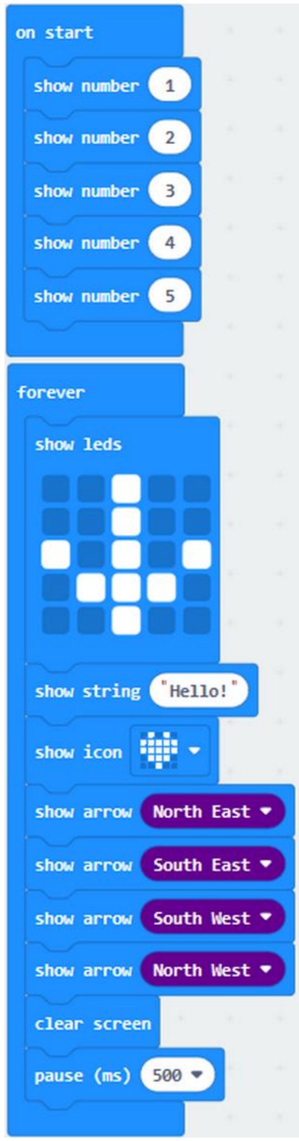


4. Test Code

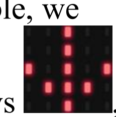
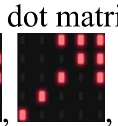
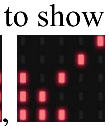
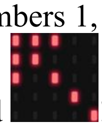
Find code blocks:



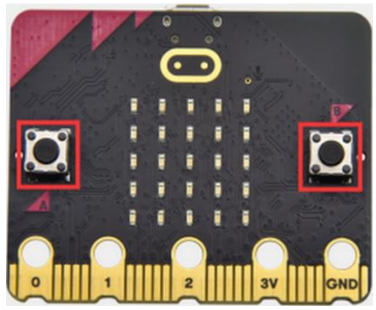
Build blocks:



5. Test Result

After uploading test code to micro:bit main board and powering the main board via the USB cable, we find that the 5*5 dot matrix start to show numbers 1, 2, 3, 4 and 5, and then it alternatively shows , "Hello!", , , ,  and !

Project 4: Programmable Buttons



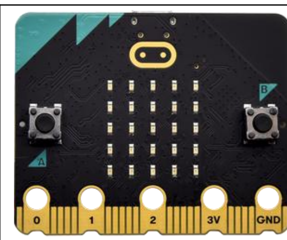
1. Introduction

Buttons can be used to control circuits. In an integrated circuit with a button, the circuit is connected when the button is pressed and if you release the button, the circuit is open.

Micro: Bit main board boasts three buttons: two programmable buttons (marked with A and B), and a reset button at back. By pressing the two programmable buttons, three different signals can be input. We can press button A or B or both so that the LED dot matrix shows A, B and AB respectively.

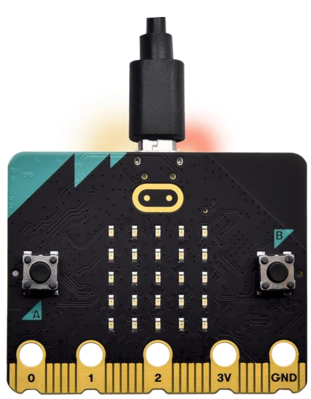
Let's get started!

2. Components

Micro:bit mainboard*1	
Micro USB cable*1	

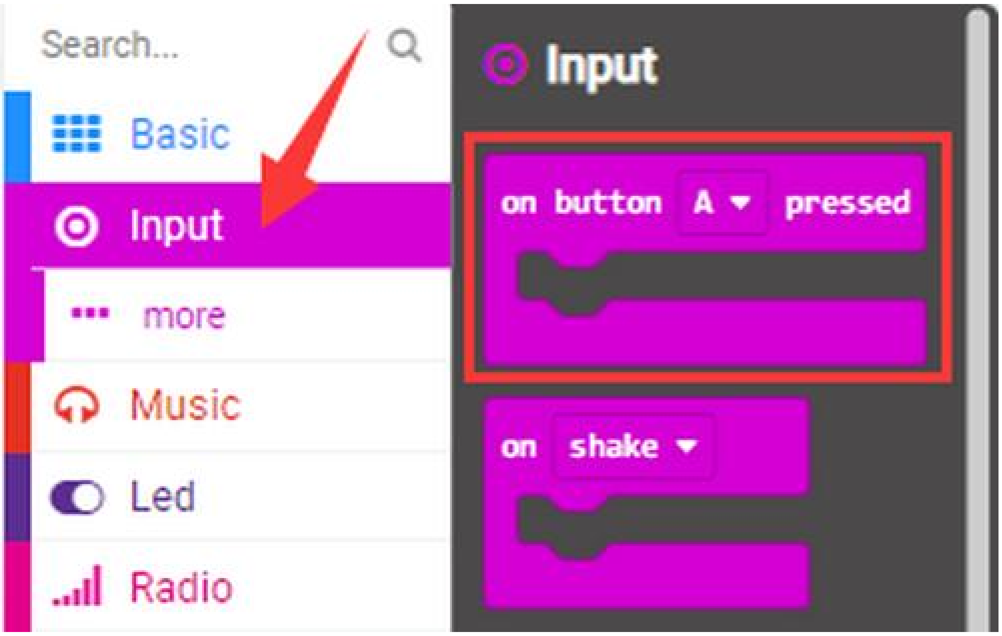
3. Connection

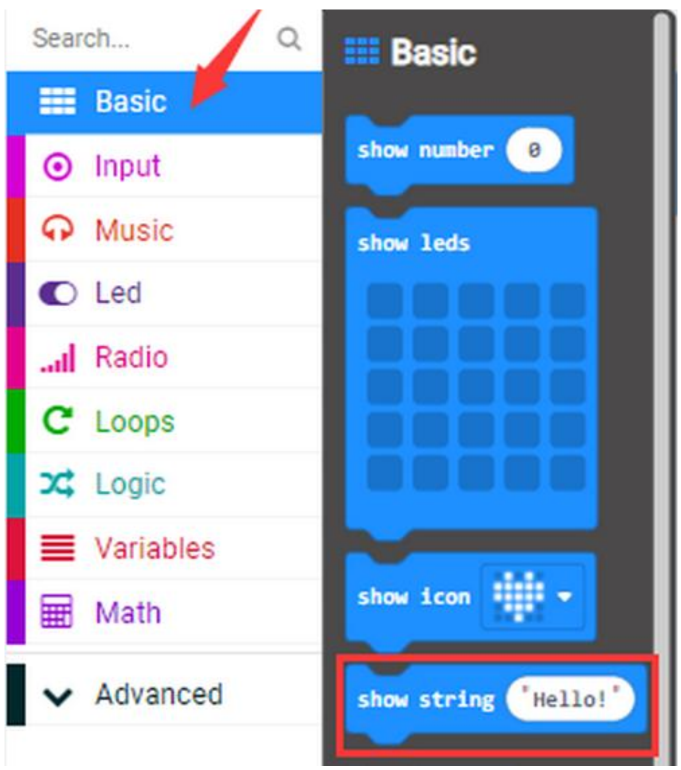
Connect the board to your computer via micro USB cable.



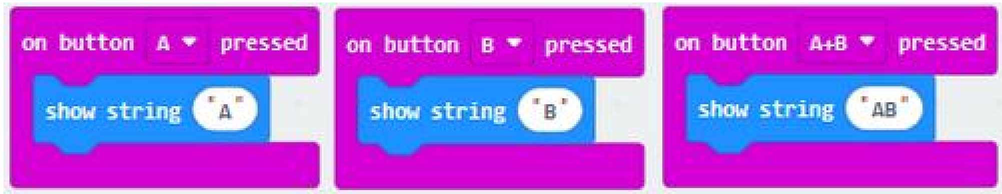
4. Test Code 1

Find code blocks:





Build blocks:

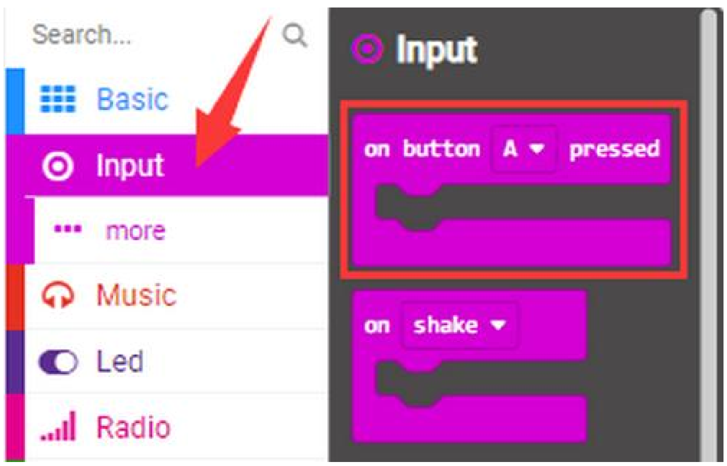


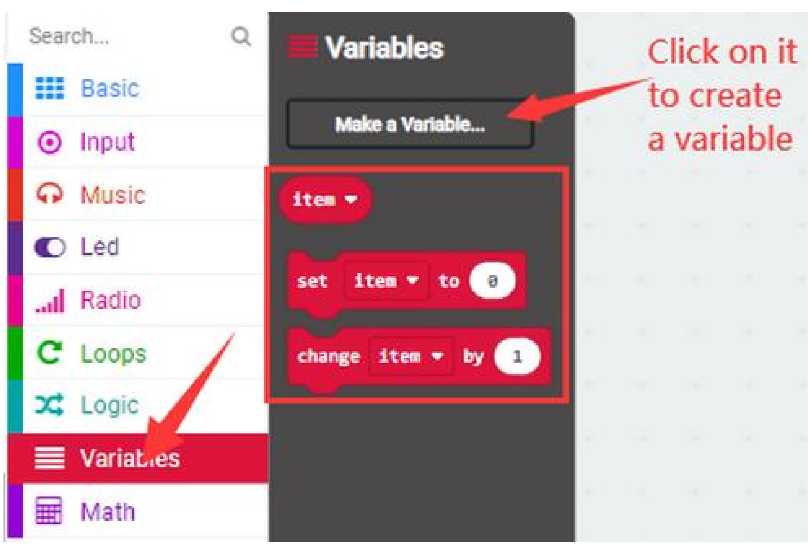
5. Test Result 1

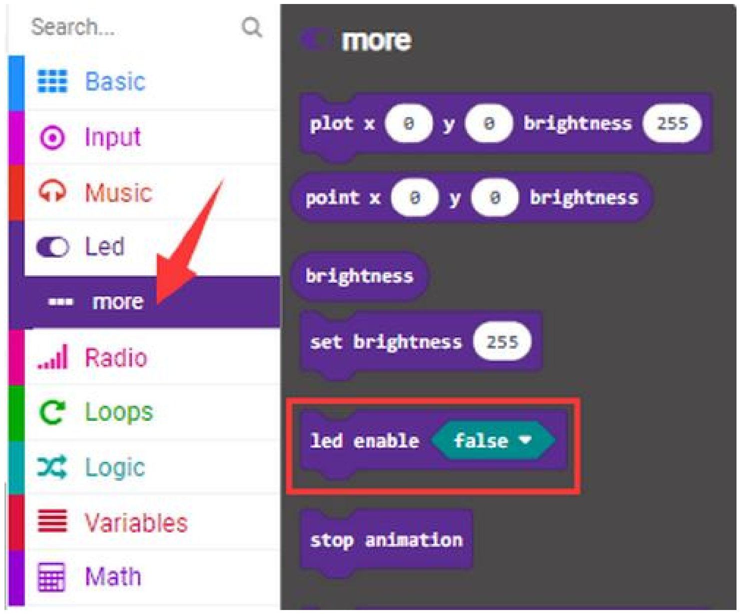
After uploading test code and powering on, the 5*5 LED dot matrix shows A if button A is pressed and then released, B if button B pressed and released, and AB if button A and B pressed together and then released.

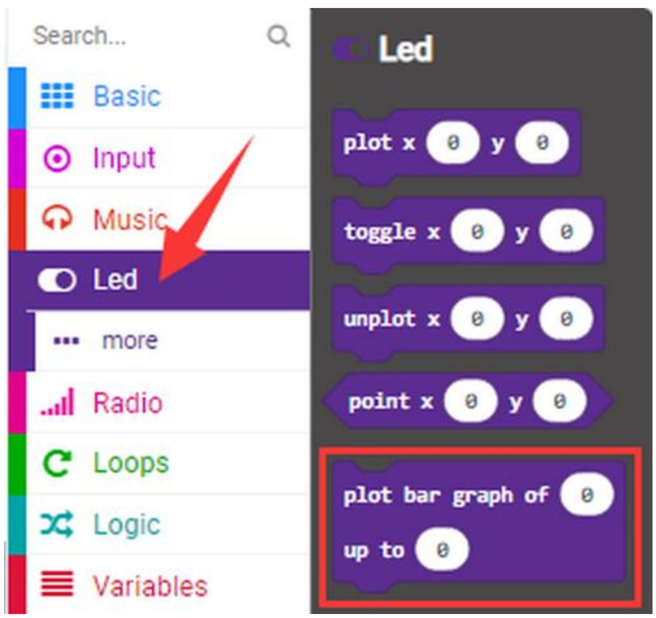
6. Test Code 2

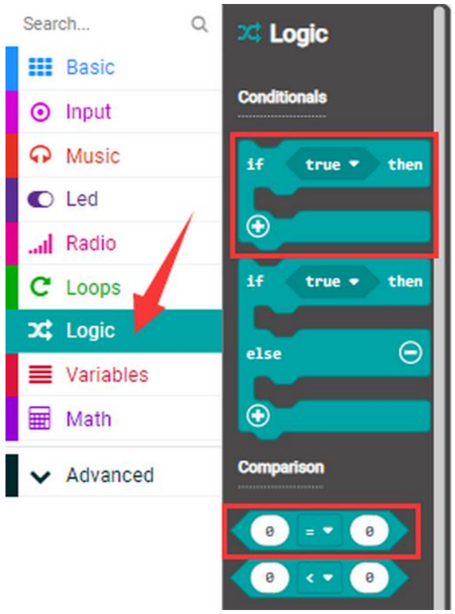
Find code blocks:



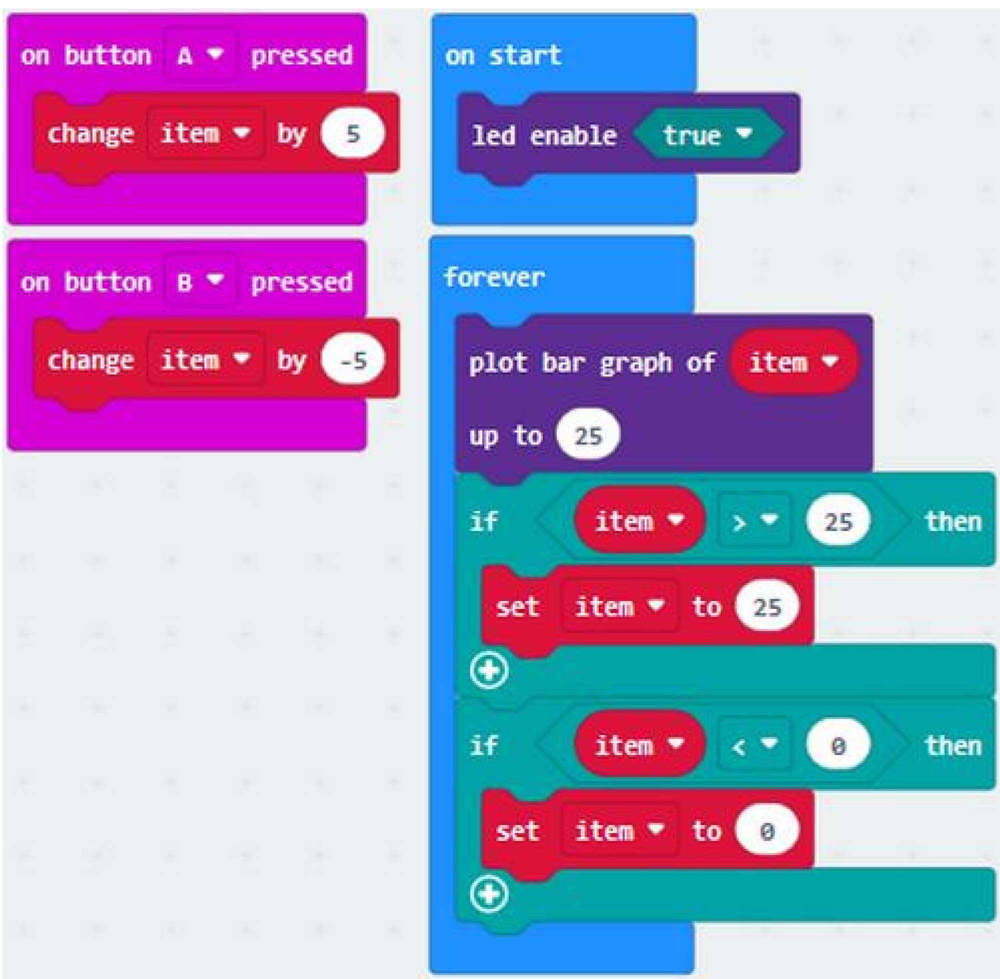



Search...
Basic
Input
Music
Led
more
Radio
Loops
Logic
Variables
Math
more
plot x 0 y 0 brightness 255
point x 0 y 0 brightness
brightness
set brightness 255
led enable false
stop animation


Search...
Basic
Input
Music
Led
more
Radio
Loops
Logic
Variables
Led
plot x 0 y 0
toggle x 0 y 0
unplot x 0 y 0
point x 0 y 0
plot bar graph of 0
up to 0



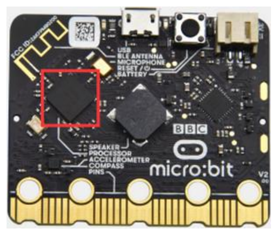
Build blocks:



7. Test Result 2

After uploading test code and powering on, when the button A is pressed, the LEDs in red increase; when the button B is pressed, the LEDs in red reduce.

Project 5: Temperature Detection

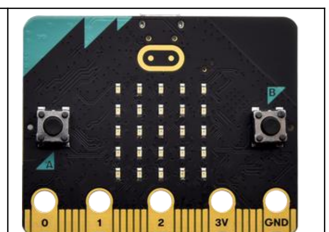


1. Introduction

The Micro:bit main board is actually not equipped with a temperature sensor, but uses nNFR52833 chip for temperature detection. Therefore, the detected value is much closer to the temperature of the processor, so there maybe deviation from the ambient value.

Its detection range is -40 ~ 105℃.

2. Components

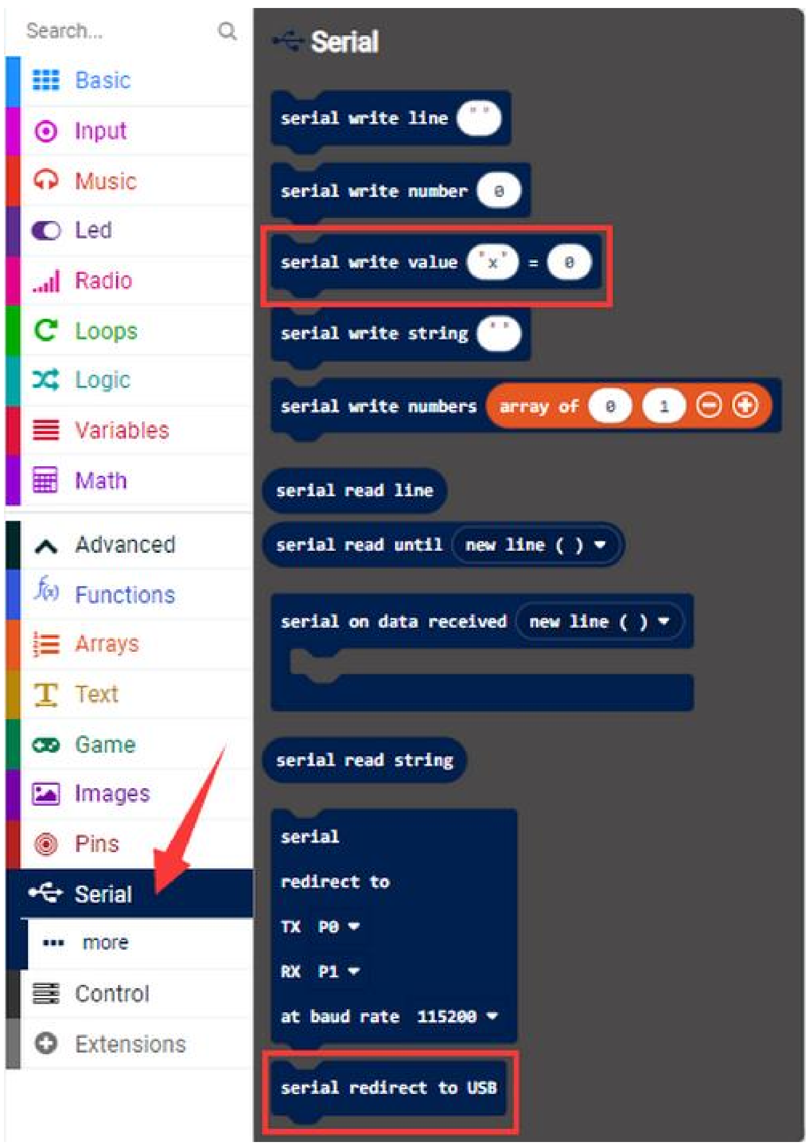
Micro:bit mainboard*1	
Micro USB cable*1	

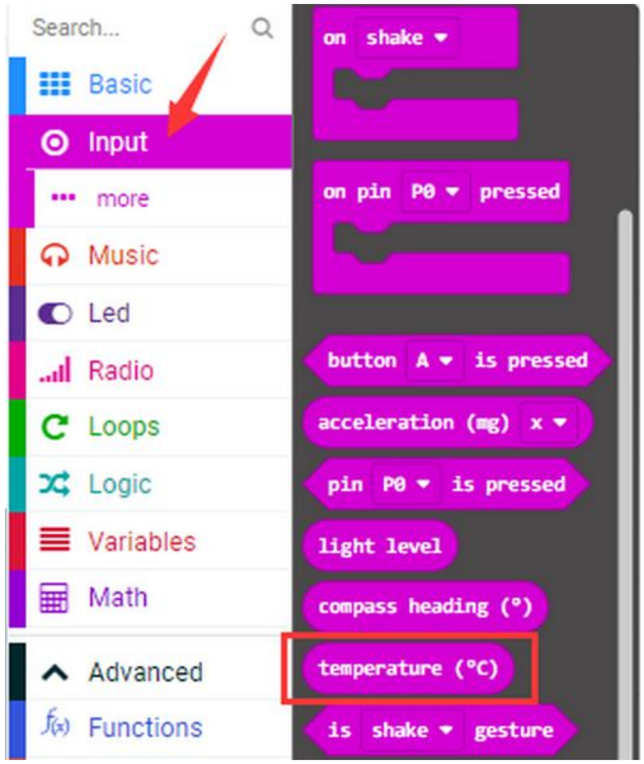
3. Connection

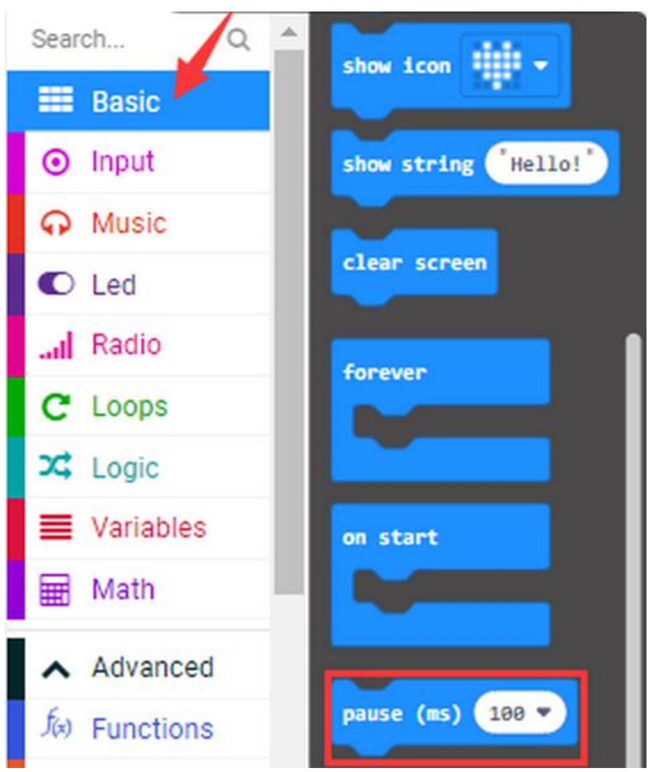
Connect the board to your computer via micro USB cable.

4. Test Code

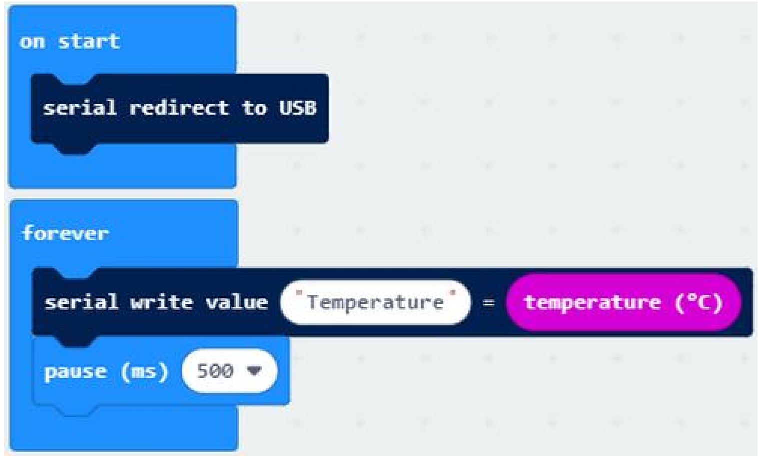
Find code blocks:




Search...
Basic
Input
more
Music
Led
Radio
Loops
Logic
Variables
Math
Advanced
Functions
on shake
on pin P0 pressed
button A is pressed
acceleration (mg) x
pin P0 is pressed
light level
compass heading (°)
temperature (°C)
is shake gesture

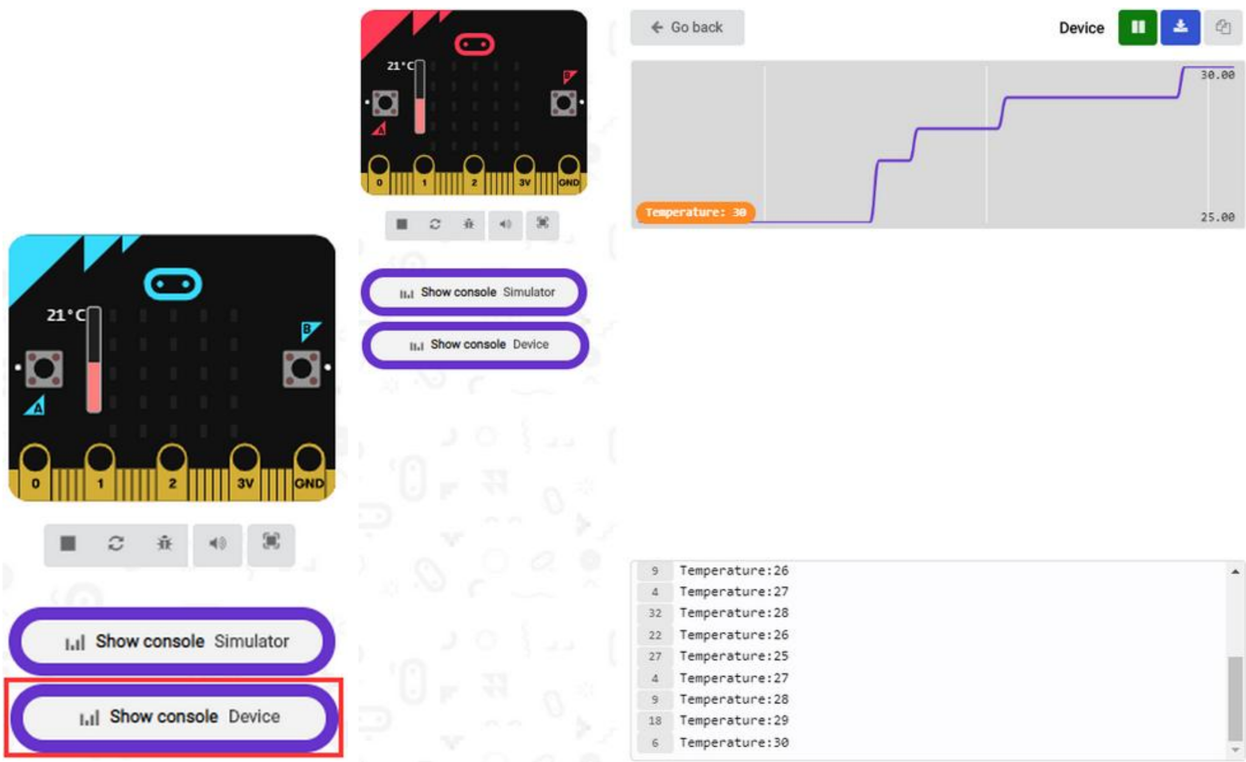

Search...
Basic
Input
Music
Led
Radio
Loops
Logic
Variables
Math
Advanced
Functions
show icon
show string "Hello!"
clear screen
forever
on start
pause (ms) 100

Build blocks:



5. Test Result 1

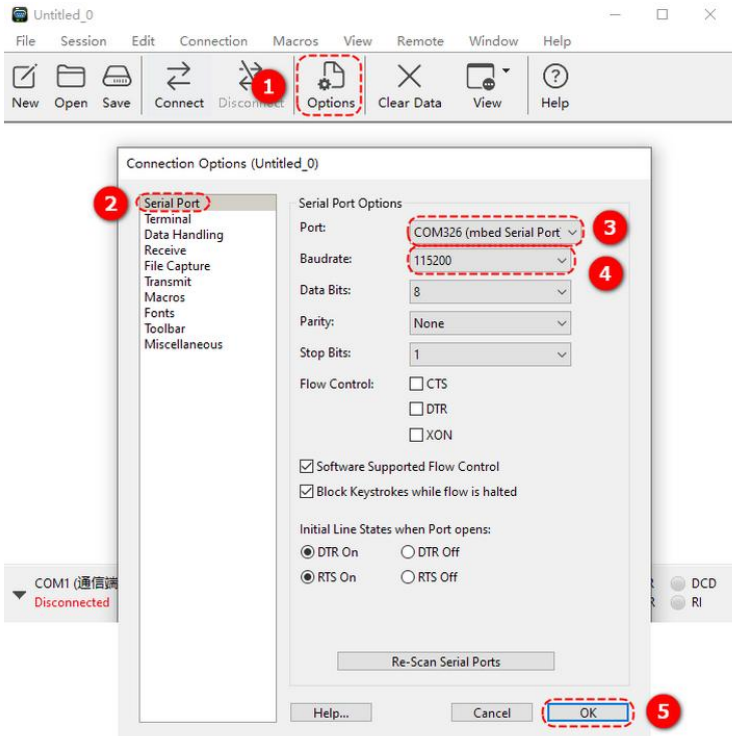
After uploading test code 1 to micro:bit main board, powering the main board via the USB cable, and click “**Show console Device**”, the temperature value shows in the serial monitor as shown below.

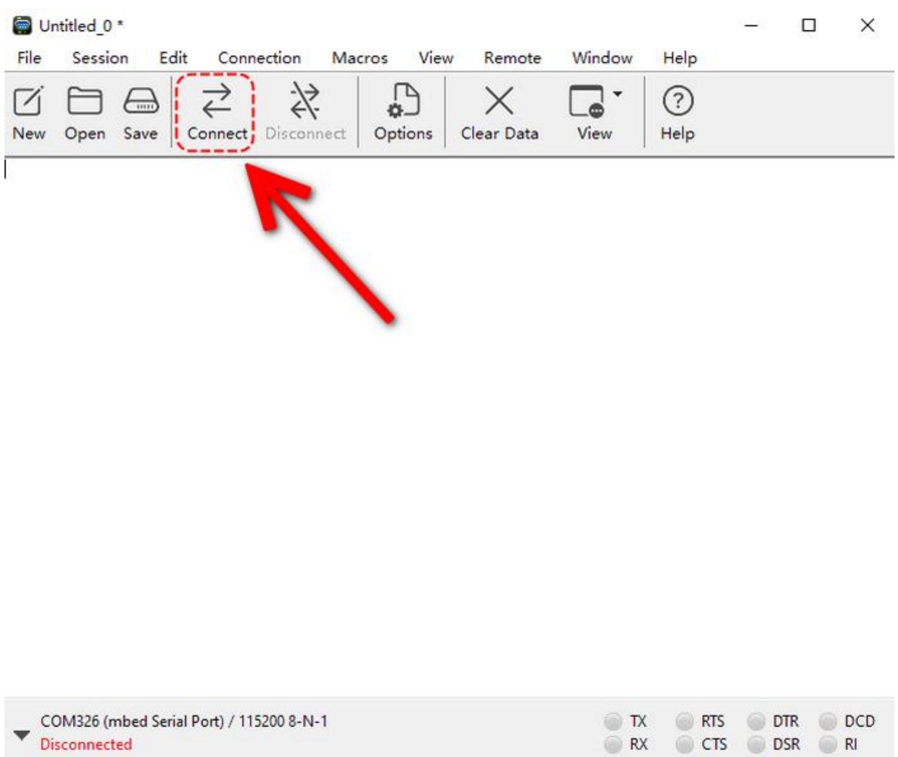


When you touch the processor nNRF52833 on the board for a while, its temperature will rise gradually and the CoolTerm serial monitor will show this change:

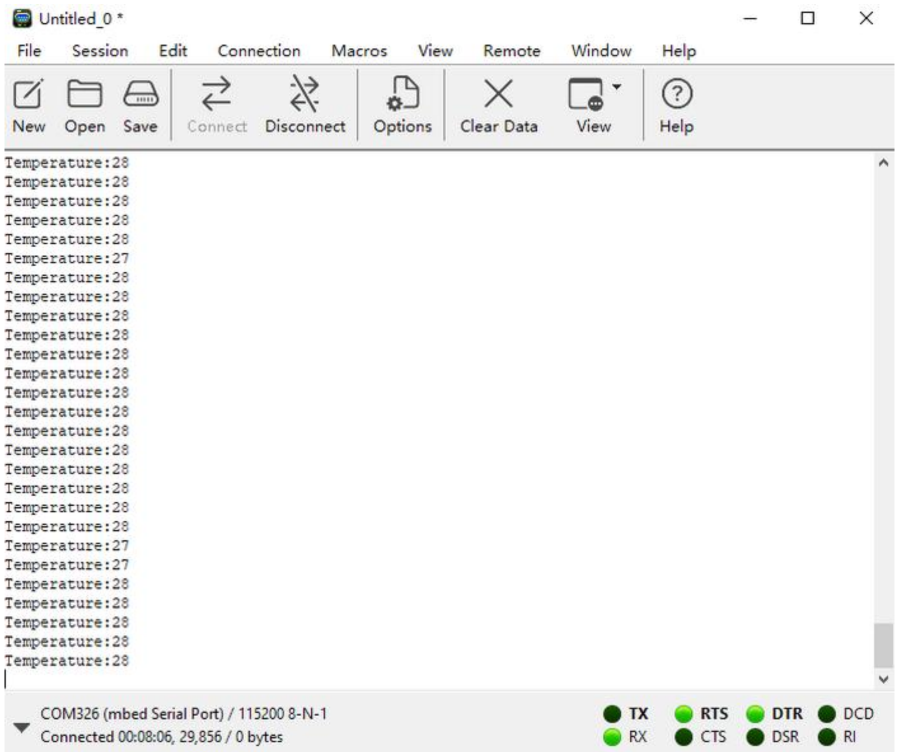
If you're running Windows 7 or 8 instead of Windows 10, Google Chrome won't be able to match devices. so you'll need CoolTerm.

Open CoolTerm and click **Options** to select **SerialPort**, set COM port and put baud rate to 115200 (after testing, the baud rate of USB SerialPort communication on Micro: Bit main board is 115200), and then click **OK** and **Connect**.



