A Project entitled

Conceptualizing IoT with M5Go

Submitted by

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Declaration

I, Chuang Alvin declare that this research report represents my own work under the supervision of Dr. So Chi Fuk Henry, and that it has not been submitted previously for examination to any tertiary institution.

Signed ___

Chuang Alvin

7/4/2022

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Project title: Conceptualizing IoT with M5GO

ABSTRACT

Due to the high significance of the Internet of Things (IoT), the society has shown more demand of IoT knowledge for the information technology industry. However, the education sector did not provide enough training for nurturing IoT talents. So, there is a huge need for curriculums and teaching packages about IoT. In this paper, a ready-to-use curriculum and teaching package were introduced, which consists of lesson plans, PowerPoints, instructional guides, and assessment worksheets. The paper also discussed about the idea of the whole design, which may let teachers to have more insights of how to utilize the package into their own teaching. Problems and modifications are also mentioned in the paper to highlight the advantages and features of the package. Also, comments from in-service teachers were also included for extra reference and provides possibilities for further improvement. Using this teaching package is welcomed; any in-service teachers & pre-service teachers can get copies of it and use it for their teaching. The whole teaching package is available at https://drive.google.com/file/d/1AbPr54v6fMoxJgPG4-SXBv1nnYL_nTl7/view?usp=sharing for anyone to download.

1 Introduction

Internet of Things (IoT) has become a relevant concept in recent years, and ideas such as "smart home" and "smart factory" have started to affect our lives more. He et al. (2016) describe that the Internet of Things is rapidly emerging as the communication infrastructure of the next generation, and we can see that IoT will become a significant topic in the following decades.

The management consulting industry had also foreseen this momentum as McKinsey Global Institute issued a report in 2015 that estimates a 3.9 – 11.1 trillion-dollar economic impact across nine sectors of industry by 2025 (He et al., 2017). The rapid growth of IoT applications has increased the demand for experienced professionals. However, IoT has not yet been formally included, even in tertiary education (He et al., 2017). We notice a massive need, yet almost no training in the market, which makes curriculums dedicated to IoT valuable to society. It is essential to let students get in touch with the latest technology to develop their interests.

The hardware set used in this curriculum is M5Go, a multi-unit IoT console. M5Go is used because of its high reliability, and it is also beginner-friendly. M5Go is implemented for various industrial-level purposes, which proves its high reliability. When students learn with this tool, they will encounter real problems that they may face in their job. Also, M5Go is

considered beginner-friendly because of the support of Blockly programming. Blockly programming can protect learners from frustration brought by syntax errors that allow learners to focus on the core computational ideas being taught (Trower & Gray, 2015).

2 Project output

This section defines the scope of IoT that will be taught in the curriculum, then introduces the package's components and features.

2.1 Scope of the curriculum

In this curriculum, the C2A2 model of the IoT data lifecycle suggested by Trilles et al. (2020) was adopted because of its conciseness. Students can differentiate IoT projects and non-IoT projects with this model without understanding too deep into the technological aspects. It defines the 4 data lifecycle phases of an IoT system and explains how raw entry data can become an action elsewhere.

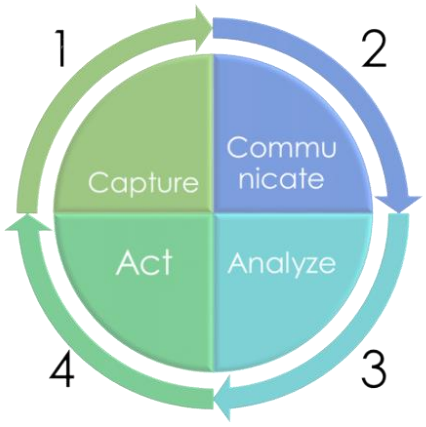

Figure 1 – The C2A2 model of the IoT data lifecycle

The whole curriculum consists of four projects and nine 60-minutes-lessons. It was designed to fit secondary 1-3 students with little programming experiences, which refers to the current situation of coding education in Hong Kong. Students can learn IoT concepts and technologies by building projects that perform tasks to solve practical problems without human intervention.

Students will learn the IoT data lifecycle step-by-step, and the data flow complexity will increase throughout the whole curriculum. It goes from wire communication to the entire IoT data lifecycle. This structure sets the foundation of communication methods and mimics the evolution of communication technologies which helps students build up a solid cognition of IoT technologies. The intended learning outcomes are established to support the teaching of the data lifecycle, which includes theoretical concepts, programming functions, and hardware utilization knowledge that will be crucial during the learning process.

Project	Data flow type	Intended learning outcome
Project 1 – Green reading lamp	Wire communication	Understand the wiring of M5GO Implement wait functions to separate iterations Utilize ANGLE & RGB unit
Project 2 – Infrared gun	Wireless communication	Understand the usage of variables Utilize If-else statement Understand the characteristics of Infrared Utilize the IR unit
Project 3 – My Observatory	Sending data through Internet	Understand the data structure of MQTT Understand the role of Thingspeak Upload data to Thingspeak Utilize the ENV unit
Project 4 – Alarm system	Use data on Internet to trigger customized action	Understand the whole IoT data life cycle Utilize React, ThingHTTP, IFTTT to create notification Utilize the PIR unit

Figure 2 – Summary of the curriculum

2.2 Components of the teaching package

For each lesson, lesson plan, PowerPoint presentation, and assessment worksheet are included. Instructional guides will also be provided if there are complicated procedural tasks.

The lesson plans consist of topics, activities, and questions for assessing purposes. The topics will outline the main concepts that the lessons should deliver, complemented by class activities that emerge practical approaches to deliver the learning objectives, followed by questions that can assess students' understanding for teachers to adjust the pace of the lesson. The order of topics makes sure that students are only exposed to one new concept at a time to increase the comprehensiveness.

The PowerPoint presentations were designed to help visualize abstract concepts and provide

instructions to the students during class activities. Colors were utilized to bind concepts for students' better memory retention. This color-functionality association method was useful to indicate what goes to where when the color is used consistently in an interface (Malamed, 2015) (improved after the pilot study).

The assessment worksheet serves as an assessment and a revision tool. Each of the questions on the assessment worksheets directly refers to one of the lesson's learning objectives. Except for assessing students, the worksheets can also be used as a revision tool to quickly revise the previous lesson's learning objective.

The instructional guides can cater the speed difference in performing procedural tasks between students with different abilities. It significantly saves time and effort of the teacher. It also helps students to catch up by themselves instead of having to seek assistance from the teacher or classmates, which may slow down the whole class.

3 Pilot Study

The pilot study of this curriculum was implemented with ten secondary 2 students who are able, have no prior knowledge of IoT, and have average to weak computer skills. Students only finish projects 1, 3, and 4 due to lack of time. Individual interviews have been done with

students enrolled in the pilot class. Interview questions were divided into knowledge acquisition, learning experience, and difficulties during the learning process.

3.1 Interview results

In the knowledge acquisition part, students self-evaluated their comprehension of IoT before and after the course (0 = Totally not understand, 10 = Totally understand). The mean score after the course is 7.25; comparing the mean score of 3.65 before the course, we can see a 3.6 increasement in the mean score. 60% of students think that it is because they understand the IoT data lifecycle; other students believe it is the technological and programming knowledge.

In the learning experience part, students were asked to define the difficulty of the course (0 = Very Easy, 10 = Very difficult). 70% of students answered 6 or below, indicating the course is mildly challenging but not too complex. Students were also asked about their enjoyment during the course (0 = Very unenjoyable, 10 = Very Enjoyable), and 80% of the students answered 8 or above, meaning that the course design can effectively maintain the learning motive of the students.

In the learning difficulties part, 40% of the students claim that the Thingspeak setup is too difficult and they even think that they cannot handle the part without the teacher's help. Some

other students also report similar issues with other setup procedures on different tools such as ThingHTTP, IFTTT, React, etc.

3.2 Problems encountered

Concluding the pilot study result, two main problems were spotted that require improvements. The first problem is that nearly half of the students cannot explicitly point out the IoT data lifecycle as what they learned. The concept is not discussed enough in class, resulting in focus misalignment between teachers and students. Another problem is that MQTT and other procedural setups were too confusing for the students, especially the procedures with multiple inputs. This can lower the efficiency of the course if brought to a full-sized class.

3.3 Modification of package

To cope with the low awareness of the concept of IoT data lifecycle, a “dataflow of the project” session was added at the end of each project so that the students could have more exposure to the dataflow of each project and categorize each action into the phases of the IoT data lifecycle. Thus, students will be more likely to aggregate the lifecycle of IoT compared to the version before the modification.

Figure 3 – "Dataflow of the project" part of project 2

Figure 4 – "Dataflow of the project" part of project 4

About the confusion problem of instructions, coloring was used to help students to match up different data with its destined field. In this way, students can better understand which chunk of data should be inputted in which field.

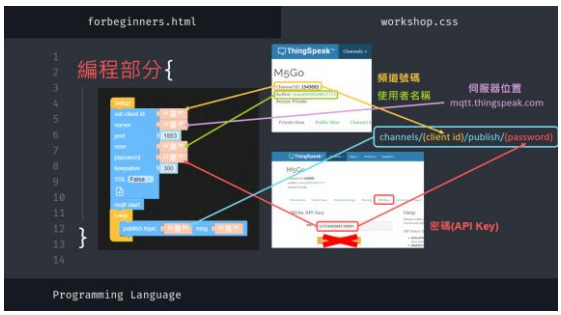

Figure 5 – Instructions shown in color

Figure 6 – Summary shown in color

4 In-service teacher consultation

Consultation sessions were implemented to get quality comments from teachers' perspectives. Three teachers were invited to comment on the curriculum and the teaching package.

About the content and structure of lesson plans & PowerPoints, teachers think that the content

of the curriculum is sufficient and achievable. However, a teacher suggested to add an additional event that let students to integrate all the knowledge in the previous lessons to design a product for the school. This kind of project can test the students' skills and train their creativity for implementing technology in real-life.

About the assessment worksheets, the teachers think that the worksheets can summarize the lesson and assess students' learning effectiveness. It can also be well-used as a revision tool at the beginning of each lesson. However, the teachers suggested that there can be more question types to better reflect students' understanding, such as matching or short questions. Also, preparing a more challenging version of homework was mentioned to further test students' depth of knowledge, leading to better planning of revision in future lessons.

About the instructional guides, Teachers think that it will save time for the teachers, and the steps in the instructional guide are clear enough. A teacher suggests being more detailed about basic operations of computer, such as how to copy a value and paste it elsewhere. Students nowadays grew up with tablets instead of computers, which makes them know less about operations of computer.

5 Conclusion

In conclusion, this IoT course is ready-to-use for teaching junior secondary students. Lesson plans, PowerPoints, instructional guides, and assessment worksheets were designed to assist the teaching process. Using this teaching package is welcomed; any in-service teachers & pre-service teachers can get copies of it and use it for their teaching. The whole teaching package is available at https://drive.google.com/file/d/1AbPr54v6fMoxJgPG4-SXBv1nnYL_nTl7/view?usp=sharing for anyone to download.

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Appendix I – Lesson plans of "Conceptualizing IoT with M5Go"

Conceptualize IoT (M5Go) Lesson 1 – What is IoT?

Date: TBC **Duration:** 60 minutes

Venue: TBC **Grade:** Secondary 2

Number of students: TBC

Level: Able student, CMI school, no prior knowledge to IoT

Subject: Computer Literacy

Topic: What is IoT?

Learning objectives: After the lesson, the students will be able to

- Distinguish the difference between Internet of Things and traditional Information Technology aspects
- Define the four parts of the IoT data life cycle
- Utilize the user interface of M5Flow to complete a "Hello World" program

Time (Minutes)	Topic	Activities	Exercise	Materials
0-5	Self-introduction & Introduction of the course			Powerpoint presentation
6-20	Introduction of IoT		Question: "What are the two characteristics of IoT?"	Powerpoint presentation
21-25	Introduction of the IoT data life cycle		Question: "Turning on a light source belongs to which stage?"	Powerpoint presentation
26-30	Introduction of M5Stack		Question: "What can you see on the M5Stack?"	Powerpoint presentation M5Go Set
31-45	Connection between M5Stack and UIFlow			Powerpoint presentation M5Go Set

46-55	Introduction of M5Flow UI	Run a hello world program		Powerpoint presentation M5Go Set
56-60	Recap key features of the lesson			Powerpoint presentation

Conceptualize IoT (M5Go) Lesson 2 – Inputs and Outputs

Date: TBC **Duration:** 60 minutes

Venue: TBC **Grade:** Secondary 2

Number of students: TBC

Level: Able student, CMI school, no prior knowledge to IoT

Subject: Computer Literacy

Topic: Inputs and Outputs

Learning objectives: After the lesson, the students will be able to

- Utilize buttons on M5Stack to be an input method
- Implement wait functions to separate iterations
- Utilize RGB unit

Time (Minutes)	Topic	Activities	Exercise	Materials
0-5	Greetings & revision		Question: "What are the two characteristics of IoT ?"	Powerpoint presentation
6-10	Button inputs		Question: "Which button is button C?"	Powerpoint presentation M5Go Set
11-20	Side LED bars and wait function	Observe the difference between blinking LEDs with and without wait		Powerpoint presentation M5Go Set
21-35	Police car alarm	Use side LED bar and wait function to mimic police alarm		Powerpoint presentation M5Go Set
36-40	Wires and connection		Question: "Which port supports	Powerpoint presentation

			most of the units?”	M5Go Set
41-55	Introduction of RGB unit	Write a program that imitate traffic light		Powerpoint presentation
56-60	Recap key features of the lesson		Question: “Which port should the RGB unit connect to ?”	Powerpoint presentation

Conceptualize IoT (M5Go) Lesson 3 – Green Reading Lamp

Date: TBC **Duration:** 60 minutes

Venue: TBC **Grade:** Secondary 2

Number of students: TBC

Level: Able student, CMI school, no prior knowledge to IoT

Subject: Computer Literacy

Topic: Green Reading Lamp

Learning objectives: After the lesson, the students will be able to

- Distinguish between warm and cold color
- Utilize ANGLE unit
- Apply connection between separate data values

Time (Minutes)	Topic	Activities	Exercise	Materials
0-5	Greetings & revision		Question: "What are the two characteristics of IoT ?"	Powerpoint presentation
6-10	Warm and cold color		Question: "What is an example of a warm color?"	Powerpoint presentation
11-25	Color switch	Use buttons to control the color of the LED unit		Powerpoint presentation M5Go Set
26-35	Introduction of ANGLE unit	Insert sample program to find the range of output of ANGLE unit		Powerpoint presentation M5Go Set
36-55	Design green reading lamp	Design a program which can change the brightness and color of the lamp		Powerpoint presentation M5Go Set

56-60	Recap key features of the lesson		Question: “How can we use an input value as an output?”	Powerpoint presentation

Conceptualize IoT (M5Go) Lesson 4 – Memory & Logic

Date: TBC **Duration:** 60 minutes

Venue: TBC **Grade:** Secondary 2

Number of students: TBC

Level: Able student, CMI school, no prior knowledge to IoT

Subject: Computer Literacy

Topic: Memory & Logic

Learning objectives: After the lesson, the students will be able to

- Utilize variables for storing data
- Read "if-else" clause and predict the outcome of a program
- Create "If-else" statement for controller to handle simple logical tasks

Time (Minutes)	Topic	Activities	Exercise	Materials
0-5	Greetings & revision			Powerpoint presentation
6-10	Variables	Download a sample program and find the difference of set and change	Question: "If I want to add a value to a variable, which command should I use?"	Powerpoint presentation M5Go Set
11-25	Design a tally register	Write a program that can count numbers on button clicks		Powerpoint presentation M5Go Set
26-40	Introduction of If-then, else-if, else blocks		What is the name of the block besides "if"	Powerpoint presentation M5Go Set
41-55	Design a grading system	Design a grading system that translates a score into a grade		Powerpoint presentation M5Go Set

		according to a grading table		
56-60	Recap key features of the lesson			Powerpoint presentation

Conceptualize IoT (M5Go) Lesson 5 – Infrared Gun

Date: TBC **Duration:** 60 minutes

Venue: TBC **Grade:** Secondary 2

Number of students: TBC

Level: Able student, CMI school, no prior knowledge to IoT

Subject: Computer Literacy

Topic: Infrared gun

Learning objectives: After the lesson, the students will be able to

- Understand the characteristics of Infrared
- Utilize IR unit

Time (Minutes)	Topic	Activities	Exercise	Materials
0-5	Greetings & revision			Powerpoint presentation
6-10	Methods of data transmission		Question: "Is there any ways that we transmit data in daily life?"	Powerpoint presentation
11-15	Introduction of infrared		Question: "Why can't we see infrared?"	Powerpoint presentation
16-25	Introduction of IR unit		Question: "Why can't we see infrared?"	Powerpoint presentation M5Go Set
26-50	Design infrared transmitter and receiver	Students are divided into 2 groups and each group work on either a transmitter or a receiver		Powerpoint presentation M5Go Set

51-55	Data flow of the project		Question: “What is the data flow of the project?”	Powerpoint presentation
56-60	Recap key features of the lesson			Powerpoint presentation

Conceptualize IoT (M5Go) Lesson 6 – My Observatory & MQTT

Date: TBC **Duration:** 60 minutes

Venue: TBC **Grade:** Secondary 2

Number of students: TBC

Level: Able student, CMI school, no prior knowledge to IoT

Subject: Computer Literacy

Topic: My Observatory & MQTT

Learning objectives: After the lesson, the students will be able to

- Utilize ENV unit
- Understand the data structure of MQTT

Time (Minutes)	Topic	Activities	Exercise	Materials
0-5	Greetings & revision			Powerpoint presentation
6-15	Introduction of ENV unit		Question: "What weather data can we gather?"	Powerpoint presentation M5Go Set
16-25	Interface & program design for observatory	Design a program that refreshes the temperature, humidity, and pressure of the environment		Powerpoint presentation M5Go Set
26-35	Introduction of MQTT		Question: "What are the two main actions that happens to an MQTT broker?"	Powerpoint presentation
36-55	Data structure and usage of MQTT	Group discussion: Think of real-life use cases suitable of MQTT's data structure	Question: "Which object can be subscribed by a user?"	Powerpoint presentation

56-60	Recap key features of the lesson			Powerpoint presentation

Conceptualize IoT (M5Go) Lesson 7 – Upload data to Thingspeak

Date: TBC **Duration:** 60 minutes

Venue: TBC **Grade:** Secondary 2

Number of students: TBC

Level: Able student, CMI school, no prior knowledge to IoT

Subject: Computer Literacy

Topic: Upload data to Thingspeak

Learning objectives: After the lesson, the students will be able to

- Understand the role of Thingspeak
- Upload data to Thingspeak

Time (Minutes)	Topic	Activities	Exercise	Materials
0-5	Greetings & revision		Question: "What is the data structure of MQTT?"	Powerpoint presentation
6-20	Introduction Thingspeak	Create an account on Thingspeak		Powerpoint presentation
21-25	Create channel on Thingspeak	Create a functional channel with suitable fields		Powerpoint presentation
26-50	Send the values of ENV Units to Thingspeak	Write a program that publish the current values of ENV unit onto Thingspeak		Powerpoint presentation M5Go set
51-55	Data flow of the project		Question: "What is the data flow of the project?"	Powerpoint presentation
56-60	Recap key features of the lesson			Powerpoint presentation

Conceptualize IoT (M5Go) Lesson 8 – Alarm System

Date: TBC **Duration:** 60 minutes

Venue: TBC **Grade:** Secondary 2

Number of students: TBC

Level: Able student, CMI school, no prior knowledge to IoT

Subject: Computer Literacy

Topic: Alarm System

Learning objectives: After the lesson, the students will be able to

- Understand the characteristics of Passive Infrared
- Utilize PIR unit
- Add extra topics to an MQTT channel

Time (Minutes)	Topic	Activities	Exercise	Materials
0-5	Greetings & revision			PowerPoint presentation
6-10	Theft detection system		Question: "What ways can we use to detect thieves?"	PowerPoint presentation
11-15	Passive Infrared and PIR unit		Question: "If a person stands still in front of the PIR unit, what will be the likely return?"	PowerPoint presentation M5Go Set
16-30	Design a theft offline detection system	Design a program that let M5Go flashes red when PIR unit detects temperature change		PowerPoint presentation M5Go Set
31-35	Add extra topic to an MQTT channel	Add the topic "PIRsensor" to the existing channel	Question: "Which tab holds the channel's topics?"	PowerPoint presentation M5Go Set

36-55	Upload the output of PIR unit	Referencing the program of previous lesson, program M5Go so that it will upload the output of PIR unit onto Thingspeak		PowerPoint presentation M5Go Set
56-60	Recap key features of the lesson			PowerPoint presentation

Conceptualize IoT (M5Go) Lesson 9 – Notification E-mail

Date: TBC **Duration:** 60 minutes

Venue: TBC **Grade:** Secondary 2

Number of students: TBC

Level: Able student, CMI school, no prior knowledge to IoT

Subject: Computer Literacy

Topic: Notification E-mail

Learning objectives: After the lesson, the students will be able to

- Understand the usage of IFTTT
- Utilize React, ThingHTTP, IFTTT to create notification
- Construct an IoT project with the four phases of IoT data lifecycle

Time (Minutes)	Topic	Activities	Exercise	Materials
0-5	Greetings & revision		Question: "What are the possible outputs of PIR unit?"	Powerpoint presentation
6-10	Notifications		Question: "Which app gives you the most notifications?"	Powerpoint presentation M5Go
11-20	Introduction of IFTTT	Find a service that you are familiar with		Powerpoint presentation
21-35	IFTTT applet	Create an IFTTT applet that can send an email while receiving a HTTP request	Question: "What is the data flow of the project?"	Powerpoint presentation
36-45	React & ThingHTTP	Setup react and Thing HTTP, sending a HTTP request		Powerpoint presentation

		when PIR sensor reads a 1		
46-55	Project testing & Data flow of the project		Question: "What is the data flow of the project?"	Powerpoint presentation M5Go Set
56-60	Recap key features of the lesson			Powerpoint presentation

Appendix II – PowerPoint slides of "Conceptualizing IoT with M5Go"

forbeginners.html

workshop.css

```
物聯網（IoT）{
    [初階概念課程]

        <數據生命周期（Data life cycle）> //由零開始的物聯網課程

}
```

主題目錄{

01 設計閱讀燈(物理電訊號交流)

02 紅外線槍（無線傳輸訊號）

03 我的天文台（數據發佈）

04 智能防盜系統（數據發佈/訂閱）

}

forbeginners.html

workshop.css

第一課 {

    什麼是物聯網？

}

1
2
3
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14

物聯網的起源

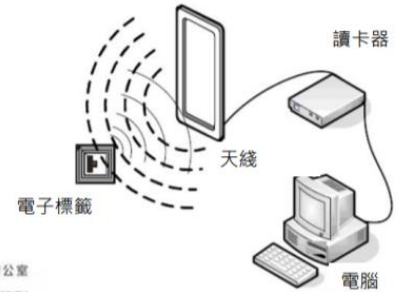
- 「物聯網」的概念最早可能是出現在比爾蓋茲(Bill Gates) 1995年所寫的書「未來之路」(**The Road Ahead**)
- 國際電信聯盟於2005年正式提出物聯網的概念
- 在物聯網的世界裡，每個裝置或物體均配置通訊晶片，以便透過附近的「基站」或「轉送站」把其收集到的數據傳送至資料處理中心或雲端，進行實時分析並作出實時應對或所需的應用

物聯網簡介

- 「互聯網」(Internet) ：連在一起的網絡
- 「物聯網」(Internet of Things) ：通過「互聯網」把裝置(device)和設備(equipment)連在一起
- 物聯網不只是把東西串起來，更重要的是讓裝置和設備之間可以互聯互通與互相交換資料並作出所需的指令

物聯網早期產品

- 現時普遍使用的無線射頻識別(Radio Frequency Identification) RFID裝置可說是物聯網的早期產品
- 日常例子:「八達通」、門卡等是運用了RFID 技術來操作。在適當的距離下，即使沒有物理接觸亦能讀取卡中的資料。
- 這些裝置不一定連接互聯網



通訊事務管理局辦公室 OFFICE OF THE COMMUNICATIONS AUTHORITY

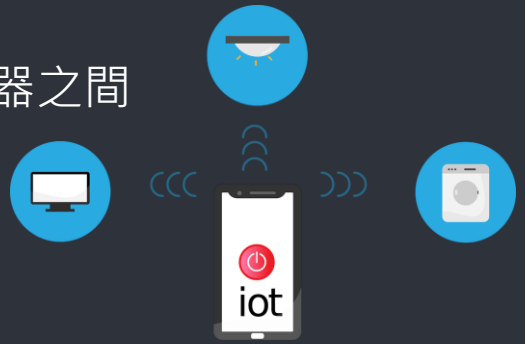
6

物聯網是什麼?{

機器與機器之間的溝通

人機交互（人與機器的互動）是傳統資訊科技領域裡的資訊交換模式。

物聯網的資訊交換模式則是機器與機器之間的互動。



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物聯網是什麼?{

通過互聯網傳輸數據

利用互聯網廣泛性，作為不同設備溝通的媒介，讓數據能夠在短時間內傳送到遠方。

由於使用了互聯網，人們可以共用傳感器及其接收的資訊，讓自己的設備更為輕便。

}

這是物聯網嗎？{

電子郵件

<在電腦裡傳送電子郵件到朋友的電子郵箱中。>

智能汽車

<感應路面情況而做出適當的選擇，例如當前車急速剎停，智能汽車能感知並避免碰撞。>

智能家居

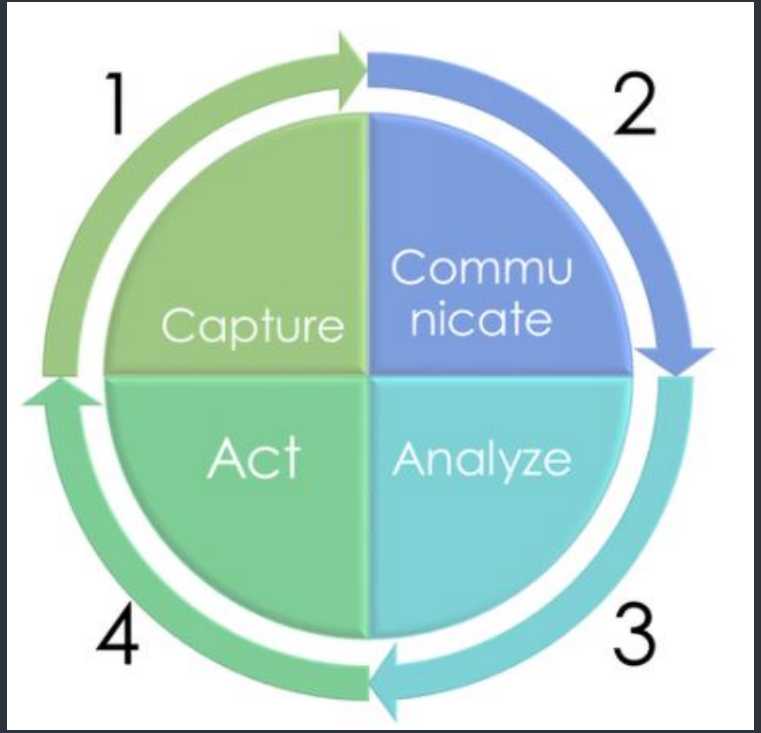
<當溫度計感測到家裡室溫高於33度時，自動開啟冷氣機以免家裡寵物中暑。>

}

物聯網的數據生命周期{

- 01 Capture 收集
- 02 Communicate 溝通
- 03 Analyze 分析
- 04 Act 行動

}



forbeginners.html

workshop.css

M5Go IoT新手套件{

```
    <M5Stack *1,
    RGB Unit *1,
    ANGLE Unit *1,
    IR Unit *1,
    ENV unit *1,
    PIR Unit *1,
    HUB Unit *1,
    USB to Type-C wire *1
    USB to POGO pins wire *1
    Grove Cable *4
    Lego parts…
    >
}
```

Programming Language

```
1
2
3
4
5
6
7
8
9
10
11
12
13
14
```

M5Stack{

    <它身上有什麼部分？>

}

連接編程環境（UIflow）{

第01步 按下紅色按鈕開啟M5Stacks。

第02步 等待到連接WiFi的畫面，然後按下右邊的按鍵，進入“Set WiFi”的頁面。

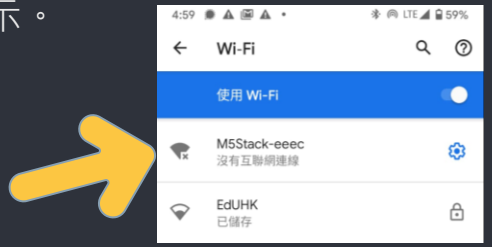
}

25%

連接編程環境（UIflow）{

第03步

連接M5Stack的WiFi，你的M5Stack WiFi名稱會在這裡顯示。



第04步

你的M5Stack將會出現Scan & Setup頁面，掃描頁面上的QR code或在瀏覽器上輸入“192.168.4.1”

