

物聯網與大數據實作

Part II. 動手實作



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國立屏東大學 電腦科學與人工智慧學系

大綱



應用情境分析 -- 遠端控制LED燈

❖ 設備A 負責遠端感測數值 (以可變電阻測試)

設備B 負責現場LED燈的控制

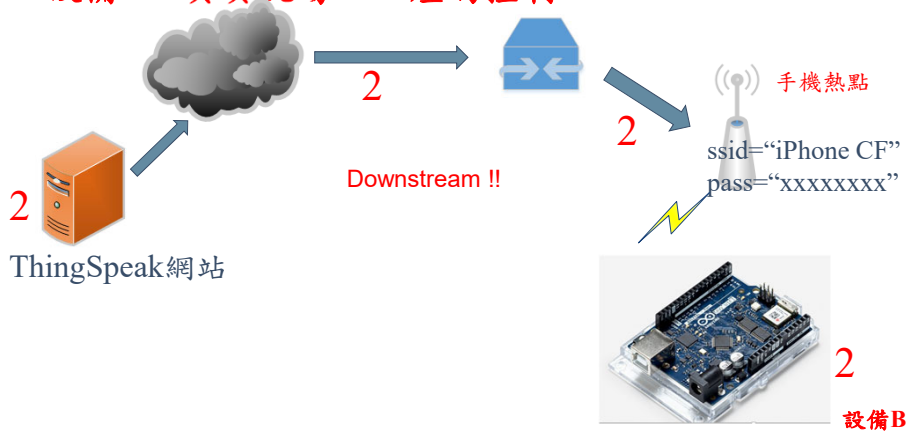


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應用情境分析 -- 遠端控制LED燈 (cont.)

❖ 設備A 負責遠端感測數值 (以可變電阻測試)

設備B 負責現場LED燈的控制



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應用情境分析 -- 遠端控制LED燈 (cont.)

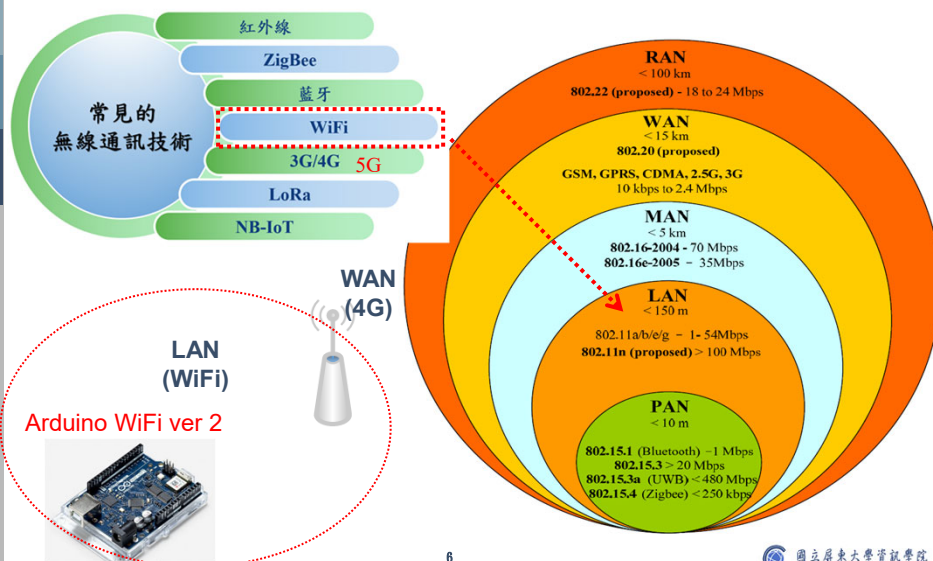
- ❖ **設備A** 負責遠端感測數值 (以可變電阻測試)
- 設備B** 負責現場LED燈的控制

1. 設備A與B都嘗試連線至AP
2. 設備A連線後負責讀取可變電阻數值，
並以範圍上傳0~4數值至Thingspeak網站
(0代表熄滅所有燈，1(2,3,4)代表打開的LEDs數量)
3. 設備B連線後隨時負責讀取Thingspeak欄位最新數值，
並依據數值點亮或關閉LEDs燈。
4. 遠端測試

當然！設備A跟設備B需要各寫一支控制程式

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物聯網設備與通訊的抉擇



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大綱

系統開發 -- 應用情境分析...