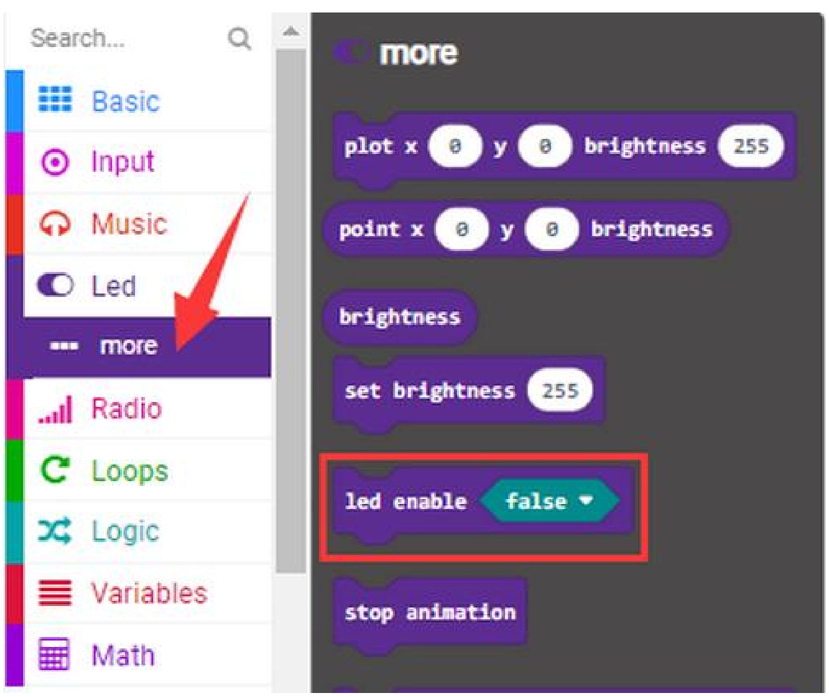


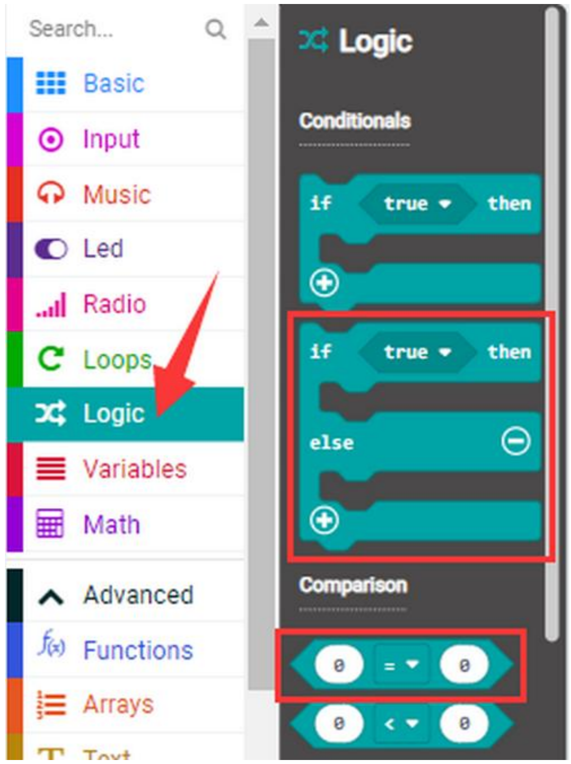
The CoolTerm serial monitor shows the change of temperature in the current environment, as shown below:



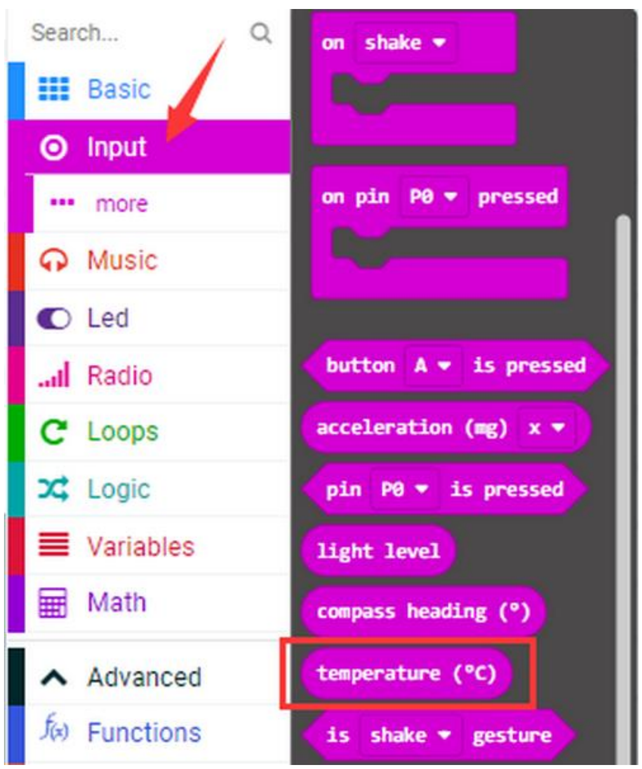
6. Test Code 2

Find code blocks:

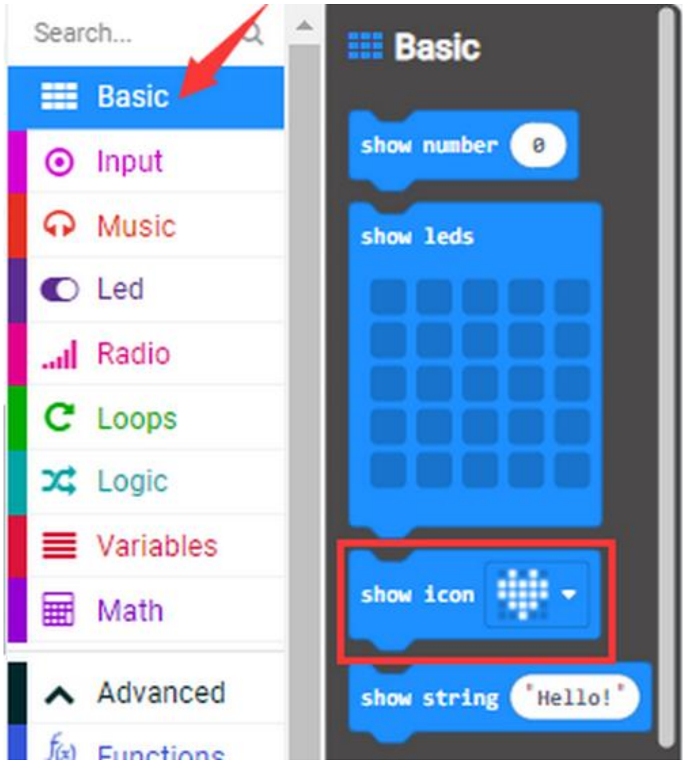




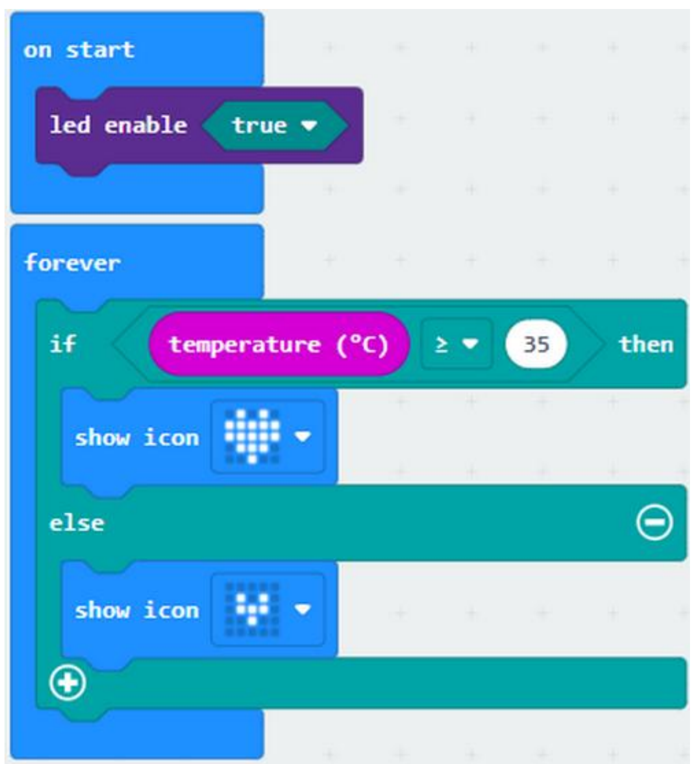
Search...
Basic
Input
Music
Led
Radio
Loops
Logic
Variables
Math
Advanced
Functions
Arrays
Logic
Conditionals
if true then
if true then
else
Comparison
0 = 0
0 < 0



Search...
Basic
Input
more
Music
Led
Radio
Loops
Logic
Variables
Math
Advanced
Functions
on shake
on pin P0 pressed
button A is pressed
acceleration (mg) x
pin P0 is pressed
light level
compass heading (°)
temperature (°C)
is shake gesture



Build blocks: 35 in the code can be modified according to actual conditions.



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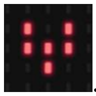
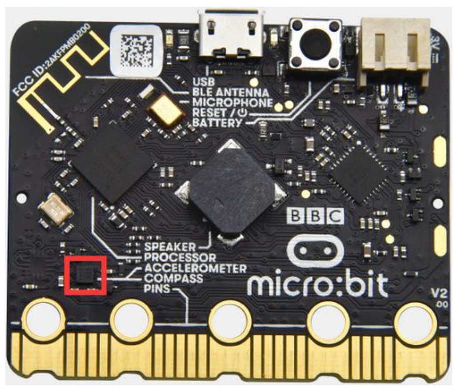
7. Test Result 2

After uploading the code 2 to the board, when the ambient temperature is less than 35℃, the 5*5 LED dot matrix shows . You may cover the sensor on the board to make the temperature equal to or become greater than 35℃, and then  will appear.

Project 6: Geomagnetic Sensor



1. Introduction

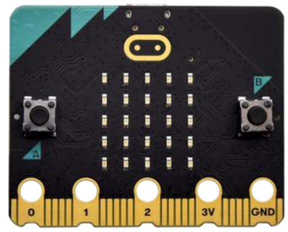
This project aims to explain the use of the Micro: bit geomagnetic sensor, which can not only detect the strength of the geomagnetic field, but also be used as a compass to find bearings. It is also an important part of the Attitude and Heading Reference System (AHRS).

Micro: Bit main board uses LSM303AGR geomagnetic sensor, which supports four modes namely 100 kHz, 400 kHz, 1 MHz and 3.4 MHz and the dynamic range of magnetic field is ±50 gauss. In the board, the magnetometer module is used in both magnetic detection and compass.

In this experiment, the compass will be introduced first, and then the original data of the magnetometer will be checked. The main component of a common compass is a magnetic needle, which can be rotated by the geomagnetic field and point toward the geomagnetic North Pole (which is near the geographic South Pole) to determine direction.

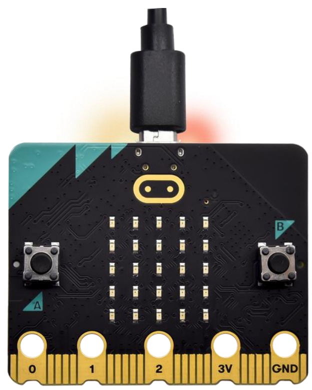
Attention: this geomagnetic sensor built in the board can help us determine bearings by showing readings in the value from 0 to 360. And we need to calibrate it for the first by rotating. Please note that metal materials around may attenuate the accuracy of the reading and calibration.

2. Components

Micro:bit mainboard*1	
Micro USB cable*1	

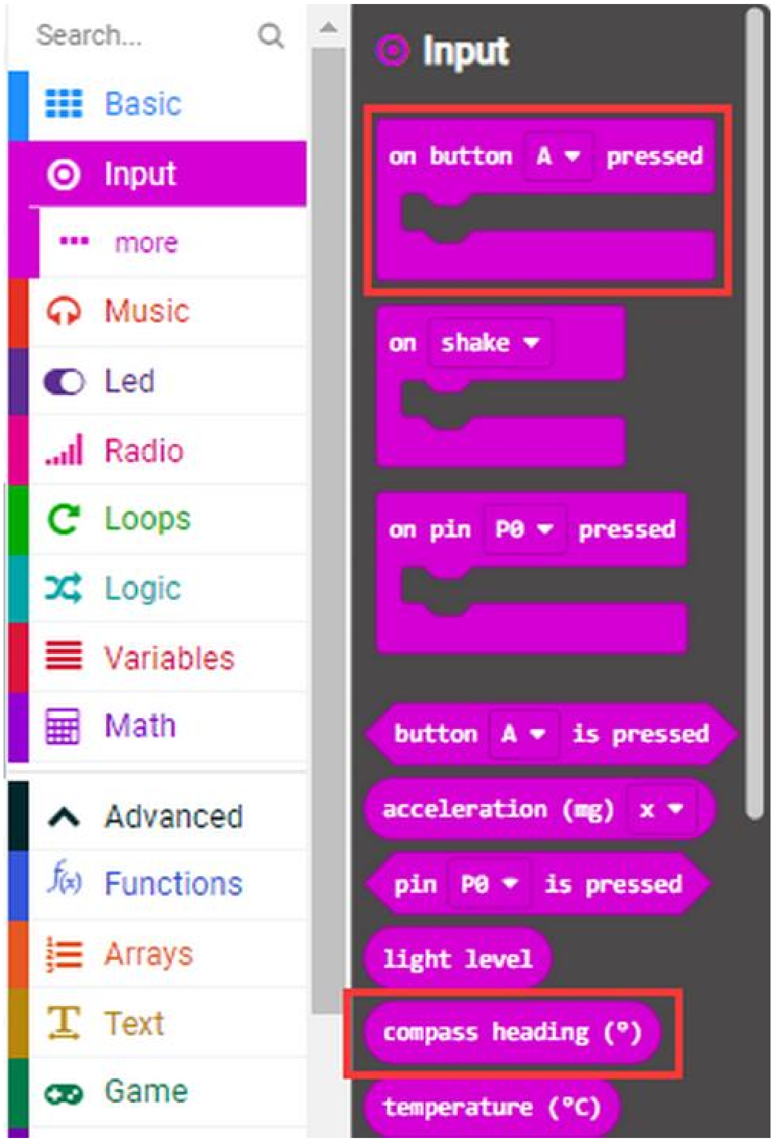
3. Connection

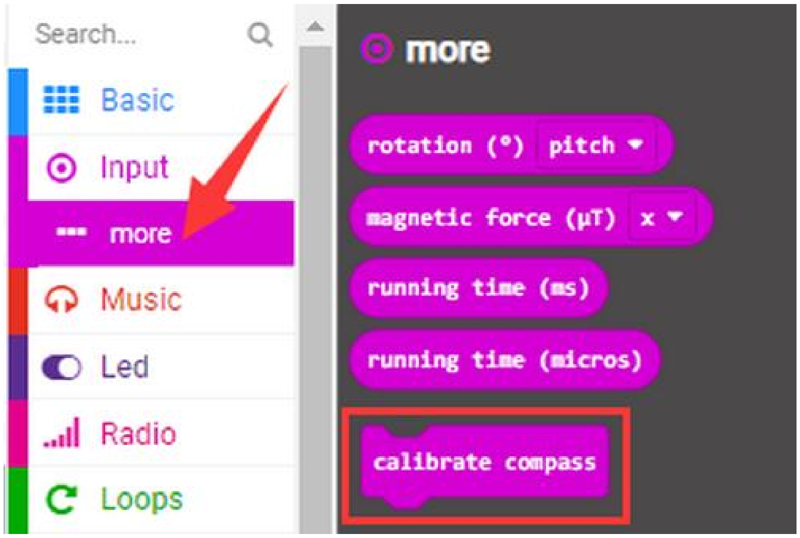
Connect the board to your computer via micro USB cable.

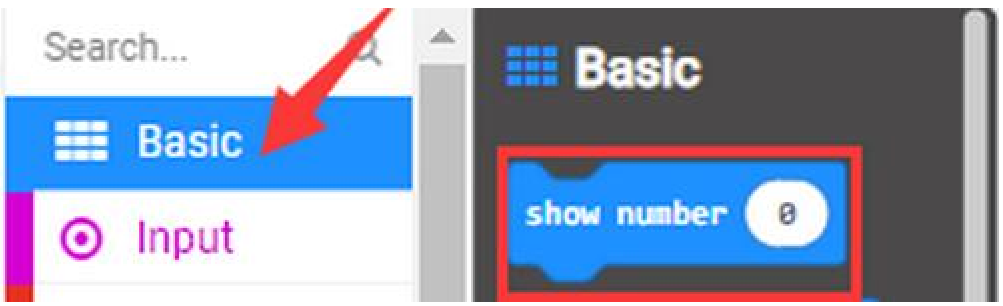


4. Test Code

Find code blocks:


Search...
Basic
Input
more
Music
Led
Radio
Loops
Logic
Variables
Math
Advanced
Functions
Arrays
Text
Game
Input
on button A pressed
on shake
on pin P0 pressed
button A is pressed
acceleration (mg) x
pin P0 is pressed
light level
compass heading (°)
temperature (°C)



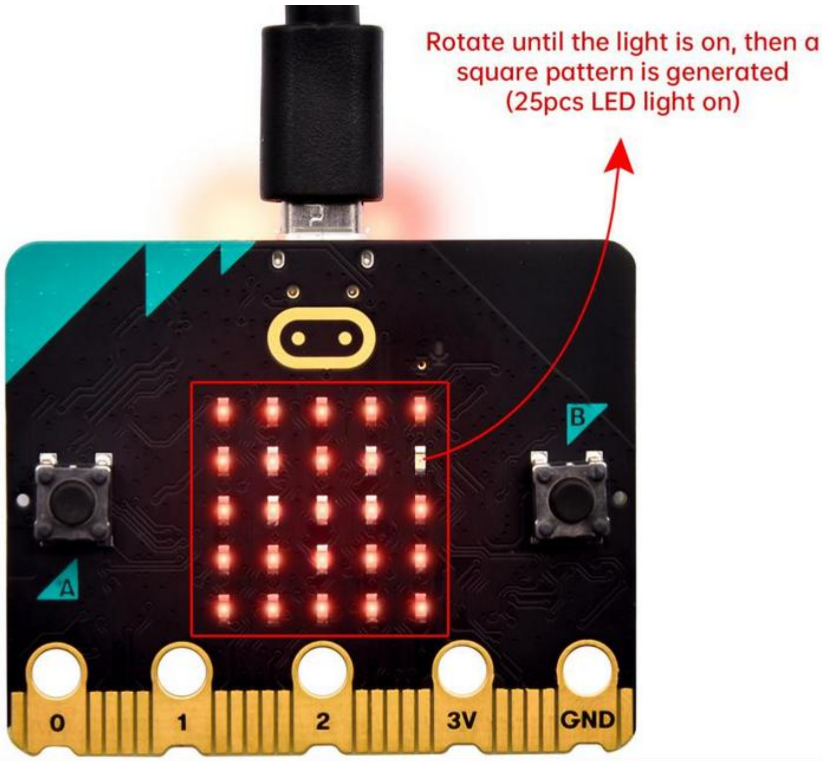


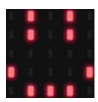
Build blocks:

Note: it is imperative to calibrate the Micro:bit board because different geomagnetic fields exist in different places. And the board requires a calibration for the first using time.

5. Test Result 1

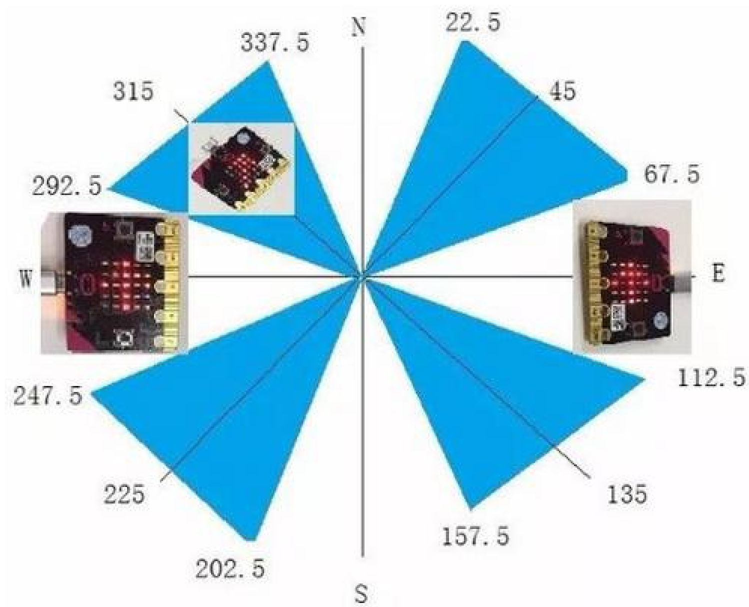
After uploading code and powering on, press the button A and the board need to be calibrate when you see LED dot matrix shows “TILT TO FILL SCREEN”. Rotate the board until all 25 red LEDs are on as shown below.



After completing calibration, a smile  will appear. Press button A, and the detected magnetometer value will show. And the direction north, east, south and west correspond to 0°, 90°, 180° and 270° respectively.

6. Test Code 2

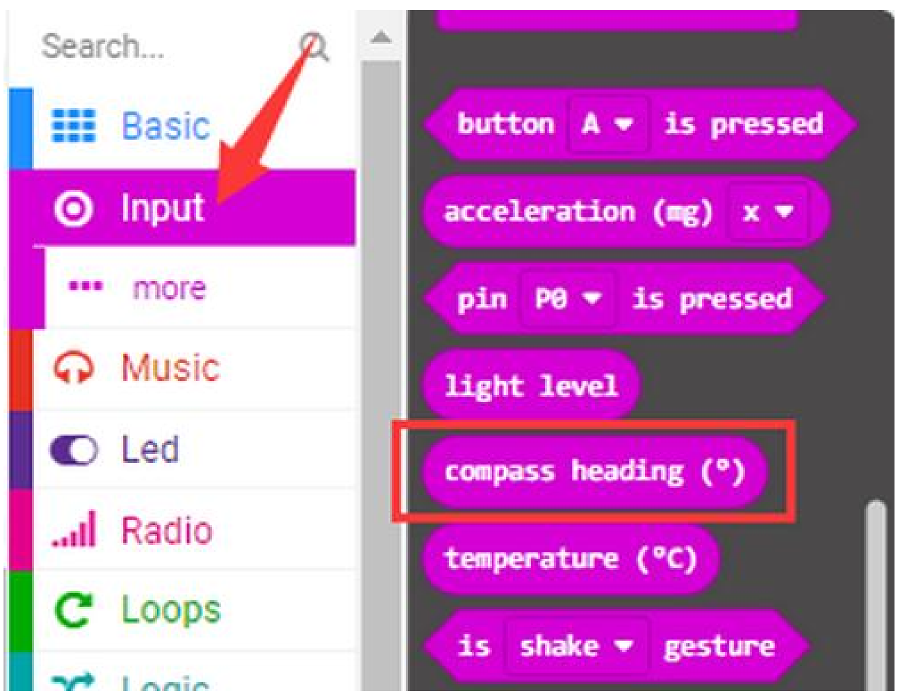
We read the value to determine direction: the arrow points to the current magnetic North Pole.

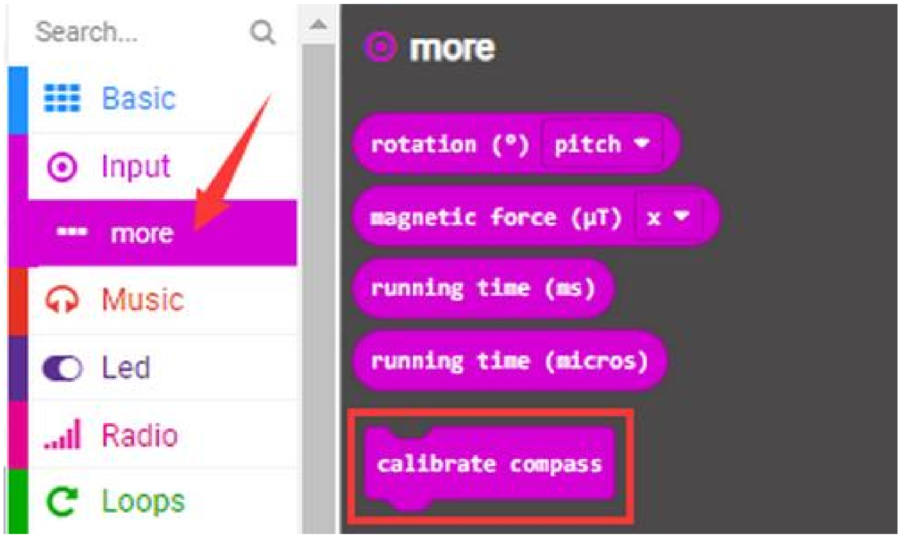


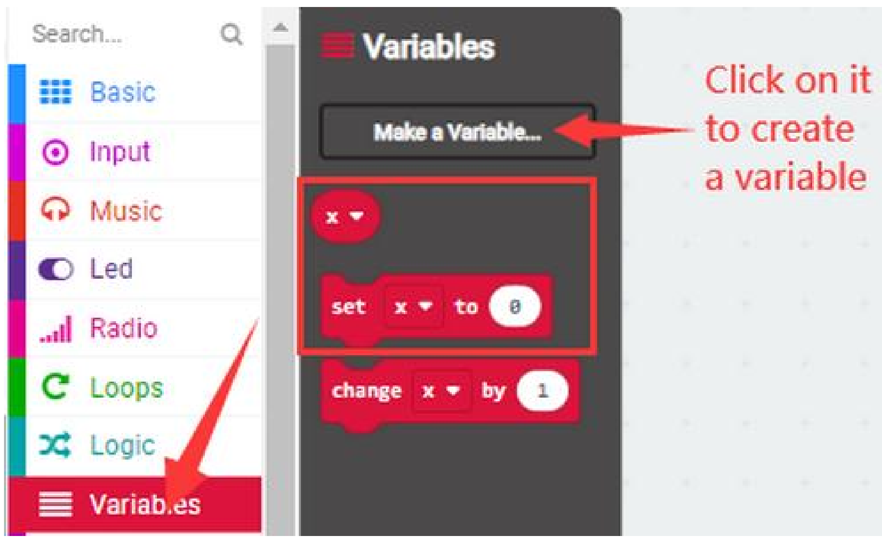
For the above picture, the arrow pointing to the upper right when the value ranges from 292.5 to 337.5.

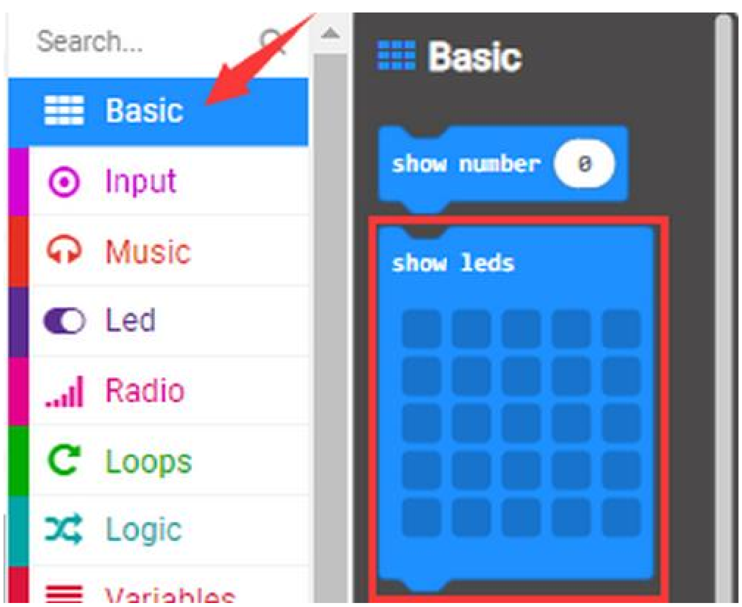
0.5 can't be input in the code, so the values we get are 293 and 338. We add other statements to make a set of complete code.

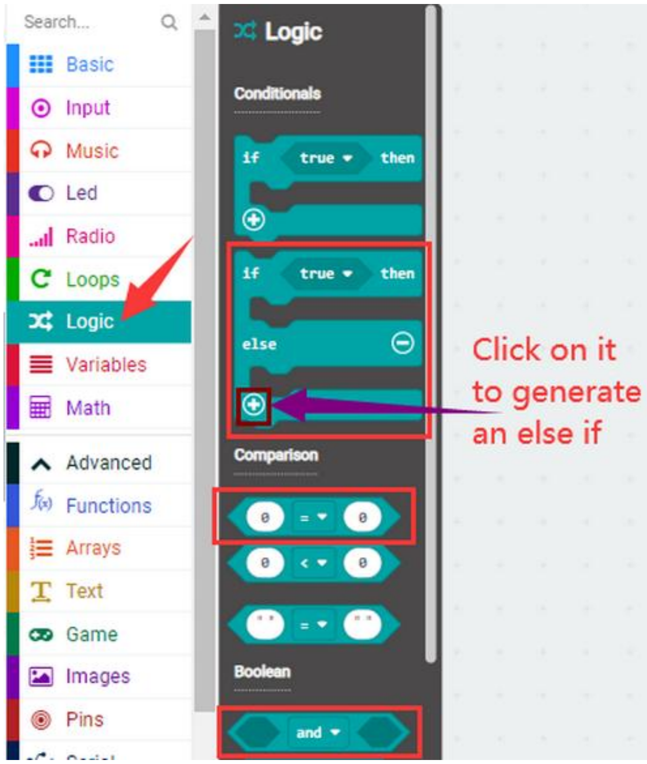
Find code blocks:



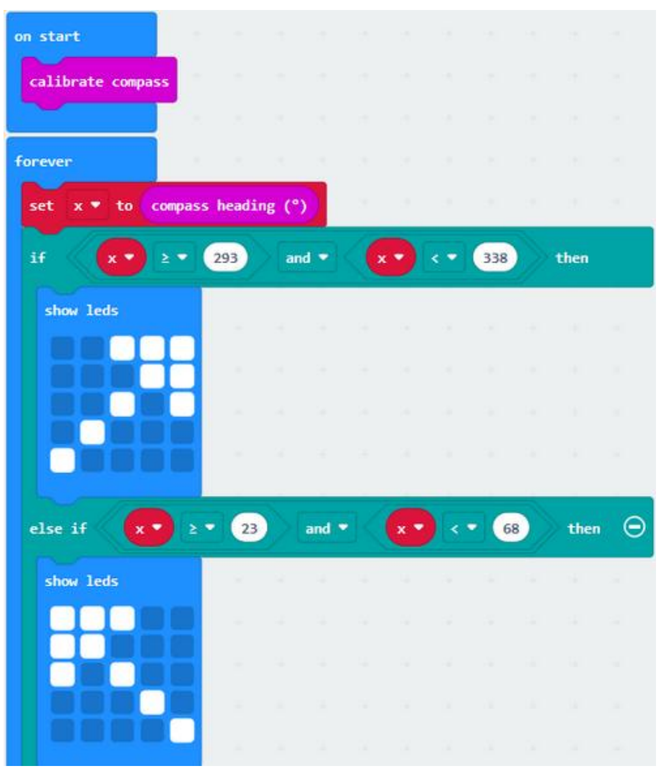

Search...
Basic
Input
more
Music
Led
Radio
Loops
more
rotation (°) pitch
magnetic force (µT) x
running time (ms)
running time (micros)
calibrate compass

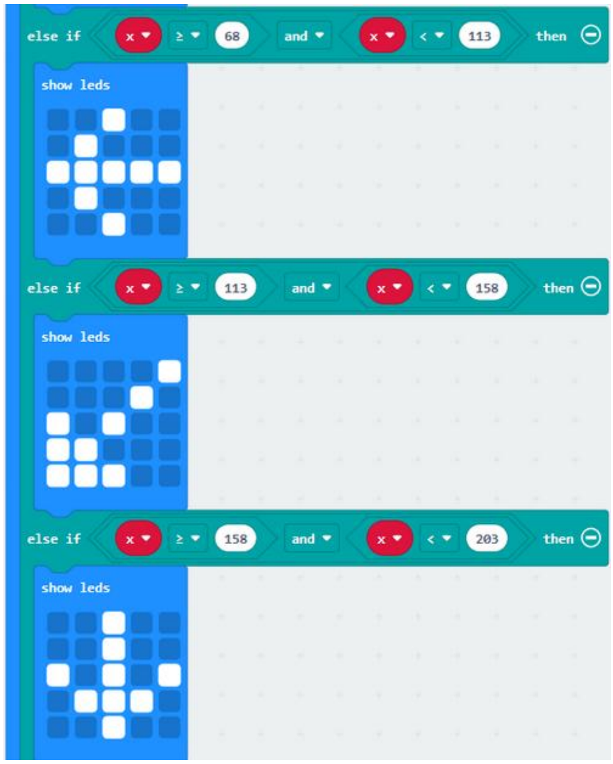

Search...
Basic
Input
Music
Led
Radio
Loops
Logic
Variables
Variables
Make a Variable...
Click on it to create a variable
x
set x to 0
change x by 1

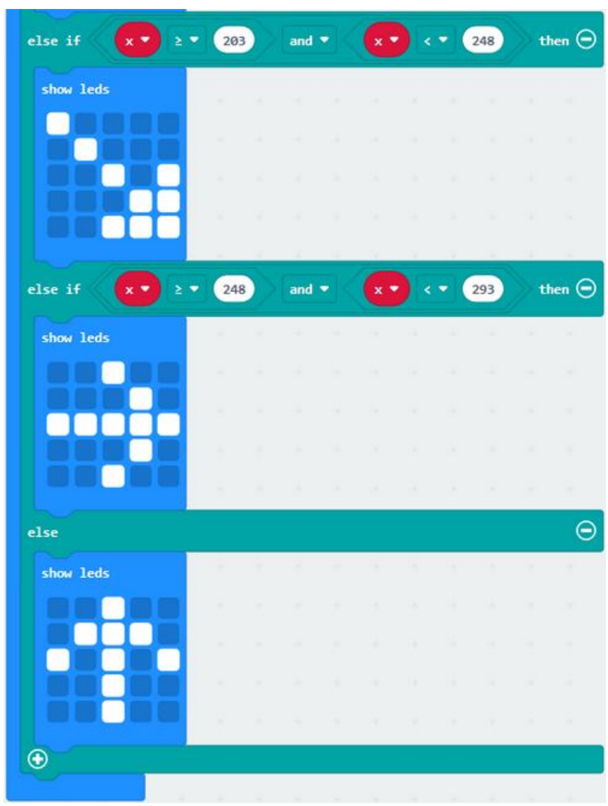

Search...
Basic
Input
Music
Led
Radio
Loops
Logic
Variables
Basic
show number 0
show leds



Build blocks:



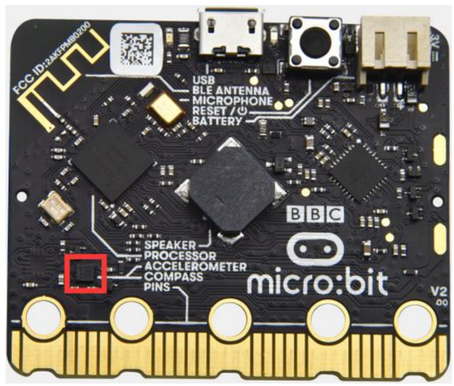

else if x ≥ 68 and x < 113 then
show leds
else if x ≥ 113 and x < 158 then
show leds
else if x ≥ 158 and x < 203 then
show leds


else if x ≥ 203 and x < 248 then
show leds
else if x ≥ 248 and x < 293 then
show leds
else
show leds

7. Test Result 2

After uploading code and calibrating, tilt micro:bit board and the LED dot matrix displays the direction signs.

Project 7: Accelerometer



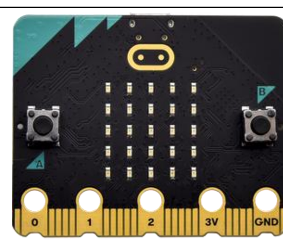
1. Introduction

The micro:bit board boasts a built-in LSM303AGR acceleration sensor (accelerometer) which includes standard, fast, plus and high-speed mode (100 kHz, 400 kHz, 1 MHz and 3.4 MHz) of I2C serial bus interface and SPI serial standard interface for external communication, with resolution of 8/10/12 bits and range of ±2g, ±4g, or ±8g.

When the micro:bit board is at rest or in uniform motion, the accelerometer only detects the acceleration of gravity. If the board is slightly swung, the detected acceleration is much less than the that of gravity, but the difference can be ignored. Therefore, we mainly detect the change of gravitational acceleration on the x, y, and z axes.

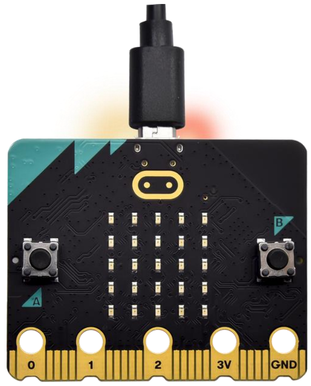
In this project, we will introduce how to measure the position of the board with the accelerometer. And then we may have a look at the original three-axis value output by the accelerometer.

2. Components

Micro:bit mainboard*1	
Micro USB cable*1	

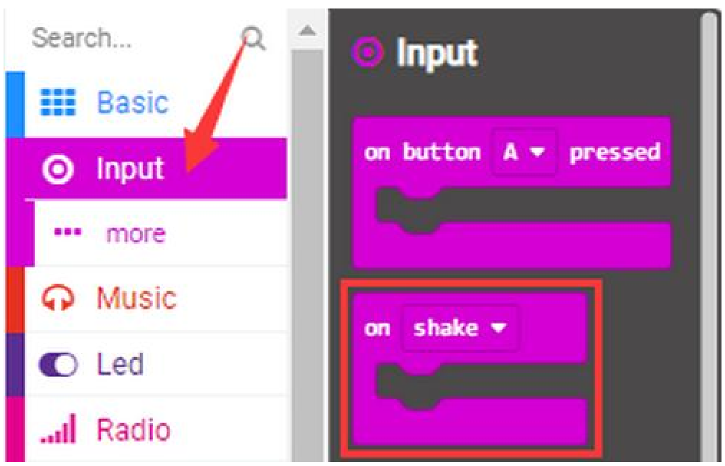
3. Connection

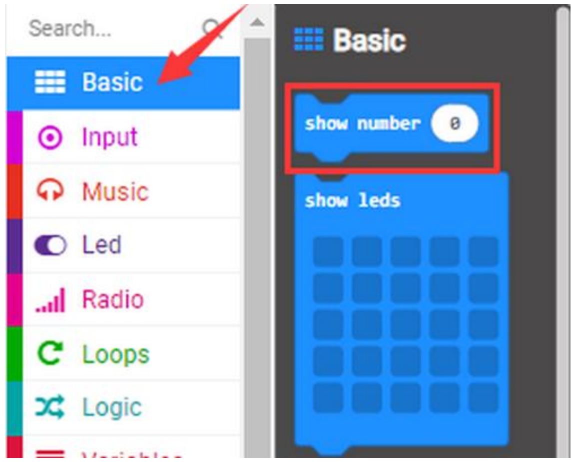
Connect the board to your computer via micro USB cable.



