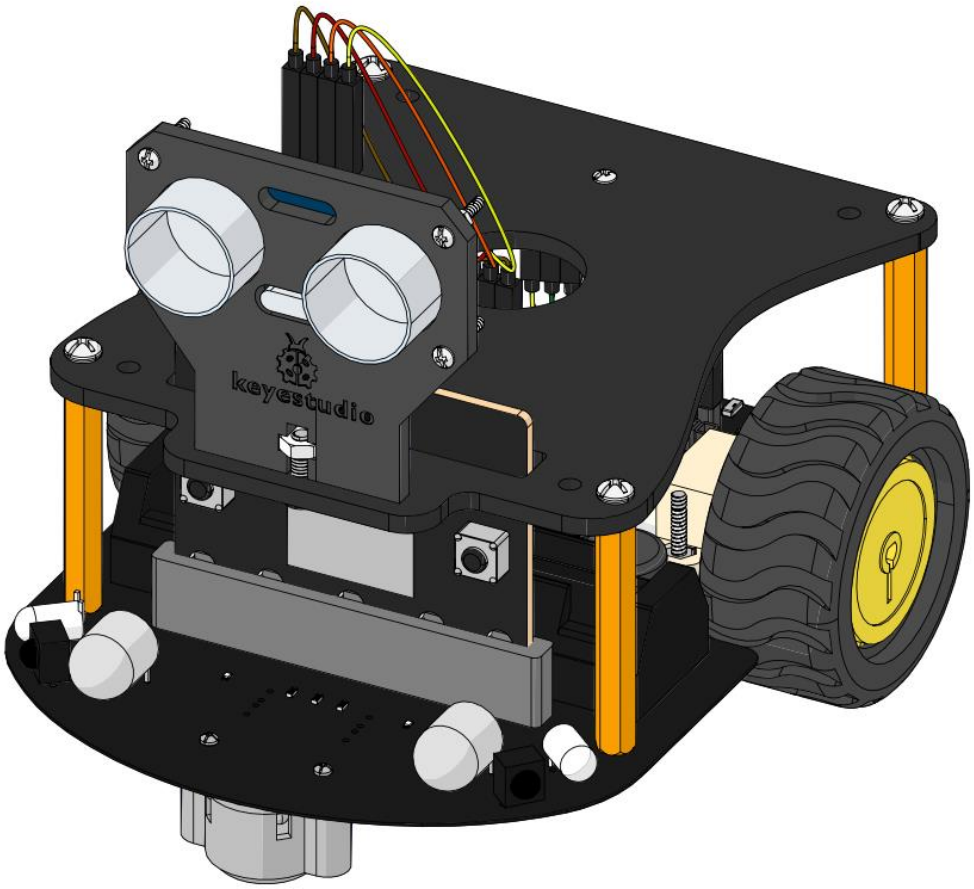
Keyestudio Micro:bit Mini Smart Robot Car Kit V2



Content

1. Description

With the popularity of programming like Python, a large number of parents enrol their children in STEM lessons to stimulate their interest and creativity.

MicroPython is a tiny open source Python programming language interpretor that runs on small embedded development boards. With MicroPython you can write clean and simple Python code to control hardware instead of having to use complex low-level languages like C or C++ (what Arduino uses for programming).

To make you have a better understanding of Python, we provide test code and projects.

The Keyestudio micro:bit smart car integrates obstacle avoidance, line tracking and IR and Bluetooth control functions. It contains passive buzzer, ultrasonic sensor, KEYES-2812-18R module, IR obstacle avoidance sensor and so on.

The passive buzzer makes music play, a KEYES-2812-18R module can display different effects, a photoresistor can detect light intensity.

Simultaneously, this smart car is chargeable. You only connect power to the port of battery holder.

2. Specifications

1) Voltage: DC 5V
2) Current: USB power supply or power supply with a capacity greater than or equal to 2A

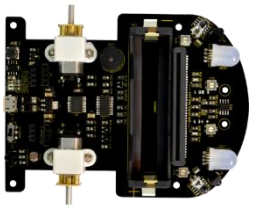
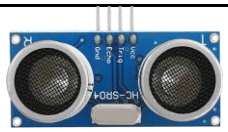
3) Maximum power: 10W

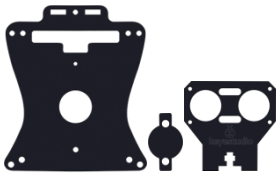
4) Operating temperature range: 0-50 degrees Celsius

5) Dimensions: 120*90.7mm

6) Environmental attributes: ROHS

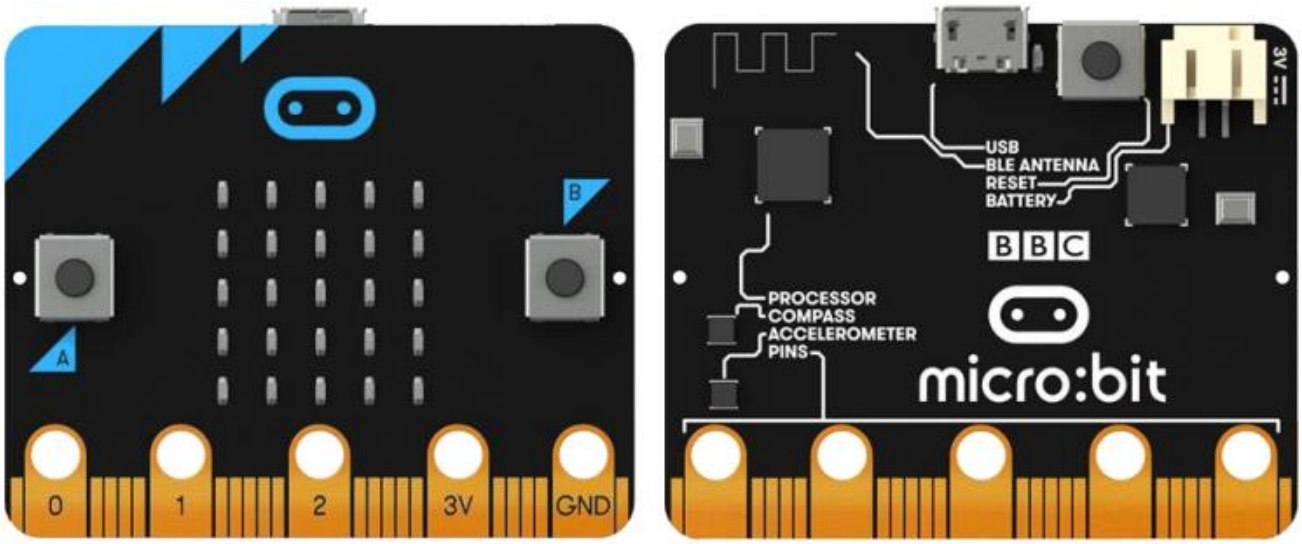
3. Product List

Electronic Components			
#	Model	QTY	Picture
1	Keyestudio Expansion Board V2	1	
2	HC-SR04 Ultrasonic Sensor	1	

3	KEYES-2812-18R Module	1	
4	Acrylic Set	1	
5	N20 Motor	2	
6	Arduino 3PI MiniQ Universal Wheel	1	
7	Insulation Gasket	3	
8	Micro:bit USB Cable	1	
9	F-M 10CM/40P/2.54/10 Dupont Line	3	
10	F-M 15CM/40P/2.54/10 Dupont Line	4	
Nut & Screw			
11	M1.6*10MM Round Head	6	

	Screws		
12	M3*6MM Round Head Screws	8	
13	M1.6 304 Stainless Nuts	6	
14	Dual Pass M3*35MM HEX Copper Bush	4	
15	M3*10MM Flat Screw	1	
16	M3 Nickel Plated Nuts	1	
17	M2.5*10MM Round Self-tapping Stainless Screws	2	
Tool			
18	3*40MM Screwdriver	1	
19	Map	1	
20	2*40MM Screwdriver	1	

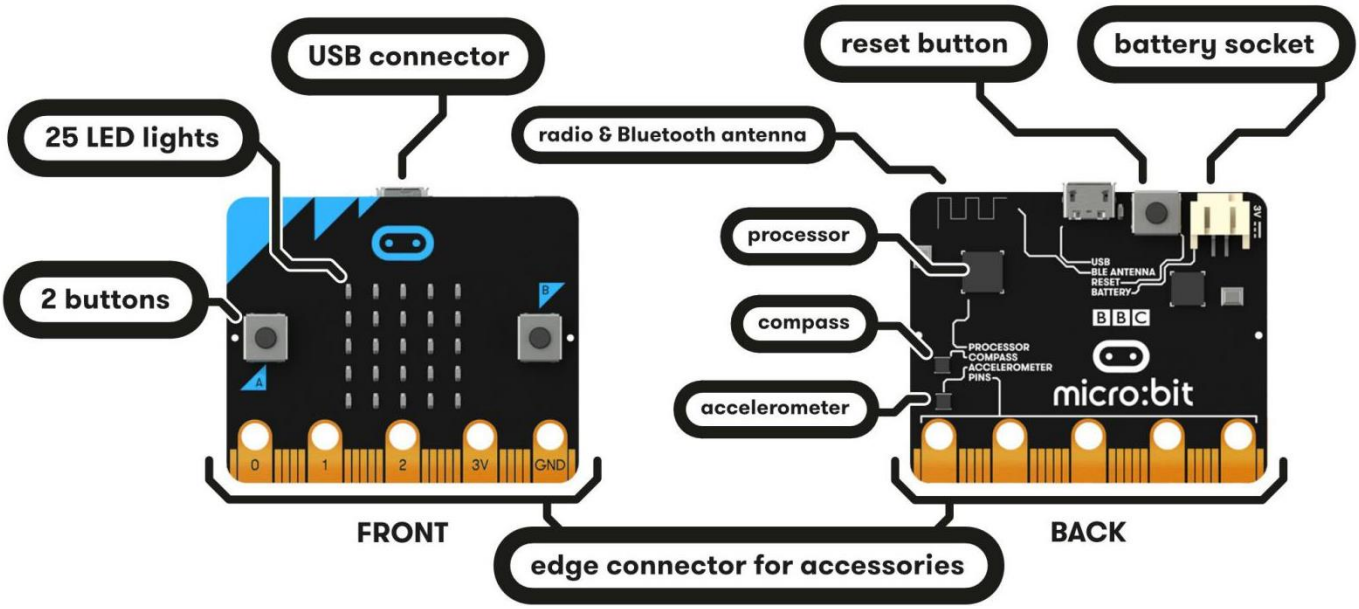
4. Micro:bit



4.1 Set up your micro:bit

For more details, enter the website please：https://microbit.org/guide/

Function:



Features:

- NRF51822 processor（16 MHz 32bit, ARM Cortex-M0, Bluetooth 4.0 low consumption/2.4GHz RF wireless, 16kB RAM and 256kB Flash）
- KL26Z micro controller（48 MHz ARM Cortex-M0+ core,128 KB Flash）
- 25 pcs programmable LEDs
- 2 programmable buttons
- Physical pins

- Light and temperature sensors
- Accelerometer(MMA8652 and I2C get the data from accelerator sensor)
- Geomagnetic sensor/compass (MAG3110, I2C obtain three-axis geomagnetic data)
- Wireless communication，by radio and Bluetooth.

Micro USB Port

More details, please enter website：https://microbit.org/guide/features/

Hardware：

The information of micro:bit board: https://tech.microbit.org/hardware/

4.2 Micro:bit Pins

Before getting started with the following projects, firstly need to figure out each pin of micro:bit main board.

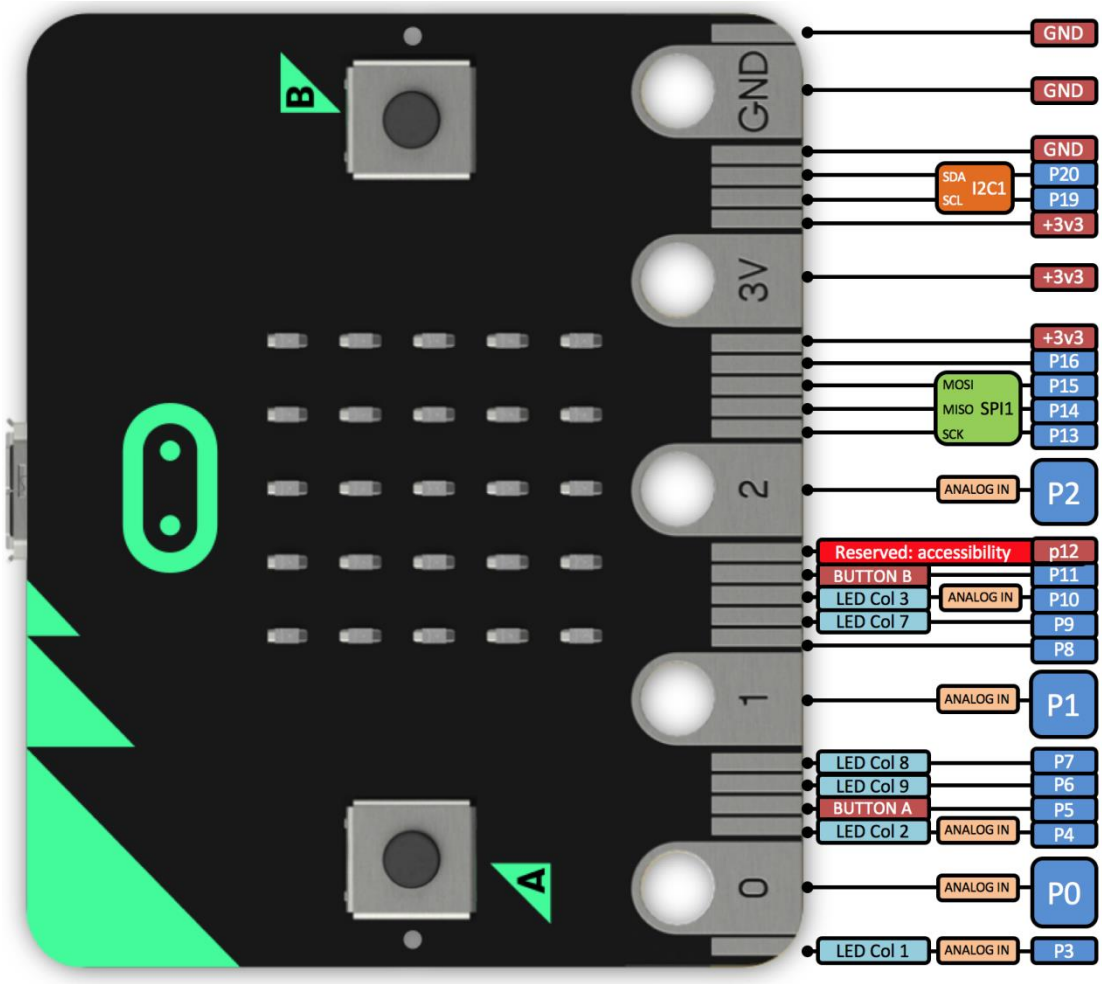
The BBC micro:bit has 25 external connections on the edge connector of the board, which we refer to as “pins”.

The edge connector is the gray area on the right side of the figure below.

There are five large pins, that are also connected to holes in the board labeled: 0, 1, 2, 3V, and GND.

And along the same edge, there are 20 small pins that you can use when plugging the BBC micro:bit into an edge connector.

Please refer to the following diagram shown below.



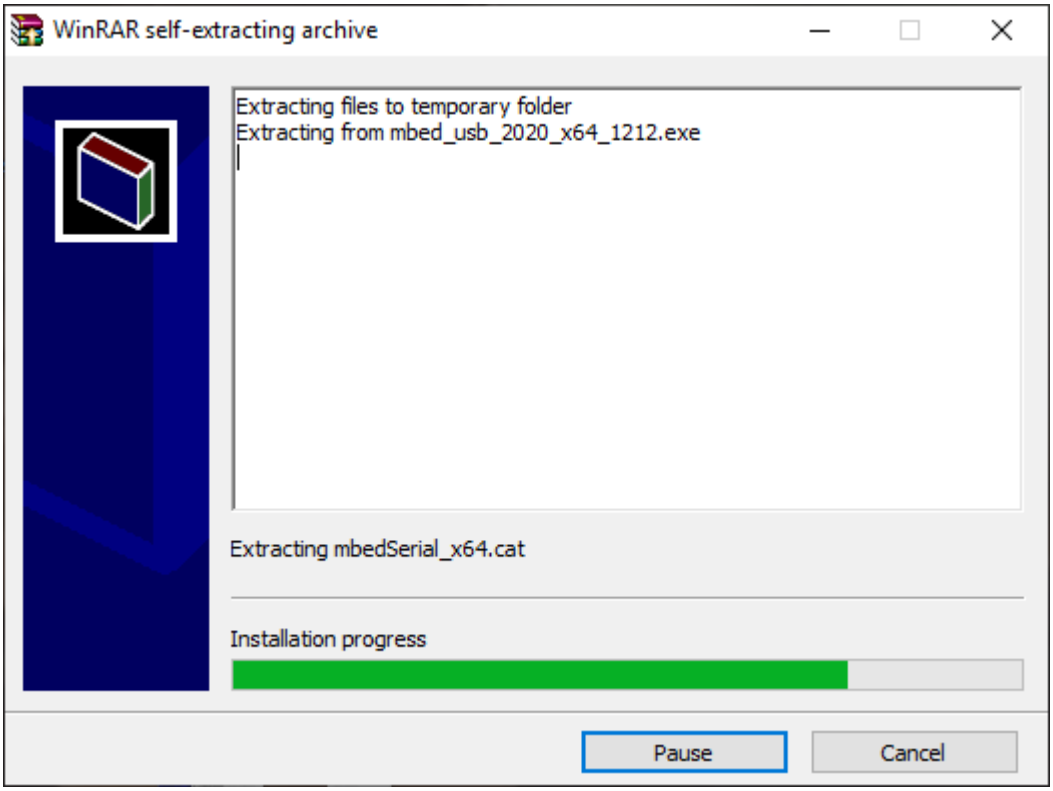
More details you could refer to the official website : : https://microbit.org/guide/hardware/pins/

1. Install Micro:bit Driver:

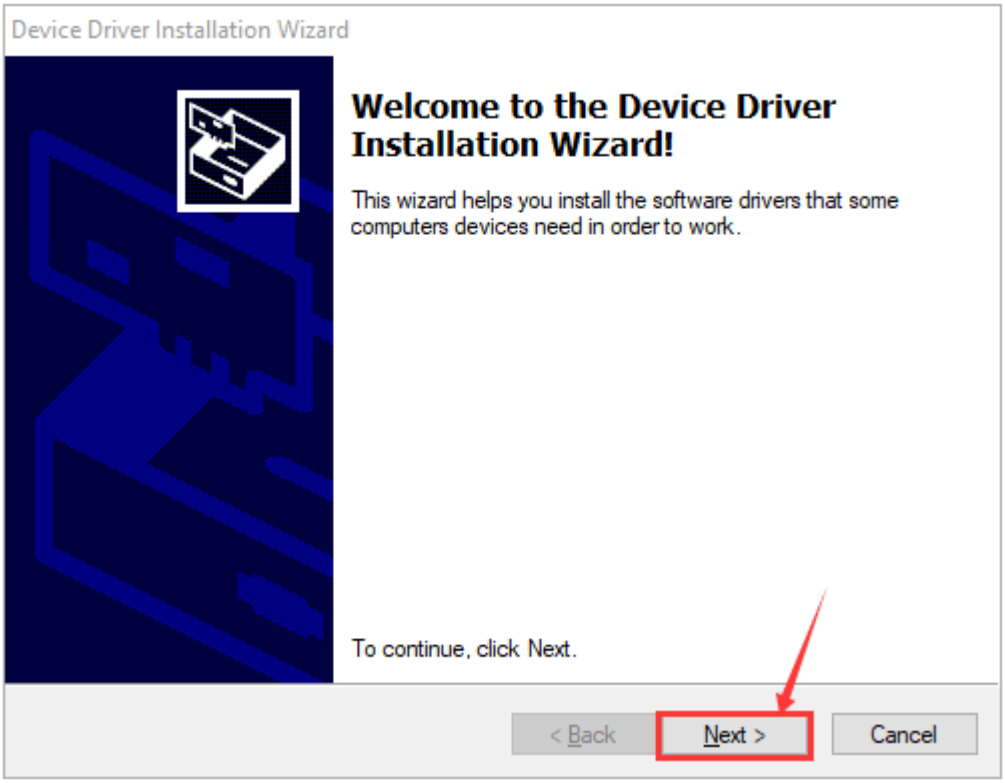
Link Micro:bit board with computer by micro USB cable, then open the link : https://fs.keyestudio.com/KS0426Driverto download the driver of Micro:bit main board.

Double-click 

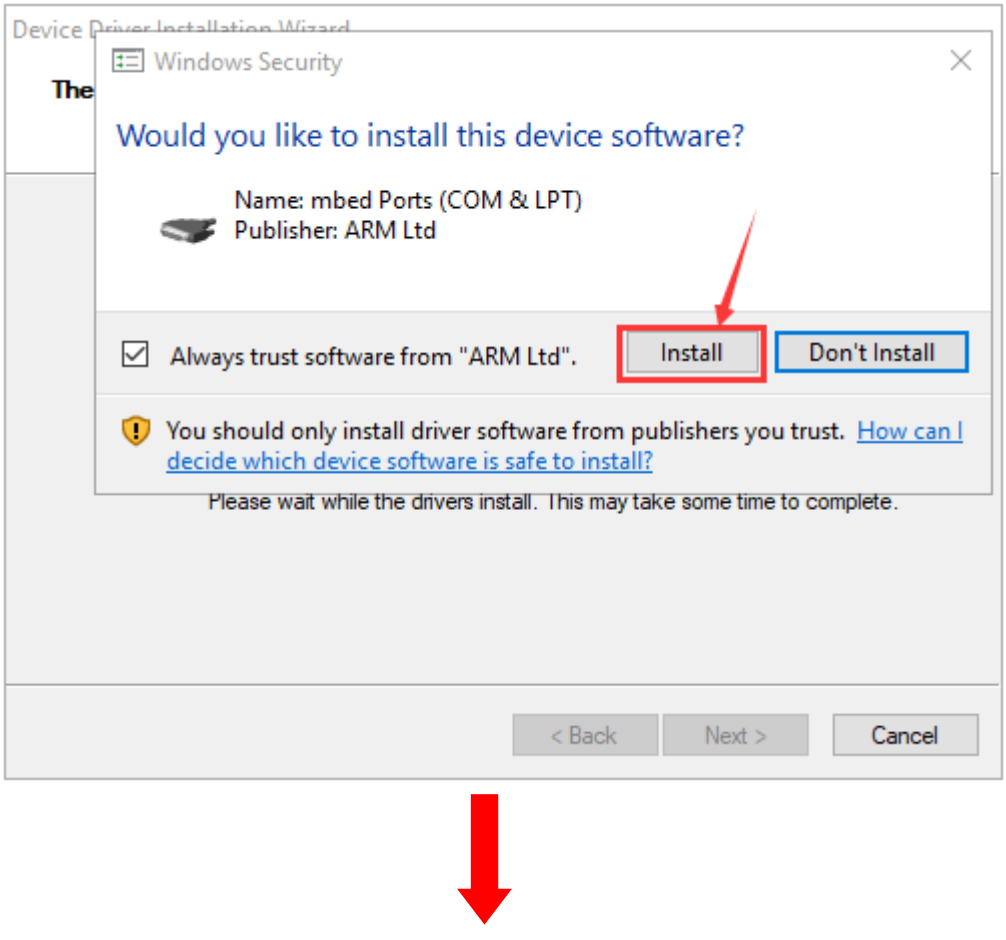
after downloading the driver.

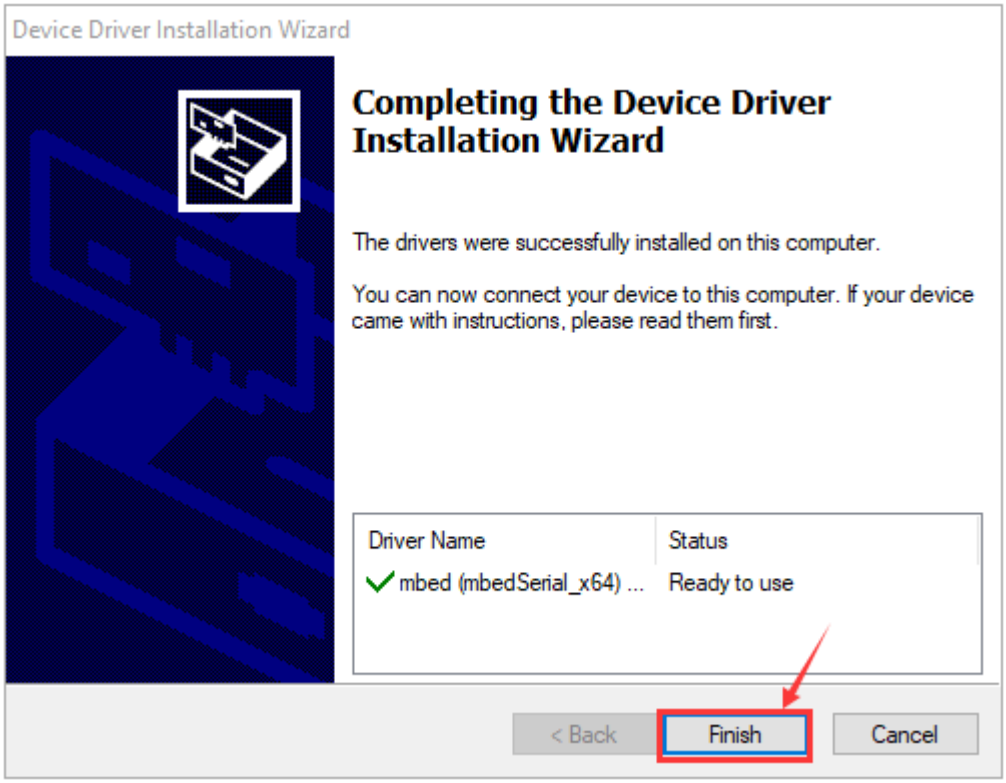


Then click “Next”

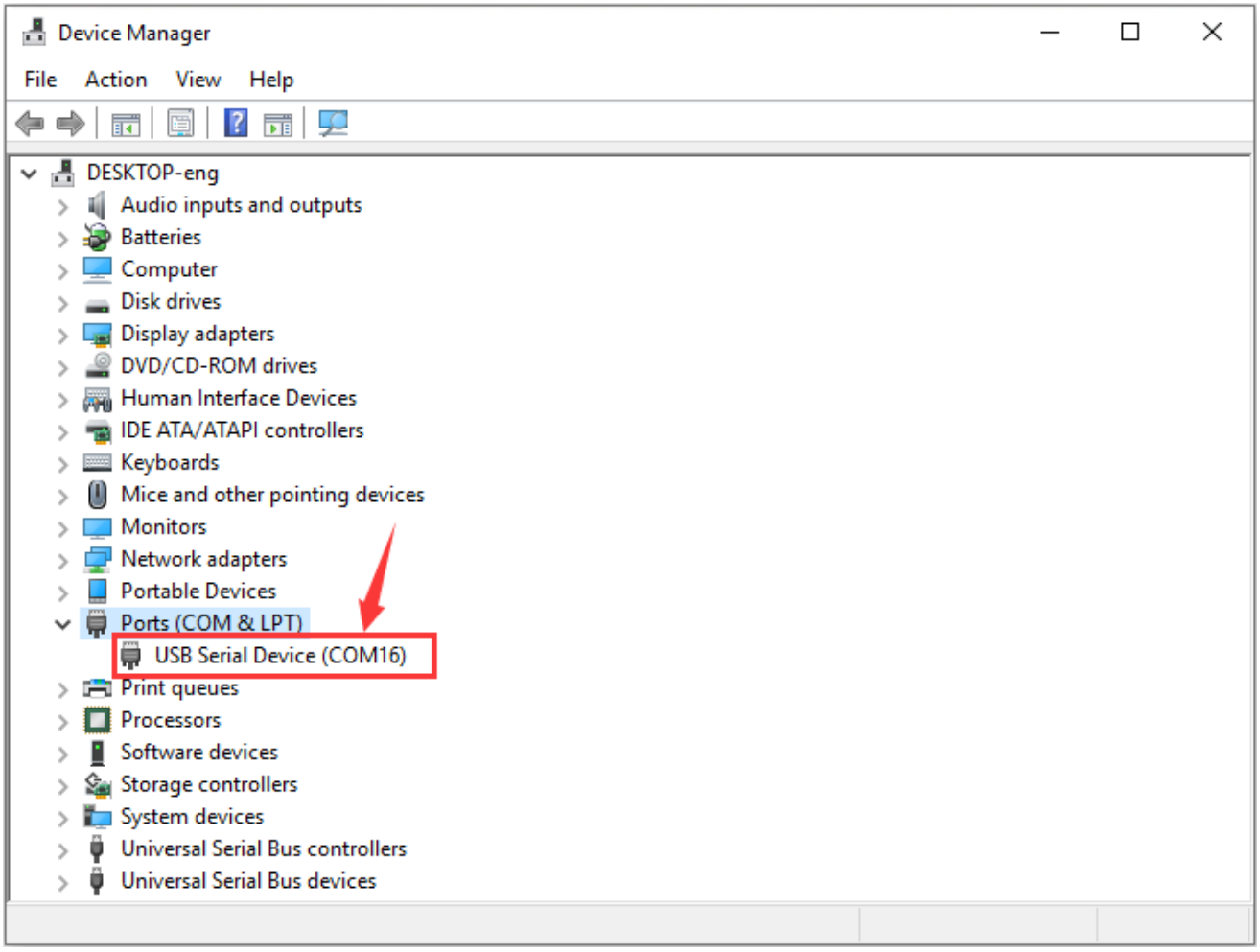


The following page pops up and click “install”

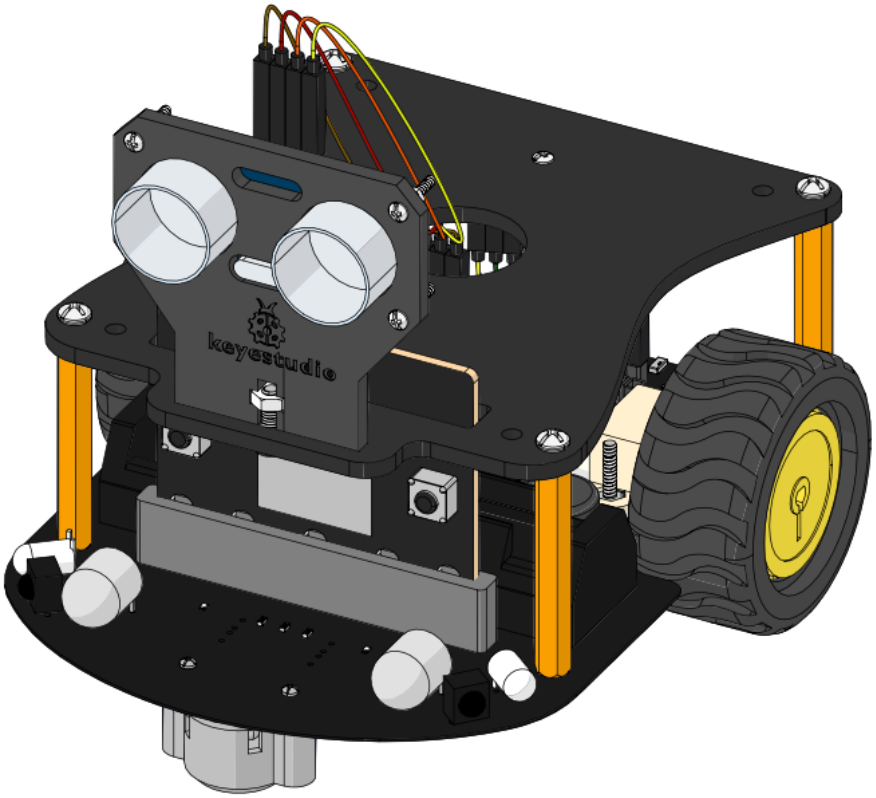




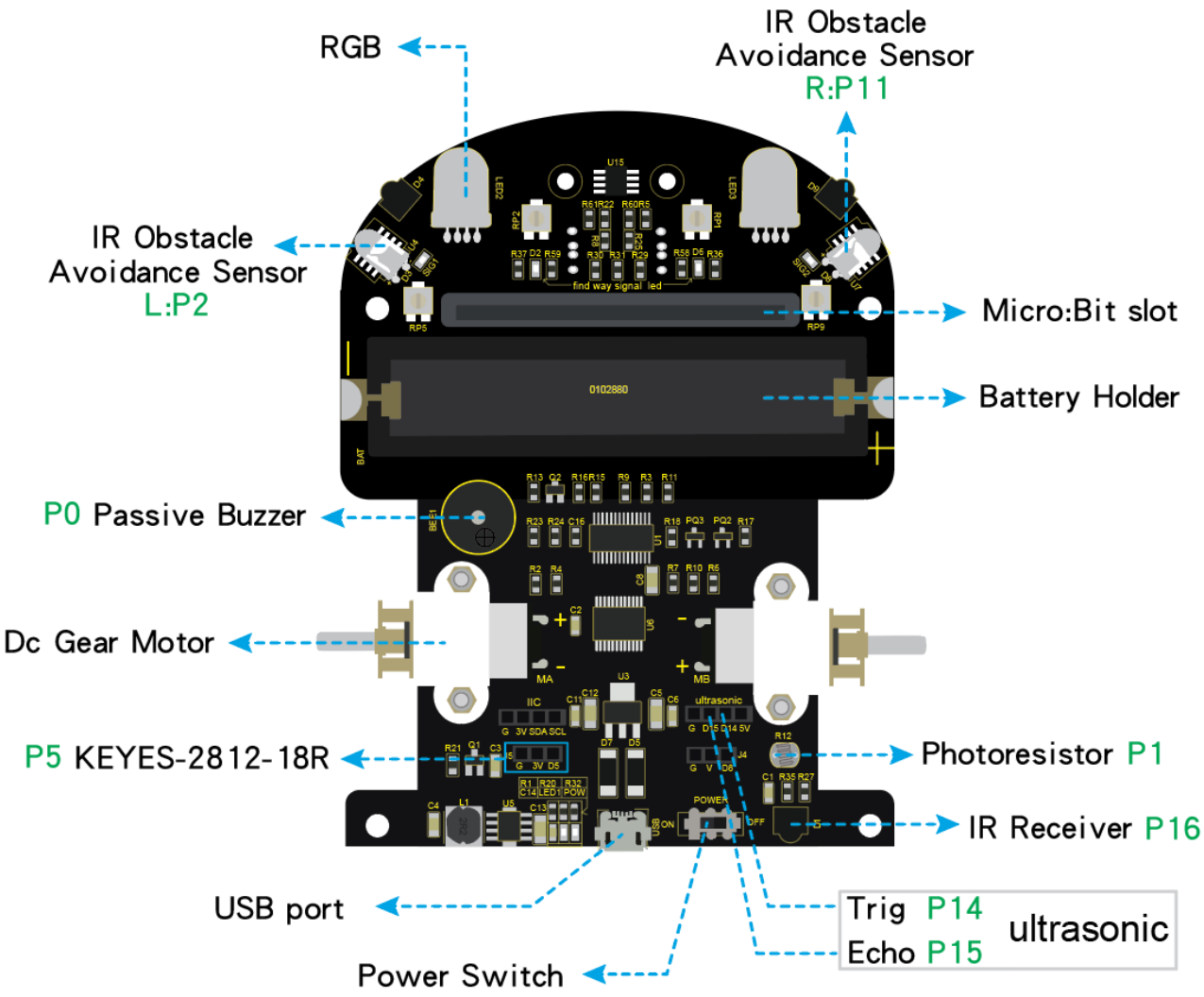
Click "Finish". Then click "Computer" —> "Properties" —> "Device manager", as shown below.

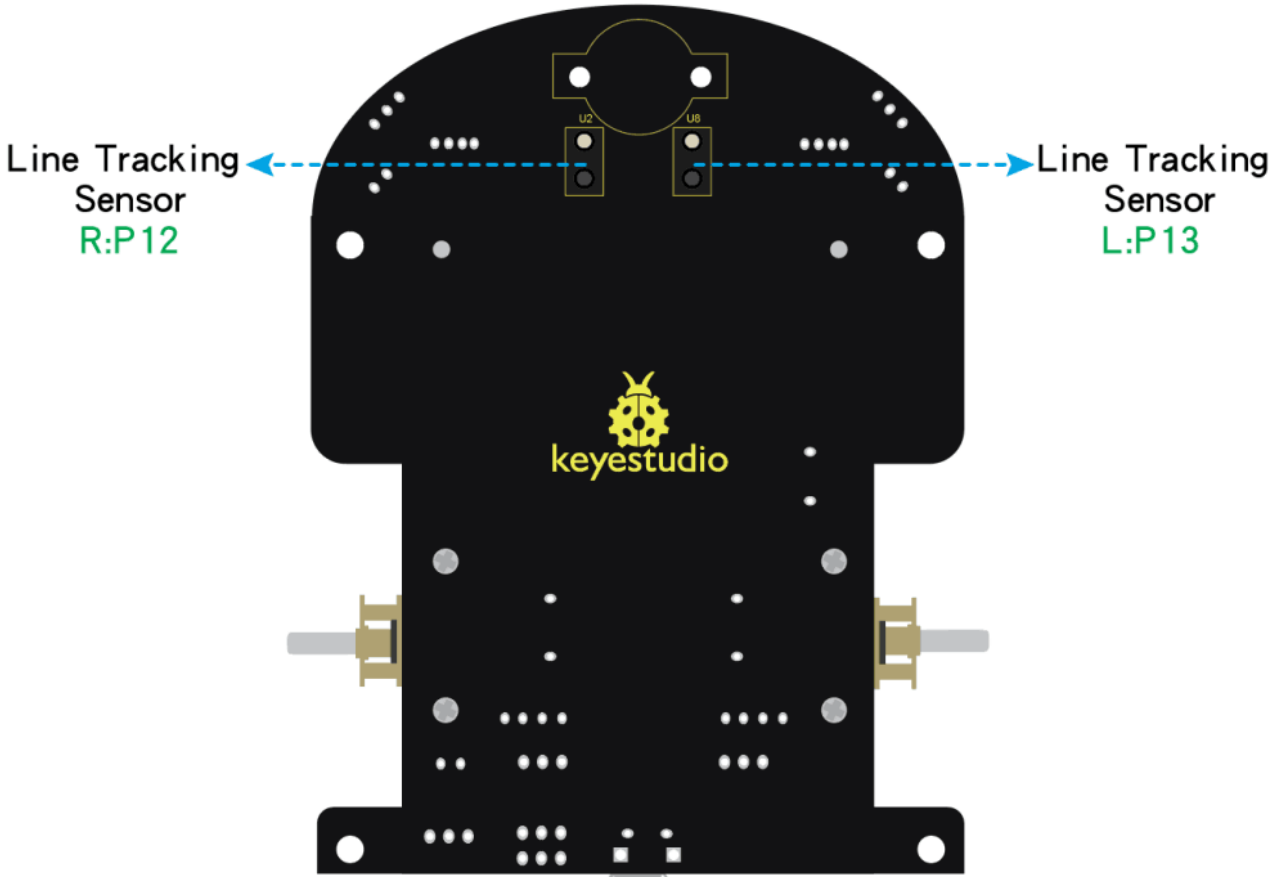

Device Manager
File
Action
View
Help
DESKTOP-eng
Audio inputs and outputs
Batteries
Computer
Disk drives
Display adapters
DVD/CD-ROM drives
Human Interface Devices
IDE ATA/ATAPI controllers
Keyboards
Mice and other pointing devices
Monitors
Network adapters
Portable Devices
Ports (COM & LPT)
USB Serial Device (COM16)
Print queues
Processors
Software devices
Storage controllers
System devices
Universal Serial Bus controllers
Universal Serial Bus devices

4.3. Keyestudio Micro:bit Mini Smart Car



Rich in sensors and peripheral devices, Keyestudio micro:bit is a multipurpose car based on micro:bit, which could help you learn how to use micro:bit and electronics knowledge.


RGB
IR Obstacle
Avoidance Sensor
R:P11
IR Obstacle
Avoidance Sensor
L:P2
Micro:Bit slot
Battery Holder
P0 Passive Buzzer
Dc Gear Motor
P5 KEYES-2812-18R
Photoresistor P1
IR Receiver P16
USB port
Power Switch
Trig P14
Echo P15
ultrasonic



Rechargeable Battery

The keyestudio micro:bit smart car is supplied power by a 18650 battery or USB port. The battery is rechargeable and maximum current is 700 mA.

Note: the battery is not included in this kit.

Indicator

Show the working status of keyestudio micro:bit smart car.

LED	Name	LED on	LED off
D2	Left line tracking sensor	Detect white object	Detect black line
D6	Right line tracking sensor	Detect white object	Detect black line
SIG1	Left obstacle avoidance sensor	Detect obstacles	No obstacle is detected
SIG2	Right obstacle avoidance sensor	Detect obstacles	No obstacle is detected
POW	Power indicator		

LED1	LED1 is always on when the power is fully charged.

Potentiometer

Potentiometer	Adjust sensitivity
RP1 Right line tracking sensor	Put a paper under the bottom of car, adjust the RP1. When D2 is on, then pull up the universal wheels for 0.5cm off the paper. The sensitivity is set well if D2 is off
RP2 Left line tracking sensor	Refer to RP1

RP5 Left obstacle avoidance sensor	Keep left obstacle avoidance sensor about 5cm away the obstacle. Adjust the RP5 and SIGI is on. The sensitivity is set well if the obstacle is removed and SIGI is off
RP9 Right obstacle avoidance sensor	Keep right obstacle avoidance sensor about 5cm away the obstacle. Adjust the RP9 and SIG2 is on. The sensitivity is set well if the obstacle is removed and SIG2 is off

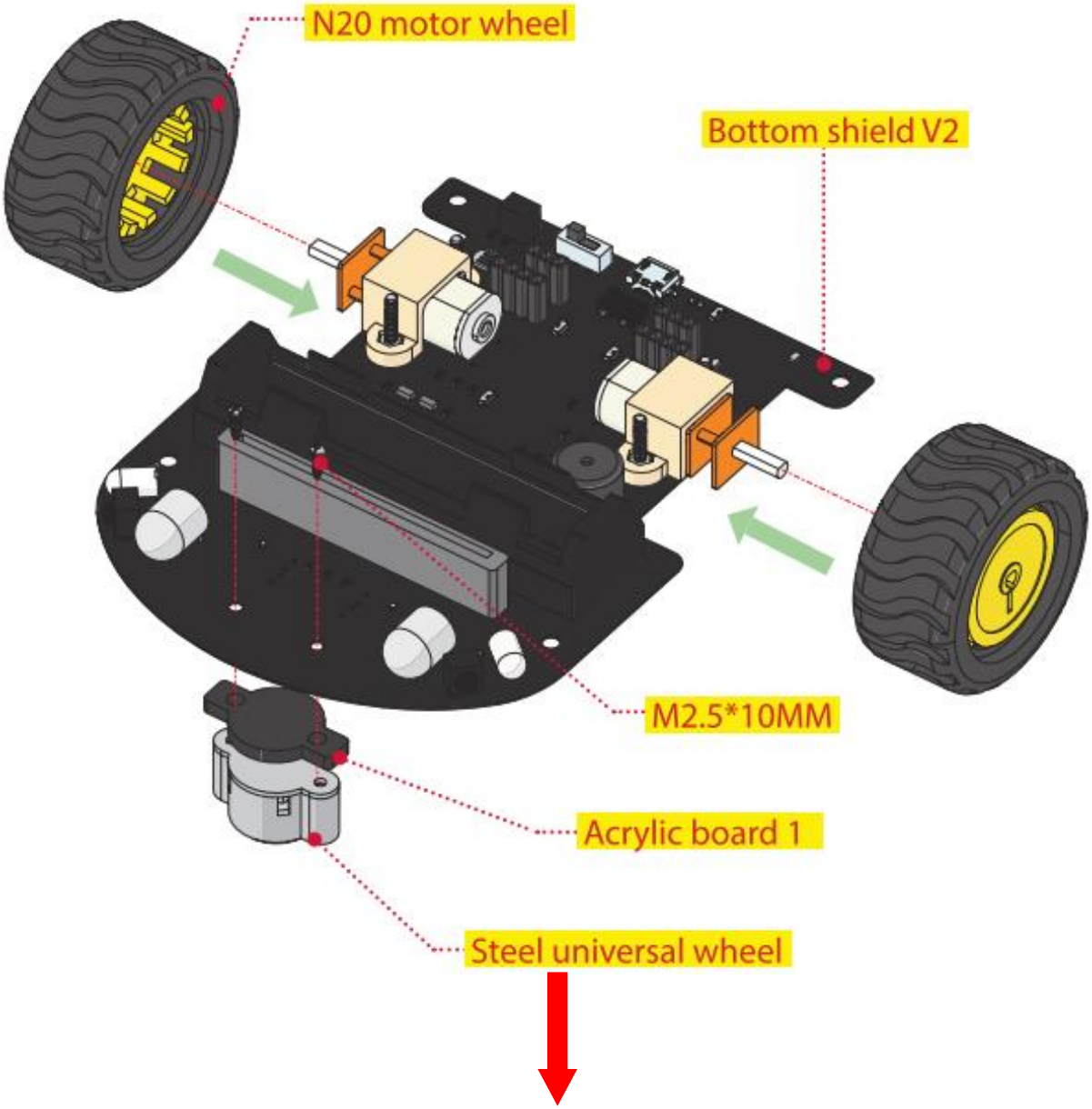
4.4 Assembly Guide

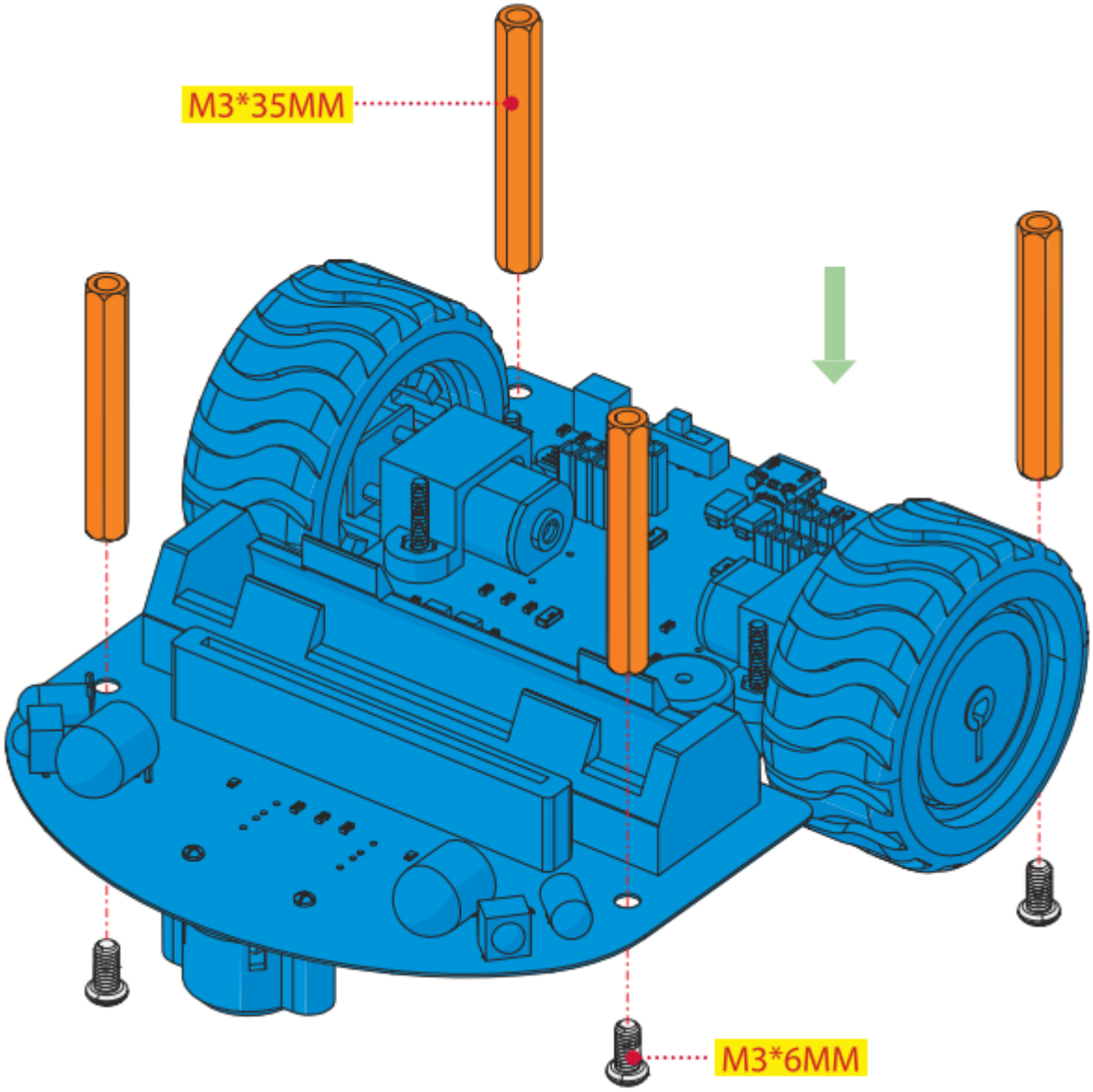
1. Install base plate of micro:bit mini smart car

(Take out the two self-tapping screws of universal wheels first, we provide the 2 pcs longer self-tapping screws to replace them, and don’ t screw them too tightly)

Prepare the parts as follows:

* N20 motor wheel *2
* M3*35MM hex copper pillar *4
* Steel universal wheel *1
* Acrylic board 1 *1
* Micro:bit robot bottom shield V2 *1
* M3*6MM round head screw *4
* M2.5*10MM Self-tapping screw *2





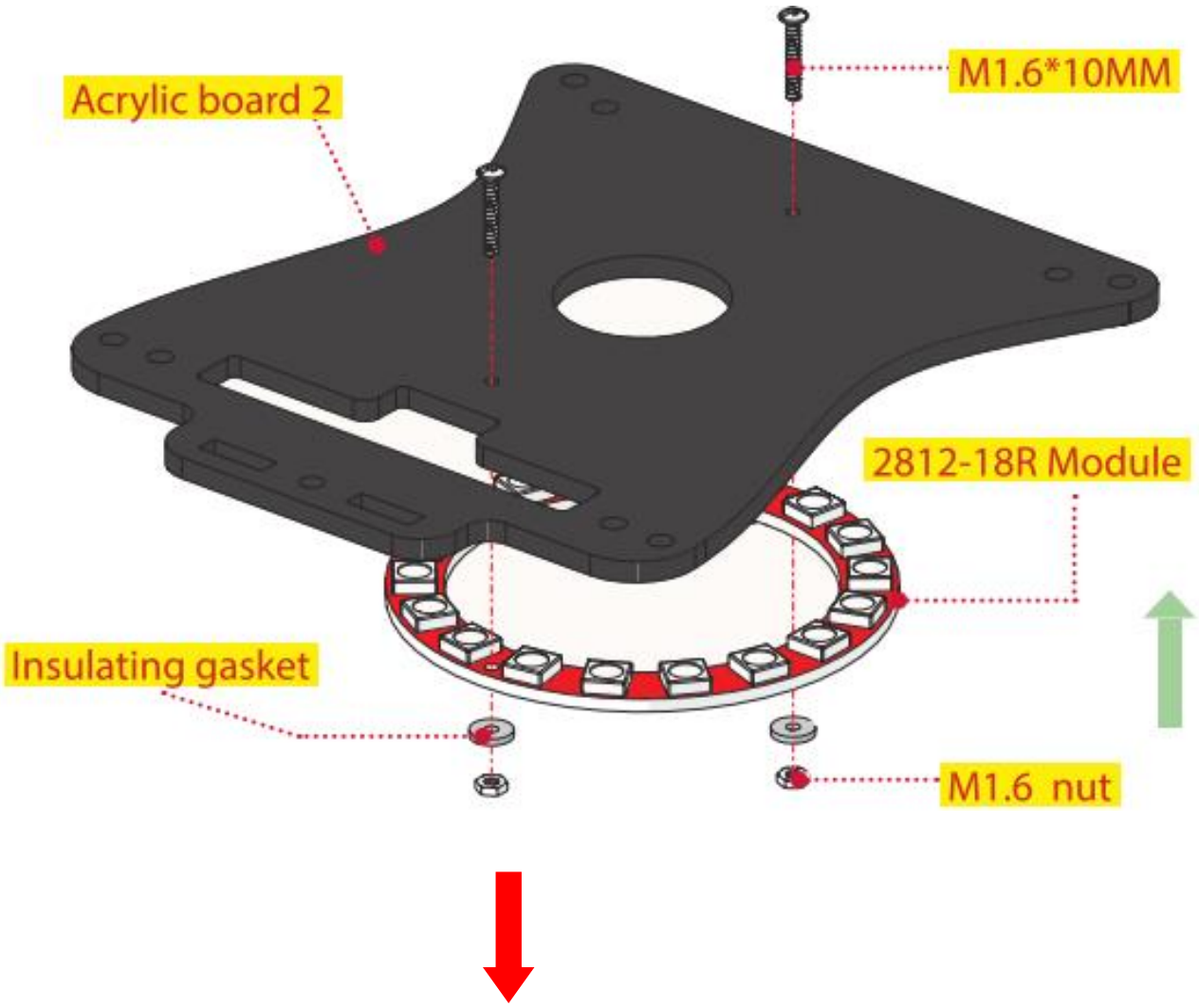
1. Mount the top board of micro:bit smart car

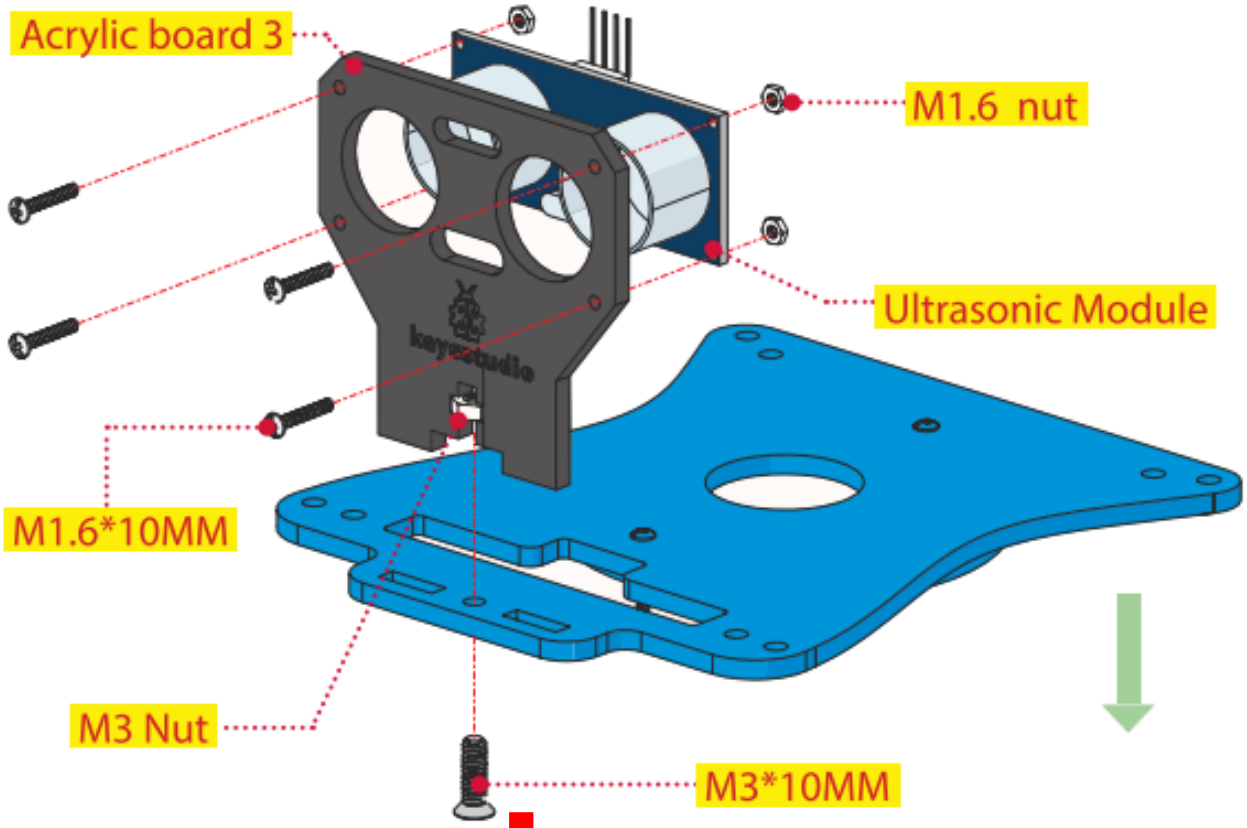
Install the base plate of mini smart robot

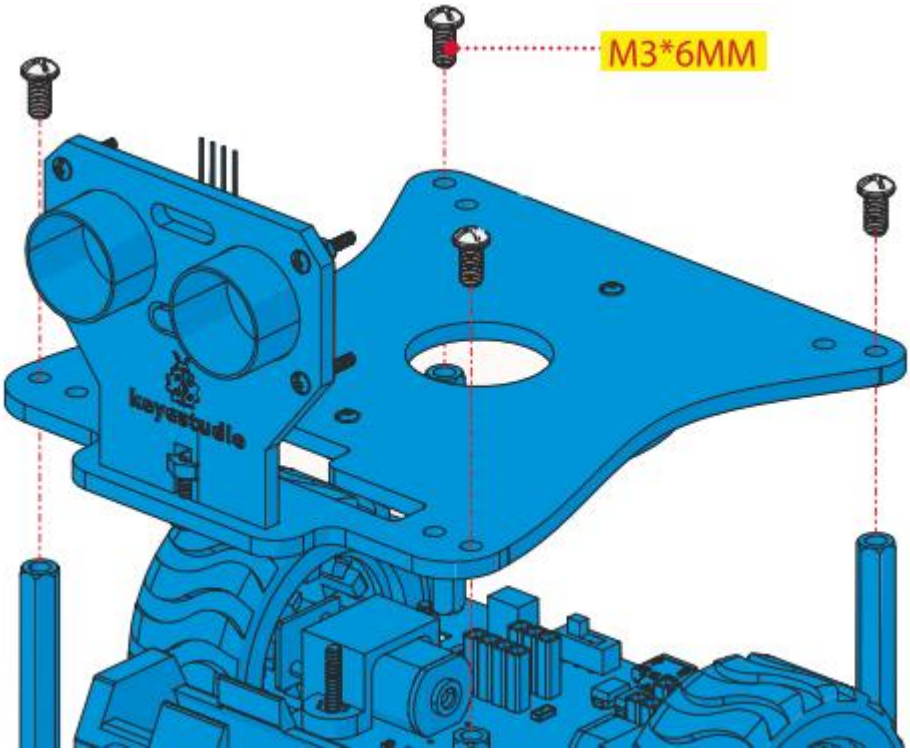
(Note：Install it after peeling off the protective film on acrylic board.)

Prepare the parts as follows:

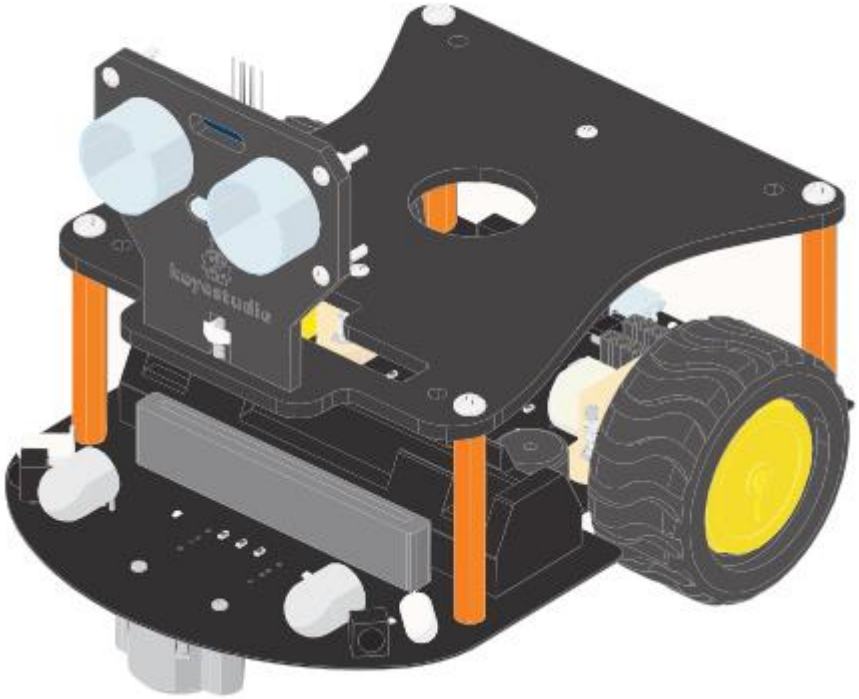
* M1.6 nut *6
* M3 nut *1
* Acrylic board 2 *1
* Acrylic board 3 *1
* Insulating gasket *2
* KEYES-2812-18R Module *1
* HC-SR04 ultrasonic sensor *1
* M3*10MM flat-head screw *1
* M3*6MM round head screw *4
* M1.6*10MM round head screw *6




Acrylic board 3
M1.6 nut
Ultrasonic Module
M1.6*10MM
M3 Nut
M3*10MM


M3*6MM

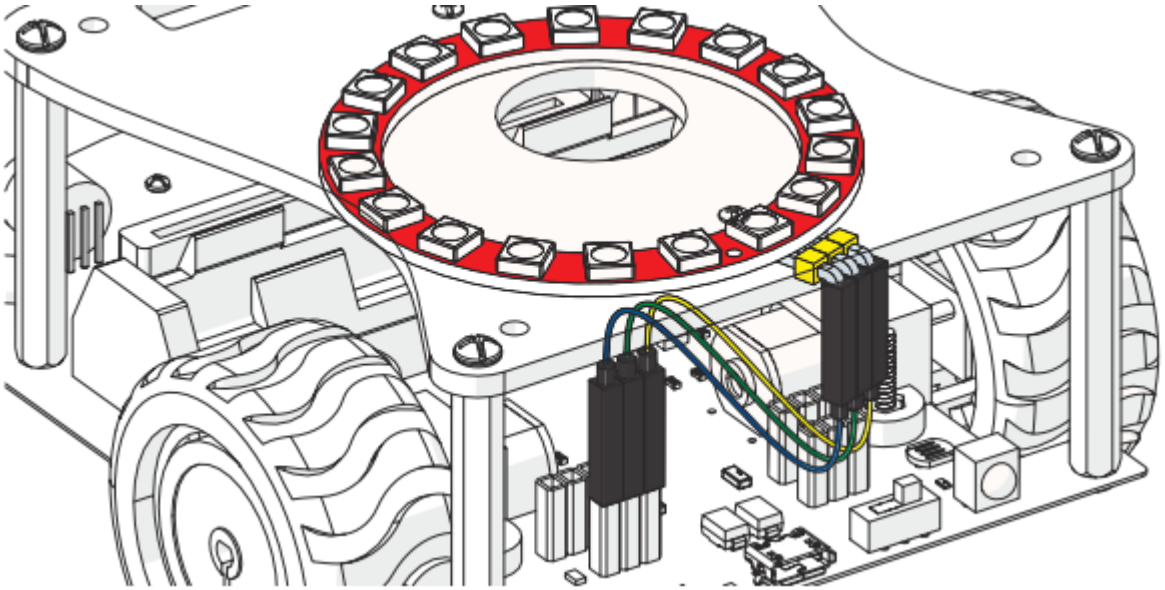
Complete renderings

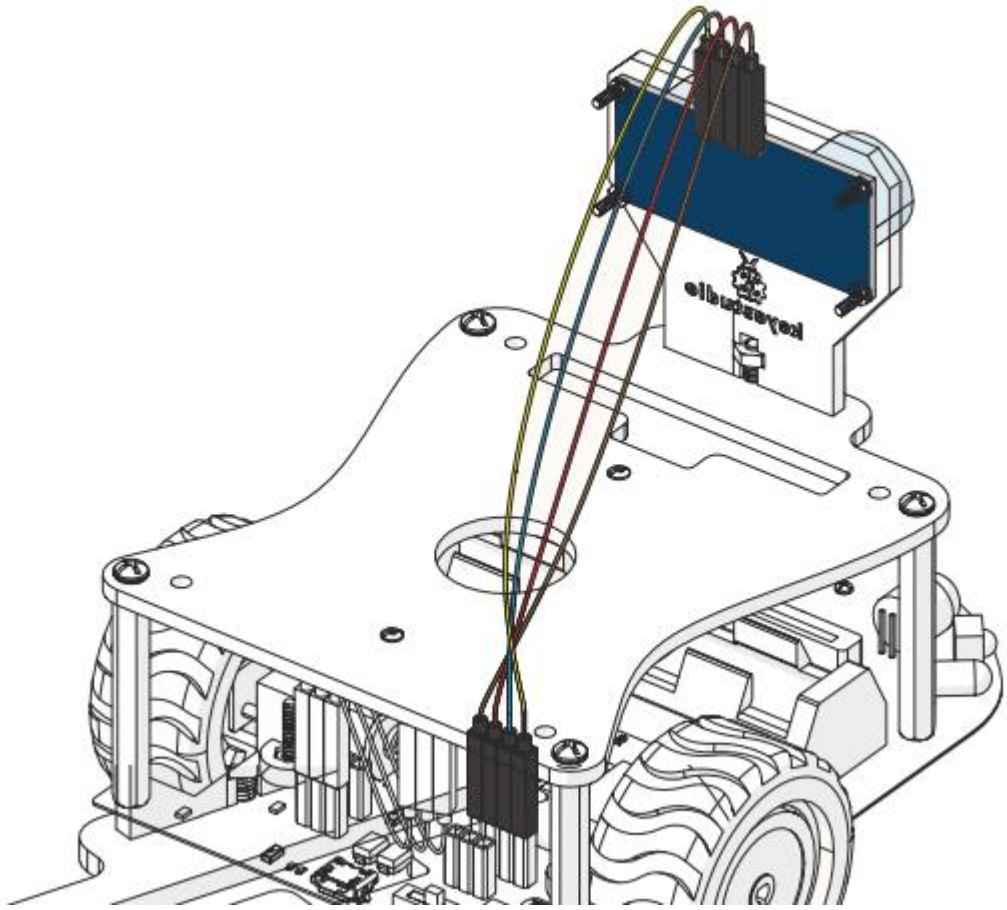


2. Wiring

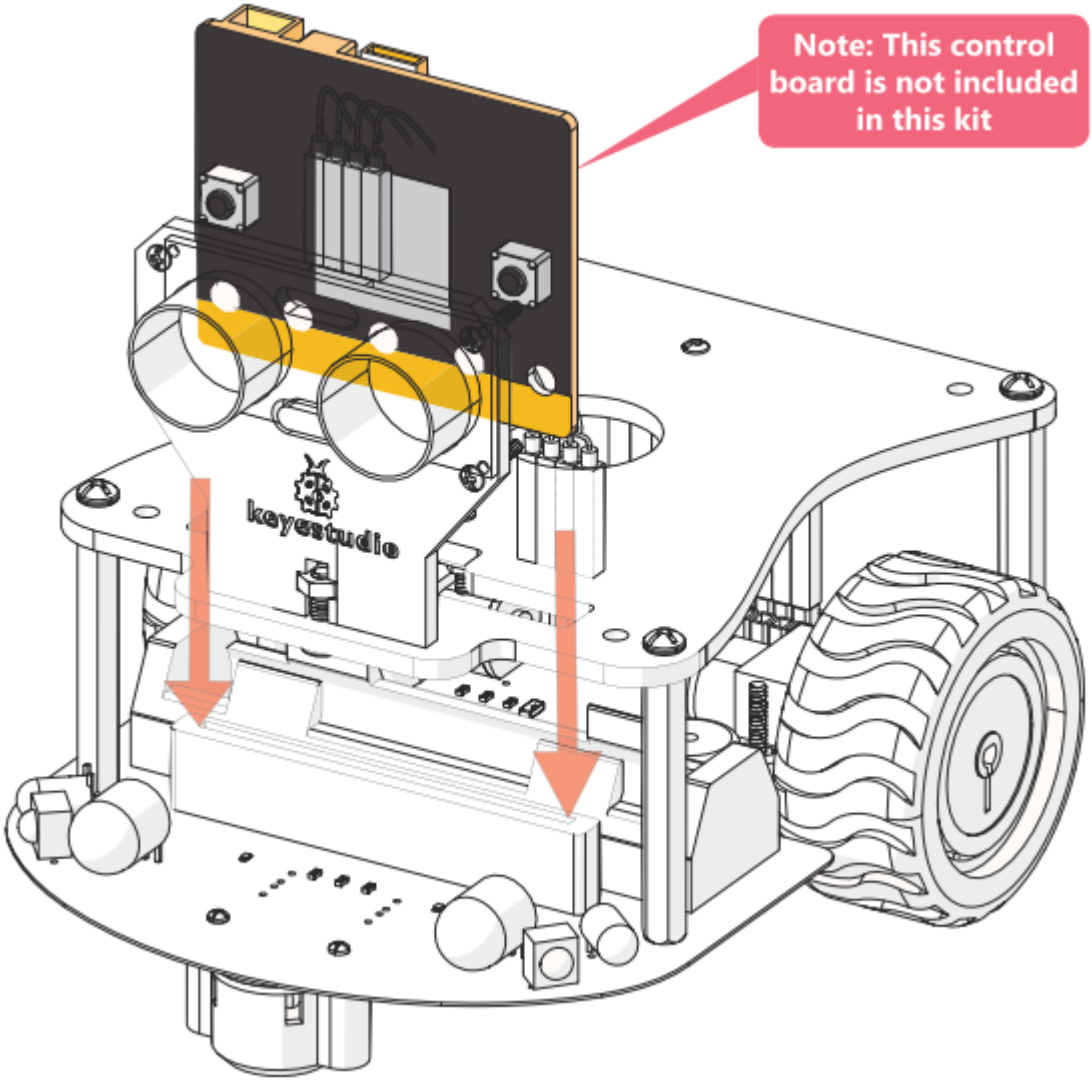
Sensors/modules	Pins	Shield
KEYES-2812-18R module	G	G
	V	V
	D1	D5
	Gnd	G

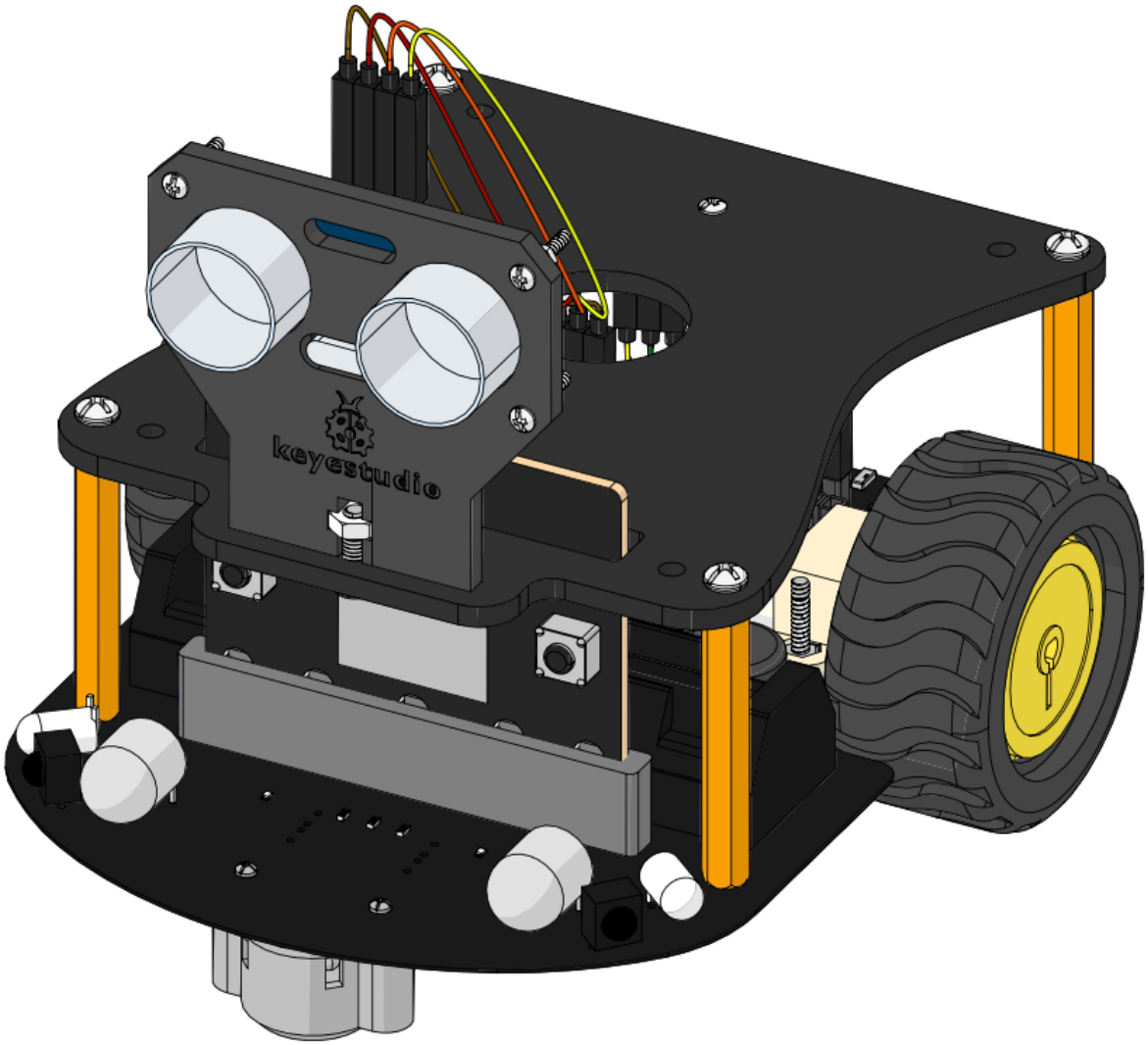
HC-SR04 Ultrasonic Sensor	Echo	D15
	Trig	D14
	Vcc	5V





3. Install Micro:bit


Note: This control board is not included in this kit
keyestudio



5. Python

What is MicroPython?

MicroPython is a tiny open source Python programming language interpreter that runs on small embedded development boards. With MicroPython you can write clean and simple Python code to control

hardware instead of having to use complex low-level languages like C or C++ (what Arduino uses for programming).

The simplicity of the Python programming language makes MicroPython an excellent choice for beginners who are new to programming and hardware. However MicroPython is also quite full-featured and supports most of Python's syntax so even seasoned Python veterans will find MicroPython familiar and fun to use.

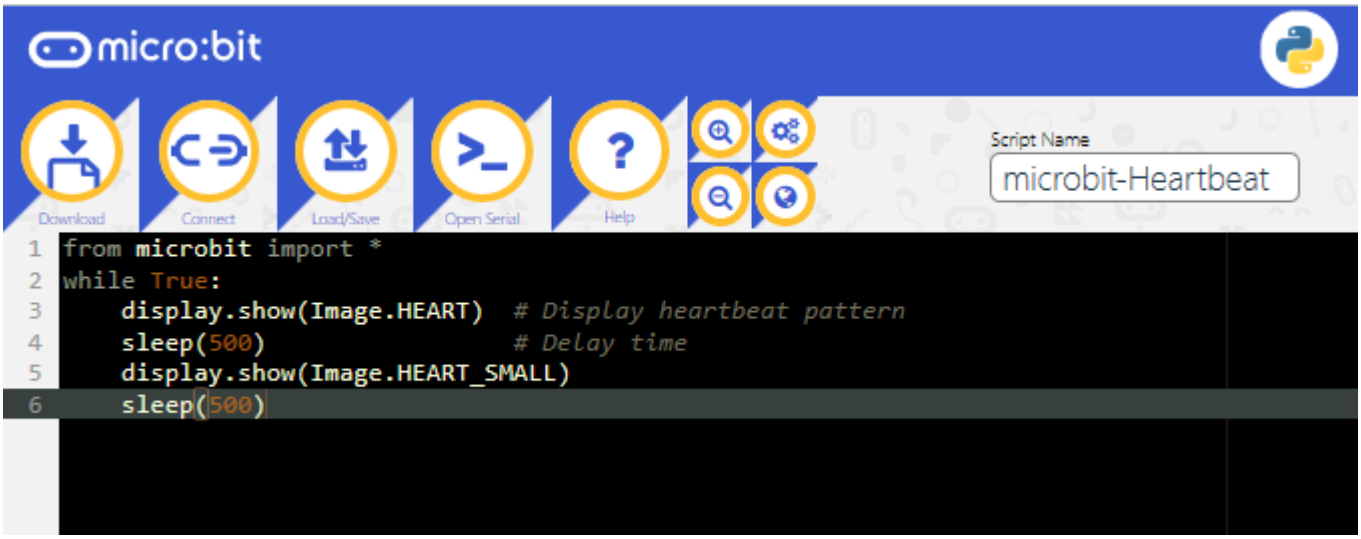
More details please log in official micro:bit website:

https://microbit-micropython.readthedocs.io/en/latest/index.html

https://microbit-micropython.readthedocs.io/en/latest/tutorials/introduction.html

Python has two types of editors (web version and offline version)

1. Web version: https://python.microbit.org/v/1.1



2. Micro:bit rolls out an offline compiling tool Mu, which facilitates to use and teach under without internet environment.

Download link: https://codewith.mu/en/download

In our projects, we still use Mu in offline mode to finish experiments

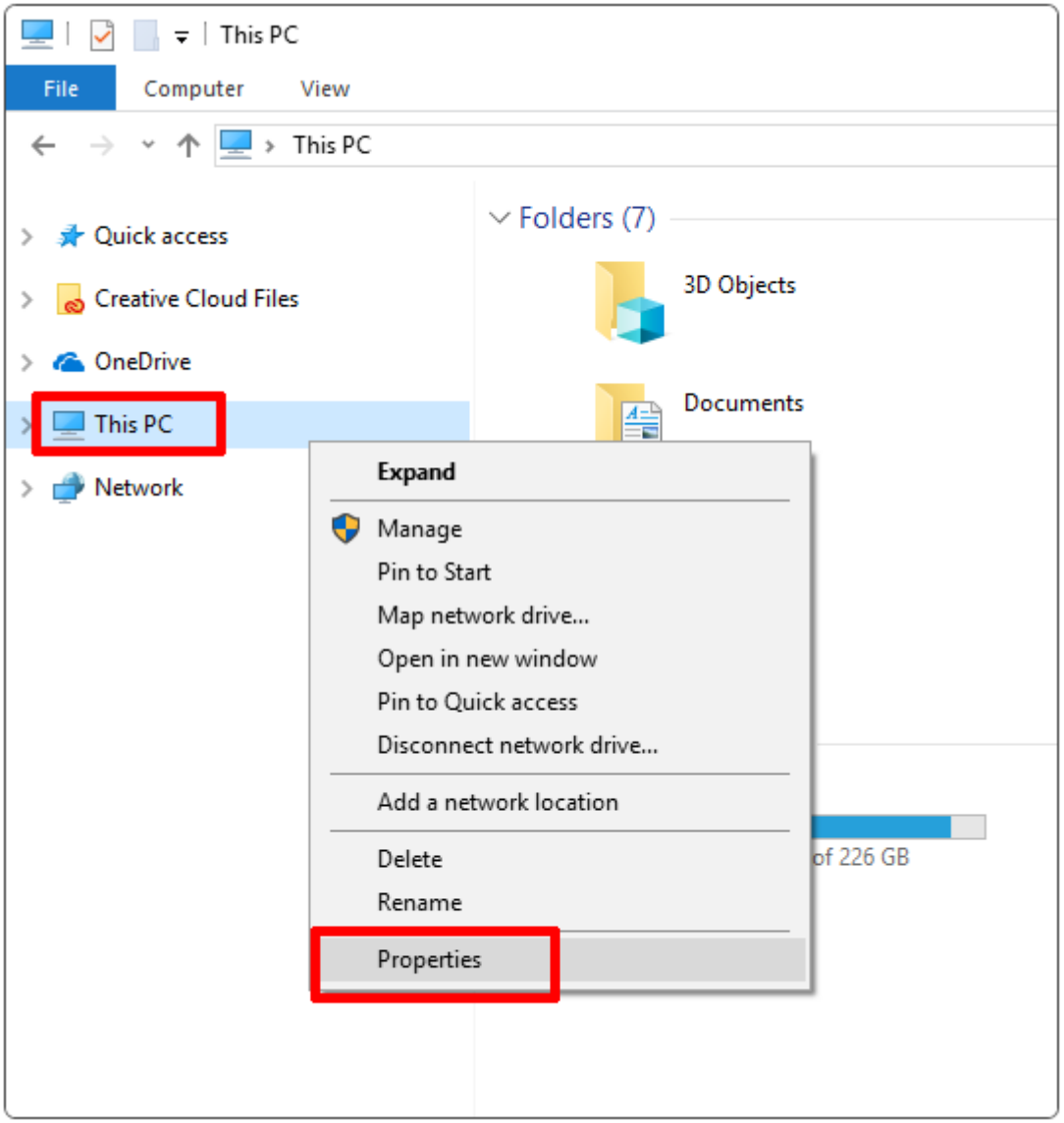
Mu

Official Website: https://codewith.mu/

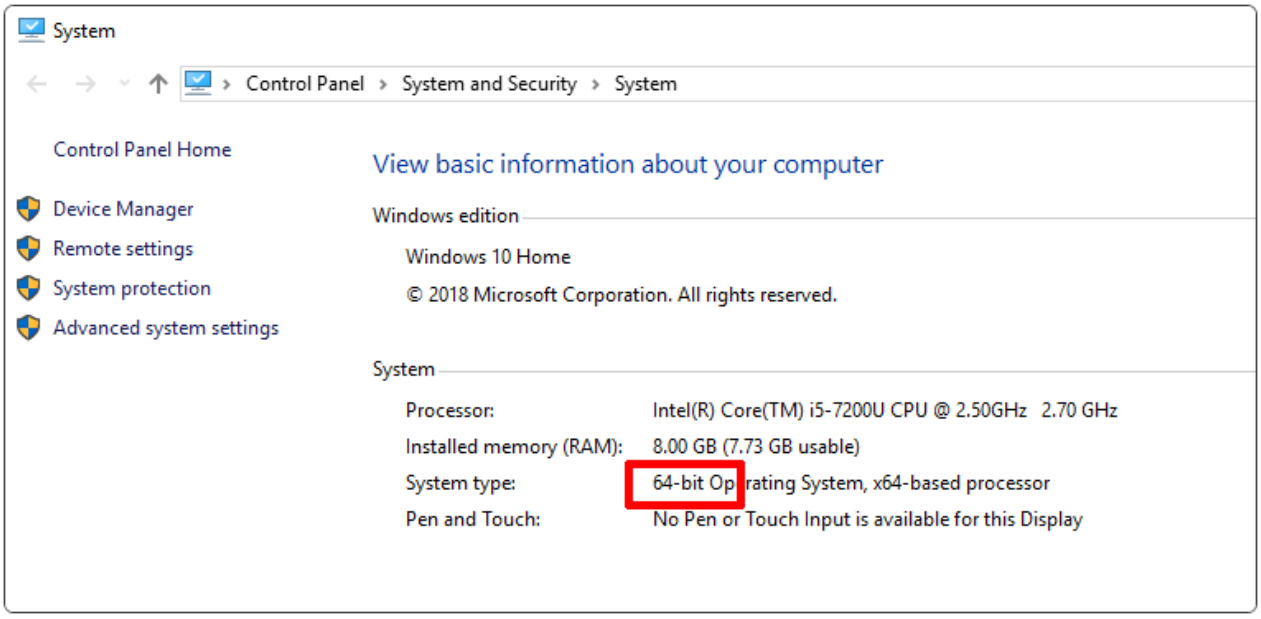
Mu, a Python code editor, is suitable for starter. Mu program only works on 32-bit and 64-bit Windows7, 8 and 10. Make sure your computer update.

