The 1st SMARTHON CUP
Singapore Smart City AI Challenge

Introductory Workshop

Final Goal

1. You will understand Product Introduction/Structure
2. Build 1-2 cases of the product
3. How to build a scene
4. Hardware feature and operation
5. Model operation
6. Learn basic wifi, and thingspeak
7. Learn AI n8n automation (Understand the concept)

Outline

1. Smarthon Smart City IoT Learning Kit
    1. What is a Smart City?
    2. Introduction to IoT:Bit
    3. Project 1: Automatic Playground Lighting
    4. Summary
2. Smarthon Smart Home IoT Maker Kit
    1. What is a Smart Home?
    2. Home Automation
    3. House Model Assembly
    4. IoT Case 10: Home Health Data Monitoring
3. Smarthon Smart Farming AIoT Learning Kit
    1. Introduction to n8n
    2. AIoT Hands-On Session (Case 10)
    3. Summary

(1) Smart City IoT Starter Kit

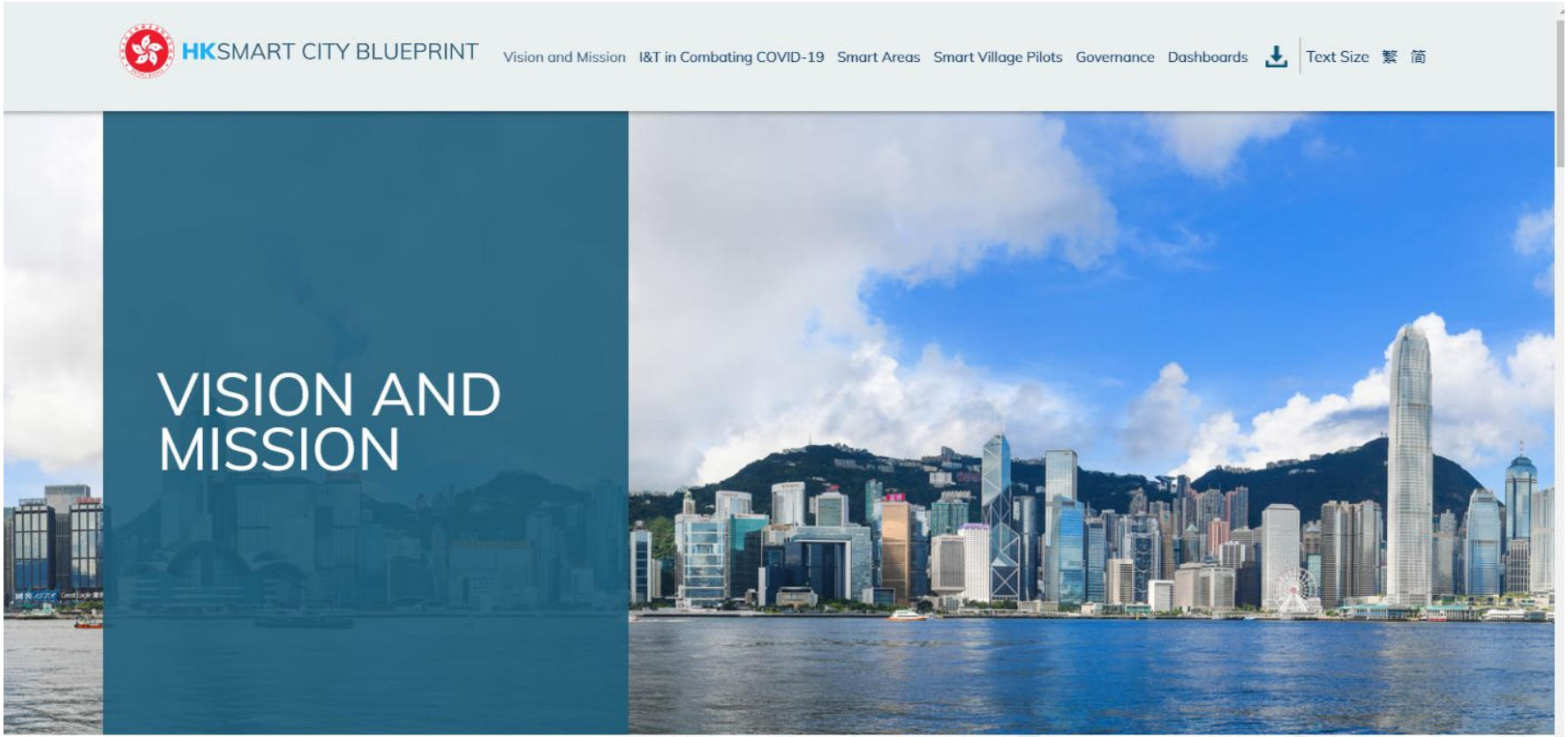
Smart City IoT Starter Kit for micro:bit

1. Suitable for P4 – S5 students (computer science subject)

2. IoT programming and building a smart city

3. The Kit set includes 11 user cases, allowing students to create their own dream modern cities.

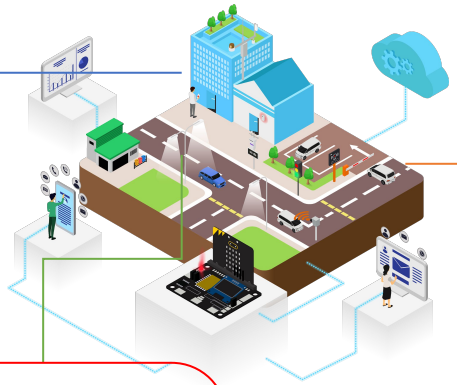




https://www.smartcity.gov.hk/mobility.html
https://www.smartcity.gov.hk/modules/custom/custom_global_js_css/assets/files/HongKongSmartCityBlueprint(EN).pdf

WHAT IS SMART CITY?

Smart city is a framework, integrating the information and communications technology (ICT) to improve the city's sustainability, efficiency and quality of life, in 6 major area - mobility, living, environment, people government and economy.



SMART LIVING
Using IoT/technology to improve the convenience / stand[illegible]ving

SMART MOBILITY
Enhance the travel experience by providing real time information

SMART GOVERNMENT
government that support the adoption and development of technology in public/ private sectors and city infrastructure

SMART ENVIRONMENT
Monitor pollution and reduce waste, develop a green

SMART ENCONOMY
strengthen the current economic pillars and develop new pillars with technology

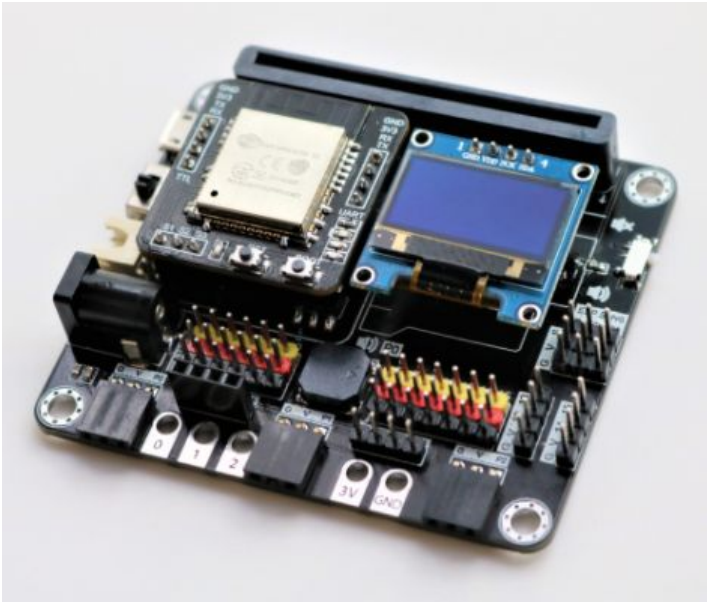
SMART PEOPLE
Provide training programming to nurture IT professions

1. Core ESP32 IoT Bit

1. Brand NEW ESP32 WIFI IoT Extension Board

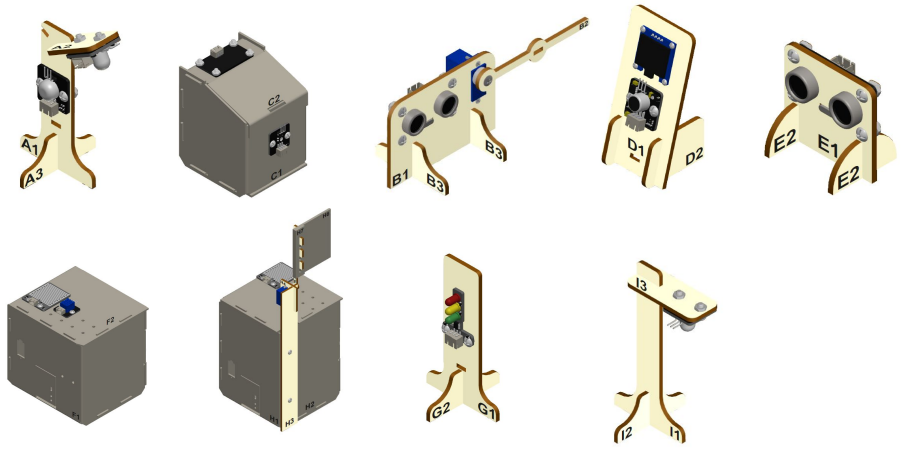
2. The most power and stable on WIFI (Thingspeak, IFTTT, mobile app control, Cloud Control, O to O)

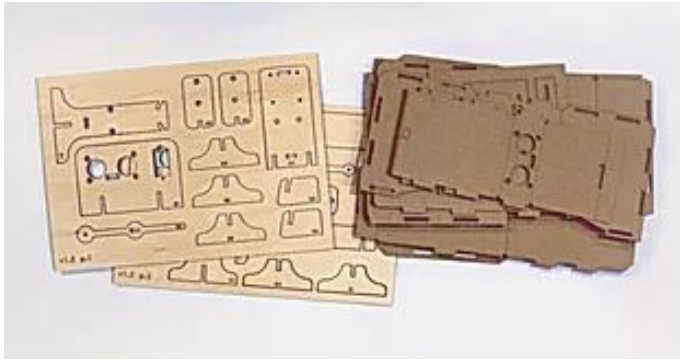
3. Focus on “IoT scene” designed IoT Extension board

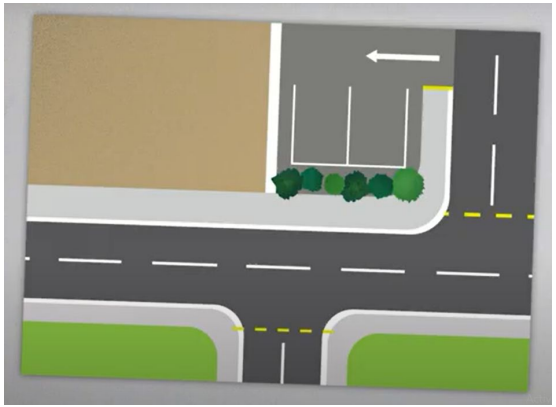


2. The built-in model and City Map

- 9 models include Smart Street Light, Smart Traffic Light, Rubbish bin. (All are already basic element on City)







- A2 Map is good for student easy to start

SMARTHON

SMART CITY IOT STARTER KIT FOR MICRO:BIT

PART LIST


(1) SMARTHON IOT:BIT


(1) RAINDROP SENSOR


(1) TRAFFIC LIGHT


(1) ULTRASONIC DISTANCE SENSOR


(1) WHITE LED


(1) MULTI-COLOUR LED (WS2812)


(1) LIGHT SENSOR


(1) NOISE SENSOR


(1) PIR MOTION SENSOR


(1) TEMPERATURE & HUMIDITY SENSOR


(1) 180° SERVO



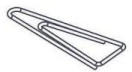
MODULE WIRE

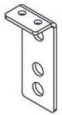


EXTENSION WIRE


(12) M2*10MM
(6) M3*10MM
(30) M4*10MM
SCREWS


(12) M2
(6) M3
(30) M4
NUTS


(3) PAPER CLIP


(2) L-SHAPED STAND


(1) SCREWDRIVER


(2) SANDPAPER


(1) BLU TACK


(1) USB CABLE


(1) BATTERY HOLDER

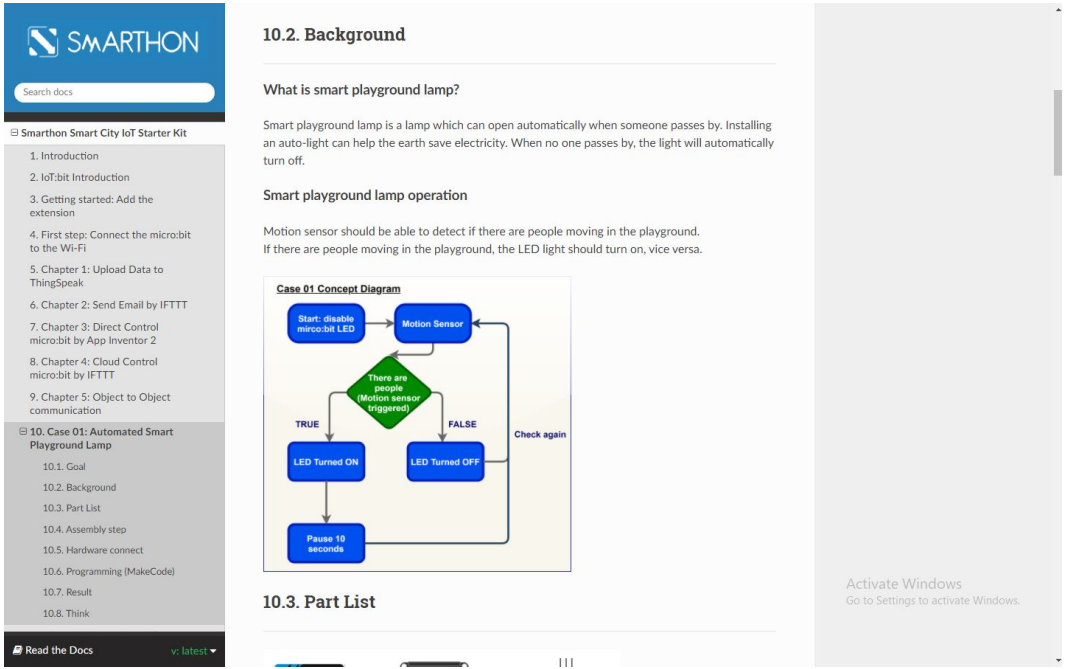

(1) CARDBOARD WOODEN MODEL


(1) CITY MAP

FOR MORE DETAIL INSTRUCTION, PLEASE
GO TO THE ONLINE DOCUMENTATION BELOW.
HTTP://SMARTHON-DOCS-EN.READTHEDOCS.IO/EN/LATEST/SMARTCITY/INDEX.HTML

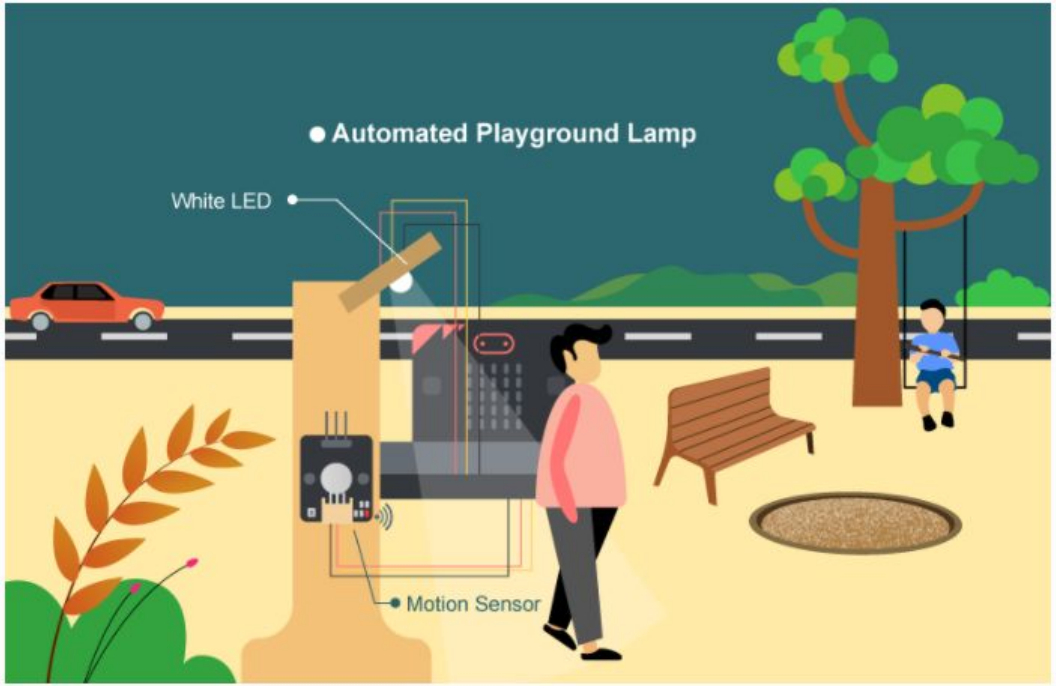
FOR MANUAL BOOK,
PLEASE SCAN THE QR CODE

Complete Online Documentation



https://smarthon-docs-en.readthedocs.io/en/latest/smartcity/1_Introduction.html

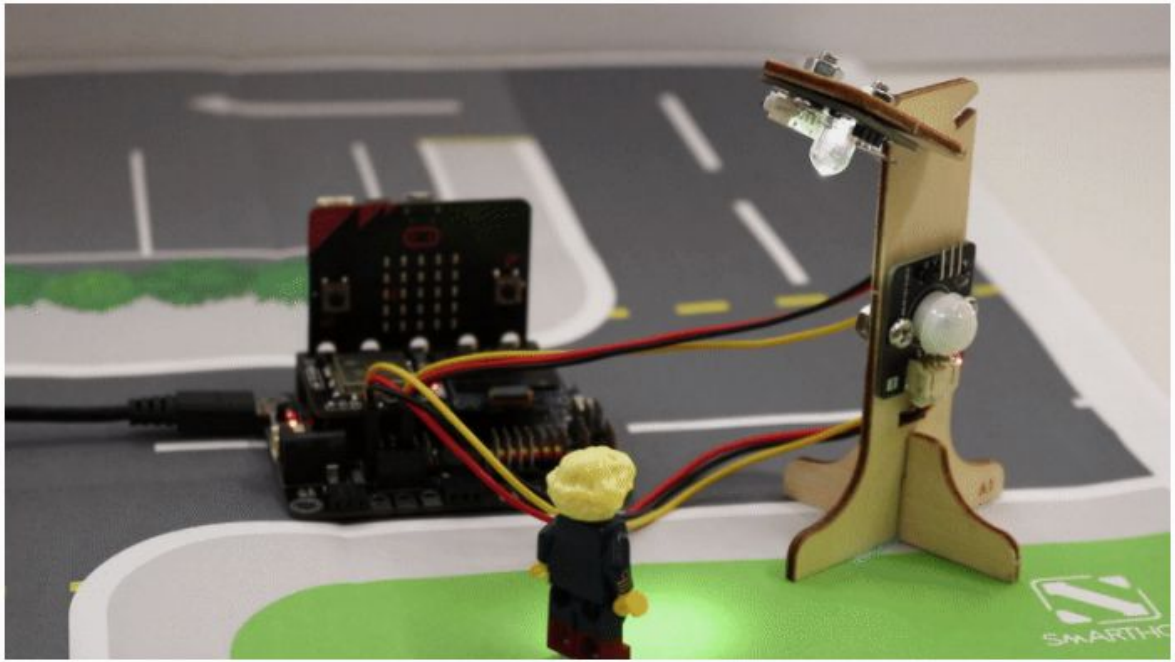
Case 1 demonstration:



Energy saving

SMART ENVIRONMENT

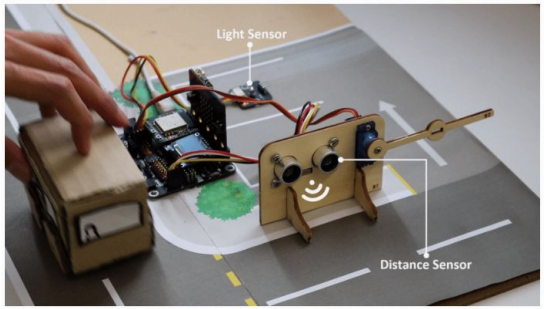
Monitor pollution and reduce waste, develop a green community



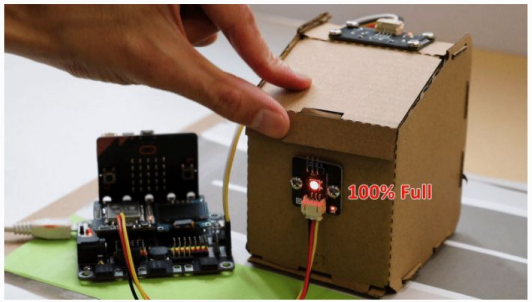
Case 2- Case 5:

They are also basic, no IoT element

SMART MOBILITY



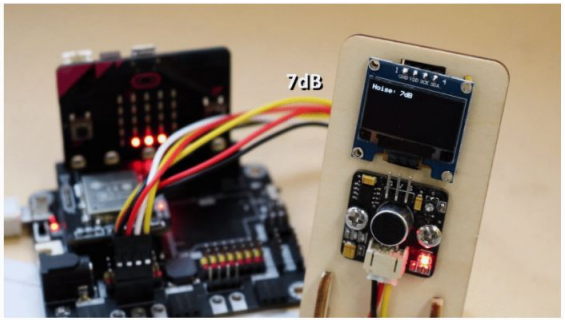
Smart Car Park Access Barrier



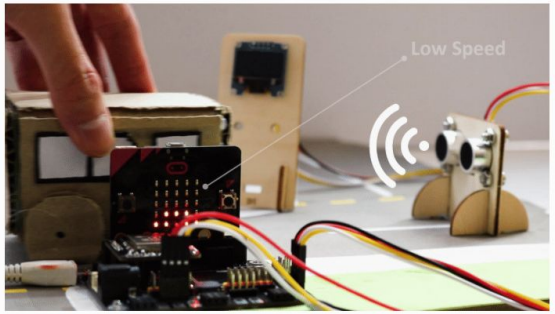
Garbage Disposal System

SMART ENVIRONMENT

SMART ENVIRONMENT



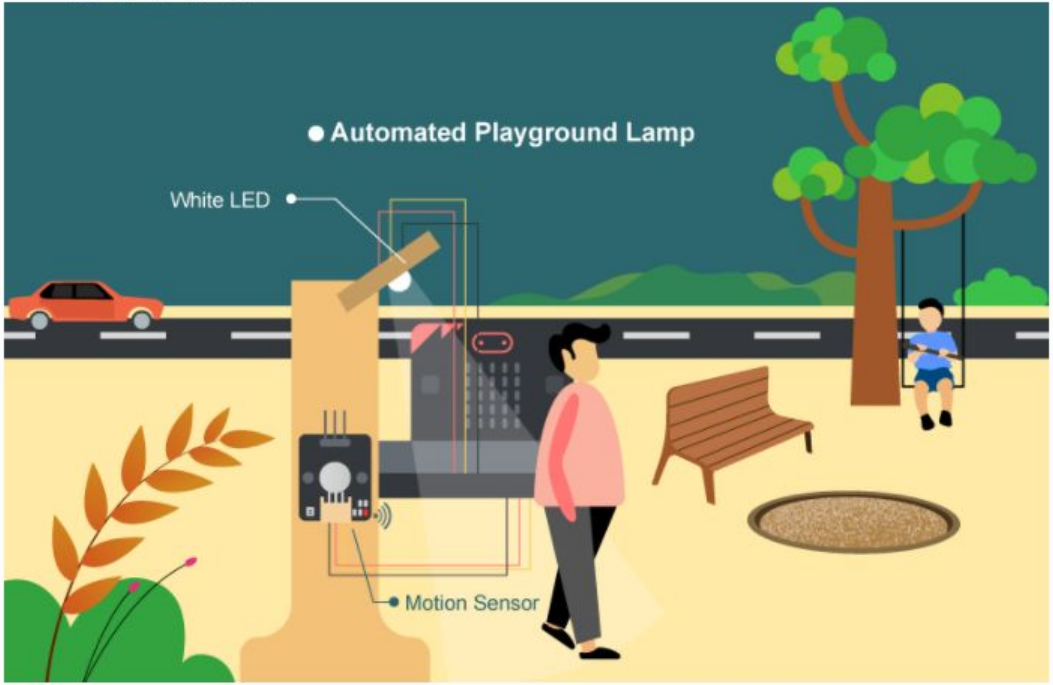
Urban Noise Detection



Car Speed monitoring

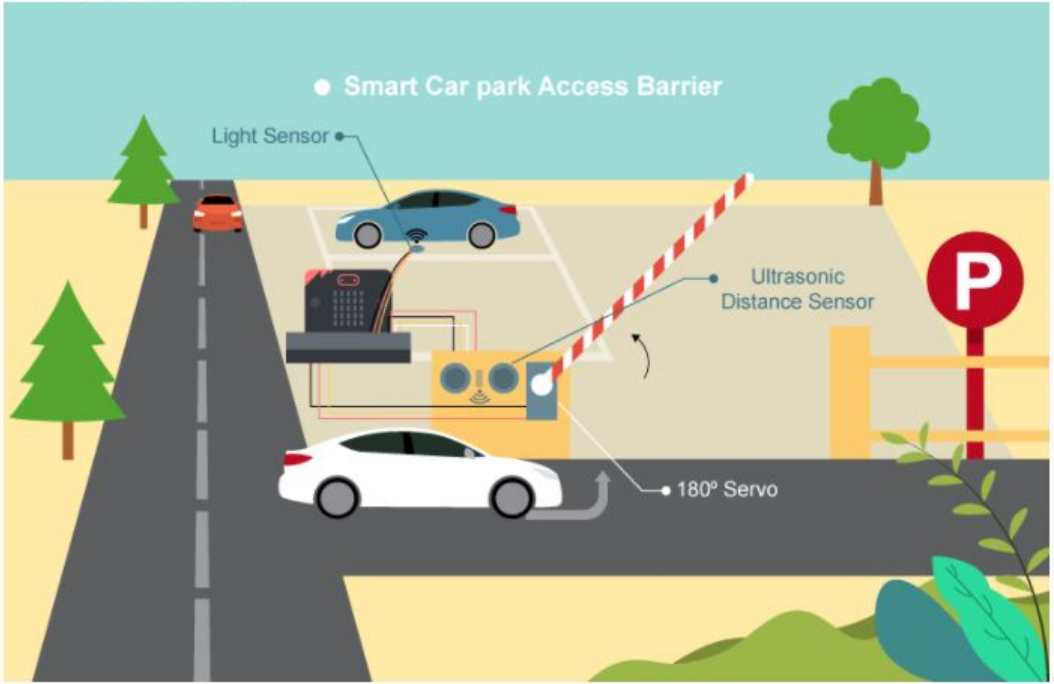
SMART MOBILITY

Case 1 practice: Automated Smart Playground Lamp



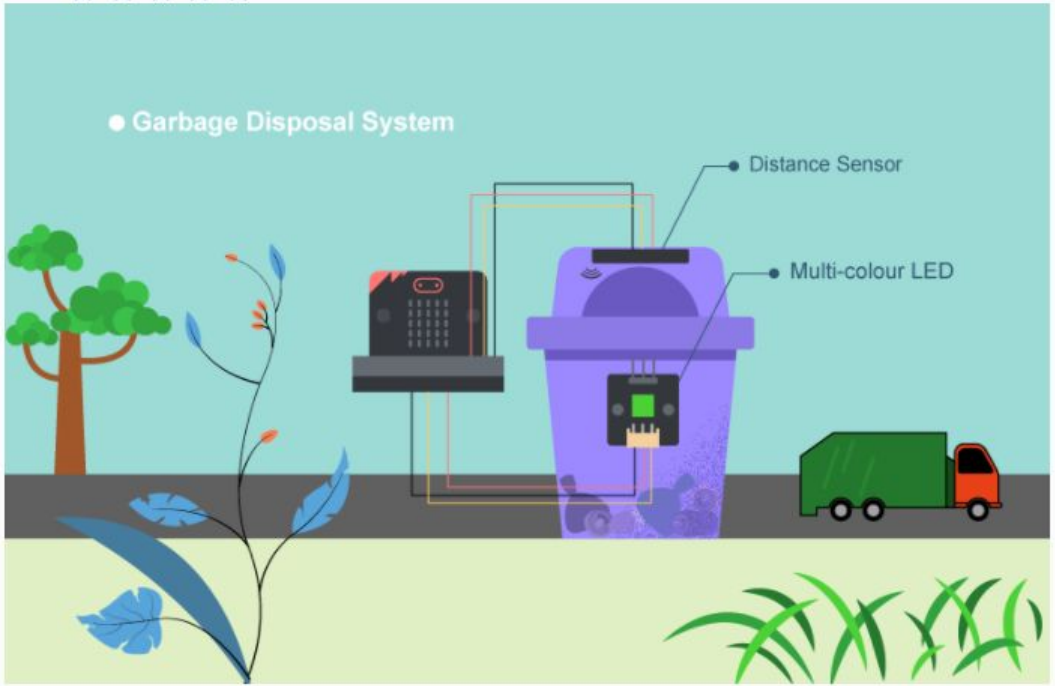
11. Case 02: Smart Car park Access Barrier

Level: ★ ★ ☆ ☆ ☆



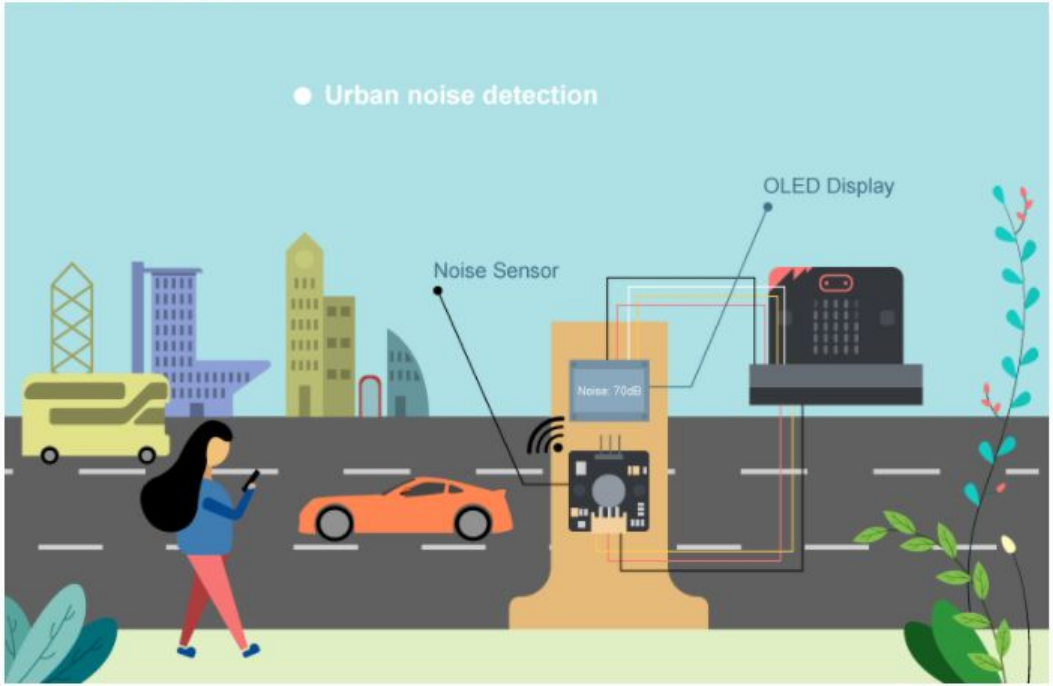
12. Case 03: Garbage disposal system

Level: ★ ★ ☆ ☆ ☆



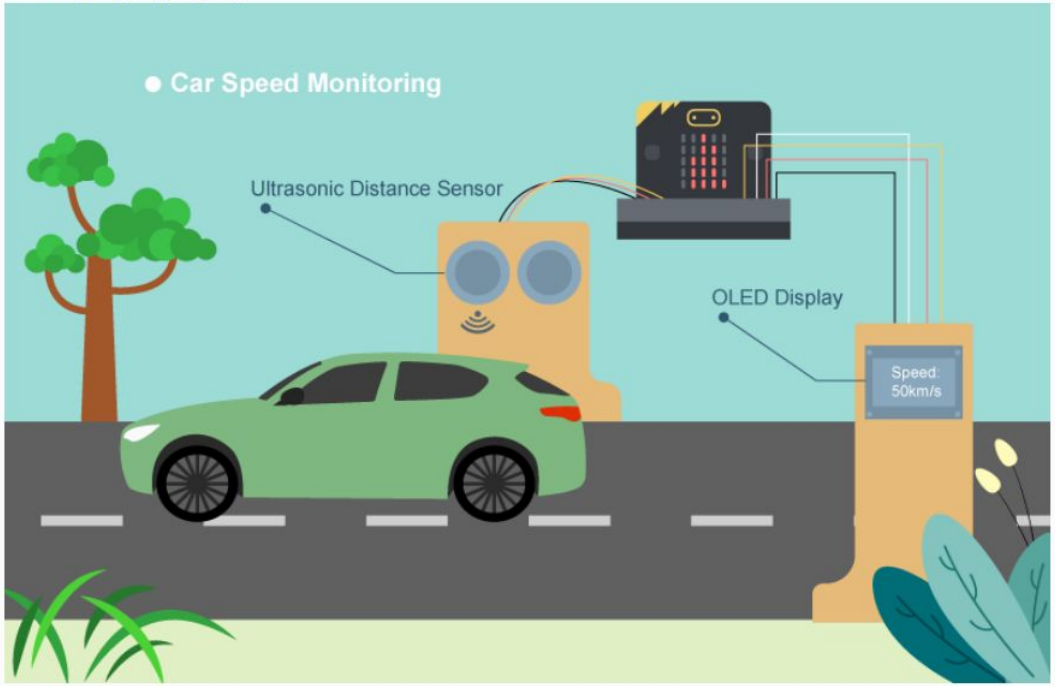
13. Case 04: Urban noise detection

Level: ★ ★ ☆ ☆ ☆



14. Case 05: Car speed monitoring

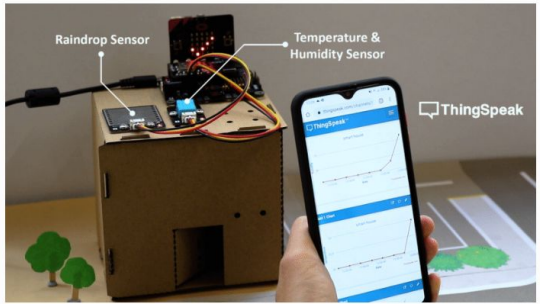
Level: ★ ★ ★ ☆ ☆



Case 6- Case 11:

They are all IoT cases

SMART LIVING

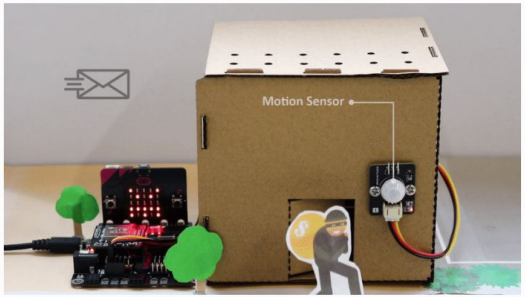


Case 06: Weather Station

1

ThingSpeak

SMART LIVING

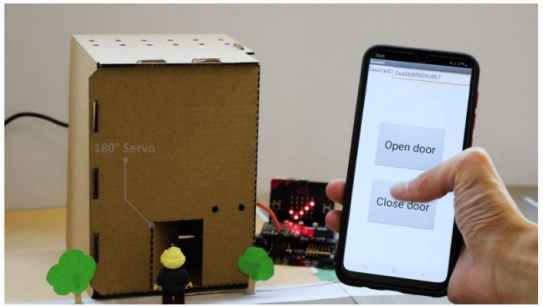


Case 07: Smart Defense System

2

IFTTT

SMART LIVING



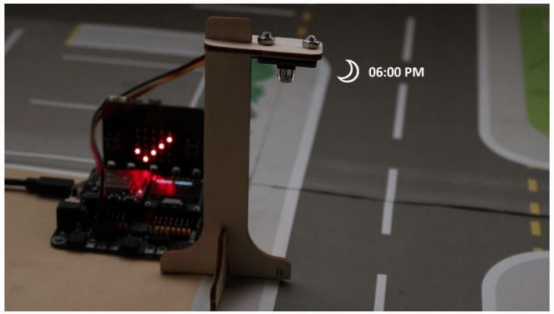
3

MIT APP INVENTOR

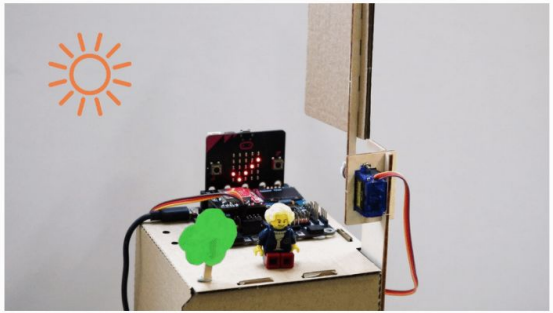
Case 09: Smart Door Control

SMART MOBILITY

SMART LIVING



Case 10: Smart Street Light

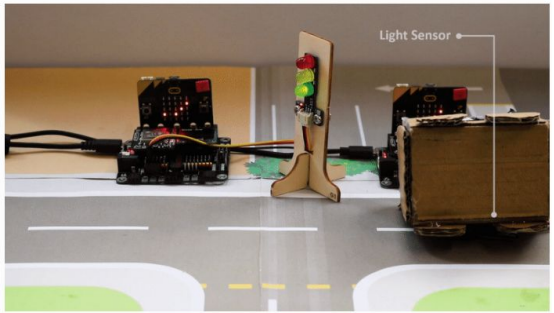


Case 11: Roof garden clothes rack

4

Cloud Control

SMART MOBILITY

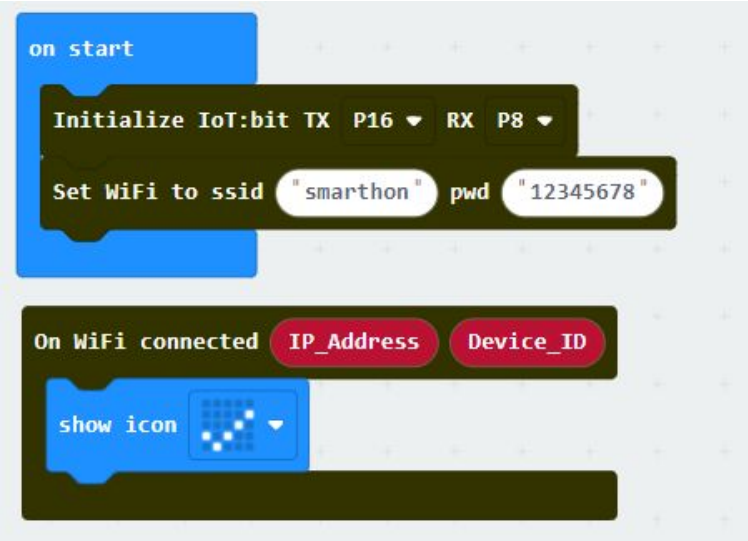


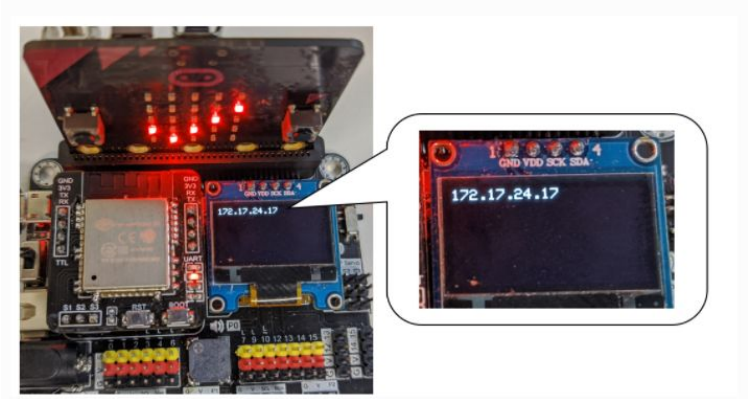
Case 8: Smart Traffic System

5

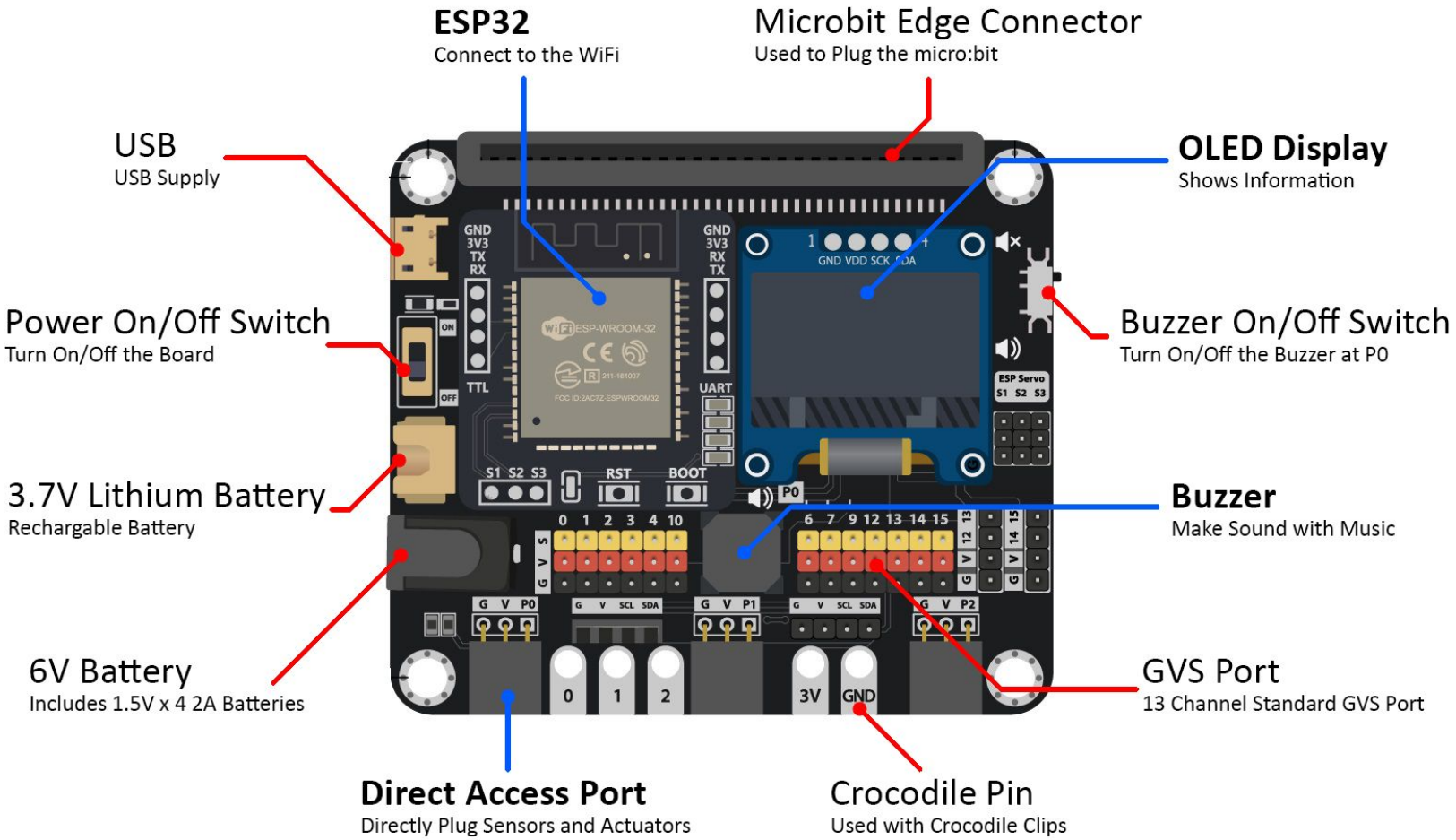
O2O Communication

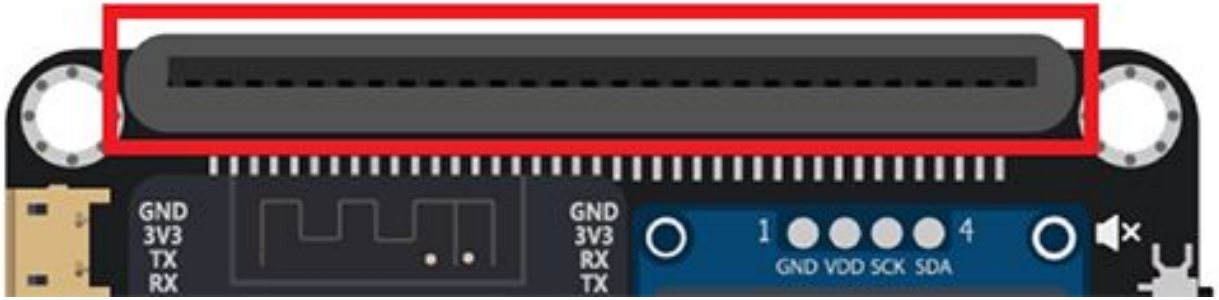
First Step: We need to connect micro:bit to the Internet



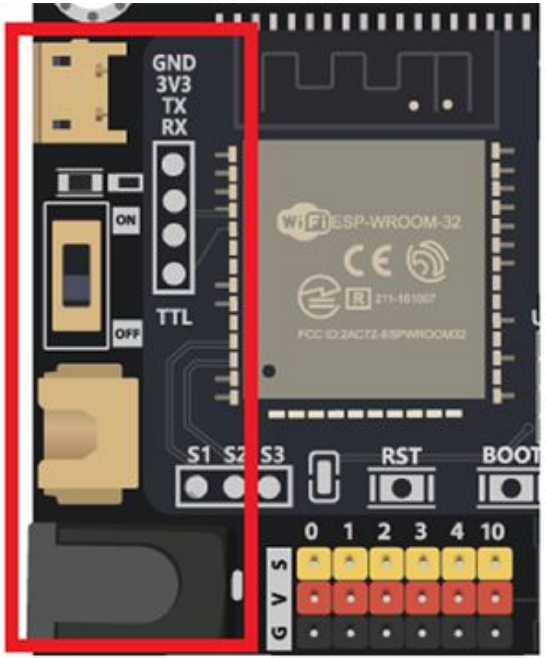


Introduction to the IoT bit

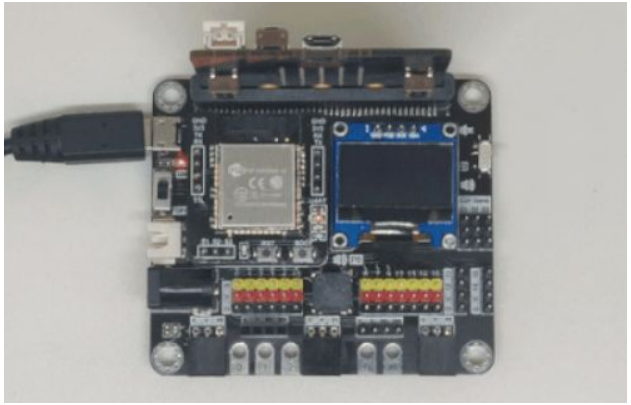

ESP32
Connect to the WiFi
Microbit Edge Connector
Used to Plug the micro:bit
USB
USB Supply
OLED Display
Shows Information
Power On/Off Switch
Turn On/Off the Board
Buzzer On/Off Switch
Turn On/Off the Buzzer at P0
3.7V Lithium Battery
Rechargable Battery
Buzzer
Make Sound with Music
6V Battery
Includes 1.5V x 4 2A Batteries
GVS Port
13 Channel Standard GVS Port
Direct Access Port
Directly Plug Sensors and Actuators
Crocodile Pin
Used with Crocodile Clips



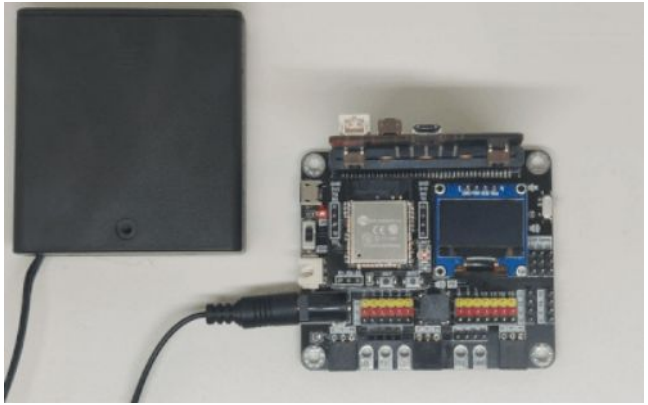
Provides a socket for micro:bit to be installed



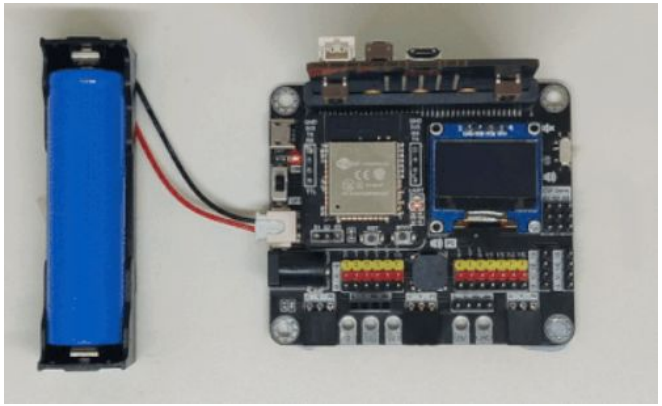
Provides three different type of methods to power on the expansion board and micro:bit. You can either choose the common 5V USB power, or 2 different ports which connect to 3.7V-6V battery box.



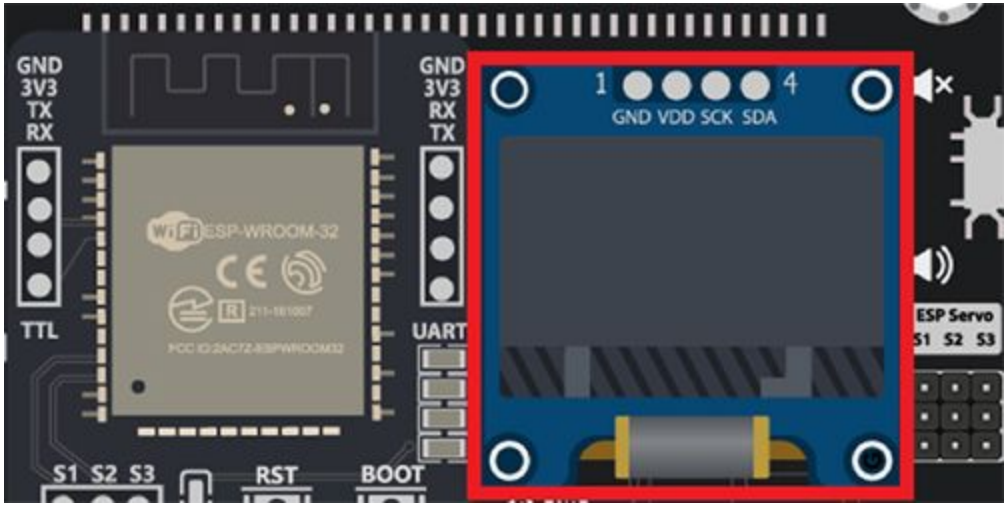
Micro-USB connection



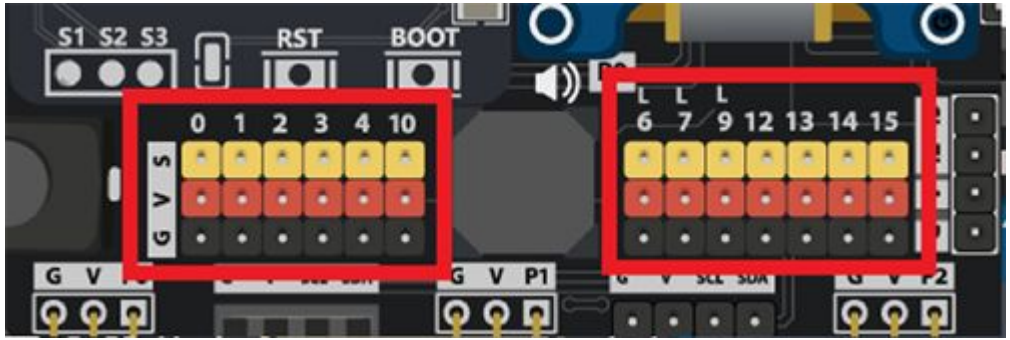
AA battery holder connection



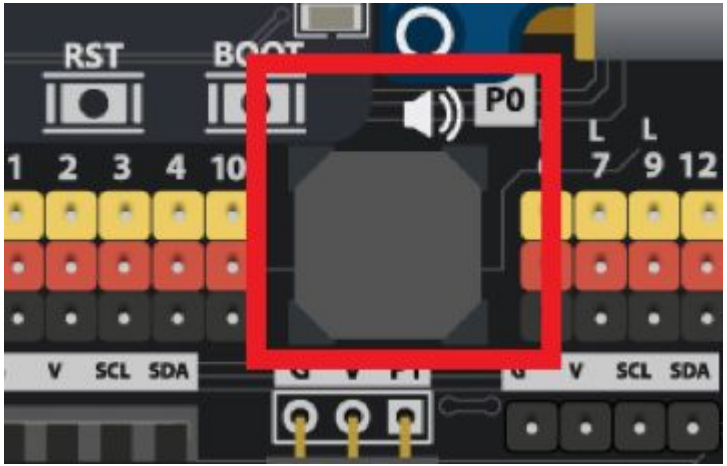
Lithium battery connection

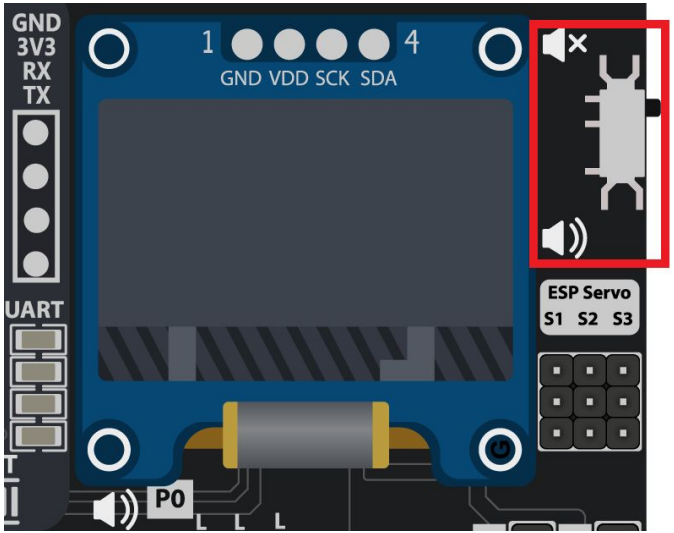

GND
3V3
TX
RX
TTL
GND
3V3
RX
TX
UART
ESP-WROOM-32
1
4
GND VDD SCK SDA
ESP Servo
S1 S2 S3
S1 S2 S3
RST
BOOT

OLED module

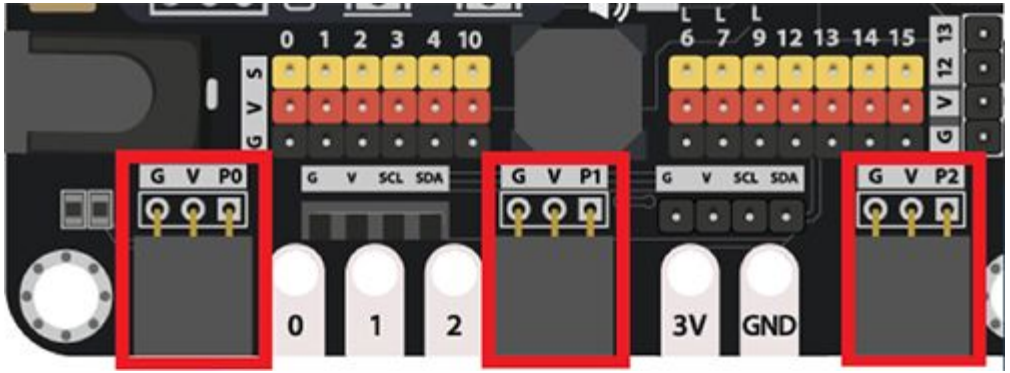


Lead out pins for the module. 13 different actuators and sensors can be connected at the same time.

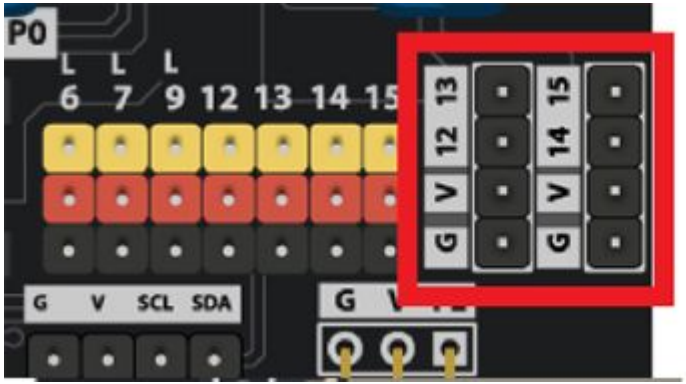




The built in buzzer (picture on the left) is connected to P0. The buzzer can generate different sounds and melodies. However, when connecting modules to P0, make sure to turn off the buzzer using the switch (picture on the right.)



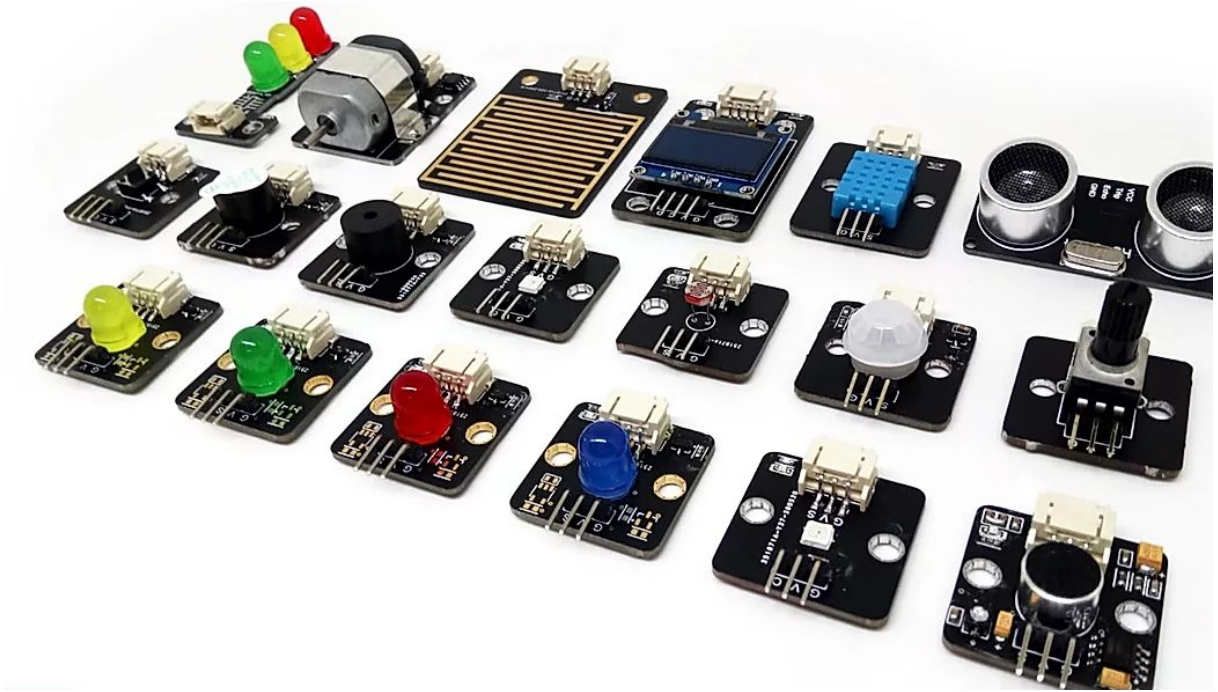
These are rapid access ports. 3 Pin sensors can be connected immediately without needing to use cables. Ports correspond to pins P0, P1, P2.



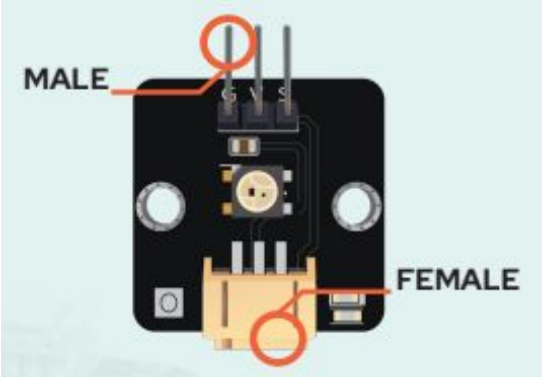
Two ports are reserved for the 4 Pins Module. Each port can connect to sensors that require to I/O pins such as distance sensor and motors. In total there are 4 I/O pins being used, they correspond to P12, P13, P14, P15.

Introduction to the Smarthon Series

1. Electronics



1 Support both female & male



2 Standard Color (Easy to learn electronics)



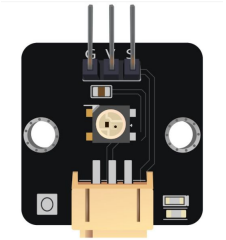
Black - GND
Red- VCC
Yellow - Signal



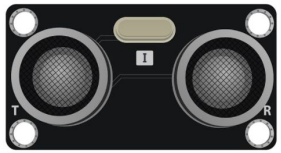
White – Another signal

3

3 pins and 4 pins support all modules



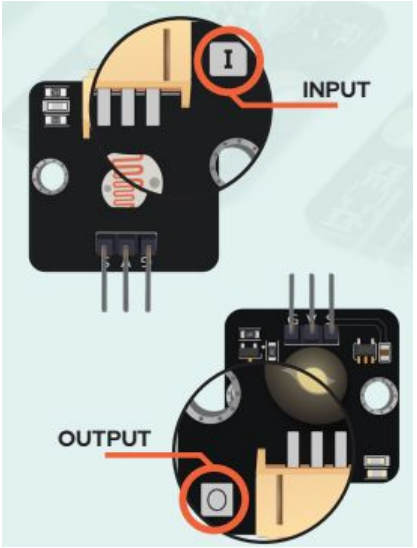
3 pin



4 pin

4

Easy to identify “Input” or “Output”



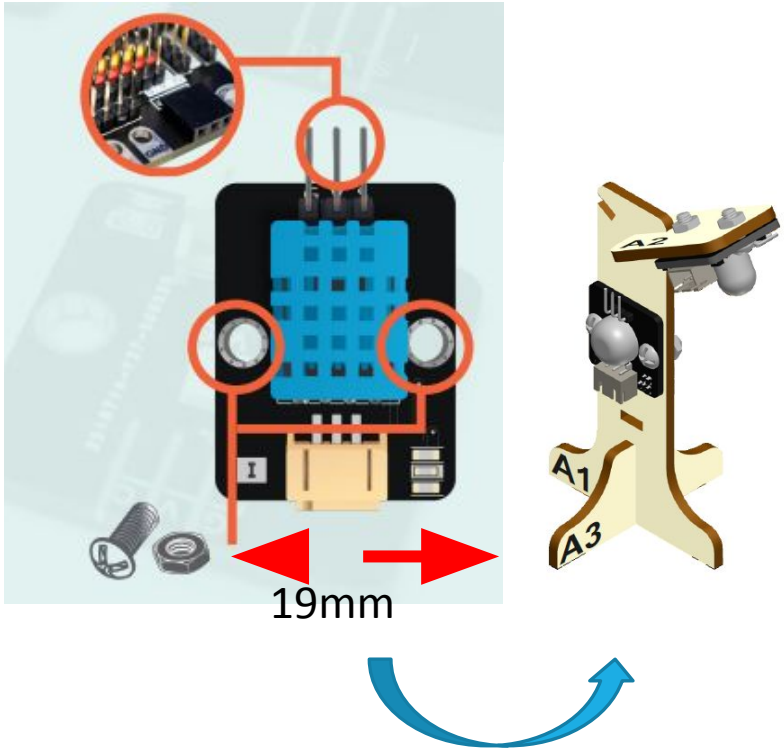
5

Easy to extend,
convenient to build model

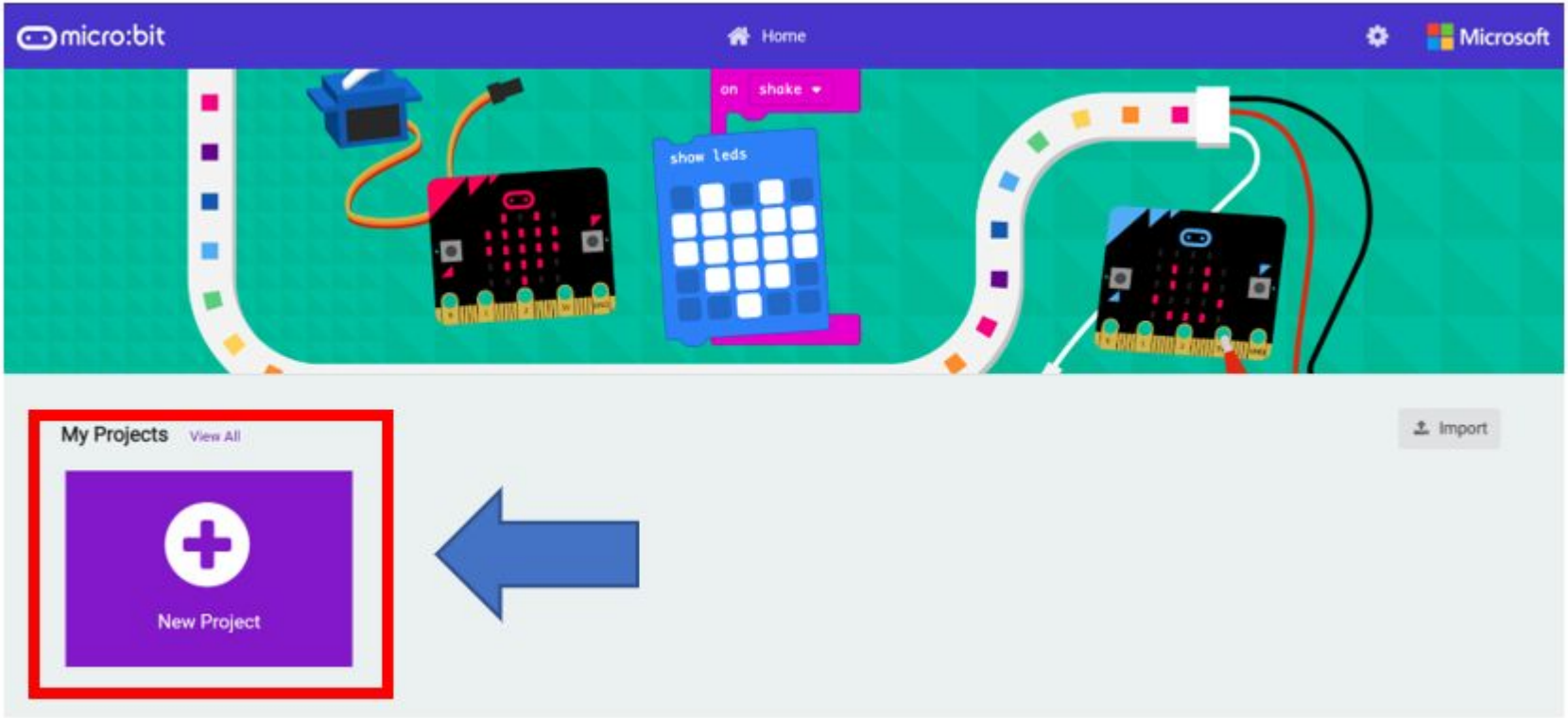


6

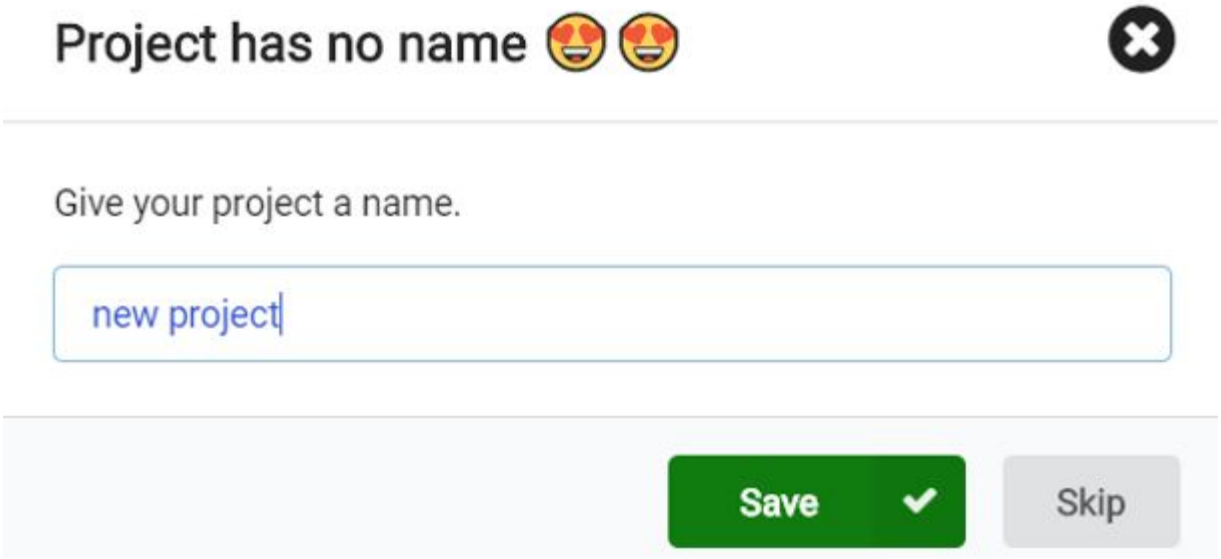
Module is designed to mount on models



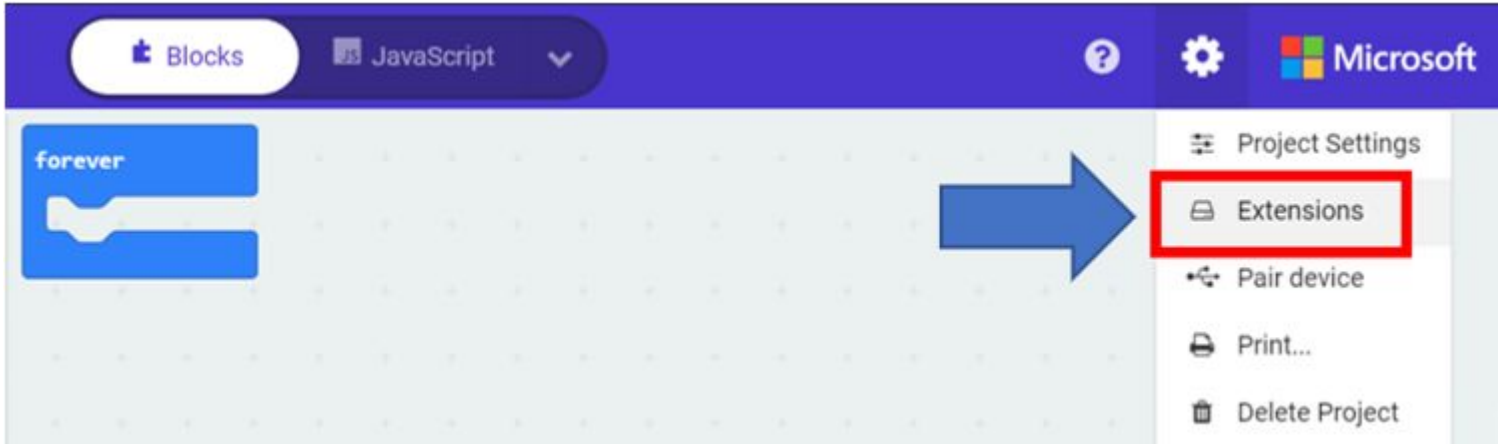
Adding the extension



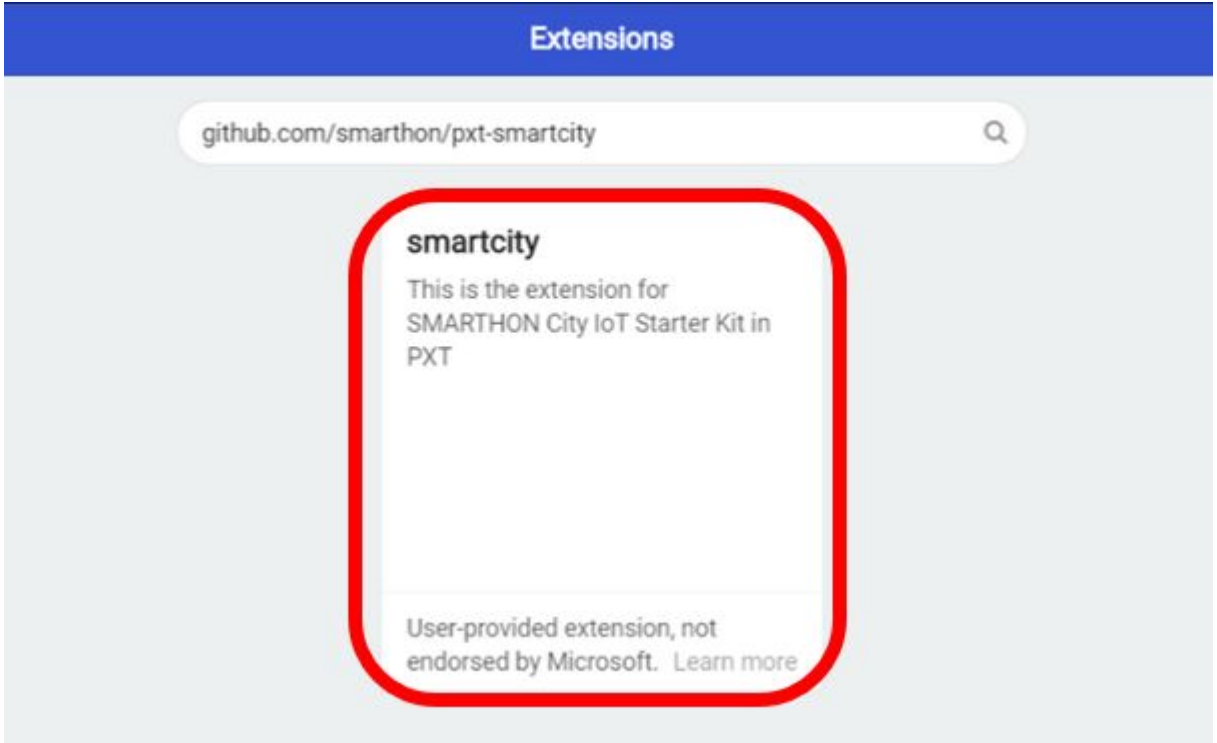
Go to MakeCode, create a new project.