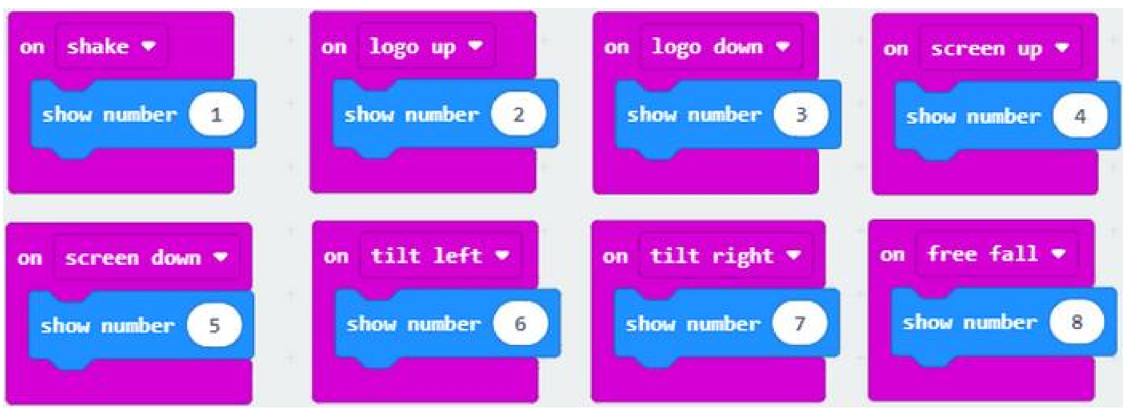
4. Test Code

Find code blocks:





Build blocks:



---

5. Test Result 1

After uploading code and powering on, if we shake the Micro:Bit board(any direction), the LED dot matrix displays the digit “1”.

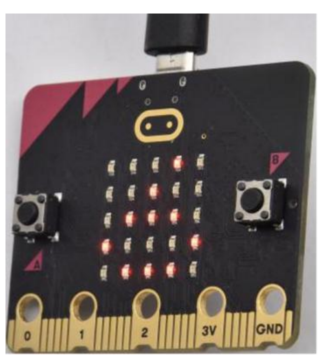
When the logo is kept above, number 2 displays.

When it is kept upside down(logo below the LED dot matrix), it shows as below.

When it is placed on the desk, the number 4 appears.

When it is covered on the desk, the number 5 exhibits.

When the board is tilted to the left, the LED dot matrix shows the number 6 as shown below.



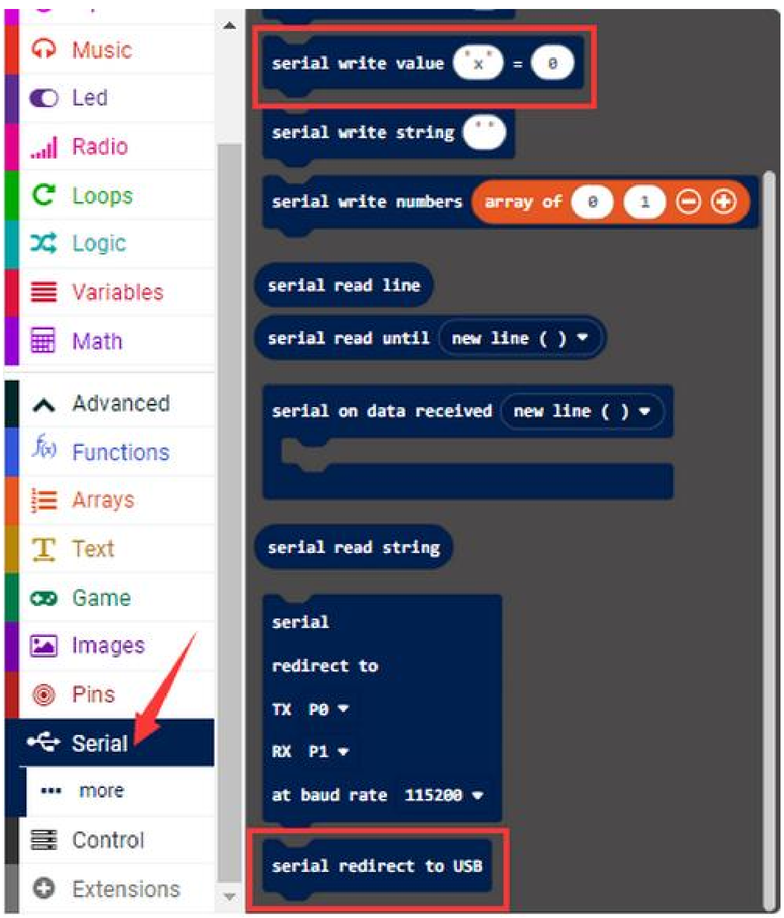
When the board is tilted to the right , the LED dot matrix displays the number 7 as shown below:

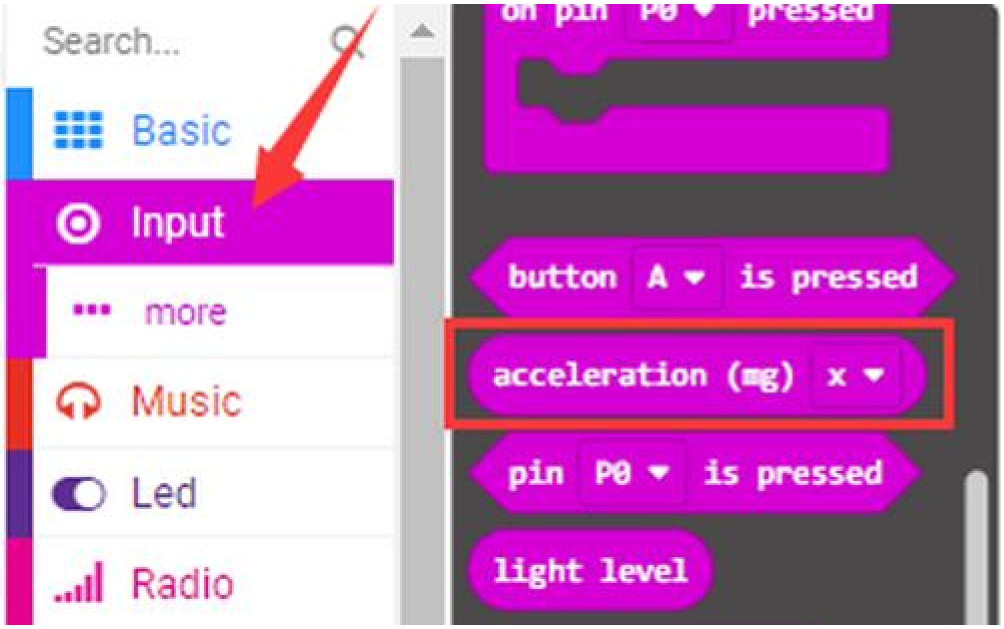
When the board falls down to the floor (a free fall), the LED dot matrix shows the number 8. (Please note that this test is not recommended for it may damage the main board.)

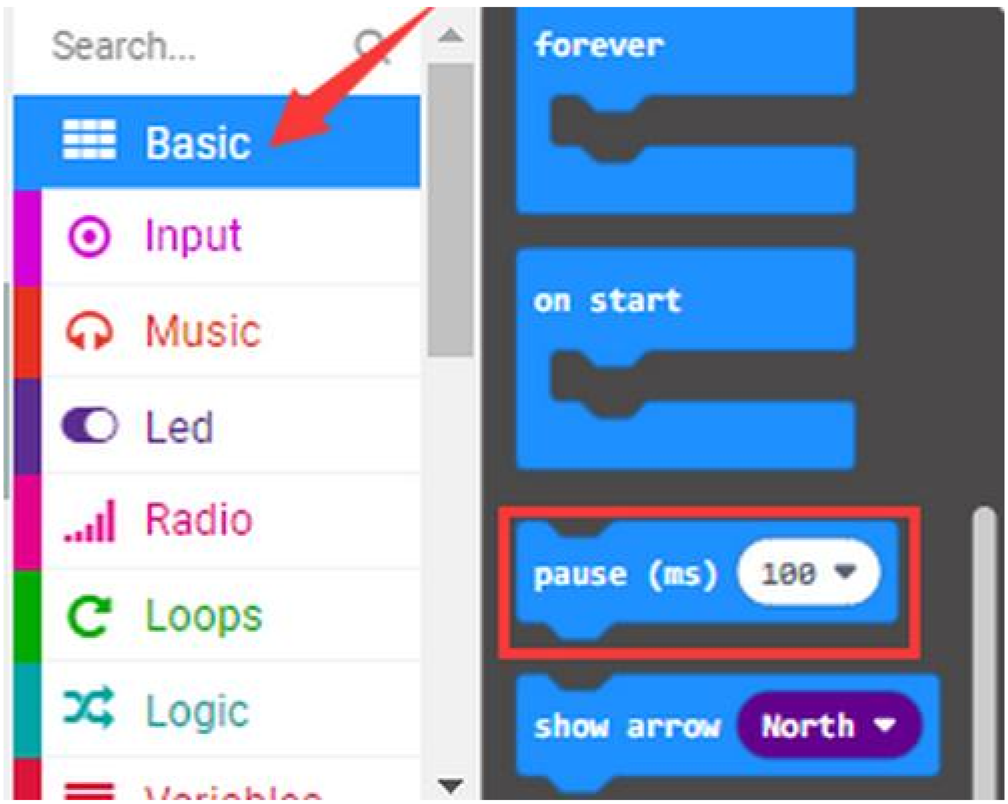
If you'd like to try this function, you can also set the acceleration to 3g, 6g or 8g. But the micro:bit board needs to be swung with 3x / 6x / 8x G-force, so we do not recommend.

6. Test Code 2

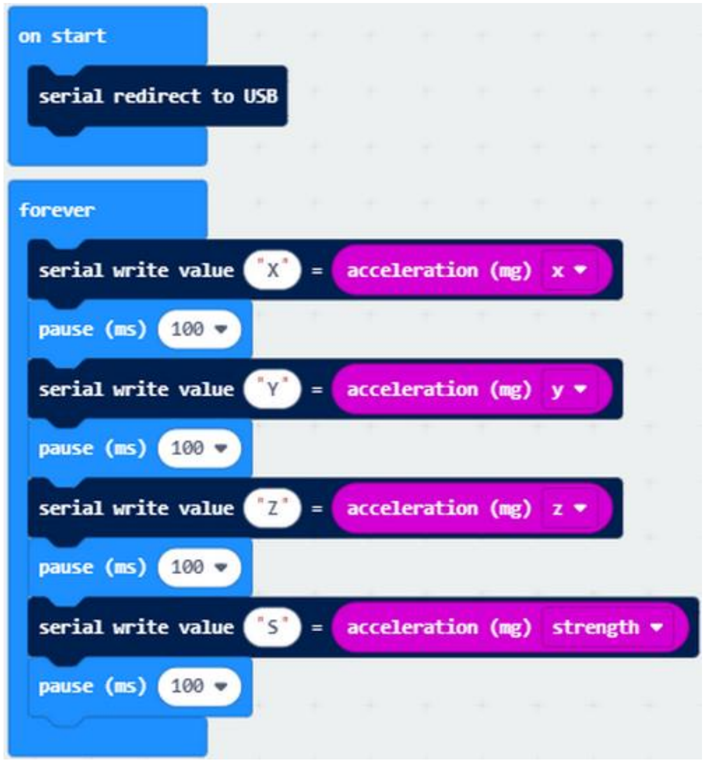
Find code blocks:





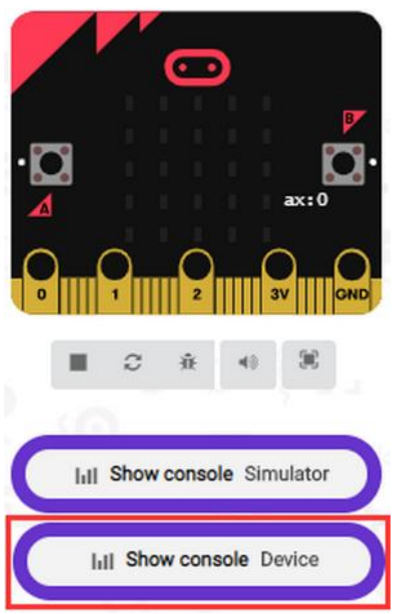


Build blocks:

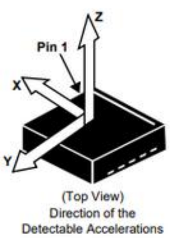


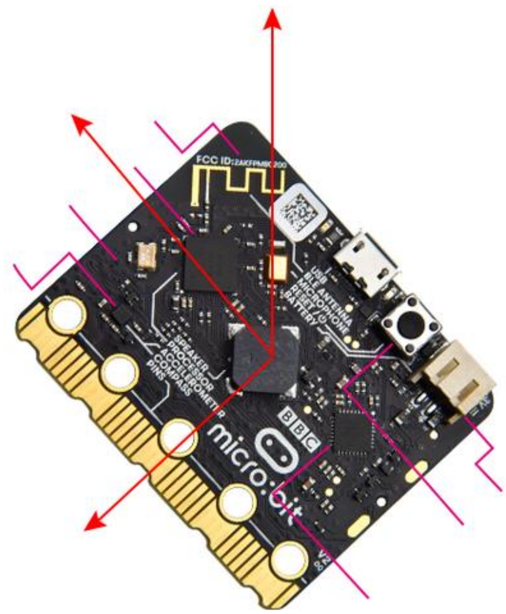
7. Test Result 2

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



After referring to the MMA8653FC data manual and the hardware schematic diagram, the accelerometer coordinate of the Micro: Bit are shown in the figure below:



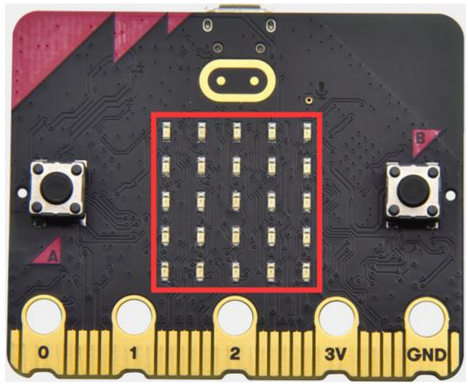


The following interface shows the decomposition value of acceleration in X axis, Y axis and Z axis respectively, as well as acceleration synthesis (acceleration synthesis of gravity and other external forces).

If you're running Windows 7 or 8 instead of Windows 10, via Google Chrome won't be able to match devices. You'll need to use the CoolTerm serial monitor to read value.

Open CoolTerm and click **Options** to select **SerialPort**, and set COM port and baud rate to 115200. Click **OK** and **Connect**. The CoolTerm serial monitor shows the data of X axis, Y axis and Z axis , as shown in the figures below:

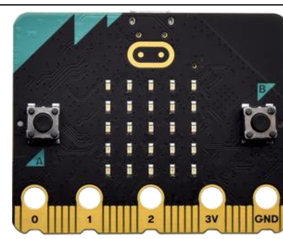
Project 8: Light Brightness Detection



1. Introduction

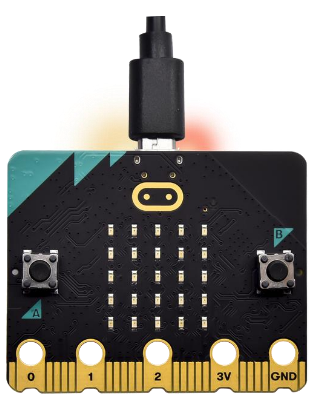
In this experiment, we will use the micro:bit board to detect light intensity. Since the micro:bit board does not contains its own photoresistor, the LED dot matrix will shoulder this job. The light signal will convert into input, and the voltage decay time is sampled so that the detected light intensity is a relative value.

2. Components

Micro:bit mainboard*1	
Micro USB cable*1	

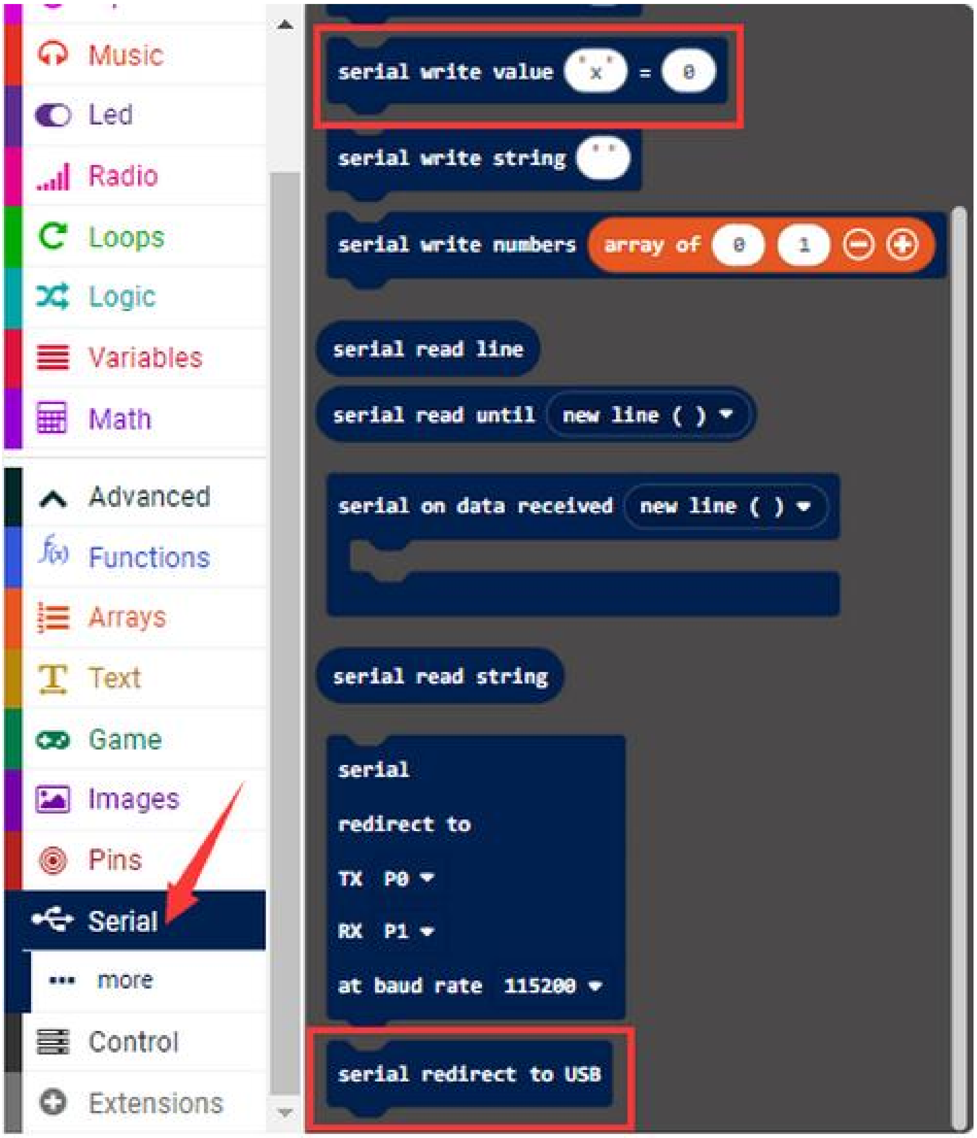
3. Connection

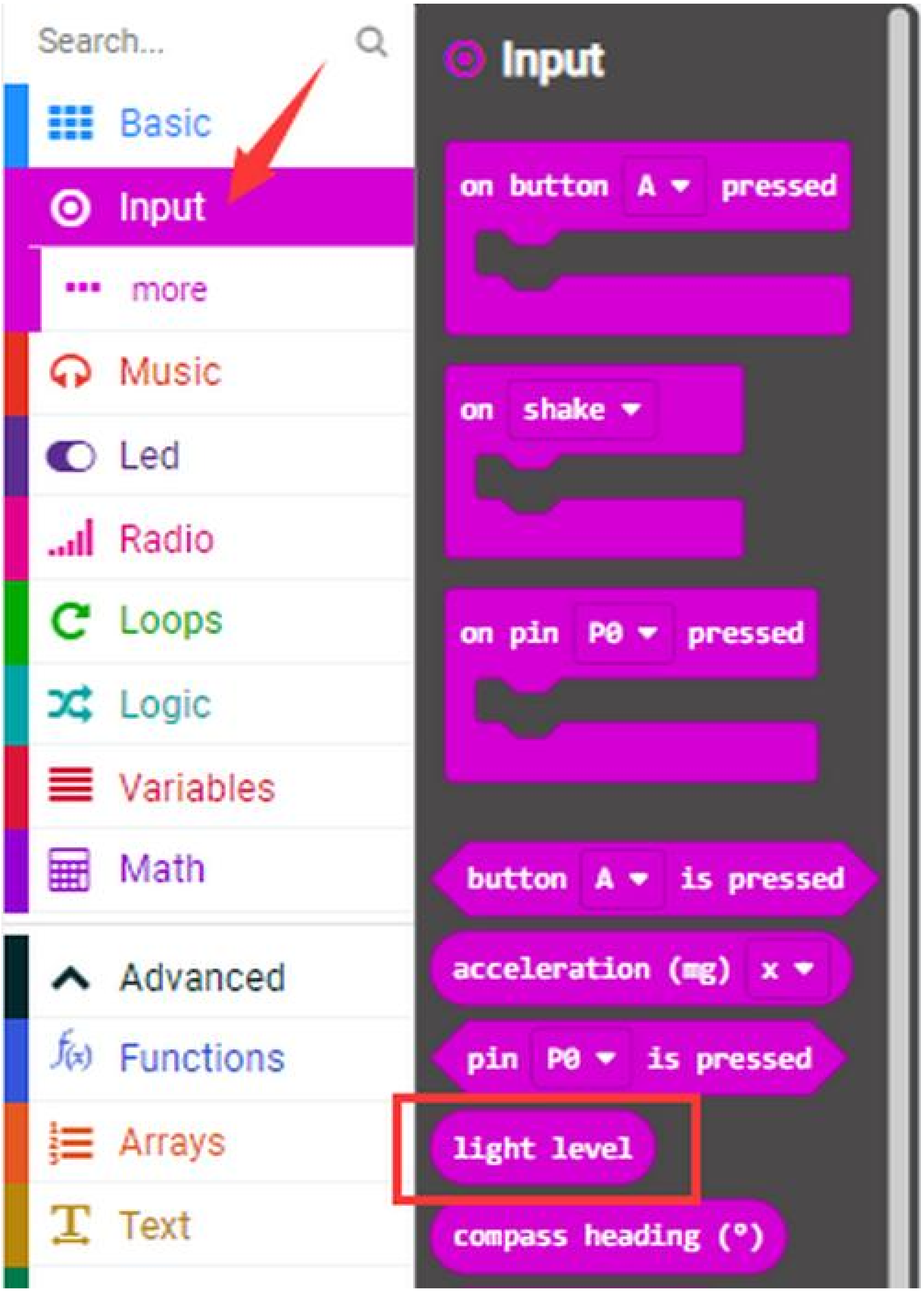
Connect the board to your computer via micro USB cable.



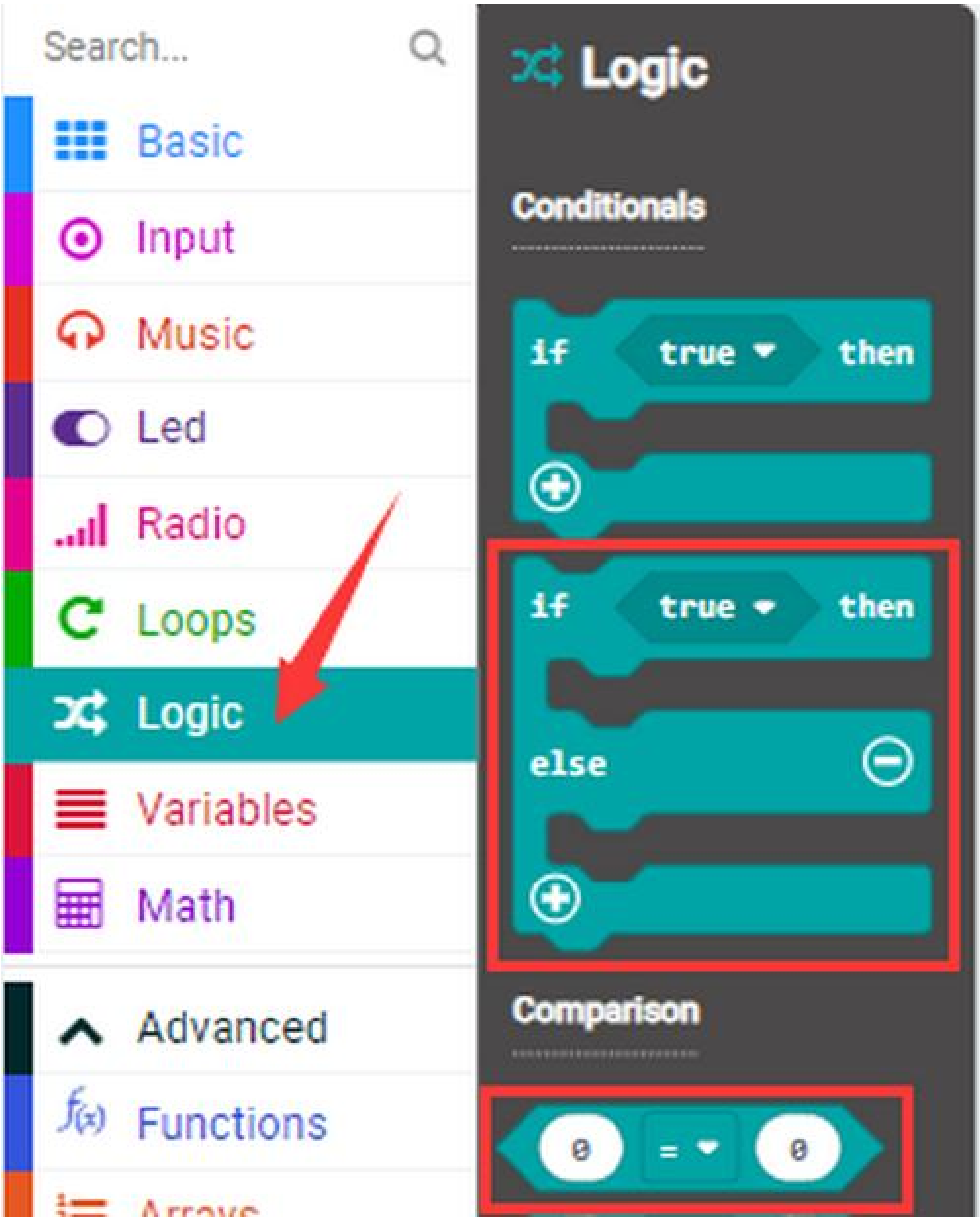
4. Test Code

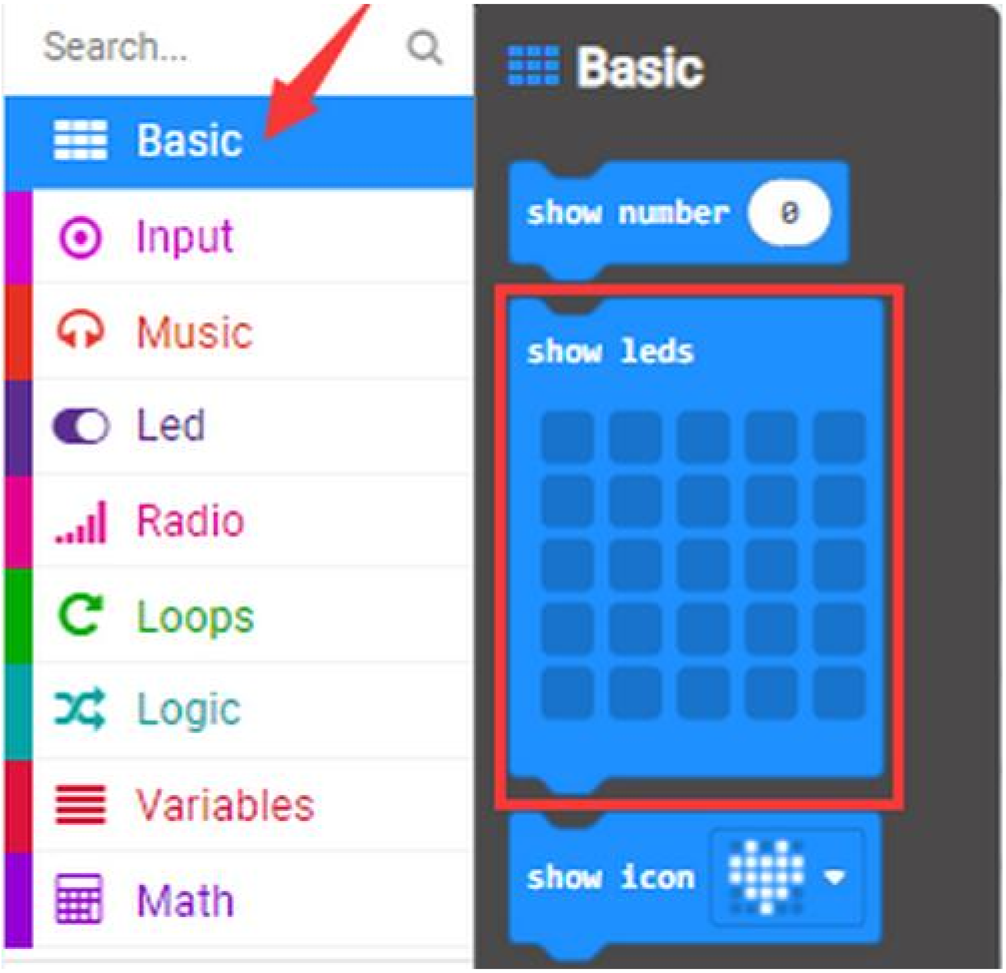
Find code blocks:



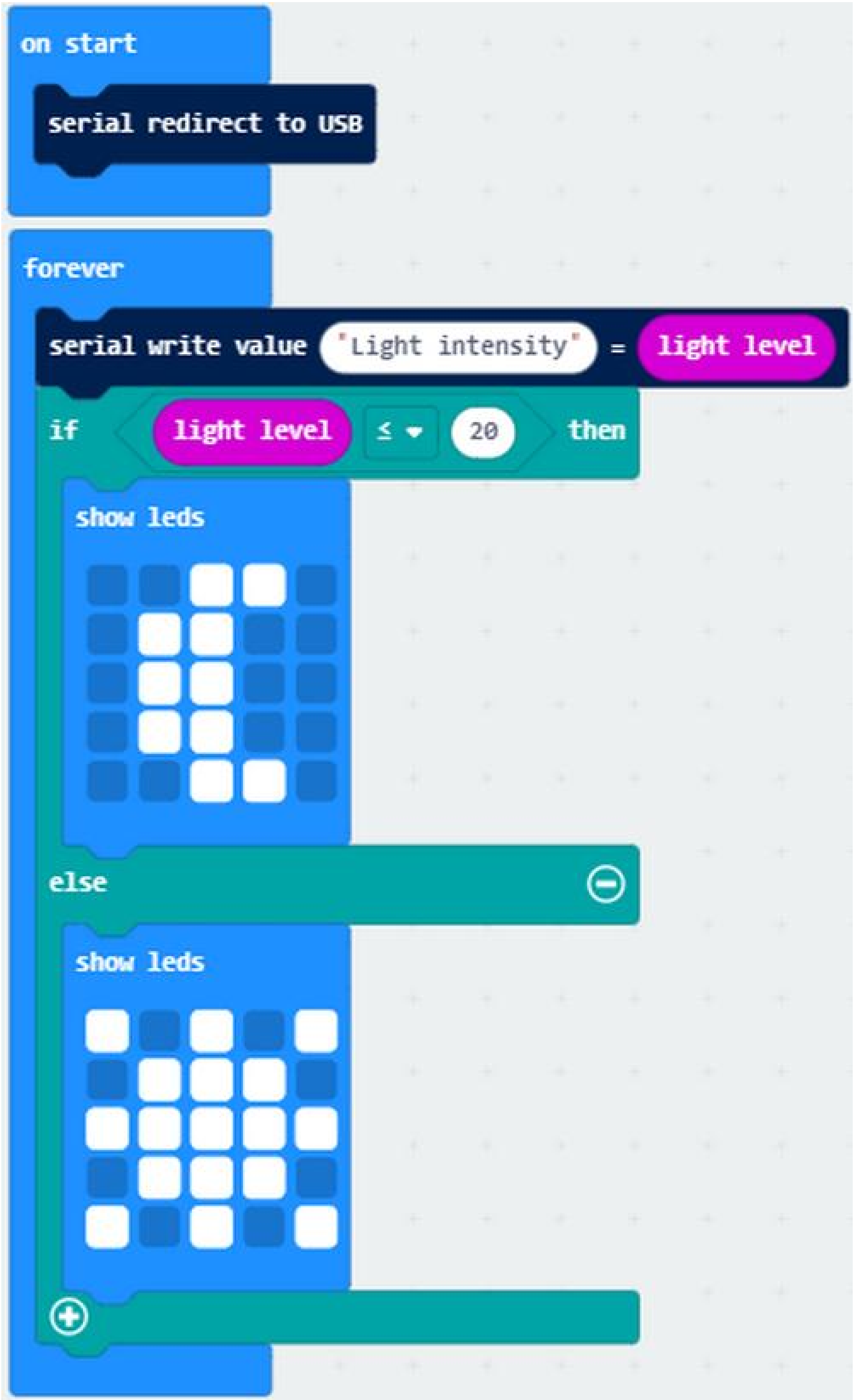


Search...
Basic
Input
more
Music
Led
Radio
Loops
Logic
Variables
Math
Advanced
Functions
Arrays
Text
Input
on button A pressed
on shake
on pin P0 pressed
button A is pressed
acceleration (mg) x
pin P0 is pressed
light level
compass heading (°)


Search...
Basic
Input
Music
Led
Radio
Loops
Logic
Variables
Math
Advanced
Functions
Logic
Conditionals
if true then
if true then
else
Comparison
0 = 0

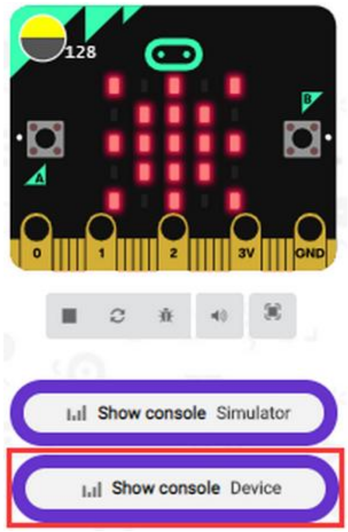


Build blocks:

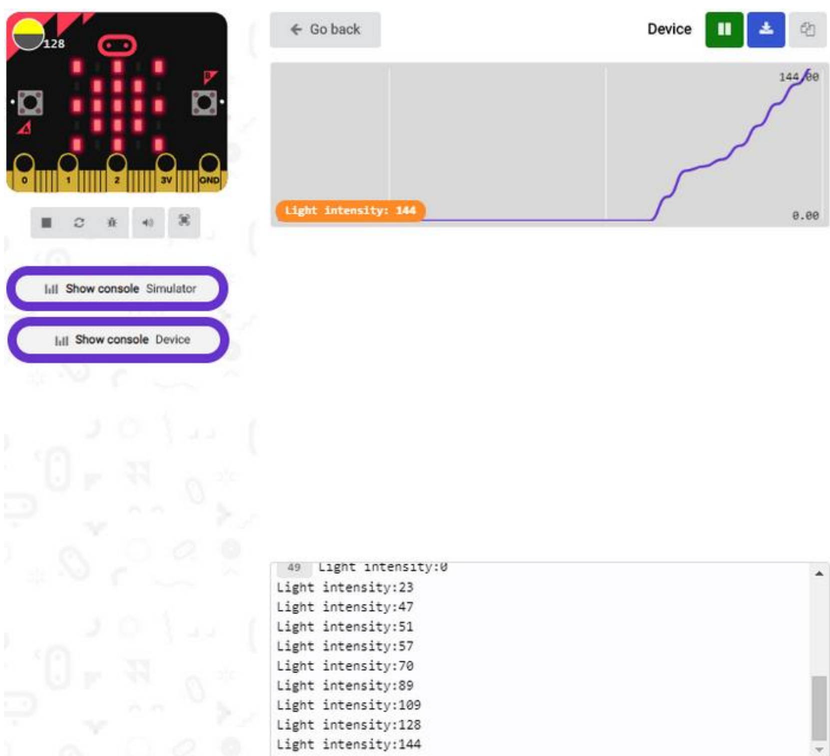

on start
serial redirect to USB
forever
serial write value "Light intensity" = light level
if light level ≤ 20 then
show leds
else
show leds

5. Test Result

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



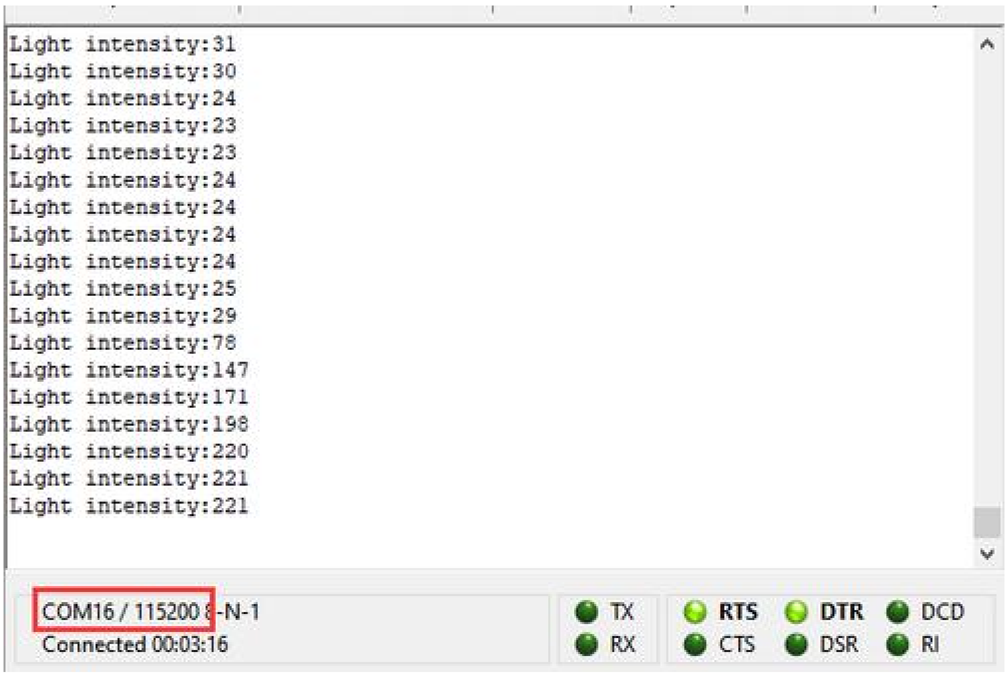
When the LED dot matrix is covered by hand, the light intensity is approximately 0; when the LED dot matrix is exposed to light, the light intensity gets stronger with the light as shown below:



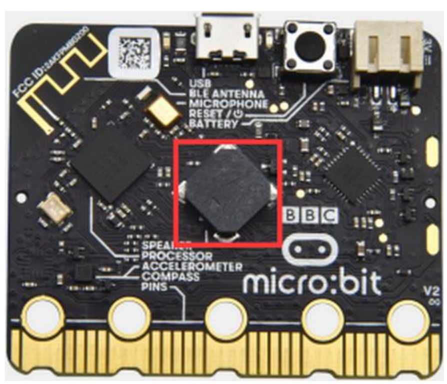
20 in the code is an arbitrary value of light intensity. If the current light value is less than or equal to 20, the icon moon will appear on the LED dot matrix. If it's bigger than 20, the sun will appear.

