keyestudio WiKi

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Dec 21, 2023

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	8.1	Q: What type of batteries should this kit be equipped with?	175
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### CHAPTER

### ONE

## **1. DESCRIPTION**

Keyestudio micro:bit desk bit car is designed by micro:bit V2. It consists of delicate servos, a control board with high quality and a yellow car body, which is extremely cool. You can control it via App or controller. In addition, a mountainous of comprehensive courses are provided to you. It is definitely the best choice for STEM creators and enthusiasts.

#### Features

- Include micro:bit V2, acrylic board and servo board.
- Easy to build: most of components can be assembled with screws and nuts.
- Equipped with RGB light, battery holder, sensors and modules, the control board can drive three servos at same time.
- Multiple purpose: walking, singing, pushing stuff, drawing and playing music.
- Support Makecode graphical programming and App control
- 21 projects included

### CHAPTER

# TWO

# 2. KIT LIST

Components			
#	Model	QTY	Picture
0	Micro:bit V2 is not included in KS4040 kitMicro:bit V2 is included in KS4041	1	
1	Keyestudio Control Board	1	

### Table 1 – continued from previous pag



Table 1 – continued from previous pag

Components			
4	Micro USB Cable	1	
1	4 Pcs Acrylic Boards	1	
2	Wheels	2	
3 Nuts/Screws	Universal Wheel	1	
1	M3*60MM Dual-pass Hex Copper Pillar	3	and the second second
2	M3*30MM Dual-pass Hex Copper Pillar	3	and the Real Property of
3	M3*30+6MM Copper Pillar	1	
4	M3*35MM Dual-pass Hex Copper Pillar	1	and the first state of
5	M3*12+6MM Copper Pillar	1	
6	M3*16MM Round Head Screws	1	2
0	M2*10MM Round Head Screws	6	Remain Control of Cont
0	M3*12MM Round Head Screws	5	2
10	M3*12MM Flat Head Screws	2	2
10	11.5 1211111 I lat Head Sciews	4	-

-

Table 1 – continued from previous pag

Components			
11	M3 Nickel Plated Nuts	4	8
12	M3 Nickel Plated Self-locking Nuts	1	Ô.
13	M2 Nickel Plated Nuts	6	8
			1
14	M1.2*4MM Round Head Self-tapping Screws	4	
Tools			
1	WB-558 White Board Pen	1	Security Marker
2	3.0*40MM Screwdriver	1	
3	2.0*40MM Screwdriver	1	finner Mile
4	M3+M4 Wrench	1	
5	1.5V AA Batteries Not included in the kit	4	CE 111143

### CHAPTER

### THREE

### **3. PREPARATION**

#### 3.1. About Micro:bit

\*\*What is micro:bit \*\*

Micro:bit is designed by BBC, aiming at helping children learning programming. Micro:bit includes a 5\*5 LED dot matrix, 2 programmable buttons, compass, Micro USB port, Bluetooth module, etc. It is only half the size of a credit card (4cm×5cm), but very powerful. It can be used to edit video games, sound and light interaction, robot control, scientific experiments, wearable device and so on.

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

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

#### **Micro: bit Pinout**

Micro:bit V2



Micro:bit V1.5



Micro:bit V1.5 VS Micro:bit V2



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

You can reboot micro:bit V2 when pressing reset and power button.

LED will get dark and the power-saving mode will be activated if you keep pressing reset and power button, which can make the life expectancy of batteries longer and activate micro:bit.

#### More resources

https://tech.microbit.org/hardware https://microbit.org/new-microbit/ https://www.microbit.org/get-started/user-guide/overview/ https://microbit.org/get-started/user-guide/features-in-depth

#### **Micro: bit Pinout**

#### V2



V1.5



#### Official website

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

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

#### Note:

a. Put it on with silicone case to prevent the short circuit due to electronic components on micro:bit V2

b. Don't interface it with high current components(such as servo MG995, DC motor) because of weak driving ability (less than 300mA) of IO port of micro:bit V2, otherwise, it will be burned out. We recommend you to work with micro:bit expansion board before using it.

c. We supply power via USB port or 3V port of micro:bit V2. However, the micro:bit shield is needed if you use 5V sensor because its voltage is 3V.



d. Remember to disable(you can use this block to disable the pin pins of micro:bit like P3, P4, P6, P7 and P10 in the code, otherwise, the data will be wrong.

e. The battery above 3.3V is not allowed to be used, otherwise, micro:bit V2 will get damaged.

f. Don't put it on the metal object to avoid short circuit.

)the common

Online Makecode editor: https://microbit.org/code

3.2. Install the Driver of Micro:bit

The installation of driver wouldn't be needed, if you already installed it.

But, you need to install the driver of micro:bit if it's your first time to use micro:bit.

Download link: https://fs.keyestudio.com/KS4040

You could download driver	file (	mbed_us	b_2020_x64_1212	exe	in	the
2. Microbit Driver	folder.					
Upload V Share	Create ~	🖸 Open 🗸				
Name ↑						
🔲 💷 Install driver of mid	crobit.docx					
mbed_usb_2020_x	64_1212.exe					

### CHAPTER

FOUR

### 4. PROGRAMMING

We will take Windows system as an example.

## 4.1 4.1 Quick Start

This chapter introduces how to program and download code to micro:bit V2. There are detailed tutorials in the official website, as shown below:

https://microbit.org/guide/quick/

Step 1: Connect Micro:bit V2

Interface micro:bit with your computer using USB cable.Guide to mobile & tablet appshttps://microbit.org/get-started/user-guide/mobile).

Macs, PCs, Chromebooks and Linux systemincluding Raspberry Pisupport microbit V2.







After connecting it to computer, red LED of micro:bit V2 will be on. There will be a MICROBIT drive in your computer, as shown below:

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File Computer V	liew			$\sim$	?
← → ~ ↑	nis PC →	√ Ū	Search This PC	Ą	
> 📌 Quick access	> Folders (7)				^
> 📃 This PC	Devices and drives (3)	~	CD D 1 (D))(1   D   C   )		
> 🚔 MICROBIT (E:)	en_windows_10_enterprise_ltsc_20 (C:)		Additions 0 bytes free of 56.9 MB	C C	
> 💣 Network	MICROBIT (E:)				
	63.9 MB free of 63.9 MB				~
11 items				8== .	

#### Step 2: Programming

Enter https://makecode.microbit.org/ (we recommend you to use Google Chrome), then click



and you will view a dialog box.

Input"heartbeat"to name your project and click"Create"

You could download Makecode app if your system is Windows 10:

https://www.microsoft.com/zh-cn/p/makecode-for-micro-bit/9pjc7sv48lcx?ocid=badgep&rtc=1&activetab=pivot:overviewtab=pi



Through MakeCode editor, you just need to drag blocks from block area into code editing area to program. Then run this code, as shown below:

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ia a	• Input			show icon	<u>.</u>		
	C Led			show icon			
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	C Loops						
	Variables						
	Advanced						
× • ∩ · ×			-				
📥 Download	heartbeat	B 0				5 6	• •

#### Step 3: Download Code

The code can be directly downloaded to micro:bit V2 if you tap "Download" icon on makecode App.

However, follow the steps below if you program via online makecode editor.

Enter online Makecode editor, tap"Download"to get a"hex"file. Then copy it into MICROBIT drive.

Or you could find out "hex" file firstly and right-click to select "Send to" MICROBITE".

Then hex file will be copied on MICROBIT drive.

