

物聯網智造基地
I O T S E R V I C E H U B

NB-IoT DSI2598+ 開發板講解 整合雷捷毫米波雷達

IDEAS Chain 網站 <https://www.ideaschain.com.tw/>

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NB-IoT :窄帶物聯網(Narrow Band Internet of Things, NB-IoT)

1. 構建於蜂窩網絡，只消耗大約180KHz的帶寬，可直接部署於GSM網絡、UMTS網絡或LTE網絡。
2. 是IoT領域一個新興的技術，支持低功耗設備在廣域網的蜂窩數據連接，也被叫作低功耗廣域網(LPWAN)。
3. 待機時間長、設備電池壽命提高至少5年以上。
4. 可透過各大電信業者提供的 NB-IoT / SIM 卡，利用電信基地台連到網際網路。
5. 其特性可增加覆蓋範圍提升 20dB，使原本透過 4G LTE網路收不到的地方(如地下室、地下管道等)也能收到訊號。

NB-IoT 與 WiFi 之差異：

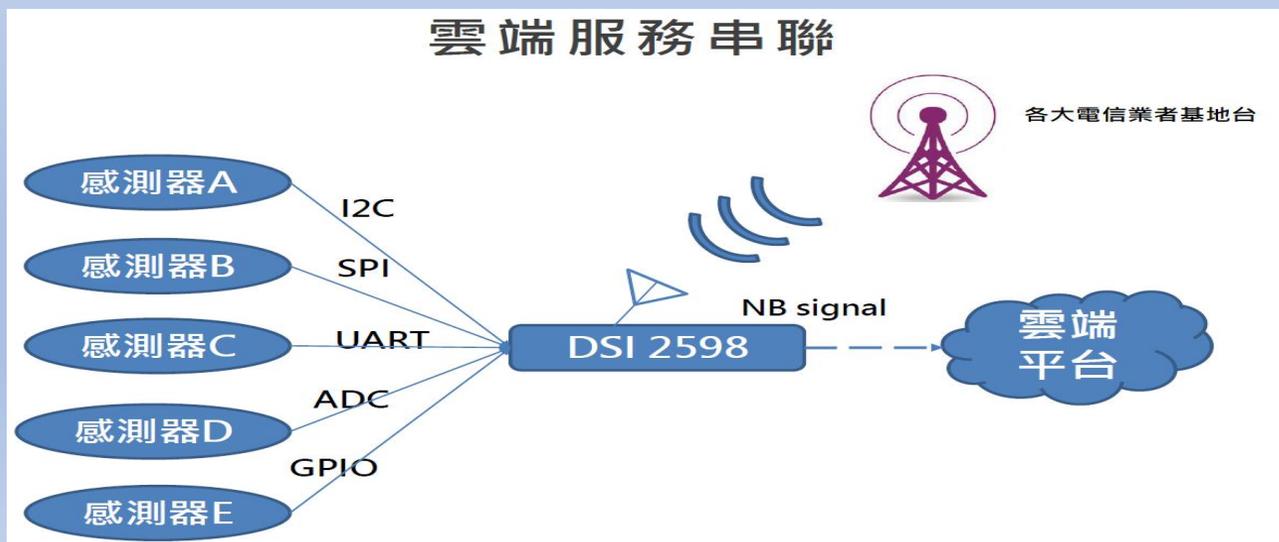
1. WiFi 透過無線基地台連上網際網路，NB-IoT 利用電信基地台連上網際網路。
2. WiFi 適用傳輸大量資料的訊息，NB-IoT 適用小資料量傳輸。
3. WiFi 連接無線基地台的距離較短，NB-IoT 由於全台基地台涵蓋率夠高，幾乎無死角。
4. WiFi 晶片耗用功率較高，NB-IoT 採用低功率晶片，使用一般 AA 電池可達 3-5 年以上。
5. WiFi 連網較易取得真實IP 位址，而NB-IoT使用的電信基地台提供的IP 位址大都為 虛擬 IP 網段。

DSI 2598+

採用MT 2625

結合 STM32F103C8T6 晶片，DSI2598第三代 NB-IoT開發板

DSI2598P使用聯發科技NB-IoT晶片-MT2625模組，STM32F103C8T6晶片，有著PWM、I2C、SPI、ADC、UART等多種腳位功能，簡單但完整，可讓使用者無縫接軌任何Arduino程式庫，進行各項功能程式開發，是改善DSI2598速度及記憶體空間不足的第三代 NB-IoT開發板。



意法半導體
STMicroelectronics N.V.



life.augmented

意法半導體晶片 STM32F103C8T6

無縫接入Arduino IDE 開發環境

Arduino的強大之處就在於它擁有完善的生態鏈。先前的貢獻者已經寫出了你可能需要的一切函式。不論是讀取溫濕度感測器的數值還是利用液晶螢幕顯示文字，你都能在網路上找到適用於Arduino的函式庫。(也可參考 [STM32duino](#) 網站)

外型與尺寸說明

30.48mm

60.00mm



支持NB-IoTR14 的系統單晶片，以超高整合度為大量物聯網設備提供兼具低功耗及成本效益的解決方案，廣泛適用於家庭、城市、工業或行動應用。

高度整合NB-IoT調制解調數字信號處理器、射頻天線及前端模擬基帶，同時結合ARM Cortex-M3 微控制器（MCU）、偽靜態隨機存儲器（PSRAM）、閃存與電源管理單元（PMU）。

整合一系列豐富的外圍輸入輸出介面，包括安全數字輸入輸出模塊（SDIO）、通用異步收發傳輸器（UART）、I2C 傳輸協議、I2S（Inter-IC Sound）、序列外圍接口（SPI）及脈衝寬度調制（PWM）。

具備強大功能於小巧的封裝尺寸和少量的管腳數目，滿足物聯網設備對成本及體積的需求，並有助於廠商簡化其產品設計流程。

DSI 2598+ 基於實時操作系統（RTOS），易於針對各種不同的應用進行客製化，比如家庭自動化、雲信標（cloud beacon）、智慧型電錶及多項物聯網靜態或行動應用。

DSI 2598+ 的寬頻前端模組支持3GPP R14 規範，涵蓋超低頻/低頻/中頻/四頻的全頻段運作，可滿足全球市場需求，進而降低成本和開發時間。

DSI2598+ Arduino 開發環境

接腳及硬體功能說明:

為了控制NBIOT BC26 通訊模組，下面列的PIN，盡量不要與其他功能並用:

PA10(Serial1.RXD) <- BC26.TX

PA9(Serial1.TXD) -> BC26.RX

PC13(OUTPUT) -> BC26.RESET(Low active)