1. Download Mu

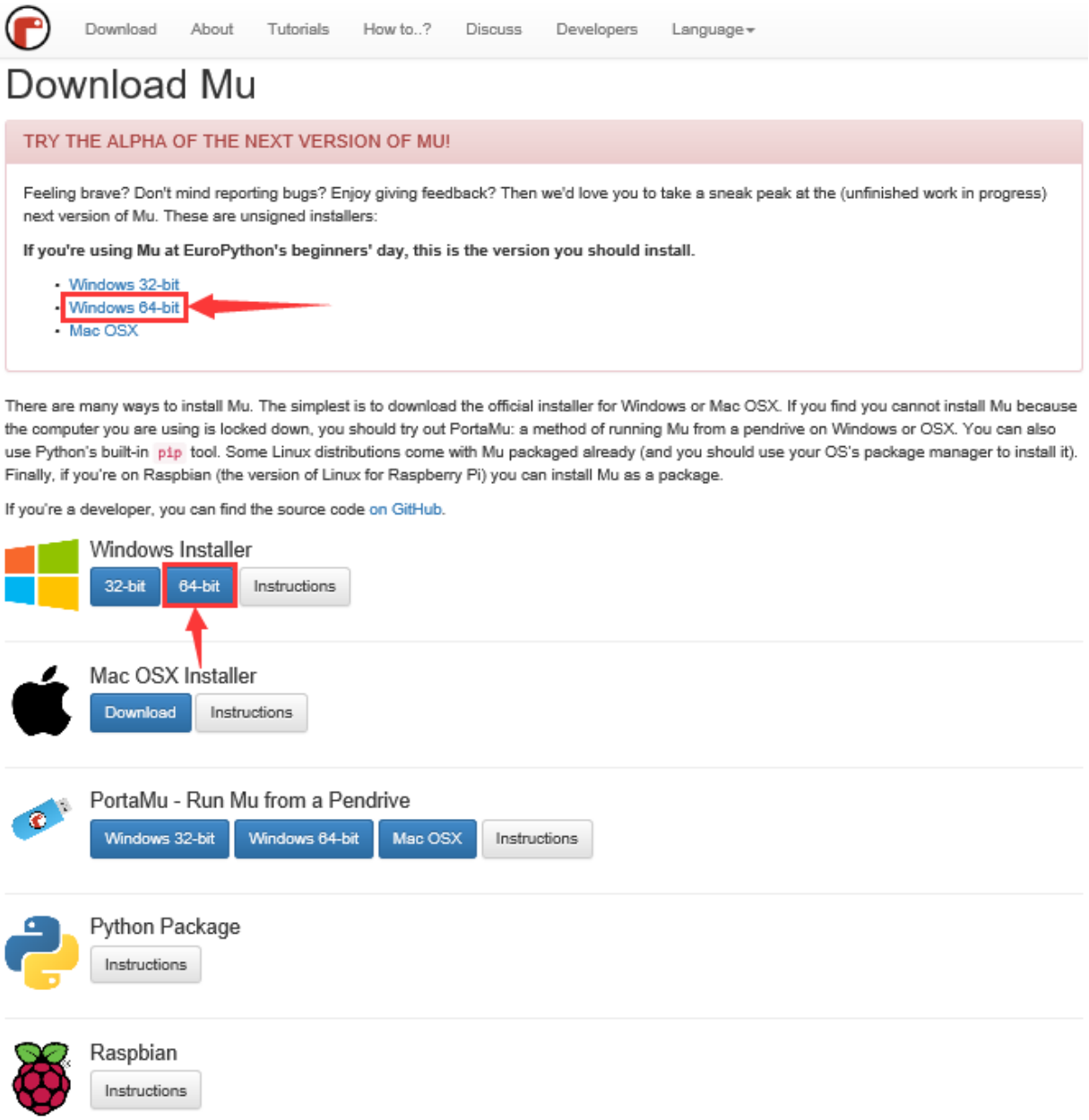
Click “This PC” and right- click to select Properties to check the version of your computer.



Below is shown system type of your computer.

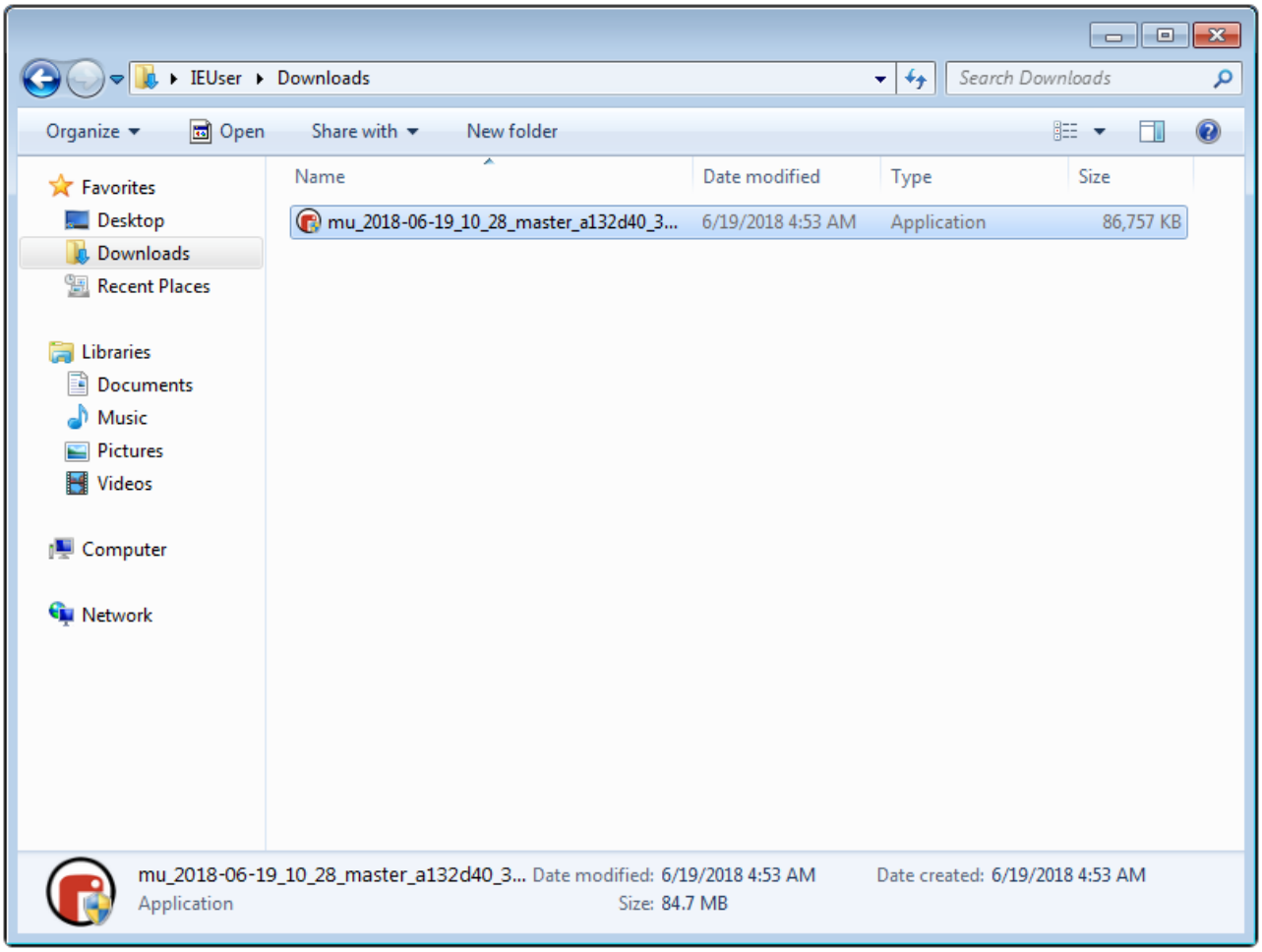


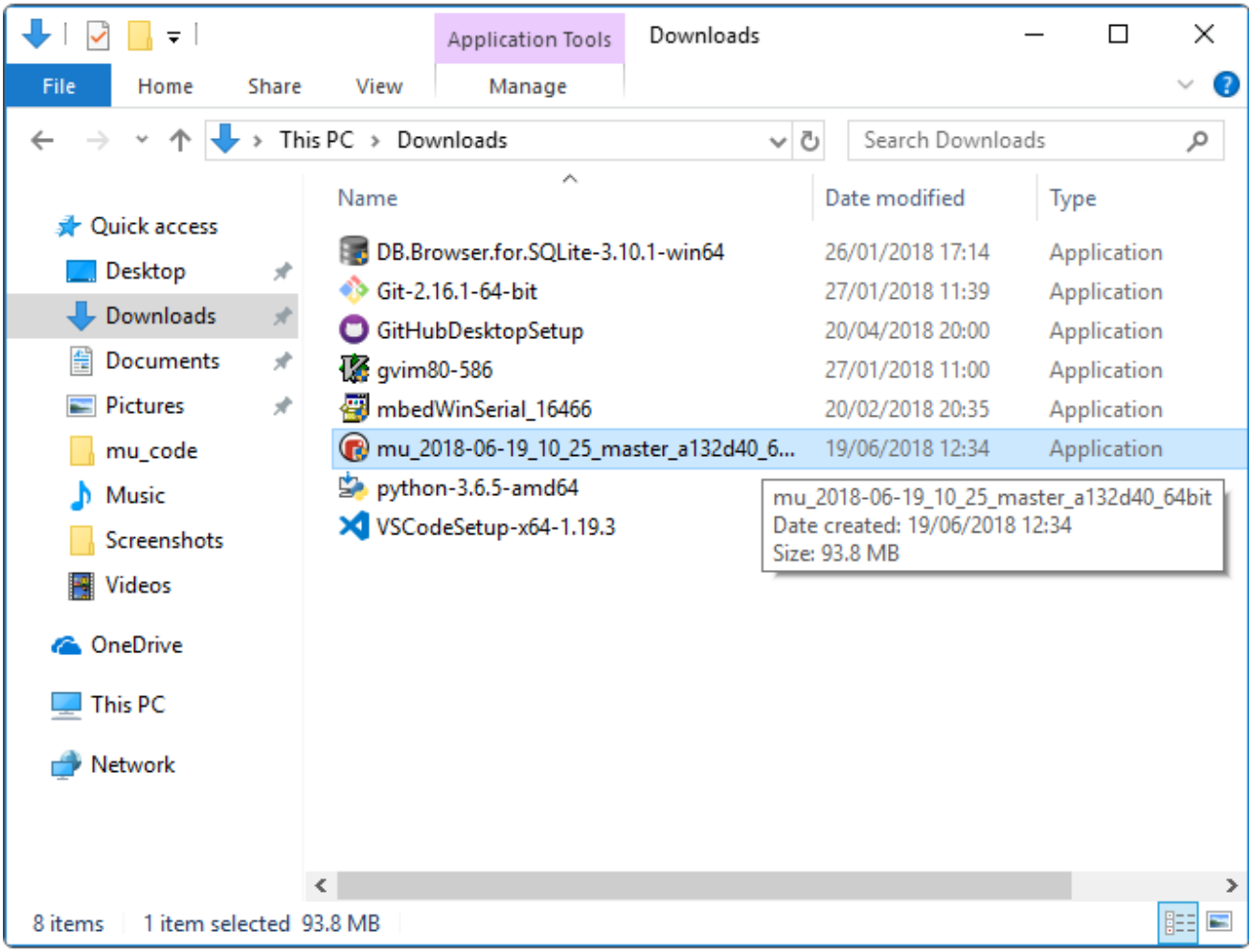
Enter linkehttps://codewith.mu/en/download to download the corresponding version of Mu.



2. Run and Install Mu

Find out the folder where Mu is downloaded and double-click file to install Mu


IEUser ▸ Downloads
Search Downloads
Organize
Open
Share with
New folder
Favorites
Desktop
Downloads
Recent Places
Libraries
Documents
Music
Pictures
Videos
Computer
Network
Name
Date modified
Type
Size
mu_2018-06-19_10_28_master_a132d40_3...
6/19/2018 4:53 AM
Application
86,757 KB
mu_2018-06-19_10_28_master_a132d40_3... Date modified: 6/19/2018 4:53 AM
Date created: 6/19/2018 4:53 AM
Application
Size: 84.7 MB

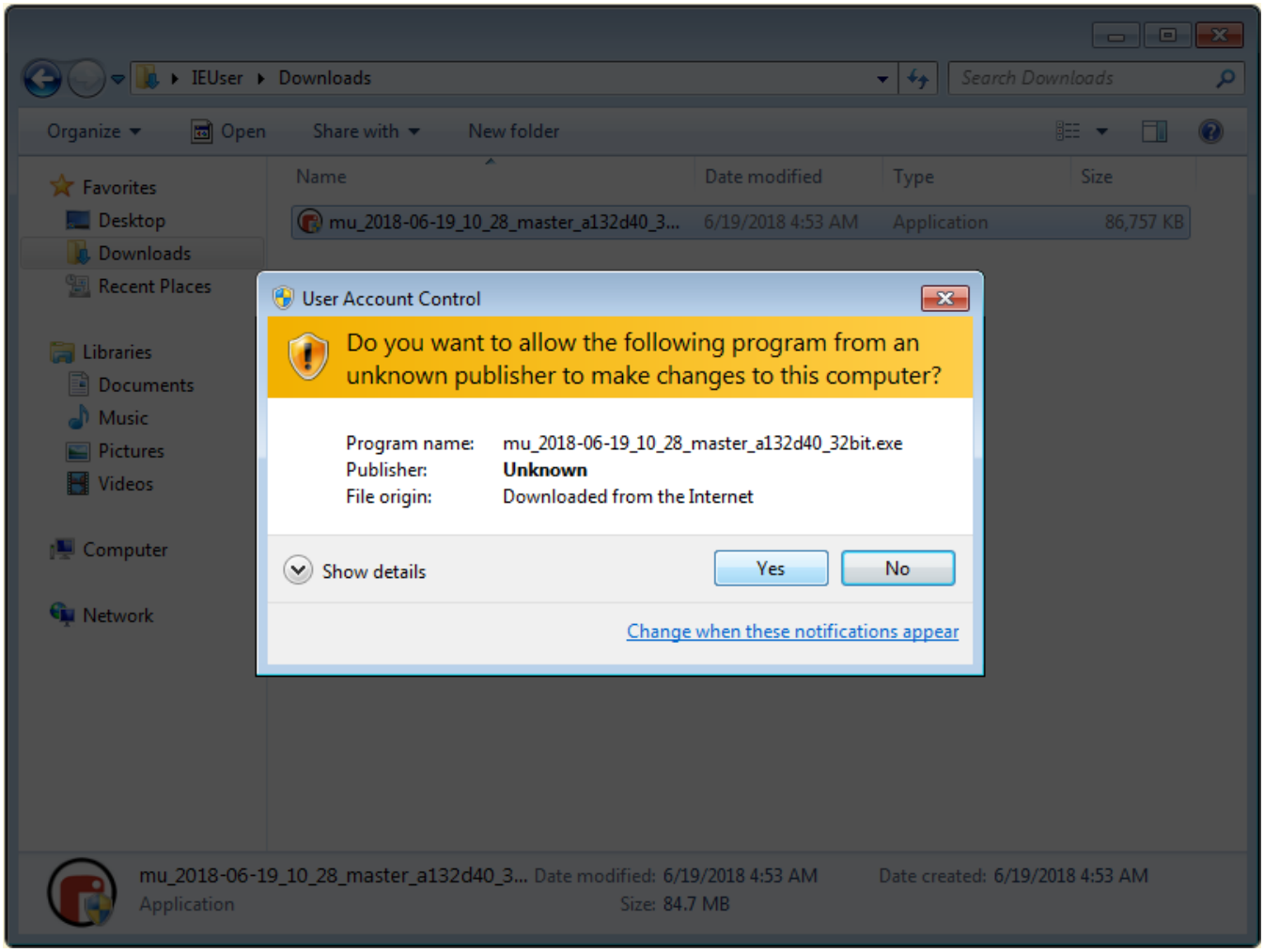


We demonstrate how to download Mu on Windows 7 and 10.

The installation method is similar.

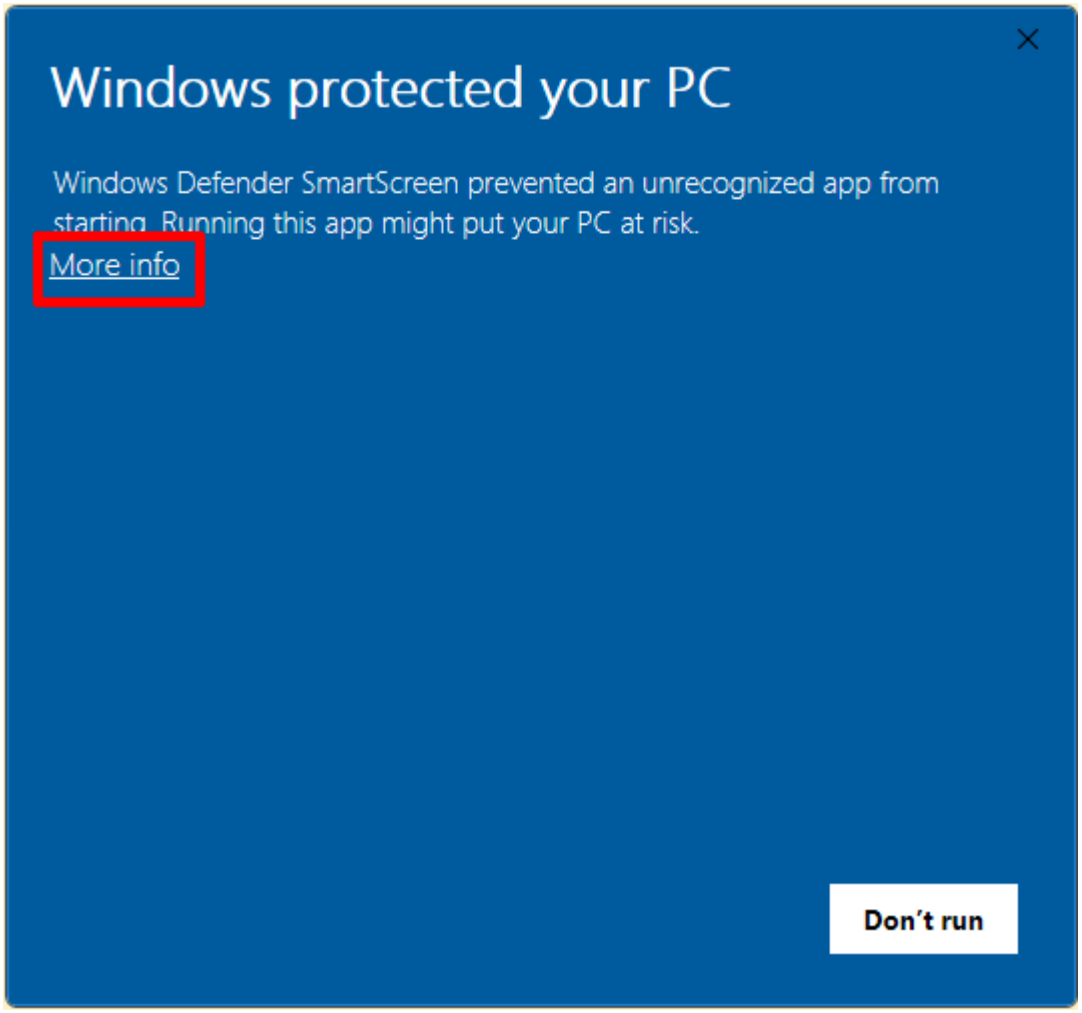
Windows 7

The dialog page will pop up, click “Yes”

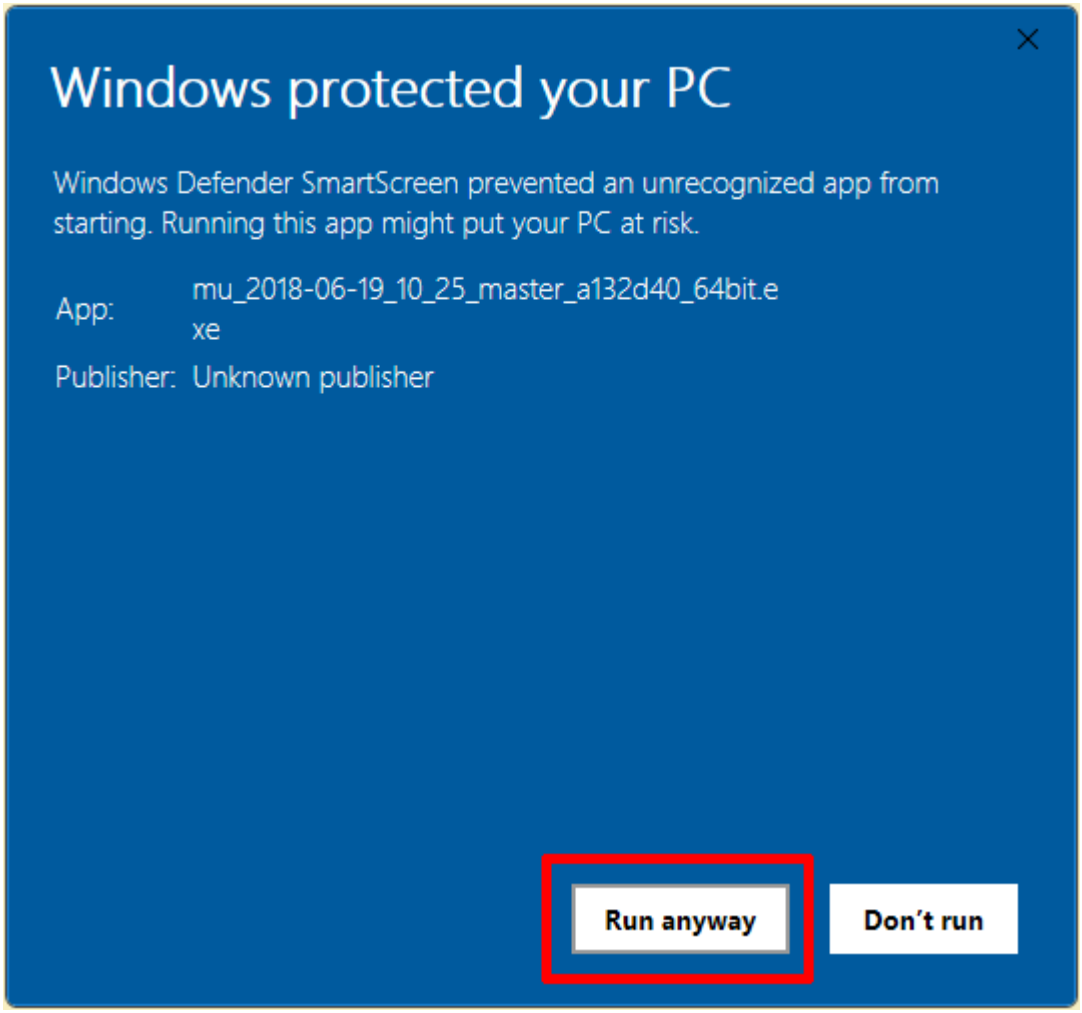


Windows 10

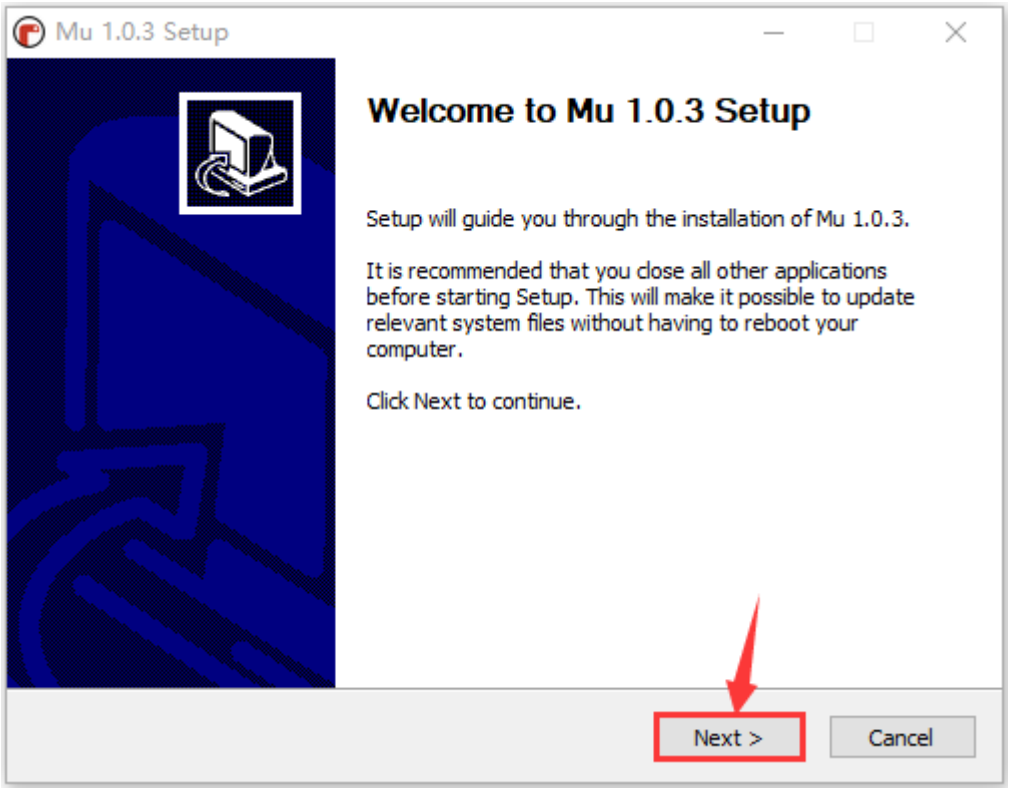
Windows Defender will pop up a warning notice, click “More info”.



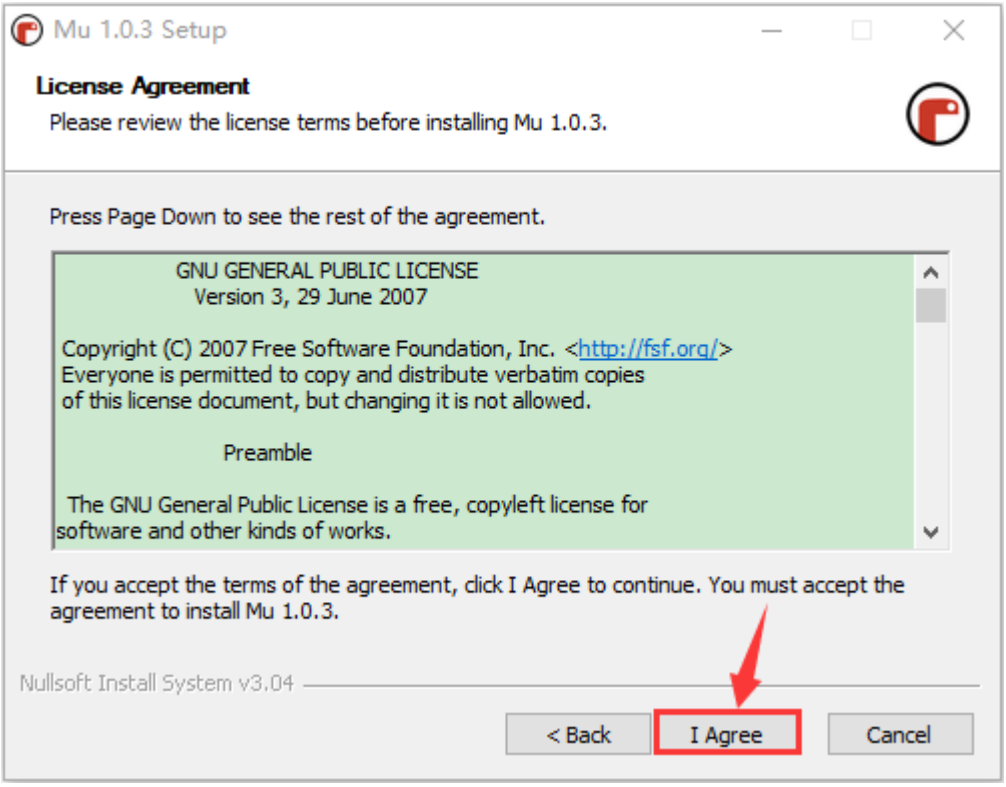
Tap "Run anyway".



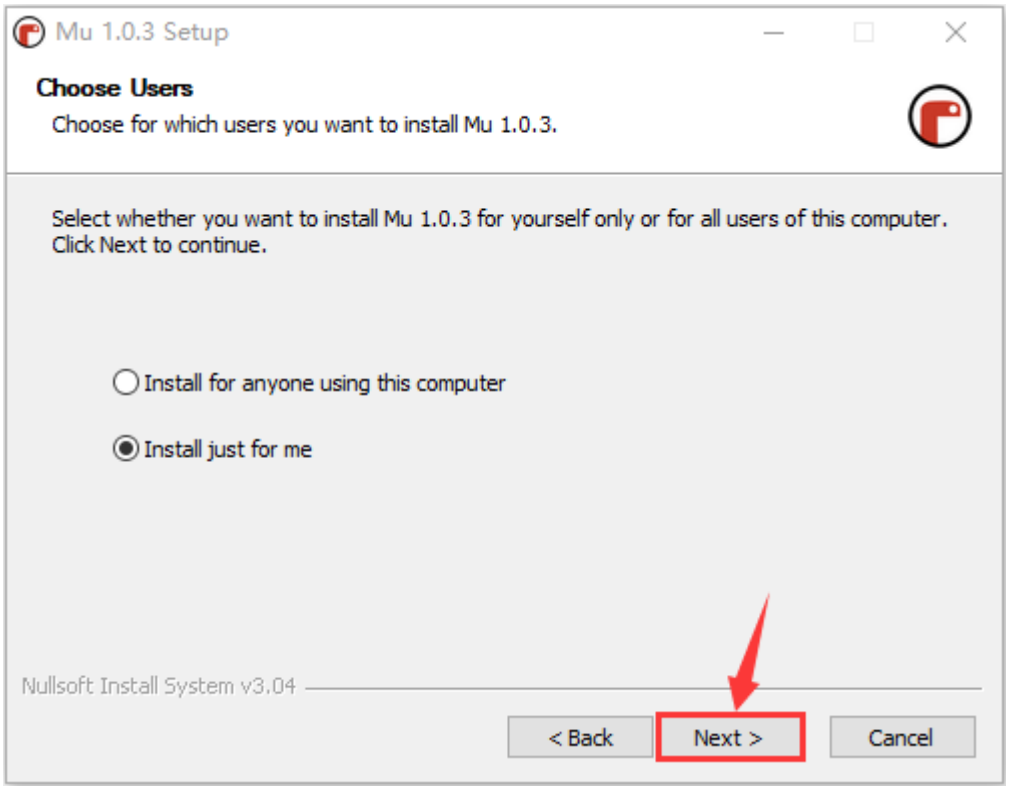
Confirm the version of Mu and tap “Next”.

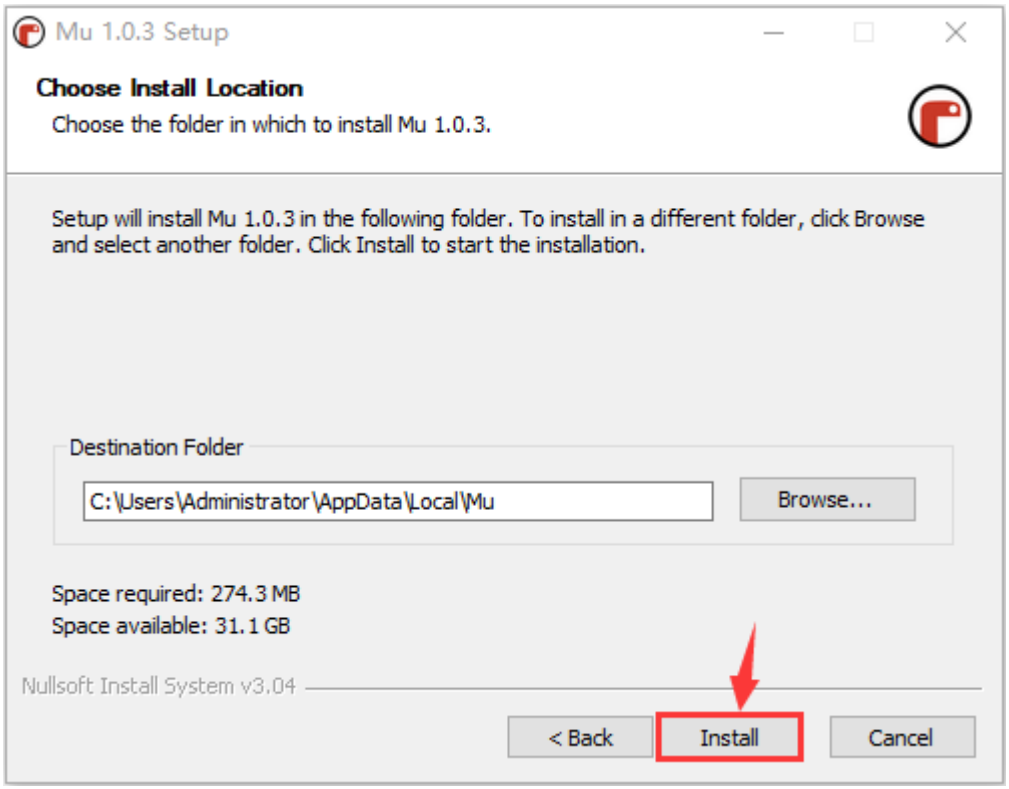


Then select "I Agree"

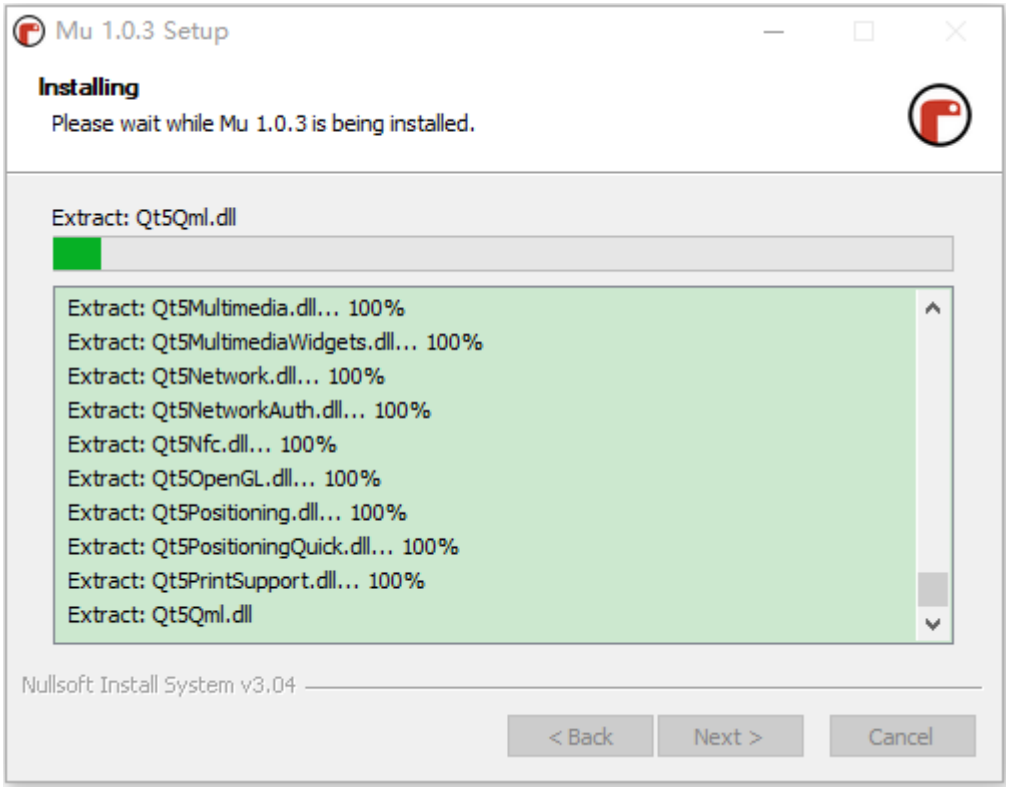


Click “Next” and “Install”

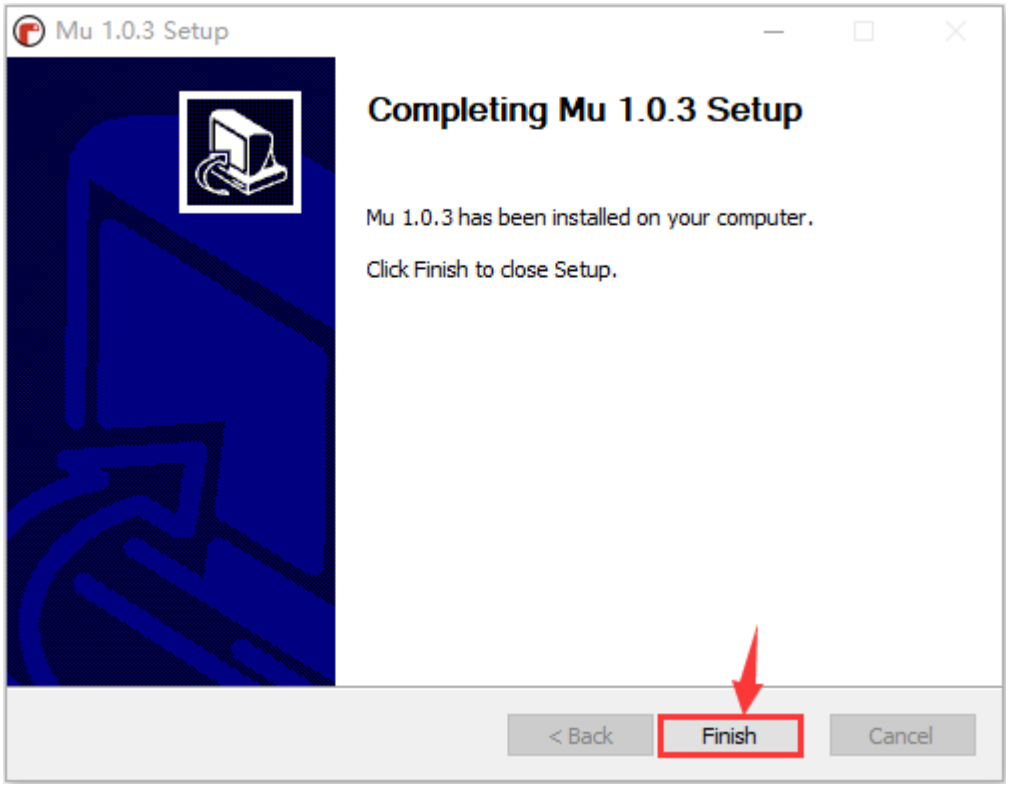




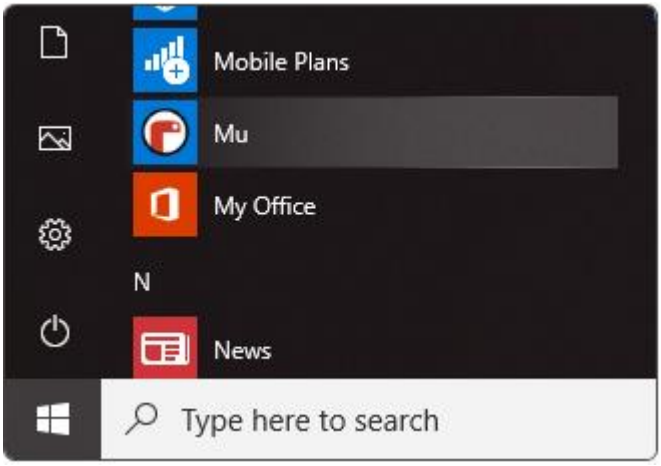
You have to wait for a while until the installation is finished.



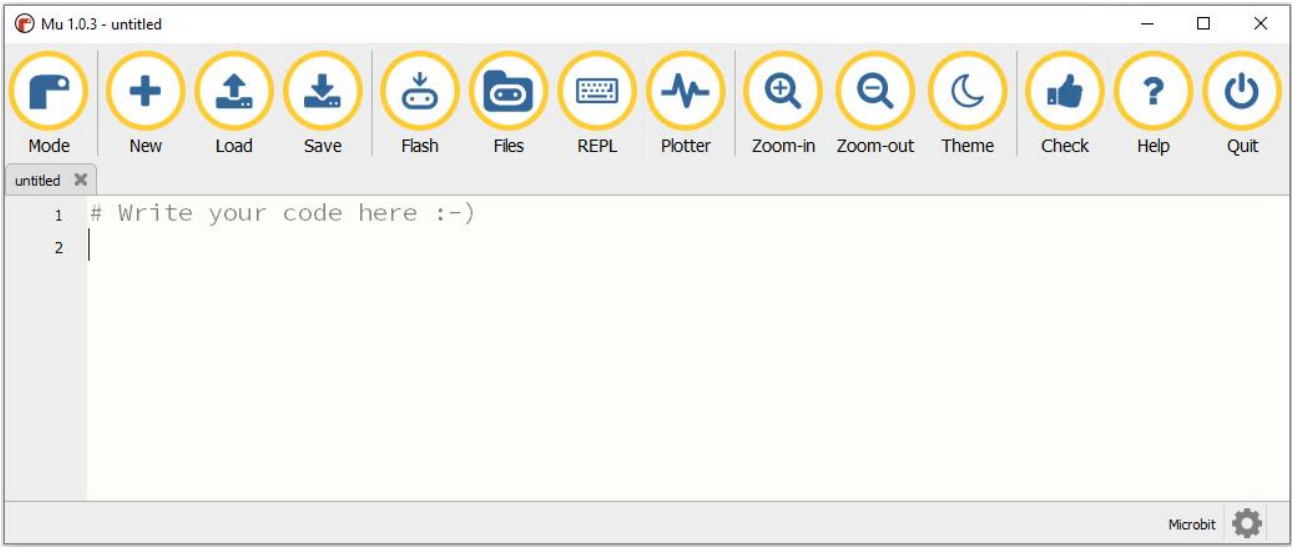
Finally, click “Finish”



Click Mu icon to get started.



Mu’ s main interface is shown below:



6. Projects

The projects from 6.1 to 6.9 are the introduction of LED matrix and built-in sensors on the micro:bit board.

6.1: Heart Beat

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.

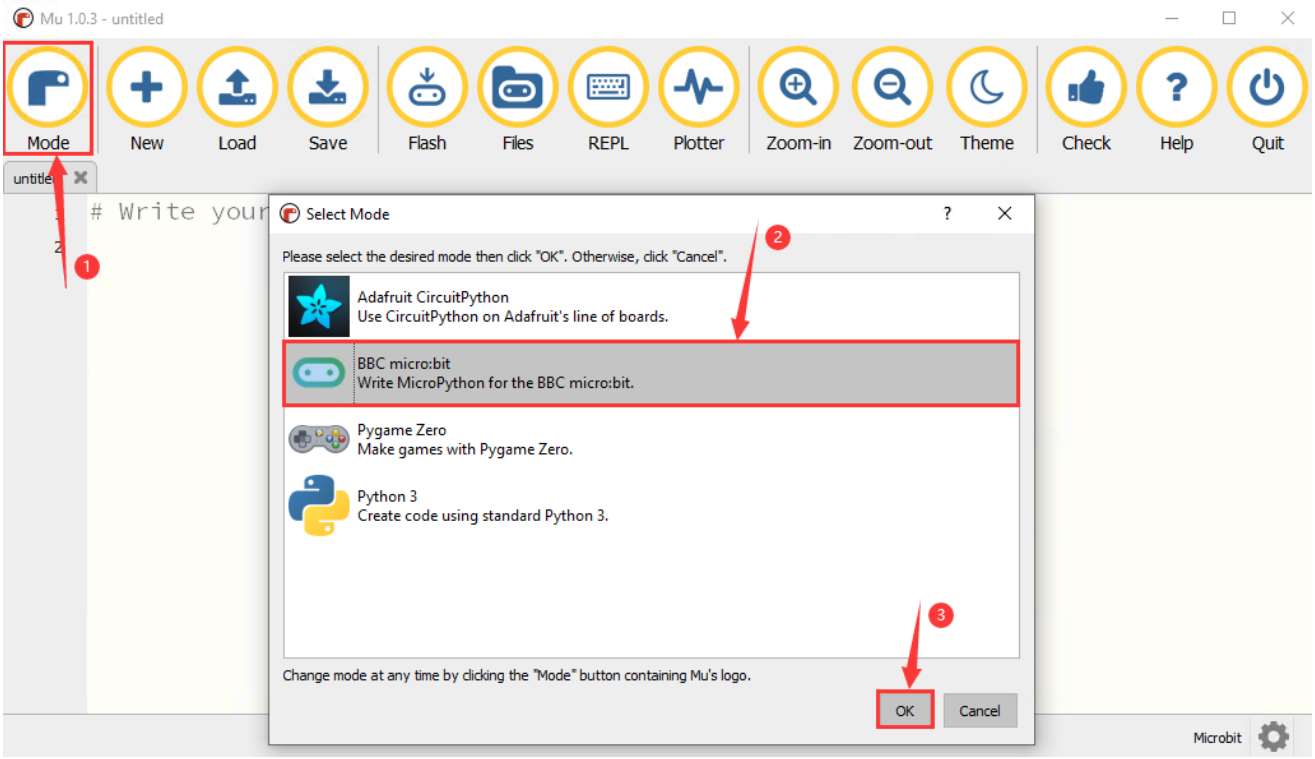
What you need to get started

(1) Link micro:bit board with computer via USB cable.

(2) Open the offline version of Mu

2. Test Code:

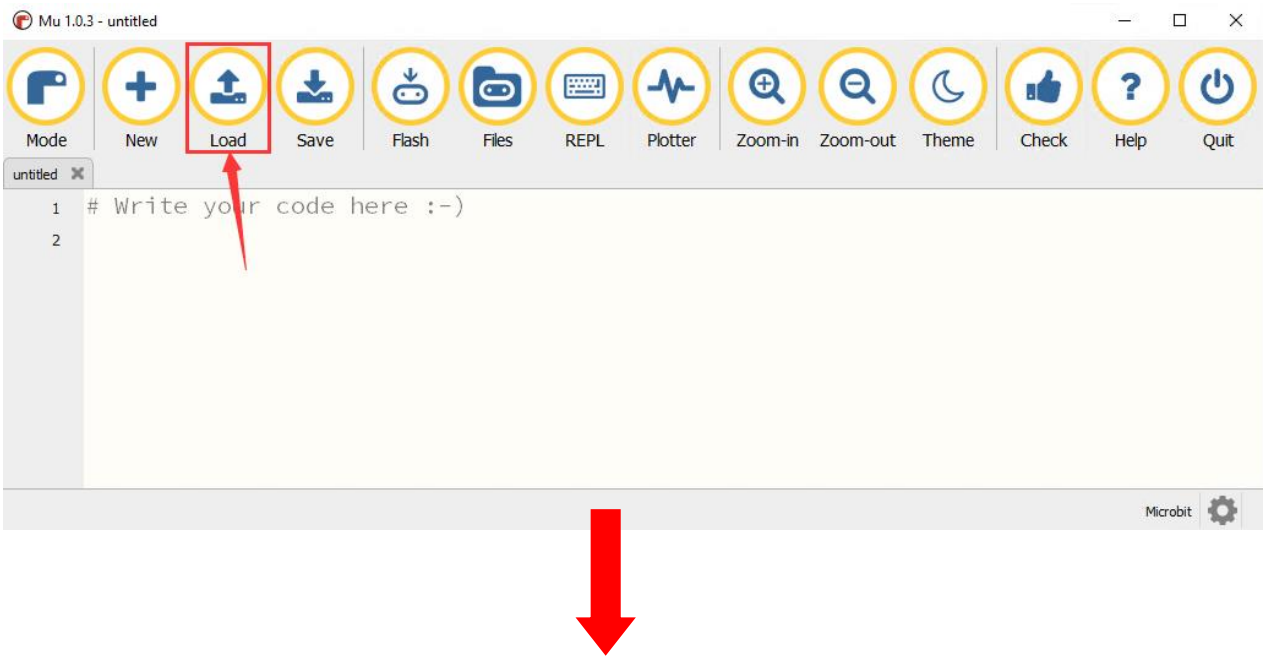
Open Mu software, click Mode, then click "BBC micro: bit" and "OK"

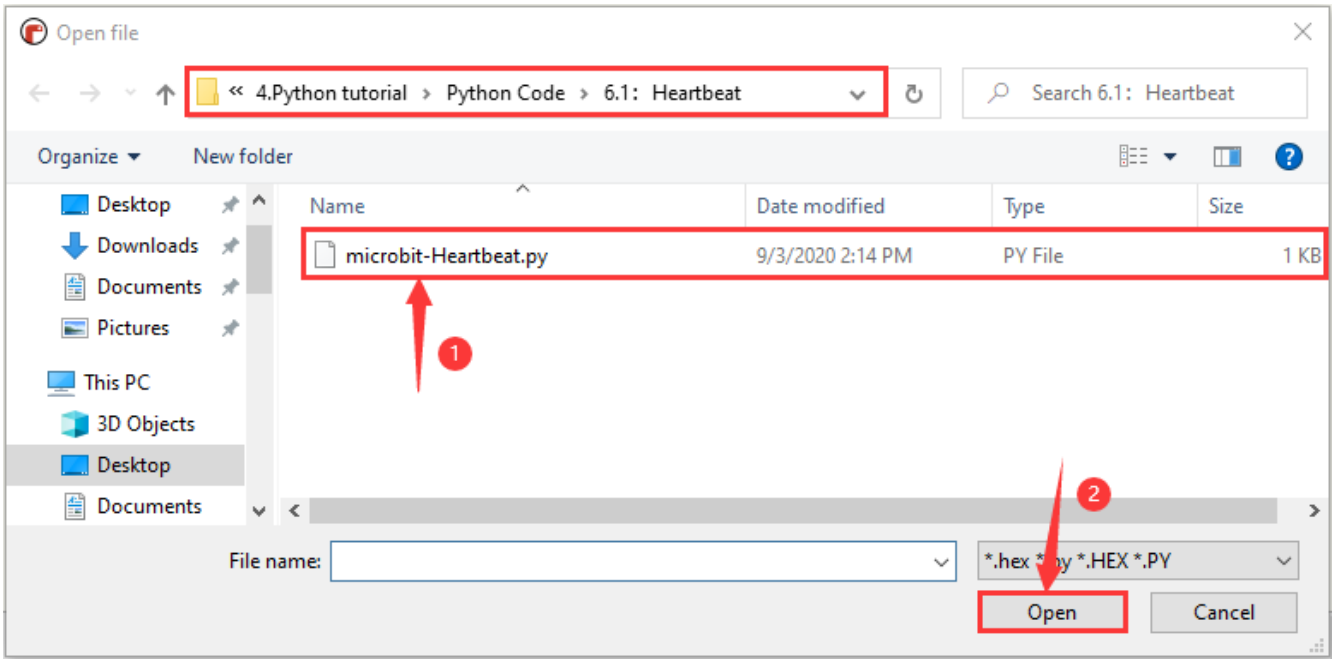


Tap "Load", select "microbit-Heartbeat.py" file and click "open"

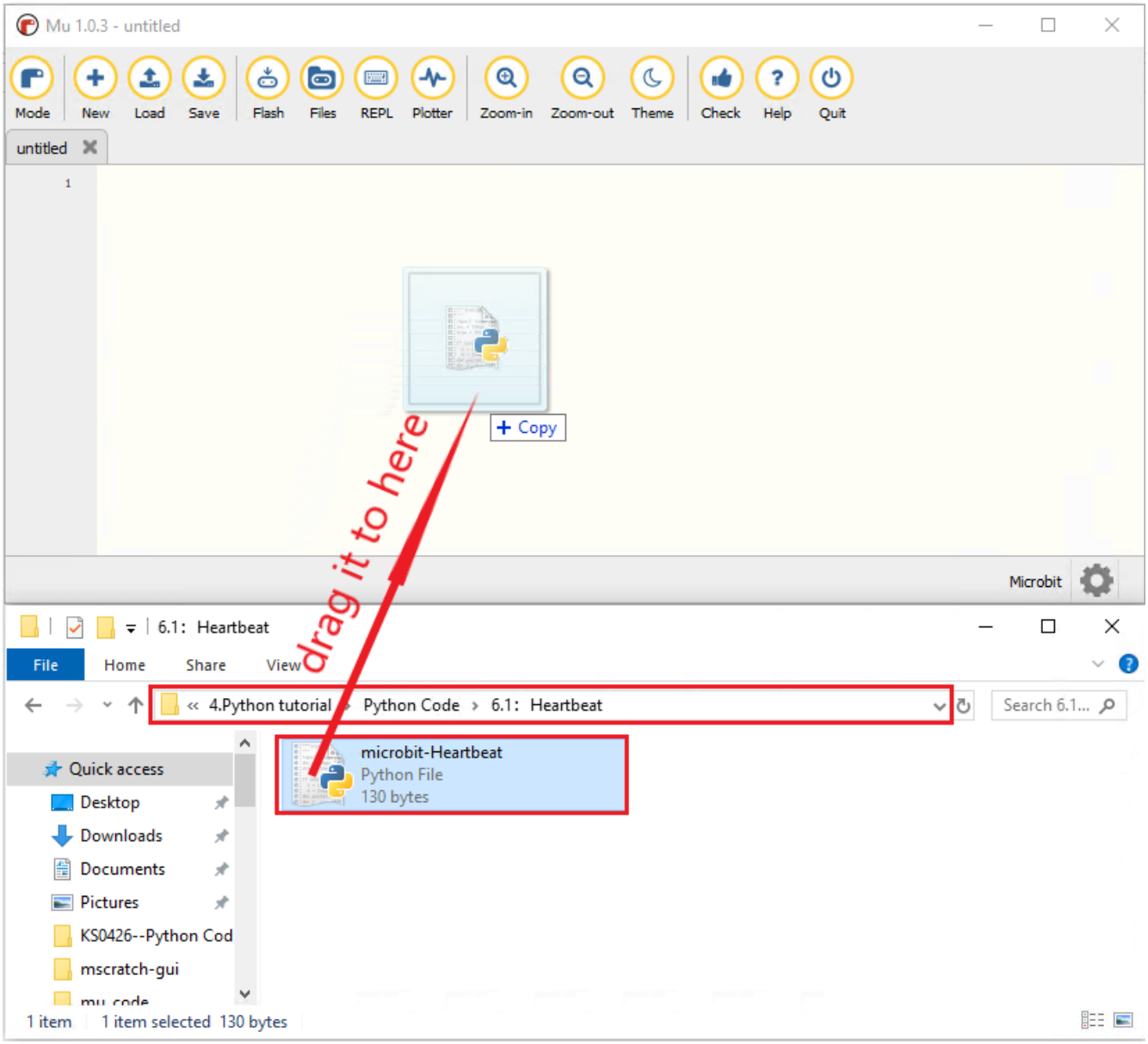
File Type	Route	File Name
Python file	../Python Code/6.1:	microbit-Heartbeat.py

	Heart beat	

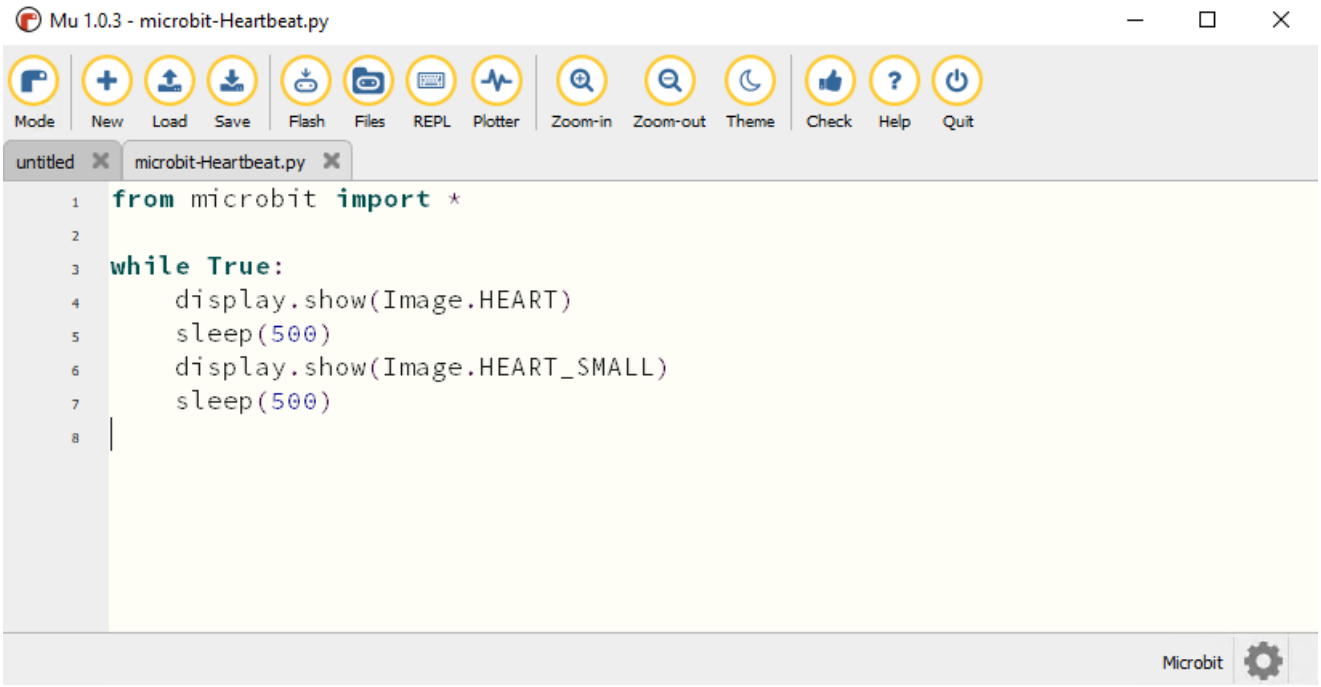




There is another way to import code. Open Mu software and drag file "microbit-Heart beat.py" into it.



The successful loading is shown below.You can also input code in the edit window yourself.(note:all English words and symbols must be written in English)



The following is a list of built-in images. If you are interested, you can select one of the following built-in images to replace the "Image.HEART" in the function show () in the figure above.

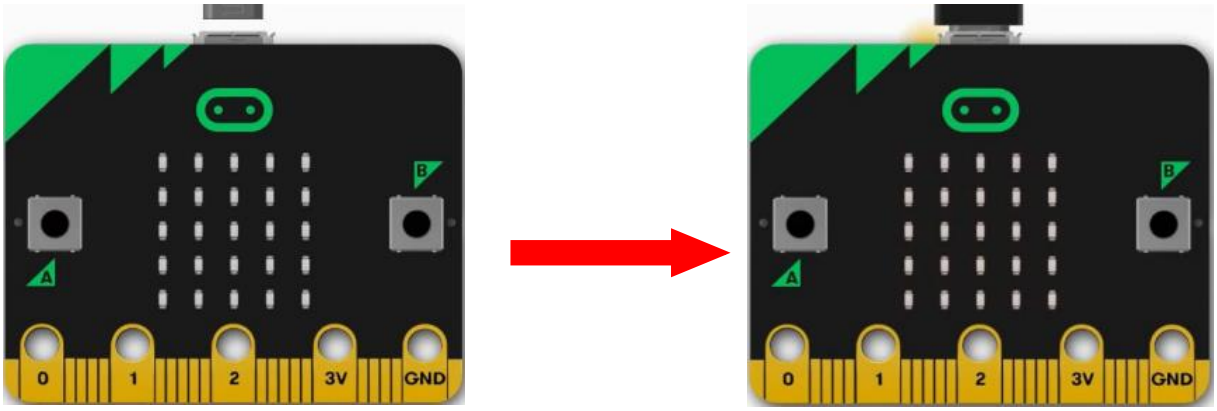
- Image.HEART
- Image.HEART_SMALL
- Image.HAPPY
- Image.SMILE
- Image.SAD
- Image.CONFUSED
- Image.ANGRY

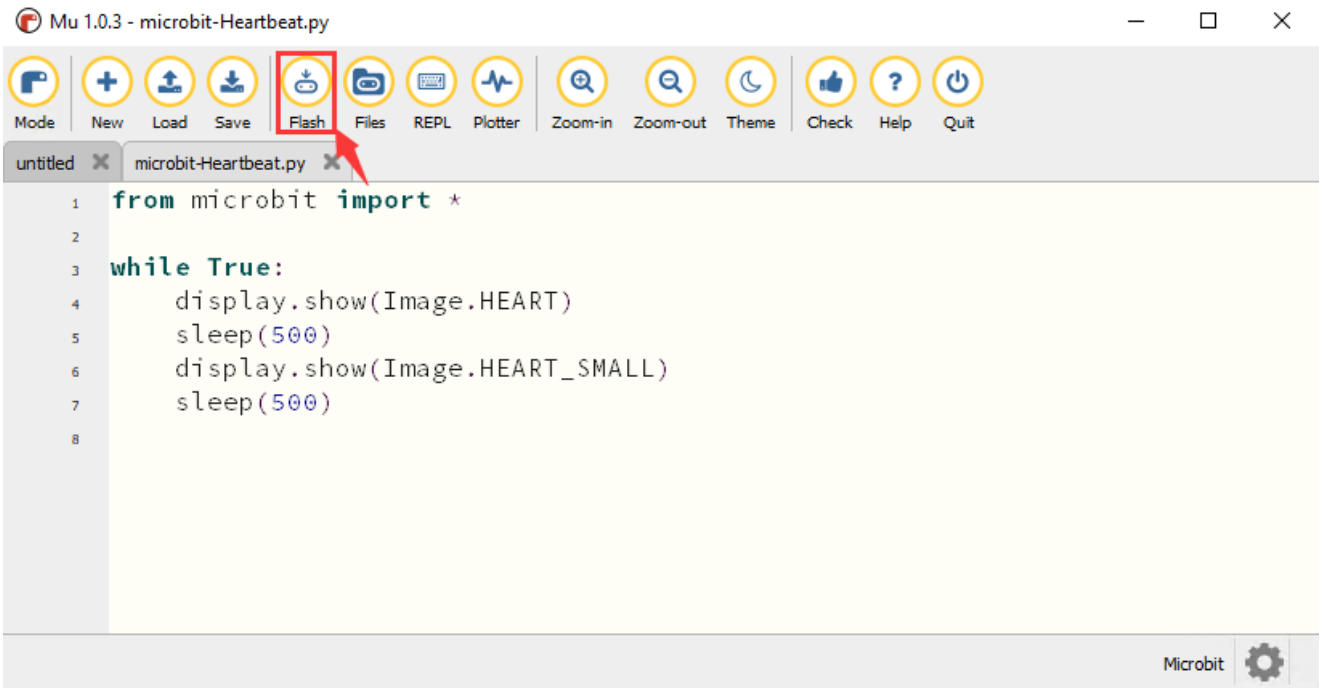
- Image.ASLEEP
- Image.SURPRISED
- Image.SILLY
- Image.FABULOUS
- Image.MEH
- Image.YES
- Image.NO
- Image.CLOCK12, Image.CLOCK11, Image.CLOCK10, Image.CLOCK9, Image.CLOCK8, Image.CLOCK7, Image.CLOCK6, Image.CLOCK5, Image.CLOCK4, Image.CLOCK3, Image.CLOCK2,Image.CLOCK1
- Image.ARROW_N, Image.ARROW_NE, Image.ARROW_E, Image.ARROW_SE, Image.ARROW_S, Image.ARROW_SW, Image.ARROW_W, Image.ARROW_NW
- Image.TRIANGLE
- Image.TRIANGLE_LEFT
- Image.CHESSBOARD
- Image.DIAMOND
- Image.DIAMOND_SMALL

- Image.SQUARE
- Image.SQUARE_SMALL
- Image.RABBIT
- Image.COW
- Image.MUSIC_CROTCHET
- Image.MUSIC_QUAVER
- Image.MUSIC_QUAVERS
- Image.PITCHFORK
- Image.PACMAN
- Image.TARGET
- Image.TSHIRT
- Image.ROLLERSKATE
- Image.DUCK
- Image.HOUSE
- Image.TORTOISE
- Image.BUTTERFLY
- Image.STICKFIGURE

- Image.GHOST
- Image.SWORD
- Image.GIRAFFE
- Image.SKULL
- Image.UMBRELLA
- Image.SNAKE，Image.ALL_CLOCKS，Image.ALL_ARROWS

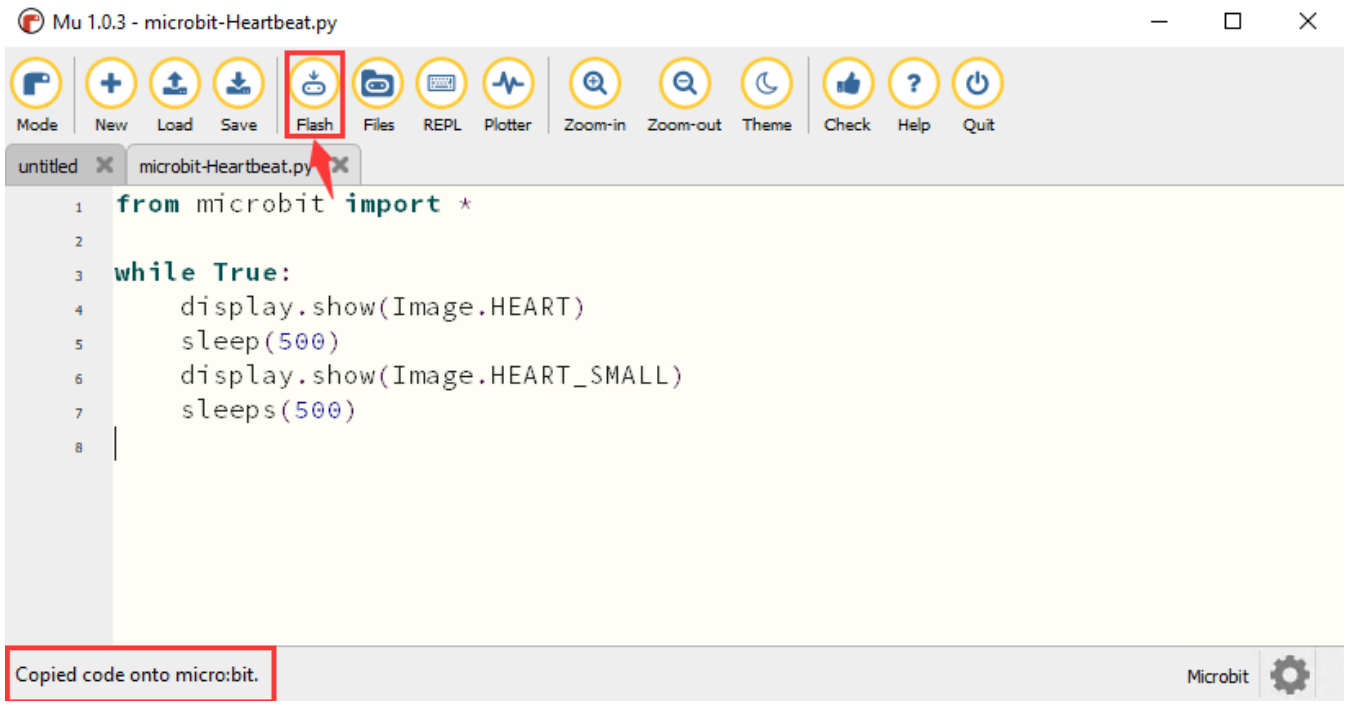
Connect micro:bit board to computer with USB cable, click “Flash” to download code to micro:bit board.



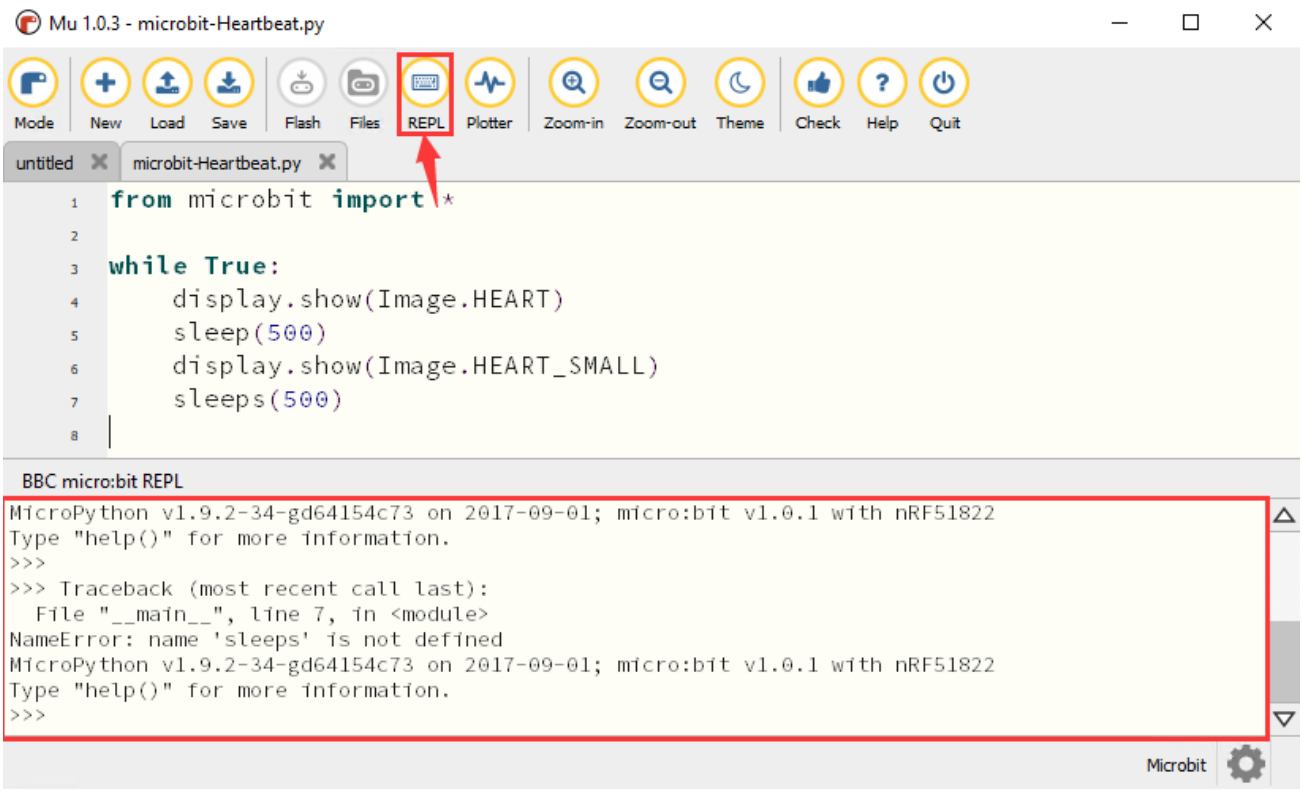


The code, even it is wrong, can be downloaded to micro:bit board successfully, yet not working on micro:bit board.

Click “Flash” to download code to micro:bit.

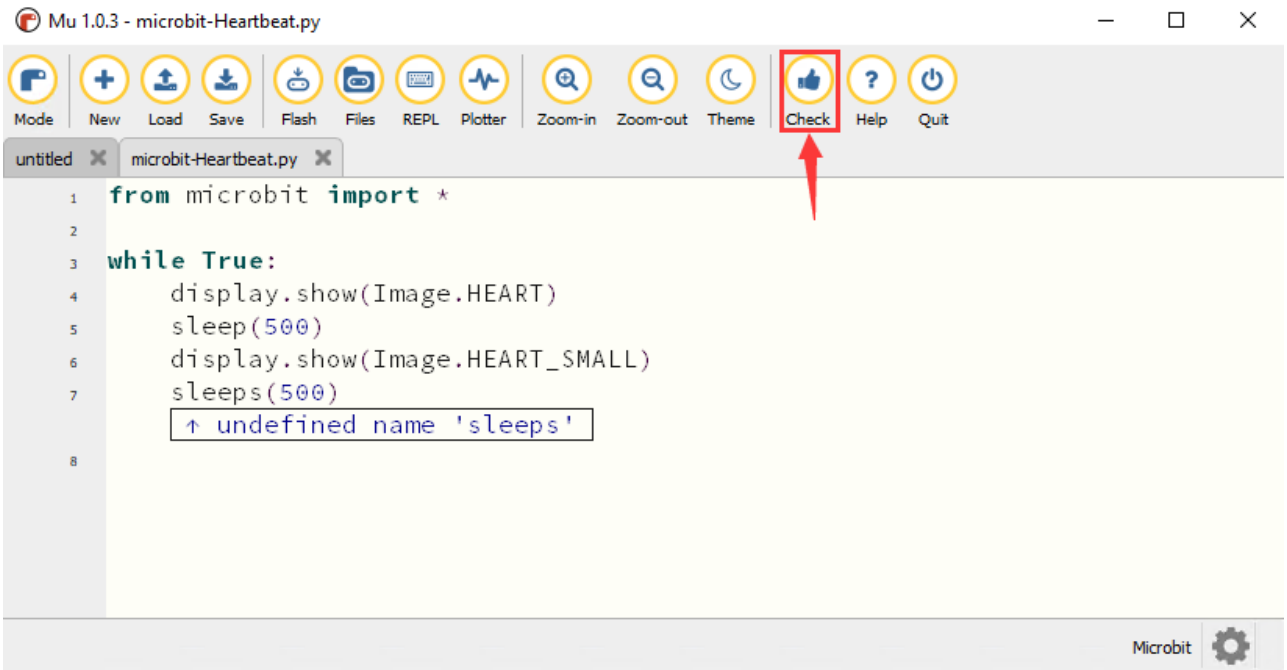


Click "REPL" and press the reset button on micro:bit, the error information will be displayed on REPL window, as shown below:

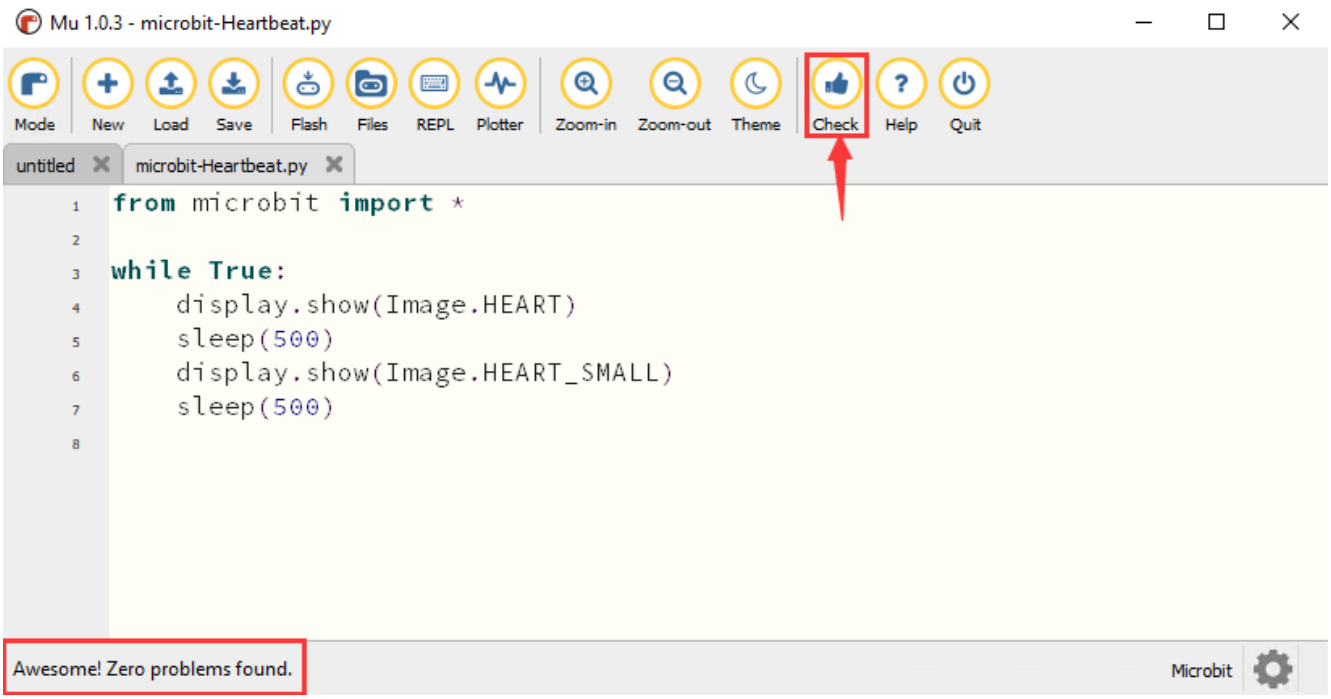


Click "REPL" again to turn off REPL mode, then you could refresh new code.

To make sure code correct, you only need to tap "Check" . The errors will be shown on the window.



Modify the code according the prompt and click "Check"



More tutorials, log in website please:https://codewith.mu/en/tutorials/

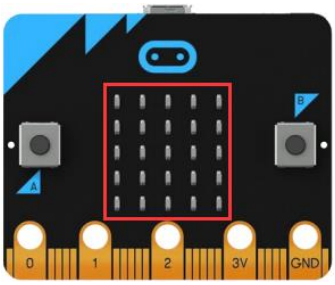
3. Test Result:

After testing, click "Flash" and download code to micro:bit, plug in power with USB cable. The micro:bit board shows "♡" and "▦" in loop way

4. Code Explanation:

from microbit **import** *	Import the library file of micro：bit
while True:	This is a permanent loop that makes micro:bit execute the code of it.
display.show(Image.HEART)	micro：bit shows “♡” pattern
sleep(500)	Delay in 500ms
display.show(Image.HEART_SMALL)	micro：bit displays “”

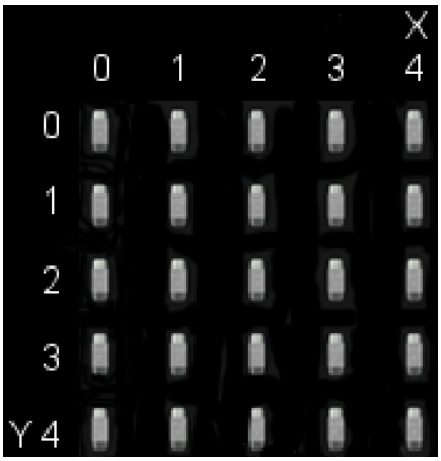
6.2：Light Up a Single LED



1. Description：

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

Virtually, we could control a 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.



What you need to get started

(1) Link micro:bit board with computer via USB cable.

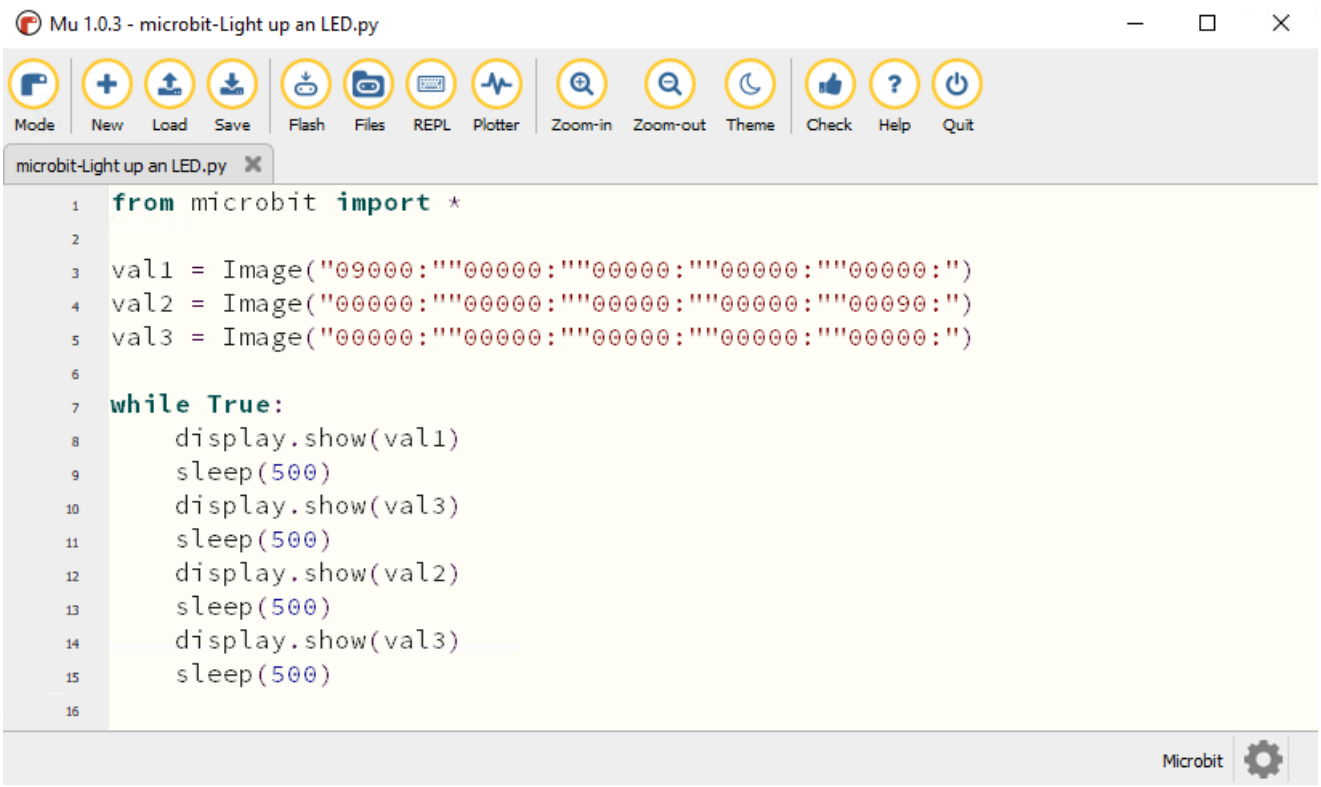
(2) Open the offline version of Mu

3. Test Code:

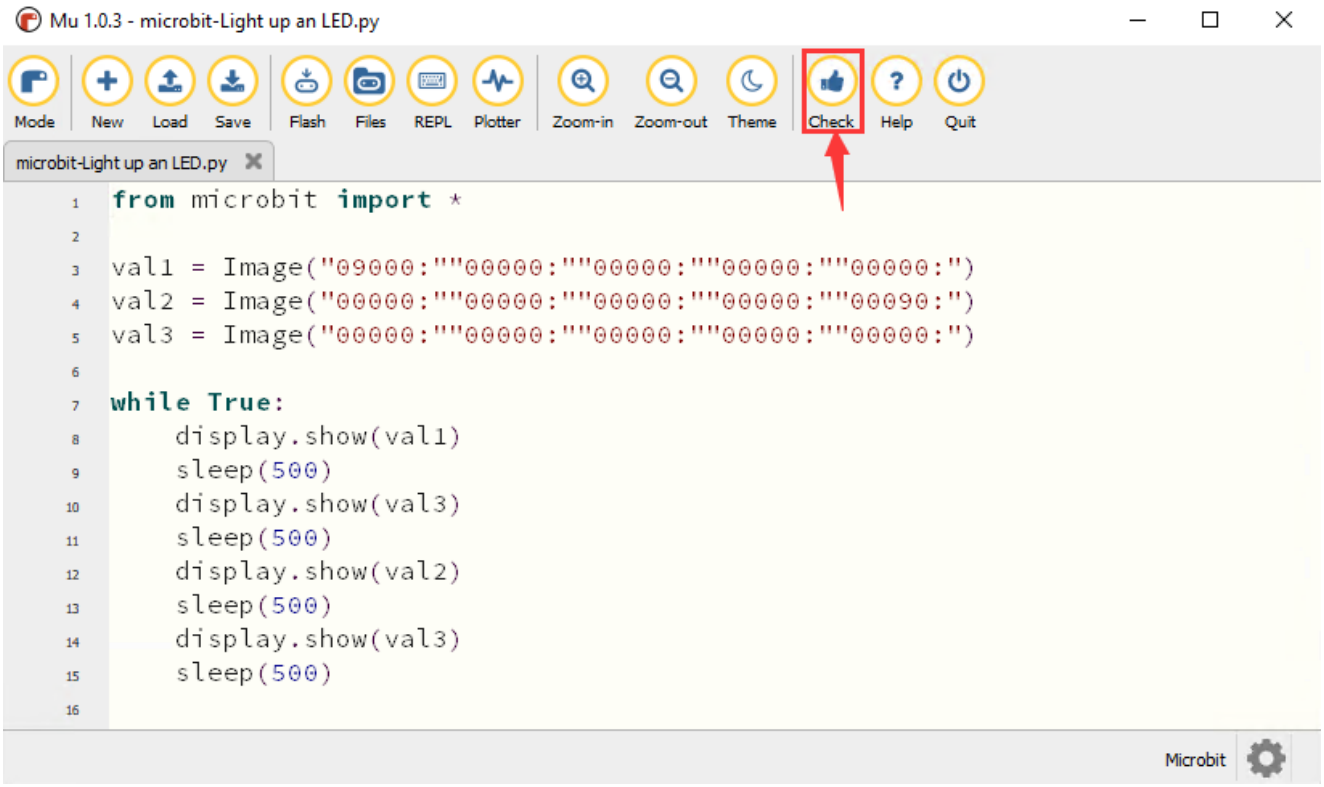
Enter Mu software and open the file "microbit-Light up an LED .py" to import code: (How to load the project code?)

