3.8 Handwritten digital control

1. Learning objectives

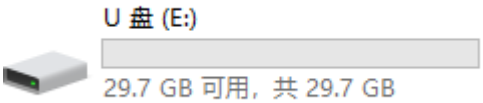
In this course, we will learn that how to make k210 vision module performs handwritten number recognition, which can recognise the numbers 0, 1, 2, 3, 4, 5, 6, 7, 8, 9.

For this experiment, we only edit the actions for 1, 2, 4, and 7, and when these numbers are recognized, the car performs different actions.

2. Preparation for class

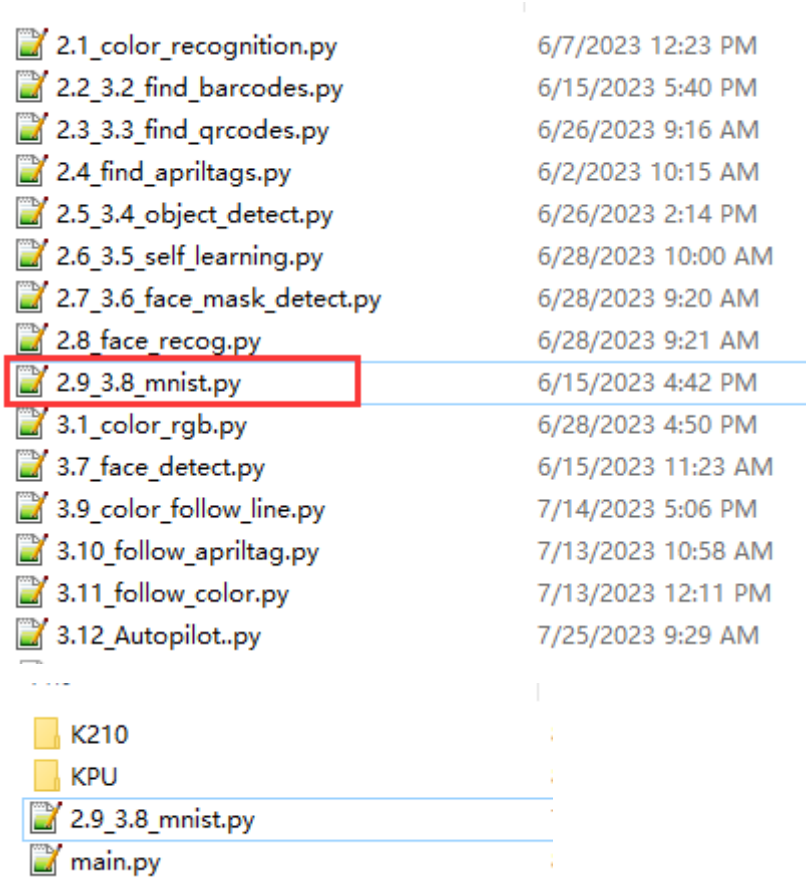
1. Remove the TF card from the k210 vision module and insert it into the card reader.

2. Plug the card reader into the computer, and wait for the computer to recognize the USB disk.



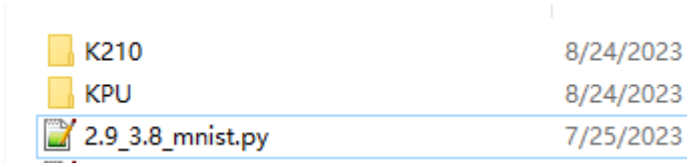
3. Then, enter the TF card. You will see following content.

4. Go to the k210 folder, find the **2.9_3.8_mnist.py** file from the folder and copy it to the root directory.



5. Delete the original **main.py** file.

   Then, re-name the **2.9_3.8_mnist.py** file as the **main.py** file.



6. After re-name, pull out the card reader, remove the TF card and insert it back into the k210 vision module.

3. Programming Methods

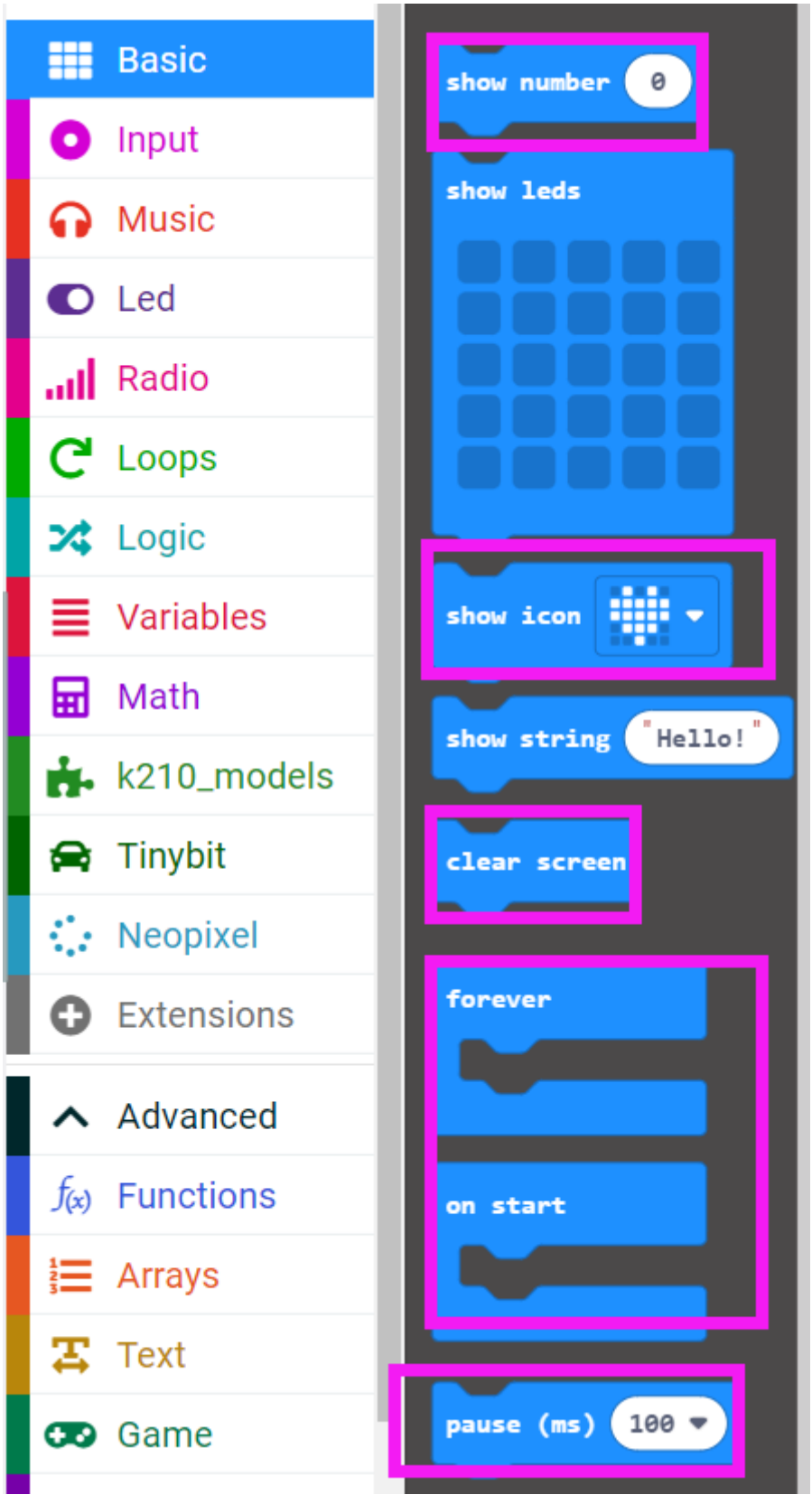
Online programming: first copy this URL https://makecode.microbit. and enter the online programming interface.