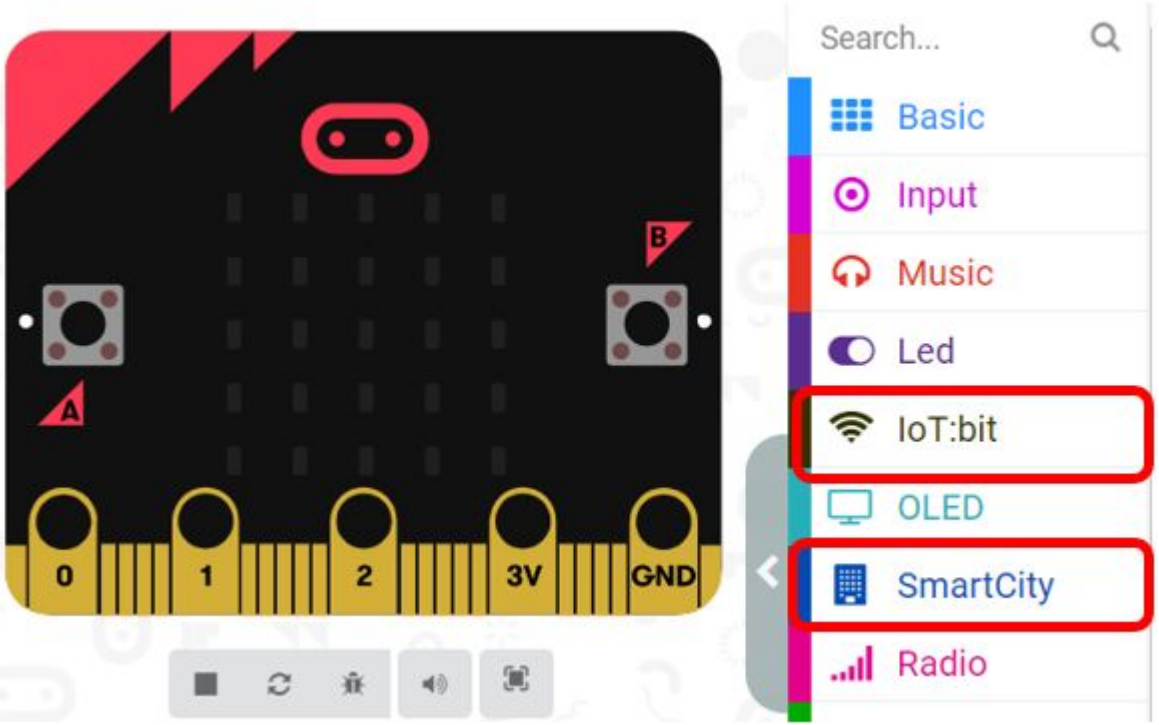
Give the project a name.



Click “  and choose “Extensions” in the pull-down menu.

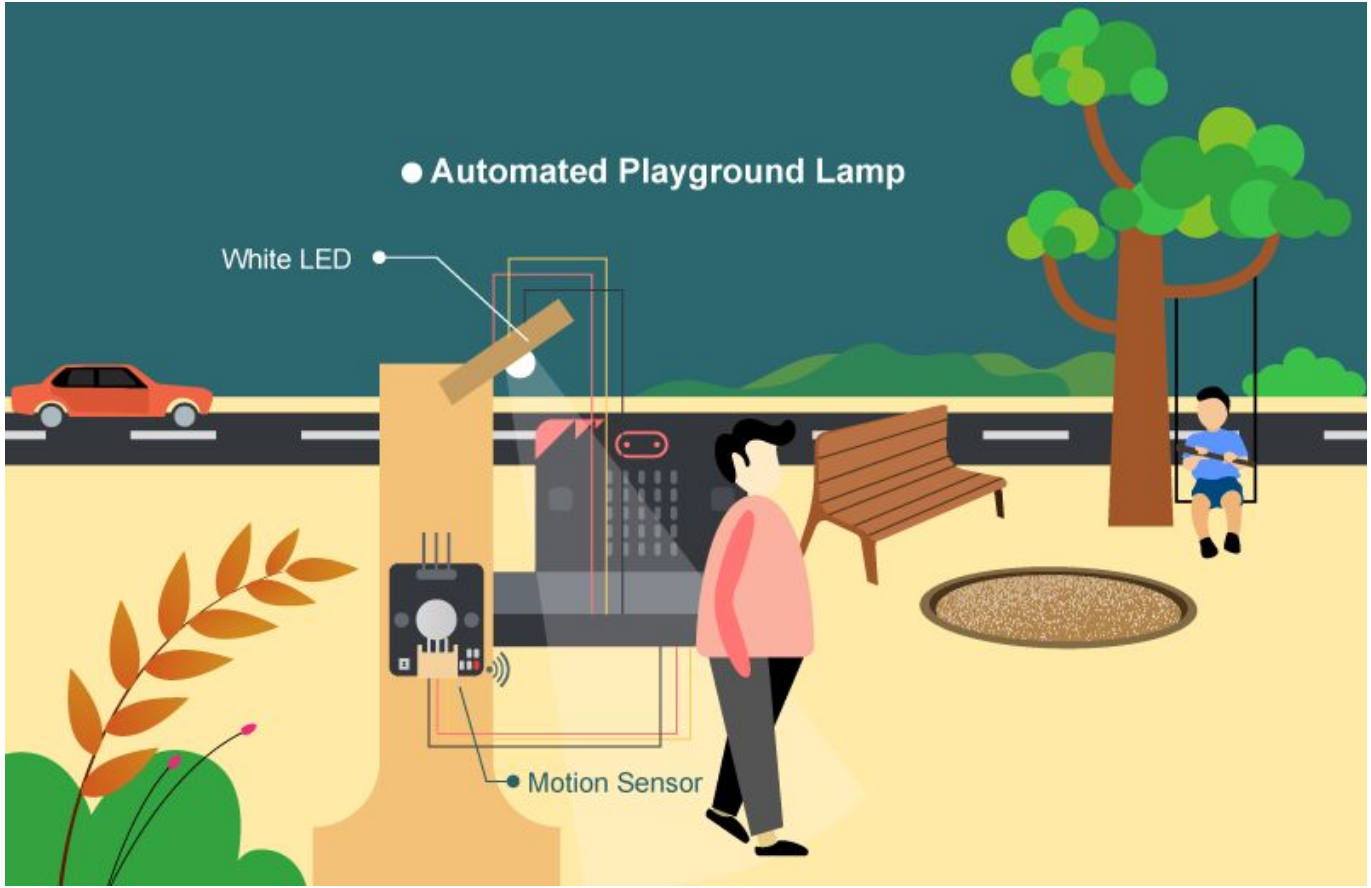


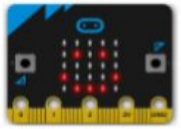
Search “https://github.com/smarthon/pxt-smartcity” and click “smartcity”



You should see “IoT:bit” and “SmartCity” extensions.

4. Building a Smart Lamp


Automated Playground Lamp
White LED
Motion Sensor



micro:bit (1)



IoT:bit (1)



White LED Light (1)



Motion Sensor (1)



3-pin module wire (2)



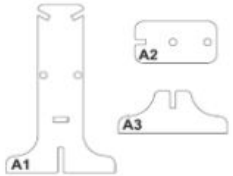
M4*10mm Screw (4)



M4*10mm Nut (4)



Screwdriver (1)

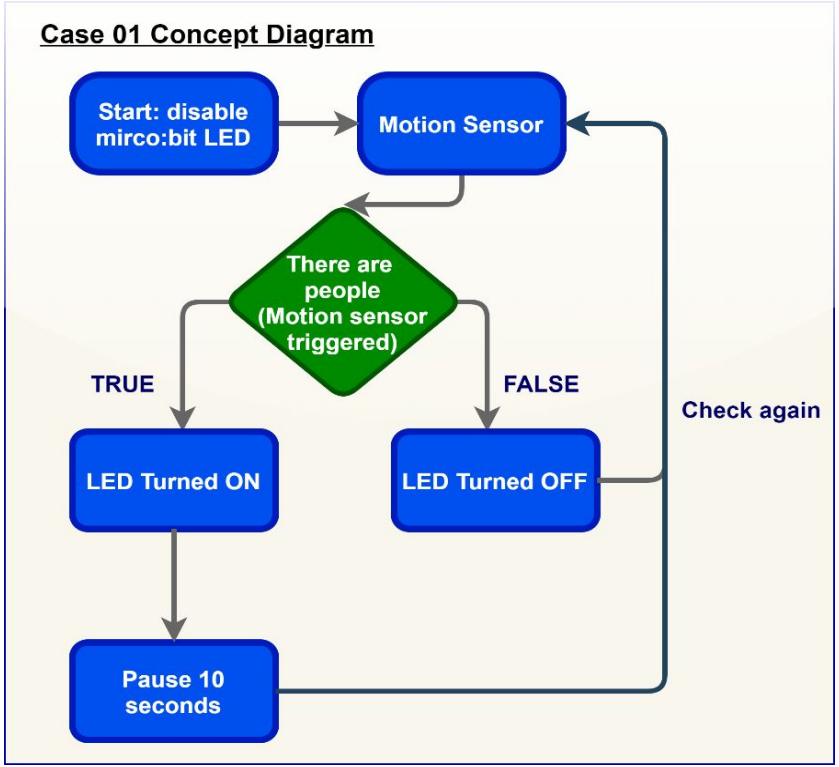


A1-A3 Model (1)

Parts List

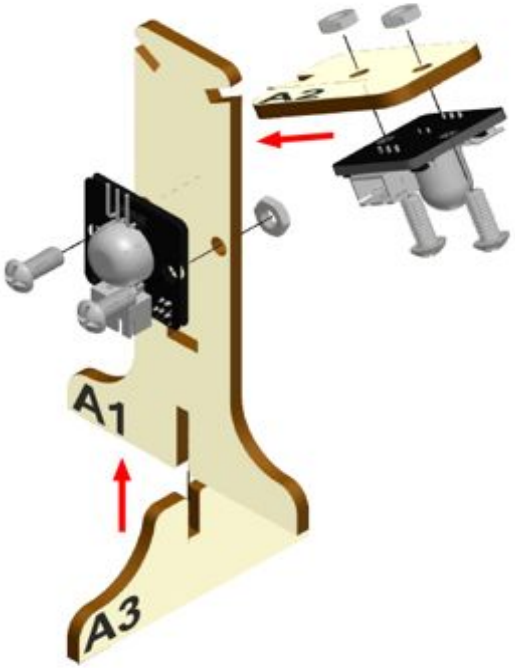
Smart Lamp

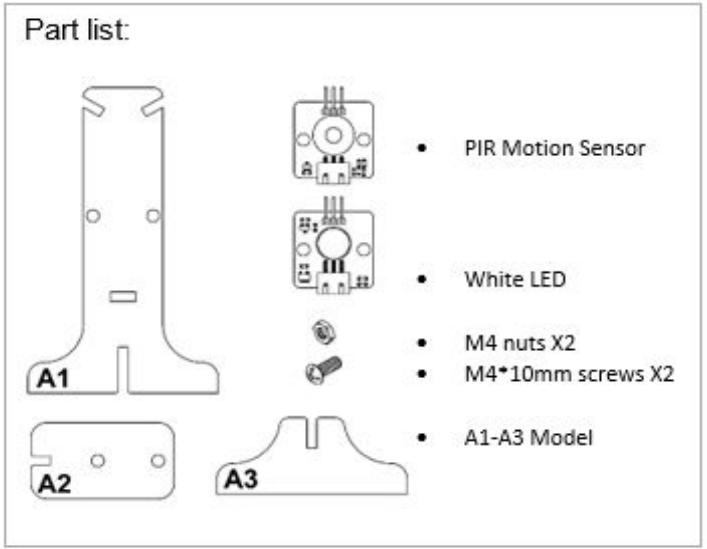
- Task
  - Make a smart playground lamp by detecting the motion nearby.
- What is a smart playground lamp?
  - Smart playground lamps can be opened automatically when someone passes by. When no one passes by, the light will be turned off automatically to save electricity.
- Smart playground lamp operation
  - Motion sensor is used to detect if there are people moving in the playground.
  - If there are people moving in the playground, the LED light will be turned on, vice versa.



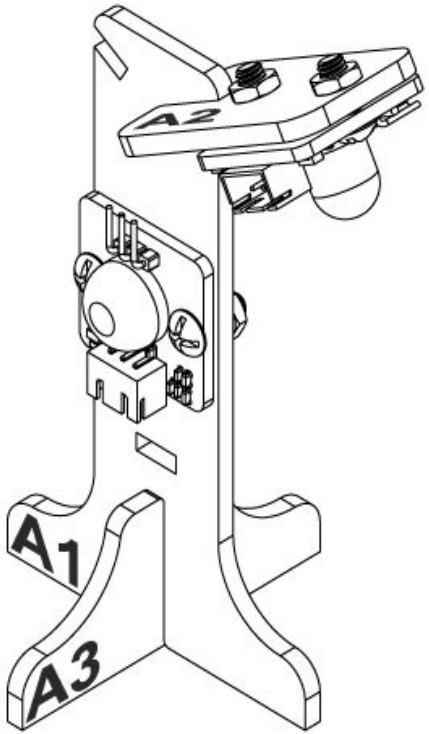
Concept Diagram

Model Assembly



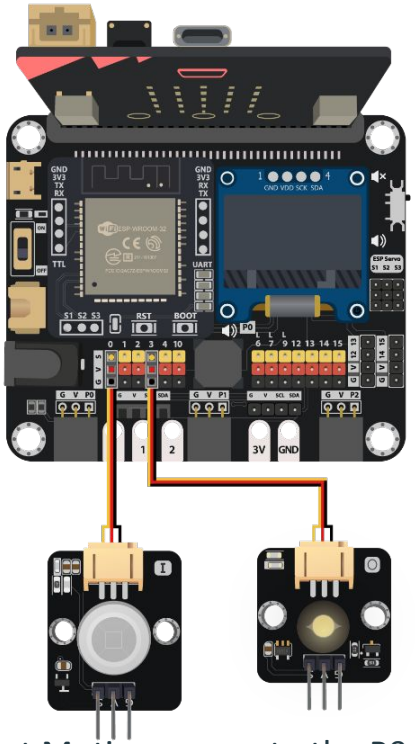


Step 1. Attach motion sensor and white LED to A1 model with M4 * 10mm screws and nuts.



Step 2. Assembly completed!

Hardware Connection



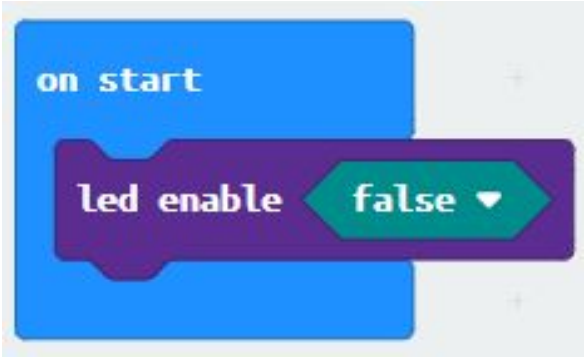
1. Connect Motion sensor to the P0 port of IoT:bit
2. Connect LED light to the P3 port of IoT:bit

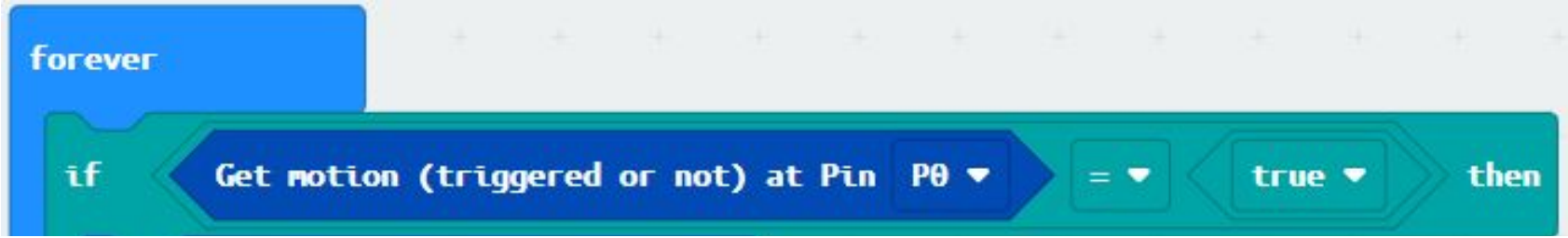
Programming

Step 1. Disable micro:bit LED.

Snap `led enable false` to `on start` Drag on start block from Basic. set Led enable is false (as P3 is used for micro:bit LED by default, LED needs to be disable before using P3)

Note that when P3 is used as LED in default setting, LED needs to be disabled.



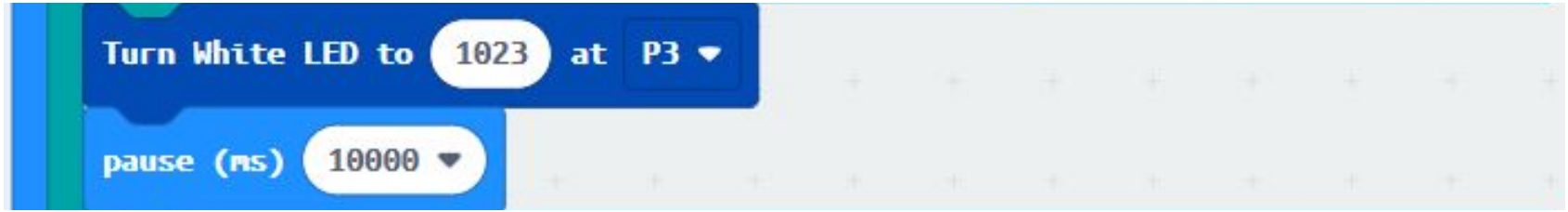


Step 2. Turn on LED by motion sensor

Drag `forever` block from `Basic`.

Snap `if statement` into `forever`.

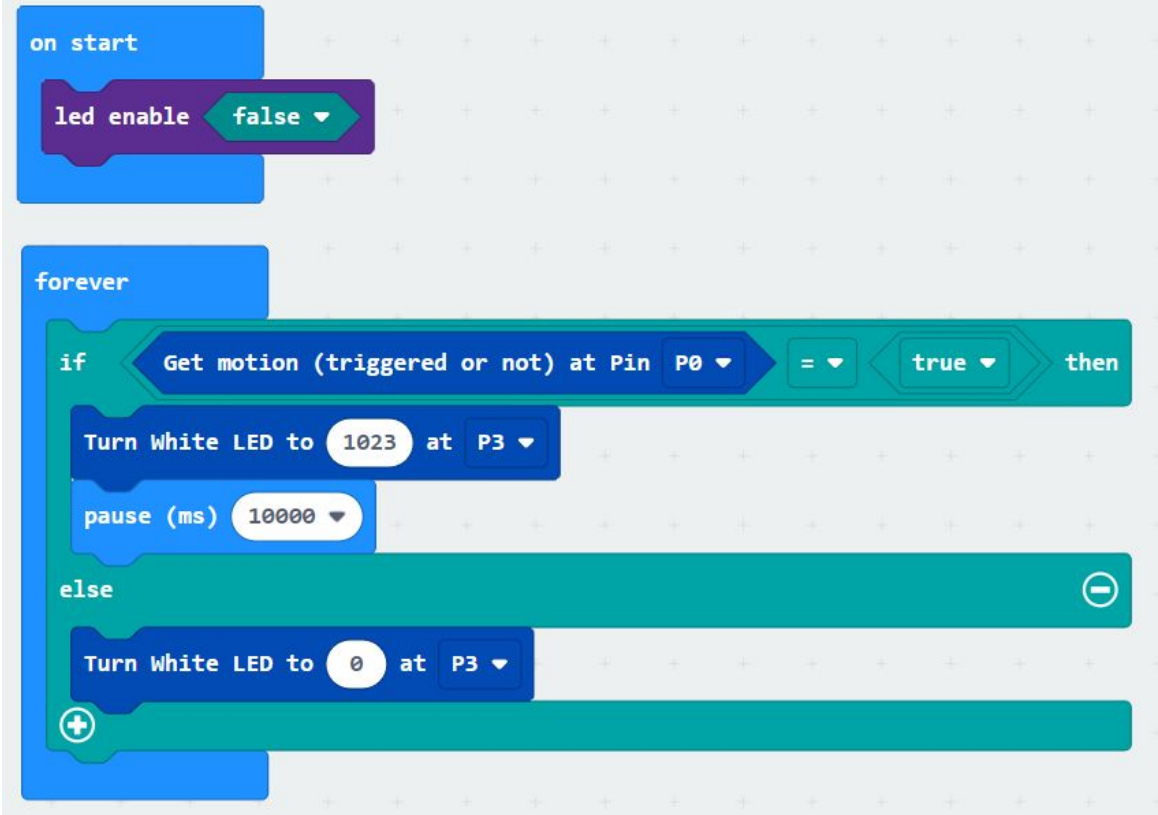
Set `get motion (triggered or not) at P0 = true` as condition of `if statement` which when motion is true there is someone passing by.



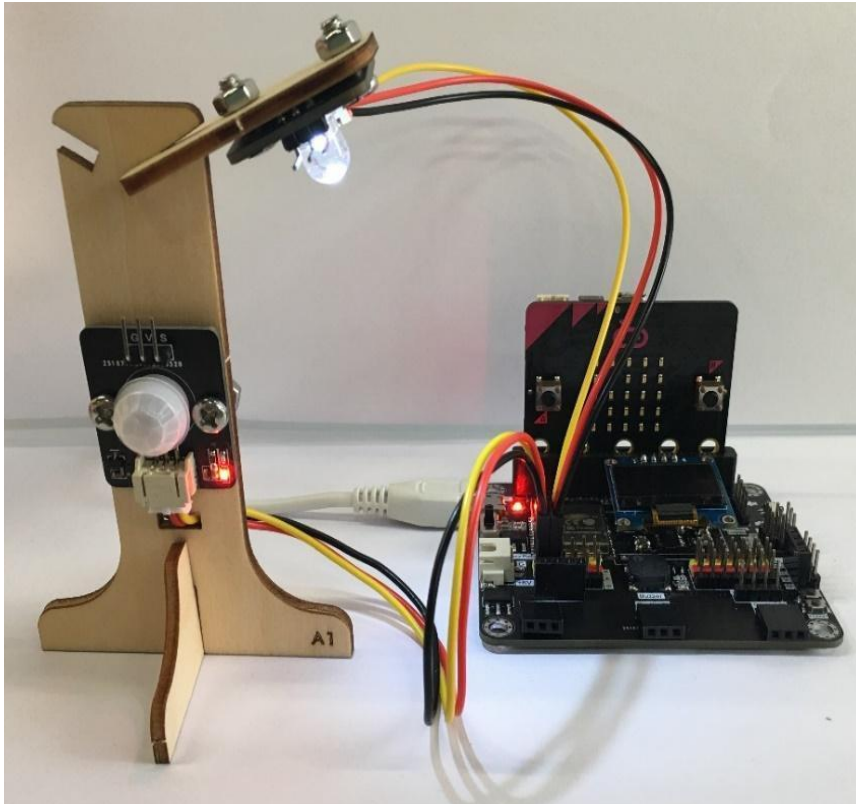
Step 3. Turn white LED to 1023 at P3 as turning on white LED and pause 10 seconds.



Step 4. Else, turn white LED to 0 at P3 as turning off white LED.



Final Program



The final result

(2) Smart Home IoT Maker Kit

Smarthon Smart Home IoT Maker Kit for Micro:bit

1. Suitable for P2 – S6 students (GE, Information Technology etc)
2. Building a Smart Home with Internet of Things (IoT) and programming
3. Includes 13 use cases, allowing students to create their own dream smart home
4. Specially designed for STEM group activities / courses



Automation:
Enable home device automation through the Internet of Things (IoT)



Energy Management
Use technology to reduce energy consumption

Security:
Use technology to monitor and protect home safety

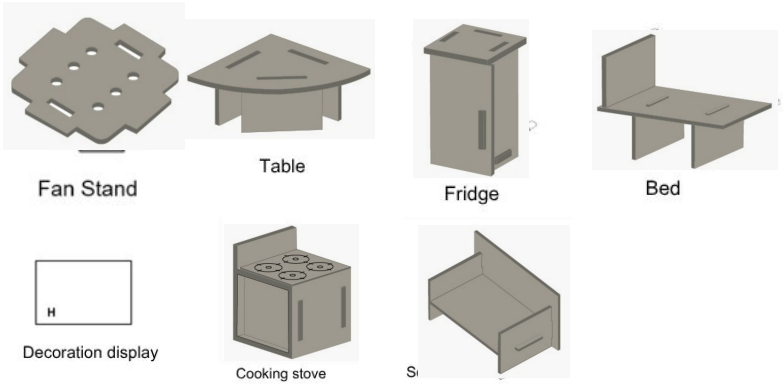
Health
Protect and improve people's health through monitoring technologies

Home Entertainment
Enrich the home entertainment experience

Internet of Things (IoT)
Connect and communicate with various devices through a network

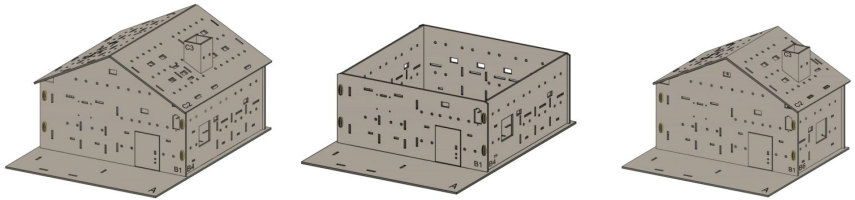
2. Built-In Home Models and Furniture

- Model included in the kit allows students to create their own smart home freely
  - 7 furniture models include sofa, table, cooking stove etc.