Type	Route	File Name
Python file	../Python code/6.2：Light up an LED	microbit-Light up an LED .py

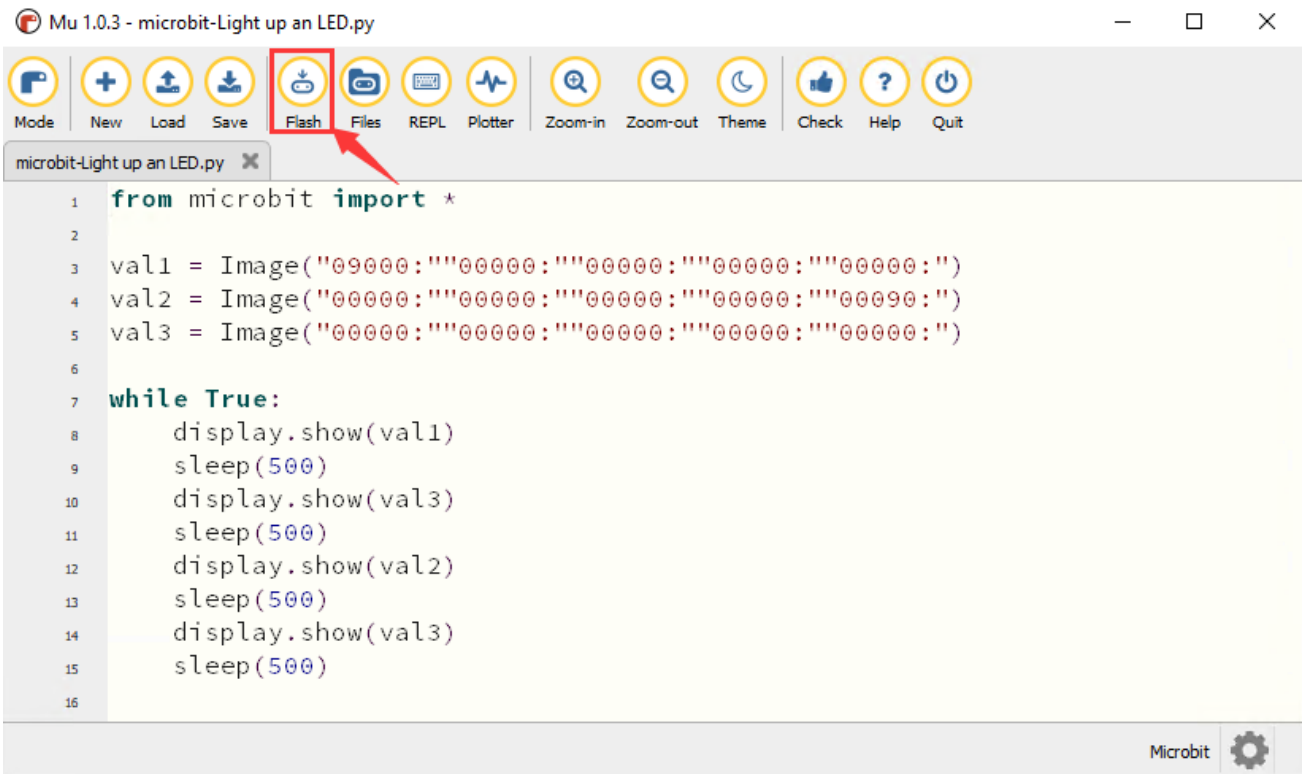
The successful loading is shown below.You can also input code in the edit window yourself.(note:all English words and symbols must be written in English)



Click “Check” to examine error in the code. The program proves wrong if underlines and cursors are shown.



If the code is correct, connect micro:bit to computer and click "Flash" to download code to micro:bit board



4. Test Result:

After downloading code, plug in power with USB cable, you will see the LED at(1,0) flashes for 0.5s then the LED at (3,4) blinks for 0.5s, in loop way.

5.Code Explanation:

from microbit **import** *	import the library file of micro:bit

val1 = Image("09000:""00000:""00000:""00000:" "00000:") val2 = Image("00000:""00000:""00000:""00000:" "00090:") val3 = Image("00000:""00000:""00000:""00000:" "00000:")	Set Image() to val1 Set pixel of LED on micro:bit to the value in 0~9 Pixel of each LED on micro:bit can be set in one of ten values If set pixel to 0 (zero) , which means in close state, literally, 0 is brightness, 9 is best brightness Set Image() to val2 Set Image() to val3
while True:	This is a permanent loop that makes micro:bit execute the code of it.
display.show(val1) sleep(500) display.show(val3)	LED at (1,0) blinks for 0.5s

sleep(500)	
display.show(val2) sleep(500) display.show(val3) sleep(500)	LED at (3,4) flashes for 0.5s

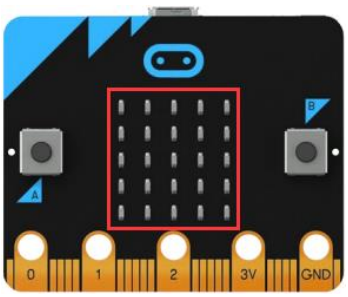
5. Reference

sleep(ms) : delay time

For more details about delay, please refer to:

https://microbit-micropython.readthedocs.io/en/latest/utime.html

6.3： 5* 5 LED Dot Matrix



1. Description:

Dot matrix gains popularity in our life, such as LED screen, bus station and the mini TV in the lift.

The dot matrix of Micro:bit board consists of 25 light emitting diodes. In previous lesson, we control LED of Micro:bit board to form patterns, numbers and character strings by setting the coordinate points. Moreover, we could adopt another way to complete the display of patterns, numbers and character strings.

2. What you need to get started

(1) Link micro:bit board with computer via USB cable.

(2) Open the offline version of Mu

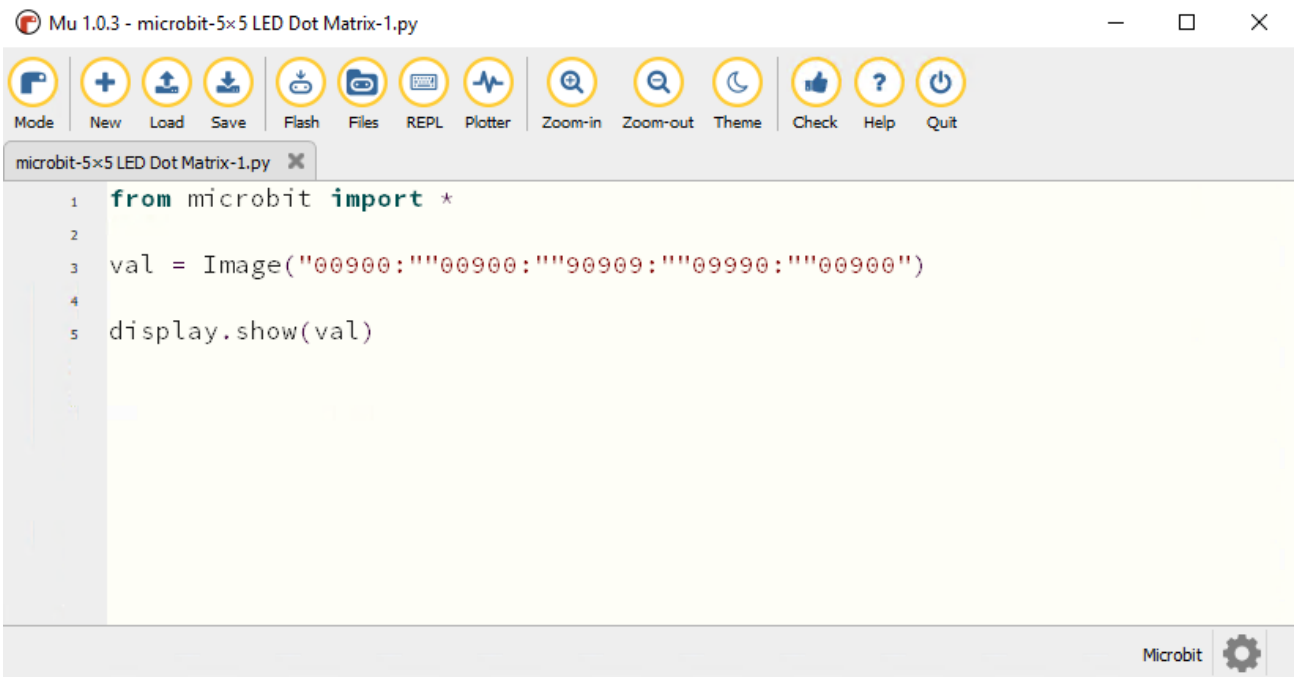
3. Test Code:

Code 1:

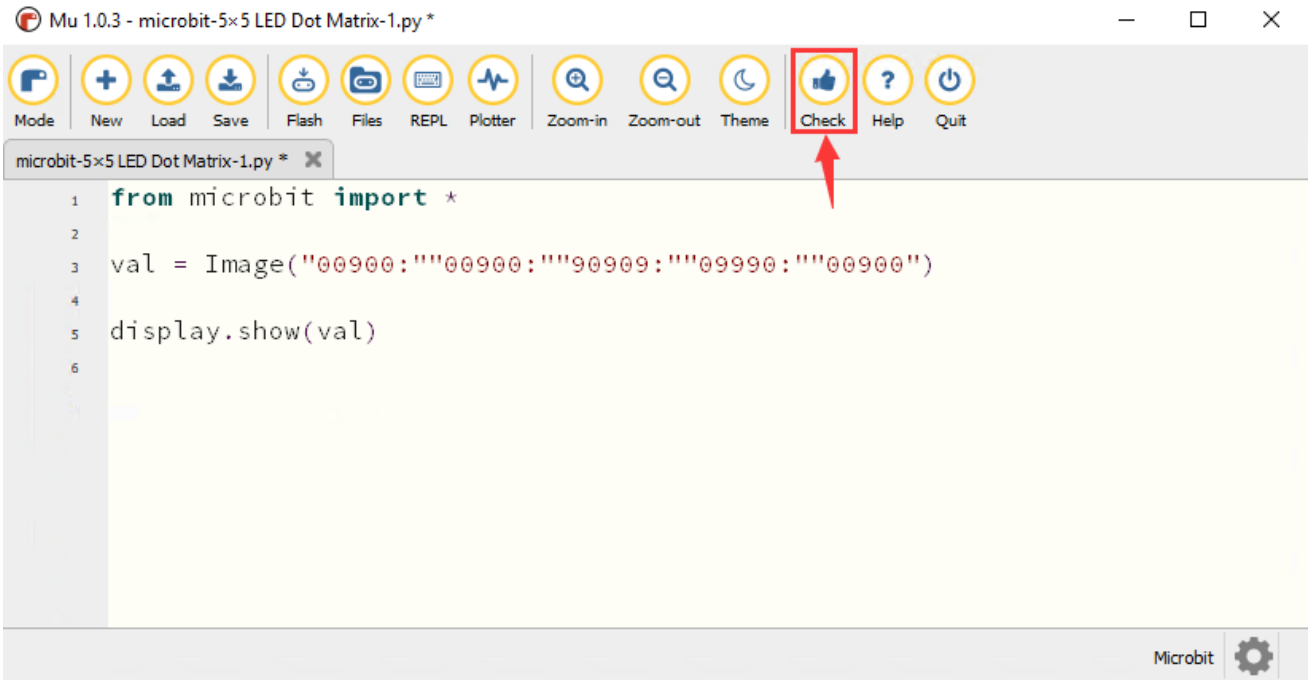
You could open "Code 1.py" file to Import code (How to load the project code?)

File Type	Route	File Name
Python file	../Python code/6.3： 5×5 LED Dot Matrix	Code 1.py

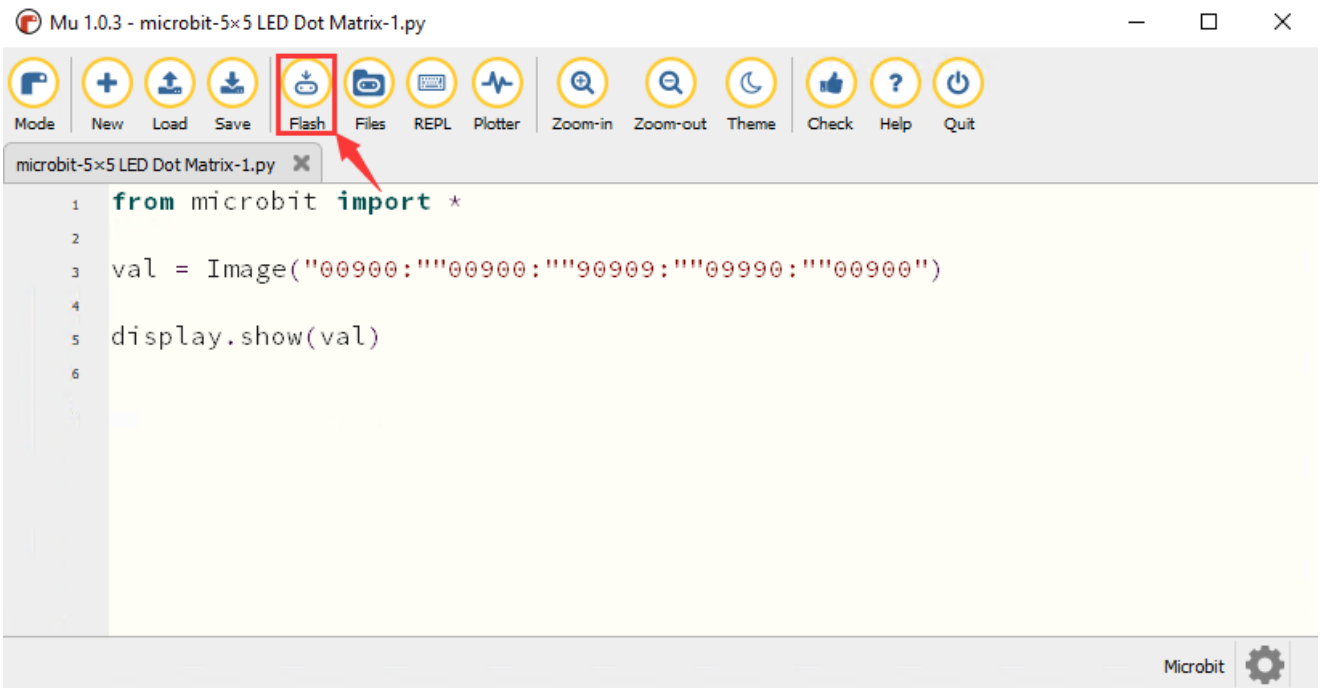
The successful loading is shown below.You can also input code in the edit window yourself.(note:all English words and symbols must be written in English)



Click “Check” to examine error in the code. The program proves wrong if underlines and cursors are shown.



If the code is correct, connect micro:bit to computer and click "Flash" to download code to micro:bit board

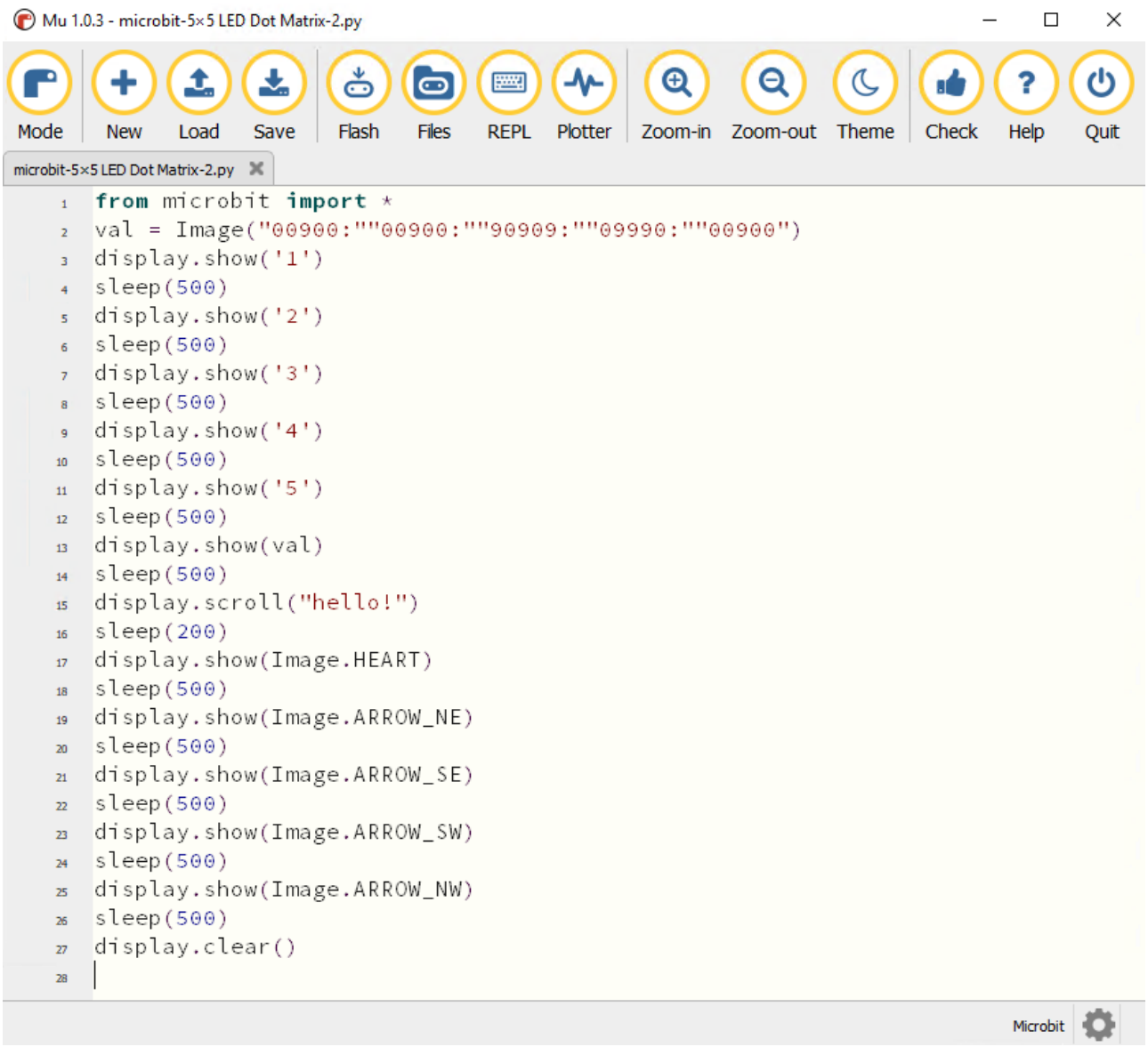


Code 2：

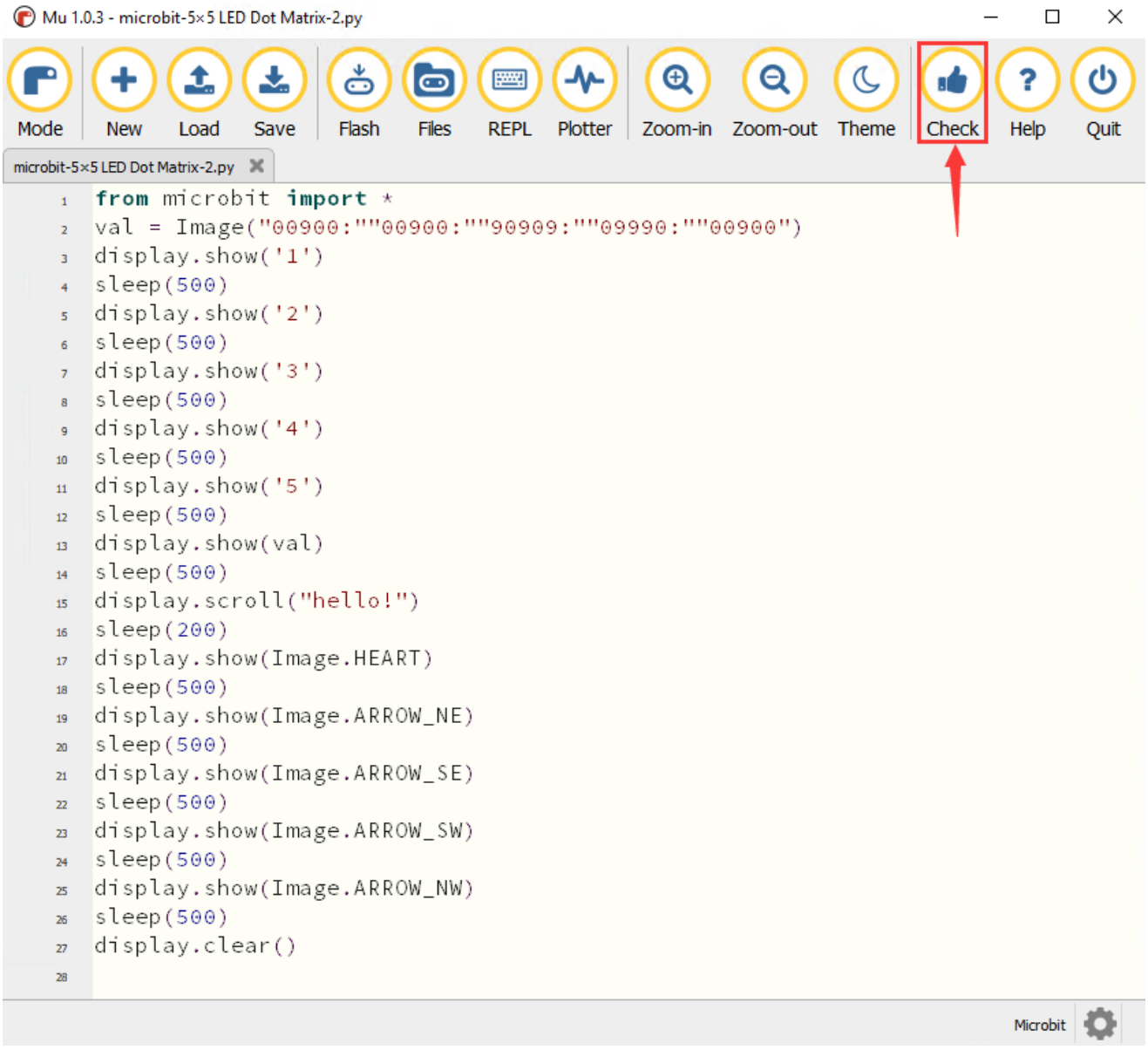
Enter Mu software and open “Code 2.py “file to import code（How to load the project code?）

File Type	Route	File Name
Python file	../Python code/6.3：5×5 LED Dot Matrix	Code 2.py

The successful loading is shown below.You can also input code in the edit window yourself.(note:all English words and symbols must be written in English)


Mu 1.0.3 - microbit-5×5 LED Dot Matrix-2.py
Mode
New
Load
Save
Flash
Files
REPL
Plotter
Zoom-in
Zoom-out
Theme
Check
Help
Quit
microbit-5×5 LED Dot Matrix-2.py
from microbit import *
val = Image("00900:""00900:""90909:""09990:""00900")
display.show('1')
sleep(500)
display.show('2')
sleep(500)
display.show('3')
sleep(500)
display.show('4')
sleep(500)
display.show('5')
sleep(500)
display.show(val)
sleep(500)
display.scroll("hello!")
sleep(200)
display.show(Image.HEART)
sleep(500)
display.show(Image.ARROW_NE)
sleep(500)
display.show(Image.ARROW_SE)
sleep(500)
display.show(Image.ARROW_SW)
sleep(500)
display.show(Image.ARROW_NW)
sleep(500)
display.clear()
Microbit

Click “Check” to examine error in the code. The program proves wrong if underlines and cursors are shown.



If the code is correct, connect micro:bit to computer and click “Flash” to download code to micro:bit board.

Mu 1.0.3 - microbit-5×5 LED Dot Matrix-2.py

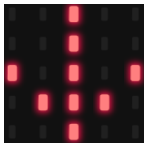
Mode | New | Load | Save | Flash | Files | REPL | Plotter | Zoom-in | Zoom-out | Theme | Check | Help | Quit

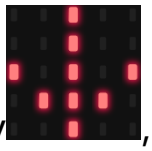
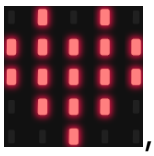
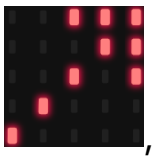
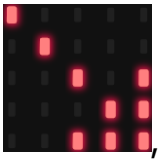
microbit-5×5 LED Dot Matrix-2.py

```
from microbit import *
val = Image("00900:""00900:""90909:""09990:""00900")
display.show('1')
sleep(500)
display.show('2')
sleep(500)
display.show('3')
sleep(500)
display.show('4')
sleep(500)
display.show('5')
sleep(500)
display.show(val)
sleep(500)
display.scroll("hello!")
sleep(200)
display.show(Image.HEART)
sleep(500)
display.show(Image.ARROW_NE)
sleep(500)
display.show(Image.ARROW_SE)
sleep(500)
display.show(Image.ARROW_SW)
sleep(500)
display.show(Image.ARROW_NW)
sleep(500)
display.clear()
```

Microbit

4. Test Result:

Upload code 1 and plug in micro:bit , we will see the  icon.

Upload code 2 and plug in micro:bit. Micro: bit starts showing number 1, 2, 3, 4, and 5, then cyclically display  , “Hello!” ,  ,  ,  ,  and  patterns.

5. Code Explanation:

from microbit **import** *	import the library file of micro:bit
val = Image("09000:""00000:""00000:""00000:""00000:")	Set Image() to variable val
display.show(val)	micro:bit shows “→”
display.show('1')	micro:bit shows “1”
sleep(500)	Delay in 500ms
display.scroll("hello!")	micro:bit scrolls to show “hello!”
display.show(Image.HEART)	micro:bit displays “❤” pattern

display.show(Image.ARROW_NE) display.show(Image.ARROW_SE) display.show(Image.ARROW_SW) display.show(Image.ARROW_NW)	micro:bit shows "Northeast" arrow micro:bit displays "Southeast" arrow micro:bit shows "Southwest" arrow micro:bit displays "Northwest" arrow
display.clear()	The LED dot matrix of micro:bit clears

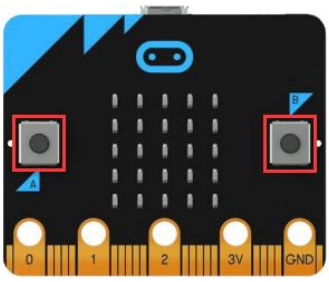
6. Reference:

display.scroll() : scroll to display the value on screen. If the value is integer or float, transfer it into character string via str ().

The display scrolls to show the values, if it is integer or float, we use str () to transfer into character strings.

More details, please refer to https://microbit-micropython.readthedocs.io/en/latest/utime.html

6.4: 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.

What you need to get started

(1) Link micro:bit board with computer via USB cable.

(2) Open the offline version of Mu

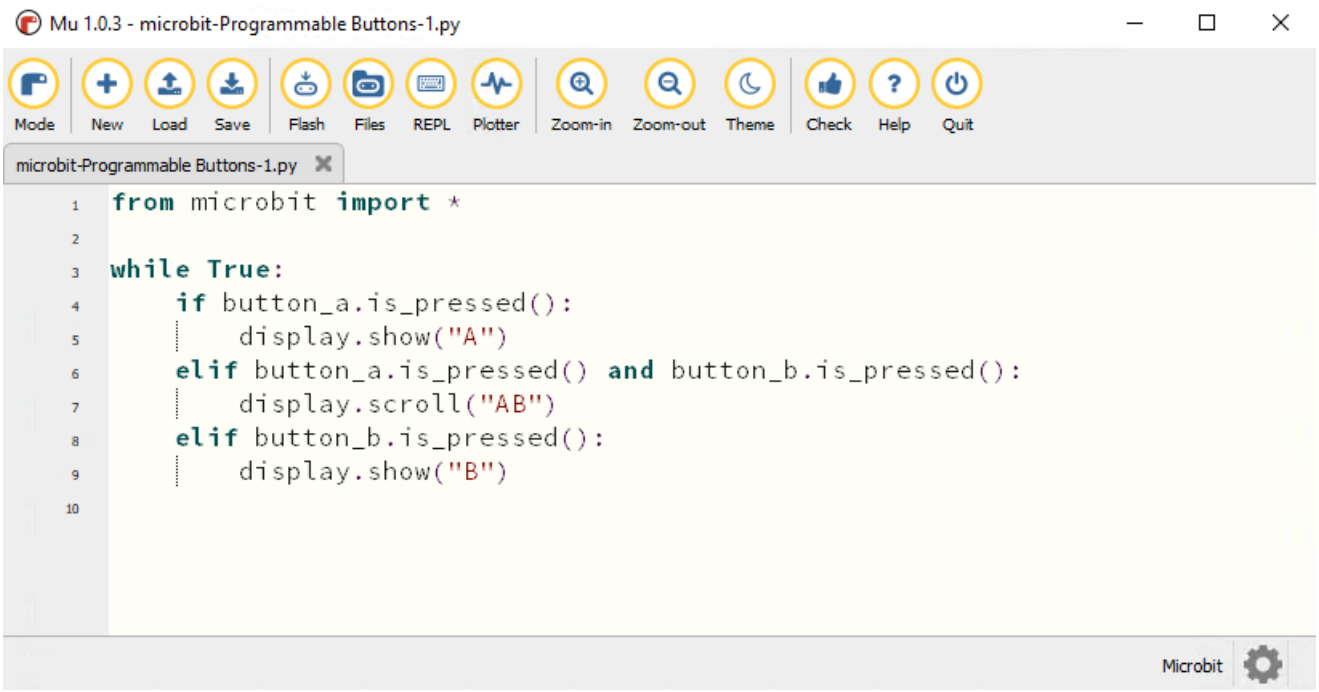
3. Test Code:

Code 1:

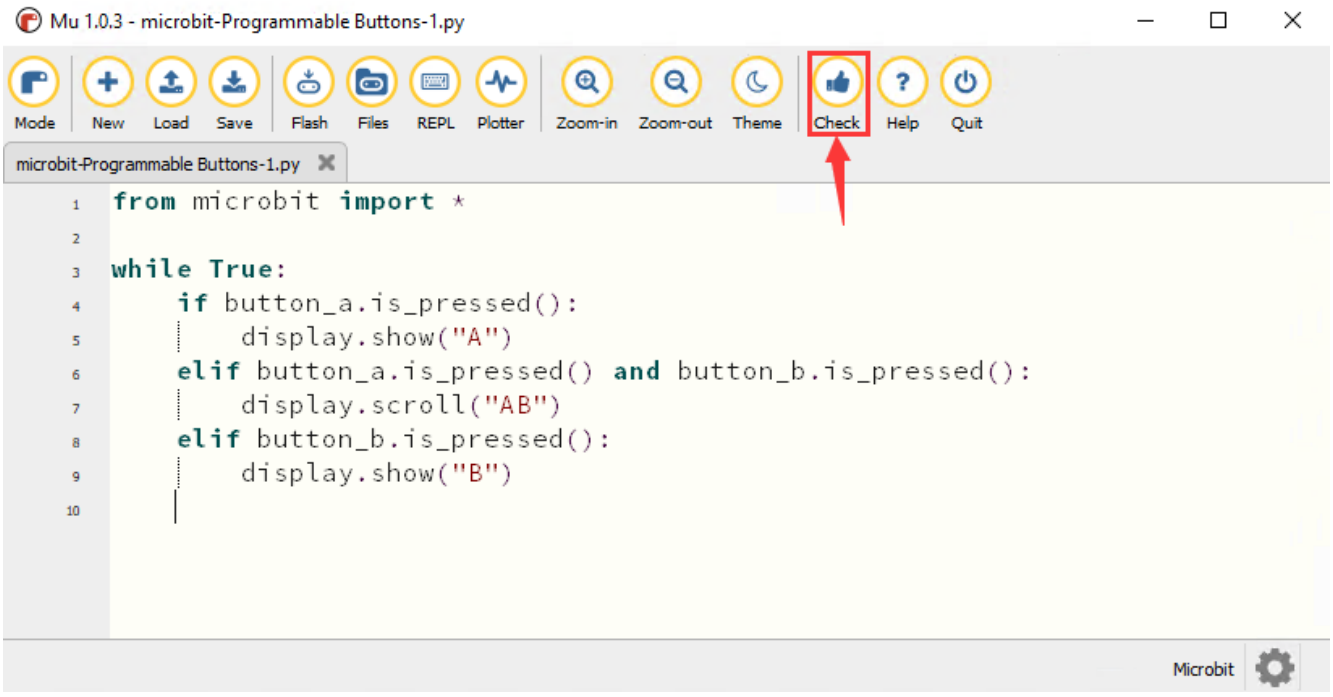
Open the file "Code 1.py" in Mu software, (How to load the project code?)

File Type	Route	File Name
Python file	../Python code/6.4: Programmable Buttons	Code 1.py

The successful loading is shown below.You can also input code in the edit window yourself.(note:all English words and symbols must be written in English)



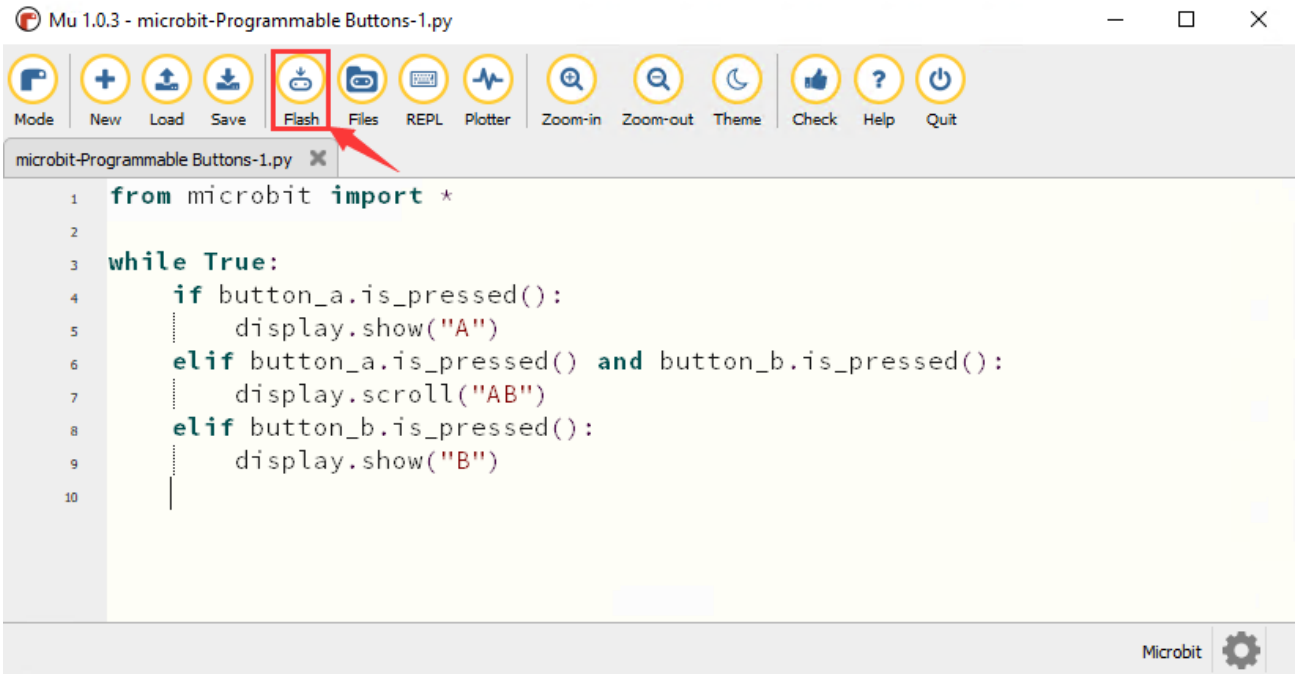
Click "Check" to examine error in the code. The program proves wrong if underlines and cursors are shown.



If the code is correct, connect micro:bit to computer and click "Flash" to

download code to micro:bit board.

Then tap “Flash” to download code to micro:bit.



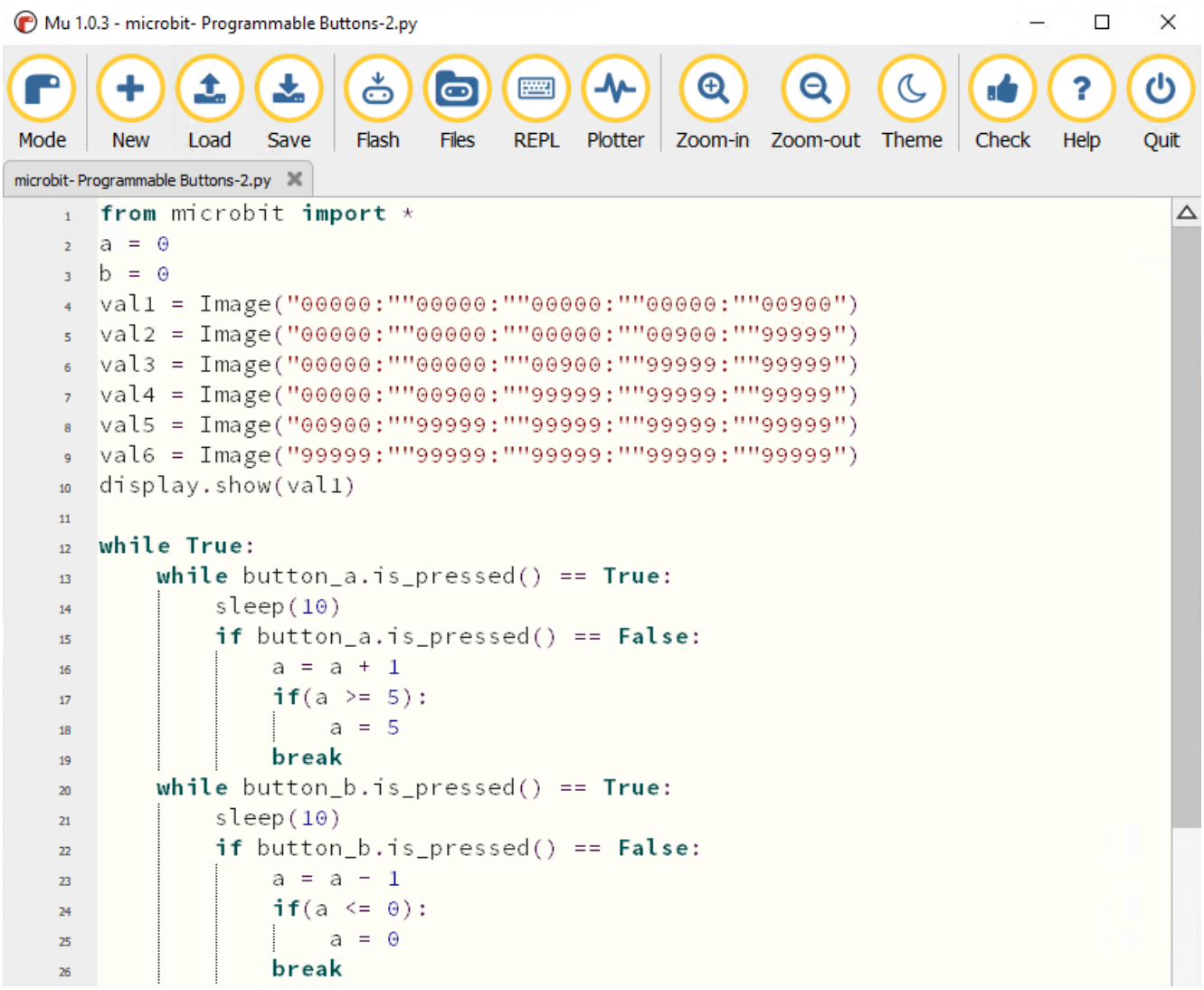
Code 2:

Open the file “Code 2.py” in Mu,

(How to load the project code?)

File Type	Route	File Name
Python file	../Projects/6.4: Programmable Buttons	Code 2.py

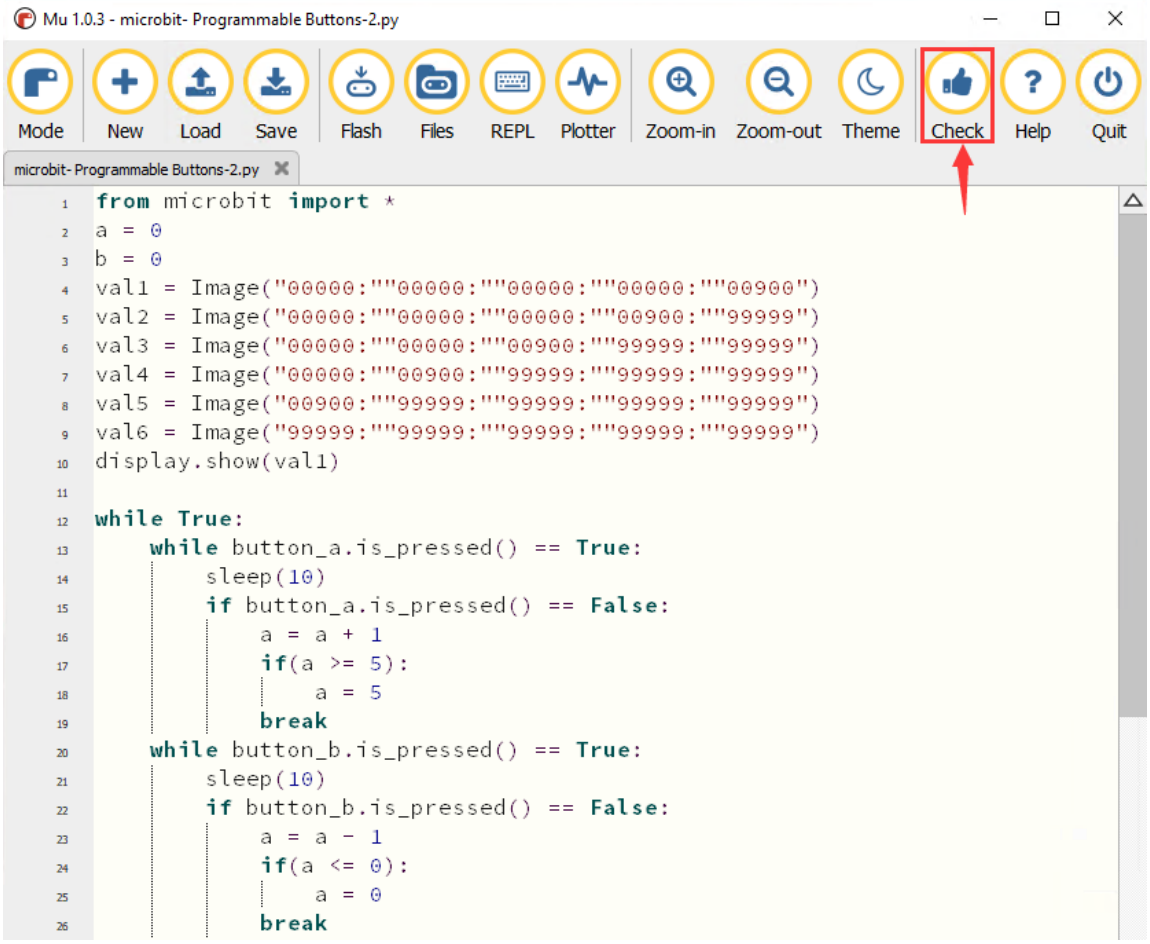
The successful loading is shown below.You can also input code in the edit window yourself.(note:all English words and symbols must be written in English)



```
    if a == 0:
        display.show(val1)
    if a == 1:
        display.show(val2)
    if a == 2:
        display.show(val3)
    if a == 3:
        display.show(val4)
    if a == 4:
        display.show(val5)
    if a == 5:
        display.show(val6)

```

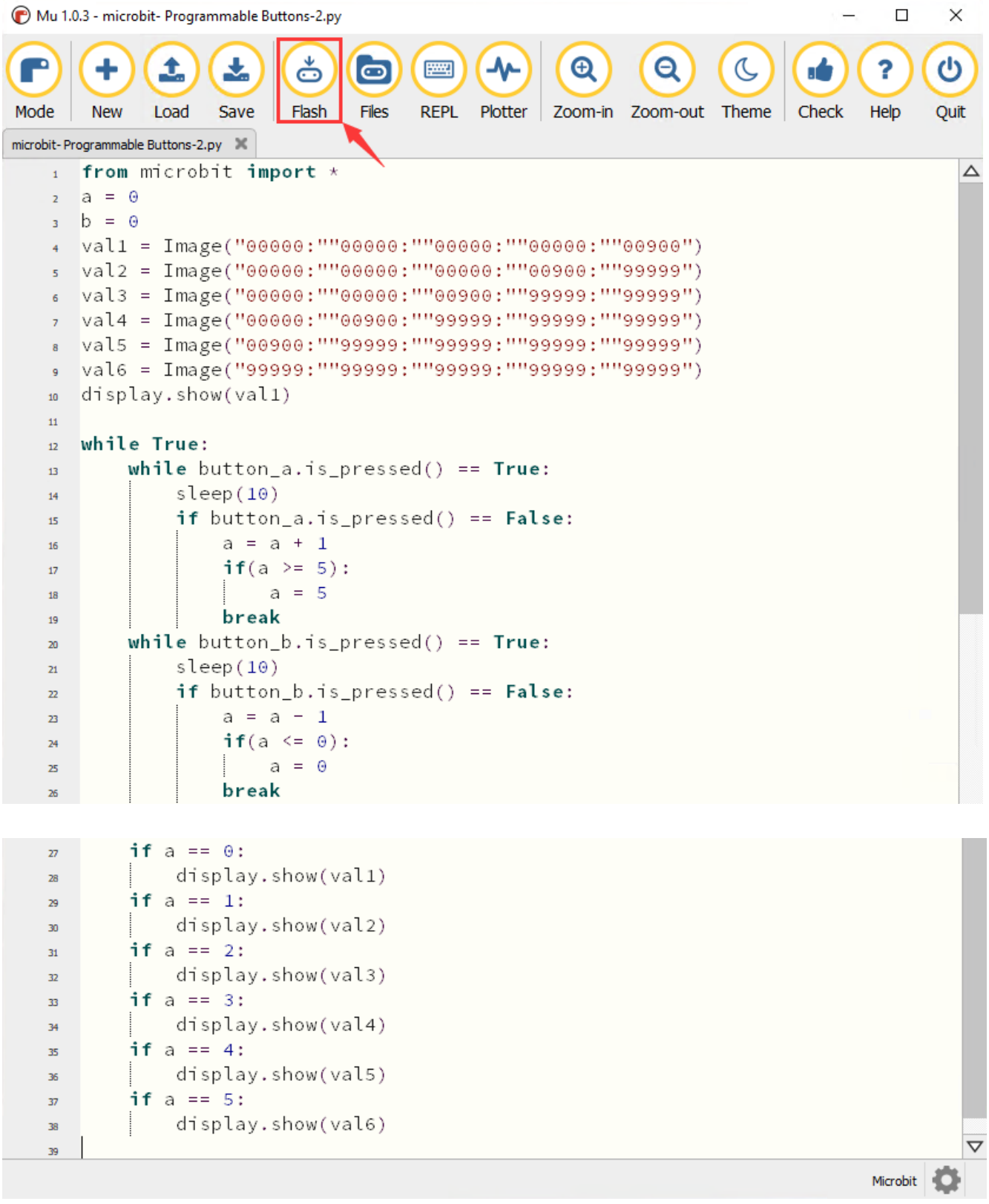
Microbit

Click “Check” to examine error in the code. The program proves wrong if underlines and cursors are shown.



```
    if a == 0:
        display.show(val1)
    if a == 1:
        display.show(val2)
    if a == 2:
        display.show(val3)
    if a == 3:
        display.show(val4)
    if a == 4:
        display.show(val5)
    if a == 5:
        display.show(val6)

Microbit
```

If the code is correct, connect micro:bit to computer and click “Flash” to download code to micro:bit board. Then click “Flash” to download code to micro:bit board.


Mu 1.0.3 - microbit- Programmable Buttons-2.py
Mode
New
Load
Save
Flash
Files
REPL
Plotter
Zoom-in
Zoom-out
Theme
Check
Help
Quit
microbit- Programmable Buttons-2.py
from microbit import *
a = 0
b = 0
val1 = Image("00000:""00000:""00000:""00000:""00900")
val2 = Image("00000:""00000:""00000:""00900:""99999")
val3 = Image("00000:""00000:""00900:""99999:""99999")
val4 = Image("00000:""00900:""99999:""99999:""99999")
val5 = Image("00900:""99999:""99999:""99999:""99999")
val6 = Image("99999:""99999:""99999:""99999:""99999")
display.show(val1)
while True:
while button_a.is_pressed() == True:
sleep(10)
if button_a.is_pressed() == False:
a = a + 1
if(a >= 5):
a = 5
break
while button_b.is_pressed() == True:
sleep(10)
if button_b.is_pressed() == False:
a = a - 1
if(a <= 0):
a = 0
break
if a == 0:
display.show(val1)
if a == 1:
display.show(val2)
if a == 2:
display.show(val3)
if a == 3:
display.show(val4)
if a == 4:
display.show(val5)
if a == 5:
display.show(val6)
Microbit

4.Test Result:

Upload code 1 and plug in micro:bit via USB cable, press "A" on Micro:bit board, character "A" will be displayed; in case that B is pressed, letter "B" will appear. So will show "AB" if you press A and B buttons simultaneously.

Upload code 2 and plug in board via USB cable. Press button A, a row of LEDs are added and light up, when B is pressed, a row of LEDs are deducted and go off.

5.Code Explanation:

from microbit **import** *	import the library file of micro:bit
while True:	This is a permanent loop that makes micro:bit execute the code of it.
if button_a.is_pressed(): display.show("A") **elif** button_a.is_pressed() **and** button_b.is_pressed():	If button A is pressed micro:bit shows "A" If button A and B are pressed at

display.scroll("AB") **elif** button_b.is_pressed(): display.show("B")	same time micro:bit displays “AB” If button B is pressed micro:bit shows “B”
while button_a.is_pressed() == **True**: sleep(10) **if** button_a.is_pressed() == **False**: a = a + 1 **if**(a >= 5): a = 5 break **while** button_b.is_pressed() == **True**: sleep(10) **if** button_b.is_pressed() == **False**: a = a - 1 **if**(a <= 0): a = 0	When the button A is pressed Delay in 10ms to eliminate the shaking of button A when button is released, Variable 2 adds 1 If variable a≥5 Variable a=5 exit the loop when button B is pressed Delay in 10ms to eliminate the shaking of button B Delay in 10ms to eliminate When the button B is released

break **if** a == 0: display.show(val1) **if** a == 1: display.show(val2) **if** a == 2: display.show(val3) **if** a == 3: display.show(val4) **if** a == 4: display.show(val5) **if** a == 5: display.show(val6)	Variable a reduces 1 gradually When a≤0 Variable a=0 exit the loop When a=0 micro:bit shows pattern val1 When a=1 micro:bit displays pattern val2 When a=2 micro:bit shows pattern val3 If a=3 micro:bit displays pattern val4 If a=4 micro:bit shows pattern val5 If a=5 micro:bit displays pattern val6

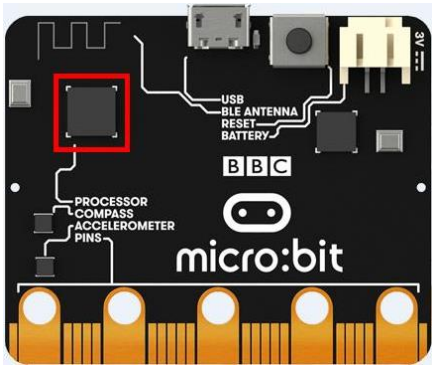
6.5: Temperature Measurement

1. Description:

Micro:bit main board contains temperature sensor, as micro:bit is small pocket-sized computer, it has a micro processor. That means this is a tiny electronic component with less power than normal computer processor, which is one of the reason your micro: bit is so small and can run on batteries.

The micro:bit processor runs the program you create for your micro:bit so when you write a program in online editors, then transfer it to your micro:bit. The processor is where your program runs.

Note: the temperature sensor is included in the processor.



What you need to get started

Link micro:bit board with computer via USB cable.

(1) Open the offline version of Mu

3. Test Code:

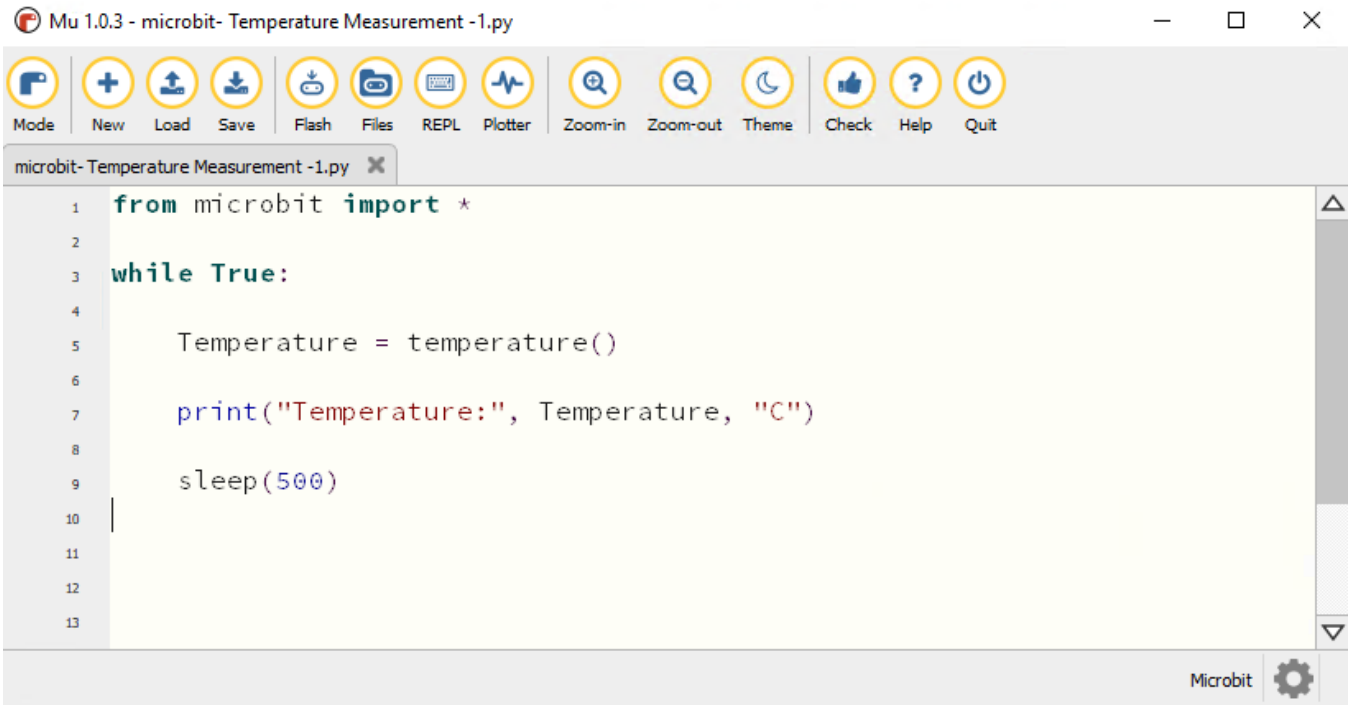
Code 1:

Open "Code 1.py " file in Mu,

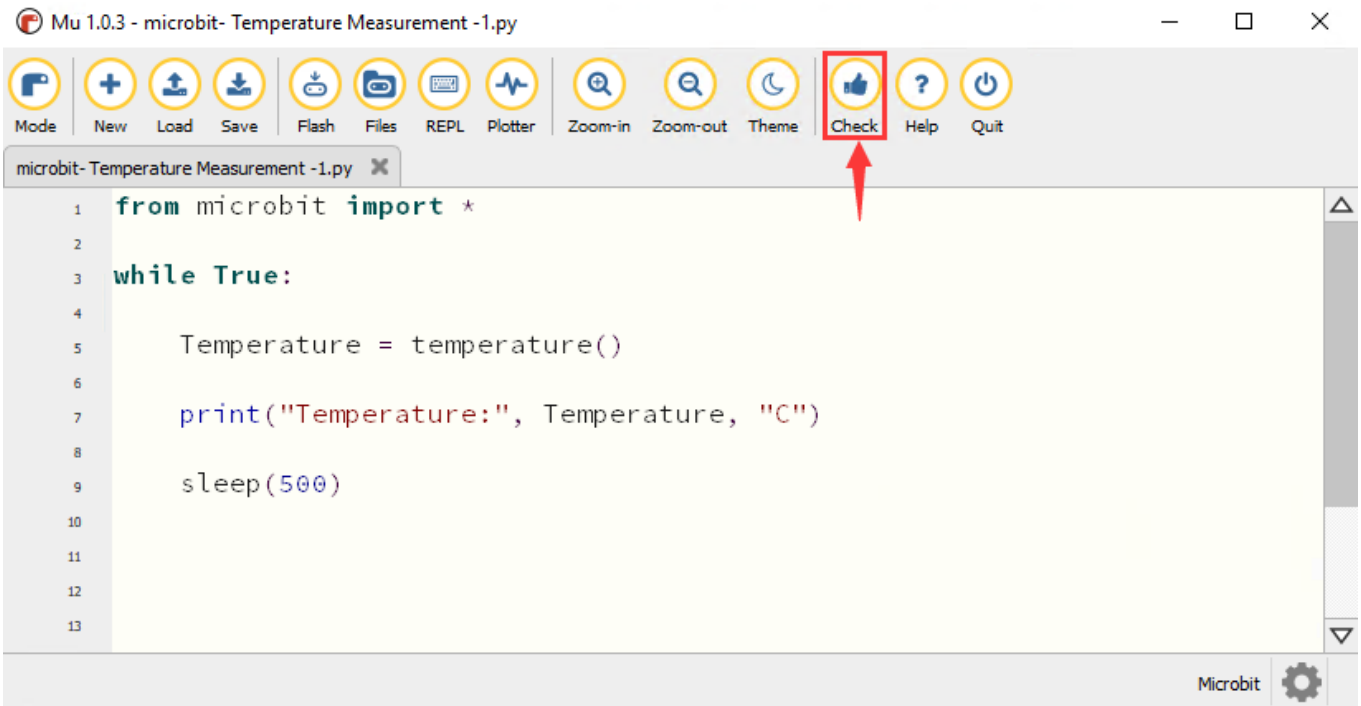
(How to load the project code?)

File Type	Route	File Name
Python file	../Python code/6.5: Temperature Measurement /	Code 1.py

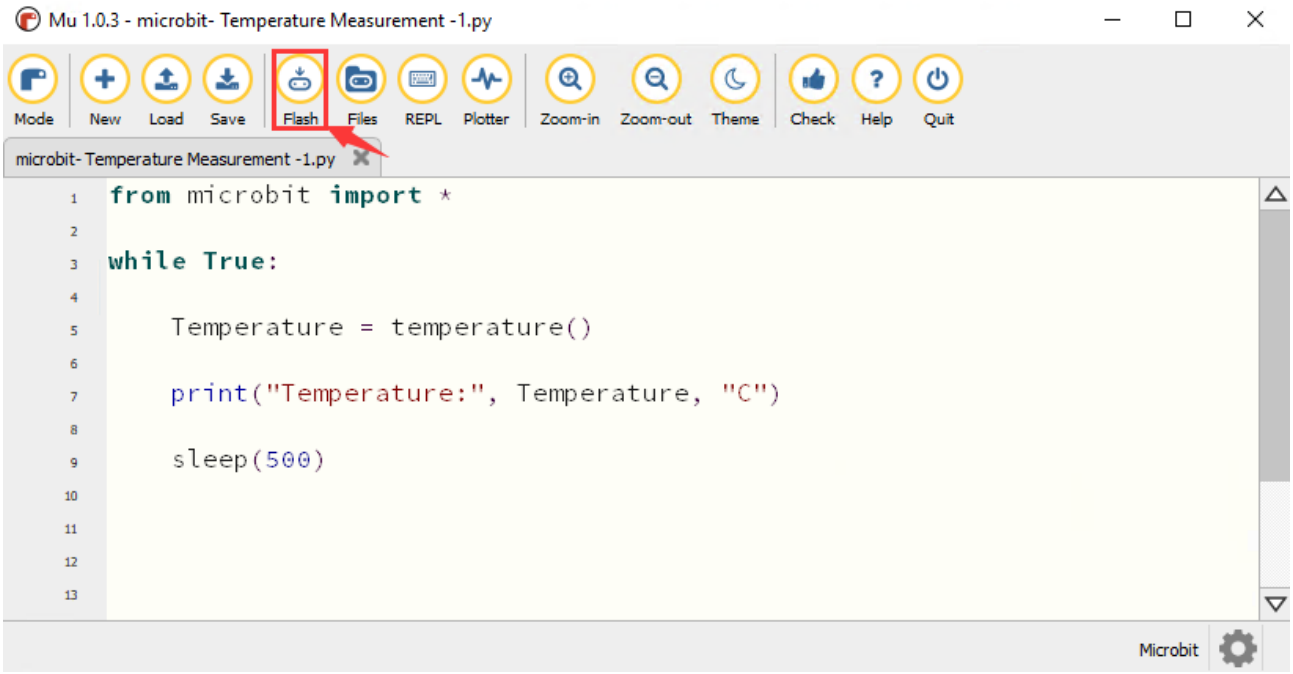
The successful loading is shown below.You can also input code in the edit window yourself.(note:all English words and symbols must be written in English)



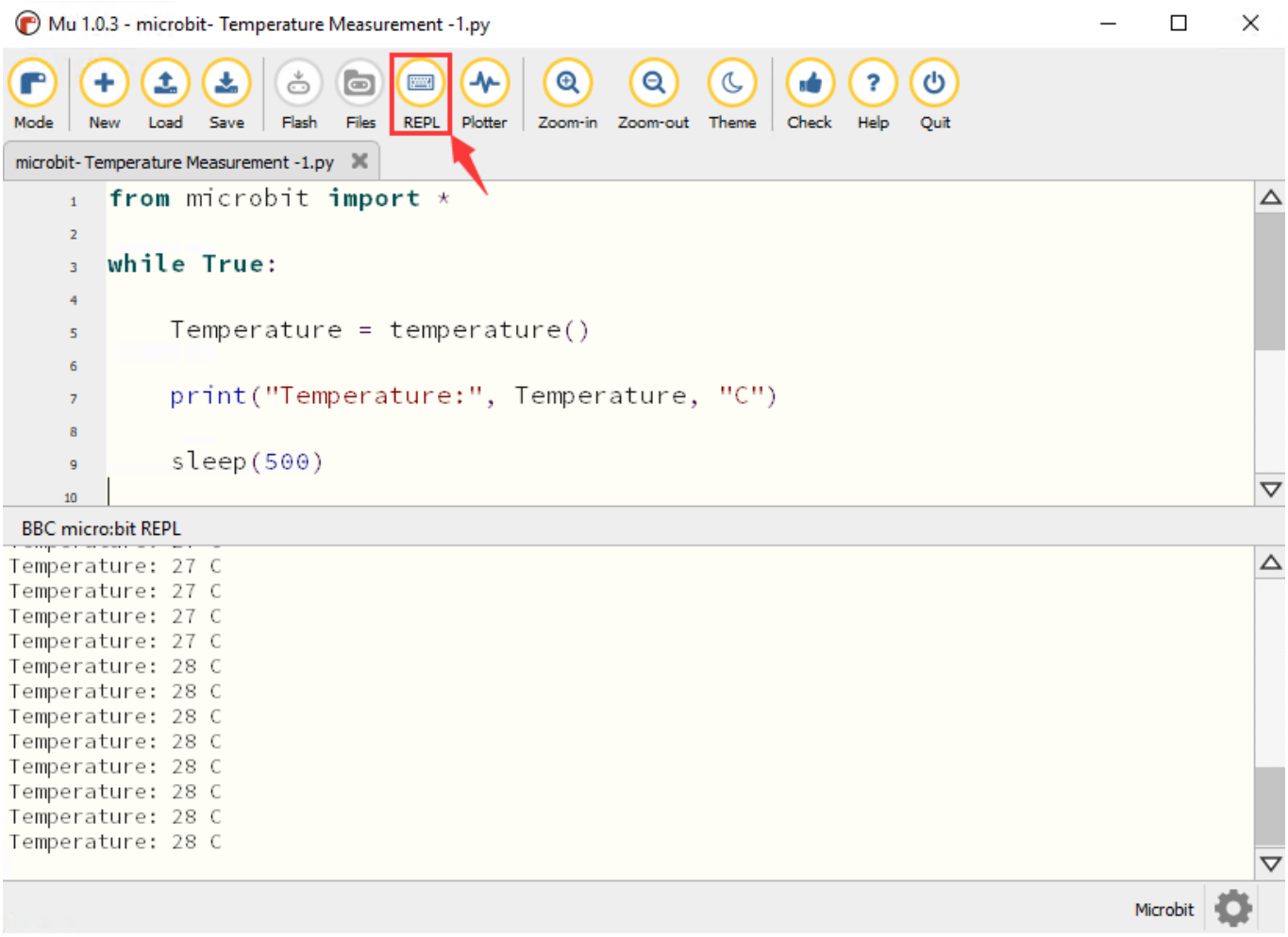
Click "Check" to examine error in the code. The program proves wrong if underlines and cursors are shown.



If the code is correct, connect micro:bit to computer and click "Flash" to download code to micro:bit board.



After downloading test code 1 to micro:bit board, keep USB connected and click **"REPL" and press the reset button on micro:bit.** Then REPL window will show the ambient temperature value, as shown below:(C stands for temperature unit)



Code 2:

Open "Code 2.py " in Mu,

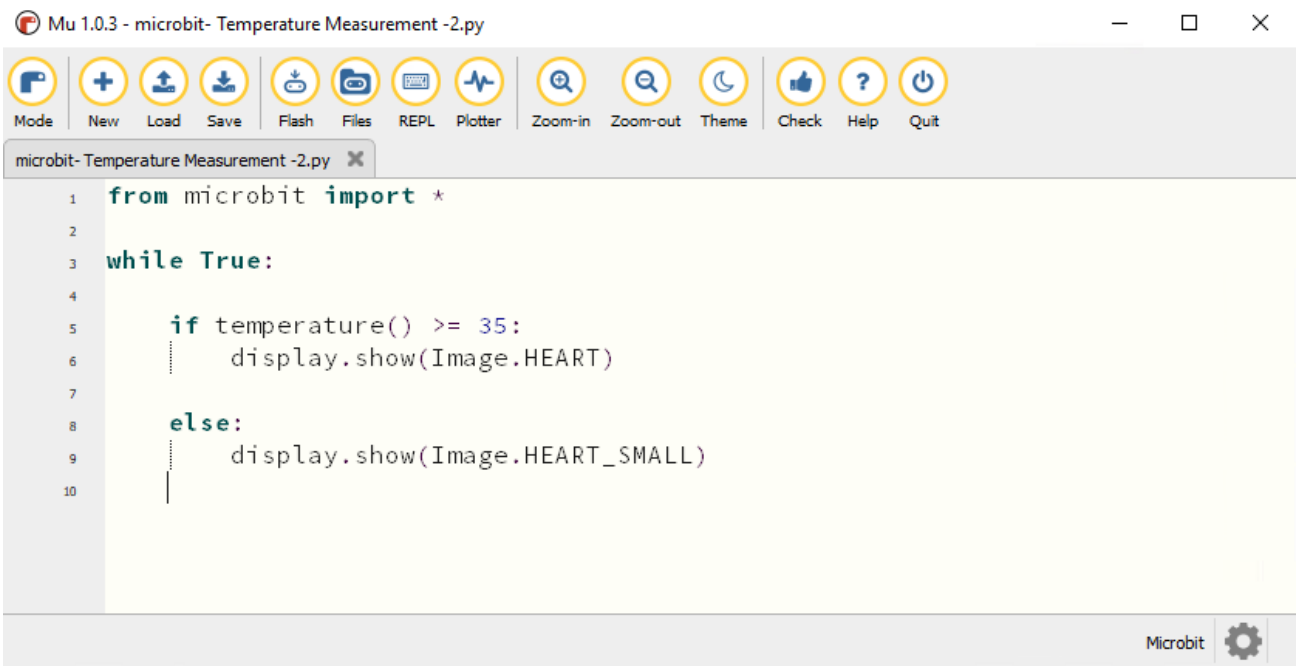
(How to load the project code?)

File Type	Route	File Name

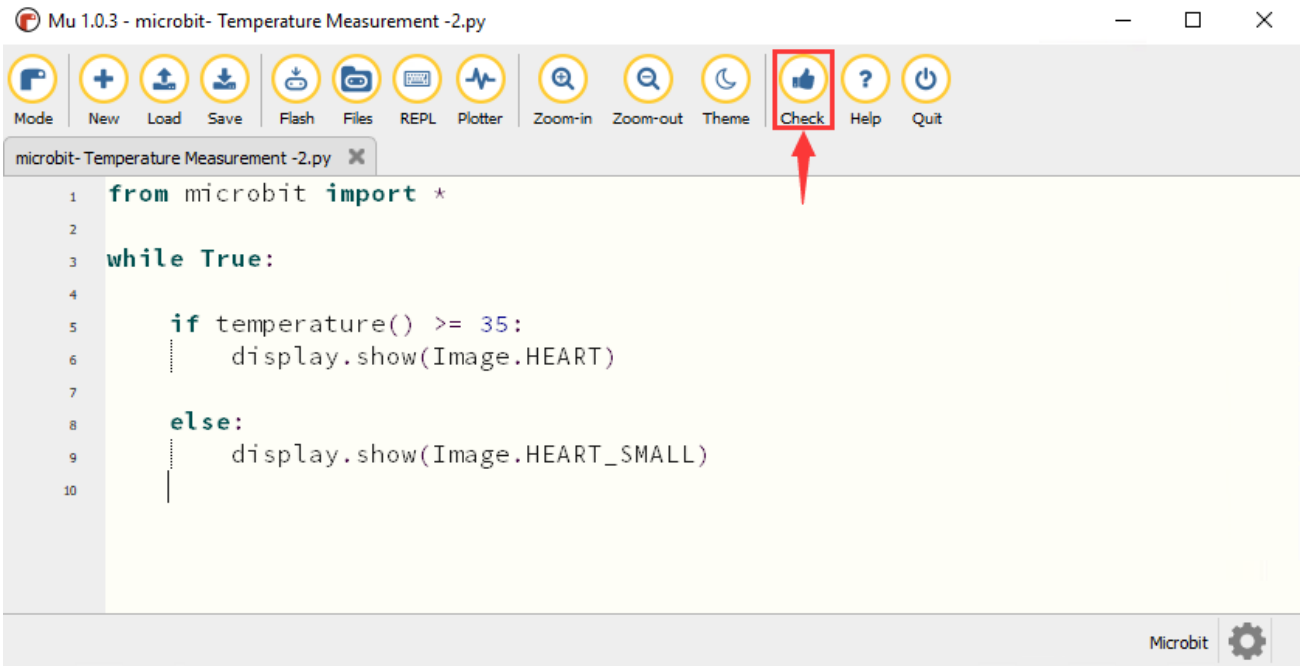
Python file	../Python code/6.5：Temperature Measurement	Code 2.py

Or, you could input code in the editing window by yourself.

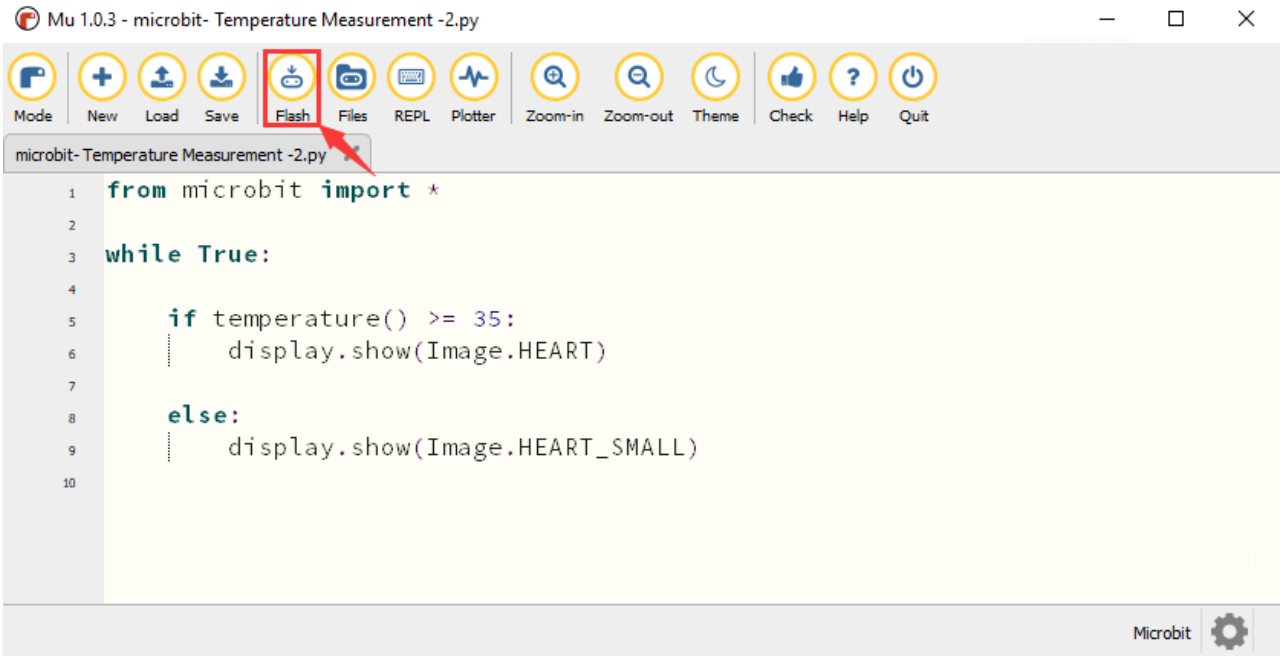
The temperature value can be set in compliance with the real temperature.



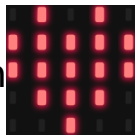
Click “Check” to examine error in the code. The program proves wrong if underlines and cursors are shown.



If the code is correct, connect micro:bit to computer and click “Flash” to download code to micro:bit board



4.Test Result:

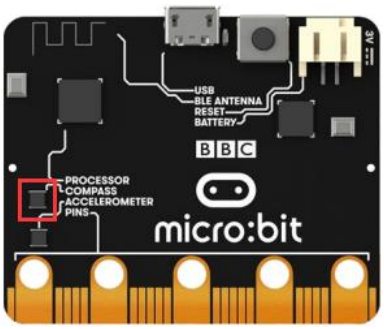
Upload the code 2 plug in micro:bit via USB cable, when the ambient temperature is less than 35℃, 5*5LED will show  . When the temperature is equivalent to or greater than 35℃, the pattern  will appear.

5.Code Explanation:

from microbit **import** *	import the library file of micro:bit
while True:	This is a permanent loop that makes micro:bit execute the code of it.
Temperature = temperature()	Set temperature() to Temperature
print("Temperature:", Temperature, "C")	BBC micro:bit REPL prints temperature value
sleep(500)	Delay in 500ms

if temperature() >= 35: display.show(Image.HEART) **else**: display.show(Image.HEART_SMALL)	If temperature value ≥35℃ micro:bit shows "♥" If temperature value<35℃ micro:bit displays "▪"

6.6: 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.

What you need to get started

(1) Link micro:bit board with computer via USB cable.

(2) Open the offline version of Mu

3. Test Code：

Code 1：

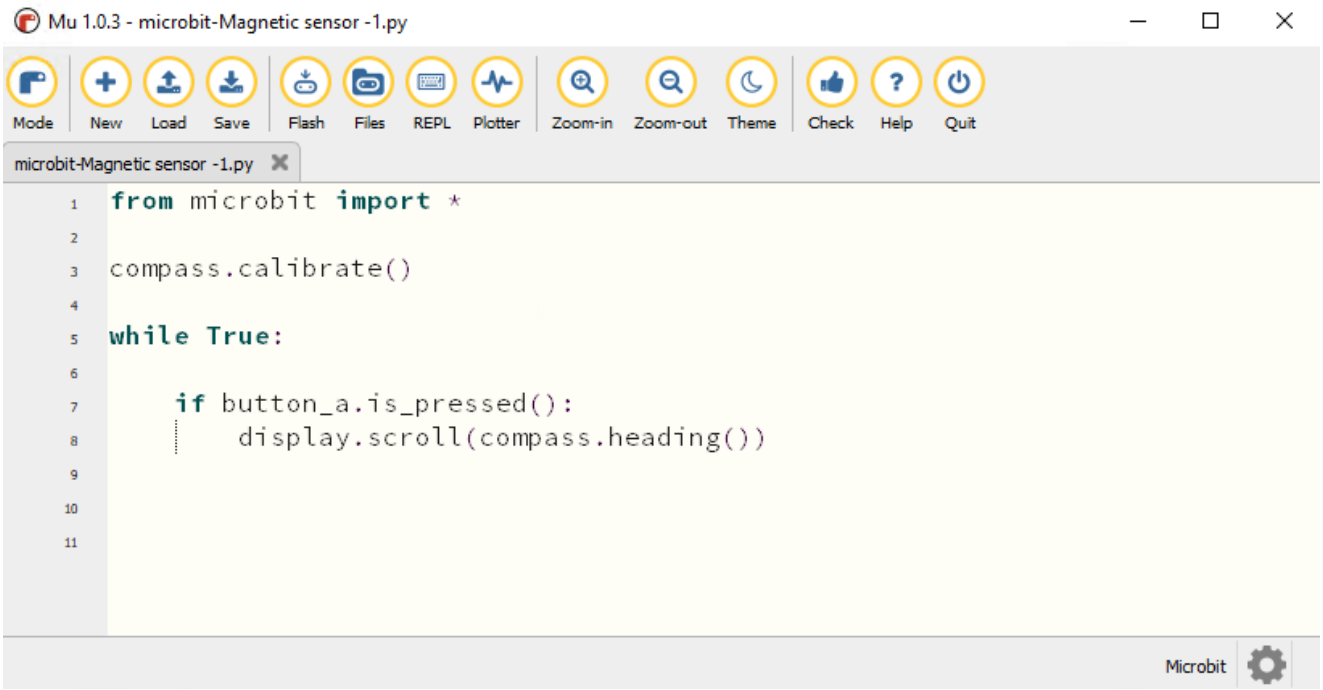
When the button A is pressed, the screen displays the value of compass.

Open file“Code 1.py“ in Mu，

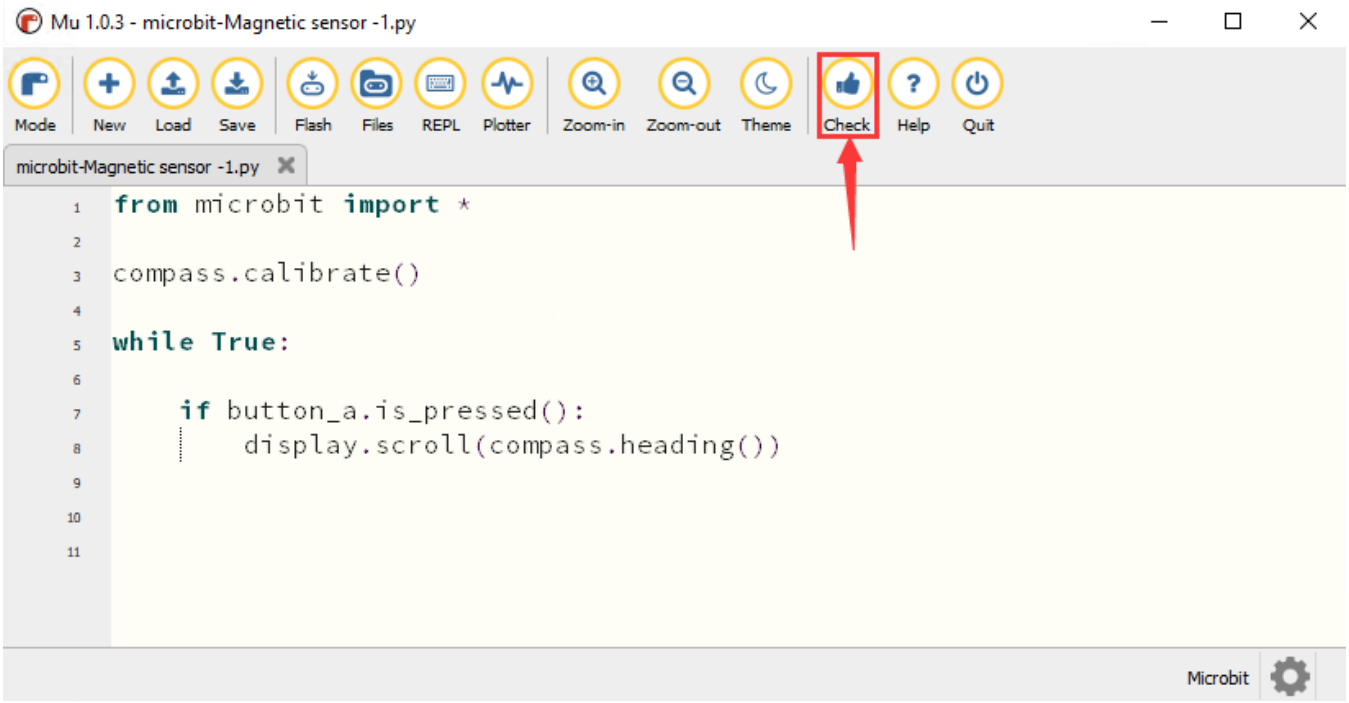
(How to load the project code?)

File Type	Route	File Name
Python file	../Python code/6.6：Microbit’ s Compass	Code 1.py

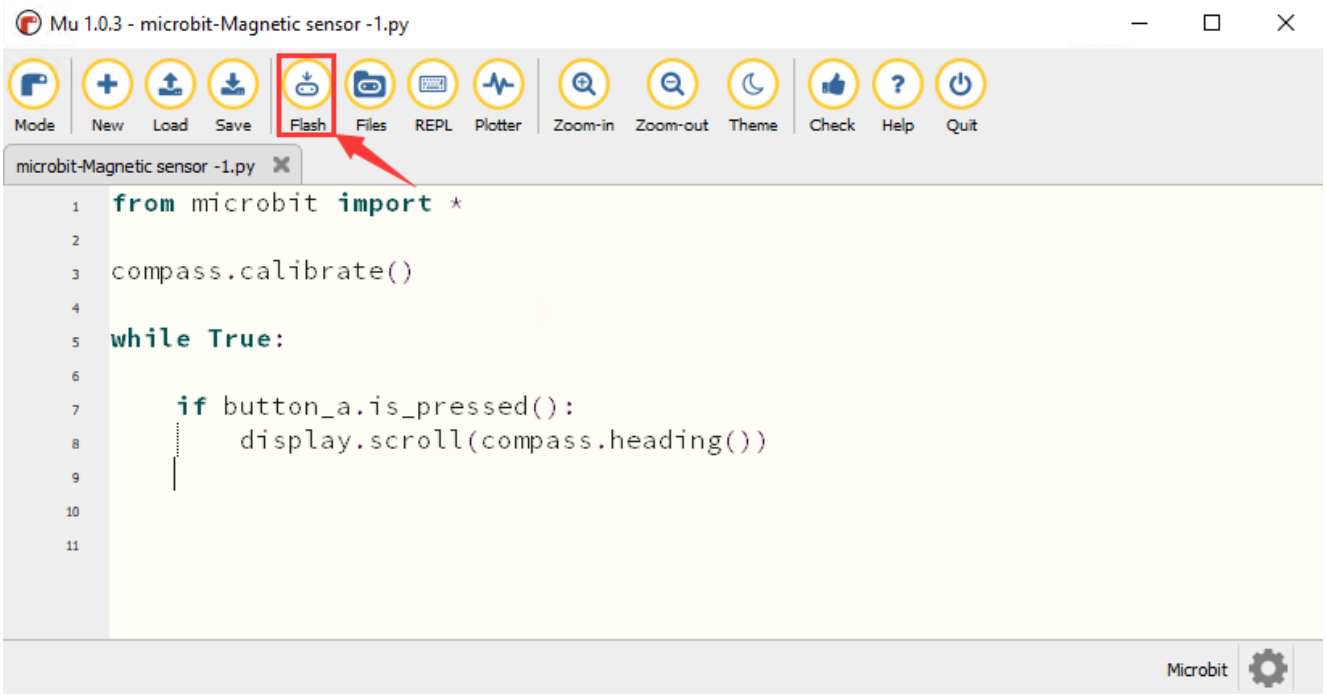
The successful loading is shown below.You can also input code in the edit window yourself.(note:all English words and symbols must be written in English)



Click “Check” to examine error in the code. The program proves wrong if underlines and cursors are shown.