If you're running Windows 7 or 8 instead of Windows 10, Google Chrome won't be able to match devices. CoolTerm will be required.

Open CoolTerm and click **Options** to select **SerialPort**, and set COM port and baud rate to 115200, click **OK** and **Connect**. The CoolTerm serial monitor shows the value of light intensity, as shown below:



Project 9: Speaker

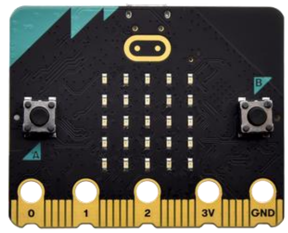


1. Introduction

Micro: Bit board boasts an built-in speaker, which makes sound to the programs easier. It is also able to make sound such as utter giggles, greetings and yawning as well as all kinds of tones, like playing the song *Ode to Joy*.

You can also turn off the built-in speaker to enjoy the beautiful music via headphones connected to GND and P0. In MakeCode, you need to turn off the speaker by "Turn off built-in speakers" block.

2. Components

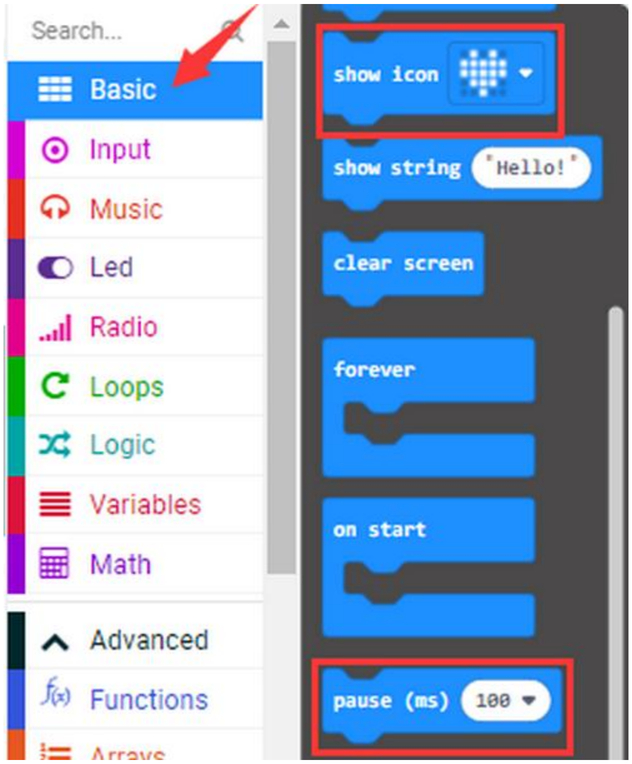
Micro:bit mainboard*1	
Micro USB cable*1	

3. Connection

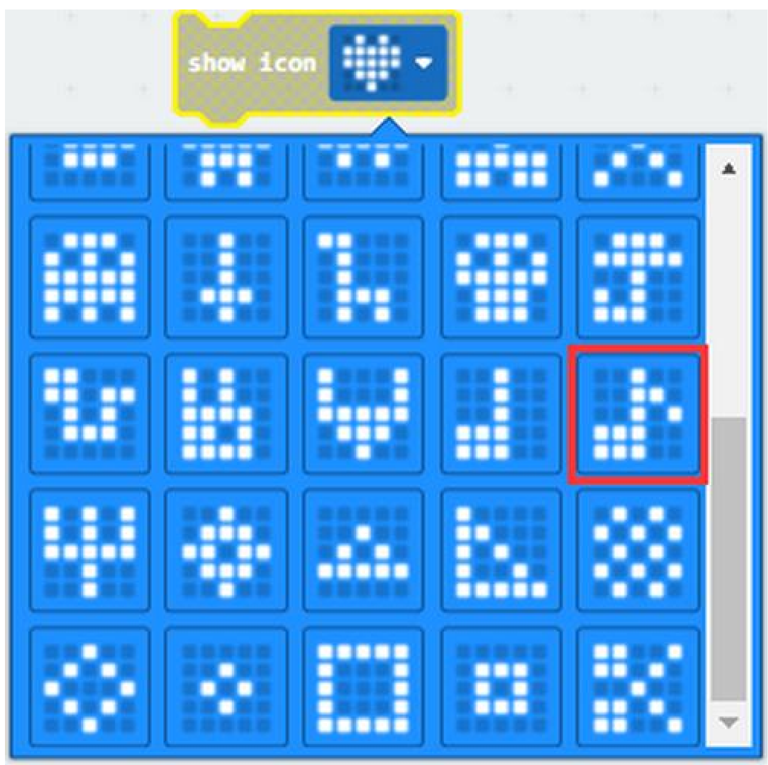
Connect the board to your computer via micro USB cable.

4. Test Code

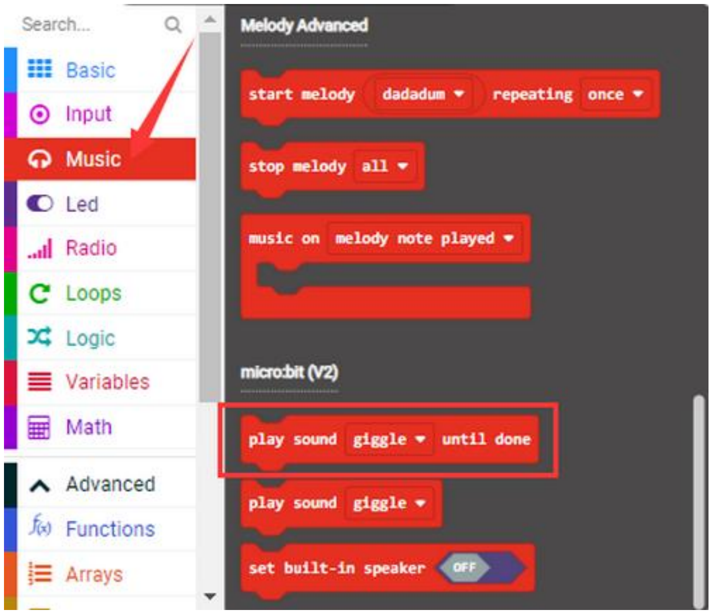
Find code blocks:



Search...
Basic
Input
Music
Led
Radio
Loops
Logic
Variables
Math
Advanced
Functions
show icon
show string "Hello!"
clear screen
forever
on start
pause (ms) 100



show icon



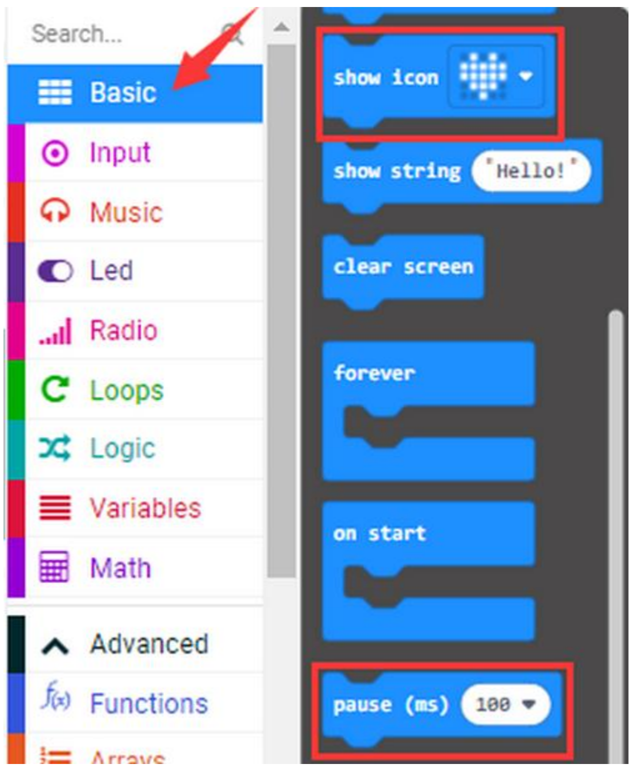
Build blocks:

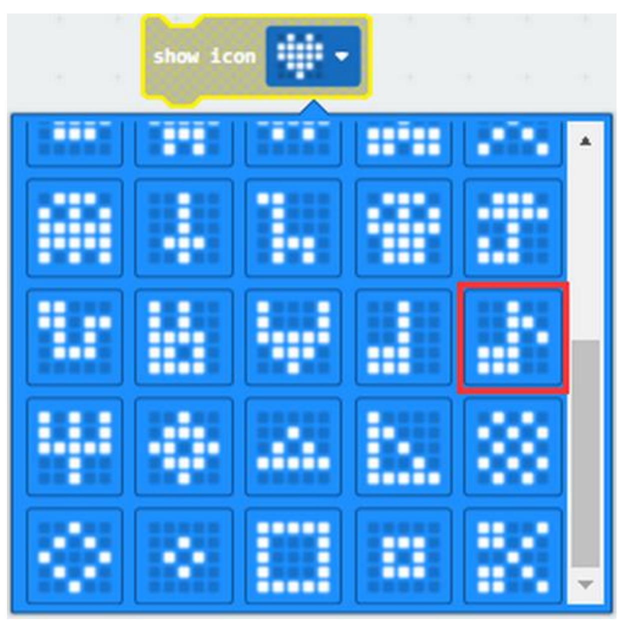
5. Test Result 1

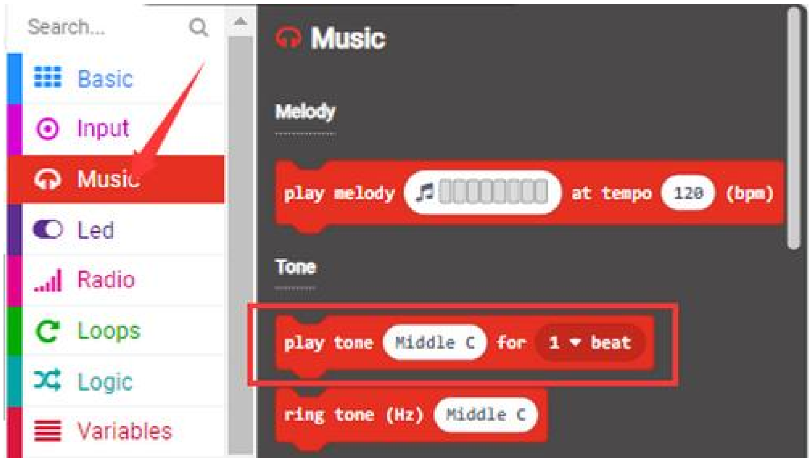
After uploading code and powering on, the speaker utters sound and the LED dot matrix shows the logo of music.

6. Test Code 2

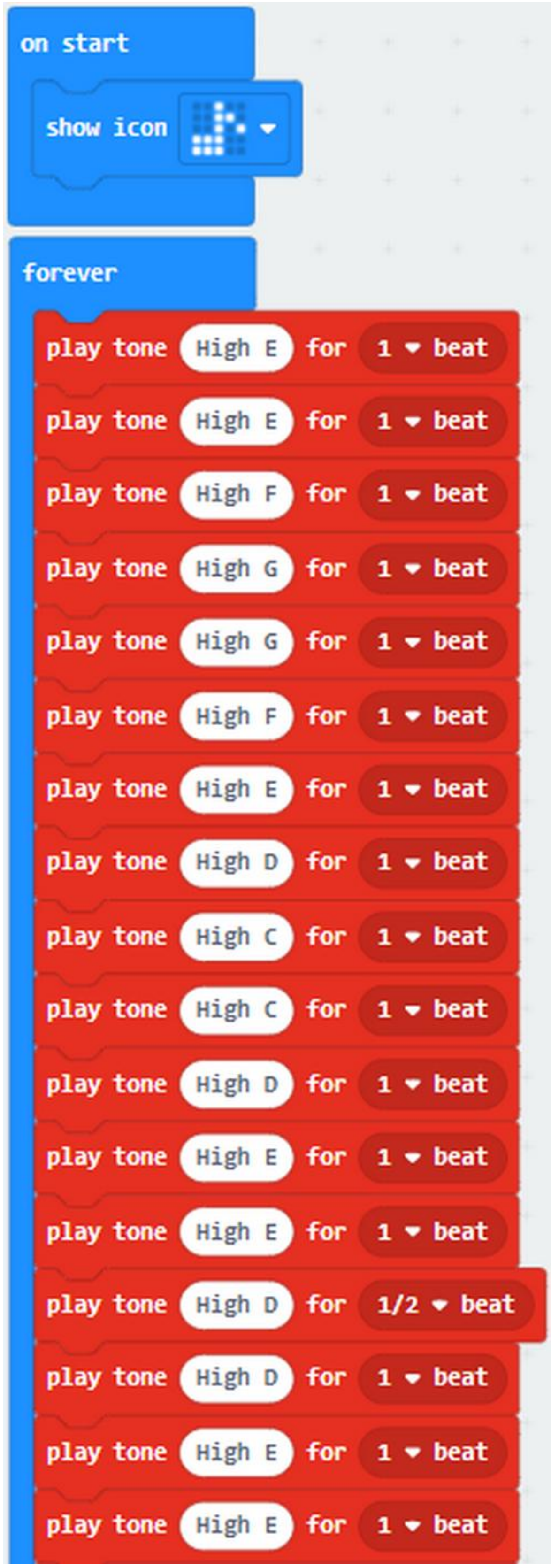
Find code blocks:

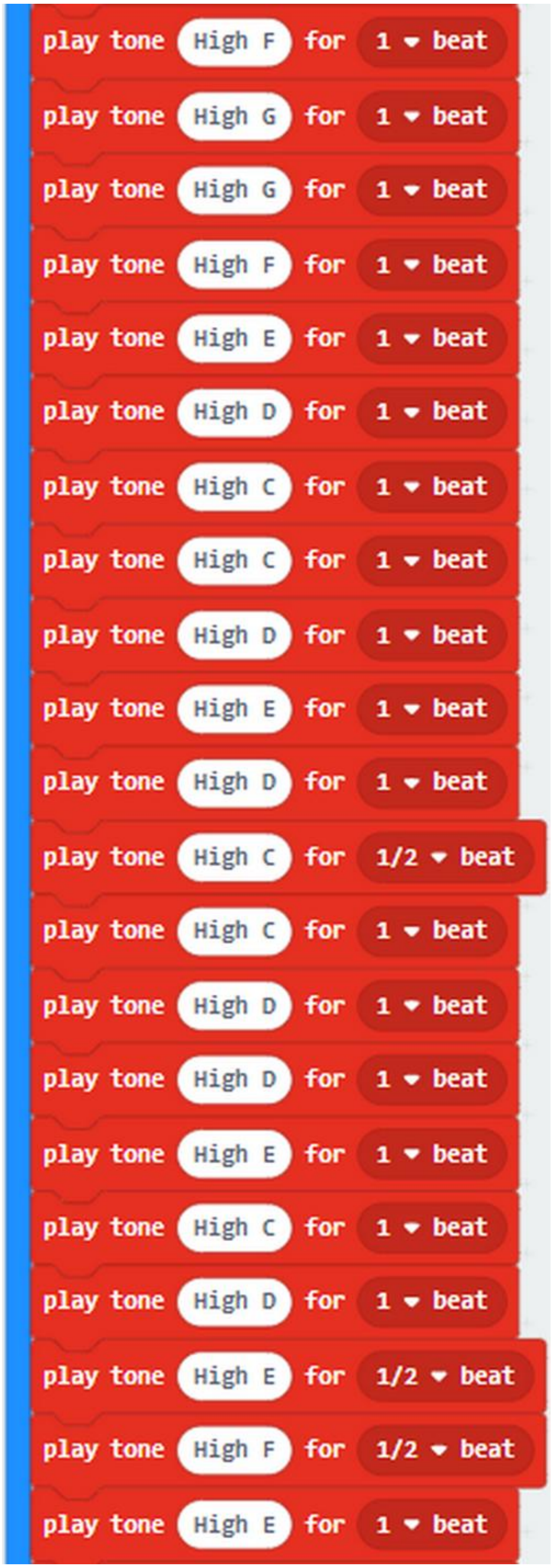


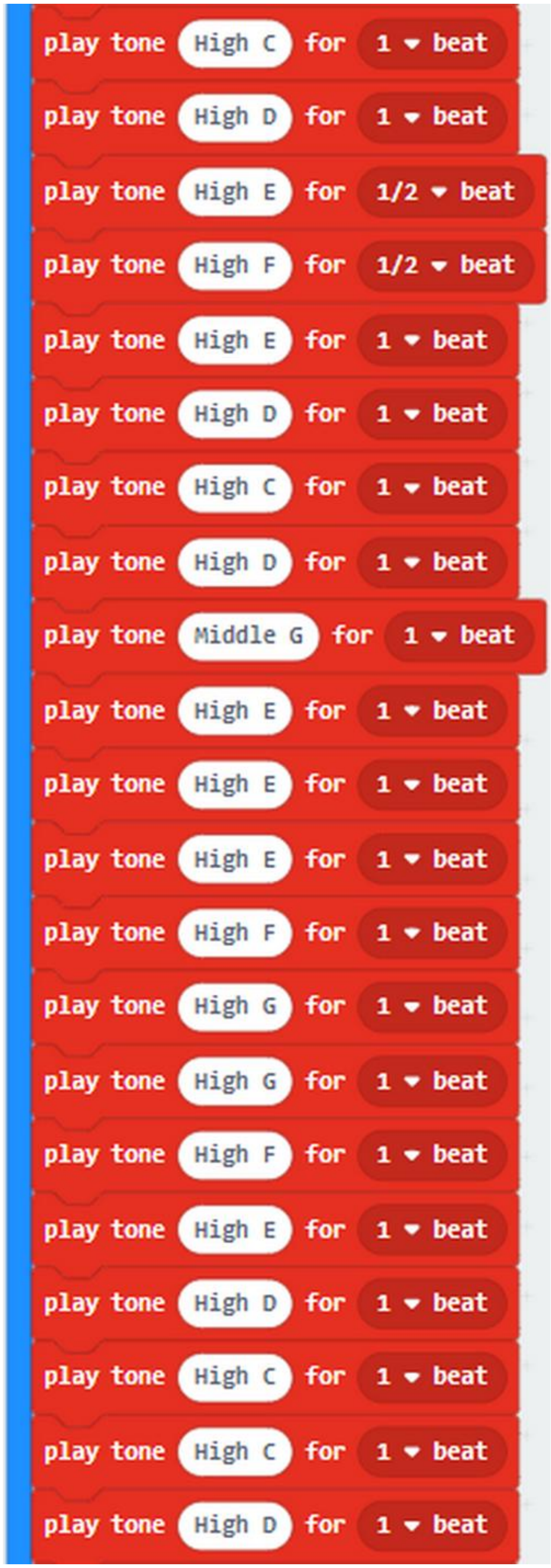


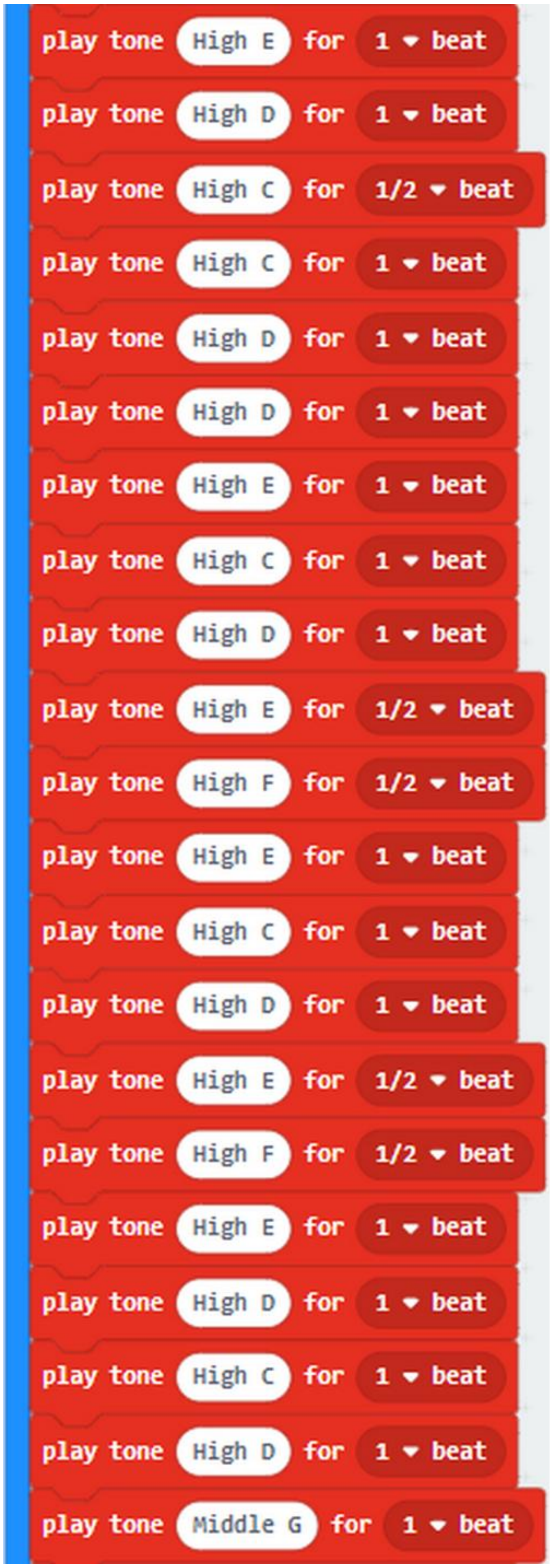


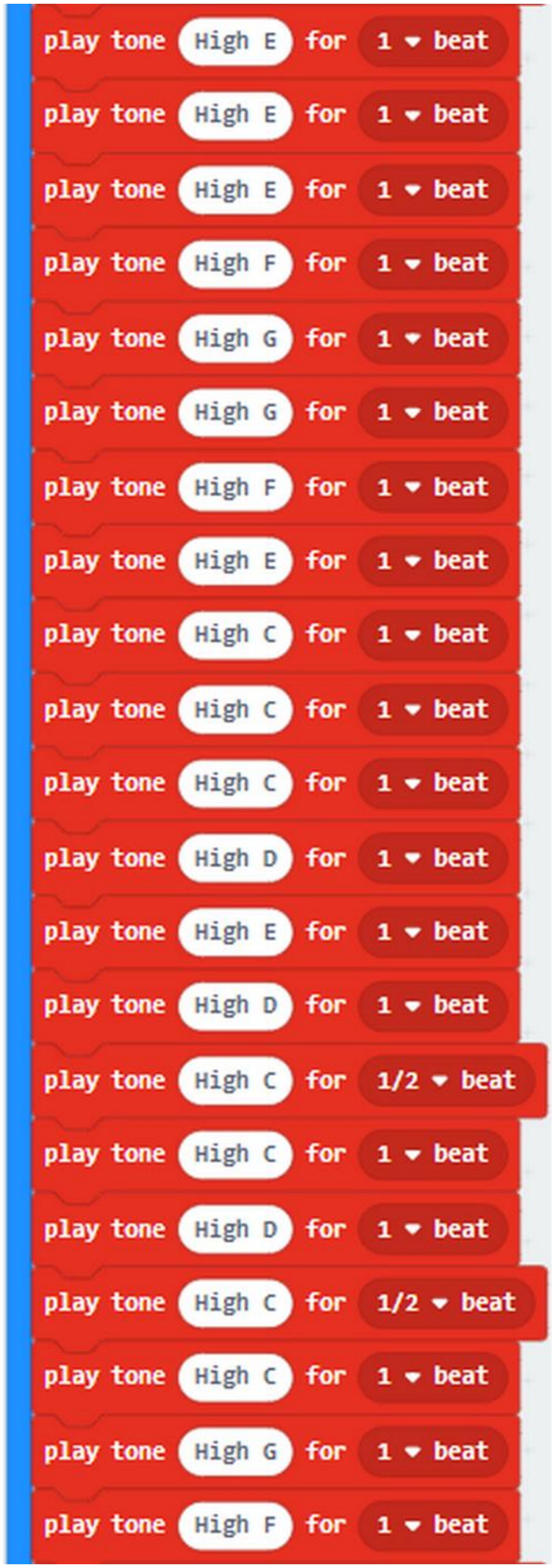
Build blocks:

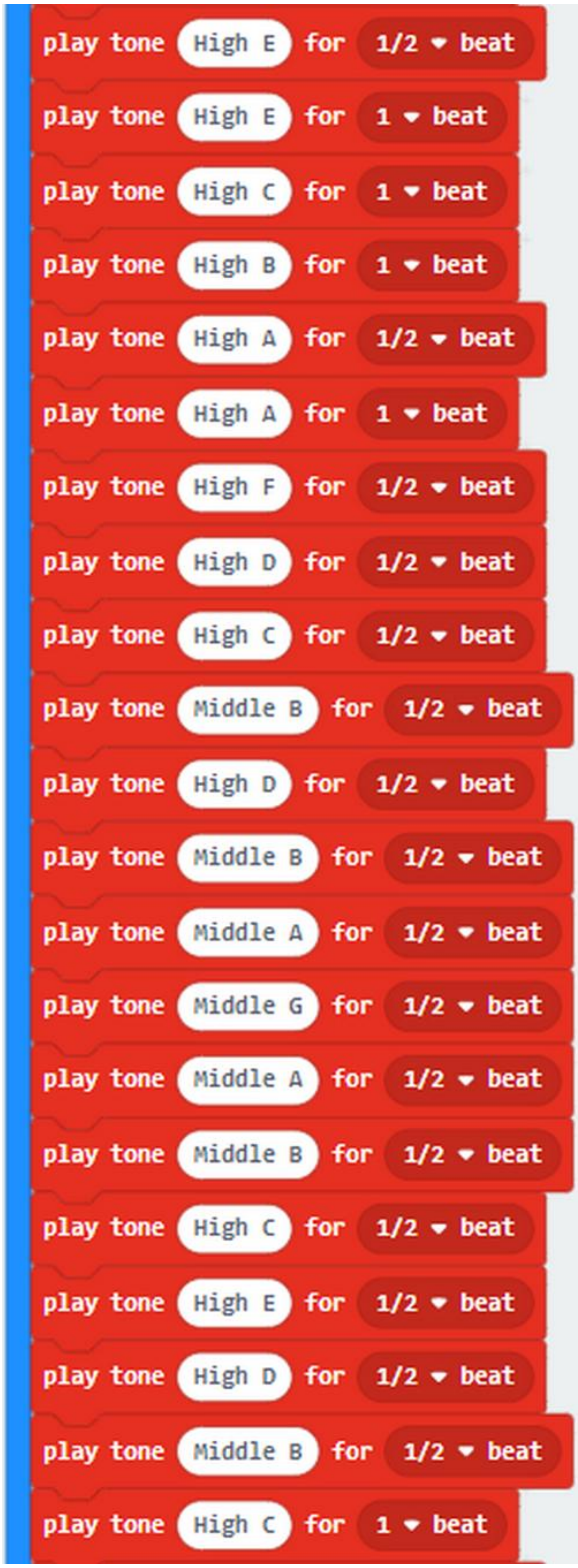

on start
show icon
forever
play tone High E for 1 beat
play tone High E for 1 beat
play tone High F for 1 beat
play tone High G for 1 beat
play tone High G for 1 beat
play tone High F for 1 beat
play tone High E for 1 beat
play tone High D for 1 beat
play tone High C for 1 beat
play tone High C for 1 beat
play tone High D for 1 beat
play tone High E for 1 beat
play tone High E for 1 beat
play tone High D for 1/2 beat
play tone High D 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

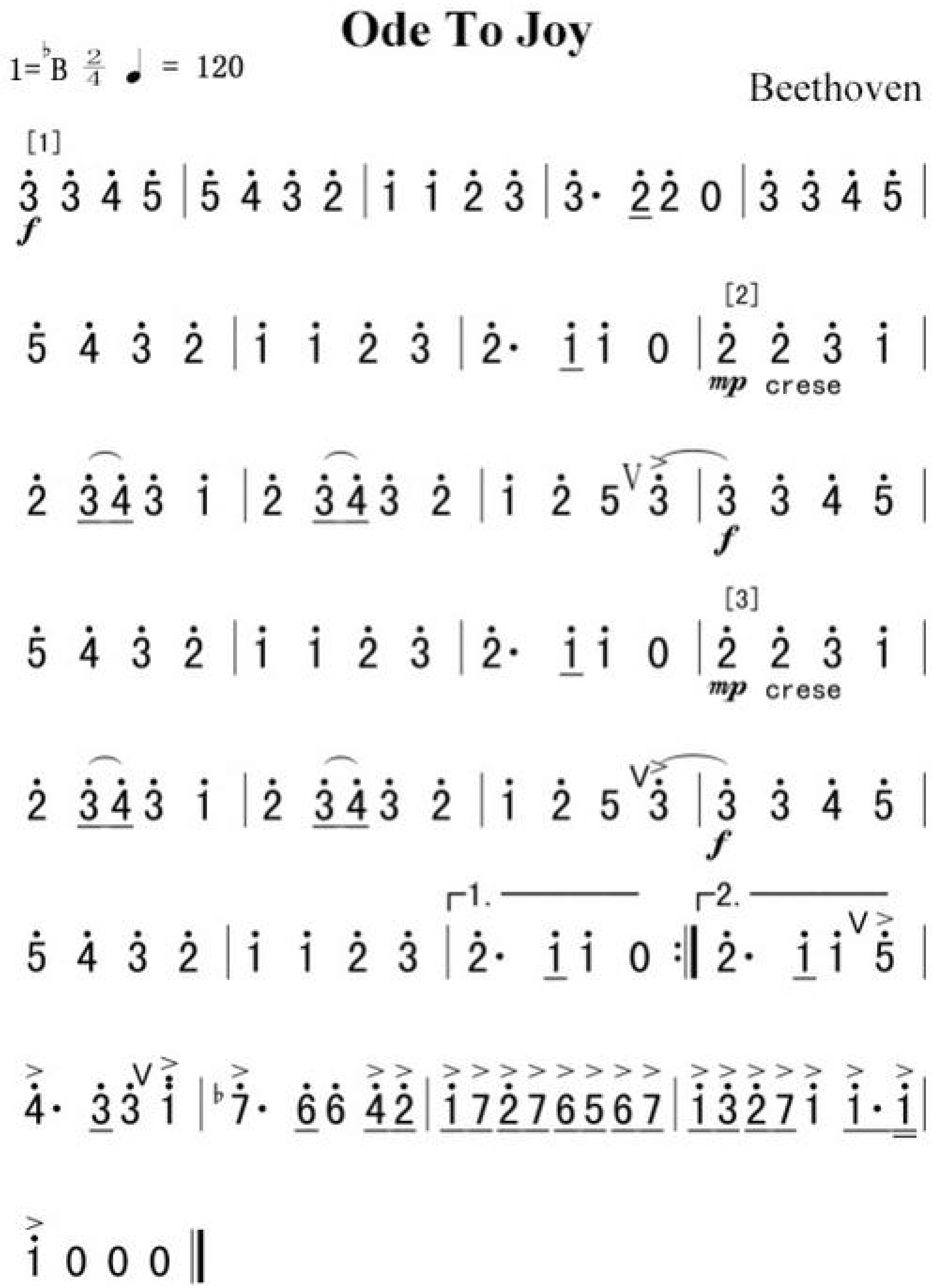

play tone High C for 1 beat
play tone High D for 1 beat
play tone High E for 1/2 beat
play tone High F for 1/2 beat
play tone High E for 1 beat
play tone High D for 1 beat
play tone High C for 1 beat
play tone High D for 1 beat
play tone Middle G for 1 beat
play tone High E for 1 beat
play tone High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

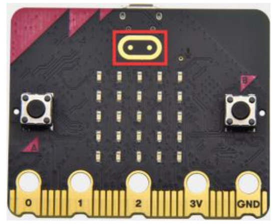

play tone High E for 1/2 beat
play tone High E for 1 beat
play tone High C for 1 beat
play tone High B for 1 beat
play tone High A for 1/2 beat
play tone High A for 1 beat
play tone High F for 1/2 beat
play tone High D for 1/2 beat
play tone High C for 1/2 beat
play tone Middle B for 1/2 beat
play tone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

Ode to Joy:



For more information about musical notations:
https://en.wikipedia.org/wiki/Numbered_musical_notation

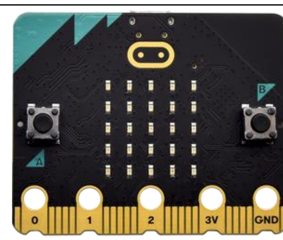
Project 10: Touch-sensitive Logo



1. Introduction

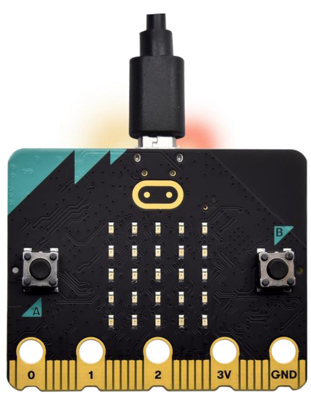
The Micro: Bit main board is equipped with a golden touch-sensitive logo, which can act as an extra button. This capacitive touch sensor senses small changes in the electric field when it is pressed or touched.

2. Components

Micro:bit mainboard*1	
Micro USB cable*1	

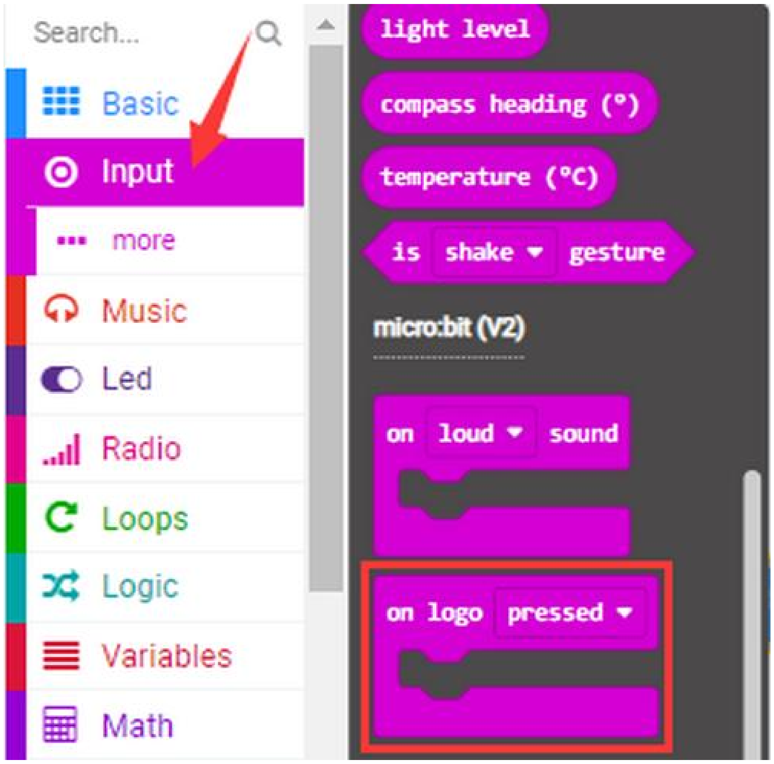
3. Connection

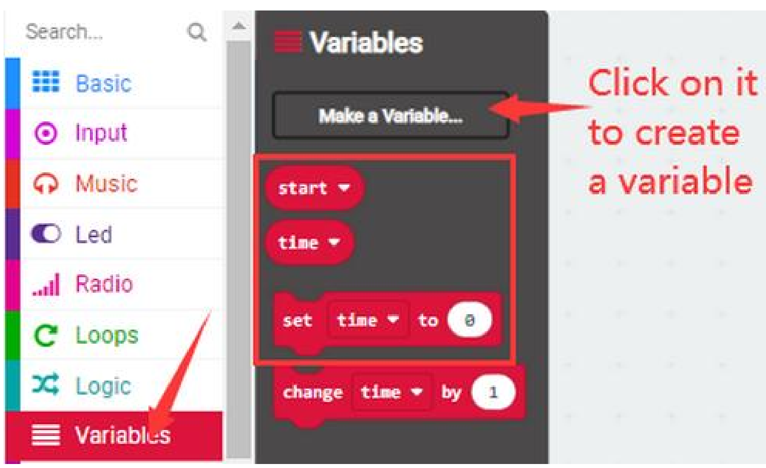
Connect the board to your computer via micro USB cable.