STM32F103
PINOUT DIAGRAM

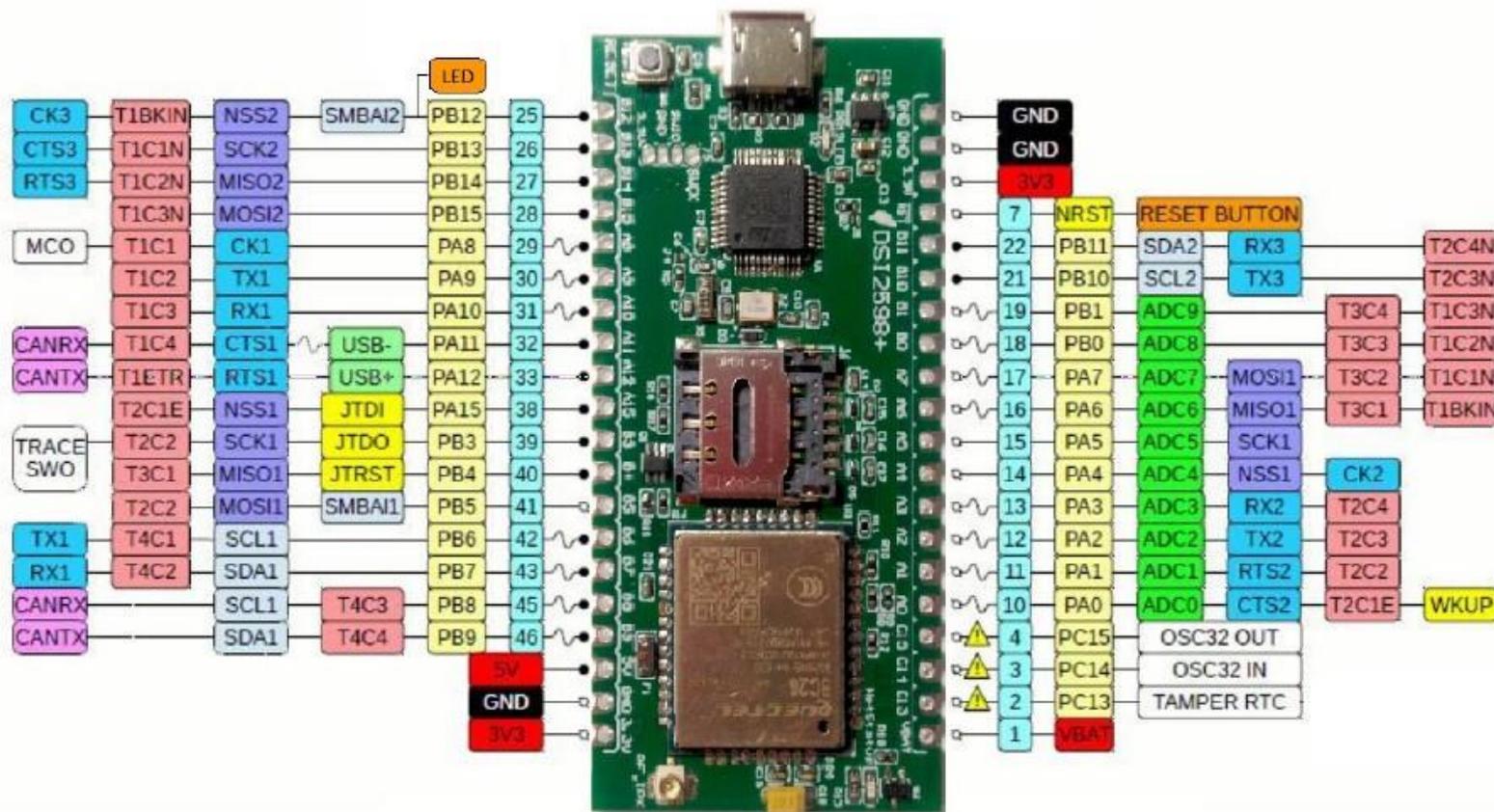
LEGEND

POWER
GROUND
PHYSICAL PIN
PIN NAME
CONTROL
ANALOG
TIMER & CHANNEL
USART
SPI
I2C
CAN BUS
USB
MISC
BOARD HARDWARE

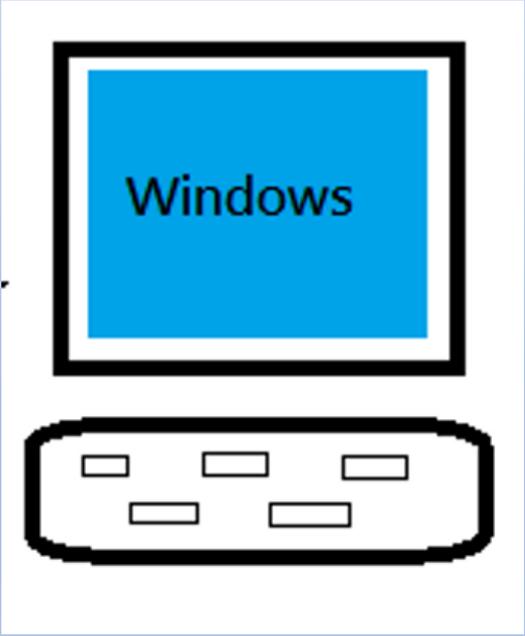
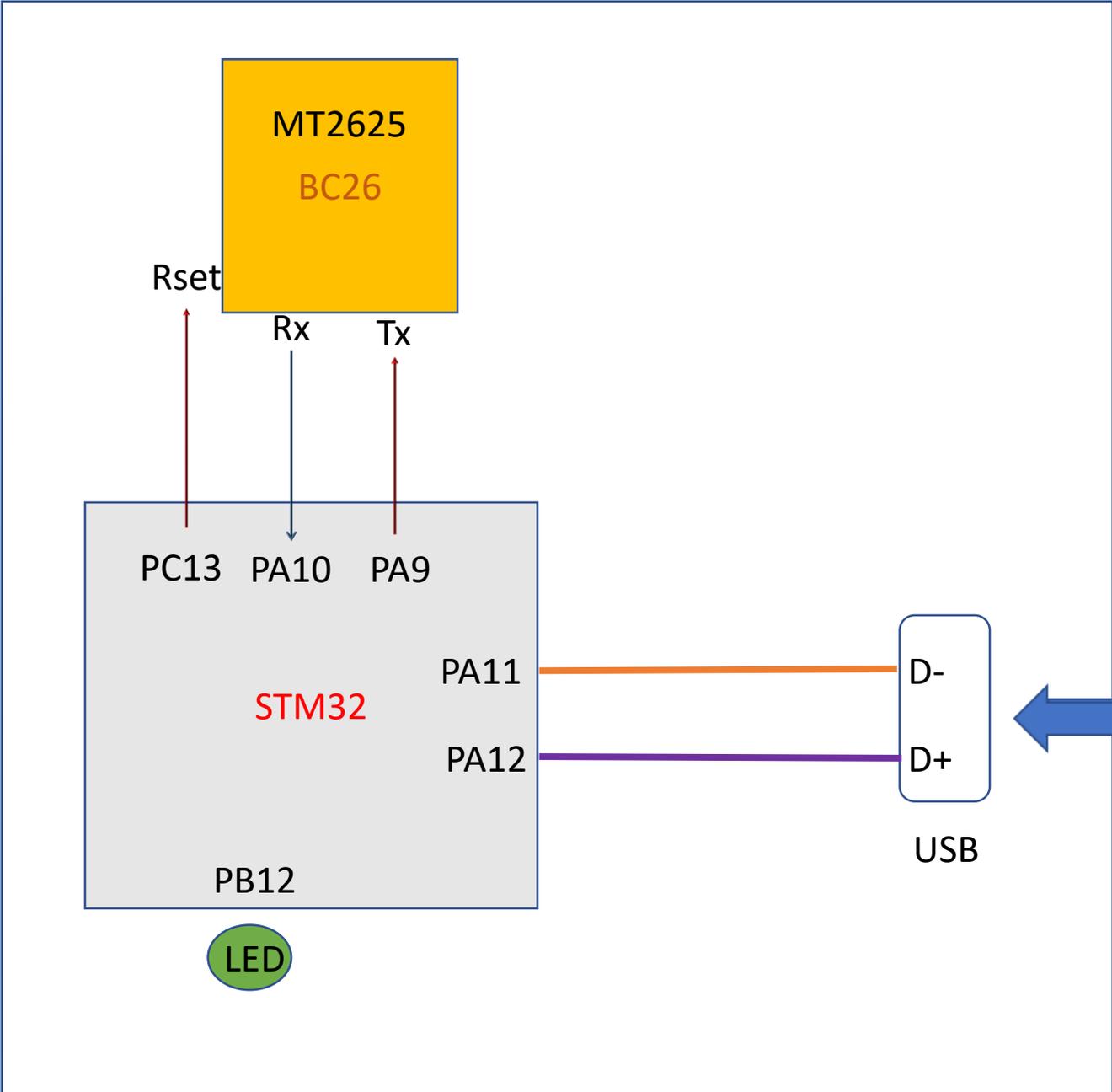
- 5V tolerant
- Not 5V tolerant
- ~ PWM pin
- Alternate function
- ⚠ PC13,PC14,PC15: Sink max 3mA, source 0mA, max 2mhz, max 30pF

Absolute MAX 150mA total source/sink for entire CPU

Max ±20mA per pin, ±8mA recommended



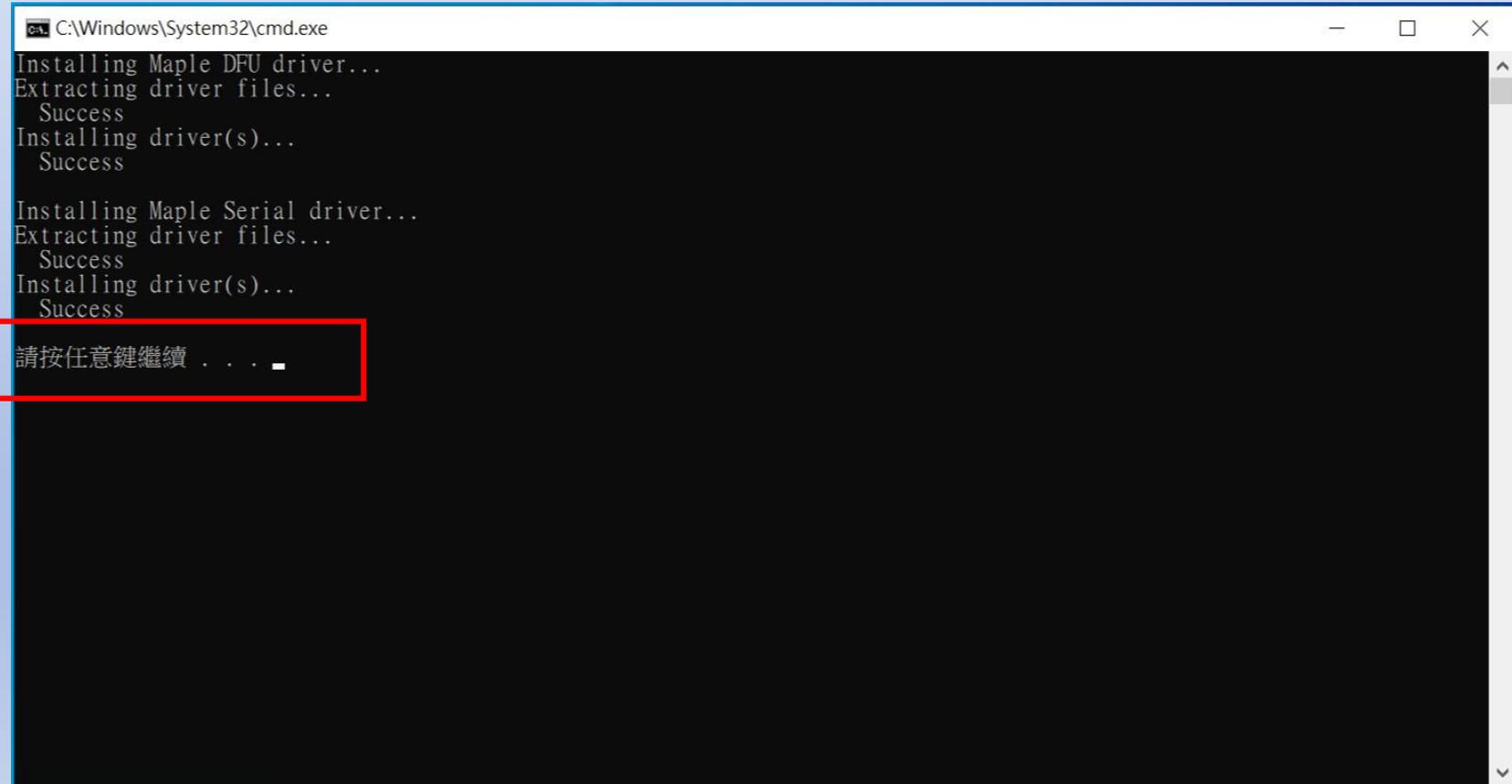
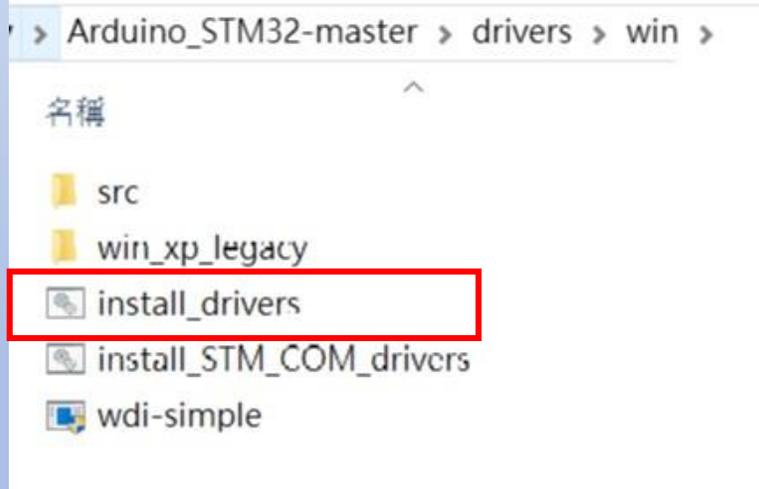
DSI2598+内部示意图



設定Arduino DSI2598+開發板的環境: (for Windows 10 作業系統)

1. 安裝DFU windows 的driver :

下載目https://github.com/rogerclarkmelbourne/Arduino_STM32
至 [Arduino_STM32-master.zip](#) , 解開檔案之後在目錄下用**系統管理者**執行
[Arduino_STM32-master\drivers\win\install_drivers.bat](#) , 會出現下列畫面