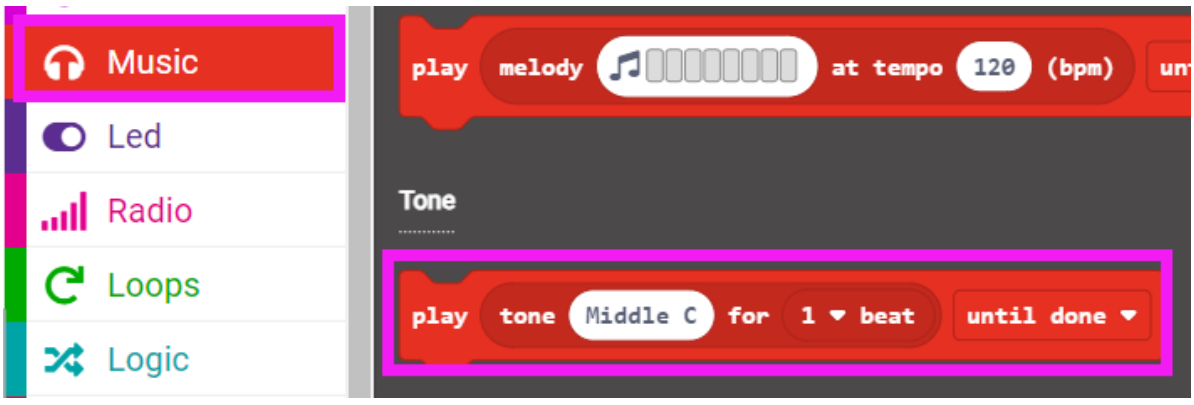
Click Extension, copy the package URL: https://github.com/YahboomTechnology/K210-Module.git to the input field, click Confirm to add package,

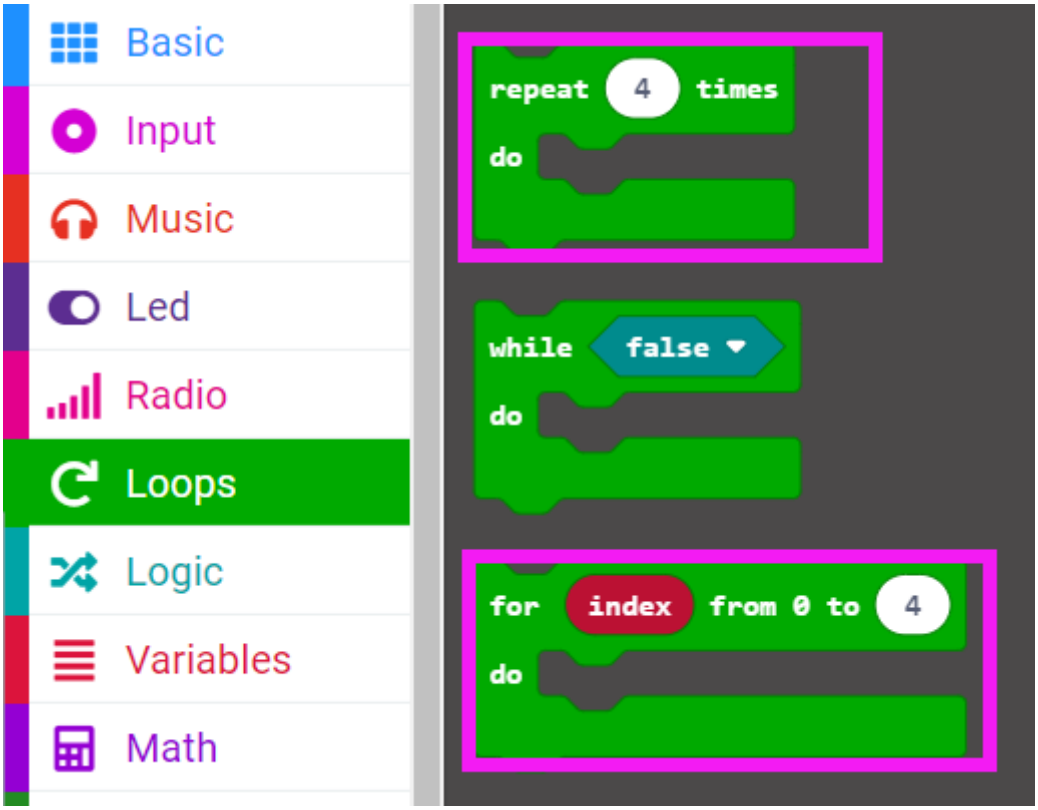
Click Extension again, copy the package URL: https://github.com/YahboomTechnology/Tiny-bitLib to the input field, click Confirm to add the package.

