TinkerGen
STEM made simple

BitGadget Kit

I Introduction

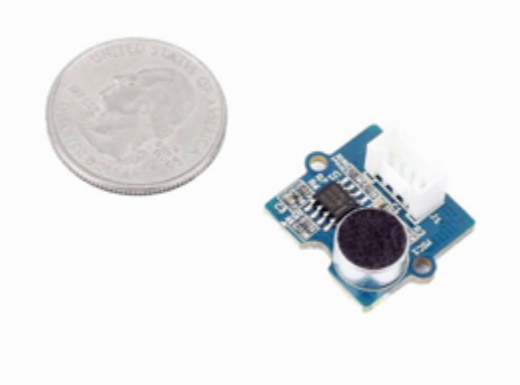
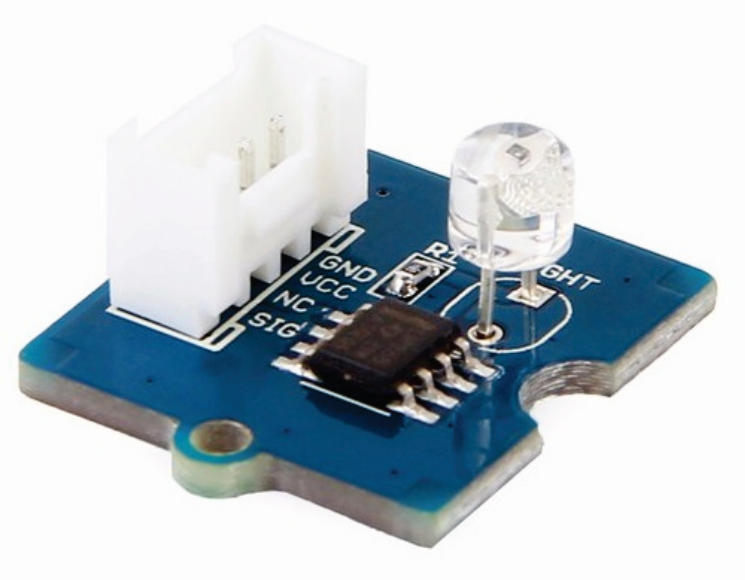
BitGadget Kit is a project kit for micro:bit intermediate users. It develops a micro:bit expansion board called BitMaker which consists of a programmable RGB LED, a buzzer and 6 Grove ports. Up to 9 Grove modules are included in the kit to boost your creativity: rotary angle sensor, light sensor, sound sensor, button, ultrasonic sensor, mini fan, vibration motor, servo and RGB LED strip. If you are already an experienced micro:bit user, you can also buy more Grove modules in Seeed to create other exciting projects.

II Modules

BitGadget Kit provides a series of items as follows: 1 BitMaker, 9 Grove modules, 1 micro USB cable and a pack of typical connection wire. Below is an information table about the module details. You can click on one of the small images to see a large version of the modules or click “More Info” to know more about them.

Name	Image	Detail
BitMaker		BitMaker is a credit card-sized, plug and play expansion board that bridges Grove modules with a micro:bit. It incorporates an inbuilt speaker for playing music and 6 Grove ports (one is an I2C port) that allows micro:bit to connect to hundreds of modules, such as sensors, actuators, communication modules and displays. More Info

Name	Image	Detail
Ultrasonic Sensor		Ultrasonic sensor is an input module for detecting objects in a measurement range about 20-400 cm. By measuring the time between transmitting and receiving the ultrasound, it's able to calculate the distance to an obstacle. More Info
Mini Fan		Mini fan is an output module composed of a DC motor, a drive board and the fan leaves. The motor can rotate when there's a high level input produced and stay at rest when there's a low level input produced. It is commonly applied to making a fan creation. The fan leaves are made of soft materials to protect you from any harm even when it's rotating rapidly. More Info
Rotary Angle Sensor		Rotary angle sensor is an input module that converts the angular position of a shaft into a digital output signal when rotated. Through the digital signal, we can know if the rotary angle sensor is rotated clockwise or counterclockwise. A

Name	Image	Detail
		clockwise rotation ordinarily produces an increased value (e.g. increase in brightness), whereas a counterclockwise rotation produces a decreased value (e.g. decrease in brightness). More Info
Sound Sensor		Sound sensor converts the analog signal of the sound wave into a digital signal in a value range from 0 to 1023. Comparing the digital signal with a specified value, we are able to know the signal comes from a quiet or noisy environment. More Info
Light Sensor		Light sensor is an input module that can convert a detected ambient light into an electrical output in the circuit. The electrical output is then transformed into a digital signal in a microcontroller. Comparing the digital signal with a specified value, we are able to know the signal comes from a bright or dark environment. More Info

Name	Image	Detail
Button		It is a momentary push button, which means that it will immediately release itself once you press it down. As an input module, it generates a HIGH signal when pressed and a LOW signal when released. It can work as a switch for circuits. More Info
Vibration Motor		Vibration motor is a mini monitor that will shake like a mute cellphone when there's a high level input produced. More Info
Servo		Servo is an output module that incorporates a DC motor, a gear train, an integrated circuit and an output shaft. The shaft of the servo can be rotated and maintain to a specific angular position by sending a coded signal to the circuit. A common use of the servo is in puppets and robots, normally with an angular motion of between 0 and 180 degrees. More Info

Name	Image	Detail
RGB LED Strip		An RGB LED strip contains 30 adjustable LEDs. You can change their RGB values to create rainbow-like effect.