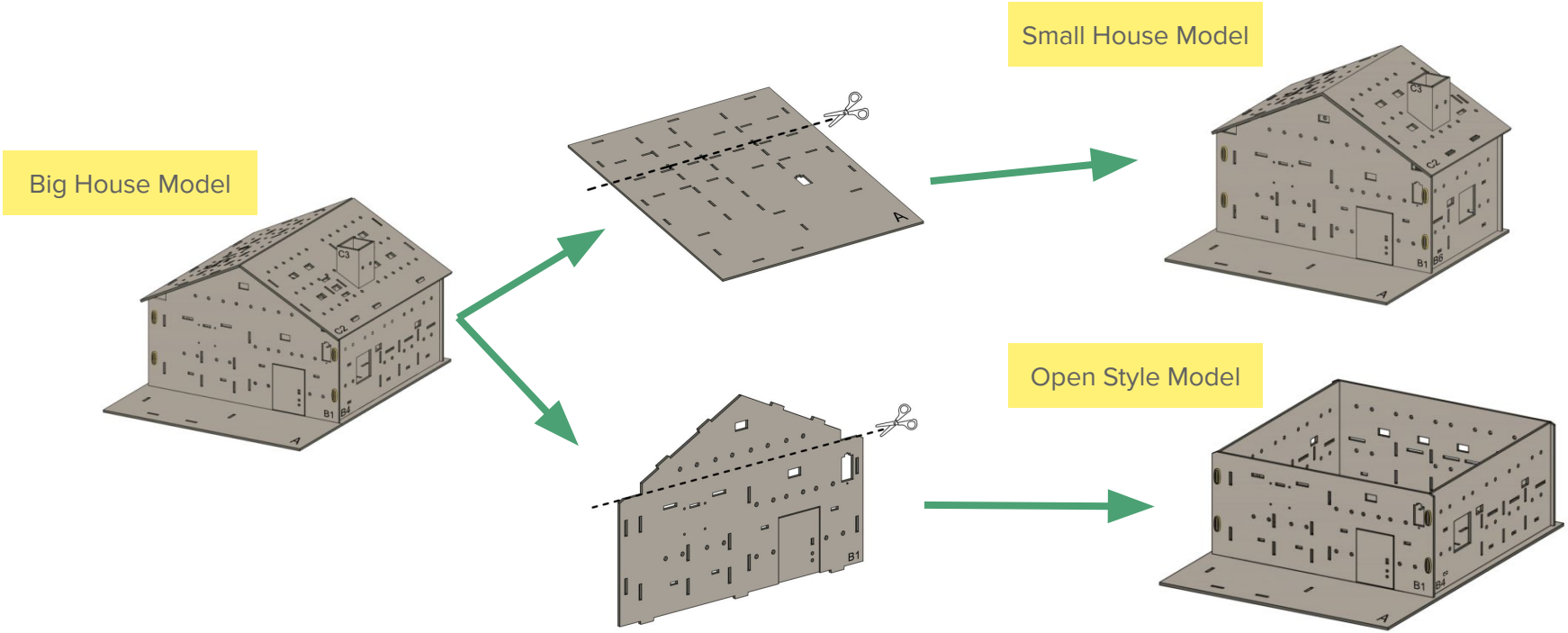
  - 1 house model that can be built in 3 styles



Big House Model | Open Style Model | Small House Model

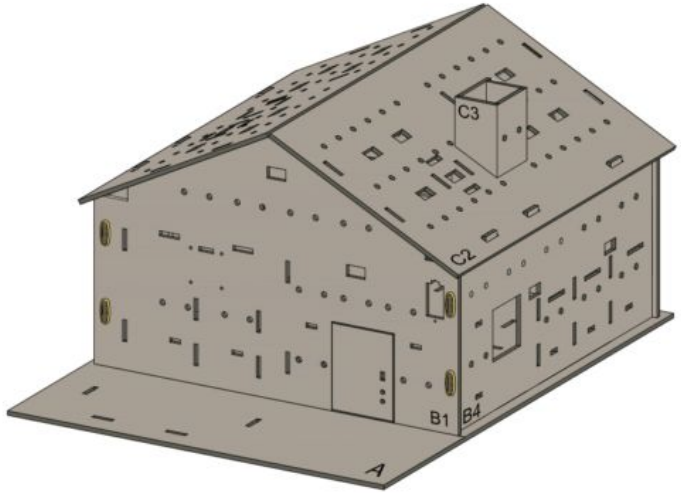
2A. 3 Styles of Home Model

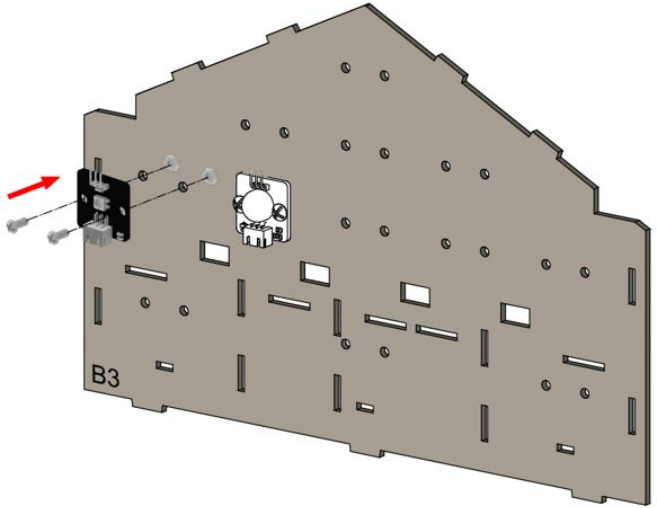
- 3 types of home can be created from the provided model



2B. High Flexibility

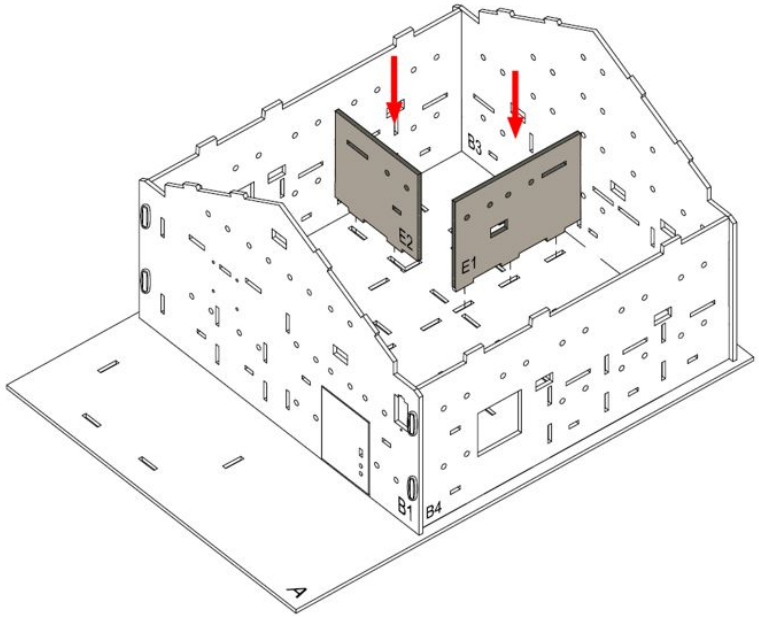
- Students can freely install sensors on various parts of the house models
    - Sensors can be installed at different heights and positions on the walls in various rooms

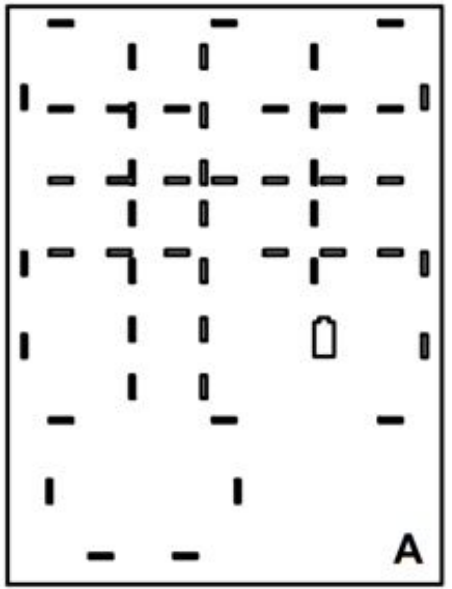




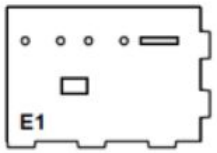
2C. Room Partition

- Students can freely build rooms on different parts of the house models



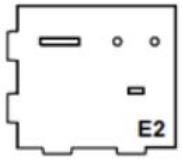


House Model: Part Code E - Interior Wall



E1 Model (1)
[Long Sensor Wall]

2 Sensors + Motor Stand



E2 Model (1)
[Short Sensor Wall]

1 Sensor + Motor Stand



Model E3 (1)
[Long Sensor Wall]

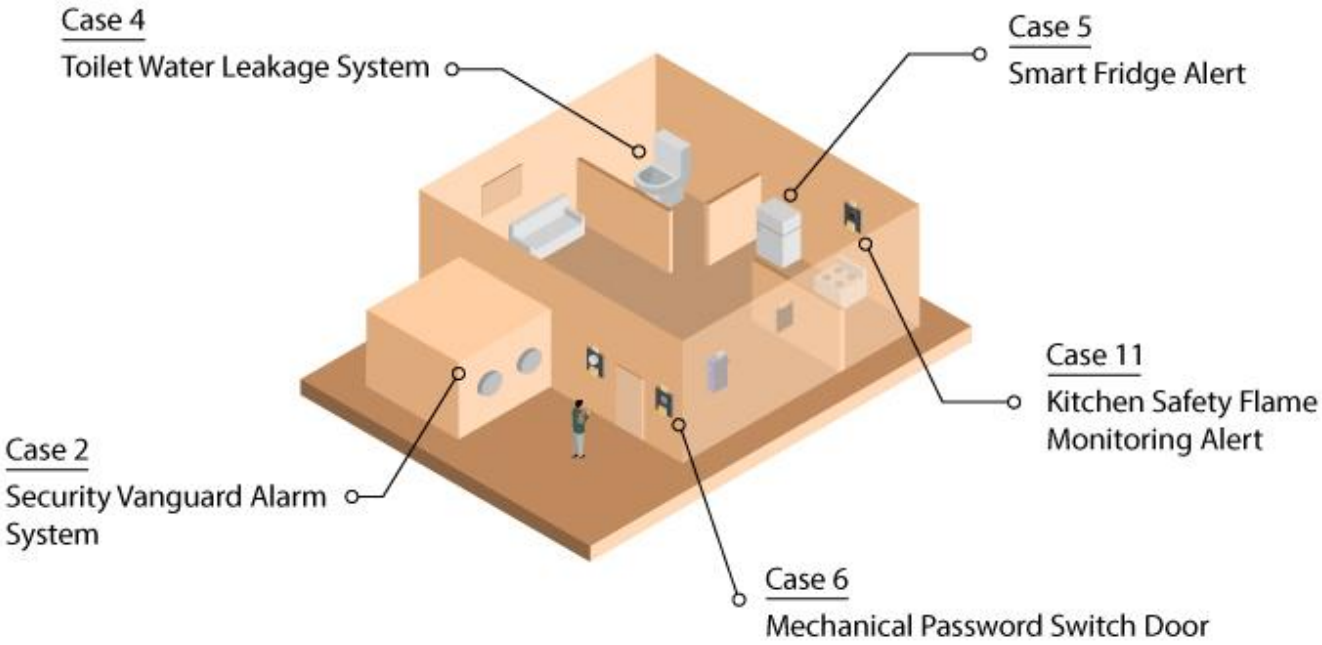
1 Display



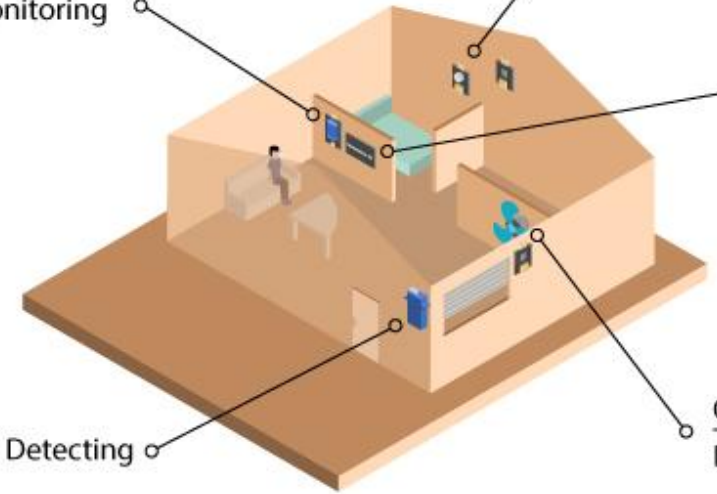
Model E4 (1)
[Sensor Display Wall]

1 Sensor + 1 Display

Housing Safety and Security



Environmental Health Living



Case 1
Smart Saving Light Bulb

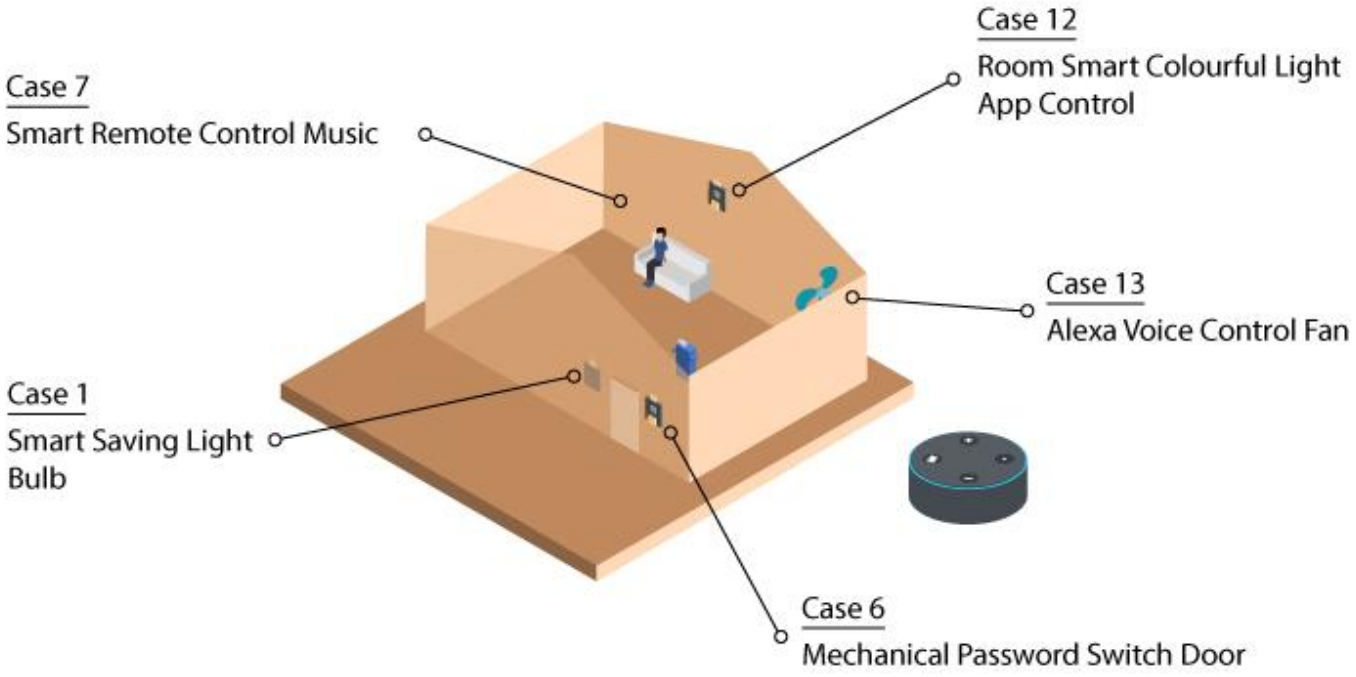
Case 10
Home Health Data Monitoring

Case 9
Smart Digital Morning Clock

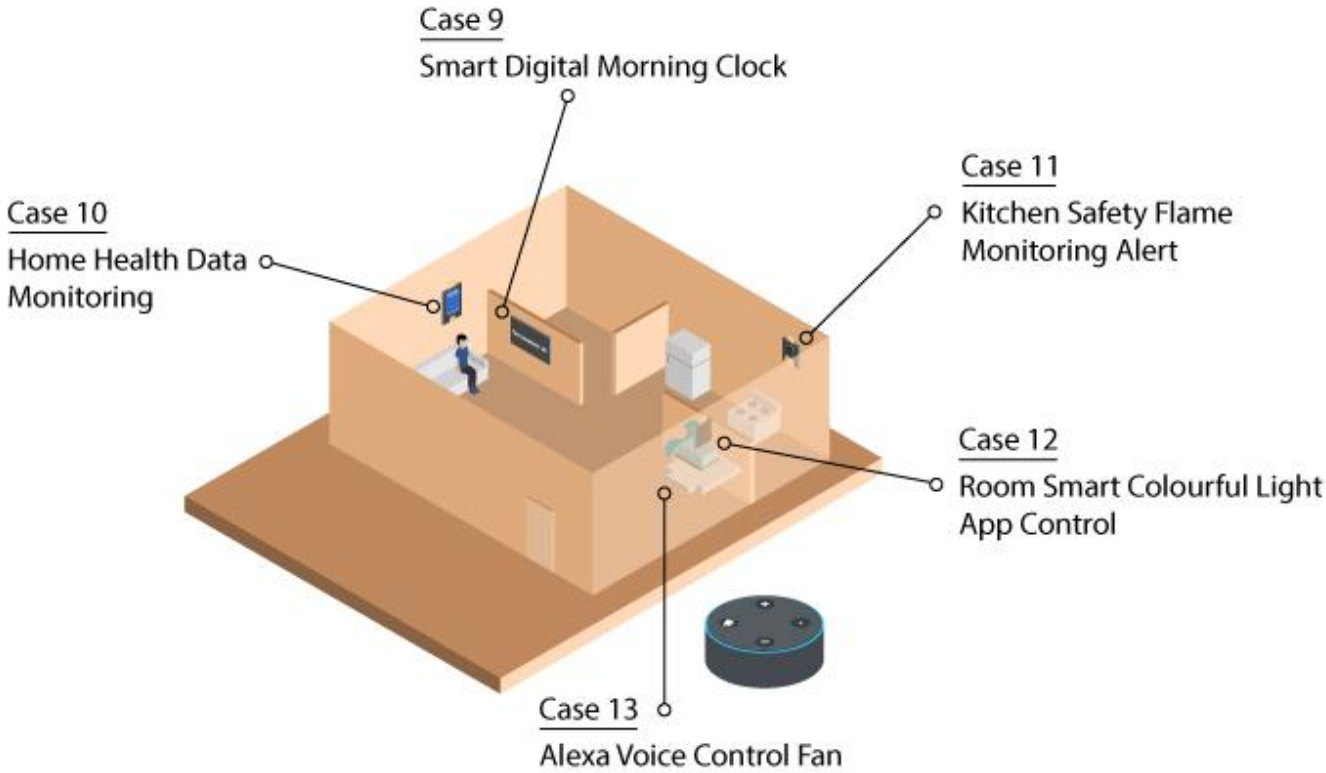
Case 8
Automatic Sunlight Detecting Curtain

Case 3
Environmental Motor Fan

Relaxing Home Automation

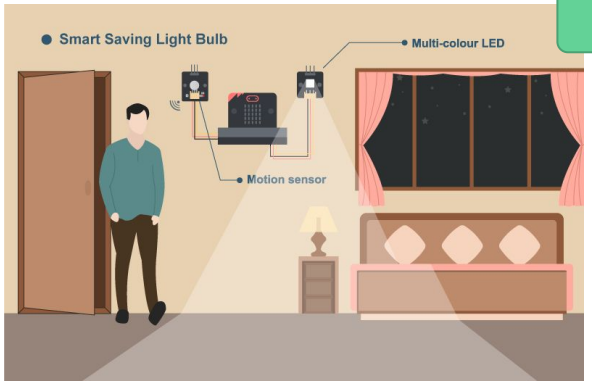


Smart IOT Intelligent Home



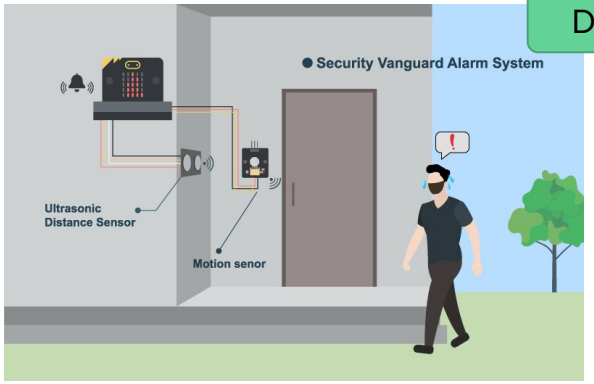
Energy Management

Room



Case 01: Smart Saving Light Bulb

Door

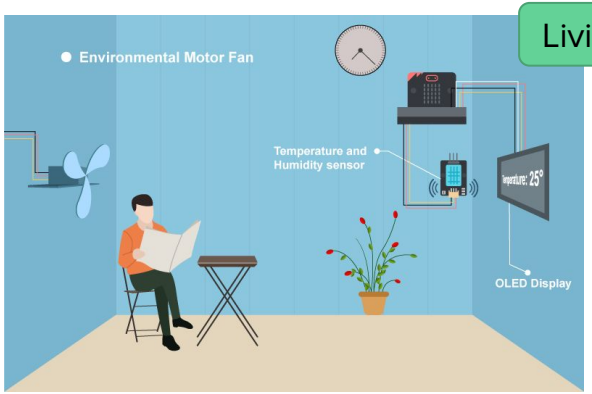


Case 02: Security Vanguard Alarm System

Security

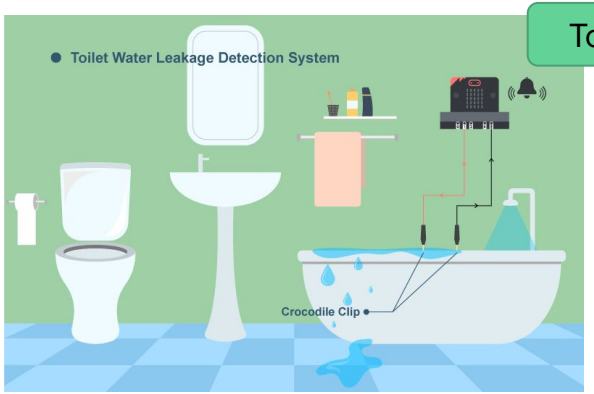
Energy Management

Living Room



Case 03: Environment Motor Fan

Toilet

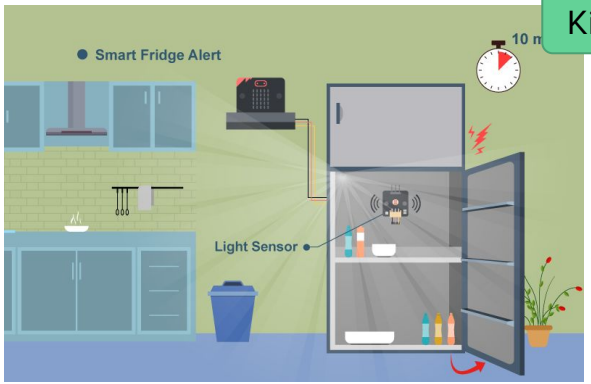


Case 04: Toilet Water Leakage Detection System

Security

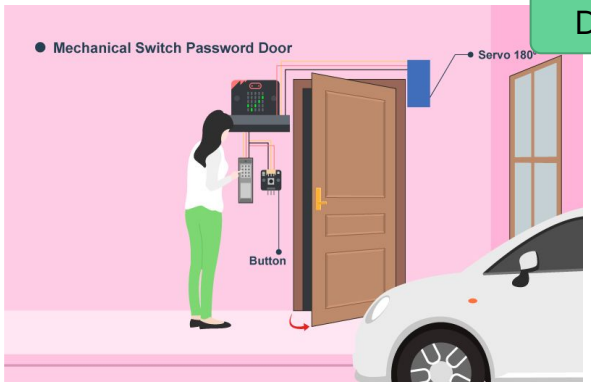
Energy Management

Kitchen



Case 05: Smart Fridge Alert

Door



Case 06: Mechanical Switch Password Door

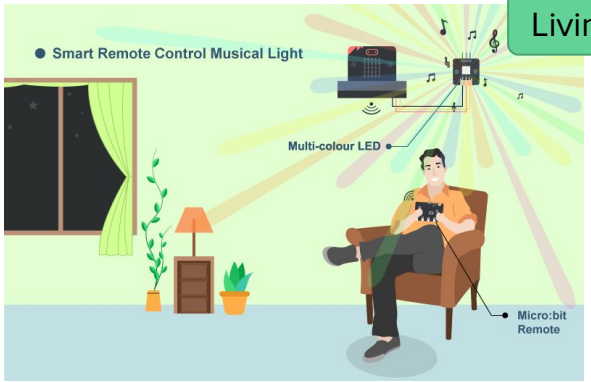
Security

Automation

Entertainment

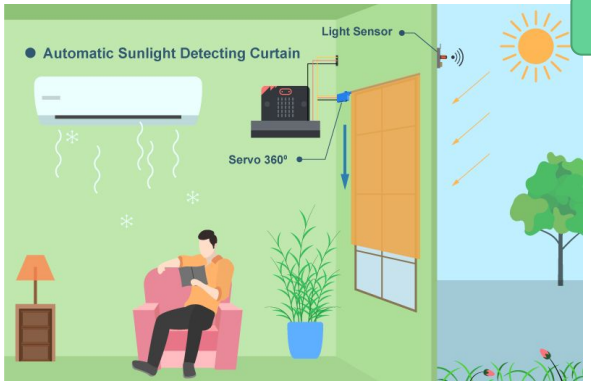
Automation

Living Room



Case 07: Smart Remote Control Musical Light

Living Room



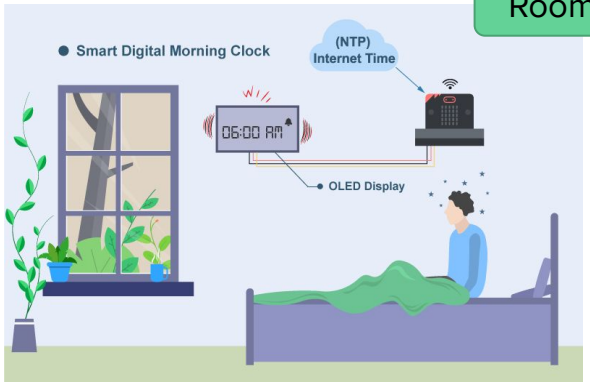
Case 08: Automatic Sunlight Detecting Curtain

Energy Management

Personal Wellness

Internet of Things (IoT)

Room



Case 09: Smart Digital Morning Clock

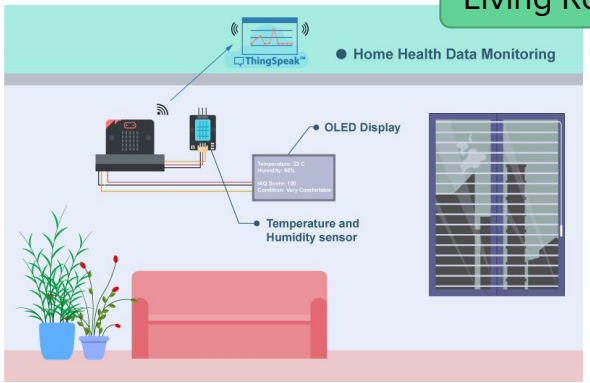
1

NTP - Time Synchronization

Personal Wellness

Internet of Things (IoT)

Living Room



Case 10: Home Health Data Monitoring

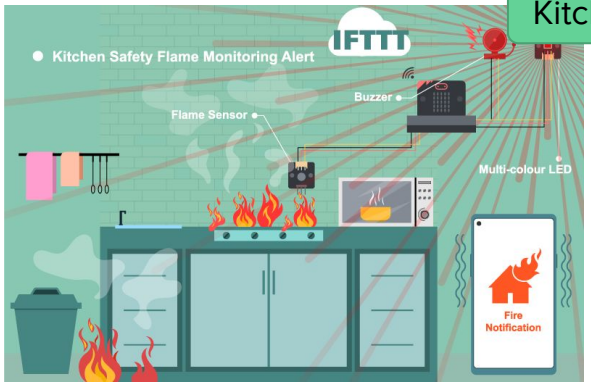
2

ThingSpeak

Security

Internet of Things (IoT)

Kitchen



3

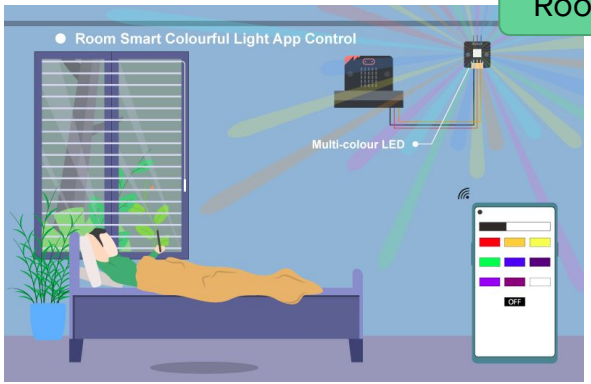
IFTTT

Case 11: Kitchen Safety Flame Monitoring Alert

Personal Wellness

Internet of Things (IoT)

Room



4

MIT APP INVENTOR

Case 12: Room Smart Colourful Light App Control

Internet of Things (IoT)

Automation



Case 13: Smart Fan Voice Control

5

IFTTT

6

Voice Assistant - Voice Control

Case 01: Smart Saving Light Bulb

Home Automation

A home automation system is a system that integrates and controls household appliances and devices through a network. Examples include security systems, heating and air-conditioning systems, video systems, and audio systems.

After receiving information from connected devices, the home automation system can automatically execute preset commands to control appliances throughout the home. Users can also remotely control household devices at any time and access their real-time status and information through the system.



Home Automation – Examples

- Voice-Controlled Lights
- Scheduled On/Off Control for Appliances

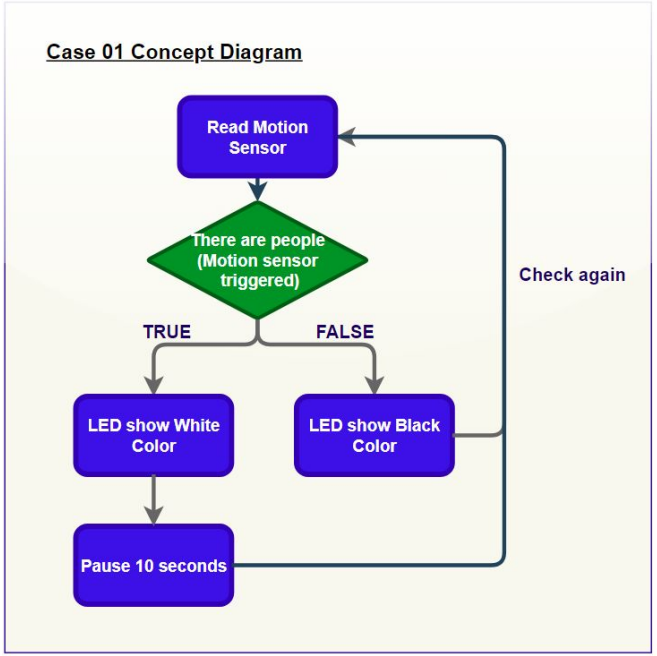


What is a Smart Light Bulb?

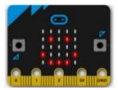
Smart light bulb is a smart light bulb that helps automation and saving electricity. When there is people coming in, the bulb will be turned on automatically. People always forget to turn off the light when he/she leave. After 10 mins, if there are no any motions inside the room, it will close the LED to save energy.

Smart Saving Light Bulb Principle

Motion sensor is used to detect the presence of human activity in the room. If there are people moving in the room, the light bulb will be turned on, vice versa.



Part List



micro:bit (1)



IoT:bit (1)



Multi-colour LED (WS2812) (1)



Motion Sensor (1)



3-pin module wire (2)



M4*10mm Screw (4)



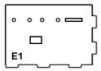
M4*10mm Nut (4)



Screwdriver (1)



Model A - C (1)
[Big House Model]



E1 Model (1)
[Long Sensor Wall]



E2 Model (1)
[Short Sensor Wall]



J1 Model (1)
[Bed]



J2 Model (1)
[Bed]

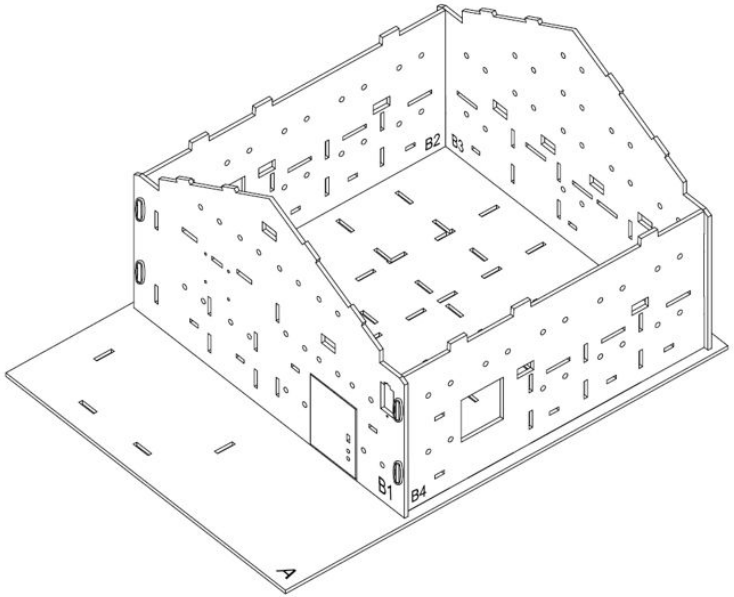


J3 Model (2)
[Bed]

Assembly step

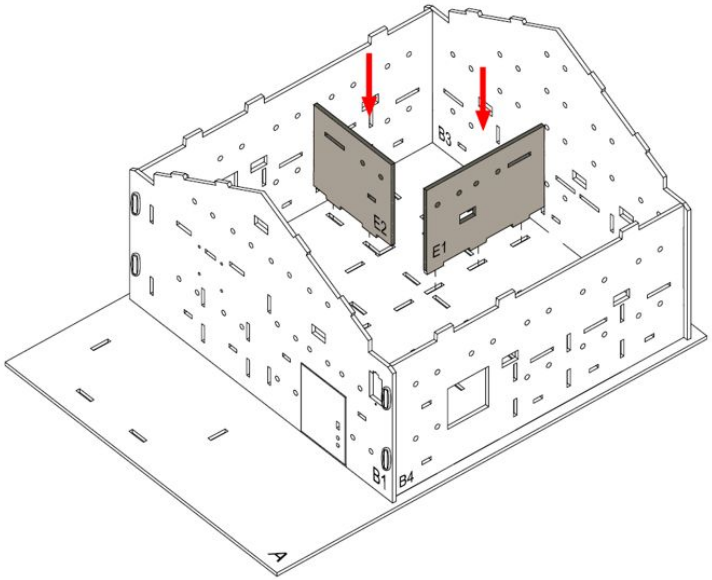
Step 1

tep 1. To start with, build the Big House Model.

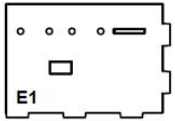


Step 2

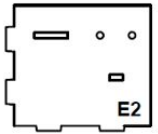
Pick one corner of the house. In this example, we pick the left upper corner, install the 2 walls (E1 & E2) to build a small room.



Part list:



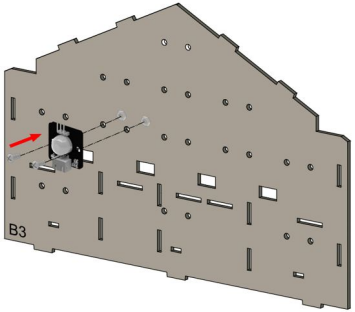
• Model E1

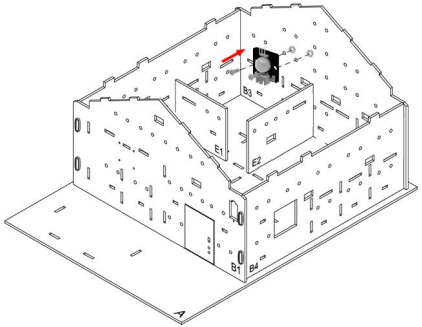


• Model E2

Step 3

Attach the PIR Motion Sensor to model B3 using M4 * 10mm screws and nuts.





Part list:



- PIR Motion Sensor



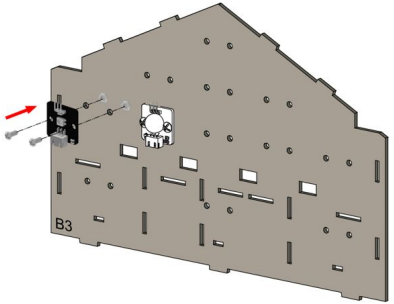
- M4 nut X2



- M4*10mm screw X2

Step 4

Attach the Multi-color LED to the model B3 using M4 * 10mm screws and nuts.



Part list:



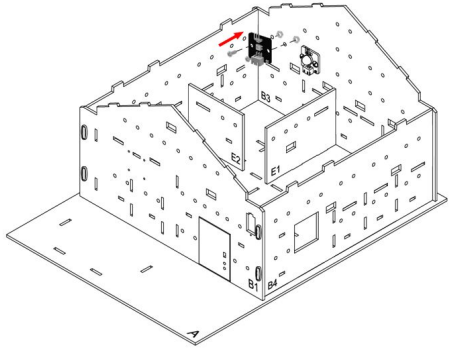
- Multi-color LED



- M4 nut X2

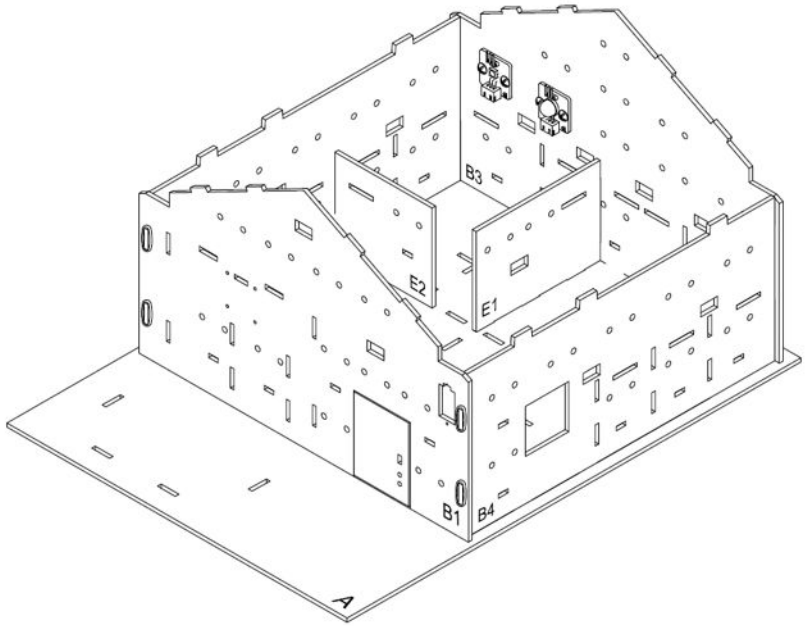


- M4*10mm screw X2



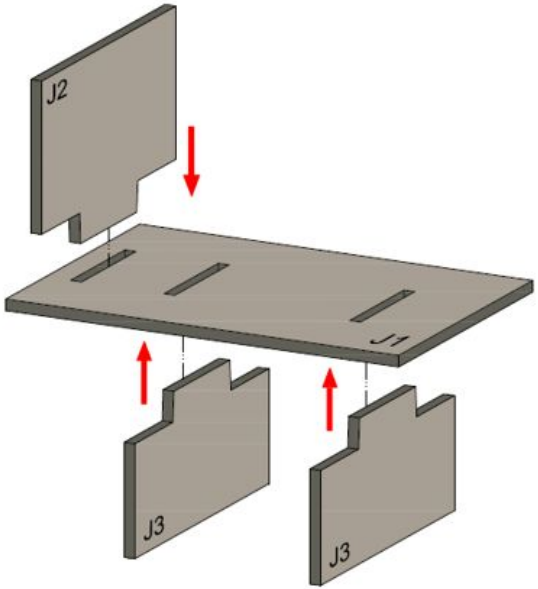
Step 5

Installation completed!