}

50%

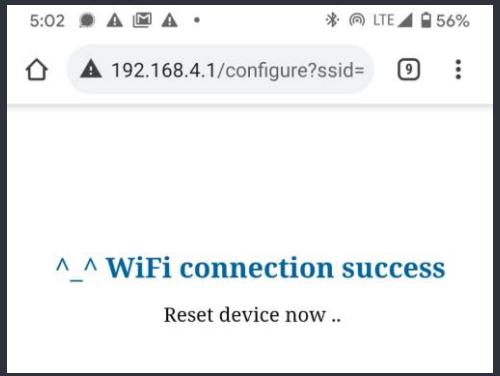
連接編程環境（UIflow）{

第05步

在瀏覽器的頁面上輸入有互聯網連接的WiFi SSID和密碼，然後按“Configure”。

第06步

等待瀏覽器出現右方頁面，然後將手提裝置連接至第5步所輸入的WiFi網絡，此時，M5Stack的畫面應如下圖。



}

75%

連接編程環境（UIflow）{

第07步

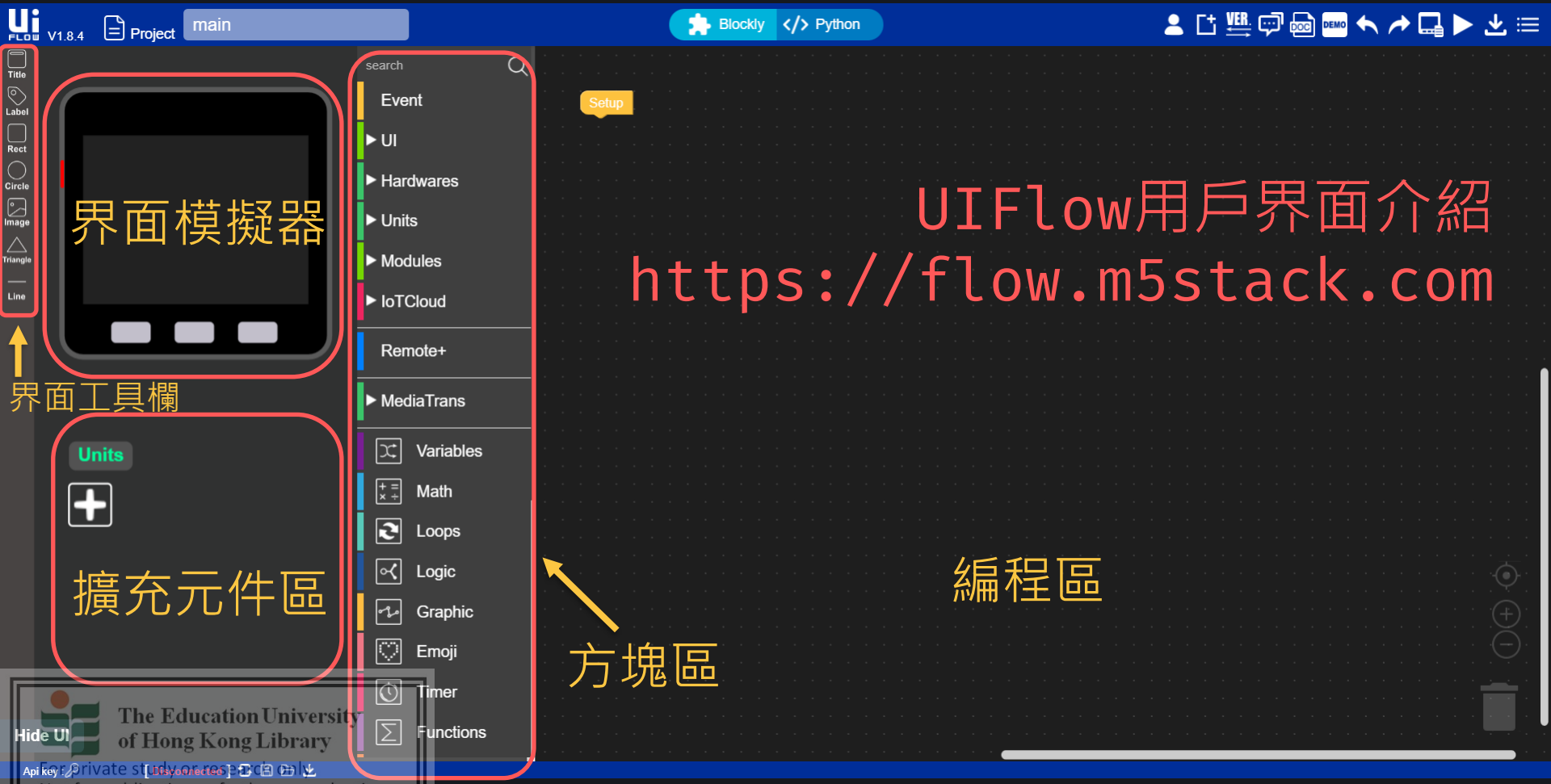
你的M5Stack會自動重啟，嘗試連接到WiFi，成功的話應該出現APIKEY和一個QR code。失敗的話，按“reconnect”再試一次便可。

第08步

使用電腦的瀏覽器訪問 https://flow.m5stack.com/，並輸入M5Stack上的APIKEY，然後按OK。

}

100%



forbeginners.html

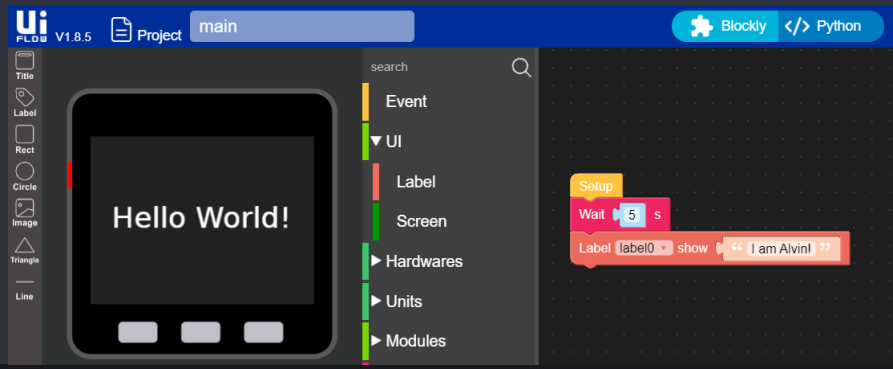
workshop.css

Hello World ! {

<在M5Stack上顯示文字>

< /1 > * 在M5Stack界面上加上一個文字標籤(Label)

< /2 > * 使用編程方塊改變文字標籤上的文字



}

課堂總結

物聯網

機器與機器之間的溝通
通過互聯網傳輸數據

物聯網的數據生命周期

01 Capture 收集　02 Communicate 溝通
03 Analyze 分析　04 Act 行動

M5Stack上顯示文字

Label Label0 Show “Hello World”

forbeginners.html

workshop.css

第二課 {

    輸入與輸出

}

上堂重溫

物聯網

機器與機器之間的溝通
通過互聯網傳輸數據

物聯網的數據生命周期

01 Capture 收集　02 Communicate 溝通
03 Analyze 分析　04 Act 行動

M5Stack上顯示文字

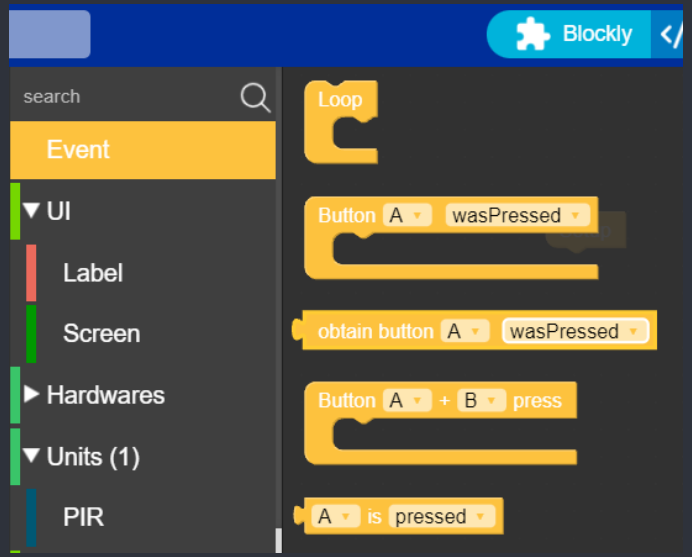
Label Label0 Show “Hello World”

按鈕控制{

方塊位置：“Event”(事件) > “Button A was pressed”(當按鈕A被按下)

用途：當按鈕A被按下，將執行裡面的內容

例子：當按鈕A被按下，側面燈條亮起紅燈
當按鈕B被按下，側面燈條亮起綠燈



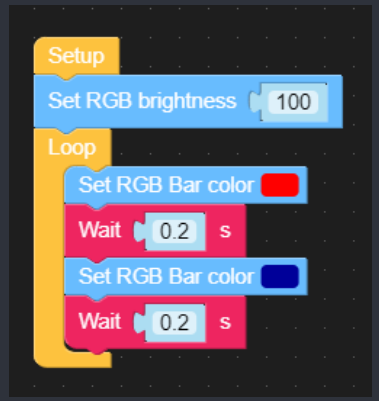
}

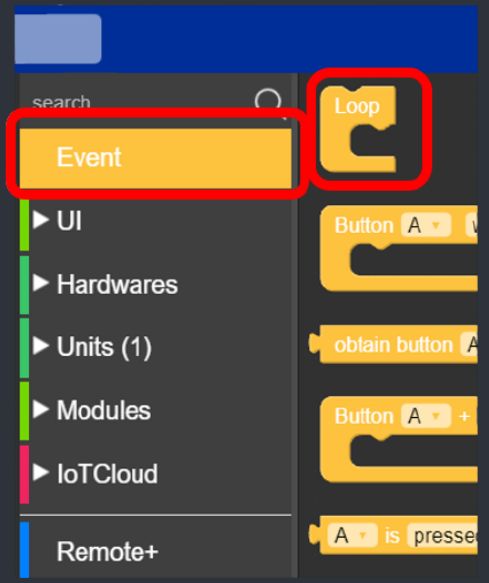
無限循環{

方塊位置：“Event”(事件) > “loop”(無限循環)

用途：將裡面的內容無限次重複運行

例子：側面燈條不斷紅藍閃爍，
每次相隔0.2秒



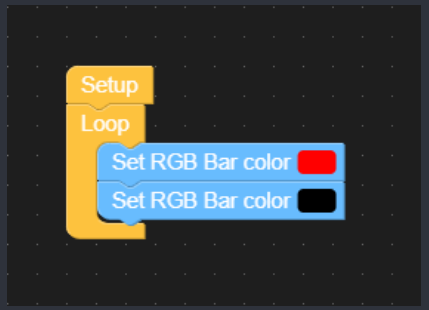


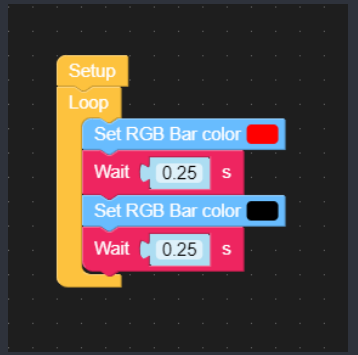
Wait（等待） {

讓M5Stack等待...

* 電子元件運行的速度很快，我們需要限制它的速度
* 使用等待來使每個循環能被觀察到

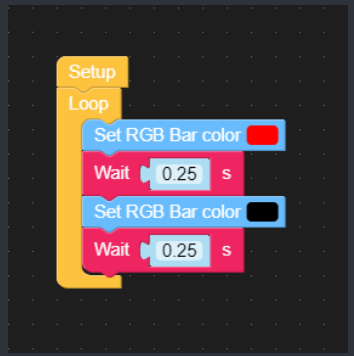
}



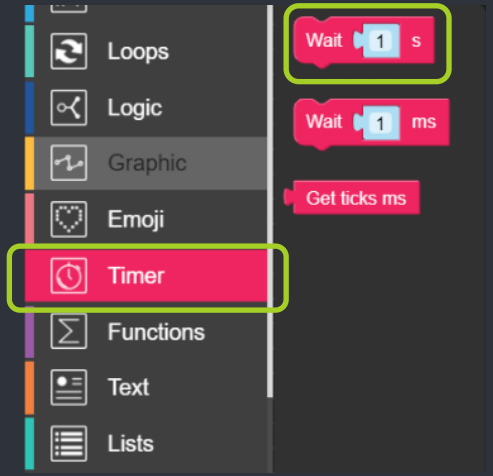


Wait （等待）

wait方塊可以控制每個循環的用時



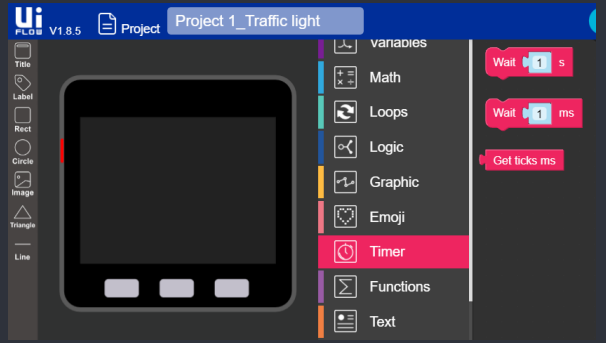
方塊位置：Timer



forbeginners.html

workshop.css

活動1 – 警車警號{



< /1 >
* 按次序亮起“紅-黑-紅-黑”色

< /2 >
* 按次序亮起“紅-藍-紅-藍”色

< /3 >
* 左面燈條閃爍紅色
* 右面燈條閃爍藍色

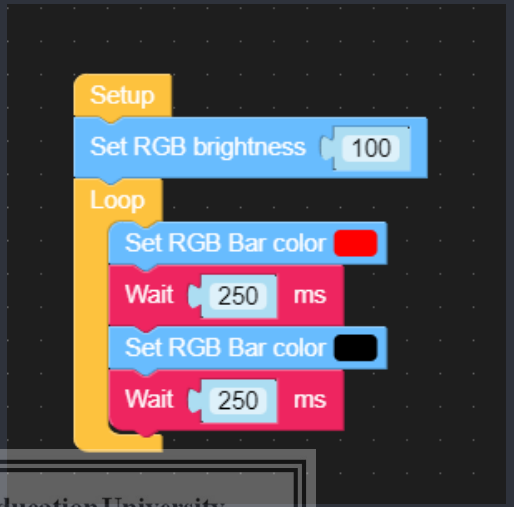
}

forbeginners.html

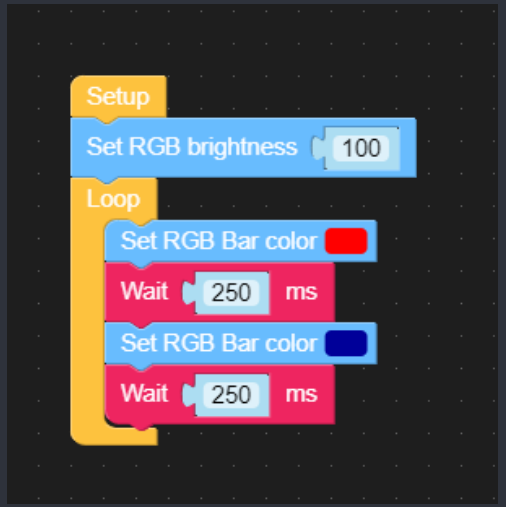
workshop.css

參考程式

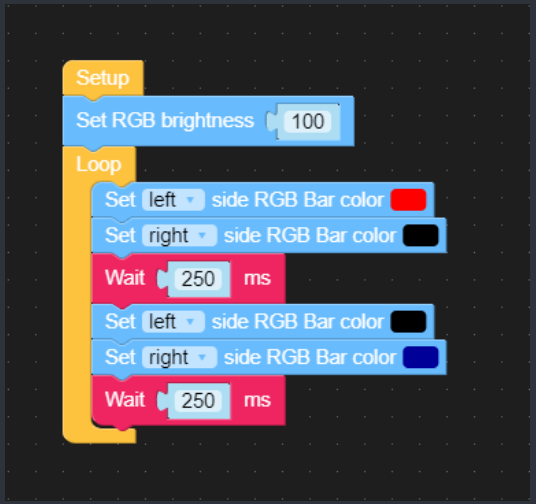
< /1 >



< /2 >



< /3 >



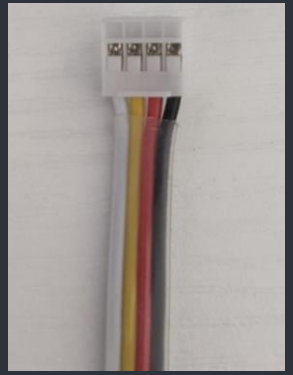
線材與連接{

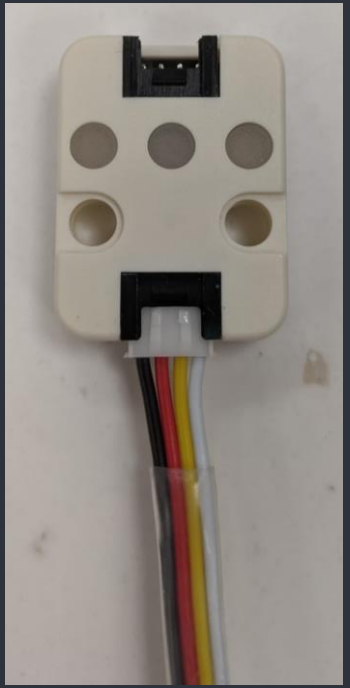
GROVE線

<注意線的方向，不要過於大力操作>

<留意GROVE線底部的兩隻牙>

}

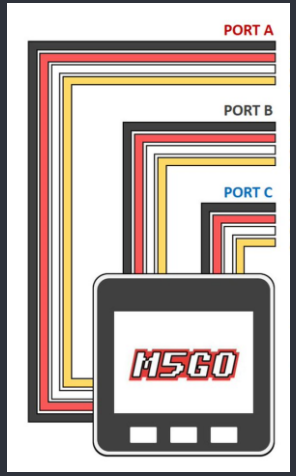




線材與連接{

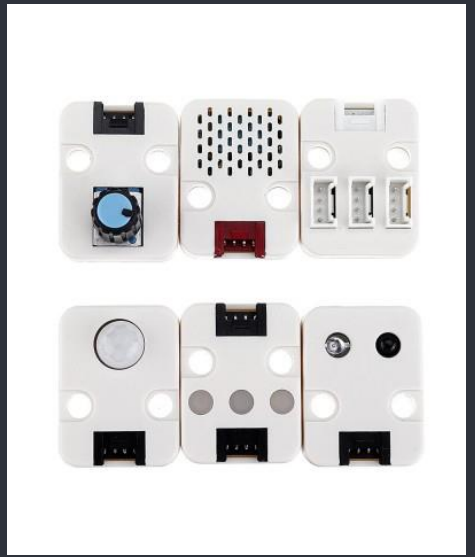
M5Stack的不同接口

M5Stack有3個接口，Port A, B, 和C。分別被標記為紅色，黑色，和藍色。



M5Go元件的接口

與M5Stack一樣，M5Go的元件也被分為三類，以顏色標誌該連接的M5Stack接口。

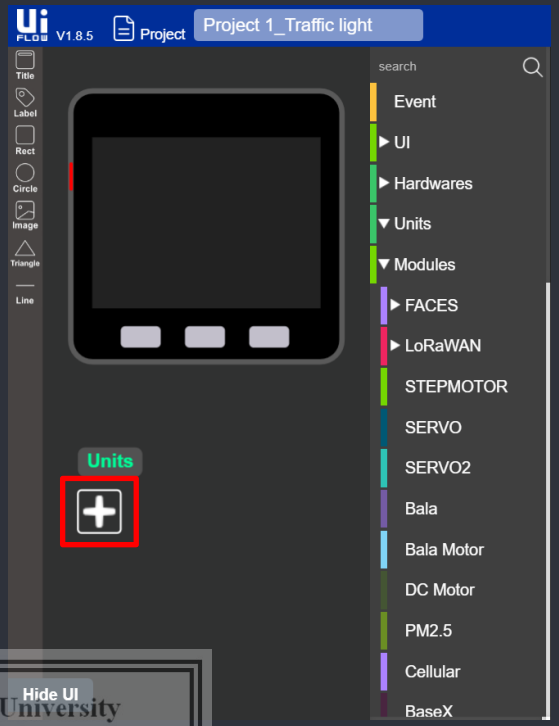


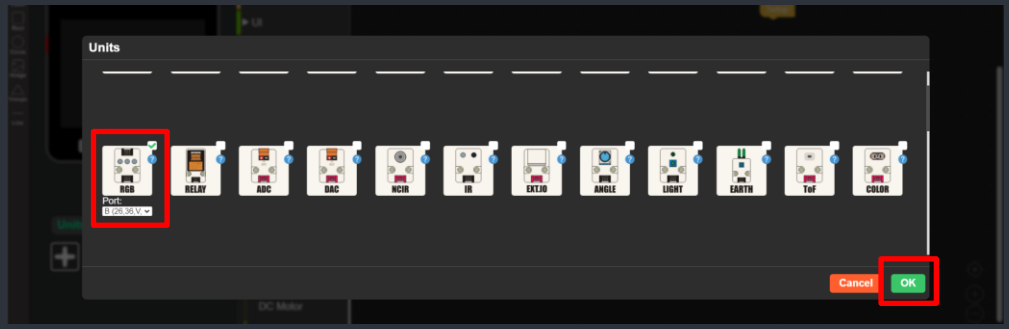
}

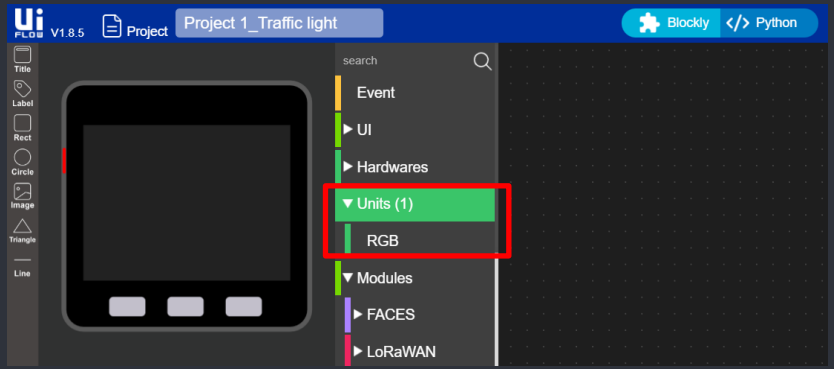
forbeginners.html

workshop.css

將元件加入專題{



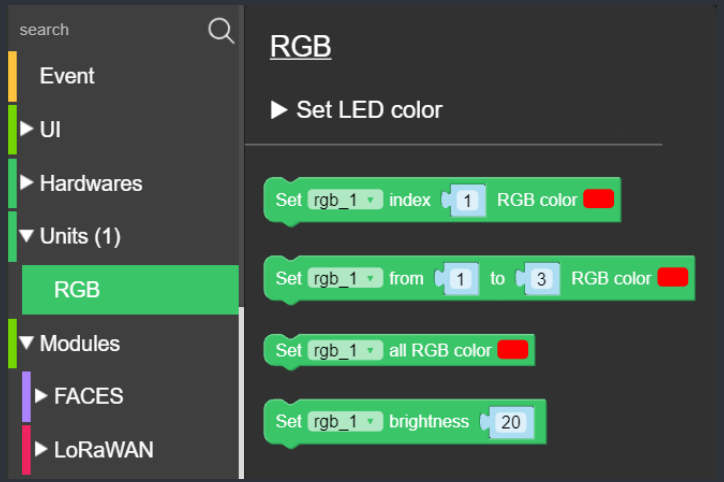




}

Programming Language

RGB 元件介紹{



設定RGB的顏色

設定RGB的亮度

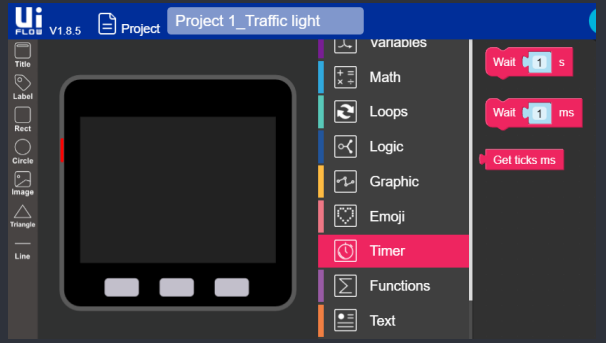
}

forbeginners.html

workshop.css

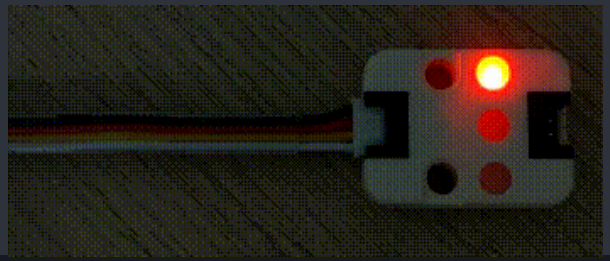
活動2 – RGB紅綠燈{

<利用RGB元件來模擬紅綠燈>



< /1 > * 當按鈕A被按下，按次序亮起“紅-紅黃-綠”色

< /2 > * 當按鈕B被按下，按次序亮起“綠-黃-紅”色



}

課堂總結

按鈕控制

當按鈕A被按下，將執行方塊裡面的內容

無限循環、等待

使用等待來使每個循環能被觀察到，並控制每個循環的用時

RGB元件控制

將元件加入專題
設定RGB的顏色和亮度

forbeginners.html

workshop.css

第三課 {

環保閱讀燈

}

上堂重溫

按鈕控制

當按鈕A被按下，將執行方塊裡面的內容

線材與連接

Port A, B, 和C。分別被標記為紅色，黑色，和藍色。
M5Go的元件以接口顏色標誌應該連接的M5Stack接口。

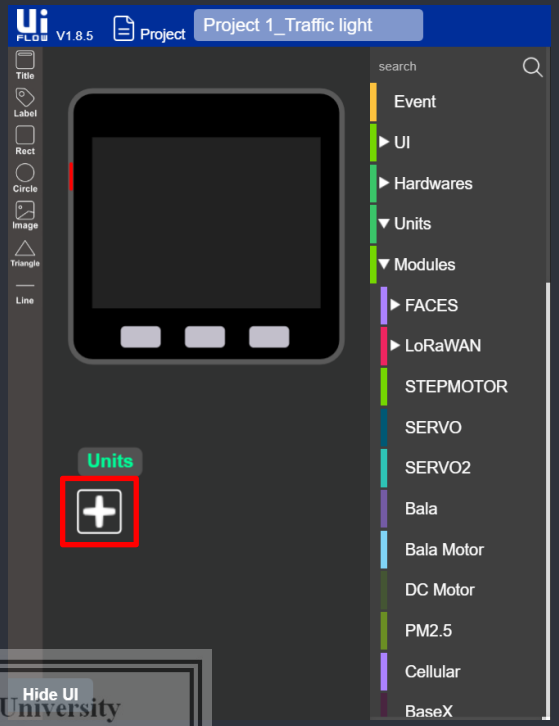
RGB元件控制

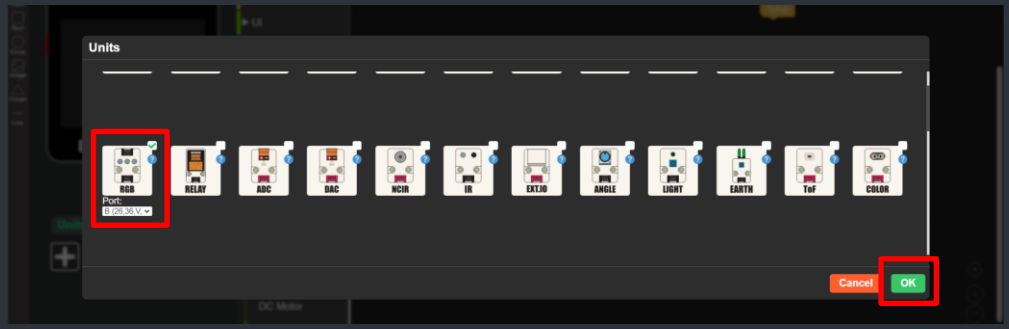
將元件加入專題
設定RGB的顏色和亮度

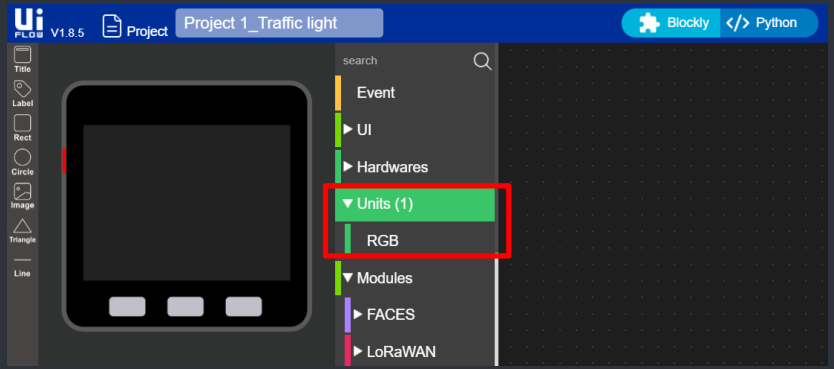
forbeginners.html

workshop.css

將元件加入專題{



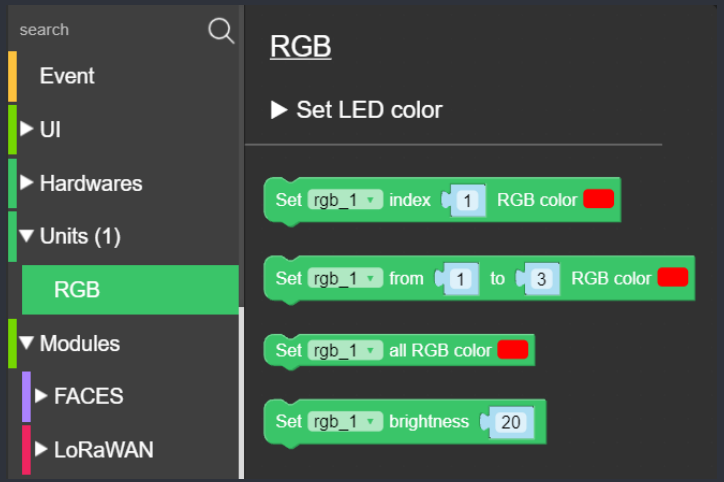




}

Programming Language

RGB 元件介紹{



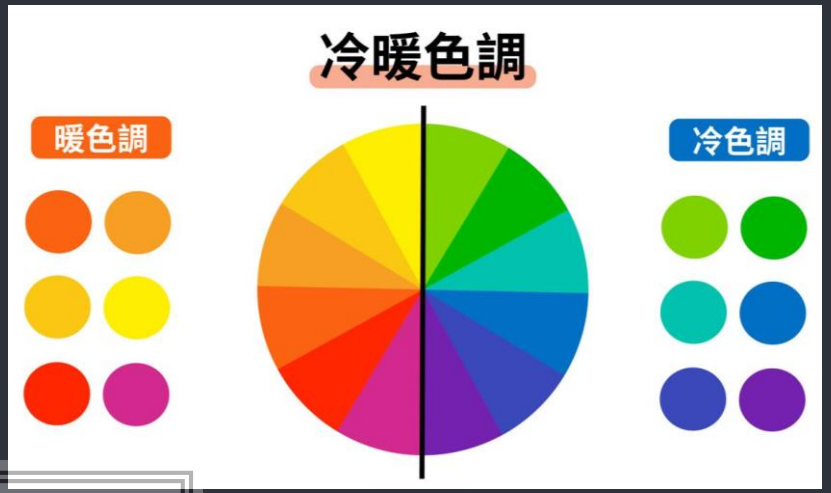
設定RGB的顏色

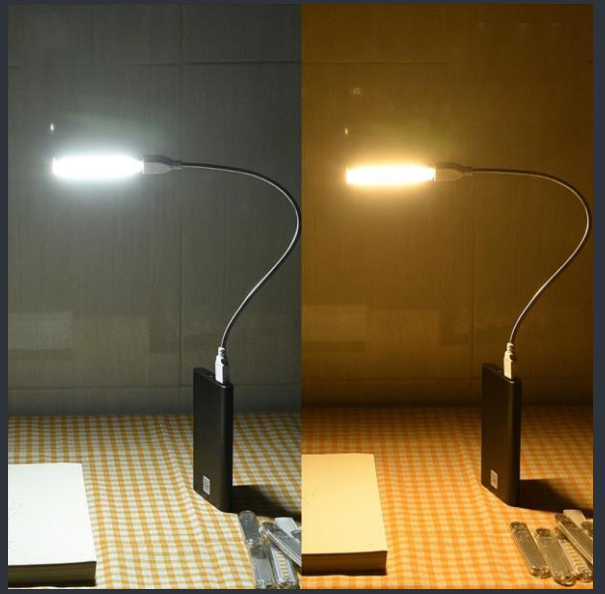
設定RGB的亮度

}

冷色與暖色{

透過不同的色調，LED燈能展示冷色與暖色。





}

活動一 – 冷、暖色燈{

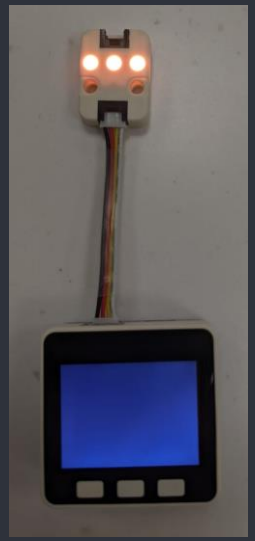
設計一個程式，令LED unit能夠切換冷暖色燈。

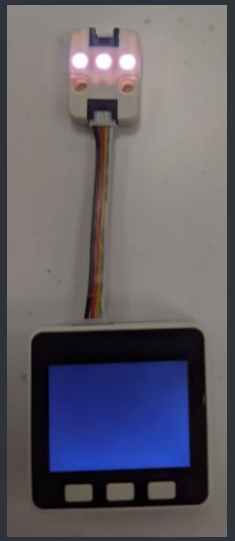
步驟1：嘗試找出兩個輸入方法

步驟2：每個輸入要令LED unit的三盞燈同時亮起同一顏色的光

額外挑戰：設計第三種燈光模式（彩虹燈）

}





如何收集輸入？{

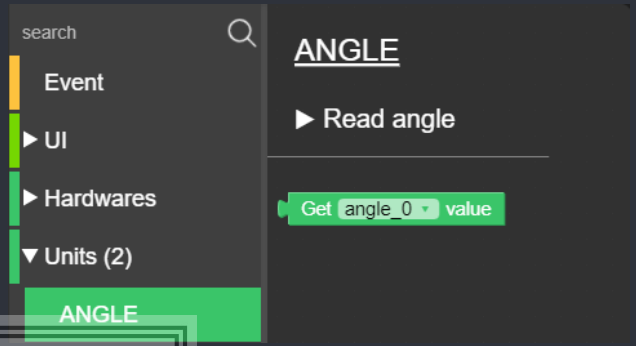
是想象一下，你想在你的閱讀燈上設計多少種亮度？

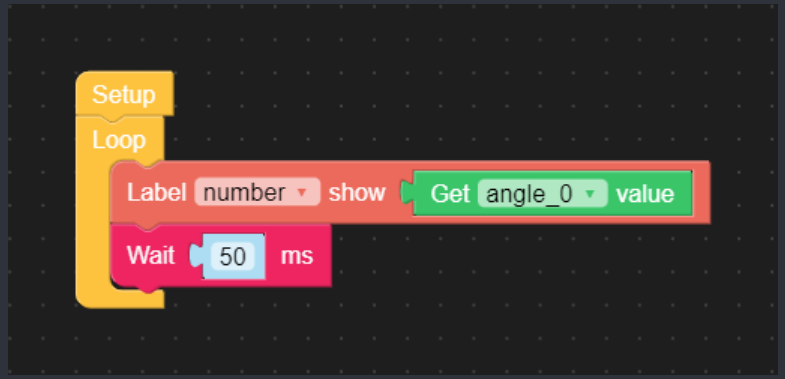
看看以下的輸入方式，他們能怎樣代表不同的設定？

}

ANGLE元件{

ANGLE元件能夠不斷讀取自身的角度值，並用作輸入用途。





}

活動二 – 環保閱讀燈{

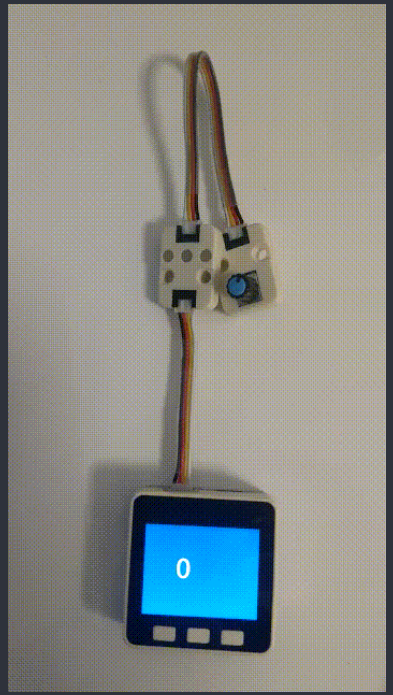
設計一個程式，利用ANGLE unit令LED unit能夠調整至不同亮度並能選取冷暖色。