系統開發初體驗 ...

設備安裝與設定...

讓設備透過AP上Internet...

ThinkSpeak網站帳號申請與測試...

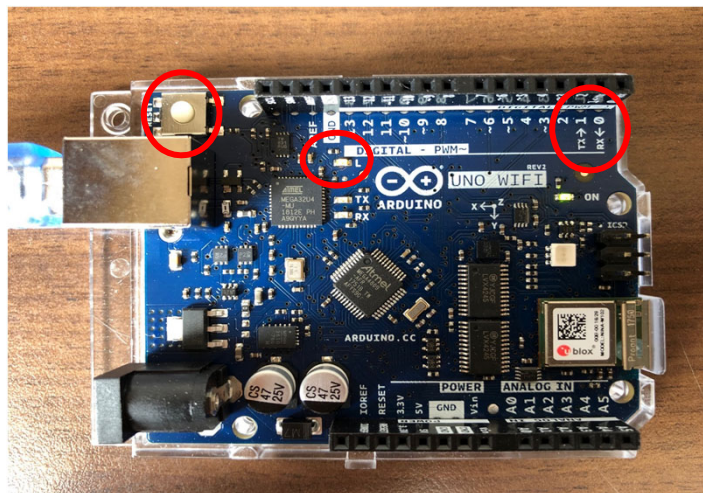
遠端控制亮燈(讀取ThinkSpeak網站數值)...

.....

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該知道的Arduino系統架構

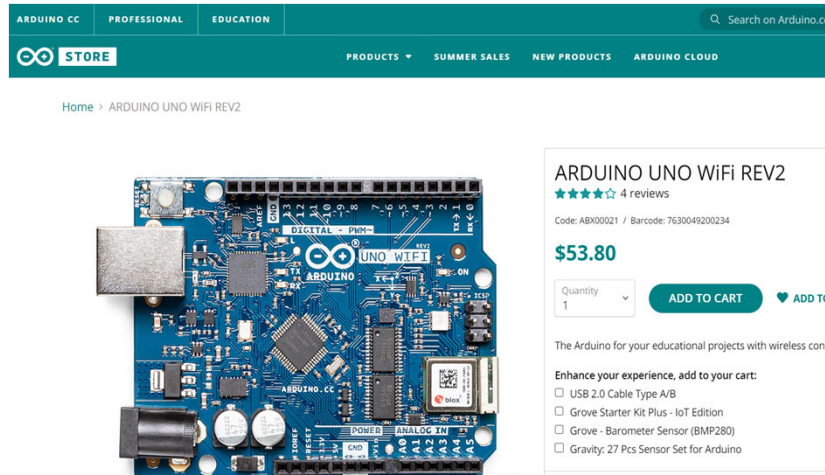
❖ 硬體...



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該知道的Arduino系統架構(cont.)

❖ 硬體...



ARDUINO CC PROFESSIONAL EDUCATION

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Home > ARDUINO UNO WiFi REV2

ARDUINO UNO WiFi REV2

★★★★☆ 4 reviews

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\$53.80

Quantity 1 ADD TO CART

The Arduino for your educational projects with wireless connectivity

Enhance your experience, add to your cart:

- ☐ USB 2.0 Cable Type A/B
- ☐ Grove Starter Kit Plus - IoT Edition
- ☐ Grove - Barometer Sensor (BMP280)
- ☐ Gravity: 27 Pcs Sensor Set for Arduino

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該知道的Arduino系統架構(cont.)

❖ 軟體(IDE安裝)...



HARDWARE SOFTWARE CLOUD DOCUMENTATION COMMUNITY BLOG ABOUT

Downloads

Arduino IDE 2.1.0

The new major release of the Arduino IDE is faster and even more powerful! In addition to a more modern editor and a more responsive interface it features autocompletion, code navigation, and even a live debugger.

For more details, please refer to the [Arduino IDE 2.0 documentation](#).

Nightly builds with the latest bugfixes are available through the section below.

SOURCE CODE

The Arduino IDE 2.0 is open source and its source code is hosted on [GitHub](#).