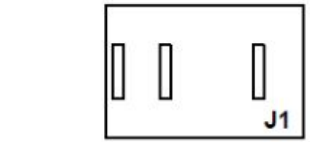


Step 6

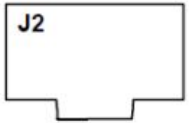
To build a Bed. Put model J2 onto the model J1, then put together all the cardboard parts (J1-J3).

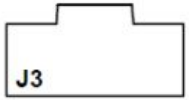


Part list:



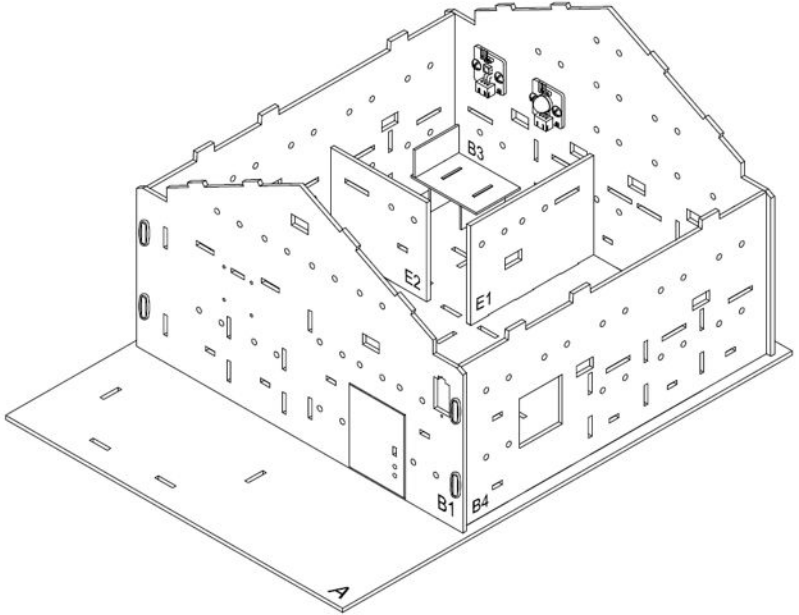
- Model J1 X1
- Model J2 X1
- Model J3 X2





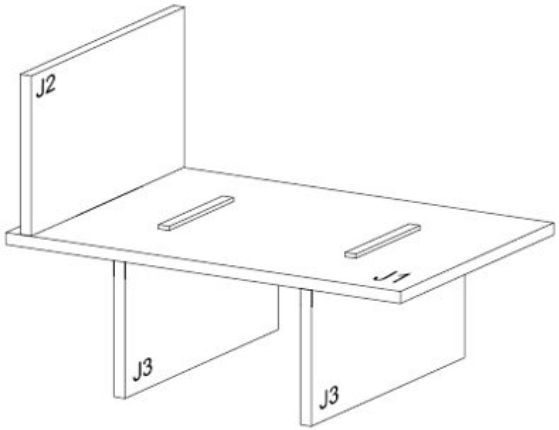
Step 9

Assembly completed!



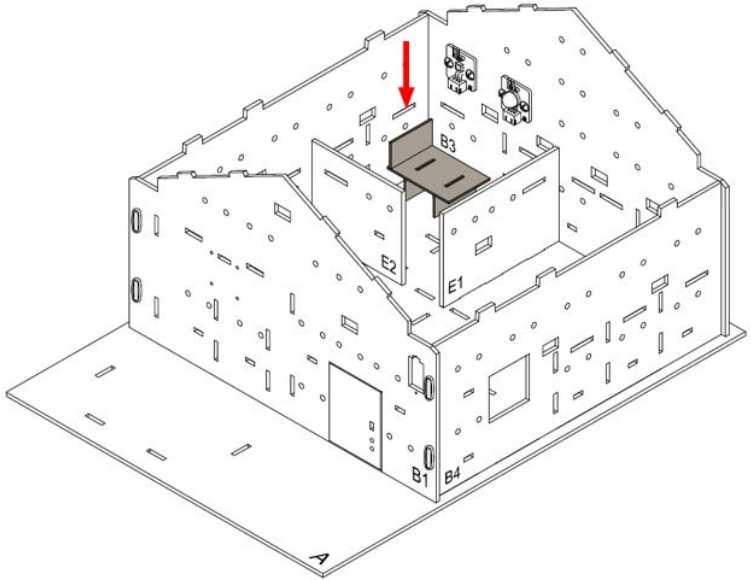
Step 7

The bed completed!

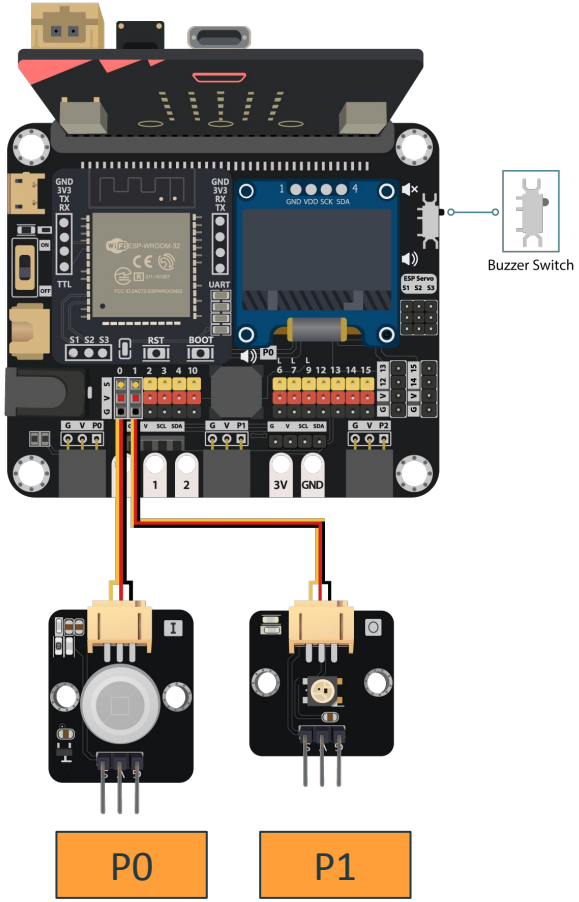


Step 8

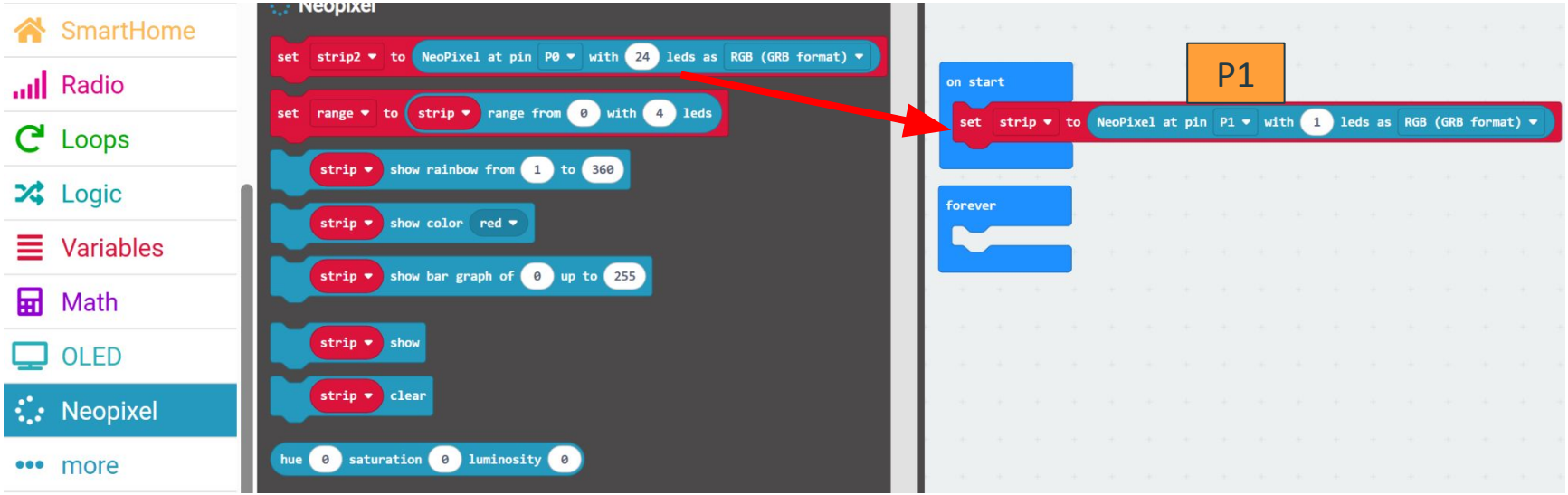
Place the bed inside the bedroom.

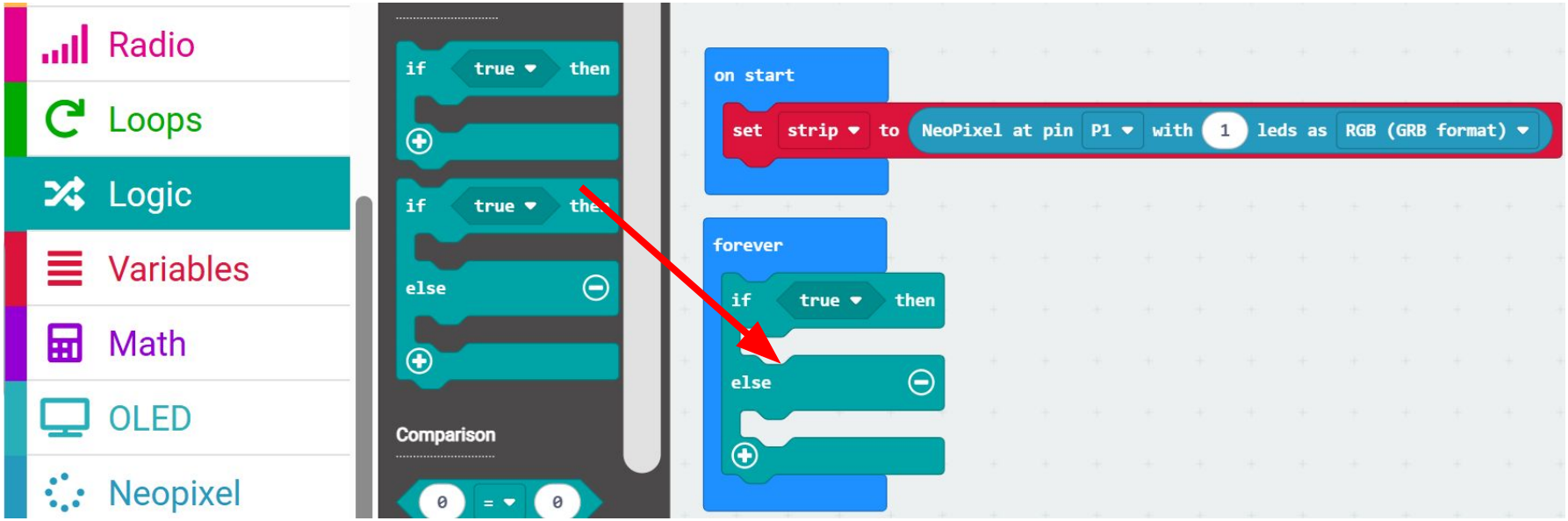


Hardware connect

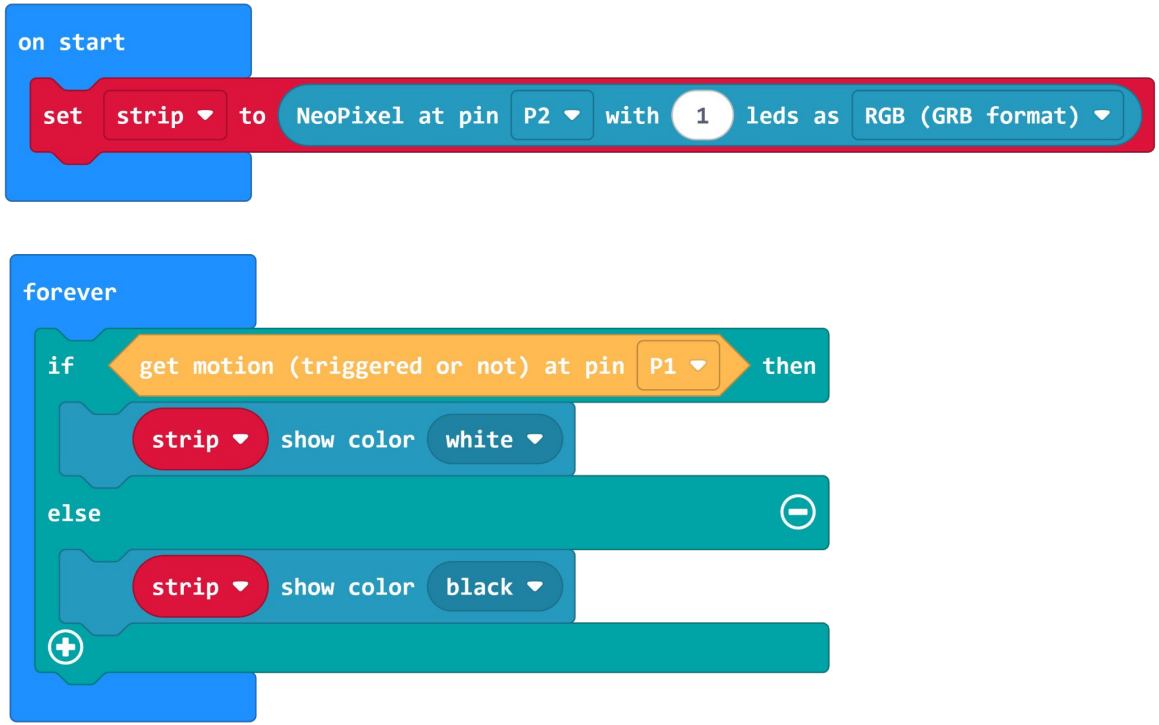

Buzzer Switch
P0
P1

Programming (MakeCode)


SmartHome
Radio
Loops
Logic
Variables
Math
OLED
Neopixel
more
Neopixel
set strip2 to NeoPixel at pin P0 with 24 leds as RGB (GRB format)
set range to strip range from 0 with 4 leds
strip show rainbow from 1 to 360
strip show color red
strip show bar graph of 0 up to 255
strip show
strip clear
hue 0 saturation 0 luminosity 0
P1
on start
set strip to NeoPixel at pin P1 with 1 leds as RGB (GRB format)
forever


Radio
Loops
Logic
Variables
Math
OLED
Neopixel
if true then
if true then
else
Comparison
0 = 0
on start
set strip to NeoPixel at pin P1 with 1 leds as RGB (GRB format)
forever
if true then
else

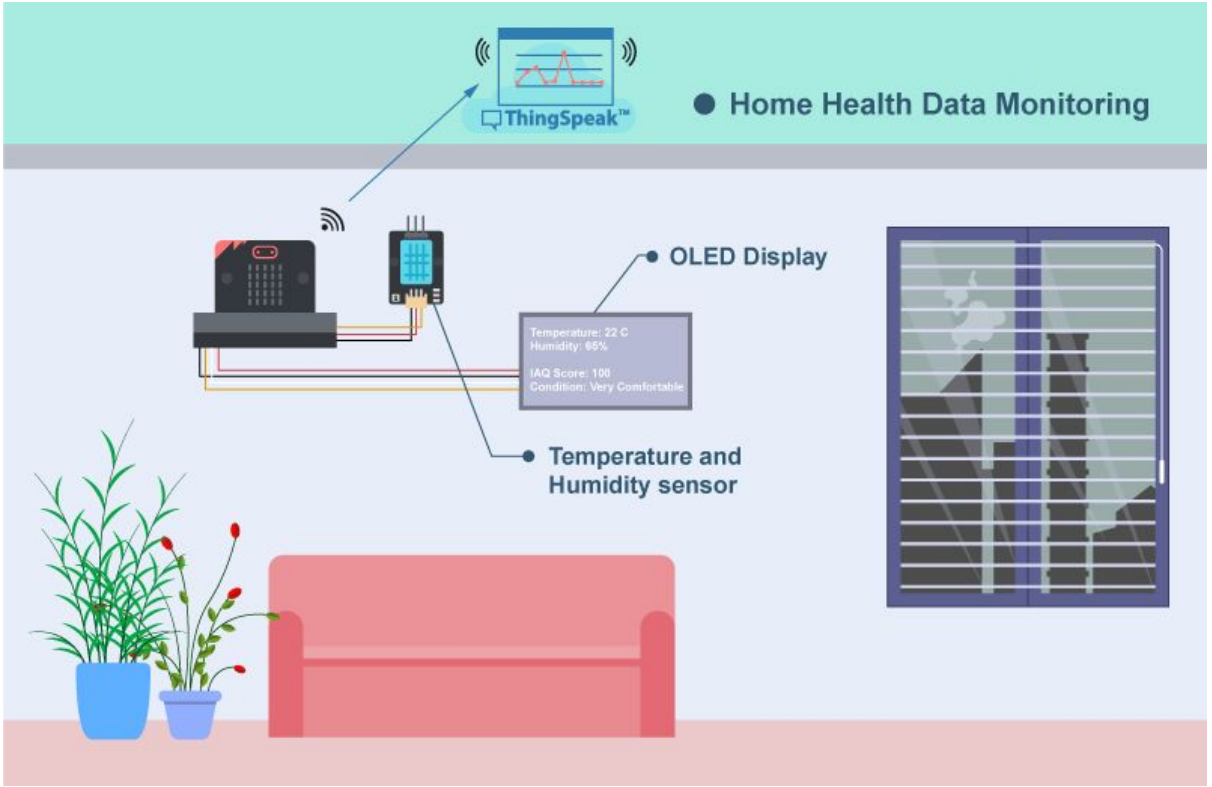
Final Programming



https://makecode.microbit.org/_K34gL5h0sgqd

IoT Case 10: Home Health Data Monitoring

IoT Case 10: Home Health Data Monitoring



Goal

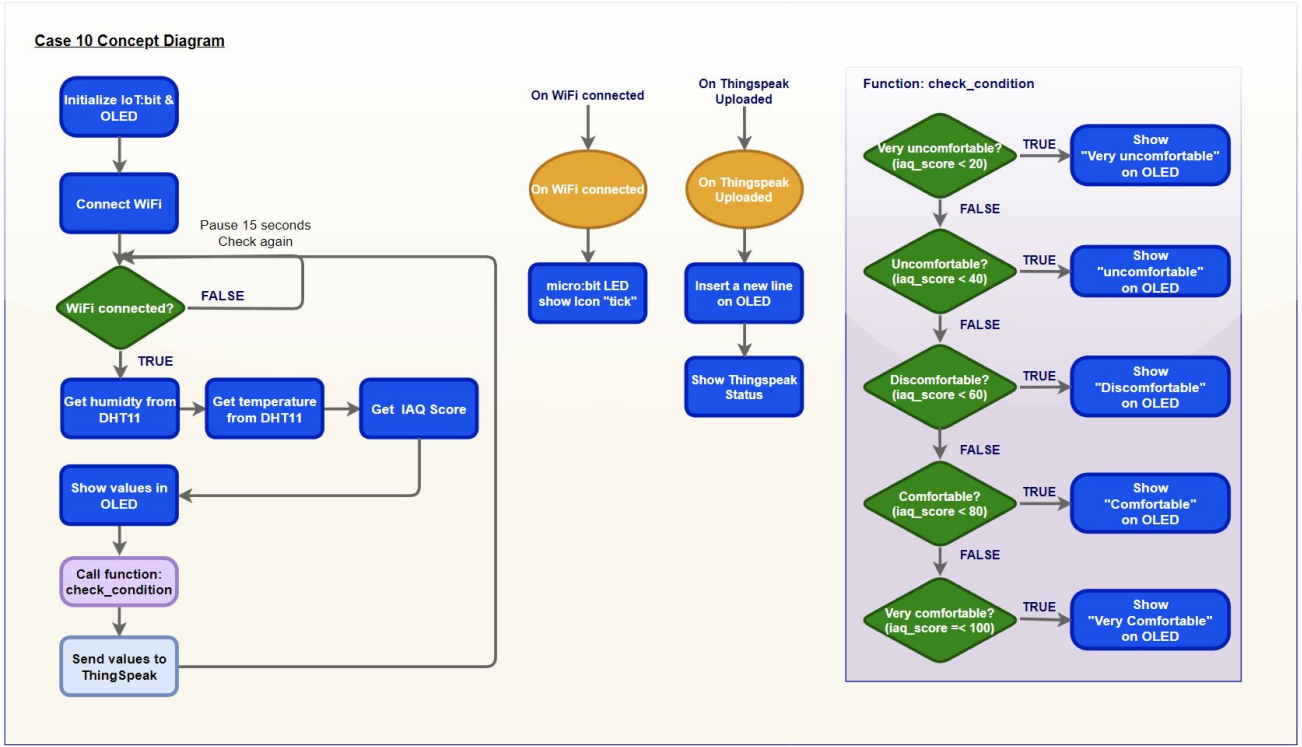
- Make a home health data monitoring system by collecting data from the sensors inside the house. Also use the temperature and humidity value to calculate the IAQ Score as reference.

What is home health data monitoring syste?

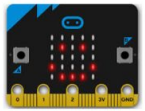
Health monitoring is the concept of tracking the conditions of different parameters inside the user’s house. For indoor, the important parameters to analyze the home comfortability are temperature, humidity, pm2.5, CO2 and VOC. In this system, we can base on temperature and humidity to measure the comfortability of the home. With the too high temperature or too low humidity will also affect the comfortability.

Home health monitoring system Principle

In this case, integrated temperature and humidity sensor DHT11 is used. It will keep track of room temperature, humidity and IAQ value, display to the OLED and upload to the Thingspeak platform for further analysis.



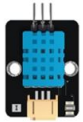
Part List



micro:bit (1)



IoT:bit with OLED (1)



Temperature and Humidity Sensor (1)



Screwdriver (1)



3-pin module wire (1)



4-pin extension wire (1)



M4*10mm Screw (2)



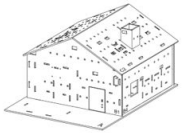
M4*10mm Nut (2)



M2*10mm Screw (4)



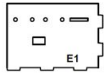
M2 Nut (4)



Model A - C (1)
[Big House Model]



Model E4 (1)
[Sensor Display Wall]



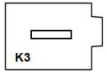
Model E1 (1)
[Long Sensor Wall]



Model K1 (1)
[Sofa]

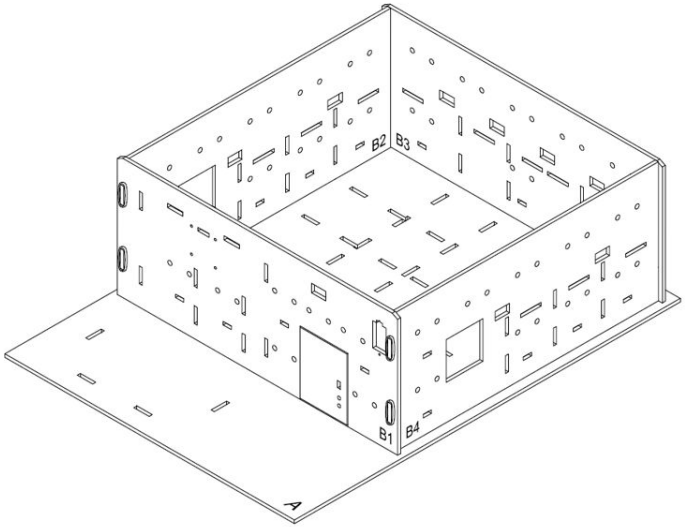


Model K2 (1)
[Sofa]

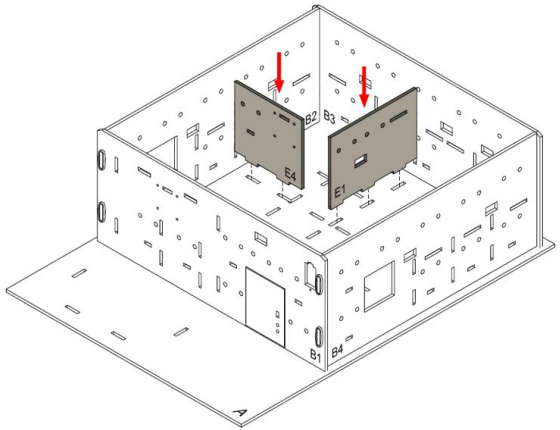


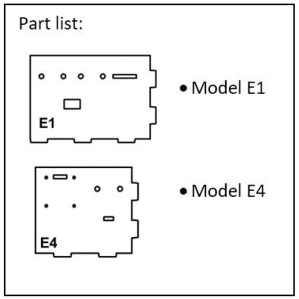
Model K3 (2)
[Sofa]

Assembly step

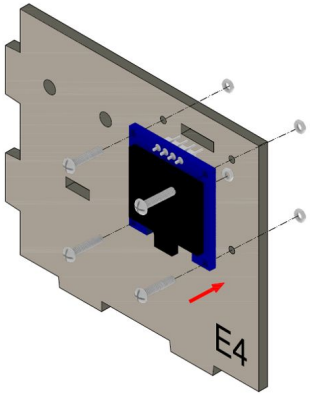


In this case, “Open Style Model” is used as a home base to start with.





Put the model E4 & E1 onto model A, align with holes at model A, B2 and B3.



Part list:



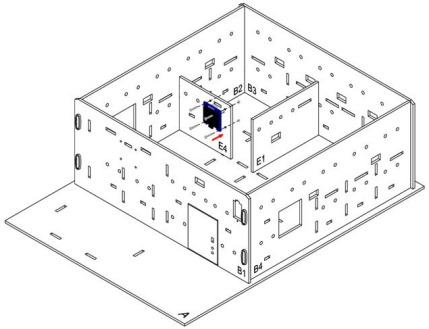
• OLED Display



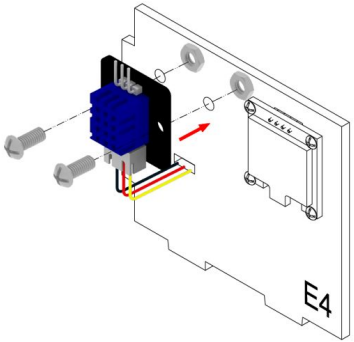
• M2 nut X4



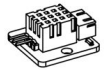
• M2*10mm screw X4



Attach the OLED display onto model E4 using M2 * 10mm screws and nuts.



Part list:



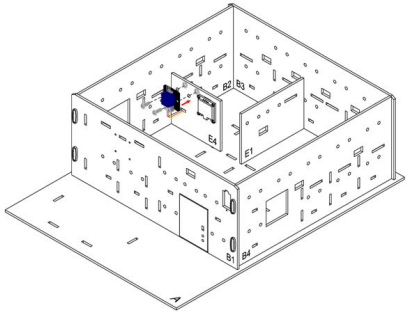
• Temperature and Humidity Sensor



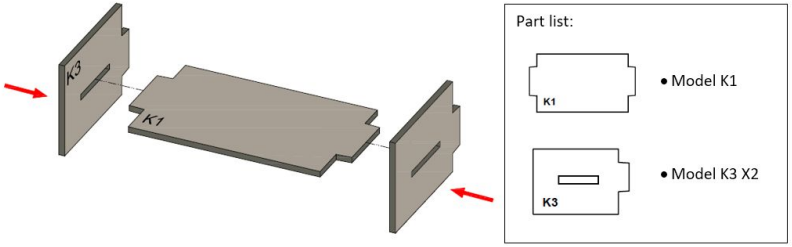
• M4*10mm screw X2



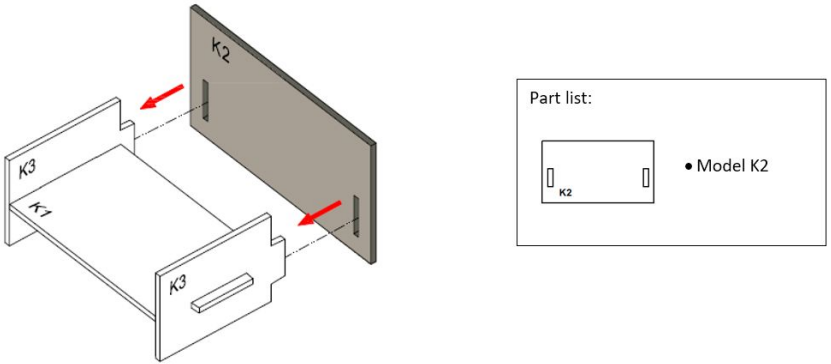
• M4 nut X2



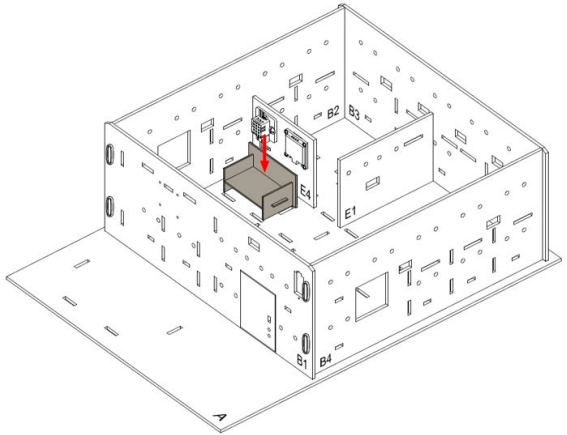
Attach the DHT11 temperature and humidity sensor onto model E4 using M4 * 10mm screws and nuts. And the connecting wire should be bended to the hole below it.



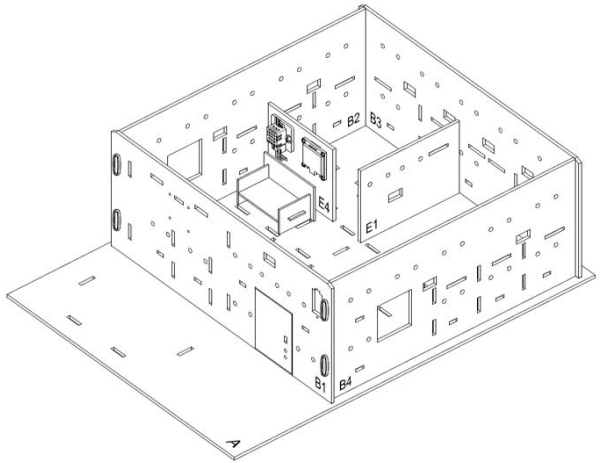
To build a sofa model. Put the model K3 to the two sides of model K1.



Put model K2 all together to the cardboard parts (K1-K3).

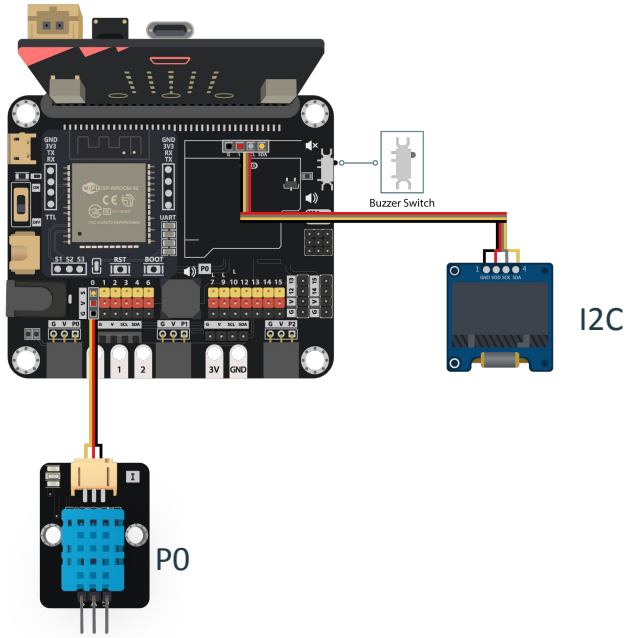


Plase the sofa model behind the model E4.



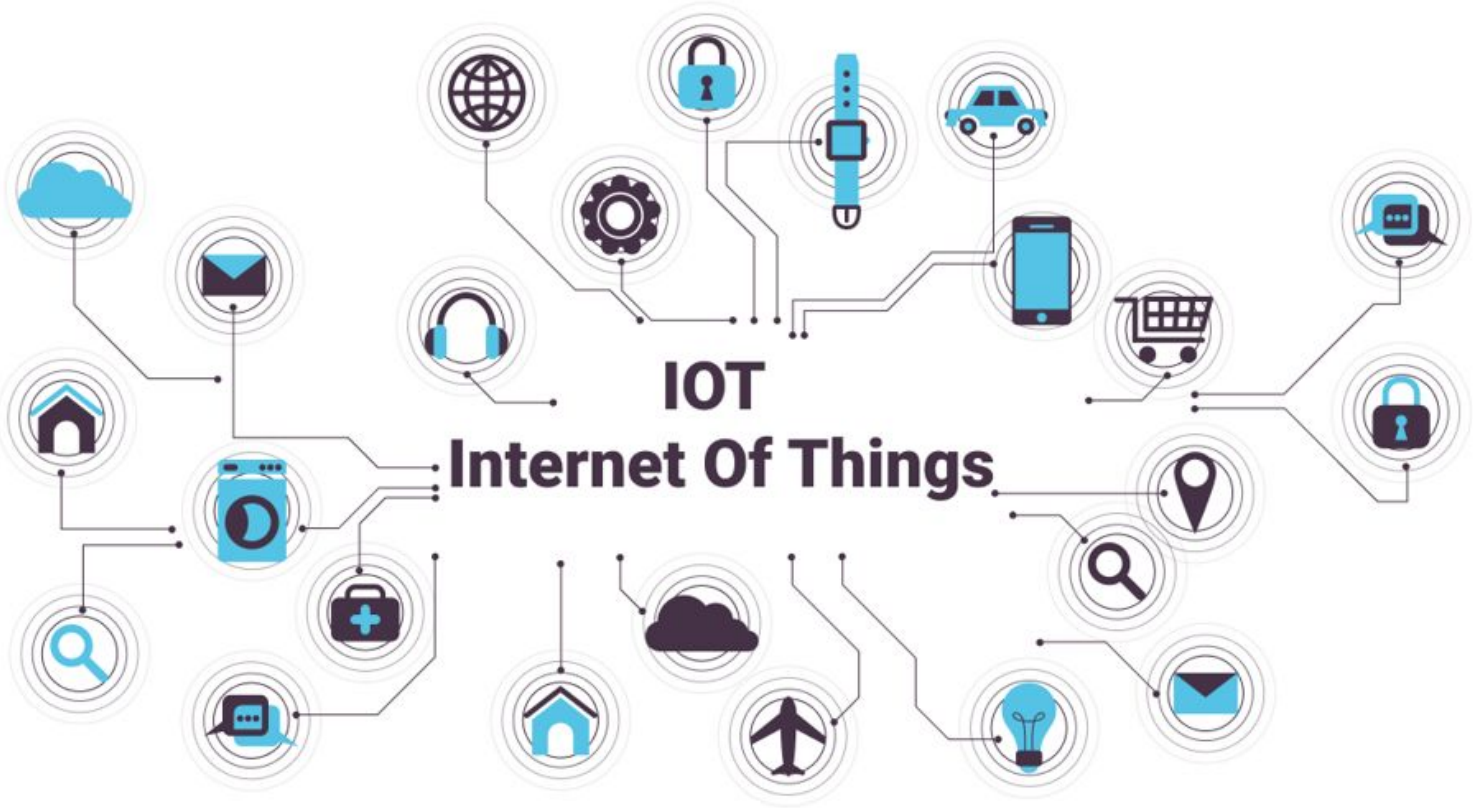
Assembly Completed!