III Tutorials

Here are some related tutorials to help you get started with BitGadget Kit.

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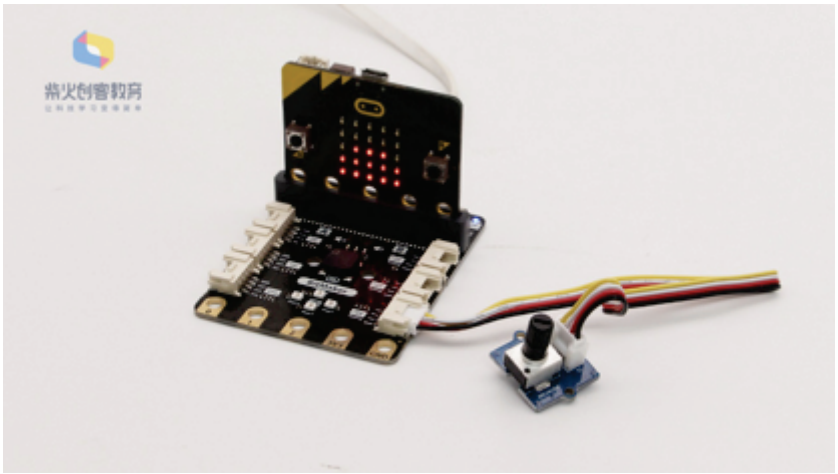
1. The LED Controller

1.1 Implementation

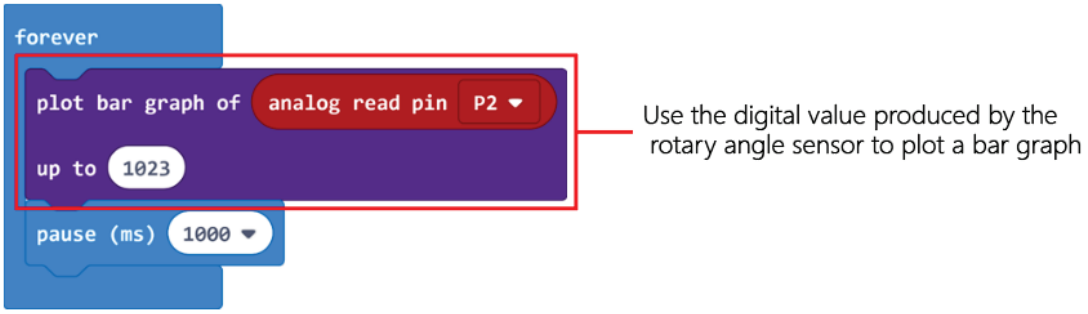
We'll make a LED controller that shows different light displays by rotating the rotary angle sensor.



1.2 Write a Program

Let's go to MakeCode: https://makecode.microbit.org
Create a new project. Firstly add a "forever" block and connect the block "plot bar graph of up to" into it. Then add a "analog read pin" block. Set the maximum as 1023,

which is the greatest value that the rotary angle sensor can produce. Finally, connect a “pause” block and set the time delay as 1,000 millisecond.



1.3 Connect a Device

Modules: micro:bit, BitMaker, rotary angle sensor
Straightly slide the micro:bit into BitMaker and be careful not to reverse it. Connect the rotary angle sensor to the port labeled as P2 on the BitMaker. Then connect the micro:bit to your PC with a USB cable. Check if the LED indicator on the micro:bit lights up. If not, you need to unplug in the USB cable and connect it to the devices again.

1.4 Download a Program

You have been introduced how to download a program in the previous tutorials, which can be simply concluded into steps as: rename a program, click the “Download” button and send it to the micro:bit.

1.5 Run a Program

Turn on the switch on the BitMaker and see if the micro:bit can work normally.

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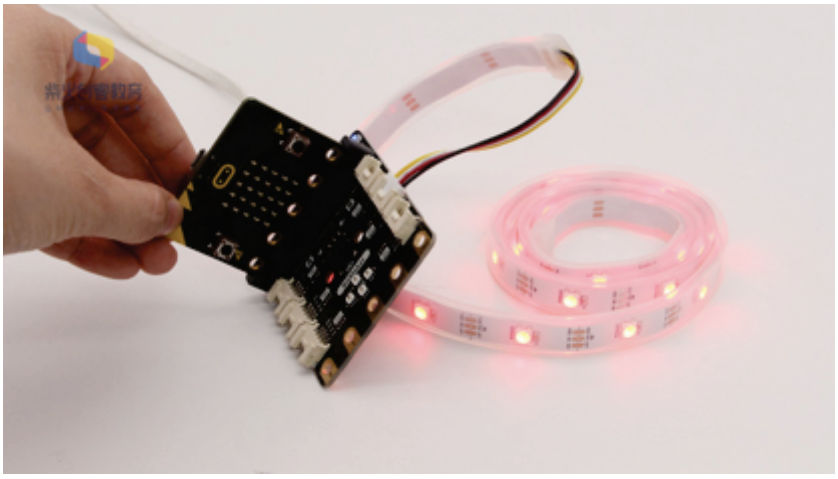
2. Fun with LED Strip

2.1 Implementation

Let’s take the challenge to another level. In this project, we’ll make the RGB LED strip blink red when the micro:bit tilts left, and blink yellow when it tilts right.