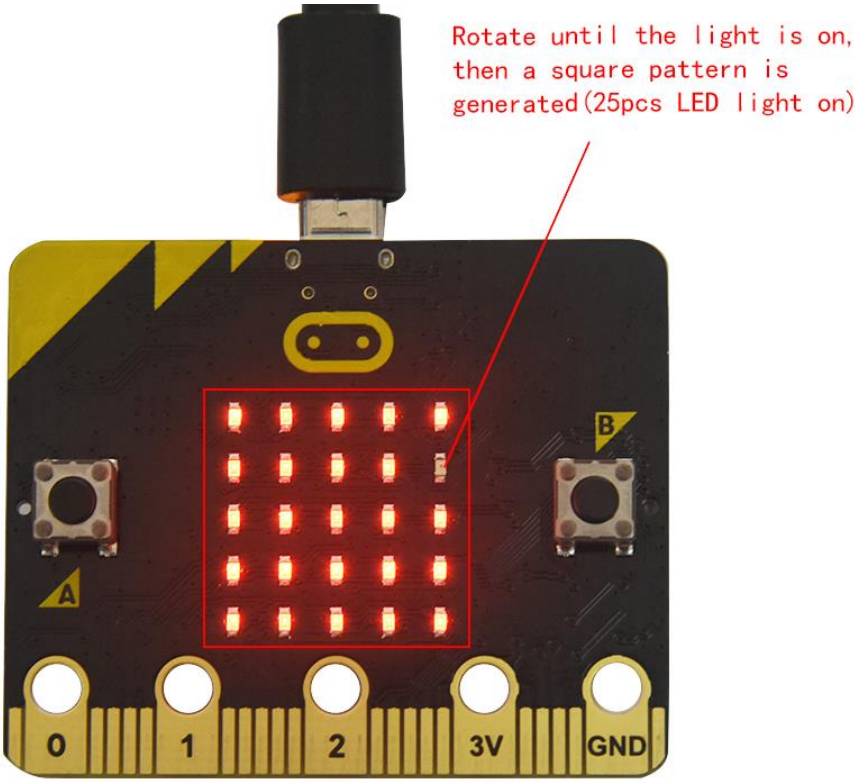
If the code is correct, connect micro:bit to computer and click “Flash” to download code to micro:bit board

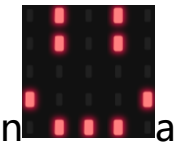


Code Explanation：

We need to calibrate micro：bit due to different magnetic field in different areas. Micro:bit will prompt you to calibrate when you use it first time.

Transfer code 1 to micro:bit, plug in micro:bit via USB cable and press button A. “TILT TO FILL SCREEN” appears on micro:bit. Then enter the calibration interface, the calibration method is to rotate the micro:bit board and display a full square pattern(25 LEDs are on), as shown in the following figure:



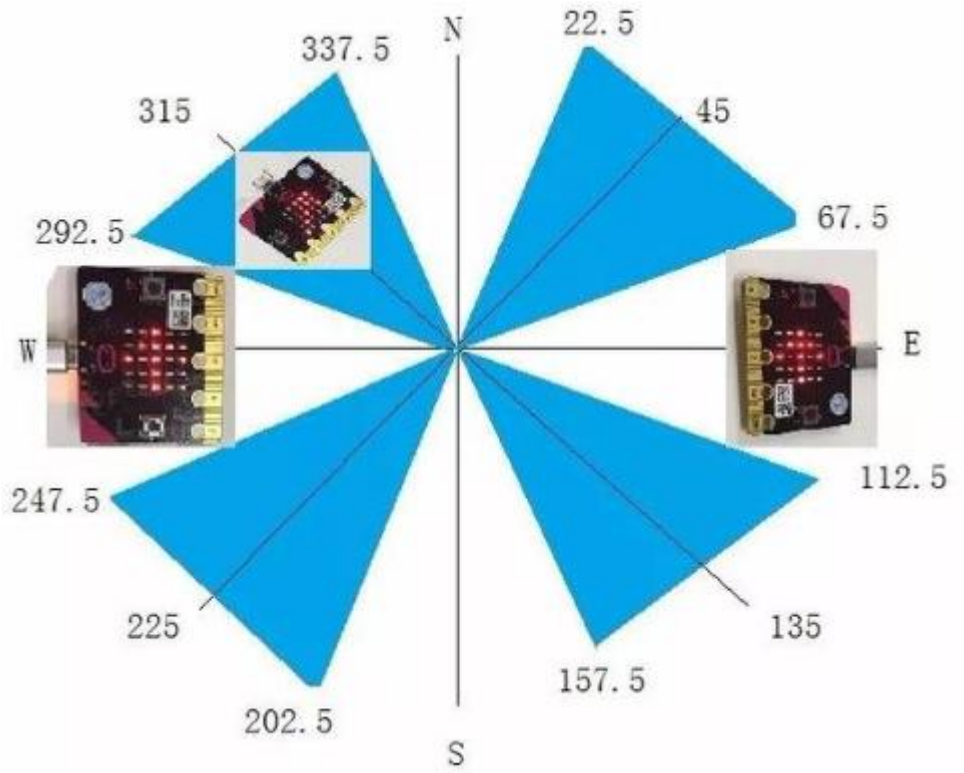
The calibration is finished until you view the smile pattern  appear.

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



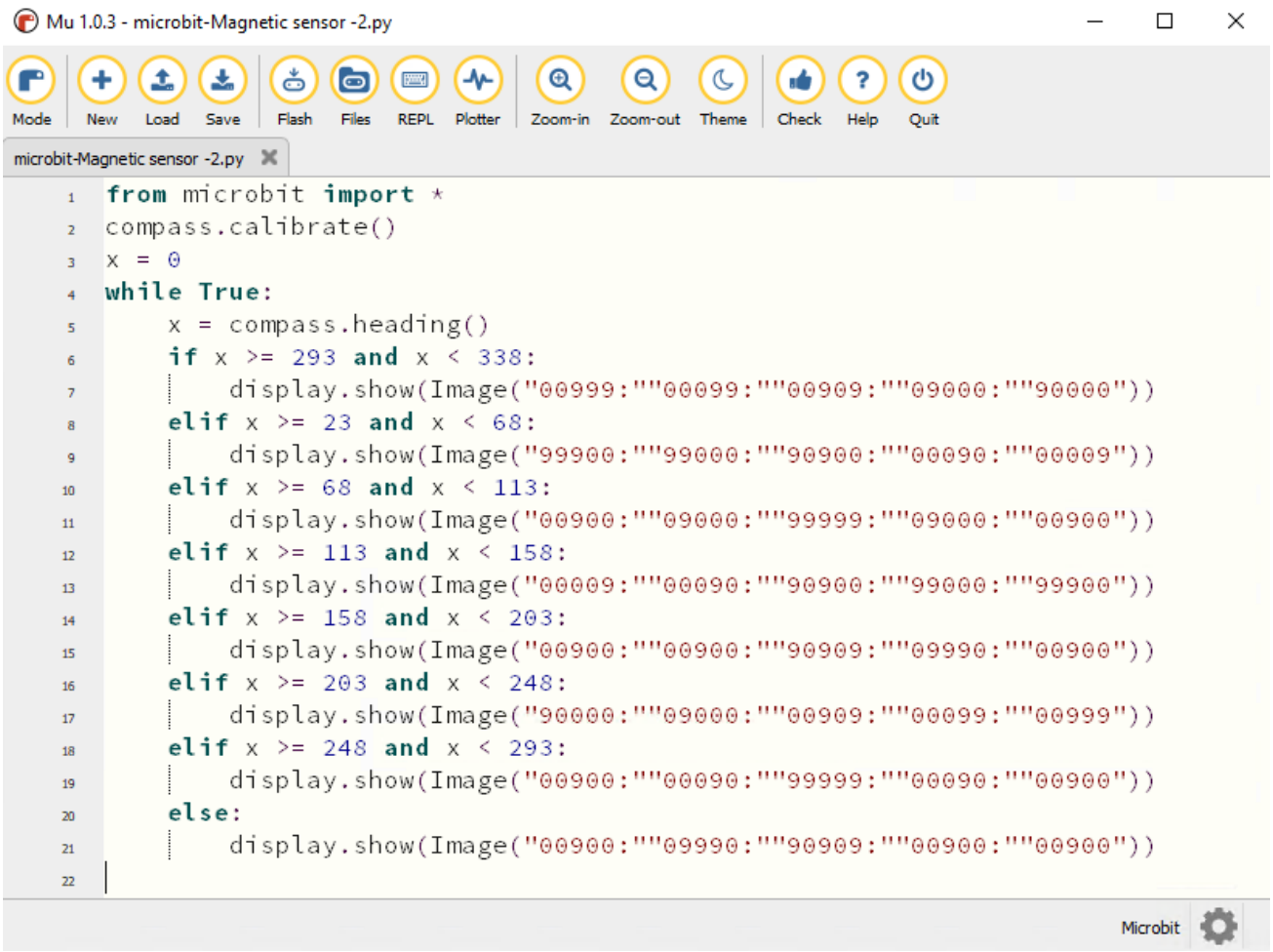
For the above picture, the arrow pointing to the upper right when the value ranges from 292.5 to 337.5. 0.5 can’ t be input in the code, thereby, the values we get are 293 and 338

Open “Code 2.py “ file in Mu，

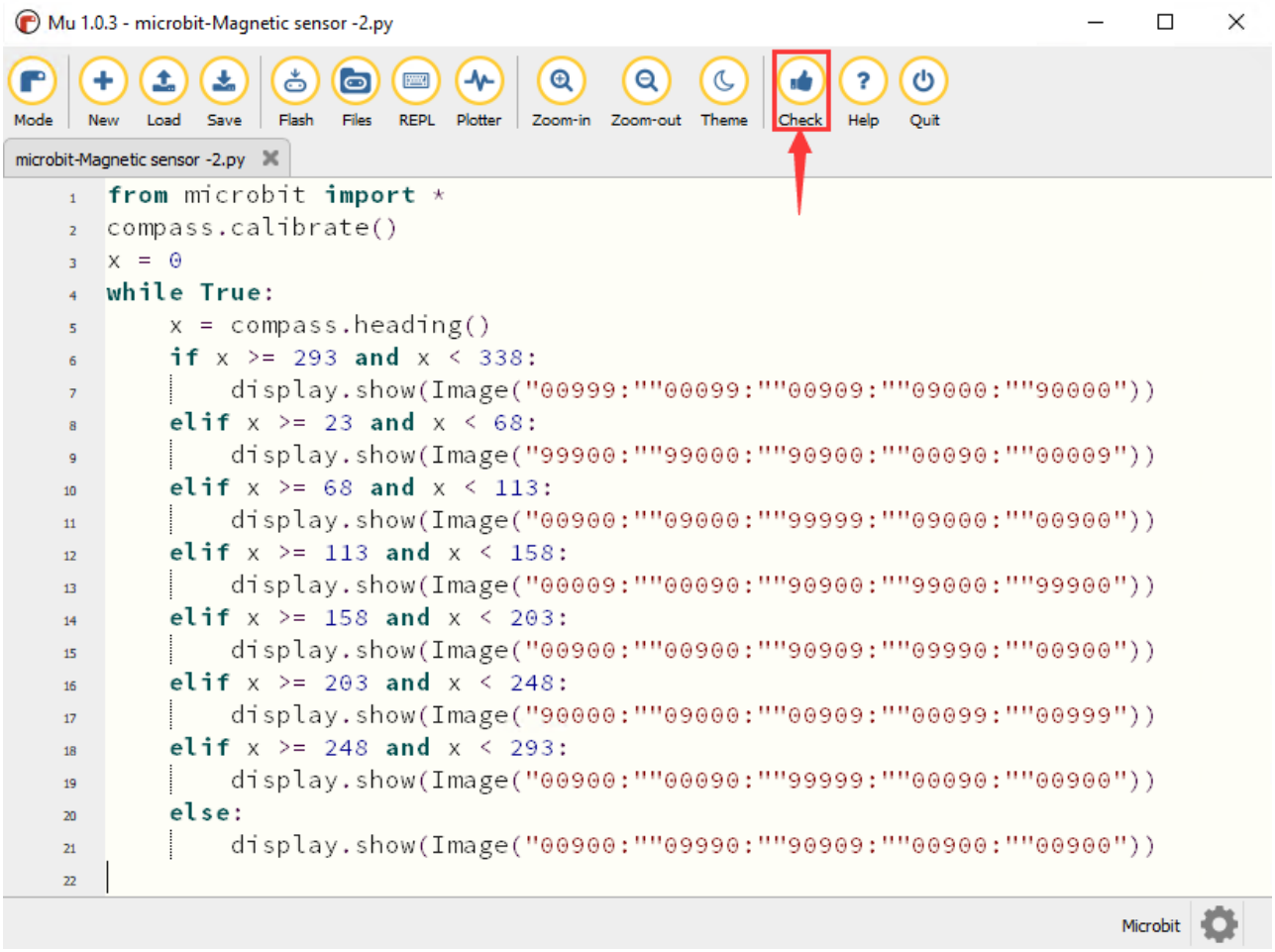
(How to load the project code?)

File Type	Route	File Name
Python file	../Python code/6.6：Microbit’ s Compass	Code 2.py

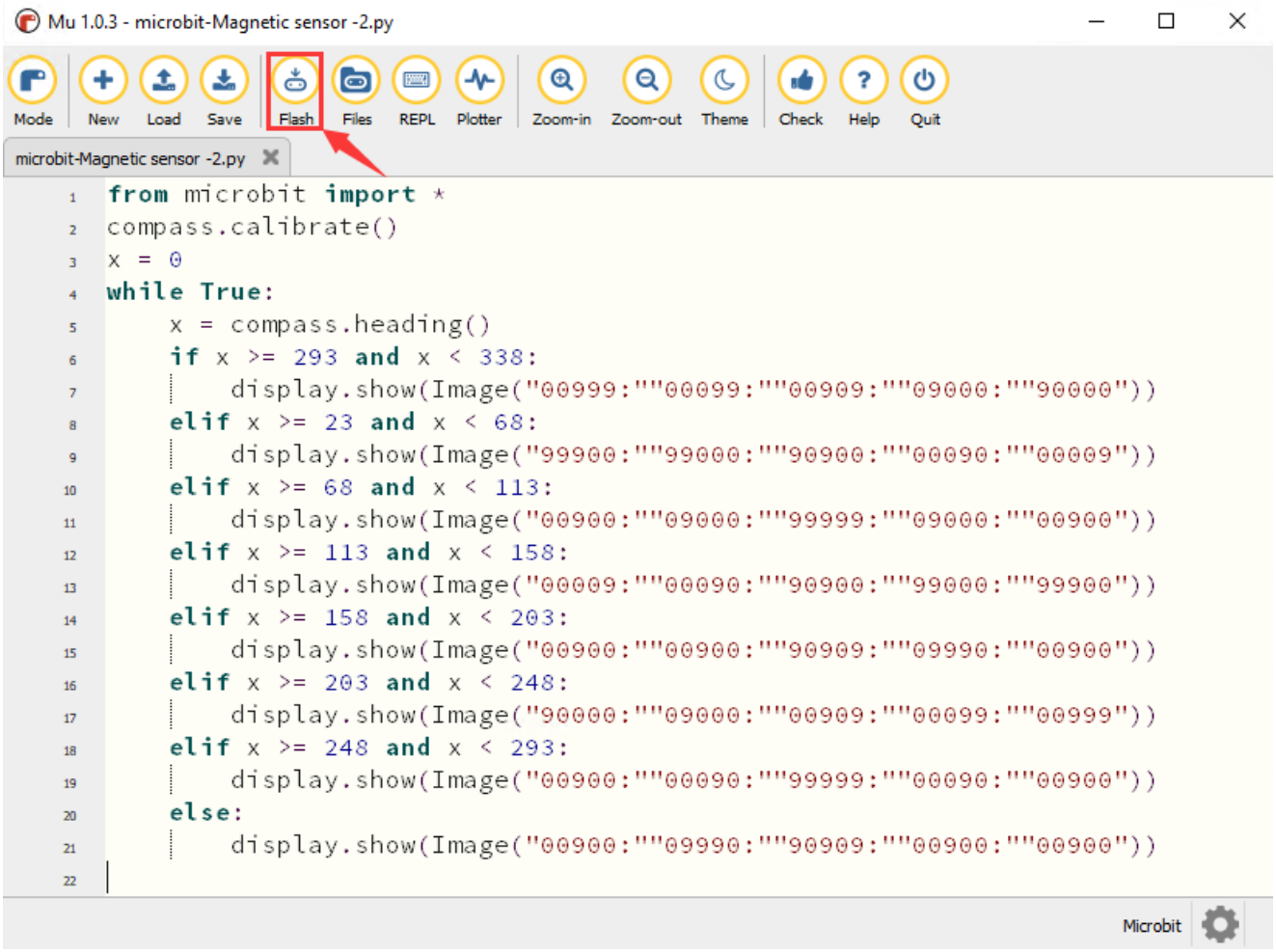
Or, you could input code in the editing window by yourself.



Click “Check” to examine error in the code. The program proves wrong if underlines and cursors are shown.



If the code is correct, connect micro:bit to computer and click “Flash” to download code to micro:bit board



4.Test Result:

Upload code 2 onto micro:bit board and don’ t plug off USB cable. After calibration, tilt Micro:bit board, the LED dot matrix displays the direction signs

5.Code Explanation:

from microbit **import** *	import the library file of micro:bit
compass.calibrate()	Compass calibration
while True:	This is a permanent loop, which makes micro:bit execute the code of it.
if button_a.is_pressed(): display.scroll(compass.heading())	When the button A is pressed Micro:bit scrolls to show the value of compass
x = 0	Set variable x=0
x = compass.heading()	Set the value of compass to variable x
if...else if...else	Condition judgement statement:if...else if...else
display.show(Image("00999:""00099:""00909:""09000:""90000"))	Micro:bit shows the Northeast arrow sign
display.show(Image("99900:""99000:""90900:""00090:""00009"))	Micro:bit shows the Northwest arrow sign
display.show(Image("00900:""09000:""99999:""09000:""0090	Micro:bit shows the Southwest arrow sign Micro:bit shows the South arrow sign Micro:bit shows the East arrow sign Micro:bit shows the North arrow sign

0")) display.show(Image("00009:"" 00090:""90900:""99000:""9990 0")) display.show(Image("00900:"" 00900:""90909:""09990:""0090 0")) display.show(Image("90000:"" 09000:""00909:""00099:""0099 9")) display.show(Image("00900:"" 00090:""99999:""00090:""0090 0")) display.show(Image("00900:"" 09990:""90909:""00900:""0090 0"))	

6.7: 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.

What you need to get started

(1) Link micro:bit board with computer via USB cable.

(2) Open the offline version of Mu

3. Test Code:

Code 1:

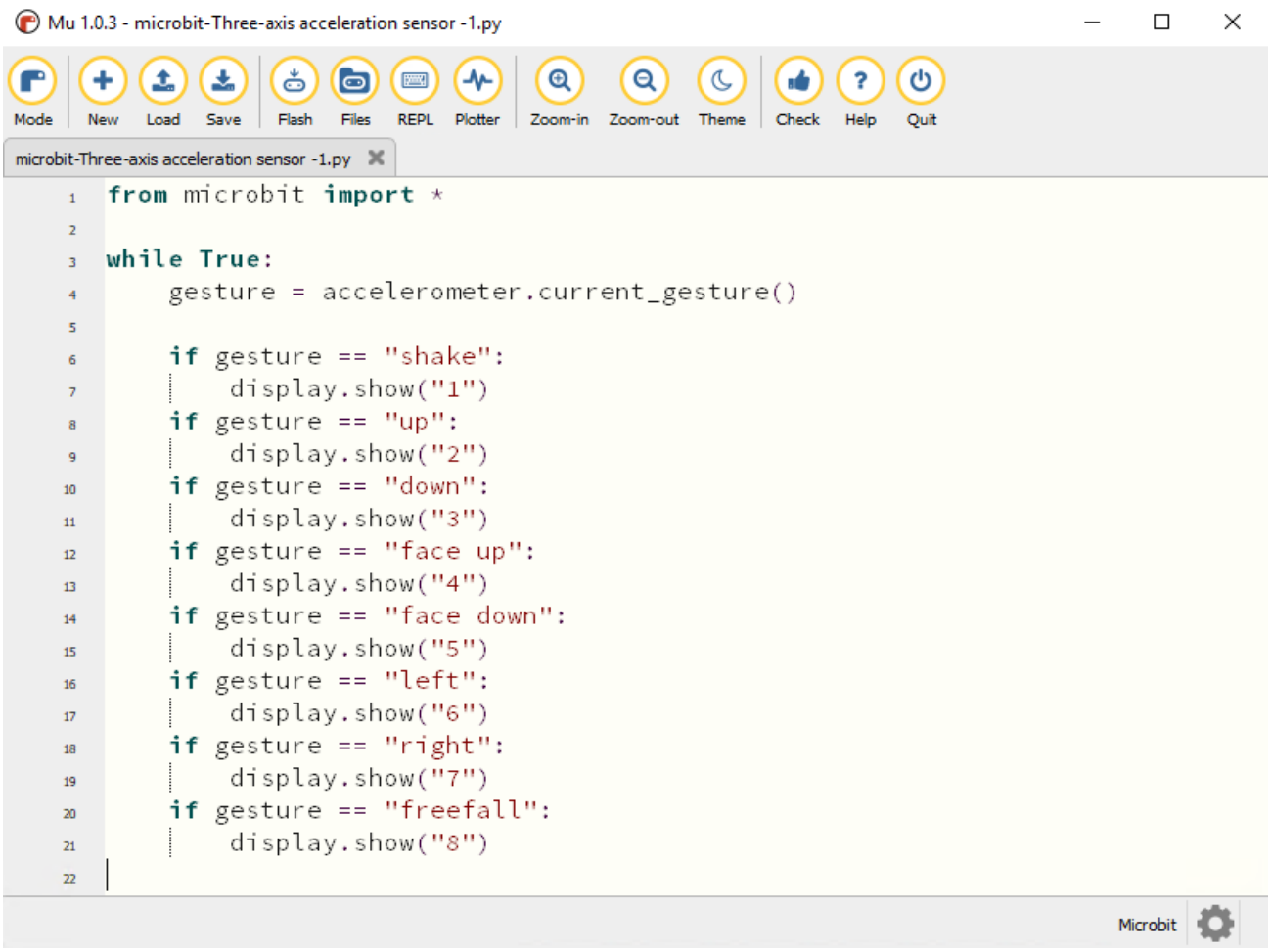
Different patterns will be displayed as a result of unequal operations

Open "Code 1.py " file in Mu

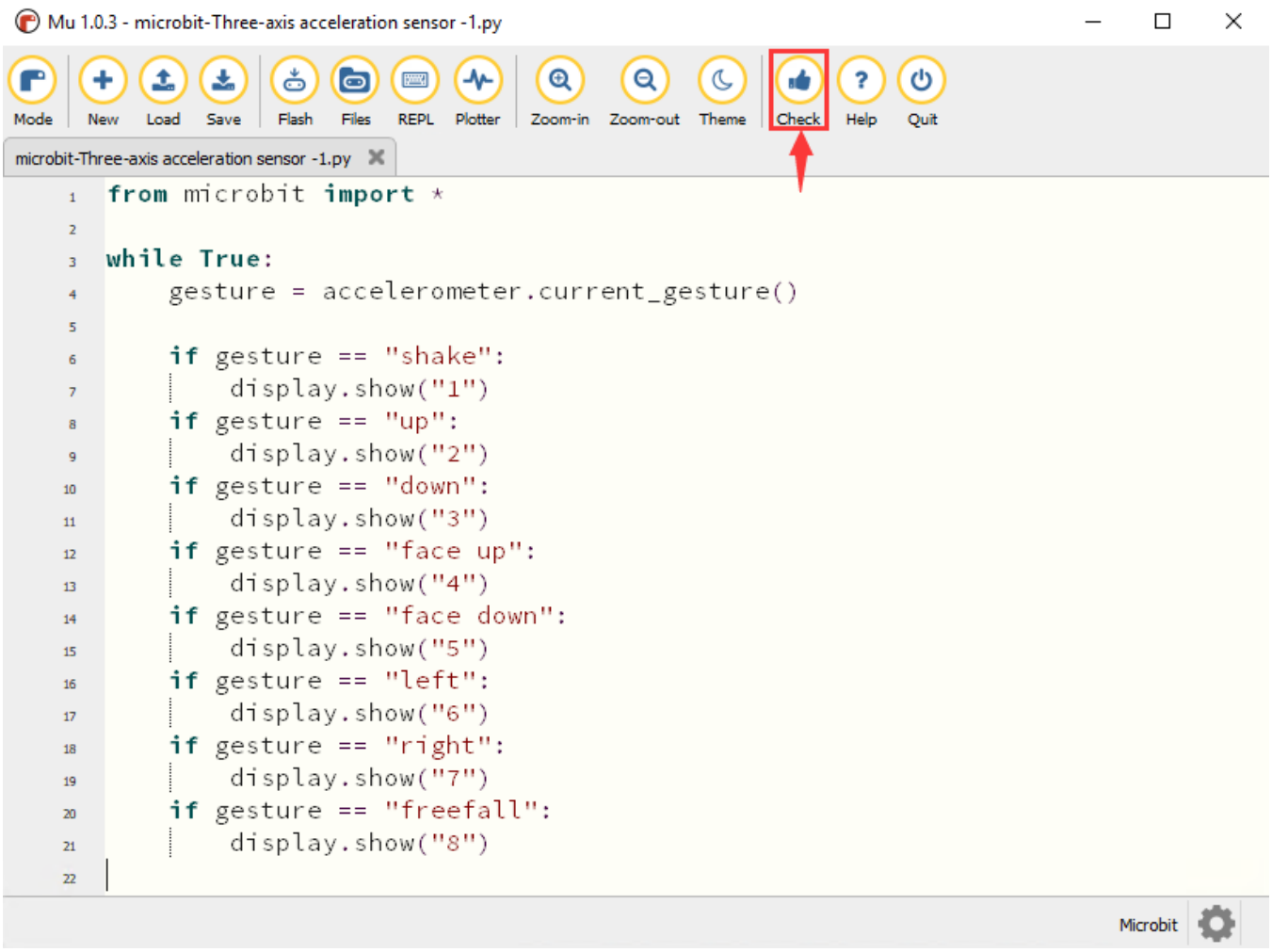
(How to load the project code?)

File Type	Route	File Name
Python file	../Python code/6.7: Accelerometer	Code 1.py

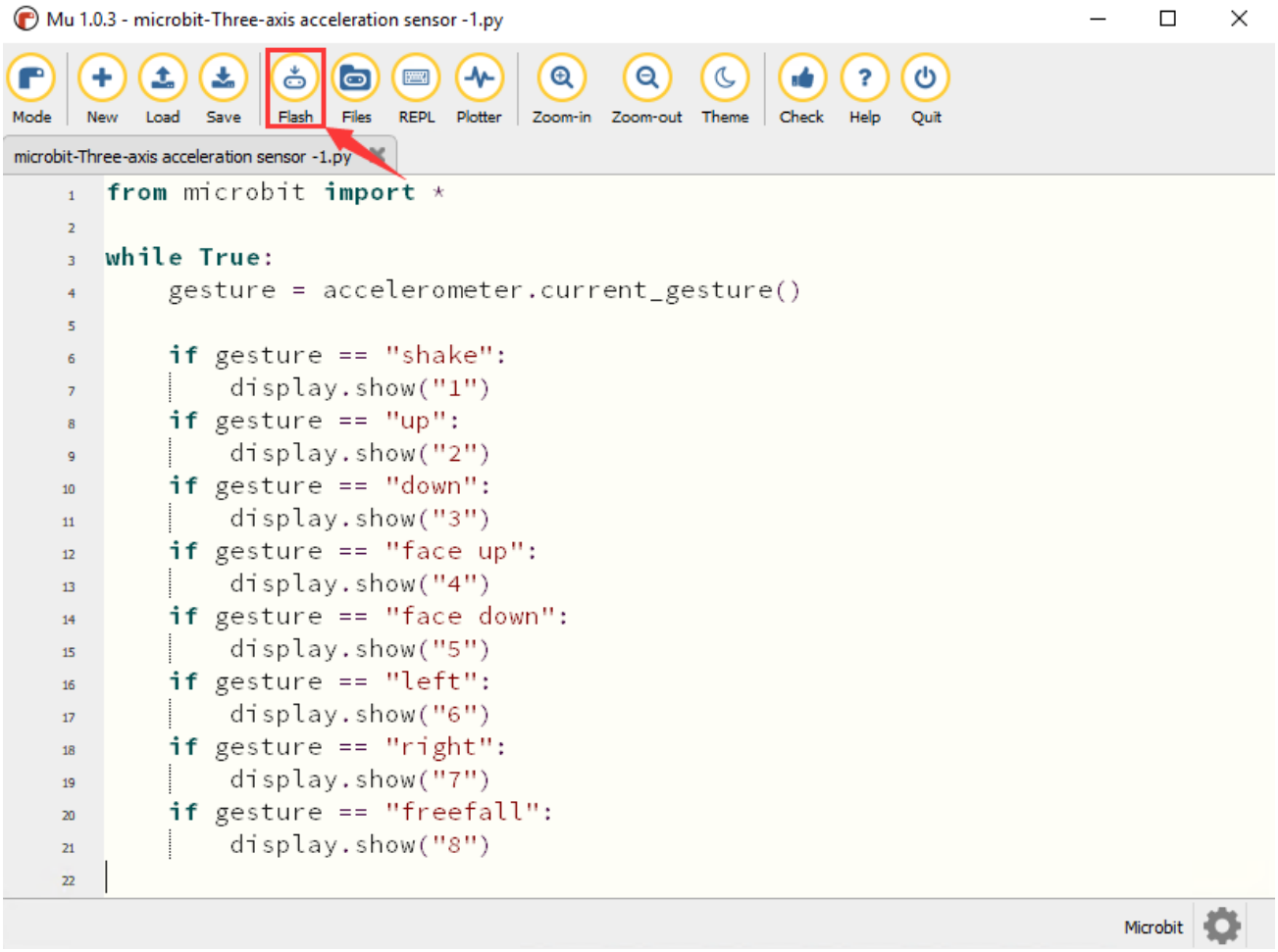
The successful loading is shown below.You can also input code in the edit window yourself.(note:all English words and symbols must be written in English)



Click "Check" to examine error in the code. The program proves wrong if underlines and cursors are shown.



If the code is correct, connect micro:bit to computer and click "Flash" to download code to micro:bit board



Code 2:

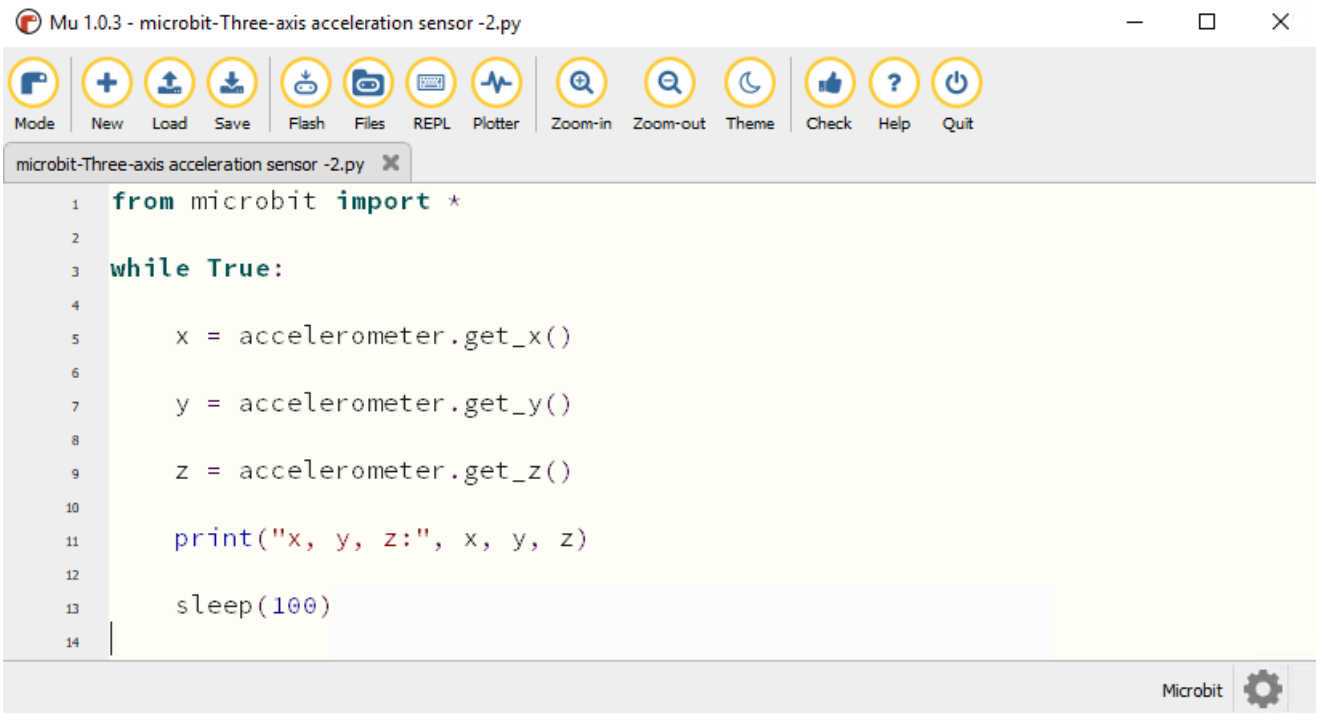
Detect different acceleration values on X, Y and Z axis.

Open file "Code 2.py" in Mu.

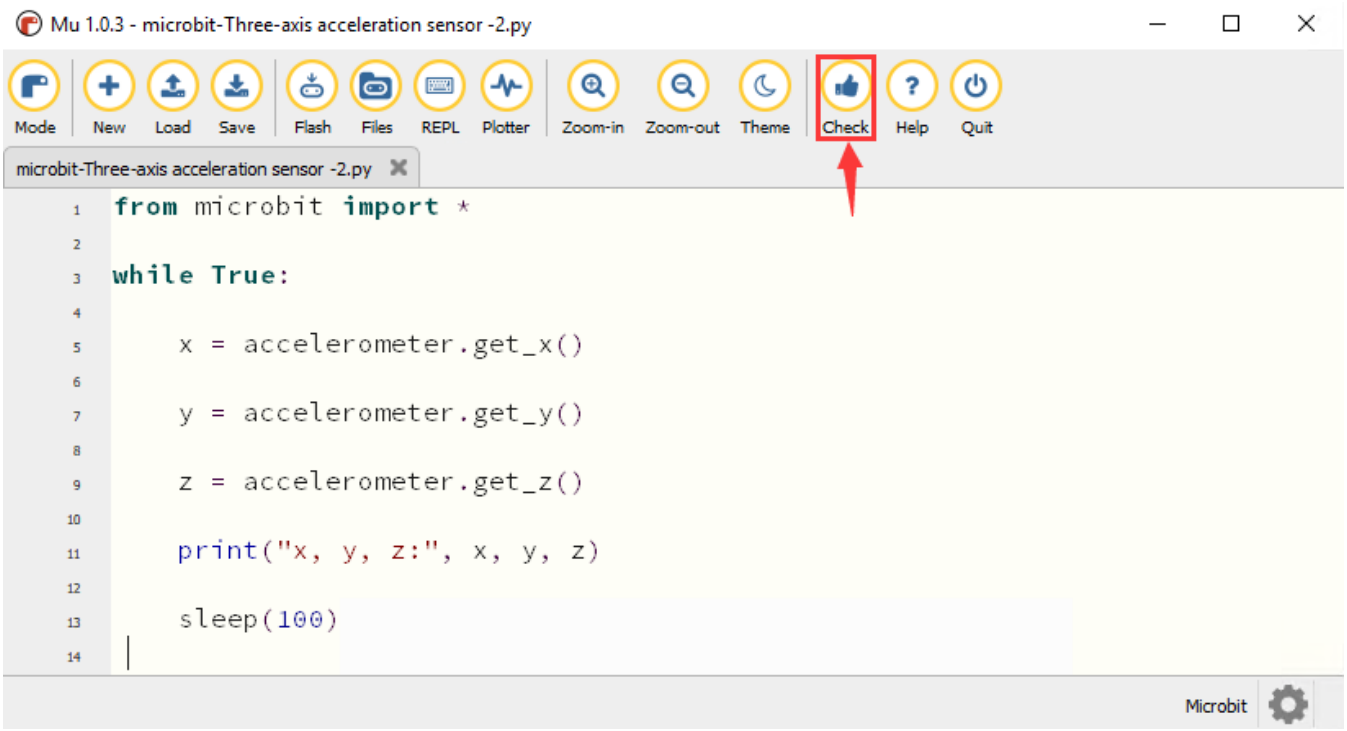
(How to load the project code?)

File Type	Route	File Name
Python file	../Python code/6.7: Accelerometer	Code 2.py

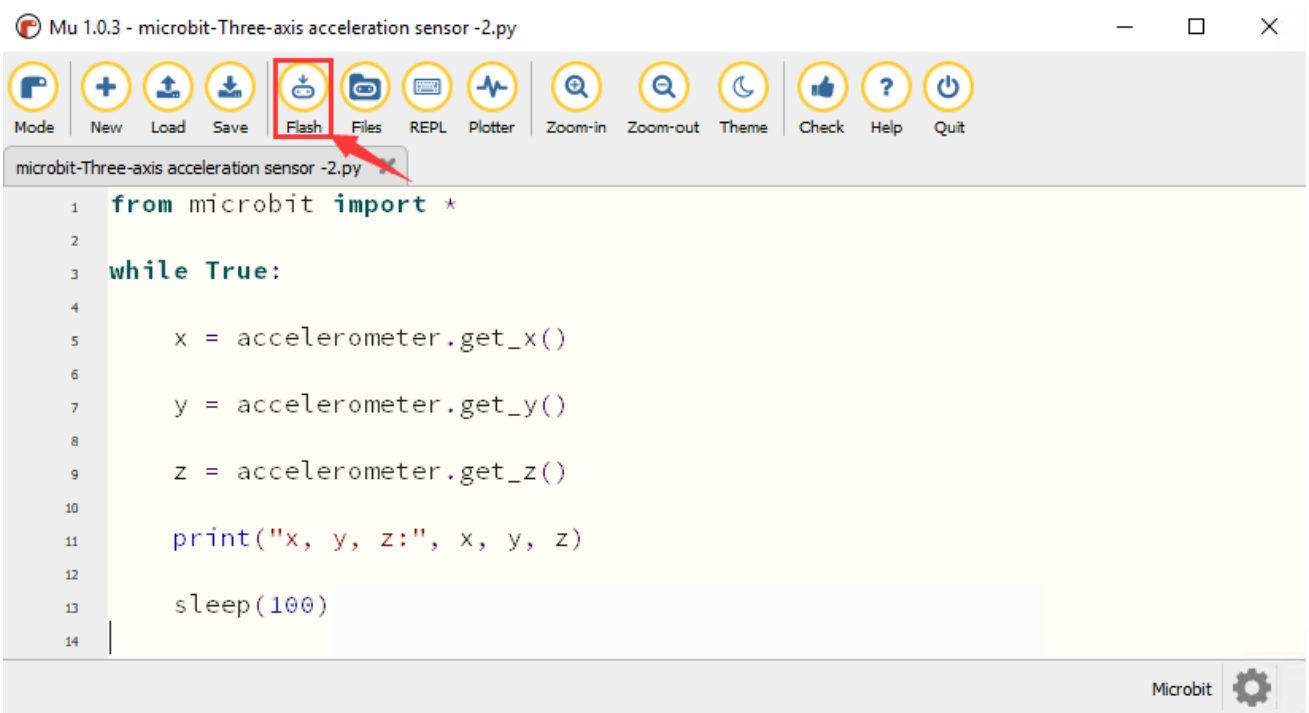
The successful loading is shown below.You can also input code in the edit window yourself.(note:all English words and symbols must be written in English)



Click “Check” to examine error in the code. The program proves wrong if underlines and cursors are shown.

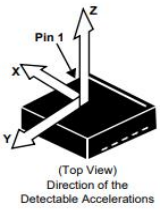


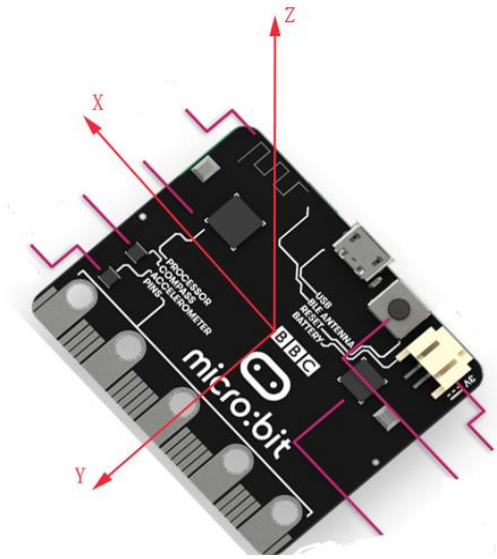
If the code is correct, connect micro:bit to computer and click "Flash" to download code to micro:bit board.



Look up the MMA8653FC manual

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

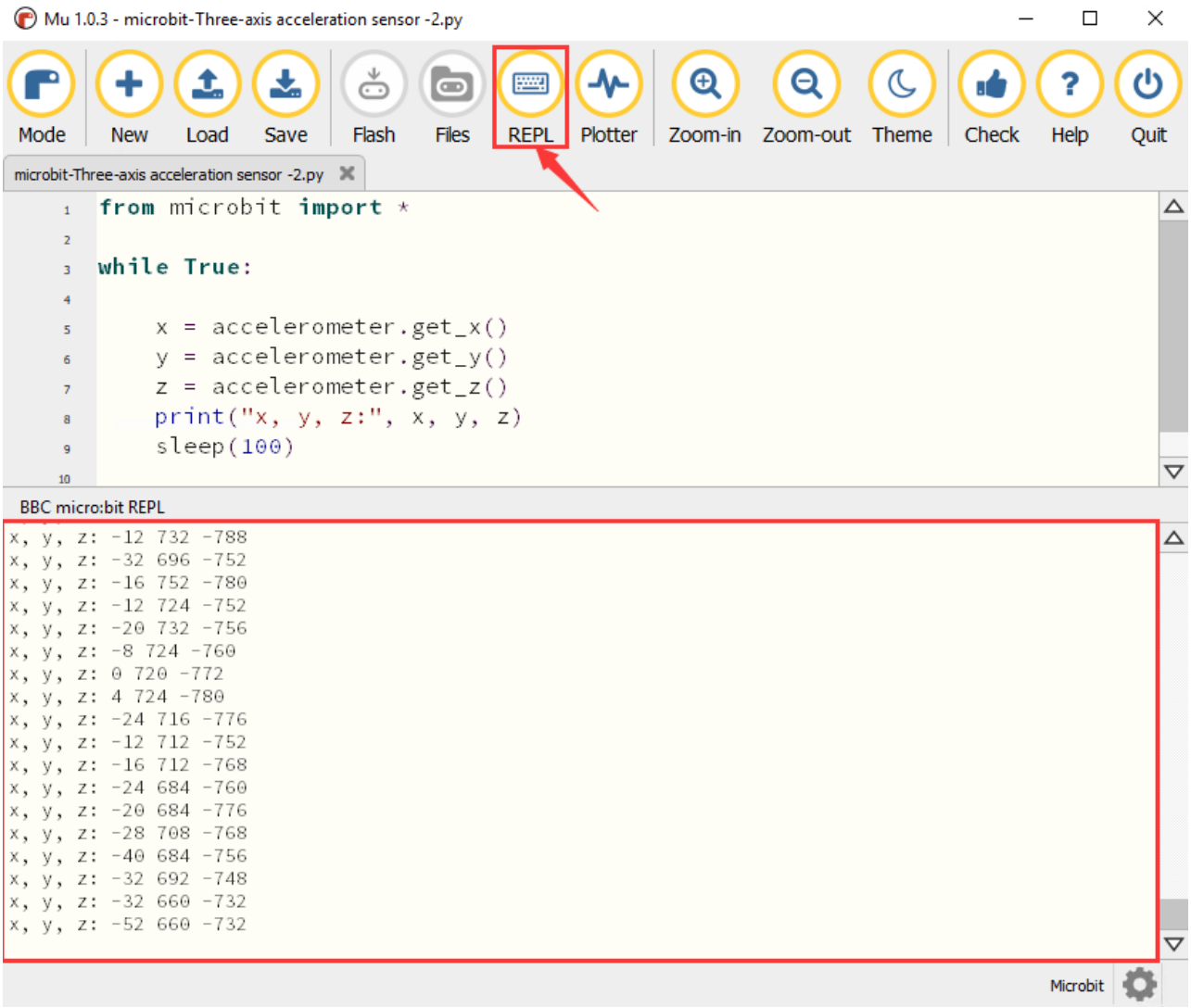




The value of acceleration on the X-axis, Y-axis, and Z-axis, as well as the synthesis of acceleration (the synthesis of gravitational acceleration and other external forces). Then flip the micro:bit board, the data is shown below:

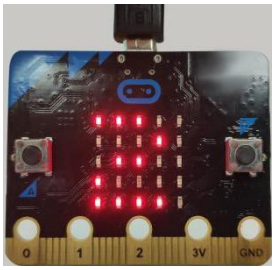
Download code 2 onto micro:bit board, and don’ t pull off the USB cable.

Click “REPL” and press the reset button. The value of acceleration on X axis, Y axis and Z axis are shown below



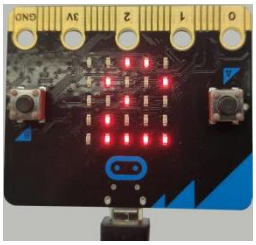
4. Test Result:

Download code 1 to micro:bit board and plug in power with USB cable shake the Micro:bit board then the number 1 appears.



When the logo points to the North, the number 2 is displayed;

When the logo points to the South, the number 3 is displayed;

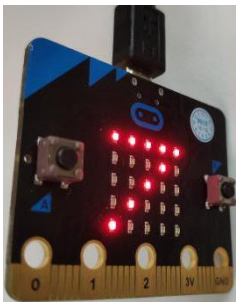


When the LED dot matrix is upward, the number 4 is shown.

On the contrary, the number 5 is displayed when the LED dot matrix is downward.

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 cause board damage)

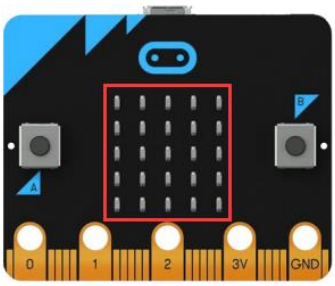
5.Code Explanation：

from microbit **import** *	import the library file of micro:bit
gesture = accelerometer.current_gesture()	Set accelerometer.current_gesture() to gesture
while True:	This is a permanent loop that makes micro:bit execute the code of it.
if gesture == "shake": display.show("1") **if** gesture == "up":	Shaking micro:bit board, number 1 will appear When log points to the North,

display.show("2") **if** gesture == "down": display.show("3") **if** gesture == "face up": display.show("4") **if** gesture == "face down": display.show("5") **if** gesture == "left": display.show("6") **if** gesture == "right": display.show("7") **if** gesture == "freefall": display.show("8")	number 2 will show up. When log points to the South, number 3 will be shown When the LED dot matrix is upward, the number 4 is shown. the number 5 is displayed when the LED dot matrix is downward. When Micro:bit board is tilt to the left, number 6 is shown. When micro:bit is tilt to the right 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.
x = accelerometer.get_x() y = accelerometer.get_y() z = accelerometer.get_z()	Read the acceleration value on x axis，the return value is integer, and set x= the read value on x axis Read the acceleration value on y

	axis，the return value is integer, and set y= the read value on y axis Read the acceleration value on z axis，the return value is integer, and set z= the read value on z axis
print("x, y, z:", x, y, z)	The value of acceleration will be shown
sleep(100)	Delay in 100ms

6.8：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 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.

What you need to get started

(1) Link micro:bit board with computer via USB cable.

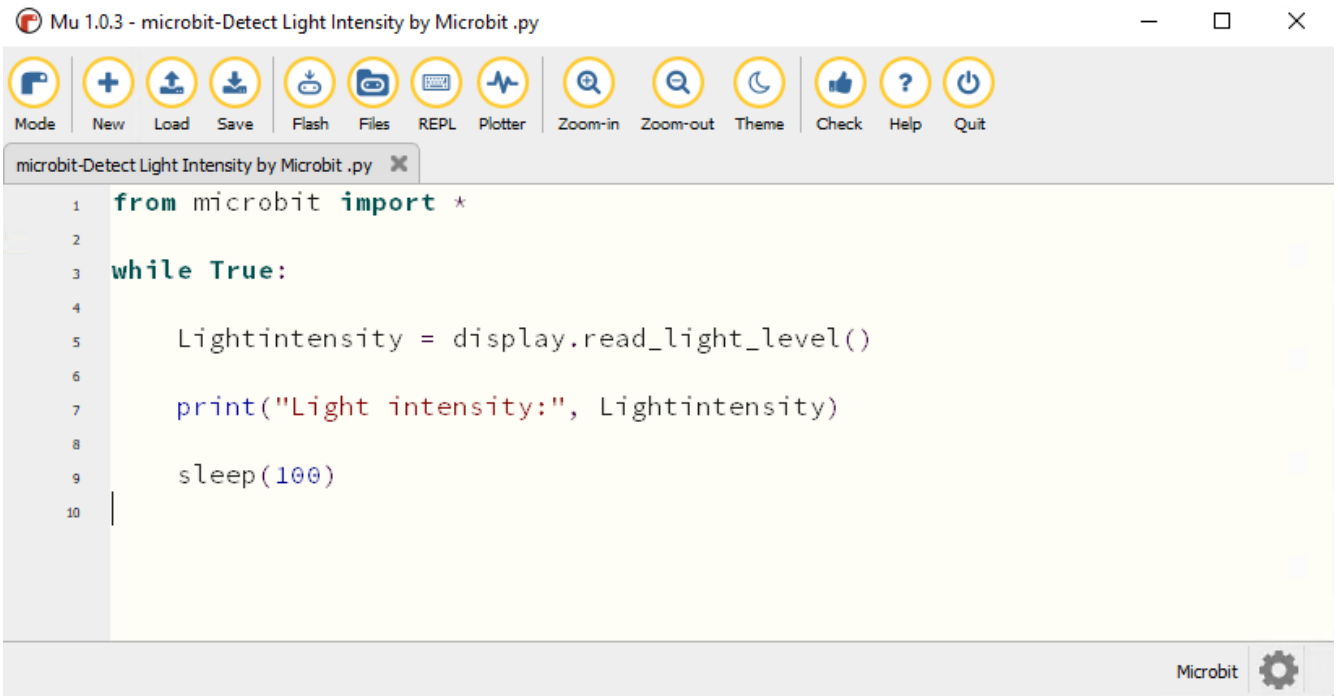
(2) Open the offline version of Mu

2. Test Code:

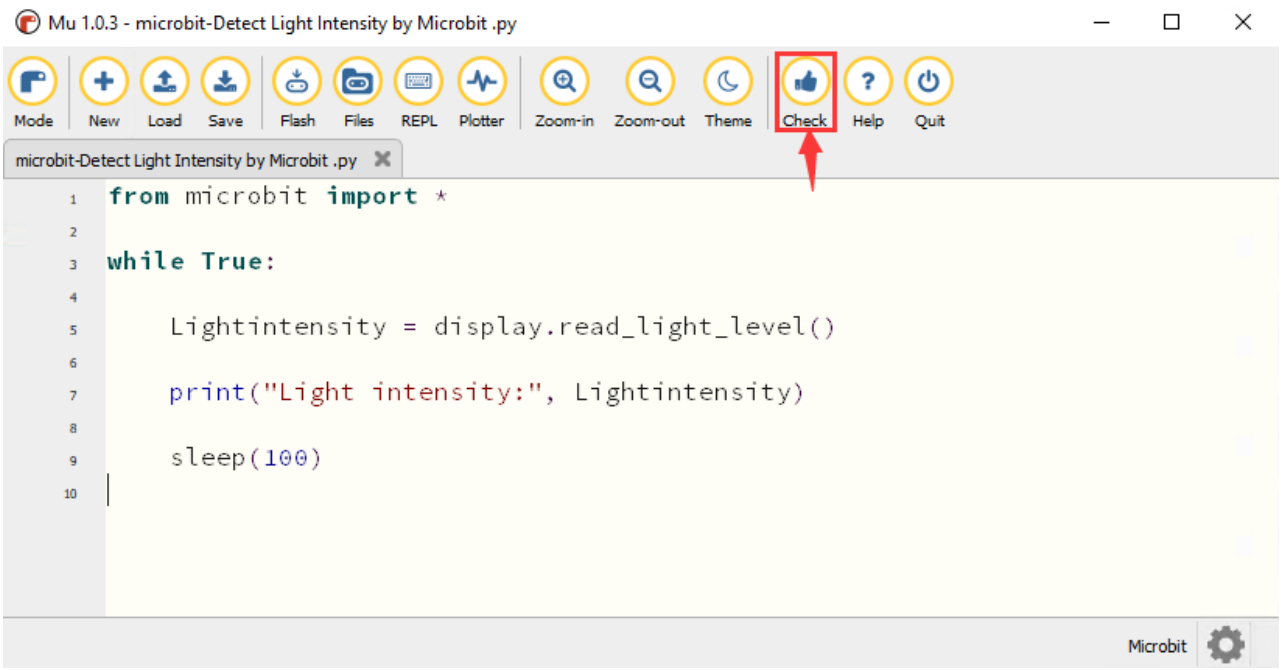
Open "microbit-Detect Light Intensity by Micro:bit .py" file in Mu software, (How to load the project code?)

File Type	Route	File Name
Python file	../Python code/6.8: Detect Light Intensity by Micro:bit	microbit-Detect Light Intensity by Micro:bit .py

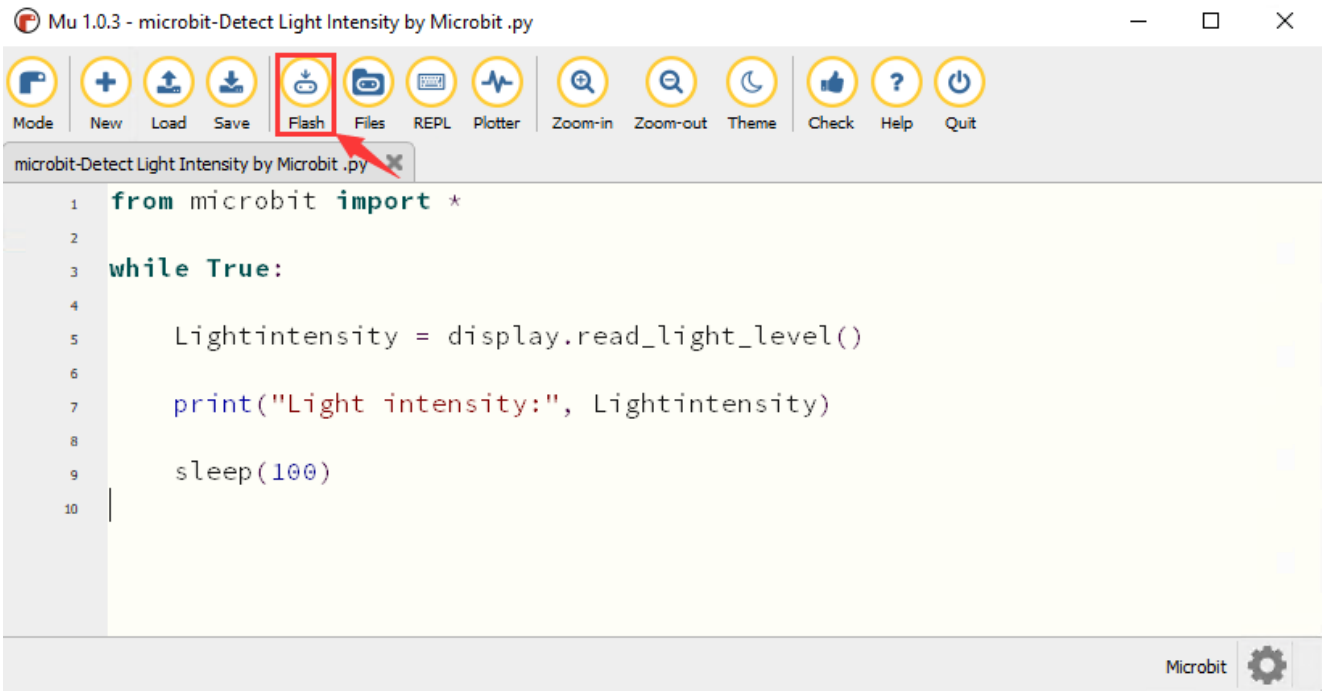
The successful loading is shown below.You can also input code in the edit window yourself.(note:all English words and symbols must be written in English)



Click "Check" to examine error in the code. The program proves wrong if underlines and cursors are shown.



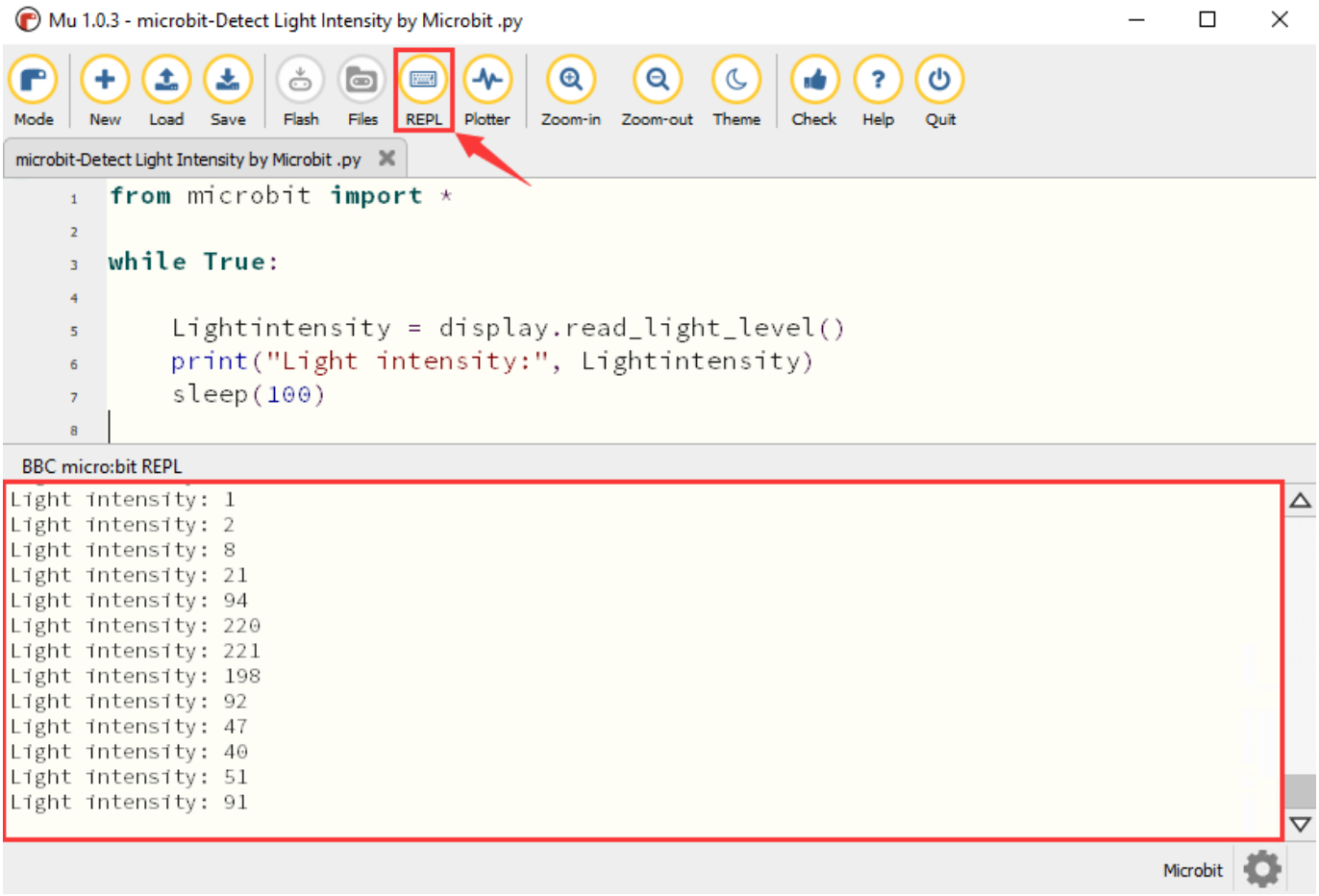
If the code is correct, connect micro:bit to computer and click "Flash" to download code to micro:bit board.



3. Test Result:

Download code onto micro:bit board, don’ t plug off USB cable. Click “REPL” and press the reset buttons, the light intensity value will be displayed, as shown below.

Covering the LED dot matrix, the intensity value is 0; on the contrary, the intensity value increases when placing micro:bit board under the sun.



5.Code Explanation:

from microbit **import** *	import the library file of micro:bit
gesture = accelerometer.current_gesture()	Set accelerometer.current_gesture() to gesture
while True:	This is permanent loop, and micro bit executes the code
Lightintensity =	Set display.read_light_level() to

display.read_light_level()	Lightintensity
print("Light intensity:", Lightintensity)	BBC microbit REPL prints the detected light intensity value
sleep(100)	Delay in 100ms

6.9: Bluetooth Wireless Communication

With 16k RAM, micro:bit owns a low-consumption Bluetooth module and support Bluetooth communication. However, BLE heap stack occupies 12K RAM, which implies that there is no enough space to run microPython.

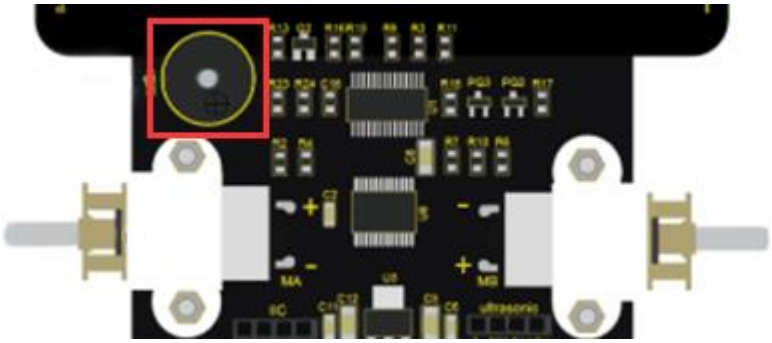
At present, microPython doesn’ t support Bluetooth.

https://microbit-micropython.readthedocs.io/en/latest/ble.html

In the sequent lessons, we will conduct experiments with micro:bit and other sensors or modules.

Special note: Disconnect power before installing or removing micro:bit on keyestudio T Type Shield, which can prevent from burning micro:bit.

6.10：Passive Sensor



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

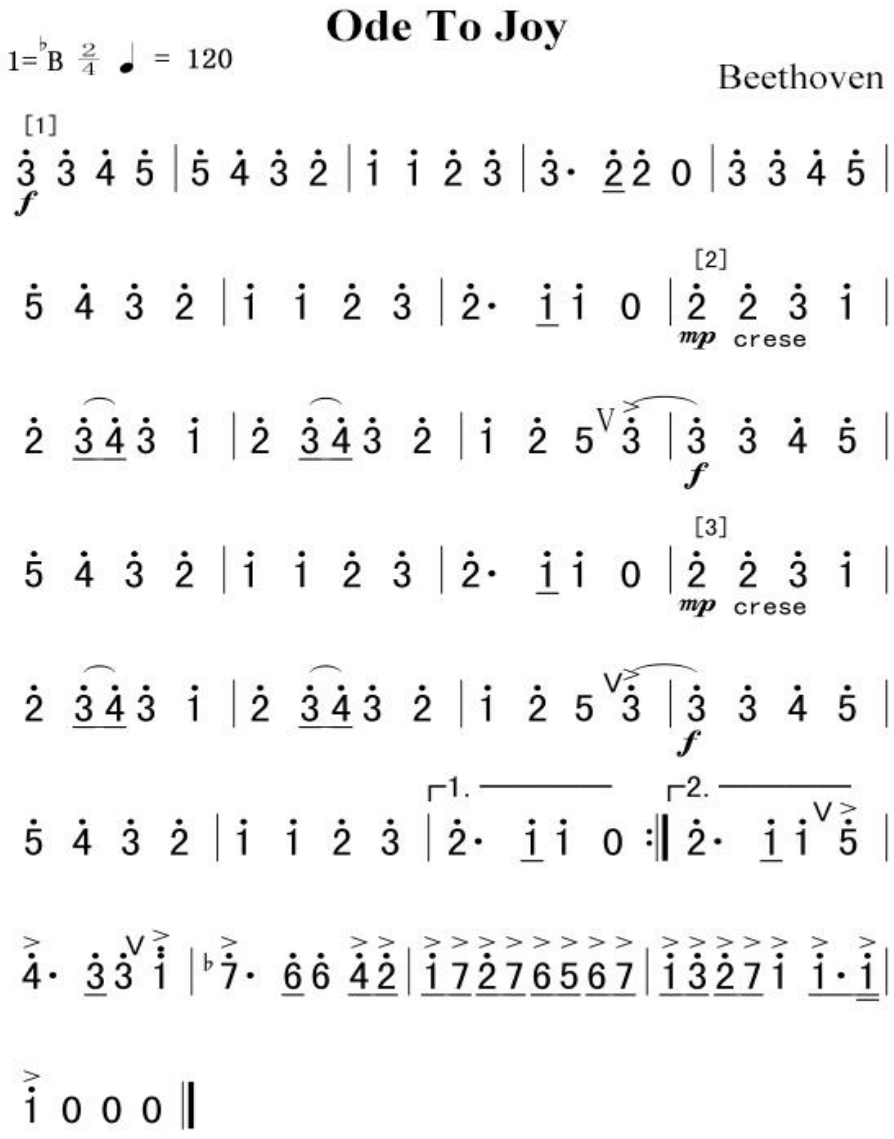
The number depends on high or low tone. The larger the number, the higher the tone. When the number is same, the frequency (tone) is getting higher and higher from C to _B.

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.

1/4Beat 1Beat 1/2Beat

(1 1 1)

Here is the notation of Ode to Joy.



What you need to get started

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

(2) Place batteries into battery holder.

(3) Plug smart car in power.

(4) Link micro:bit board with computer via USB cable.

(5) Open the offline version of Mu

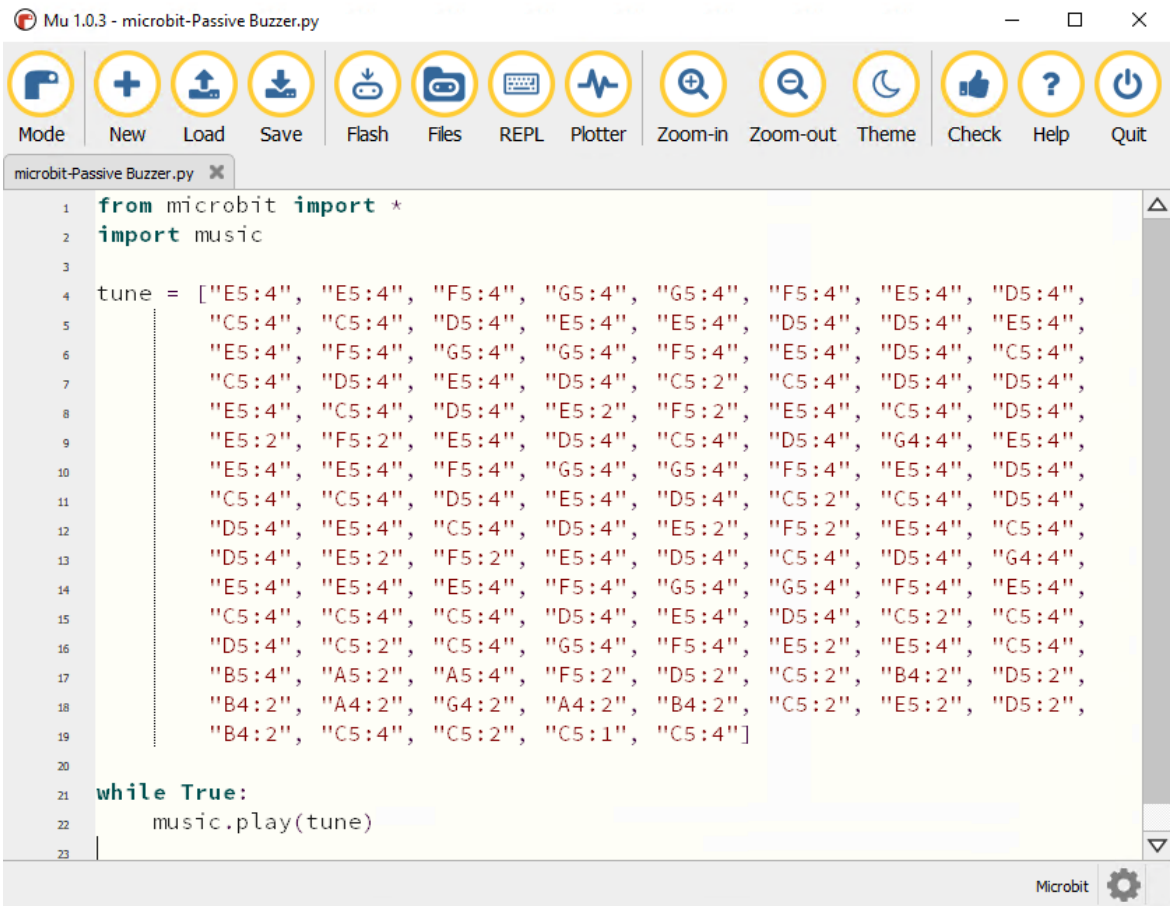
2. Test Code:

Open "microbit-Passive Buzzer.py " file in Mu software,

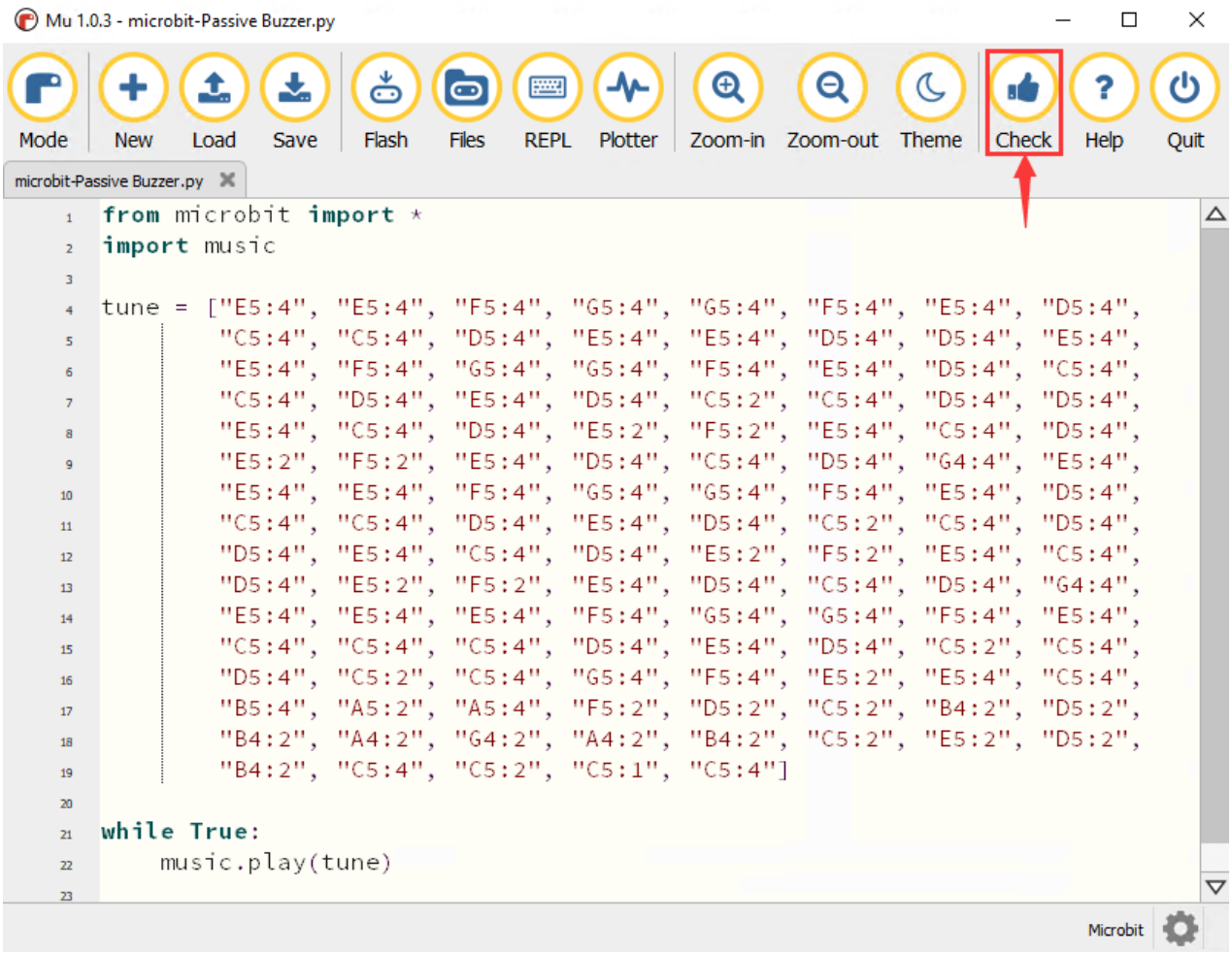
(How to load the project code?)

File Type	Route	File Name
Python file	../Python code/6.10: Passive Buzzer	microbit-Passive Buzzer.py

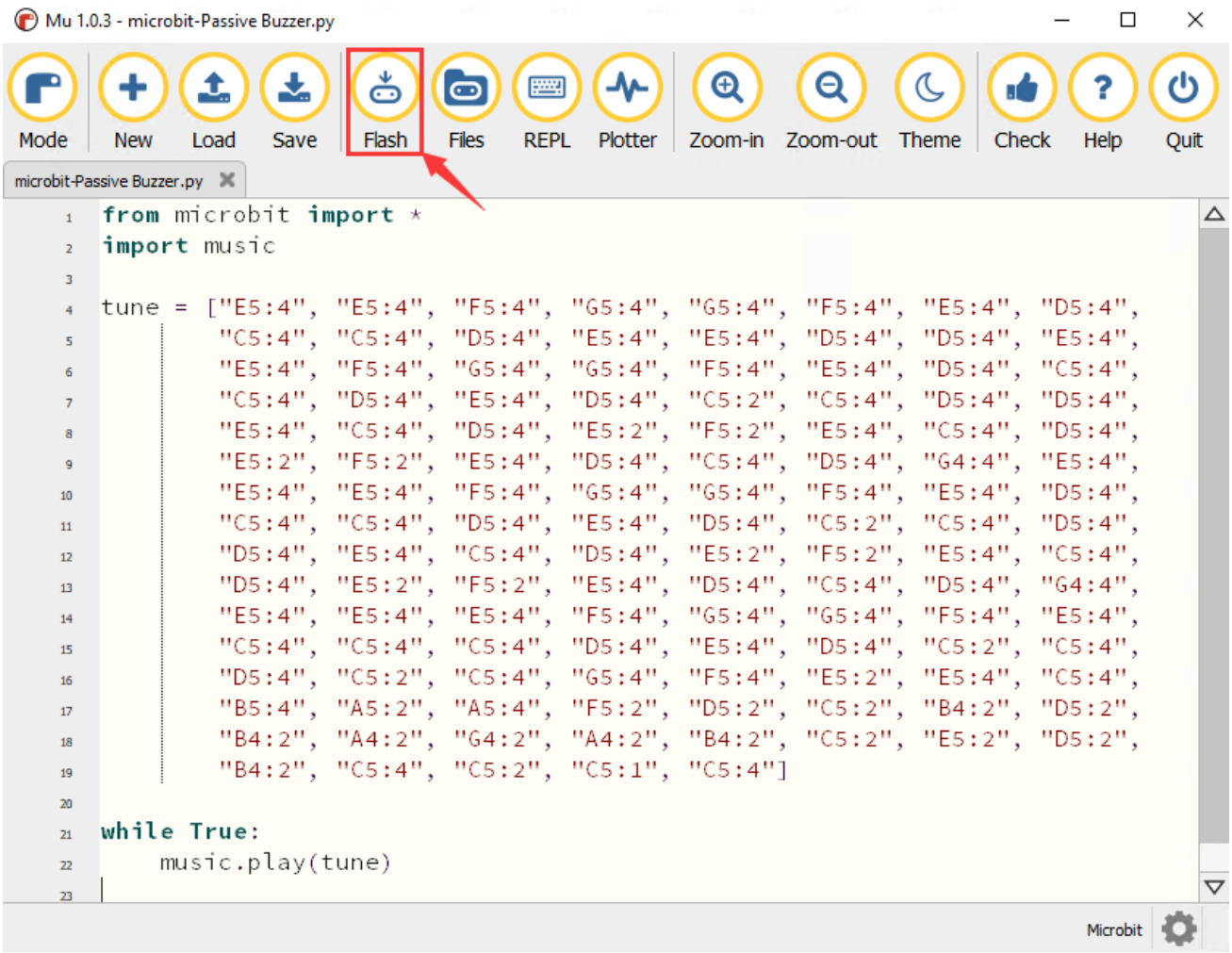
The successful loading is shown below.You can also input code in the edit window yourself.(note:all English words and symbols must be written in English)



Click “Check” to examine error in the code. The program proves wrong if underlines and cursors are shown.



If the code is correct, connect micro:bit to computer and click "Flash" to download code to micro:bit board.



4 .Test Result:

Download code onto micro:bit board, and turn on the switch on robot car;

"Ode to joy" song will be played in loop way.

5.Code Explanation:

from microbit **import** *	import the library file of micro:bit

import music	import music files containing the control of sound
tune = ["E5:4", "E5:4", "F5:4", "G5:4", "G5:4", "F5:4", "E5:4", "D5:4", "C5:4", "C5:4", "D5:4", "E5:4", "E5:4", "D5:4", "D5:4", "E5:4", "E5:4", "F5:4", "G5:4", "G5:4", "F5:4", "E5:4", "D5:4", "C5:4", "C5:4", "D5:4", "E5:4", "D5:4", "C5:2", "C5:4", "D5:4", "D5:4", "E5:4", "C5:4", "D5:4", "E5:2", "F5:2", "E5:4", "C5:4", "D5:4", "E5:2", "F5:2", "E5:4", "D5:4", "C5:4", "D5:4", "G4:4", "E5:4", "E5:4", "E5:4", "F5:4", "G5:4", "G5:4", "F5:4", "E5:4", "D5:4", "C5:4", "C5:4", "D5:4", "E5:4", "D5:4", "C5:2",	Create variable tune

"C5:4", "D5:4", "D5:4", "E5:4", "C5:4", "D5:4", "E5:2", "F5:2", "E5:4", "C5:4", "D5:4", "E5:2", "F5:2", "E5:4", "D5:4", "C5:4", "D5:4", "G4:4", "E5:4", "E5:4", "E5:4", "F5:4", "G5:4", "G5:4", "F5:4", "E5:4", "C5:4", "C5:4", "C5:4", "D5:4", "E5:4", "D5:4", "C5:2", "C5:4", "D5:4", "C5:2", "C5:4", "G5:4", "F5:4", "E5:2", "E5:4", "C5:4", "B5:4", "A5:2", "A5:4", "F5:2", "D5:2", "C5:2", "B4:2", "D5:2", "B4:2", "A4:2", "G4:2", "A4:2", "B4:2", "C5:2", "E5:2", "D5:2", "B4:2", "C5:4", "C5:2", "C5:1", "C5:4"]	
while True:	This is a permanent loop that

	makes micro:bit execute the code of it.
music.play(tune)	Call the function play（） to save the notes in variable tune

6. References:

music.play()： used to play music and MicroPython has abundant **music melody.**

More info, please the below link:

https://microbit-micropython.readthedocs.io/en/latest/tutorials/music.html

6.11： 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.

1. What you need to get started

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

(2) Put batteries into battery holder

(3) Turn on the switch at the back of micro:bit car

(4) Link micro:bit board with computer via USB cable.

(5) Open the offline version of Mu

2. Test Code：

Code 1

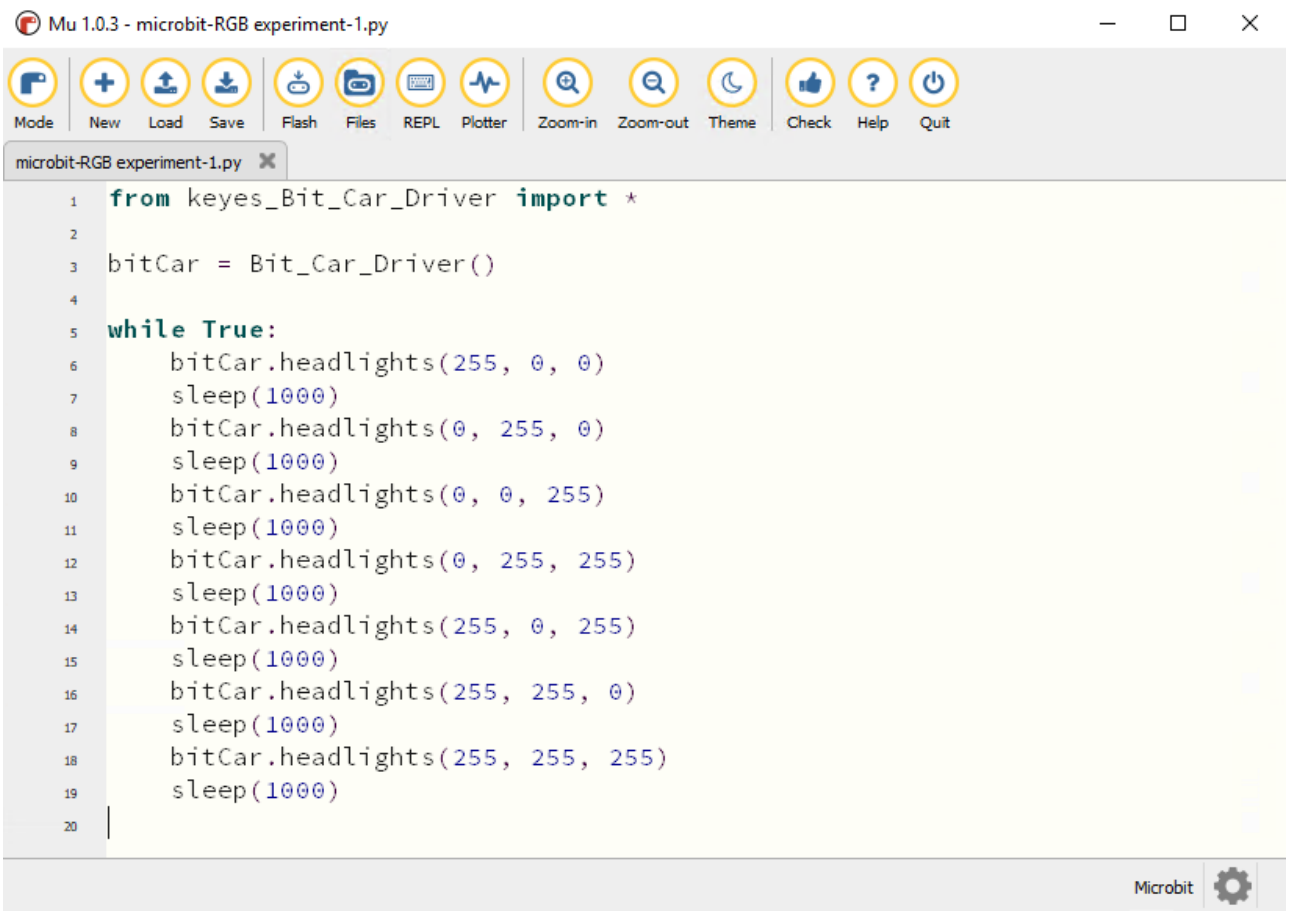
RGB shows seven colors in loop way.

Open “Code 1.py” file in Mu

(How to load the project code?)