接線



IoT (Thingspeak)

All the things are connected to the internet.



Why the things need to be connected to the Internet? What is the purpose?

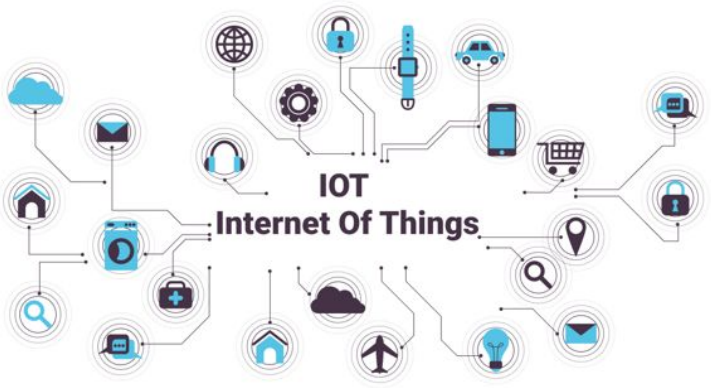
Do the control

Upload data

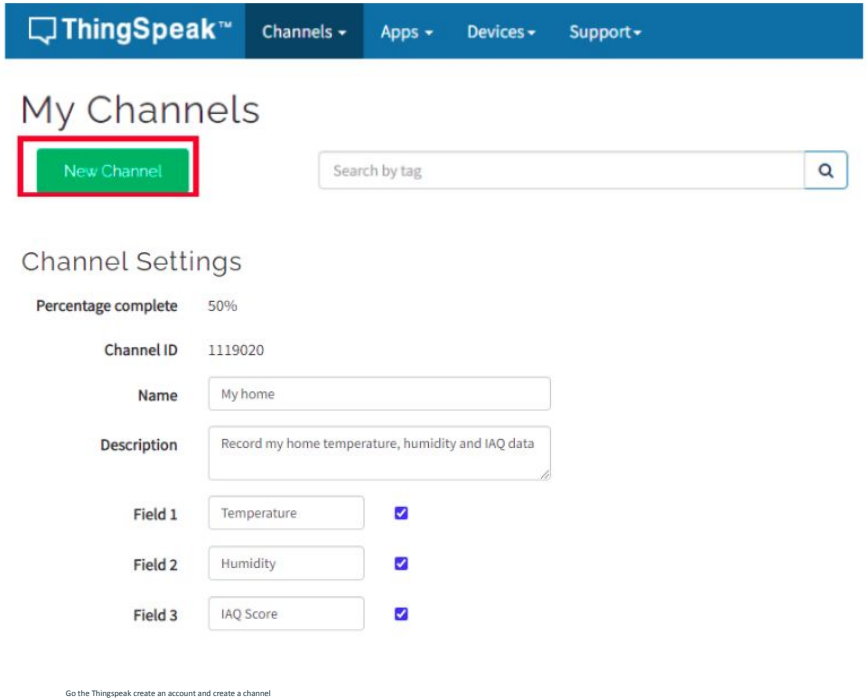
The things can communicate with each other

Use Internet service like email etc

Smarter

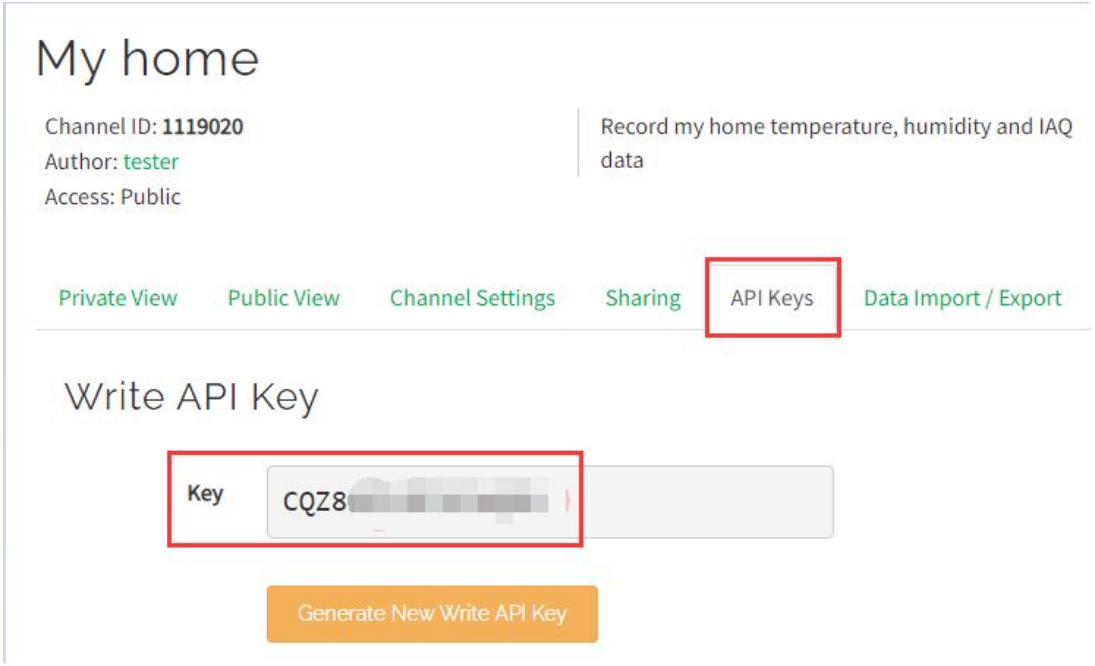


Step 1. Create Thingspeak channel



Go the Thingspeak create an account and create a channel

Step 2. Get channel API



After created a new channel, get the write in API

Programming

Step 1. Initialize OLED, IoT:bit and connect to WiFi, create and initialize variables



Step 2. Show icon "tick" after WiFi connection



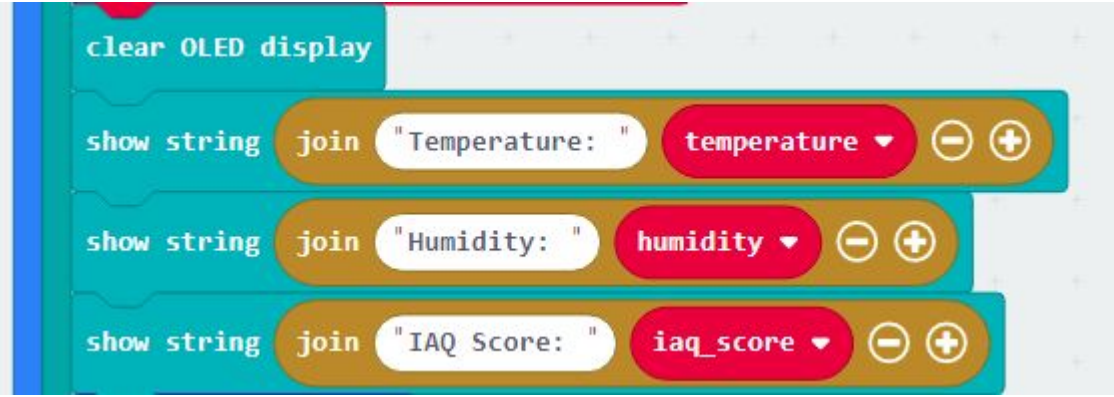
Step 3. Create the function



Step 4. Read the Temperature and Humidity sensor data



Step 5. Show the data on display

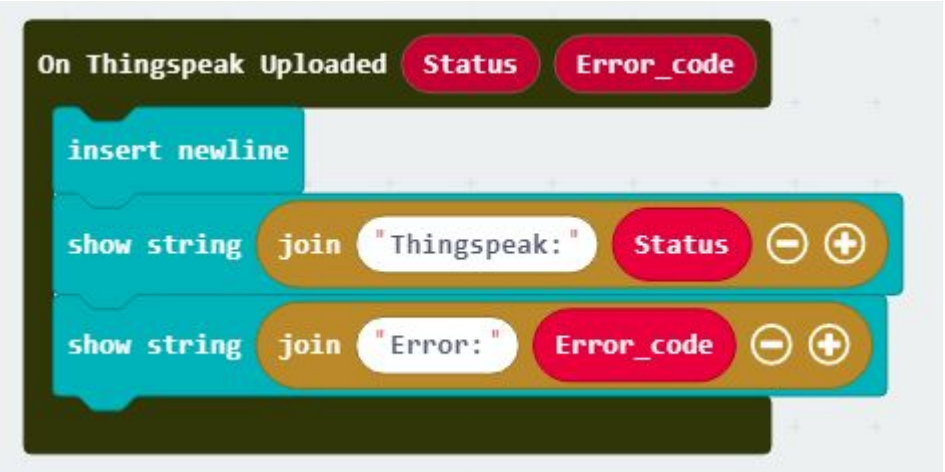




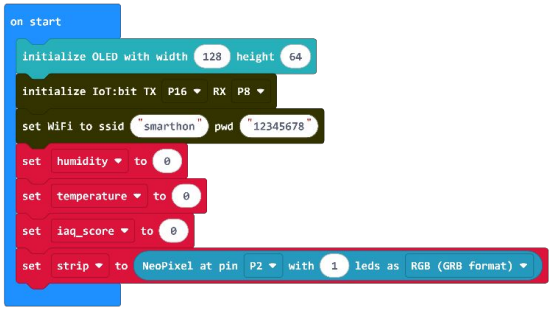
Upload to Thingspeak

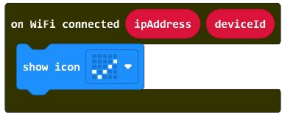


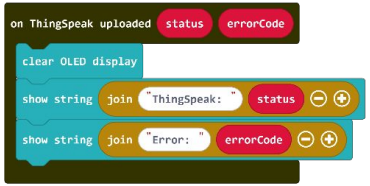
Step 8. Check Thingspeak upload status

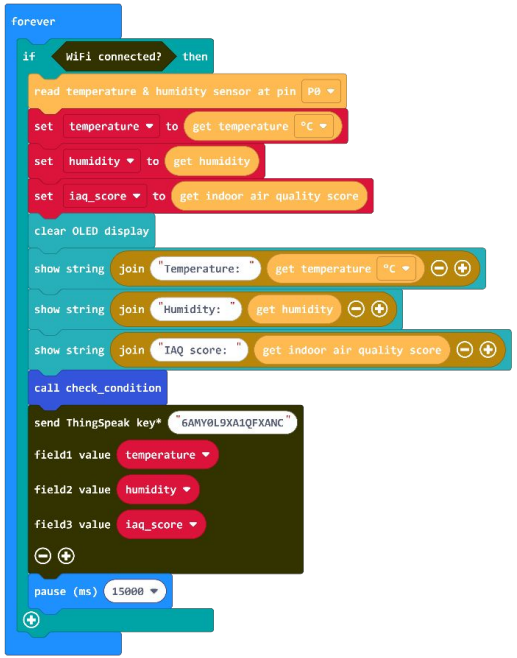


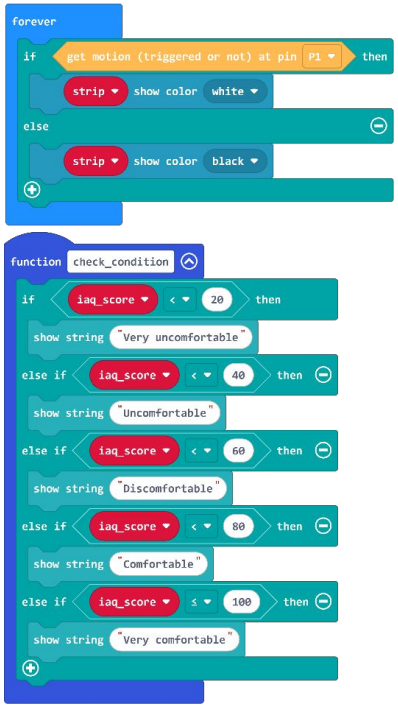
Full Program









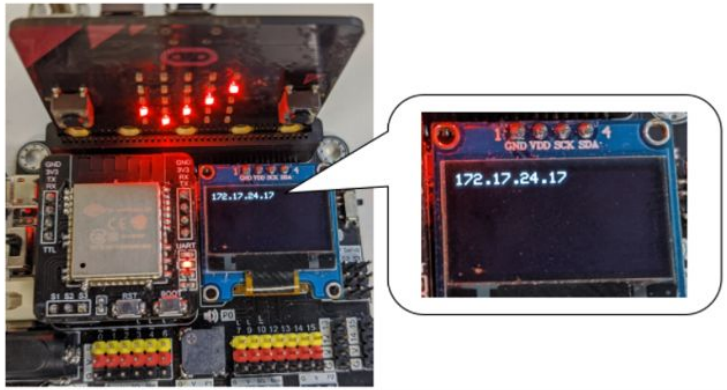


https://makecode.microbit.org/_Ej6LuRd0aCRH

Connect the Micro:bit to Wi-Fi

```
on start
    Initialize IoT:bit TX P16 RX P8
    Set WiFi to ssid "smarthon" pwd "12345678"

On WiFi connected IP_Address Device_ID
    show icon
```



(3) Smart Garden AIoT Farmer Kit

Smarthon Smart Garden AIoT Farmer Kit

- Suitable for P4 – S6 students
- Planting with Internet of Things (IoT) and programming
- Includes 10 use cases, allowing students to plant with intelligent systems
- Specially designed for STEM group activities / courses



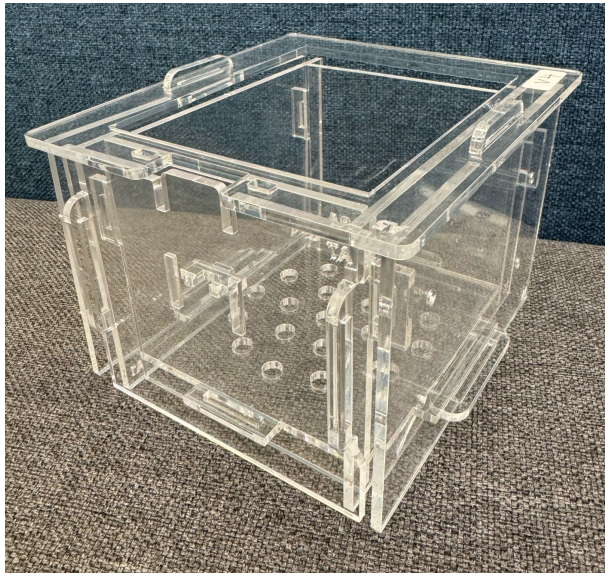
Planting Materials and Model

Planting materials and model included in the kit allows students to plant with ease

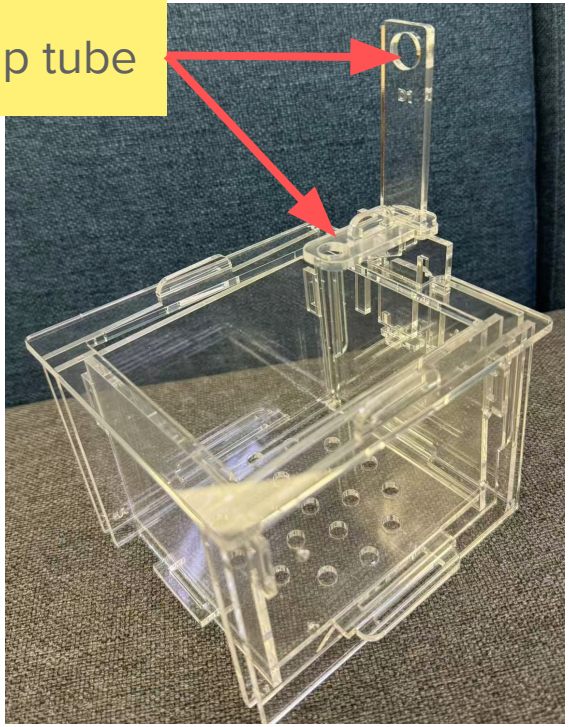
- 1 plant pot model
- 1 module stand
- Planting materials including soil, seed, wooden stick, iron wire, cups, pot tray and plastic mat



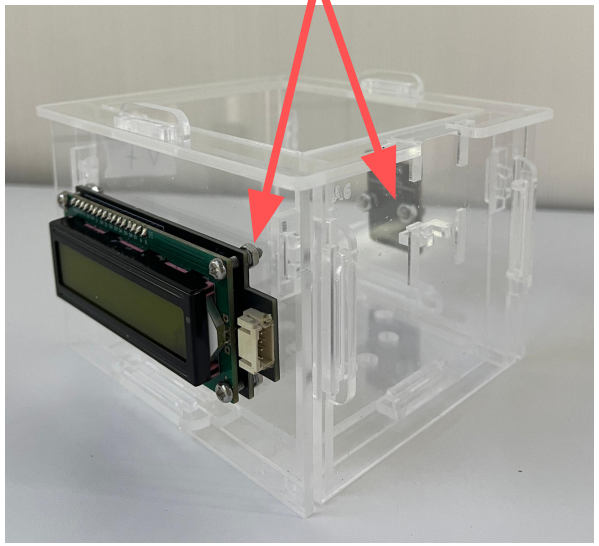
2A. Plant Pot Model



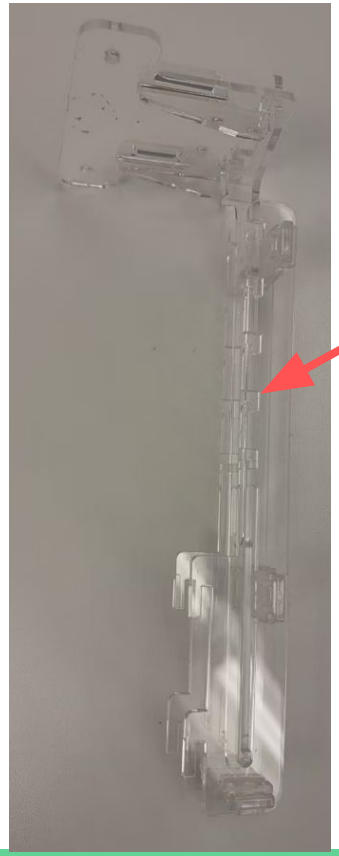
Fixing hole for water pump tube



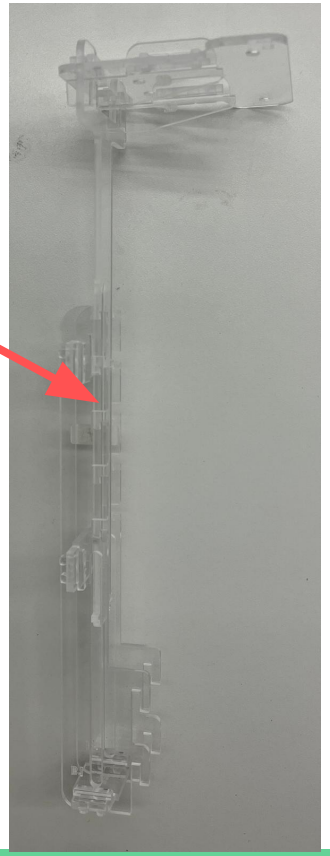
Holes for installing modules



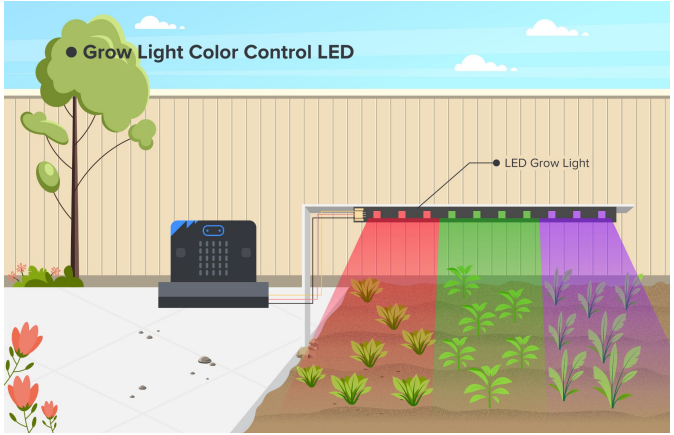
2B. Module Stand



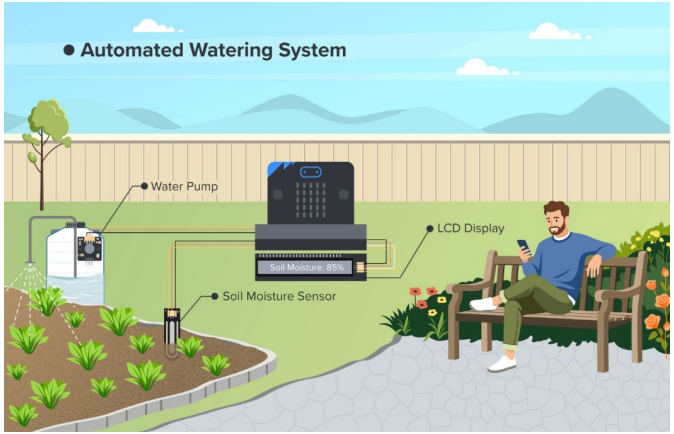
Can adjust height



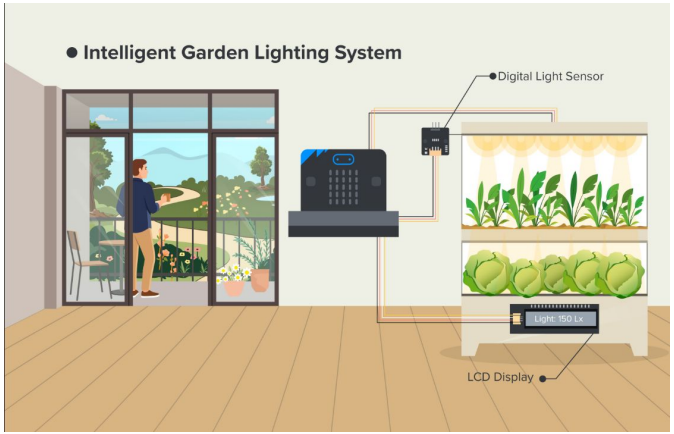
Basic Use Case Overview (Case 01 - 04)



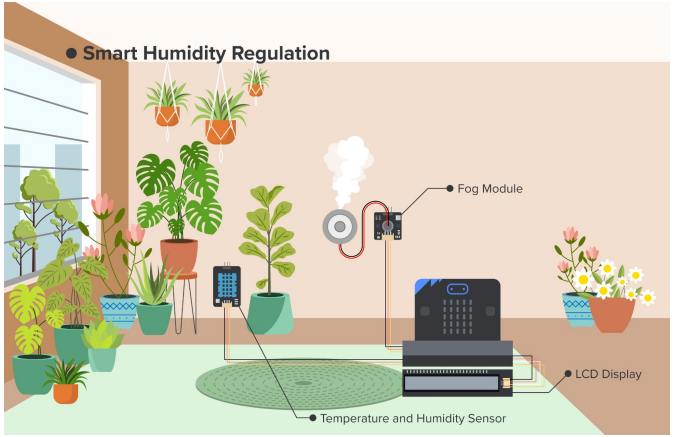
Case 01: Grow Light Color Control



Case 02: Automated Watering System



Case 03: Intelligent Garden Lighting System



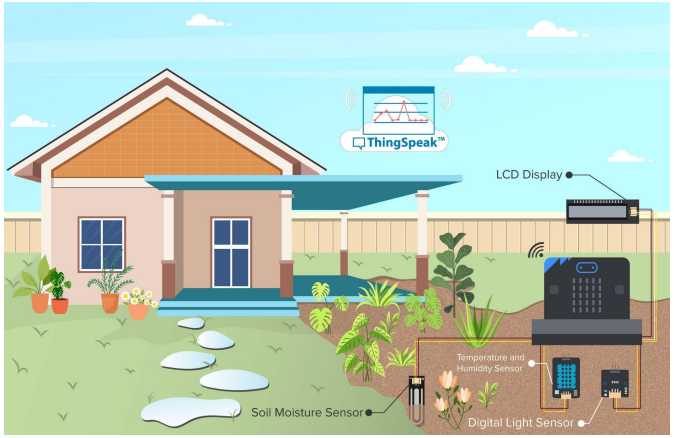
Case 04: Smart Humidity Regulation

IoT Use Case Overview (Case 05 - 10)

In this kit, you will learn important IoT core knowledge

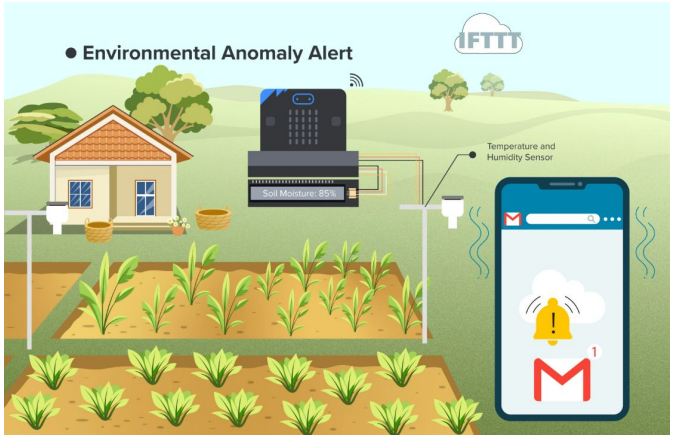
Basic: Connect Micro:bit to Wi-Fi		
ThingSpeak	Data Upload	Case 5
IFTTT	Send Notification	Case 6
	Cloud Control	Case 7, 8
Blynk	Remote Control	Case 9
n8n	AI Data Analysis	Case 10

ThingSpeak



IoT Case 05: Garden Environment Data Monitoring

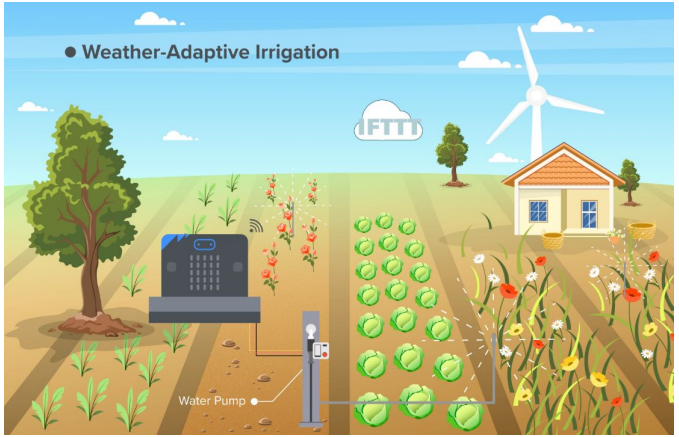
IFTTT



IoT Case 06: Environmental Anomaly Alert



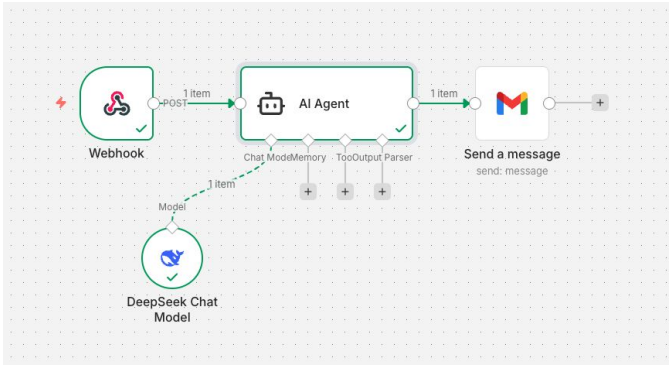
IoT Case 07: Automated Lighting Schedule Control



IoT Case 08: Weather-Adaptive Irrigation



IoT Case 09: Remote Water Pump Control

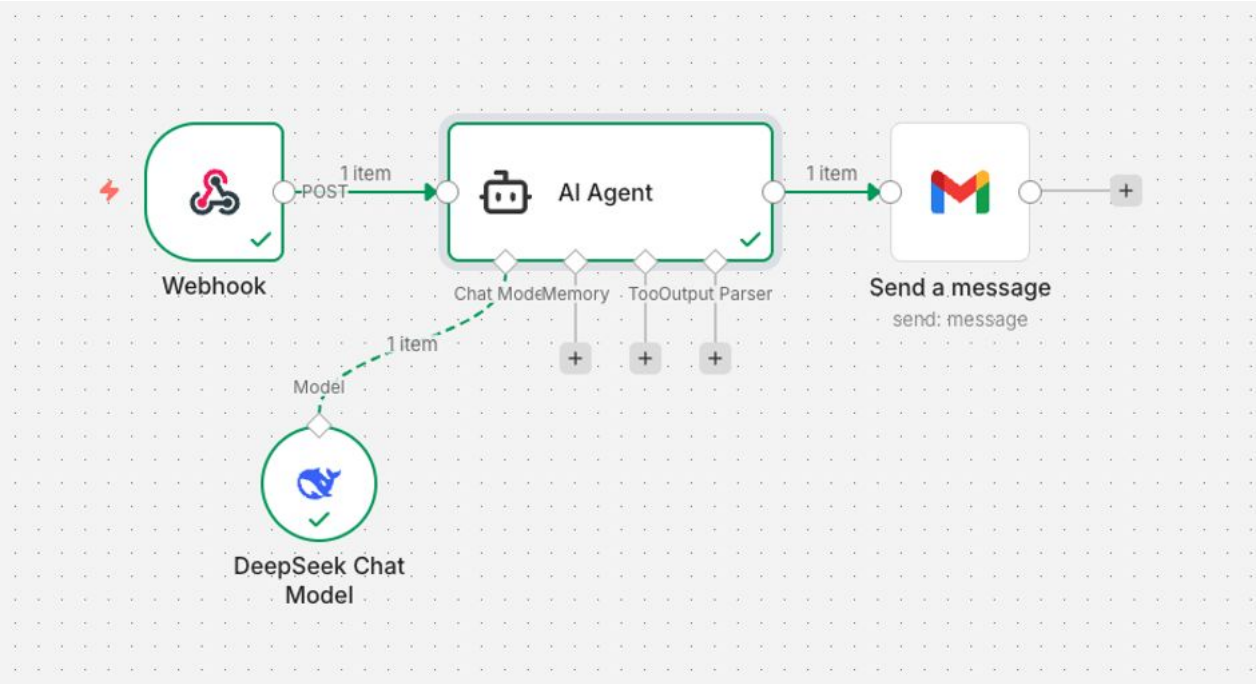


AIoT Case 10: Generating Growth AI Report

AIoT Hands On Session (Case 10)

Goal

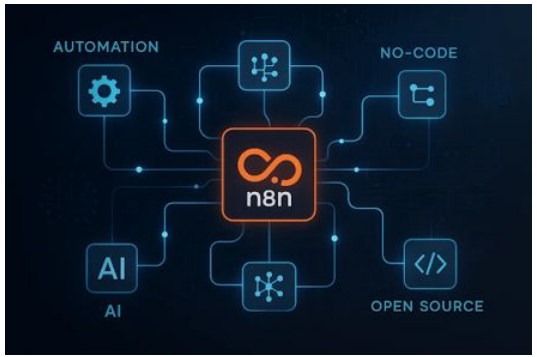
Generate plant growth AI report using n8n and send to users via email



n8n

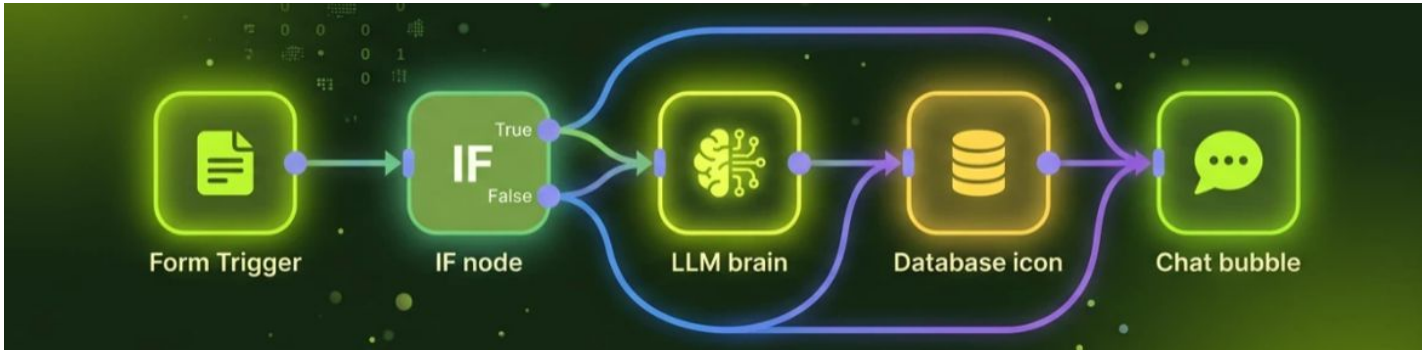
- Workflow automation platform designed for connecting IoT devices, AI models and online services
- Build end-to-end automation by using a drag-and-drop interface to design workflow logic
- Provide pre-built nodes to receive hardware data, call AI models, process information and send automatic emails and reports in real time

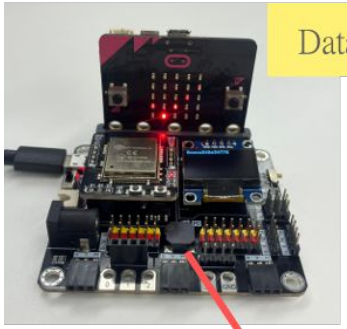




n8n

- Open source
- Similar to IFTTT - Connecting apps and services
  - Multi-step v.s. Single-step workflow
- Supports > 1000 integrations (apps, APIs, messaging services etc)
  - AI agents available