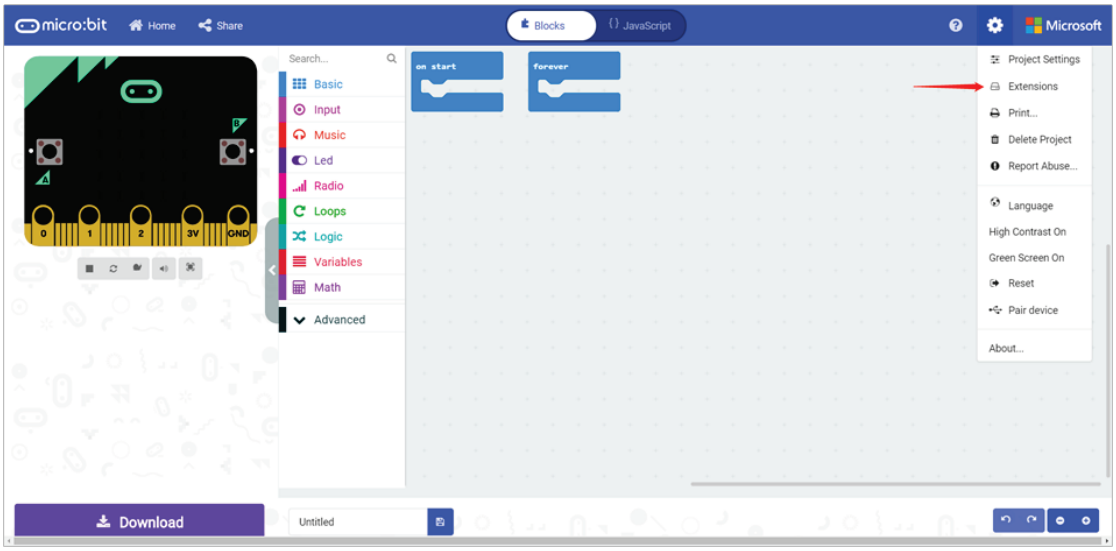


2.2 Write a Program

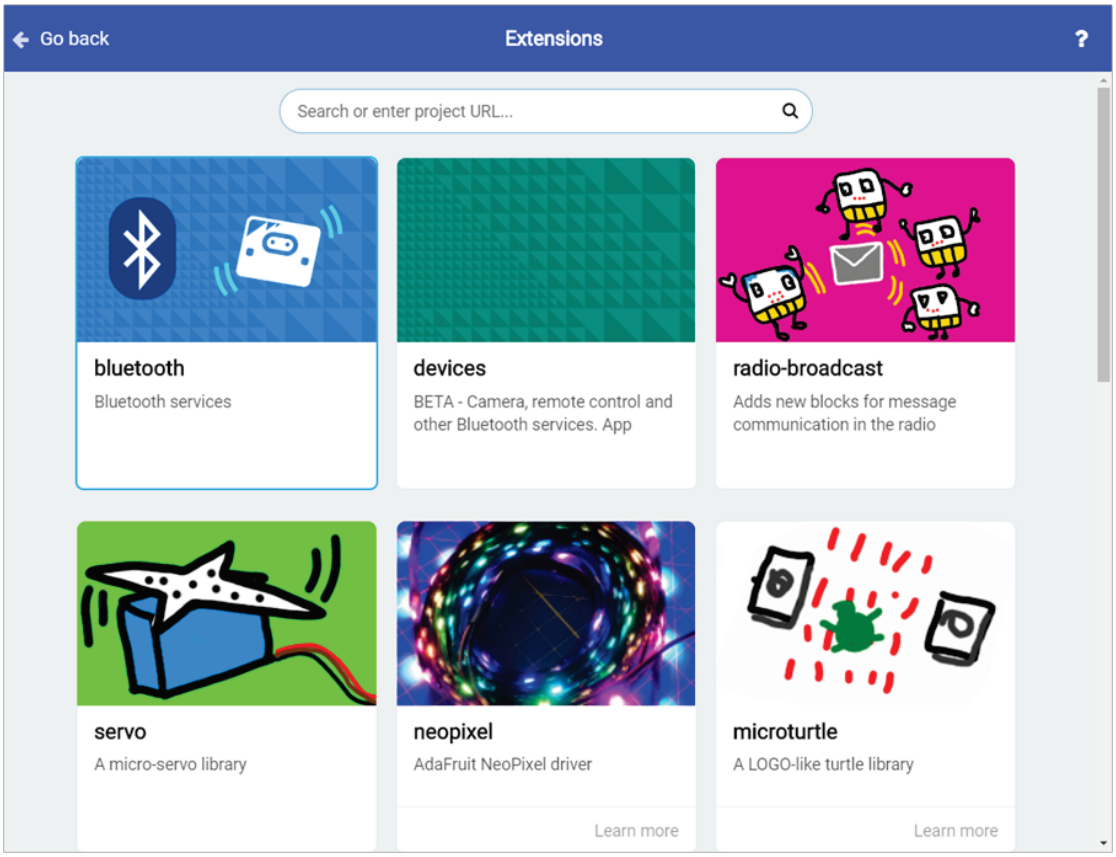
Note that in MakeCode we don't have blocks that control the Grove modules and BitMaker. Therefore we need to add a MakeCode extension for the BitGadget Kit to make sure that everything goes on well. Let's learn how to do it now!