🖊   🕑 📙 🗢   Downloads					_		×	
File Home Share $\leftarrow \rightarrow \lor \uparrow \downarrow \lor$ This F	View PC > Downloads		ڻ <i>ب</i>	Sear	rch Downloads		¥ × م	-
<ul> <li>✓ Quick access</li> <li>Desktop</li> <li>✓ Downloads</li> <li>✓ Downloads</li> </ul>	microbit-heartbeat .hex         Open with         Scan with Windows Defender							
📰 Pictures 🖈	Give access to Restore previous versions	>						
MICROBIT (E:)	Send to Cut Copy Create shortcut Delete Rename	>	<ul> <li>Blu</li> <li>Co</li> <li>De</li> <li>Do</li> <li>Fax</li> <li>Fax</li> </ul>	etoo mpre sktop cum reci iil rec	th device essed (zipped) folde o (create shortcut) ents pient tipient	r		
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📌 Quick access 📃 Desktop 🛛 🖈	microbit-heartbeat .hex				
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MICROBIT (E:)	⊘ More details				
item 1 item selected 6	IO KR				8== 1

The yellow indicator will flash when transferring "hex" into micro:bit V2. And it is solid on after the file is copied. Step 4: Run Program

Download code to micro:bit V2 and plug in power with USB cable.

 $5 \ge 5$  LED will show heartbeat pattern.





Power via micro USB & via external power3V You can edit the code in other ways: https://microbit.org/code/ https://microbit.org/projects/

# 4.2 4.2. Makecode

Navigate https://makecode.microbit.org/ on Google Chrome, and enter online makecode editor. Perhaps, you can open makecode app for Windows 10.



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	Search Q	on start	forever		
	Basic			_	
.m.	<ul> <li>Input</li> </ul>				
	G Music				
	C Led				
0 1 2 3V OND	Radio				
🔳 C 🔅 🐠 🕄 🧹	C Loops				
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	Variables				
	Math				
	Advanced				
	<ul> <li>Advanced</li> </ul>				
📥 Download 🛛 🚥	heartbeat				ი ი 😑 მ

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

After powering on or resetting, "on start" means that the code in the block only executes once, while "forever" implies that the code runs cyclically.

## 4.3 4.3. Quick Download

You can click"download"to transfer code to micro:bit V2 if you use makecode App for Windows 10.

Whereas, the online Makecode editor requires intricate steps.

Operating Google Chrome on Android, ChromeOS, Linux, macOS or Windows 10 system, you can achieve the quick download.

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

You can refer to the following steps to connect and pair device.

#### **Device Pairing :**

Interface micro:bit V2 with computer using USB cable.



⊙micro:bit	倄 Home	< 🔹 Blocks	JavaScrip	t 🗸	8	٥		Microsoft
	Home	Search Q Search Search Search Search Q Search Q Search Q Search Q Search Q Search Sear	on start	fore she	ver w icon			Microsoft
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	Pair device fo	r one-click download	on start	forev	و در ا	0		Microsoft
± Downlo	Connect the computer with Use the microt the micro:bit	e micro:bit to your a USB cable JSB port on the top of heartbeat	Pair your mi Click 'Pair devic BBC micro:bit C DAPLink CMSIS	e' below a MSIS-DAF DAP from	nd sele or h the lis	ct t	5 0	
Then select the devi	ice you want to c	connect and tap	onnect in the	e window.				

If there is no device in the window, please refer to the following link https://makecode.microbit.org/device/usb/webusb/ troubleshoot



After connecting successfully, press buttons and download code to micro:bit V2.

🖸 micro:bit 🖀 Home ≼	E Blocks	LE J	avaScript	~	(	9	٠	-	Vicros	soft
	Search Q	on start		foreve	r		1.		4	
	Basic		e	show	icon	-				
	<ul> <li>Input</li> </ul>	_	-			-				
	O Music			show	icon	10	•			
	C Led									
0 1 2 3V OND	Radio									
■ C A + S	C Loops									
× • • • • • • • • • • • • • • • • • • •	C Logic									
- U. T. O.	Variables									
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* <i>F</i> <b>R</b> ~ * () ^	Download	d completed	1						1	
+ Download	heartbeat	8	O,				ς Γ	٩	•	•

# 4.4 4.4. How to Import Extension Library

Next, we need to import Desk Bit extension library for further lessons. Add a Desk Bit extension library



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	Search Q	on star	۰t		f	oreve			幸	Project Settings
	Basic								8	Extensions
.m .m.	<ul> <li>Input</li> </ul>	_						2	• <del>;</del>	Pair device
	O Music								₽	Print
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Download	Car	E	9	0					۳)	<b>۰ و</b>

Copy https://github.com/keyestudio-team/DeskBit in the searching box to search desk bit extension library.

🗲 Go back		Extensions	?
	https://gith	ub.com/keyestudio-team/DeskBit	Q 2
		Desk_Bit	
	3		
		User-provided extension not	
		endorsed by Microsoft. Learn more	
After the installation	on, extension library 📢	B DeskBit will appear in the	page, and download Neopixel extension
library 🎌 Neo	pixel		

👓 micro:bit 🖪 Home 🔹	Blocks	JavaScr	ript 🗸	•	٠		Microsoft
	Search Q	on start		forever			
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·n n.	<ul> <li>Input</li> </ul>			+ +			
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Note: the extension library added is only valid to one project, therefore, it won't appear in other projects. You need to import Desk Bit extension library again when creating new projects.

Update or Delete Desk Bit Extension Library.

Refer to the following instruction please, if you intend to update or delete Desk Bit extension library.

Click "Js JavaScript" button to switch into text code.

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	Search Q	on start		foreve	er.		÷
	Basic					· •	
	Music	* *	* *	+ +	+ +	ж. ж.	
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0 1 1 2 3V OND	I Radio						
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	Math						
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	Neopixel						
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Download •••	Car		<u> </u>		ິ ເ		• •

Click "Explorer" to get extension library.

🖸 micro:bit 🛛 💣 मल	ome <	Blocks	JavaScript	<ul><li>✓</li><li>Ø</li></ul>	۰ ا	Microsoft
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Explorer   main.blocks   main.ts   pxt.json   README.md   Core   radio   · <th><ul> <li>Search Q</li> <li>Basic</li> <li>Input</li> <li>Music</li> <li>Led</li> <li>Radio</li> <li>Loops</li> <li>Loops</li> <li>Logic</li> <li>Variables</li> <li>Math</li> <li>DeskBit</li> <li>Neopixel</li> <li>Advanced</li> </ul></th> <th><pre>1 basic.foreve 2 3 }) 4</pre></th> <th>r(function ()</th> <th></th>	<ul> <li>Search Q</li> <li>Basic</li> <li>Input</li> <li>Music</li> <li>Led</li> <li>Radio</li> <li>Loops</li> <li>Loops</li> <li>Logic</li> <li>Variables</li> <li>Math</li> <li>DeskBit</li> <li>Neopixel</li> <li>Advanced</li> </ul>	<pre>1 basic.foreve 2 3 }) 4</pre>	r(function ()	
bulit 🗸	- Car		) () <b>"</b>	<b>۲ و و</b>

## 4.5 4.5. Resources and Code

Download Linkhttps://fs.keyestudio.com/KS4040

After downloading the tool package, you can open a file named KS4040 (KS4041) Keyestudio Microbit Desk Bit car. It can be placed everywhere in your computer. Open the file and you will find following files:



## 4.6 4.6. Import Code

We provide every program with hex file. You can import it directly or program in Makecode blocks area, therefore, the extension library must be added.

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

Open online Makecode editor or Makecode App.


Open files from your computer

## 0

Your GitHub Repo... Clone or create your own GitHub repository Open a shared project URL or GitHub repo

## 4.6. 4.6. Import Code

Open .mkcd or .hex file	Θ
Select a .mkcd or .hex file to open.	
Choose File No file chosen	
You can import files by dragging and dropping them anywhere in th	he editor!
	Go ahead! 🗸
hoose file "…/Makecode Code/Project 1_ Heart Go ahead!	beat/Project 1_ Heart beat.hex", then tap
Open	×
← → · ↑ A Makecode Code → Project 1_ Heart beat	✓ ♂ Search Project 1_ Heart beat
Organize 🔻 New folder	<b>■</b> • <b>1 (</b>
Documents * ^	
This PC	- 0
SWPS网盘	
3D Objects     heartbeat.mp4     Project 1_Heart     beat.hex	2
File name:	
	Open Cancel
Open .mkcd or .hex file	
My Project: Select a .mkcd or .hex file to open.	Import
You can import files by dragging and dropping t	hem anywhere in the editor!
	Go abead!