Data Collection

micro:bit IoT:bit | 植物生長健康監測報告 收件匣 ×

Sophia Tang <sophia.tang.smarthon@gmail.com>
寄給 我

感測項目	數值	單位 / 範圍
溫度	26	°C
濕度	62	%
土壤水分	92	0–100
光照	581	1-65535

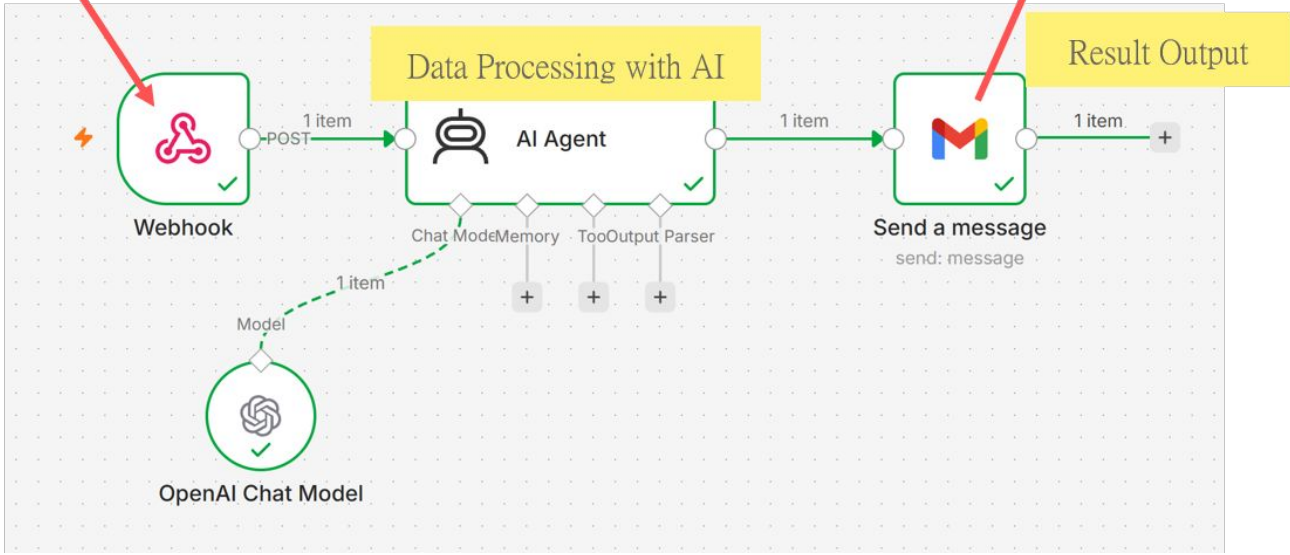
診斷輸出如下：

專家養護建議

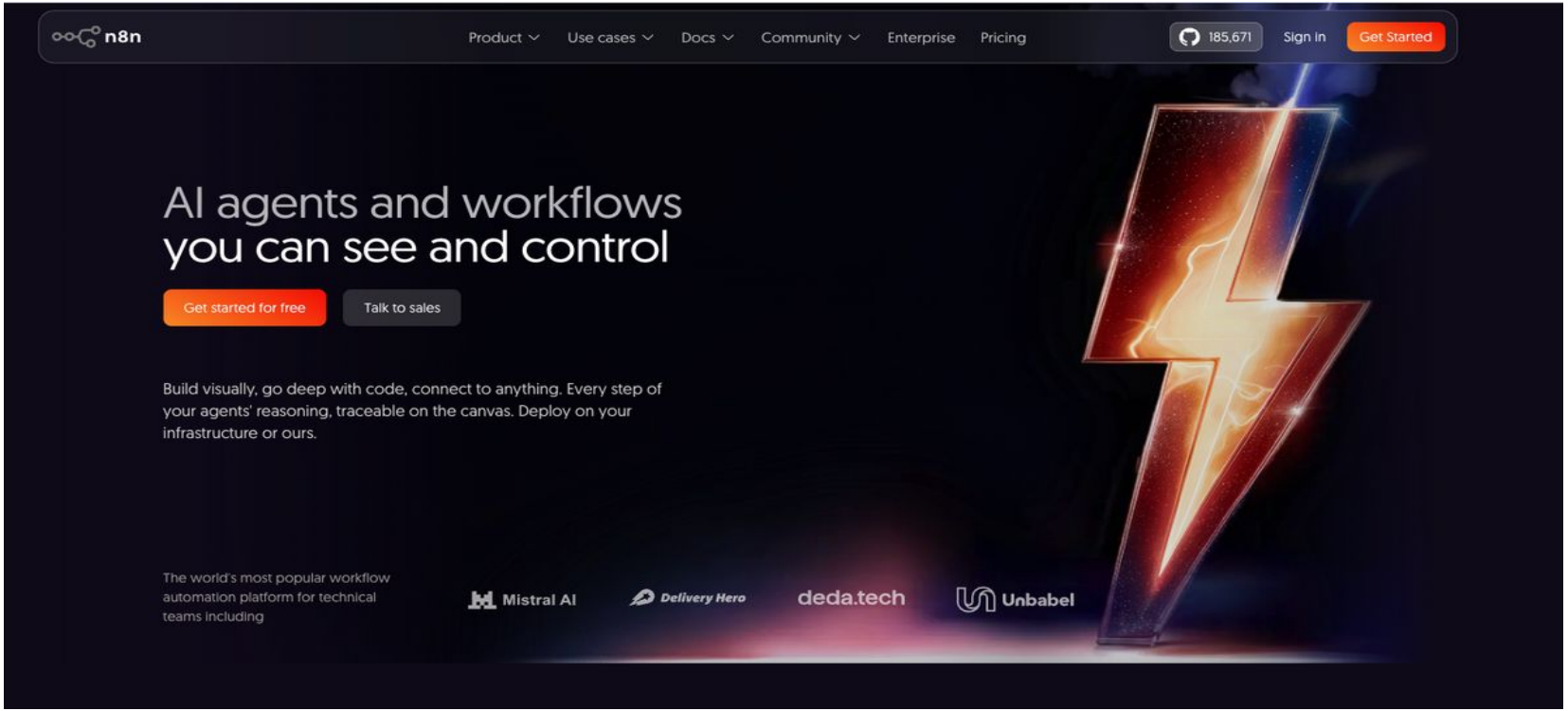
- 【現狀總結】：土壤含水率偏高（92），且光照偏弱（581），主要風險為根部缺氧與病害滋生。
- 【即時動作】：1) 立即停止澆水並檢查盆底排水與土壤通氣性（如有必要換盆或鬆土）；2) 將植株暫移至光線較好處或啟用補光，避免長時間弱光下持續潮濕。
- 【長期預警】：若不改善排水與光照，24小時內土壤仍會維持高濕，可能出現根腐、葉片泛黃脫落及病菌徵兆；改善通風與光照可在24小時內緩解惡化風險。

Data Processing with AI

Result Output

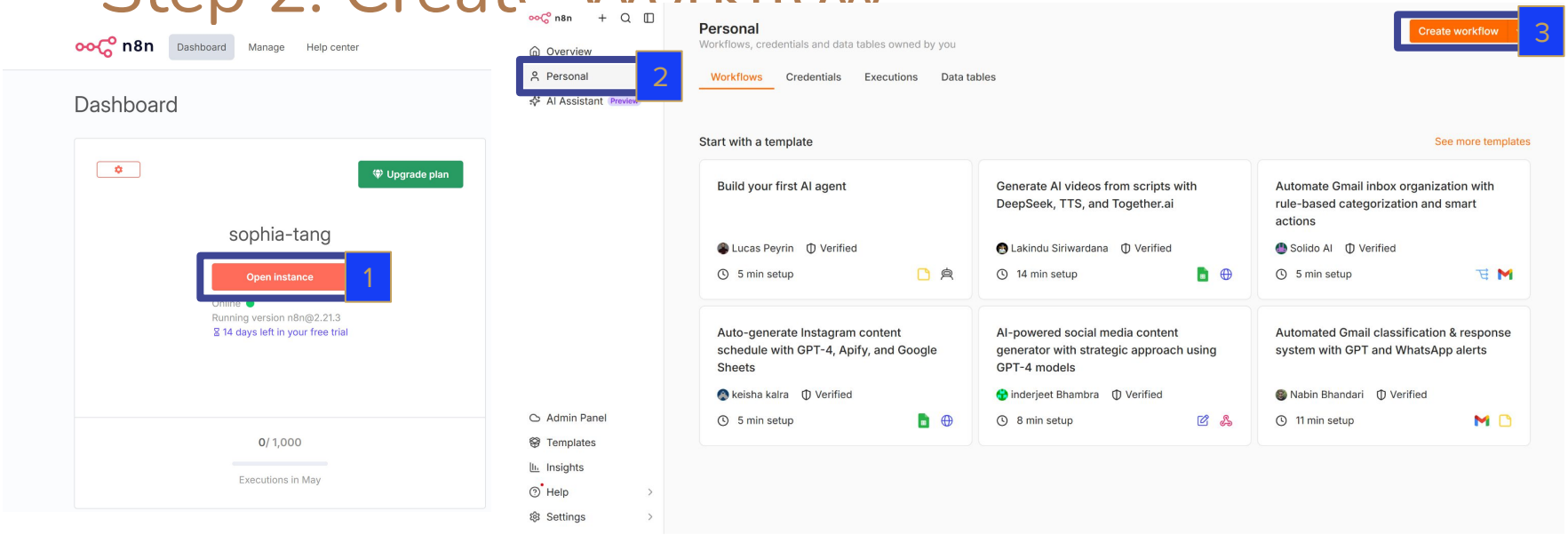


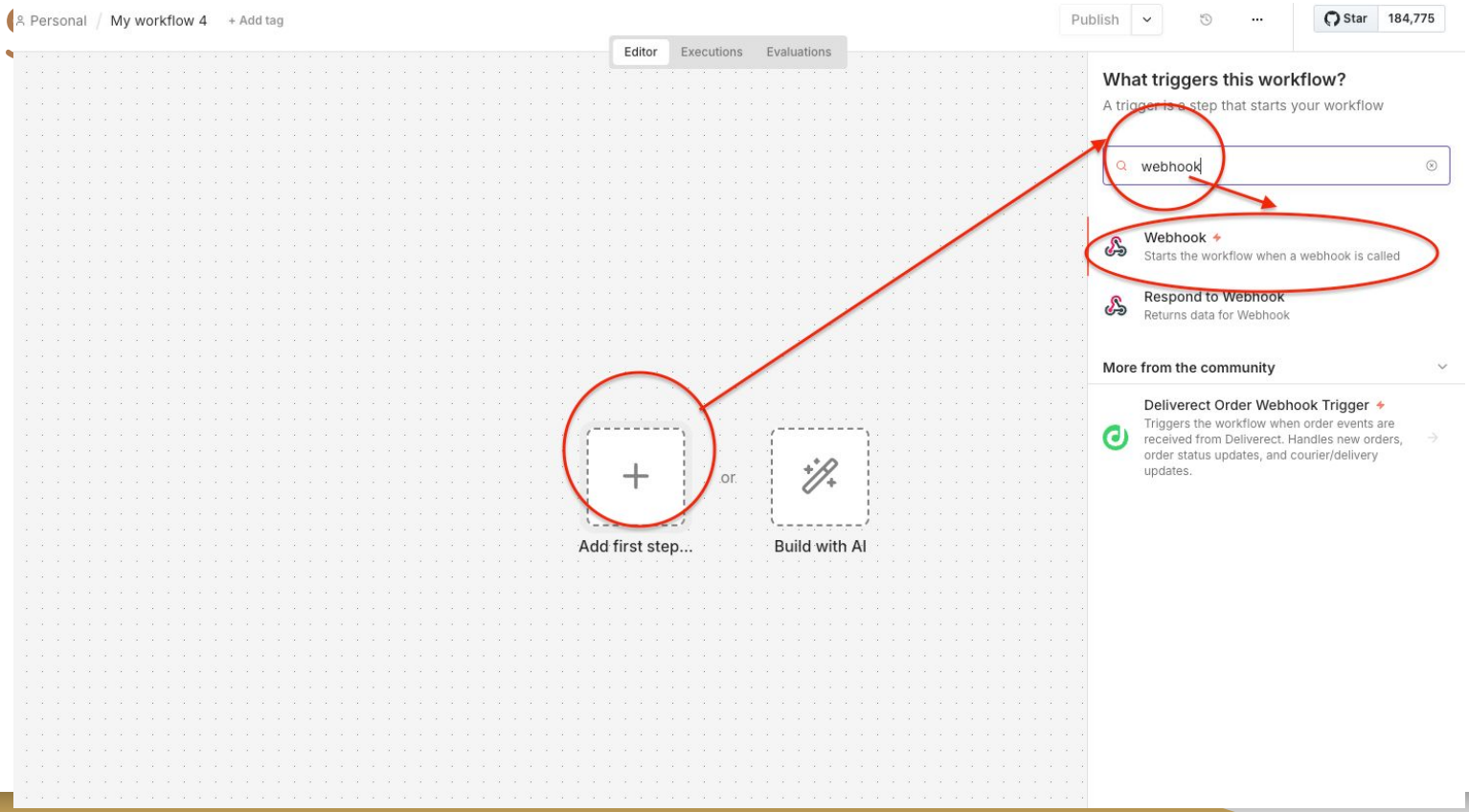
n8n Setup

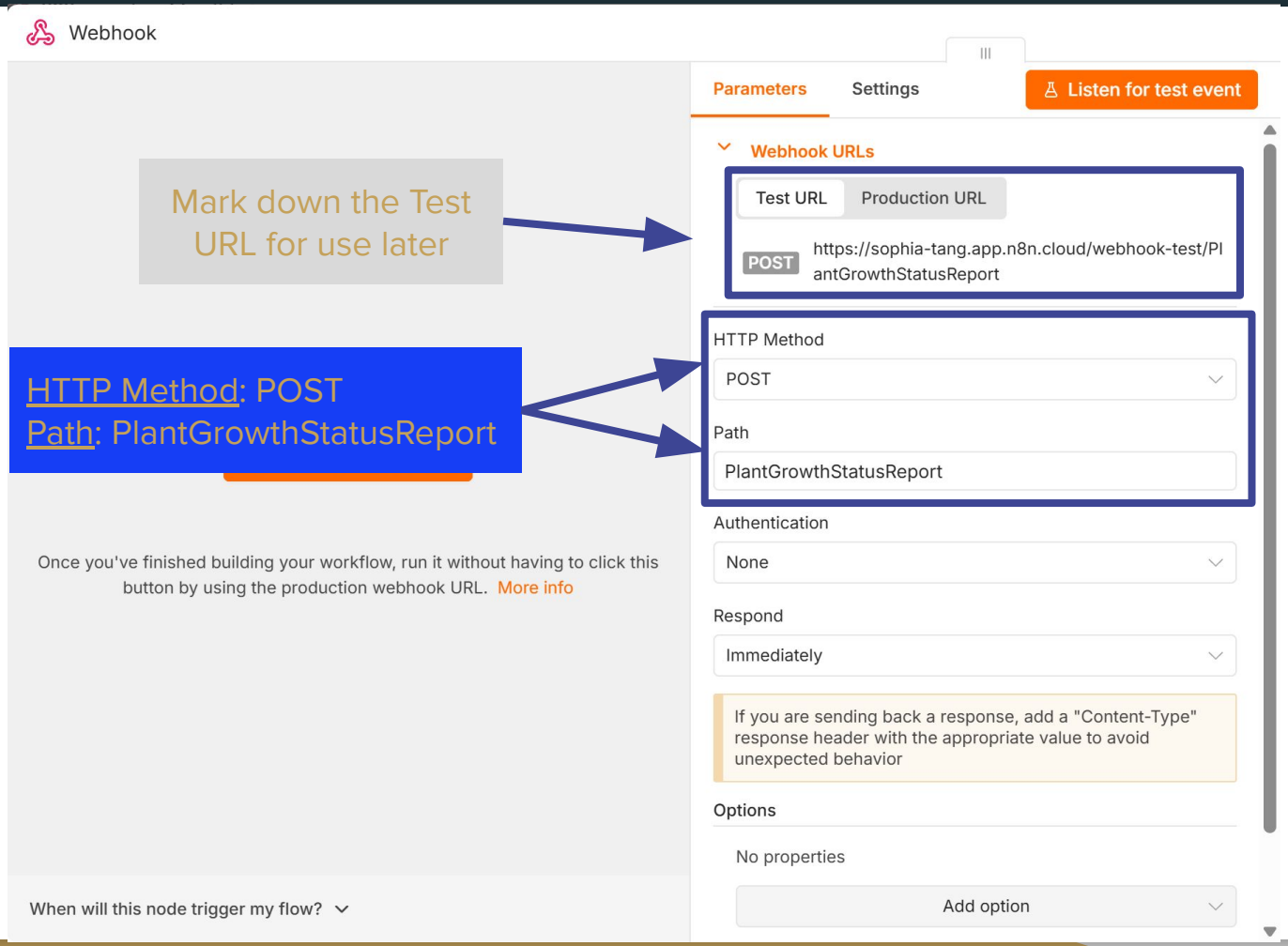

n8n
Product
Use cases
Docs
Community
Enterprise
Pricing
185,671
Sign in
Get Started
AI agents and workflows
you can see and control
Get started for free
Talk to sales
Build visually, go deep with code, connect to anything. Every step of your agents' reasoning, traceable on the canvas. Deploy on your infrastructure or ours.
The world's most popular workflow automation platform for technical teams including
Mistral AI
Delivery Hero
deda.tech
Unbabel

https://n8n.io/

Step 2: Create Workflow




Personal / My workflow 4
+ Add tag
Publish
Star 184,775
Editor
Executions
Evaluations
What triggers this workflow?
A trigger is a step that starts your workflow
webhook
Webhook
Starts the workflow when a webhook is called
Respond to Webhook
Returns data for Webhook
More from the community
Deliverect Order Webhook Trigger
Triggers the workflow when order events are received from Deliverect. Handles new orders, order status updates, and courier/delivery updates.
or
Add first step...
Build with AI


Webhook
Mark down the Test URL for use later
HTTP Method: POST
Path: PlantGrowthStatusReport
Once you've finished building your workflow, run it without having to click this button by using the production webhook URL. More info
When will this node trigger my flow?
Parameters
Settings
Listen for test event
Webhook URLs
Test URL
Production URL
POST
https://sophia-tang.app.n8n.cloud/webhook-test/PlantGrowthStatusReport
HTTP Method
POST
Path
PlantGrowthStatusReport
Authentication
None
Respond
Immediately
If you are sending back a response, add a "Content-Type" response header with the appropriate value to avoid unexpected behavior
Options
No properties
Add option

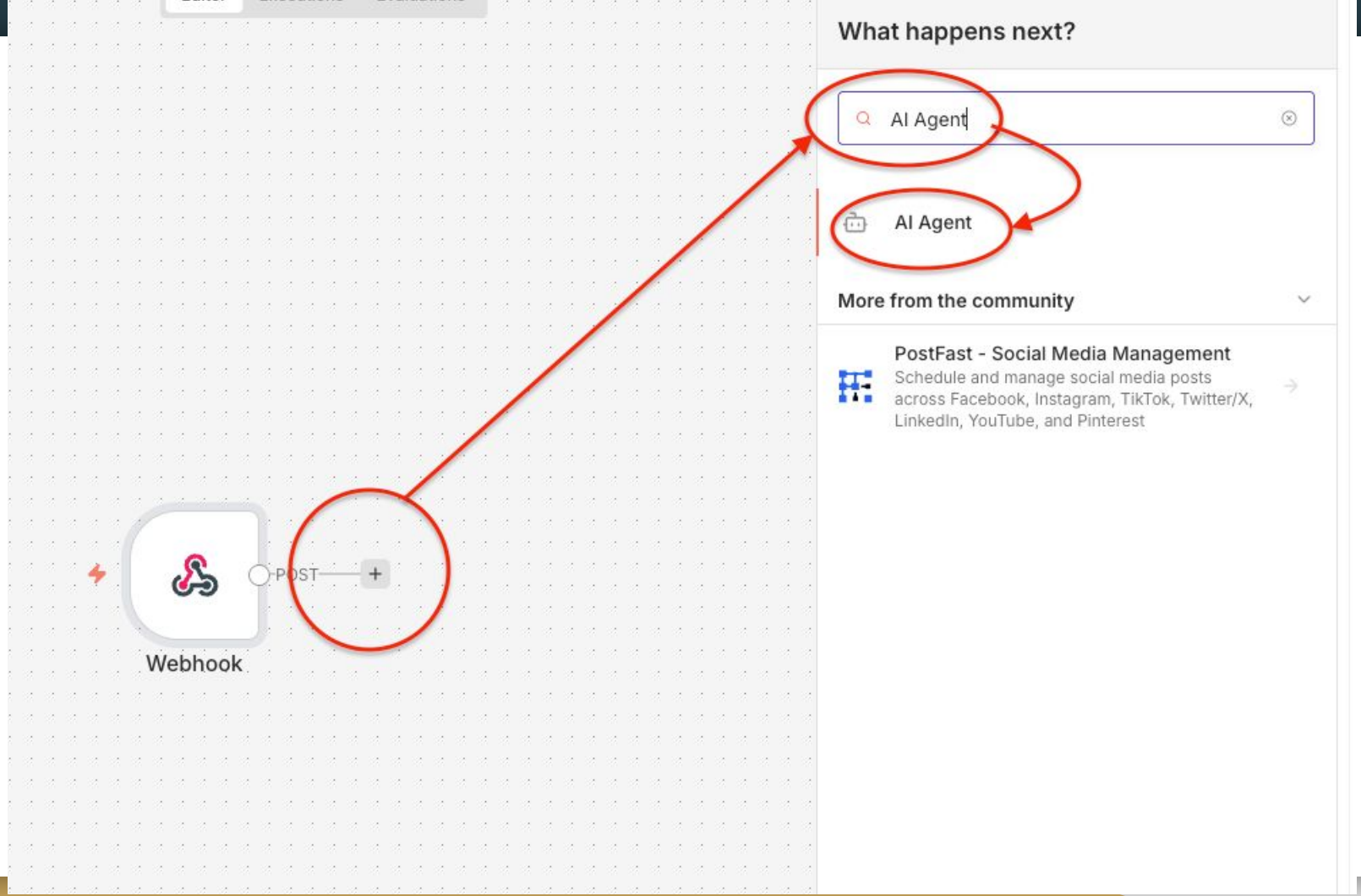
Step 4: Set Up Workflow - AI Agent

Get the prompt for the AI Agent



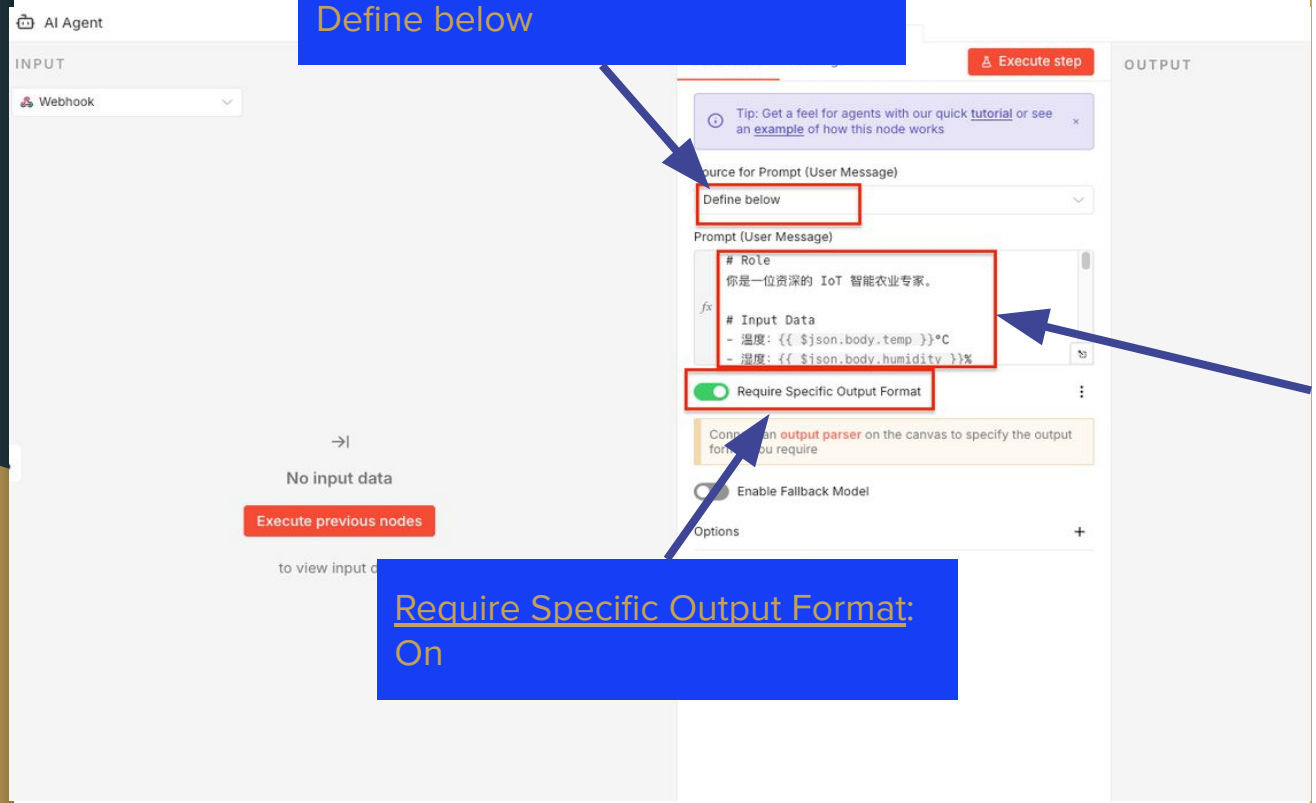
https://drive.google.com/file/d/1UL2xUU6ygTd0o1xwyMi8QyNx5DtwzeOs/view?usp=sharing

```
# Role
你是一位資深的 IoT 智能農業專家。
# Input Data
- 溫度: {{ $json.body.temp }}°C
- 濕度: {{ $json.body.humidity }}%
- 土壤水分: {{ $json.body.moisture }} (0-100)
- 光照: {{ $json.body.light }} (1-65535)
# Task
生成 HTML 植物健康報告。
# 專家建議格式要求（嚴格遵守）
請在 HTML 的 <p> 標籤後，使用以下固定格式輸出【專家養護建議】:
1.【現狀總結】:用一句話概括當前植物面臨的最核心問題。
2.【即時動作】:列出 1-2 條用戶現在立刻需要執行的操作（如:加水、移至陰涼處）。
3.【長期預警】:根據當前數 值，預測未來 24 小時可能出現的變化。
# 約束
- 嚴禁使用 Markdown 標籤（```html）。
- 每個建議項必須使用 <li> 標籤包裹，放在一個 <ul> 列表裡。
- 語氣要專業且簡練。
# Output HTML Structure
<div>
 <table border="1" cellpadding="6" cellspacing="0" style="border-collapse:collapse">
   <thead>
    <tr style="background:#f2f2f2">
     <th>感測項目 </th>
     <th>數值</th>
     <th>單位 / 範圍 </th>
    </tr>
   </thead>
   <tbody>
    <tr>
     <td>溫度 </td>
     <td>{{ $json.body.temp }}</td>
     <td>°C</td>
    </tr>
    <tr>
     <td>濕度 </td>
     <td>{{ $json.body.humidity }}</td>
     <td>%</td>
    </tr>
    <tr>
     <td>土壤水分 </td>
     <td>{{ $json.body.moisture }}</td>
     <td>0–100</td>
    </tr>
    <tr>
     <td>光照 </td>
     <td>{{ $json.body.light }}</td>
     <td>1-65535</td>
    </tr>
   </tbody>
 </table>
 <h4 style="color: #2d5a27;">📋 專家養護建議 </h4>
 <ul>
<li><strong>【現狀總結】: </strong>{在這裡填入 內容}</li>
<li><strong>【即時動作】: </strong>{在這裡填入 內容}</li>
<li><strong>【長期預警】: </strong>{在這裡填入 內容}</li>
 </ul>
</div>
```


What happens next?
AI Agent
AI Agent
More from the community
PostFast - Social Media Management
Schedule and manage social media posts across Facebook, Instagram, TikTok, Twitter/X, LinkedIn, YouTube, and Pinterest
POST
Webhook

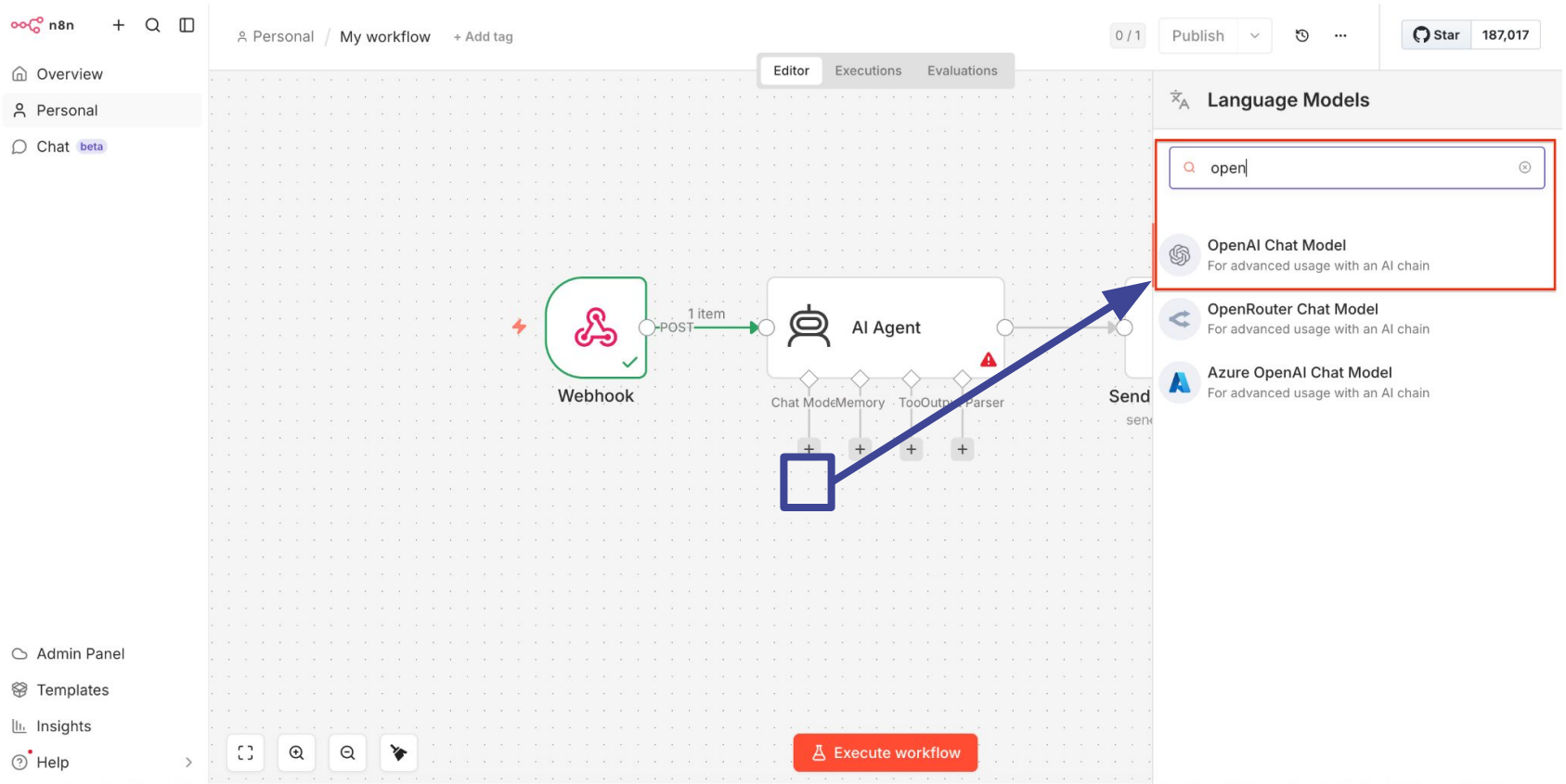
Source for Prompt (User Message): Define below

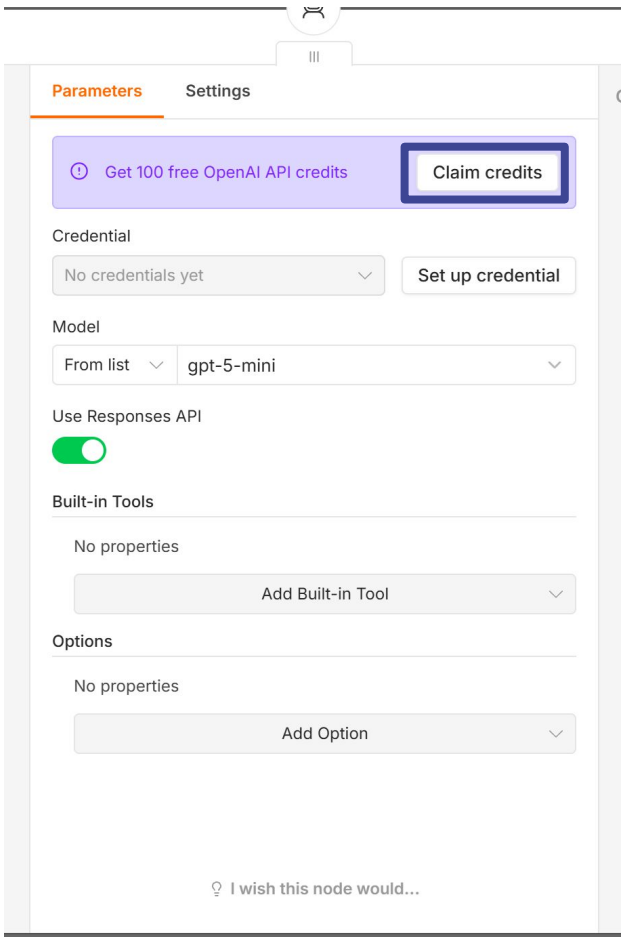
Require Specific Output Format: On



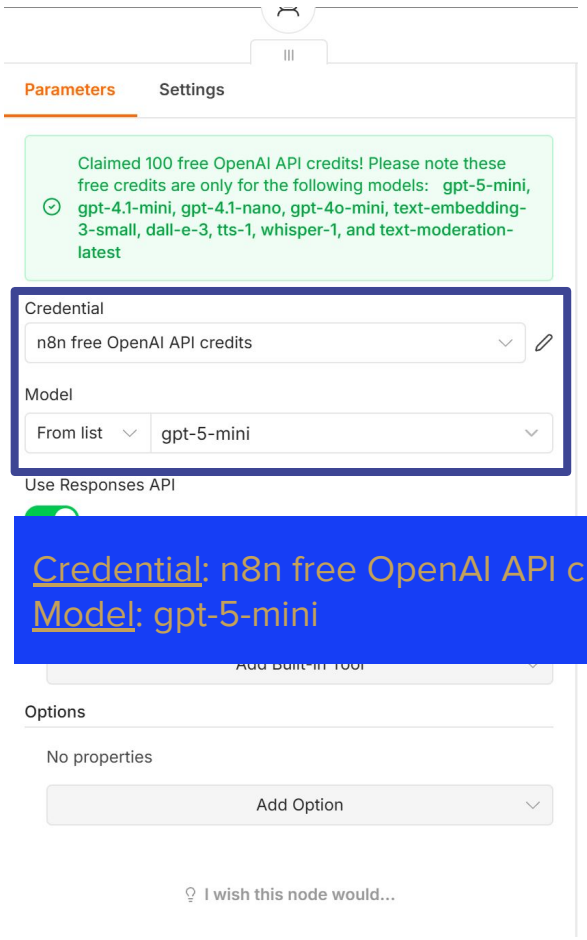
Prompt

```
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# Input Data
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- 每個建議項必須使用 <li> 標籤包裹，放在一個 <ul> 列表裡。
- 語氣要專業且簡練。
# Output HTML Structure
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     <th>數值</th>
     <th>單位 / 範圍</th>
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   </thead>
   <tbody>
    <tr>
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     <td>{{ $json.body.temp }}</td>
     <td>°C</td>
    </tr>
    <tr>
     <td>濕度 </td>
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    </tr>
    <tr>
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     <td>{{ $json.body.moisture }}</td>
     <td>0–100</td>
    </tr>
    <tr>
     <td>光照 </td>
     <td>{{ $json.body.light }}</td>
     <td>1-65535</td>
    </tr>
   </tbody>
 </table>
 <h4 style="color: #2d5a27;">📋 專家養護建議 </h4>
 <ul>
<li><strong>【現狀總結】: </strong>{在這裡填入 內容}</li>
<li><strong>【即時動作】: </strong>{在這裡填入 內容}</li>
<li><strong>【長期預警】: </strong>{在這裡填入 內容}</li>
 </ul>
</div>
```