[How to Add the Extension of BitGadget Kit]
Go to MakeCode: https://makecode.microbit.org

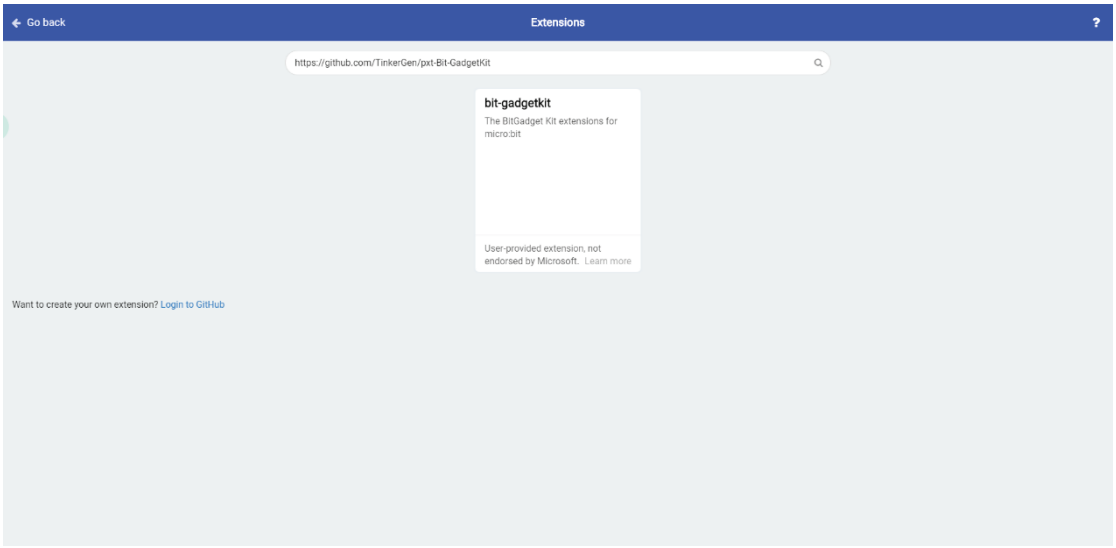
Step 1 Click the gear icon (for settings) on the blue bar in MakeCode.



- Step 2 Select "Extensions" from the drop-down list which takes you to the extensions page.

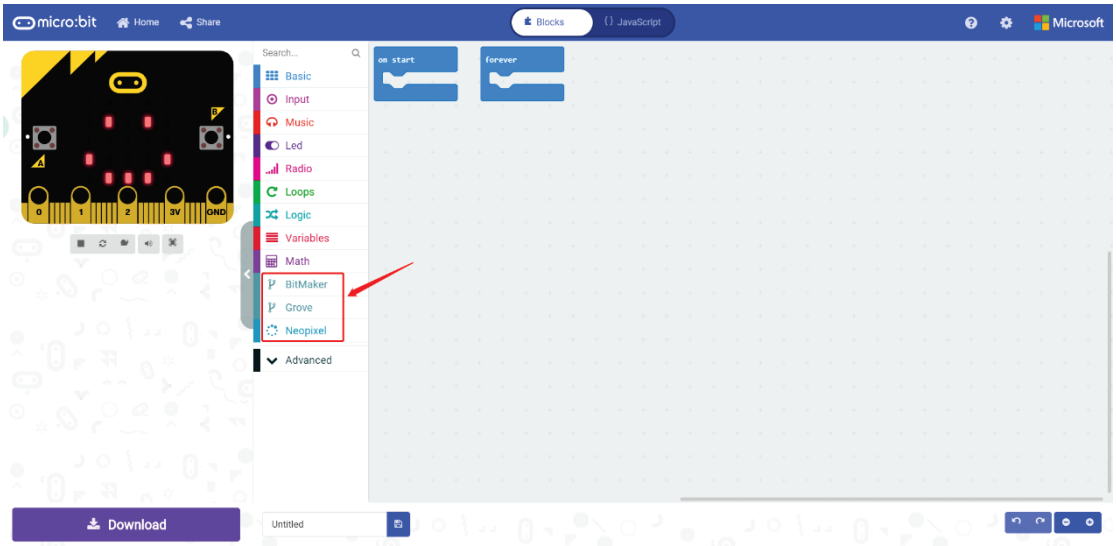


- Step 3 Input the address of the BitGadget Kit extension into the search box: https://github.com/TinkerGen/pxt-Bit-GadgetKit