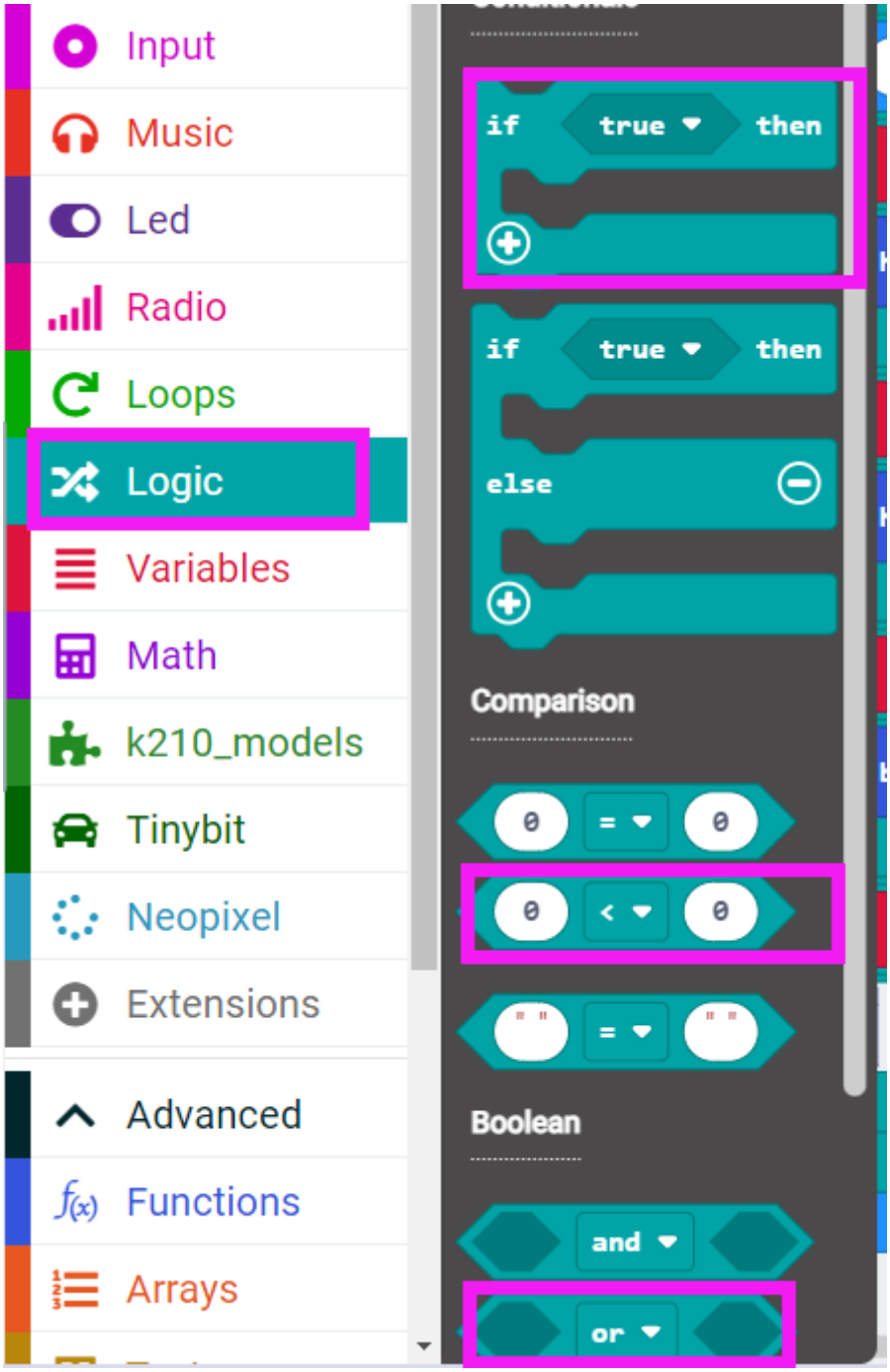
Finally you can use the K210 Vision Module package and Tinybit's building blocks.