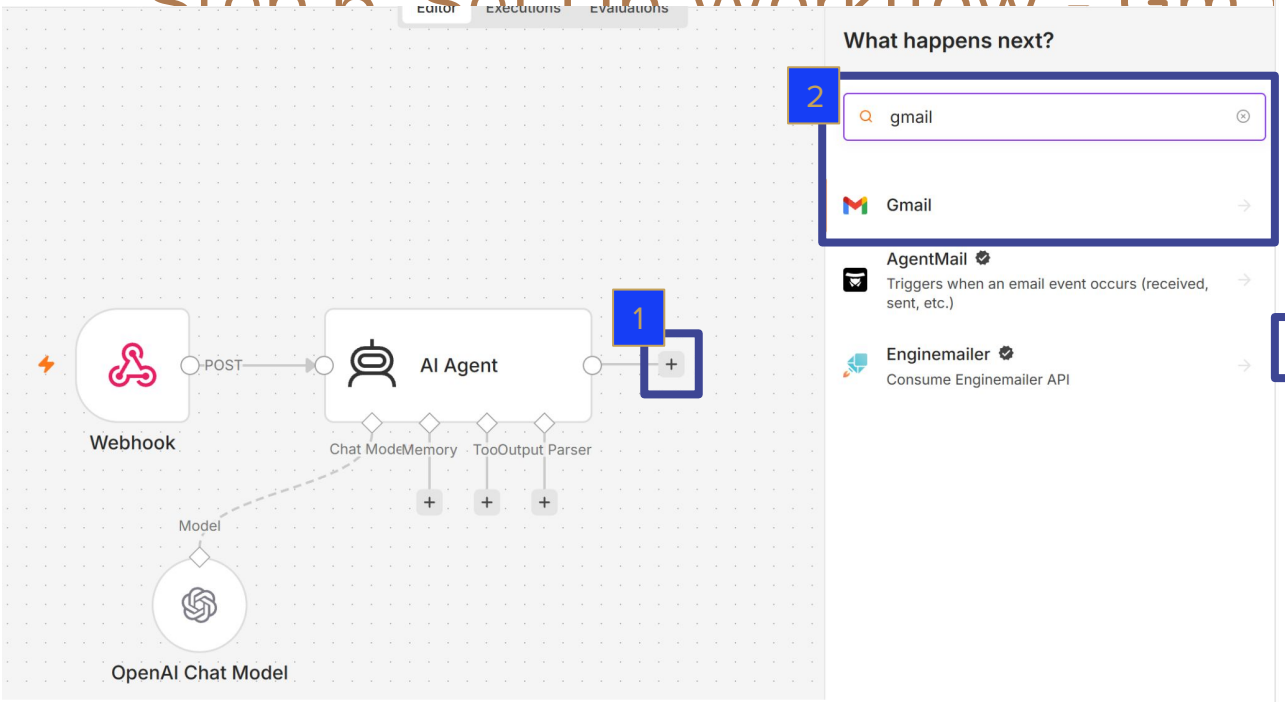

n8n
Overview
Personal
Chat beta
Admin Panel
Templates
Insights
Help
Personal / My workflow
+ Add tag
0 / 1
Publish
Star 187,017
Editor
Executions
Evaluations
Webhook
1 item
POST
AI Agent
Chat Mode
Memory
Parser
Send
Execute workflow
Language Models
open
OpenAI Chat Model
For advanced usage with an AI chain
OpenRouter Chat Model
For advanced usage with an AI chain
Azure OpenAI Chat Model
For advanced usage with an AI chain

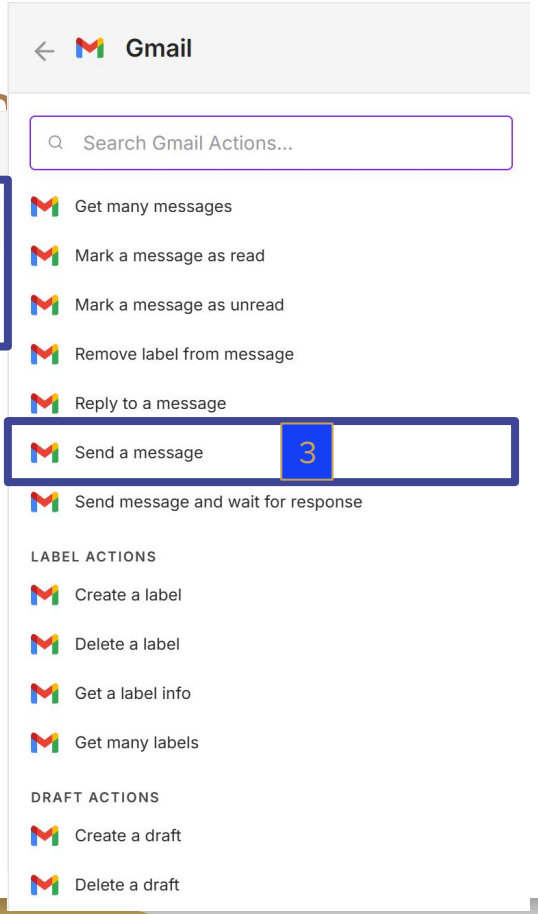

Parameters
Settings
Get 100 free OpenAI API credits
Claim credits
Credential
No credentials yet
Set up credential
Model
From list
gpt-5-mini
Use Responses API
Built-in Tools
No properties
Add Built-in Tool
Options
No properties
Add Option
I wish this node would...

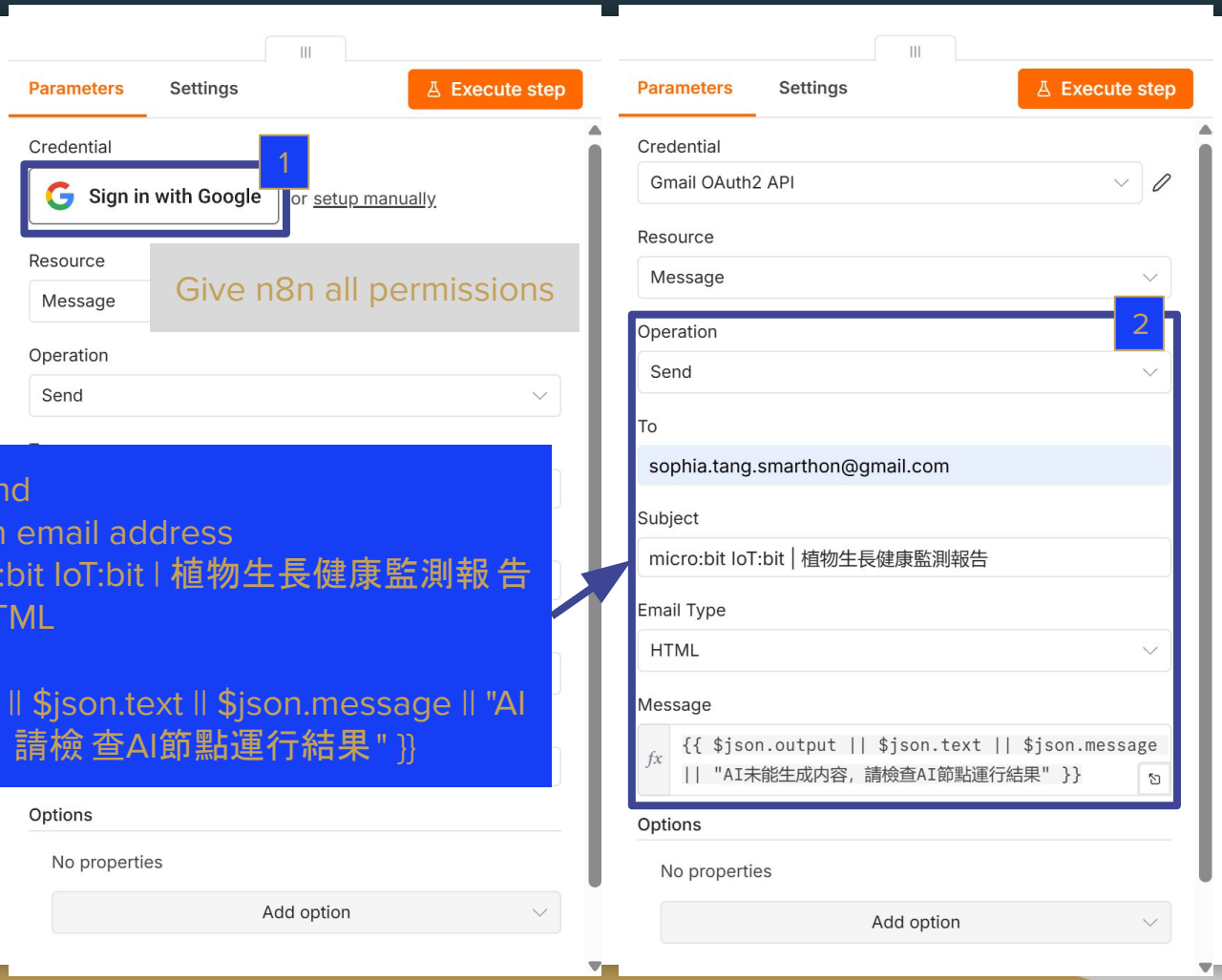



Parameters
Settings
Claimed 100 free OpenAI API credits! Please note these free credits are only for the following models: gpt-5-mini, gpt-4.1-mini, gpt-4.1-nano, gpt-4o-mini, text-embedding-3-small, dall-e-3, tts-1, whisper-1, and text-moderation-latest
Credential
n8n free OpenAI API credits
Model
From list
gpt-5-mini
Use Responses API
Credential: n8n free OpenAI API credits
Model: gpt-5-mini
Options
No properties
Add Option
I wish this node would...

Step 6: Set Up Workflow - Gma

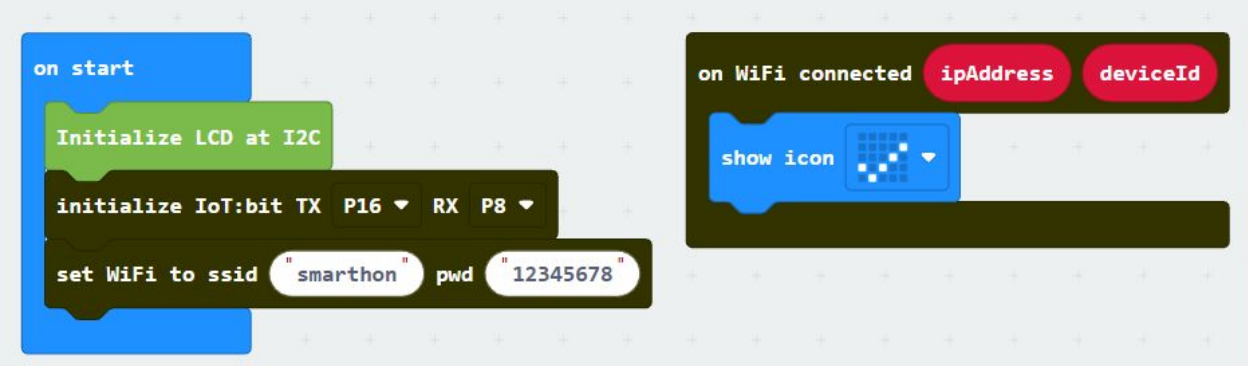




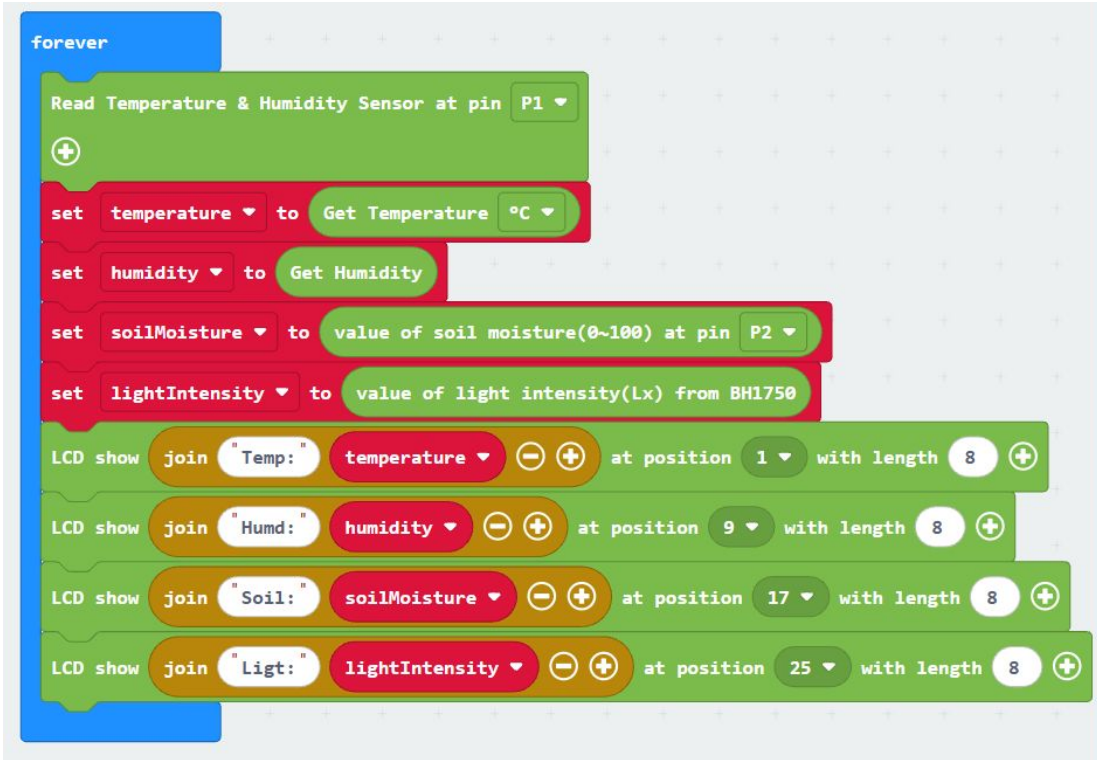

Parameters
Settings
Execute step
Credential
1
Sign in with Google
or setup manually
Resource
Message
Give n8n all permissions
Operation
Send
Operation: Send
To: Destination email address
Subject: micro:bit IoT:bit | 植物生長健康監測報 告
Email Type: HTML
Message:
{{ $json.output || $json.text || $json.message || "AI 未能生成內容，請檢 查AI節點運行結果 " }}
Options
No properties
Add option
Parameters
Settings
Execute step
Credential
Gmail OAuth2 API
Resource
Message
2
Operation
Send
To
sophia.tang.smarthon@gmail.com
Subject
micro:bit IoT:bit | 植物生長健康監測報告
Email Type
HTML
Message
fx
{{ $json.output || $json.text || $json.message || "AI未能生成內容，請檢查AI節點運行結果" }}
Options
No properties
Add option

Programming

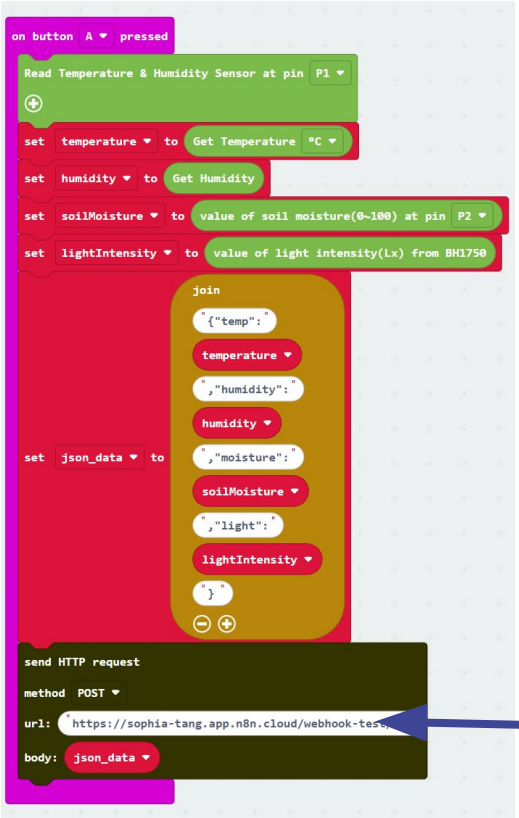
Step 1: Connect to Wifi



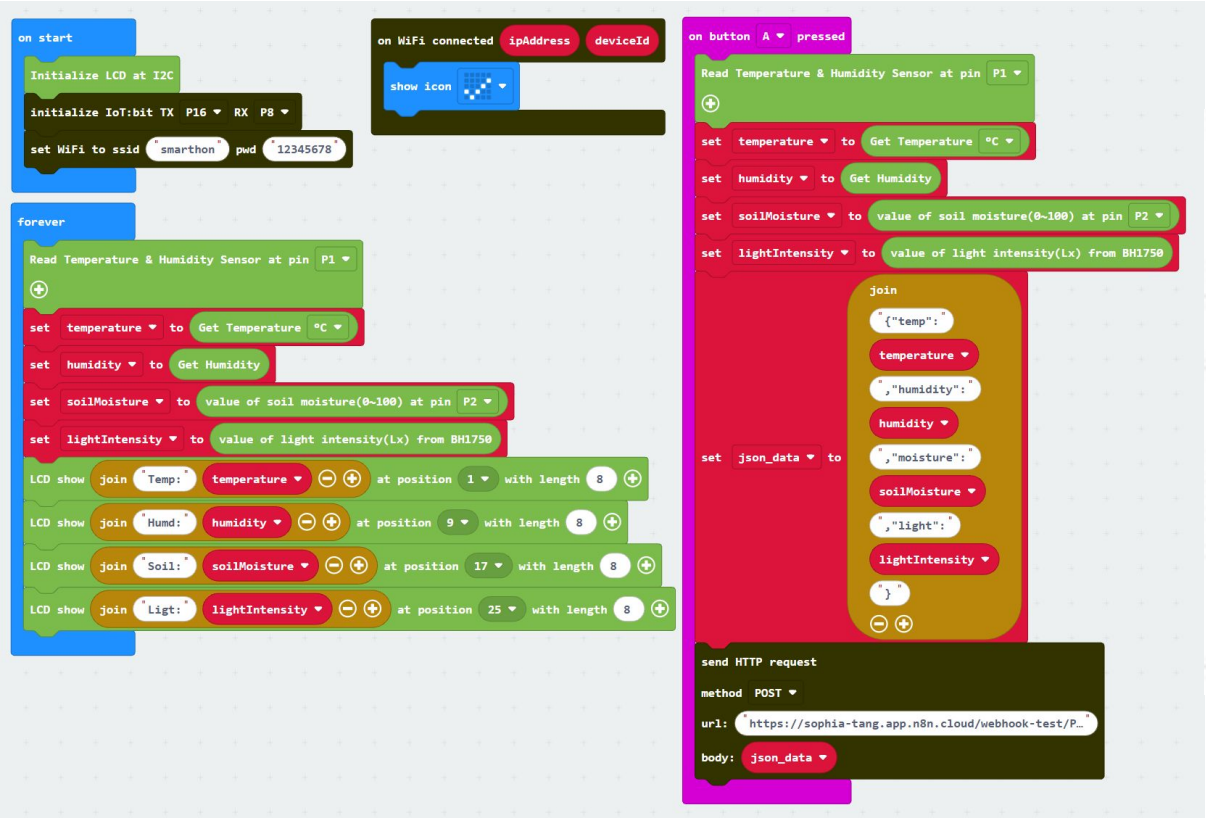
Step 2: Collect Environment Data



Step 3: Send Collected Data to n8n

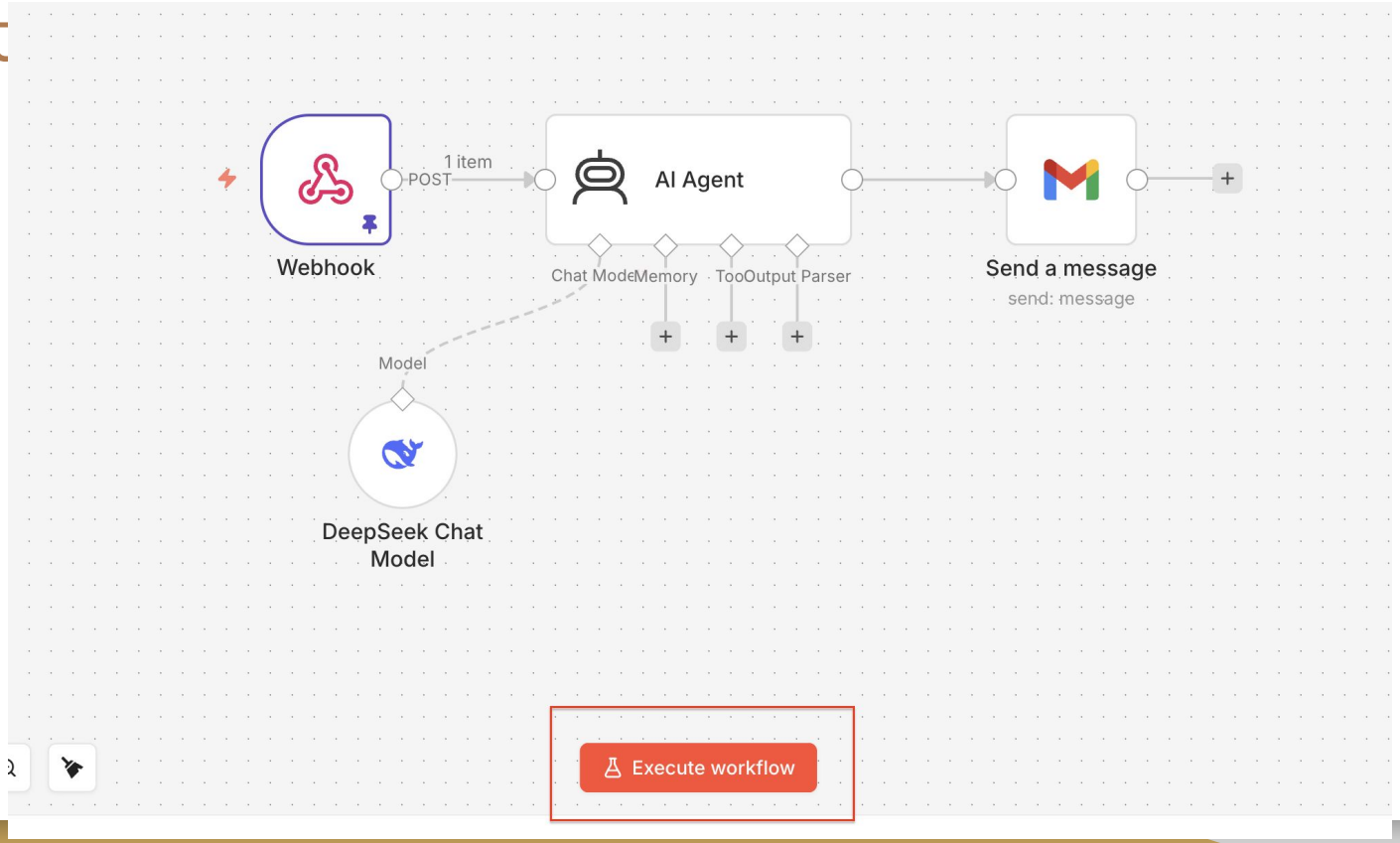


Fill in the Test URL from n8n


on start
Initialize LCD at I2C
initialize IoT:bit TX P16 RX P8
set WiFi to ssid "smarthon" pwd "12345678"
forever
Read Temperature & Humidity Sensor at pin P1
set temperature to Get Temperature °C
set humidity to Get Humidity
set soilMoisture to value of soil moisture(0~100) at pin P2
set lightIntensity to value of light intensity(Lx) from BH1750
LCD show join "Temp:" temperature at position 1 with length 8
LCD show join "Humd:" humidity at position 9 with length 8
LCD show join "Soil:" soilMoisture at position 17 with length 8
LCD show join "Ligt:" lightIntensity at position 25 with length 8
on WiFi connected ipAddress deviceId
show icon
on button A pressed
Read Temperature & Humidity Sensor at pin P1
set temperature to Get Temperature °C
set humidity to Get Humidity
set soilMoisture to value of soil moisture(0~100) at pin P2
set lightIntensity to value of light intensity(Lx) from BH1750
set json_data to join "{"temp":" temperature "," humidity ":" humidity "," moisture":" soilMoisture "," light":" lightIntensity "}"
send HTTP request
method POST
url: "https://sophia-tang.app.n8n.cloud/webhook-test/P…"
body: json_data

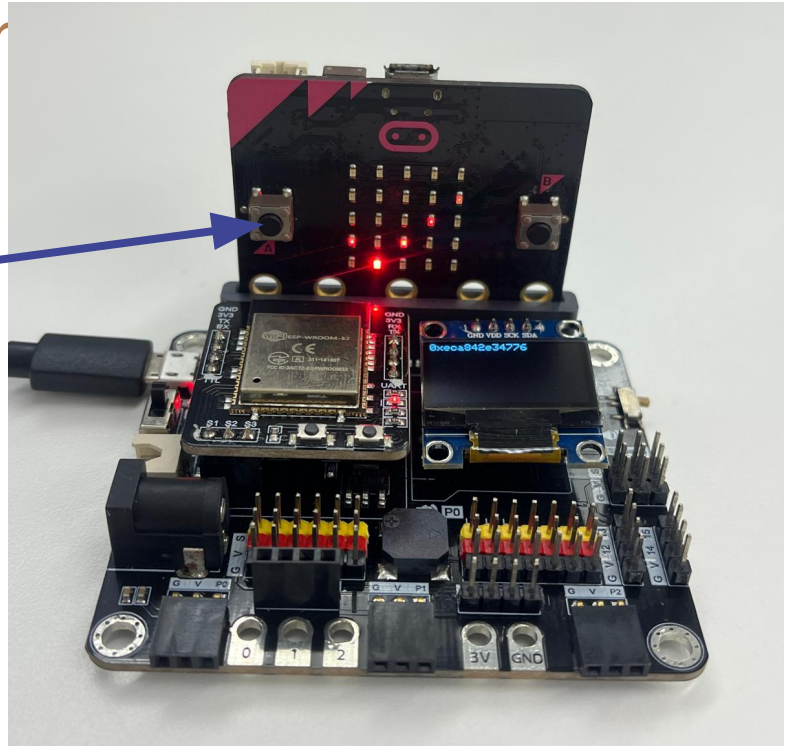
Execution

St


1 item
POST
Webhook
AI Agent
Chat Mode
Memory
Too
Output Parser
Send a message
send: message
Model
DeepSeek Chat Model
Execute workflow

Step 2: Tur

Press button A once



Result

micro:bit IoT:bit | 植物生長健康監測報告 收件匣 ×

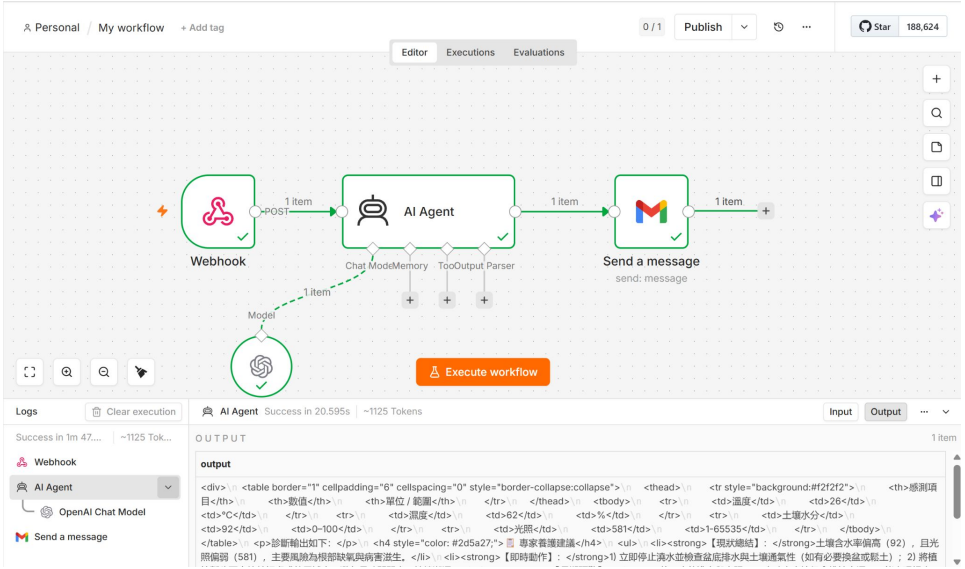
Sophia Tang <sophia.tang.smarthon@gmail.com>
寄給 我

感測項目	數值	單位 / 範圍
溫度	26	°C
濕度	62	%
土壤水分	92	0–100
光照	581	1-65535

診斷輸出如下：

📋 專家養護建議

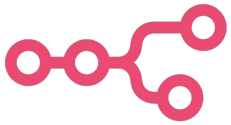
- **【現狀總結】**：土壤含水率偏高（92），且光照偏弱（581），主要風險為根部缺氧與病害滋生。
- **【即時動作】**：1) 立即停止澆水並檢查盆底排水與土壤通氣性（如有必要換盆或鬆土）；2) 將植株暫移至光線較好處或啟用補光，避免長時間弱光下持續潮濕。
- **【長期預警】**：若不改善排水與光照，24小時內土壤仍會維持高濕，可能出現根腐、葉片泛黃脫落及病菌徵兆；改善通風與光照可在24小時內緩解惡化風險。



Pricing

Pricing

n8n and large language models are charged seperately



n8n

+

Gemini

deepseek

OpenAI

Copilot

n8n



- 14-day free trial available
- All programs will be removed after 21 days

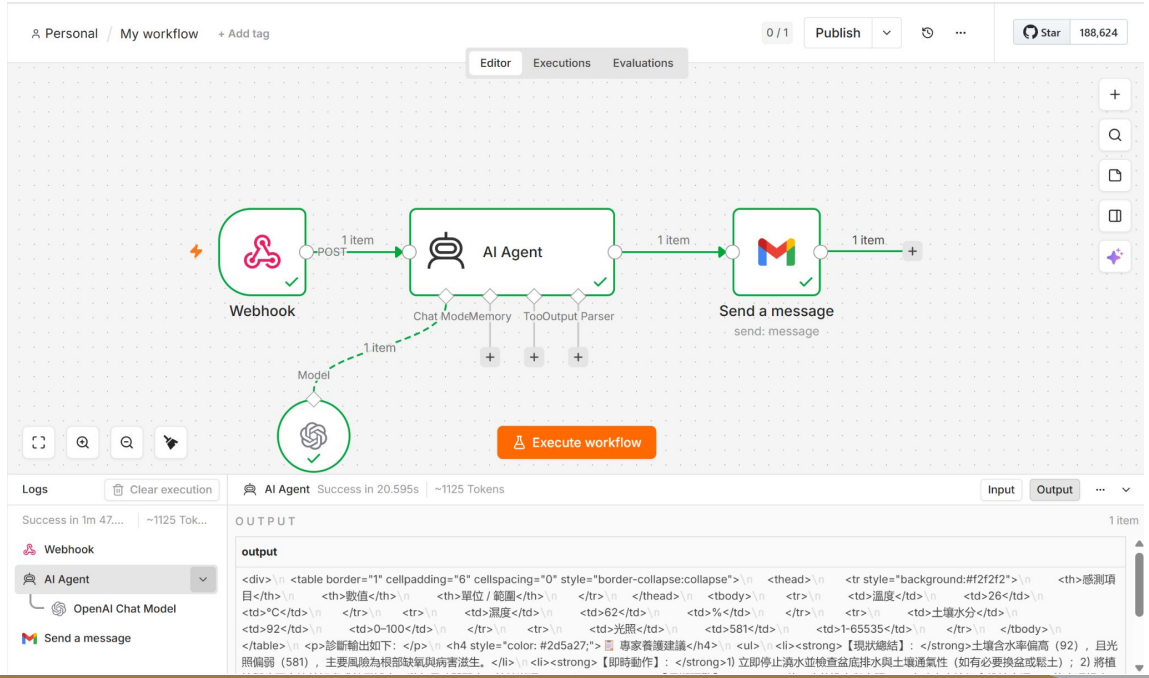
Free	14-day free trial	ALL
starter	24€/mo, billed monthly ≈200HKD	5 Active Workflows / 2.5K Executions
pro	60€/mo, billed monthly ≈550HKD	15 active workflows / 10k executions

- Active Workflows : The number of workflows n8n can run simultaneously at the same time
- One workflow execution = a single successful run of your entire workflow from start to end

Self-Hosted n8n Cloud

n8n

We are planning to host our own n8n Cloud in the future for free use



Large Language Models (LLMs)

n8n can connect to the following LLMs:

- Deepseek
- Gemini
- Copilot
- OpenAI









Deepseek	先充值才能使用	不需要	- 性價比高，最低只需幾元 - 容易取得 API	目前沒有免費試用	- 輸出效果較好 - 有時候會不穩定	充值到帳戶
Gemini	- 每天有免費額度可以使用 - 進入收費階段後，費用在三者中最高	需要，可能會被封鎖	生成效果最穩定	- 需要 VPN - 免費額度限制較多	生成效果最穩定	- 綁定信用卡 - 預付款
OpenAI	- n8n 自帶一個免費模型 - 正式版需要充值使用 - 按 tokens 計費，價格在三者中屬中間水平	n8n free credit: 不需要 正式版: 需要	有免費的n8n自帶模型	- 免費版效果一般 - 正式版需要 VPN	- 免費版效果一般 - 正式版較穩定	充值到帳戶







What you know now

1. You will understand Product Introduction/Structure
2. Build 1-2 cases of the product
3. How to build a scene
4. Hardware feature and operation
5. Model operation
6. Learn basic wifi, and thingspeak
7. Learn AI n8n automation (Understand the concept)

END