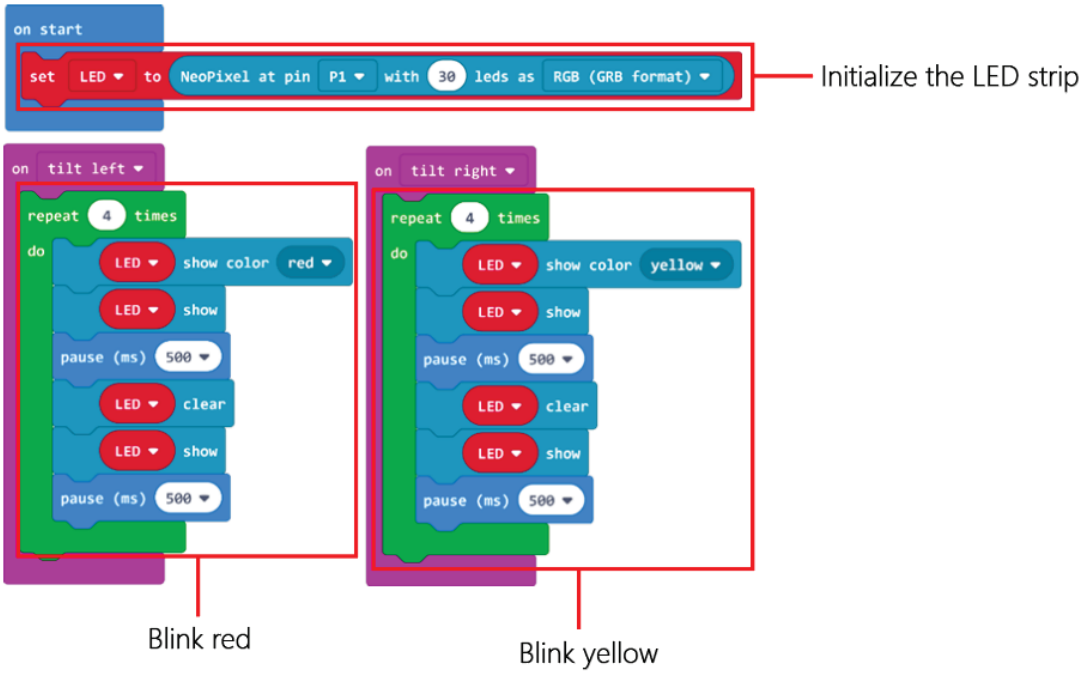
If a prompt says that this extension does not exist, please close the browser and try again.

- Step 4 Click the extension package which takes you back to the homepage. You will see that the BitGadget Kit extension is then successfully added.



Let's move to the task after we added the extension.

Firstly, we need to add the Neopixel extension. Let's create a new project to go to the workspace. Click "Extensions" from "Advanced" and select "Neopixel" from the pop-up page.
Next, add an "on start" block. Confirm the LEDs quantity and set the color format. Then, find out the block "on shake" from the tab "Input" and select "tilt left". Connect a "repeat 4 times" block from the "Loops" tab into the block "on tilt left". These two blocks together make the micro:bit repeat a designated action 4 times when it tilts left. Similarly, if you select "tilt right", the micro:bit will execute the same action when it tilts right.
Select the block "strip show color red" from "neopixel" and connect it into the two blocks above, and still keep the color as red. Connect the blocks "strip show" and "pause (ms) 500" underneath. Then, add the blocks "strip clear", "strip show" and "pause (ms) 500" by turns. The strip will blink when this program starts running. Similarly, when you select "tilt right", you just need to select a yellow color and repeat the steps above.



2.3 Connect a Device

Modules: micro:bit, BitMaker, RGB LED strip
Straightly slide the micro:bit into BitMaker and be careful not to reverse it. Connect the LED strip to the port labeled as P1 on the BitMaker. Then connect the micro:bit to your PC with a USB cable. Check if the LED indicator on the micro:bit lights up. If not, you need to unplug in the USB cable and connect it to the devices again.

2.4 Download a Program

You have been introduced how to download a program in the previous tutorials, which can be simply concluded into steps as: rename a program, click the “Download” button and send it to the micro:bit.

2.5 Run a Program

Turn on the switch on the BitMaker and see if the micro:bit can work normally.

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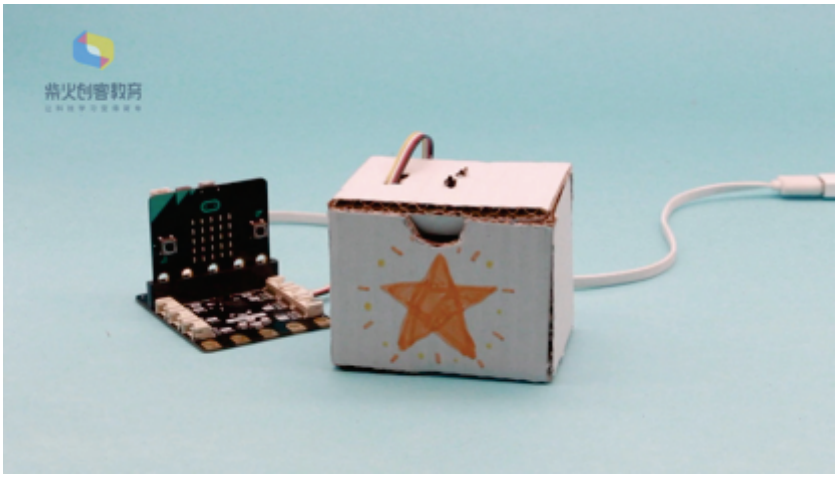
3. The Secret Box