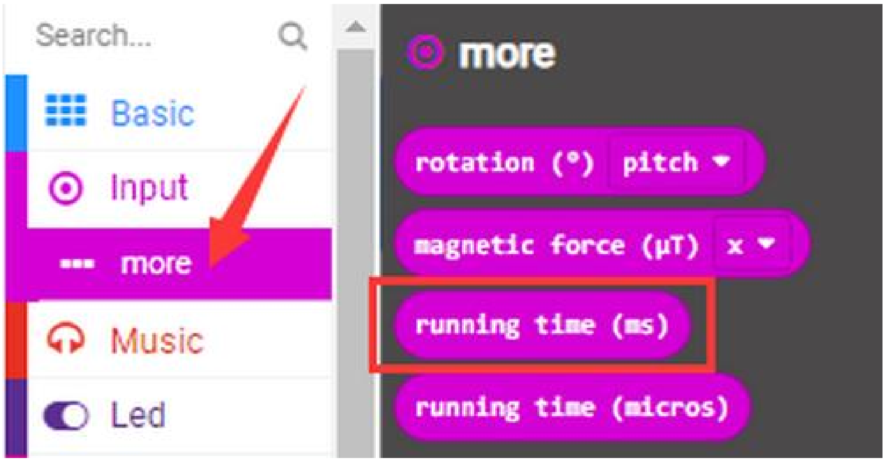


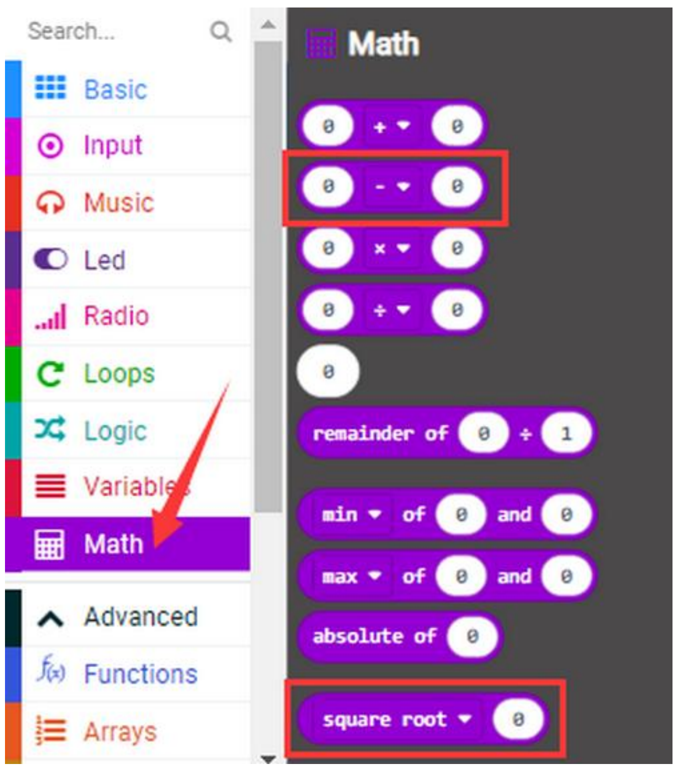
4. Test Code

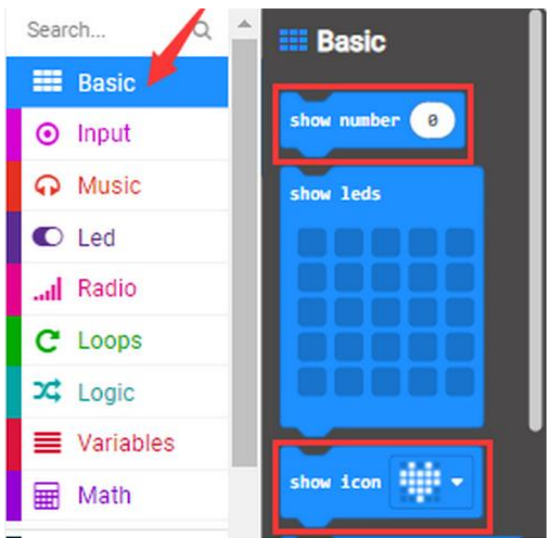
Find code blocks:


Search...
Basic
Input
more
Music
Led
Radio
Loops
Logic
Variables
Math
light level
compass heading (°)
temperature (°C)
is shake gesture
micro:bit (V2)
on loud sound
on logo pressed


Search...
Basic
Input
Music
Led
Radio
Loops
Logic
Variables
Variables
Make a Variable...
Click on it to create a variable
start
time
set time to 0
change time by 1


Search...
Basic
Input
more
Music
Led
more
rotation (°) pitch
magnetic force (µT) x
running time (ms)
running time (micros)


Search...
Basic
Input
Music
Led
Radio
Loops
Logic
Variables
Math
Advanced
Functions
Arrays
Math
0 + 0
0 - 0
0 × 0
0 ÷ 0
0
remainder of 0 ÷ 1
min of 0 and 0
max of 0 and 0
absolute of 0
square root 0

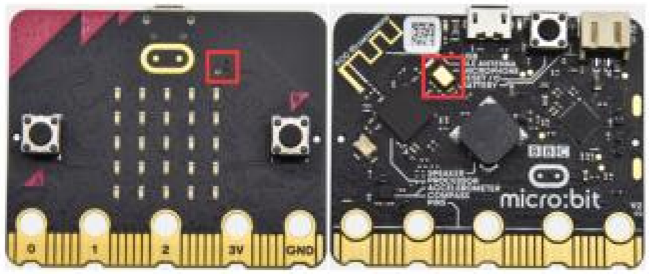


Build blocks:

5. Test Result

After uploading the code and powering on, the LED dot matrix exhibits the heart pattern "❤" when the logo is pressed or touched, and it displays digit when the logo is released. The longer it is pressed, the bigger the number is when it is released.

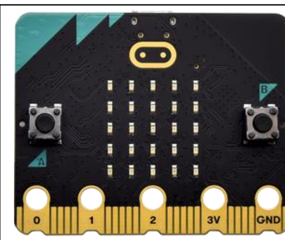
Project 11: Microphone



1. Introduction

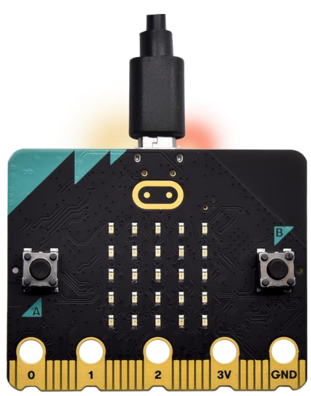
The Micro:bit mainboard is built with a microphone which can test the volume of ambient environment. When you clap, the microphone LED indicator turns on. So, you can make a disco lighting changing with music. The microphone is placed on the opposite side, and an LED indicator is next to the hole that lets sound pass. When the board detects sound, the LED indicator lights up.

2. Components

Micro:bit mainboard*1	
Micro USB cable*1	

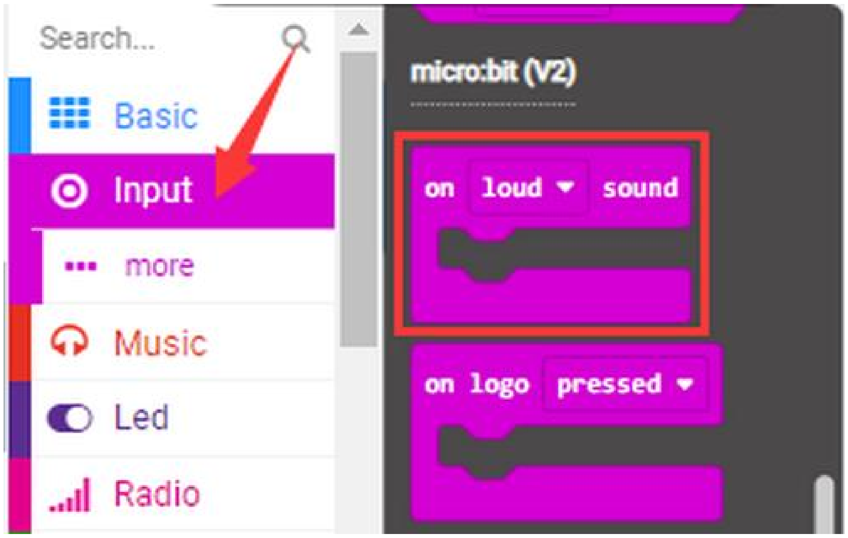
3. Connection

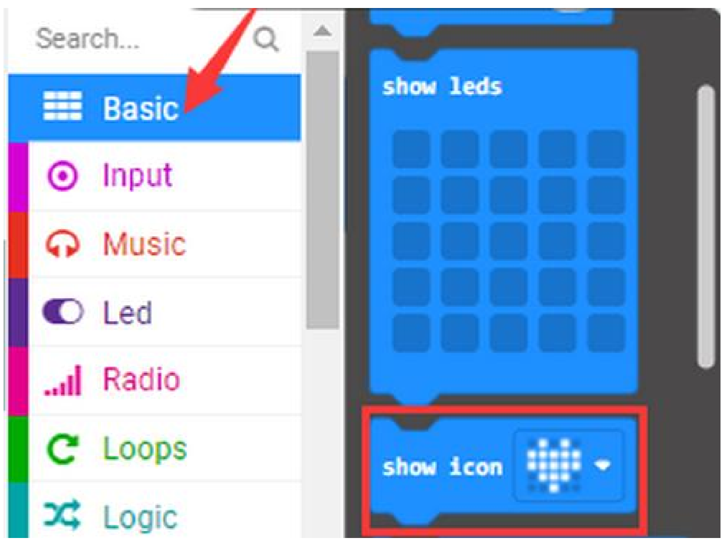
Connect the board to your computer via micro USB cable.



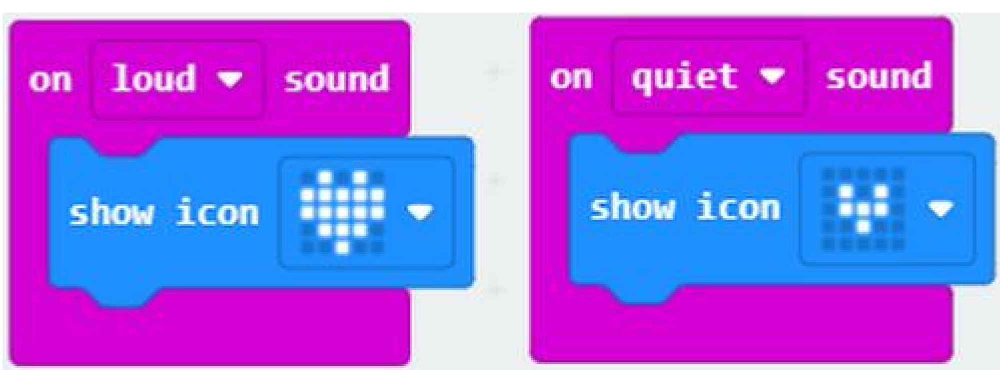
4. Test Code

Find code blocks:

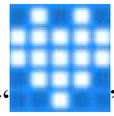
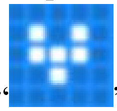




Build blocks:

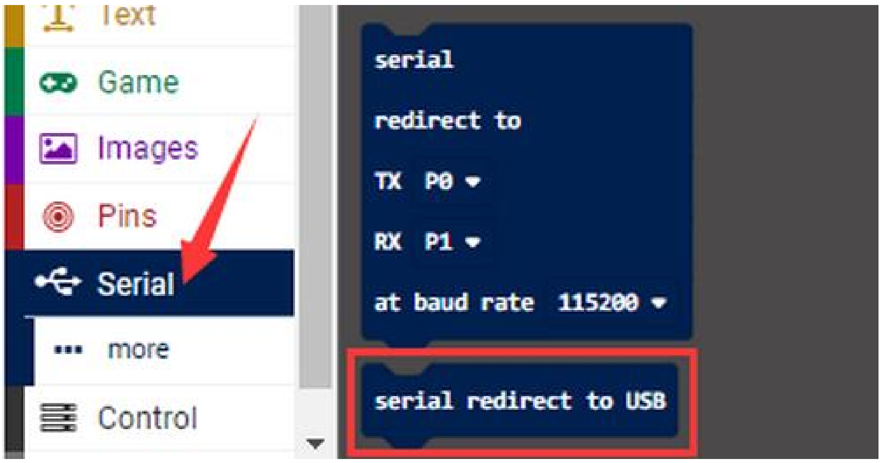


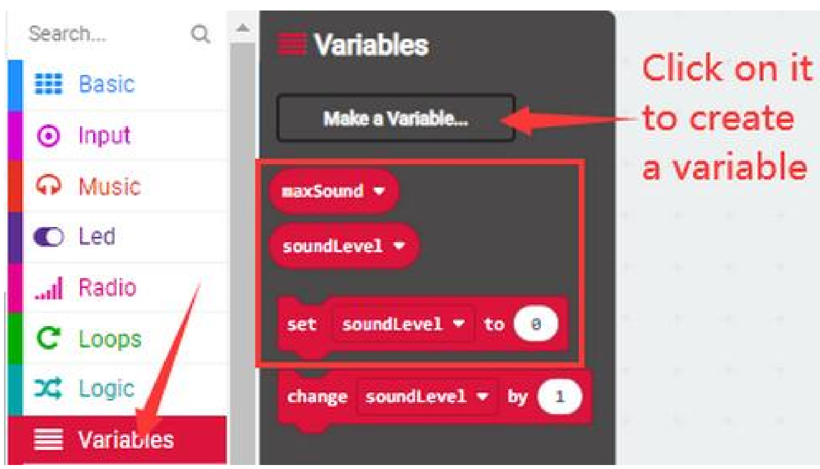
5. Test Result 1

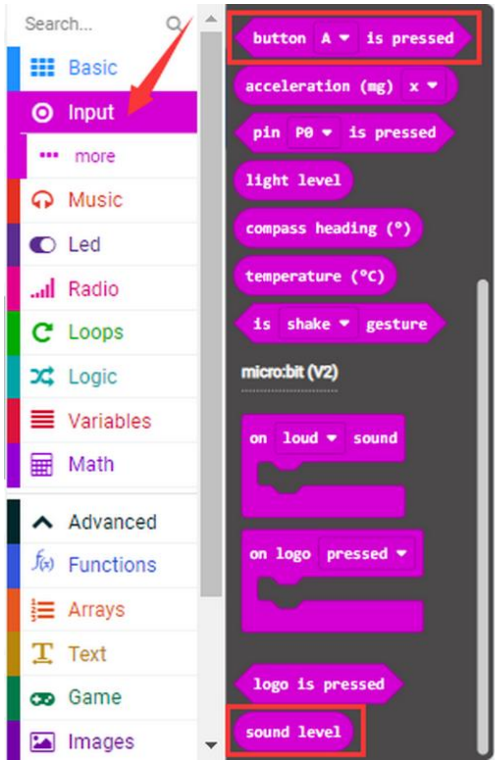
After uploading test code to micro:bit main board and powering the board via the USB cable, the LED dot matrix displays "" when you clap, and "" appears when it is quiet around.

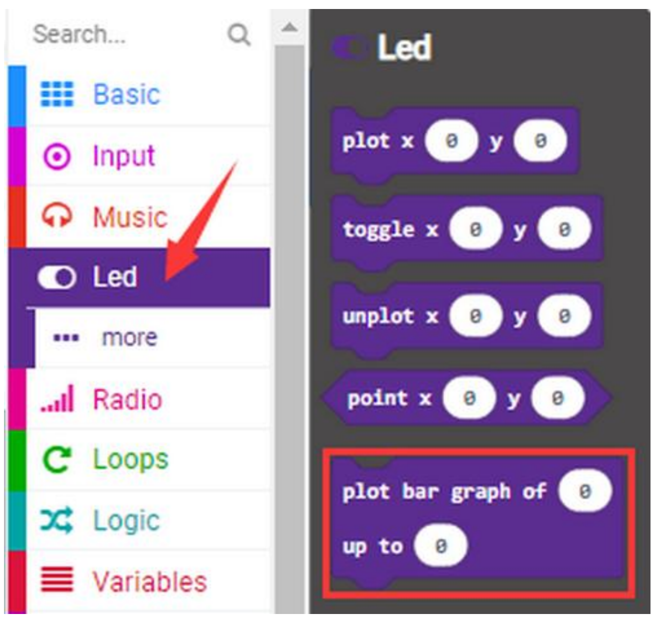
6. Test Code 2

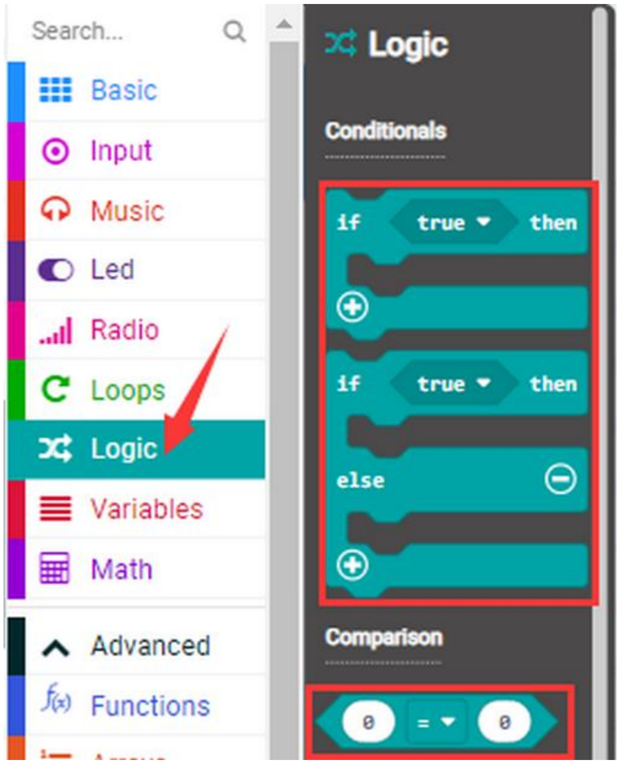
Find code blocks:

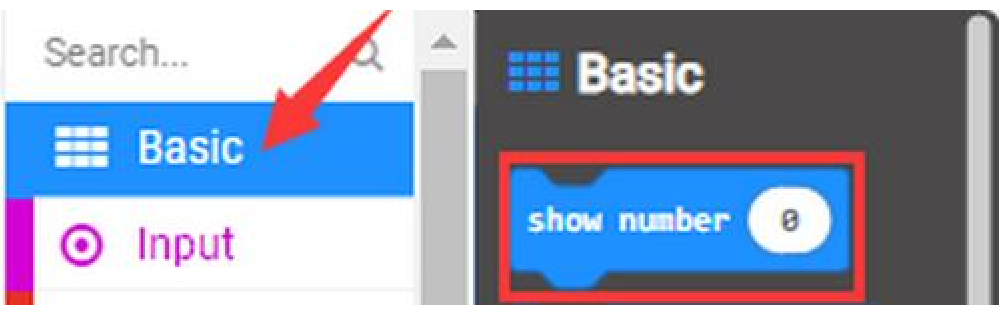




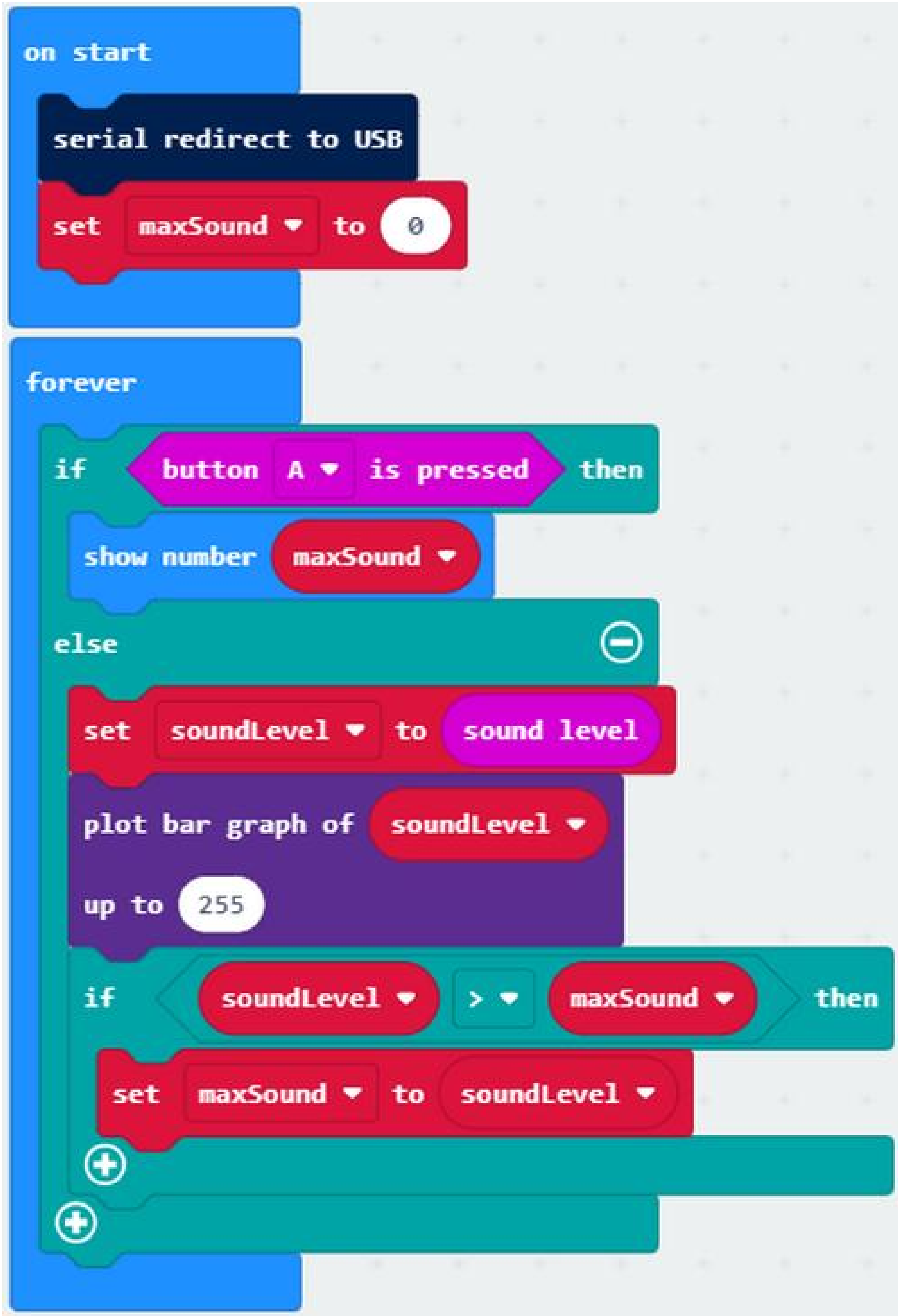

Search...
Basic
Input
more
Music
Led
Radio
Loops
Logic
Variables
Math
Advanced
Functions
Arrays
Text
Game
Images
button A is pressed
acceleration (mg) x
pin P0 is pressed
light level
compass heading (°)
temperature (°C)
is shake gesture
micro:bit (V2)
on loud sound
on logo pressed
logo is pressed
sound level


Search...
Basic
Input
Music
Led
more
Radio
Loops
Logic
Variables
Led
plot x 0 y 0
toggle x 0 y 0
unplot x 0 y 0
point x 0 y 0
plot bar graph of 0
up to 0



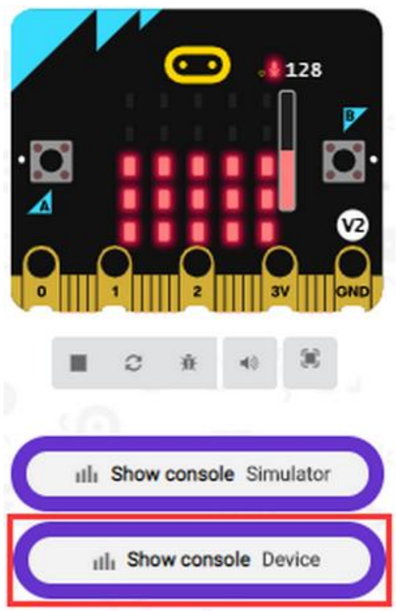


Build blocks:

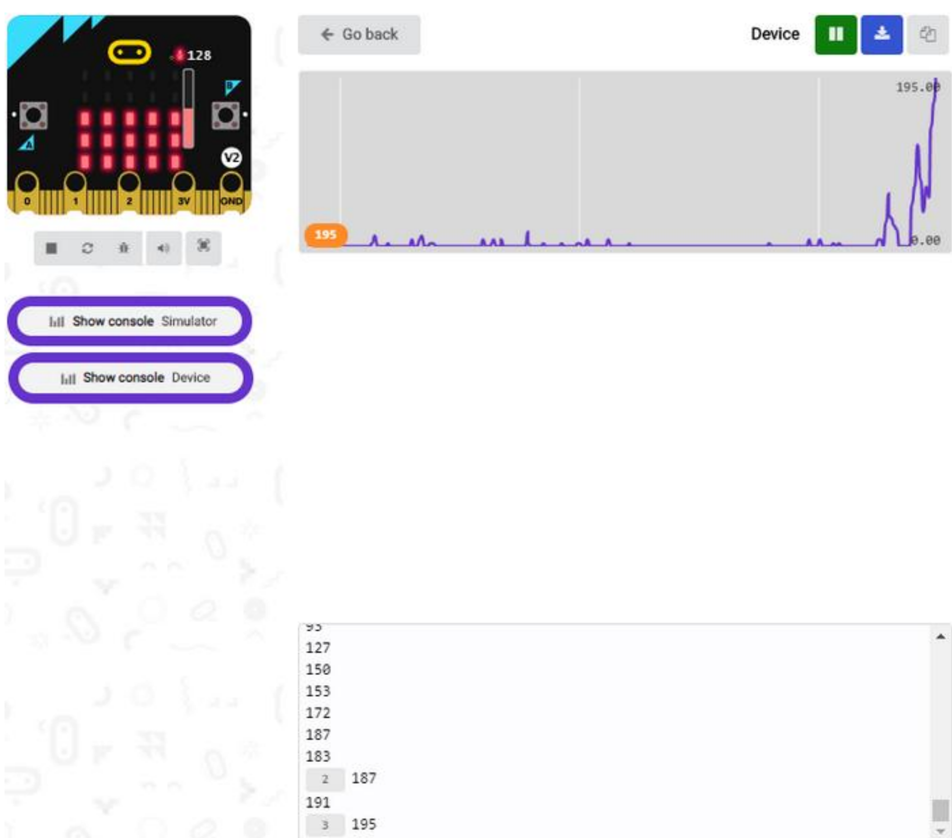

on start
serial redirect to USB
set maxSound to 0
forever
if button A is pressed then
show number maxSound
else
set soundLevel to sound level
plot bar graph of soundLevel
up to 255
if soundLevel > maxSound then
set maxSound to soundLevel

7. Test Result 2

Upload test code and power on and click “Show console Device” as shown below:



The louder the sound is, the greater the sound value will show on the serial monitor:



When the button A is pressed, the LED dot matrix displays the value of the biggest volume. Please note that the biggest volume can be reset via the Reset button. When you clap, the LED dot matrix shows the pattern of the sound.

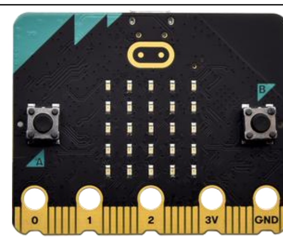
Project 12: Play Music

1. Introduction

In the previous projects, we have learned about the touch-sensitive logo and the speaker respectively.

In the project, we will combine these two components to play music. We will apply the Logo to control the speaker to sing songs.

2. Components

Micro:bit mainboard*1	
Micro USB cable*1	

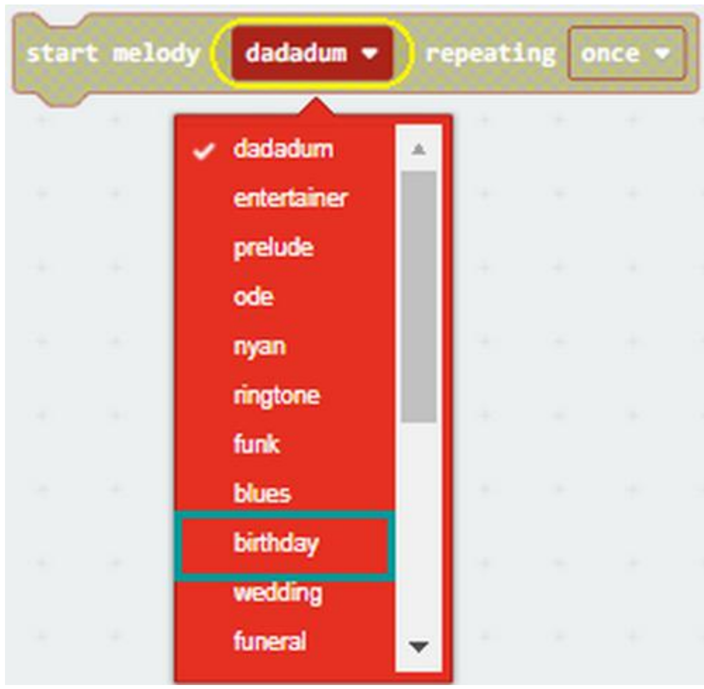
3. Connection

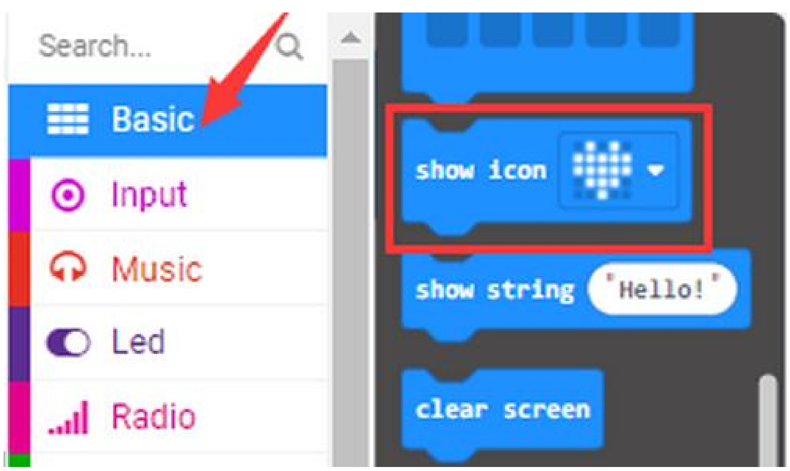
Connect the board to your computer via micro USB cable.

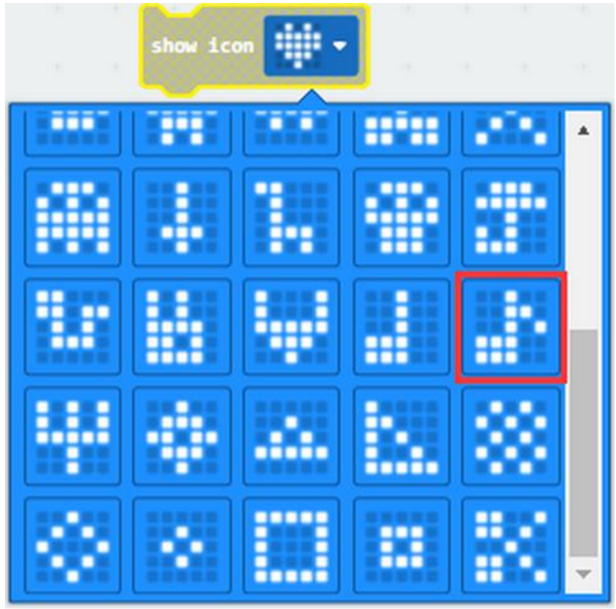
4. Test Code

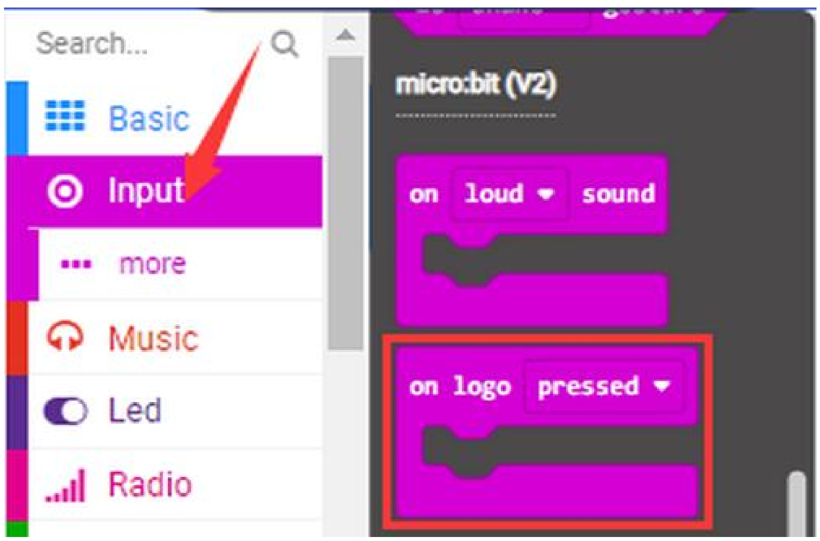
Find code blocks:


Search...
Basic
Input
Music
Led
Radio
Loops
1 beat
tempo (bpm)
Melody Advanced
start melody dadadum repeating once
stop melody all

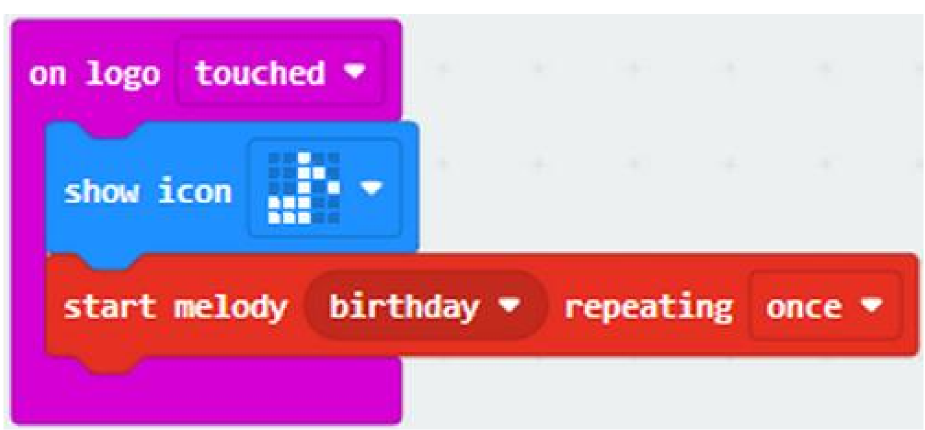

start melody dadadum repeating once
dadadum
entertainer
prelude
ode
nyan
ringtone
funk
blues
birthday
wedding
funeral


Search...
Basic
Input
Music
Led
Radio
show icon
show string "Hello!"
clear screen





Build blocks:



5. Test Result

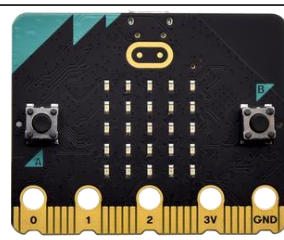
After uploading test code to micro:bit main board and powering the board via the USB cable, the speaker plays *Birthday Song* when the logo is touched.

Project 13: Dodge Bullets

1. Introduction

We have learned about the two programmable buttons: button A and B. In this project, we will combine them with LED dot matrix to design a game: Dodge Bullets.