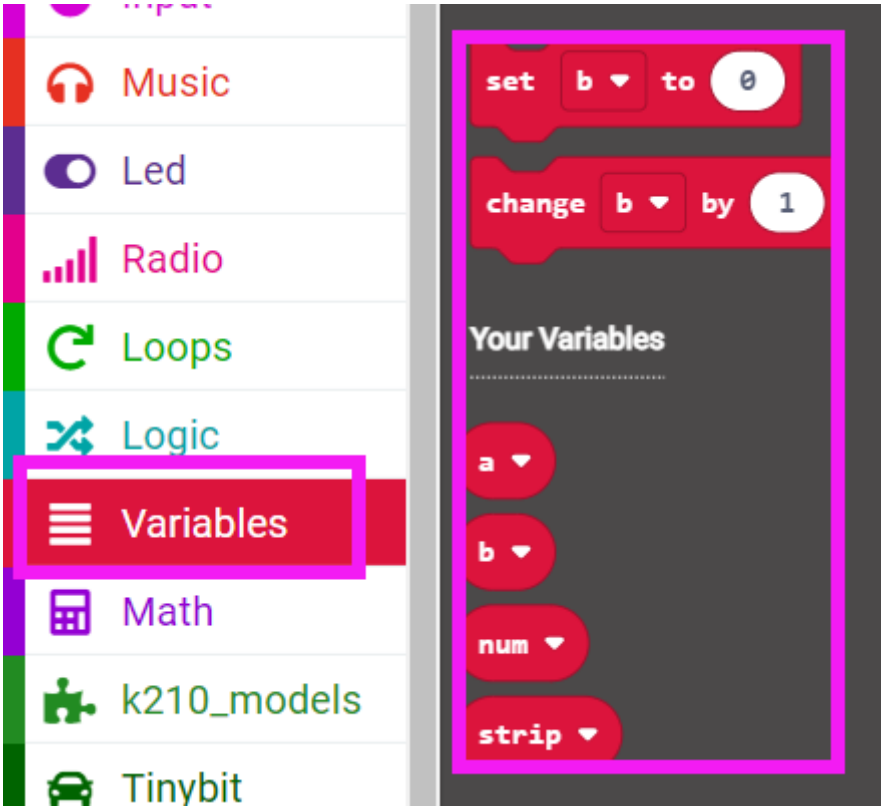
4. Blocks

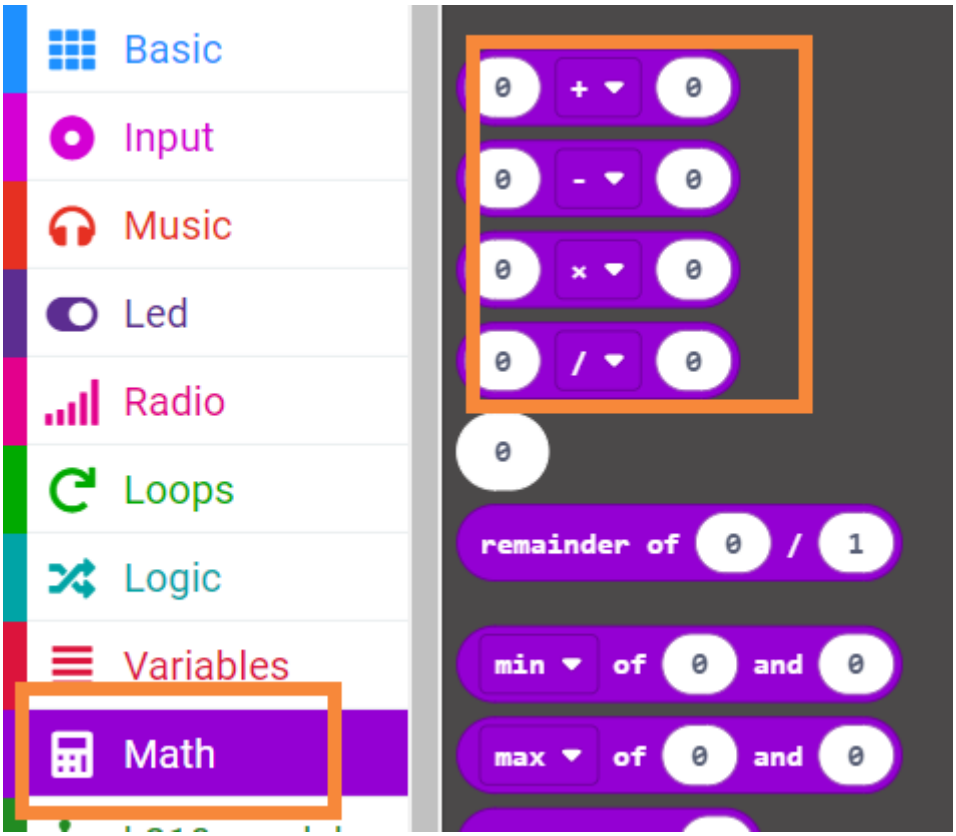

Basic
Input
Music
Led
Radio
Loops
Logic
Variables
Math
k210_models
Tinybit
Neopixel
Extensions
Advanced
Functions
Arrays
Text
Game
show number 0
show leds
show icon
show string "Hello!"
clear screen
forever
on start
pause (ms) 100