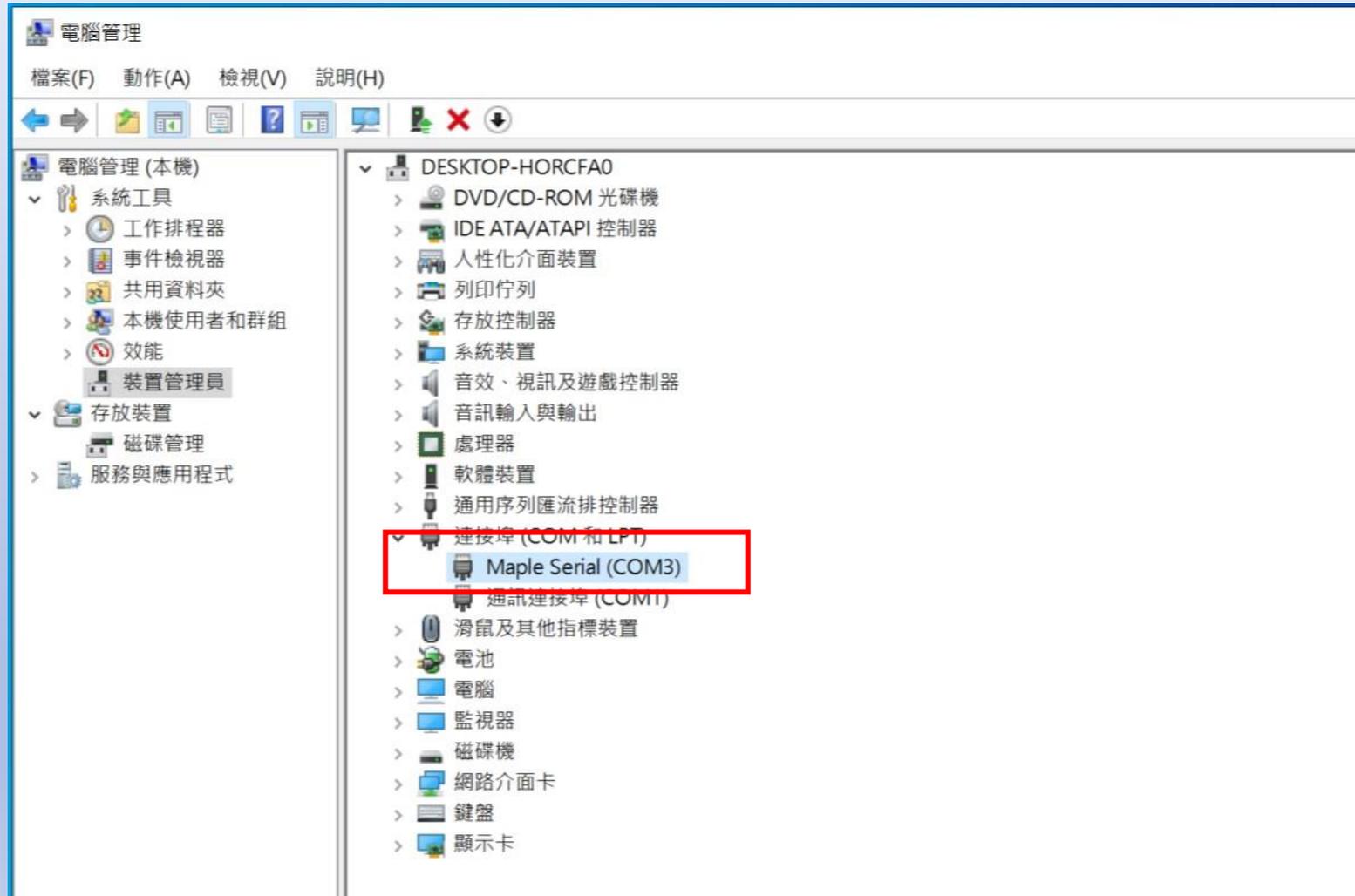


```
C:\Windows\System32\cmd.exe
Installing Maple DFU driver...
Extracting driver files...
Success
Installing driver(s)...
Success

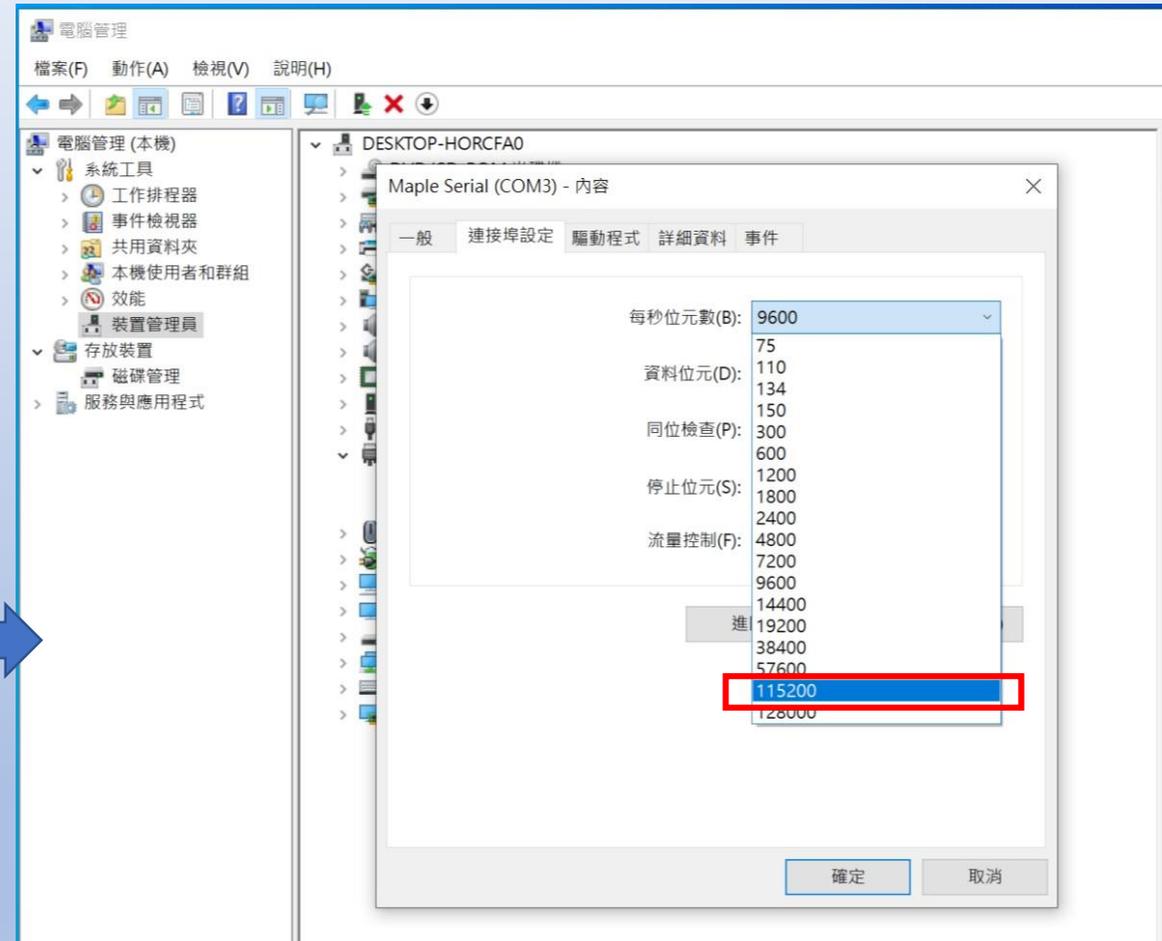
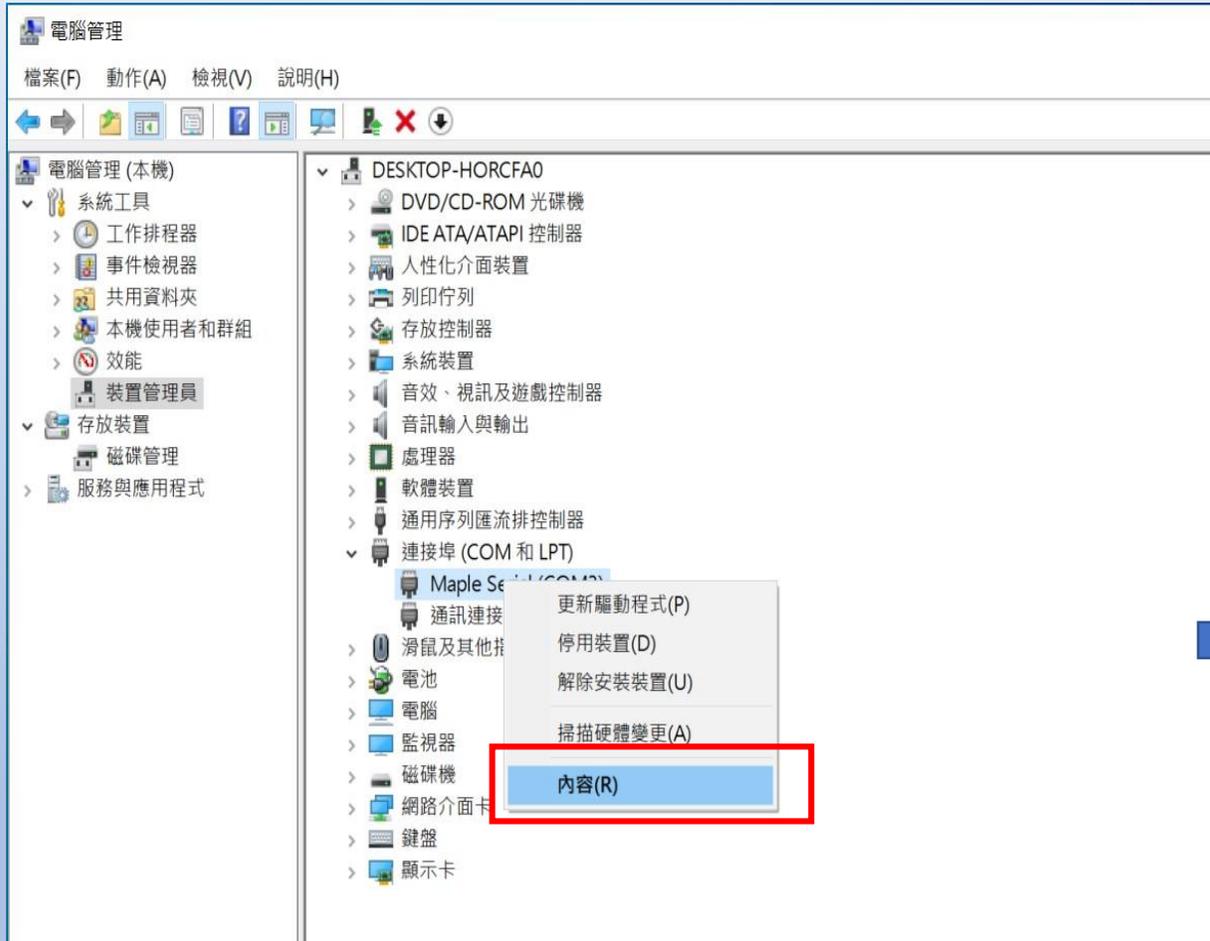
Installing Maple Serial driver...
Extracting driver files...
Success
Installing driver(s)...
Success

請按任意鍵繼續 . . . .
```

2.將DSI2598+ 透過MicroUSB 線插入電腦 USB port 中，透過檢視電腦管理介面
確認出現以下畫面：



3.更改傳輸速率，加快傳輸動作！！



完成驅動程式的安裝

4. 安裝 Arduino IDE for 1.8.13 (1)

The image shows three sequential screenshots of the Arduino Setup installation wizard:

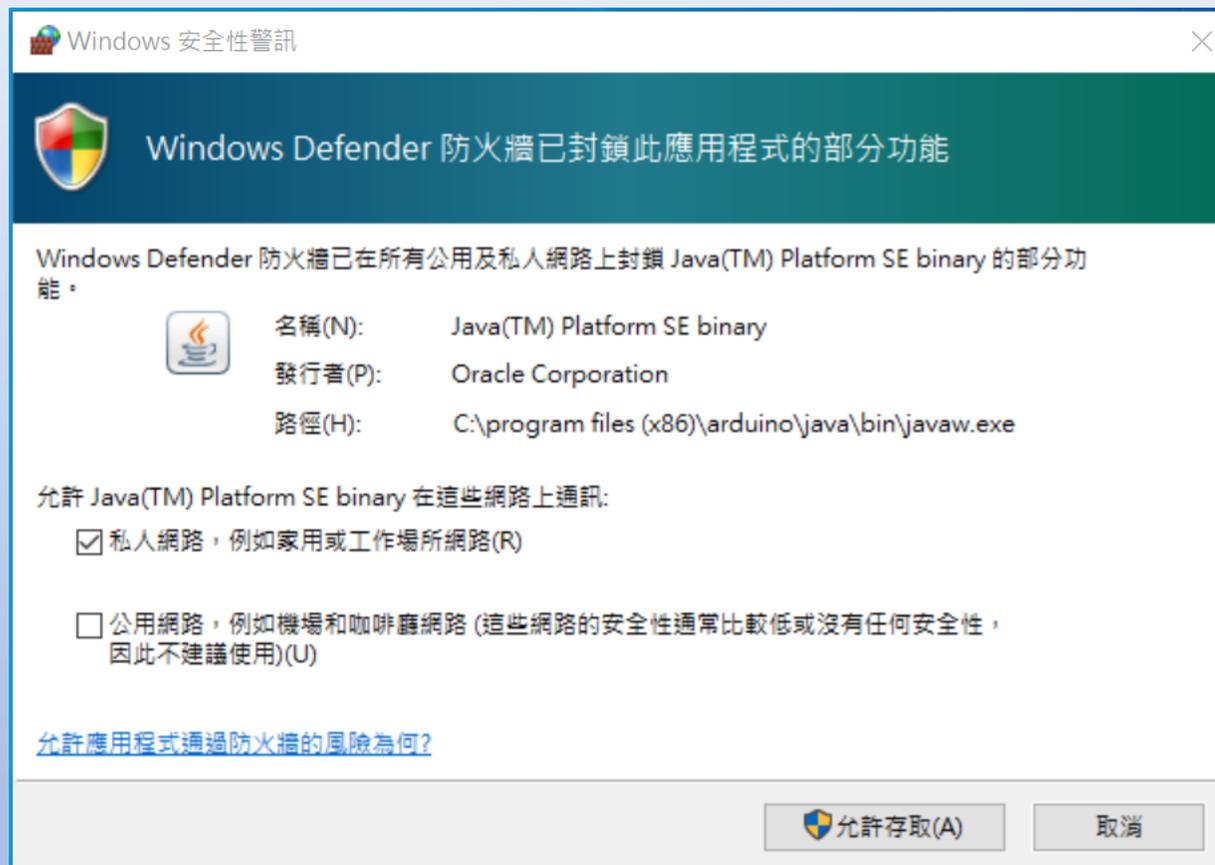
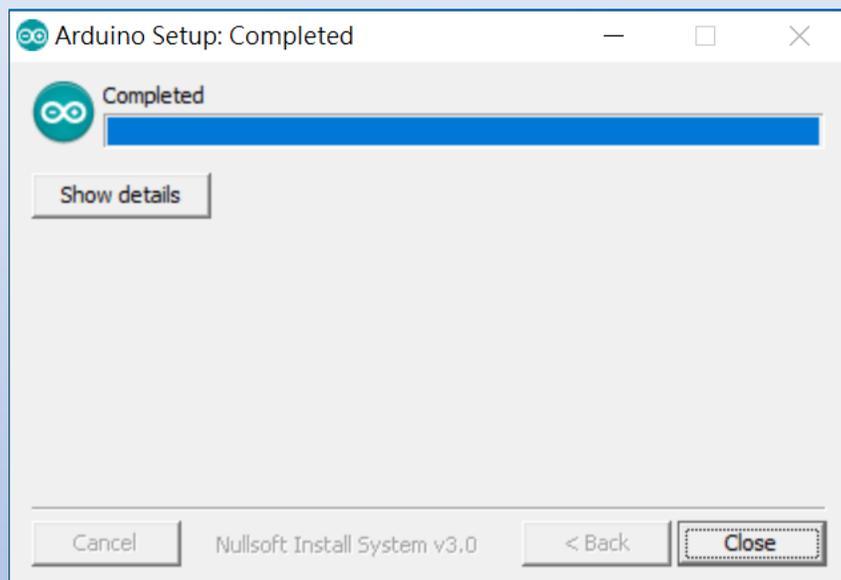
- Arduino Setup: License Agreement:** Displays the GNU Lesser General Public License (Version 3, 29 June 2007) and asks the user to accept the terms. The "I Agree" button is highlighted.
- Arduino Setup: Installation Options:** Allows the user to select components to install. All options are checked: "Install Arduino software", "Install USB driver", "Create Start Menu shortcut", "Create Desktop shortcut", and "Associate .ino files". The space required is 535.4MB.
- Arduino Setup: Installation Folder:** Shows the destination folder as "C:\Program Files (x86)\Arduino". The space required is 535.4MB and the space available is 22.9GB. The "Install" button is highlighted.