DOWNLOAD OPTIONS

Windows Win 10 and newer, 64 bits

Linux AppImage 64 bits (X86-64)

Linux ZIP file 64 bits (X86-64)

macOS Intel, 10.14: "Mojave" or newer, 64 bits

macOS Apple Silicon, 11: "Big Sur" or newer, 64 bits

Release Notes

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該知道的Arduino系統架構(cont.)

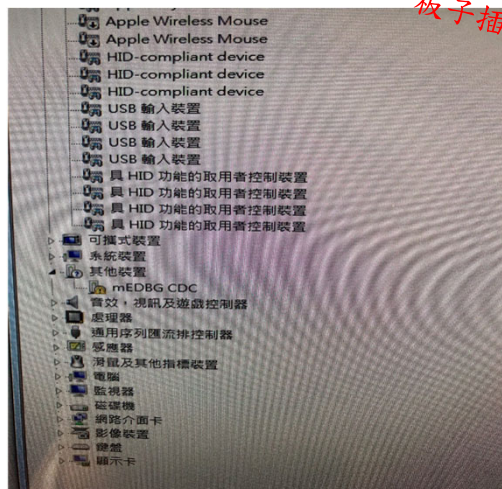
❖ 軟體(IDE安裝)...



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理論加動手

❖ 設備操作(Arduino UNO WiFi)遇到的痛苦...



板子插上但驅動程式抓不到!!

開發程式(IDE)
到官網下載最新，
但還是不理我!!

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理論加動手

❖ 解決過程...

- Google!!
- 中文資料不多...
- 資訊還是需要英文...

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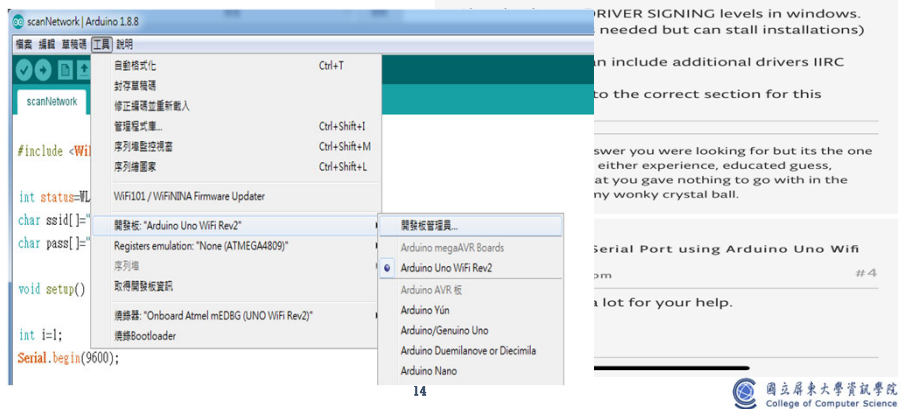


理論加動手

❖ 解決過程...

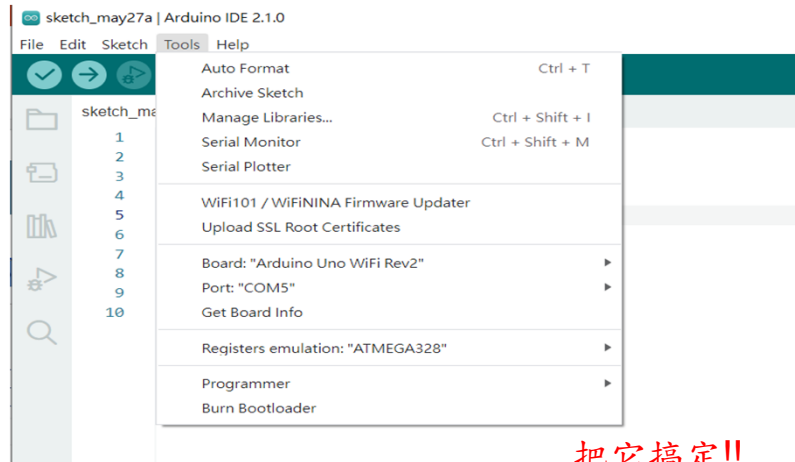
- Google!!
- 中文資料不多...
- 資訊還是需要英文...

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安裝IDE以及驅動程式

❖ 最後成果畫面...