步驟1：先獲取ANGLE unit的數值。

步驟2：想想要如何運用ANGLE unit的數值來控制LED unit的亮度。

步驟3：加入活動一的冷暖色選項。

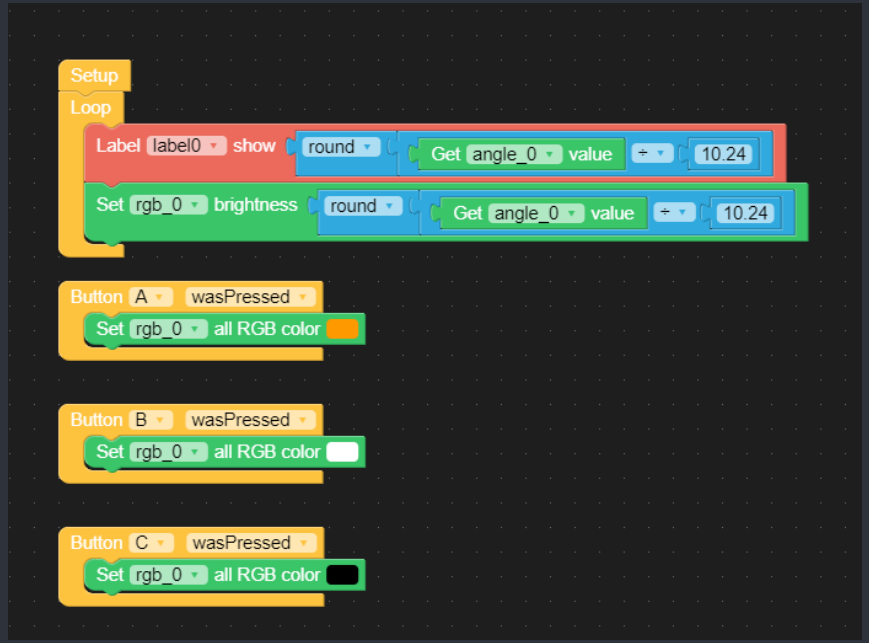
}



forbeginners.html

workshop.css

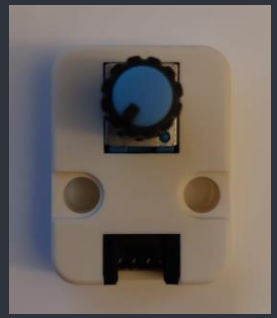
參考程式

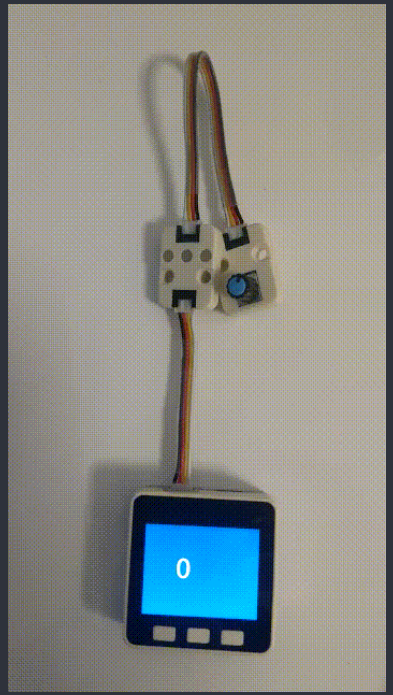


數據流向{

嘗試觀測我們剛完成的環保閱讀燈，看看我們...

* 從哪裡輸入
* 數據經過哪裡
* 輸出在哪裡體現





}

課堂總結

冷色與暖色

不同的環境與用途會適合用不同顏色的燈光。

ANGLE元件

在ANGLE元件裡只有一個功能，讀取ANGLE元件的數值

使用輸入數值

將輸入的數值修改後，可以用作其他元件的輸出

forbeginners.html

workshop.css

第四課 {

記憶和判斷

}

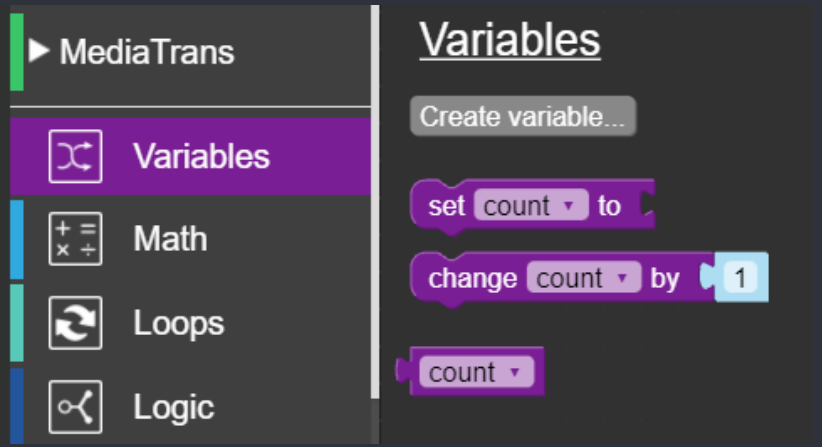
變數{

變數能夠記住一個數值，並在你需要它的時候呼喚出來。

變數有兩種更改數值的方式：

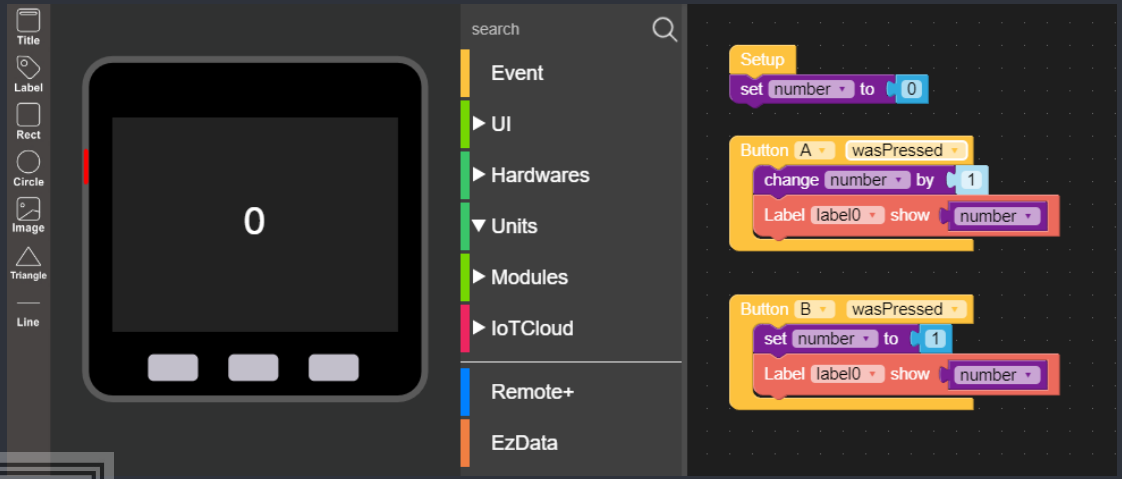
- 設為（set）
- 改變（change）

}



活動一 – 變數體驗{

試編寫以下程式，然後留意set和change的差別



}

活動二 – 記數器{

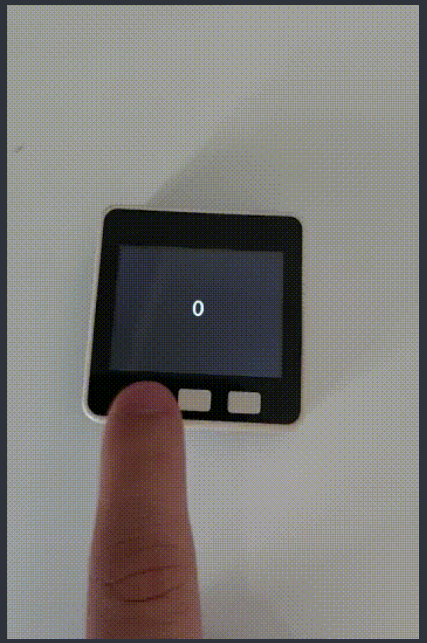
設計一個程式，令M5Stack具有以下三種功能。

功能1：當按鈕A被按下，將屏幕的數值增加1

功能2：當按鈕B被按下，將屏幕的數值歸零

功能3：當按鈕C被按下，將屏幕的數值還原至歸零前的數值

}



If-then（如果-那麼）{

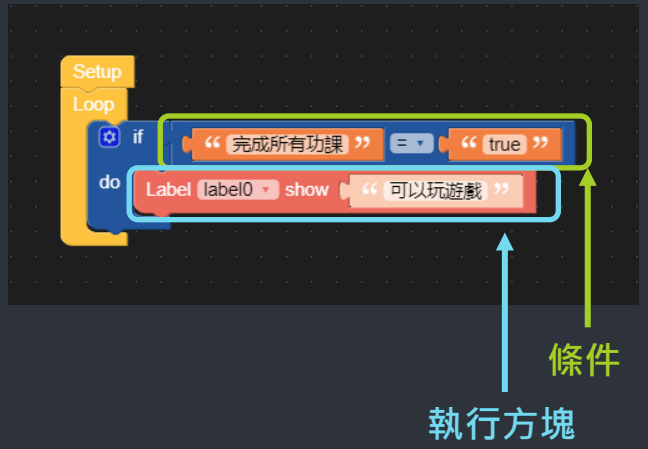
例子：如果**你完成所有功課**，
就**可以玩遊戲**了。

條件

執行方塊

條件：需要判斷的方塊

執行方塊：只有條件成立才會執行



}

Else（否則）{

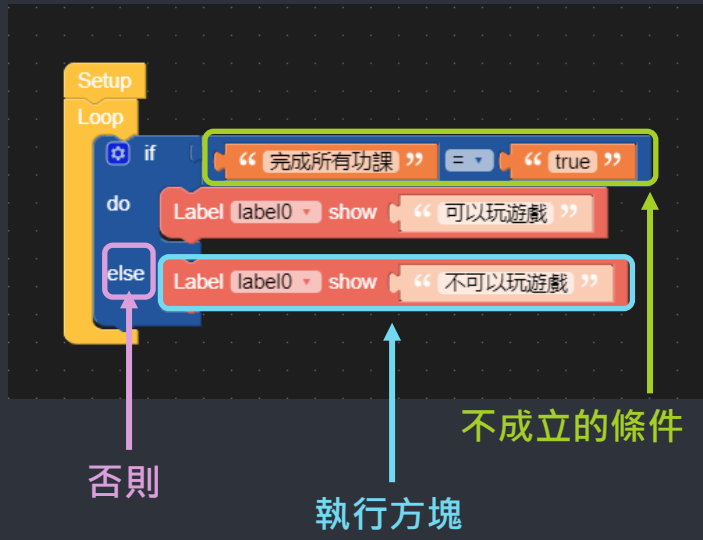
不成立的條件

例子：如果完成所有功課，
就可以玩遊戲，否則，
就不可以玩遊戲了。

執行方塊

否則：當所有條件不成立時才會執行

}



Else if（否則如果）{

否則如果：當上面的條件不成立時才會進行判斷

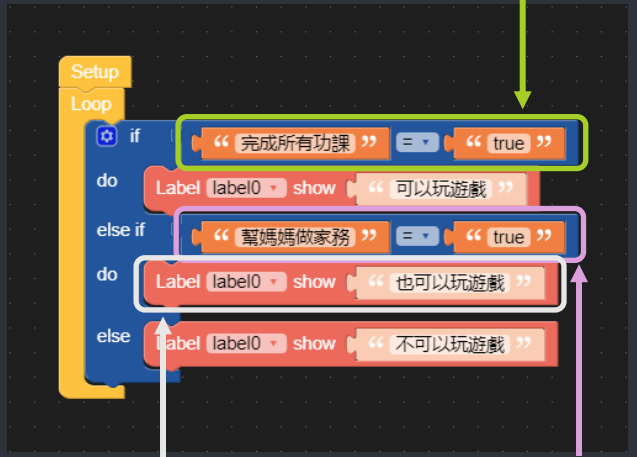
不成立的條件

例子：如果你沒有完成所有功課，就不可以玩遊戲了，但是如果你幫了媽媽做家務，你也可以玩遊戲。

另一個條件

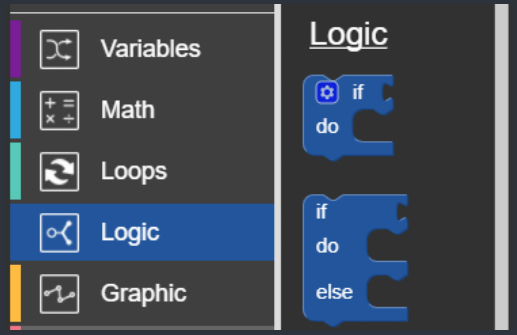
另一個條件的執行方塊

}

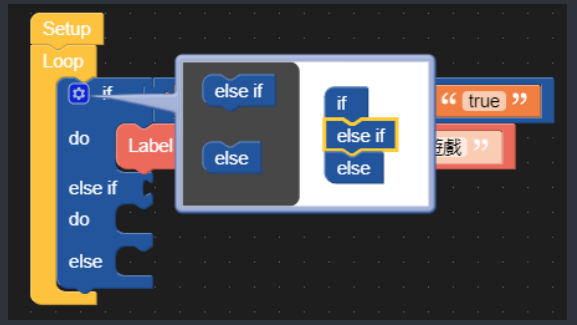


If block（如果方塊）{

方塊位置：Logic



點擊齒輪以改變方塊的結構（加入else和else if）



}

活動三 – 分級器{

設計一個程式，利用“If-else”令M5Stack將學生的成績分成不同等級。

分數	等級
90 - 100	A
75 – 89	B
60 – 74	C
0 – 59	F

}

forbeginners.html

workshop.css

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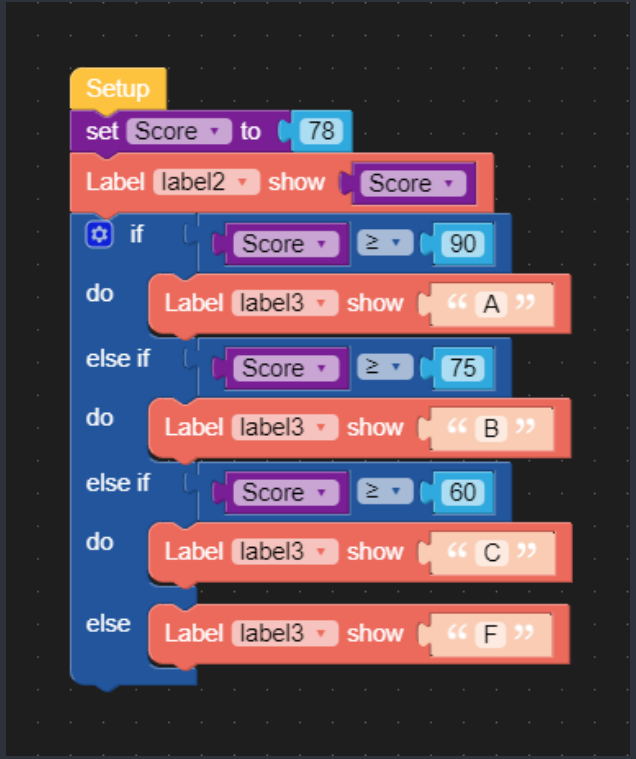
參考程式



課堂總結{

< /1 > * 變數有兩種更改數值的方式：
設為（set） 和 改變（change）

< /2 > * 只要條件成立，執行方塊便會執行

< /3 > * 條件判斷由上至下執行，只有當條件不成立時，才會考慮下方其他的條件。

}

forbeginners.html

workshop.css

第五課 {

    紅外線槍

}

上堂重溫{

< /1 > * 變數有兩種更改數值的方式：
設為（set） 和 改變（change）

< /2 > * 只要條件成立，執行方塊便會執行

< /3 > * 條件判斷由上至下執行，只有當條件不成立時，才會考慮下方其他的條件。

}

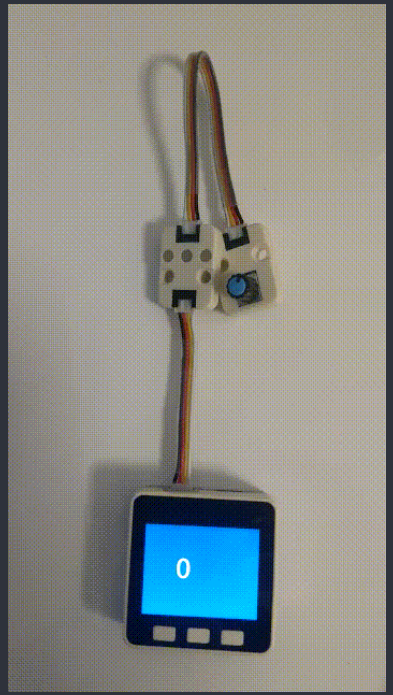
數據傳輸{

在閱讀燈的專題裡，我們用了什麼媒介去控制訊號的傳播呢？

試想想我們在哪裡進行輸入，然後訊號會從哪裡走到哪裡？

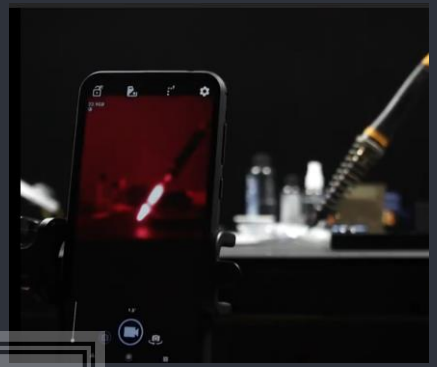
還有，我們有什麼其他方法可以傳送訊號？

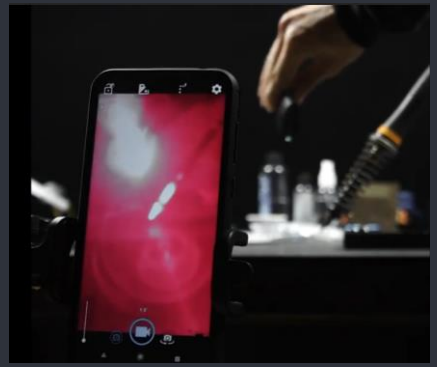
}

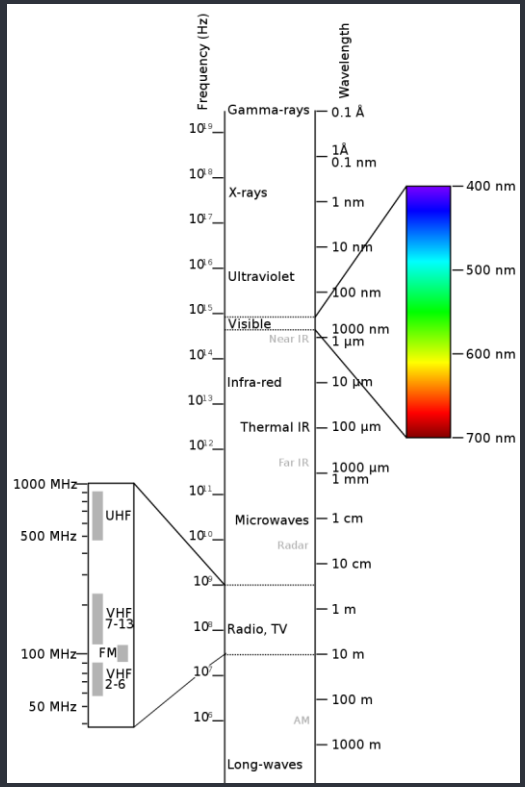


紅外線{

紅外線（英語：Infrared，簡稱IR）
是可見光譜紅色端外的光線，因其不屬於可見光，所以肉眼不可見。





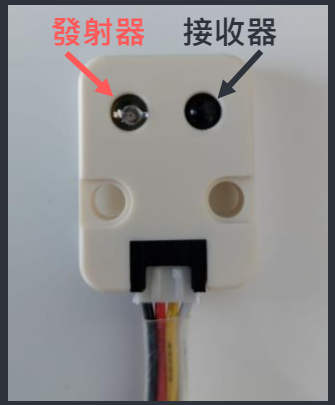


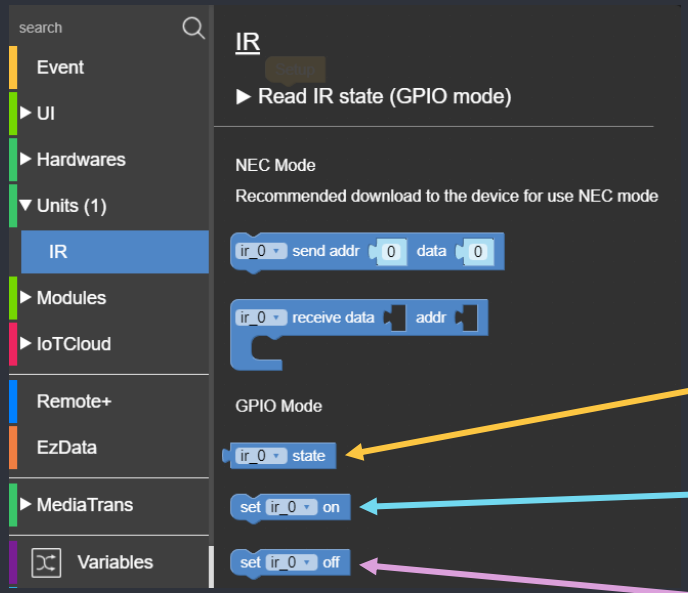
}

forbeginners.html

workshop.css

IR 元件介紹{





獲取接收器數值（1或0）

開啟發射器

關閉發射器

}

分組活動（A組：製作紅外線槍）{

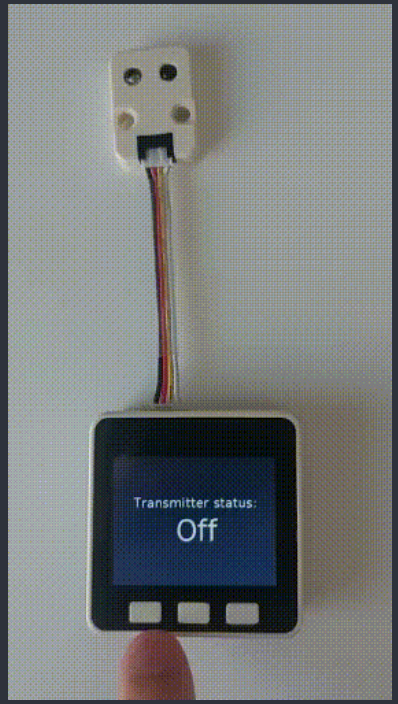
設計一個程式，使M5Stack上的按鈕能夠操控IR unit發射紅外線與否。

步驟1：嘗試找出兩個輸入方法

步驟2：每個輸入要令IR unit發射器改變至適當的狀態

步驟3：將IR unit發射器的狀態顯示在屏幕上

}



分組活動（B組：製作槍靶）{

設計一個程式，當IR unit接收到紅外線時，記錄並顯示接收到紅外線的次數。

步驟1：利用如果-那麼方塊不斷判定接收器是否接收到紅外線

步驟2：接收到的話，把記錄接收到紅外線次數的變數更新

步驟3：讓M5Stack側面的LED燈條閃爍紅燈三次

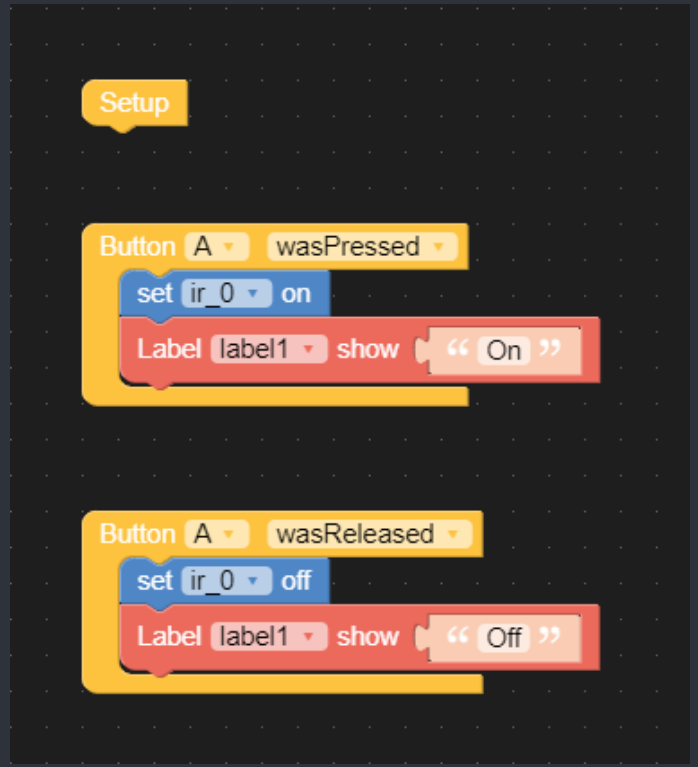
}

forbeginners.html

workshop.css

參考程式

（A組：紅外線槍）



forbeginners.html

workshop.css

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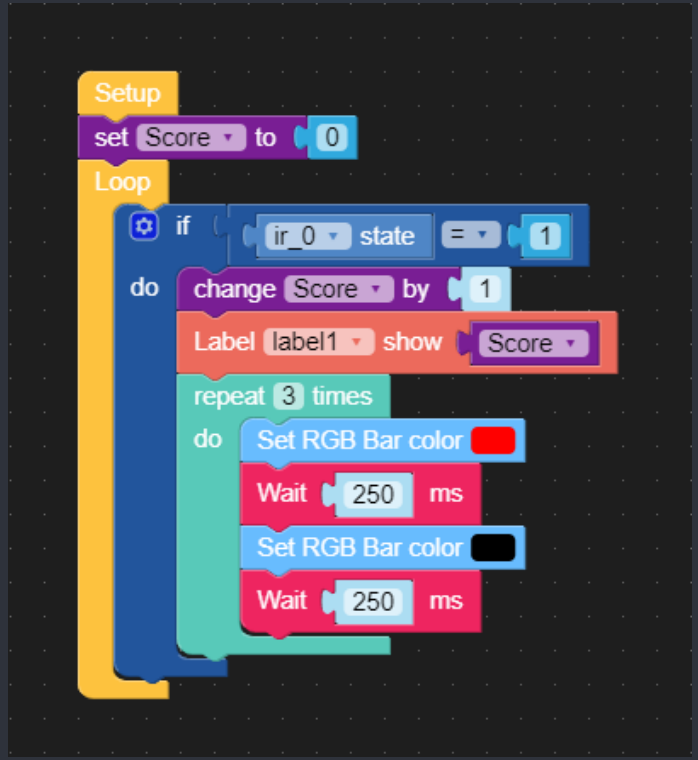
參考程式

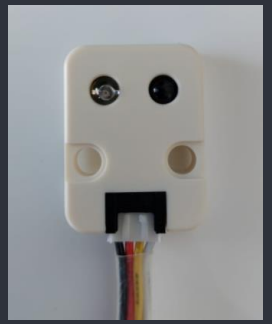
(B組：槍靶)



數據流向{

尝試觀測我們剛完成的紅外線槍，看看我們...