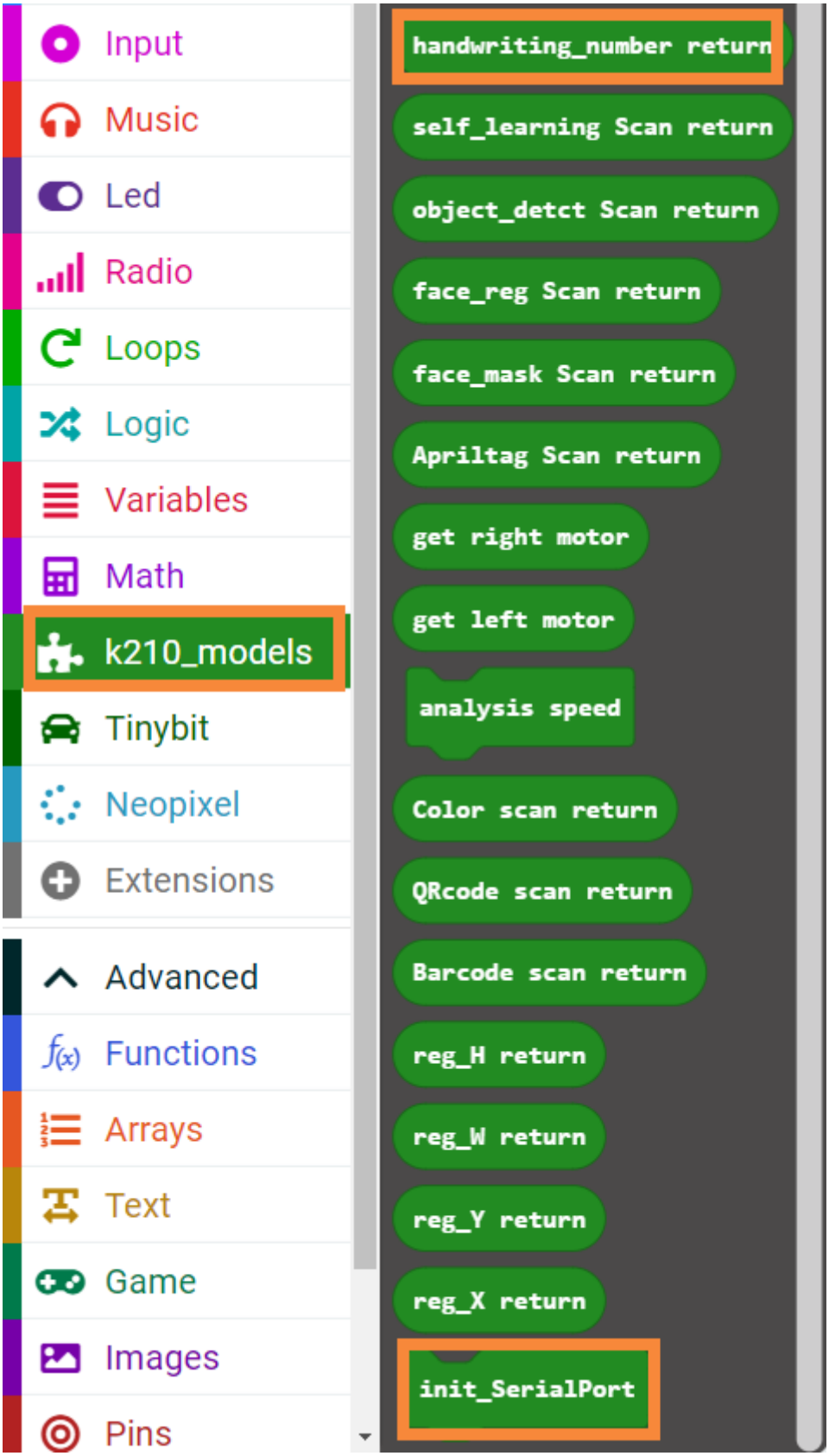

Music
Led
Radio
Loops
Logic
play melody at tempo 120 (bpm)
Tone
play tone Middle C for 1 beat until done

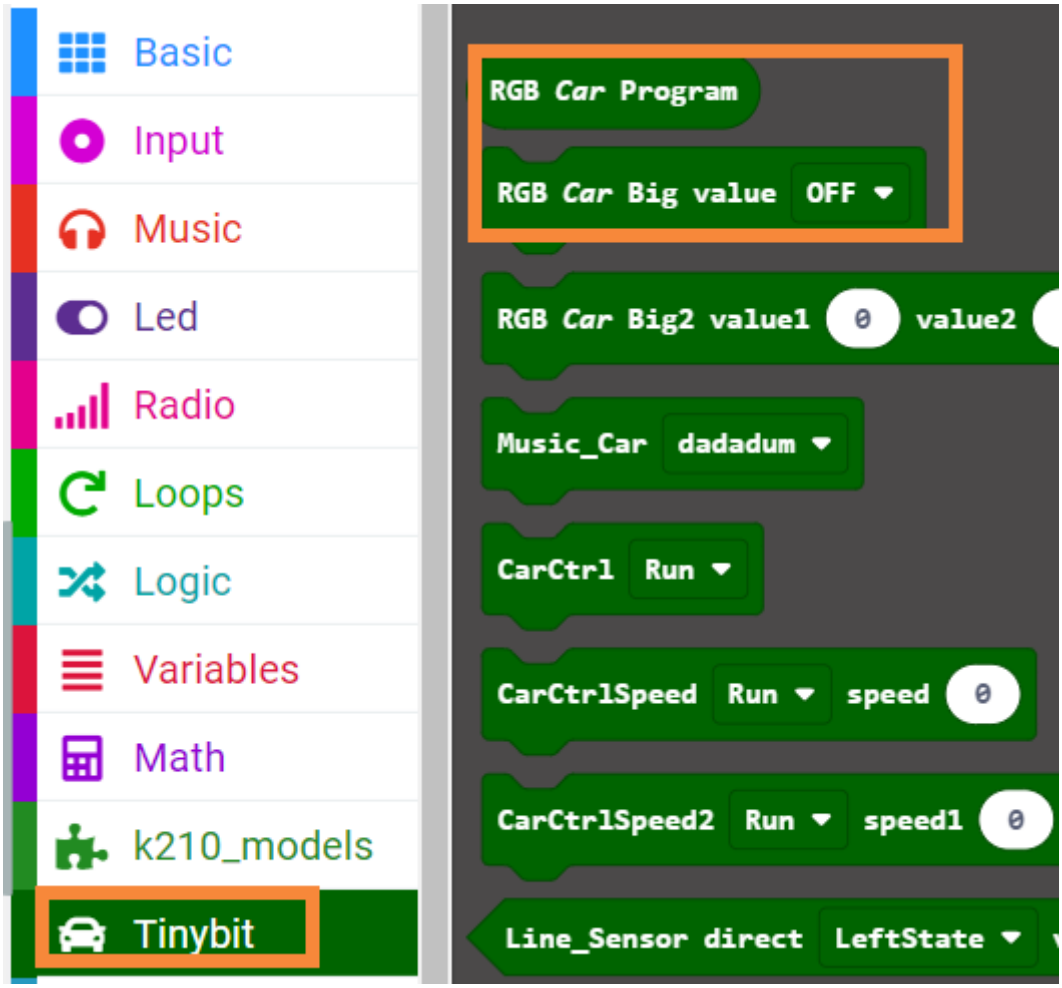

Basic
Input
Music
Led
Radio
Loops
Logic
Variables
Math
repeat 4 times
do
while false
do
for index from 0 to 4
do