Open .mkcd or .hex file	8
Select a .mkcd or .hex file to open.	
Choose File Project 1_ Heart beat.hex	
You can import files by dragging and dropping them anywhere in the editor!	
Go ahead!	~

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



The program is imported successfully after a few seconds.

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🗠 Download 🛛	C	Heartbeat		8	ြ					ľ	0	*   •	•	0

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

Here, we need CoolTerm software to read data.

For the whole projects, we will use CoolTerm software.

Let's install it firstly.

# 4.7 4.7. Install CoolTerm

CoolTerm program is used to read the serial communication.

Download CoolTerm program:

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

- 1. After the download, we need to install CoolTerm win , and we take example of the Window system
- 2. Choose "win"

## CoolTerm



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

4. Double-click 🚽 CoolTerm.exe			
CoolTerm Libs	2020/4/21 11:20	File folder	
CoolTerm Resources	2020/4/21 11:20	File folder	
🗲 CoolTerm.exe	2019/5/17 22:56	Application	5,314 KB
🖄 msvcp120.dll	2019/4/3 14:33	Application extension	645 KB
🖄 msvcp140.dll	2019/4/3 14:33	Application extension	625 KB
S msvcr120.dll	2019/4/3 14:33	Application extension	941 KB
ReadMe.txt	2019/5/18 20:35	Text Document	31 KB
🗟 vccorlib140.dll	2019/4/3 14:33	Application extension	387 KB
🗟 vcruntime140.dll	2019/4/3 14:33	Application extension	88 KB
Windows System Requirements.txt	2018/1/7 14:29	Text Document	1 KB
XojoGUIFramework64.dll	2019/4/3 14:33	Application extension	30,801 KB

Note: Firstly, you have to install the driver of micro:bit and connect micro:bit V2 to computer.



The functions of each button on the toolbar are listed below: http://wiki.keyestudio.com/index.php/File:IDE.png



ICON	FUNCTION
New	Onens un a new Terminal
	opens up a new terminar
Open	Opens a saved Connection
H Save	Saves the current Connection to disk
Connact	
connect	Opens the Serial Connection
Disconnect	Closes the Serial Connection
Clear Data	Clears the Paceived Data
Options	Opens the Connection Options Dialog
HEX View Hex	Displays the Terminal Data in Hexadecimal Format
? Help	Displays the Help Window

CHAPTER

**FIVE** 

## 5. INSTALL MICRO:BIT DESK BIT CAR

## 1. Install micro:bit V2 and control board

Note: take out the 5 pcs M3\*6MM flat screws from control board



b. Then fix micro:bit onto control board with 5 pcs M3\*6MM flat screws, as shown below;





2. Mount the right board







## 3. Assemble left board





4. Mount Base Plate







5. Install the insertion part of control board







6. Fix the boards of desk bit car











7. Fix left arm







8. Mount Wheels







9. Mount Right Arm



KS4013 > Tutorial > 3.Makecode Tutorial > Test Code >

Open the shared folder in the resource link:

and find out the folder "Initialize  $180^{\circ}$  servo", Initialize 180° servo Initialize  $180^{\circ}$  servo to  $0^{\circ}$ .



180° servo					
PO					
G (Brown) , V (Red), S (Yellow)					
SERVO 3					



Dial the DIP switch to ON end to power on

Dial the DIP switch to SERVO end to control servo

Download code to micro:bit V2 and plug in power with USB cable. Rotate servo to  $0^\circ$ 





10. Install the fork part

















Component	Servo	Servo of right wheel	Servo of left wheel			
	(180°)	(360°)	(360°)			
	PO	P1	P2			
Pins of	G (Brown)	G (Brown)	G (Brown)			
Mierechit V2	V (Red)	V (Red)	V (Red)			
WICO.DIT V2	S (Yellow)	S (Yellow)	S (Yellow)			
	SERVO 3	SERVO 1	SERVO 2			





Servo of arm servo of left wheel



servo of right wheel

Insert the control board with micro:bit V2 into the car





## CHAPTER

SIX

## 6. PROJECTS

# 6.1 Project 1: Heartbeat



## **Description:**

Prepare a Micro:bit V2, a USB cable and a computer. Next we will conduct a basic experiment that a heartbeat pattern flashes on micro:bit board.

## **Components Needed:**

• Micro:bit V2 \*1

• Micro USB Cable\*1

## Wiring Up:

Interface micro:bit V2 with your computer using micro USB cable.



## **Test Results:**

You can enter this website https://makecode.micro:bit.org/reference to get more information even you're a starter. Edit your code in the link: https://makecode.micro:bit.org/

on start				forever
				show icon
				show icon 🐺 💌

Download code to micro:bit V2 (refer to chapter 4.3), and keep micro USB cable connected. Then image "" and "!!! will be shown on micro:bit ceaselessly.

If download unsuccessfully, disconnect micro:bit V2 and reboot it please.

Then download code to V2 board again.


# 6.2 Project 2: Light Up A Single LED

## **Description:**

In this project, we will turn on one LED of micro:bit V2.

#### **Components Needed:**

- Micro:bit V2 \*1
- Micro USB Cable\*1

## Wiring Up:



Interface micro:bit V2 with your computer using micro USB cable.

## **Component Overview**

Micro:bit V2 consists of 25 light-emitting diodes, 5 pcs in a group. They correspond to x and y axis. Then the 5\*5 matrix is formed. Moreover, every diode locates at the point of x and y axis.

Virtually, we could control an LED by setting coordinate points. For instance, set coordinate point00to turn on the LED at row 1 and column 1; light up LED at the row 1 and column 3, we could set20) and so on.



**Test Results** 



Download code to micro:bit V2 and connect it to computer with USB cable, the LED at coordinate point (1,0) flashes for 1 s and the LED at (3,4blinks for 1s, alternately.

## 6.3 Project 3: 5 x 5 LED Dot Matrix



## **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 have controlled 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.

#### **Components Needed:**

- Micro:bit V2 \*1
- Micro USB Cable\*1

## Wiring Up:

Interface micro:bit V2 with your computer using micro USB cable.



Test Code:

on start			
show number 1	5		
show number 2			
show number 3			
show number 4			
show number 5			
forever	ĺ		
show leds			
show string "H	ello	1	
show icon	•	1	
show icon	•th F	act	
show icon in Nor	• •th E	ast	2
show icon show arrow Nor show arrow Sou	•th E	ast ast	
show icon in Nor show arrow Nor show arrow Sou show arrow Sou	•th E rth E rth V	ast ast lest	
show icon show arrow Nor show arrow Sou show arrow Sou show arrow Nor	•th E nth E nth W	iast iast lest lest	
show icon Nor show arrow Nor show arrow Sou show arrow Sou show arrow Nor clear screen	-th E nth E nth V	ast ast lest lest	
show icon in a show arrow Nor show arrow Sou show arrow Sou show arrow Nor clear screen pause (ms) 500	•th E uth E uth V •th V	ast ast lest	

## **Test Results:**

Download code to micro:bit V2, and and keep USB cable connected. Micro:bit V2 will display 1, 2, 3, 4 and 5 and sep-



# 6.4 Project 4: Programmable Buttons



## **Description:**

The circuit is controlled by button. The circuit is connected when the button is pressed; however, the circuit is disconnected when released.

Micro:bit V2 has three buttons which are the reset button on the back and two programmable buttons(A, B) on the front.

Let's do experiments to know how they works

#### **Components Needed:**

- Micro:bit V2 \*1
- Micro USB Cable\*1

Wiring Up:



Interface micro:bit V2 with your computer using micro USB cable.

Test Code 1:



#### Test Results 1:

Download code to micro:bit V2 and keep USB cable connected.

5×5 LED dot matrix will show "A" if button A is pressed, in case that button B is pressed, "B" will appear. So will micro:bit V2 show "AB" if you press A and B buttons simultaneously.