* 從哪裡輸入
* 數據經過哪裡
* 輸出在哪裡體現



在這個專題中，數據經過了什麼新的地方？

}

課堂總結{

< /1 > * 紅外線是肉眼不可見的光線，可用作無線訊息傳播。

< /2 > * IR元件由一個發射器和一個接收器所組成，
可發射和接收紅外線。

}

forbeginners.html

workshop.css

第六課 {

    我的天文台(MQTT)

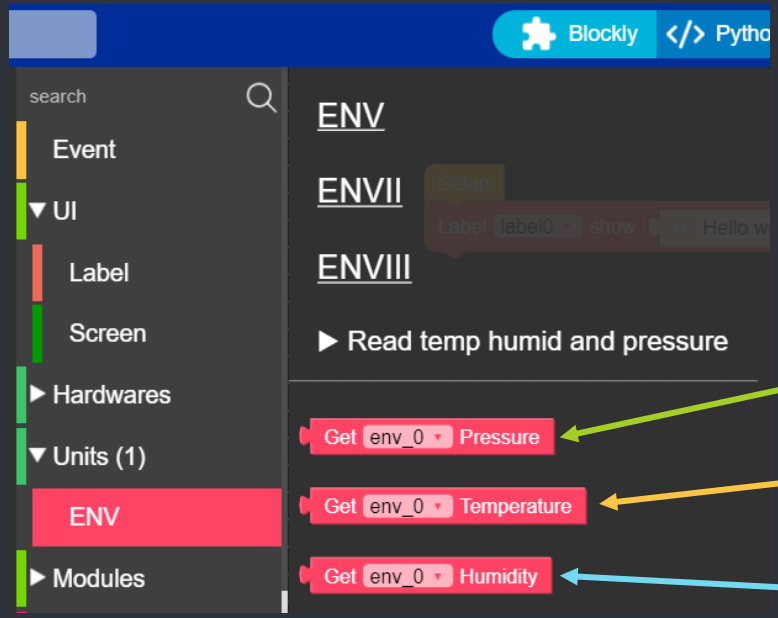
}

天氣數據{

試想想日常生活中有什麼關於天氣的數據

}

ENV 元件介紹{



獲取大氣壓力值

獲取溫度值

獲取濕度值

}

活動一 – 界面設計{

設計一個界面，讓M5Stack在螢幕上同時顯示

溫度值（Temperature）
濕度值（Humidity）
大氣壓力值（Pressure）

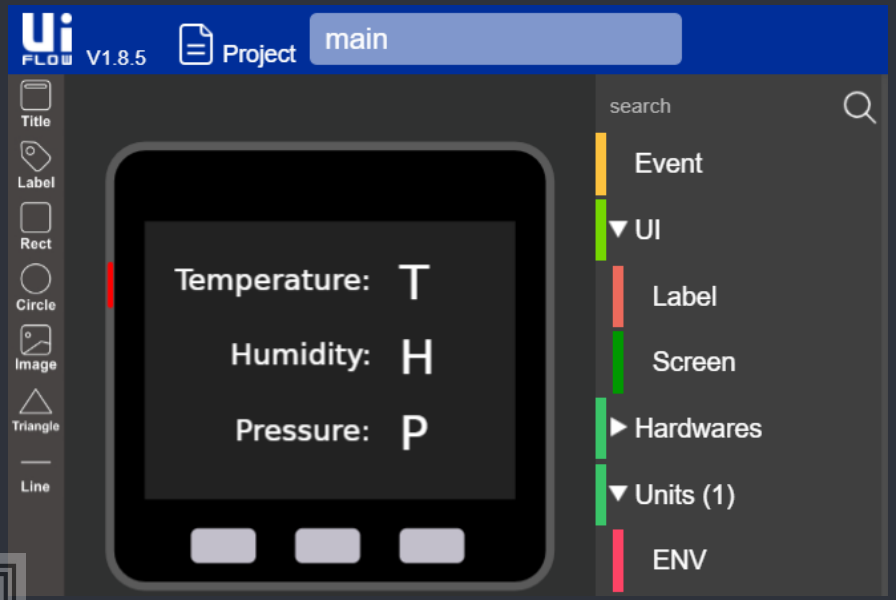
目標1：同時顯示三個值
目標2：清楚標註三個值的意思

}

forbeginners.html

workshop.css

示範設計



活動二 – 程式設計{

設計一個程式，讓M5Stack在螢幕上不斷顯示現時的

溫度值（Temperature）
濕度值（Humidity）
大氣壓力值（Pressure）

目標1：不斷更新上述三個數值

目標2：將每一個數值只用一行表示

}

forbeginners.html

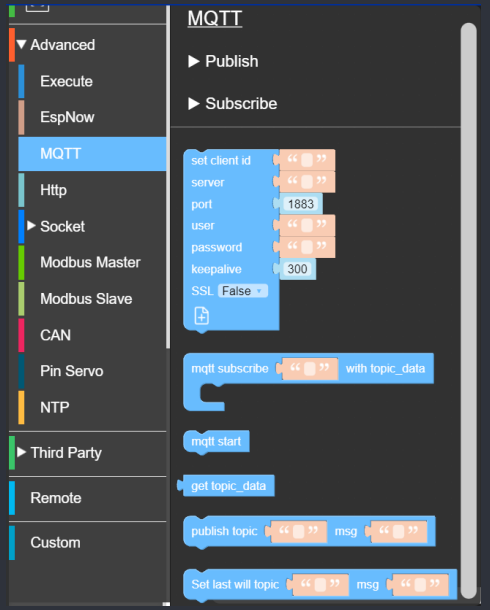
workshop.css

參考程式

將資料發佈到互聯網 {

[MQTT]

MQTT是大部分物聯網用到的訊息協定



}

forbeginners.html

workshop.css

MQTT

通訊協定

發佈/訂閱

YouTube裡面所發生的事情{

發佈

YouTuber（創作者）將影片上傳至YouTube（平台）

訂閱

用戶可以追蹤一個頻道，當頻道上傳影片時，用戶可以獲得通知

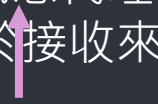
}

MQTT是什麼？

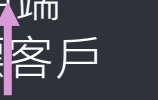
訊息佇列遙測傳輸
Message Queuing Telemetry Transport

基於發佈/訂閱體系的通訊協定

MQTT協定裡有兩種角色：訊息代理（message broker）與客戶端（client）。訊息代理用於接收來自客戶端的訊息並轉發至目標客戶端。



YouTube伺服器



YouTube用戶
（Youtuber / 你）

裝置可以將訊息發佈到頻道（Channel）內的一個主題(Topic)，而裝置也可以訂閱一個頻道內的主題，以接收被發佈到該主題的訊息。

YouTube的資料架構{

- YouTube伺服器 包含著不同YouTuber創作的影片
- 頻道（YouTuber） 一個YouTuber的所有影片會被收集在同一個頻道當中
- 播放清單 同樣性質的影片會被收集到同一個播放清單
- 影片 不同的影片有不同的內容

}

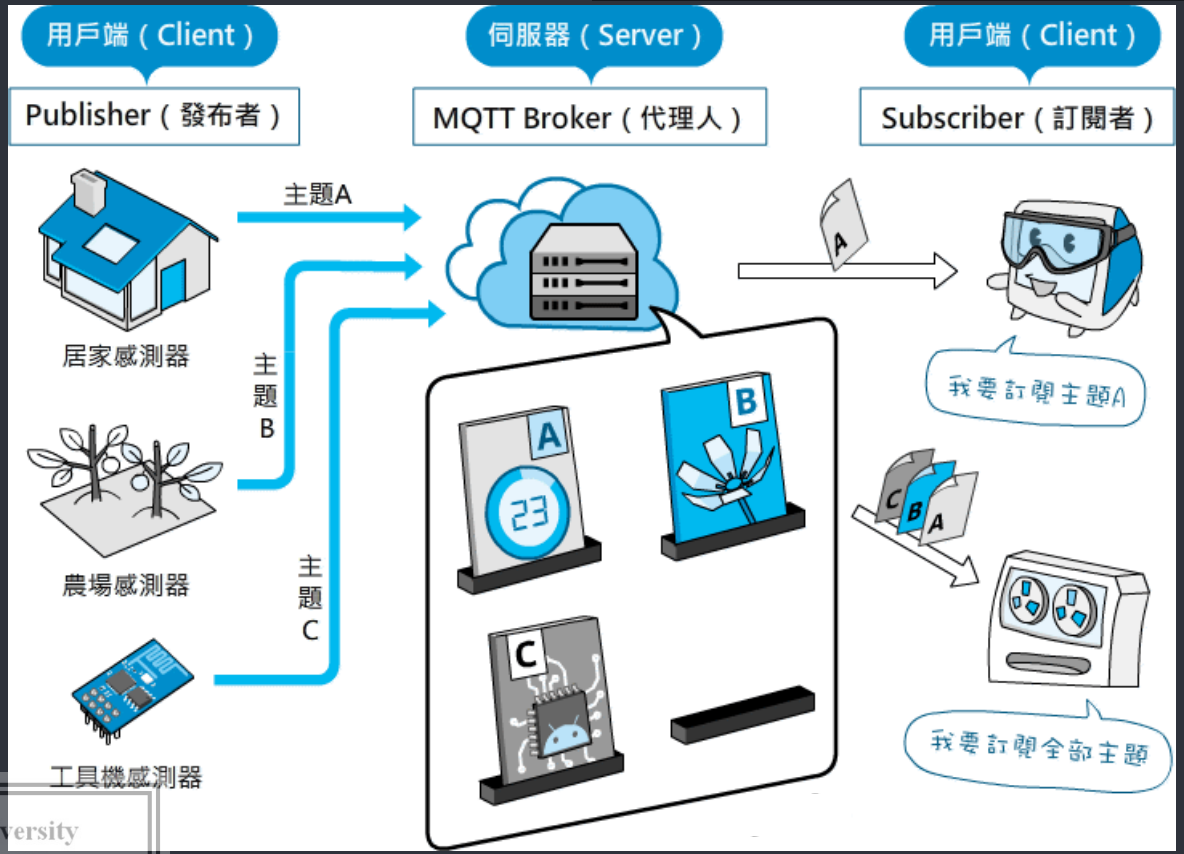
MQTT的資料架構{

- MQTT代理人（伺服器） MQTT代理人管理著不同的頻道
- 頻道（項目/專題） 一個項目的所有數據會收集在同一個頻道當中
- 主題（數據種類） 同樣性質的數據會被收集到同一個主題
- 數據（某時間的數據） 不同時間點的數據有著不同的內容
  例子：11/11/2021 23:00:00 24°C

}

YouTube 與 MQTT的資料架構

YouTube		MQTT
YouTube伺服器		MQTT代理人（伺服器）
頻道（YouTuber）		頻道（項目/專題）
播放清單		主題（數據種類）
影片		數據（某時間的數據）



活動3 – MQTT的妙用

兩人一組

使用三分鐘與身邊的同學討論你會使用MQTT來傳送什麼資料，並在下方記錄。

課堂總結{

< /1 >
* ENV元件能同時獲取
  - 溫度值（Temperature）
  - 濕度值（Humidity）
  - 大氣壓力值（Pressure）

< /2 >
* MQTT是一種基於發佈/訂閱體系的通訊協定，其資料架構由以下所組成：
  - MQTT代理人
  - 頻道
  - 主題
  - 數據

}

forbeginners.html

workshop.css

第七課 {

    上傳資料到Thingspeak

}

上堂重溫{

< /1 >
* ENV元件能同時獲取
  - 溫度值 (Temperature)
  - 濕度值 (Humidity)
  - 大氣壓力值 (Pressure)

< /2 >
* MQTT是一種基於發佈/訂閱體系的通訊協定，其資料架構由以下所組成：
  - MQTT代理人
  - 頻道
  - 主題
  - 數據

}

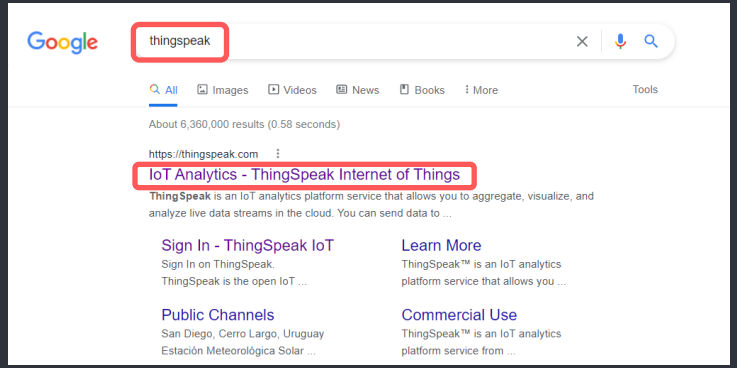
ThingSpeak{

- 免費物聯網服務平台
- 作為MQTT代理人的角色
- 允許用戶使用該平台進行數據發佈和訂閱頻道

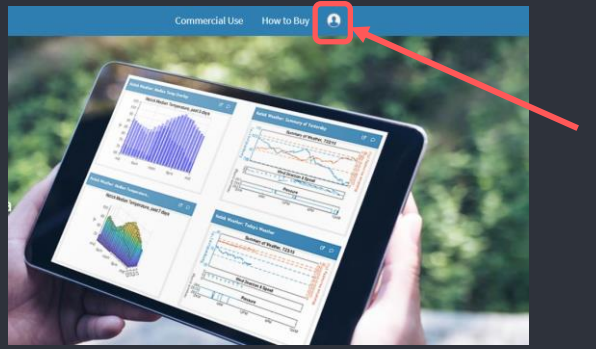
}

ThingSpeak註冊流程{

第01步 在Google Chrome 搜尋“ThingSpeak”，選擇第一個選項



第02步 在ThingSpeak主頁點擊「使用者」圖示

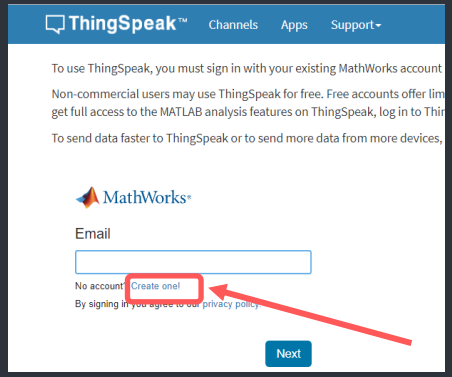


}

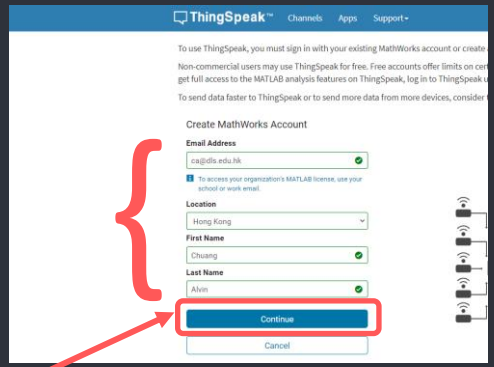
16%

ThingSpeak註冊流程{

第03步 點擊 “Create one!”



第04步 在新增賬戶頁面依次序填上電郵地址，地區，姓氏，和名字

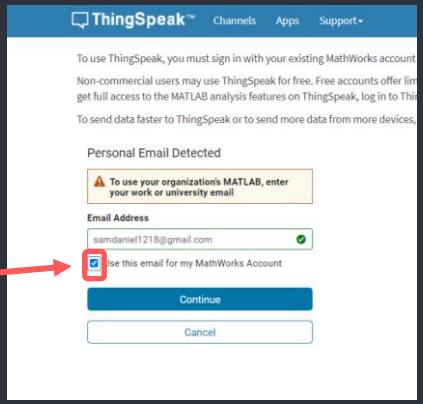


}

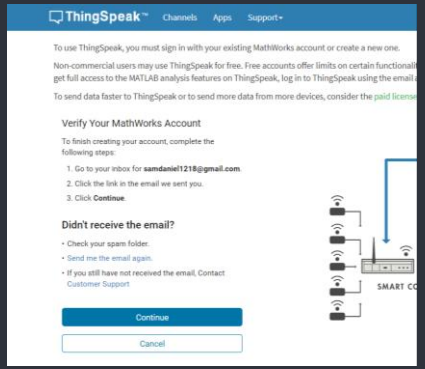
33%

ThingSpeak註冊流程{

第05步 系統需要你確認使用個人Gmail賬戶，把方格打剔，然後點擊“Continue”



第06步 到達這個頁面後，打開一個新的分頁，開啟Gmail

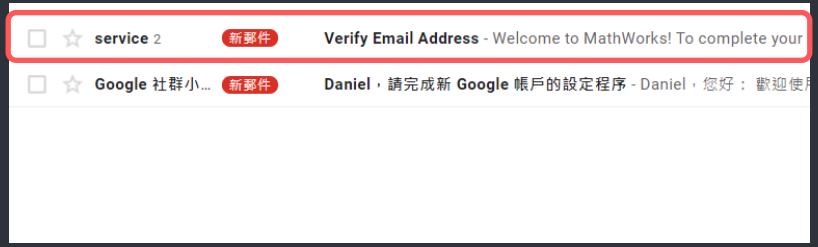


}

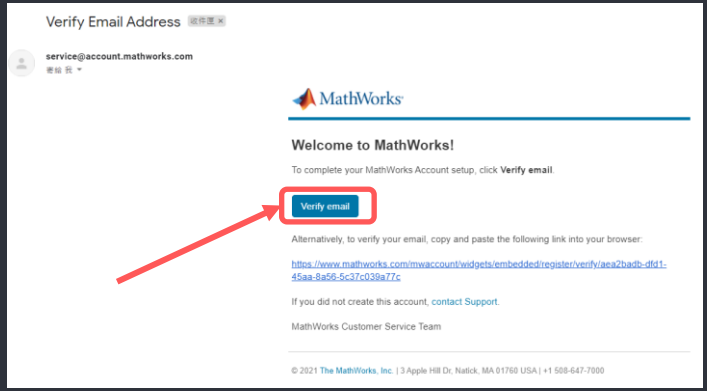
50%

ThingSpeak註冊流程{

第07步 在Gmail裡尋找“Verify Email Address”的郵件，然後打開它



第08步 點擊 “Verify email”

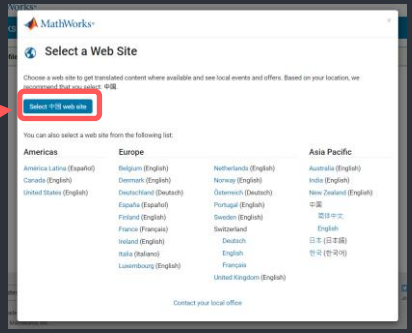


}

67%

ThingSpeak註冊流程{

第09步 點擊 “Select 中國 website”



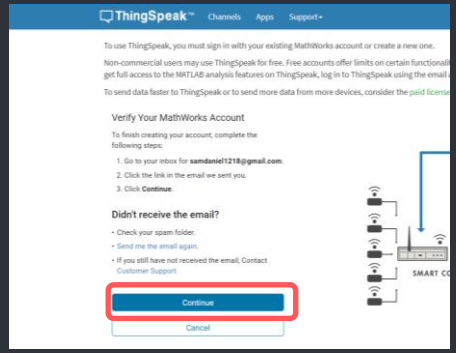
第10步 選擇後，頁面會顯示「您的個人資料已驗證」

}

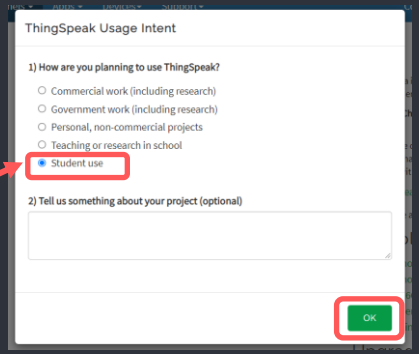
83%

ThingSpeak註冊流程{

第11步 返回打開Gmail前（步驟6）的頁面，點擊“Continue”



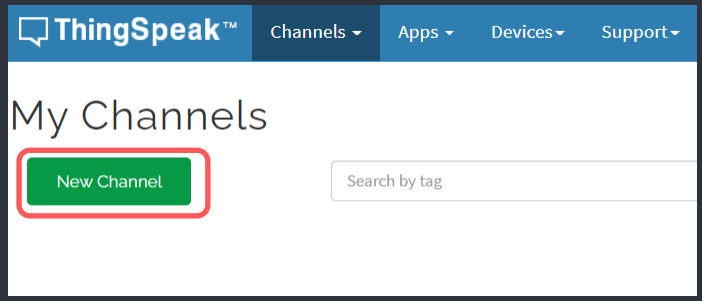
第12步 在問卷中選擇“Student use”，然後點擊“OK”



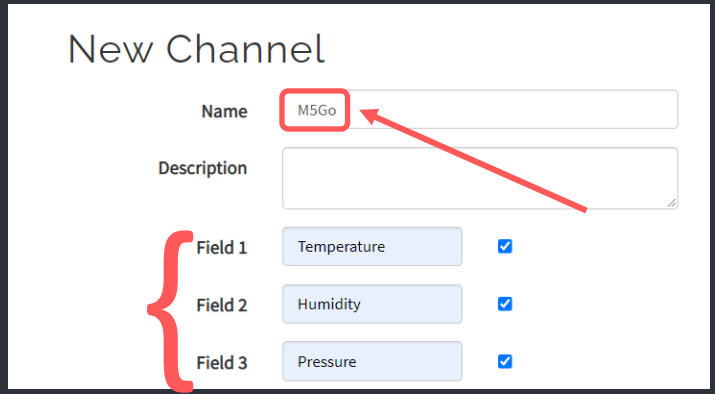
} 100%

在ThingSpeak創建頻道{

第01步 在主頁點擊“New Channel”



第02步 進入頁面後，填寫頻道名稱為“M5Go”，然後勾選三個數欄，分別輸入“Temperature”，“Humidity”，和“Pressure”

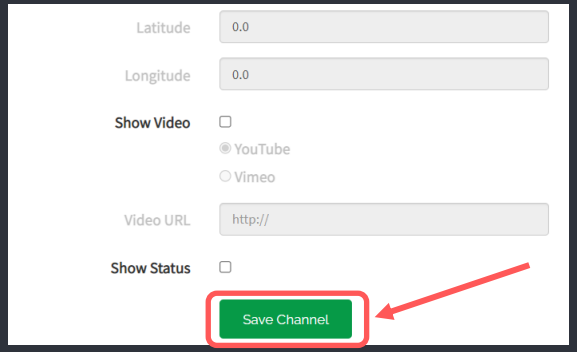


}

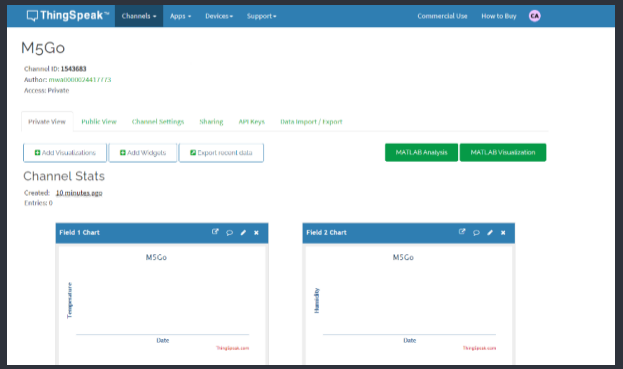
50%

在ThingSpeak創建頻道{

第03步 在頁面下方點擊“Save Channel”



第04步 然後頁面會自動導航至頻道（M5Go）的主頁



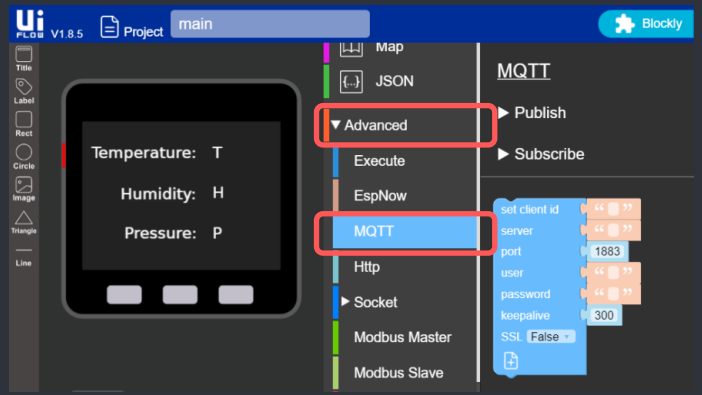
}

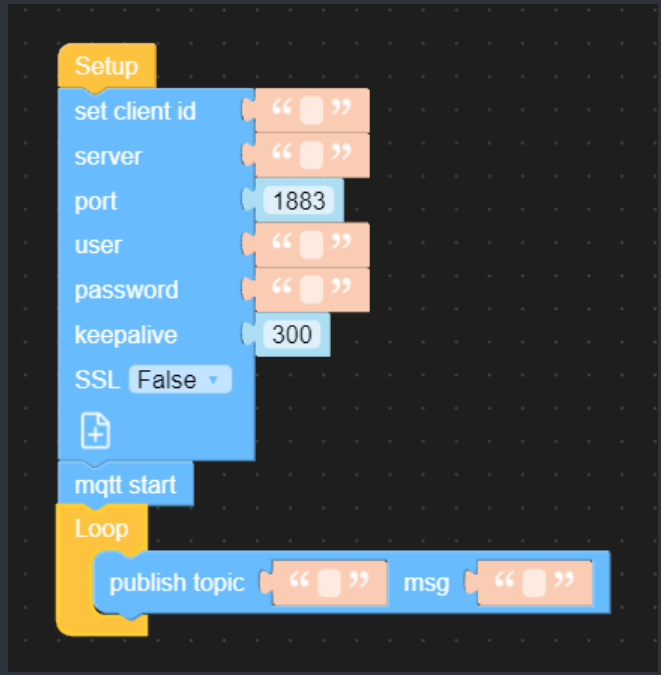
100%

forbeginners.html

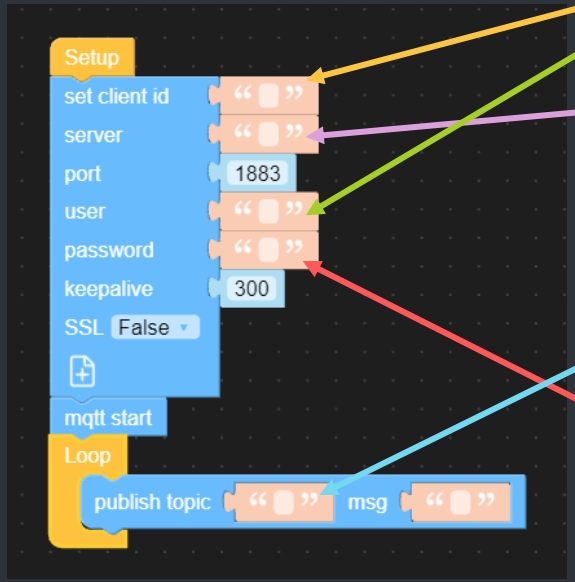
workshop.css

1
2 編程部分{
3
4
5
6
7
8
9
10
11
12 }
13
14





編程部分{



}

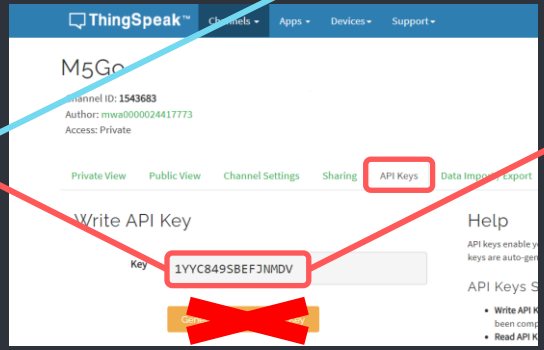
頻道號碼

使用者名稱

伺服器位置

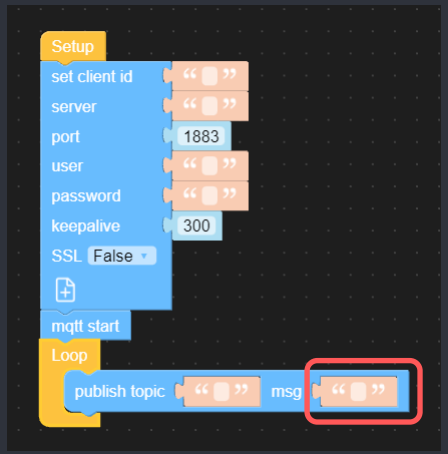
mqtt.thingspeak.com

channels/(client id)/publish/(password)



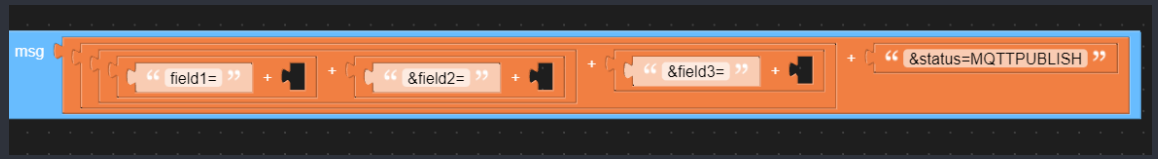
密碼(API Key)

編程部分{



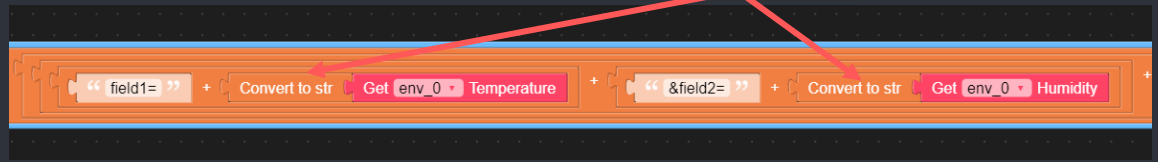
}

< /1 > 在Text分頁找到上方兩種方塊，並模仿下圖編寫程式



< /2 > 在每個空格中放入對應的數據獲取方塊

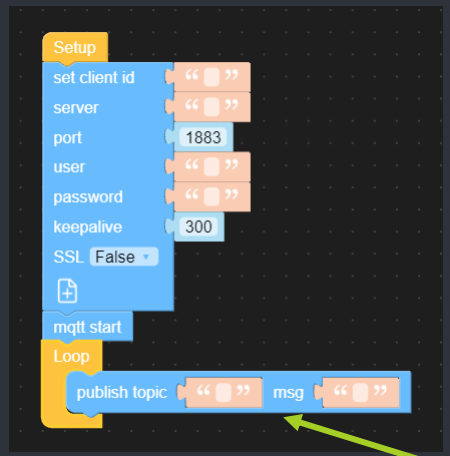
< /3 > 在每個數據獲取方塊前面加上 Convert to str 方塊，將其變成文字