2. Components

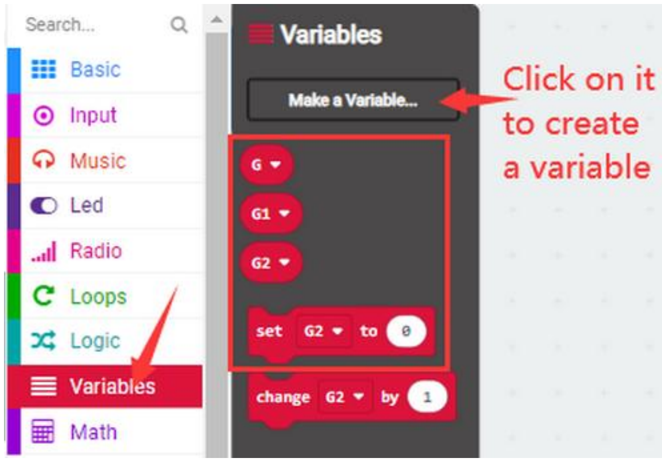
Micro:bit mainboard*1	
Micro USB cable*1	

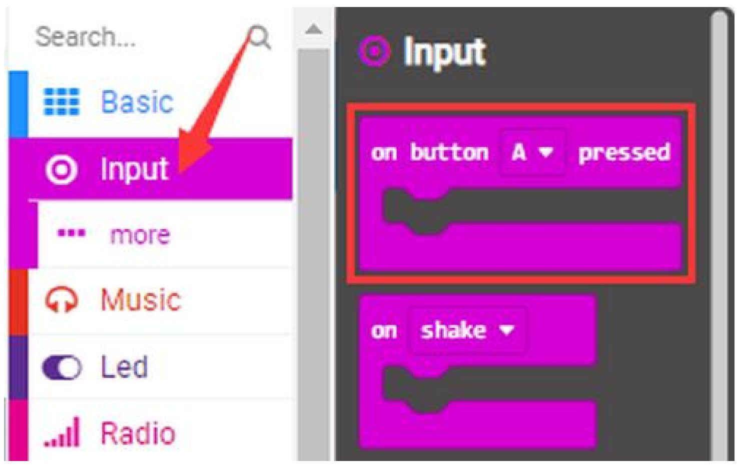
3. Connection

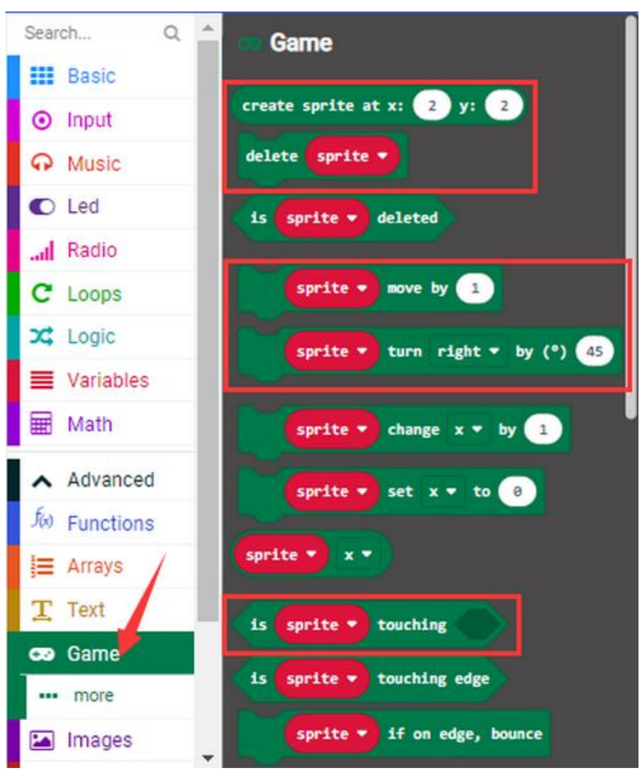
Connect the board to your computer via micro USB cable.

4. Test Code

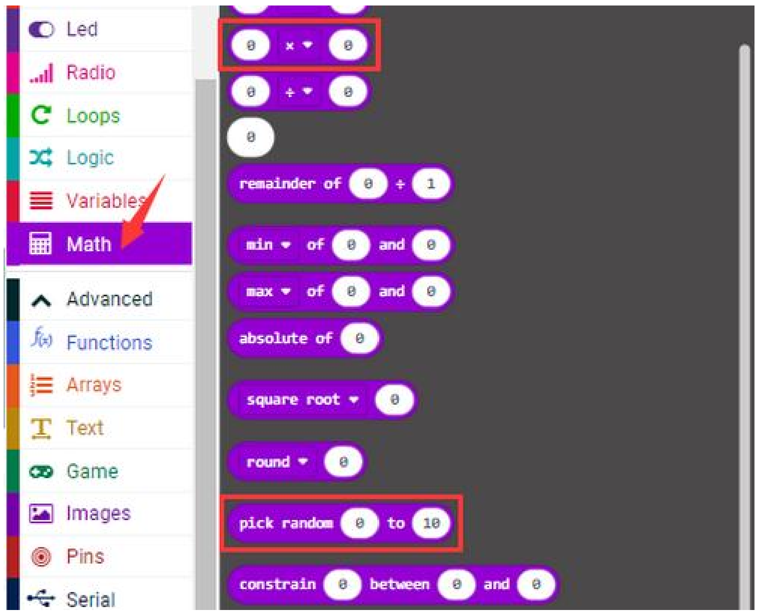
Find code blocks:

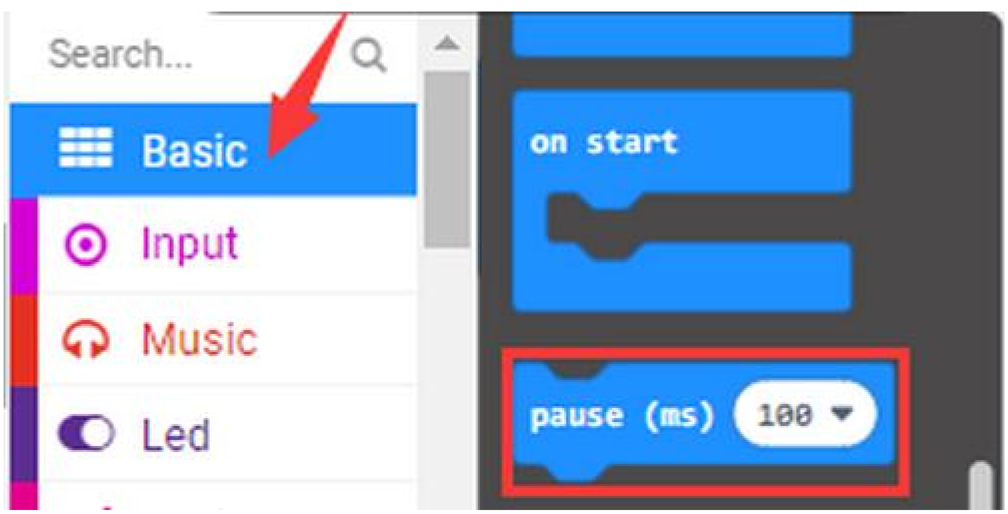

Search...
Basic
Input
Music
Led
Radio
Loops
Logic
Variables
Math
Variables
Make a Variable...
Click on it
to create
a variable
G
G1
G2
set G2 to 0
change G2 by 1

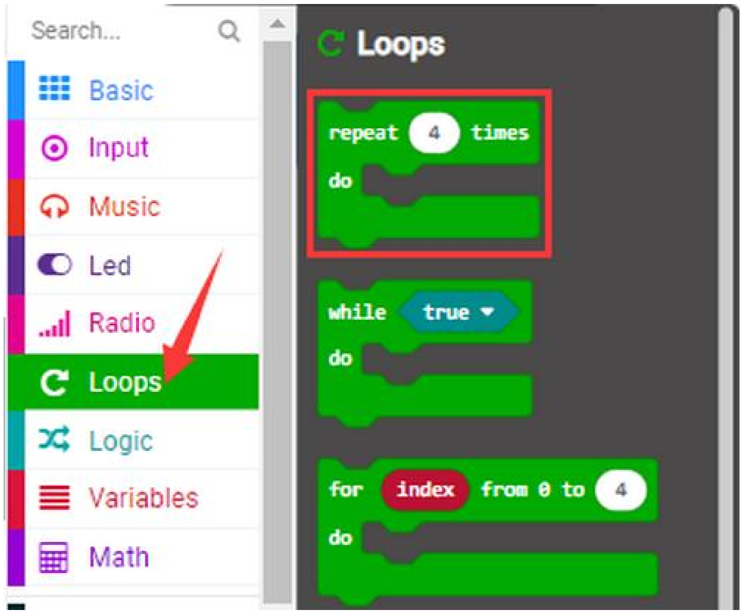

Search...
Basic
Input
more
Music
Led
Radio
Input
on button A pressed
on shake


Search...
Basic
Input
Music
Led
Radio
Loops
Logic
Variables
Math
Advanced
Functions
Arrays
Text
Game
more
Images
Game
create sprite at x: 2 y: 2
delete sprite
is sprite deleted
sprite move by 1
sprite turn right by (°) 45
sprite change x by 1
sprite set x to 0
sprite x
is sprite touching
is sprite touching edge
sprite if on edge, bounce

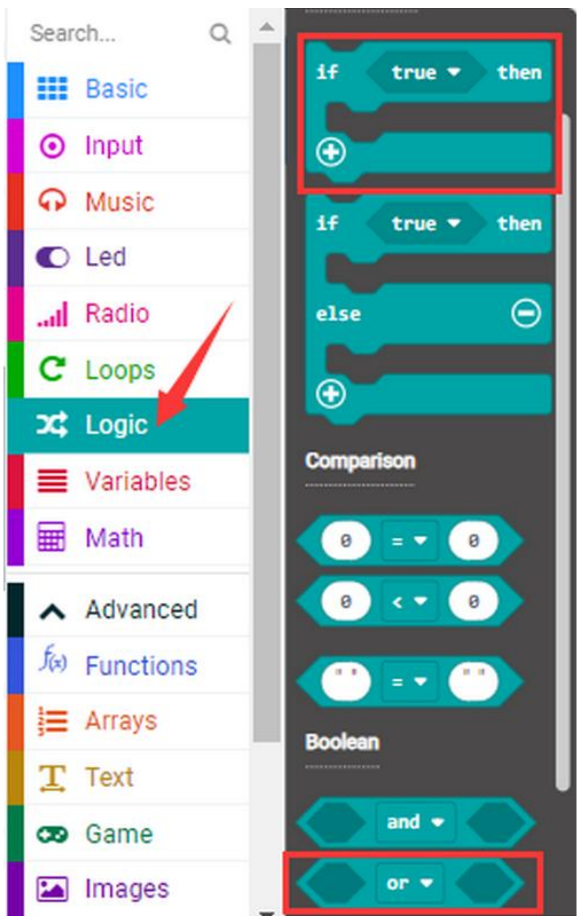

Arrays
Text
Game
more
Images
Pins
Serial
change score by 1
start countdown (ms) 10000
score
game over
is game over


Led
Radio
Loops
Logic
Variables
Math
Advanced
Functions
Arrays
Text
Game
Images
Pins
Serial
0 × 0
0 ÷ 0
0
remainder of 0 ÷ 1
min of 0 and 0
max of 0 and 0
absolute of 0
square root 0
round 0
pick random 0 to 10
constrain 0 between 0 and 0


Search...
Basic
Input
Music
Led
on start
pause (ms) 100

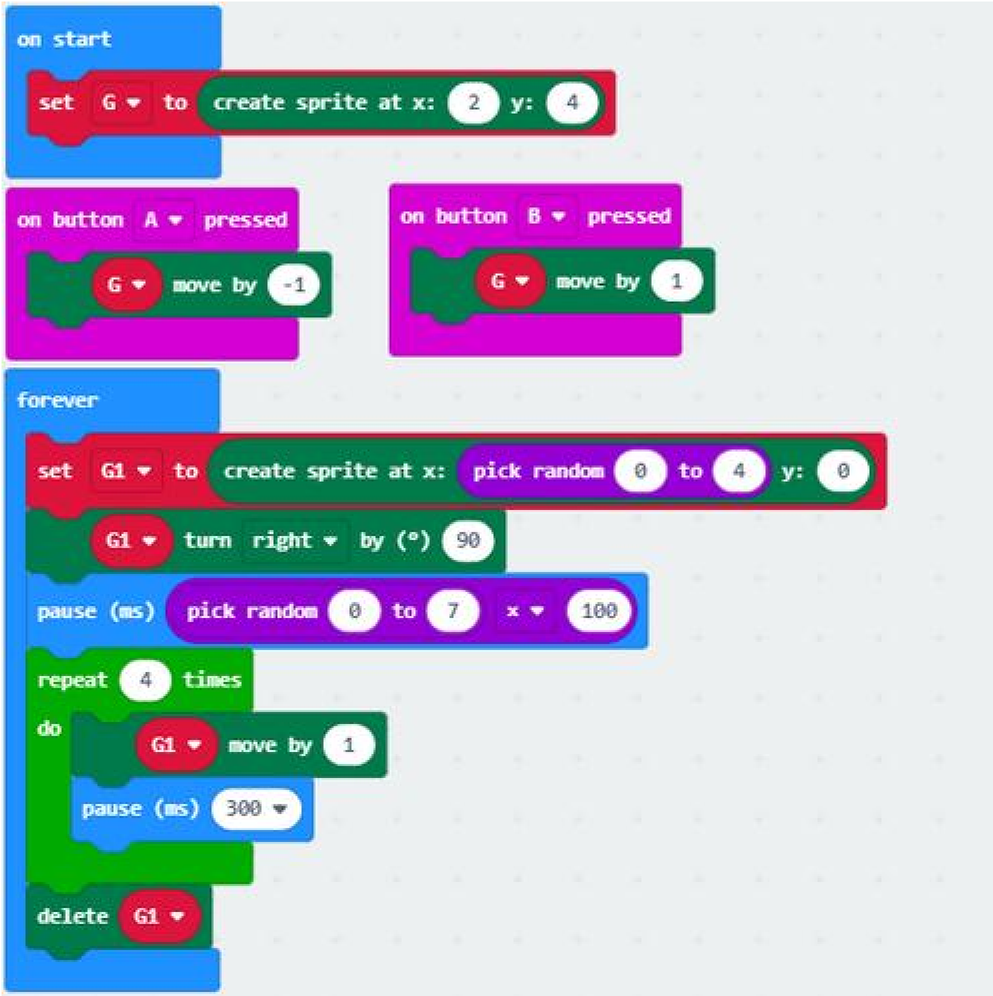


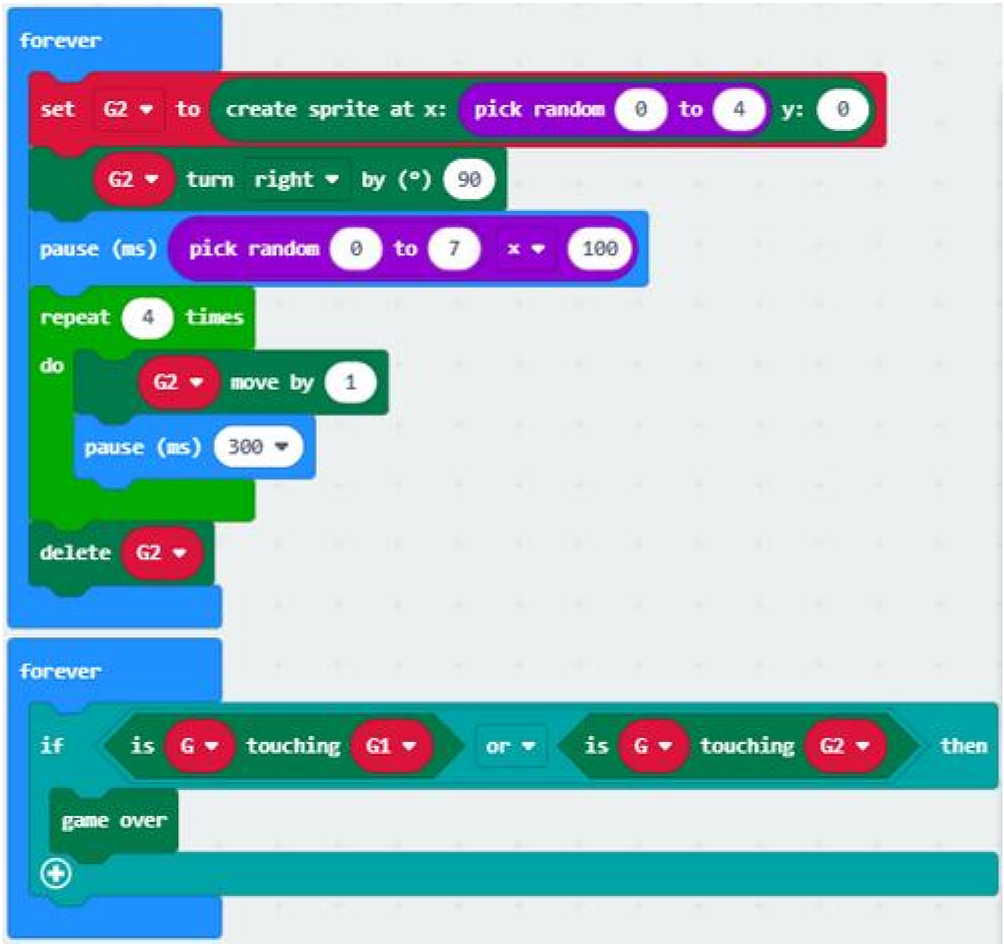
Search...
Basic
Input
Music
Led
Radio
Loops
Logic
Variables
Math
Loops
repeat 4 times
do
while true
do
for index from 0 to 4
do



Search...
Basic
Input
Music
Led
Radio
Loops
Logic
Variables
Math
Advanced
Functions
Arrays
Text
Game
Images
if true then
if true then
else
Comparison
Boolean
and
or

Build blocks:





---

6. Test Result 1

The game begins when the code is uploaded to the main board. The bullets fall off and we need to control the role G by Button A and B to shun them. If the role fail to avert the attacks, game is over.

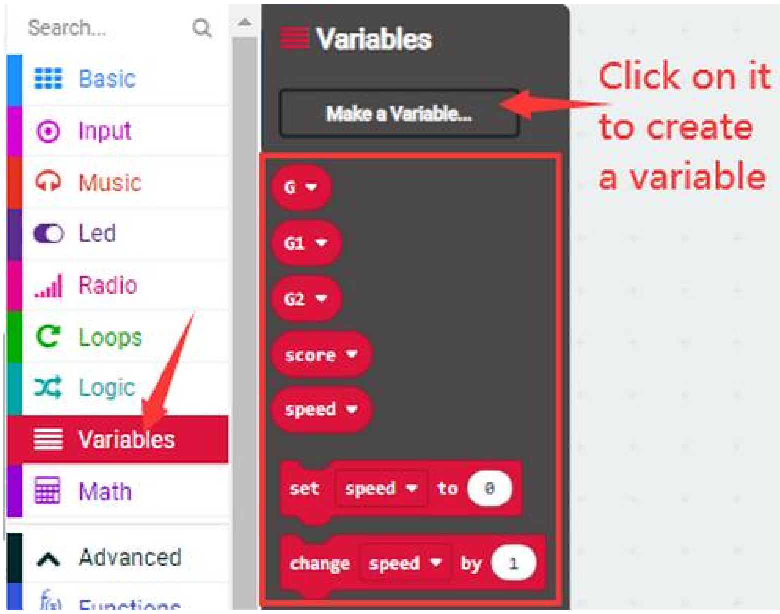
7. Game 2

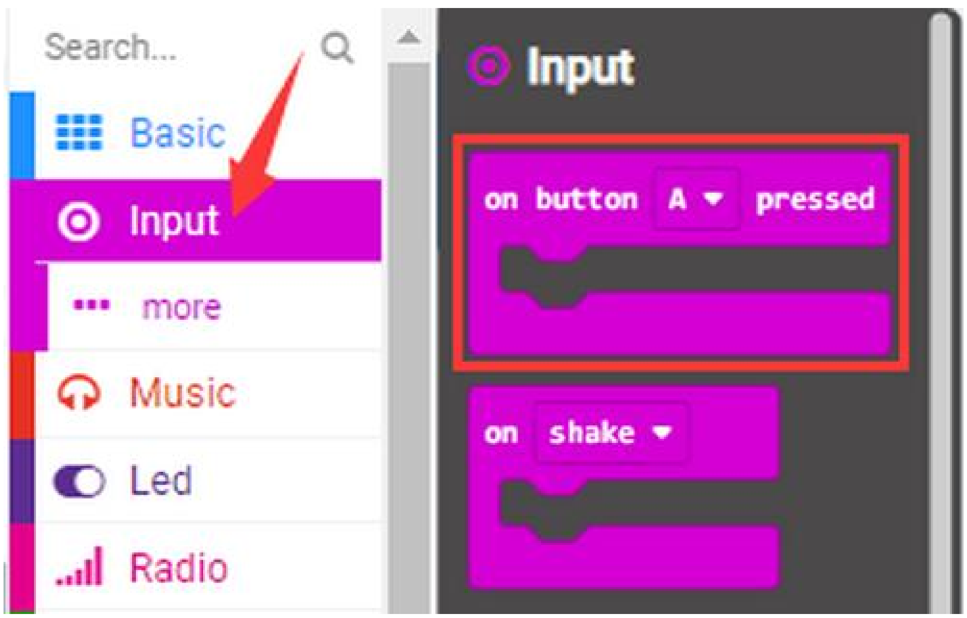
Dodge bullets! Earn points!

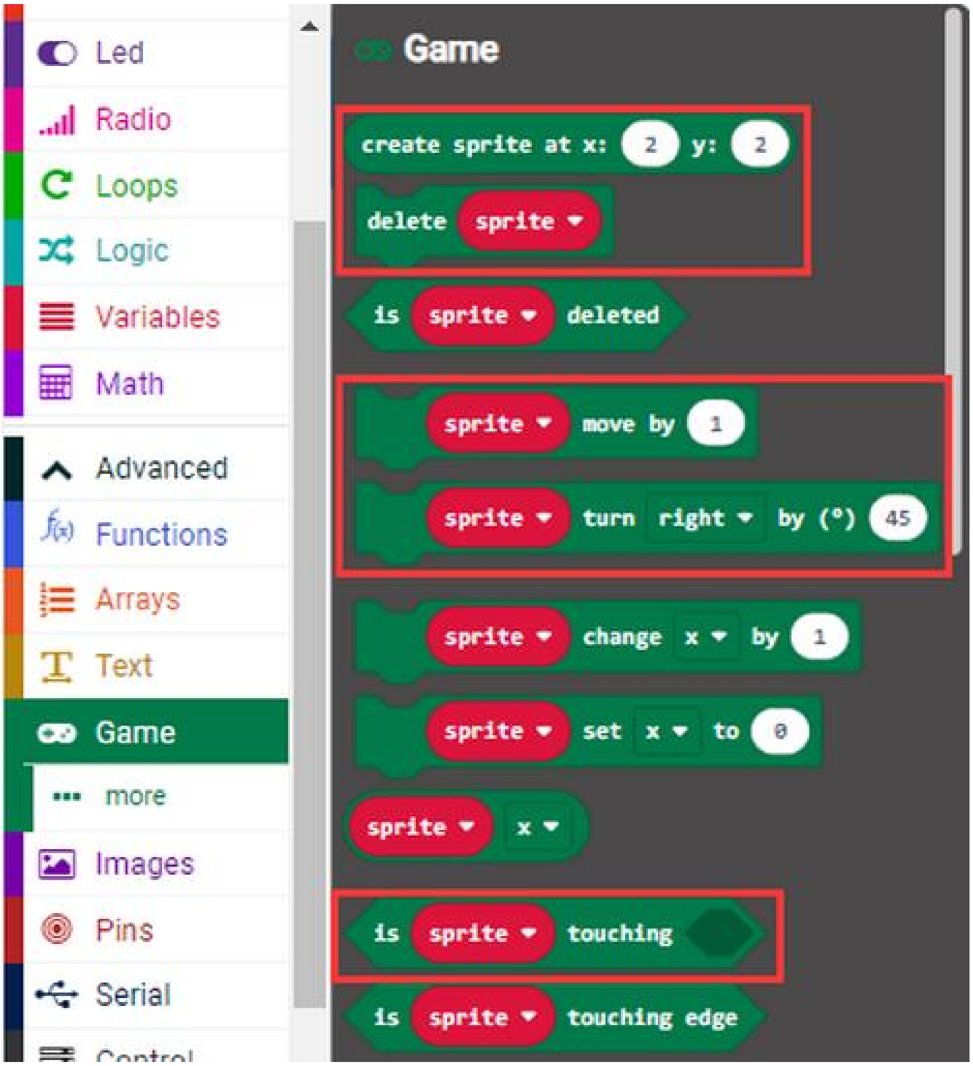
Get one point for dodging one bullet; Game over when the role G is hit by bullet and the points will be output. Press A and B together, restart the game.

8. Test Code 2

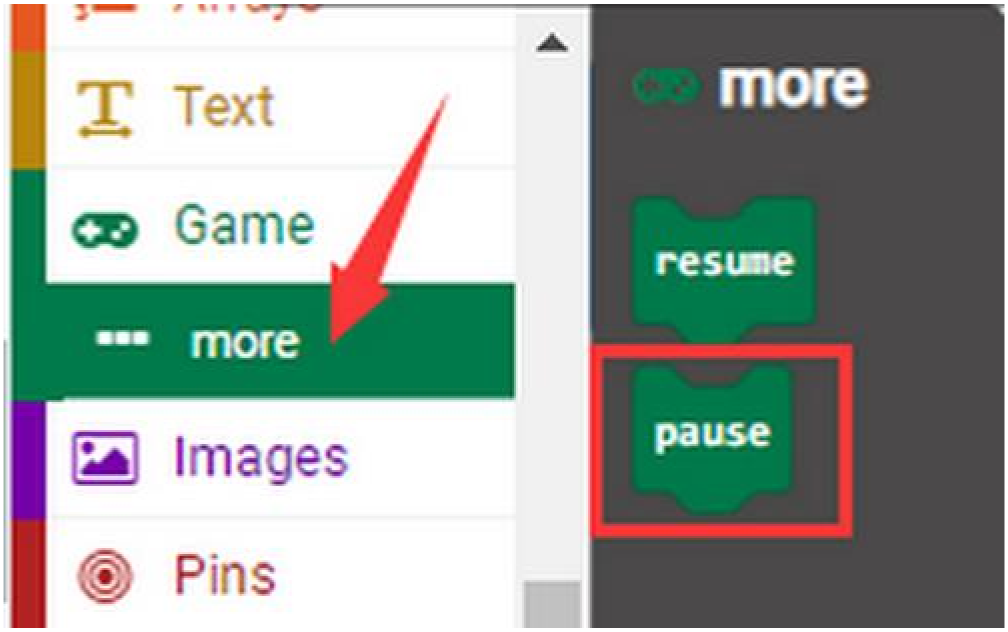
Find code blocks:

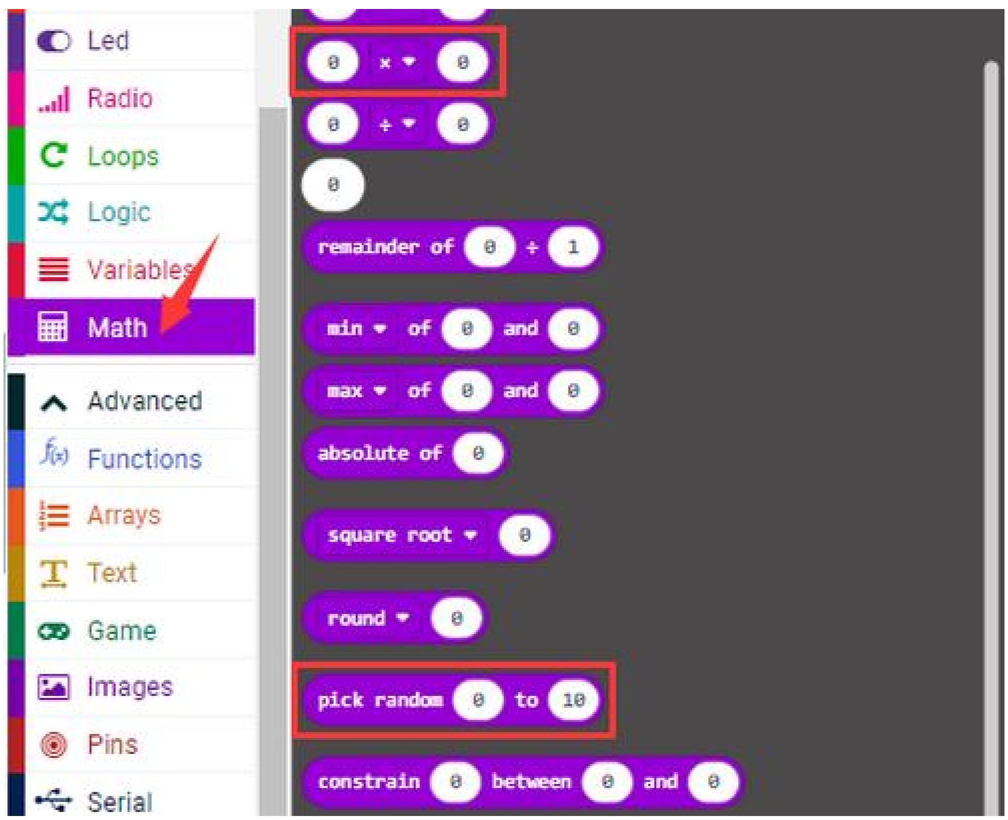

Search...
Basic
Input
Music
Led
Radio
Loops
Logic
Variables
Math
Advanced
Variables
Make a Variable...
Click on it to create a variable
G
G1
G2
score
speed
set speed to 0
change speed by 1

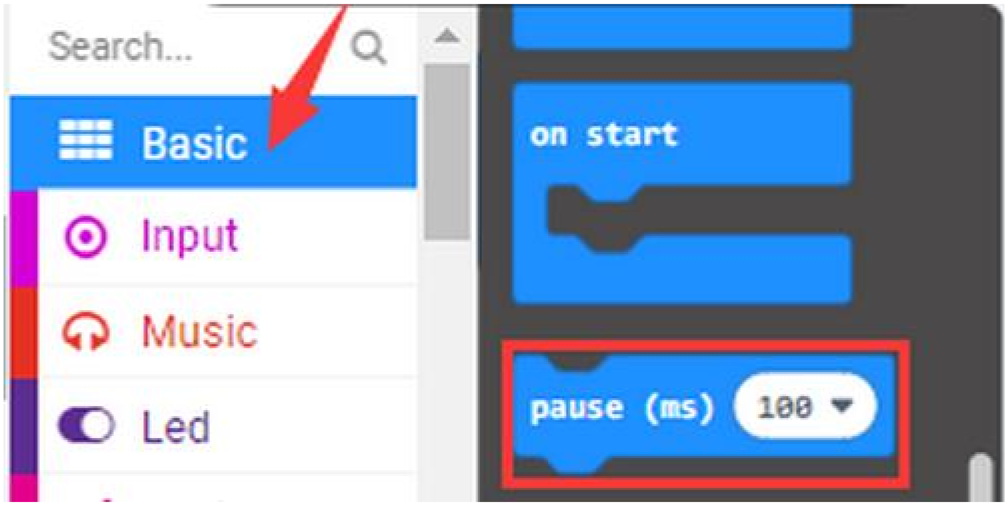

Search...
Basic
Input
more
Music
Led
Radio
Input
on button A pressed
on shake

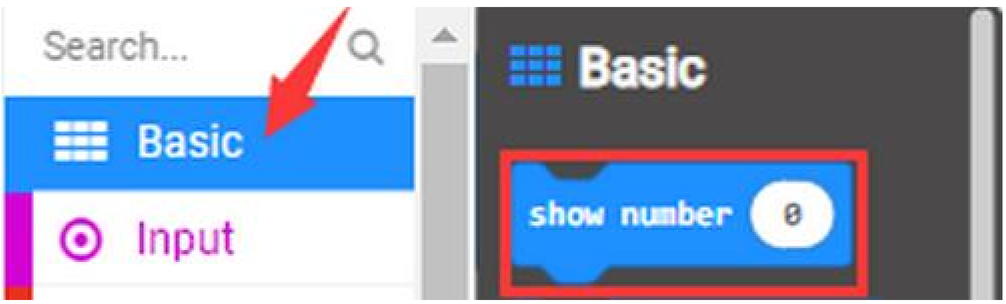

Led
Radio
Loops
Logic
Variables
Math
Advanced
Functions
Arrays
Text
Game
more
Images
Pins
Serial
Game
create sprite at x: 2 y: 2
delete sprite
is sprite deleted
sprite move by 1
sprite turn right by (°) 45
sprite change x by 1
sprite set x to 0
sprite x
is sprite touching
is sprite touching edge

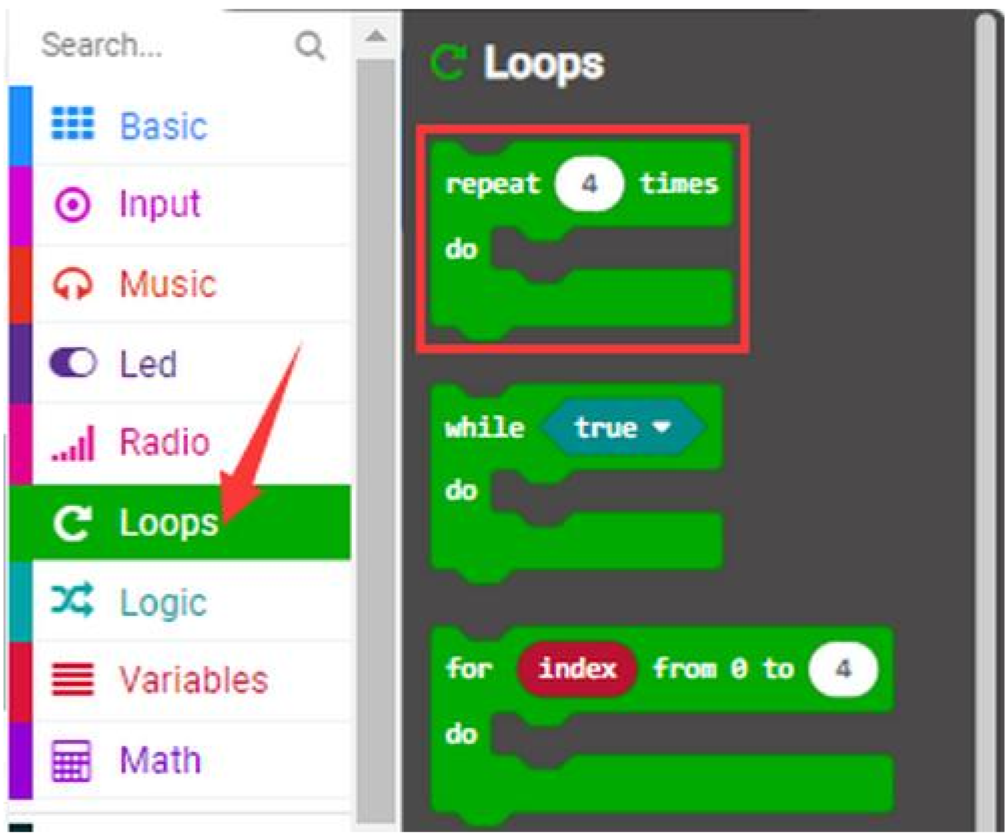

Arrays
Text
Game
more
Images
Pins
start countdown (ms) 10000
score
game over
is game over

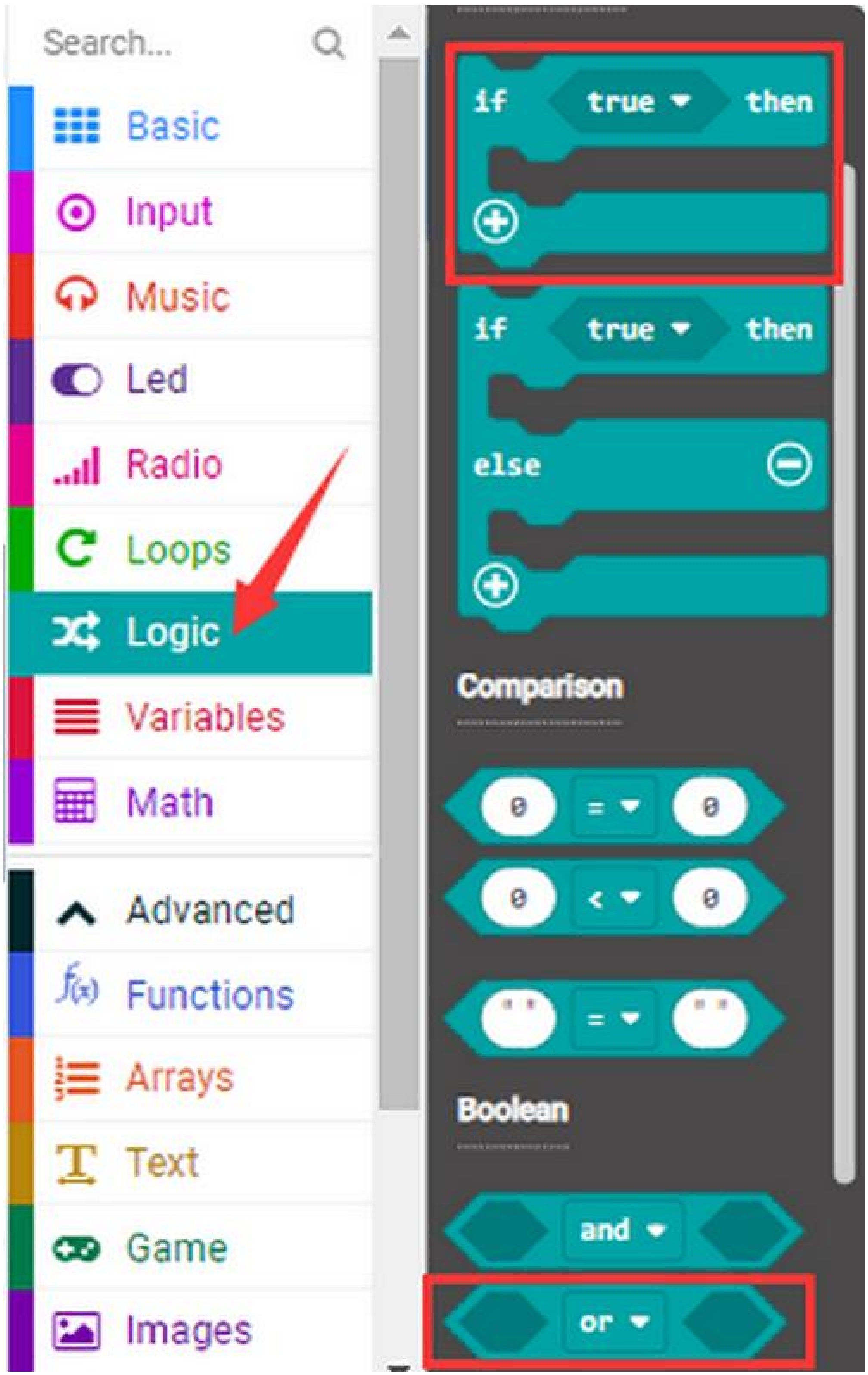

Text
Game
more
Images
Pins
more
resume
pause


Led
Radio
Loops
Logic
Variables
Math
Advanced
Functions
Arrays
Text
Game
Images
Pins
Serial
0 × 0
0 ÷ 0
0
remainder of 0 ÷ 1
min of 0 and 0
max of 0 and 0
absolute of 0
square root 0
round 0
pick random 0 to 10
constrain 0 between 0 and 0