3.1 Implementation

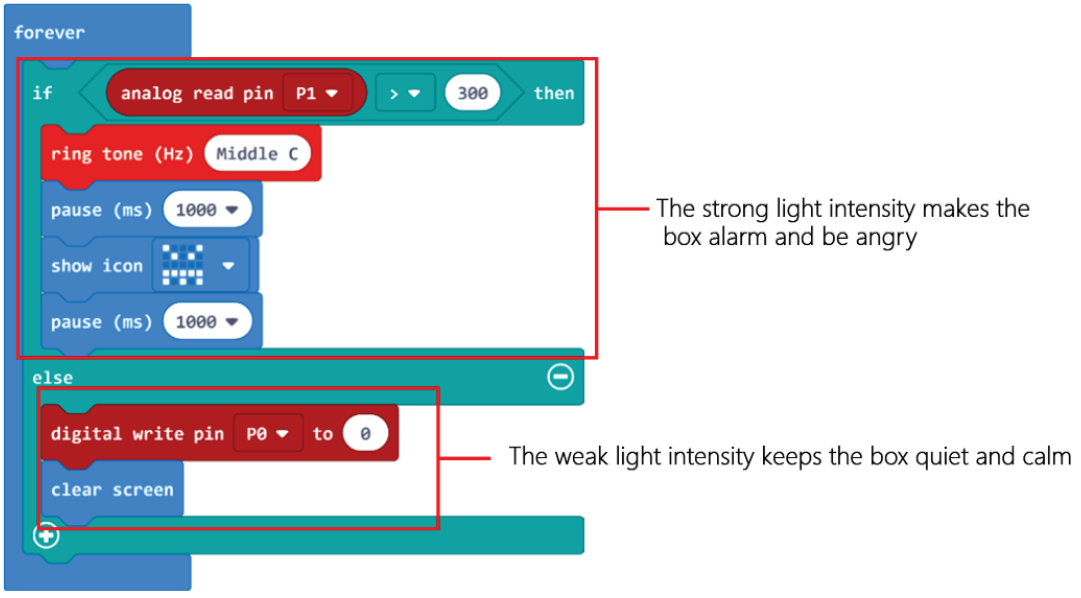
We’ll use cardboard to make a gadget called secret box. If the box’s opened and it senses there’s light outside, it will alarm and show an angry face to remind us that it was opened by someone.



3.2 Write a Program

[Still we use a same method in Tutorial 1 to add the BitGadget Kit extension.] Create a new project to go to the workspace and add a “forever” block. Connect an “IF THEN ELSE” statement into the “forever” block. Follow this program logic: if the light sensor (we connect it to P1) produces a value greater than 300, then the micro:bit alarms and displays an angry face. If the value is not greater than 300, the micro:bit does not alarm nor show any faces.

Note: Make sure to selecting “analog read pin”. 300 is an adjustable value.



3.3 Connect a Device

Modules: micro:bit, BitMaker, light sensor
Straightly slide the micro:bit into BitMaker and be careful not to reverse it. Connect the light sensor to the port labeled as P1 on the BitMaker. Then connect the micro:bit to your PC with a USB cable. Check if the LED indicator on the micro:bit lights up. If not, you need to unplug in the USB cable and connect it to the devices again.

3.4 Download a Program

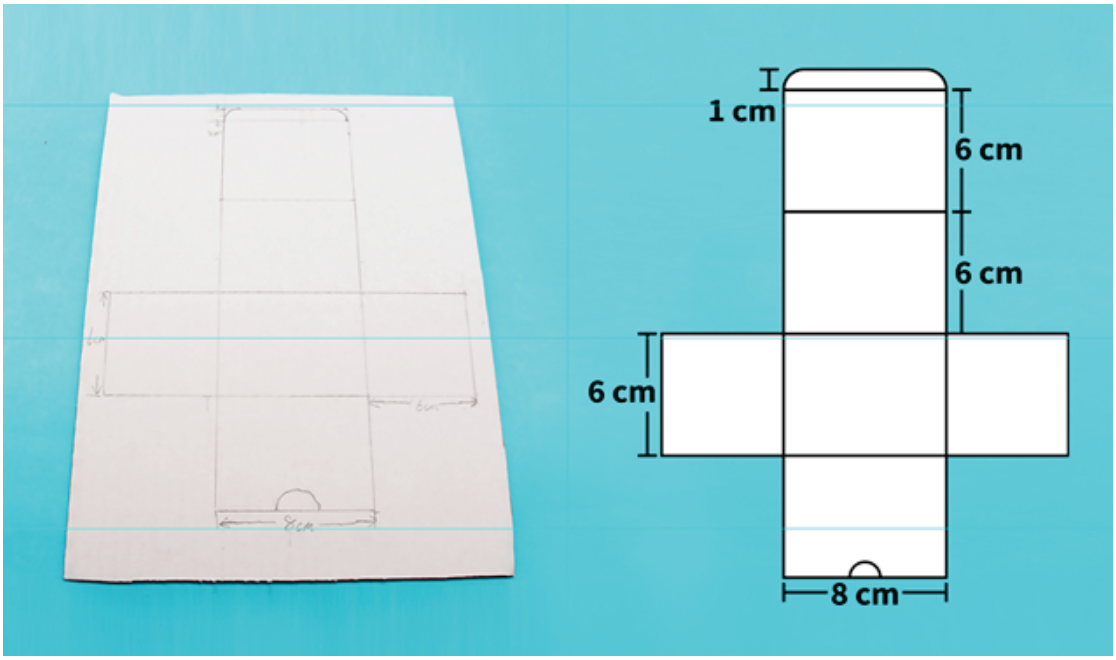
You have been introduced how to download a program in the previous tutorials, which can be simply concluded into steps as: rename a program, click the “Download” button and send it to the micro:bit.