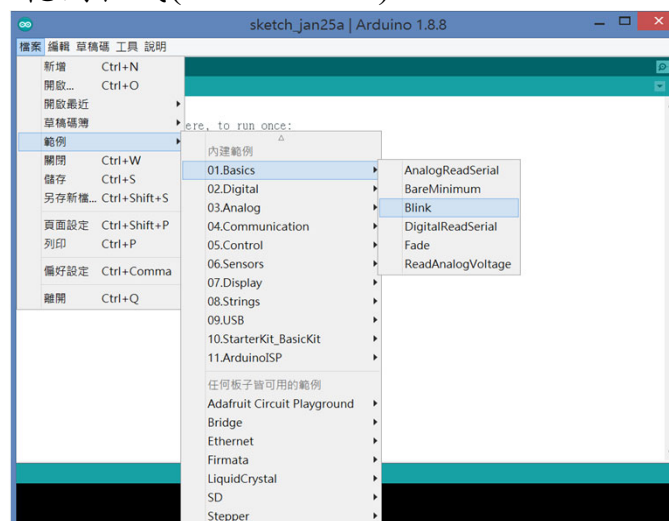


把它搞定!!

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開始測試...

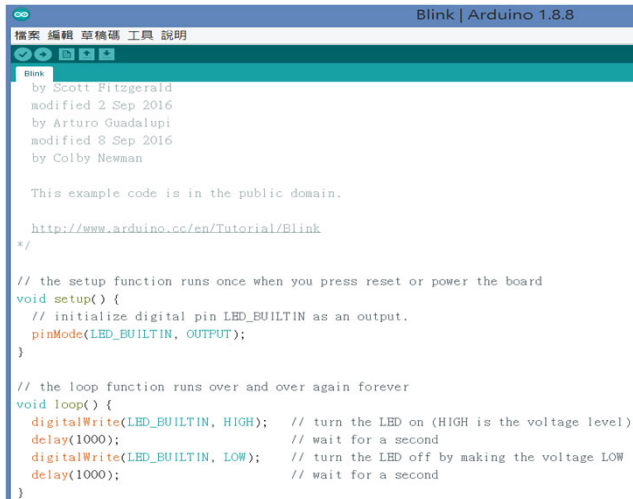
❖ 開啟範例程式(Basic...blink)



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測試...

❖ 開啟範例程式(Basic...blink)



The screenshot shows the Arduino IDE interface with the 'Blink' example code loaded. The title bar reads 'Blink | Arduino 1.8.8'. The menu bar includes '檔案', '編輯', '草稿碼', '工具', and '說明'. The code editor contains the following text:

```
Blink
by Scott Fitzgerald
modified 2 Sep 2016
by Arturo Guadalupi
modified 8 Sep 2016
by Colby Newman

This example code is in the public domain.

http://www.arduino.cc/en/Tutorial/Blink
*/

// the setup function runs once when you press reset or power the board
void setup() {
  // initialize digital pin LED_BUILTIN as an output.
  pinMode(LED_BUILTIN, OUTPUT);
}

// the loop function runs over and over again forever
void loop() {
  digitalWrite(LED_BUILTIN, HIGH);  // turn the LED on (HIGH is the voltage level)
  delay(1000);                      // wait for a second
  digitalWrite(LED_BUILTIN, LOW);   // turn the LED off by making the voltage LOW
  delay(1000);                      // wait for a second
}
```

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測試

❖ Sample codes

```
void setup() {
  pinMode(LED_BUILTIN, OUTPUT);
}
```

```
void loop() {
  digitalWrite(LED_BUILTIN, HIGH);
  delay(1000);
  digitalWrite(LED_BUILTIN, LOW);
  delay(1000);
}
```

可以嘗試加快閃爍速度!!

用我們自己的燈泡!!

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大綱




- 系統開發 -- 應用情境分析...
- 系統開發初體驗...
- 設備安裝與設定...
- 讓設備透過AP上Internet...
- ThinkSpeak網站帳號申請與測試...
- 遠端控制亮燈(讀取ThinkSpeak網站數值)...
-

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讓設備透過AP上Internet

❖ 目的: 透過熱點連線，並顯示結果
結果如下:

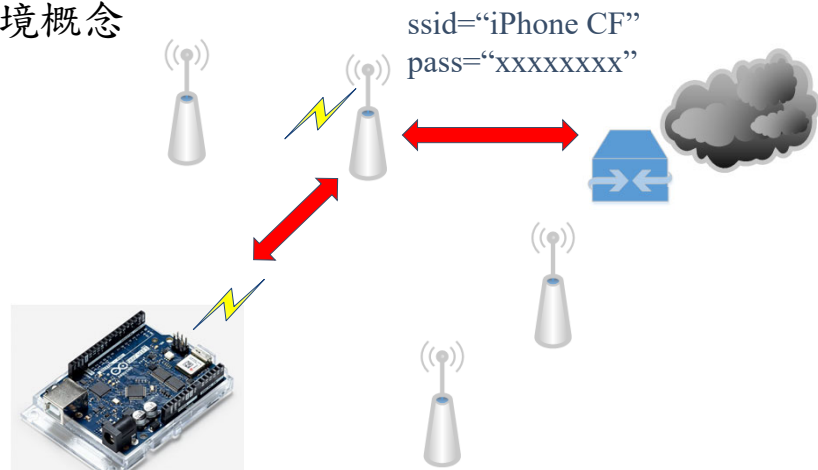


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基本概念

❖ 環境概念



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基本概念 (cont.)

❖ 初始程式

記得安裝 WiFiNINA.h



```
#include <WiFiNINA.h>

int status=WL_IDLE_STATUS;
char ssid[] = "iPhone CF";
char pass[] = "xxxxxxx";

void setup() {
  int i=1;
  Serial.begin(9600);

  while (status!=WL_CONNECTED && i<=10) {
    Serial.print("嘗試連線第 ");
    Serial.print(i);
    Serial.println("次...");

    status=WiFi.begin(ssid,pass);

    if (status!=WL_CONNECTED)
      Serial.println("無法連線");
    else
      Serial.println("成功連線");

    i++;
    delay(5000);
  }
}

void loop() {
}
```

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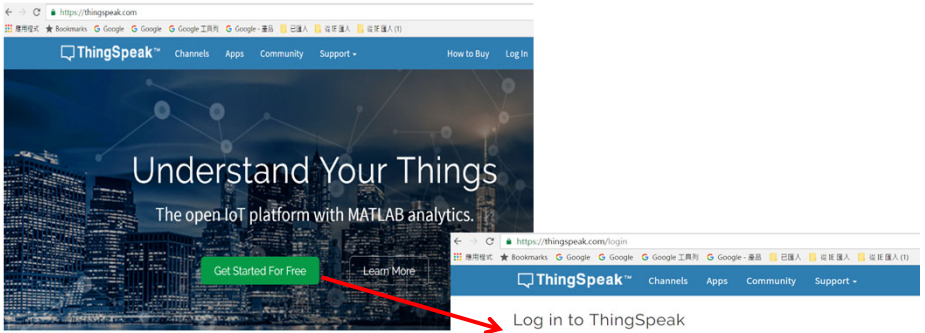
處理步驟及流程

1. 進入Thingspeak網站申請帳號及密碼 (<https://thingspeak.com>)
需e-mail認證且須另外申請Mathwork帳號 (登入網站使用)
2. 建立channel及欄位 (將會產生相關空間及欄位)
3. 寫入(讀取)時使用的key需自行紀錄 (通關密語, 相當重要。
為一個自動產生之亂數key值)
4. 透過http寫入數值 (可使用瀏覽器傳輸http指令), 或未來由其他平台將數值傳上
並儲存。
`https://api.thingspeak.com/update?api_key=YFZV2DKSAD56NBxx&field1=10`
5. 直接進入網站查看是否已經寫入。

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登入



The screenshot shows the ThingSpeak website. The main banner reads "Understand Your Things" and "The open IoT platform with MATLAB analytics." Below this is a "Get Started For Free" button. A red arrow points from this button to the "Log in to ThingSpeak" link on the login page. The login page has fields for "Email ID" (containing "cfwang2") and "Password", a "Sign in" button, and links for "Forgot your password?" and "New user? Sign up for the first time".