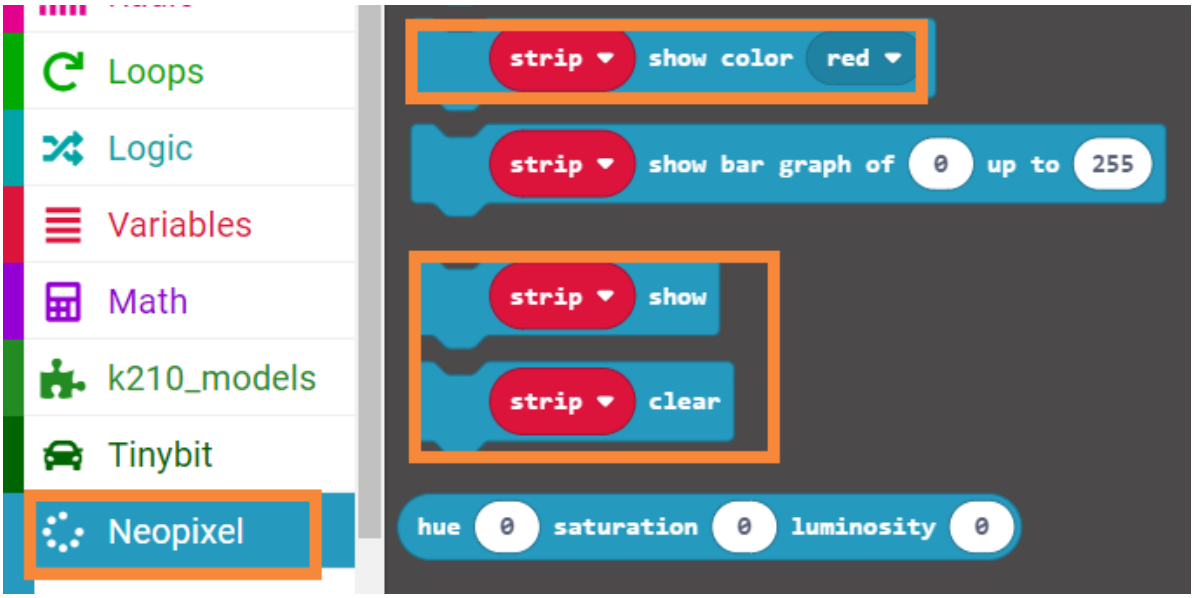

Input
Music
Led
Radio
Loops
Logic
Variables
Math
k210_models
Tinybit
Neopixel
Extensions
Advanced
Functions
Arrays
if true then
if true then
else
Comparison
0 = 0
0 < 0
" " = " "
Boolean
and
or

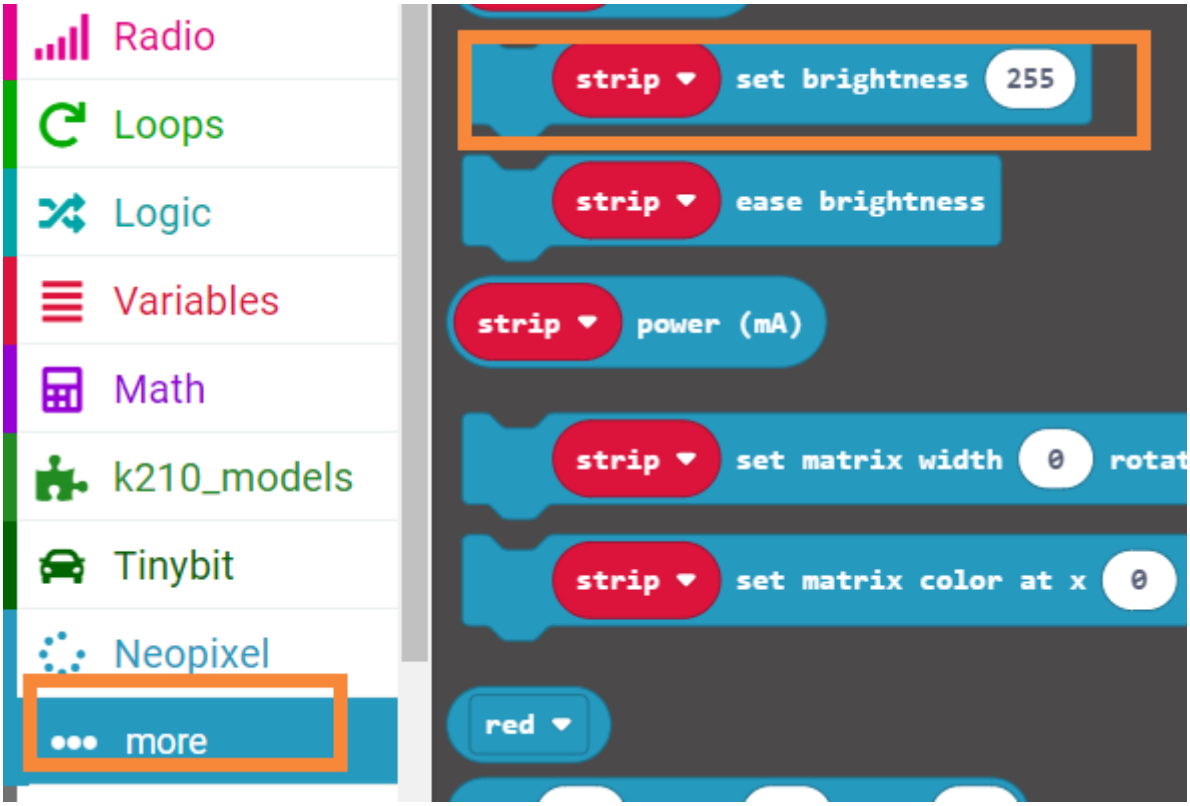

Music
Led
Radio
Loops
Logic
Variables
Math
k210_models
Tinybit
set b to 0
change b by 1
Your Variables
a
b
num
strip