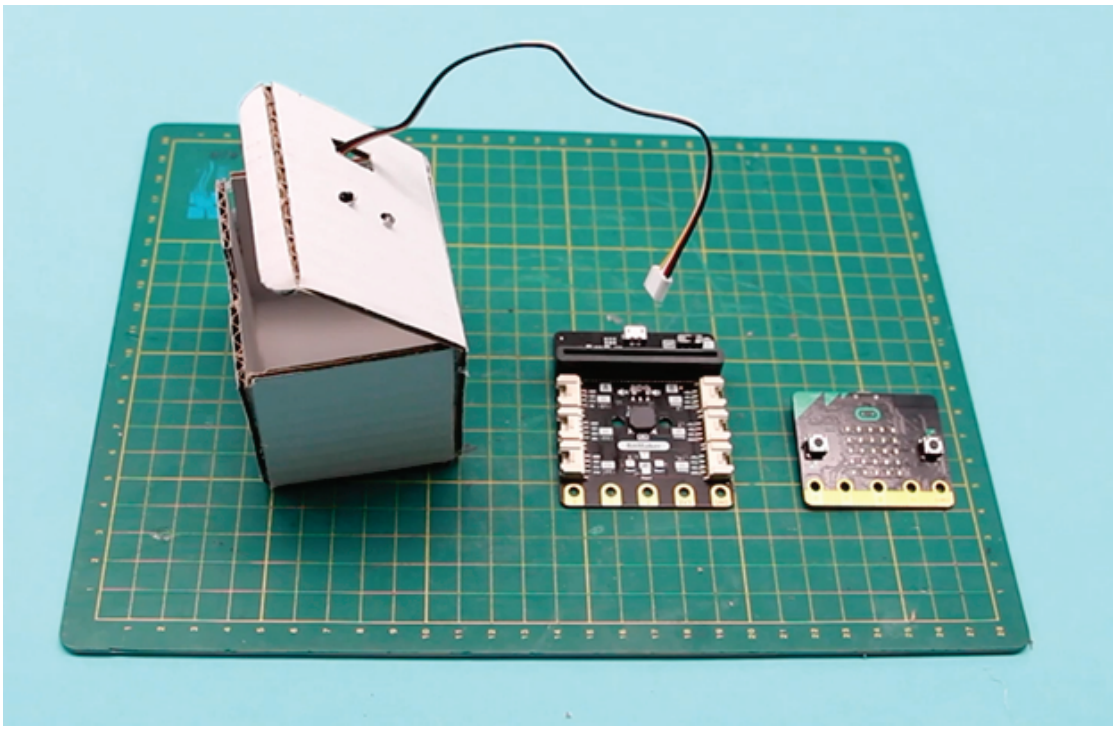
3.5 Run a Program

Turn on the switch on the BitMaker and see if the micro:bit can work normally.

3.6 Create an Outer Case

Materials: cutting mat, cardboard (A4 size), pencil, scissors, craft knife, ruler, hot melt glue & gun, plastic rivets (2 pieces, use double-sided tape instead if you don’t have rivets)





Combine the micro:bit and BitMaker to this device. Power on the whole gadget. You can also decorate the box as you like. Once you complete all of the steps, let's check out how it works!

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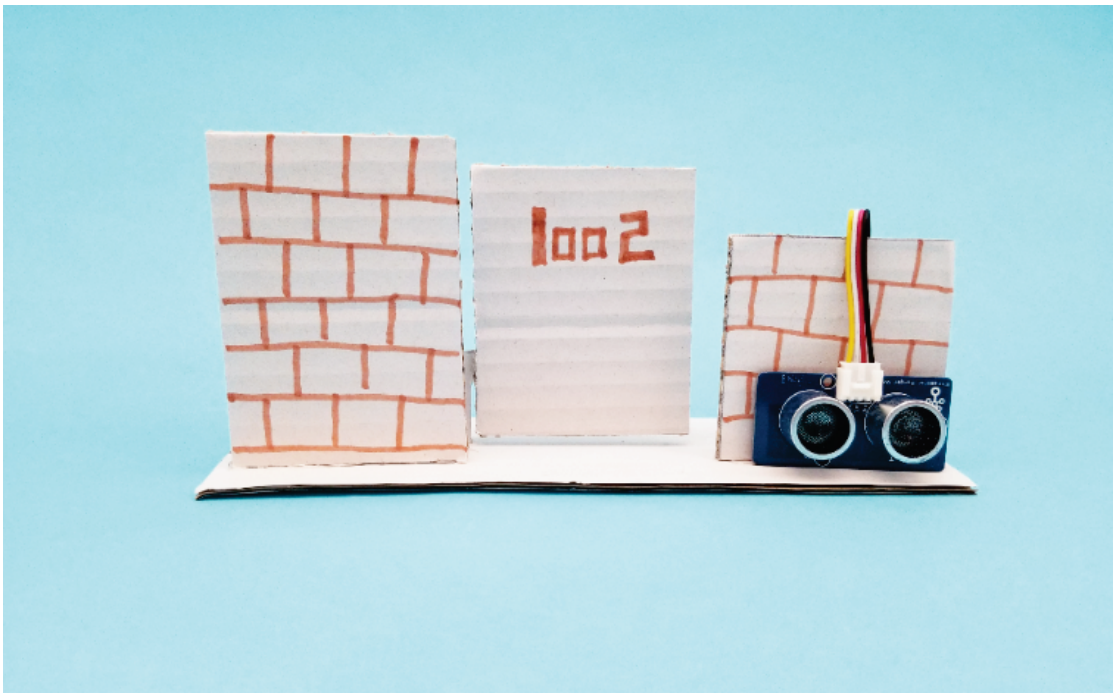
4. Automatic Door