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處理步驟及流程

1. 進入Thingspeak網站申請帳號及密碼 (<https://thingspeak.com>) 需e-mail認證且須另外申請Mathwork帳號 (登入網站使用)
2. **建立channel及欄位 (將會產生相關空間及欄位)**
3. 寫入(讀取)時使用的key需自行紀錄 (通關密語, 相當重要。為一個自動產生之亂數key值)
4. 透過http寫入數值 (可使用瀏覽器傳輸http指令), 或未來由其他平台將數值傳上並儲存。
`https://api.thingspeak.com/update?api_key=YFZV2DKSAD56NBxx&field1=10`
5. 直接進入網站查看是否已經寫入。

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進入設定channel

The screenshot shows the 'My Channels' page on the ThingSpeak website. A red arrow points to the 'New Channel' button. Below the button is a table listing channels.

Name	Created	Updated
IoT_LED	2023-05-27	2023-05-27 14:26

At the bottom right, there is a logo for 國立屏東大學資訊學院 (College of Computer Science, National Pingtung University).

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相關欄位顯示

The screenshot shows the 'IoT_LED' channel settings page. A red arrow points to the 'Sharing' tab, with the text '開啟分享' (Enable sharing) next to it. The 'Channel Sharing Settings' section shows the option 'Share channel view with everyone' selected.

Channel ID: 21655
 Author: cfwang2
 Access: Private

Private View Public View Channel Settings **Sharing** API Keys Data Import / Export

Add Visualizations Add Widgets Export recent data

Channel Stats
 Created: 7 minutes ago
 Entries: 0

Field 1 Chart
 IoT_LED
 Lights

Channel Sharing Settings
☐ Make channel view private
☒ Share channel view with everyone
☐ Share channel view only with the following users:

Email Address Enter email here Add User

At the bottom right, there is a logo for 國立屏東大學資訊學院 (College of Computer Science, National Pingtung University).

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處理步驟及流程

1. 進入Thingspeak網站申請帳號及密碼 (<https://thingspeak.com>) 需e-mail認證且須另外申請Mathwork帳號 (登入網站使用)
2. 建立channel及欄位 (將會產生相關空間及欄位)
3. 寫入(讀取)時使用的key需自行紀錄 (通關密語, 相當重要。為一個自動產生之亂數key值)
4. 透過http寫入數值 (可使用瀏覽器傳輸http指令), 或未來由其他平台將數值傳上並儲存。
`https://api.thingspeak.com/update?api_key=YFZV2DKSAD56NBxx&field1=10`
5. 直接進入網站查看是否已經寫入。

相關欄位顯示(cont.)

Channel ID: 2133
Author: cfwang2
Access: Public

Private View Public View Channel Settings API Keys Data Import / Export

Write API Key

Key: 05BLCZKRRVCXS

Generate New Write API Key

Read API Keys

Key: 0H32V2F51SFYRH

Note:

Save Note Delete API Key

Generate New Read API Key

Help

API keys enable you to write data to a channel or read data from a private channel. API keys are auto-generated when you create a new channel.

API Keys Settings

- **Write API Key:** Use this key to write data to a channel. If you feel your key has been compromised, click **Generate New Write API Key**.
- **Read API Keys:** Use this key to allow other people to view your private channel feeds and charts. Click **Generate New Read API Key** to generate an additional read key for the channel.
- **Note:** Use this field to enter information about channel read keys. For example, add notes to keep track of users with access to your channel.

Create a Channel

POST `https://api.thingspeak.com/channels.json`
`api_key=05BLCZKRRVCXS`
`name=My New Channel1`

Update a Channel

PUT `https://api.thingspeak.com/channels/2133`
`api_key=0H32V2F51SFYRH`
`name=updated_Channel1`

Clear a Channel

DELETE `https://api.thingspeak.com/channels/2133/feeds.json`
`api_key=0H32V2F51SFYRH`

Delete a Channel

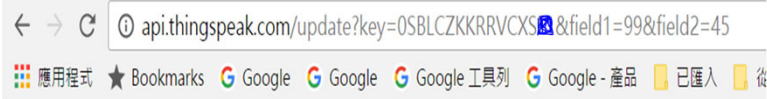
DELETE `https://api.thingspeak.com/channels/2133`
`api_key=0H32V2F51SFYRH`

處理步驟及流程

1. 進入Thingspeak網站申請帳號及密碼 (<https://thingspeak.com>) 需e-mail認證且須另外申請Mathwork帳號 (登入網站使用)
2. 建立channel及欄位 (將會產生相關空間及欄位)
3. 寫入(讀取)時使用的key需自行紀錄 (通關密語，相當重要。為一個自動產生之亂數key值)
4. 透過http寫入數值 (可使用瀏覽器傳輸http指令)，或未來由其他平台將數值傳上並儲存。
`https://api.thingspeak.com/update?api_key=YFZV2DKSAD56NBxx&field1=10`
5. 直接進入網站查看是否已經寫入。