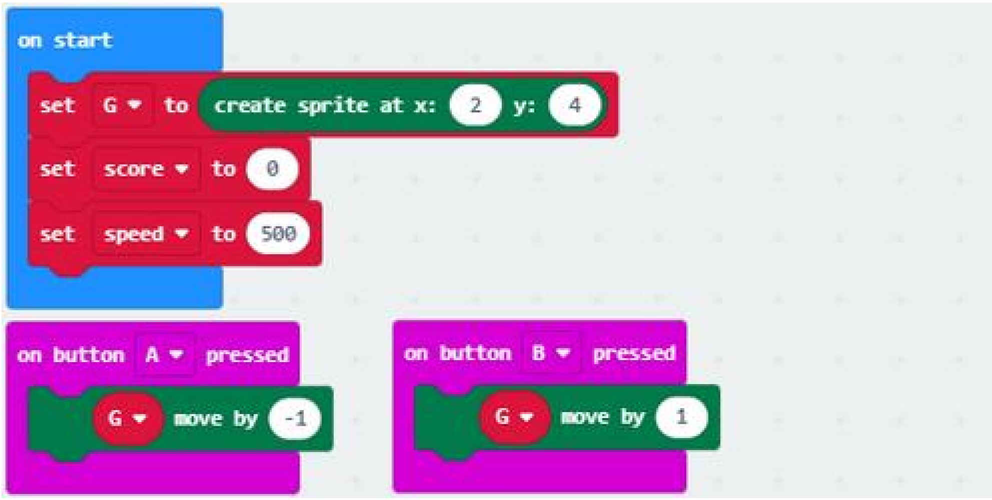

Search...
Basic
Input
Music
Led
on start
pause (ms) 100

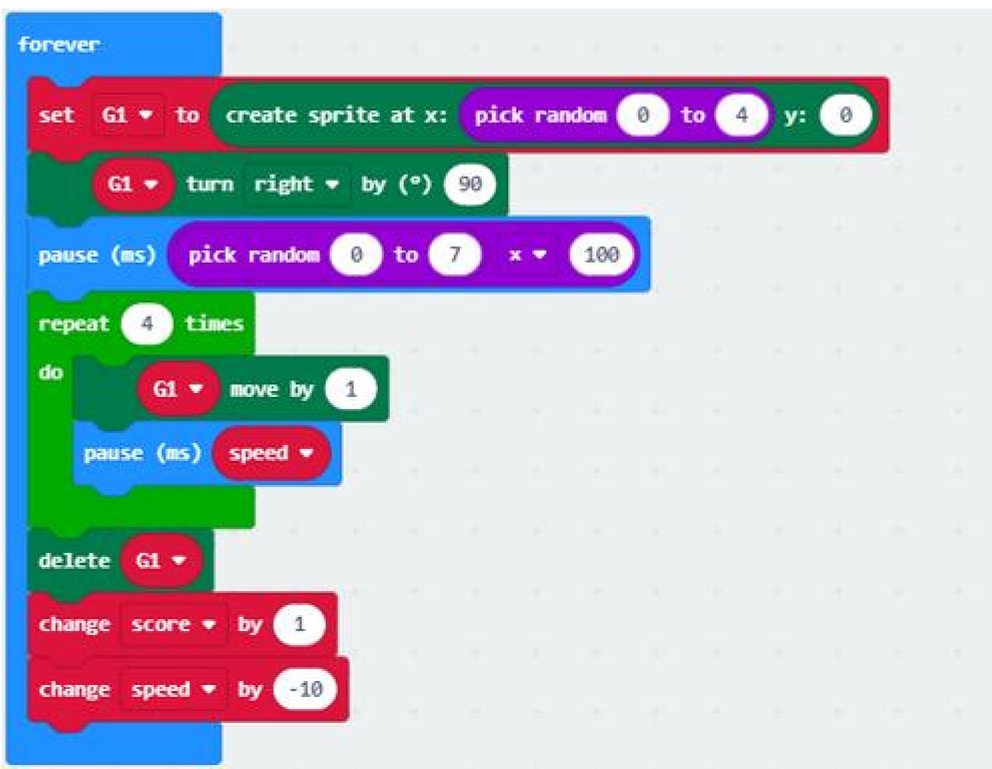

Search...
Basic
Input
Basic
show number 0

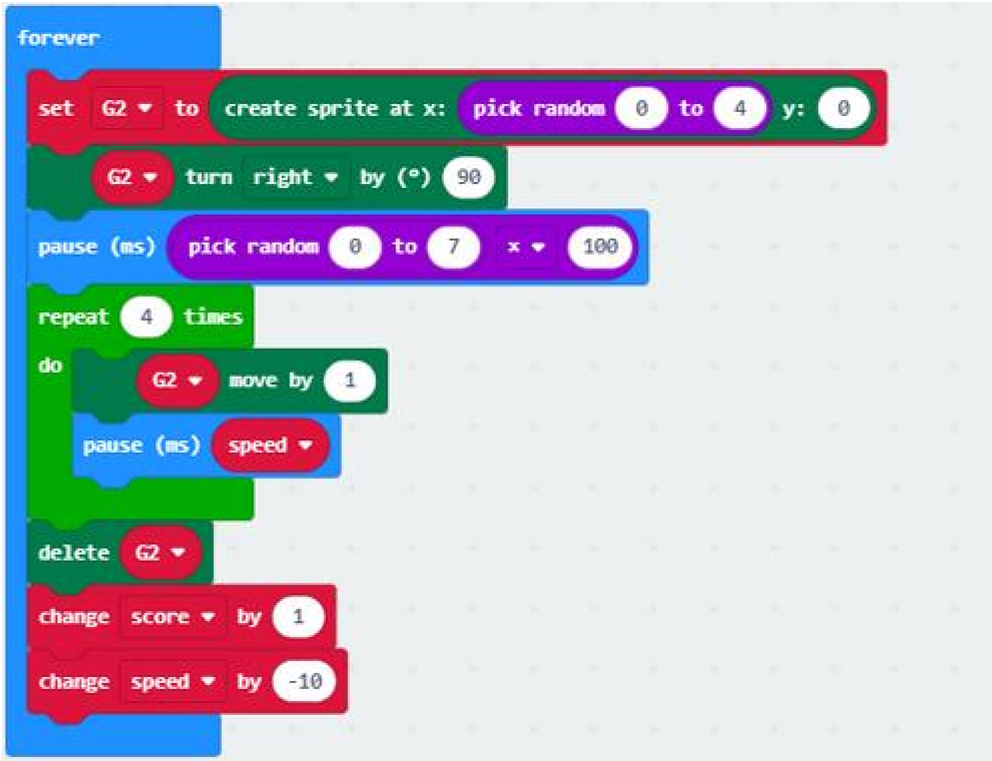

Search...
Basic
Input
Music
Led
Radio
Loops
Logic
Variables
Math
Loops
repeat 4 times
do
while true
do
for index from 0 to 4
do

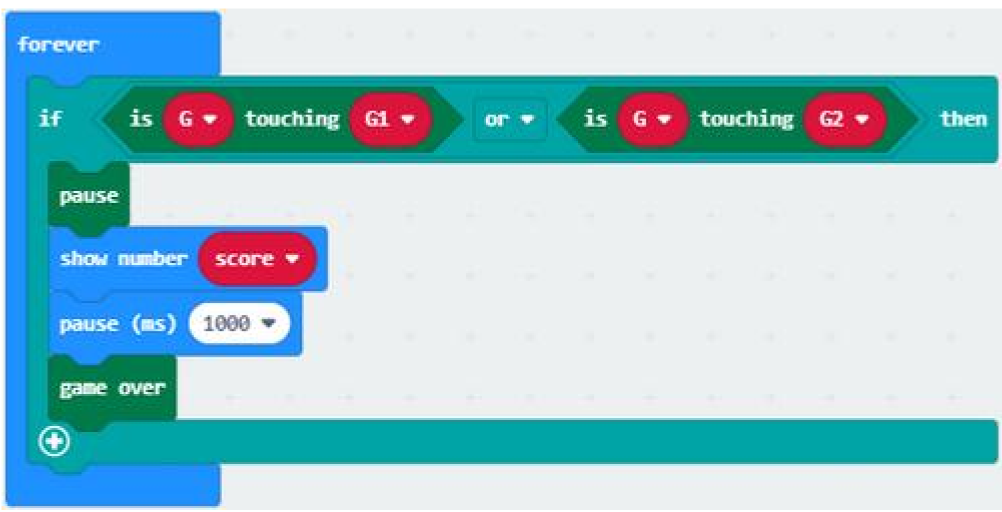


Build blocks:


on start
set G to create sprite at x: 2 y: 4
set score to 0
set speed to 500
on button A pressed
G move by -1
on button B pressed
G move by 1


forever
set G1 to create sprite at x: pick random 0 to 4 y: 0
G1 turn right by (°) 90
pause (ms) pick random 0 to 7 x 100
repeat 4 times
do
G1 move by 1
pause (ms) speed
delete G1
change score by 1
change speed by -10



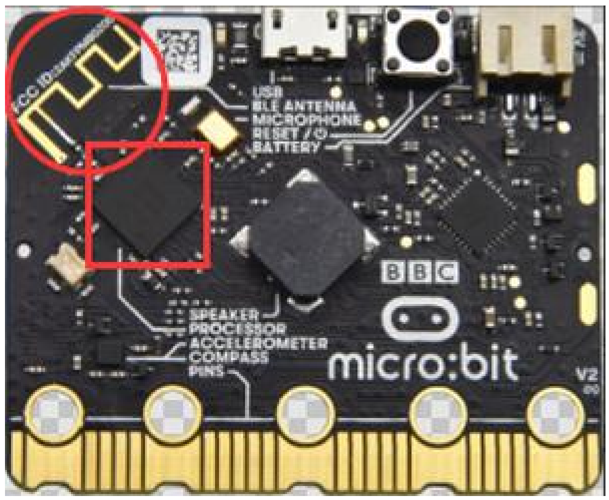


9. Test Result 2

The game begins when the code is uploaded to the main board. The bullets fall off and we control the role G by Button A and B to shun them. 1 score will be tallied for each successful dodging. If the role fail to avert the attacks, the game is over and gained scores displays.

Press buttons A and B at the same time, and the game starts again.

Project 14: Bluetooth Wireless Communication



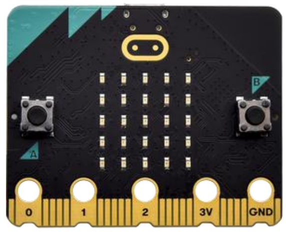
1. Introduction

The Micro:bit main board comes with a nRF52833 processor with a built-in BLE(Bluetooth Low Energy) Bluetooth 5.1 device and a 2.4GHz antenna for Bluetooth wireless communication, so that 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 to transmit code or signals. Firstly, we should connect a 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. Components

Micro:bit mainboard*1	
Micro USB cable*1	
smart phone/IPad*1	

3. Connection

Connect the board to your computer via micro USB cable.

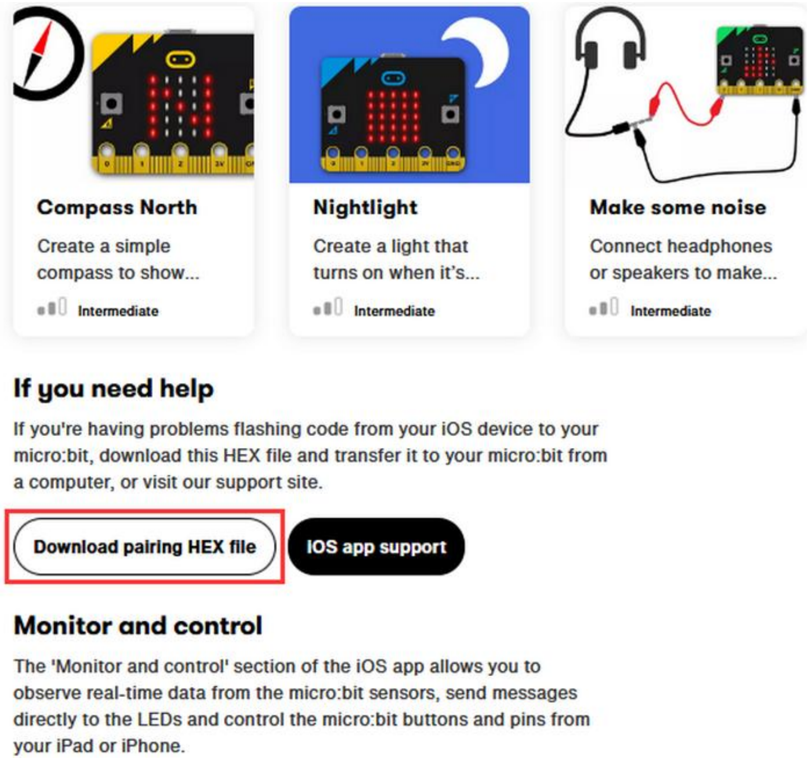
4. Procedures

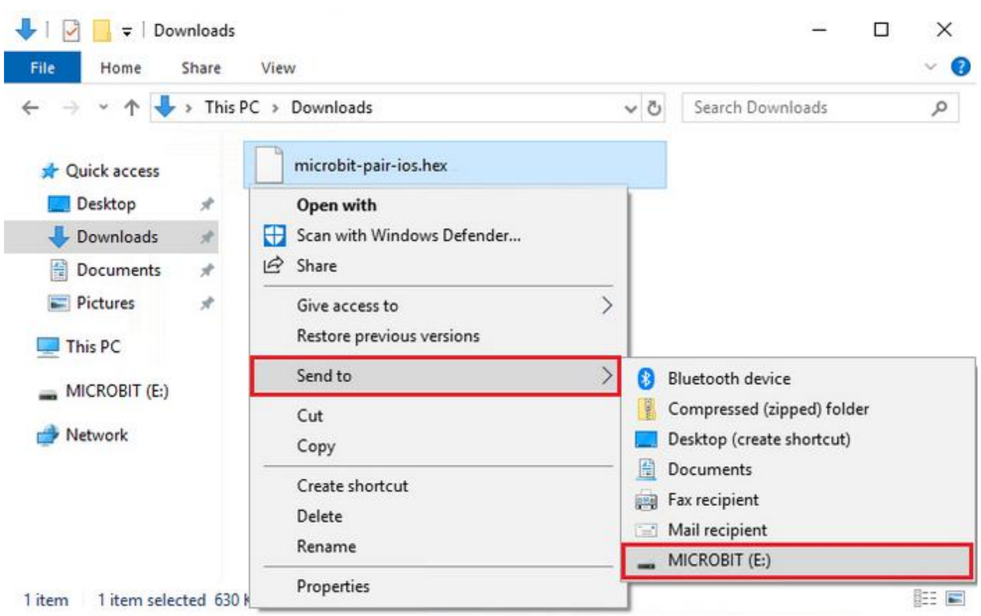
We will demonstrate on iPhone/iPad/MAC devices. Android/Windows devices may take these as a reference.

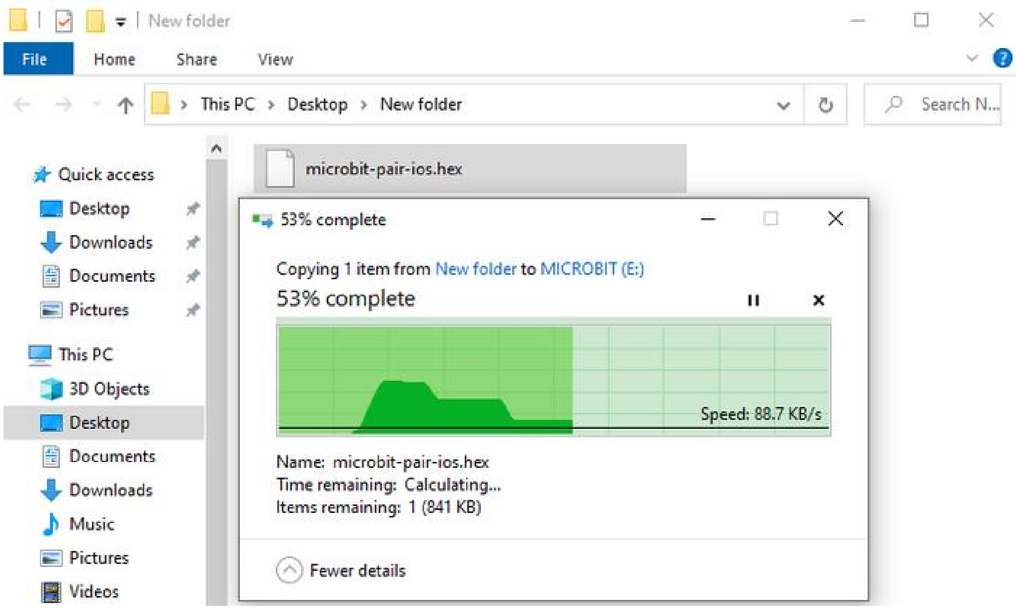
(1) Firmware (iOS/MAC only)

iOS/MAC: https://www.microbit.org/get-started/user-guide/ble-ios/

Click “Download pairing HEX file” to download the Micro: Bit firmware and upload the downloaded firmware to the Micro: Bit main board.







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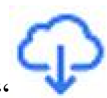
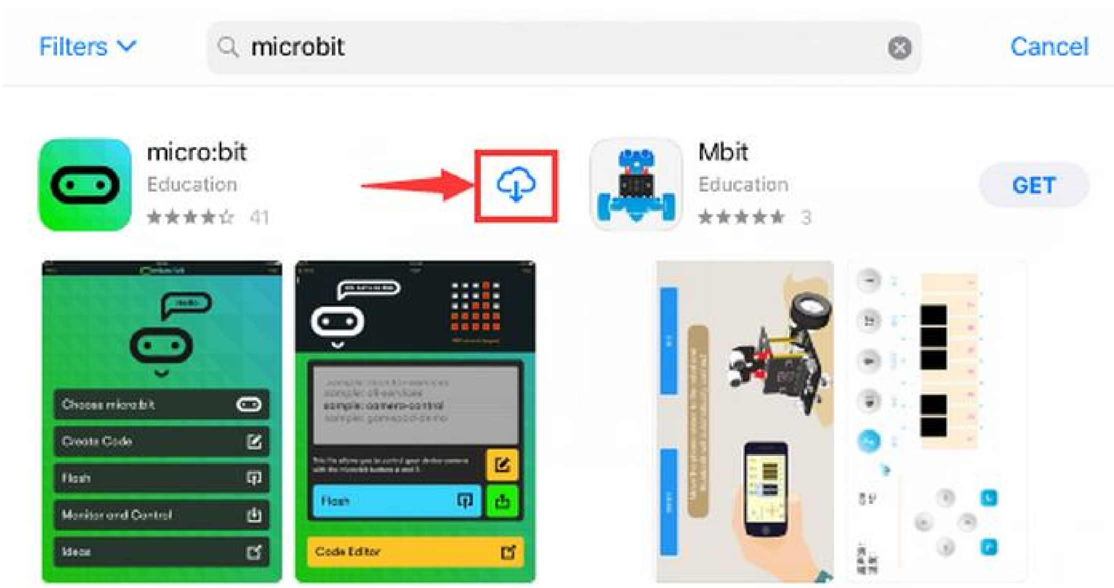
(2) Micro:bit APP

Open App Store  and search “micro bit” and click “  ” to download the APP.

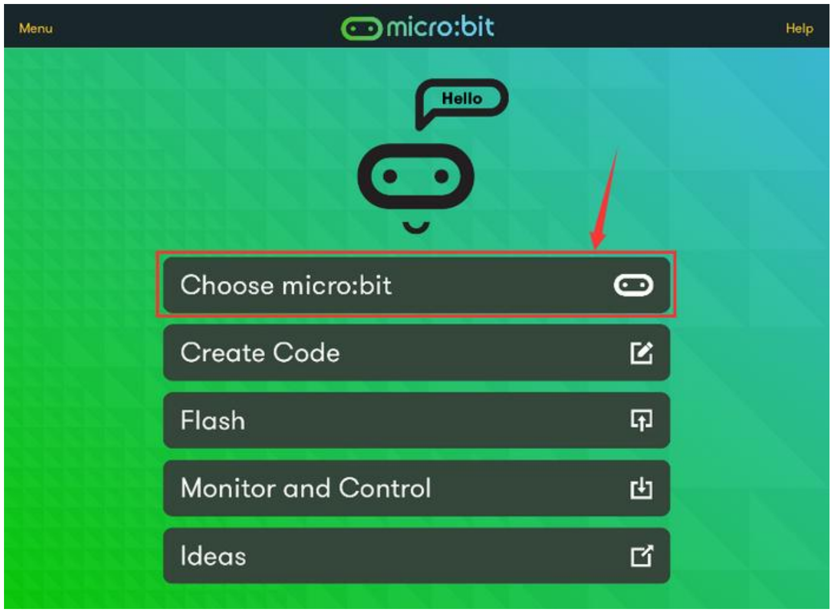


(3) Connection

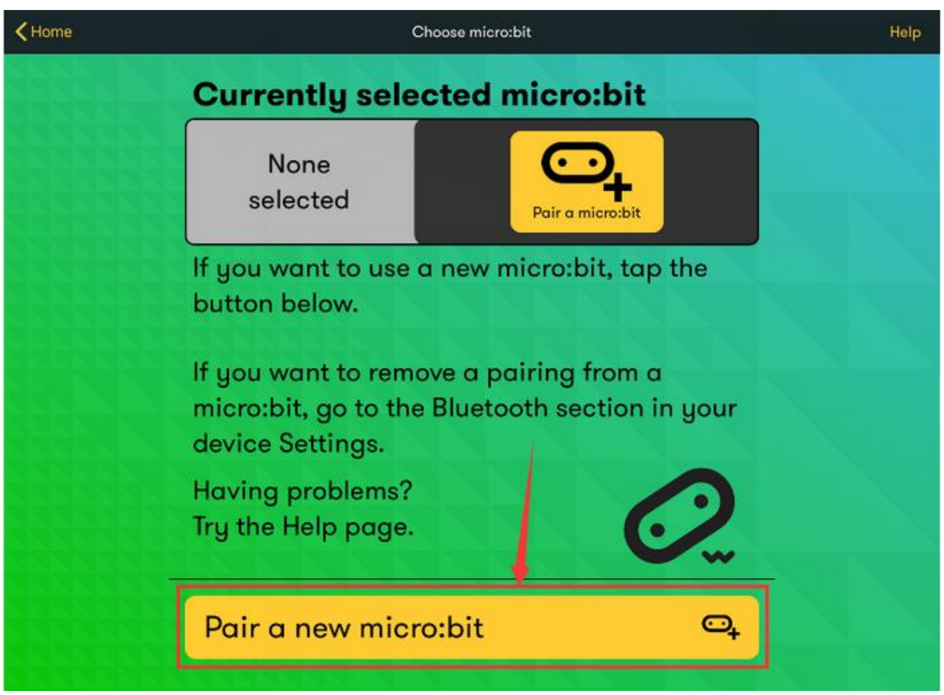
Connect your Apple device with Micro: Bit main board.

- Turn on Bluetooth on the device.

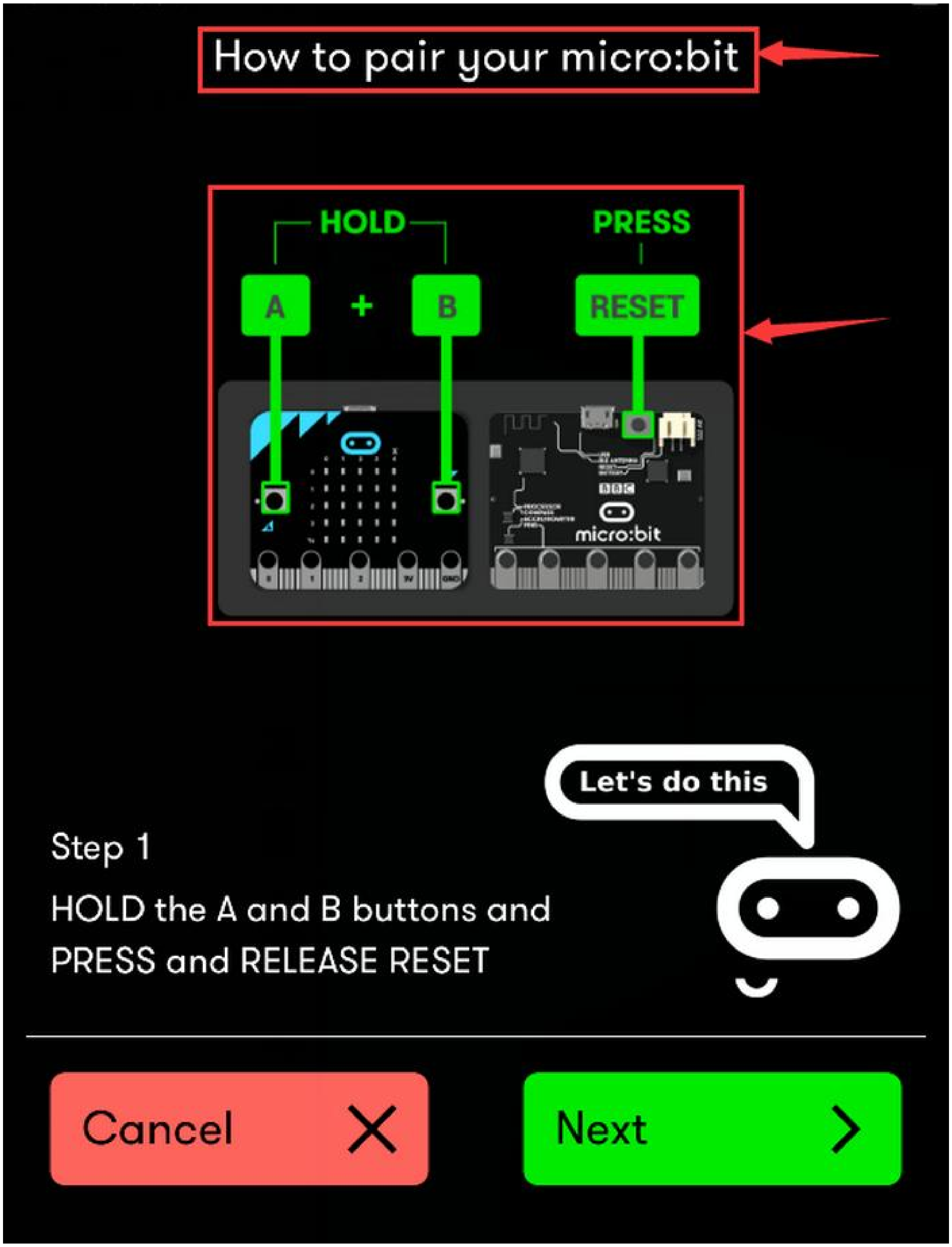
- Open APP, ensure the board is connected to the device and select “Choose micro:bit”to start pairing Bluetooth.



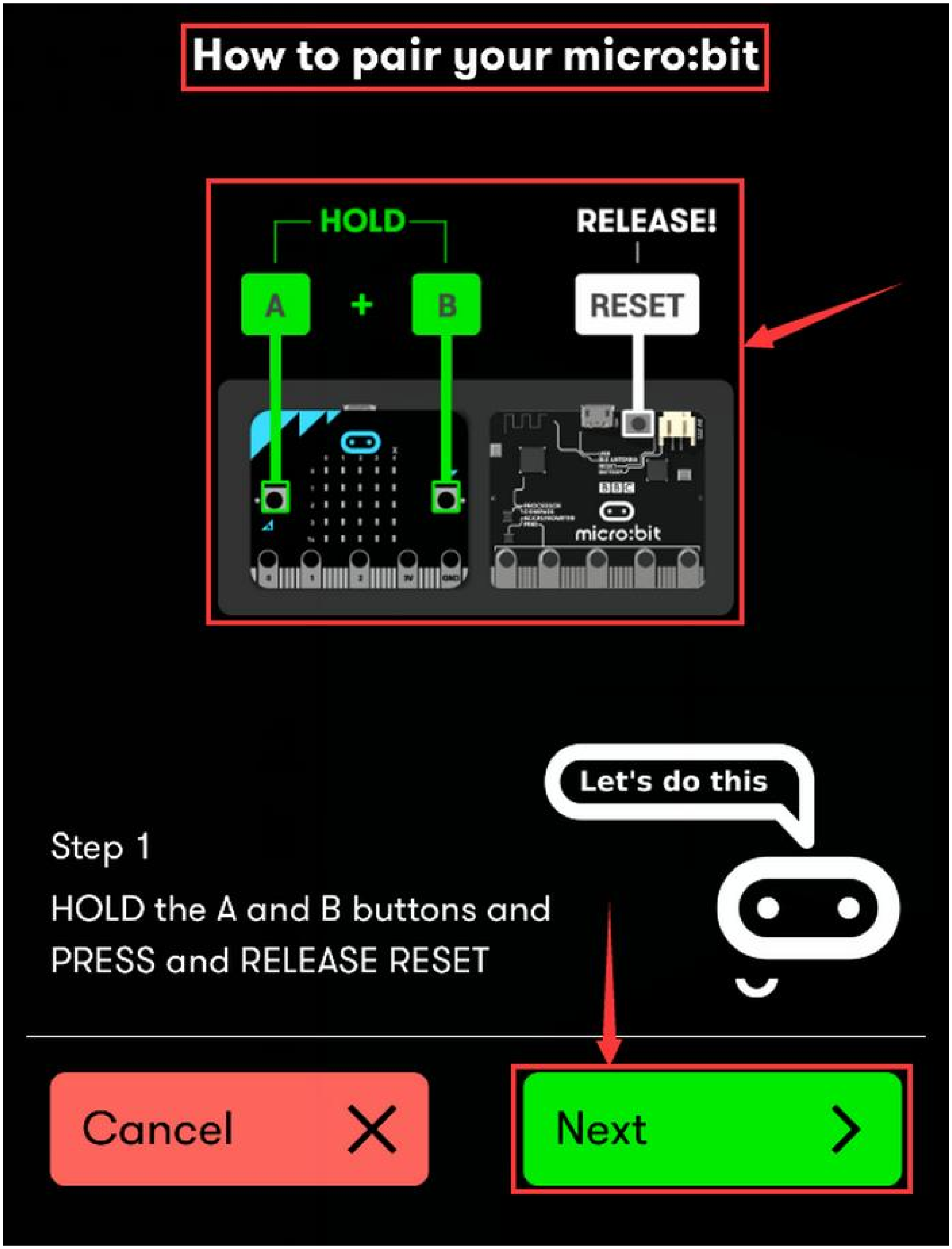
- Pair a new micro:bit.



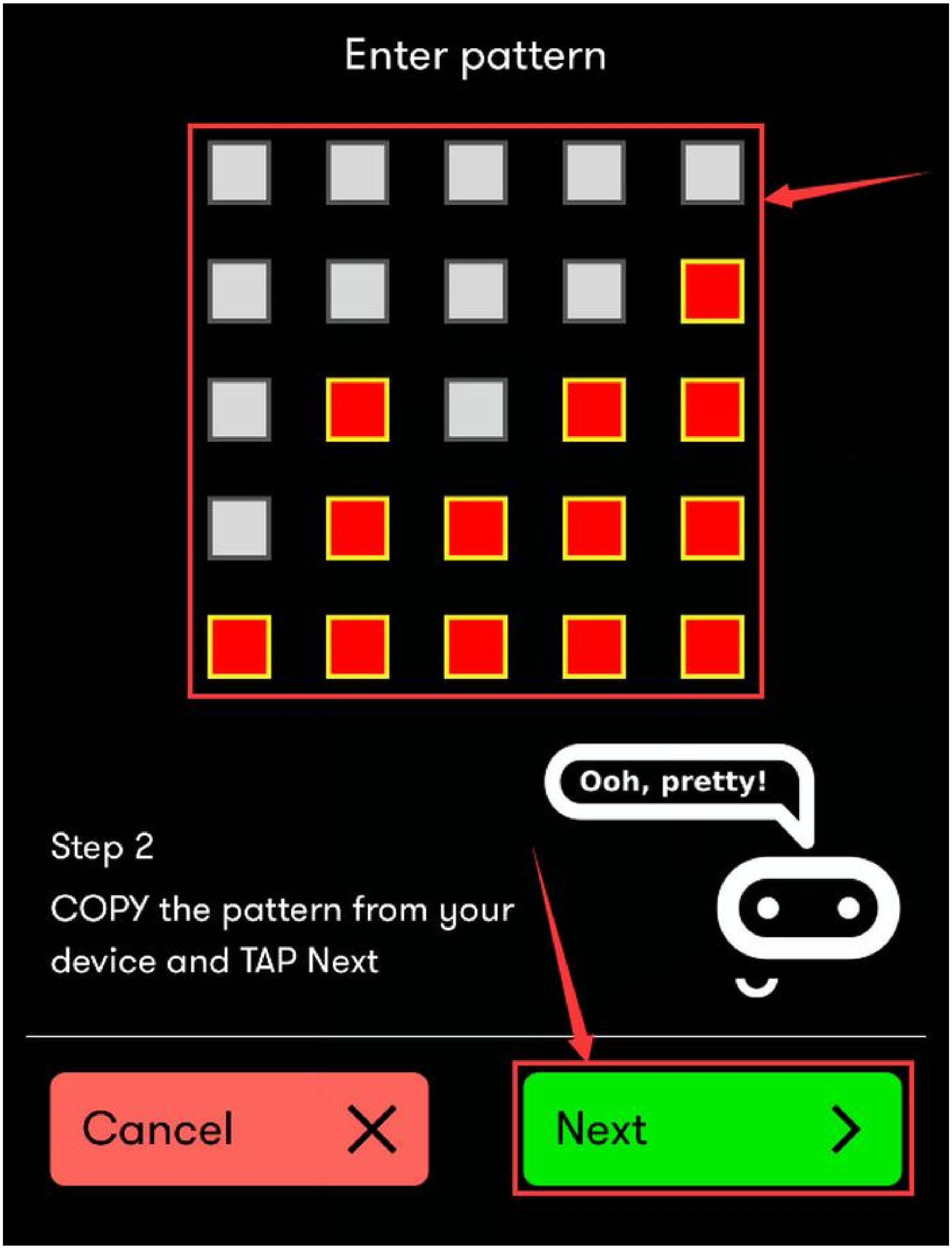
- Following the instructions to press button A and B at the same time(do not release them until you are told to) and press Reset & Power button for a few seconds.