File Type	Route	File Name
Python file	../Python code/6.11： RGB Experiments	microbit-Code 1.py

The successful loading is shown below.You can also input code in the edit window yourself.(note:all English words and symbols must be written in English)

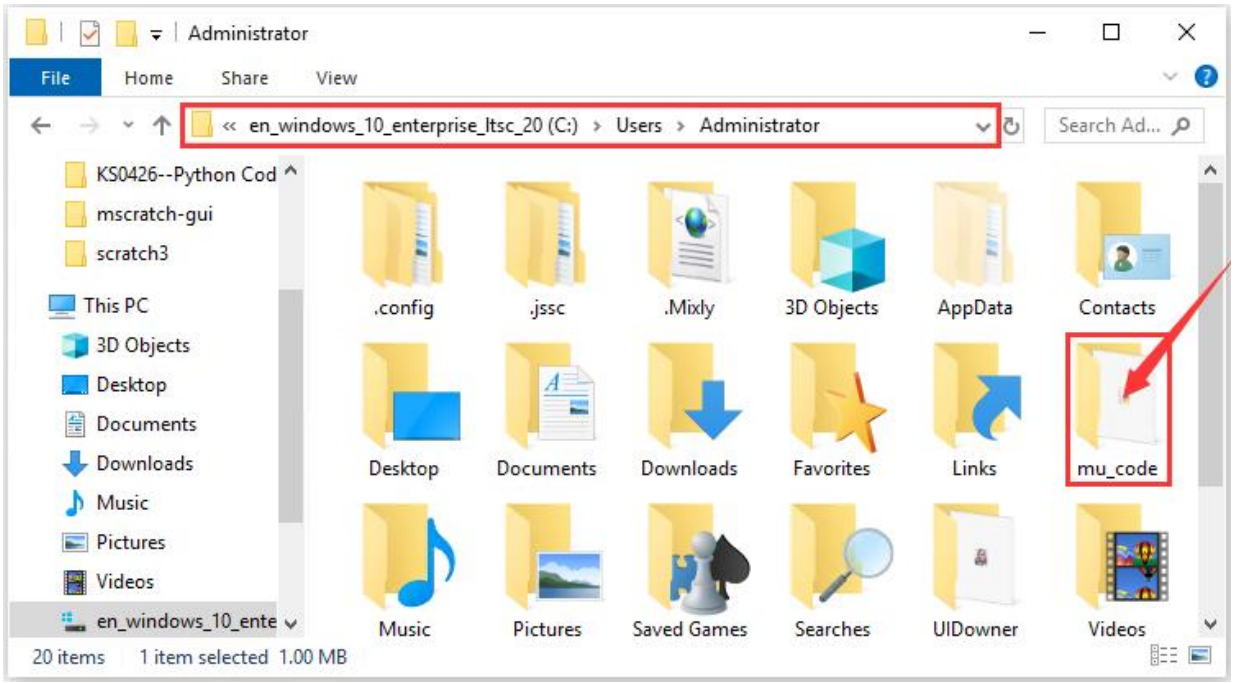


Import "keyes_Bit_Car_Driver.py " File

Don' t click "Flash" immediately, you need to firstly import "keyes_Bit_Car_Driver.py" file which includes the control method of micro:bit smart robot car, making Python code control robot car easily.

Files are mostly stored in the mu_code directory in your home directory. Mu’ s default directory is “Mu_code” .

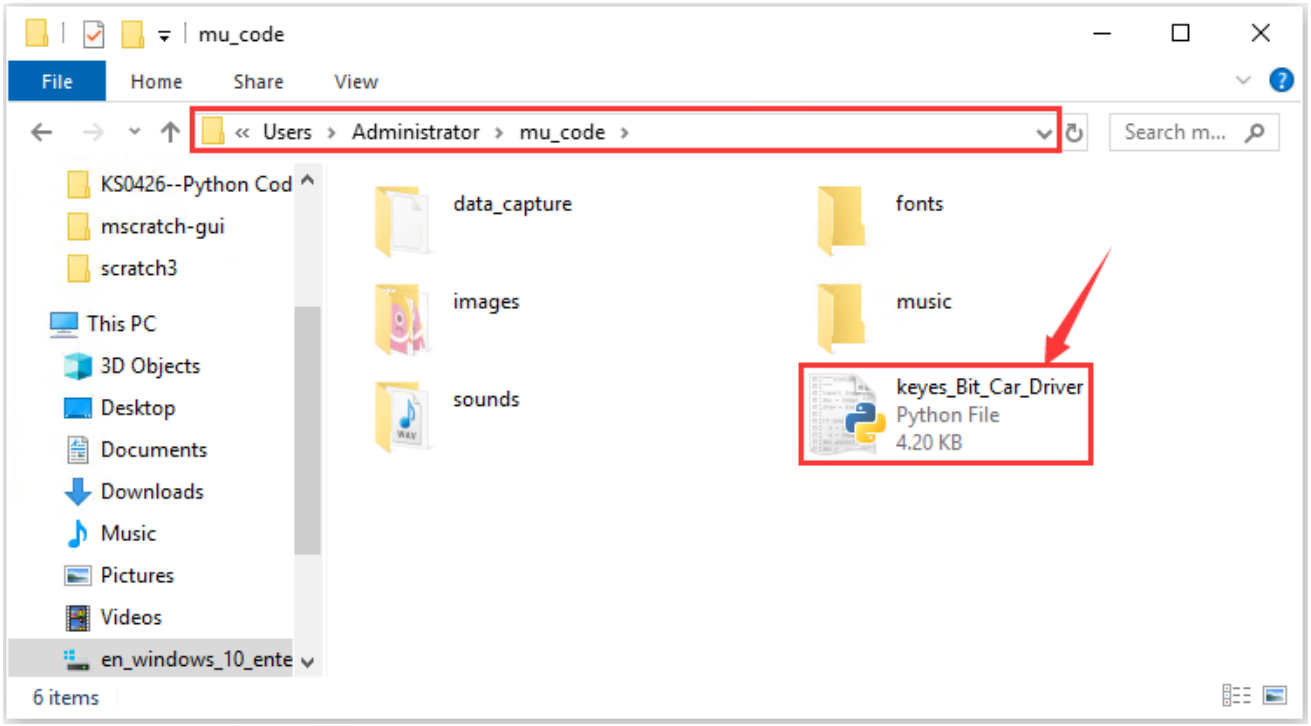
Refer to the link: https://codewith.mu/en/tutorials/1.0/files



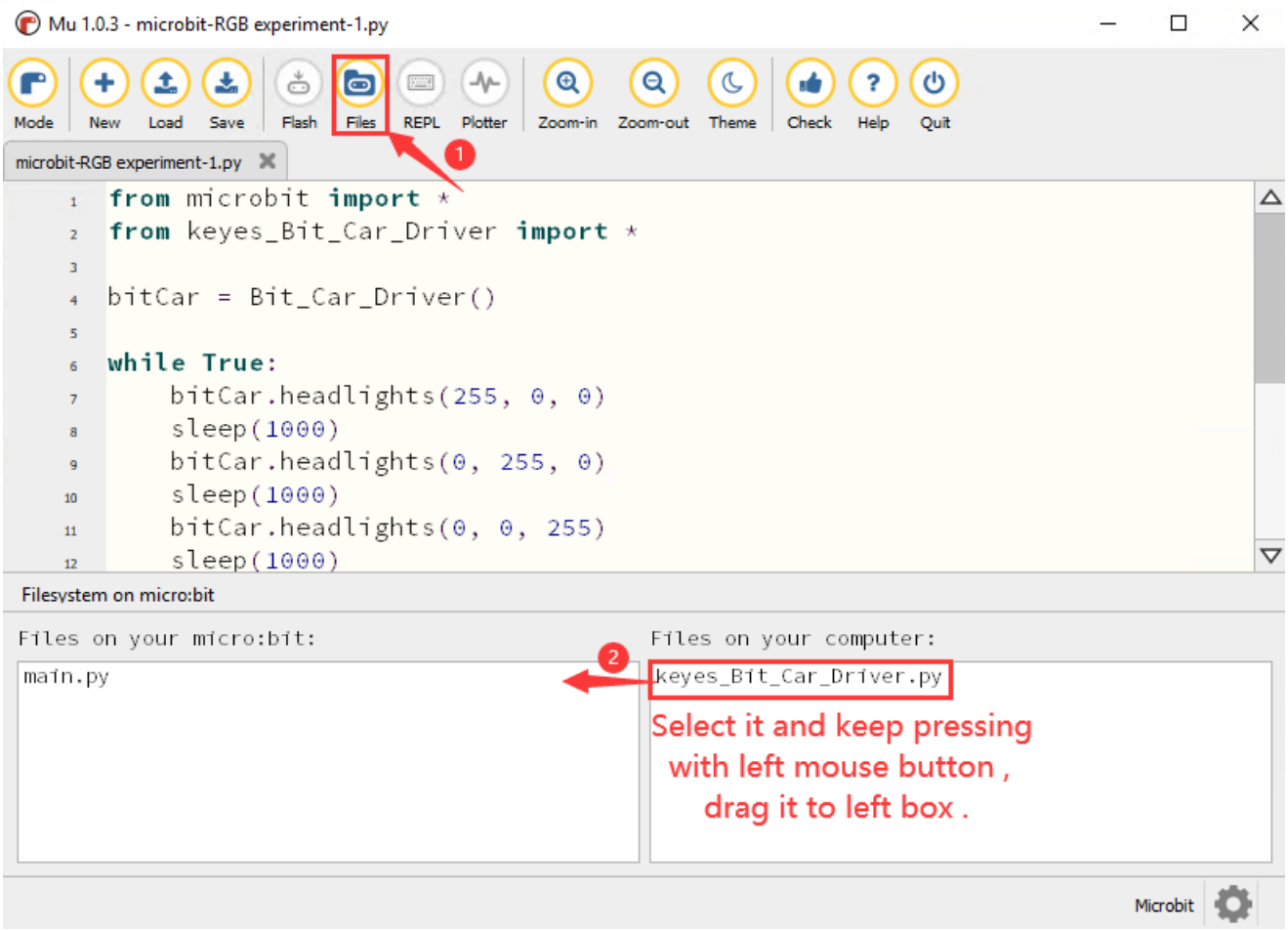
File type	Path	File name
Python file	.. /Python Code/ Libraries	keyes_Bit_Car_Driver.py

Therefore, copy “keyes_Bit_Car_Driver.py “ to “mu_code” folder, as shown

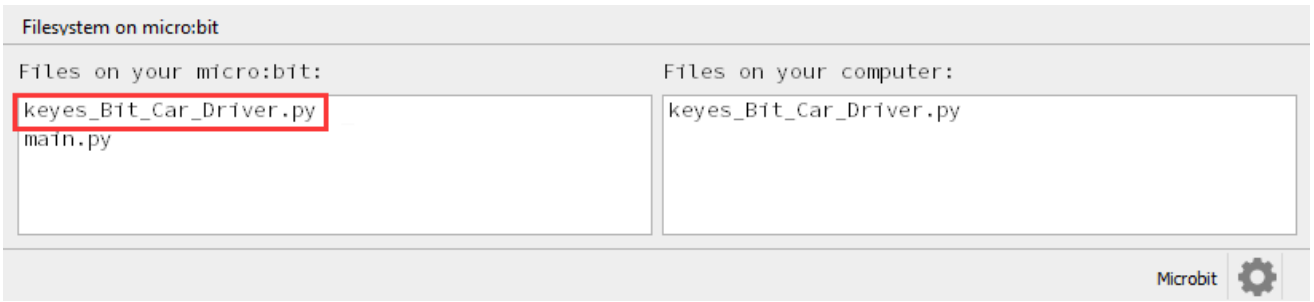
below:



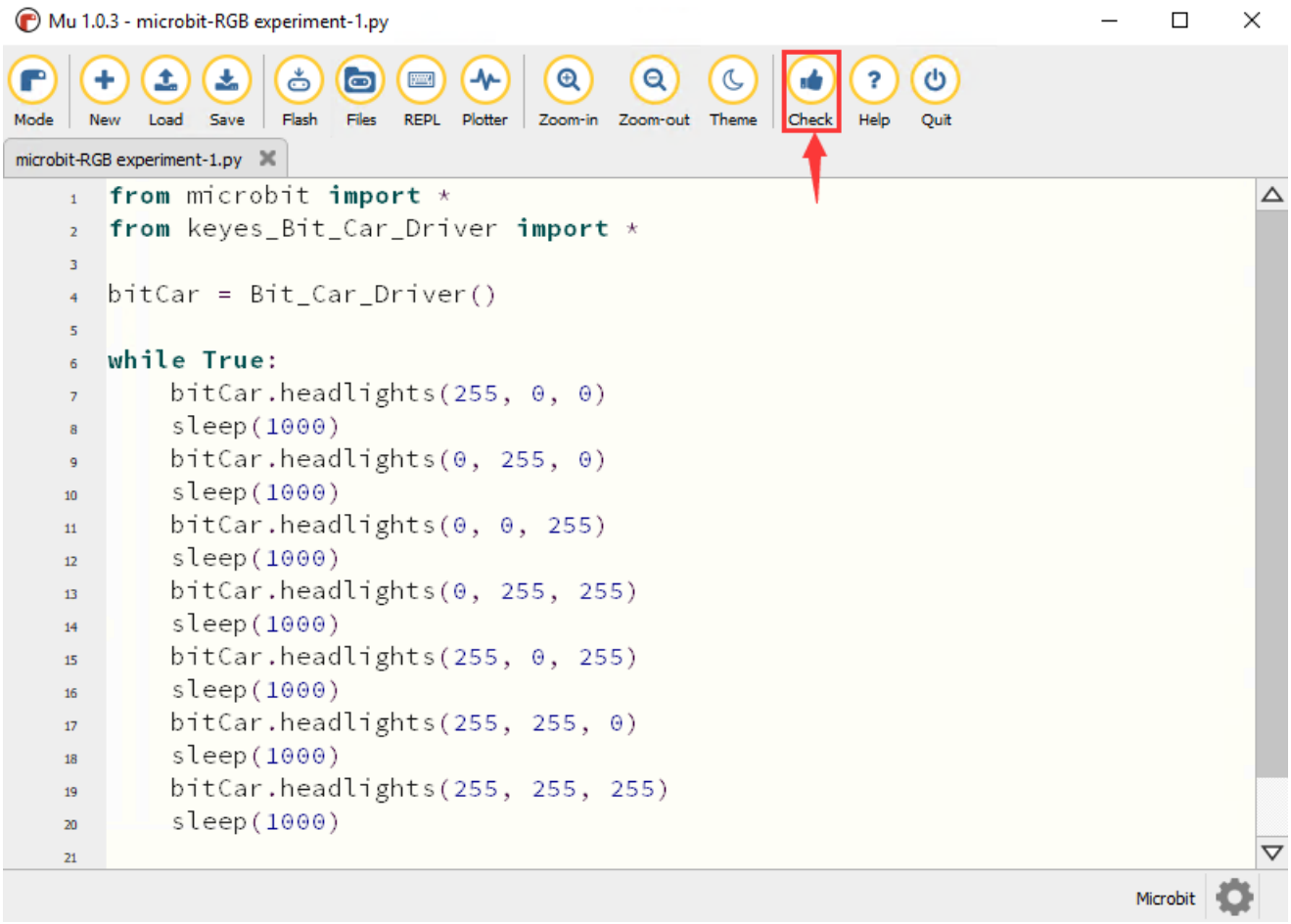
Open Mu, connect micro:bit to computer, click “Files” and drag “keyes_Bit_Car_Driver.py” library file to micro:bit.



You could view it in the left column, after importing "keyes_Bit_Car_Driver" file



Tap "Check" button to confirm if the code has errors. The program proves wrong if there are underlines and cursors

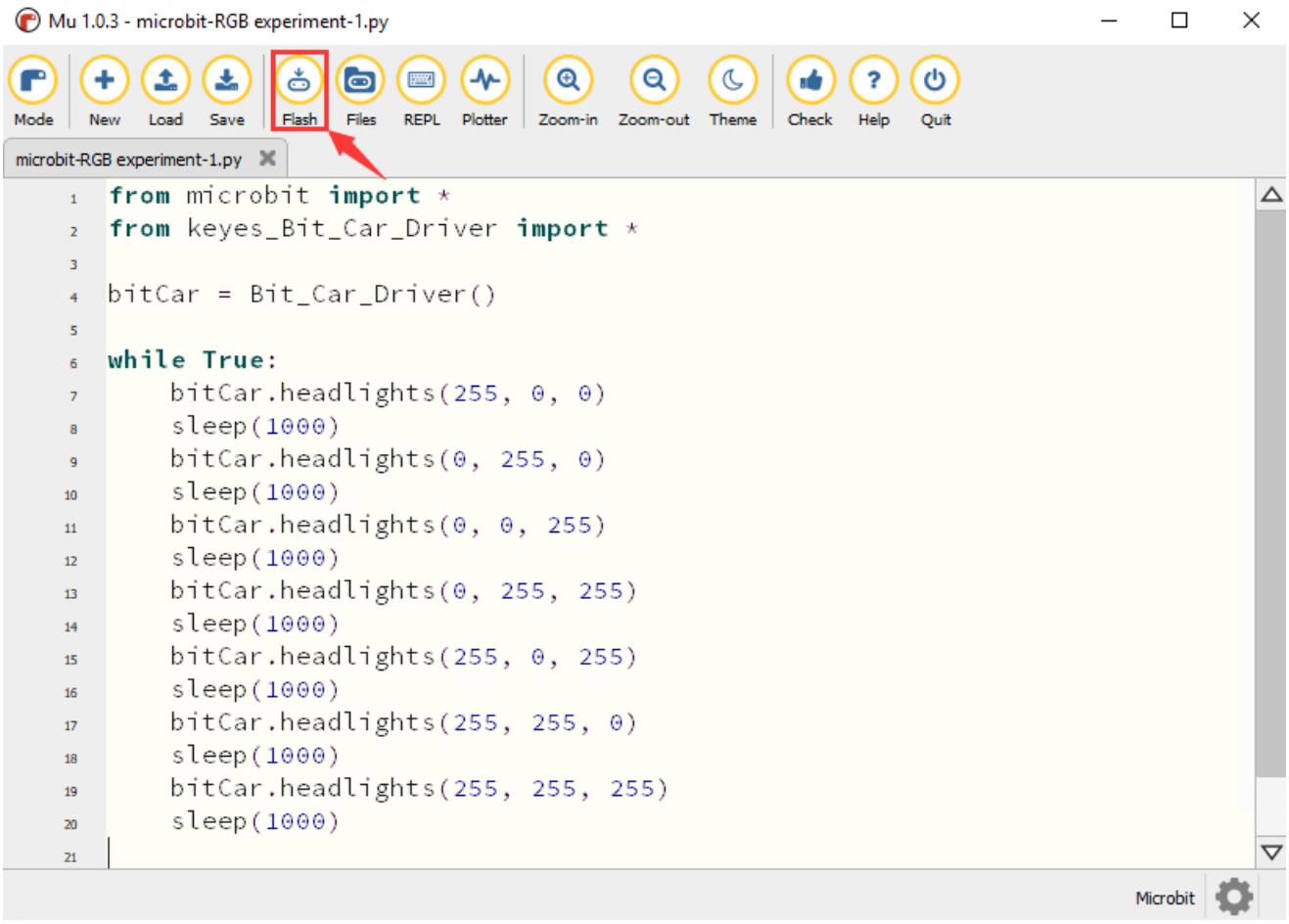


Besides, the prompt signs will appear. The prompt is a warning sign which doesn’ t indicate wrong code.

```
↑ 'from keyes_Bit_Car_Driver import *' used; unable to detect undefined names
```

```
↑ 'Bit_Car_Driver' may be undefined, or defined from star imports: keyes_Bit_Car_Driver
```

If the code is correct, connect micro:bit to computer and click “Flash” to download code to micro:bit board



Click "Flash" and appear errors, you need to confirm if you import "keyes_Bit_Car_Driver.py" library.

Note: You need to import "keyes_Bit_Car_Driver.py" file to micro:bit.

If you program with different micro:bit, the library file "keyes_Bit_Car_Driver.py" needs to be imported again to a new micro:bit

Code 2：

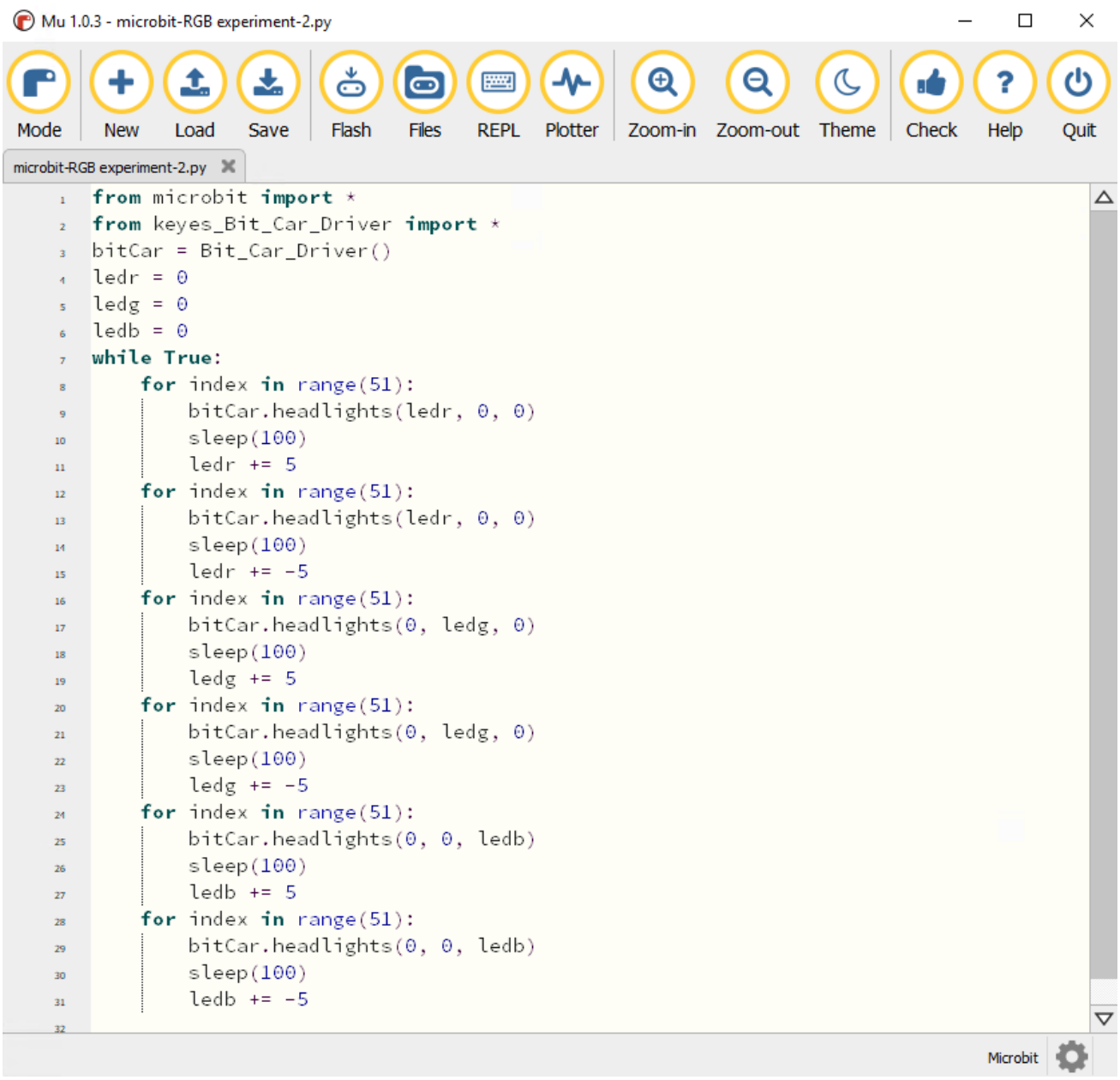
Display different color

Open file “microbit- Code 2.py ” in Mu，

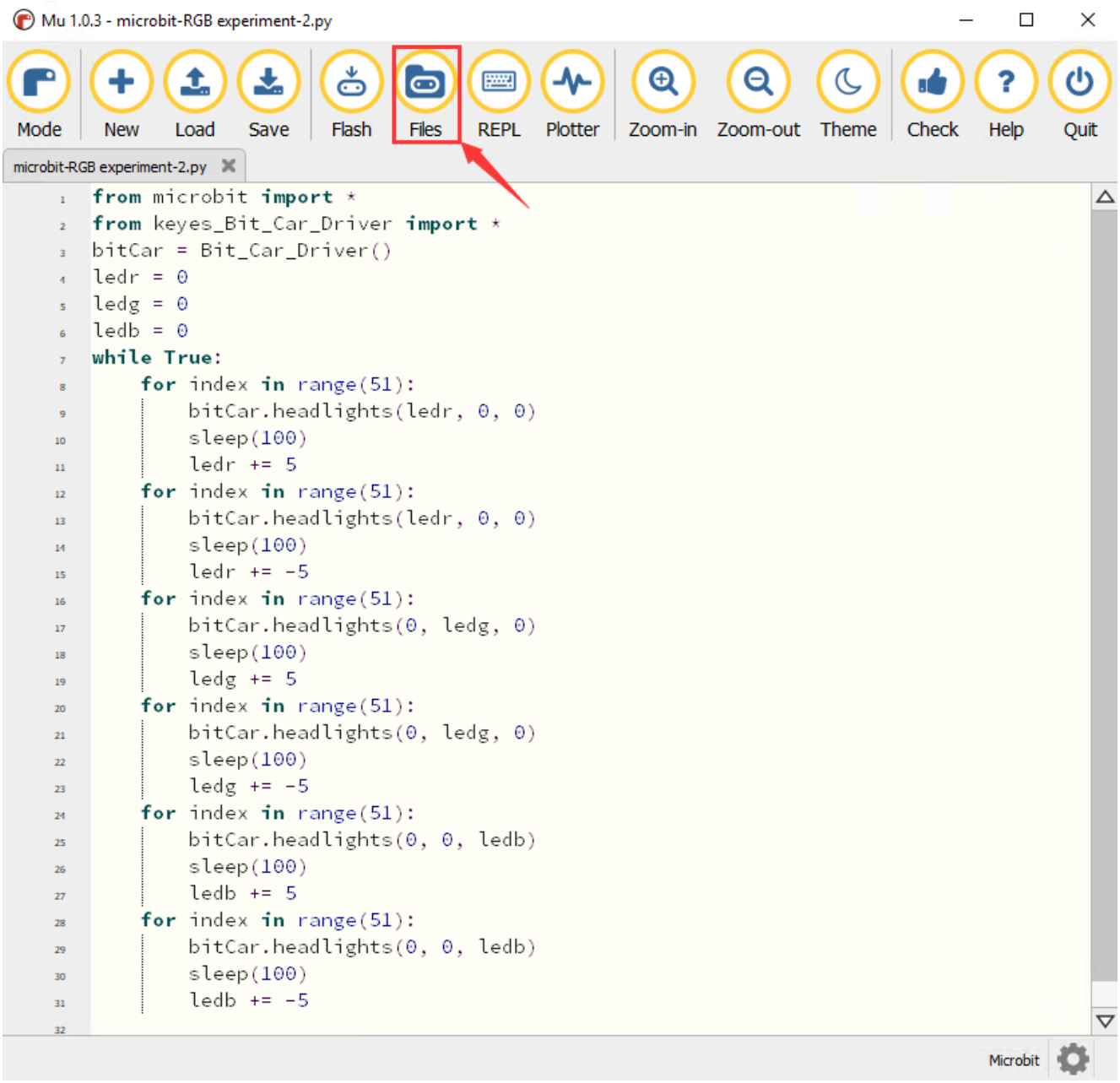
(How to load the project code?)

File Type	Route	File Name
Python file	../Python code/6.11： RGB Experiments	microbit- Code 2.py

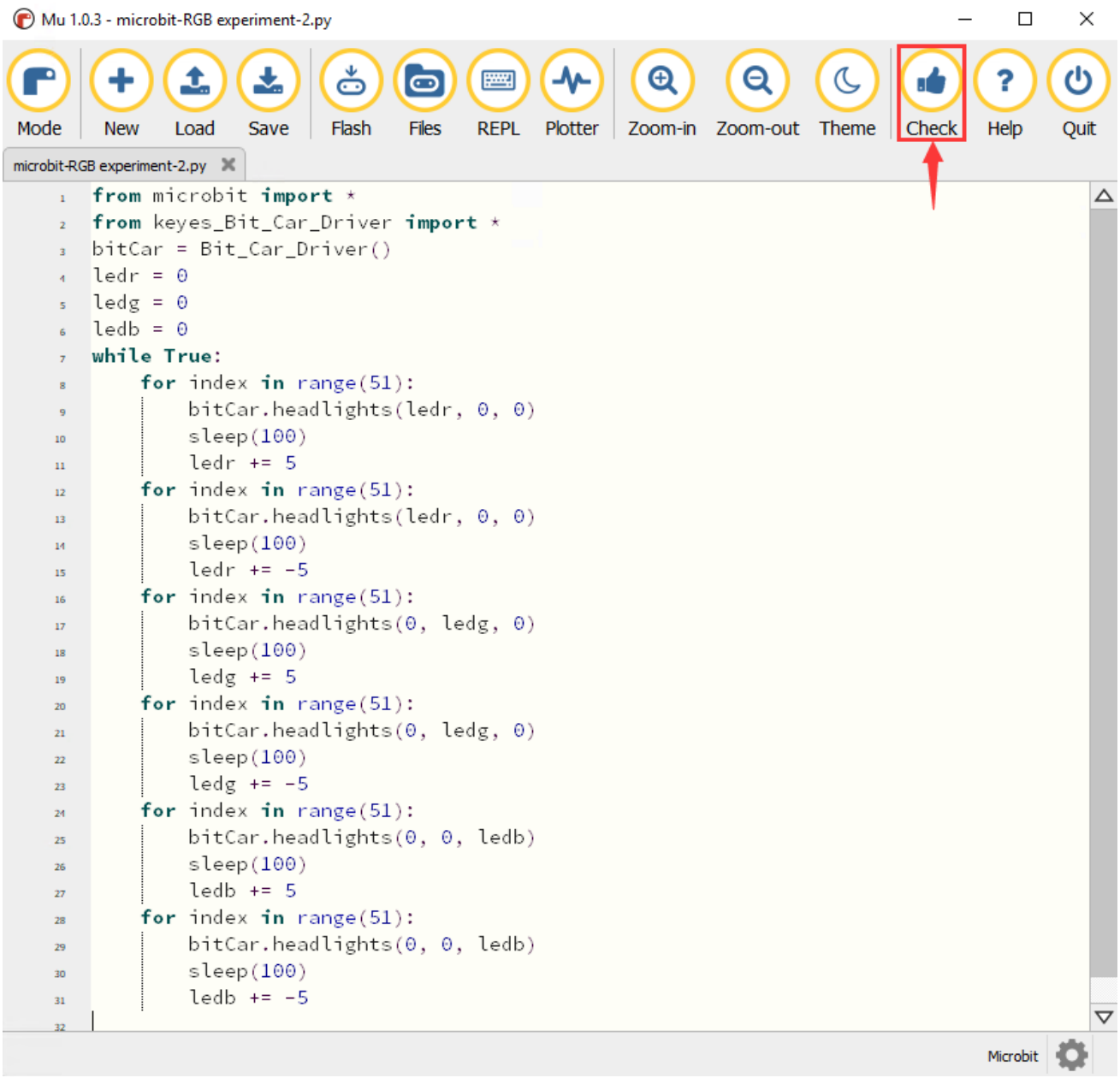
The successful loading is shown below.You can also input code in the edit window yourself.(note:all English words and symbols must be written in English)



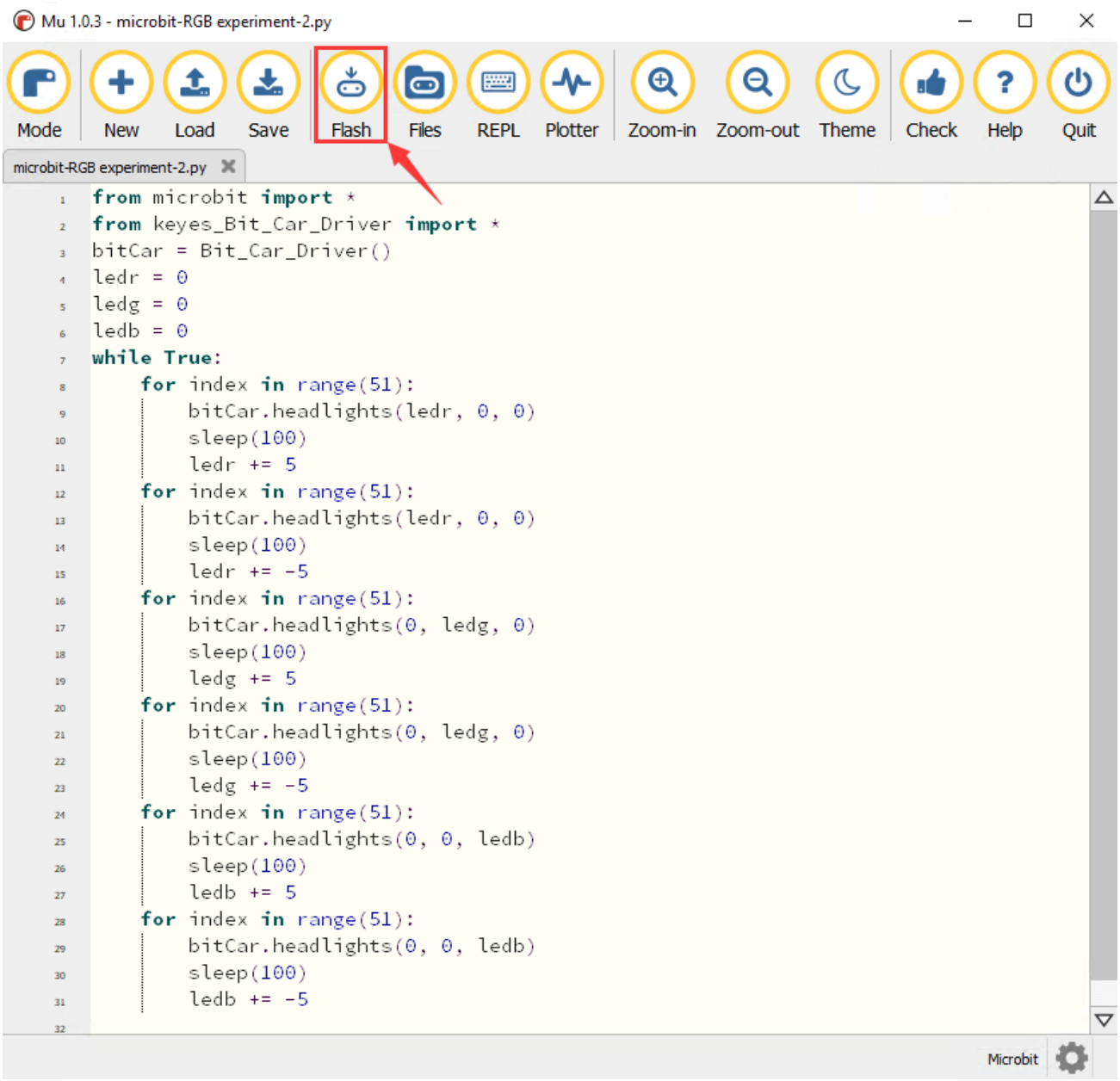
Click "Files" to import "keyes_Bit_Car_Driver.py" library file to micro:bit (How to import files?) . If micro:bit has library inside, you don't need add one.



Click “Check” to examine error in the code. The program proves wrong if underlines and cursors are shown.



If the code is correct, connect micro:bit to computer and click "Flash" to download code to micro:bit board



4. Test Result:

Download code 1 to micro:bit board and turn on the switch at the back of micro:bit car, 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 and turn on the switch at the back of

micro:bit car, 2 RGB lights show different color in loop way.

5. Code Explanation:

from microbit **import** *	import the library file of micro:bit
from keyes_Bit_Car_Driver **import** *	Import the library file of keyes_Bit_Car_Driver
bitCar = Bit_Car_Driver()	instantiate
while True:	This is a permanent loop that makes micro:bit execute the code of it.
bitCar.headlights(255, 0, 0) sleep(1000) bitCar.headlights(0, 255, 0) sleep(1000) bitCar.headlights(0, 0, 255) sleep(1000) bitCar.headlights(0, 255, 255) sleep(1000)	2 RGB LEDs light up red color Delay 1000ms 2 RGB LEDs light up green color Delay in 1000ms 2 RGB LEDs light up blue color Delay in1000ms 2 RGB light up indigo color Delay in1000ms

bitCar.headlights(255, 0, 255) sleep(1000) bitCar.headlights(255, 255, 0) sleep(1000) bitCar.headlights(255, 255, 255) sleep(1000)	2 RGB LEDs light up dark red color Delay in1000ms 2 RGB LEDs light up yellow color Delay in1000ms 2 RGB LEDs light up white color Delay in1000ms
ledr = 0	Set the initial value of ledr to 0
ledg = 0	Set the initial value of ledg to 0
ledb = 0	set the initial value of ledb to 0
for index **in** range(51):	Repeat 51 times
bitCar.headlights(ledr, 0, 0)	Set RGB lights of car: R：led-r G：0 B：0
bitCar.headlights(0, ledg, 0)	Set RGB lights of car: R：0 G：ledg B：0
bitCar.headlights(0, 0, ledb)	Set 2 RGB lights R：0 G: 0 B：ledb
ledr += 5 ledr += -5	Change the value of led-r by 5 Change the value of led-r by -5

ledg += 5	Change the value of ledg by 5
ledg += -5	Change the value of ledg by -5
ledb += 5	Change the value of ledb by 5
ledb += -5	Change the value of ledb by -5

6.12：KEYES-2812-18R Module

1.Description：

The KEYES-2812-18R module is fully compatible with micro:bit, in this lesson, we make it display different colors through P5 end(D5 of shield) on micro:bit board.

	Name	RGB (R,G,B)	Code (16)		Name	RGB (R,G,B)	Code (16)

	Red	255, 0, 0	#FF0000		Orange	255, 165, 0	#FFA500
	Yellow	255, 255, 0	#FFFF00		Green	0, 255, 0	#00FF00
	Blue	0, 255, 0	#0000FF		indigo	75, 0, 130	#4B0082
	violet	238, 130, 238	#EE82EE		purple	160, 32, 240	#A020F0
	Black	0, 0, 0	#000000		white	255, 255, 255	#FFFFFF
.....	.....	.....	.....	.....	.....	.....	.....
Alter tone of color to get different color							

What you need to get started

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

(2) Put batteries into battery holder

(3) Turn on the switch at the back of micro:bit car

(4) Link micro:bit board with computer via USB cable.

(5) Open the offline version of Mu

2. Test Code:

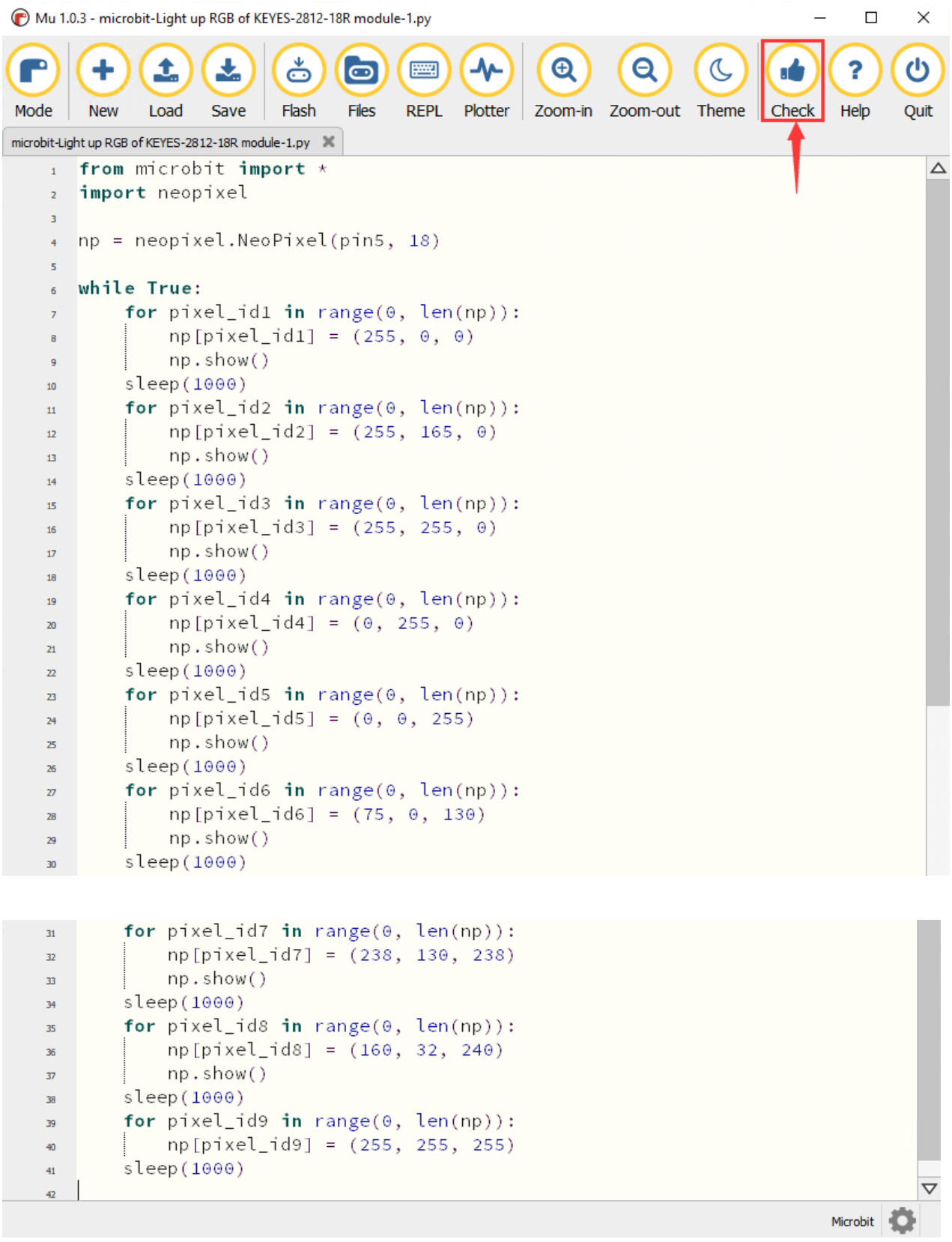
Code 1:

Open "microbit-Code 1.py" file in Mu, (How to load the project code?)

File Type	Route
Python file	../Python code/6.12: KEYES-2812-18R module

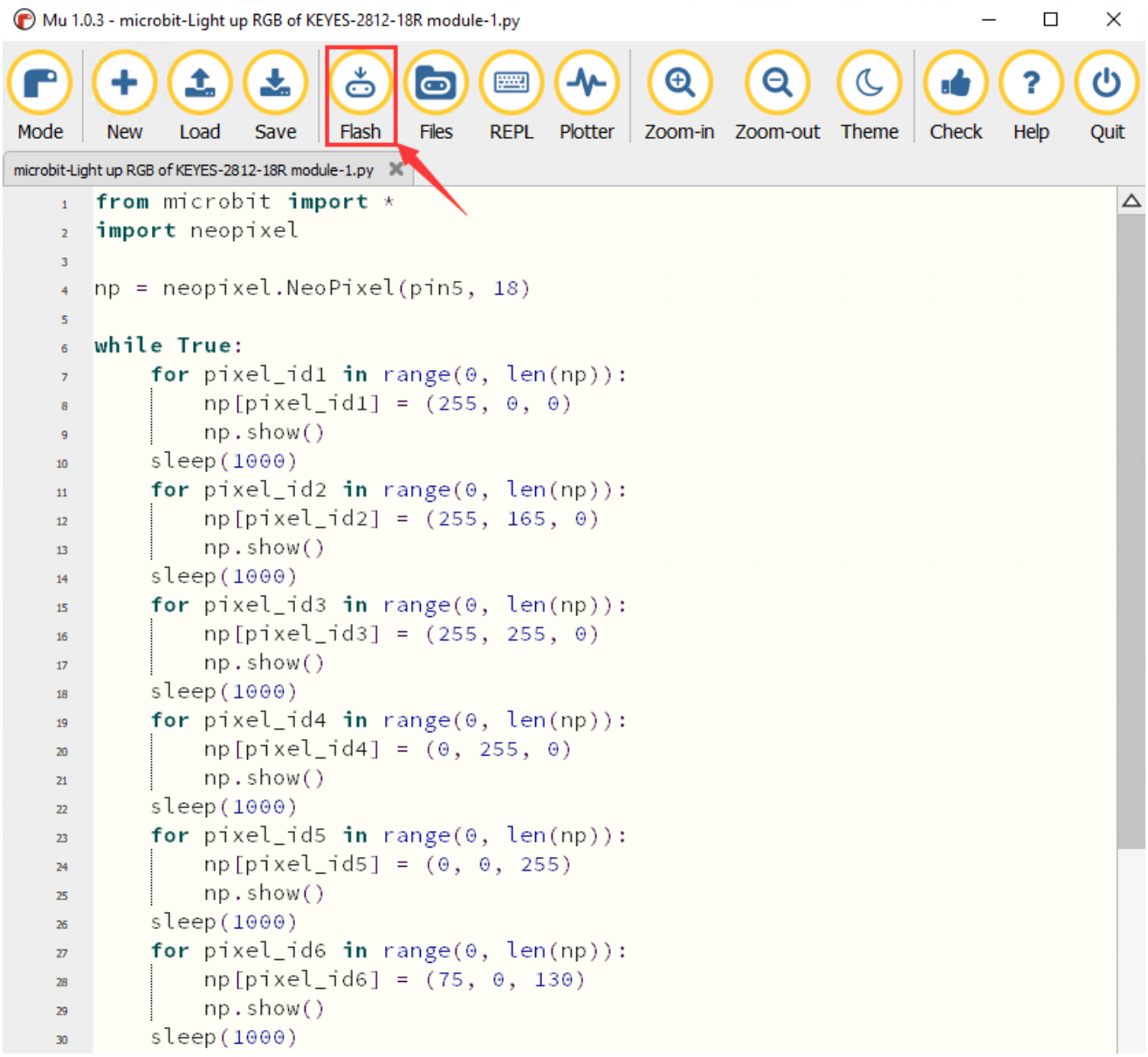
The successful loading is shown below.You can also input code in the edit window yourself.(note:all English words and symbols must be written in English)

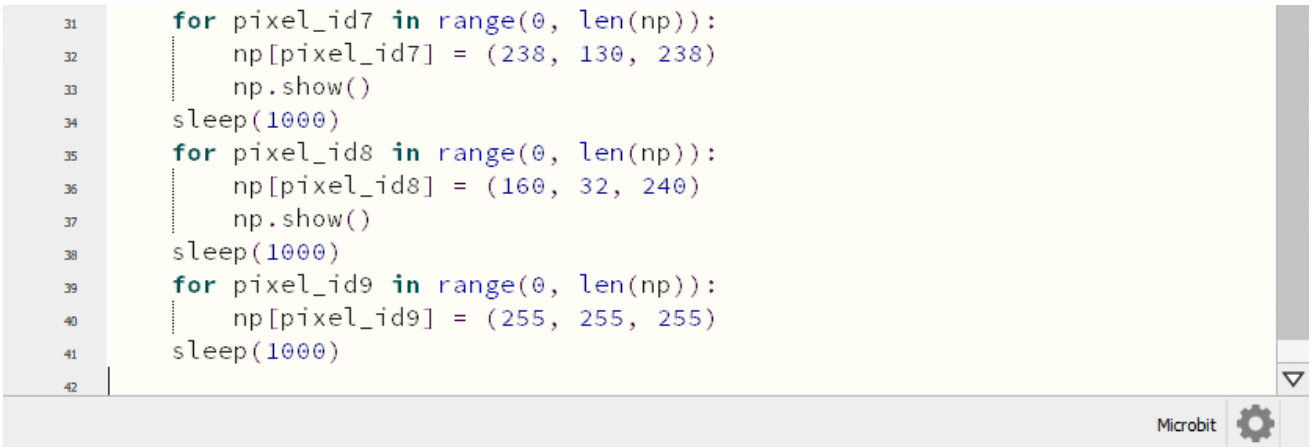
Click “Check” to examine error in the code. The program proves wrong if underlines and cursors are shown.



If the code is correct, connect micro:bit to computer and click "Flash" to

download code to micro:bit board





Code 2：

Open “microbit-Code 2.py” file in Mu（How to load the project code?）

File Type	Route
Python file	../Python code/6.12：KEYES-2812-18R module/

The successful loading is shown below.You can also input code in the edit window yourself.(note:all English words and symbols must be written in English)

Mu 1.0.3 - microbit-Light up RGB of KEYES-2812-18R module-2.py

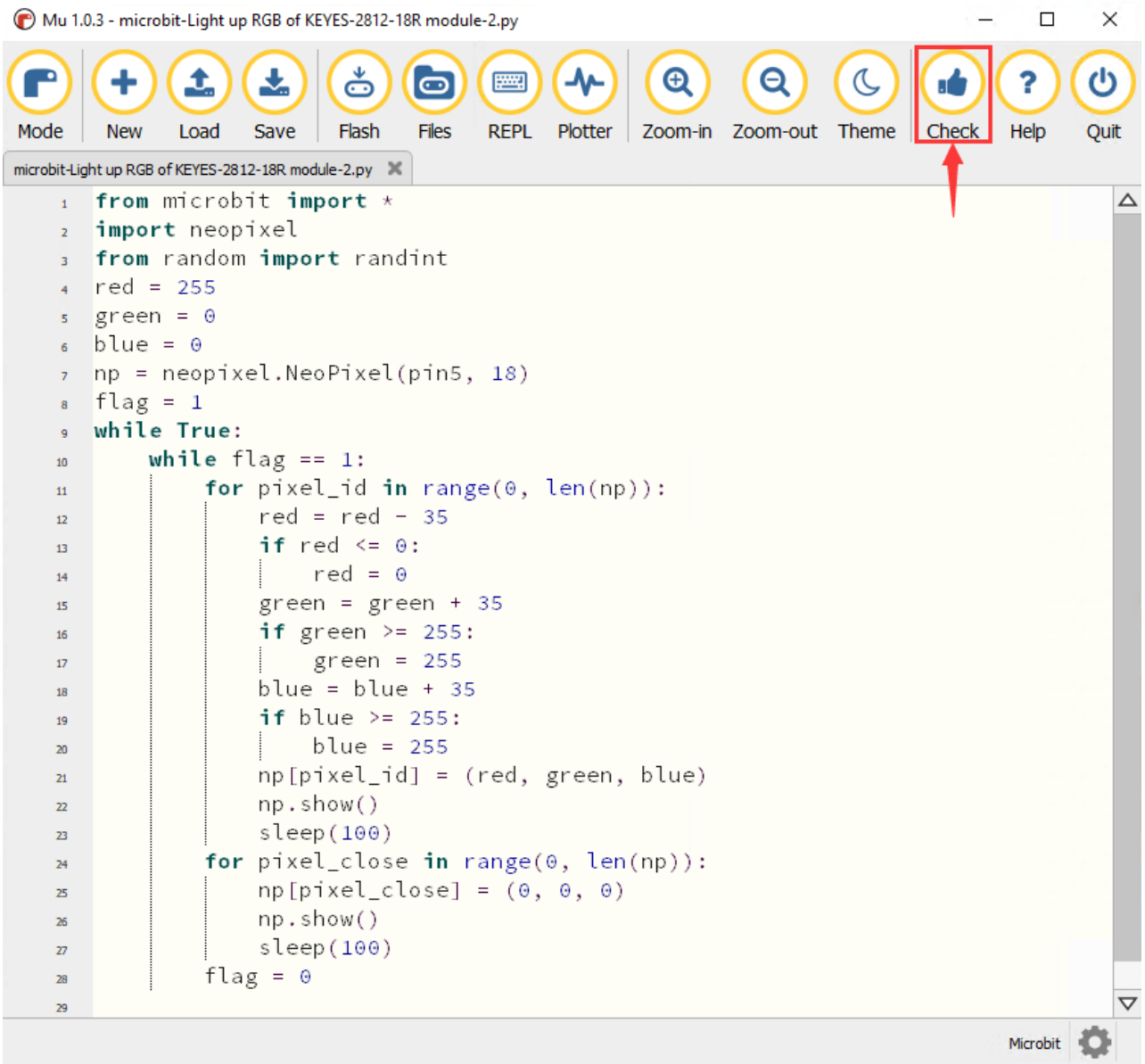
Mode | New | Load | Save | Flash | Files | REPL | Plotter | Zoom-in | Zoom-out | Theme | Check | Help | Quit

microbit-Light up RGB of KEYES-2812-18R module-2.py

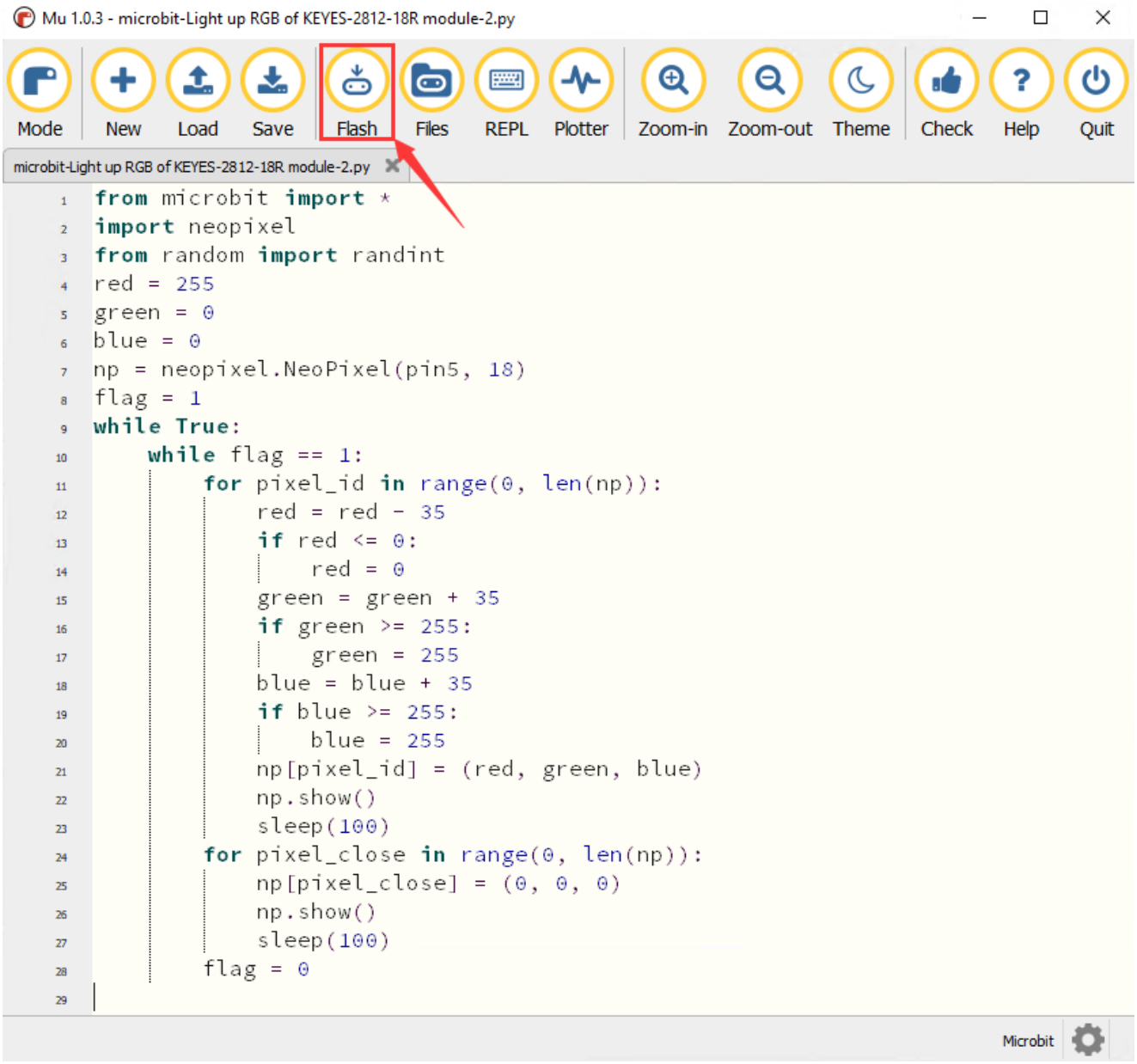
```
from microbit import *
import neopixel
from random import randint
red = 255
green = 0
blue = 0
np = neopixel.NeoPixel(pin5, 18)
flag = 1
while True:
    while flag == 1:
        for pixel_id in range(0, len(np)):
            red = red - 35
            if red <= 0:
                red = 0
            green = green + 35
            if green >= 255:
                green = 255
            blue = blue + 35
            if blue >= 255:
                blue = 255
            np[pixel_id] = (red, green, blue)
            np.show()
            sleep(100)
        for pixel_close in range(0, len(np)):
            np[pixel_close] = (0, 0, 0)
            np.show()
            sleep(100)
        flag = 0

```

Microbit

Click “Check” to examine error in the code. The program proves wrong if underlines and cursors are shown.



If the code is correct, connect micro:bit to computer and click "Flash" to download code to micro:bit board

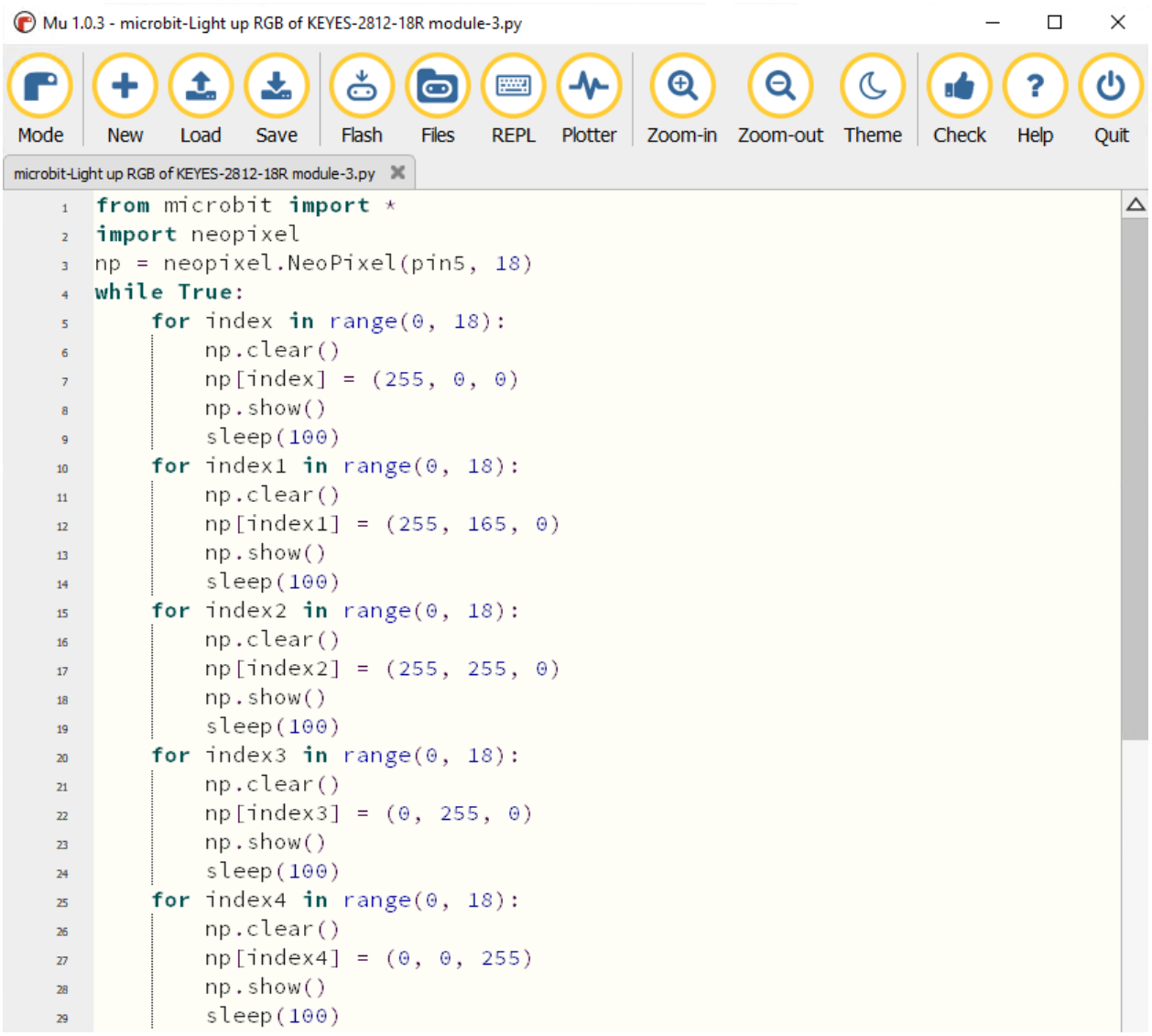


Code 3:

Open "microbit-Code 3.py" file in Mu, (How to load the project code?)

File Type	Route
Python file	../Python code/6.12：KEYES-2812-18R module/

The successful loading is shown below.You can also input code in the edit window yourself.(note:all English words and symbols must be written in English)

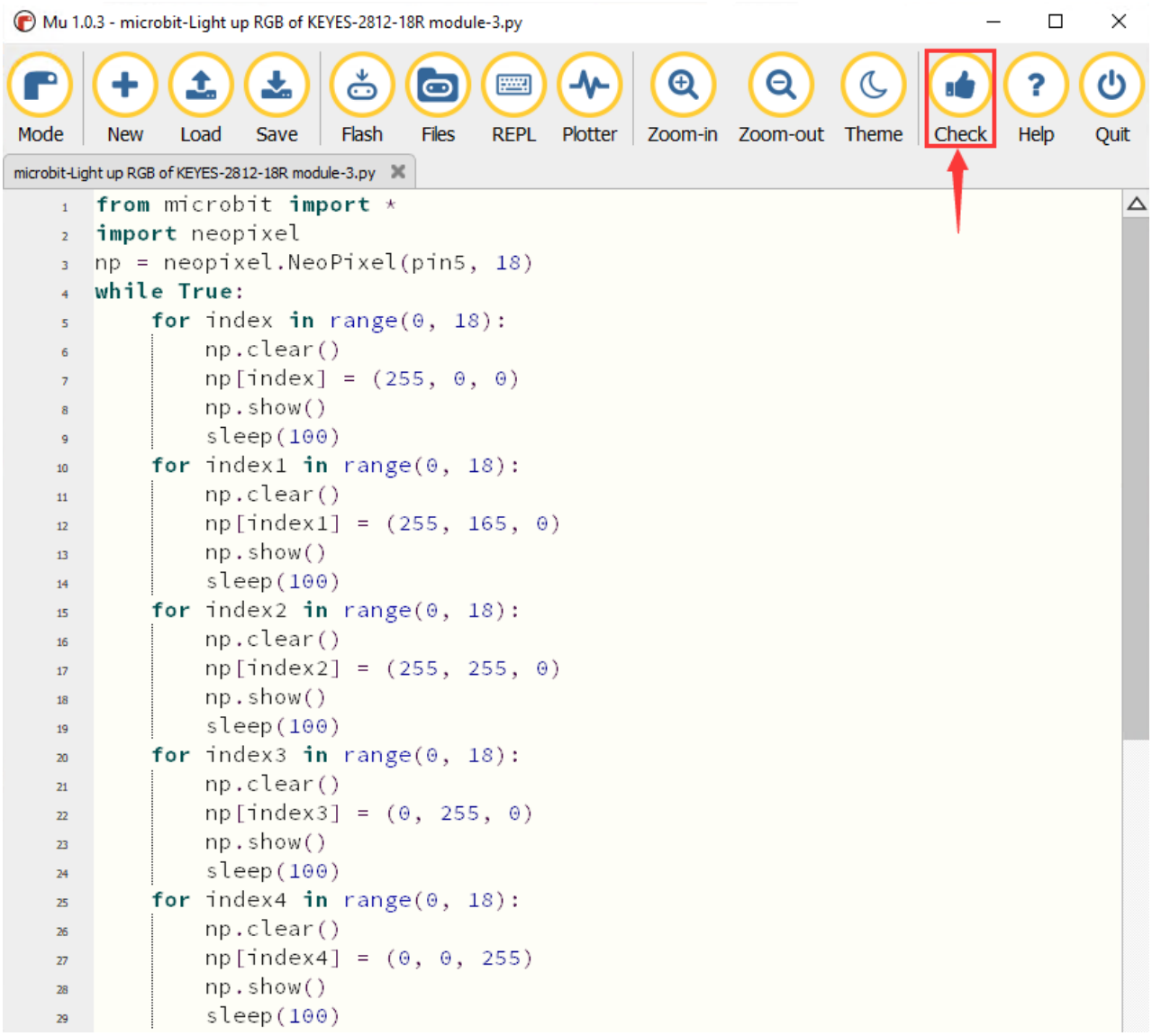



```
from microbit import *
import neopixel
np = neopixel.NeoPixel(pin5, 18)
while True:
    for index in range(0, 18):
        np.clear()
        np[index] = (255, 0, 0)
        np.show()
        sleep(100)
    for index1 in range(0, 18):
        np.clear()
        np[index1] = (255, 165, 0)
        np.show()
        sleep(100)
    for index2 in range(0, 18):
        np.clear()
        np[index2] = (255, 255, 0)
        np.show()
        sleep(100)
    for index3 in range(0, 18):
        np.clear()
        np[index3] = (0, 255, 0)
        np.show()
        sleep(100)
    for index4 in range(0, 18):
        np.clear()
        np[index4] = (0, 0, 255)
        np.show()
        sleep(100)
```

```
    for index5 in range(0, 18):
        np.clear()
        np[index5] = (75, 0, 130)
        np.show()
        sleep(100)
    for index6 in range(0, 18):
        np.clear()
        np[index6] = (238, 130, 238)
        np.show()
        sleep(100)
    for index7 in range(0, 18):
        np.clear()
        np[index7] = (160, 32, 240)
        np.show()
        sleep(100)
    for index8 in range(0, 18):
        np.clear()
        np[index8] = (255, 255, 255)
        np.show()
        sleep(100)

```

Microbit

Click “Check” to examine error in the code. The program proves wrong if underlines and cursors are shown.

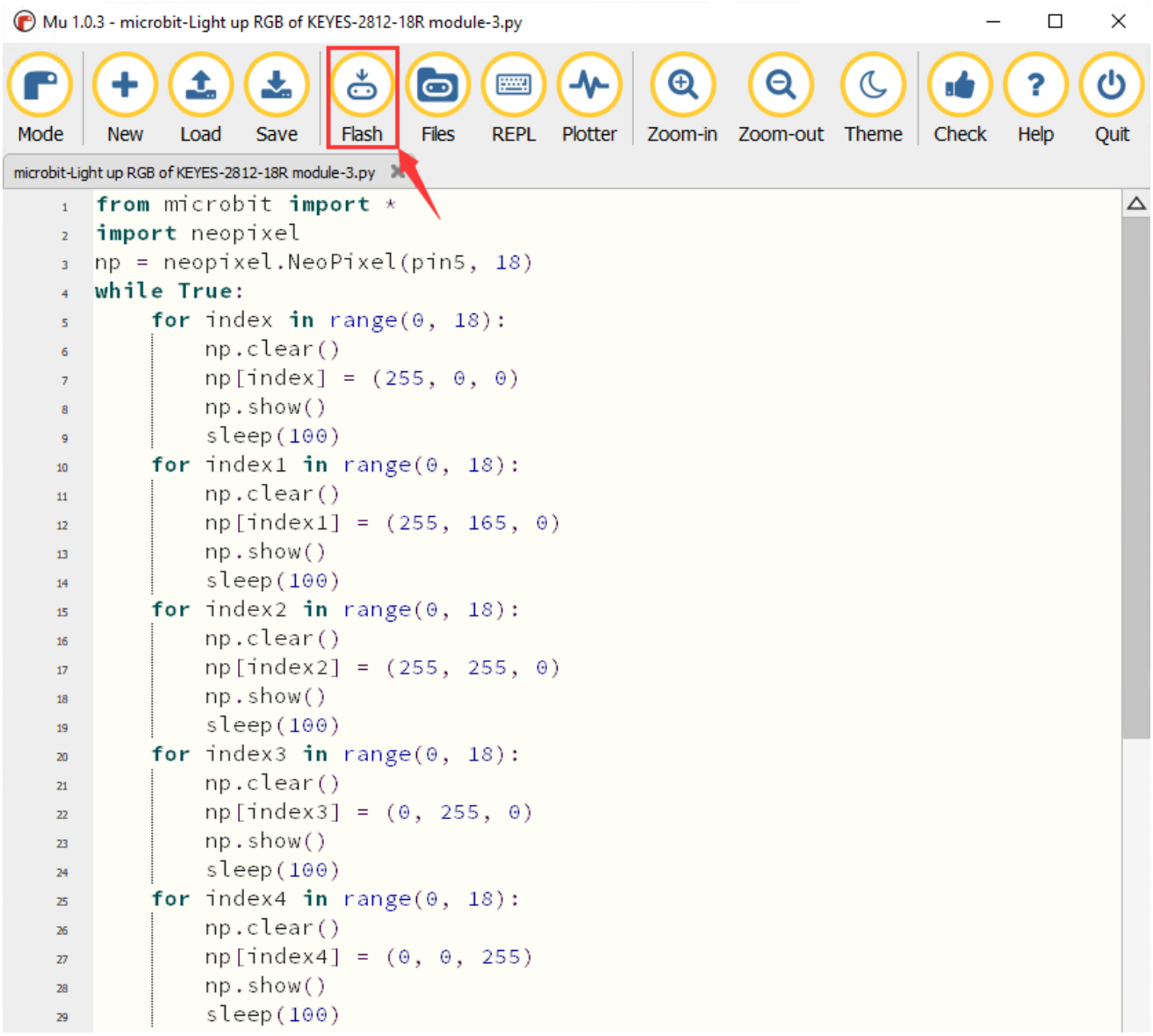



```
from microbit import *
import neopixel
np = neopixel.NeoPixel(pin5, 18)
while True:
    for index in range(0, 18):
        np.clear()
        np[index] = (255, 0, 0)
        np.show()
        sleep(100)
    for index1 in range(0, 18):
        np.clear()
        np[index1] = (255, 165, 0)
        np.show()
        sleep(100)
    for index2 in range(0, 18):
        np.clear()
        np[index2] = (255, 255, 0)
        np.show()
        sleep(100)
    for index3 in range(0, 18):
        np.clear()
        np[index3] = (0, 255, 0)
        np.show()
        sleep(100)
    for index4 in range(0, 18):
        np.clear()
        np[index4] = (0, 0, 255)
        np.show()
        sleep(100)
```

```
    for index5 in range(0, 18):
        np.clear()
        np[index5] = (75, 0, 130)
        np.show()
        sleep(100)
    for index6 in range(0, 18):
        np.clear()
        np[index6] = (238, 130, 238)
        np.show()
        sleep(100)
    for index7 in range(0, 18):
        np.clear()
        np[index7] = (160, 32, 240)
        np.show()
        sleep(100)
    for index8 in range(0, 18):
        np.clear()
        np[index8] = (255, 255, 255)
        np.show()
        sleep(100)
```

Microbit

If the code is correct, connect micro:bit to computer and click “Flash” to download code to micro:bit board




```
from microbit import *
import neopixel
np = neopixel.NeoPixel(pin5, 18)
while True:
    for index in range(0, 18):
        np.clear()
        np[index] = (255, 0, 0)
        np.show()
        sleep(100)
    for index1 in range(0, 18):
        np.clear()
        np[index1] = (255, 165, 0)
        np.show()
        sleep(100)
    for index2 in range(0, 18):
        np.clear()
        np[index2] = (255, 255, 0)
        np.show()
        sleep(100)
    for index3 in range(0, 18):
        np.clear()
        np[index3] = (0, 255, 0)
        np.show()
        sleep(100)
    for index4 in range(0, 18):
        np.clear()
        np[index4] = (0, 0, 255)
        np.show()
        sleep(100)
```

```
    for index5 in range(0, 18):
        np.clear()
        np[index5] = (75, 0, 130)
        np.show()
        sleep(100)
    for index6 in range(0, 18):
        np.clear()
        np[index6] = (238, 130, 238)
        np.show()
        sleep(100)
    for index7 in range(0, 18):
        np.clear()
        np[index7] = (160, 32, 240)
        np.show()
        sleep(100)
    for index8 in range(0, 18):
        np.clear()
        np[index8] = (255, 255, 255)
        np.show()
        sleep(100)

```

Microbit

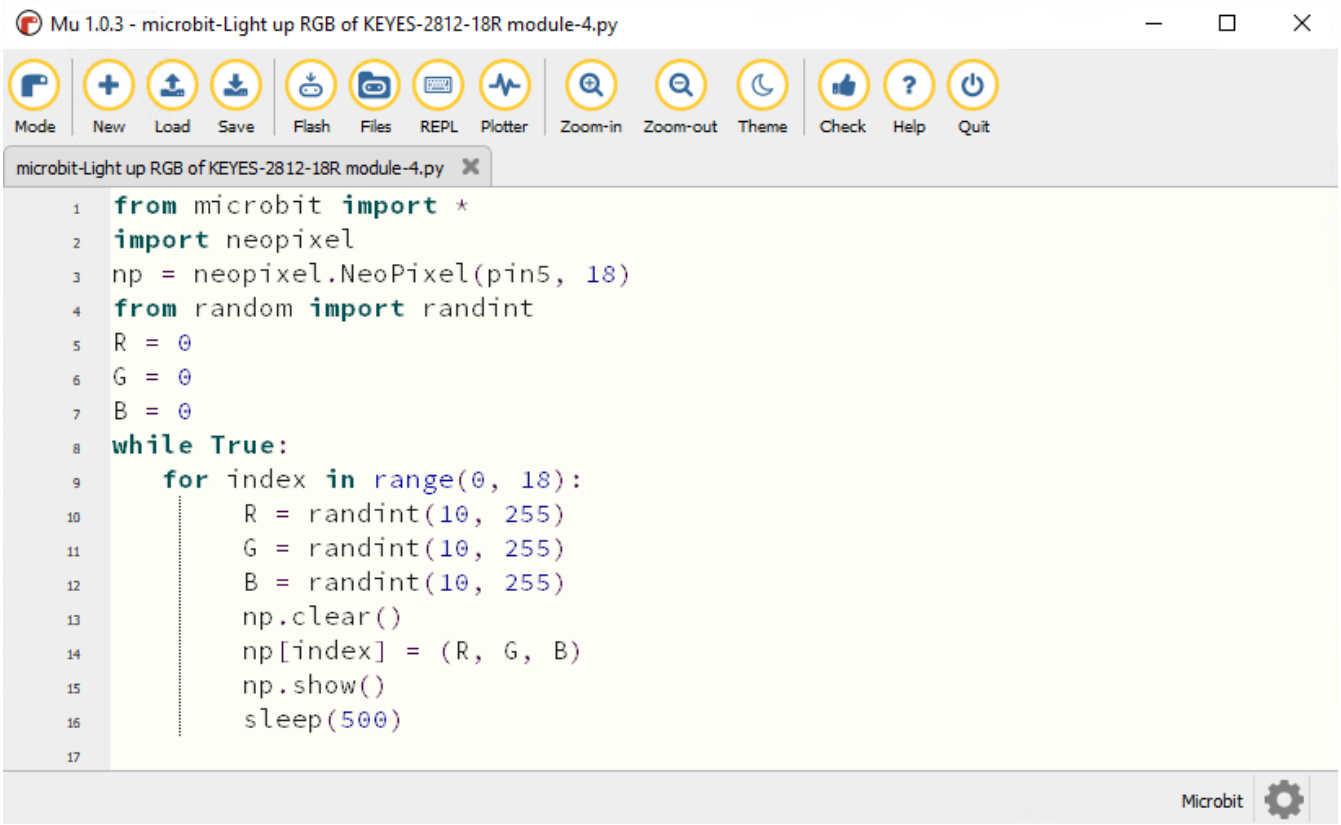
Code 4:

Open "microbit-Code 4.py" file,

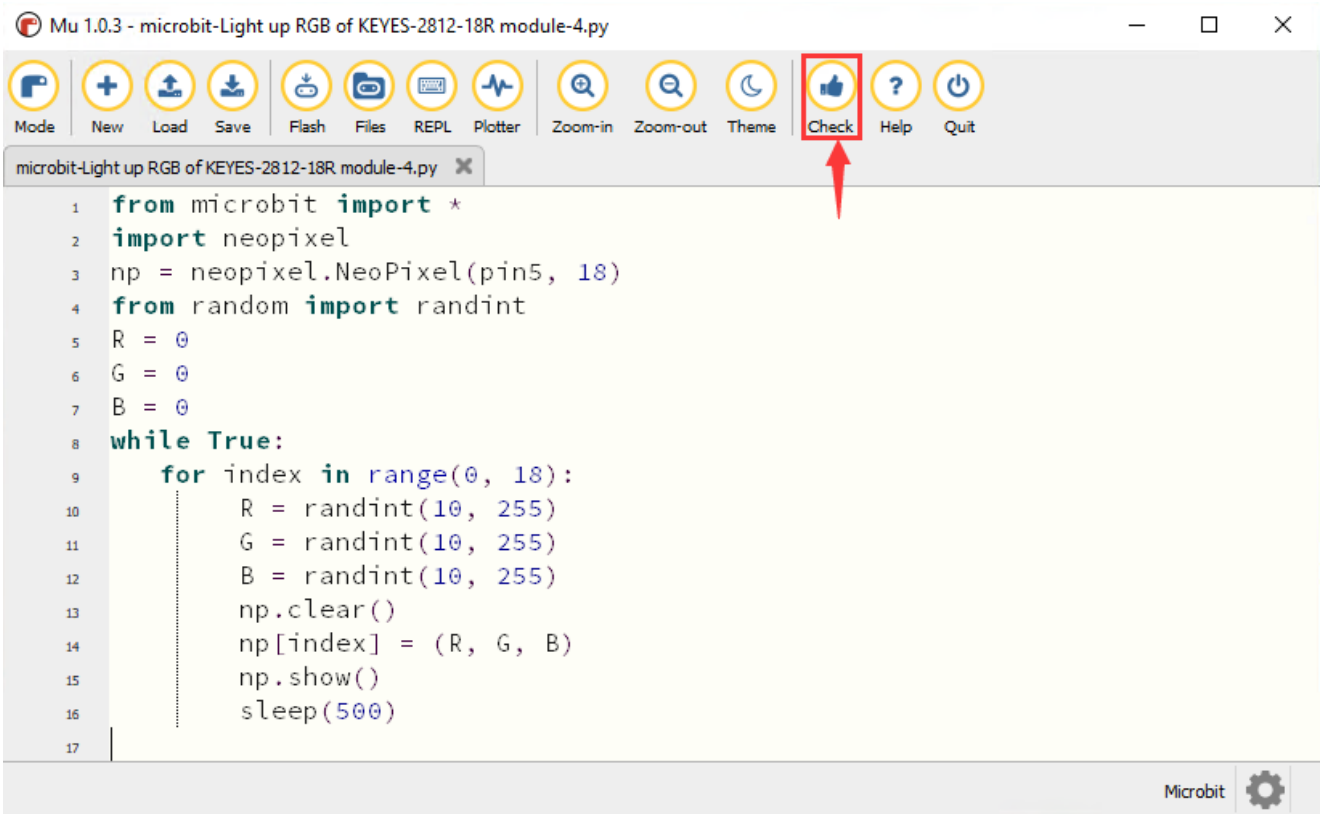
(How to load the project code?)

File Type	Route
Python file	../Python code/6.12: KEYES-2812-18R module/

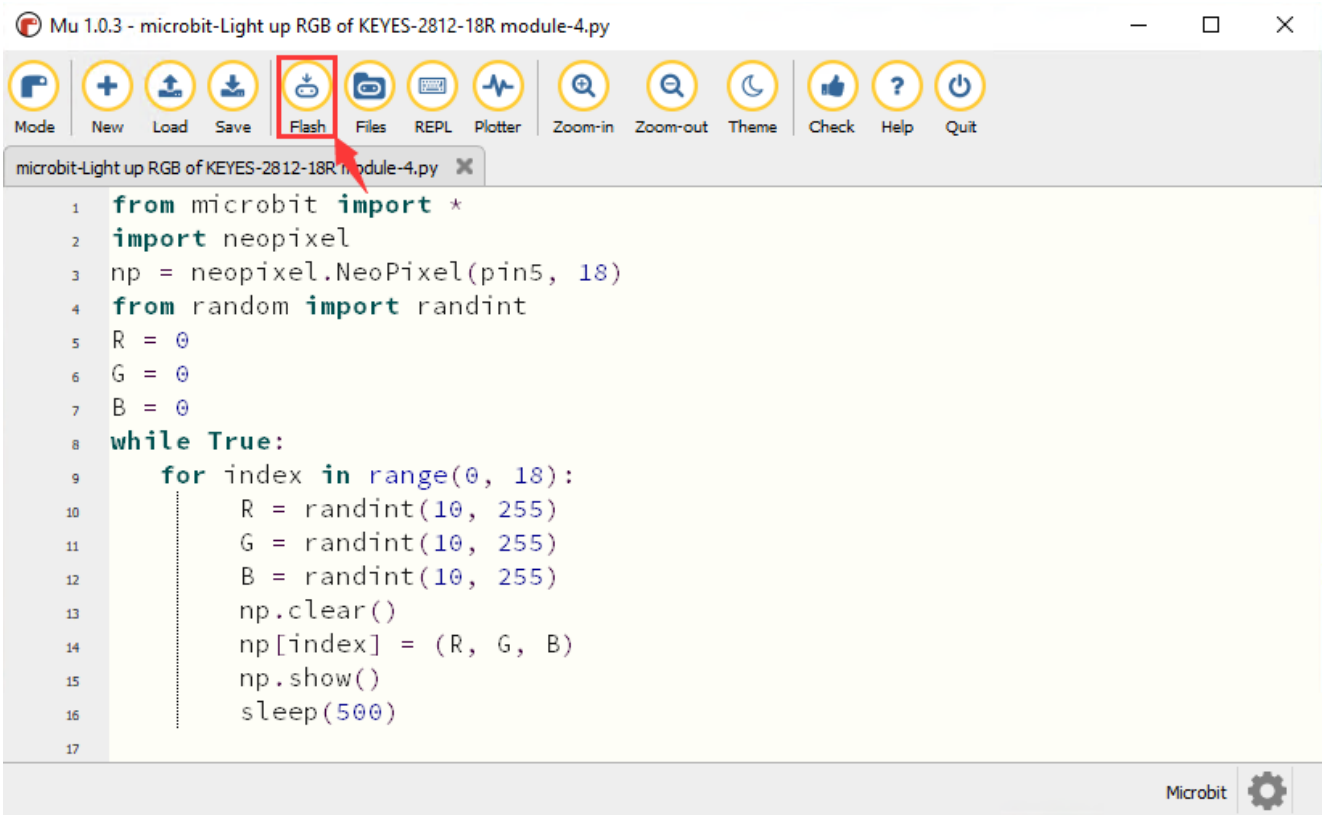
The successful loading is shown below.You can also input code in the edit window yourself.(note:all English words and symbols must be written in English)



Click "Check" to examine error in the code. The program proves wrong if underlines and cursors are shown.



If the code is correct, connect micro:bit to computer and click "Flash" to download code to micro:bit board.



4.Test Result:

Download code 1 to micro:bit, turn on the switch on robot car and every RGB on KEYES-2812-18R module displays same color.

Download code 2 to micro:bit, turn on the switch on robot car, 18 pcs RGB on KEYES-2812-18R light up and go off one by one.

Download code 3 to micro:bit, turn on the switch on robot car, every RGB

light on KEYES-2812-18R shows the same color and turns off one by one.

Download code 4 to micro:bit, turn on switch on robot car. Every RGB light on KEYES-2812-18R lights up random color and goes off one by one.