The image shows three sequential screenshots of Windows Security prompts for installing device software:

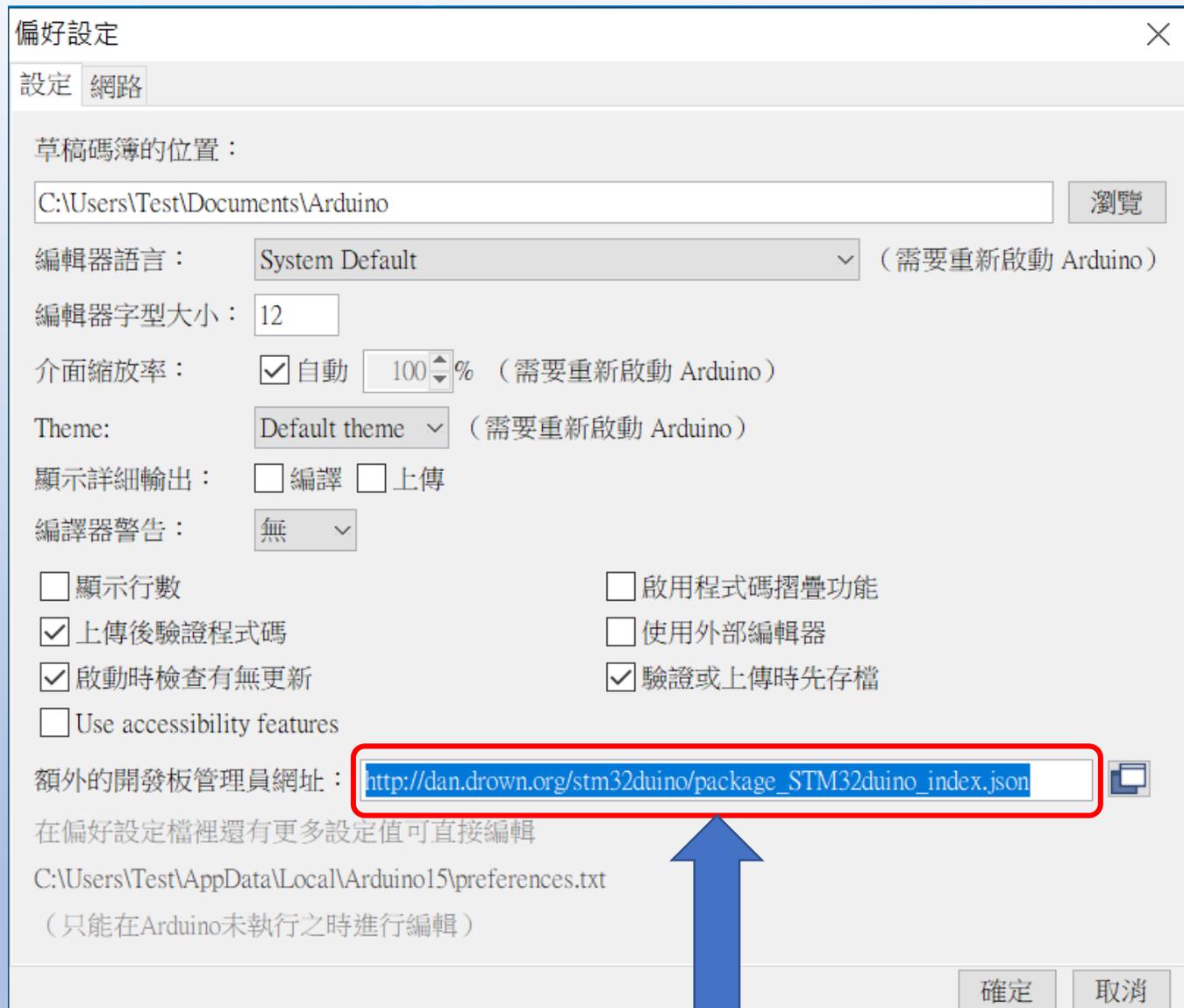
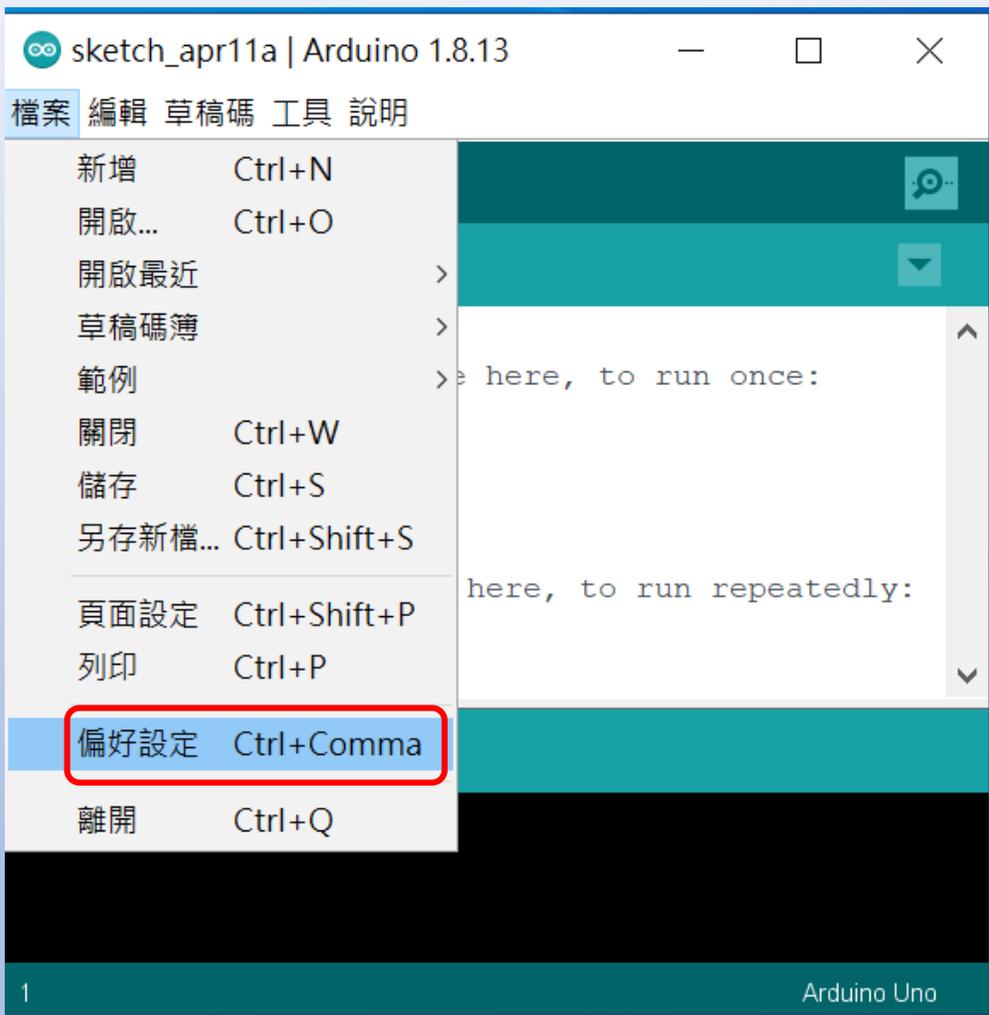
- Windows 安全性:** Prompting to install software from "Adafruit Industries LLC 連接埠 (COM 和 LPT)". The "安裝(I)" button is highlighted.
- Windows 安全性:** Prompting to install software from "Arduino srl". The "安裝(I)" button is highlighted.
- Windows 安全性:** Prompting to install software from "Arduino LLC". The "安裝(I)" button is highlighted.

Each prompt includes a warning icon and a link to "如何判定哪些裝置軟體可安全地進行安裝?" (How to determine which device software can be safely installed?).

4. 安裝 Arduino IDE for 1.8.13 (2)



5. 設定 STM32 所需的管理員網址



http://dan.drown.org/stm32duino/package_STM32duino_index.json

6. 安裝開發板套件：

開發板 → 開發板管理員 → 類型:全部 STM32 → 選擇 STM32F1xx/GD32Fxx boards → 安裝

The image shows the Arduino IDE interface with the 'Tools' menu open. The '開發板: "Arduino Uno"' option is highlighted in the menu. The '開發板管理員' (Board Manager) window is also open, showing the 'STM32' type selected in the dropdown menu. The main list of boards is visible, with 'STM32F1xx/GD32F1xx boards' highlighted.

開發板管理員...

- Arduino Yún
- Arduino Uno
- Arduino Duemilanove or Diecimila
- Arduino Nano
- Arduino Mega or Mega 2560
- Arduino Mega ADK
- Arduino Leonardo
- Arduino Leonardo ETH
- Arduino Micro
- Arduino Esplora
- Arduino Mini
- Arduino Ethernet
- Arduino Fio
- Arduino BT
- LilyPad Arduino USB
- LilyPad Arduino
- Arduino Pro or Pro Mini
- Arduino NG or older
- Arduino Robot Control
- Arduino Robot Motor
- Arduino Gemma
- Adafruit Circuit Playground
- Arduino Yún Mini
- Arduino Industrial 101

開發板管理員

類型 全部 **STM32**

STM32F4xx boards

by **stm32duino**
此套件包含的開發板：
STM32 Discovery F407, STM32F4Stamp F405, Netduino2 F405.
[Online Help](#)
[More Info](#)