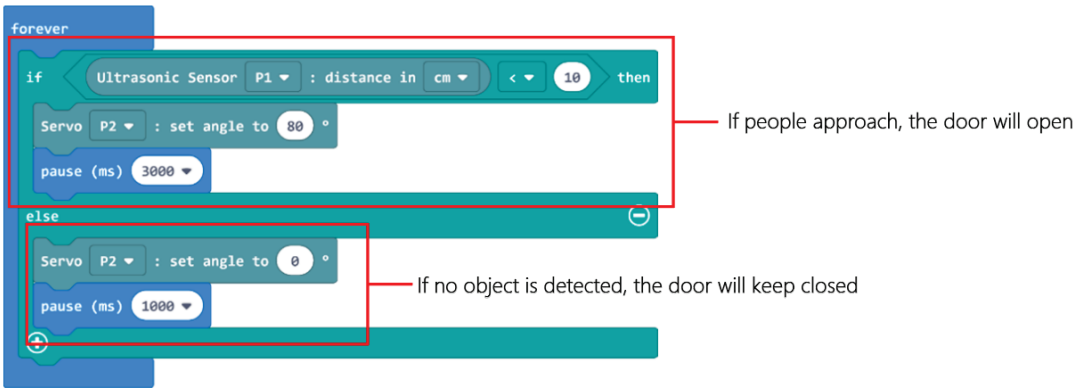
4.1 Implementation

Let's use the ultrasonic sensor, micro:bit and BitMaker to make an automatic door. When someone approaches, the door opens automatically.



4.2 Write a Program

[Still we use a same method in Tutorial 1 to add the BitGadget Kit extension.] As usual, add a "forever" block. Follow this program logic: if the ultrasonic sensor measures a distance less than 10, then the servo rotates to 80 degrees and pauses for 3 seconds, else, it stays at rest (0 degrees) and pauses for 1 second. The angular position and the time delay are adjustable.



4.3 Connect a Device

Modules: micro:bit, BitMaker, ultrasonic sensor, servo
Straightly slide the micro:bit into BitMaker and be careful not to reverse it. Connect the ultrasonic sensor to the port labeled as P1 on the BitMaker, while connect the

servo to P2. Then connect the micro:bit to your PC with a USB cable. Check if the LED indicator on the micro:bit lights up. If not, you need to unplug in the USB cable and connect it to the devices again.

4.4 Download a Program

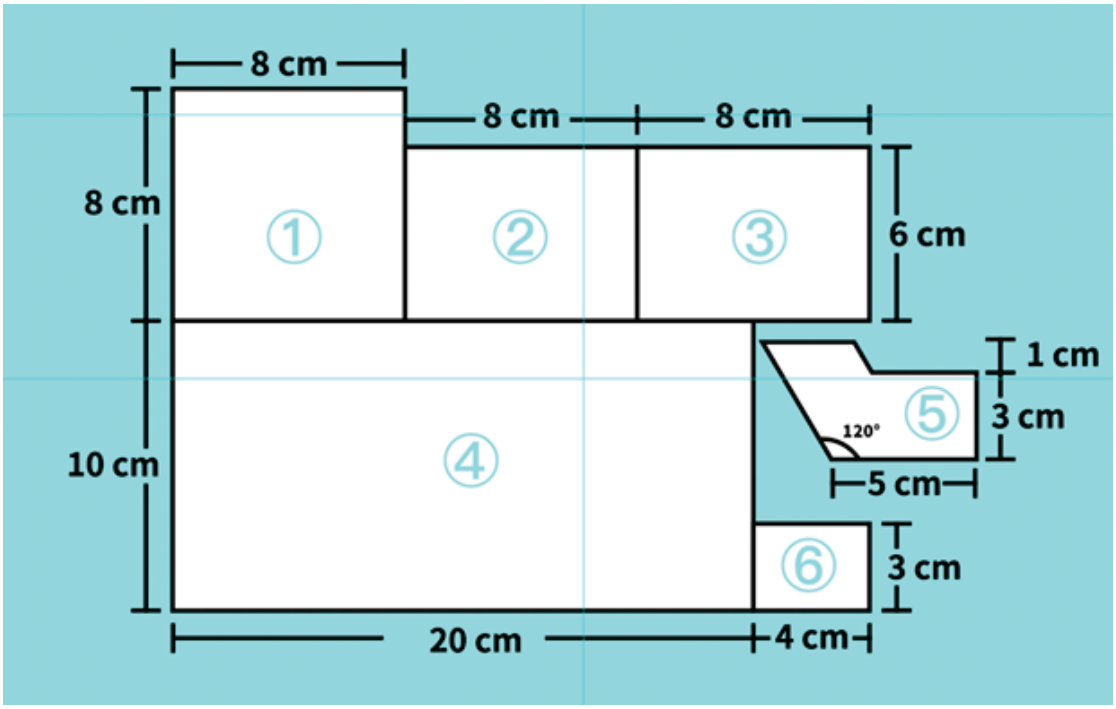
You have been introduced how to download a program in the previous tutorials, which can be simply concluded into steps as: rename a program, click the “Download” button and send it to the micro:bit.

4.5 Run a Program

Turn on the switch on the BitMaker and see if the micro:bit can work normally.

4.6 Create an Outer Case

Materials: cutting mat, cardboard (A4 size), pencil, scissors, craft knife, ruler, hot melt glue & gun, plastic rivets (2 pieces, use double-sided tape instead if you don’t have rivets)



Combine the micro:bit and BitMaker to this device. Power on the whole gadget. You can also decorate the door as you like. Once you complete all of the steps, let's check out how it works!

III Course Materials

You can see course materials related to the micro:bit and BitGadget Kit on our online learning platform Make2Learn via this address: https://make2learn.tinkergen.com/

IV Attachments

Attachment: BitGadget Kit Tutorial Source Code