5.Code Explanation:

from microbit **import** *	import the library file of micro:bit
import neopixel	Import the library file of neopixel
np = neopixel.NeoPixel(pin5, 18)	Initialize Neopixel set Neopixel to initialize P5 with 18 LEDs
np.clear()	Turn off RGB on Neopixel strip
while True:	This is a permanent loop that makes micro:bit execute the code of it.This is a permanent loop, which makes micro:bit execute the code in this loop
for pixel_id1 **in** range(0, len(np)):	Set RGB to pixel_id1 in the range of

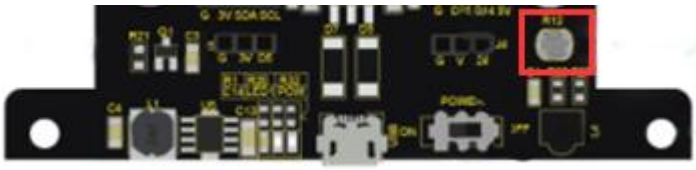
	（0，len（np））
for index **in** range(0, 18):	Set the pixel of RGB to index in the range of（0，18）
np.show()	Show the current pixel on Neopixel strip
np[pixel_id1] = (255, 0, 0) np[pixel_id2] = (255, 165, 0) np[pixel_id3] = (255, 255, 0) np[pixel_id4] = (0, 255, 0) np[pixel_id5] = (0, 0, 255) np[pixel_id6] = (75, 0, 130) np[pixel_id7] = (238, 130, 238) np[pixel_id8] = (160, 32, 240) np[pixel_id9] = (255, 255, 255)	Set pixel_id1 to light up red color on Neopixel strip Set pixel_id2 to light up orange color on Neopixel strip Set pixel_id2 to light up yellow color on Neopixel strip Set pixel_id4 to light up green color on Neopixel strip Set pixel_id5 to light up blue color on Neopixel strip Set pixel_id6 to light up indigo color on Neopixel strip Set pixel of RGB on Neopixel strip

	pixel_id7 shows violet color Set pixel of RGB on Neopixel strip pixel_id8 displays purple color Set pixel of RGB on Neopixel strip pixel_id9 displays white color Set pixel_id9 to light up white color on Neopixel strip
from random **import** randint	Import randint from random variables
flag = 1	Set the initial value of flag to 1
red = 255 green = 0 blue = 0	Set the initial value of variable red to 255 Set the initial value of variable green to 0 Set the initial value of variable blue to 0
while flag == 1:	When flag=1
red = red - 35 green = green + 35	Variable red reduces 35 gradually Variable green adds 35 gradually

blue = blue + 35	Variable blue adds 35 gradually
if red <= 0: red = 0 **if** green >= 255: green = 255 **if** blue >= 255: blue = 255	If variable red≤0 Variable red=0 If Variable green≥255 Variable green=255 If Variable blue≥255 Variable blue=255
np[pixel_id] = (red, green, blue)	Set pixel_id to flash colorful light on Neopixel strip
for pixel_close **in** range(0, len(np)):	Pixel of RGB is pixel_close in the range of（0，len（np））
np[pixel_close] = (0, 0, 0)	Set RGB on Neopixel strip to light off
R = 0 G = 0 B = 0	Set the initial value of R to 0 Set the initial value of G to 0 Set the initial value of B to 0
R = randint(10, 255) G = randint(10, 255)	Set R=randint(10, 255) Set G=randint(10, 255)

B = randint(10, 255)	Set B=randint(10, 255)

6.13：Photoresistor



1. Description：

The photocell sensor (photoresistor) is a resistor made by the photoelectric effect of a semiconductor. It is very sensitive to ambient light, thus its resistance value vary with different light intensity.

We use its features to design a circuit and generate a photoresistor sensor module. The signal end of the module is connected to the analog port of the microcontroller. When the light intensity increases, the resistance decreases, and the voltage of the analog port rises, that is, the analog value of the microcontroller also goes up. Otherwise, when the light intensity decreases, the resistance increases, and the voltage of the analog port declines. That is, the analog value of the microcontroller becomes smaller. Therefore, we can use the photoresistor sensor module to read the corresponding analog value and sense the light intensity in the

environment.

It is commonly applied to light measurement, control and conversion, light control circuit as well.

The smart robot car comes with photoresistor. In the experiment, we control 18 RGB lights by photoresistor. The darker the ambient environment, the lighter the RGB.

What you need to get started

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

(2) Put batteries into battery holder

(3) Turn on the switch at the back of micro:bit car

(4) Link micro:bit board with computer using USB cable.

(5) Open the offline version of Mu

2. Test Code：

Code 1：

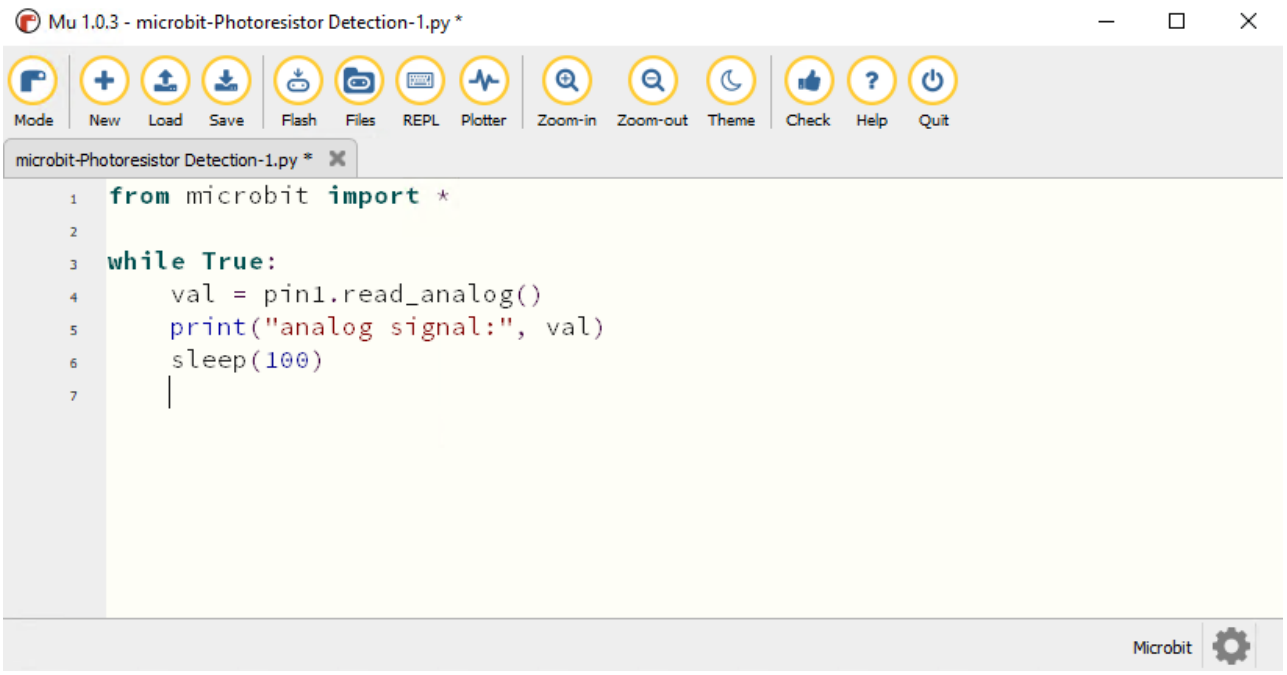
Detect light intensity through photoresistor

Open “microbit-Code 1.py ” in Mu，

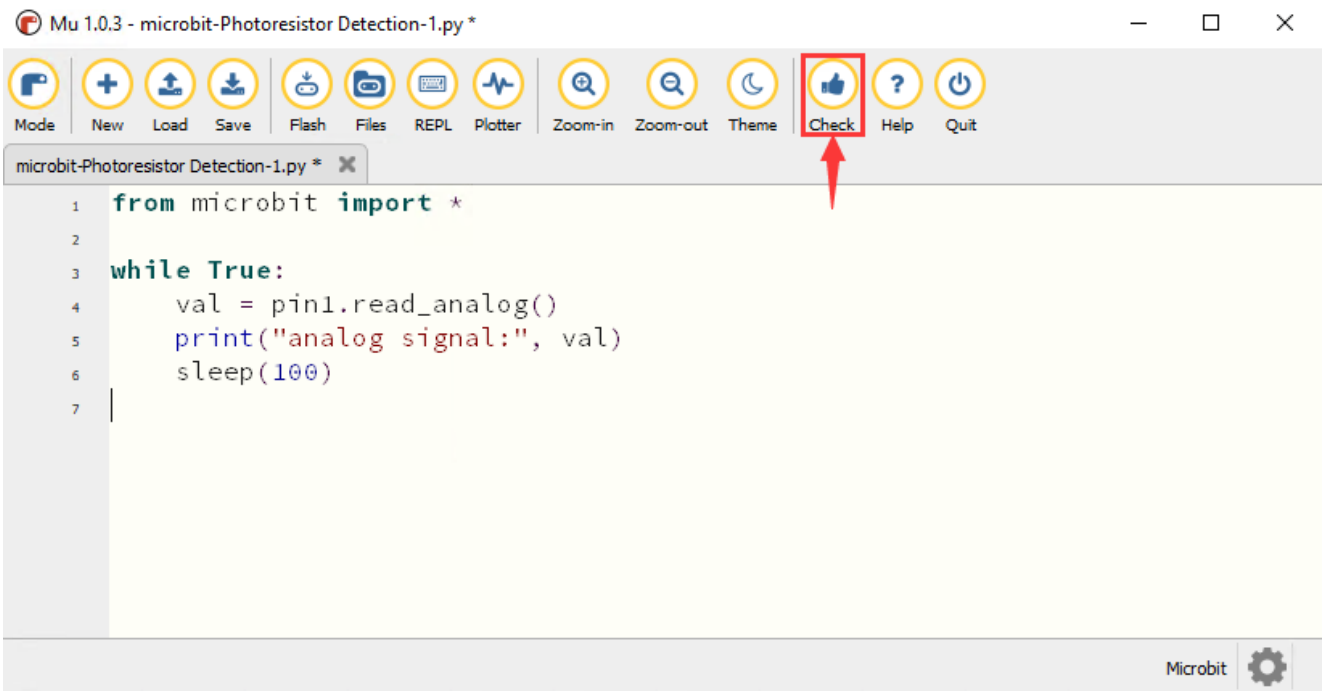
(How to load the project code?)

File Type	Route	File Name
Python file	../Python code/6.13： Photoresistor /	microbit-Code 1.py

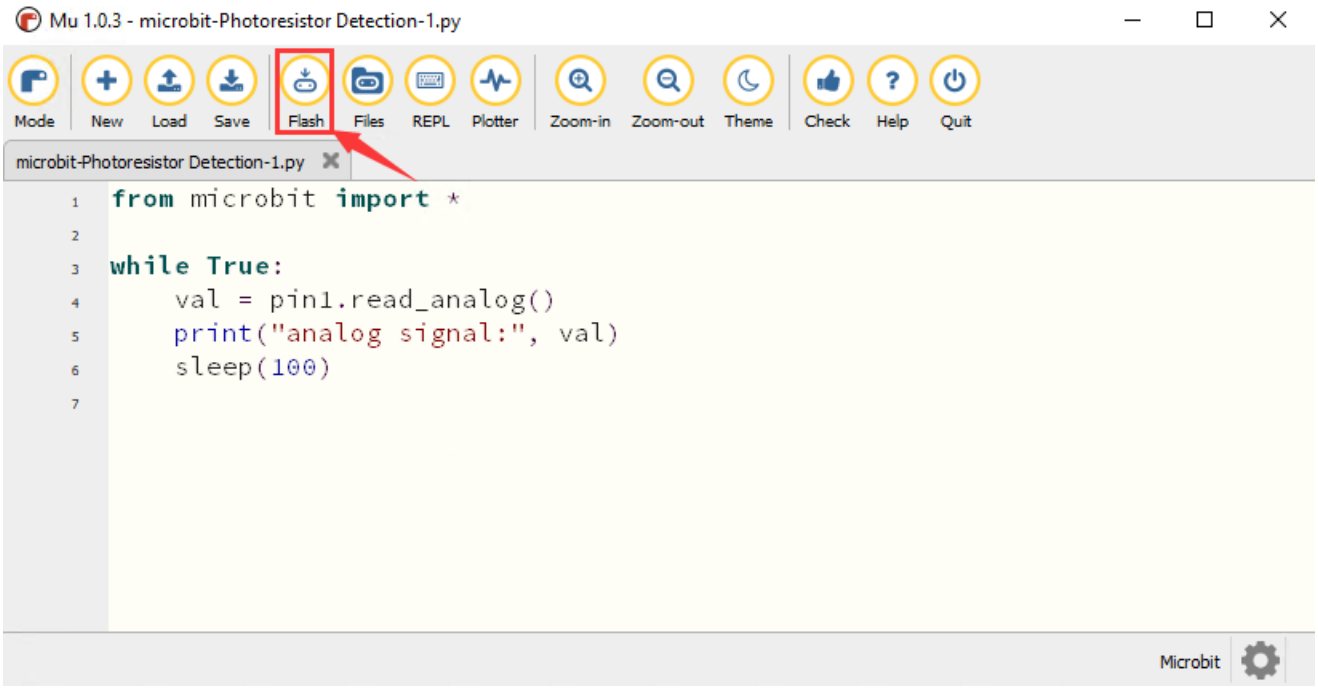
The successful loading is shown below.You can also input code in the edit window yourself.(note:all English words and symbols must be written in English)



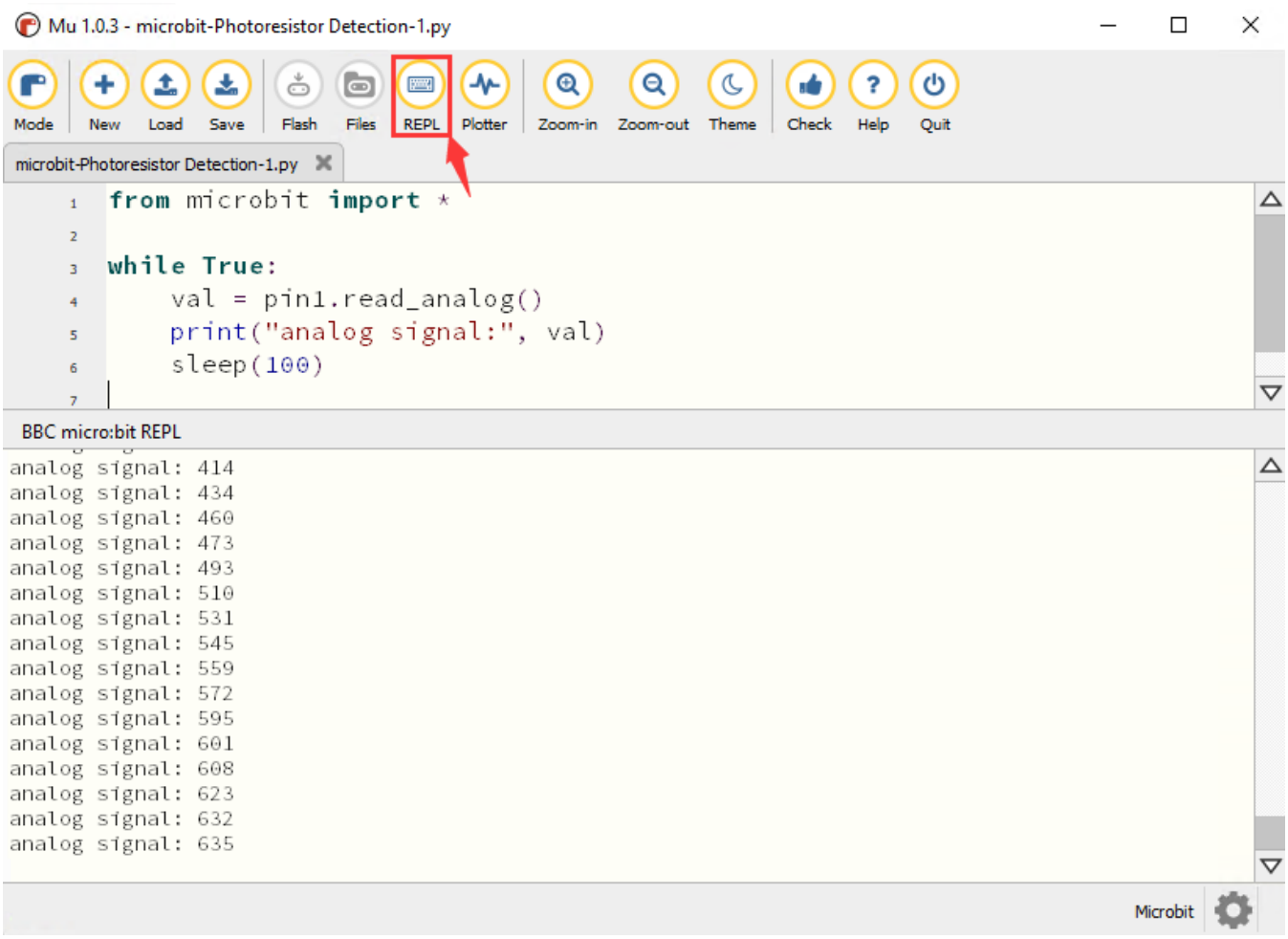
Click "Check" to examine error in the code. The program proves wrong if underlines and cursors are shown.



If the code is correct, connect micro:bit to computer and click "Flash" to download code to micro:bit board



Download code 1 to micro:bit and plug micro:bit into power. Click **"REPL" button and press reset button on micro:bit board.** BBC microbit REPL shows the intensity value. The value varies with the external light intensity. The weaker the light intensity is, the smaller the value is. As shown below:



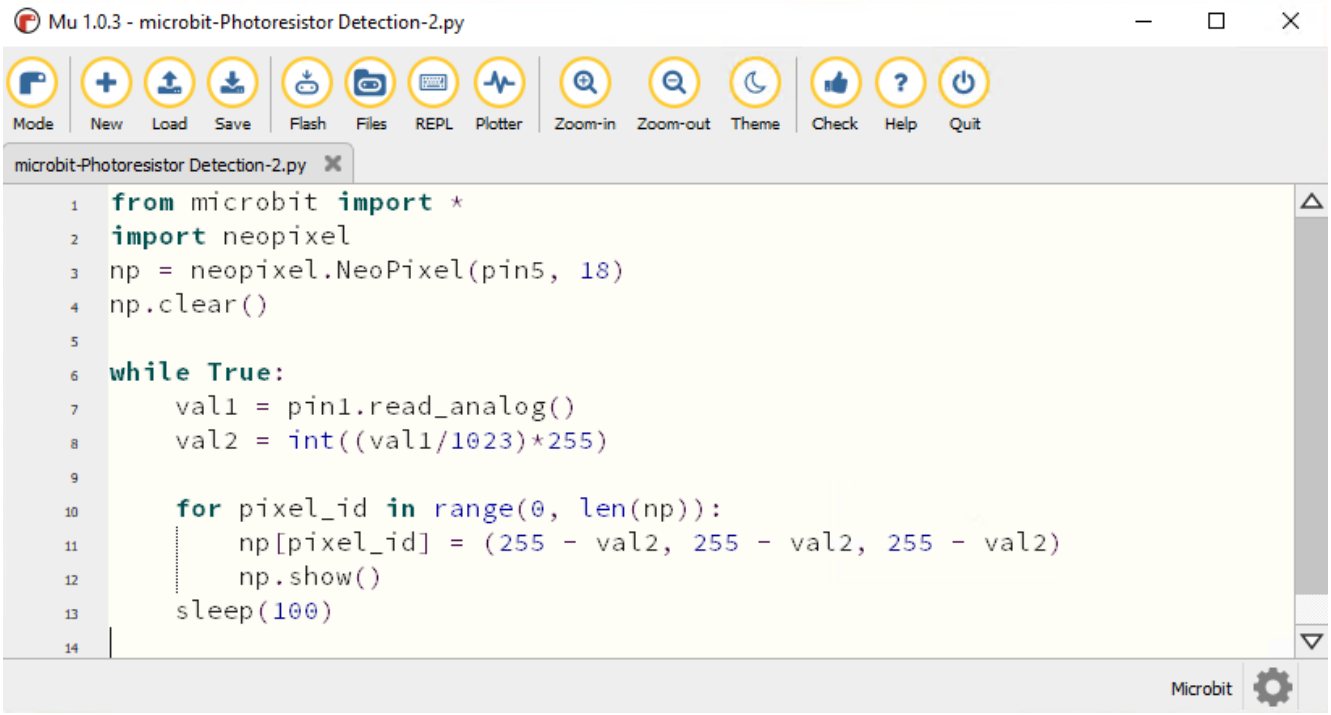
Code 2:

Open "microbit-Code 2.py" file in Mu,

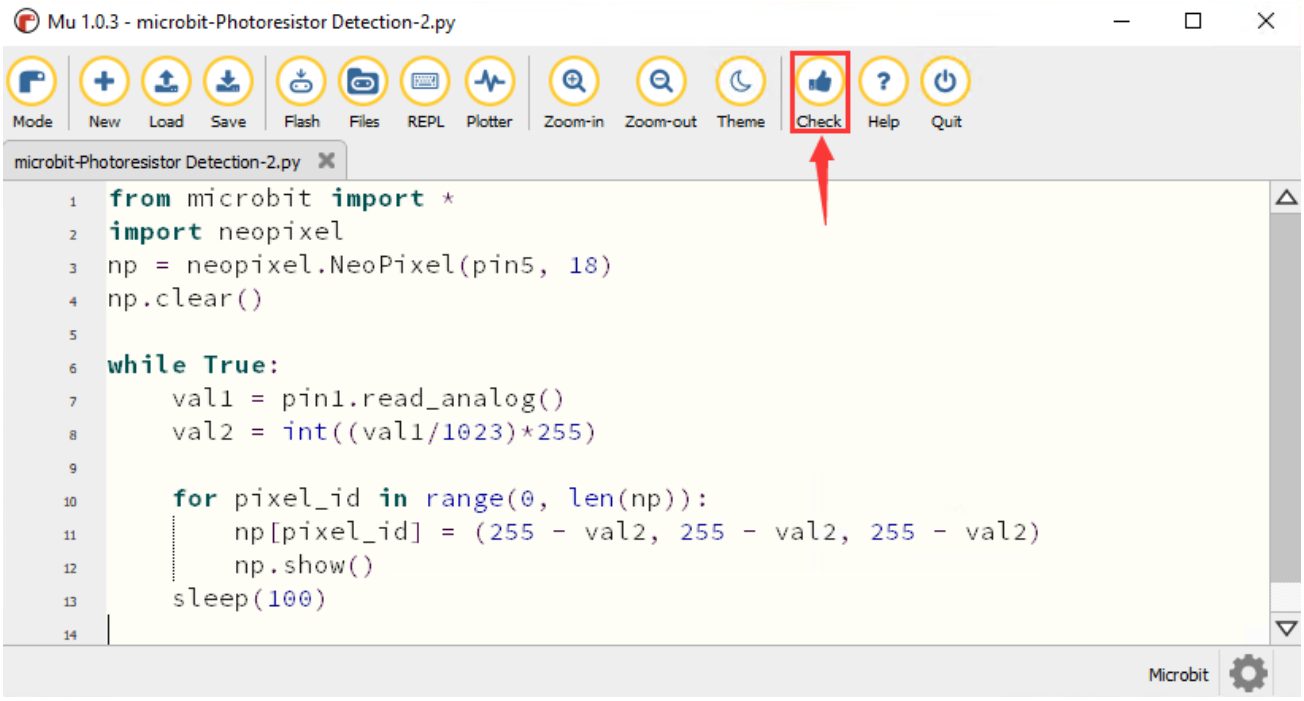
(How to load the project code?)

File Type	Route	File Name
Python file	../Python code/6.13: Photoresistor	microbit-Code 2.py

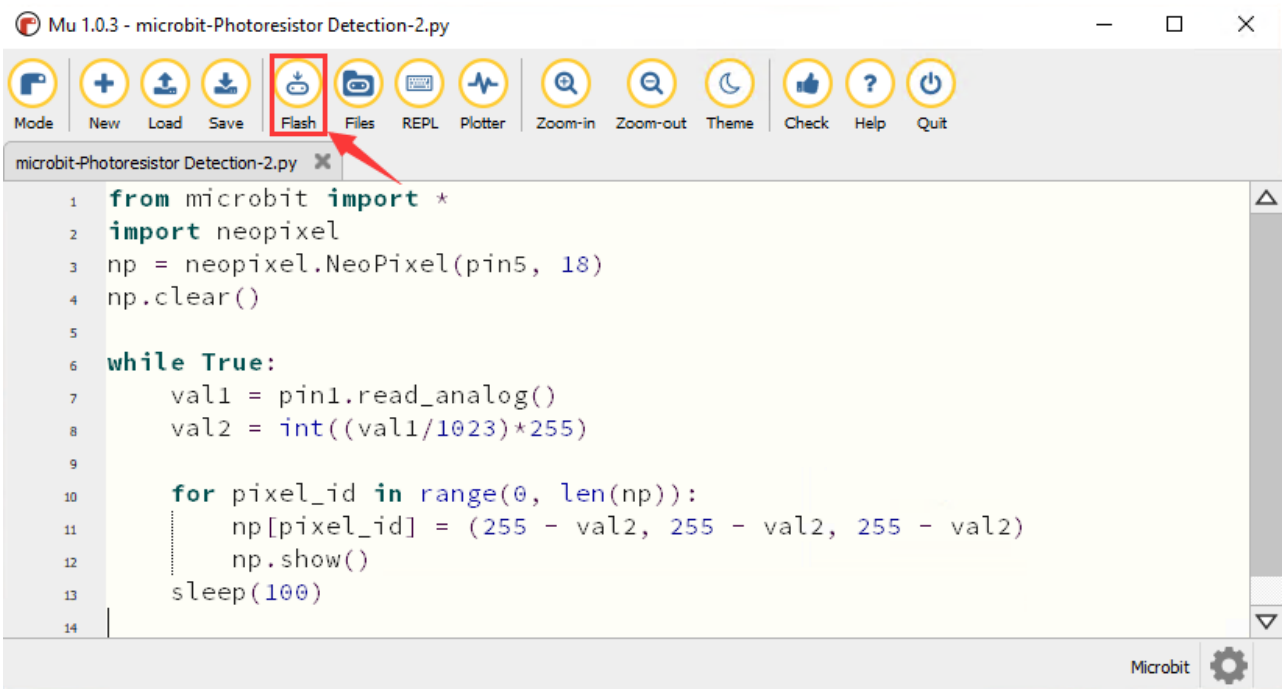
The successful loading is shown below.You can also input code in the edit window yourself.(note:all English words and symbols must be written in English)



Click “Check” to examine error in the code. The program proves wrong if underlines and cursors are shown.



If the code is correct, connect micro:bit to computer and click "Flash" to download code to micro:bit board



4. Test Result:

Download code2 to micro:bit, turn on the switch on robot car, then

KEYES-2812-18R module shows white color. The weaker the light intensity is, the brighter the KEYES-2812-18R gets.

5. Code Explanation:

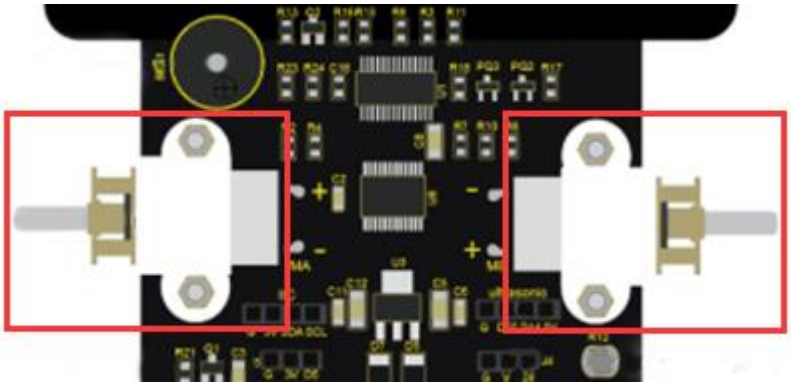
from microbit **import** *	import the library file of micro:bit
import neopixel	Import the library file of neopixel
np = neopixel.NeoPixel(pin5, 18)	Initialize Neopixel
np.clear()	RGB goes off
while True:	This is a permanent loop that makes micro:bit execute the code of it.
val1 = pin1.read_analog()	Set the light intensity value of photoresistor of P1 to val
val2 = int((val1/1023)*255)	Set int((val1/1023)*255) to val2
for pixel_id **in** range(0, len(np)):	Set the pixel of RGB to pixel_id in the range of（0，len（np））
np[pixel_id] = (255 - val2, 255 - val2, 255 - val2)	Set the color of pixel_id to RGB（red 255-val green 255-val blue 255-val）

np.show()	Display the current pixel_id on Neopixel strip
sleep(100)	Delay in 100ms

6. Reference:

read_analog() : read the voltage of pin, and more details please refer to https://microbit-micropython.readthedocs.io/en/latest/pin.html

6.14: Motor Driving



1. Description:

Keyestudio Micro: bit robot car is equipped with two DC geared motors.

DC geared motor is integration of reducer and motor, which is widely

applied to steel and machinery industry.

The shield of smart car is inclusive of PCA9685PW and TB6612FNG chip.

In order to save the resources of IO ports, we control the rotation speed and direction by TB6612FNG chip.

What you need to get started

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

(2) Put batteries into battery holder

(3) Turn on the switch at the back of micro:bit car

(4) Link micro:bit board with computer via USB cable.

(5) Open the offline version of Mu

2. Test Code：

Code 1：

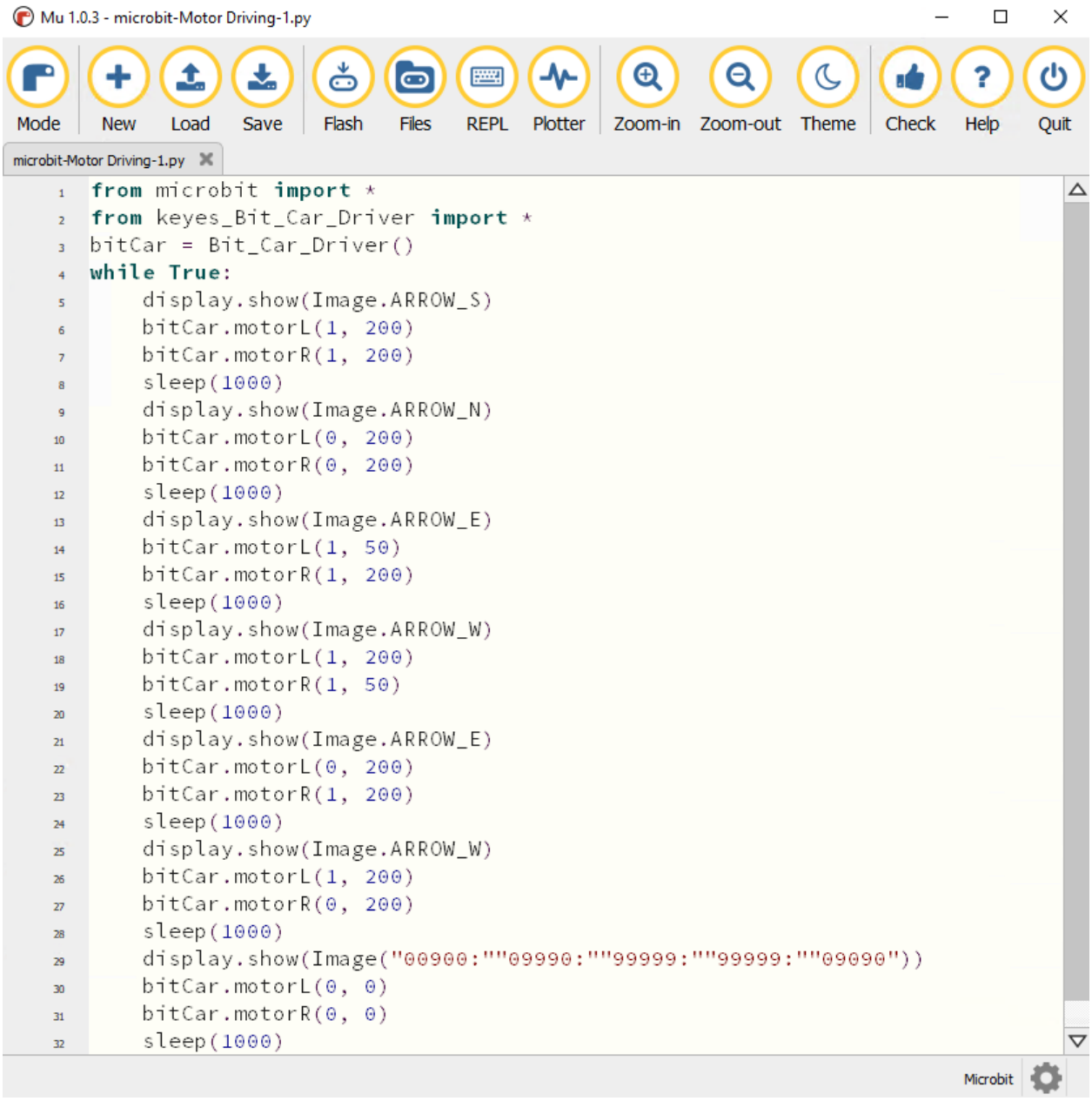
CarRun

Open “microbit-Code 1.py” file in Mu，

(How to load the project code?)

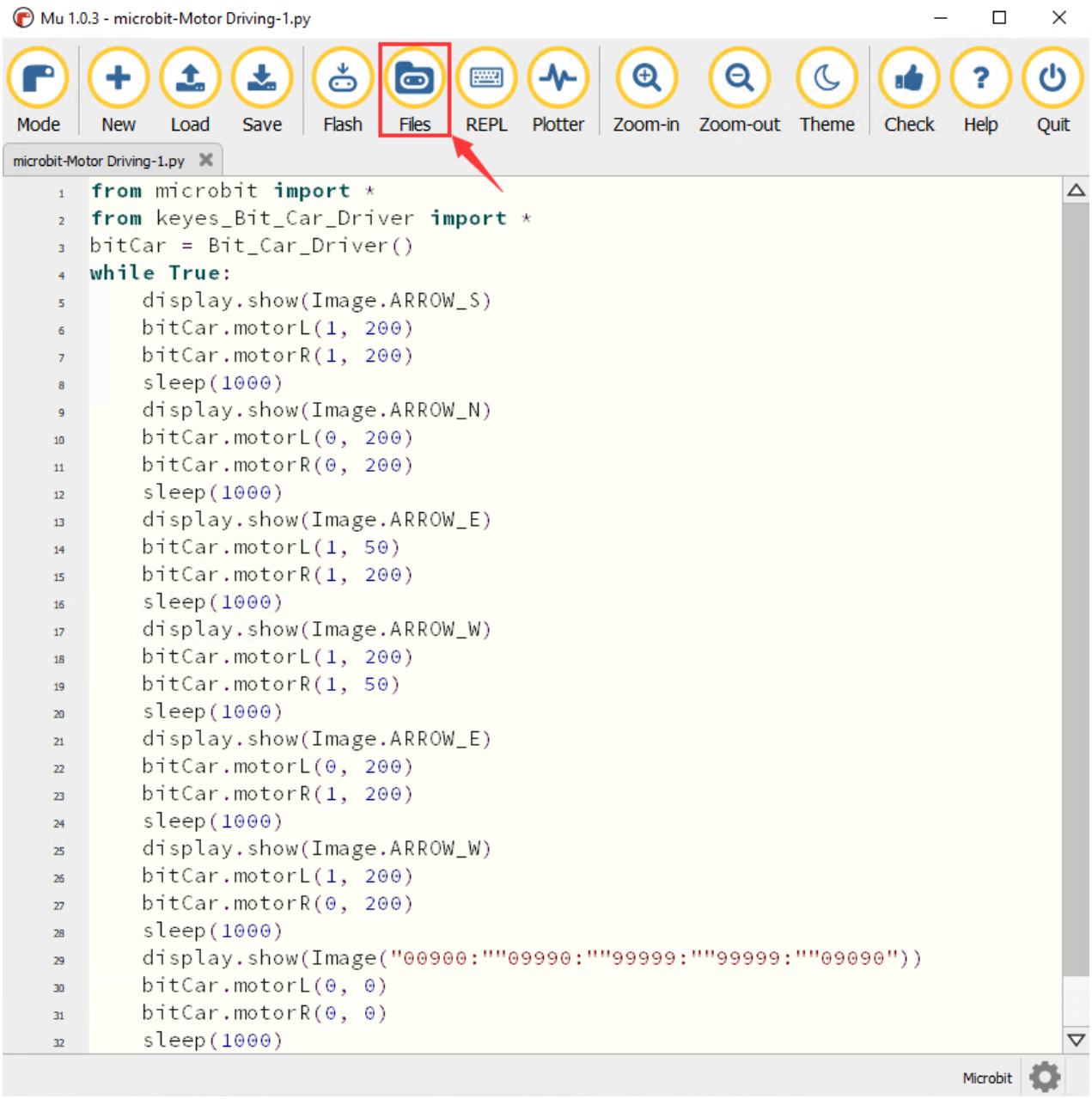
File Type	Route	File Name
Python file	../Python code/6.14： Motor Driving	microbit-Code 1.py

The successful loading is shown below.You can also input code in the edit window yourself.(note:all English words and symbols must be written in English)

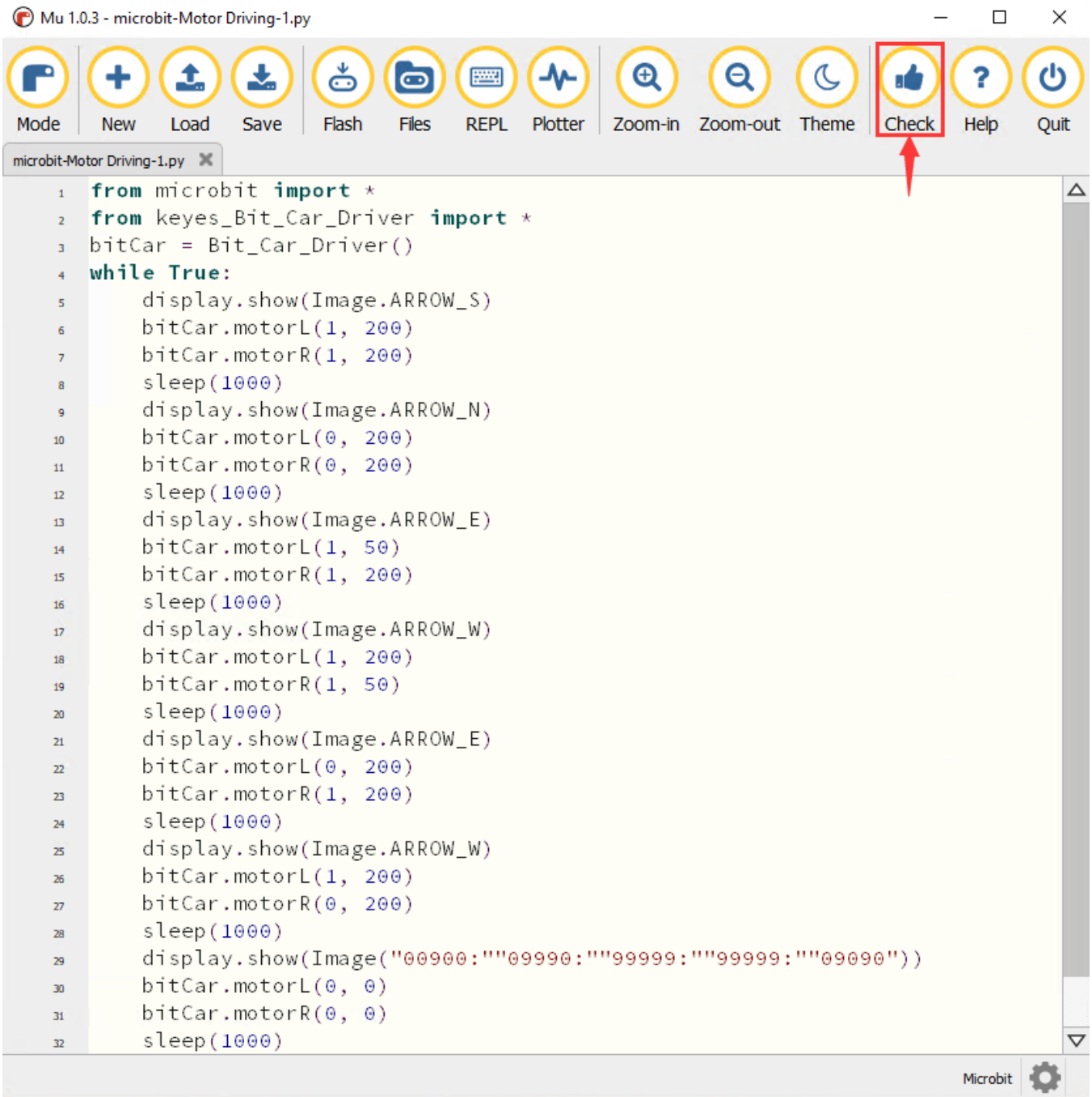


Click “Files” to import the library file of “keyes_Bit_Car_Driver.py” to micro:bit (How to import files?)

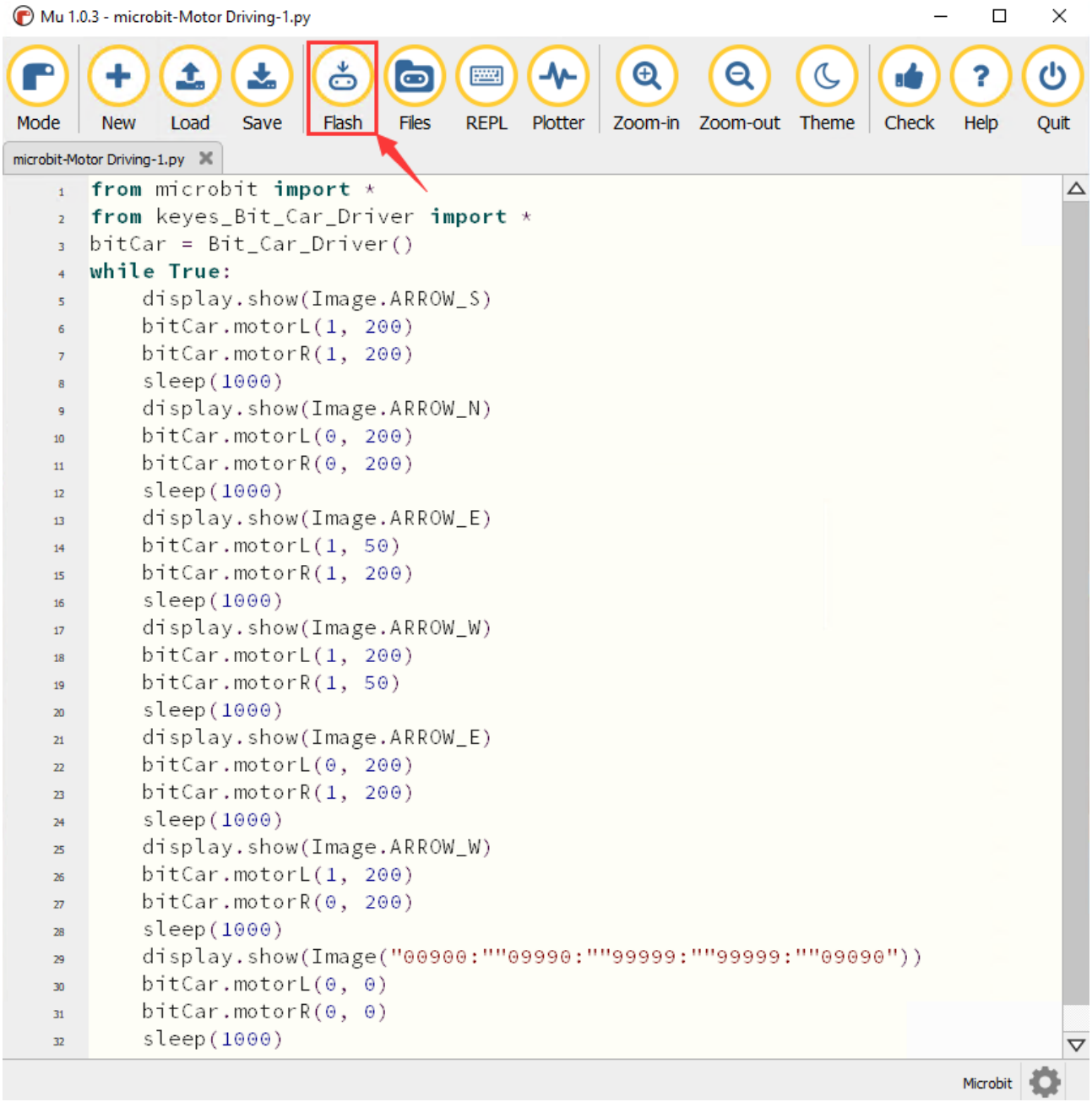
If micro:bit has library, you don’ t need to add one.



Click “Check” to examine error in the code. The program proves wrong if underlines and cursors are shown.



If the code is correct, connect micro:bit to computer and click “Flash” to download code to micro:bit board.



Code 2:

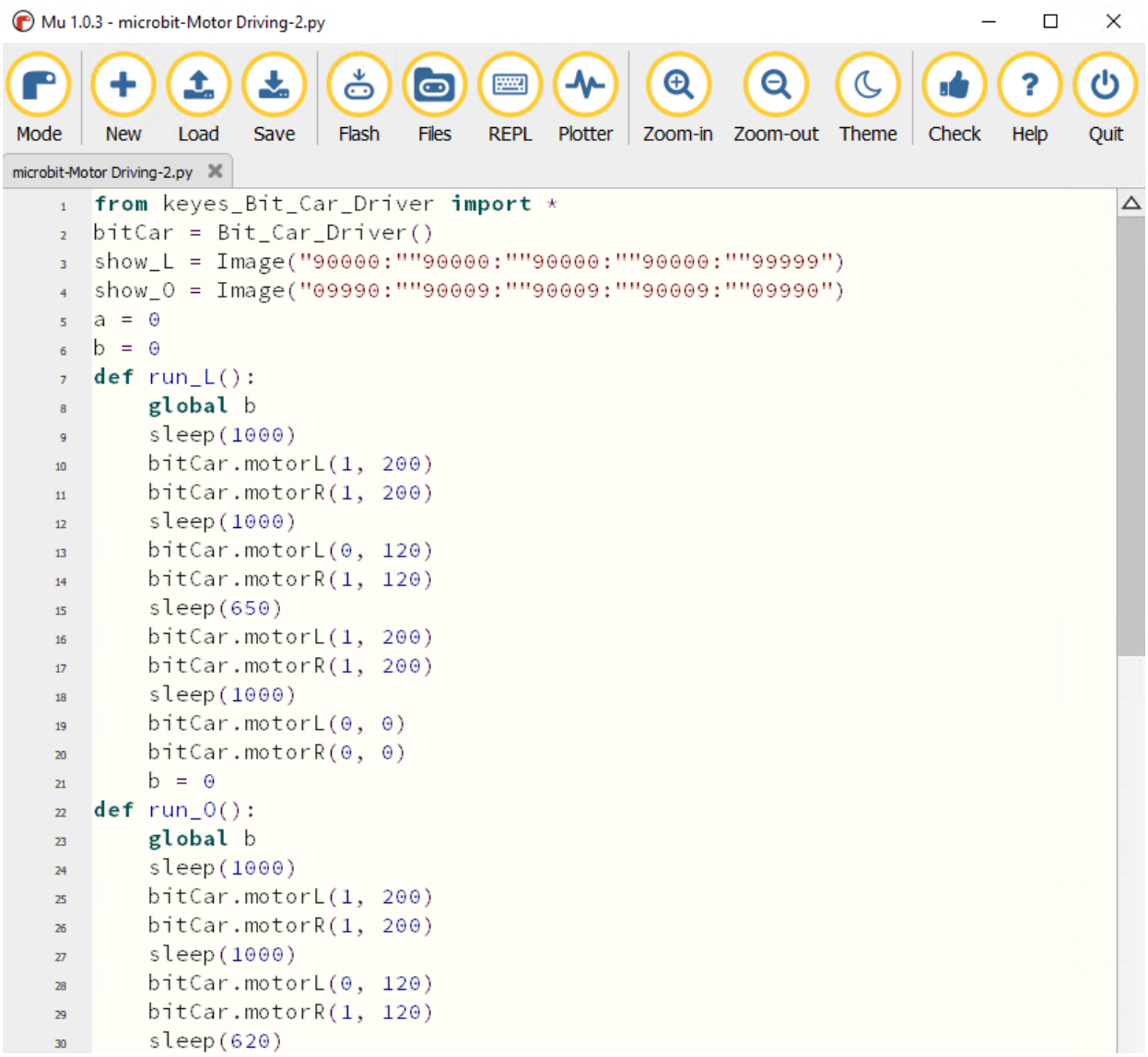
Open “microbit-Code 2.py” file in Mu.

(How to load the project code?)

File Type	Route	File Name
Python file	../Python code/6.14： Motor Driving	microbit-Motor Driving-2.py

The successful loading is shown below.You can also input code in the edit window yourself.(note:all English words and symbols must be written in English)

Note: Download code 2 to micro:bit, and turn on the switch of micro:bit. (Note: the control pin of right obstacle avoidance sensor and B button are P11. To prevent the obstacle avoidance sensor from interfering button B, we could screw the potentiometer RP9 clockwise to turn off the right obstacle sensor.




```
from keyes_Bit_Car_Driver import *
bitCar = Bit_Car_Driver()
show_L = Image("90000:""90000:""90000:""90000:""99999")
show_O = Image("09990:""90009:""90009:""90009:""09990")
a = 0
b = 0
def run_L():
    global b
    sleep(1000)
    bitCar.motorL(1, 200)
    bitCar.motorR(1, 200)
    sleep(1000)
    bitCar.motorL(0, 120)
    bitCar.motorR(1, 120)
    sleep(650)
    bitCar.motorL(1, 200)
    bitCar.motorR(1, 200)
    sleep(1000)
    bitCar.motorL(0, 0)
    bitCar.motorR(0, 0)
    b = 0
def run_O():
    global b
    sleep(1000)
    bitCar.motorL(1, 200)
    bitCar.motorR(1, 200)
    sleep(1000)
    bitCar.motorL(0, 120)
    bitCar.motorR(1, 120)
    sleep(620)
```

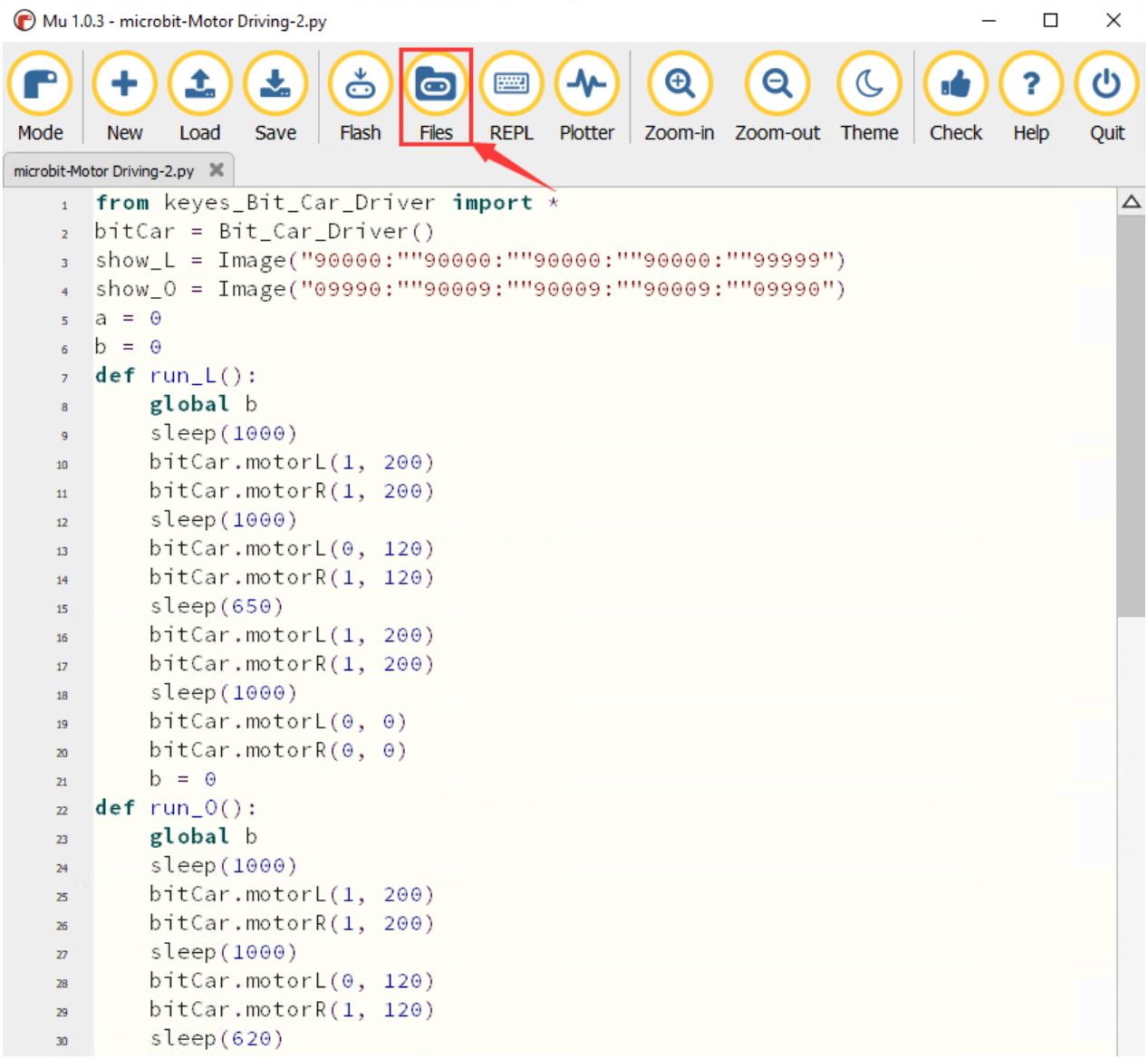
```
    bitCar.motorL(1, 200)
    bitCar.motorR(1, 200)
    sleep(1000)
    bitCar.motorL(0, 120)
    bitCar.motorR(1, 120)
    sleep(620)
    bitCar.motorL(1, 200)
    bitCar.motorR(1, 200)
    sleep(1000)
    bitCar.motorL(0, 120)
    bitCar.motorR(1, 120)
    sleep(620)
    bitCar.motorL(1, 200)
    bitCar.motorR(1, 200)
    sleep(1000)
    bitCar.motorL(0, 0)
    bitCar.motorR(0, 0)
    b = 0
while True:
    if button_a.was_pressed():
        a = a + 1
        if a >= 3:
            a = 0
    if button_b.was_pressed():
        b = 1
```

```
    if (a == 1):
        display.show(show_L)
        if b == 1:
            run_L()
    elif a == 2:
        display.show(show_0)
        if b == 1:
            run_0()
```

Microbit

Click “Files” to import the library of “keyes_Bit_Car_Driver.py “ to micro:bit.

(How to import files?)



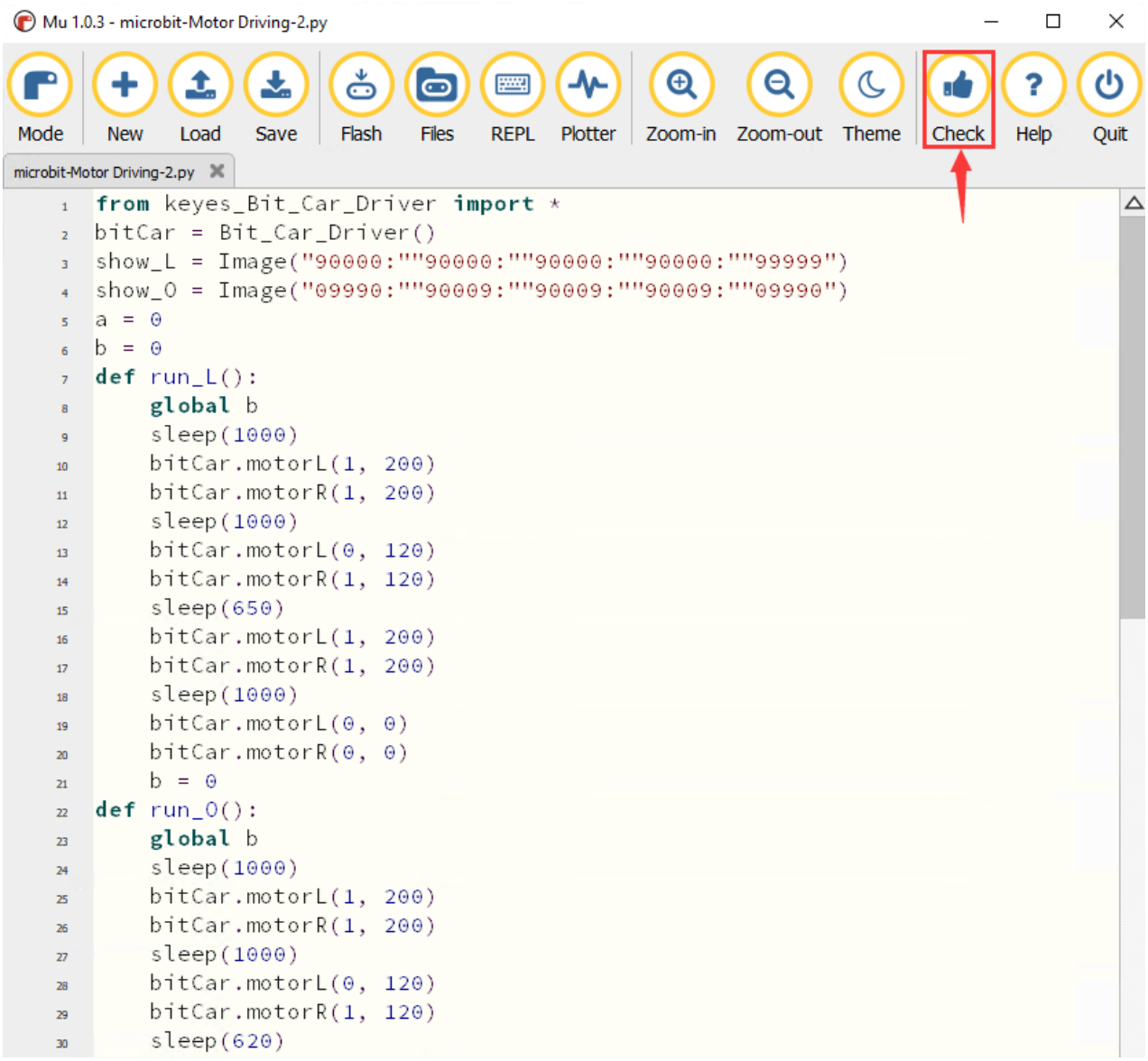

```
from keyes_Bit_Car_Driver import *
bitCar = Bit_Car_Driver()
show_L = Image("90000:""90000:""90000:""90000:""99999")
show_O = Image("09990:""90009:""90009:""90009:""09990")
a = 0
b = 0
def run_L():
    global b
    sleep(1000)
    bitCar.motorL(1, 200)
    bitCar.motorR(1, 200)
    sleep(1000)
    bitCar.motorL(0, 120)
    bitCar.motorR(1, 120)
    sleep(650)
    bitCar.motorL(1, 200)
    bitCar.motorR(1, 200)
    sleep(1000)
    bitCar.motorL(0, 0)
    bitCar.motorR(0, 0)
    b = 0
def run_O():
    global b
    sleep(1000)
    bitCar.motorL(1, 200)
    bitCar.motorR(1, 200)
    sleep(1000)
    bitCar.motorL(0, 120)
    bitCar.motorR(1, 120)
    sleep(620)
```

```
    bitCar.motorL(1, 200)
    bitCar.motorR(1, 200)
    sleep(1000)
    bitCar.motorL(0, 120)
    bitCar.motorR(1, 120)
    sleep(620)
    bitCar.motorL(1, 200)
    bitCar.motorR(1, 200)
    sleep(1000)
    bitCar.motorL(0, 120)
    bitCar.motorR(1, 120)
    sleep(620)
    bitCar.motorL(1, 200)
    bitCar.motorR(1, 200)
    sleep(1000)
    bitCar.motorL(0, 0)
    bitCar.motorR(0, 0)
    b = 0
while True:
    if button_a.was_pressed():
        a = a + 1
        if a >= 3:
            a = 0
    if button_b.was_pressed():
        b = 1
```

```
    if (a == 1):
        display.show(show_L)
        if b == 1:
            run_L()
    elif a == 2:
        display.show(show_0)
        if b == 1:
            run_0()
```

Microbit

Click “Check” to examine error in the code. The program proves wrong if underlines and cursors are shown.



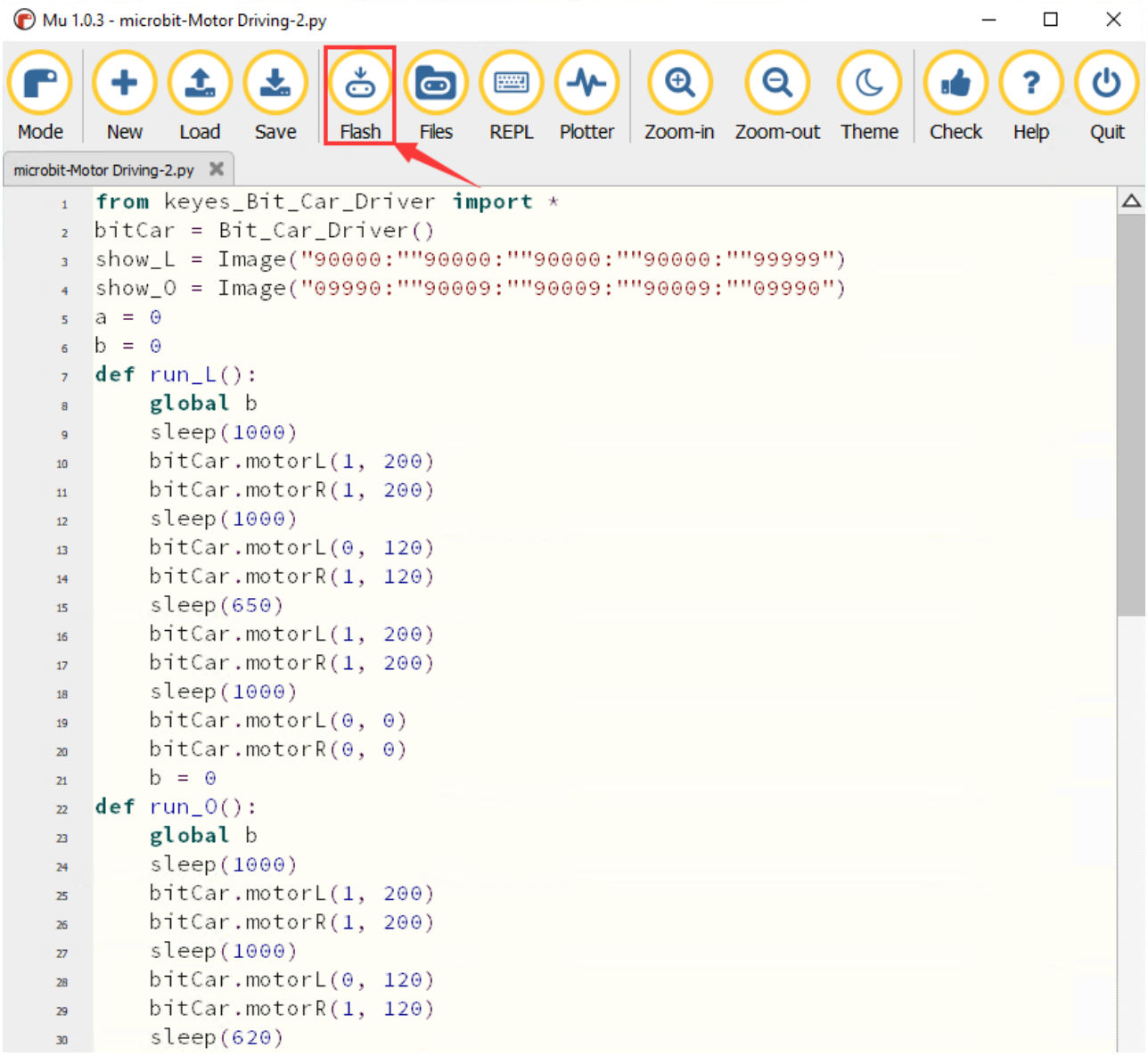

```
from keyes_Bit_Car_Driver import *
bitCar = Bit_Car_Driver()
show_L = Image("90000:""90000:""90000:""90000:""99999")
show_O = Image("09990:""90009:""90009:""90009:""09990")
a = 0
b = 0
def run_L():
    global b
    sleep(1000)
    bitCar.motorL(1, 200)
    bitCar.motorR(1, 200)
    sleep(1000)
    bitCar.motorL(0, 120)
    bitCar.motorR(1, 120)
    sleep(650)
    bitCar.motorL(1, 200)
    bitCar.motorR(1, 200)
    sleep(1000)
    bitCar.motorL(0, 0)
    bitCar.motorR(0, 0)
    b = 0
def run_O():
    global b
    sleep(1000)
    bitCar.motorL(1, 200)
    bitCar.motorR(1, 200)
    sleep(1000)
    bitCar.motorL(0, 120)
    bitCar.motorR(1, 120)
    sleep(620)
```

```
    bitCar.motorL(1, 200)
    bitCar.motorR(1, 200)
    sleep(1000)
    bitCar.motorL(0, 120)
    bitCar.motorR(1, 120)
    sleep(620)
    bitCar.motorL(1, 200)
    bitCar.motorR(1, 200)
    sleep(1000)
    bitCar.motorL(0, 120)
    bitCar.motorR(1, 120)
    sleep(620)
    bitCar.motorL(1, 200)
    bitCar.motorR(1, 200)
    sleep(1000)
    bitCar.motorL(0, 0)
    bitCar.motorR(0, 0)
    b = 0
while True:
    if button_a.was_pressed():
        a = a + 1
        if a >= 3:
            a = 0
    if button_b.was_pressed():
        b = 1
```

```
    if (a == 1):
        display.show(show_L)
        if b == 1:
            run_L()
    elif a == 2:
        display.show(show_0)
        if b == 1:
            run_0()
```

Microbit

If the code is correct, connect micro:bit to computer and click "Flash" to download code to micro:bit board




```
from keyes_Bit_Car_Driver import *
bitCar = Bit_Car_Driver()
show_L = Image("90000:""90000:""90000:""90000:""99999")
show_O = Image("09990:""90009:""90009:""90009:""09990")
a = 0
b = 0
def run_L():
    global b
    sleep(1000)
    bitCar.motorL(1, 200)
    bitCar.motorR(1, 200)
    sleep(1000)
    bitCar.motorL(0, 120)
    bitCar.motorR(1, 120)
    sleep(650)
    bitCar.motorL(1, 200)
    bitCar.motorR(1, 200)
    sleep(1000)
    bitCar.motorL(0, 0)
    bitCar.motorR(0, 0)
    b = 0
def run_O():
    global b
    sleep(1000)
    bitCar.motorL(1, 200)
    bitCar.motorR(1, 200)
    sleep(1000)
    bitCar.motorL(0, 120)
    bitCar.motorR(1, 120)
    sleep(620)
```

```
    bitCar.motorL(1, 200)
    bitCar.motorR(1, 200)
    sleep(1000)
    bitCar.motorL(0, 120)
    bitCar.motorR(1, 120)
    sleep(620)
    bitCar.motorL(1, 200)
    bitCar.motorR(1, 200)
    sleep(1000)
    bitCar.motorL(0, 120)
    bitCar.motorR(1, 120)
    sleep(620)
    bitCar.motorL(1, 200)
    bitCar.motorR(1, 200)
    sleep(1000)
    bitCar.motorL(0, 0)
    bitCar.motorR(0, 0)
    b = 0
while True:
    if button_a.was_pressed():
        a = a + 1
        if a >= 3:
            a = 0
    if button_b.was_pressed():
        b = 1
```

```
    if (a == 1):
        display.show(show_L)
        if b == 1:
            run_L()
    elif a == 2:
        display.show(show_0)
        if b == 1:
            run_0()
```

Microbit

4.Test Result:

Download code 1 to micro:bit, and turn on the switch on robot car. The robot car will go forward for 1s, back for 1s, turn left for 1s, right for 1s, turn anticlockwise for 1s, clockwise for 1 and stop 1s. Matrix also displays

the patterns.

Note: Download code 2 to micro:bit, and turn on the switch of micro:bit. (Note: the control pin of right obstacle avoidance sensor and B button are P11. To prevent the obstacle avoidance sensor from interfering button B, we could screw the potentiometer RP9 clockwise to turn off the right obstacle sensor.

When the button A and B are firstly pressed, micro" bit will show "L", the route of car is "L". When they are pressed again,"□"is shown on micro:bit, and route of car is "□".

5. Code Explanation:

from microbit **import** *	import the library file of micro:bit
from keyes_Bit_Car_Driver **import** *	Import the library of keyes_Bit_Car_Driver
bitCar = Bit_Car_Driver()	Set Bit_Car_Driver() to

	bitCar
while True:	This is permanant loop, and make micro:bit excute the codeThis is a permanent loop that makes micro:bit execute the code of it.
display.show(Image.ARROW_S) display.show(Image.ARROW_N) display.show(Image.ARROW_E) display.show(Image.ARROW_W) display.show(Image("00900:""09990:""99999:""99999:""09090"))	micro:bit shows arrow pointing to South micro:bit shows arrow pointing to North micro:bit shows arrow pointing to East micro:bit shows arrow pointing to West micro:bit displays “♡”

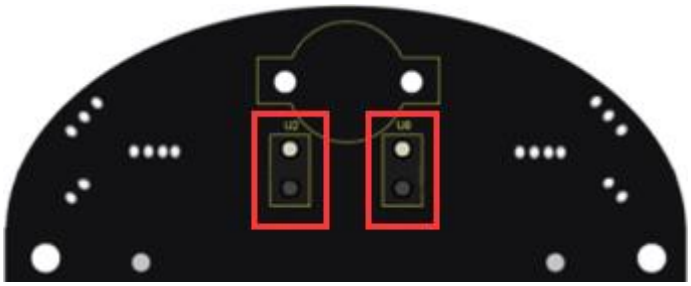
bitCar.motorL(1, 200) bitCar.motorR(1, 200)	The left motor of car rotates clockwise at the speed of PWM200 （1: clockwise，0: anticlockwise；PWM100 means speed（0~255）） The right motor of car rotates clockwise at the speed of PWM200
bitCar.motorL(0, 200) bitCar.motorR(0, 200)	The left motor of car rotates anticlockwise at the speed of PWM200 The right motor of car rotates anticlockwise at the speed of PWM200
sleep(1000)	Delay in 1000ms
a = 0 b = 0	Set the initial value of a to 0

	Set the initial value of b to 0
def run_L(): **def** run_O():	Define subroutine run_L()
show_L = Image("90000:""90000:""90000:""90000:""99999")	Set show_L=Image()

if button_a.was_pressed():	If button A is pressed,
a = a + 1	a = a + 1
if a >= 3:	If a≥3
a = 0	a=0
if button_b.was_pressed():	If button B is pressed,
b = 1	b=1
if (a == 1):	If a=1
display.show(show_L)	micro:bit shows “L” pattern
if b == 1:	If b=1
run_L()	The track of car is route L
elif a == 2:	If a=2
display.show(show_O)	micro:bit shows “O” image
if b == 1:	If b=1
run_O()	The track of car is route O

6.15：Line Tracking Car

6.15.1：Line Tracking Sensor



1. Description：

The V2 expansion board of keyestudio Micro：bit mini smart robot car comes with two line tracking elements 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.

What you need to get started

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

(2) Put batteries into battery holder

(3) Turn on the switch at the back of micro:bit car

(4) Link micro:bit board with computer via USB cable.

(5) Open the offline version of Mu

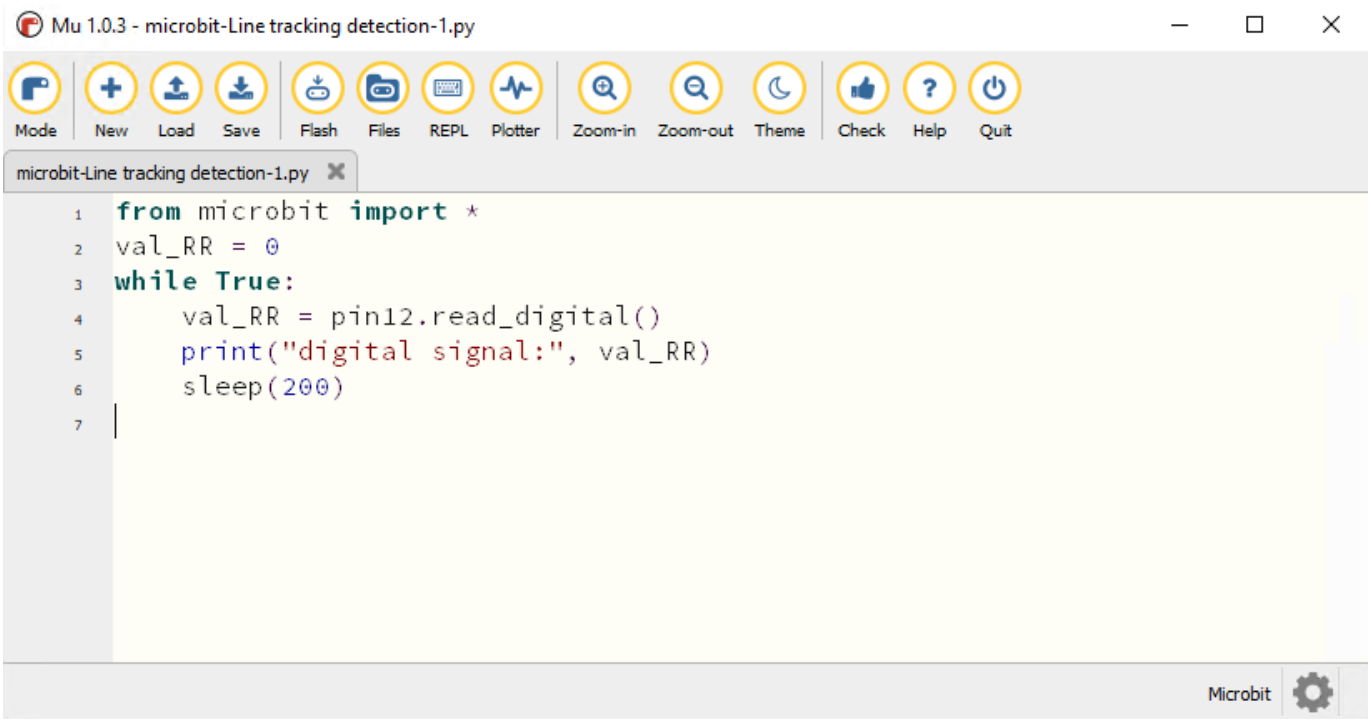
2. Test Code:

Code 1:

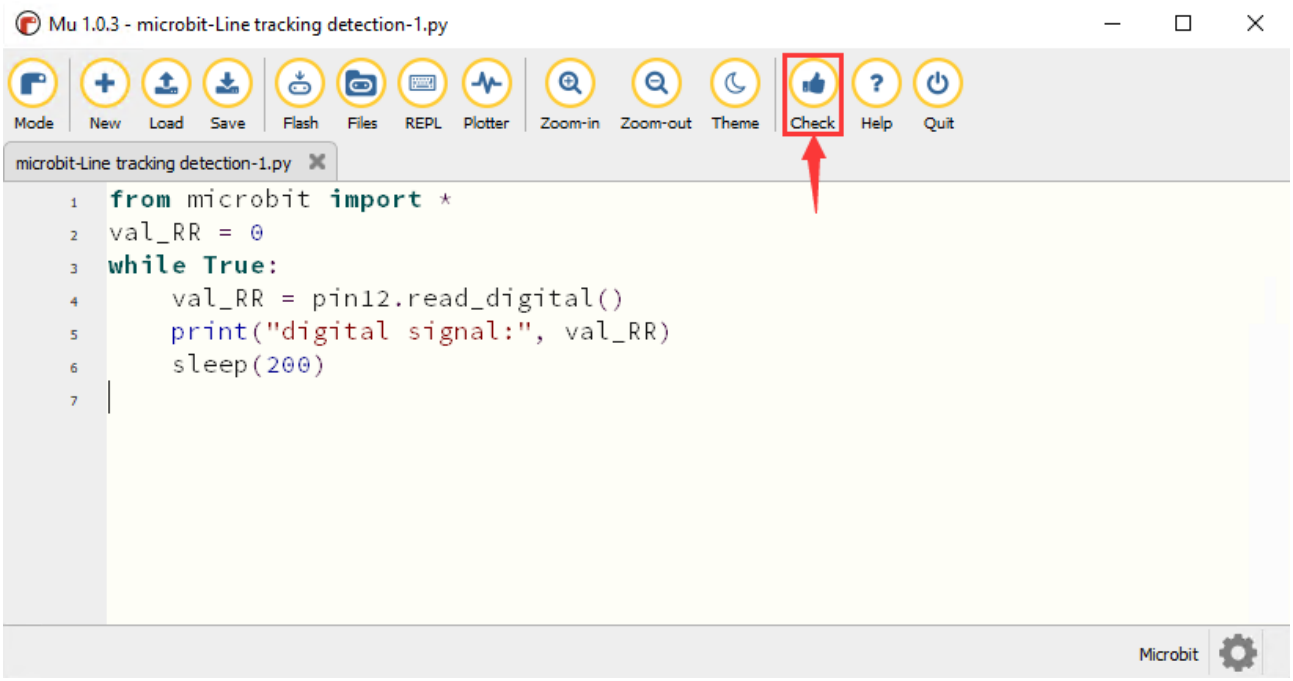
Open the file "Code 1.py" in Mu (How to load the project code?)

File Type	Route	File Name
Python file	../Python code/6.15: Line tracking car/6.15.1	Code 1.py

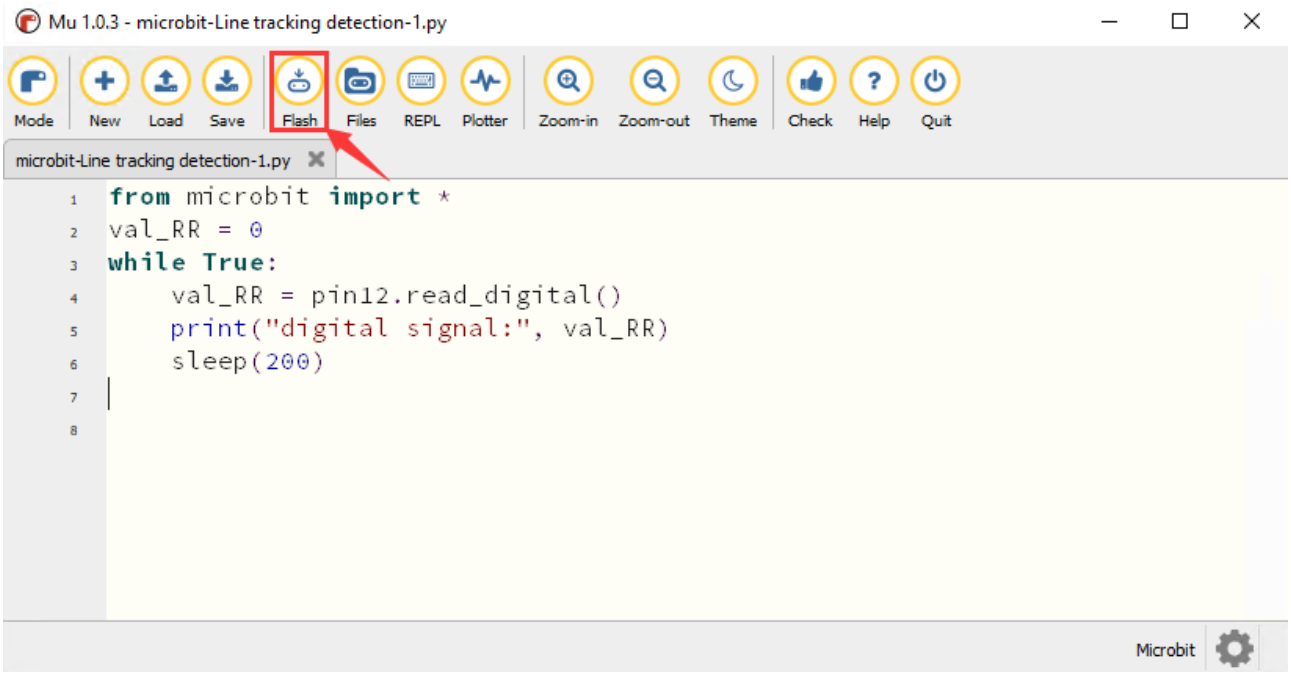
The successful loading is shown below.You can also input code in the edit window yourself.(note:all English words and symbols must be written in English)



Click “Check” to examine error in the code. The program proves wrong if underlines and cursors are shown.

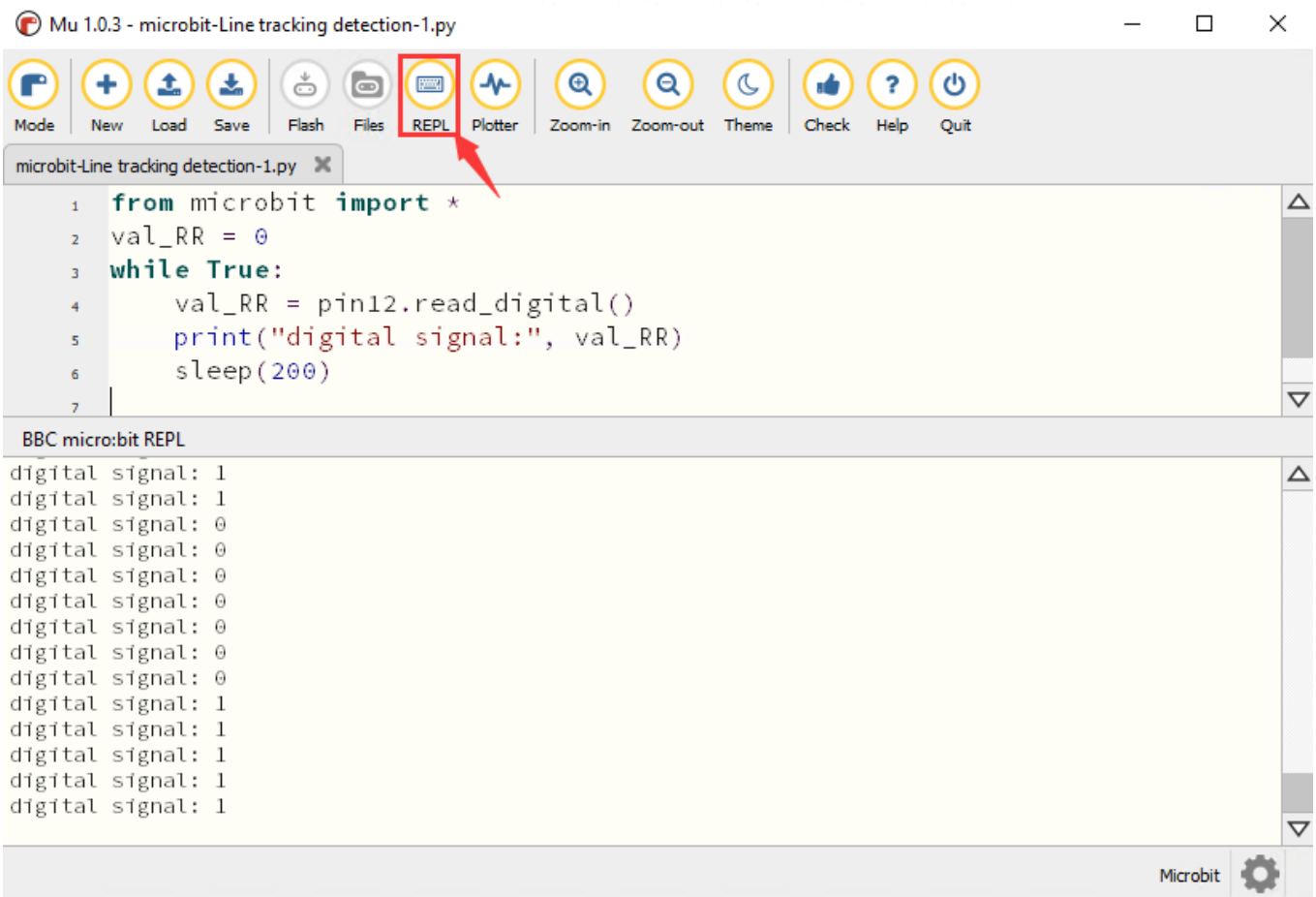


If the code is correct, connect micro:bit to computer and click “Flash” to download code to micro:bit board



Download code 1 onto micro:bit board, don’ t plug off USB cable. Click “REPL” and press the reset buttons, the readings detected by right line tracking sensor are displayed on monitor.

When the right line tracking sensor detects white object, 0 will be shown and D6 will be on; when no white objects and only black object are detected, 1 will be displayed and D6 will be off, as shown below.