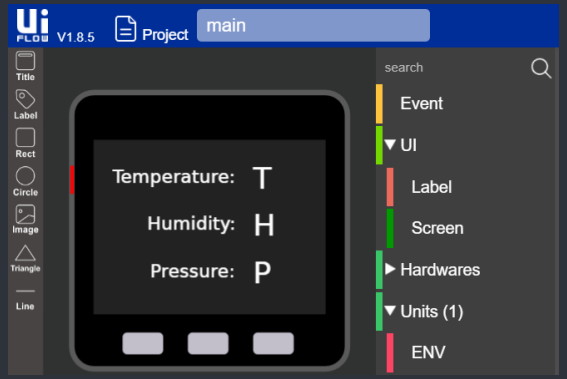


forbeginners.html

workshop.css

```
1
2   編程部分{
3
4
5
6
7
8
9
10
11
12  }
13
14
```





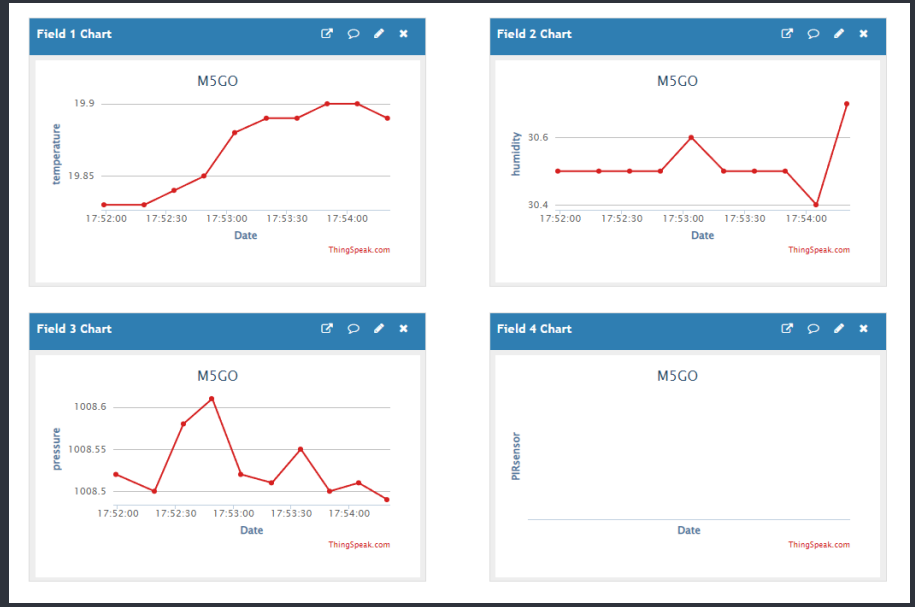
加入上一堂的界面

加入上一堂的程式到Loop裡面

上傳訊息到Thingspeak{

上傳到Thingspeak後，你可以透過任何裝置實時觀測你的個人天氣站的訊息。

}



forbeginners.html

workshop.css

數據流向{

ThingSpeak

}

forbeginners.html

workshop.css

物聯網的數據生命周期{

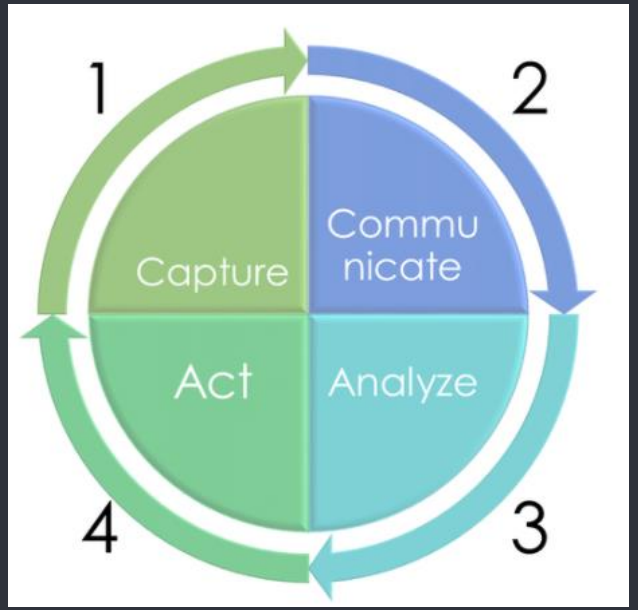
01 Capture 收集

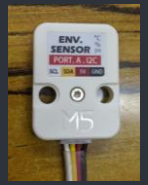
02 Communicate 溝通

03 Analyze 分析

04 Act 行動

}





ThingSpeak

Programming Language

課堂總結{

< /1 > * Thingspeak是一個免費的物聯網服務平台，它作為MQTT代理人的角色，允許用戶使用該平台進行數據發佈和訂閱頻道

< /2 > * 上傳資料到MQTT伺服器時，需要以下資訊：
  - **頻道號碼 Client ID (Channel ID)**
  - **使用者名稱 User (Author)**
  - **伺服器位置 Server** “mqtt.thingspeak.com”
  - **頻道地址 Topic** “channels/(client id)/publish/(password)”
  - **密碼 Password (API Key)**

}

forbeginners.html

workshop.css

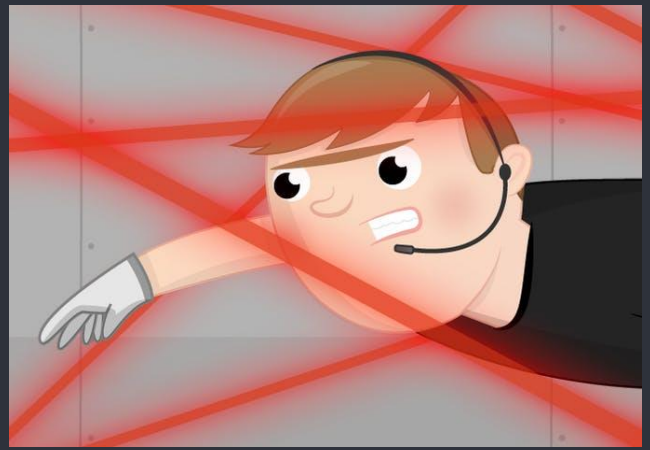
第八課{

智能防盜系統

}

防盜系統{

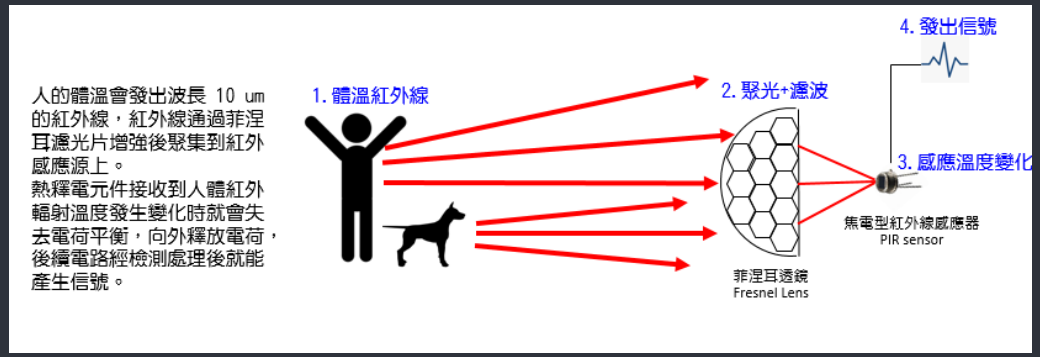
試想象防盜系統能怎樣偵測到小偷



}

紅外線{

溫體動物在一般情況下會釋放出紅外線，
能被特殊的感測器所感測到。

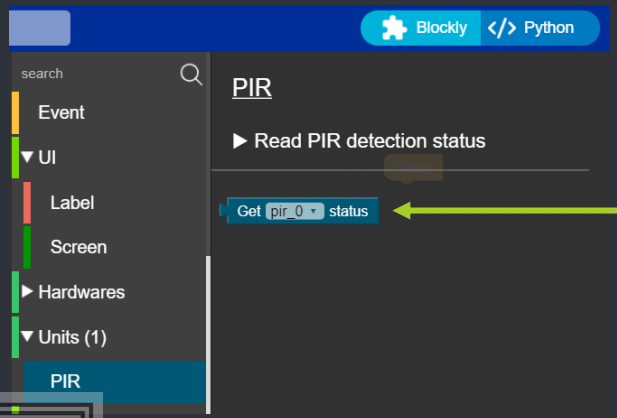


}

PIR 元件介紹{

被動紅外線感測器

能感測到溫體動物釋放出的紅外線。

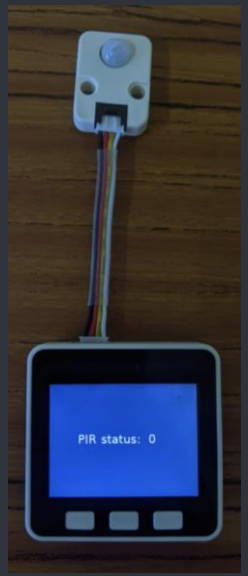


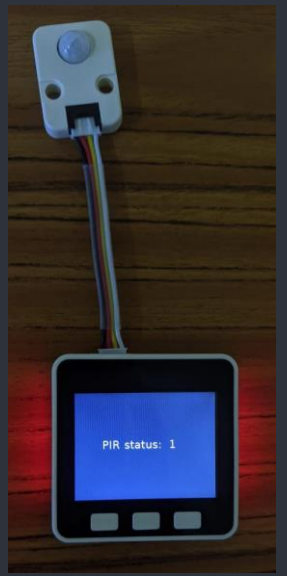
獲取狀態值
（感受到溫度變化 = 1）
（感受不到溫度變化 = 0）

}

活動一 – 防盜系統設計{

設計一個程式，如果PIR Unit感應到溫度變化，讓M5Stack的側面燈條閃爍紅色燈光。





目標1：對比及輸出PIR Unit的數值

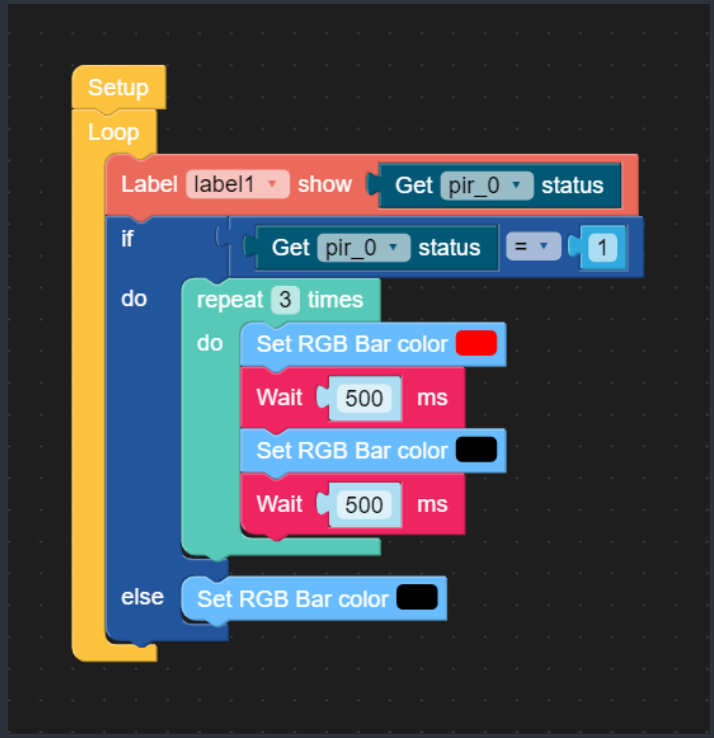
目標2：令燈條閃爍紅色燈光

}

forbeginners.html

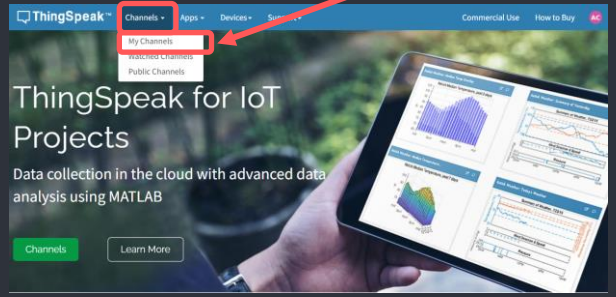
workshop.css

參考程式

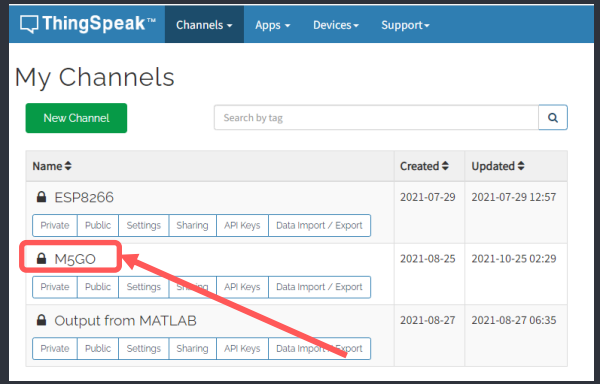


在ThingSpeak頻道增加主題{

第01步 在主頁點擊“Channels”>“My Channels”



第02步 選擇你上一堂創建的頻道

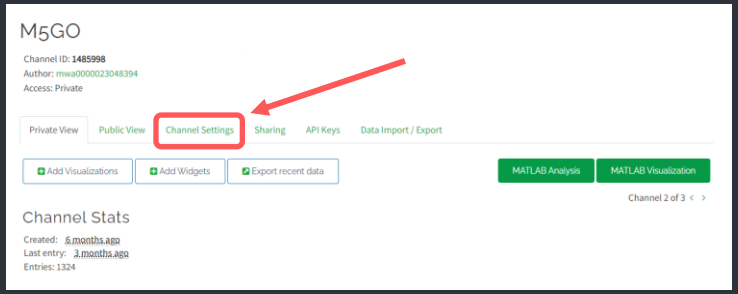


}

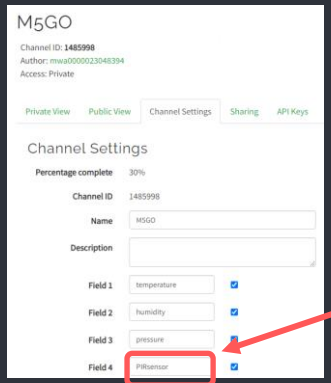
50%

在ThingSpeak頻道增加主題{

第03步 選擇 “Channel Settings”



第04步 然後在field 4填上新的主題名稱 “PIRsensor”



} 100%

活動二 – 將PIR元件的輸出上傳到ThingSpeak{

試參考上一堂的程式，設計一個程式，將PIR元件的輸出實時上傳到ThingSpeak。

目標1：建立MQTT連線

目標2：向適當的主題發佈PIR元件的輸出

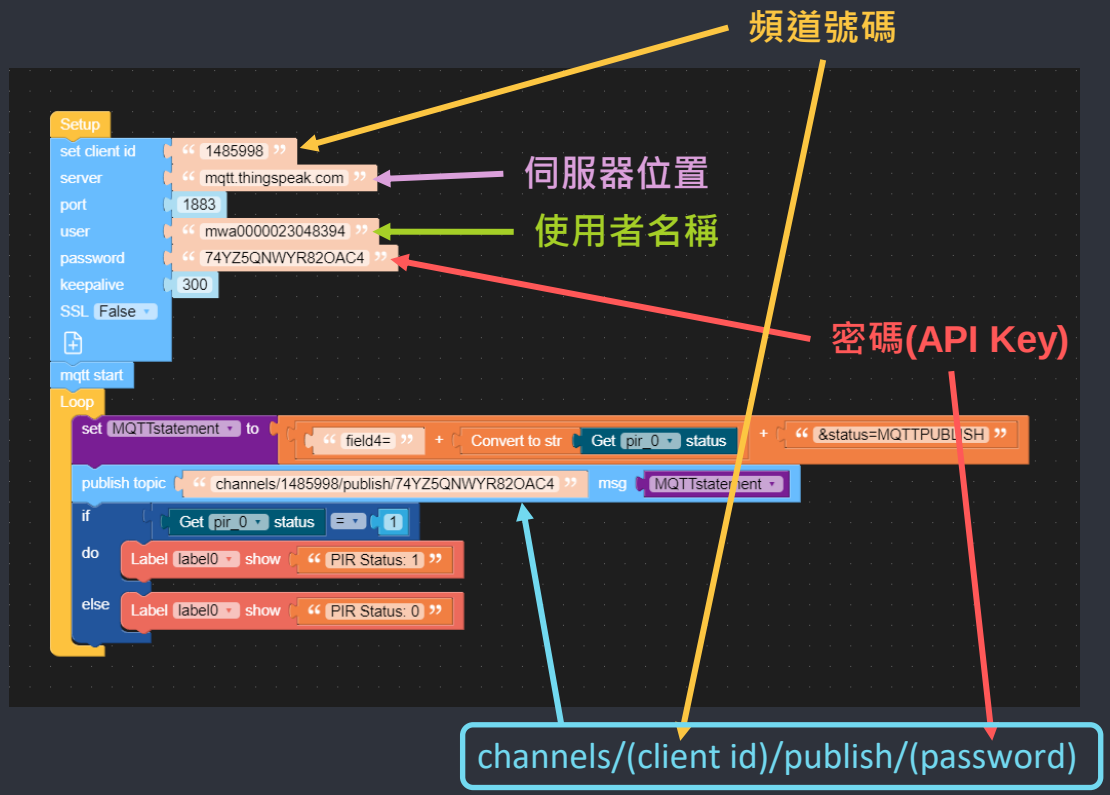
額外目標：如果PIR元件的輸出為1，讓M5Stack的側面燈條閃爍紅色燈光。

}

forbeginners.html

workshop.css

參考程式



課堂總結{

< /1 >
* 溫體動物在一般情況下會釋放出紅外線，能被特殊的感測器所感測到。

< /2 >
* PIR元件的輸出只會是0或者1，分別代表感應到和感應不到溫度變化

< /3 >
* MQTT的頻道上可以有多種不同的主題，不過發佈者需要在發佈時指明數據屬於哪個主題(Field)

}

第九課{

    警告電郵

}

上堂重溫{

< /1 >
* 溫體動物在一般情況下會釋放出紅外線，稱為被動紅外線，能被特殊的感測器所感測到。

< /2 >
* PIR元件的輸出只會是0或者1，分別代表感應到和感應不到溫度變化

< /3 >
* MQTT的頻道上可以有多種不同的主題，不過發佈者需要在發佈時指明數據屬於哪個主題(Field)

}

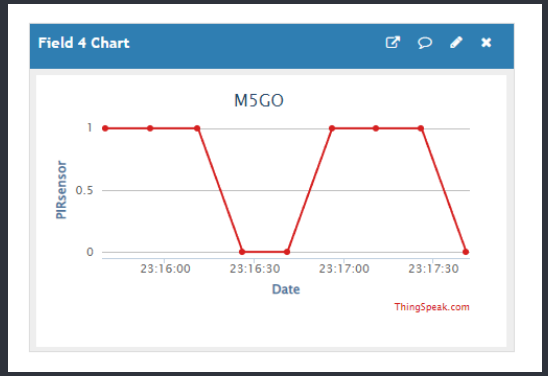
通知{

在上一堂中，我們把PIR元件的輸出上傳到了Thingspeak。

但是，這個程式沒有通知的功能，需要我們一直監測PIR元件的輸出。

我們需要令PIR元件在偵測到人後，能夠主動通知使用者。

試想想我們日常生活裡有什麼途徑會直接接收到不同的訊息。



}

數據流向{

上傳PIR輸出

在伺服器上儲存數據

ThingSpeak

如果PIR輸出=1
執行動作...

React

執行HTTP指令

ThingHTTP

如果收到某個HTTP指令...
發送電郵到...

IFTTT

}

forbeginners.html

workshop.css

```
IFTTT{

}
```

IFTTT是一個網絡服務平台，通過其他不同平台的條件來決定是否執行下一條命令。

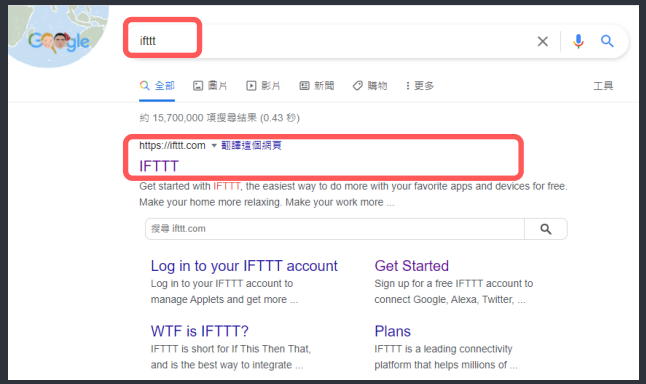
簡單來說就是一個跨平台的“如果-那麼”

由於其跨平台的特性，IFTTT被廣泛地應用在物聯網專題上。

創建IFTTT服務{

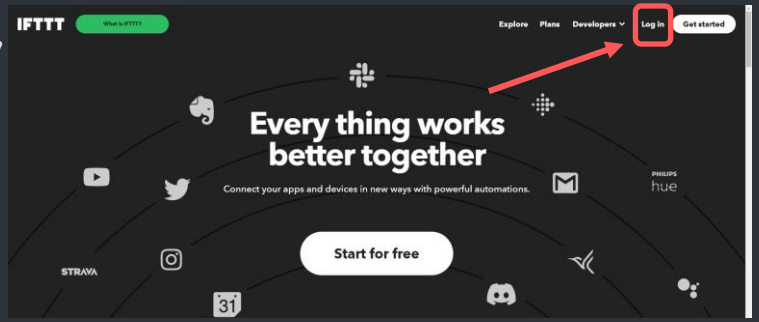
第01步

在Google Chrome 搜尋“IFTTT”，選擇第一個選項



第02步

在IFTTT主頁點擊“Log in”



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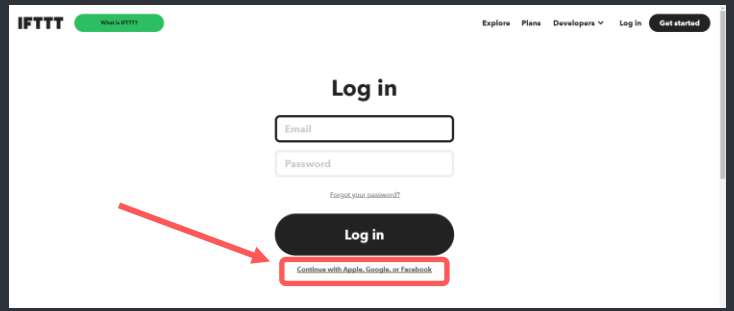
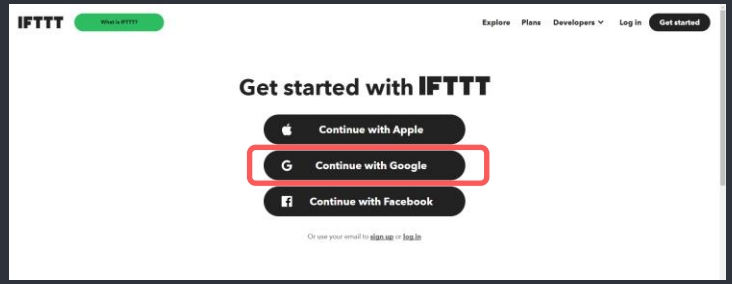
創建IFTTT服務{

第03步 點擊 “Continue with Apple, Google, or Facebook”



第04步 選擇 “Continue with Google”



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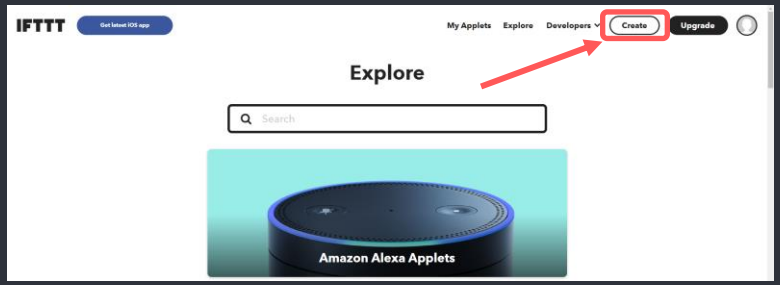
創建IFTTT服務{

第05步　選擇一個Google賬號

第06步　點擊“Create”



}

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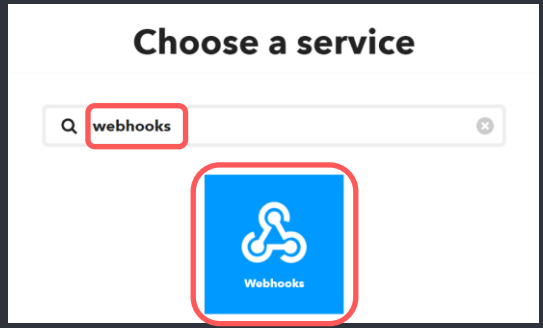
創建IFTTT服務{

第07步 點擊在 If this 旁邊的 “Add”

第08步 搜尋並選擇 “Webhooks”



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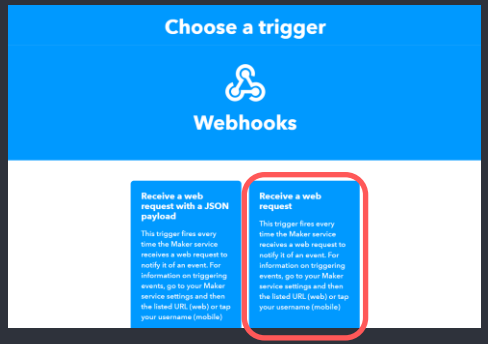
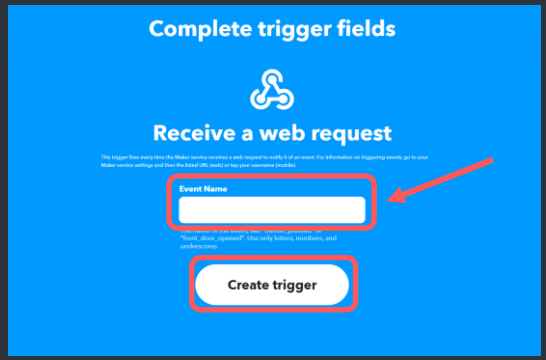
創建IFTTT服務{

第09步 選擇 “Receive a web request”



第10步 輸入事件名稱，即是什麼事件會觸發電郵，可以輸入“person_detected”，然後點擊 “Create trigger”



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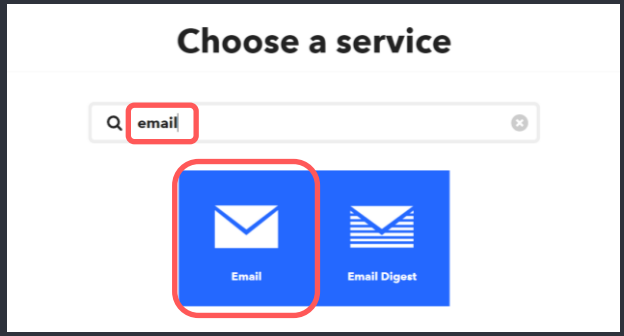
63%

創建IFTTT服務{

第11步 返回打開Gmail前（步驟6）的頁面，點擊“Continue”

第12步 在問卷中選擇“Student use”，然後點擊“OK”



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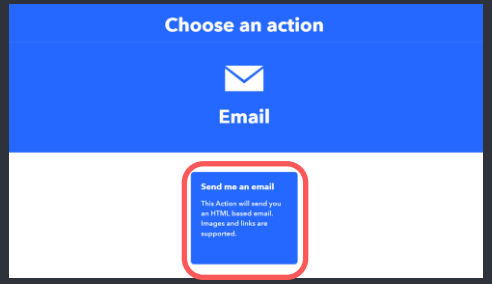
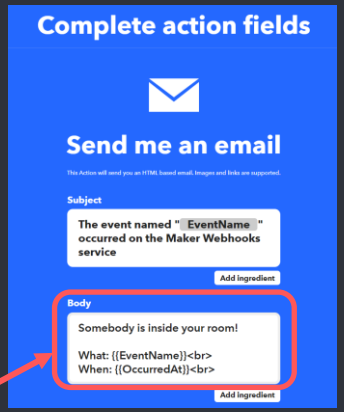
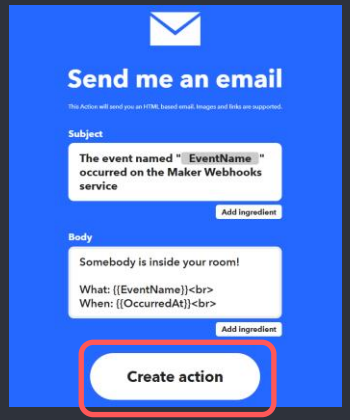
創建IFTTT服務{

第13步 選擇 “Send me an email”



第14步 在Body框中寫下你想傳送的訊息，然後點擊“Create Action”





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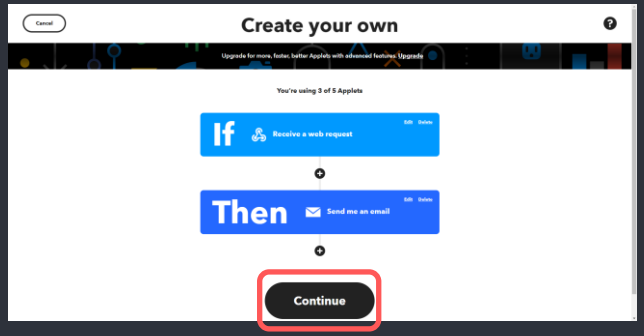
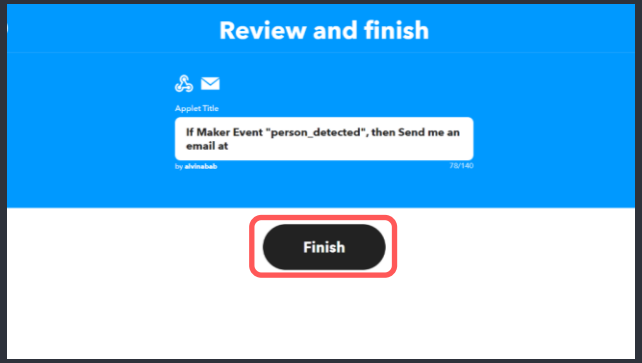
創建IFTTT服務{

第15步 If欄和Then欄將會顯示剛選擇的選項，然後點擊“Continue”



第16步 點擊“Finish”，但不要關閉IFTTT頁面



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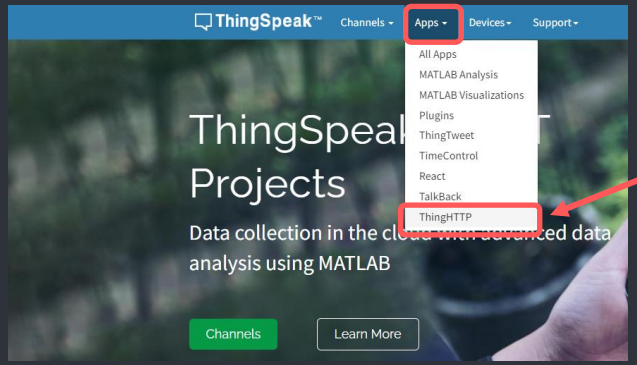
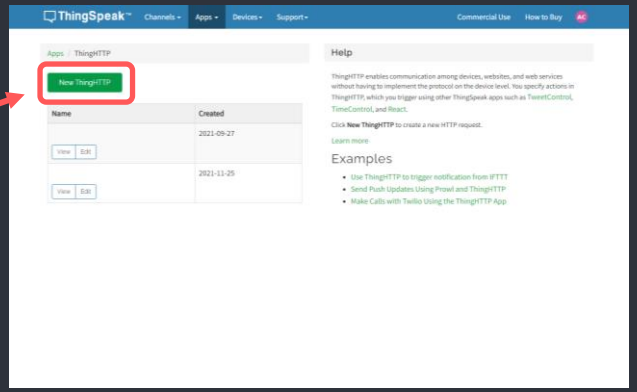
設定 ThingHTTP{