Test Code 2:



## Test Results 2:

Download code to micro:bit V2 and keep USB cable connected. A row of luminous LEDs are added if button A is pressed; and when B is pressed, a row of luminous LEDs are deducted.

## 6.5 Project 5: Temperature Measurement



## 1. Description:

We will introduce how to detect ambient temperature by micro:bit V2. Its detection range is -40°C~105°C.

#### 2. Components Needed:

- Micro:bit V2 \*1
- Micro USB Cable\*1

#### 3. Wiring Up:



Interface micro:bit V2 with your computer using micro USB cable.

#### 4. Test Code and Results:



Download code to micro:bit V2 and plug in power with USB cable. Then click "Show console Device" button.



Open serial interface and display the temperature value, as shown below



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

Here, we need CoolTerm software to read data.

Open CoolTerm, click Options to select SerialPort. Set COM port and 115200 baud rate (the baud rate of USB serial communication of micro:bit V2 is 115200 through the test). Click "OK" and "Connect".

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

✔ Untitled_0 File Edit Connection View V	Vindow Help
New Open Save Connect	Disconnect Clear Data Options View Hex Help
Connection Options (Untit	led_0)
Serial Port Ierminal Receive Transmit Miscellaneous	Serial Port Options   Port:   COM19   Baudrate:   COM19   Baudrate:   COM19   Data Bits:   8   Parity:   none   Stop Bits:   1   Flow Control:   CTS   DTR   XON   Software Supported Flow Control    Software Supported Flow Control    Block Keystrokes while flow is halted   Initial Line States when Port opens:    Initial Line States when Port opens:    DTR On   DTR Off   RTS On

ontitled_0		<b>Ⅰ</b> – □ ×
File Edit Connection View	Window Help	
New Open Save Connect	Disconnect Clear Data	Options View Hex Help
Connection Options (Untit	led_0)	
Serial Port	Serial Port Options	
Terminal Receive	Port: COM16	<ul> <li>✓</li> </ul>
Transmit Miscellaneous	Baudrate: 9600	~
U	Data Bits: 300 600	
	Parity: 1200 1800	
	Stop Bits: 2400 3600	
	Flow Control: 4800 7200	
	9600 14400	
	19200 28800	
	Software Supp 38400	
	230400	
	Initial Line States Custom     OTR On OTR Of	ff
	RTS On     ORTS Of	ff
	Re-Scan Se	rial Ports
	Ca	ancel OK





## 6.6 Project 6: Geomagnetic Sensor



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 LSM303AGR three-axis magnetometer whose the range of magnetic field is  $\pm 50$  gauss. In this project, we will introduce how compass detect data and determine direction.

Then we can read the value detected by it to determine the location. We need to calibrate the micro:bit V2 when magnetic sensor works.

#### 2. Components Needed:

- Micro:bit V2 \*1
- Micro USB Cable\*1
- 3. Wiring Up:



Interface micro:bit V2 with your computer using micro USB cable

#### 4. Test Code 1 and Results 1:



Download code to micro:bit V2 and keep USB connected.

As the button A is pressed, LED dot matrix indicates that "TILT TO FILL SCREEN" then enter the calibration interface.

The calibration method: rotate the micro:bit V2 to make LED dot matrix display a full square (25 LEDs are on), as shown in the following figure:





The calibration won't be finished until you view the smile pattern **Dependent** appear.

The serial monitor will show  $0^{\circ}$ ,  $90^{\circ}$ ,  $180^{\circ}$  and  $270^{\circ}$  when button A is pressed.

## 5. Test Code and Results 2:

											(°)	ding	compass head	x 🔹 to 😽
then	38	3	< •	(°)	ading	s he	compas	and 🔻	>[	293	≥ ▼	<b>)</b>	s heading (°	compass
								-						v leds
													$\mathbf{H}$	
													L ·	

The above code means that the direction is North and the value of magnetometer is read continuously.





The micro:bit V2 shows the **control of the value** is between 292.5 and 337.5. The value should be 293 and 338 because decimal is not allowed to be filled in the code.

#### **Complete Test Code 2**



else if x 🔹 2 🕶	68		and 🔻		ו	< •	1	13	the	• Θ
show leds		÷	2	1	1	+	÷		1	
else if x > 2 •	113		and	•	×		•	158	the	en Θ
show leds										
else if x • 2 •	158		and	- <	×	•	- (	203	the	en 🗩
show leds	1	*	1	1	1.0		1	1	10	

else if x • 2	- 20:	3	and	•<	x	<	•	248	tł	ien Θ
show leds										
	+	+	+	-	+	+	+	+	+	+
else if x 🔹 🛓	- 248		and	-<	x	<	•	293	tł	ien Θ
show leds										
	+	+	+	÷	+	+	÷	-	+	+
else										Θ
show leds	+	+	+	÷	+	+	+	+	+	+
$\odot$										

#### Result 2:

Download code to micro:bit V2 and keep USB cable connected.

After calibration (see the result1) and tilt micro:bit V2, the direction signs will be shown.

## 6.7 Project 7: Accelerometer



#### **Description:**

The micro:bit V2 has a built-in LSM303AGR three-axis acceleration sensor (accelerometer). Its I2C interface works on external communication, the range can be set to 1g, 2g, 4g and 8g.

We usually detect the posture of accelerometer.

In this project, we will check the value detected by accelerometer.

#### **Components Needed:**

- Micro:bit V2 \*1
- Micro USB Cable\*1

## Wiring Up:



Interface micro:bit V2 with your computer using micro USB cable

**Test Code1and Results 1:** 



Download code to micro:bit V2 and keep USB cable connected.

Micro:bit V2 will display 1 if shaken.

Place micro:bit V2 vertically(logo up), then the number 2 is displayed:



Place micro:bit V2 vertically(logo down), then the number 3 is displayed:





Place micro:bit V2 horizontally (facing up), then the number 4 is displayed:

On the contrary, place micro:bit V2 horizontally (facing down), then the number 5 is displayed:

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



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



When it is free fall(accidentally making it fall), number 8 will appear on dot matrix.Notewe don't recommend you to

make it free fall, it will make board damage)





Download code to micro:bit V2, keep USB cable connected, and click "Show Console Device"



According to MMA8653FC manual, the acceleration coordinates of the accelerometer are shown in the following figure:



Direction of the Detectable Accelerations



The decomposition value of acceleration on the X-axis, Y-axis, and Z-axis, and the synthesis value of acceleration (the synthesis of gravitational acceleration and other external forces) are shown below:



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

Here, we need CoolTerm software to read data.

Open CoolTerm, click Options to select SerialPort.

Set COM port and 115200 baud rate(the baud rate of USB serial communication of Micro:bit is 115200 through the test).

Click "OK" and "Connect".

CoolTerm serial monitor displays the acceleration value on x, y and z axis, as shown below:

✓ Untitled_0 *	_		$\times$
File Edit Connection View Window Help			
Image: New Open SaveImage: SaveI	HEX View Hex	Help	
S:922 X:-912 Y:864 Z:-620 S:1320 X:-280 Y:-676 Z:-296 S:1364 X:-180 Y:-836 Z:-4 S:878			^
X:-812 Y:-268 Z:-300 S:518 X:140 Y:-372 Z:1004 S:1108 X:-656 Y:-268 Z:-992 S:740 X:84 Y:-40			*
			*
COM16 / 115200 -N-1 Connected 00:00:05	S 🕒 DT	R 🕘 DCI R 🕘 RI	)



## 6.8 Project 8: Detect Light Intensity by Micro:bit

## 1. Description:

This project will introduce how micro:bit V2 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.