Code 2：

Open file “Code 2.py in Mu.（How to load the project code?）

File Type	Route	File Name
Python file	../Python code/6.15：Line tracking car/6.15.1	microbit-Code 2 .py

The successful loading is shown below.You can also input code in the edit window yourself.(note:all English words and symbols must be written in English)

Mu 1.0.3 - microbit-Line tracking detection-2.py

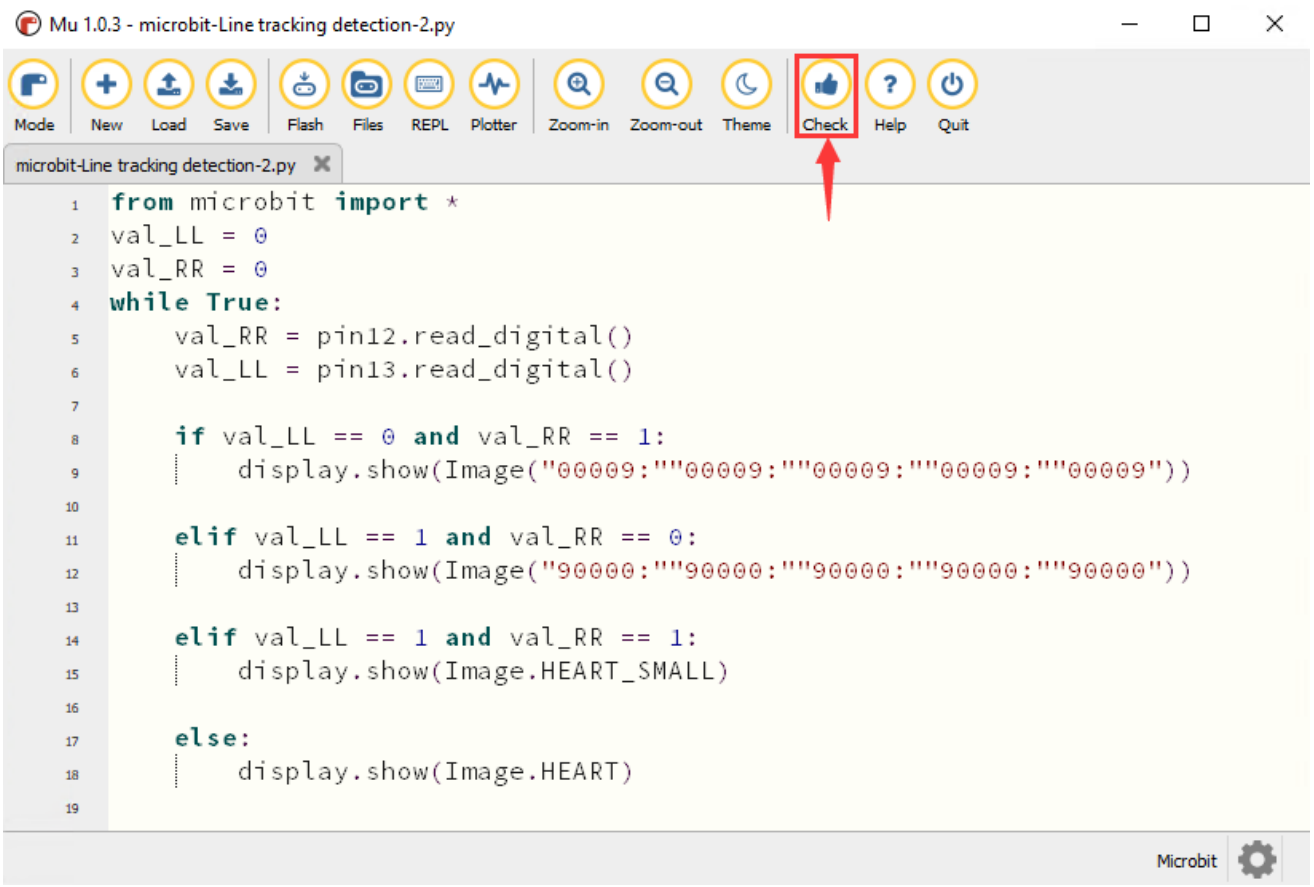
Mode | New | Load | Save | Flash | Files | REPL | Plotter | Zoom-in | Zoom-out | Theme | Check | Help | Quit

microbit-Line tracking detection-2.py

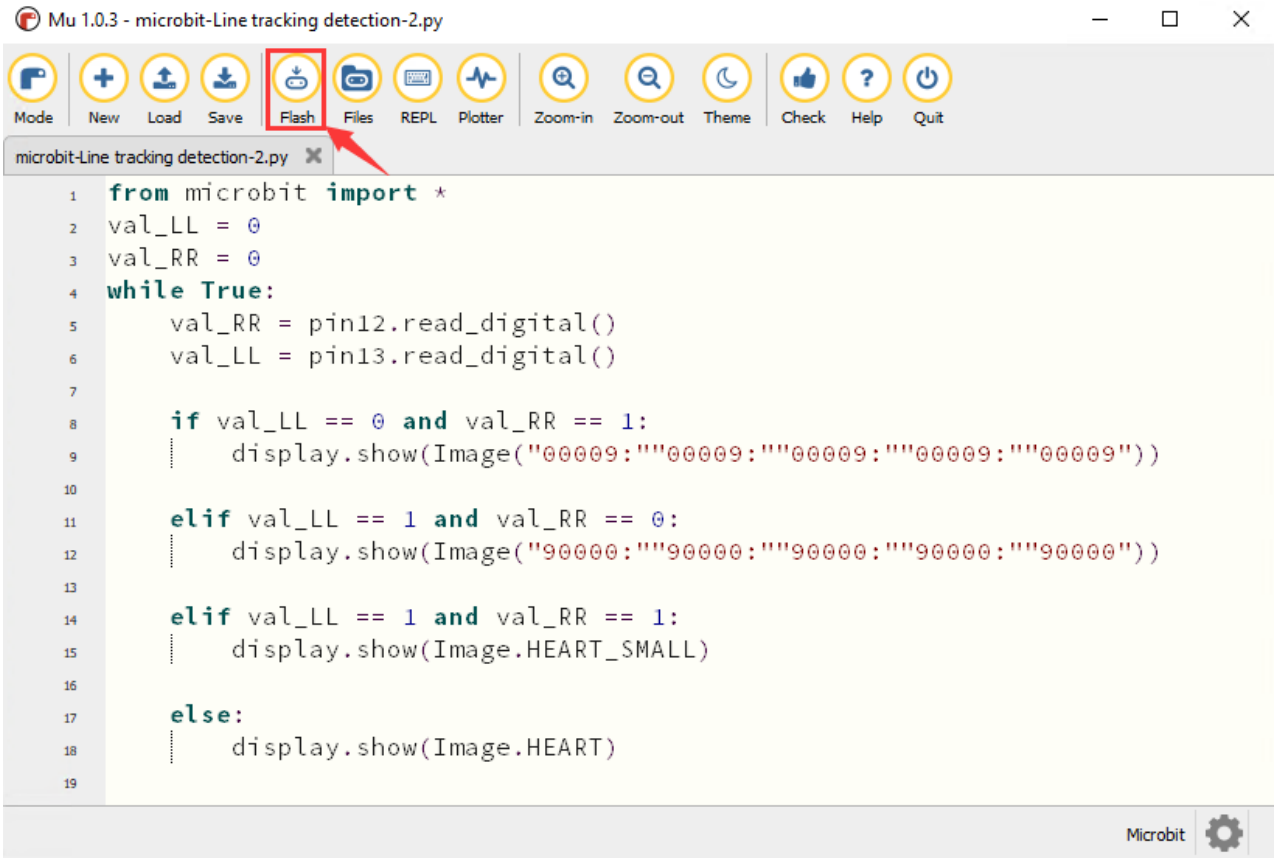
```
from microbit import *
val_LL = 0
val_RR = 0
while True:
    val_RR = pin12.read_digital()
    val_LL = pin13.read_digital()

    if val_LL == 0 and val_RR == 1:
        display.show(Image("00009:""00009:""00009:""00009:""00009"))

    elif val_LL == 1 and val_RR == 0:
        display.show(Image("90000:""90000:""90000:""90000:""90000"))

    elif val_LL == 1 and val_RR == 1:
        display.show(Image.HEART_SMALL)

    else:
        display.show(Image.HEART)

```

Microbit

Click “Check” to examine error in the code. The program proves wrong if underlines and cursors are shown.



If the code is correct, connect micro:bit to computer and click "Flash" to download code to micro:bit board.



4.Test Result:

Download code 2 to micro:bit, turn on the switch on robot car. When white object is detected by left sensor, micro bit shows "I" pattern at its left and D2 is on.

When only right sensor detects the white object, micro bit shows "I" pattern at its right and D6 is on.

If both of line tracking sensors detect black object or no object is detected, "▪" will be shown on micro:bit.

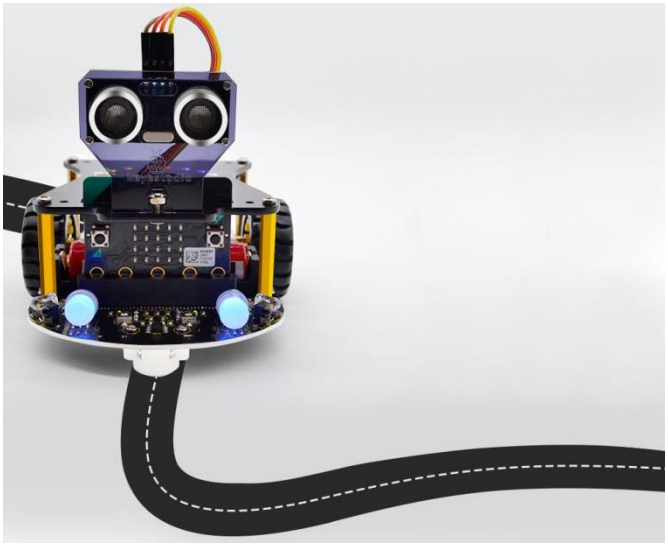
If both detect white object, "♡" will be shown and D2 and D6 will be on.

5.Code Explanation:

from microbit **import** *	import the library file of micro:bit
val_RR = 0	Set the initial value of val_RR to 0
val_LL = 0	Set the initial value of val_LL to 0
while True:	This is a permanent loop that makes micro:bit execute the code of it.
val_RR = pin12.read_digital()	Set the digital signal read by tracking sensor connected to pin12, to val_RR
val_LL = pin13.read_digital()	Set the digital signal read by tracking sensor connected to pin13, to val_LL
print("Light intensity:", Lightintensity)	BBC microbit REPL prints the digital signals read by line tracking sensor
sleep(100)	Delay in 100ms
if val_LL == 0 **and** val_RR == 1: display.show(Image("00009:""000	When val_LL = 0 and val_RR = 1 micro:bit shows "1" on the left

09:""00009:""00009:""00009")) **elif** val_LL == 1 **and** val_RR == 0: display.show(Image("90000:""900 00:""90000:""90000:""90000")) **elif** val_LL == 1 **and** val_RR == 1: display.show(Image.HEART_SMA LL) **else:** display.show(Image.HEART)	When val_LL = 1 and val_RR = 0 micro:bit shows “1” on the right When val_LL =1 and val_RR = 1micro:bit displays “”. If the above conditions are not met, micro:bit displays “”.

6.15.2：Line Tracking Car

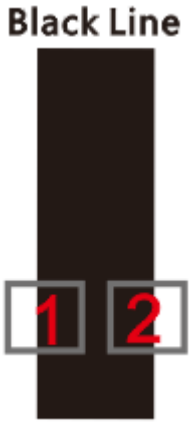


1. Description：

In this lesson we will combine line tacking sensors with 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.

If two line tracking sensors detect black line, the smart car will go forward; if only left sensor detects black line, robot car will turn left; if only right sensor detects black line, smart car will turn right; if black line is not detected, car will stop.



What you need to get started

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

(2) Put batteries into battery holder

(3) Turn on the switch at the back of micro:bit car

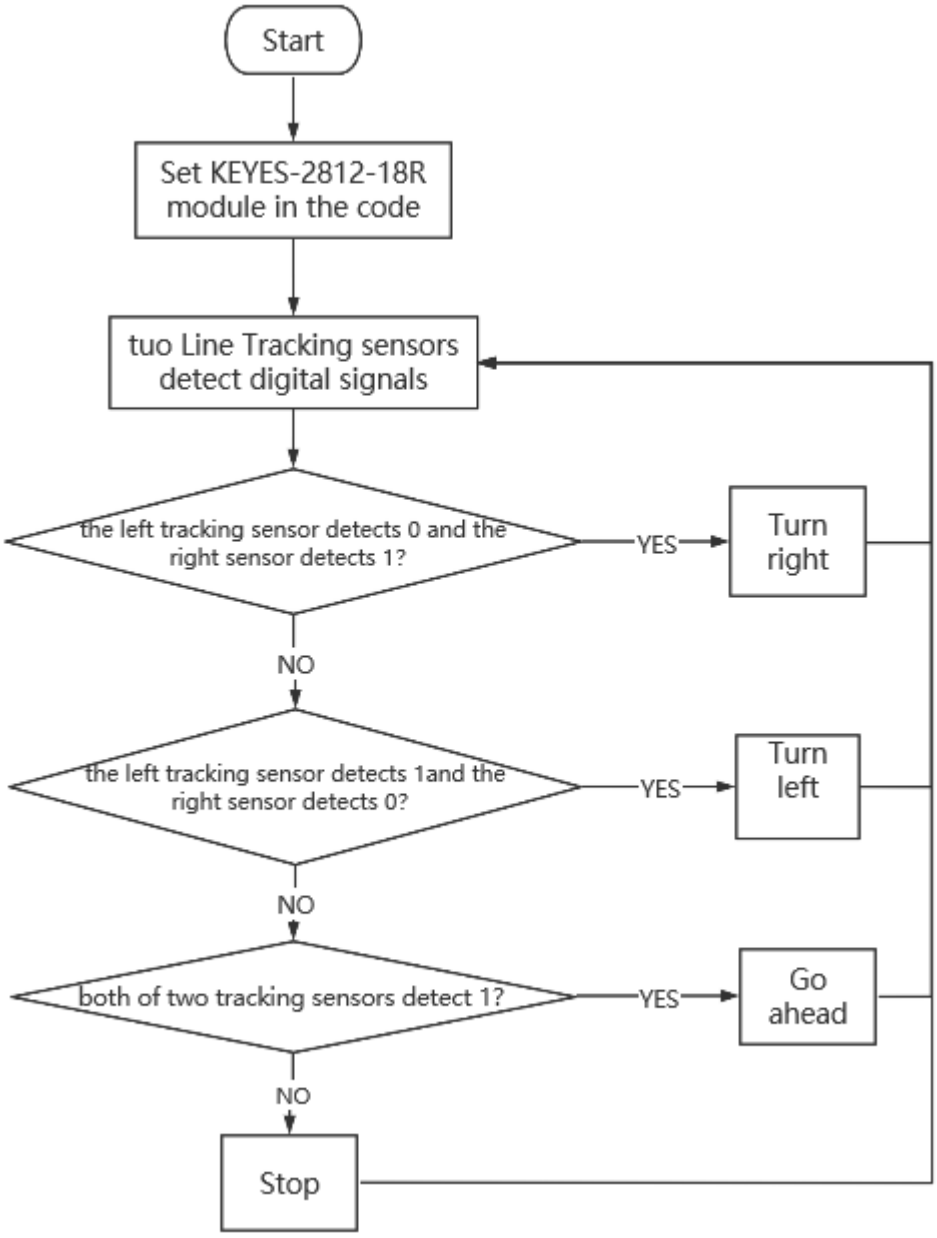
(4) Link micro:bit board with computer via USB cable.

(5) Open the offline version of Mu

2.

Flow Chart

Left/Right line tracking sensor（Level）		Line tracking Smart Car
Low（0）	High（1）	Turn right
High（1）	Low（0）	Go back
High（1）	High（1）	Go forward
Low（0）	Low（0）	Stop

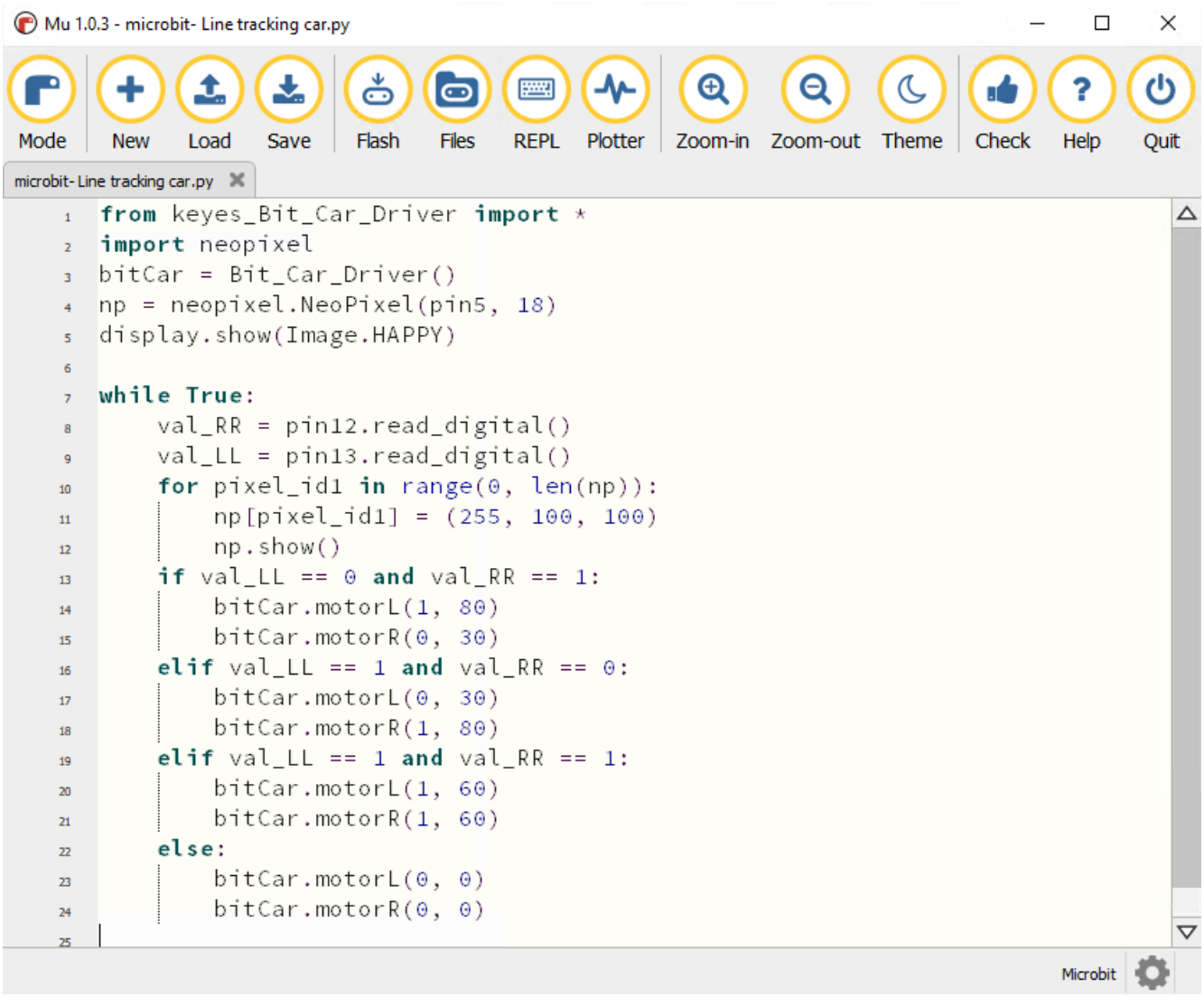


3. Test Code:

Open "microbit- Line Tracking Car.py " in Mu: (How to load the project code?)

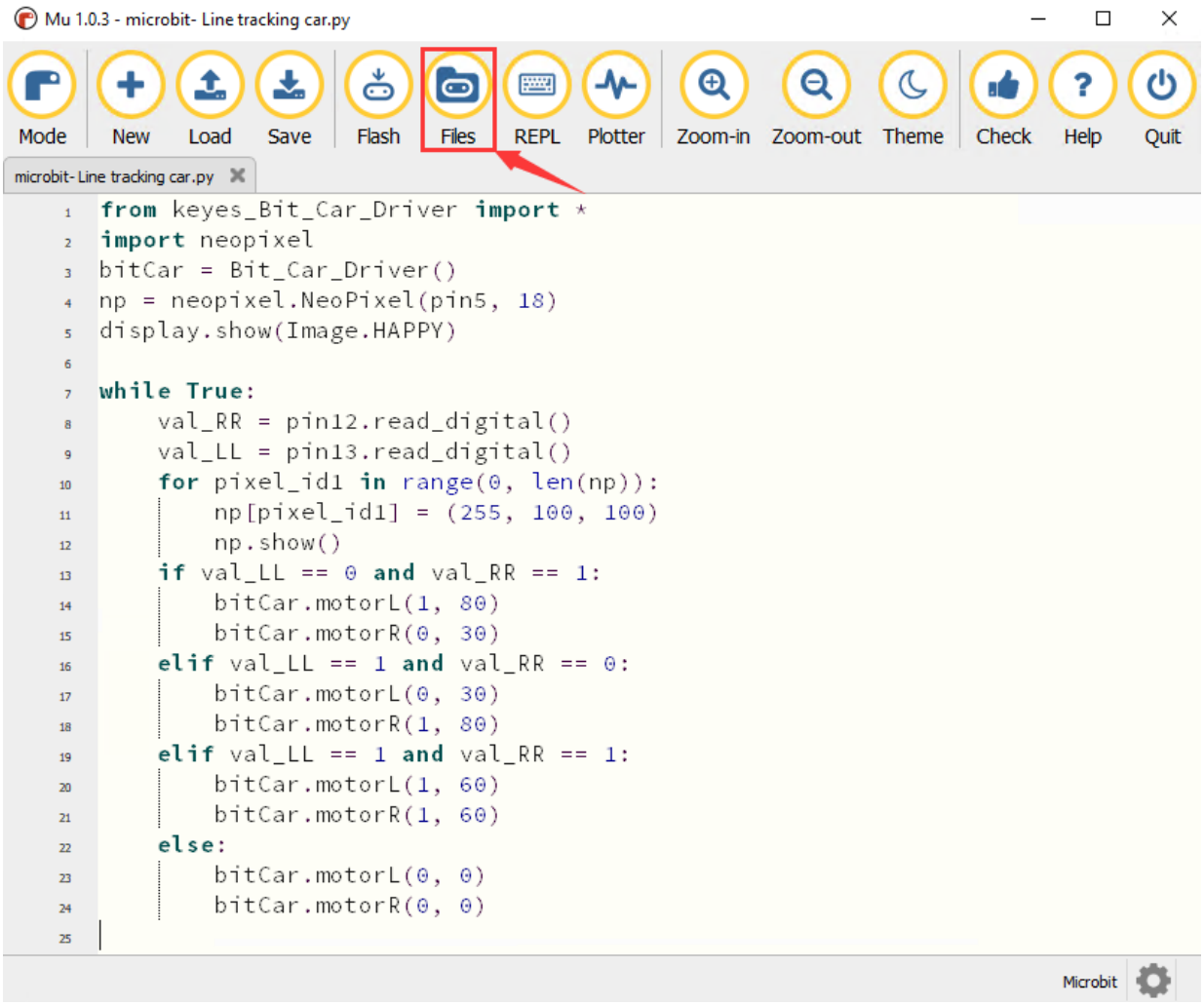
File Type	Route	File Name
Python file	../Python Code/6.15： Line tracking car/6.15.2	microbit- Line Tracking Car.py

The successful loading is shown below.You can also input code in the edit window yourself.(note:all English words and symbols must be written in English)

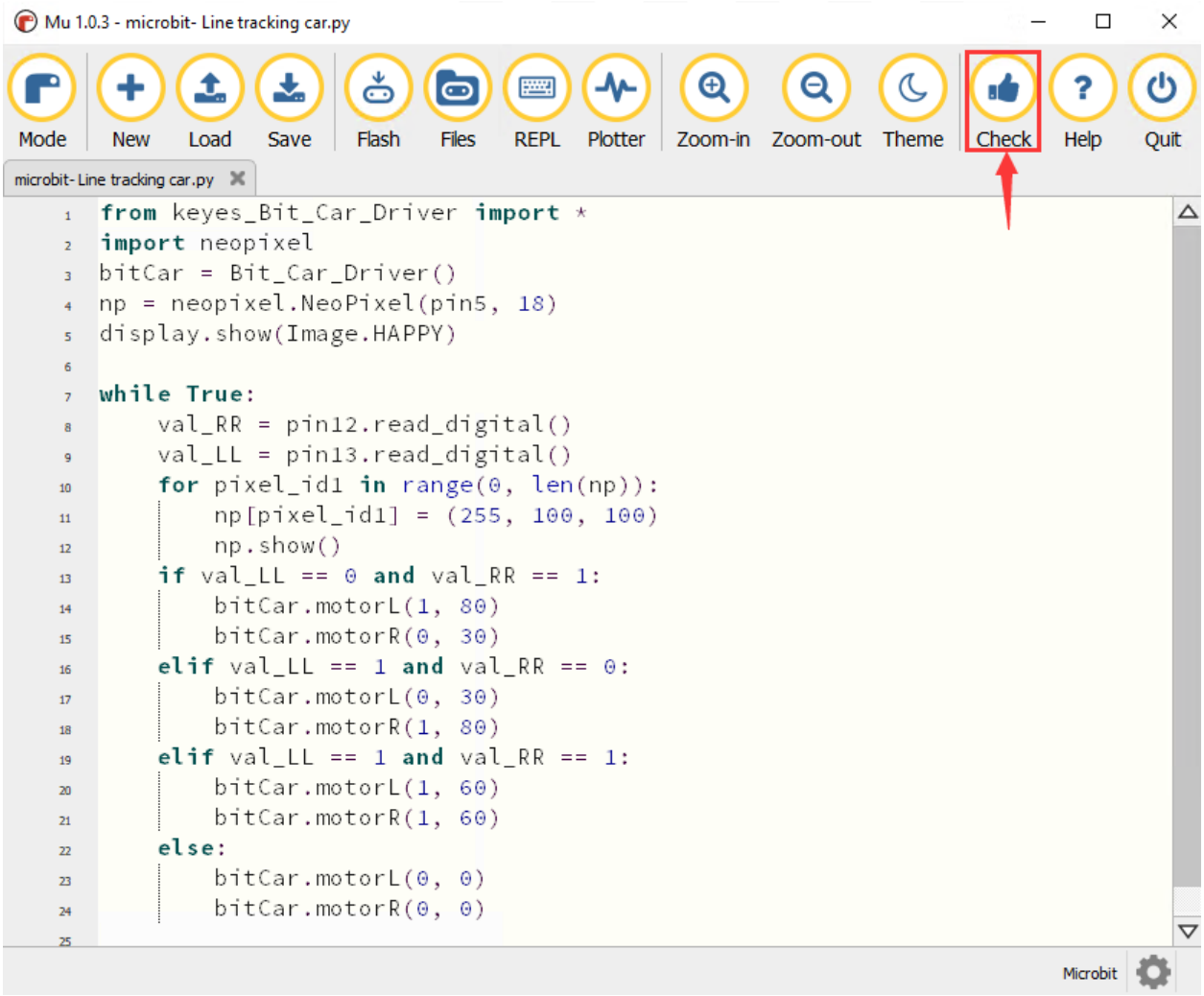


Click "Files" to import the library file of "keyes_Bit_Car_Driver.py to micro:bit (How to import files?)

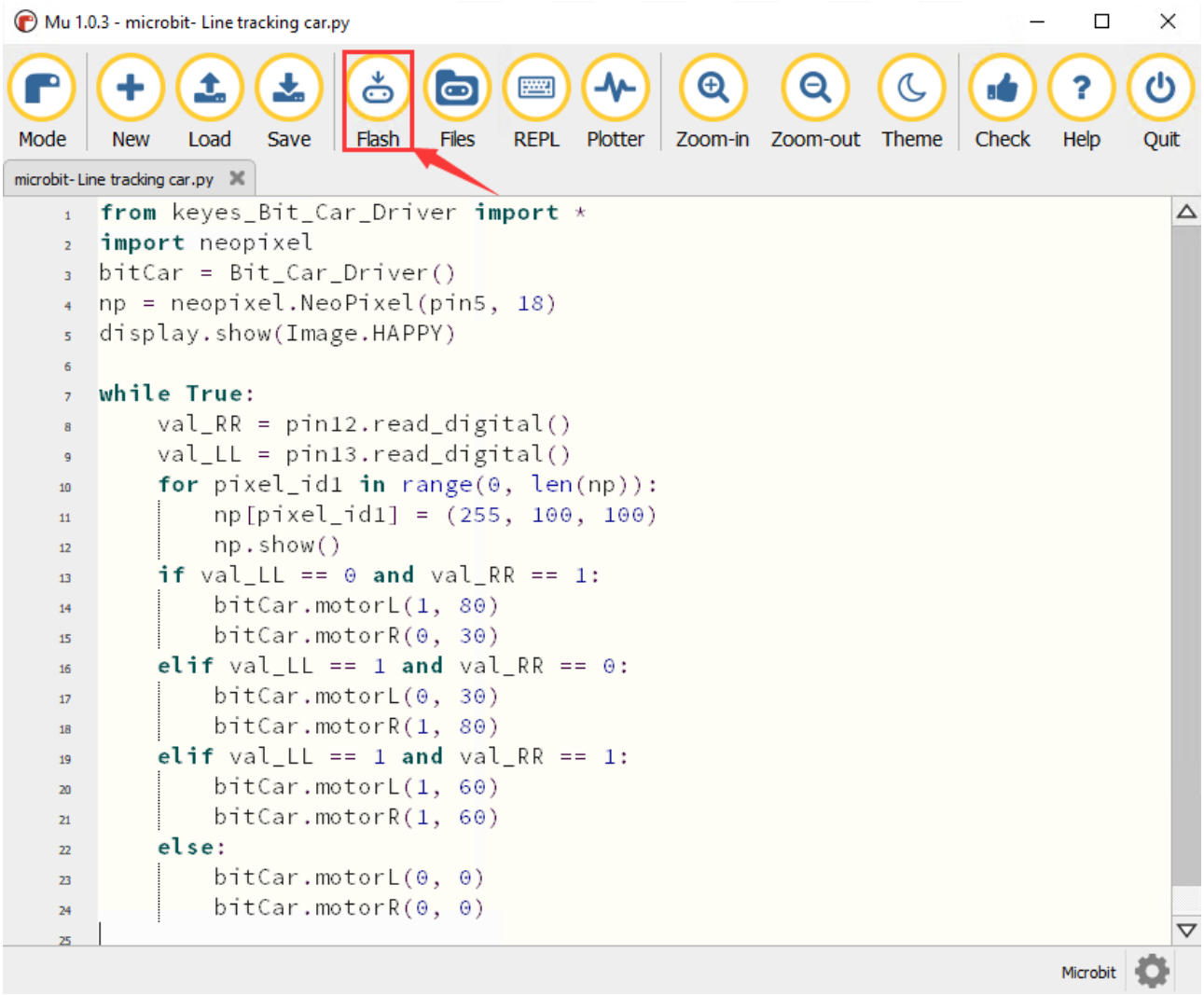
If micro:bit has library, you don' t need to add one.



Click "Check" to examine error in the code. The program proves wrong if underlines and cursors are shown.



If the code is correct, connect micro:bit to computer and click "Flash" to download code to micro:bit board



4. Test Result:

Download code to micro:bit and turn on the switch at the back of micro:bit car.

The car can follow black traces and KEYES-2812-18R module lights up.

Note: (1) the width of black trace should be wider than the distance between two line tracking sensors.

Avoid to test smart car under the strong light.

5. Code Explanation:

from keyes_Bit_Car_Driver **import ***	Import the library file of keyes_Bit_Car_Driver
import neopixel	Import the library file of neopixel
bitCar = Bit_Car_Driver()	Set Bit_Car_Driver() to bitCar
np = neopixel.NeoPixel(pin5, 18)	Initialize Neopixel
display.show(Image.HAPPY)	micro:bit shows the smile pattern
while True:	This is a permanent loop that makes micro:bit execute the code of it.
val_RR = pin12.read_digital()	Set the digital signal read by line tracking sensor connected to P12, to val_RR
val_LL = pin13.read_digital()	set the digital signal read by line tracking sensor connected P13, to val_LL

for pixel_id1 in range(0, len(np)): np[pixel_id1] = (255, 100, 100) np.show()	set the pixel of RGB to pixel_id1 in the range of （0，len（np）） Set the pixel of RGB on Neopixel strip to pixel_id1 on (255, 100, 100) Display pixel on Neopixel strip
if val_LL == 0 **and** val_RR == 1: bitCar.motorL(1, 80) bitCar.motorR(0, 30) **elif** val_LL == 1 and val_RR == 0: bitCar.motorL(0, 30) bitCar.motorR(1, 80) **elif** val_LL == 1 and val_RR == 1: bitCar.motorL(1, 60) bitCar.motorR(1, 60) **else:** bitCar.motorL(0, 0) bitCar.motorR(0, 0)	If val_LL = 0 and val_RR = 1 Left motor rotates clockwise at thes peed of PWM 80（1: clockwise，0: anticlockwise；speed: PWM 80（0~255）） Right motor rotates anticlockwise at the speed of PWM 30 When val_LL =1 and val_RR = 0 Left motor rotates anticlockwise at the speed of PWM 30 Right motor rotates clockwise at the speed of PWM 80 When val_LL = 1 and val_RR = 1 Left motor rotates clockwise at the

	speed of PWM 60 Right motor rotates clockwise at the speed of PWM 60 If the above conditions are not met Left motor doesn’ t rotate Right motor doesn’ t rotate

6.16: Ultrasonic Follow Smart Car

6.16.1: 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.

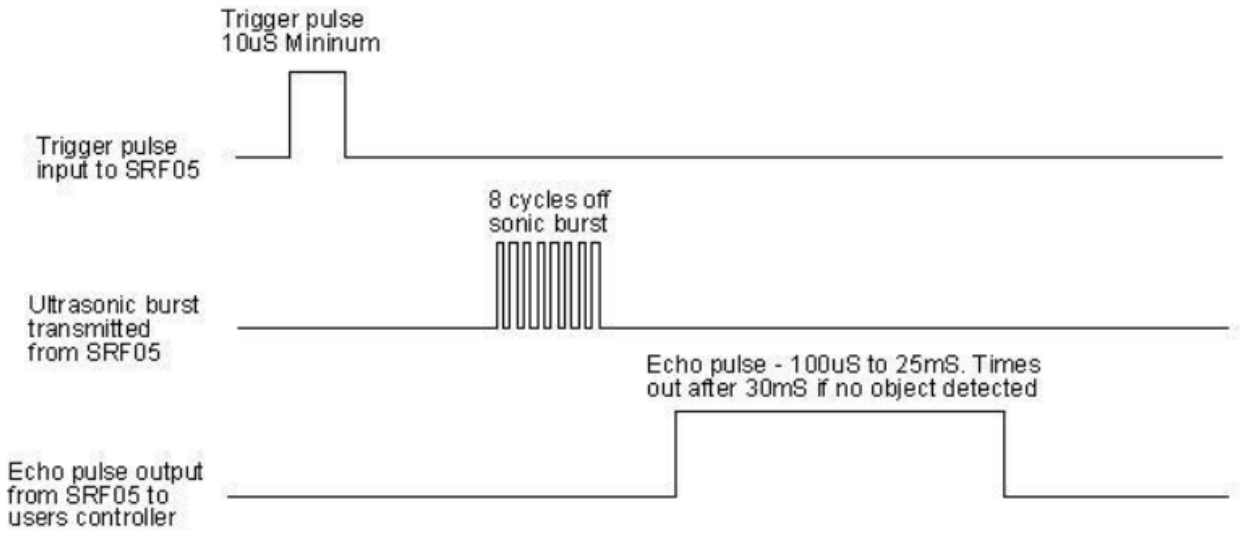
The HC-SR04 or the ultrasonic sensor is being used in a wide range of

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.

1. 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. Specification:

- 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. What you need to get started

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

(2) Put batteries into battery holder

(3) Turn on the switch at the back of micro:bit car

(4) Link micro:bit board with computer via USB cable.

(5) Open the offline version of Mu

5. Test Code:

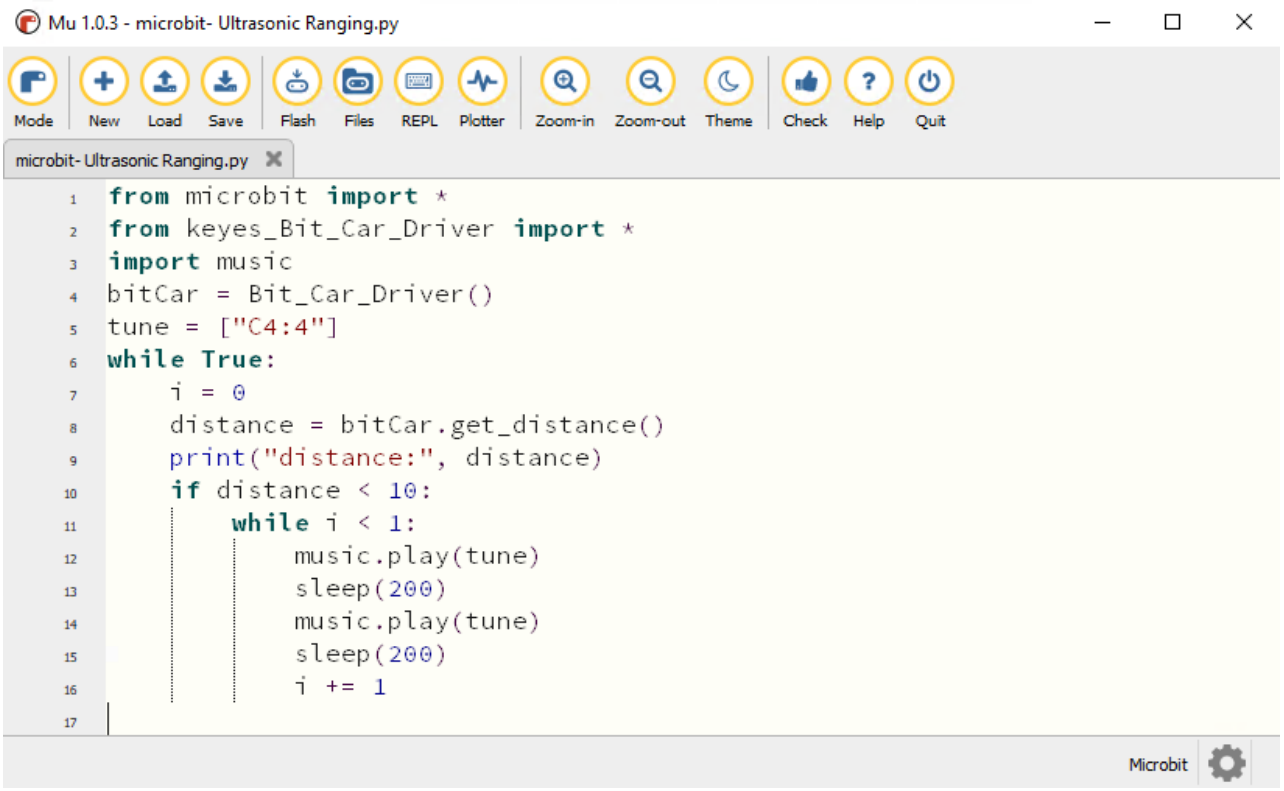
Open "6.16.1- Ultrasonic Ranging.py" file in Mu software

(How to load the project code?)

File Type	Route	File Name

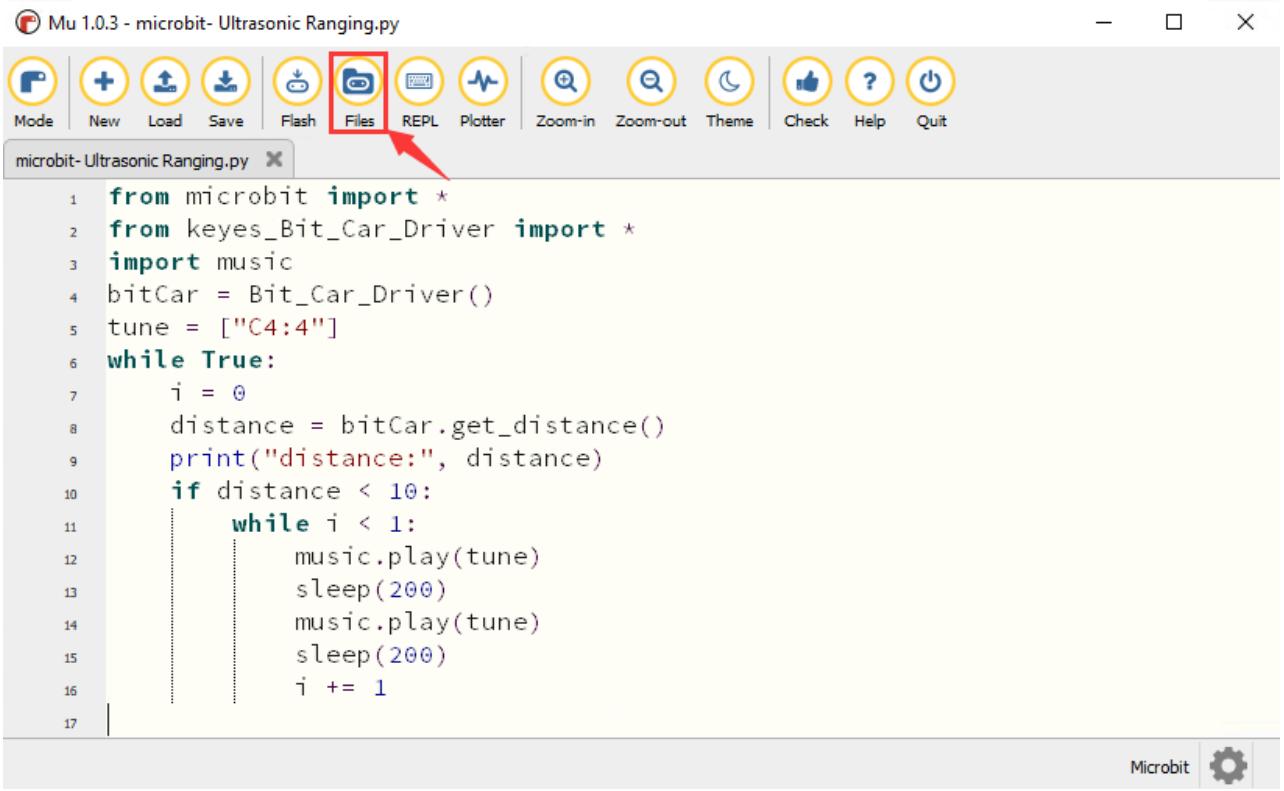
Python file	../Python code/6.16： Ultrasonic Follow Smart car	6.16.1- Ultrasonic Ranging.py

The successful loading is shown below.You can also input code in the edit window yourself.(note:all English words and symbols must be written in English)

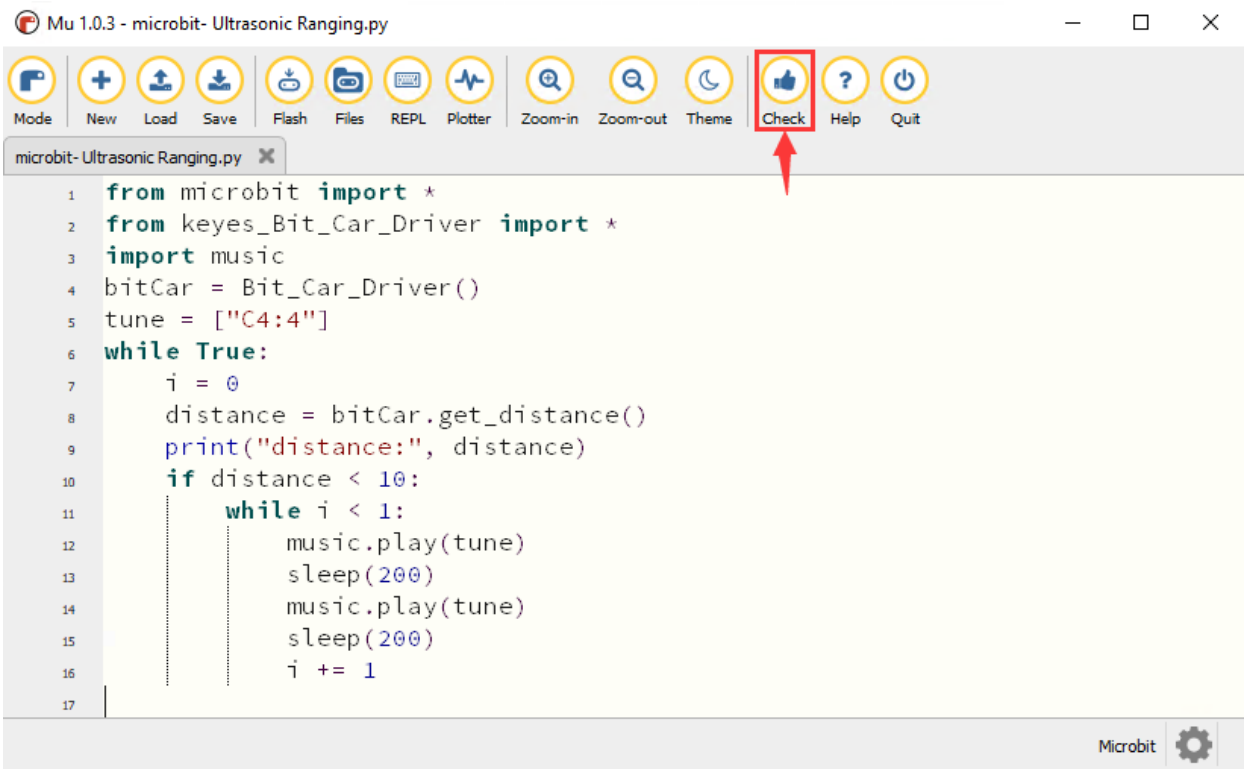


Click “Files” to import the library file of “keyes_Bit_Car_Driver.py to micro:bit (How to import files?)

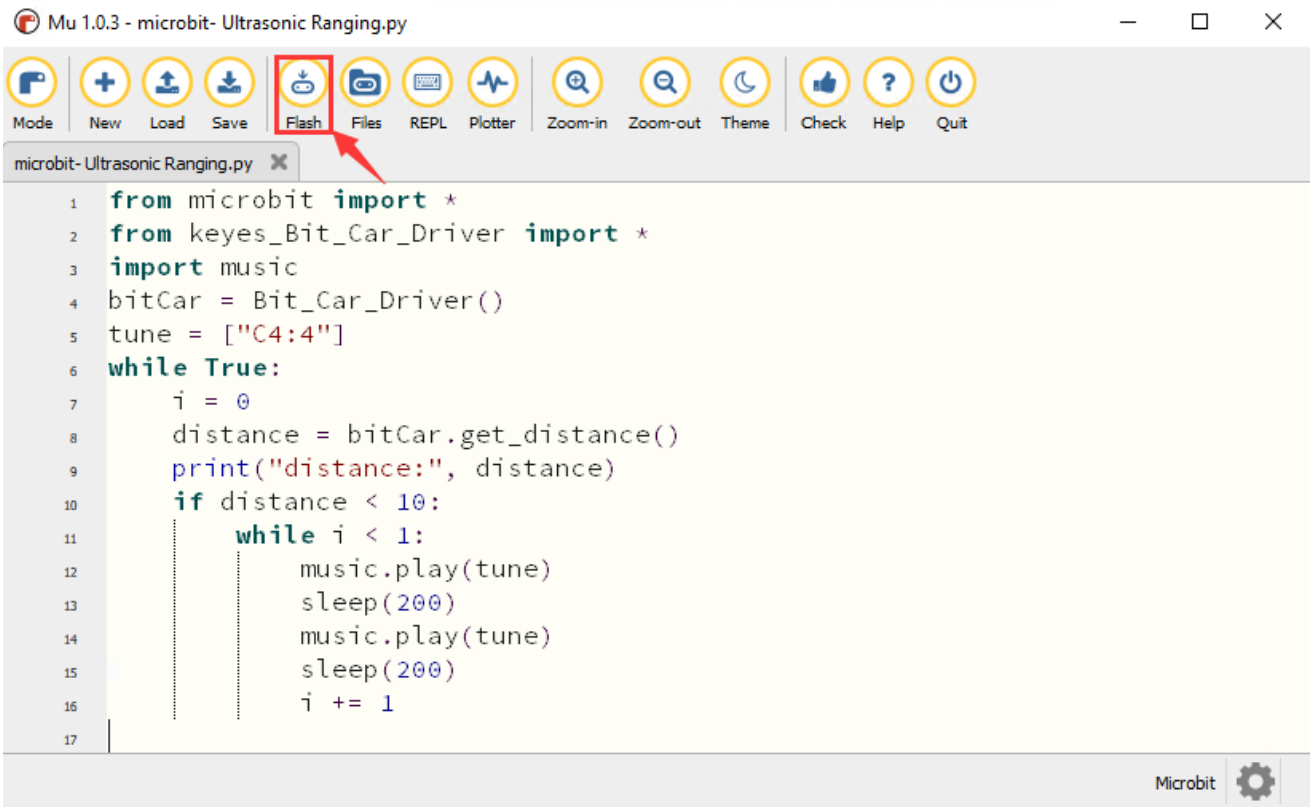
If micro:bit has library, you don’ t need to add one.



Click “Check” to examine error in the code. The program proves wrong if underlines and cursors are shown.

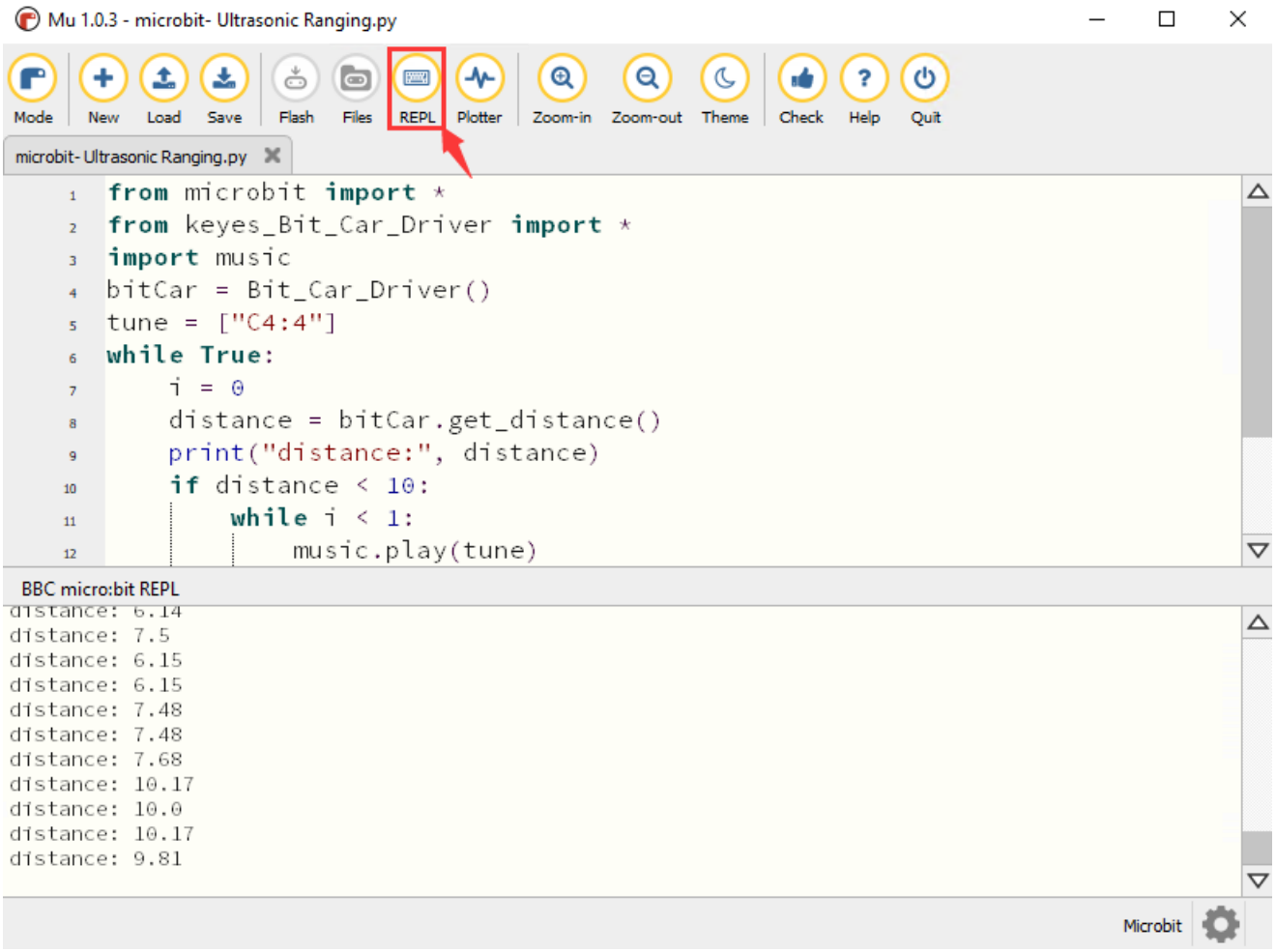


Make sure code correct, connect micro:bit to computer via USB cable, turn on the switch of keyestudio Micro:bit robot car and click "Flash" to download code to micro:bit.



6. Test Result:

After downloading code, keep USB cable connected, click **"REPL" button and press the reset button.** REPL window shows the distance value between the ultrasonic sensor and the obstacle(as shown below), when the distance between obstacle and ultrasonic sensor is less than 10cm, the passive buzzer emits sound.

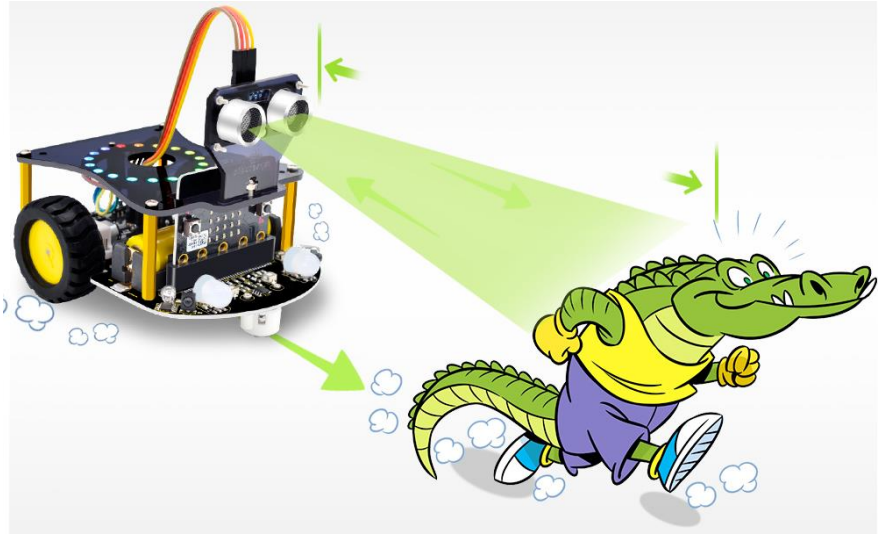


6. Code Explanation:

from microbit **import** *	import the library file of microbit
from keyes_Bit_Car_Driver **import** *	import the library file of keyes_Bit_Car_Driver
bitCar = Bit_Car_Driver()	instantiate
import music	import the library file of music
tune = ["C4:4"]	Create variable tune to save notes

while True:	This is a permanent loop that makes micro:bit execute the code of it.
i = 0	Set variable i=0
distance = bitCar.get_distance()	Set bitCar.get_distance() to distance
print("distance:", distance)	BBC microbit REPL window shows the distance value between the ultrasonic sensor and the obstacle
if distance < 10:	**if** distance < 10
while i < 1:	When i < 1
music.play(tune) sleep(200) music.play(tune) sleep(200)	Passive buzzer emits “tick,tick”
i += 1	Variable i plus 1

6.16.2： 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.

What you need to get started

Insert micro:bit board into slot of V2 shield.

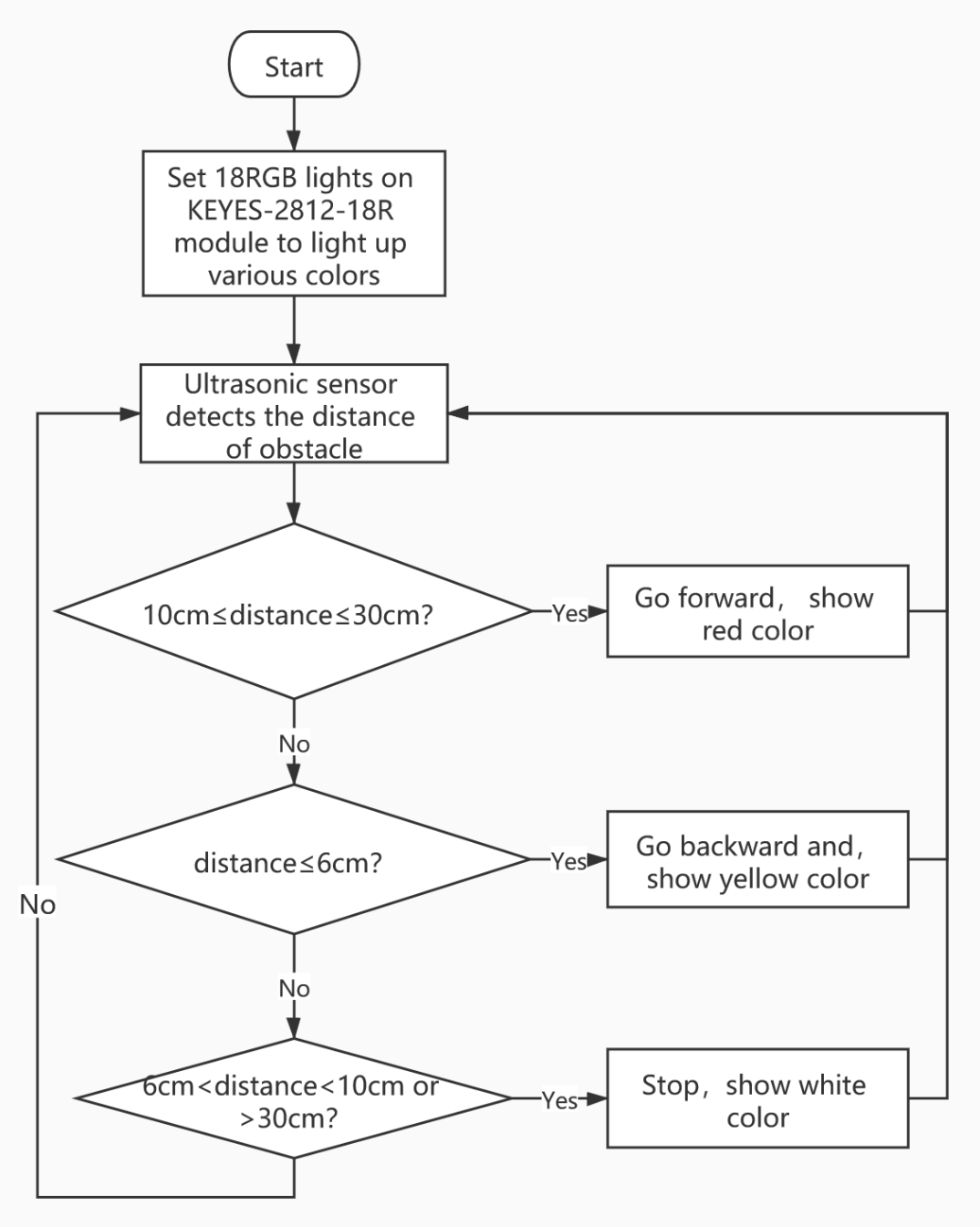
(1) Put batteries into battery holder

(2) Turn on the switch at the back of micro:bit car

(3) Link micro:bit board with computer via USB cable.

(4) Open the offline version of Mu

3. Flow Chart

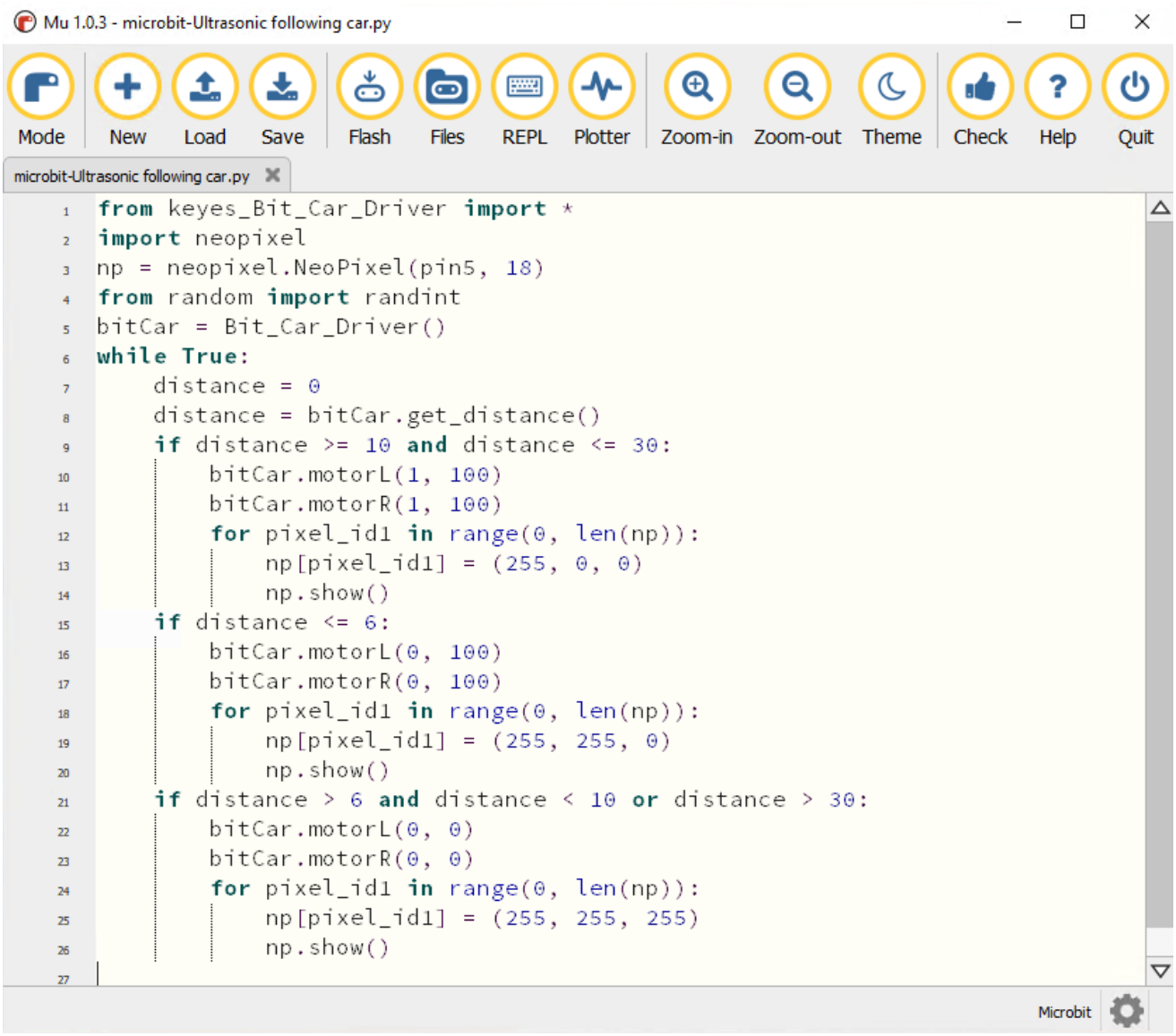

Start
Set 18RGB lights on KEYES-2812-18R module to light up various colors
Ultrasonic sensor detects the distance of obstacle
10cm≤distance≤30cm?
Yes
Go forward， show red color
No
distance≤6cm?
Yes
Go backward and， show yellow color
No
6cm<distance<10cm or >30cm?
Yes
Stop，show white color
No

3. Test Code:

Open "6.16.2-Ultrasonic Follow Smart Car.py" file in Mu, (How to load the project code?)

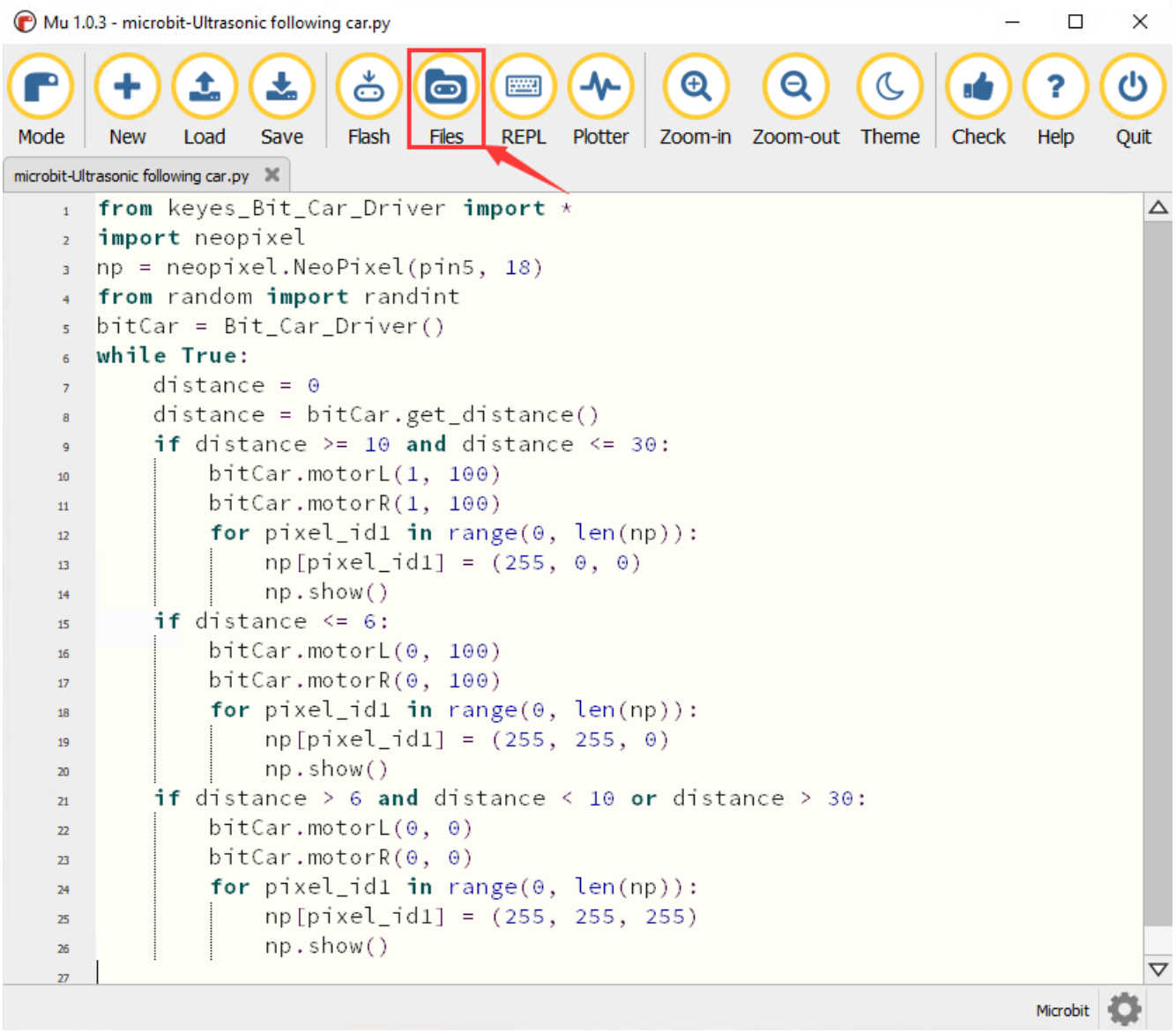
File Type	Route	File Name
Python file	../Python code/6.16: Ultrasonic following car	6.16.2-Ultrasonic Follow Smart Car.py

The successful loading is shown below.You can also input code in the edit window yourself.(note:all English words and symbols must be written in English)

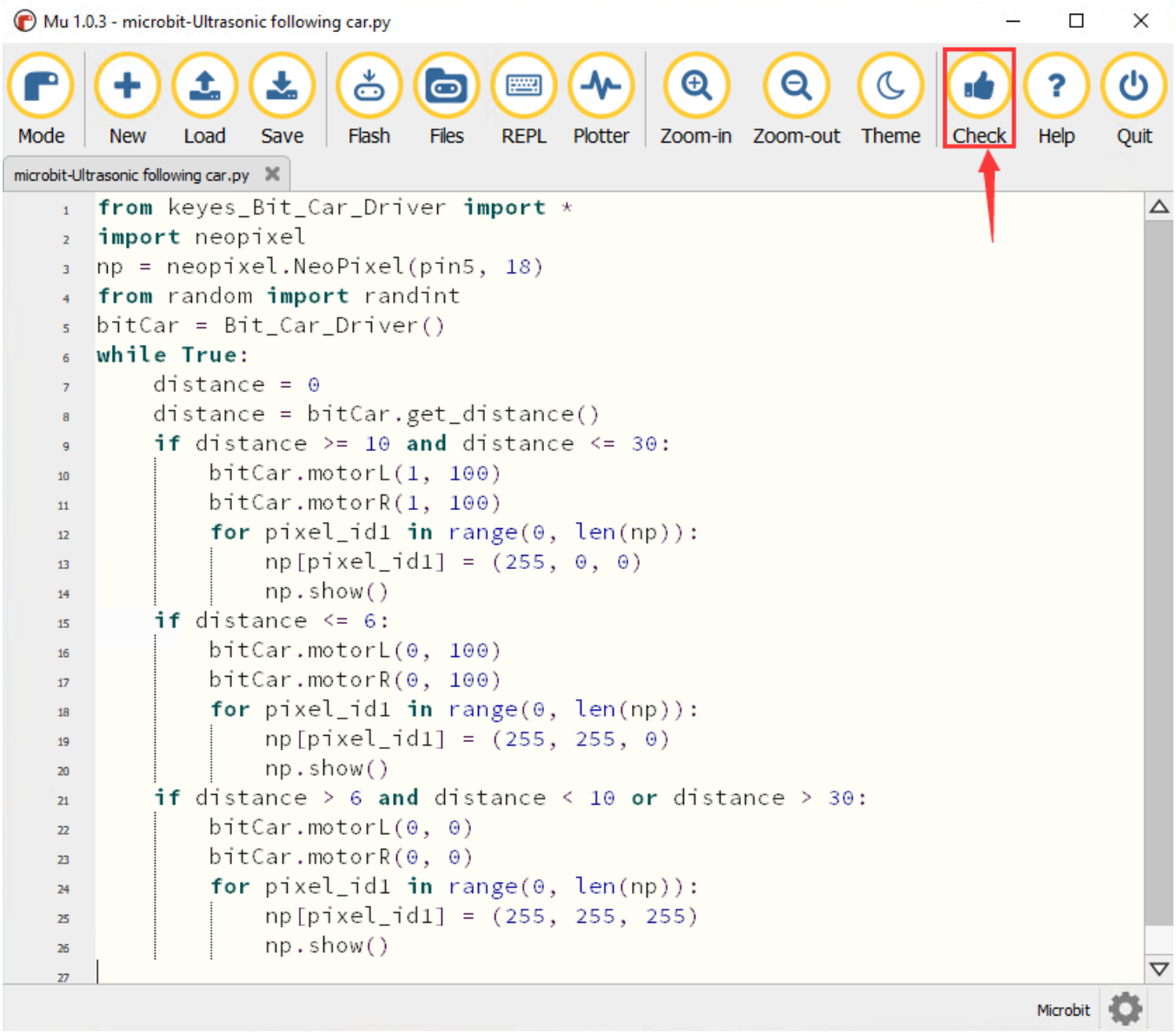


Click “Files” to import the library file of “keyes_Bit_Car_Driver.py” to micro:bit (How to import files?)

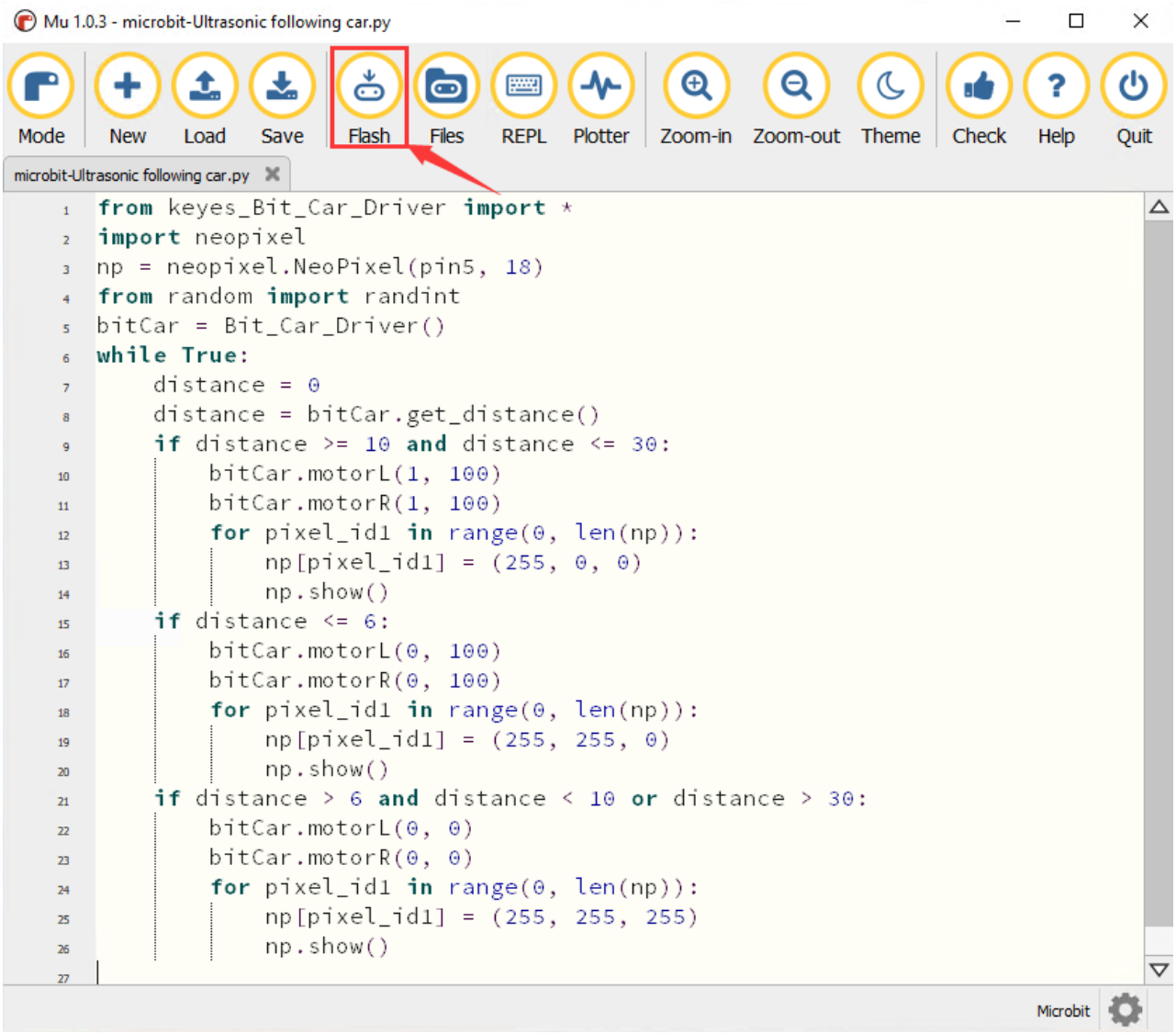
If micro:bit has library, you don’ t need to add one.



Click “Check” to examine error in the code. The program proves wrong if underlines and cursors are shown.



Make sure code correct, connect micro:bit to computer via USB cable, turn on the switch of keyestudio Micro:bit robot car and click "Flash" to download code to micro:bit board.



5.Test Result:

After downloading code, turn on the switch of robot car, as a result, the car will follow the obstacle to move and KEYES-2812-18R module will display different colors.

6.Code Explanation:

from keyes_Bit_Car_Driver **import** *	Import the library file of keyes_Bit_Car_Driver
bitCar = Bit_Car_Driver()	instantiate
import neopixel	Import the library file of neopixel
np = neopixel.NeoPixel(pin5, 18)	Initialize Neopixel
from random **import** randint	Import randint from random variables
while True:	This is a permanent loop that makes micro:bit execute the code of it.
distance = 0	Set the initial value of distance to 0
distance = bitCar.get_distance()	Set distance = bitCar.get_distance()
if distance >= 10 **and** distance <= 30: bitCar.motorL(1, 100) bitCar.motorR(1, 100) **for** pixel_id1 **in** range(0, len(np)): np[pixel_id1] = (255, 0, 0) np.show()	If distance ≥10 and distance ≤ 30 Left motor rotates clockwise at the speed of PWM100 Right motor rotates clockwise at the speed of PWM100 RGB pixel is pixel_id1 in the range of (0，len（np）) Set pixel_id1 to light up red color

if distance <= 6: bitCar.motorL(0, 100) bitCar.motorR(0, 100) **for** pixel_id1 **in** range(0, len(np)): np[pixel_id1] = (255, 255, 0) np.show() **if** distance > 6 **and** distance < 10 **or** distance > 30: bitCar.motorL(0, 0) bitCar.motorR(0, 0) **for** pixel_id1 **in** range(0, len(np)): np[pixel_id1] = (255, 255, 255) np.show()	Display pixel on Neopixel strip If distance ≤6 Left motor rotates anticlockwise at the speed of PWM100 Right motor rotates anticlockwise at the speed of PWM100 RGB pixel is pixel_id1 in the range of （0，len（np）） Set pixel_id1to light up yellow color Display pixel on Neopixel strip If distance > 6, distance < 10 or distance > 30 left motor doesn’ t rotate right motor doesn’ t rotate RGB pixel is pixel_id1 in the range of （0，len（np）） Set pixel_id1 to light up white color Display pixel on Neopixel strip

6.17：Obstacle Avoidance and Follow Smart Car

6.17.1：Obstacle Avoidance Function

1. **Description：**

The shield of smart car comes with two IR obstacle avoidance sensors which adopt transmitting tube and receiving tube.

The IR rays will reflect back to receiving tube if there is an obstacle. Next, sensor will determine the obstacle and send test result to microcontroller.

After a series of processing analysis, the smart car will avoid the obstacle.

The low level (0) will be output when the obstacle is detected, otherwise, the high level(1) will be output

IR obstacle avoidance sensor is generally applied to obstacle avoiding, line tracking, anti-falling, counter and production line cutting and liquid level detection, etc

What you need to get started

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

(2) Put batteries into battery holder

(3) Turn on the switch at the back of micro:bit car

(4) Link micro:bit board with computer via USB cable.

(5) Open the offline version of Mu

3. Test Code:

Code 1:

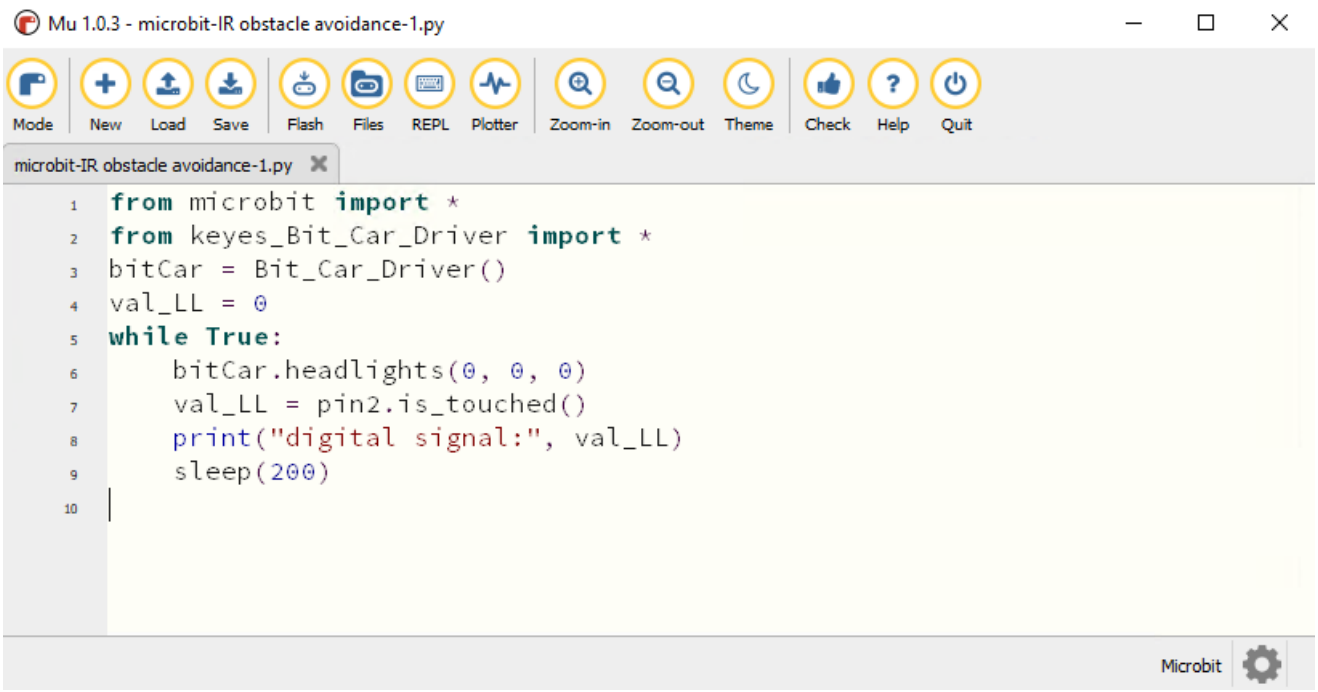
Open file "Code 1.py " in Mu,

(How to load the project code?)

File Type	Route	File Name

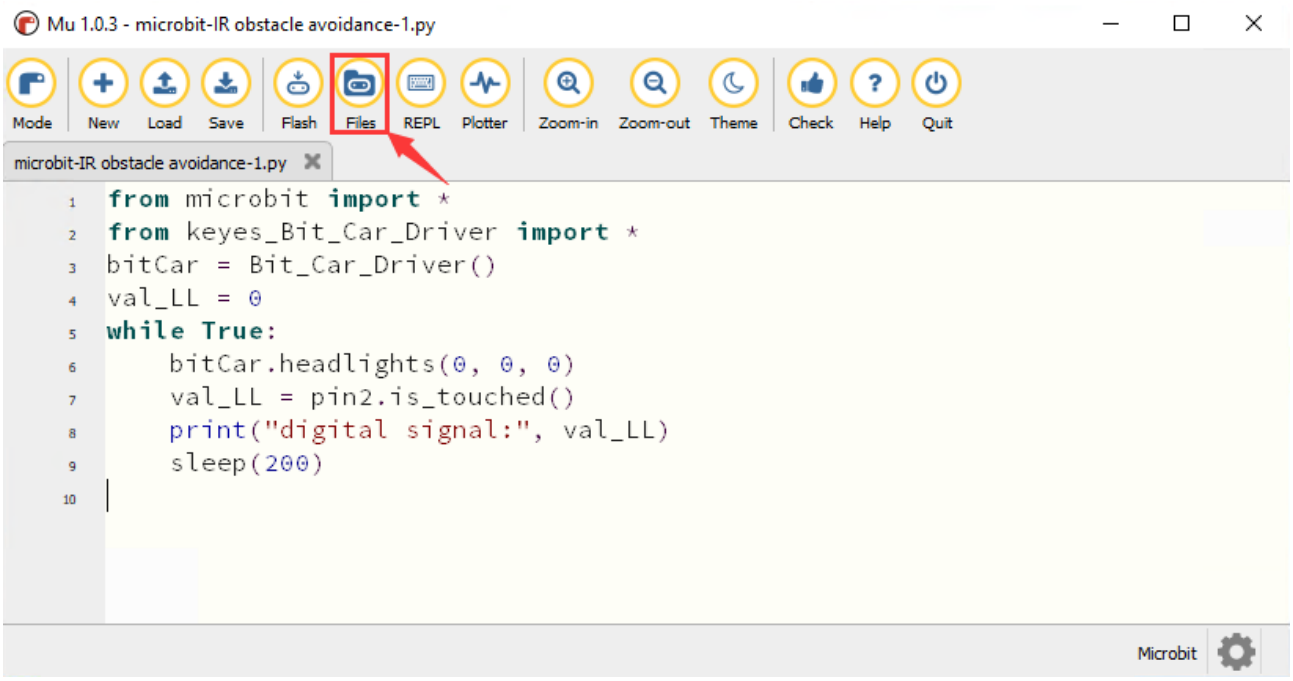
Python file	../Python code/6.17： Obstacle Avoidance&Follow Smart Car/6.17.1	Code 1.py

The successful loading is shown below.You can also input code in the edit window yourself.(note:all English words and symbols must be written in English)

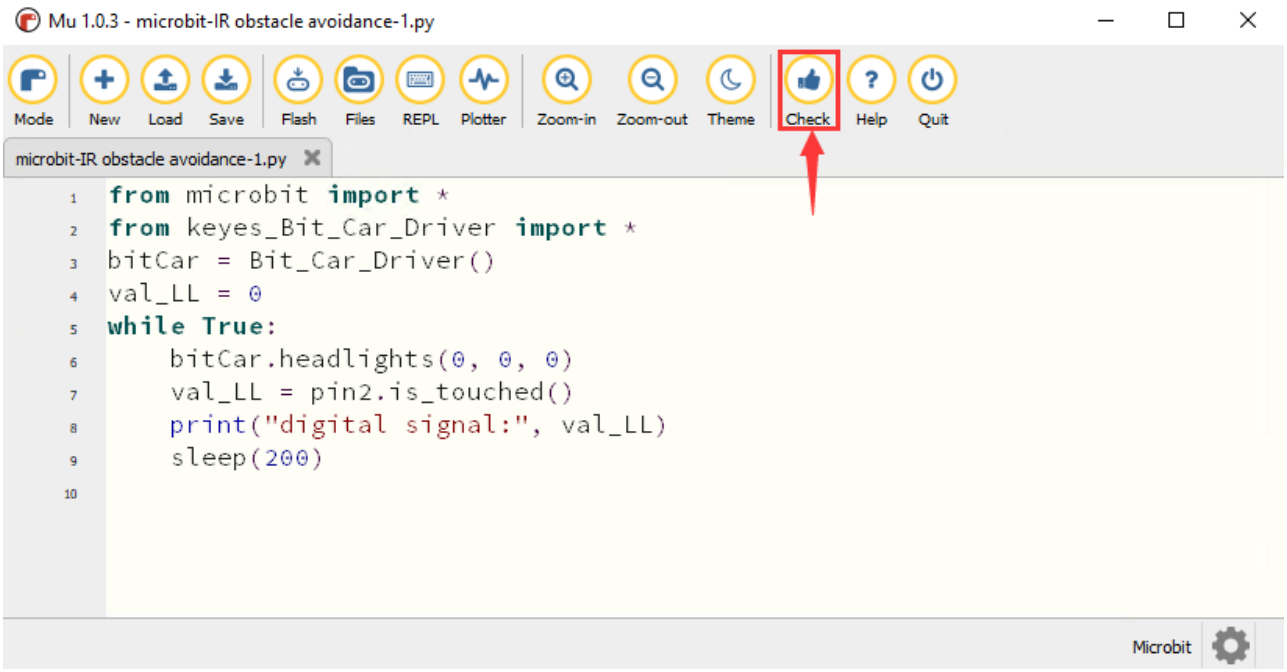


Click “Files” to import the library file of “keyes_Bit_Car_Driver.py to micro:bit (How to import files?)