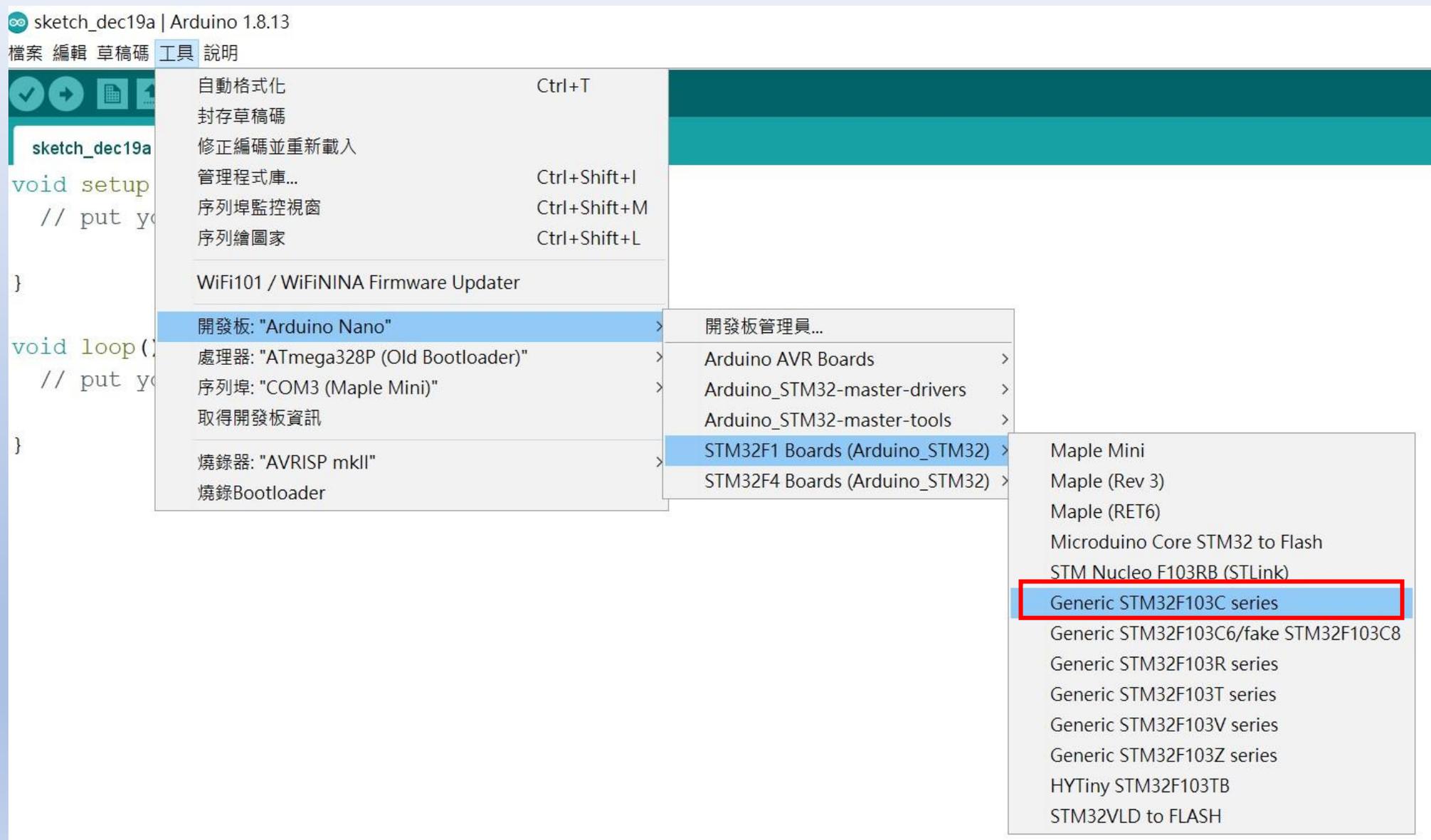
STM32F1xx/GD32F1xx boards

by **stm32duino**
此套件包含的開發板：
Maple Mini, Maple (Rev 3), Maple (RET6), Microduino Core STM32 to Flash, STM Nucleo F103RB (STLink), Generic STM32F103C series, Generic STM32F103R series, Generic STM32F103T series, Generic STM32F103V series, Generic STM32F103Z series, Generic GD32F103C series.
[Online Help](#)
[More Info](#)

2021.3.18 **安裝**

關閉

7.開啟 Arduino IDE 程式，設定以下動作：



8. 確認設定與以下畫面相同：



The screenshot shows the Arduino IDE interface with the 'Tools' menu open. The menu items are as follows:

- 自動格式化 (Ctrl+T)
- 封存草稿碼
- 修正編碼並重新載入
- 管理程式庫... (Ctrl+Shift+I)
- 序列埠監控視窗 (Ctrl+Shift+M)
- 序列繪圖家 (Ctrl+Shift+L)
- WiFi101 / Wi-Fi NINA Firmware Updater
- 開發板: "Generic STM32F103C series" >
- Variant: "STM32F103C8 (20k RAM, 64k Flash)" >
- Upload method: "STM32duino bootloader" >
- CPU Speed(MHz): "72Mhz (Normal)" >
- Optimize: "Smallest (default)" >
- 序列埠: "COM3 (Maple Mini)" >
- 取得開發板資訊
- 燒錄器 >
- 燒錄Bootloader

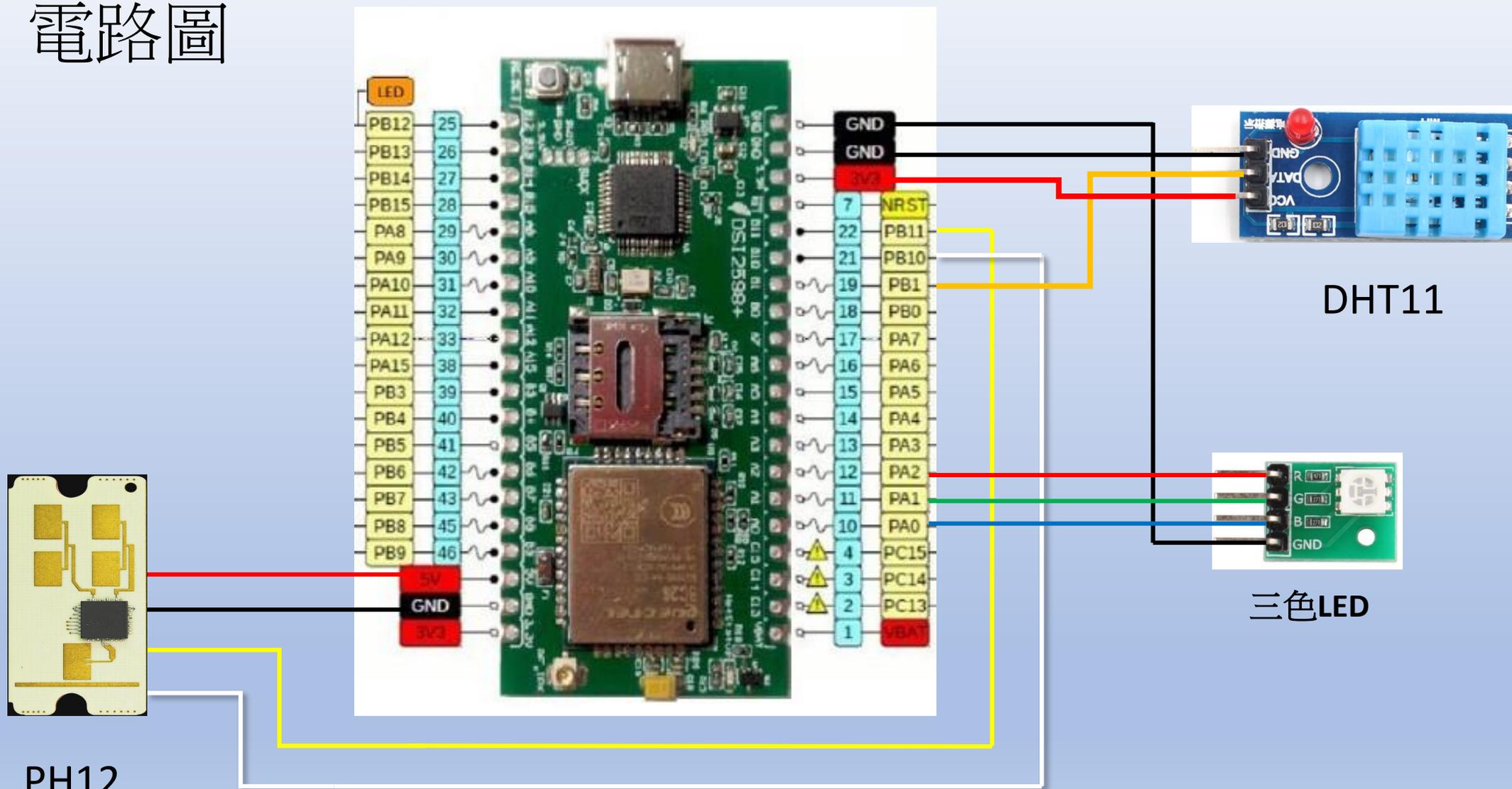
The settings for the development board, variant, upload method, CPU speed, and optimization are highlighted with a red box. A blue arrow points from the warning box to this red box.



請注意：若之後任意更改設定，有可能讓板子啟動方式毀損，導致系統再也找不到該序列埠 (Maple Mini) !!

DSI 2598+

電路圖



PH12

DHT11

三色LED

DHT11 溫度與溼度感測器

•DHT11 是一個結合濕度計和測溫元件量測週遭空氣環境，並與一個高性能八位元單晶片相連接，將所量測到的溫、濕度資料拆解成為數位訊號，再由感測器接腳將資料送出。使用上很簡單，但是抓取資料時必須要特別注意時間的掌控，而且每筆資料的抓取時間間隔要2秒鐘以上，不能太快。

- DHT11 的規格如下：
- 濕度測量範圍：20~90%;
- 濕度測量精度：±5%;
- 溫度測量範圍：0~50°C
- 溫度測量精度：±2°C
- 電源供應範圍：3~5V
- 頻率不可超過：0.5Hz (每2秒一次)



基礎感測器練習：

STEP 1：打開DHT11.ino，並至Arduino的工具->序列埠中找到USB模組的COM PORT編號，可至控制台確認。

The screenshot shows the Arduino IDE interface for a project named 'DHT11'. The 'Tools' menu is open, and 'COM3 (Maple Mini)' is selected as the serial port. The code editor shows the following code:

```
1 #include <DHT.h>
2
3 String
4 String
5
6 const int DHTPIN = 2;
7 SimpleDHT dht(DHTPIN);
8 int error = 0;
9 float temperature;
10 float humidity;
11 float Ctemp;
12 float Chumidity;
13
14
15 void setup()
16 {
17   Serial.begin(115200);
18   Serial1.begin(115200);
19   delay(5000);
20   Serial.println("初始化完成 ....");
21 }
```

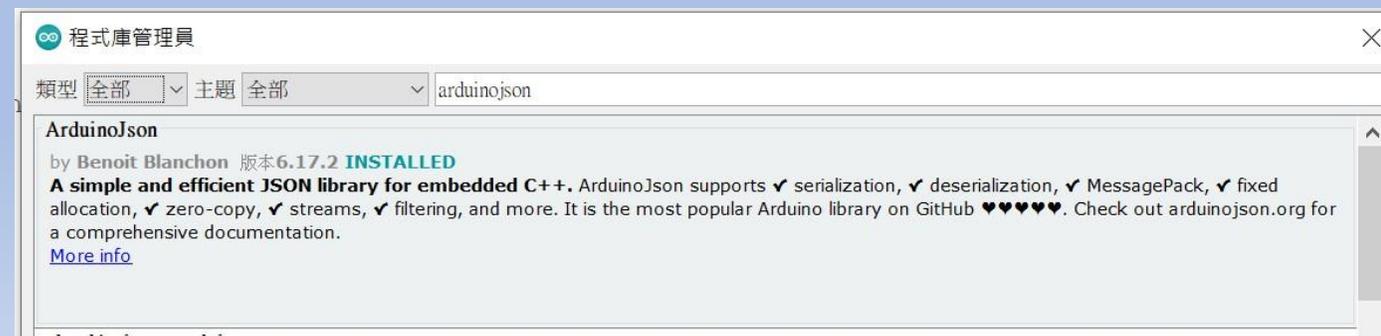
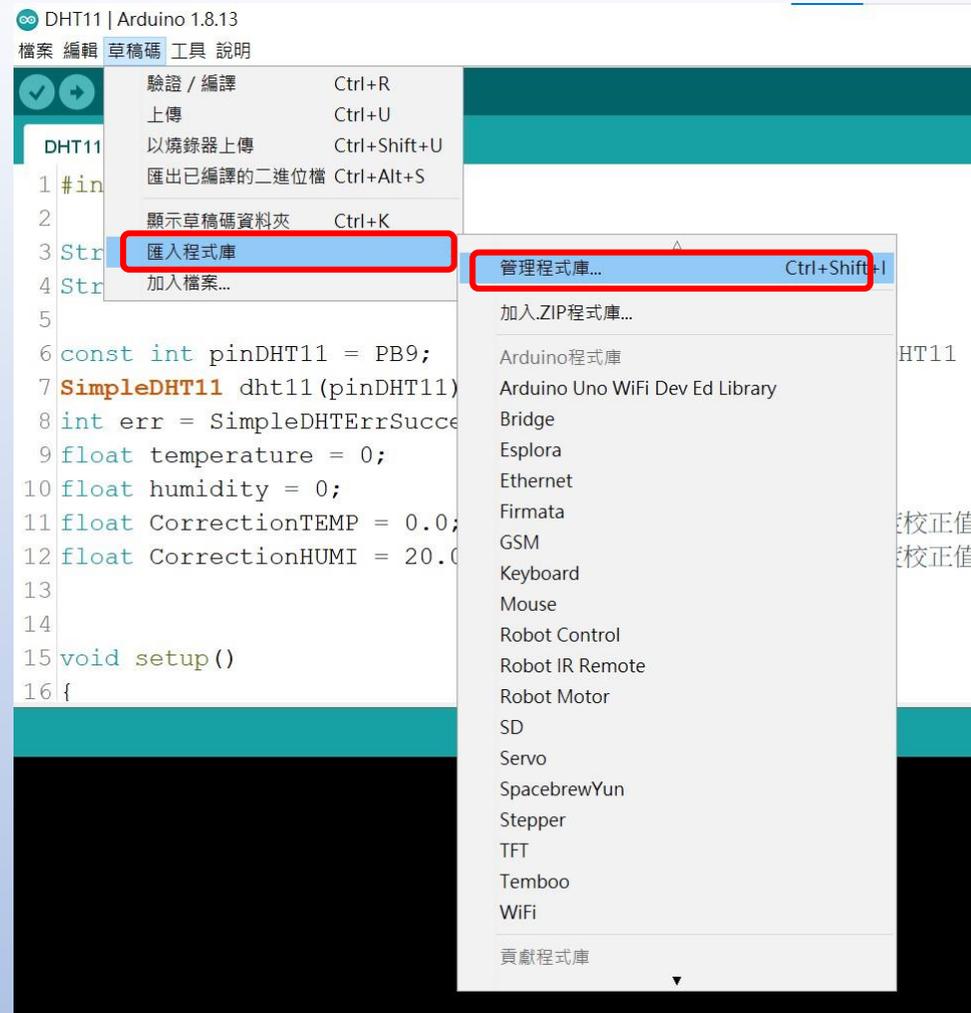
On the right side of the IDE, there is a comment: `// DHT11 溫濕度傳感器 使用 PB9 腳位`. Below the Tools menu, there is a small table showing the selected serial port:

序列埠	值
COM3 (Maple Mini)	值

程式編譯時，請先安裝所需的程式庫：

SimpleDHT 1.0.12 & ArduinoJson

STEP 2：選擇 工具 ->開發板->Generic
STM32F103C series，然後按下上傳
(Ctrl+U)，將程式燒錄進去



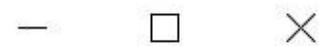
```
DHT11
1 #include <SimpleDHT.h>
2
3 String Sensor1="Temperature";
4 String Sensor2="Humidity";
5
6 const int pinDHT11 = PB9;           // DHT11 溫濕度傳感器 使用 PB9 腳位
7 SimpleDHT11 dht11(pinDHT11);
8 int err = SimpleDHTErrSuccess;
9 float temperature = 0;
10 float humidity = 0;
11 float CorrectionTEMP = 0.0;        // 溫度校正值
12 float CorrectionHUMI = 20.0;       // 溼度校正值
13
14
15 void setup() {
16 {
```

上傳完畢。

```
bytes_per_flash=700
Starting download: [#####] finished!
error resetting after download: usb_reset: could not reset device, win error: 0xw000:m000s0b0C

state(8) = dfuMANIFEST-WAIT-RESET, status(0) = No error condition is present
Done!
Resetting USB to switch back to runtime mode
```

COM3



傳送

初始化完成

=====
溫溼度模組 DHT11 檢測中.....

攝氏溫度：33.00 °C環境溼度：47.00 %

=====
溫溼度模組 DHT11 檢測中.....

攝氏溫度：33.00 °C環境溼度：40.00 %

=====
溫溼度模組 DHT11 檢測中.....

攝氏溫度：33.00 °C環境溼度：39.00 %

自動捲動 Show timestamp

NL & CR



115200 baud



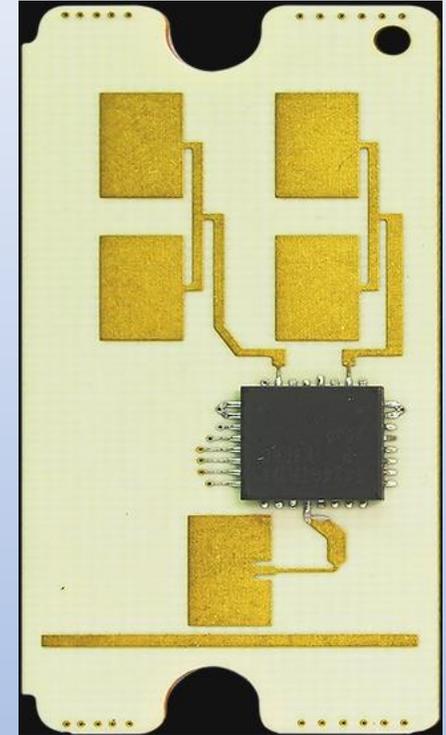
Clear output

SenseBoost12-PH12

K 波段1發2收毫米波雷達感測器，尺寸精巧適合整合於小型產品中。可偵測物體的距離, 方位角度, 移動速度及移動方向。常使用於家用安防攝影機, 智慧門鈴及自動門控制系統

產品特色

- 工作在24GHz的雷達感測器-ISM-頻段
- 1路發射, 2路接收
- 偵測移動物體的距離、方位角度、移動方向和速度
- 擴展操作溫度範圍從-40°C 到 +85°C
- 尺寸精巧



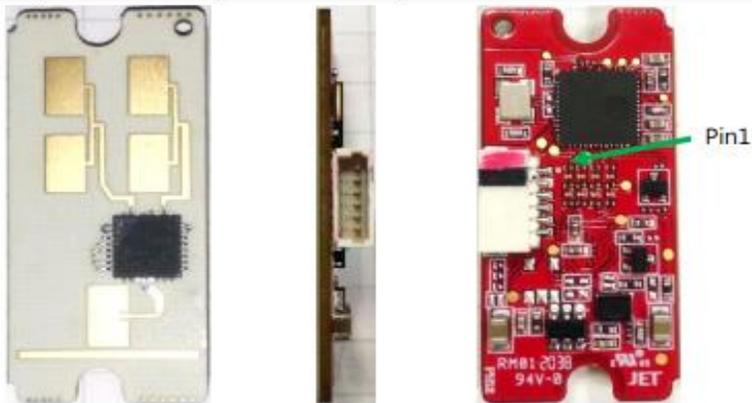
2. PH12 硬體接線

PH12 模塊如下圖

總共 6pin, 由上而下依序是:

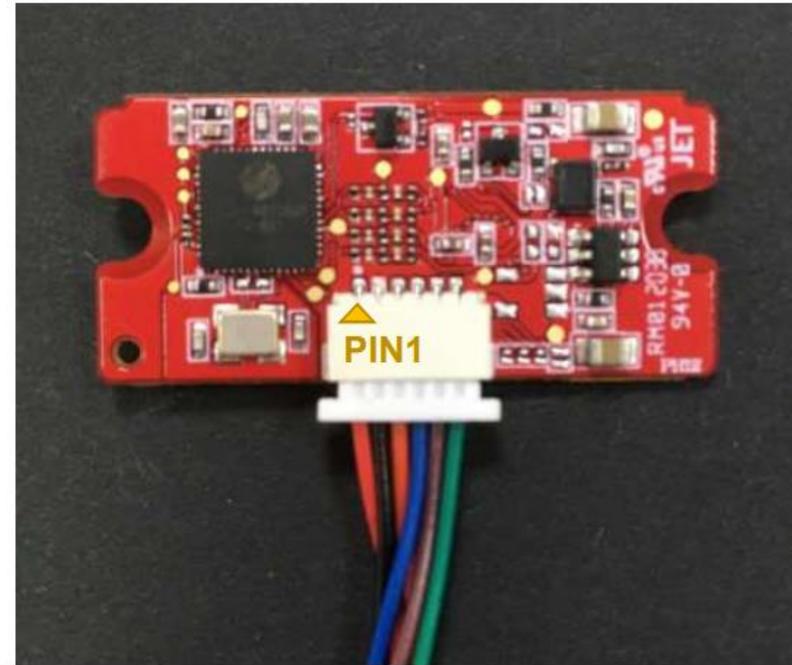
1. VCC 電源: 3.0V~5.5V, 建議使用 5V 供電,如下圖綠色箭頭
2. GND
3. TX: UART Tx 115200bps 接主機 Rx, VIH = 2.6V
4. RX: UART Tx 115200bps 接主機 Tx.
5. GPIO_1: Interrupt output pin. 當 2DMode 偵測到物體觸發為 Low.
6. GPIO_2: 保留未來功能.

PIN#	I/O	In/Out	Description
1	Vcc	Input	Supply voltage
2	GND	Input	Analog ground
3	TX	Output	115200bps UART
4	RX	Input	115200bps UART
5	GPIO_1	Output	I/O port (Low: 0V, High: 2.6V)
6	GPIO_2	Output	I/O port (Low: 0V, High: 2.6V)



Cable Connection

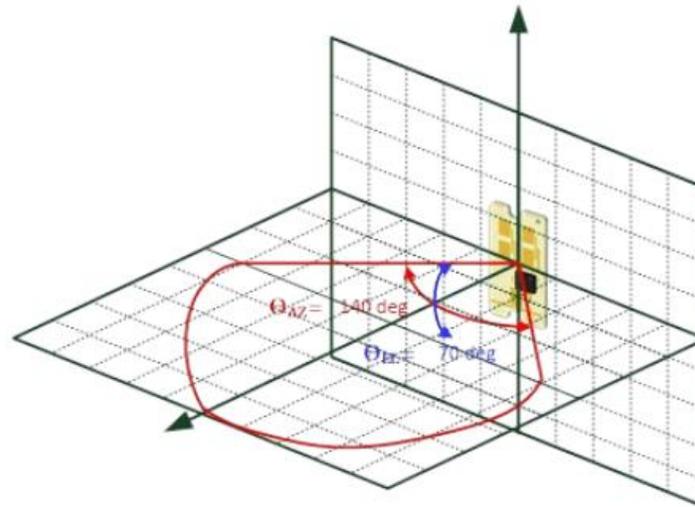
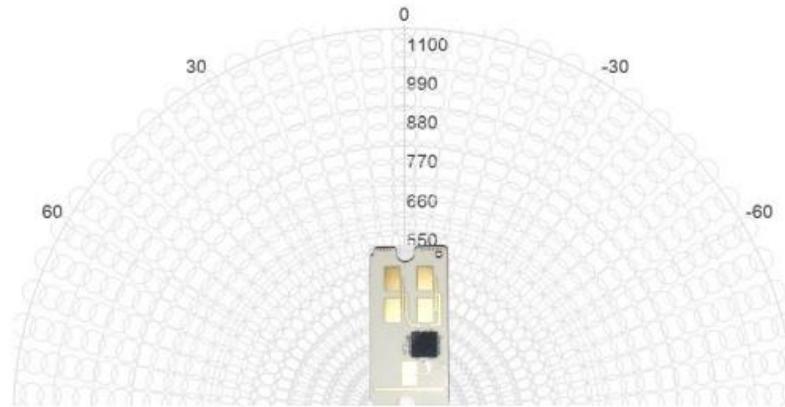
PIN#	I/O	In/Out	Description
1	Vcc	Input	Supply voltage 5V
2	GND	Input	Analog ground
3	TX	Output	115200bps UART
4	RX	Input	115200bps UART
5	GPIO_1	Output	I/O port (Low: 0V, High: 2.6V)
6	GPIO_2	Output	I/O port (Low: 0V, High: 2.6V)



2. PH12 Placement

PH12 must be placed vertically as below:

Horizontal placement will make the angle error.



4.3 UART 讀取 PH12:

PH12 會定時將 Data 送出,依照以下格式:

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
RGF RESPONSE	0x55	0xAA	0x3	1	0x1	5	0x08	id (LSB 4-bit unsigned int)	xxx (3-bit)	angle sign (MSB 1-bit)	angle degree (unsigned int 8)	amp vrms vm (unsigned int 16)	motion range cm (unsigned int 16)	x
<p>1. id : target id. 4-integer. The value is undefined now. It always provides 10 IDs from 0 to 9.</p> <p>2. angle sign: 1 bit. 1: positive angle(+) / 0: negative angle(-). The angle of front middle is defined as 0 degree, left as positive and right as negative.</p> <p>3. angle: angle of the moving target in degree unit. It is represented in 8-bit unsigned integer from 0 to 180 degree.</p> <p>4. amp vrms vm: amplitude of the target reflection in mV unit. The amplitude is represented in 16-bit unsigned integer from 0 to 3300 mV.</p> <p>5. motion range: distance of the moving target in cm unit. The distance is represented in 16-bit unsigned integer from 0 to 65535 cm.</p>														

id: Data6 的低 7bit 為目標 ID,0x00~0x0A, 可支援 10 組 ID.

angle sign: Data6 的最高 bit 為角度正負號, angle sign=1 正角度在左邊; angle sign=0 負角度在右邊.

angle degree:0°~90°, 代表目標的角度方位, 注意要搭配 angle sign 1/0 確認方向.

amp vrms vm: 雷達回波參數, 尚未開放

motion range cm: 目標距離, Data6 是 MSB, Data5 是 LSB, 合成一個以 cm 級的距離.