## 2. Components Needed:

- Micro:bit V2 \*1
- Micro USB Cable\*1

## 3. Wiring Up:



Interface micro:bit V2 with your computer using micro USB cable

## 4. Test Code and Test Results:

on start								
serial redirect	to USB							
	1.0							
forever								
serial write val	ue (Li	ght i	ntens	ity'	= 1	ight	level	
if light l	evel	≤ 🕶	20	th	en			
show leds								
else				(	Ð			
chev Jack								

Download code to micro:bit V2 and keep USB cable connected, and click "Show Console Device"



The intensity value is 0 when covering LED dot matrix. And the value varies with the light intensity. When placing micro:bit V2 under the sunlight, the stronger the light is, and the larger the intensity value is. As shown below:

128	← Go back	Device 🔲 📥 🗠
	Light intensity: 144	144, <del>6</del> 0 0.00
III Show console Simulator		
III Show console Device		
* ~ ~ ~ ~		
	49 Light intensity:0 Light intensity:23	
	Light intensity:4/ Light intensity:51 Light intensity:57	
	Light intensity:70 Light intensity:89	
	Light intensity:109 Light intensity:128	
	Light intensity:144	-

Number 20 is a random light intensity value we set. Micro:bit V2 will show "moon" picture when the light intensity is less than or equivalent to 20; however, the "sun" image will appear if the value is more than 20.

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

Here, we need CoolTerm software to read data.

Open "CoolTerm", click "Options" to select "SerialPort", and set "COM" port and 115200 baud rate(the baud rate of USB serial communication of micro:bit V2 is 115200 through the test).

Then click "OK" and "Connect".

The light intensity value is shown below:

✓ Untitled_0 *	_	
File Edit Connection View Window Help		
New Open Save Connect Disconnect	ions View	EX ?
Light intensity:31		^
Light intensity:30		
Light intensity:24		
Light intensity:23		
Light intensity:23		
Light intensity:24		
Light intensity:25		
Light intensity:29		
Light intensity:78		
Light intensity:147		
Light intensity:171		
Light intensity:198		
Light intensity:220		
Light intensity:221		
Light intensity:221		
		~
COM16 / 115200 8-N-1	RTS	DTR ODCD

# 6.9 Project 9: Speaker



## 1. Description

The micro:bit V2 has built-in speaker for emitting different tones. You can composite a song like"Ode to Joy" and other beautiful songs.

#### 2. Components Needed:

- Micro:bit V2 \*1
- Micro USB Cable\*1

#### 3. Wiring Up:



Interface micro:bit V2 with your computer using micro USB cable

#### 4. Test Code and Results 1:

on start			
show icon			
forever			
play sound	giggle 🔻	until	done
pause (ms)	1000 -		
play sound	happy 🔻	until	done
pause (ms)	1000 -		
play sound	hello 🔻	until	done
pause (ms)	1000 🔻		
play sound	yawn 🔻	until d	one
pause (ms)	1000 -		

Download code to micro:bit V2 and plug in power with USB cable.

Then microbit V2 shows music icon and emits sound.

## 5. Test Code and Results 2:

on start						
serial red	irect	to	USB			
set built-	in spe	eako	er 🧹	0		
forever						
play tone	High	E	for	1 •	beat	e.
play tone	High	E	for	1 •	beat	
play tone	High	F	for	1 •	beat	
play tone	High	G	for	1 •	beat	1
play tone	High	G	for	1 •	beat	1
play tone	High	F	for	1 •	beat	ľ
play tone	High	E	for	1 •	beat	Ĩ
play tone	High	D	for	1 •	beat	
play tone	High	c	for	1 •	beat	
play tone	High	c	for	1 •	beat	
play tone	High	D	for	1 •	beat	
play tone	High	E	for	1 -	beat	
play tone	High	E	for	1 •	beat	
play tone	High	D	for	1/2	🔻 beat	

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

play tone High F for 1/2 • beat
play tone High E for 1 • beat
play tone High C for 1 • beat
play tone High D for 1 • beat
play tone High E for 1/2 - beat
play tone High F for 1/2 • beat
play tone High E for 1 • beat
play tone High D for 1 • beat
play tone High C for 1 • beat
play tone High D for 1 • beat
play tone Middle G for 1 • beat
play tone Middle G for 1 • beat play tone High E for 1 • beat
play tone Middle G for 1 • beat play tone High E for 1 • beat play tone High E for 1 • beat
play tone Middle G for 1 • beat play tone High E for 1 • beat play tone High E for 1 • beat play tone High E for 1 • beat
play tone Middle G for 1 • beat play tone High E for 1 • beat play tone High E for 1 • beat play tone High E for 1 • beat play tone High F for 1 • beat
play tone Middle G for 1 • beat play tone High E for 1 • beat play tone High E for 1 • beat play tone High E for 1 • beat play tone High F for 1 • beat play tone High G for 1 • beat
play tone Middle G for 1 • beat play tone High E for 1 • beat play tone High E for 1 • beat play tone High E for 1 • beat play tone High F for 1 • beat play tone High G for 1 • beat play tone High G for 1 • beat
play tone Middle G for 1 • beat play tone High E for 1 • beat play tone High E for 1 • beat play tone High E for 1 • beat play tone High F for 1 • beat play tone High G for 1 • beat play tone High G for 1 • beat play tone High F for 1 • beat
play tone Middle G for 1 • beat play tone High E for 1 • beat play tone High E for 1 • beat play tone High E for 1 • beat play tone High F for 1 • beat play tone High G for 1 • beat play tone High G for 1 • beat play tone High F for 1 • beat play tone High F for 1 • beat play tone High F for 1 • beat
play tone High C for 1 • beat
----------------------------------
play tone High C for 1 • beat
play tone High D for 1 • beat
play tone High E for 1 • beat
play tone High D for 1 • beat
play tone High C for 1/2 • beat
play tone High C for 1 • beat
play tone High D for 1 • beat
play tone High D for 1 • beat
play tone High E for 1 - beat
play tone High C for 1 • beat
play tone High D for 1 • beat
play tone High E for 1/2 • beat
play tone High F for 1/2 • beat
play tone (High E) for (1 • beat
play tone High C for 1 • beat
play tone High D for 1 • beat
play tone High E for 1/2 • beat
play tone High F for 1/2 ▼ beat
play tone High E for 1 • beat

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



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

The music note is shown below:

Ode To Joy  $1 = B \frac{2}{4} = 120$ Beethoven 5 4 3 2 | 1 1 2 3 | 2 <u>1</u> 1 0 | 2 2 3 1 | 5 4 3 2 | i i 2 3 | 2 · <u>i</u> i 0 | <sup>[3]</sup>  $\dot{2} \ \underline{\dot{34}} \dot{3} \dot{1} \dot{1} \dot{2} \ \underline{\dot{34}} \dot{3} \dot{2} \dot{1} \dot{1} \dot{2} \ 5 \overset{\sqrt{3}}{3} \dot{1} \dot{3} \dot{3} \dot{3} \dot{4} \dot{5} \dot{1}$  $\dot{\mathbf{5}} \ \dot{\mathbf{4}} \ \dot{\mathbf{3}} \ \dot{\mathbf{2}} \ \big| \ \dot{\mathbf{i}} \ \ \dot{\mathbf{i}} \ \dot{\mathbf{2}} \ \dot{\mathbf{3}} \ \big| \ \dot{\mathbf{2}} \cdot \ \underline{\mathbf{i}} \ \mathbf{i} \ \mathbf{0} \ \vdots \\ \left| \ \dot{\mathbf{2}} \cdot \ \underline{\mathbf{i}} \ \mathbf{i} \ \mathbf{0} \ \vdots \\ \left| \ \dot{\mathbf{2}} \cdot \ \underline{\mathbf{i}} \ \mathbf{i} \ \mathbf{0} \right|$  $\dot{4} \cdot \dot{3} \dot{3} \dot{3} \dot{1} |_{\dot{1}} \dot{7} \cdot \dot{6} \dot{6} \dot{4} \dot{2} |_{\dot{1}} \dot{7} \dot{2} \dot{7} \dot{6} \dot{5} \dot{6} \dot{7} |_{\dot{1}} \dot{3} \dot{2} \dot{7} \dot{1} \dot{1} \dot{1} \dot{1} \dot{1} \dot{1} \dot{1}$ ioool

More resourcehttps://en.wikipedia.org/wiki/Numbered\_musical\_notation

Download code to micro:bit V2 and plug in power with USB cable, as a result, micro:bit V2 emits song"Ode to Joy".