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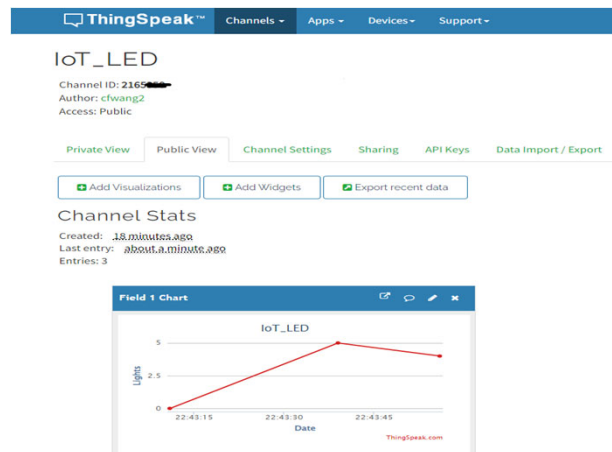
寫數值進入ThingSpeak 網站之中 (代表已成功寫入6次)



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Thingspeak 網站之中之結果



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準備上傳至Thingspeak網站格式

- ❖ 以瀏覽器執行
https://api.thingspeak.com/update?api_key=5HI7QVGK5I31LTxx&field1=1
- ❖ 若TCP連線已經完成，HTTP request message為
[GET /update?api_key=5HI7QVGK5I31LTxx&field1=1](https://api.thingspeak.com/update?api_key=5HI7QVGK5I31LTxx&field1=1)

P.S. key的數值因帳號而異，須至Thingspeak網站查詢

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大綱

系統開發 -- 應用情境分析...

系統開發初體驗 ...

設備安裝與設定...

讓設備透過AP上Internet...

ThingSpeak網站帳號申請與測試...

遠端控制亮燈(讀取ThingSpeak網站數值)...

.....

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實驗 根據讀取數值來改變LED亮滅

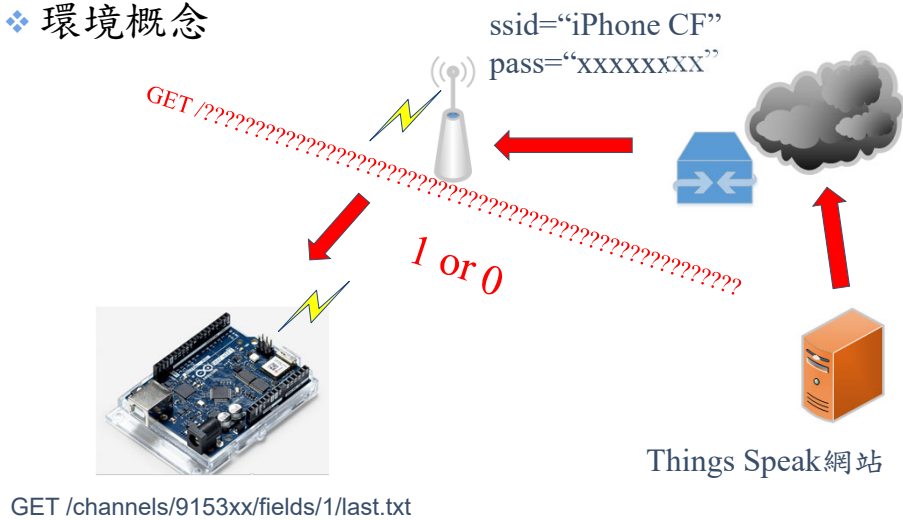
- ❖ 硬體環境: 在Arduino上裝上LED燈泡
- ❖ 目的: 將Thingspeak讀取到的數值進行判斷(field1)，數值1就把燈打開；數值為0則熄滅。
- ❖ 結果如下:



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基本概念

❖ 環境概念



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基本概念 (cont.)