第01步 在Thingspeak主頁頂部欄選擇 “Apps” > “ThingHTTP”



第02步 點擊 “Add ThingHTTP”



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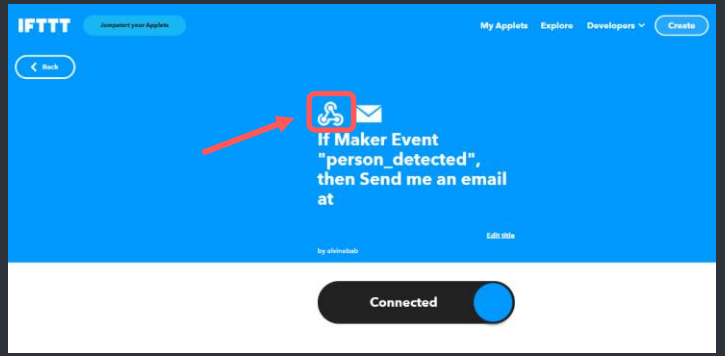
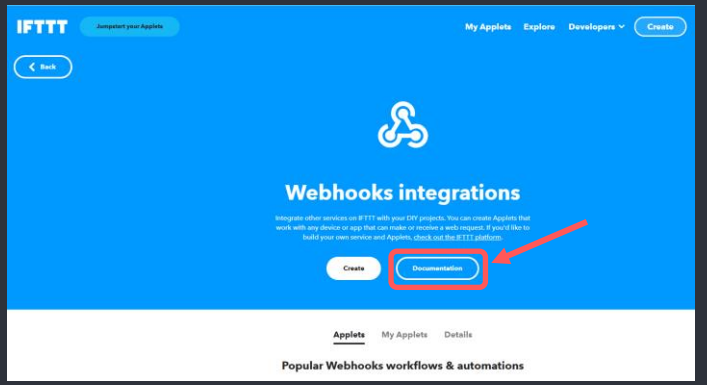
設定 ThingHTTP{

第03步 回到IFTTT頁面，點擊“Webhooks” 標誌



第04步 點擊“Documentation”



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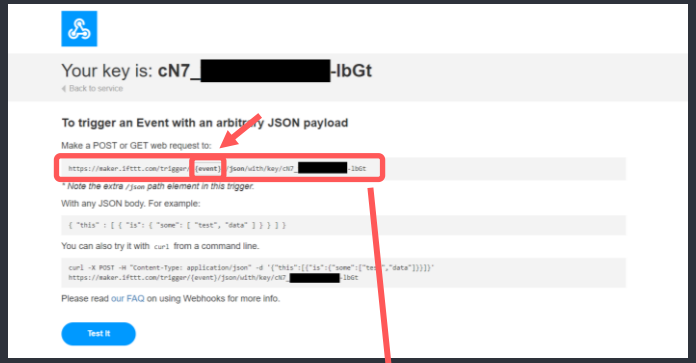
設定 ThingHTTP{

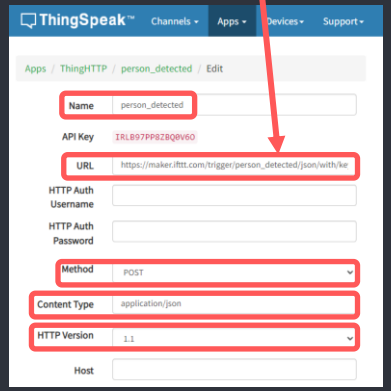
第05步

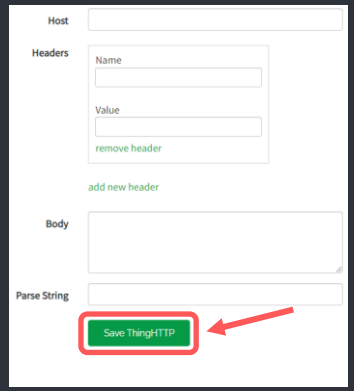
將你IFTTT的事件名稱，貼上到下方“event”欄位中，然後複製整條連結



第06步

回到Thingspeak，在URL欄貼上連結，在Name欄填上事件名稱，Method欄選擇POST，Content Type輸入application/json，HTTP Version 選擇 1.1，然後點擊 “Save ThingHTTP”





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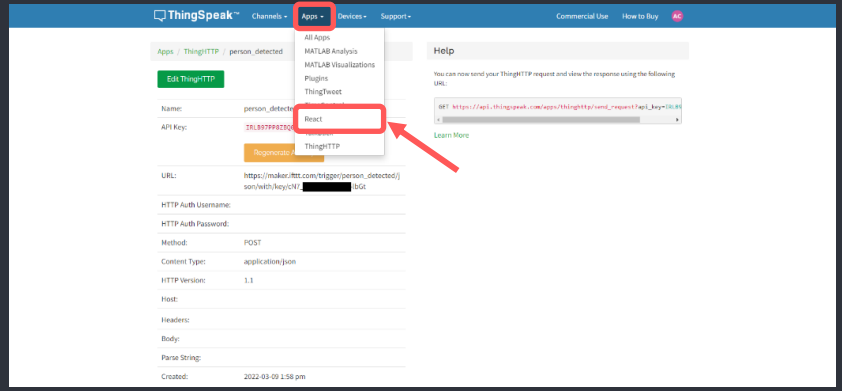
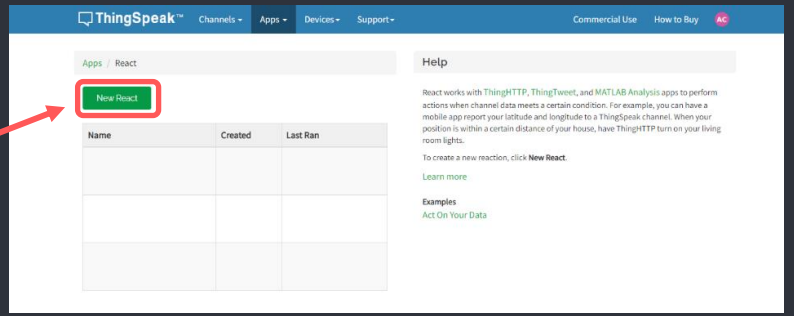
設定 React{

第01步 在頂部欄選擇 “Apps” > “React”



第02步 點擊 “New React”



}

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forbeginners.html

workshop.css

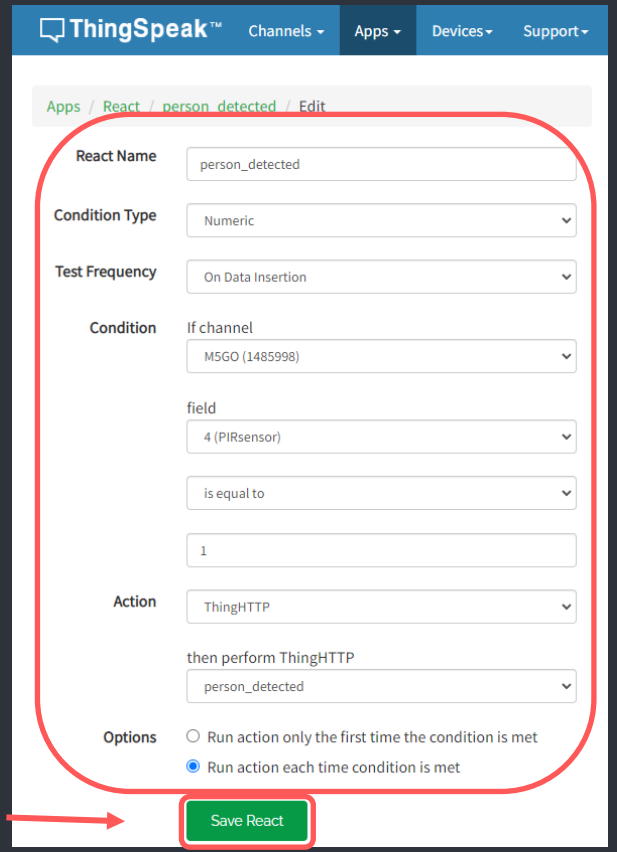
設定 React{

第03步

在React name 欄輸入事件名稱,
Condition Type 選擇 “Numeric”,
Test frequency 選擇 “On Data Insertion”,
If channel 選擇你的頻道,
Field 選擇 “PIRsensor”, “is equal to”, 1,
Action 選擇 “ThingHTTP”,
Then perform ThingHTTP 選擇事件名稱,
Options 選擇 “Run action each time condition is met”,
最後點擊 “Save React”

}

100%



forbeginners.html

workshop.css

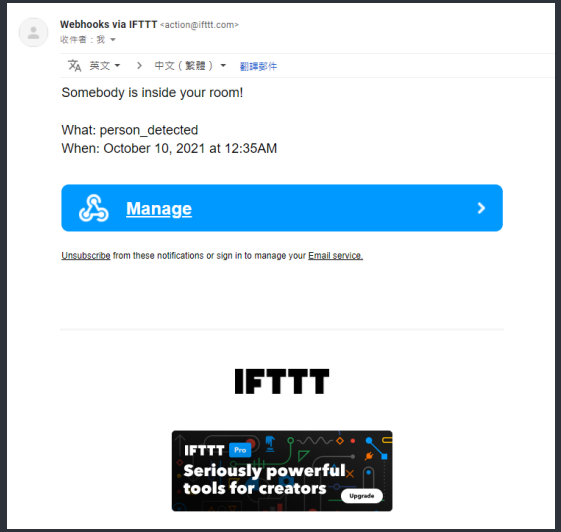
測試你的專題{

當你完成了IFTTT，ThingHTTP，和React的設定後，你的電子郵箱應該能夠收到你在IFTTT設定的電郵。

如果未能收到電郵，可以嘗試：

* 查看垃圾郵件
* 檢查IFTTT程式有否開啟
* 檢查ThingHTTP的URL
* 檢查React有否被運行

}



數據流向{

上傳PIR輸出

在伺服器上儲存數據

ThingSpeak

如果PIR輸出=1
執行動作...

React

執行HTTP指令

ThingHTTP

如果收到某個HTTP指令...
發送電郵到...

IFTTT

}

物聯網的數據生命周期{

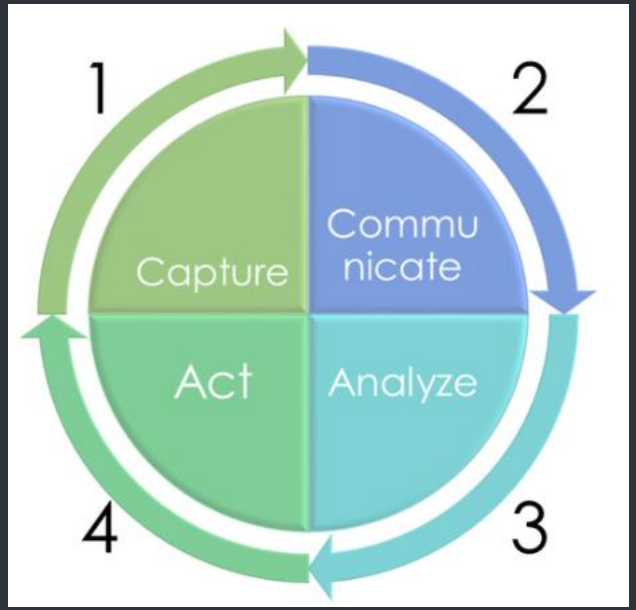
01 Capture 收集

02 Communicate 溝通

03 Analyze 分析

04 Act 行動

}



ThingSpeak

React

ThingHTTP

IFTTT

課堂總結{

< /1 > * IFTTT是一個網絡服務平台，通過其他不同平台的條件來決定是否執行下一條命令。

< /2 > * 透過React、ThingHTTP、和IFTTT，我們可以將MQTT頻道上的資料轉化成主動通知

< /3 > * 透過建立物聯網數據生命週期的四部分（收集，溝通，分析，行動），就能夠設計出完整的物聯網專題

}

Appendix III – Worksheets of "Conceptualizing IoT with M5Go"

姓名: ———————————— 班別: ————————（ ）

第一課 – 什麼是物聯網?

1. 以下哪一個不屬於物聯網的應用?

A. 當土壤濕度感測器感測到泥土乾旱，自動啟動澆水系統
B. 當溫度感測器感應到室溫過高時，自動開啟冷氣機
C. 當被動紅外感測器感應到街上有人時，自動啟動街燈
D. 當銀行發現到了信用卡結賬日期，自動為你進行結賬

D

2. 小明設計了一套系統，當房門被打開時，會自動開燈。開燈這個動作屬於物聯網的數據生命周期的哪一個部分?

A. 收集
B. 溝通
C. 分析
D. 行動

D

3. 要令 M5Stack 連接 M5Flow 平台，需要在 (i) 輸入 (ii)。

A. (i) M5Flow, (ii) API Key
B. (i) M5Stack, (ii) API Key
C. (i) M5Flow, (ii) 密碼
D. (i) M5Stack, (ii) 密碼

A

姓名: ———————————— 班別: ————————（ ）

第二課 – 輸入與輸出

1. 以下哪個是對“Loop”方塊中的正確描述?

A. “Loop”方塊優先處理在它以內的方塊
B. “Loop”方塊會不斷執行在它以內的第一個方塊
C. “Loop”方塊會不斷執行在它以內的所有方塊
D. “Loop”方塊會不斷執行在它以外的所有方塊

C

2. 以下哪個不是“wait”方塊的用處?

A. 使方塊執行時間延遲
B. 令 M5Stack 等待至下一個用戶輸入
C. 減低 M5stack 每秒執行方塊的數量
D. 使“loop”方塊中的每個循環能被觀察到

B

3. 以下哪一個關於 RGB 元件的描述是正確的?

A. 連接 LED unit 到 M5Stack 時，要將其插在 Port A
B. RGB 元件的三盞燈只能同時顯示一種顏色
C. RGB 元件因為只能顯示紅、綠、藍三色而被命名為 RGB 元件
D. RGB 元件的三盞燈只能同時為一種亮度

D

姓名：______________________　　　　班別：__________ (　　)

第三課 – 環保閱讀燈

1. 以下哪種顏色不屬於暖色？

   A. 黃色
   B. 橙色
   C. 紅色
   D. 綠色

D

2. 以下哪個是 ANGLE 元件的用處？

   A. 量度三角形的角度
   B. 計算並顯示 M5Stack 所面向的角度
   C. 讀取自身的角度值，並用作輸入用途
   D. 調整 M5Stack 的角度至 ANGLE 元件的角度

C

3. 怎樣才能將 ANGLE 元件的輸出值用作操控 RGB 元件亮度？

   A. 將 ANGLE 元件的輸出值範圍調至 RGB 的亮度範圍，然後其設為 RGB 元件的亮度
   B. 在屏幕上顯示 ANGLE 元件的輸出值，然後把屏幕上的數值寫進 RGB 元件
   C. 把 ANGLE 元件與 RGB 元件連接起來
   D. 直接將 RGB 元件的量度設為 ANGLE 元件的輸出值

A

姓名: ———————————— 班別: ———————— (　　)

第四課 – 記憶和判斷

1. 小明首先將變數 num 設為 5，以下那些方塊會將變數 num 的數值變成 10?
   (i) – 將變數 num 設為 5
   (ii) – 將變數 num 設為 10
   (iii) – 將變數 num 改變 5
   (iv) – 將變數 num 改變 10

   A. 只有(ii)
   B. 只有(iv)
   C. (ii) 和 (iii)
   D. (i) 和 (iv)

   C

2. 以下哪個關於如果方塊的描述是錯的?

   A. 如果方塊能在 Logic 分頁中找到
   B. 在如果方塊裡面，需要判斷的方塊叫做條件
   C. 如果條件成立，便會執行執行方塊
   D. 如果條件成立，程式會繼續判斷下方否則如果的條件

   D

3. 以下是一部籃球機的出票系統，試推算它在 score = 17 時的輸出。

   A. Printing 20 tickets
   B. Printing 15 tickets
   C. Printing 10 tickets
   D. Thanks for playing!

   C

姓名：_____ 班別：_____（ ）

第五課 – 紅外線槍

1. 以下哪一種關於紅外線的描述是對的?

A. 紅外線是紅色的，所以被稱為紅外線
B. 紅外線是能量集中的光線，被照射到會造成燒傷
C. 微波爐使用紅外線技術把食物翻熱
D. 紅外線能用來傳送信號

D

2. 以下哪個關於 IR 元件的描述是錯的?

A. IR 元件由一個發射器和一個接受其所組成
B. IR 元件需要插在 Port B
C. 我們可以透過觀測 IR 元件的發射器得知發射器是否開啟中
D. IR 元件的接收器數值只會是 1 或 0

C

3. 以下那一項關於紅外線槍數據流向的描述是錯誤的。

A. 當紅外線槍的 M5Stack 按鈕被按下，M5Stack 透過 Grove 線傳送開啟發射器的指令給 IR 元件
B. 紅外線槍的 IR 元件透過 Grove 線把訊息傳送到槍靶的 IR 元件
C. 槍靶的 IR 元件收到訊息後，透過 Grove 線把訊息傳送到槍靶的 M5Stack
D. 當槍靶的 M5Stack 收到訊息後，透過電訊號傳送指令到 LED 燈條令其閃爍紅燈

B

姓名：_____ 班別：_____（ ）

第六課 – 我的天文台(MQTT)

1. 以下哪一種數值是 ENV 元件不能獲取的?

A. 大氣壓力值
B. 紫外線指數
C. 溫度值
D. 濕度值

B

2. 以下哪個關於 MQTT 的描述是錯的?

A. MQTT 是一種基於發佈/訂閱體系的通訊協定
B. MQTT 協定裡有兩種角色：發佈者與接收者
C. 裝置可以將訊息發佈到頻道內的主題，也可以訂閱頻道內的主題
D. 裝置可以訂閱一個頻道，以接收頻道內所有主題的訊息

B

3. 以下那一項不屬於 MQTT 的資料架構。

A. MQTT 發佈者
B. 頻道
C. 主題
D. 數據

A

姓名：_____ 班別：_____（ ）

第七課 – 上傳資料到 Thingspeak

1. 以下哪一種關於 Thingspeak 的描述是錯的?

A. Thingspeak 是一個免費物聯網服務平台
B. Thingspeak 的角色是 MQTT 代理人
C. Thingspeak 允許用戶使用該平台進行數據發佈和訂閱頻道
D. 在訂閱 Thingspeak 的 MQTT 頻道時，需要使用發佈者的 API Key

D

2. 以下哪個不是發佈訊息到 MQTT 伺服器所需要的資料?

A. 頻道號碼
B. 伺服器位置
C. 發佈者的位置
D. 發佈者的使用者名稱

C

3. 以下那一項關於我的天文台專題是正確的。

A. 我的天文台專題有走過物聯網的數據生命周期的四個階段
B. 只要 M5Stack 不斷發佈 ENV 元件的數據，使用者在其它網絡登入 Thingspeak 也能實時觀測到 ENV 元件的數據
C. 只有發佈者自己能夠看到頻道上的數據
D. Thingspeak 能夠隨時訪問你的 M5Stack 以獲取 ENV 元件的數據

B

姓名：_____ 班別：_____（ ）

第八課 – 智能防盜系統

1. 以下哪一種關於被動紅外線的描述是錯的？

A. 人類在一般情況下會釋放出紅外線
B. 只有人類會釋放出被動紅外線
C. 被動紅外線感測器不需要使用任何能量來進行偵測
D. 被動紅外線感測器只能夠偵測到溫體動物

B

2. 以下哪項關於 PIR 元件的描述是錯的？

A. PIR 元件需要接駁到 Port B
B. PIR 元件的輸出只會是 0 或 1
C. 只要 PIR 元件偵測到被動紅外線就會輸出 1
D. 只要用手把 PIR 元件遮擋著，它就不能夠接收其他的被動紅外線

C

3. 以下那一項關於 Thingspeak 是正確的？

A. 若要新增 MQTT 主題，必須要新增一個新的 MQTT 頻道
B. 在新增 MQTT 主題時，必需指明它的數據類型
C. 我們可在 Channel settings 分頁中新增 MQTT 主題
D. Thingspeak 能夠自動分別收到的數據屬於哪個主題

C

姓名：_____ 班別：_____（ ）

第九課 – 警告電郵

1. 以下哪項關於 IFTTT 的描述是錯的？

A. IFTTT 會重複執行收到的 HTTP 指令
B. 如果 IFTTT 程序達到了預設的條件，就會執行預設的命令
C. IFTTT 就是一個跨平台的“如果-那麼”
D. IFTTT 能夠跨平台使用

A

2. 以下哪項關於智能防盜系統專題的描述是錯的？

A. React 會因應 Thingspeak 主題的數據而執行 ThingHTTP 程序
B. ThingHTTP 會發送 HTTP 指令到 IFTTT
C. 當 IFTTT 收到 HTTP 指令，就會發送預設的電郵
D. 當電郵地址收到電郵後，就會發送訊息到 M5Stack，令其 LED 燈條閃爍紅燈

D

3. 以下那一項關於智能防盜系統數據生命周期的描述是錯的？

A. PIR 元件屬於系統的收集階段
B. M5Stack 上傳資料到 Thingspeak 屬於系統的溝通階段
C. ThingHTTP 屬於系統的分析階段
D. IFTTT 發送電郵屬於系統的行動階段

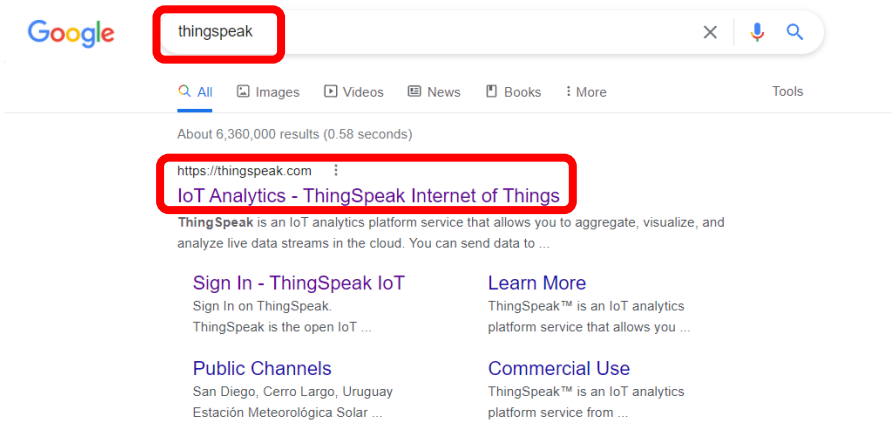
C

Appendix IV – Thingspeak instructional guides (Lesson 7)

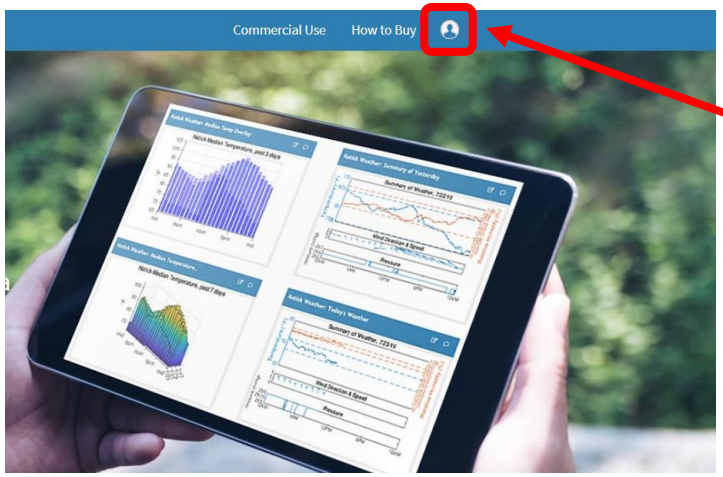
單元三 - 我的天文台

ThingSpeak 註冊流程

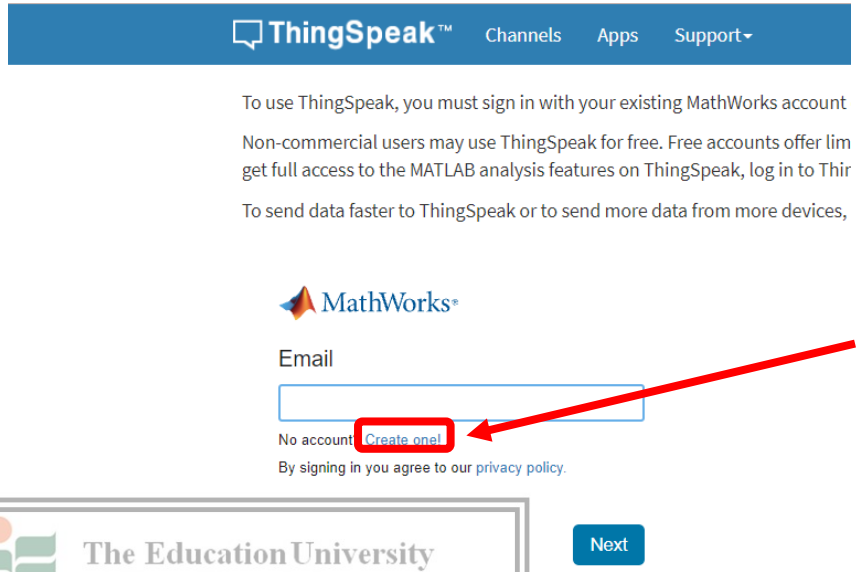
1. 在 Google Chrome 搜尋 “ThingSpeak”，選擇第一個選項



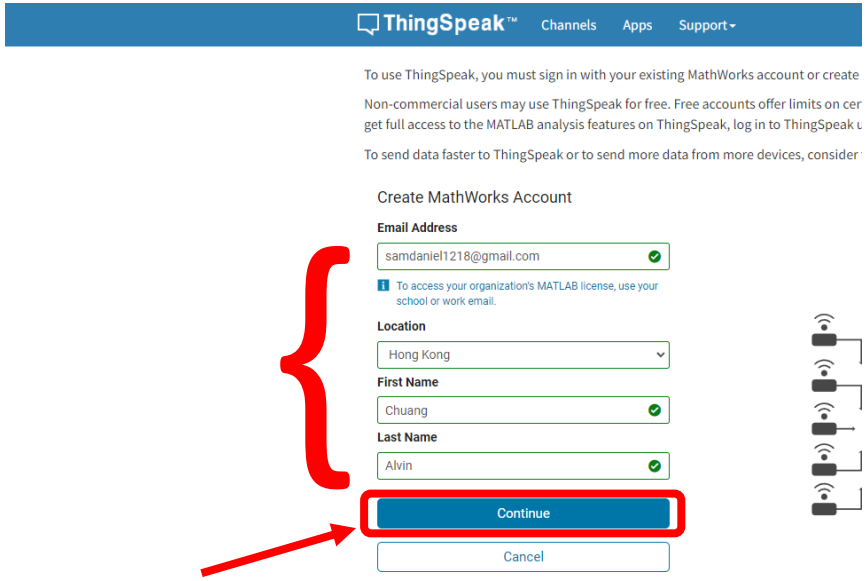
2. 在 ThingSpeak 主頁點擊「使用者」圖示



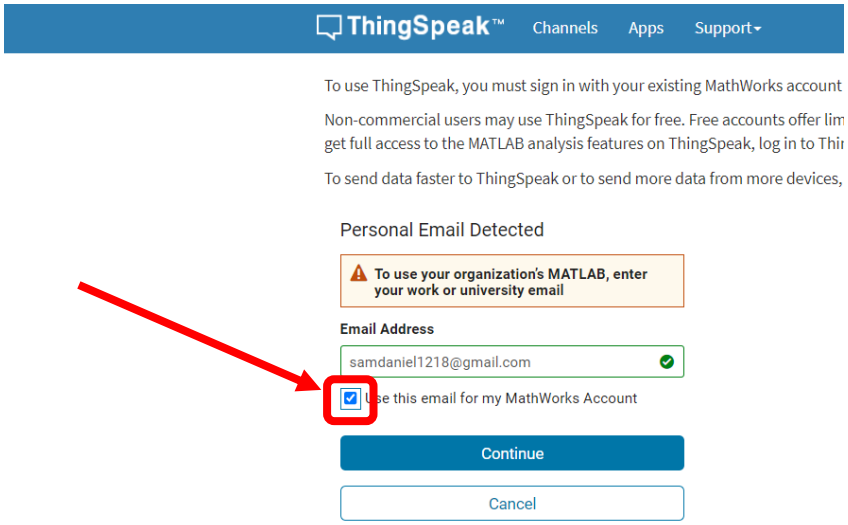
3. 點擊 “Create one!”