## 6.10 Project 10: Touch Sensitive Logo



#### Description

Micro:bit V2 has a touch sensitive logo as a input. It is fundamentally a capacitive touch sensor which can sense the tiny changes in the current.

#### **Components Needed:**

- Micro:bit V2 \*1
- Micro USB Cable\*1

Wiring Up:



Interface micro:bit V2 with your computer using micro USB cable

#### Test Code and Result:



Download code to micro:bit V2 and keep USB cable connected.



Micro:bit V2 will show "" if you touch logo

, on the contrary, the number will be shown if the log



is not touched.

## 6.11 Project 11: Microphone



#### 1. Description

The micro:bit V2 has a built-in microphone which can detect the sound intensity. Additionally, there is a microphone LED indicator at the back.

Its indicator will turn on if you clap your hands; therefore, we can make an analog noise detection watch.

#### 2. Components Needed:

- Micro:bit V2 \*1
- Micro USB Cable\*1

#### 3. Wiring Up:



Interface micro:bit V2 with your computer using micro USB cable.

#### 4. Test Code and Results 1



Download code to micro:bit V2, and keep micro USB connected. Pattern "" will be displayed when you clap your hands; however, pattern """ will appear when in the quit environment.

#### 5. Test Code and Results 2



Download code to micro:bit V2 and keep micro USB cable connected. Click "Show console device".



The output sound value increases when the sound amplifies, as shown below;

<b>1128</b>	← Go back	Device 🔲 🔺 🖄
		195.00
	195 A. M. AN L	
III Show console Simulator		
III Show console Device		
	95 127	
	150 153 172	
	187 183	
	2 187 191 3 195	

Micro:bit V2 will show the maximum value of sound intensity (Note: set the maximum value via reset button), when button A is pressed; whereas, the sound level icon will be shown when clapping.



### 6.12 Project 12: Bluetooth Wireless Communication

#### 1. Description:

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

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

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

#### 2. Preparation

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

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

#### 3. Procedures:

For Apple devices, enter this link https://www.microbit.org/get-started/user-guide/ble-ios/ with your computer first,

#### Download pairing HEX file

and then click to download the Micro: Bit firmware to a folder or desk, and upload the downloaded firmware to the Micro: Bit main board V2.



# If you need help

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

Download pairing HEX file

**iOS app support** 

### Monitor and control

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

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🔮 Documents 🛛 🖈	🖻 Share				
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Search "micro bit" in your App Store to download the APP micro:bit.

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ktece	Code Láter C	in a second	9

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

Turn on the Bluetooth of your Apple device.



Open the APP micro:bit to select item to start pairing.

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

 $\odot$ 

Menu	💿 micro:bit		Help
	Choose micro:bit	O	
	Create Code	Ľ	
	Flash	ធ្	
	Monitor and Control	也	
	ldeas	വ	
Secondly, click	air a new micro:bit	C	<mark>4</mark> ,

<b>&lt;</b> Home	Choose micro:bit	Help
	Currently selected micro:bit	
	None selected	
	If you want to use a new micro:bit, tap the	
	If you want to remove a pairing from a micro:bit, go to the Bluetooth section in your device Settings.	
	Having problems? Try the Help page.	
	Pair a new micro:bit 😋	

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

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







Enter po	attern
	Ooh, pretty!
Step 2	
COPY the pattern from you	r 🖸
device and TAP Next	
Cancel X	Next >
Still click	



Then, a dialog box props up as shown below. Then tap



A few seconds later, the match is done and the LED dot matrix displays the "" pattern. Tap





Click Create Code

### page and write code.

Menu		🖸 micro:bit		Help
		Hello		
	Choose micr	o:bit	O	
	Create Code		Ľ	
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	ldeas		വ	
G New Pr	oject	Create a Project Give your project a name.	Create	
then select Creat	and the box			appears, and



œmicro:bit	🖀 Home	4	Blocks	JavaS	cript	~	)	?	)	٥		Mic	rosoft
		1	Search Q	on start		-	(1)	(1)	(4)		(8)	(8)	90 - 0
$\sim$			Basic	led enable	true -								
·D	p.		<ul> <li>Input</li> </ul>			1							
4		2	O Music	forever									
	0.0		C Led	show leds									
0      1      2	3V      OND		I Radio										
■ C ±	*) E		C Loops										
			C Logic										
		<	Variables										
			📰 Math	pause (ms)	500 👻	а.							
		Ч	✔ Advanced	show leds									
				pause (ms)	500 🔻	ч.							
🛓 Downloa	ad	0	Pick a name	8	o	ر				r	c ا	•	0
Name the code as "1	"and click		to save it.										

🗂 micro:bit 🖀 Home	Secks	JavaScript	~	8	٠		Mi	croso	ft
	Search Q	on start		а.	8 8	(4)			
	III Basic	led enable true	•						
·0 ••••• 0·	<ul> <li>Input</li> </ul>								
	Music	forever							
$\circ \circ \circ \circ \circ$	C Led	show leds	μ.						
0 1 2 000 000	I Radio		а.						
	C Loops		1.						
(n)	🗙 Logic								
OF TO S	Variables								
9	Hath								
	✓ Advanced	show leds	f.						
			÷.						
			ι.						
		∎++++	1.						
		pause (ms) 500 +							
🛓 Download 🛛	1				<b>ا</b> م	٩	•	ø	
lick the third item						[	ſ	to en	ter

The default code program for uploading is the one saved just now and named "1".





<b>&lt;</b> Home	Flash	Help
i C	OK. Let's do this	nicro:bit [zivip]
1 sam san Wednes 9:32:08 Flash	aple: monitor-services aple: camera-control aday, May 6, 2020 AM	
Code	Editor	C



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



Projects below all conduct with the built-in sensors and the LED dot matrix while the following ones will carry out with the help of external sensors.

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

## 6.13 Project 13: SK6812-P4 RGB



#### Description

The control board comes with five SK6812-P4 RGB lights controlled by micro:bit V2. In this lesson, we will make five SK6812-P4 RGB lights display three effects.

Note: the servo of car's arm is interfaced with P0. You can control it via DIP switch.

Control board:

http://ks4042-keyestudio-micro-bit-shield-for-mini-servo-car-v20.readthedocs.io/

#### Preparations

- 1. A desk bit car
- 2. Place batteries into battery holder.
- 3. Dial the DIP switch of mini servo car to ON end and plug in power
- 4. Dial the DIP switch of mini servo car to RGB end to control RGB
- 5. Interface micro:bit V2 with computer using USB cable.
- 6. Enter online Makecode editor

You don't need to add Desk Bit extension library(refer to chapter 4.6) if you choose to import Hex file.

However, you need to add desk bit extension library first if you intend to edit code in the Makecode window(refer to chapter 4.4).

#### **Test Code and Results 1:**



Five pcs WS2812 RGB lights of mini servo car turn on, changing color one by one.

**Test Code and Results 2:** 

on s	tart													
set	t strip 🔹 to	NeoP	ixel	at pin	PØ	• W	ith	5 1	eds as	RGB	(GRB	form	at) 🔻	
						-			-					
fore	ver													
fo	r index from	n 0 to	4											
do	strip •	clea	r											
	strip •	set	pixe	l color	at	inde	ex 🔹	to (	red 🔻					
	strip •	show	1		1		120							
	pause (ms) 2	200 •												
fo	r index from	m 0 to	4											
do	strip •	clea	r											
	strip •	set	pixe	l color	at	inde	ex 🔹	to (	orange	•				
	strip •	show	1		1									
	pause (ms) 2	200 💌												
fo	r index from	m 0 to	4											
do	strip •	clea	r											
	strip •	set	pixe	l color	at	inde	ex 🔹	to (	yellow	•				
	strip •	show	1											
	pause (ms) 2	200 -												

for <b>index</b> from 0 to 4										
do strip 🔻 clear										
strip 🔻 set pixel	color	at	index	•	to (	green 🖣				
strip - show										
pause (ms) 200 💌										
for <b>index</b> from 0 to 4										
do strip ▼ clear	1									
strip 🔹 set pixel	color	at	index	•	to (	blue 🔻				
strip - show										
pause (ms) 200 💌										
for <b>index</b> from 0 to 4										
do strip ▼ clear										
strip 🔻 set pixel	color	at	index	•	to (	indigo	•			
strip - show										
pause (ms) 200 💌										



Five WS2812RGB lights turn up, like flow light.