❖ 初始程式(宣告部分)

```
// 功能:  
// 1. 嘗試10次連線  
// 2. 印出 MAC address --- 格式修正  
// 3. 印出 local IP & Gateway IP  
// 4. 準備上傳至 Things Speak網站之HTTP request message (要求下載數值)  
// 5. 與Things Speak網站建立TCP 連線, 並從網站下載數值回來  
// 6. 根據數值結果決定亮燈 -- 1則亮, 0則暗  
  
#include <SPI.h>  
#include <WiFiNINA.h>  
  
byte mac[6];  
int val=0;  
int val1=8;  
int last_state=8;  
String upload;  
int i=0;  
  
int status=WL_IDLE_STATUS;  
char ssid[]="iPhone CF";  
char pass[]="cf205666";  
  
char server[]="api.thingspeak.com";  
WiFiClient client;
```

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基本概念 (cont.)

❖ 初始程式(其他副程式)

```
void print_MAC(){  
  
    // WiFi.macAddress(mac);  
    Serial.print("MAC:");  
    for (i=5;i>=1;i--){  
        if (mac[i]<16) Serial.print("0");  
        Serial.print(mac[i],HEX);  
        Serial.print(":");  
    }  
    Serial.println(mac[0],HEX);  
}
```

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基本概念 (cont.)

❖ 初始程式(setup() 1/3)

熱點連線!!

```
void setup() {  
    // put your setup code here, to run once:  
    int i=1;  
    Serial.begin(9600);  
    pinMode(LED_BUILTIN,OUTPUT);  
  
    // 嘗試連線  
  
    while (status!=WL_CONNECTED && i<=10) {  
        Serial.print("嘗試連線第 ");  
        Serial.print(i);  
        Serial.println("次...");  
  
        status=WiFi.begin(ssid,pass);  
  
        if (status!=WL_CONNECTED)  
            Serial.println(" 無法連線");  
        else  
            Serial.println(" 成功連線");  
  
        i++;  
        delay(5000);  
    }  
}
```

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基本概念 (cont.)

❖ 初始程式(setup() 2/3)

相關資訊列印!!

```
if (status==WL_CONNECTED){  
  WiFi.macAddress(mac);  
  print_MAC();  
  Serial.println("");  
  
  IPAddress ip=WiFi.localIP();  
  Serial.print("IP Address: ");  
  Serial.println(ip);  
  Serial.println("");  
  
  IPAddress gateway=WiFi.gatewayIP();  
  Serial.print("Gateway Address: ");  
  Serial.println(gateway);  
  Serial.println("");  
}
```

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基本概念 (cont.)

❖ 初始程式(setup() 3/3) Thingspeak網站連線， 並取得第一筆資料!!

```
upload="GET /channels/915307/fields/1/last.txt";  
Serial.print("  :  ");  
Serial.println(upload);  
  
if (client.connect(server, 80)) {  
  Serial.println("connected to server ");  
  client.println(upload);  
  client.println();  
}  
}
```

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基本概念 (cont.)

❖ 初始程式(loop()部分)

```
void loop() {  
    while (client.available()) {  
        char c = client.read();  
        Serial.print("reading incoming data : ");  
        Serial.write(c);  
        i=(int) c-48;  
        Serial.println("");  
        Serial.println(i);  
        if (i==1) digitalWrite(LED_BUILTIN,HIGH); else digitalWrite(LED_BUILTIN,LOW);  
    }  
  
    // if the server's disconnected, stop the client:  
    if (!client.connected()) {  
        Serial.println();  
        Serial.print("connection teardown");  
        // client.stop();  
  
        if (client.connect(server, 80)) {  
            Serial.println("connected to server ");  
            client.println(upload);  
            client.println();  
        }  
    }  
  
    delay(5000);  
}
```

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基本概念 (cont.)

❖ 初始程式(loop()部分，局部放大)

```
void loop() {  
    while (client.available()) {  
        char c = client.read();  
        Serial.print("reading incoming data : ");  
        Serial.write(c);  
        i=(int) c-48;  
        Serial.println("");  
        Serial.println(i);  
        if (i==1) digitalWrite(LED_BUILTIN,HIGH); else digitalWrite(LED_BUILTIN,LOW);  
    }  
  
    // if the server's disconnected, stop the client:  
    if (!client.connected()) {
```

決定燈泡的反應!!

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基本概念 (cont.)

❖ 嘗試修改程式成妳/你心裡想要的效果...

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Thank You!