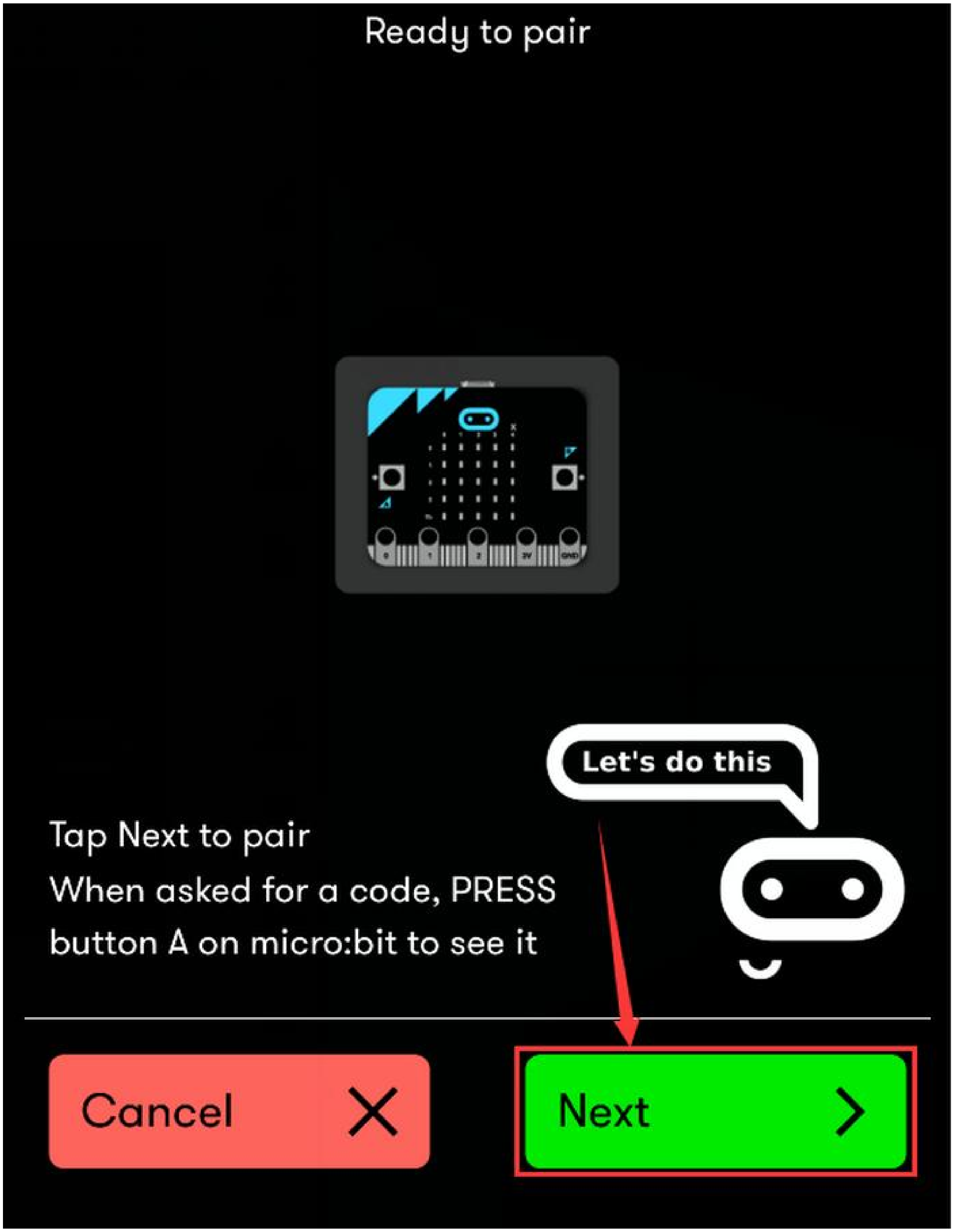
- Release the Reset & Power button, you will see a password pattern shows on the LED dot matrix. Now , release buttons A and B and click “Next”.

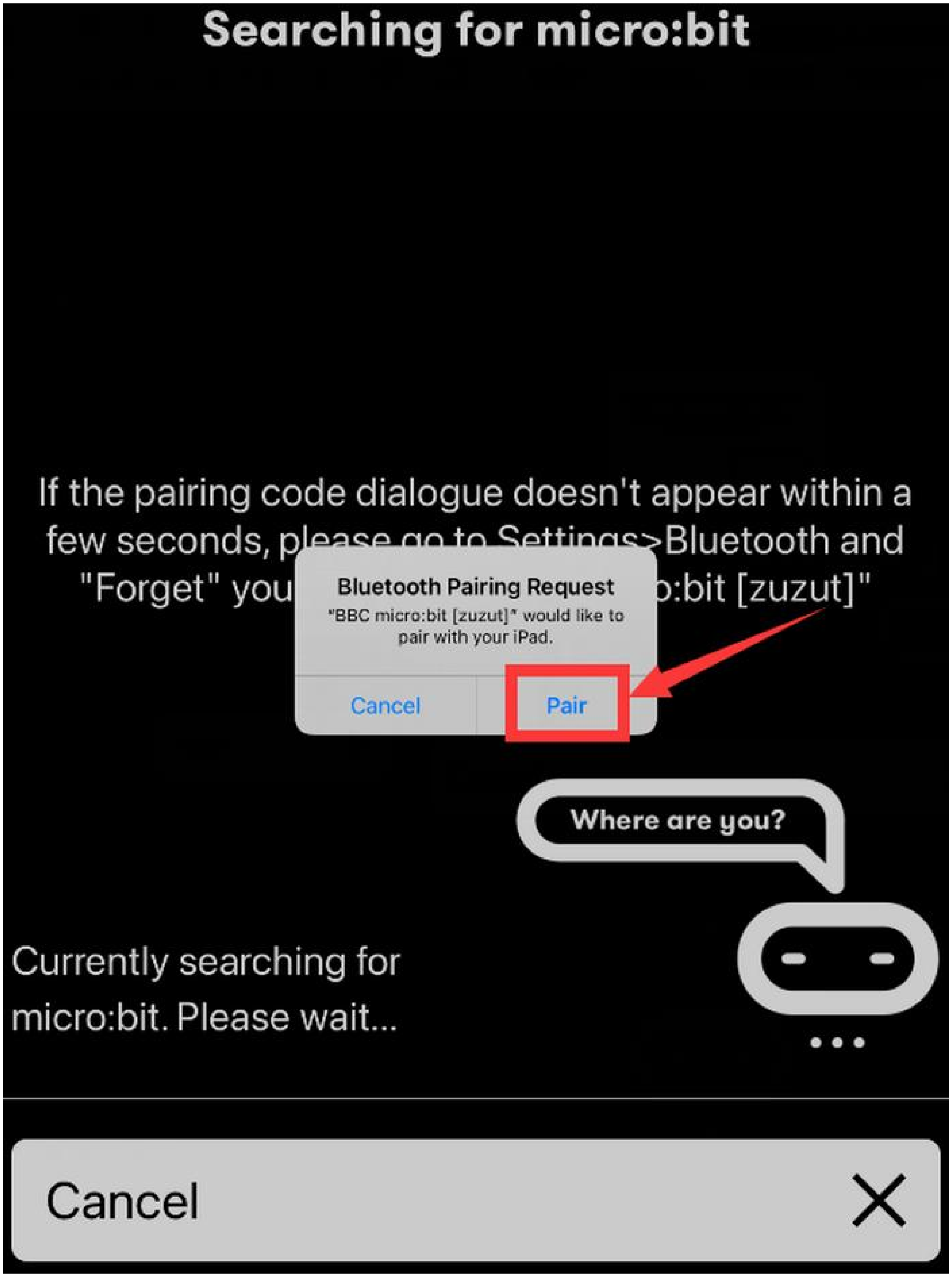


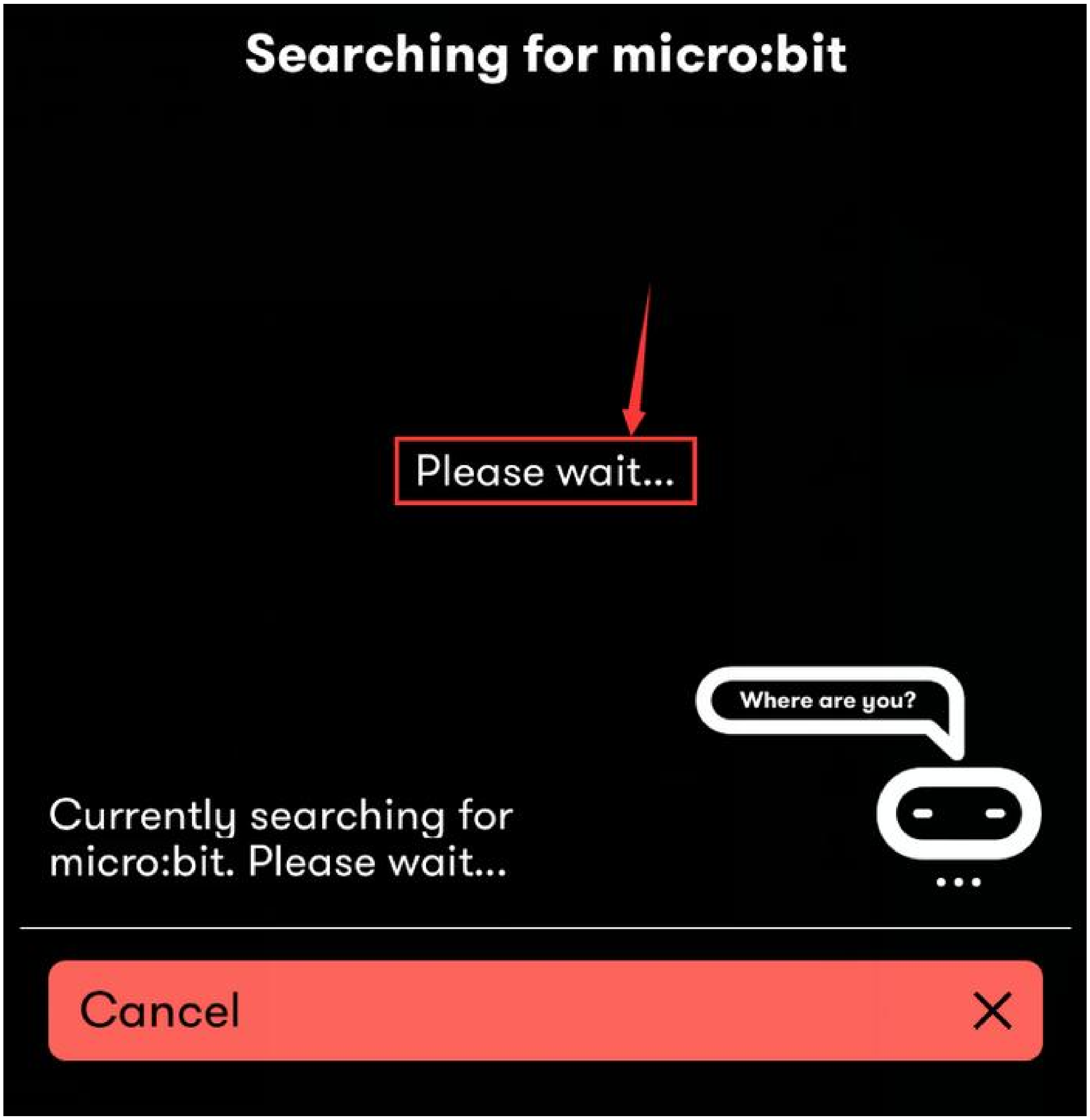
- Set the password pattern on your Apple device as the same pattern showed on the matrix and click “Next”.



- 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.


Ready to pair
Let's do this
Tap Next to pair
When asked for a code, PRESS
button A on micro:bit to see it
Cancel
Next


Searching for micro:bit
If the pairing code dialogue doesn't appear within a few seconds, please go to Settings>Bluetooth and "Forget" you
o: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

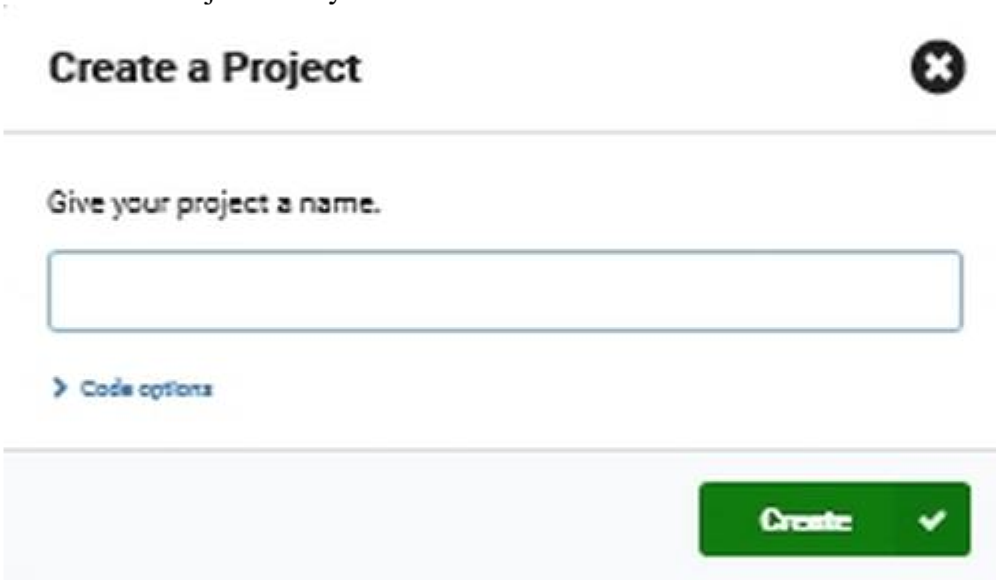

Searching for micro:bit
Please wait...
Where are you?
Currently searching for micro:bit. Please wait...
Cancel

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

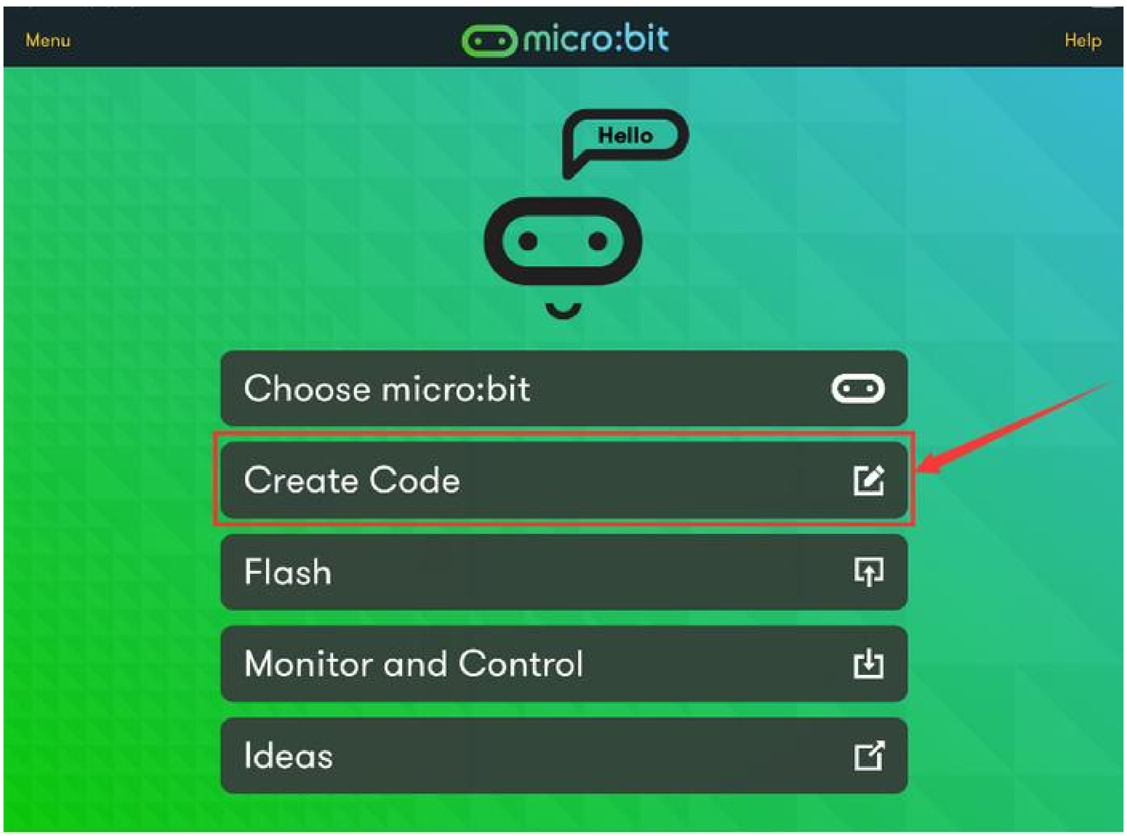
(4) Create Code

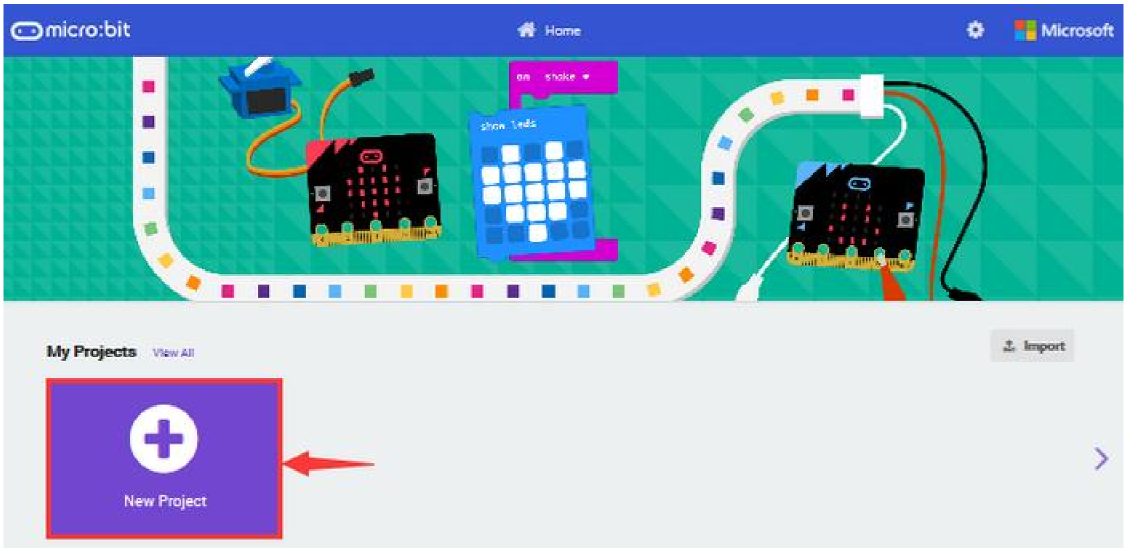
Click “Create Code” to enter the programming page and write code.

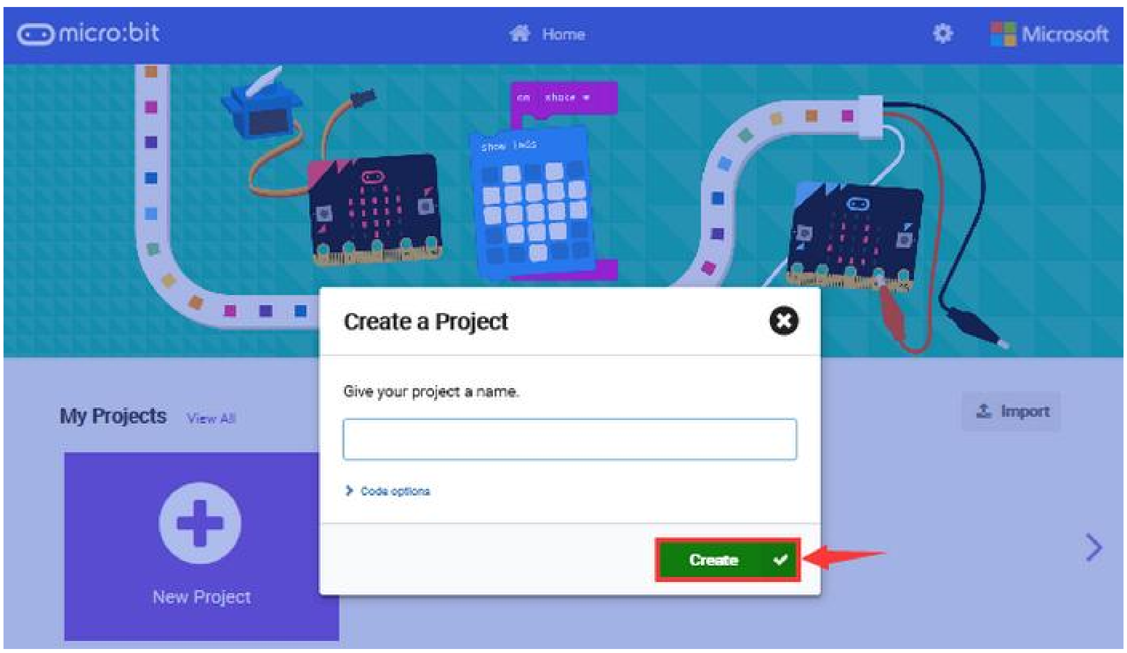
Click "New Project" and you will see

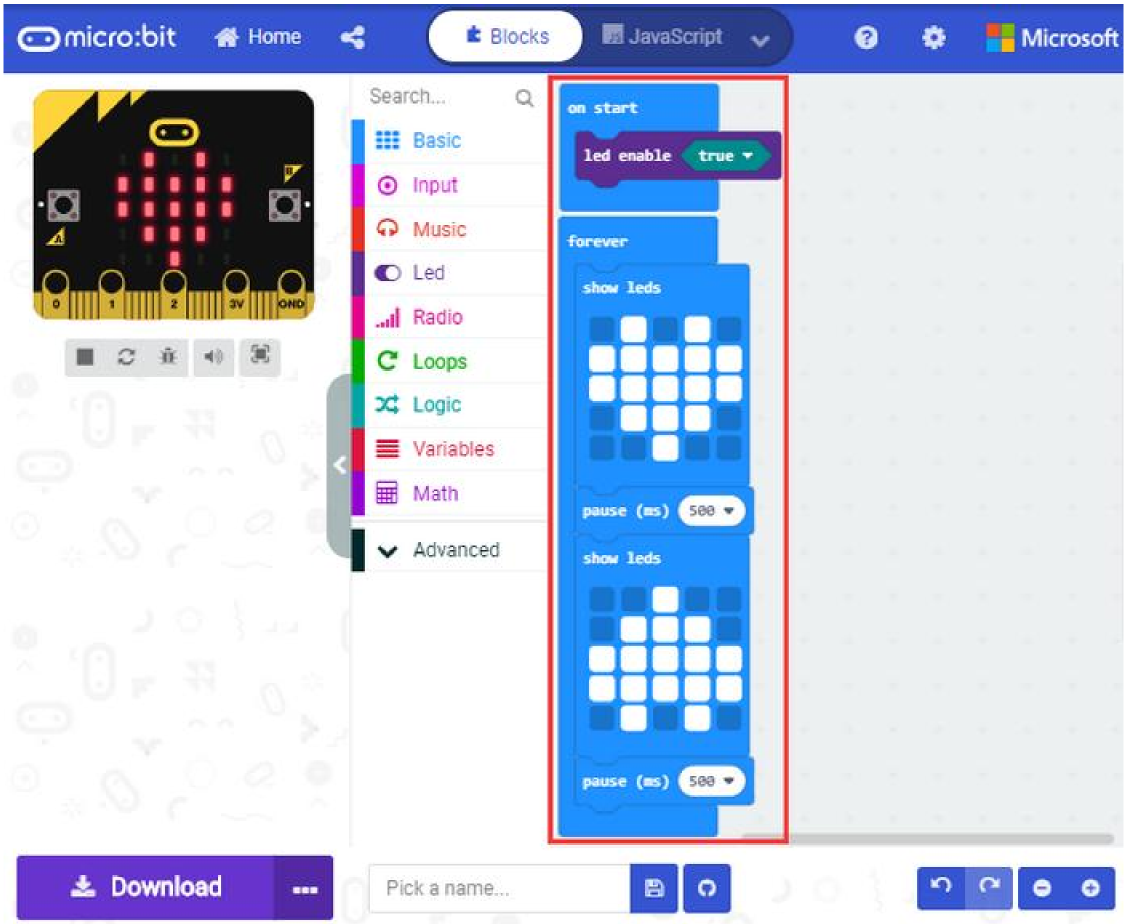


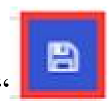
and then select “Create √”.

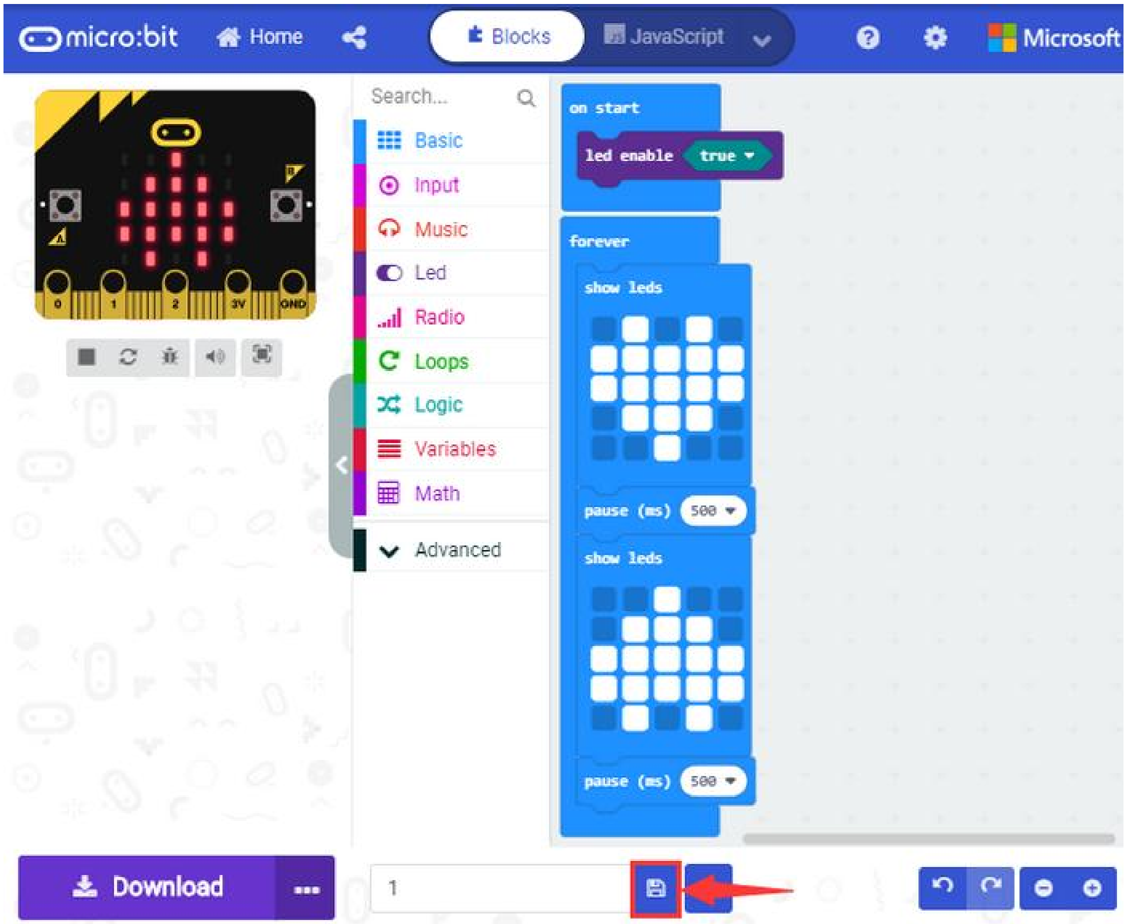



micro:bit
Home
Microsoft
My Projects
View All
Import
New Project


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

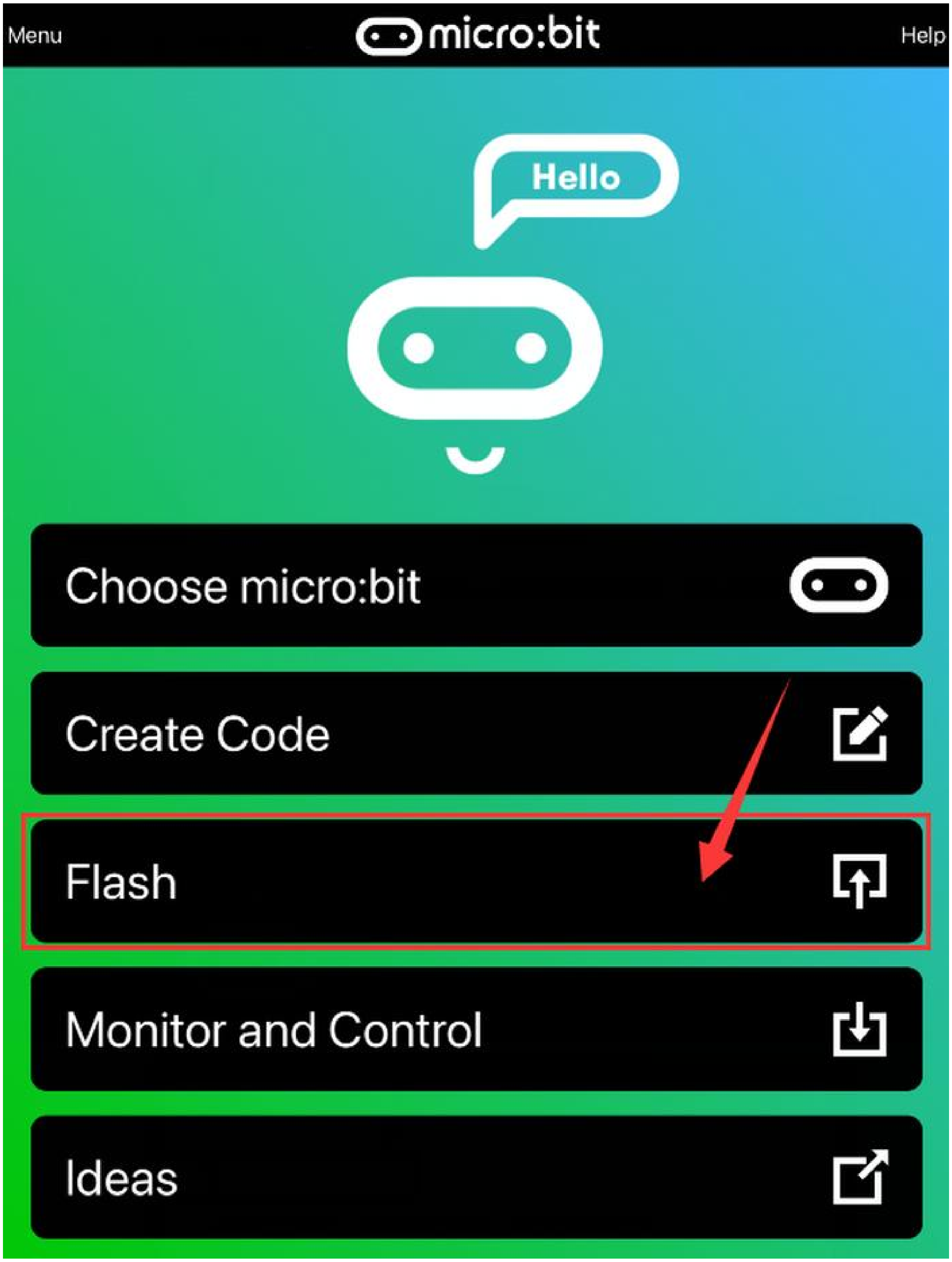


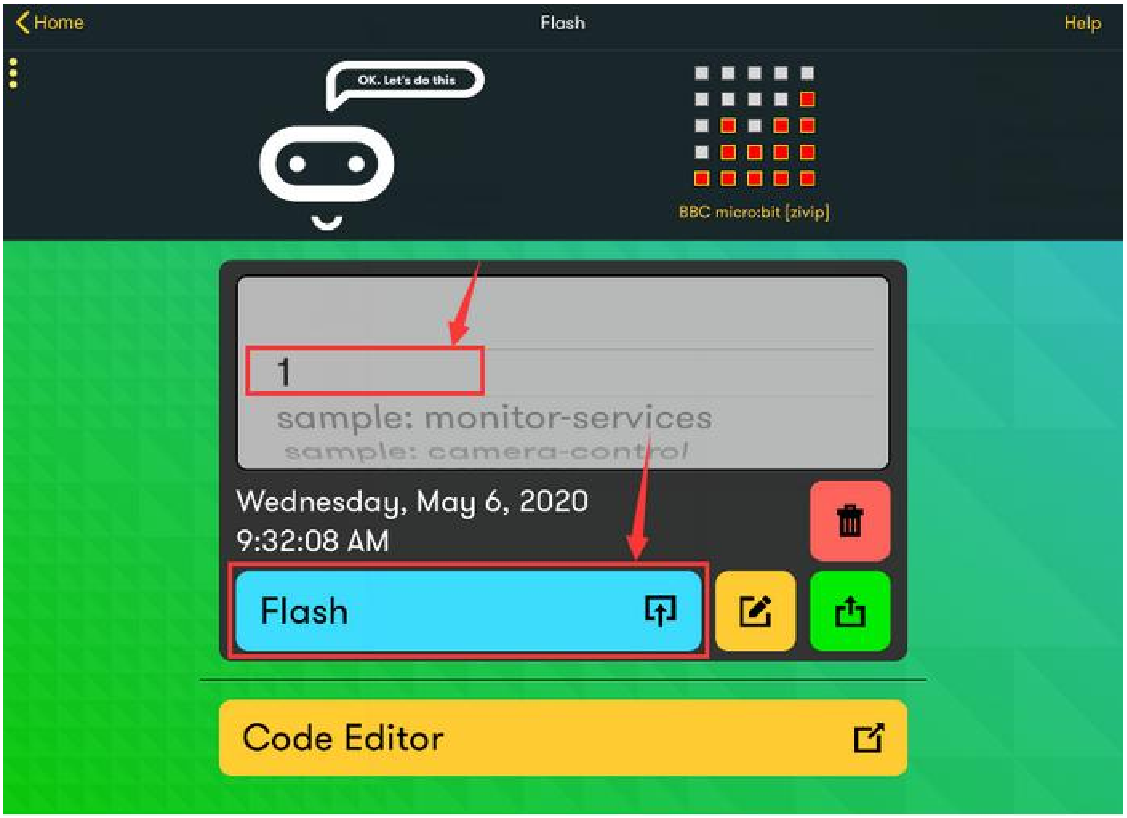
Name the project as “1 “and click “  ” to save the code.



Click “Flash” to enter the uploading page.

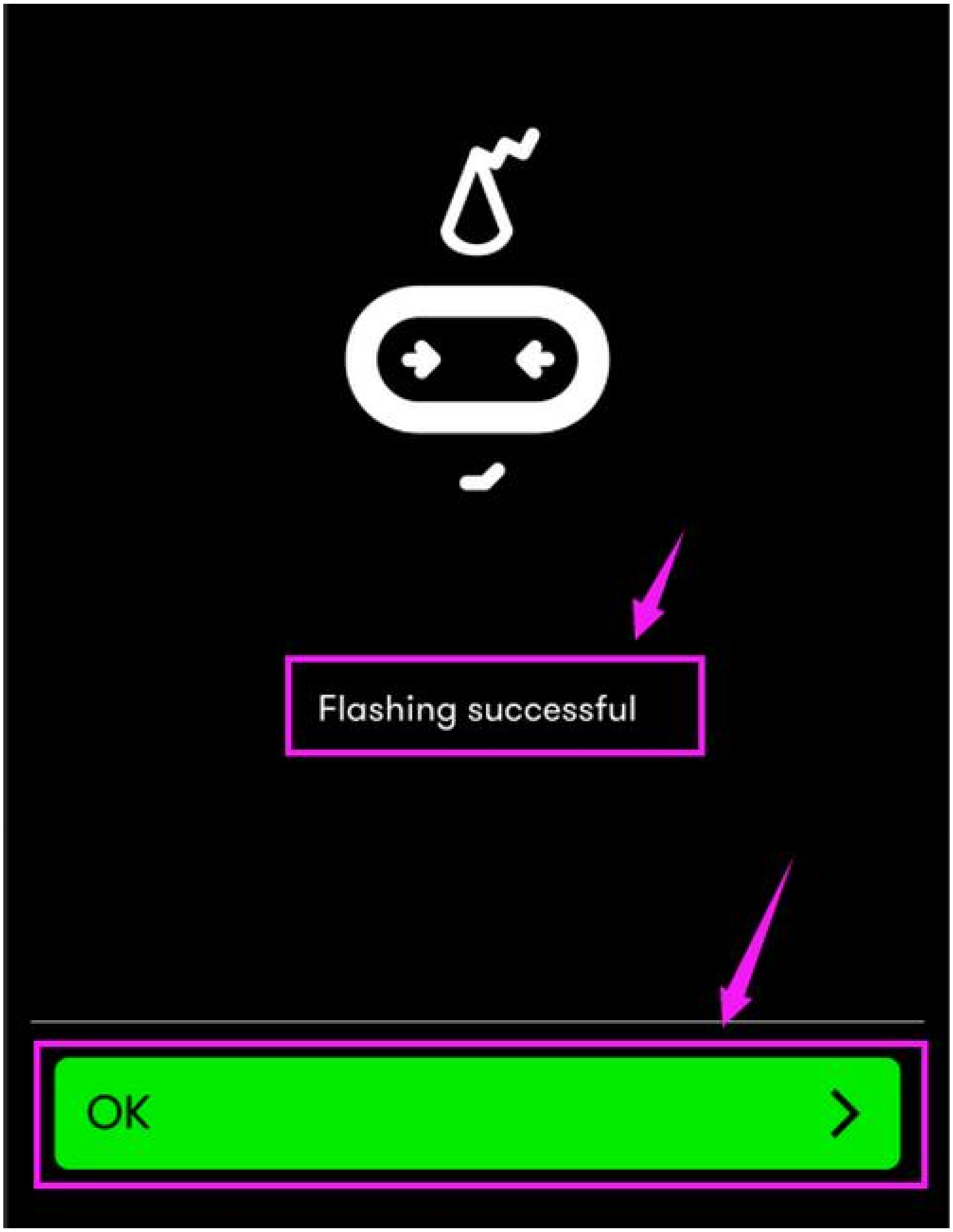
The default code program for uploading is the one saved just now and named "1" and then click "Flash" to upload the code program "1".


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 program “1” is uploaded successfully a few seconds later, the App will show as below and the LED dot matrix will display a heart pattern.


Flashing successful
OK