舉例收到如下封包:

1	2	3	4	5	6	7	8	9	10	11	12	13	14
55	AA	31	15	08	01	15	00	00	23	01	00	00	C6

0x55 0xAA: 固定為 start byte

0x31 0x15: RESPONSE[目標]的命令

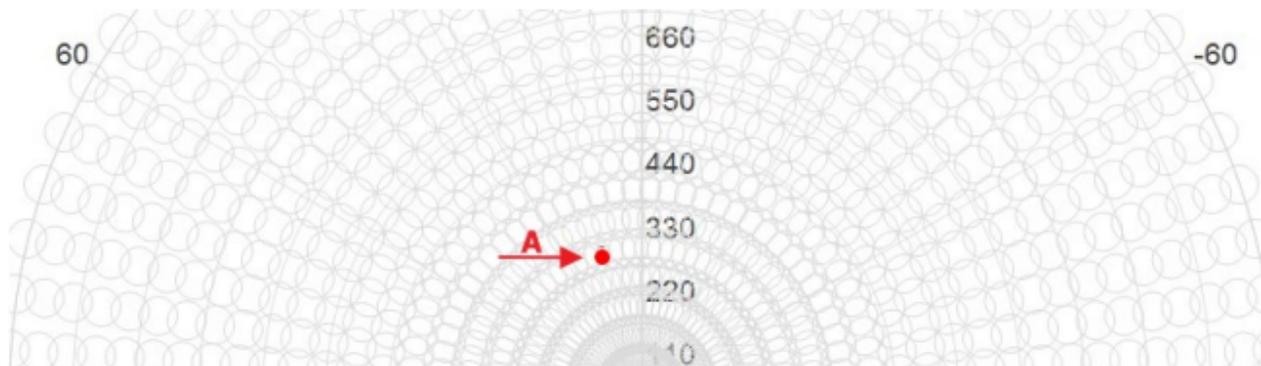
0x08:後面接 8 個 byte

0x01: ID=1 的目標在左邊, 當 ID=81 代表目標 1 跑到右半邊

0x15: 目標角度 21° , 16 進制為 0x15

0x23 0x01:目標距離為 0x123 為 291cm

此為一個 ID=1 的目標在左邊 21° 距離 291cm,大約下圖 A 點位置.





```
PH12Get
1 byte PH12_inData[14]={0x55,0xAA,0x31,0x15,0x08,0x00,0x01,0xFF,0xFF,0xFF,0xFF,0xFF,0xFF,0xFF};
2 byte PH12_rbuf[8];
3 int PH12_number=0;
4 struct PH12_Info
5 {
6   byte Direction;
7   byte Angle;
8   int Distance;
9 };
10
11 struct PH12_Info PH12_Data;
12
13 bool Get_PH12Data()
14 {
15   byte i;
16   bool flag=false;
```

```
void setup() {
  // put your setup code here, to run once:
  Serial.begin(115200);
  Serial3.begin(115200);
  pinMode(PA0,OUTPUT);
  pinMode(PA1,OUTPUT);
  pinMode(PA2,OUTPUT);
}
```

```
void loop()
{
  Get_PH12Data();
}
```

```
COM3
傳送
90 角度 216 距離
90 角度 215 距離
90 角度 213 距離
91 角度 213 距離
91 角度 212 距離
91 角度 210 距離
91 角度 208 距離
91 角度 206 距離
91 角度 204 距離
91 角度 202 距離
92 角度 205 距離
92 角度 204 距離
92 角度 208 距離
92 角度 207 距離
92 角度 205 距離
自動捲動 Show timestamp NL & CR 115200 baud Clear output
```

3.1. ATI Display Product Identification Information

The execution command returns product identification information.

ATI Display Product Identification Information	
Execution Command ATI	Response Quectel_Ltd <Object Id> Revision: <revision> OK
Maximum Response Time	300ms

Parameter

<Object Id>	Identifier of device type
<revision>	Revision of software release

3.2. ATE Set Command Echo Mode

The execution command determines whether or not the UE echoes characters received from external MCU during command state.

ATE Set Command Echo Mode

Execution Command	Response
ATE<value>	OK
Maximum Response Time	300ms

Parameter

<value>	0	Echo mode OFF
	<u>1</u>	Echo mode ON

3.4. AT+IPR Set TE-TA Fixed Local Rate

Please refer to *Chapter 6* for possible <err> values.

AT+IPR Set TE-TA Fixed Local Rate

Test Command AT+IPR=?	Response +IPR: (list of preferred auto baud <rate>s),(list of supported fixed-only <rate>s) OK
Read Command AT+IPR?	Response +IPR: <rate> OK
Write Command AT+IPR=<rate>	Response OK If there is any error, response: ERROR or +CME ERROR: <err>
Maximum Response Time	300ms

Parameter

<rate>	Baud rate per second
	<u>0</u> (Auto baud)
	110
	300
	1200
	2400
	4800
	9600
	19200
	38400
	57600
	115200
	230400
	460800
	921600

NOTES

1. The setting will apply to all channels routed through one connection level for UART.
2. The command is not applicable for USB interface.

AT+QGACT Activate/Deactivate a PDN Context

Write Command

```
AT+QGACT=<op>,<pdp_type/cid>,<apn>[,<user_name>,<pwd>[,<bearer_type>[,<sim_id>]]]
```

Response

If the PDN context is already in active/inactive state:

```
+QGACT: <cid>,<type>,<result>[,<activated_pdp_type>]
```

OK

If the PDN context is not in active/inactive state:

```
+QGACT: <cid>
```

OK

```
+QGACT: <cid>,<type>,<result>[,<activated_pdp_type>]
```

AT+QCGDEFCONT Set Default PSD Connection Settings

Test Command

AT+QCGDEFCONT=?

Response

+QCGDEFCONT: (list of supported <PDP_type>s)

OK

Read Command

AT+QCGDEFCONT?

Response

+QCGDEFCONT: <PDP_type>,<APN>,<username>,<password>

OK

Write Command

AT+QCGDEFCONT=<PDP_type>[,<APN>[,<username>[,password]]]

Response

OK

If there is any error, response:

ERROR

or

+CME ERROR: <err>

Maximum Response Time

300ms

4.2. AT+QBAND Get and Set Mobile Operation Band

The command is used to get the currently registered band or set the bands to be locked. Please refer to **Chapter 6** for possible <err> values.

AT+QBAND Get and Set Mobile Operation Band

Test Command AT+QBAND=?	Response +QBAND: (list of supported <band number>s)[,(list of supported <Operating Bands>s)] OK
Read Command AT+QBAND?	Response +QBAND: <Operating Band> OK

2019年 台灣頻段支援表

電信\頻段	FDD - LTE 700MHz(B28)	FDD - LTE 900MHz(B8)	FDD - LTE 1800MHz(B3)	FDD - LTE 2100MHz(B1)	FDD - LTE 2600MHz(B7)	TDD - LTE 2600(B38/B41)
中華電信		◎	◎	◎	◎	
遠傳電信	◎		◎	◎	◎	◎
台灣大哥大	◎		◎	◎		
台灣之星		◎		◎	◎	
亞太	◎	◎ (通話限定)				◎

◎ 支援 700MHz 頻段 (僅限 4G LTE 網路使用)

3.10. AT+CGSN Request Product Serial Number

The execution command returns the IMEI (International Mobile station Equipment Identity) number and related information. For a TA which does not support <snt>, only "OK" is returned.

Please refer to **Chapter 6** for possible <err> values.

AT+CGSN Request Product Serial Number

Test Command AT+CGSN=?	Response When TE supports <snt> and the command is executed successfully: +CGSN: (list of supported <snt>s) OK
Write Command AT+CGSN=<snt>	Response When <snt>=0: <sn> OK When <snt>=1: +CGSN: <imei>

AT&W Store Current Parameters to User Defined Profile

Execution Command	Response
AT&W[<n>]	OK
Maximum Response Time	300ms

Parameter

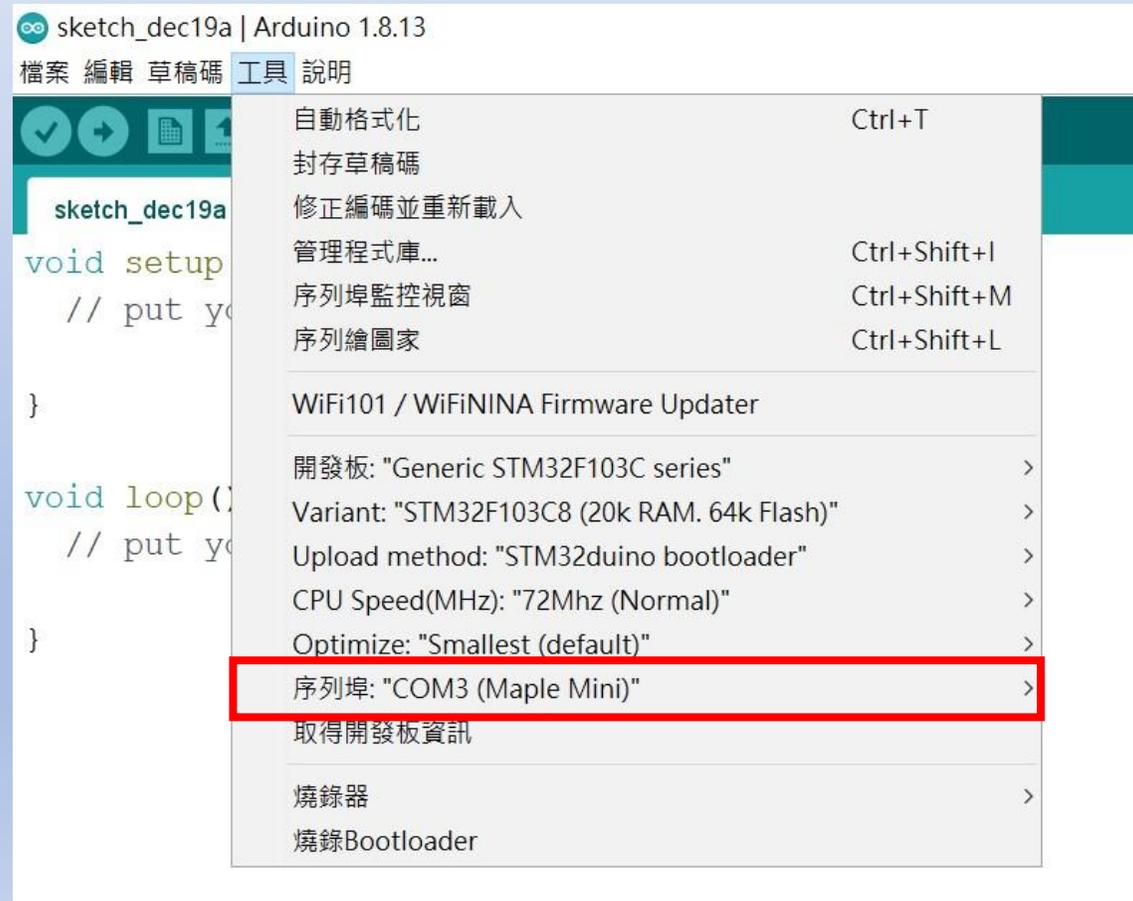
<n> 0 Profile number to store current parameters