**Test Code and Results 3:** 



5 pcs WS2812RGB of control board display random color, like flow light.

## 6.14 Project 14: Servo

#### Description

The servo is applied widely, especially in robots. In this chapter, we will learn its working principle and how it works.

#### Preparations

- 1. A desk bit car
- 2. Place batteries into battery holder.
- 3. Dial the DIP switch of mini servo car to ON end and plug in power
- 4. Dial the DIP switch of mini servo car to SERVO end to control servo.
- 5. Interface micro:bit V2 with computer using USB cable.
6. Enter online Makecode editor

You don't need to add Desk Bit extension library(refer to chapter 4.6) if you choose to import Hex file.

However, you need to add desk bit extension library first if you intend to edit code in the Makecode window (refer to chapter 4.4).

#### **Components Knowledge**



Servo motor is a position control rotary actuator. It mainly consists of housing, circuit board, core-less motor, gear and position sensor. Its working principle is that the servo receives the signal sent by MCU or receiver and produces a reference signal with a period of 20ms and width of 1.5ms, then compares the acquired DC bias voltage to the voltage of the potentiometer and obtain the voltage difference output.

In general, servo has three line in brown, red and orange. Brown wire is grounded, red one is positive pole line and orange one is signal line.

#### How to control 180° and 360° servo:

360° servo only controls the direction and speed instead of angles like 180° servo.



#### 360° Servo

For instance, the servo is controlled by pin P1 of micro:bit V2. The speed of servo can be set by filling number behind

"to" in . as shown below:

 $0^{\circ}$  indicates full speed along one direction,  $180^{\circ}$  implies full speed along the other direction.  $90^{\circ}$  represents static.



The right wheel rotates clockwise in full speed.

Download the following code to micro:bit V2.



Right wheel stay static

Download the following code to micro:bit v2

on start				
set servo P1	•	angle	to	180 °
		1	1.0	

#### Right wheel rotates anticlockwise in full speed

 $0^{\circ}$  means the full speed along one direction,  $0^{\circ} \sim 90^{\circ}$  implies that the speed gradually reduces; however,  $90^{\circ}$  is staying static,  $90^{\circ} \sim 180^{\circ}$  stands for the increasing speed along the opposite direction, and 180 means full speed along the opposite direction.

180° Servo

#### 180° Servo is controlled by pin P0 of micro:bit V2.

The speed of servo can be set by filling number in the box behind"to", as shown below:

Download the following code to micro:bit V2.



The servo of arm rotates to  $0^{\circ}$ .

Download the following code to micro:bit.



When rotating to  $90^{\circ}$ , the arm of desk bit car is on the middle level.

The servo of arm rotates to  $90^{\circ}$ 

Download the following code to micro:bit.



The servo of arm rotates to  $180^{\circ}$ 

#### Test Code and Results 1:



Servo of arm rotates from  $0^{\circ}$  to  $45^{\circ}$ ,  $90^{\circ}$  to  $135^{\circ}$  and  $180^{\circ}$ .

Test Code and Results 2:

on s	tart	forever e te te te
		set servo P1 ▼ angle to 0 °
191	<u>.</u>	pause (ms) 5000 🗸
		set servo P1 ▼ angle to 90 °
		pause (ms) 2000 💌
		set servo P1 ▼ angle to 180 °
		pause (ms) 5000 💌
		set servo P1 ▼ angle to 90 °
		pause (ms) 2000 🔹

The right wheel rotates for 5s, stops for 2s, rotates anticlockwise for 5s and stops 2s.

# 6.15 Project 15: Desk Bit Arm

#### Description

In previous lesson, we can make V2 board display different patterns. In this lesson, we will control the arm of desk bit car to perform a series of actions.

#### Preparations

- A desk bit car
- Place batteries into battery holder
- Dial the DIP switch to ON end to power on
- Dial the DIP switch to SERVO end
- Interface micro:bit V2 with computer using USB cable
- Enter online Makecode editor.

You don't need to add Desk Bit extension library(refer to chapter 4.6) if you choose to import Hex file.

However, you need to add desk bit extension library first if you intend to edit code in the Makecode window(refer to chapter 4.4).

#### **Test Code and Result:**

on start	forever
set servo P0 • angle to 100	show number count •
set count • to 0	
	+ + + + + +
<u> </u>	n logo released 🔻
on logo touched 💌	Angle of Car's arm: 100 °
Angle of Car's arm: 10 °	change count • by 1

Plug in power, touch logo of V2 board, then desk bit car will rotate its arm; however, the arm of desk bit car will return the original place if not touching logo; V2 board will show how many times you touch.

# 6.16 Project 16: Desk Bit Walks

#### Description

This chapter introduces how to control 360° servo. We will make desk bit car go forward and backward, turn left and right and stop.

#### Preparations

- A desk bit car
- Place batteries into battery holder
- Dial the DIP switch to ON end to power on
- Dial the DIP switch to SERVO end.
- Interface micro:bit V2 with computer using USB cable
- Enter online Makecode editor.

You don't need to add Desk Bit extension library(refer to chapter 4.6) if you choose to import Hex file.

However, you need to add desk bit extension library first if you intend to edit code in the Makecode window(refer to chapter 4.4).

#### **Test Code and Results:**

on start		
show icon		
forever		
Car runForward • sp	eed:	50
pause (ms) 1000 🔻		
Car runBack 🔹 speed	: 50	
pause (ms) 1000 🔻	+	+
Car leftRotation -	speed:	50
pause (ms) 1000 🔻		
Car rightRotation •	speed	50
pause (ms) 1000 🔻		+
Car Stop		
pause (ms) 1000 🔻		

Download code to micro:bit V2, dial DIP switch to ON end to power on. The car runs forward, backward, turns and right and stops.

# 6.17 Project 17: Sing and Dance

#### Description

In this lesson, we will make desk bit car sing and dance.

#### Preparations

- A desk bit car
- Place batteries into battery holder
- Dial the DIP switch to ON end to power on
- Dial the DIP switch to RGB end
- Interface micro:bit V2 with computer using USB cable
- Enter online Makecode editor.

You don't need to add Desk Bit extension library(refer to chapter 4.6) if you choose to import Hex file.

However, you need to add desk bit extension library first if you intend to edit code in the Makecode window(refer to chapter 4.4).

#### **Test Code and Results:**

on start													
show icon	-												
set strip 🔹 to	NeoPi	ixel a	at pin	PØ	• wi	th	5 <b>)</b> 1e	ds as	RGB	(GRB	forma	it) 🔻	
on button A * nr	essed												
Car runForward	<ul> <li>spee</li> </ul>	:d:	100										
strip • s	how col	or (	red 🔻	Ĺ									
play tone Middl	e E fo	r 1	▼ beat										
strip • s	how col	or (t	blue 🔹										
Car runBack •	speed:	100	✓ beat	9									
play tone Middl	e D fo	r (1	• beat										
strip • s	how col	or	green 1										
play tone Low A	for	1 🕶 I	beat	+									
strip • s	how col	or ()	yellow	•									
play tone Middle	e E fo	r (1/	/2 <b>•</b> be	at									
strip • s	how col	or	orange	•									
play tone Middl	e D fo	r 1/	/2 <b>v</b> be	at	*								









Music Note:



More resourcehttps://en.wikipedia.org/wiki/Numbered\_musical\_notation

Download code to micro:bit V2 and dial DIP switch to ON end. Pressing A button, you will hear a song and desk bit car will go forward and backward, rotate to left and right, with RGB displaying different colors.