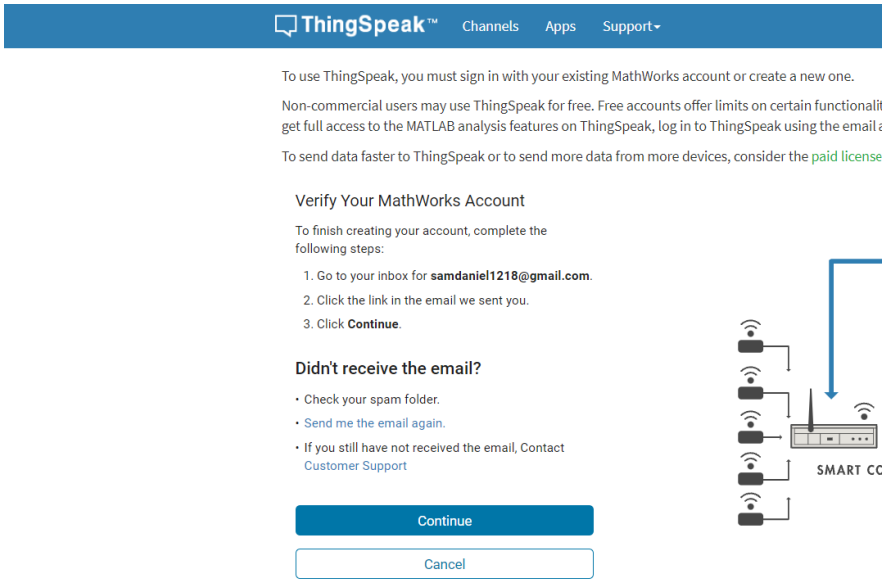
4. 在新增賬戶頁面依次序填上電郵地址，地區，姓氏，和名字



5. 系統需要你確認使用個人 Gmail 賬戶，把方格打剔，然後點擊“Continue”

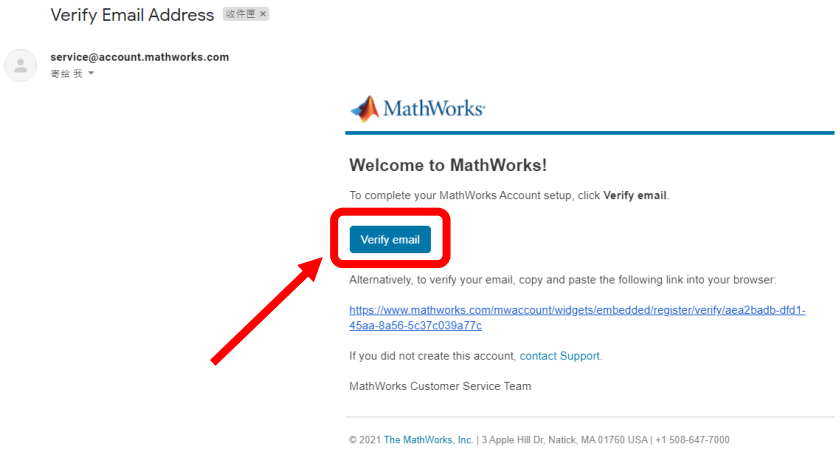


6. 到達這個頁面後，打開一個新的分頁，開啟 Gmail

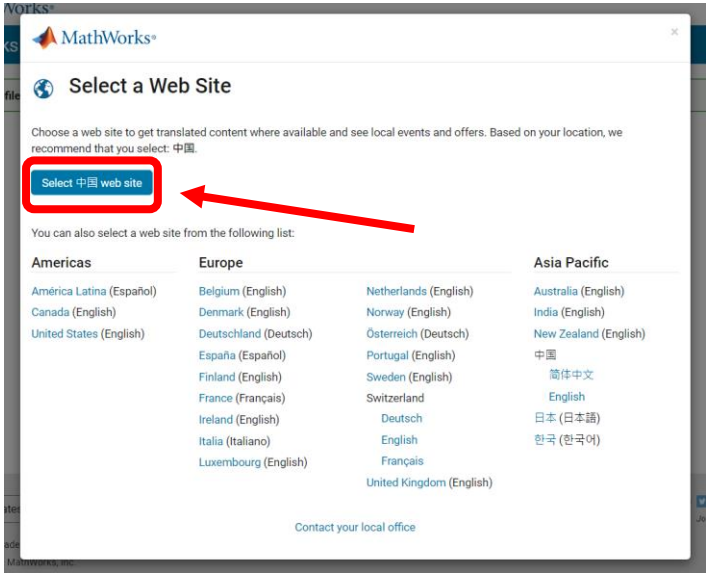


7. 在 Gmail 裡尋找“Verify Email Address”的郵件，然後打開它

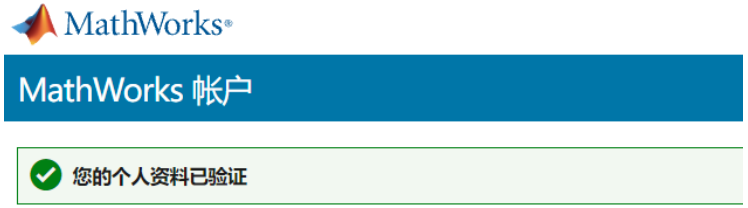
8. 點擊 “Verify email”



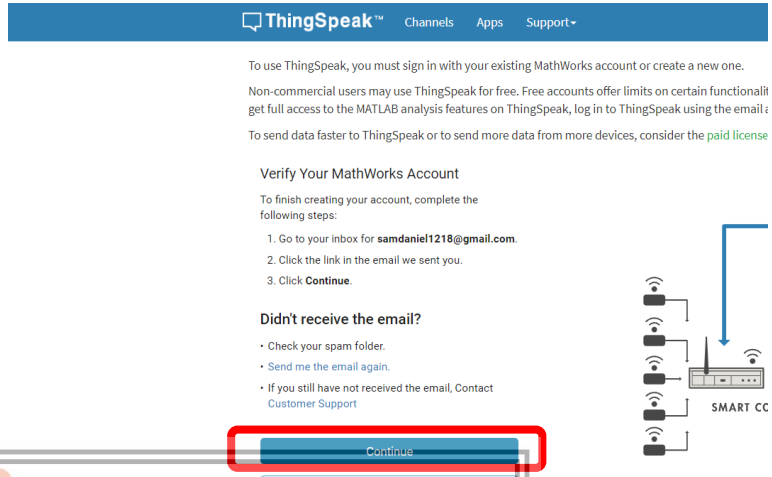
9. 點擊 “Select 中國 website”



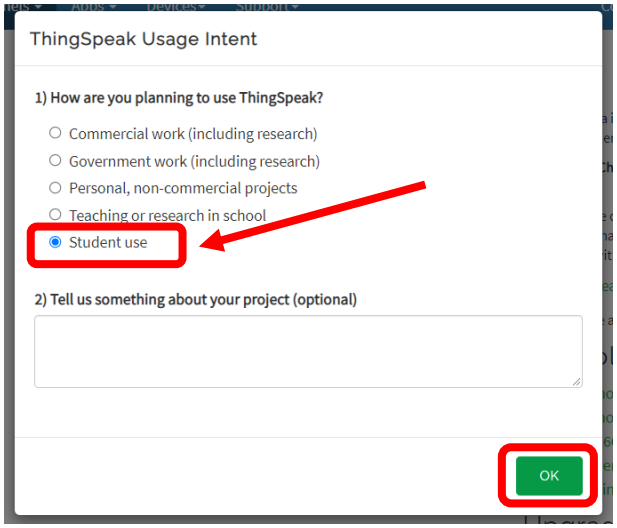
10. 選擇後，頁面會顯示「您的個人資料已驗證」



11. 返回打開 Gmail 前（步驟 6）的頁面，點擊 “Continue”

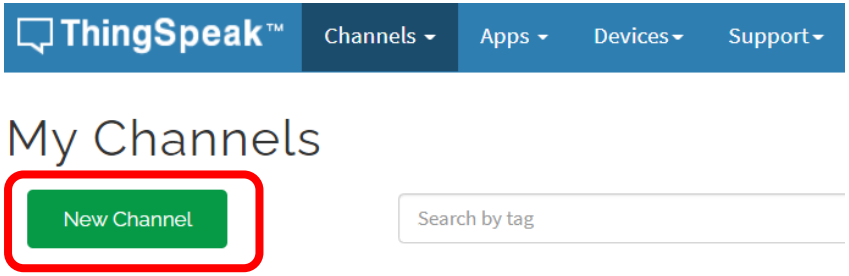


12. 在問卷中選擇“Student use”，然後點擊“OK”

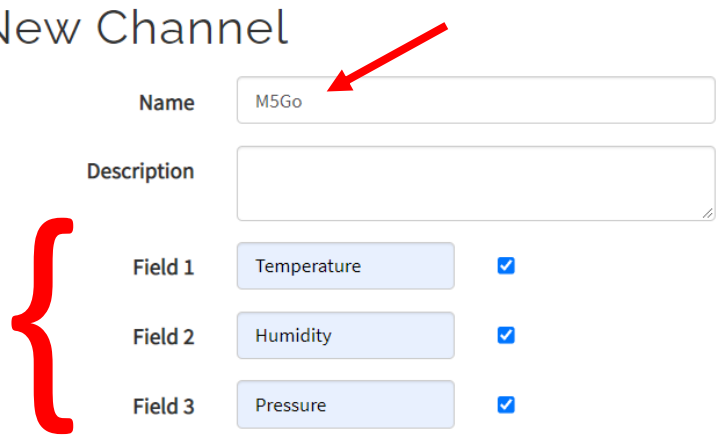


在 ThingSpeak 創建頻道

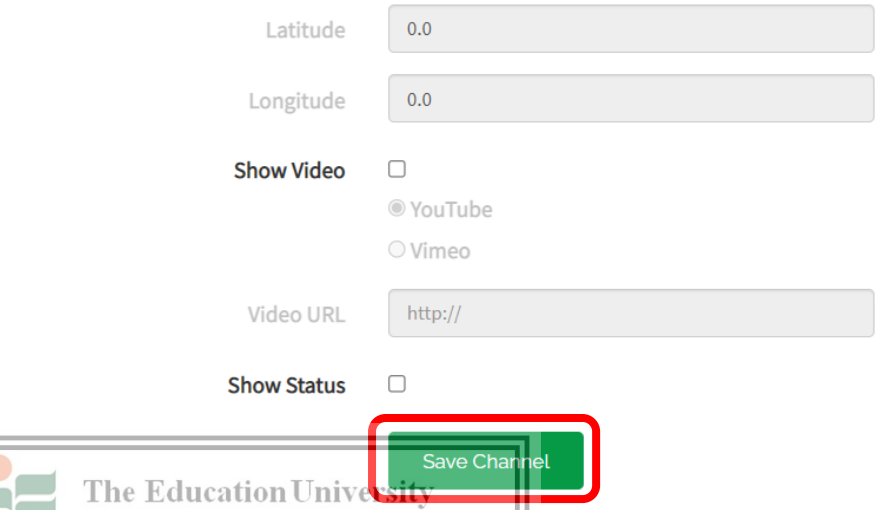
1. 在主頁點擊 “New Channel”



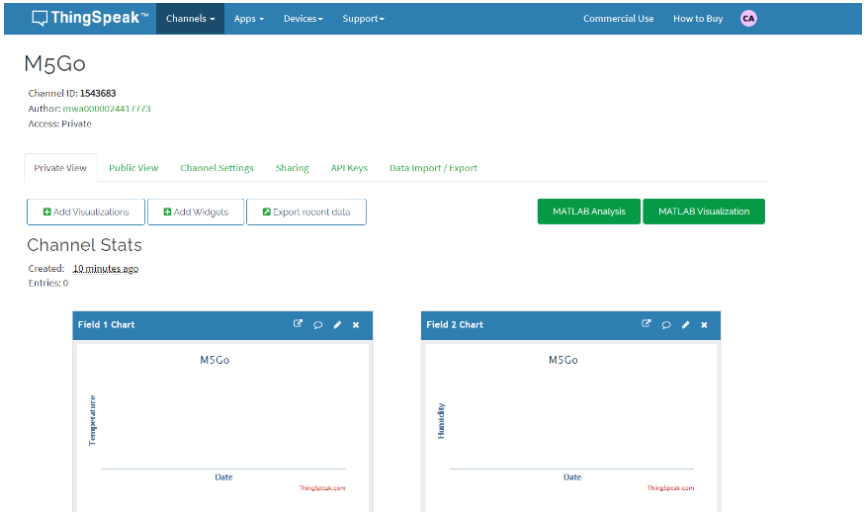
2. 進入頁面後，填寫頻道名稱為“M5Go”，然後勾選三個數據欄，分別輸入“Temperature”，“Humidity”，和“Pressure”



3. 在頁面下方點擊“Save Channel”

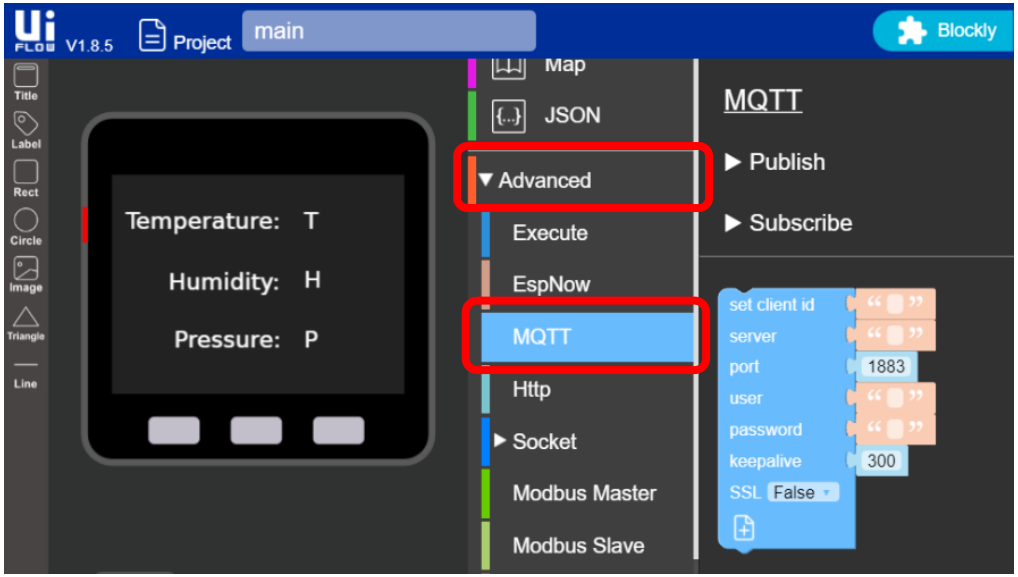


4. 然後頁面會自動導航至頻道（M5Go）的主頁

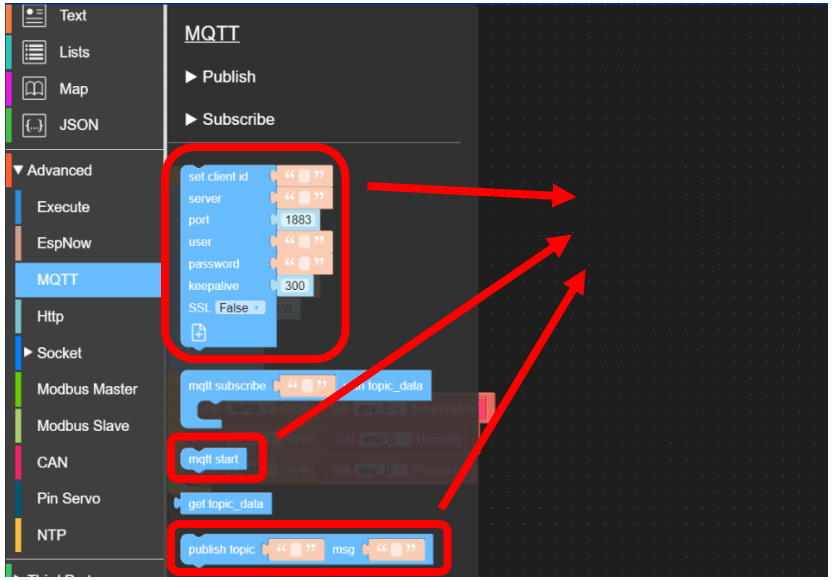


將數據傳輸至 ThingSpeak

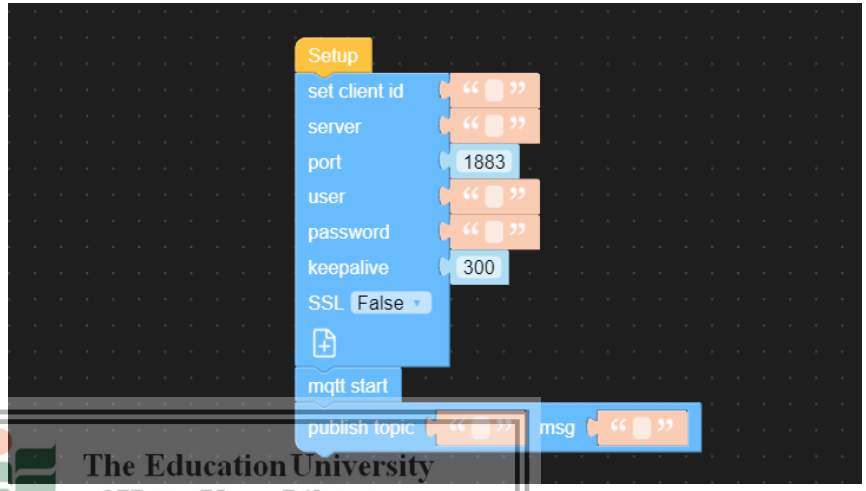
1. 在方塊區底部，展開“Advanced”選單，選擇“MQTT”



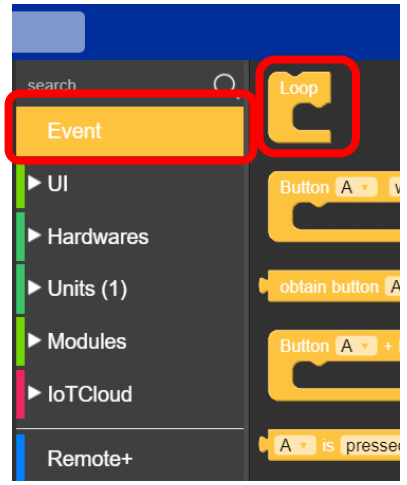
2. 將“set client ID”，“mqtt start”，“publish topic”拉出程式區

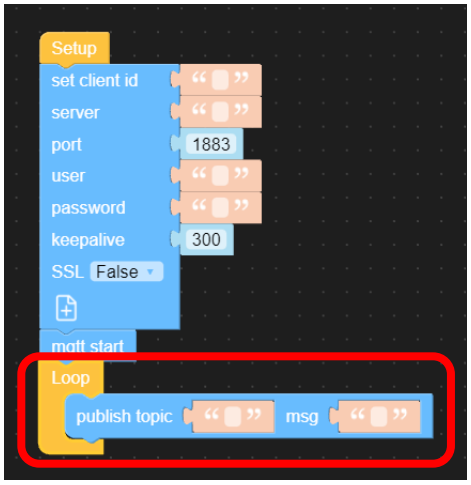


3. 將三個方塊依照圖中順序排好

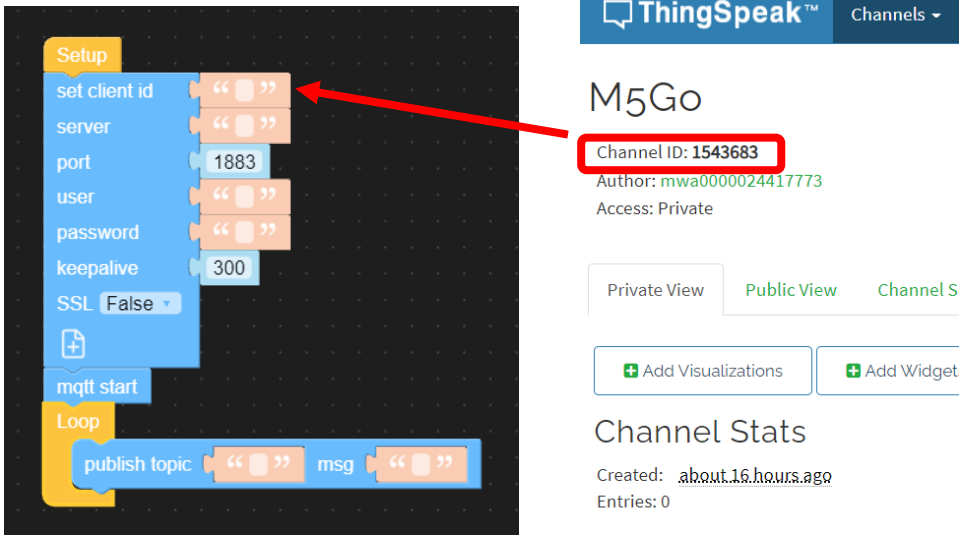


4. 在方塊區頂部，選擇“Event”，拉出“Loop”並包覆著“publish topic”

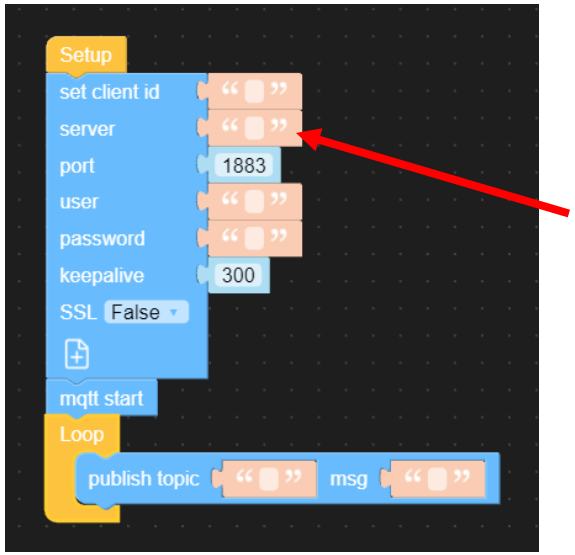




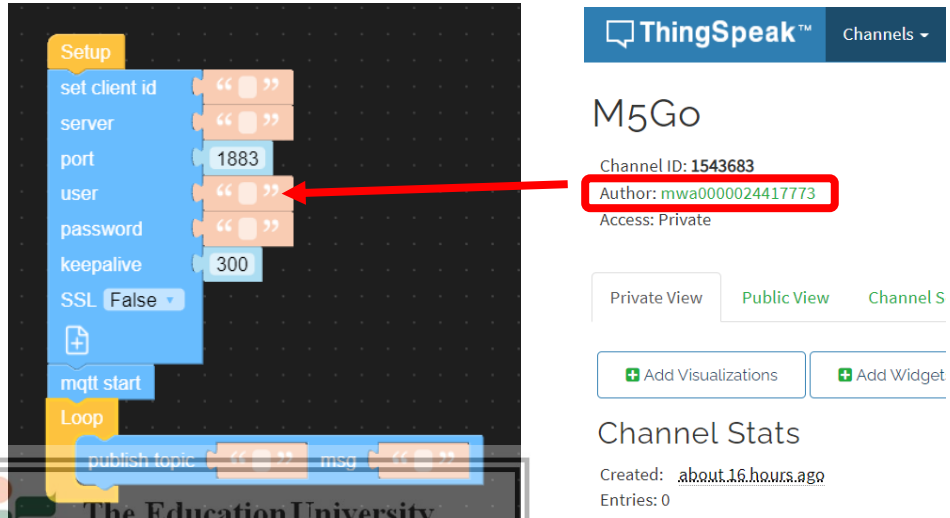
5. 在“cliend id”欄輸入 ThingSpeak 的 Channel ID



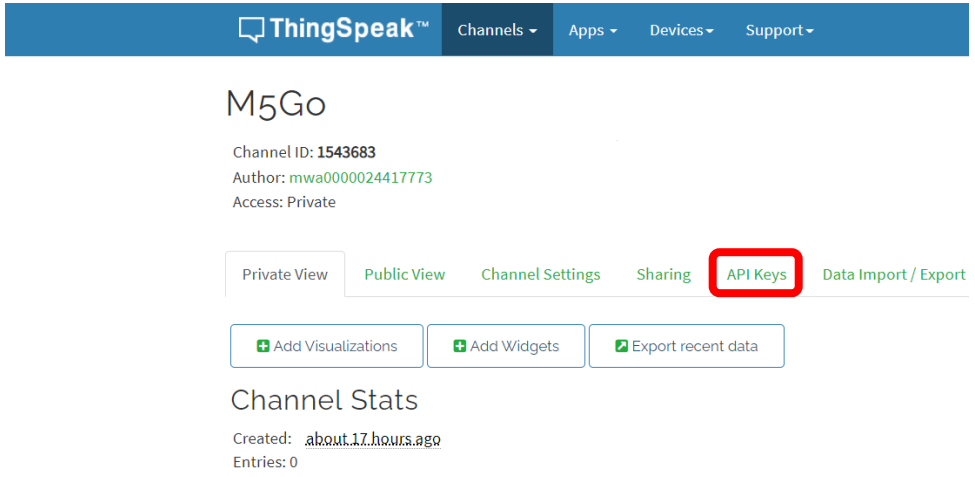
6. 在“server”欄輸入“mqtt.thingspeak.com” *（可在 VLE 複製）*



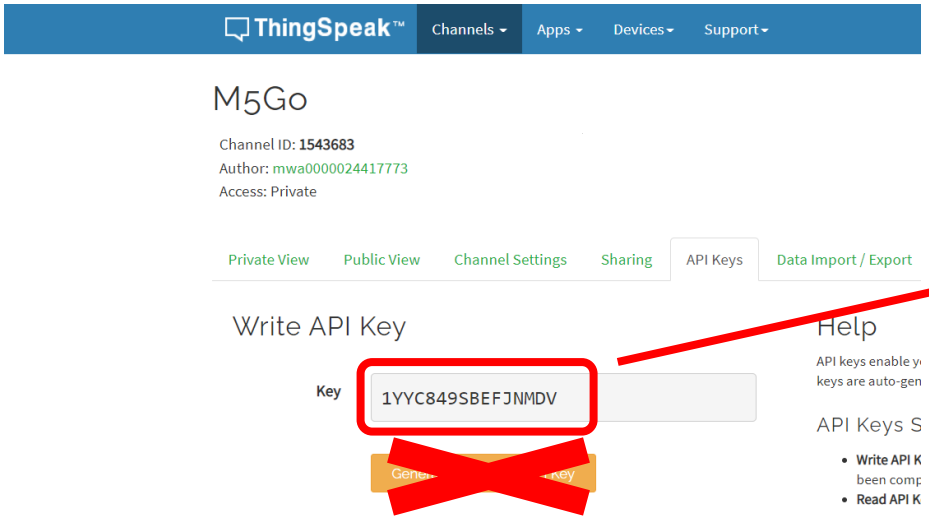
7. 在“user”欄中輸入 ThingSpeak 的 Author



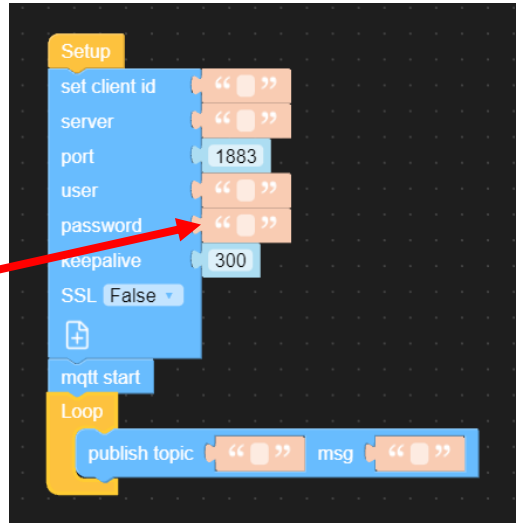
8. 在 ThingSpeak 界面，點擊“API Keys”



9. 這個頁面會有你的“Write API Key”，<u>切勿</u>點擊下面的按鈕

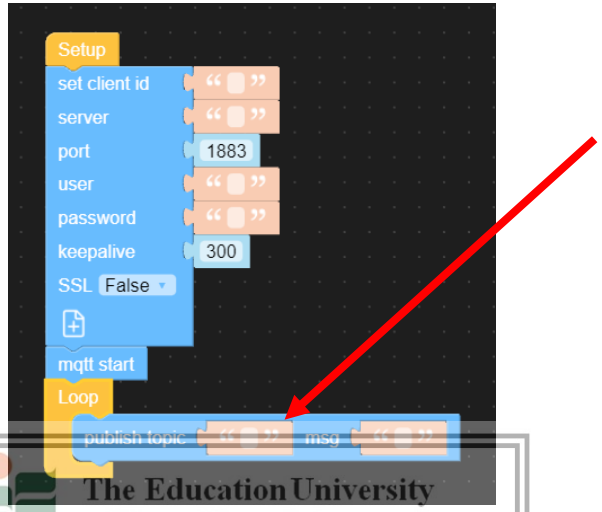


10. 在“password”欄中輸入 ThingSpeak 的“Write API Key”



11. 在“Topic”中輸入“channels/(client id)/publish/(password)” *（可在 VLE 複製）*

例子：channels/1485998/publish/74YZ5QNWYR82OAC4

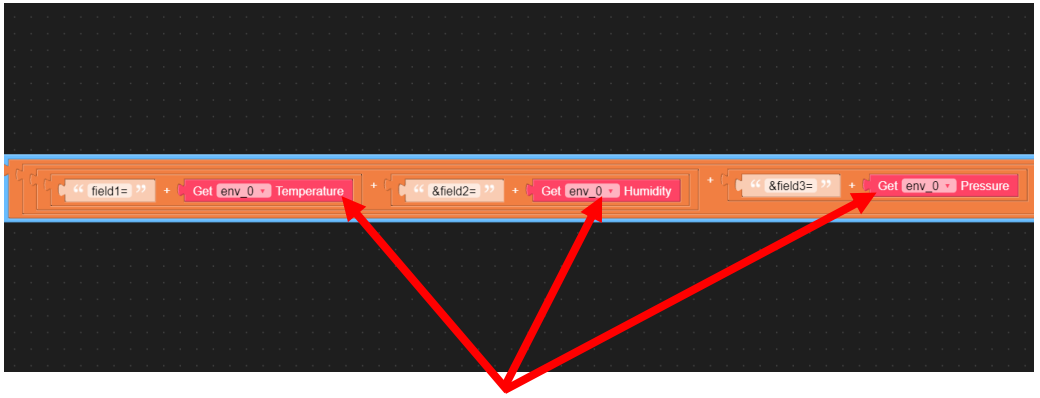


12. 在方塊區，選擇“Text”，拉到選單下方並選取下圖的方塊

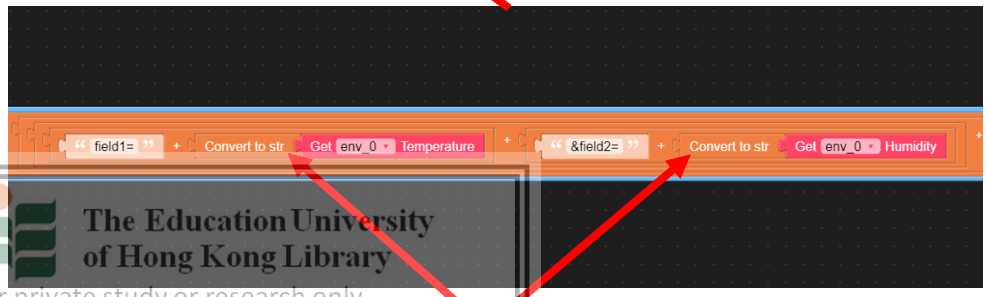
（這方塊能讓多個字串組合在一起）

13. msg 的格式為“field1=(Temperature 值)&field2=(Humidity 值)&field3=(Pressure 值)&status=MQTTPUBLISH”

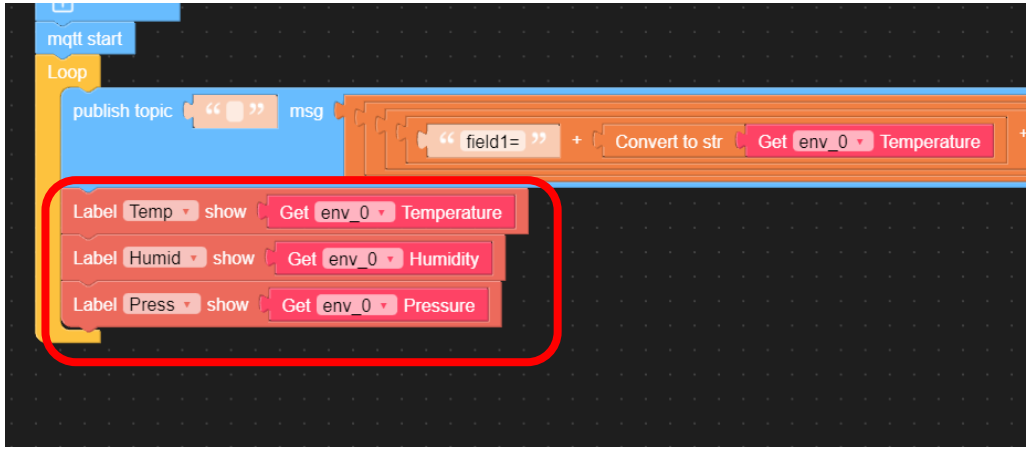
14. 在每個空格中放入對應的數據獲取方塊



15. 在每個數據獲取方塊前面加上“Convert to str”方塊，將其變成文字



16. 將改變 M5Stacks 上標籤文字的方塊也放進“loop”裡面

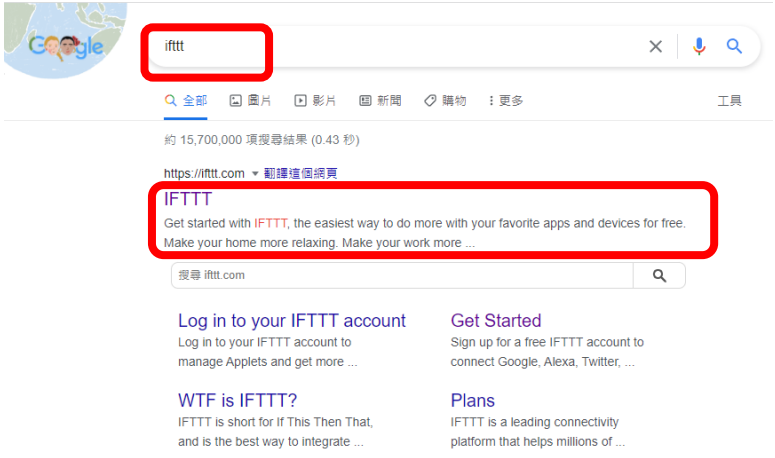


Appendix V – IFTTT, ThingHTTP, React instructional guides (Lesson 9)