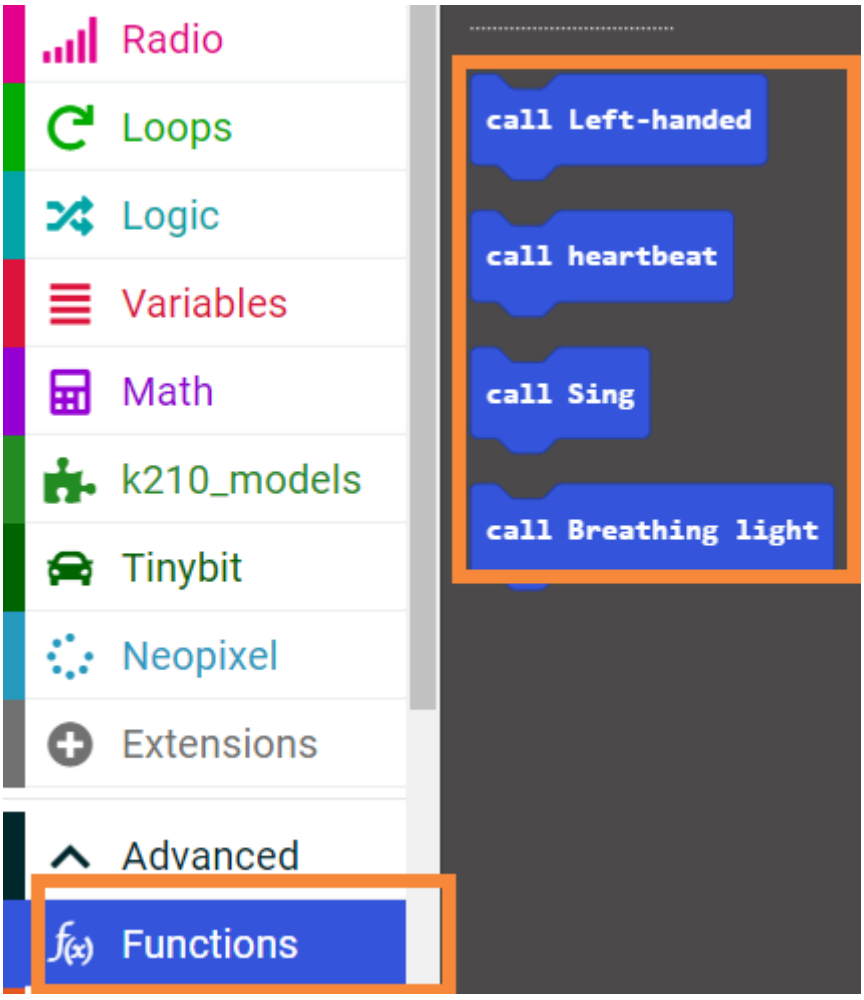

Basic
Input
Music
Led
Radio
Loops
Logic
Variables
Math
0 + 0
0 - 0
0 x 0
0 / 0
0
remainder of 0 / 1
min of 0 and 0
max of 0 and 0


Input
Music
Led
Radio
Loops
Logic
Variables
Math
k210_models
Tinybit
Neopixel
Extensions
Advanced
Functions
Arrays
Text
Game
Images
Pins
handwriting_number return
self_learning Scan return
object_detct Scan return
face_reg Scan return
face_mask Scan return
Apriltag Scan return
get right motor
get left motor
analysis speed
Color scan return
QRcode scan return
Barcode scan return
reg_H return
reg_W return
reg_Y return
reg_X return
init_SerialPort

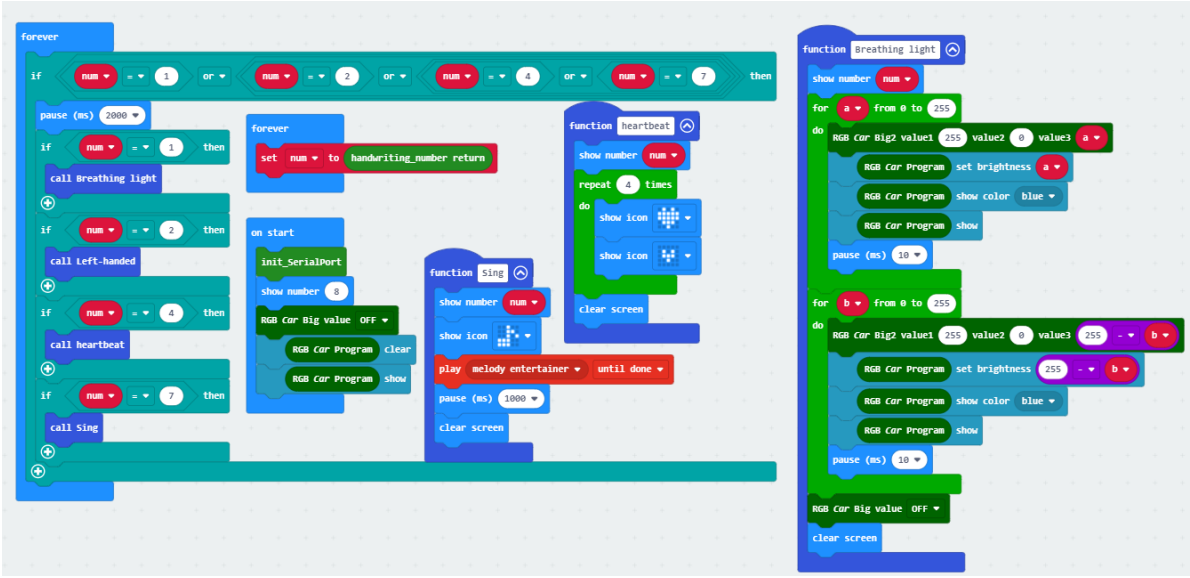

Basic
Input
Music
Led
Radio
Loops
Logic
Variables
Math
k210_models
Tinybit
RGB Car Program
RGB Car Big value OFF
RGB Car Big2 value1 0 value2
Music_Car dadadum
CarCtrl Run
CarCtrlSpeed Run speed 0
CarCtrlSpeed2 Run speed1 0
Line_Sensor direct LeftState