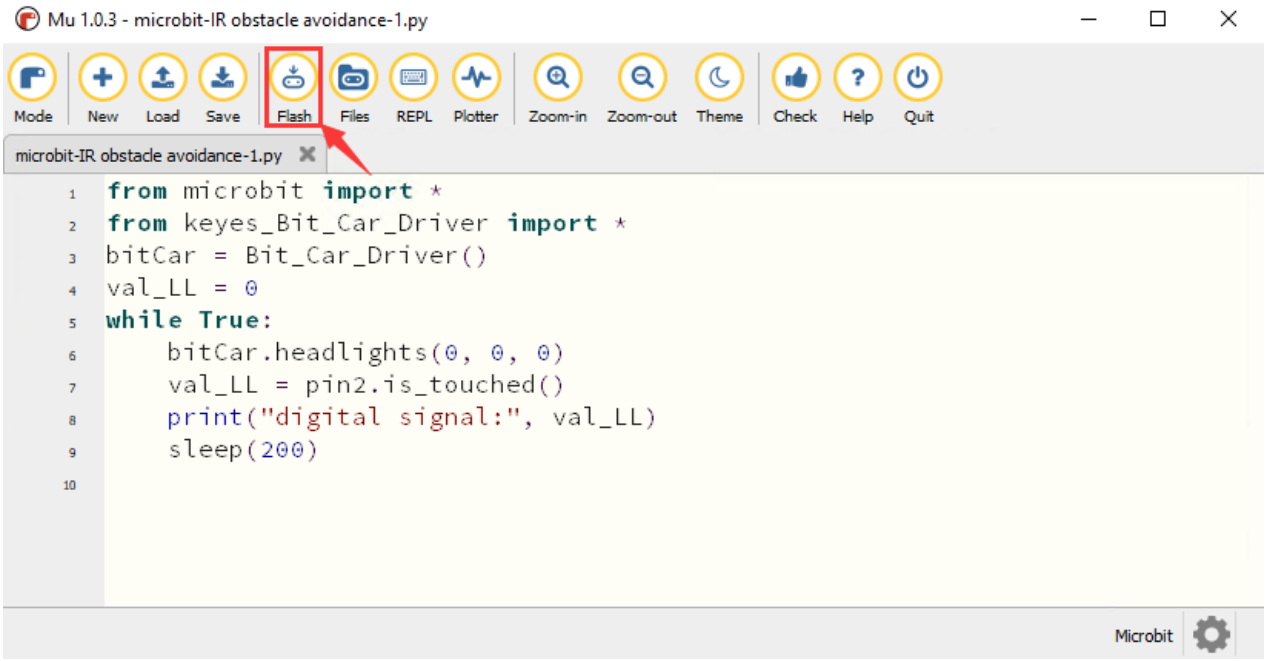
If micro:bit has library, you don’ t need to add one.



Click "Check" to examine error in the code. The program proves wrong if underlines and cursors are shown.



If the code is correct, connect micro:bit to computer and click "Flash" to download code to micro:bit board



After downloading code, keep USB cable connected, click **"REPL" button and press the reset button.**

BBC microbit REPL window prints "True" and "False".

Signal end will output "True" when the obstacle is detected, and SIG1 indicator will light up; otherwise, the signal end will output "False" and SIG1 indicator will go off.

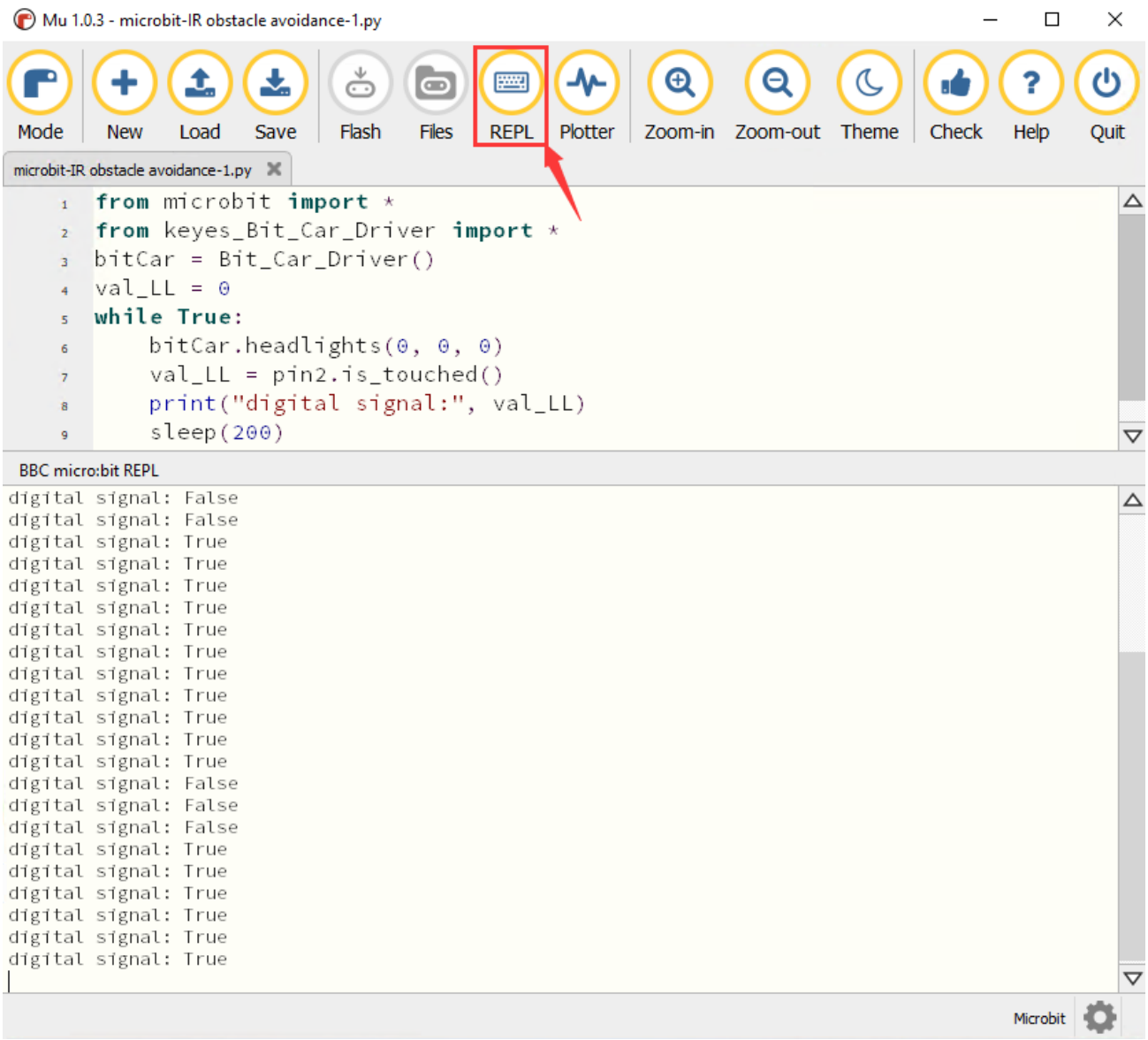
(official website:

https://microbit-micropython.readthedocs.io/en/v1.0.1/pin.html

the micro:bit has external weak (10M) pull-ups fitted on pins 0, 1 and 2 only, in order for the touch sensing to work. Return True if the pin is being

touched with a finger, otherwise return False)

Pin	Type	Function
0	Touch	Pad 0
1	Touch	Pad 1
2	Touch	Pad 2
3	Analog	Column 1
4	Analog	Column 2
5	Digital	Button A
6	Digital	Column 9
7	Digital	Column 8



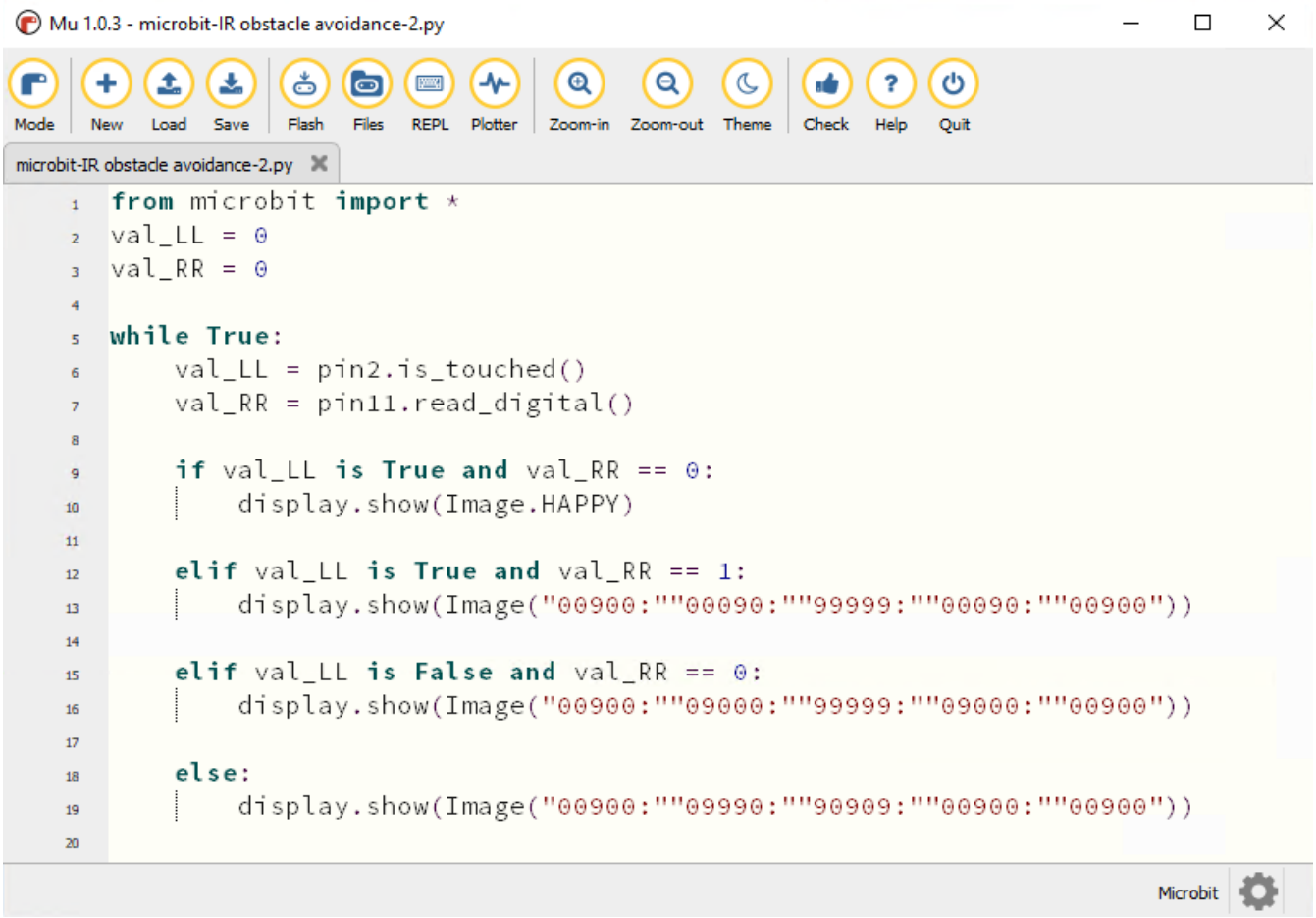
Code 2:

Open "Code 2.py" in Mu

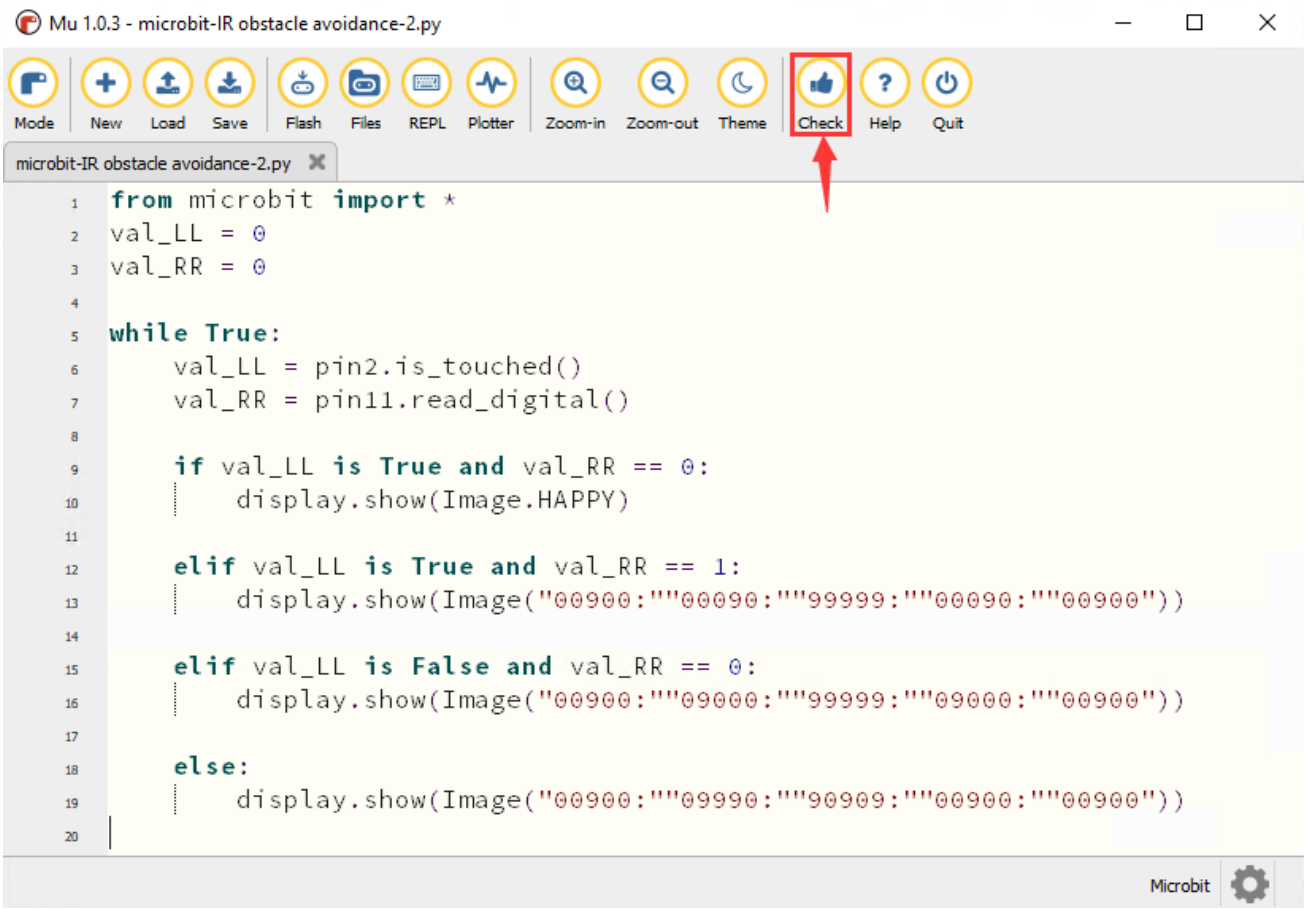
(How to load the project code?)

File Type	Route	File Name
Python file	../Python code/6.17： Obstacle Avoidance&Follow Smart Car/6.17.1	Code 2.py

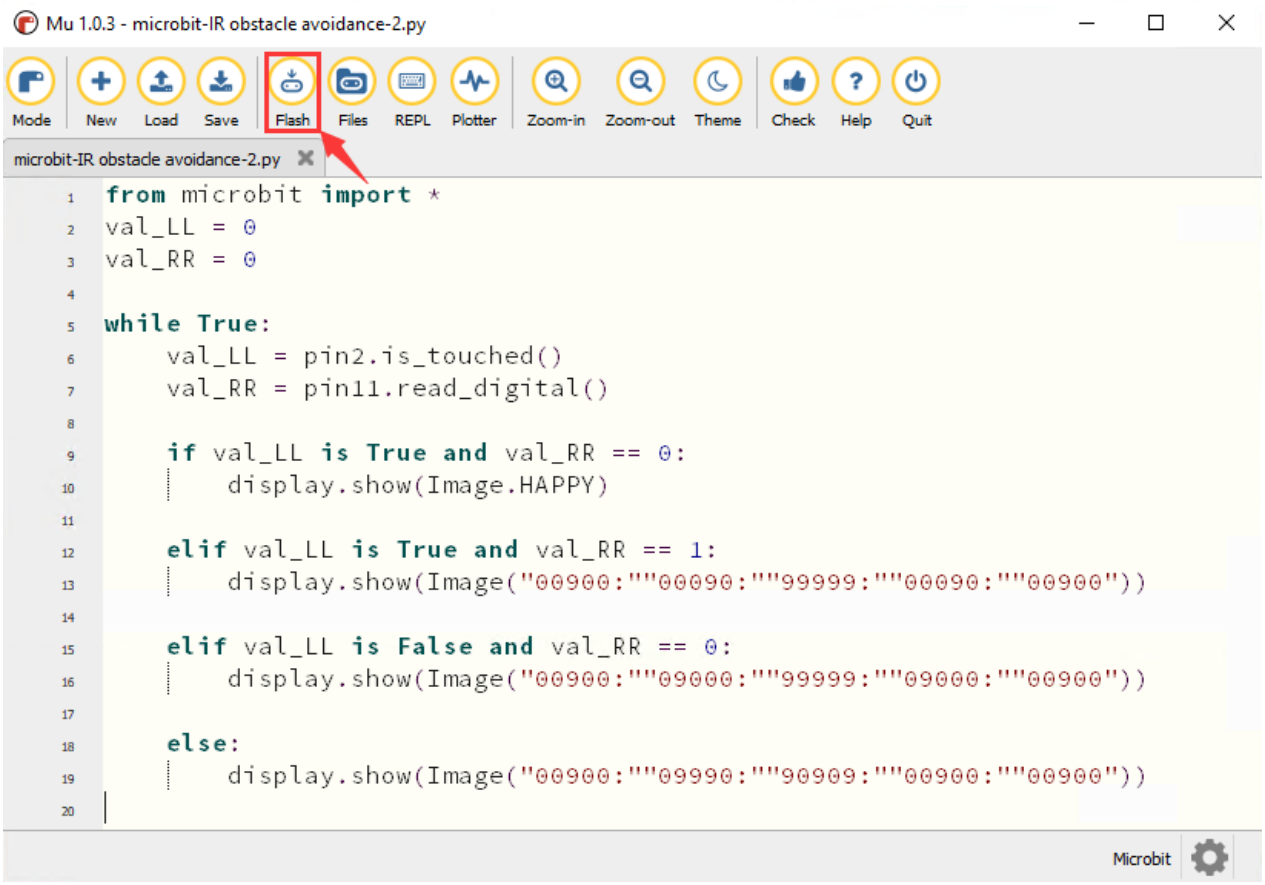
The successful loading is shown below.You can also input code in the edit window yourself.(note:all English words and symbols must be written in English)



Click “Check” to examine error in the code. The program proves wrong if underlines and cursors are shown.



If the code is correct, connect micro:bit to computer and click "Flash" to download code to micro:bit board.



2. Test Result:

Download code 2 to micro:bit, plug in power using USB cable and turn on the switch of robot car.

(1) When both obstacle avoidance sensors detect the obstacle, micro:bit show will smile face.

(2) When only left obstacle avoidance sensor detects the obstacle, micro:bit will display the leftward arrow.

(3) When only right obstacle avoidance sensor detects the obstacle,

micro:bit will display the rightward arrow.

(4) When neither of them detects the obstacle, micro:bit will display the upward arrow.

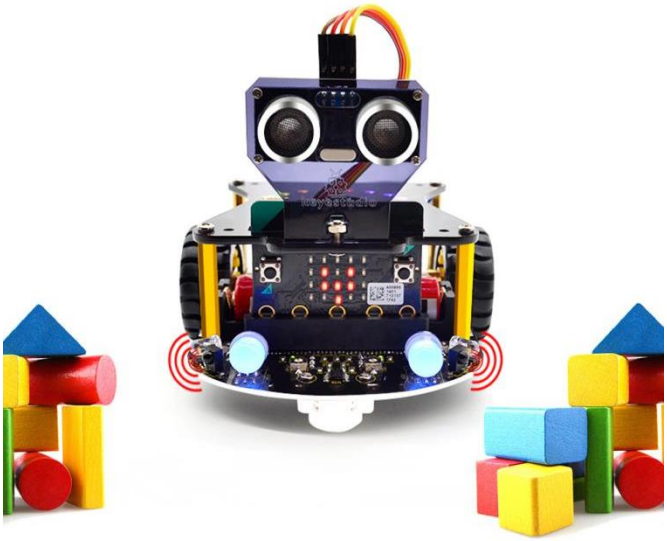
3. Code Explanation:

from microbit **import ***	Import the library file of micro;bit
from keyes_Bit_Car_Driver **import ***	Import the library file of keyes_Bit_Car_Driver
bitCar = Bit_Car_Driver()	instantiate
val_LL = 0	Set the initial value of val_LL to 0
val_RR = 0	Set the initial value of val_RR to 0
while True:	This is a permanent loop that makes micro:bit execute the code of it.
bitCar.headlights(0, 0, 0)	Turn off 2 pcs RGB lights

val_LL = pin2.is_touched()	Set the value of P2 read by pin2.is_touched() command , to val_LL
val_RR = pin11.read_digital()	Set the digital signal read by P11 to val_RR
print("digital signal:", val_LL)	BBC microbit REPL prints the signals read by IR obstacle avoidance sensor
sleep(200)	Delay in 200ms
if val_LL is True **and** val_RR == 0: display.show(Image.HAPPY) **elif** val_LL is True **and** val_RR == 1: display.show(Image("00900:""00090:""99999:""00090:""00900") **elif** val_LL is False **and** val_RR == 0: display.show(Image("00900:""09000:""99999:""09000:""00900")) **else**:	If val_LL is True and val_RR == 0; micro:bit displays the smile pattern, If val_LL is True **and** val_RR == 1 micro:bit displays “←” pattern If val_LL is False and val_RR == 0; micro:bit shows “→” pattern If the above conditions are not met micro:bit displays “↑” pattern

display.show(Image("00900:""099 90:""90909:""00900:""00900"))	

6.17.2：Obstacle Avoidance Smart Car



1. Description:

We’ ve learned the knowledge of obstacle avoidance sensor. In this project, we will integrate ultrasonic sensor, IR obstacle avoidance sensor and car expansion board to make an obstacle avoidance smart car.

Its principle is to detect the distance between the car and obstacle by ultrasonic sensor and IR obstacle avoidance sensors and control the motion of smart car.

Left obstacle avoidance sensor is controlled by P2 and right one is decided by P11

What you need to get started

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

(2) Put batteries into battery holder

(3) Turn on the switch at the back of micro:bit car

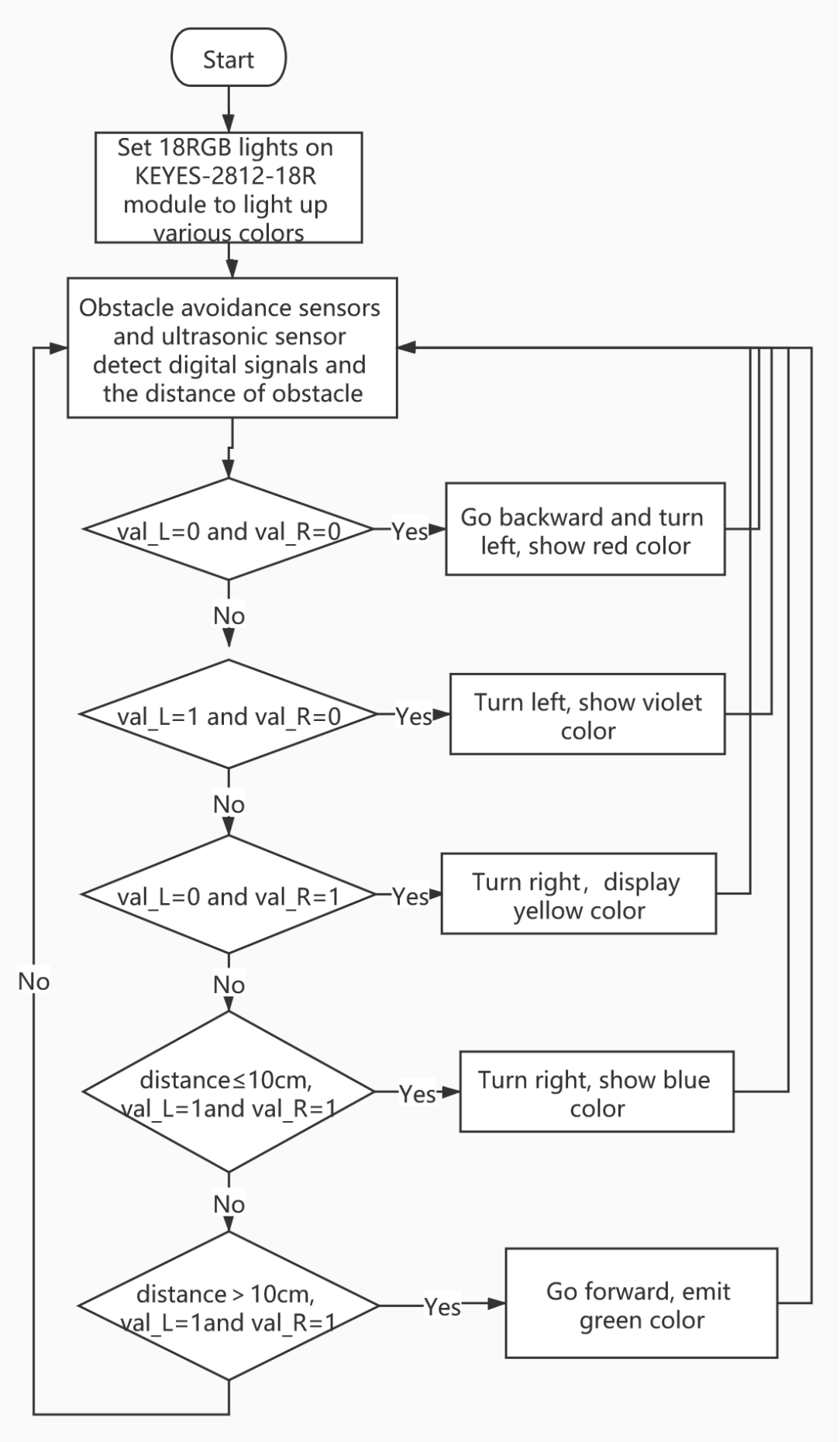
(4) Link micro:bit board with computer via USB cable.

(5) Open the offline version of Mu

Warning: the obstacle avoidance sensor can't work normally under strong light which contains a mountain of invisible light including IR and

ultraviolet rays.

3. Flow Chart


Start
Set 18RGB lights on KEYES-2812-18R module to light up various colors
Obstacle avoidance sensors and ultrasonic sensor detect digital signals and the distance of obstacle
val_L=0 and val_R=0
Yes
Go backward and turn left, show red color
No
val_L=1 and val_R=0
Yes
Turn left, show violet color
No
val_L=0 and val_R=1
Yes
Turn right, display yellow color
No
distance≤10cm, val_L=1and val_R=1
Yes
Turn right, show blue color
No
distance > 10cm, val_L=1and val_R=1
Yes
Go forward, emit green color
No

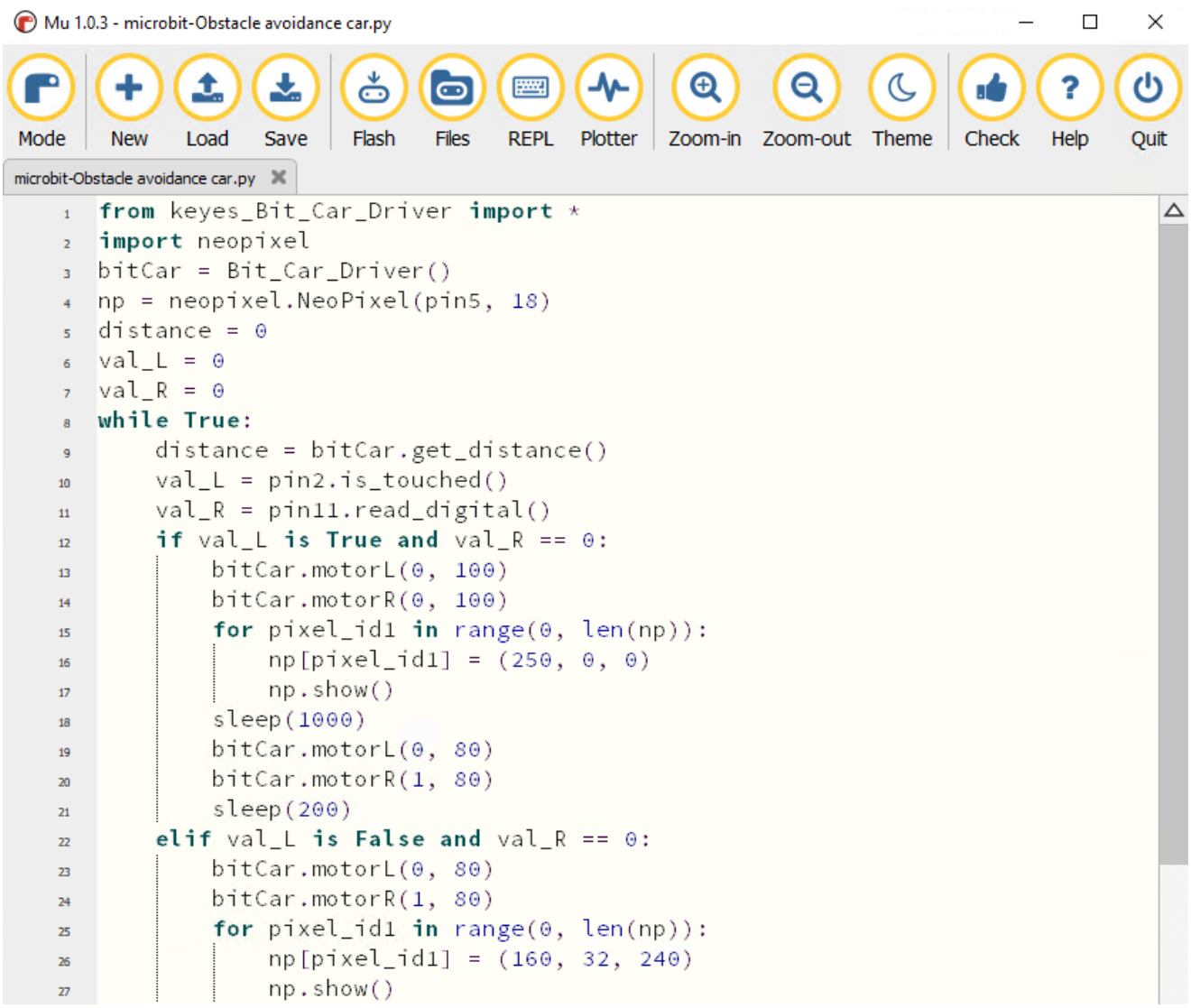
4. Test Code:

Open "6.17.2.py" in Mu software

(How to load the project code?)

File Type	Route	File Name
Python file	../Python code/6.17: Obstacle avoidance&following robot car	6.17.2.py

The successful loading is shown below.You can also input code in the edit window yourself.(note:all English words and symbols must be written in English)

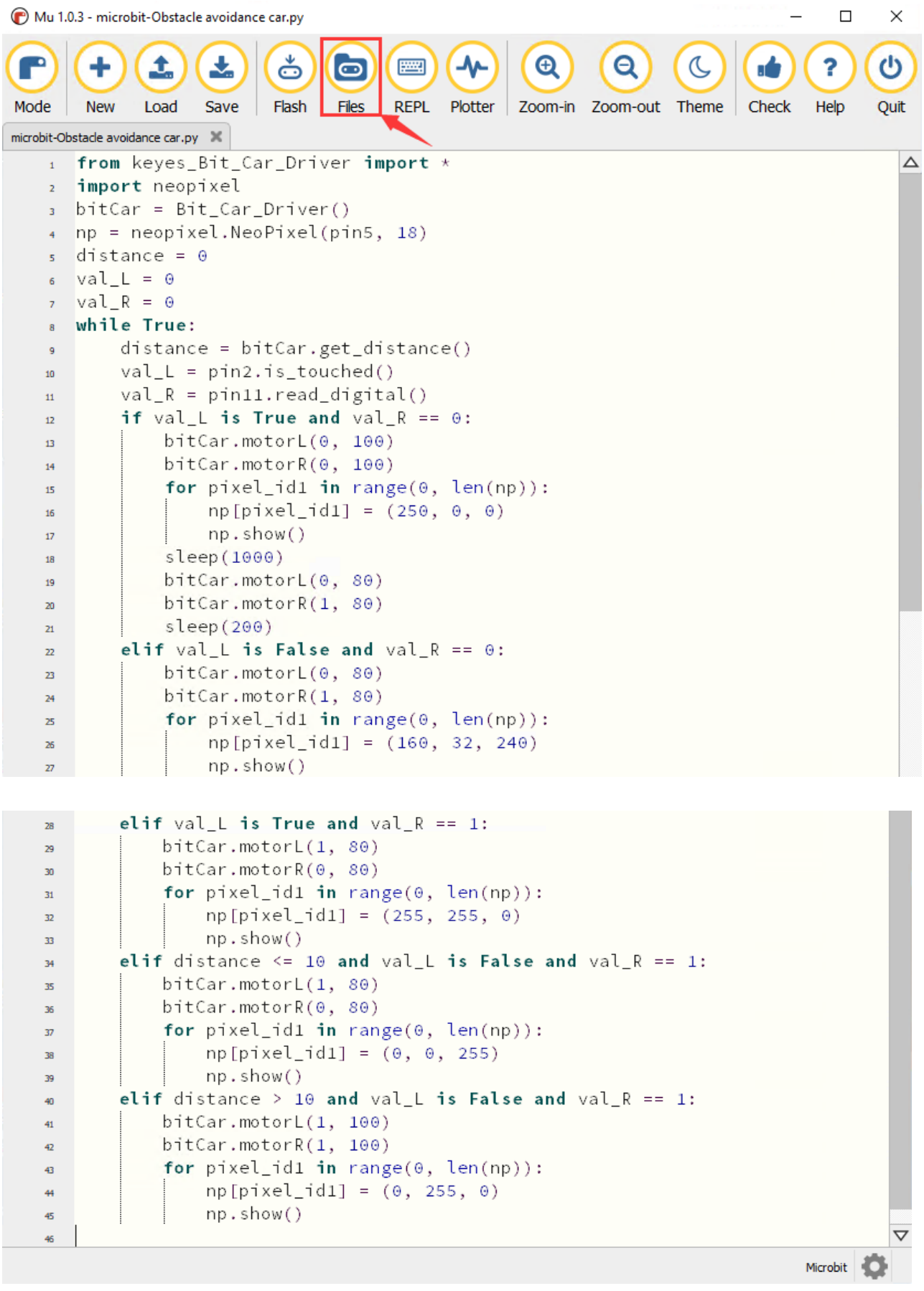



```
from keyes_Bit_Car_Driver import *
import neopixel
bitCar = Bit_Car_Driver()
np = neopixel.NeoPixel(pin5, 18)
distance = 0
val_L = 0
val_R = 0
while True:
    distance = bitCar.get_distance()
    val_L = pin2.is_touched()
    val_R = pin11.read_digital()
    if val_L is True and val_R == 0:
        bitCar.motorL(0, 100)
        bitCar.motorR(0, 100)
        for pixel_id1 in range(0, len(np)):
            np[pixel_id1] = (250, 0, 0)
            np.show()
        sleep(1000)
        bitCar.motorL(0, 80)
        bitCar.motorR(1, 80)
        sleep(200)
    elif val_L is False and val_R == 0:
        bitCar.motorL(0, 80)
        bitCar.motorR(1, 80)
        for pixel_id1 in range(0, len(np)):
            np[pixel_id1] = (160, 32, 240)
            np.show()
```

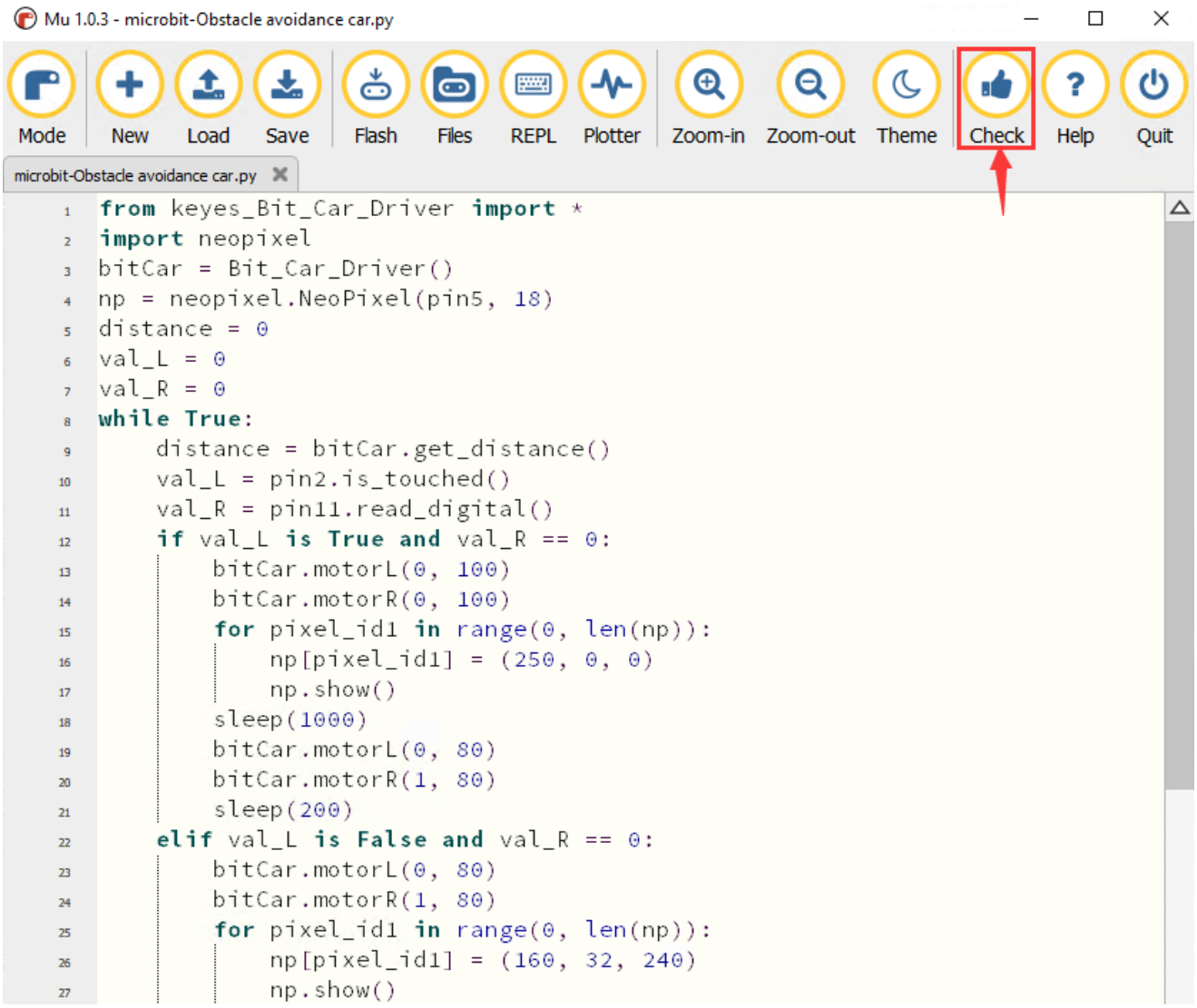
```
    elif val_L is True and val_R == 1:
        bitCar.motorL(1, 80)
        bitCar.motorR(0, 80)
        for pixel_id1 in range(0, len(np)):
            np[pixel_id1] = (255, 255, 0)
            np.show()
    elif distance <= 10 and val_L is False and val_R == 1:
        bitCar.motorL(1, 80)
        bitCar.motorR(0, 80)
        for pixel_id1 in range(0, len(np)):
            np[pixel_id1] = (0, 0, 255)
            np.show()
    elif distance > 10 and val_L is False and val_R == 1:
        bitCar.motorL(1, 100)
        bitCar.motorR(1, 100)
        for pixel_id1 in range(0, len(np)):
            np[pixel_id1] = (0, 255, 0)
            np.show()

Microbit
```

Click “Files” to import the library file of “keyes_Bit_Car_Driver.py” to micro:bit (How to import files?)

If micro:bit has library, you don’ t need to add one.


Mu 1.0.3 - microbit-Obstacle avoidance car.py
Mode
New
Load
Save
Flash
Files
REPL
Plotter
Zoom-in
Zoom-out
Theme
Check
Help
Quit
microbit-Obstacle avoidance car.py
from keyes_Bit_Car_Driver import *
import neopixel
bitCar = Bit_Car_Driver()
np = neopixel.NeoPixel(pin5, 18)
distance = 0
val_L = 0
val_R = 0
while True:
distance = bitCar.get_distance()
val_L = pin2.is_touched()
val_R = pin11.read_digital()
if val_L is True and val_R == 0:
bitCar.motorL(0, 100)
bitCar.motorR(0, 100)
for pixel_id1 in range(0, len(np)):
np[pixel_id1] = (250, 0, 0)
np.show()
sleep(1000)
bitCar.motorL(0, 80)
bitCar.motorR(1, 80)
sleep(200)
elif val_L is False and val_R == 0:
bitCar.motorL(0, 80)
bitCar.motorR(1, 80)
for pixel_id1 in range(0, len(np)):
np[pixel_id1] = (160, 32, 240)
np.show()
elif val_L is True and val_R == 1:
bitCar.motorL(1, 80)
bitCar.motorR(0, 80)
for pixel_id1 in range(0, len(np)):
np[pixel_id1] = (255, 255, 0)
np.show()
elif distance <= 10 and val_L is False and val_R == 1:
bitCar.motorL(1, 80)
bitCar.motorR(0, 80)
for pixel_id1 in range(0, len(np)):
np[pixel_id1] = (0, 0, 255)
np.show()
elif distance > 10 and val_L is False and val_R == 1:
bitCar.motorL(1, 100)
bitCar.motorR(1, 100)
for pixel_id1 in range(0, len(np)):
np[pixel_id1] = (0, 255, 0)
np.show()
Microbit

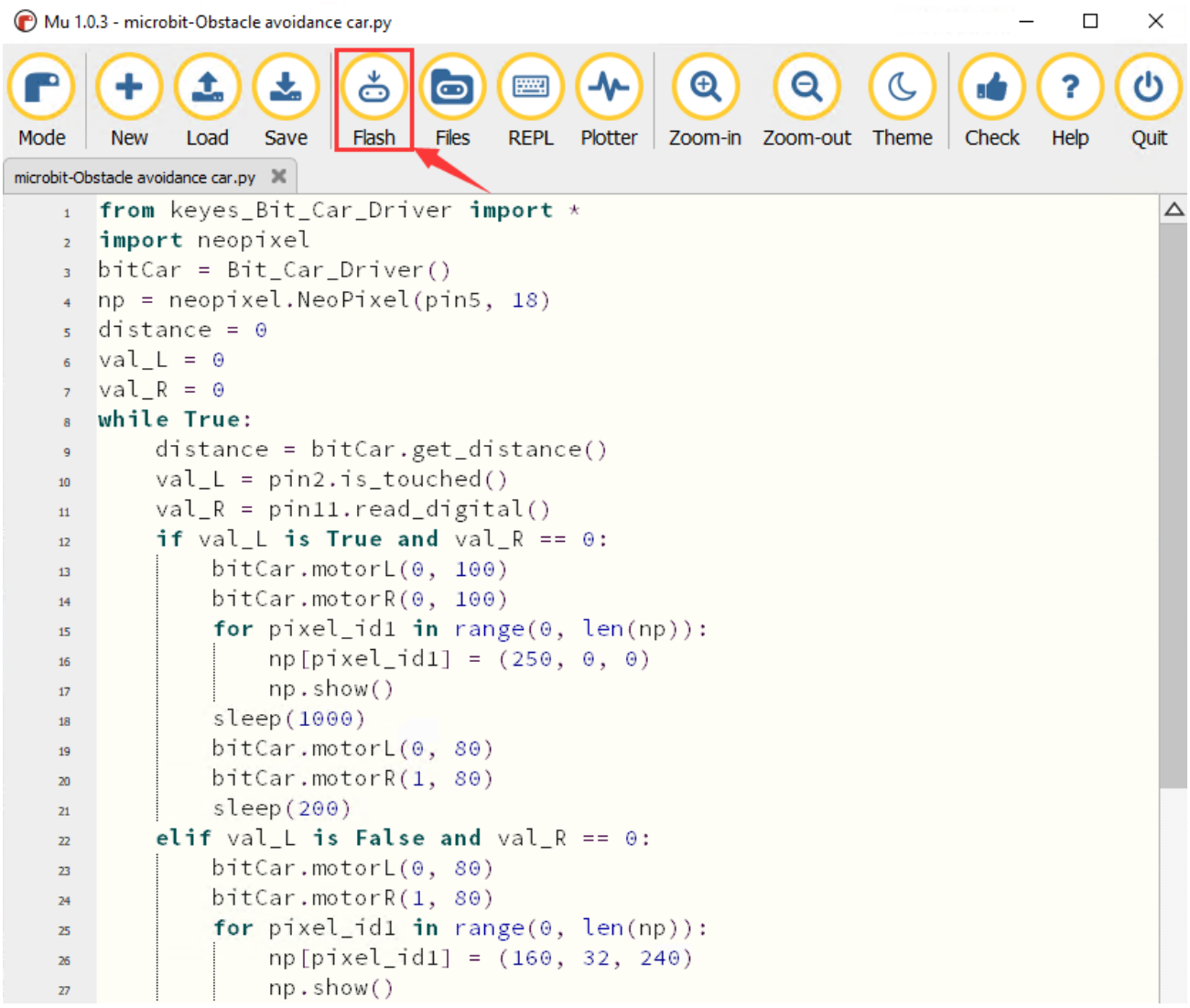
Click “Check” to examine error in the code. The program proves wrong if underlines and cursors are shown.



```
    elif val_L is True and val_R == 1:
        bitCar.motorL(1, 80)
        bitCar.motorR(0, 80)
        for pixel_id1 in range(0, len(np)):
            np[pixel_id1] = (255, 255, 0)
            np.show()
    elif distance <= 10 and val_L is False and val_R == 1:
        bitCar.motorL(1, 80)
        bitCar.motorR(0, 80)
        for pixel_id1 in range(0, len(np)):
            np[pixel_id1] = (0, 0, 255)
            np.show()
    elif distance > 10 and val_L is False and val_R == 1:
        bitCar.motorL(1, 100)
        bitCar.motorR(1, 100)
        for pixel_id1 in range(0, len(np)):
            np[pixel_id1] = (0, 255, 0)
            np.show()
```

Microbit

After downloading code, keep USB cable connected, turn on the switch of robot car. And tap “Flash” to download code to micro:bit board.




```
from keyes_Bit_Car_Driver import *
import neopixel
bitCar = Bit_Car_Driver()
np = neopixel.NeoPixel(pin5, 18)
distance = 0
val_L = 0
val_R = 0
while True:
    distance = bitCar.get_distance()
    val_L = pin2.is_touched()
    val_R = pin11.read_digital()
    if val_L is True and val_R == 0:
        bitCar.motorL(0, 100)
        bitCar.motorR(0, 100)
        for pixel_id1 in range(0, len(np)):
            np[pixel_id1] = (250, 0, 0)
            np.show()
        sleep(1000)
        bitCar.motorL(0, 80)
        bitCar.motorR(1, 80)
        sleep(200)
    elif val_L is False and val_R == 0:
        bitCar.motorL(0, 80)
        bitCar.motorR(1, 80)
        for pixel_id1 in range(0, len(np)):
            np[pixel_id1] = (160, 32, 240)
            np.show()
```

```
    elif val_L is True and val_R == 1:
        bitCar.motorL(1, 80)
        bitCar.motorR(0, 80)
        for pixel_id1 in range(0, len(np)):
            np[pixel_id1] = (255, 255, 0)
            np.show()
    elif distance <= 10 and val_L is False and val_R == 1:
        bitCar.motorL(1, 80)
        bitCar.motorR(0, 80)
        for pixel_id1 in range(0, len(np)):
            np[pixel_id1] = (0, 0, 255)
            np.show()
    elif distance > 10 and val_L is False and val_R == 1:
        bitCar.motorL(1, 100)
        bitCar.motorR(1, 100)
        for pixel_id1 in range(0, len(np)):
            np[pixel_id1] = (0, 255, 0)
            np.show()
```

Microbit

5. Test Result:

After downloading code, turn on the switch of robot car. As a result, the car will avoid the obstacle automatically

6.Code Explanation:

from keyes_Bit_Car_Driver **import** *	Import the library file of keyes_Bit_Car_Driver
bitCar = Bit_Car_Driver()	instantiate
import neopixel	Import the library file of neopixel
np = neopixel.NeoPixel(pin5, 18)	Initialize Neopixel

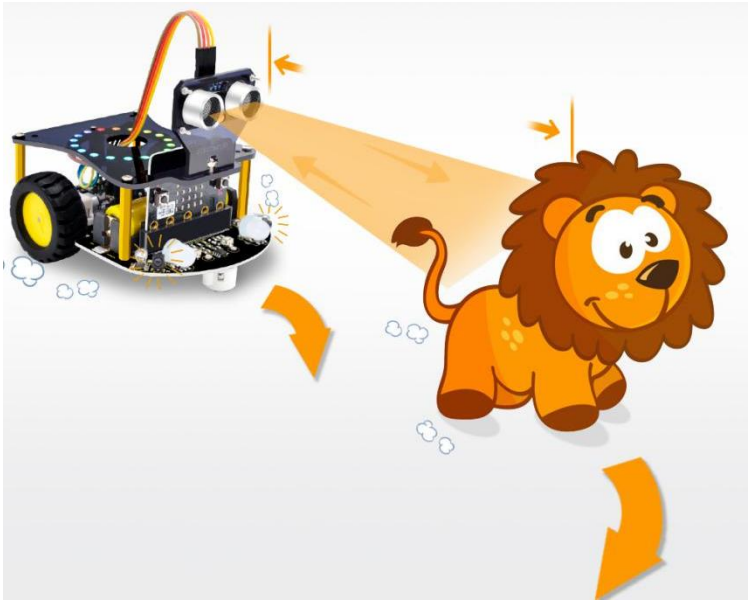
distance = 0	Set the initial value of distance to 0
val_L = 0	Set the initial value of val_L to 0
val_R = 0	Set the initial value of val_R to 0
while True:	This is a permanent loop that makes micro:bit execute the code of it.
distance = bitCar.get_distance()	Set bitCar.get_distance() to variable distance
val_L = pin2.is_touched()	Set the value of P2 read by pin2.is_touched() command, to val_LL
val_R = pin11.read_digital()	Set the digital signal read by P11 to val_RR
if val_L is True **and** val_R == 0: bitCar.motorL(0, 100) bitCar.motorR(0, 100) **for** pixel_id1 **in** range(0, len(np)): np[pixel_id1] = (250, 0, 0) np.show() sleep(1000)	If val_L is True and val_R = 0 The left motor rotates clockwise at the speed of PWM100 The right motor rotates clockwise at the speed of PWM100 Set pixel of RGB to pixel_id1 Set pixel_id1 to show red color

bitCar.motorL(0, 80) bitCar.motorR(1, 80) sleep(200) **elif** val_L is False **and** val_R == 0: bitCar.motorL(0, 80) bitCar.motorR(1, 80) **for** pixel_id1 **in** range(0, len(np)): np[pixel_id1] = (160, 32, 240) np.show() **elif** val_L is True **and** val_R == 1: bitCar.motorL(1, 80) bitCar.motorR(0, 80) **for** pixel_id1 **in** range(0, len(np)): np[pixel_id1] = (255, 255, 0) np.show() **elif** distance <= 10 **and** val_L is False **and** val_R == 1:	Set pixel on Neopixel strip Delay in 1000ms The left motor rotates anticlockwise at the speed of PWM80 The right motor rotates clockwise at the speed of PWM80 Delay in 200ms If val_L is False and val_R =0 The left motor rotates anticlockwise at the speed of PWM80 The right motor rotates clockwise at the speed of PWM80 Set pixel of RGB to pixel_id1 Set pixel_id1 to display purple color Set pixel on Neopixel strip If val_L is True and val_R = 1 The left motor rotates clockwise at the speed of PWM80

bitCar.motorL(1, 80) bitCar.motorR(0, 80) **for** pixel_id1 **in** range(0, len(np)): np[pixel_id1] = (0, 0, 255) np.show() **elif** distance > 10 **and** val_L is False **and** val_R == 1: bitCar.motorL(1, 100) bitCar.motorR(1, 100) **for** pixel_id1 **in** range(0, len(np)): np[pixel_id1] = (0, 255, 0) np.show()	The right motor rotates anticlockwise at the speed of PWM80 Set pixel of RGB to pixel_id1 Set pixel_id1 to show yellow color Set pixel on Neopixel strip If distance ≤10 and val_L is False and val_R = 1 The left motor rotates clockwise at the speed of PWM80 The right motor rotates anticlockwise at the speed of PWM80 Set pixel of RGB to pixel_id1 Set pixel_id1 to display blue color Set pixel on Neopixel strip If distance > 10 and val_L is False and val_R = 1 The left motor rotates clockwise at

	the speed of PWM100 The right motor rotates anticlockwise at the speed of PWM100 Set pixel of RGB to pixel_id1 Set pixel_id1 to show green color Set pixel on Neopixel strip

6.17.3：Following Smart Car



1.Description：

In this chapter, we will integrate ultrasonic sensor, IR obstacle avoidance sensor and car expansion board to make a multi-directional follow smart

car. Its principle is to detect the distance between the car and obstacle by ultrasonic sensor and IR obstacle avoidance sensors and control the motion of smart car.

What you need to get started

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

(2) Put batteries into battery holder

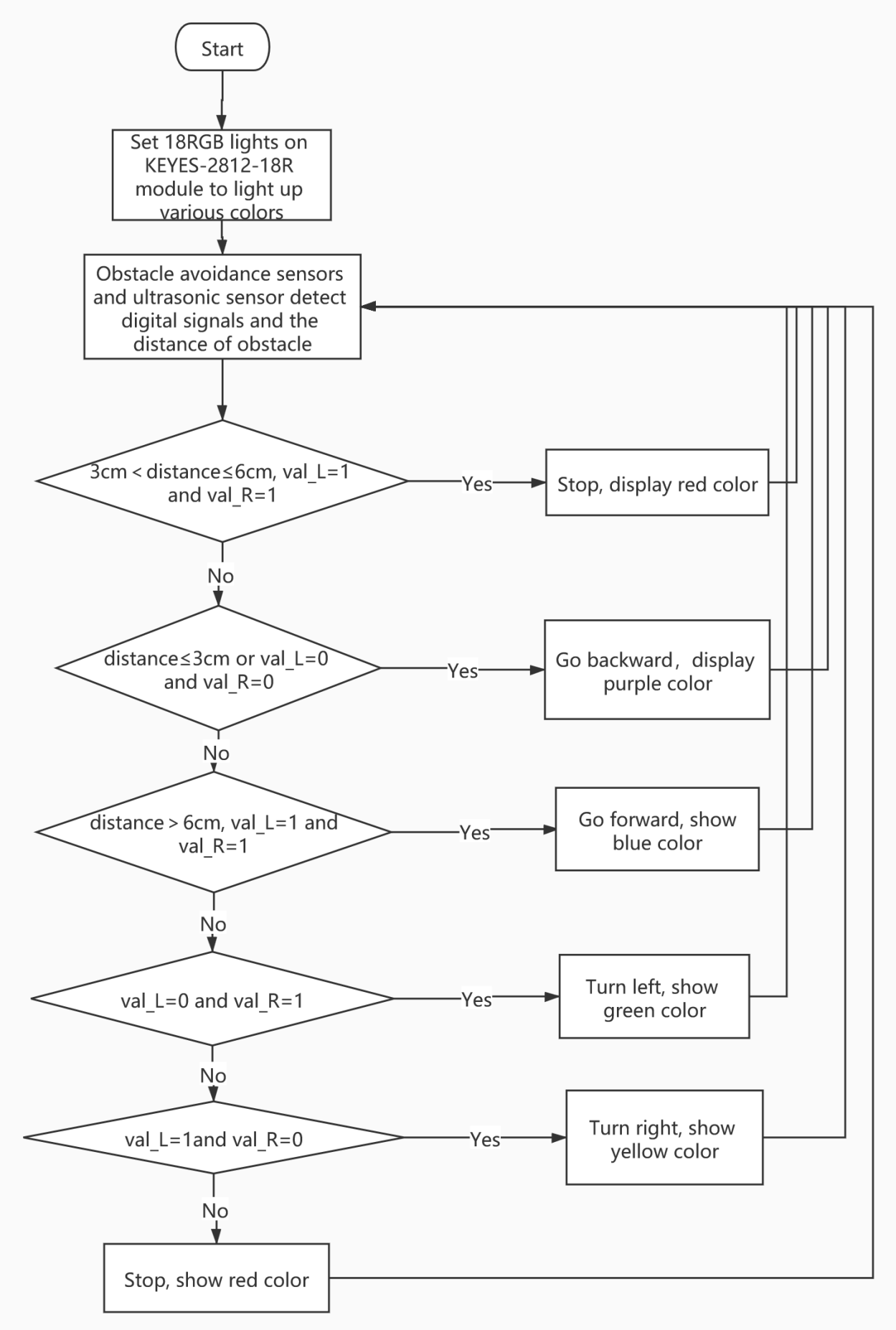
(3) Turn on the switch at the back of micro:bit car

(4) Link micro:bit board with computer via USB cable.

(5) Open the offline version of Mu

Warning: the obstacle avoidance sensor can't work normally under strong light which contains a mountain of invisible light including IR and ultraviolet rays.

Flow Chart:


Start
Set 18RGB lights on KEYES-2812-18R module to light up various colors
Obstacle avoidance sensors and ultrasonic sensor detect digital signals and the distance of obstacle
3cm < distance≤6cm, val_L=1 and val_R=1
Yes
Stop, display red color
No
distance≤3cm or val_L=0 and val_R=0
Yes
Go backward, display purple color
No
distance > 6cm, val_L=1 and val_R=1
Yes
Go forward, show blue color
No
val_L=0 and val_R=1
Yes
Turn left, show green color
No
val_L=1and val_R=0
Yes
Turn right, show yellow color
No
Stop, show red color

4.Test Code：

Open “6.17.3.py” in Mu

(How to load the project code?)

File Type	Route	File Name
Python file	../Python code/6.17： Obstacle avoidance&following robot car	6.17.3.py

The successful loading is shown below.You can also input code in the edit window yourself.(note:all English words and symbols must be written in English)

Mu 1.0.3 - microbit-Multi-directional Follow Robot Car.py.py

Mode | New | Load | Save | Flash | Files | REPL | Plotter | Zoom-in | Zoom-out | Theme | Check | Help | Quit

microbit-Multi-directional Follow Robot Car.py.py

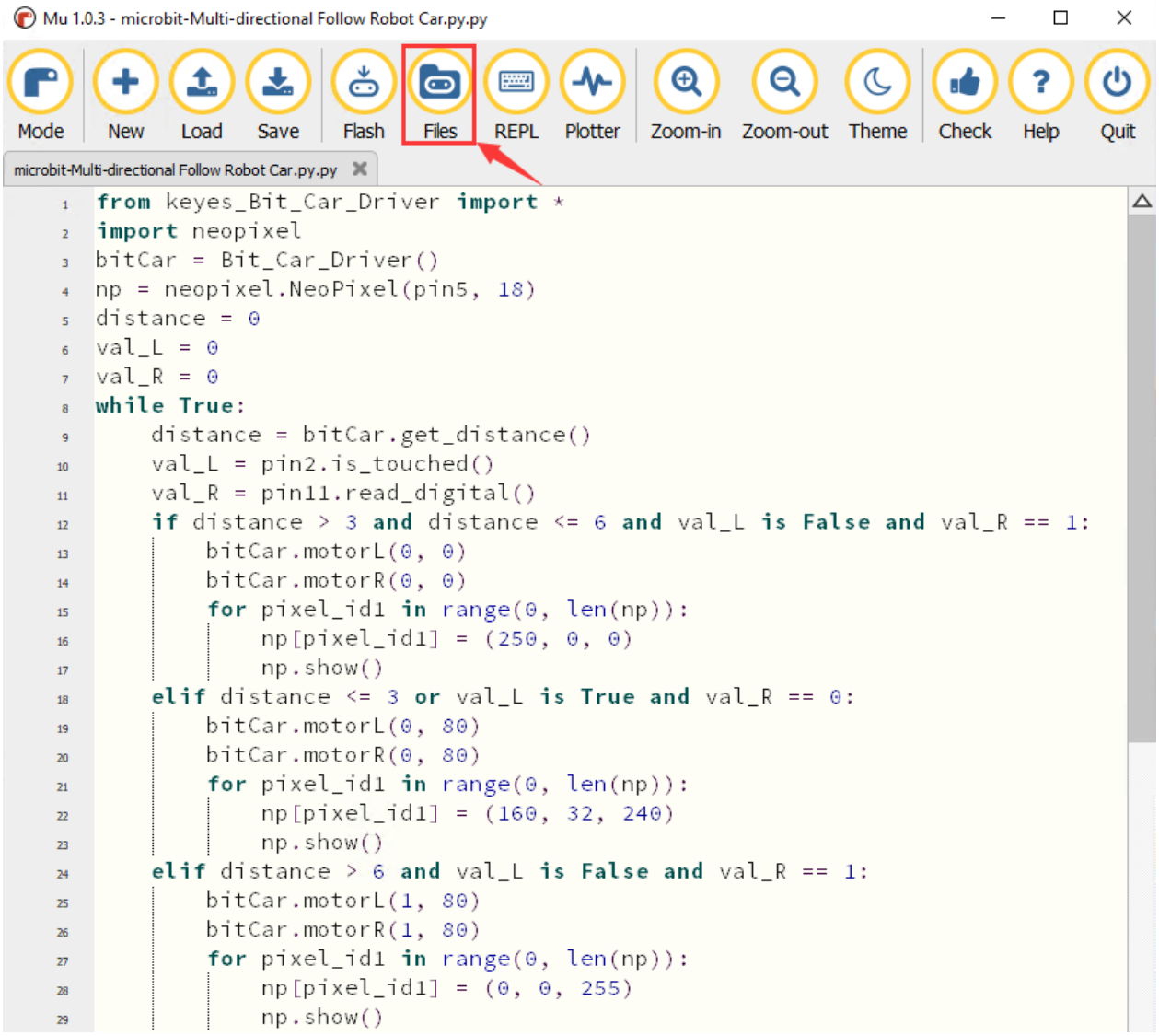
```
from keyes_Bit_Car_Driver import *
import neopixel
bitCar = Bit_Car_Driver()
np = neopixel.NeoPixel(pin5, 18)
distance = 0
val_L = 0
val_R = 0
while True:
    distance = bitCar.get_distance()
    val_L = pin2.is_touched()
    val_R = pin11.read_digital()
    if distance > 3 and distance <= 6 and val_L is False and val_R == 1:
        bitCar.motorL(0, 0)
        bitCar.motorR(0, 0)
        for pixel_id1 in range(0, len(np)):
            np[pixel_id1] = (250, 0, 0)
            np.show()
    elif distance <= 3 or val_L is True and val_R == 0:
        bitCar.motorL(0, 80)
        bitCar.motorR(0, 80)
        for pixel_id1 in range(0, len(np)):
            np[pixel_id1] = (160, 32, 240)
            np.show()
    elif distance > 6 and val_L is False and val_R == 1:
        bitCar.motorL(1, 80)
        bitCar.motorR(1, 80)
        for pixel_id1 in range(0, len(np)):
            np[pixel_id1] = (0, 0, 255)
            np.show()
```

```
    elif val_L is True and val_R == 1:
        bitCar.motorL(0, 80)
        bitCar.motorR(1, 80)
        for pixel_id1 in range(0, len(np)):
            np[pixel_id1] = (0, 255, 0)
            np.show()
    elif val_L is False and val_R == 0:
        bitCar.motorL(1, 80)
        bitCar.motorR(0, 80)
        for pixel_id1 in range(0, len(np)):
            np[pixel_id1] = (255, 255, 0)
            np.show()
    else:
        bitCar.motorL(0, 0)
        bitCar.motorR(0, 0)
        for pixel_id1 in range(0, len(np)):
            np[pixel_id1] = (255, 0, 0)
            np.show()

```

Microbit

Click “Files” to import the library file of “keyes_Bit_Car_Driver.py to micro:bit (How to import files?)

If micro:bit has library, you don’ t need to add one.

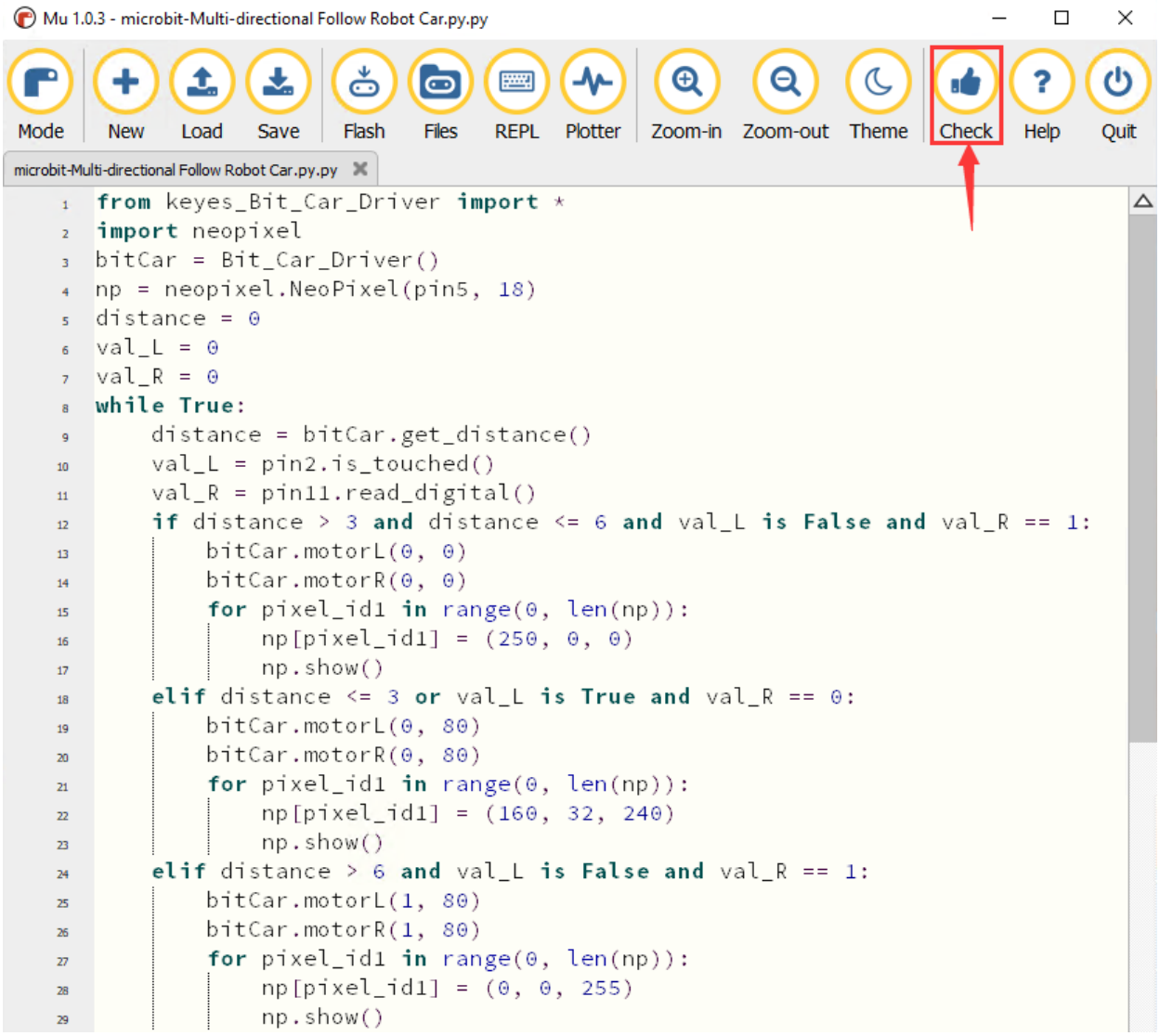



```
from keyes_Bit_Car_Driver import *
import neopixel
bitCar = Bit_Car_Driver()
np = neopixel.NeoPixel(pin5, 18)
distance = 0
val_L = 0
val_R = 0
while True:
    distance = bitCar.get_distance()
    val_L = pin2.is_touched()
    val_R = pin11.read_digital()
    if distance > 3 and distance <= 6 and val_L is False and val_R == 1:
        bitCar.motorL(0, 0)
        bitCar.motorR(0, 0)
        for pixel_id1 in range(0, len(np)):
            np[pixel_id1] = (250, 0, 0)
            np.show()
    elif distance <= 3 or val_L is True and val_R == 0:
        bitCar.motorL(0, 80)
        bitCar.motorR(0, 80)
        for pixel_id1 in range(0, len(np)):
            np[pixel_id1] = (160, 32, 240)
            np.show()
    elif distance > 6 and val_L is False and val_R == 1:
        bitCar.motorL(1, 80)
        bitCar.motorR(1, 80)
        for pixel_id1 in range(0, len(np)):
            np[pixel_id1] = (0, 0, 255)
            np.show()
```

```
    elif val_L is True and val_R == 1:
        bitCar.motorL(0, 80)
        bitCar.motorR(1, 80)
        for pixel_id1 in range(0, len(np)):
            np[pixel_id1] = (0, 255, 0)
            np.show()
    elif val_L is False and val_R == 0:
        bitCar.motorL(1, 80)
        bitCar.motorR(0, 80)
        for pixel_id1 in range(0, len(np)):
            np[pixel_id1] = (255, 255, 0)
            np.show()
    else:
        bitCar.motorL(0, 0)
        bitCar.motorR(0, 0)
        for pixel_id1 in range(0, len(np)):
            np[pixel_id1] = (255, 0, 0)
            np.show()

```

Microbit

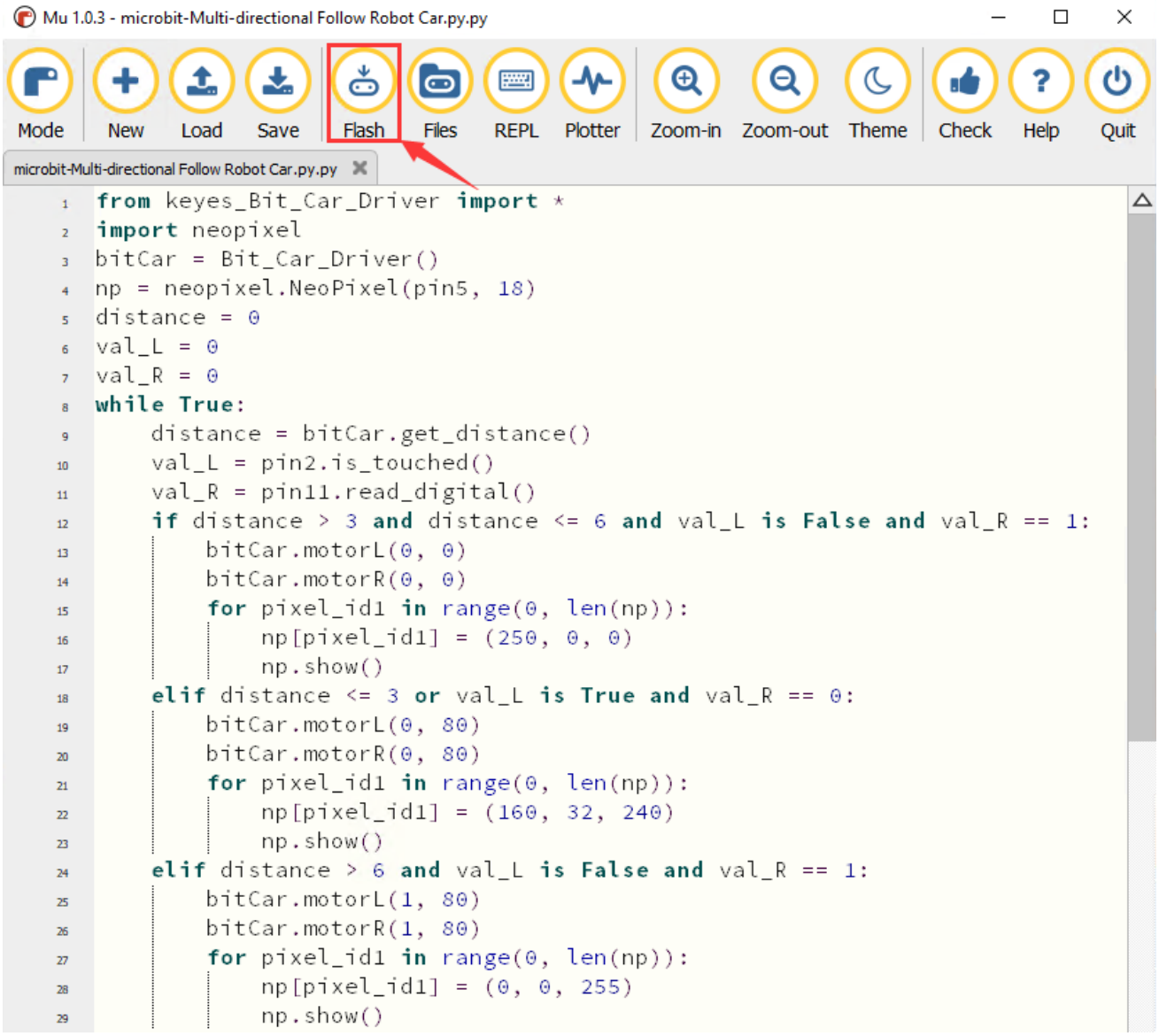
Click “Check” to examine error in the code. The program proves wrong if underlines and cursors are shown.


Mu 1.0.3 - microbit-Multi-directional Follow Robot Car.py.py
Mode
New
Load
Save
Flash
Files
REPL
Plotter
Zoom-in
Zoom-out
Theme
Check
Help
Quit
microbit-Multi-directional Follow Robot Car.py.py
from keyes_Bit_Car_Driver import *
import neopixel
bitCar = Bit_Car_Driver()
np = neopixel.NeoPixel(pin5, 18)
distance = 0
val_L = 0
val_R = 0
while True:
distance = bitCar.get_distance()
val_L = pin2.is_touched()
val_R = pin11.read_digital()
if distance > 3 and distance <= 6 and val_L is False and val_R == 1:
bitCar.motorL(0, 0)
bitCar.motorR(0, 0)
for pixel_id1 in range(0, len(np)):
np[pixel_id1] = (250, 0, 0)
np.show()
elif distance <= 3 or val_L is True and val_R == 0:
bitCar.motorL(0, 80)
bitCar.motorR(0, 80)
for pixel_id1 in range(0, len(np)):
np[pixel_id1] = (160, 32, 240)
np.show()
elif distance > 6 and val_L is False and val_R == 1:
bitCar.motorL(1, 80)
bitCar.motorR(1, 80)
for pixel_id1 in range(0, len(np)):
np[pixel_id1] = (0, 0, 255)
np.show()

```
    elif val_L is True and val_R == 1:
        bitCar.motorL(0, 80)
        bitCar.motorR(1, 80)
        for pixel_id1 in range(0, len(np)):
            np[pixel_id1] = (0, 255, 0)
            np.show()
    elif val_L is False and val_R == 0:
        bitCar.motorL(1, 80)
        bitCar.motorR(0, 80)
        for pixel_id1 in range(0, len(np)):
            np[pixel_id1] = (255, 255, 0)
            np.show()
    else:
        bitCar.motorL(0, 0)
        bitCar.motorR(0, 0)
        for pixel_id1 in range(0, len(np)):
            np[pixel_id1] = (255, 0, 0)
            np.show()

```

Microbit

Make sure code correct, connect micro:bit to computer via USB cable, turn on the switch of keyestudio micro:bit robot car and click "Flash" to download code to micro:bit.




```
from keyes_Bit_Car_Driver import *
import neopixel
bitCar = Bit_Car_Driver()
np = neopixel.NeoPixel(pin5, 18)
distance = 0
val_L = 0
val_R = 0
while True:
    distance = bitCar.get_distance()
    val_L = pin2.is_touched()
    val_R = pin11.read_digital()
    if distance > 3 and distance <= 6 and val_L is False and val_R == 1:
        bitCar.motorL(0, 0)
        bitCar.motorR(0, 0)
        for pixel_id1 in range(0, len(np)):
            np[pixel_id1] = (250, 0, 0)
            np.show()
    elif distance <= 3 or val_L is True and val_R == 0:
        bitCar.motorL(0, 80)
        bitCar.motorR(0, 80)
        for pixel_id1 in range(0, len(np)):
            np[pixel_id1] = (160, 32, 240)
            np.show()
    elif distance > 6 and val_L is False and val_R == 1:
        bitCar.motorL(1, 80)
        bitCar.motorR(1, 80)
        for pixel_id1 in range(0, len(np)):
            np[pixel_id1] = (0, 0, 255)
            np.show()
```

```
    elif val_L is True and val_R == 1:
        bitCar.motorL(0, 80)
        bitCar.motorR(1, 80)
        for pixel_id1 in range(0, len(np)):
            np[pixel_id1] = (0, 255, 0)
            np.show()
    elif val_L is False and val_R == 0:
        bitCar.motorL(1, 80)
        bitCar.motorR(0, 80)
        for pixel_id1 in range(0, len(np)):
            np[pixel_id1] = (255, 255, 0)
            np.show()
    else:
        bitCar.motorL(0, 0)
        bitCar.motorR(0, 0)
        for pixel_id1 in range(0, len(np)):
            np[pixel_id1] = (255, 0, 0)
            np.show()

```

Microbit

5.Test Result:

After downloading code, turn on the switch of robot car, the car will follow the obstacle to move.

6.Code Explanation:

from keyes_Bit_Car_Driver **import** *	Import the library file of keyes_Bit_Car_Driver
bitCar = Bit_Car_Driver()	instantiate
import neopixel	Import the library file of neopixel

np = neopixel.NeoPixel(pin5, 18)	Initialize Neopixel
distance = 0	Set the initial value of distance to 0
val_L = 0	Set the initial value of val_L to 0
val_R = 0	Set the initial value of val_R to 0
while True:	This is a permanent loop that makes micro:bit execute the code of it.
distance = bitCar.get_distance()	Set bitCar.get_distance() to distance
val_L = pin2.is_touched()	Set the value of P2 read by pin2.is_touched()z command, to val_LL
val_R = pin11.read_digital()	Set the digital signal read by P11 to val_RR
if distance > 3 **and** distance <= 6 **and** val_L is False **and** val_R == 1: bitCar.motorL(0, 0) bitCar.motorR(0, 0) **for** pixel_id1 **in** range(0, len(np)): np[pixel_id1] = (250, 0, 0) np.show()	If distance > 3 and distance ≤ 6 val_L is False, val_R =1 left motor doesn’ t rotate right motor doesn’ t rotate Set the pixel of RGB to pixel_id1 in the range of 0-len（np） Set pixel_id1to show red color

elif distance <= 3 **or** val_L is True **and** val_R == 0: bitCar.motorL(0, 80) bitCar.motorR(0, 80) **for** pixel_id1 **in** range(0, len(np)): np[pixel_id1] = (160, 32, 240) np.show() **elif** distance > 6 **and** val_L is False **and** val_R == 1: bitCar.motorL(1, 80) bitCar.motorR(1, 80) **for** pixel_id1 **in** range(0, len(np)): np[pixel_id1] = (0, 0, 255) np.show() **elif** val_L is True **and** val_R == 1: bitCar.motorL(0, 80) bitCar.motorR(1, 80)	Set pixel of RGB to pixel_id1 If distance ≤ 3 or val_L is True and val_R = 0 The left motor rotates anticlockwise at the speed of PWM80 The right motor rotates anticlockwise at the speed of PWM80 Set pixel of RGB to pixel_id1 Set pixel_id1 to display purple color Display pixel on Neopixel strip Otherwise, if distance > 6 and val_L is False and val_R =1 The left motor rotates clockwise at the speed of PWM80 The right motor rotates clockwise at the speed of PWM80 Set pixel of RGB to pixel_id1 Set pixel_id1to show blue color

for pixel_id1 **in** range(0, len(np)): np[pixel_id1] = (0, 255, 0) np.show() **elif** val_L is False **and** val_R == 0: bitCar.motorL(1, 80) bitCar.motorR(0, 80) **for** pixel_id1 **in** range(0, len(np)): np[pixel_id1] = (255, 255, 0) np.show() **else**: bitCar.motorL(0, 0) bitCar.motorR(0, 0) **for** pixel_id1 **in** range(0, len(np)): np[pixel_id1] = (255, 0, 0) np.show()	Display pixel on Neopixel strip If val_L is True and val_R = 1 The left motor rotates anticlockwise at the speed of PWM80 The right motor rotates clockwise at the speed of PWM80 Set pixel of RGB to pixel_id1 Set pixel_id1 to show green color Display pixel on Neopixel strip If val_L is False and val_R = 1 The left motor rotates clockwise at the speed of PWM80 The right motor rotates anticlockwise at the speed of PWM80 Set pixel of RGB to pixel_id1 Set pixel_id1 to display yellow color Display pixel on Neopixel strip If the above conditions are not met

	left motor doesn’ t rotate right motor doesn’ t rotate Set pixel of RGB to pixel_id1 Set pixel_id1 to show red color Display pixel on Neopixel strip

6.18： Multi-purpose Smart Car

With 16k RAM, micro:bit owns a low-consumption Bluetooth module and support Bluetooth communication. However, BLE heap stack occupies 12K RAM, which implies that there is no enough space to run microPython.

At present, microPython doesn’ t support Bluetooth, thereby, we can’ t make a multi-purpose smart car.

https://microbit-micropython.readthedocs.io/en/latest/ble.html

9. Resources

1. BBC microbit MicroPython：

https://microbit-micropython.readthedocs.io/en/latest/tutorials/introduction.html

2. The Micro Python language

https://docs.openmv.io/reference/index.html

3. Ustruct Library:

https://docs.openmv.io/library/ustruct.html

4. Math Library:

https://docs.openmv.io/library/math.html

5.utime(sleep_us,tick_us) Library File:

https://docs.openmv.io/library/utime.html#