# 6.18 Project 18: Dodge Bullet

#### 1. Description:

In this project, we will introduce an interesting game-Dodge Bullet

You can play this game with button A and B.

#### 2. Components Needed:

- Micro:bit V2 \*1
- Micro USB Cable\*1
- 3. Wiring Up:



Interface micro:bit V2 with your computer using micro USB cable.

#### 4. Game 1

This game should be played on micro:bit V2. There are random LED G1 and G2 lit, and an LED G(at the bottom of micro:bit V2).

When G1 and G2 are falling down, you can move them to left and right with button A and B so as to prevent G from attacking.

If one of them attacks G, game will be over. However, game starts when pressing A and B at same time.

#### on start create sprite at x: to 2 set G on button В pressed on button А pressed G move by 1 G move by -1 forever pick random create sprite at x: 0 G1 🔻 to set 4 to G1 🔹 90 turn right 🕶 by (°) 0 pause (ms) pick random to 7 100 times repeat 4 do G1 💌 move by 1 300 🕶 pause (ms) delete G1 •

#### 5. Test Code and Results 1:



Download code to micro:bit V2. You can view some random LEDs falling. Then you need to press button A and B to stop them from attacking G.

#### 6. Game 2

For game 2, we make a change in the game 1. You can be given one point if G avoids the random falling down LED, however, if it meets random LED, game will be over and the scores will appear. Press button A and B at same time to start new game.

#### 7. Test Code and Results 2:

on start	+ +		+						
set G 🔹 to crea	ate sprite a	tx:	2 3	y: 4					
set score 🕶 to	0								
set speed ▼ to	500								
			+	+	+	+			
on button A 🕶 press	sed	on b	utton	B 🔻	pres	sed			
G v move by	-1		G	•	ove by	1			

forever										
set 61 • to 🛛	reate spri	te at x:	pick	random	0 t	• 4	) у:	0		
G1 🔹 turn	right 🕶	by (°)	90	1		1				
pause (ms) pick	random (	) to	7 ×	- 100						
repeat 4 time	s									
do (61 🔹	nove by 1									
pause (ms)	speed •									
delete 61 🔻										
change score 🔻	by 1									
change speed 🔻	by -10									



Download code to micro:bit V2. You can press button A and B to control G when the random lit LED is falling down.

You can be given one point if G dodges the random falling and lit LED. However, if it meets random LED, game will be over and the scores will appear. Press button A and B at same time to start new game.

# 6.19 Project 19: Read Bluetooth Data

#### Description

The micro:bit V2 integrates the low consumption BLE device and pairs with phones or iPad. Thus, we can build communication between V2 board and device.

Micro:bit V2 has on-board Bluetooth for iOS and Android system.

In this project, we will introduce how to use App and its App interface.

#### Preparation

- 1. A desk bit car
- 2. Interface micro:bit V2 with computer using USB cable.

You don't need to add Bluetooth extension library(refer to chapter 4.6) if you choose to import Hex file.

However, you need to add Bluetooth extension library first if you intend to edit code in the Makecode window. As shown below:

🗲 Go back	Extensions	
Search or	enter project URL	٩
*		
bluetooth Bluetooth services	devices BETA - Camera, remote control and	radio The radio services
	other Bluetooth services. App	

Bluetooth can't work with radio at same time because of hardware, therefore, their libraries are not compatible either.

The prompt will inform of you to delete radio library, as shown below



Then "Bluetooth" extension library will be installed, as shown below











d. Enable Bluetooth of your device, click "Connect" icon on App and choose "BCC micro:bit" among the searching results, after a while, Bluetooth is connected.

#### **Android System**

Navigate the website https://play.google.com/store/apps/details?id=com.keyestudio.deskbit to download App. Perhaps you can download Desk Bit App in the Google play store.

Note: Allow app to access your location.



# Desk Bit

keyestudio Tools 3+

Add to Wishlist

Install



Open"Desk Bit", the interface is shown below





Enable Bluetooth of cellphone, click **connect** and select "BCC micro:bit" among the searching results. Then click **connect**, Bluetooth is connected, as shown below

gDevice-beacon BE:AC:10:00:00:01				
	connect			
gDevice-beacon BE:AC:10:00:00:02		BBC microfit binori		1
	connect	EC:AF:27:4E:EE:83	is connected	

The icon "Show console device" won't be shown on Makecode editor due to the Bluetooth of micro:bit V2, therefore, the control characters sent by App can't be read either.

Here, the CoolTerm software is needed, which is used to read the characters sent by App.



Open "CoolTerm", click Options to select "SerialPort", and set "COM" port and 115200 baud rate(the baud rate of USB serial communication of micro;bit V2 is 115200 through the test).

Then click "OK" and "Connect".

The light intensity value is shown below:

💉 l	Intitled	_0 *					_		$\times$	
File	Edit	Connectio	n View	Window Help						
New	Cope	n Save	Connect	Disconnect	Clear Data	Options	HEX View H	lex	? Help	
Q										^
F										
E										
L										
B									r	~
	M16 /	115200	I_1		TY			R 🖱	DCD	-
Co	onnecte	d 00:03:04	v-1		● RX	CTS	DSI	R 🍯	RI	

The function of each icon on App is shown below:

4:23 PM Fri Jan 15		🗢 @ 🕫 70% 🔲
Connect	Bluetooth Serial	disconnect



if you intend to edit code in

# 6.20 Project 20: Control LED Dot Matrix by Bluetooth

#### Description

In this lesson, we will make micro:bit V2 show pictures and numbers via App.

#### Preparation

- A desk bit car
- Interface micro:bit V2 with computer using USB cable

You don't need to add Bluetooth extension library(refer to chapter 4.6) if you choose to import Hex file.

Extensions

However, you need to add Bluetooth extension library first in the Makecode window. As shown below:



**Test Code and Results:** 







click "disconnect" icon on App to disconnect Bluetooth, pattern' matrix.

6.21 Project 21: Multi-purpose Desk Bit Car

#### Description

In previous lesson, we introduced how to use App and test each icons.

In this lesson, we will control the desk bit car via App to make it perform different functions.

#### Preparation

- A desk bit car
- Place batteries into battery holder
- Dial the DIP switch to ON end
- Interface micro:bit V2 with computer using USB cable
- Enter online Makecode editor.

You don't need to add desk bit extension library(refer to chapter 4.6) if you choose to import Hex file.

However, you need to add desk bit extension library first if you intend to edit code in the Makecode window(refer to chapter 4.4).

#### **Test Code and Results:**

'appears on LED dot



Note: Remember to dial the DIP switch to RGB end if you want to control RGB by Bluetooth. Dial DIP switch to SERVO end if you want to control the servo of right arm.



The Keyestudio micro:bit desk bit car can be controlled by App.

4:23 PM Fri Jan 15		🗢 @ 🕫 70% 🔲
Connect	Bluetooth Serial	disconnect



#### Drawing

Back is a circular column



Place the pen of this kit into circular column, set code and download it to micro:bit V2, then the mini car can draw on the paper. Furthermore, you can make desk bit car push light stuffs by setting code.

#### CHAPTER

## SEVEN

## 7. RESOURCES

https://fs.keyestudio.com/KS4040

https://makecode.microbit.org

https://tech.microbit.org/hardware

https://microbit.org/new-microbit

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

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

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

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

https://microbit.org/guide/quick/

https://microbit.org/get-started/user-guide/mobile

https://microbit.org/code

https://microbit.org/projects

### CHAPTER

## EIGHT

## 8.FAQ

## 8.1 Q: What type of batteries should this kit be equipped with?

A: 4 AA batteries, each one with the diameter of 14MM and height of 49MM. Please install batteries in a correct way and do not reverse them! For younger learners, please operate under the accompaniment of parents.

## 8.2 Q: Can this kit expands to other modules?

A: Yes.

## 8.3 Q: Servo doesn't work.

A: It may be stuck by itself or by wires when mount the bottom plate. before installing, please adjust the servo to  $0^{\circ}$  first. For how, please refer to the installation guidance.