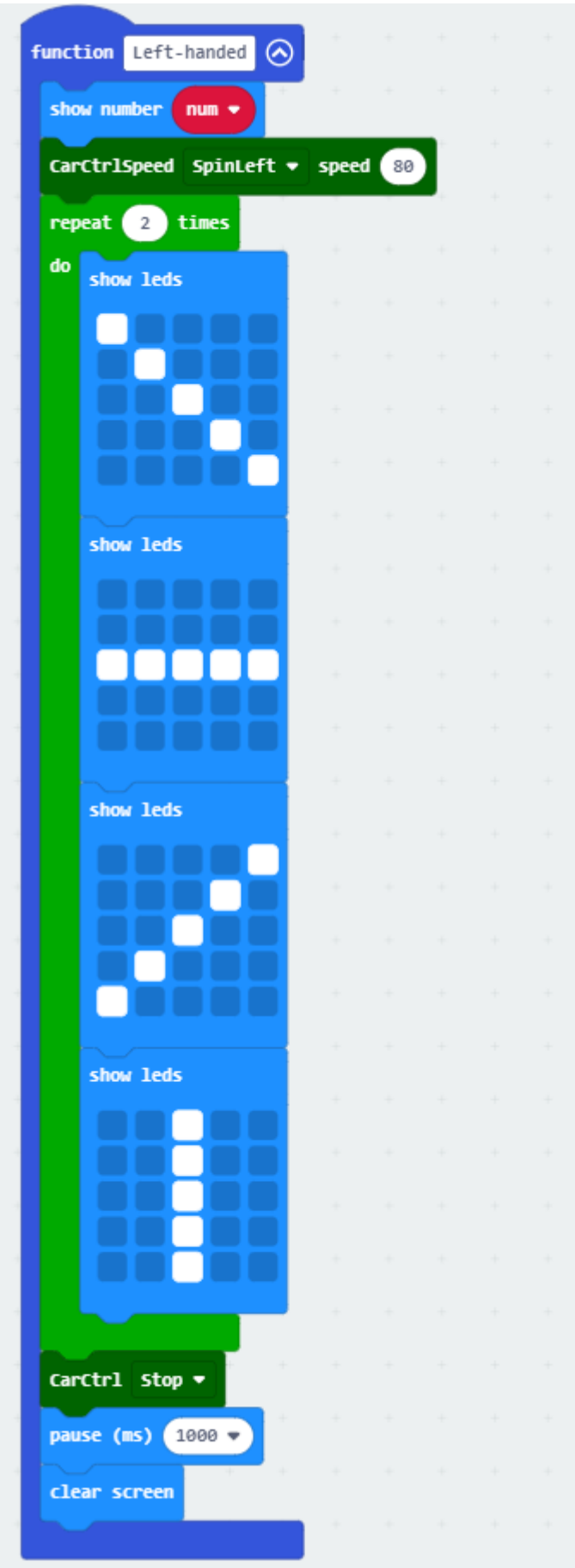

Loops
Logic
Variables
Math
k210_models
Tinybit
Neopixel
strip show color red
strip show bar graph of 0 up to 255
strip show
strip clear
hue 0 saturation 0 luminosity 0


Radio
Loops
Logic
Variables
Math
k210_models
Tinybit
Neopixel
more
strip set brightness 255
strip ease brightness
strip power (mA)
strip set matrix width 0 rotat
strip set matrix color at x 0
red


Radio
Loops
Logic
Variables
Math
k210_models
Tinybit
Neopixel
Extensions
Advanced
Functions
call Left-handed
call heartbeat
call Sing
call Breathing light

5. Code


forever
if num = 1 or num = 2 or num = 4 or num = 7 then
pause (ms) 2000
if num = 1 then
call Breathing light
if num = 2 then
call Left-handed
if num = 4 then
call heartbeat
if num = 7 then
call Sing
forever
set num to handwriting_number return
on start
init_SerialPort
show number 8
RGB Car Big value OFF
RGB Car Program clear
RGB Car Program show
function Sing
show number num
show icon
play melody entertainer until done
pause (ms) 1000
clear screen
function heartbeat
show number num
repeat 4 times
do
show icon
show icon
clear screen
function Breathing light
show number num
for a from 0 to 255
do
RGB Car Big2 value1 255 value2 0 value3 a
RGB Car Program set brightness a
RGB Car Program show color blue
RGB Car Program show
pause (ms) 10
for b from 0 to 255
do
RGB Car Big2 value1 255 value2 0 value3 255 - b
RGB Car Program set brightness 255 - b
RGB Car Program show color blue
RGB Car Program show
pause (ms) 10
RGB Car Big value OFF
clear screen



6. Download code

Connect the Micro:bit board to the computer via microusb cable, the computer will pop up a USB stick.

Then, select the **k210_Handwritten_digital_control.hex** code and right click to send it to the Micro:bit U disk.

Wait until sending is complete and unplug the Micro:bit usb cable. Plug the Micro:bit board into the car.

7. Experimental Phenomena

After starting the car, the dot matrix of the microbit scrolls to display the number 8.

Wait for the screen to display the camera image, then point the camera at the handwritten number.

In this experiment, we performed different actions when we recognized the numbers 1, 2, 4, and 7.

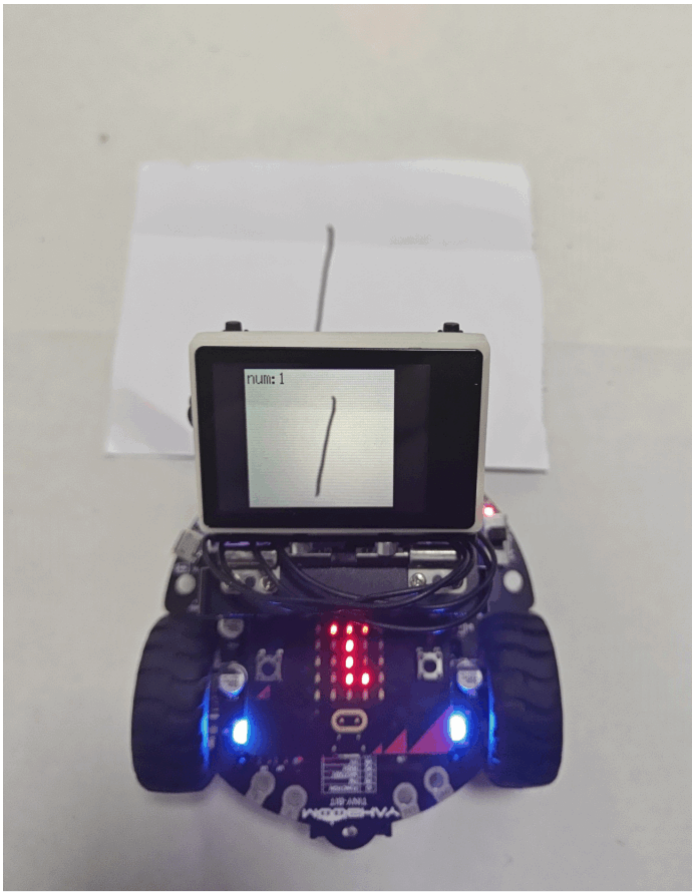
When num:1 appears in the upper left corner of the display, wait for about 2 seconds, the LED dot matrix of the microbit will display the number 1, and the car will light up the breathing light;

When num:2 appears in the upper left corner of the display, wait for about 2 seconds, the LED dot matrix of the microbit will display the number 2, the car will rotate left on the spot, and the LED dot matrix of the microbit will display the dynamic rotating pattern;

When num:4 appears in the upper left corner of the display, wait for about 2 seconds, the LED dot matrix of the microbit will display the number 4, and the dot matrix of the microbit will display the dynamic heartbeat;

When num:7 appears in the upper left corner of the display, wait for about 2 seconds, the LED dot matrix of the microbit will display the number 7, the car will display the music pattern, and start playing music.

As shown below.




num: 7