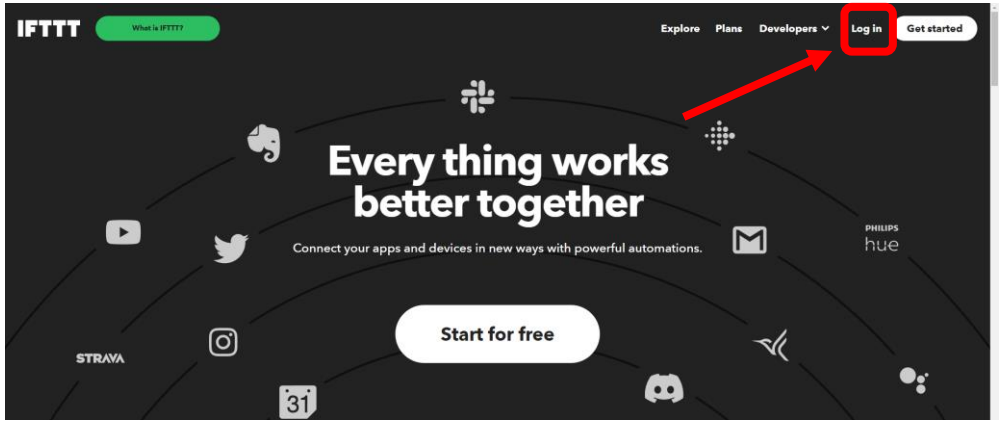
單元四 – 智能防盜系統

創建 IFTTT 服務

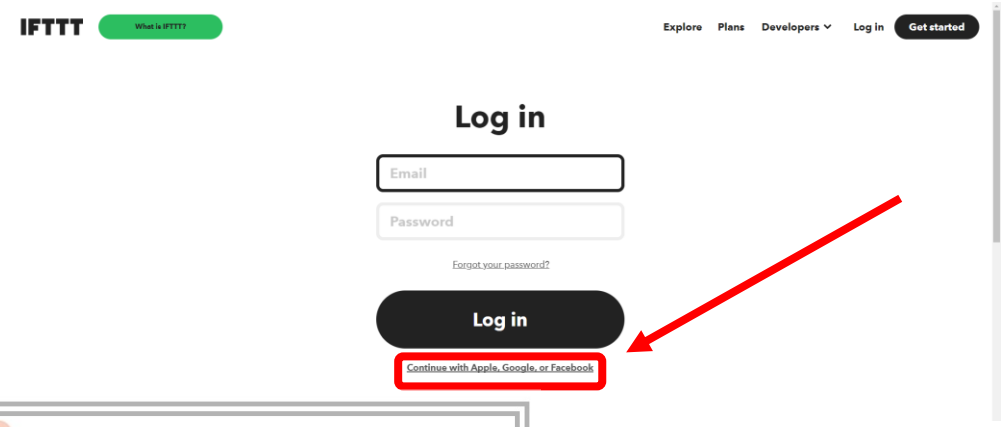
1. 在 Google Chrome 搜尋 “IFTTT”，選擇第一個選項



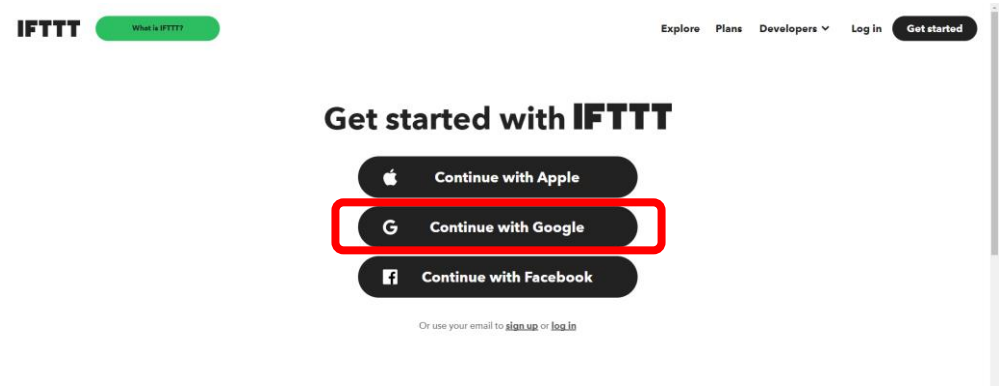
2. 在 IFTTT 主頁點擊“Log in”



3. 點擊 “Continue with Apple, Google, or Facebook”

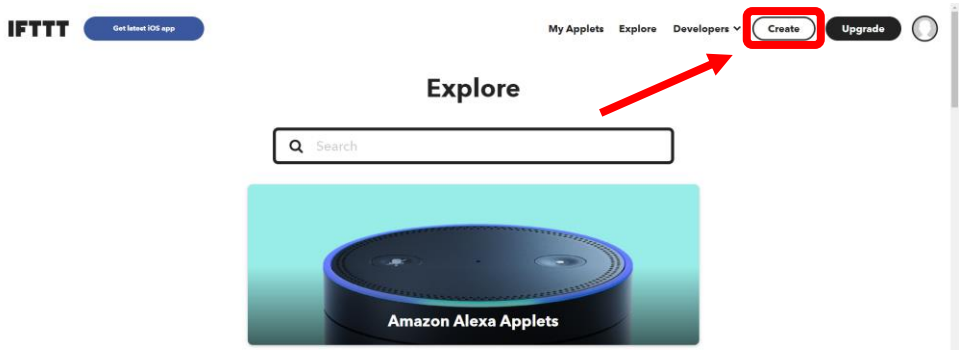


4. 選擇 “Continue with Google”

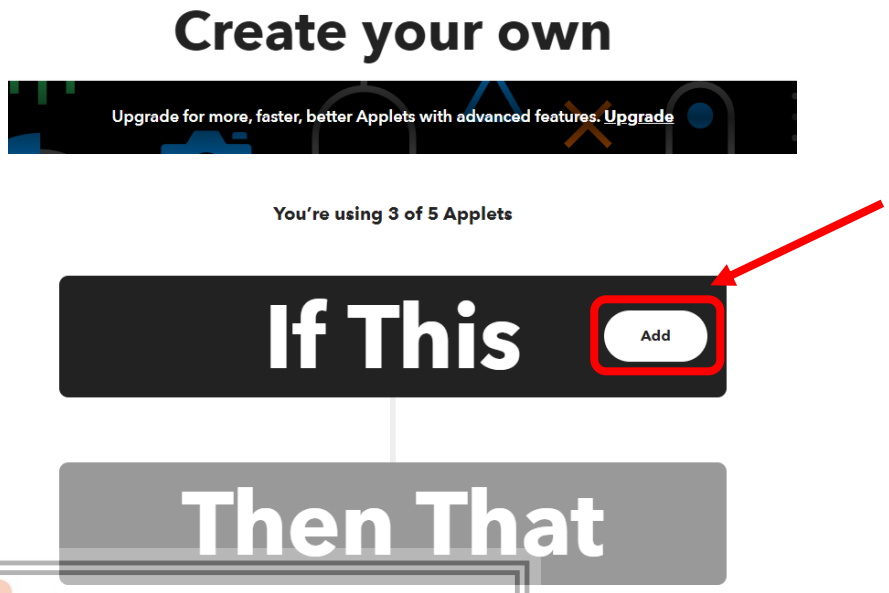


5. 選擇一個 Google 賬號

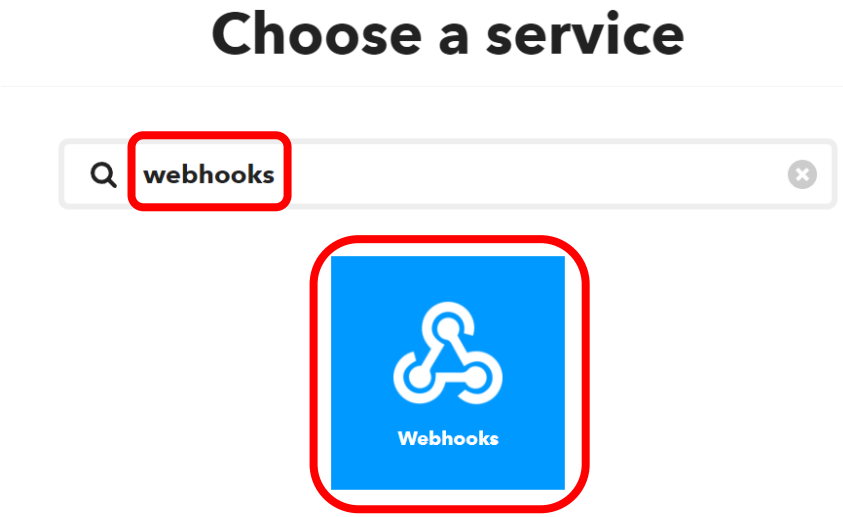
6. 點擊 “Create”



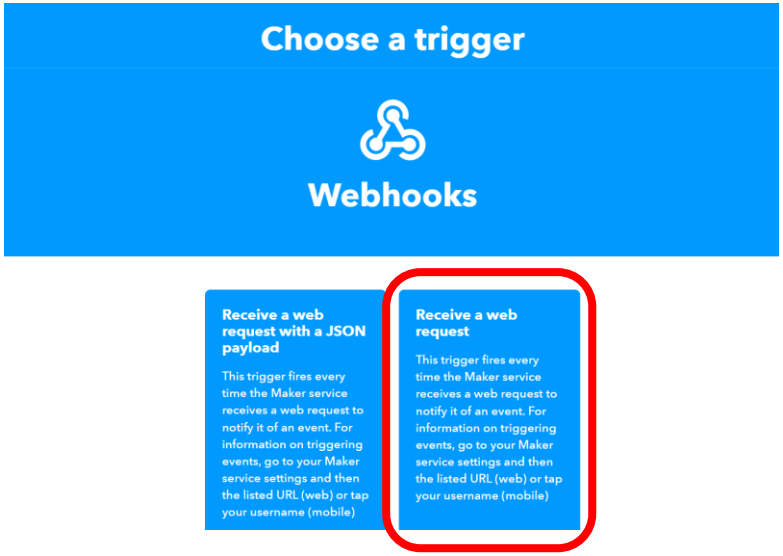
7. 點擊在 If this 旁邊的 “Add”



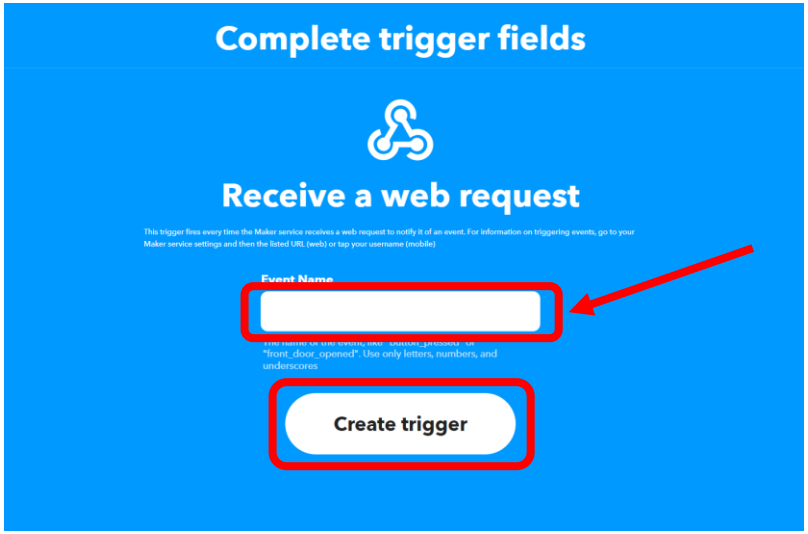
8. 搜尋並選擇 “Webhooks”



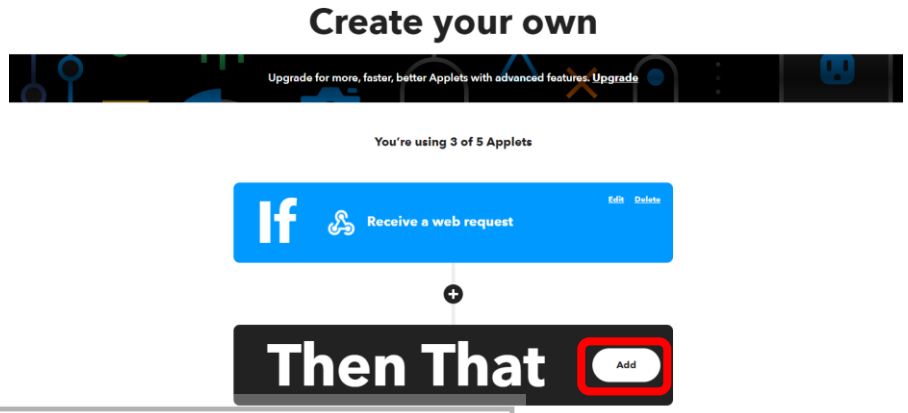
9. 選擇 “Receive a web request”



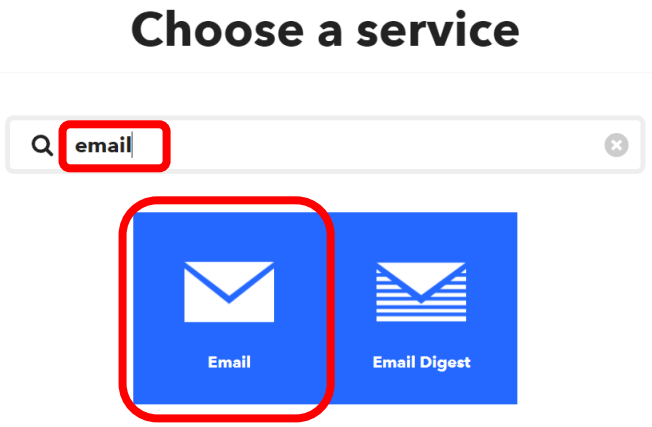
10. 輸入事件名稱，即是什麼事件會觸發電郵，可以輸入 “person_detected”，然後點擊 “Create trigger”



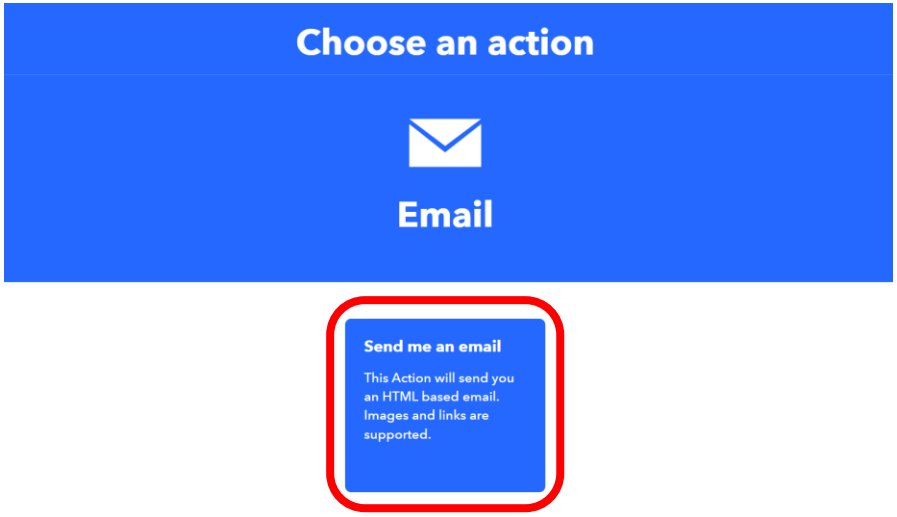
11. If 欄將會顯示剛選擇的觸發條件，然後點擊在 Then that 旁邊的 “Add”



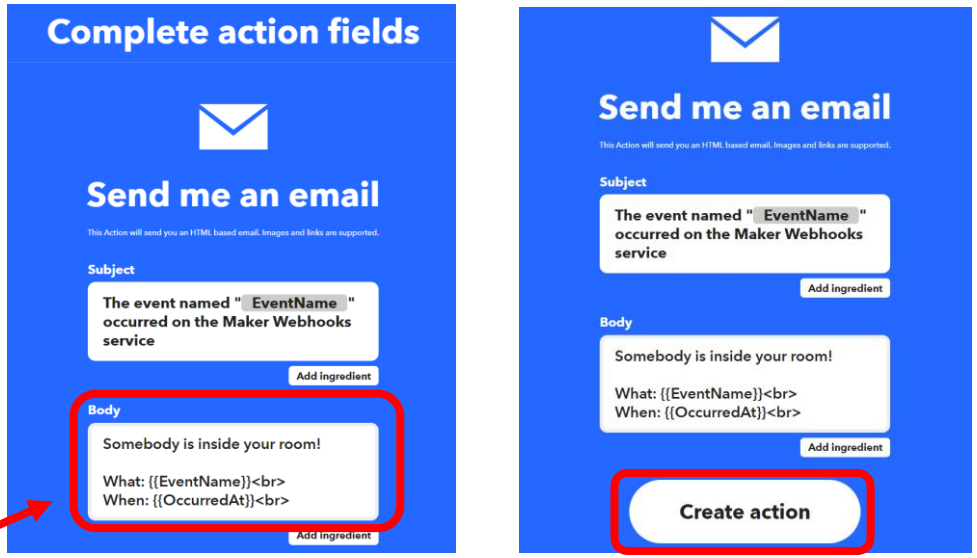
12. 搜尋並選擇 “Email”



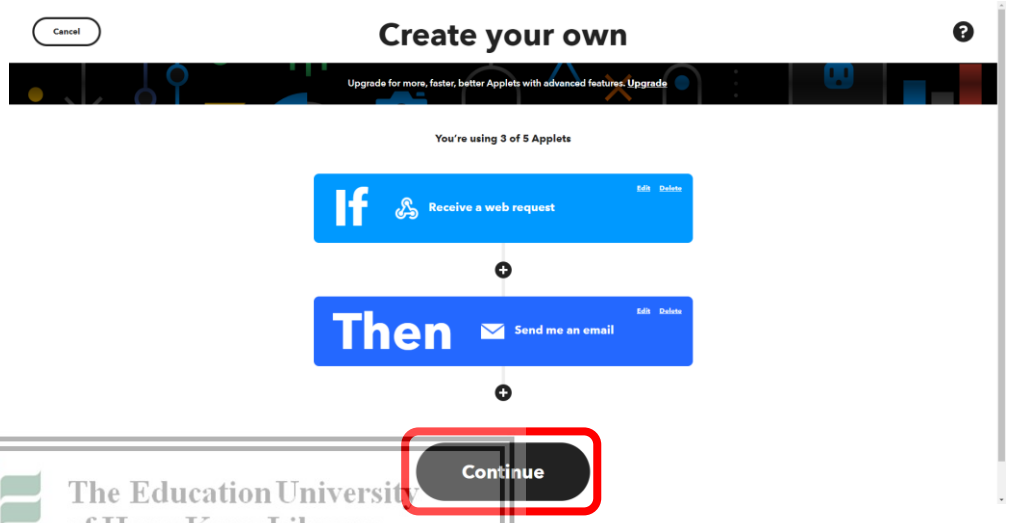
13. 選擇 “Send me an email”



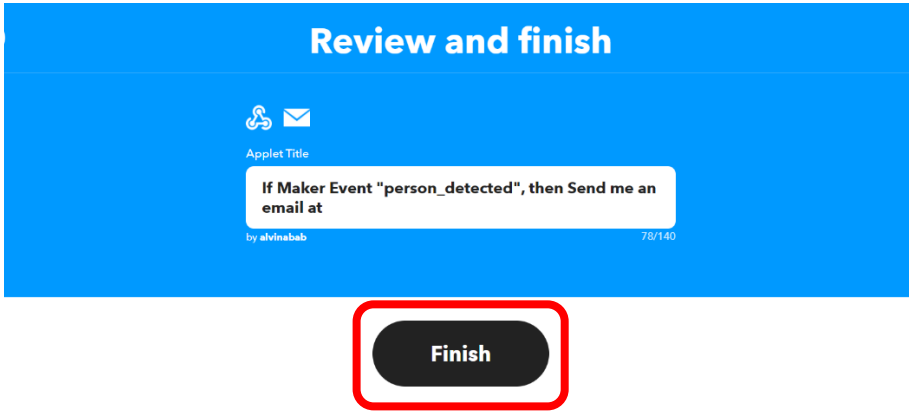
14. 在 Body 框中寫下你想傳送的訊息，然後點擊“Create Action”



15. If 欄和 Then 欄將會顯示剛選擇的選項，然後點擊 “Continue”

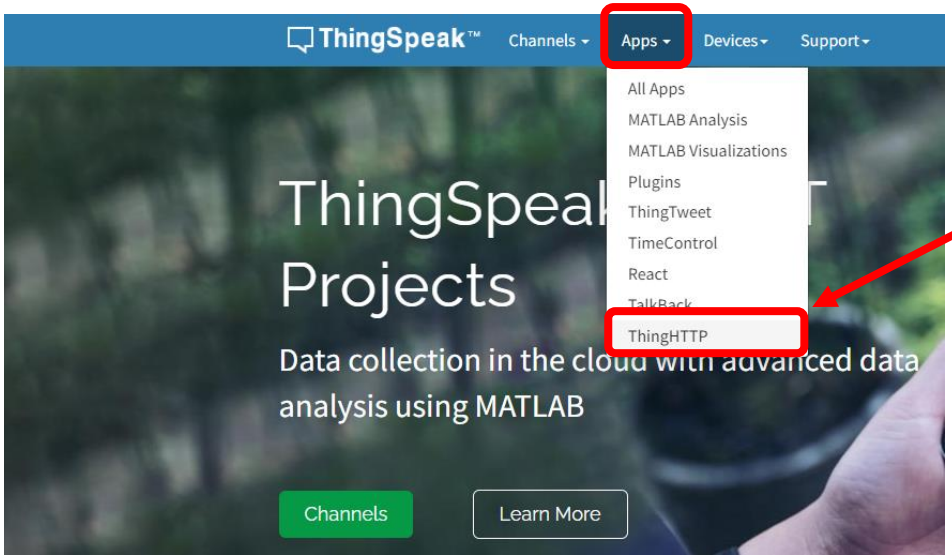


16. 點擊 “Finish”，但不要關閉 IFTTT 頁面

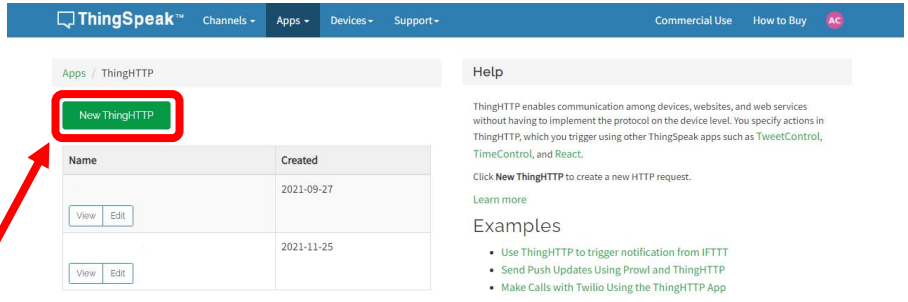


設定 ThingHTTP

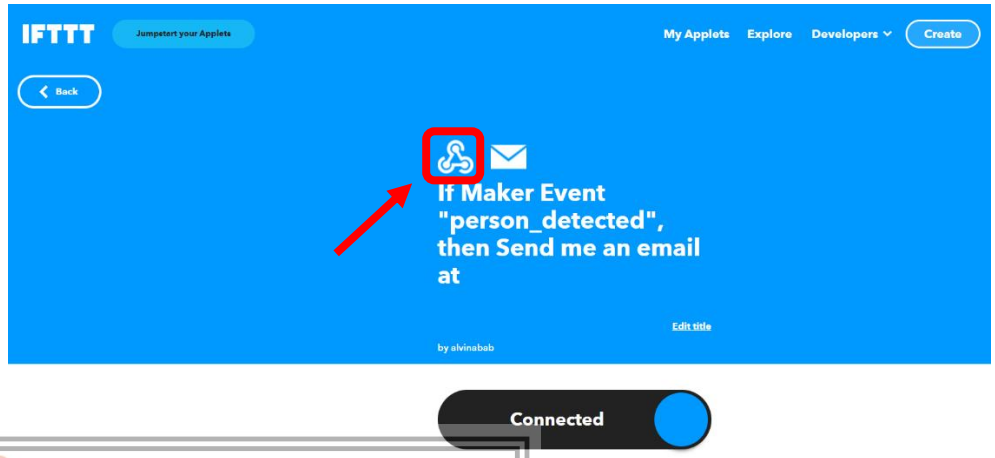
1. 在 Thingspeak 主頁頂部欄選擇 “Apps” > “ThingHTTP”



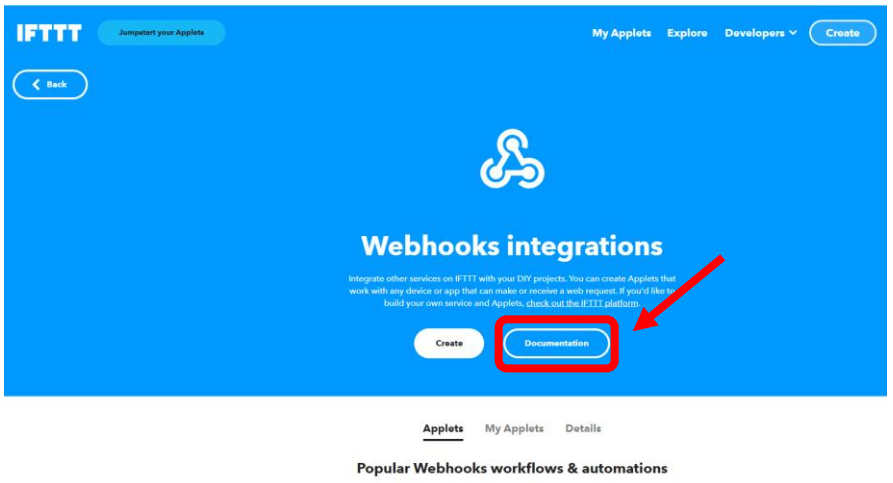
2. 點擊 “Add ThingHTTP”



3. 回到 IFTTT 頁面，點擊 “Webhooks” 標誌

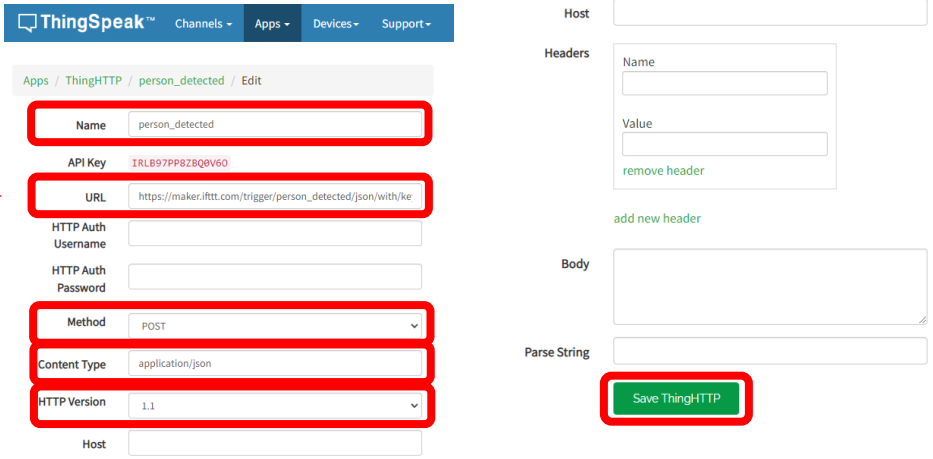


4. 點擊 “Documentation”



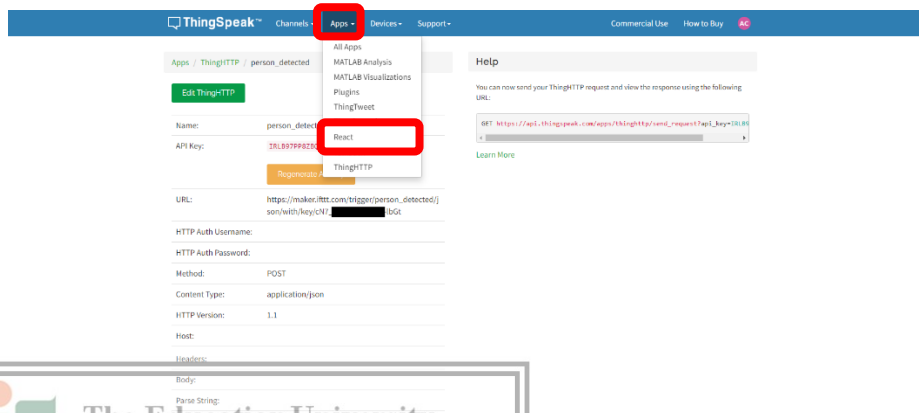
5. 將你 IFTTT 的事件名稱，貼上到下方“event”欄位中，然後複製整條連結

6. 回到 Thingspeak，在 URL 欄貼上連結，在 Name 欄填上事件名稱，Method 欄選擇 POST，Content Type 輸入 application/json，HTTP Version 選擇 1.1，然後點擊“Save ThingHTTP”

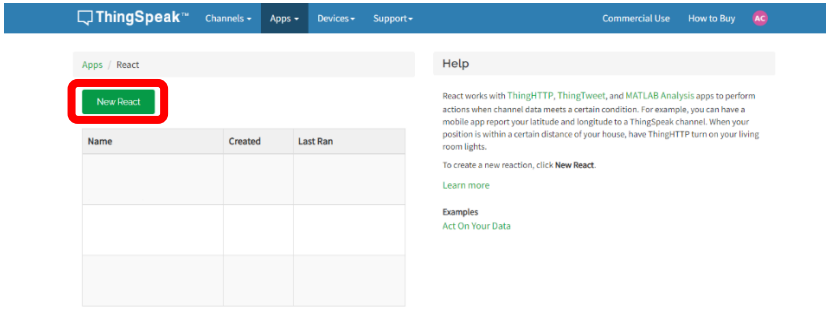


設定 React

1. 在頂部欄選擇“Apps” > “React”



2. 點擊“New React”



3. 在 React name 欄輸入事件名稱，Condition Type 選擇 “Numeric”，Test frequency 選擇 “On Data Insertion”，If channel 選擇你的頻道，Field 選擇 “PIRsensor”， “is equal to”，1，Action 選擇 “ThingHTTP”，然後選擇事件名稱，Options 選擇 “Run action each time condition is met”，最後點擊 “Save React”