APN 設定

資料來源：資策會

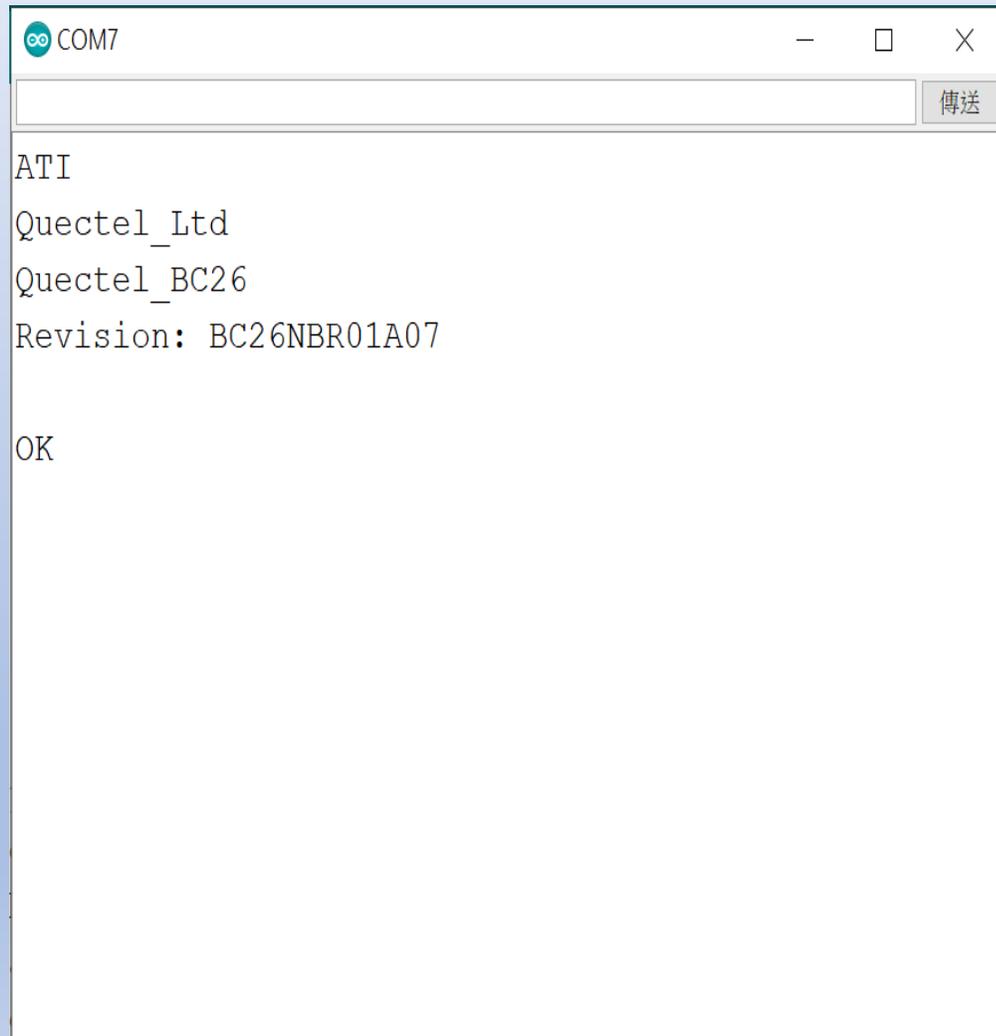
STEP 1：打開DSI2598P_ATcommand.ino，並至Arduino的工具->序列埠中找到USB
模組的COM PORT編號，可至控制台確認。

STEP 2：選擇工具->開發板->Generic STM32F103C series，然後按下上傳 (Ctrl+U)，將
程式燒錄進去。



STEP 3：打開 序列埠監控視窗，在上方輸入欄中輸入**ATI** 指令，可先輸入「**ATI**」，查看模組是否有回覆版本訊息。

STEP 4：啟用APN：`AT+QGACT=1,1,"apn","internet.iot"`



```
COM7
ATI
Quectel_Ltd
Quectel_BC26
Revision: BC26NBR01A07
OK
```



```
COM7
ATI
Quectel_Ltd
Quectel_BC26
Revision: BC26NBR01A07
OK
AT+QGACT=1,1,"apn","internet.iot"
+QGACT: 2
OK
+QGACT: 2,1,0
```

STEP 5 : 註冊APN : AT+QCGDEFCONT="IP","internet.iot"

資料來源 : 資策會

STEP 6 : 頻寬設定 : AT+QBAND=1,8

STEP 7 : 重新啟動模組 : AT+QRST=1

2019年 台灣頻段支援表

電信頻段	FDD - LTE 700MHz(B28)	FDD - LTE 900MHz(B8)	FDD - LTE 1800MHz(B3)	FDD - LTE 2100MHz(B1)	FDD - LTE 2600MHz(B7)	TDD - LTE 2600(B38/B41)
中華電信		◎	◎	◎	◎	
遠傳電信	◎		◎	◎	◎	◎
台灣大哥大	◎			◎		
台灣之星		◎		◎	◎	
亞太	◎	◎ (通話限定)				◎

```
COM7
ATI
Quectel_Ltd
Quectel_BC26
Revision: BC26NBR01A07
OK
AT+QGACT=1,1,"apn","internet.iot"
+QGACT: 2
OK
+QGACT: 2,1,0
AT+QCGDEFCONT="IP","internet.iot"
OK
```

```
COM7
Quectel_BC26
Revision: BC26NBR01A07
OK
AT+QGACT=1,1,"apn","internet.iot"
+QGACT: 2
OK
+QGACT: 2,1,0
AT+QCGDEFCONT="IP","internet.iot"
OK
AT+QBAND=1,8
OK
```

```
COM7
OK
AT+QBAND=1,8
OK
AT+QRST=1
RbRQBBER ?tY?
RbRQBBER ?tY?
RDY
+CFUN: 1
+CPIN: READY
+IP: 10.85.230.245
```

設定檢查

資料來源：資策會

STEP 1：

Sim卡狀態查詢：AT+CPIN?

回覆：READY，表示有找到SIM卡
回覆：ERROR，表示沒有SIM卡

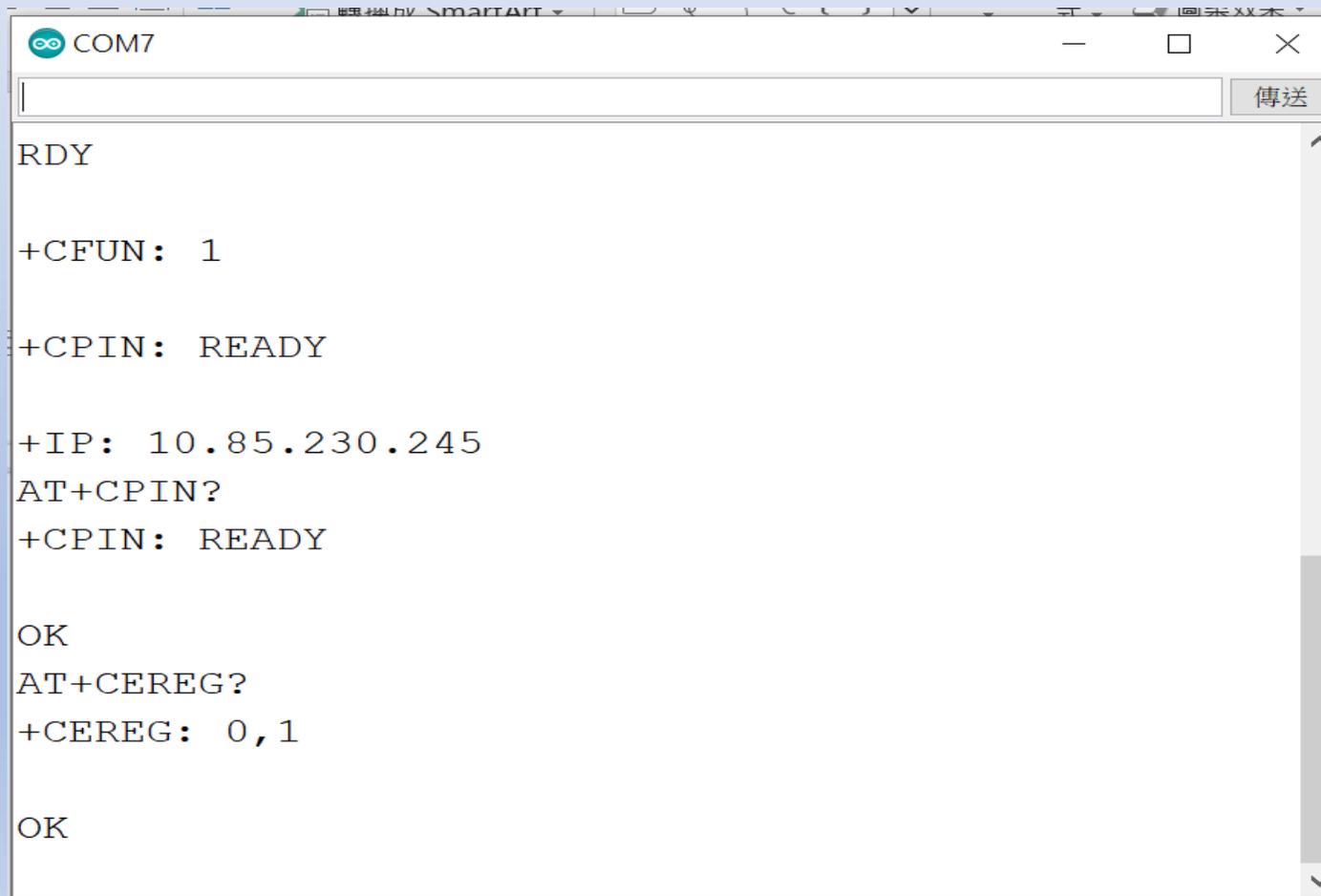
STEP 2：

APN狀態查詢：AT+CEREG?

回覆：+CEREG= 0,1，表示已經進入APN的網域。

回覆：+CEREG= 0,2，表示已經尚未註冊入APN的網域。

回覆：+CEREG= 0,0，表示沒有SIM卡。



The screenshot shows a serial terminal window titled 'COM7'. The text displayed in the terminal is as follows:

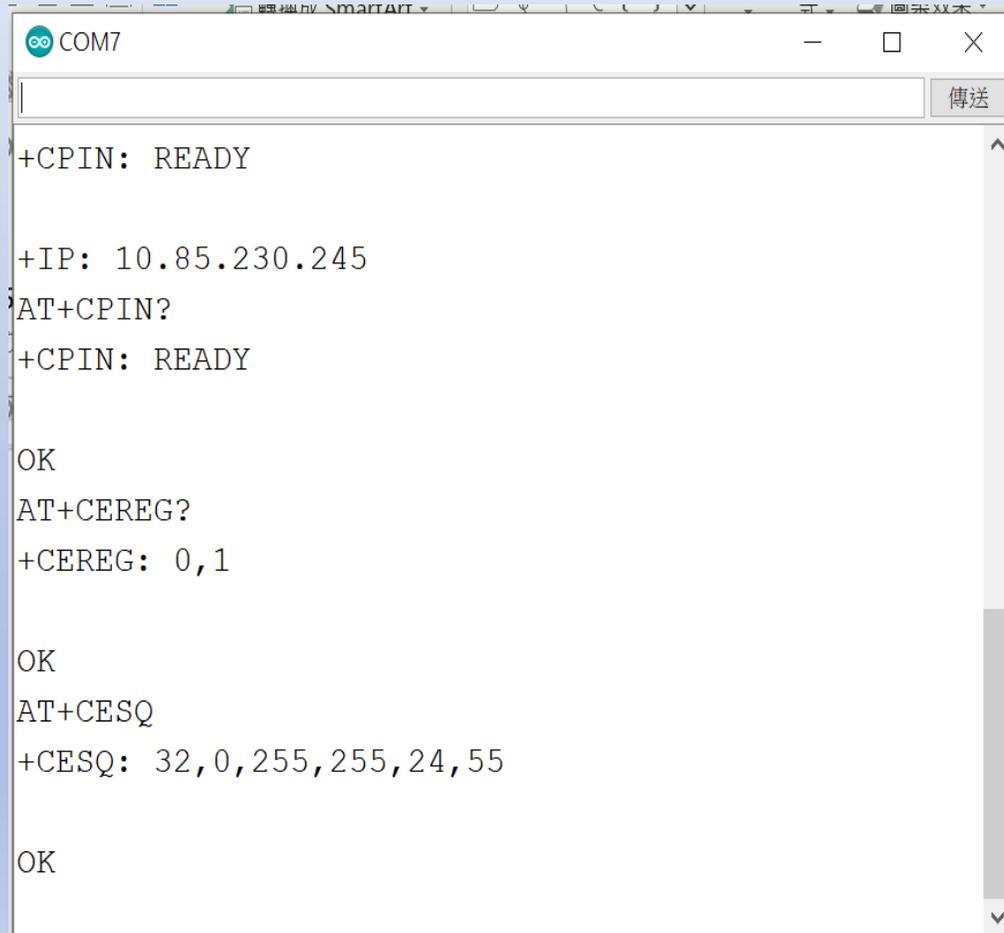
```
RDY  
  
+CFUN: 1  
  
+CPIN: READY  
  
+IP: 10.85.230.245  
AT+CPIN?  
+CPIN: READY  
  
OK  
AT+CEREG?  
+CEREG: 0,1  
  
OK
```

STEP 3 :

訊號強度查詢：AT+CESQ

回覆：+CESQ：xx, 0, 255, 255, 255

xx：0~99，0：未有訊號，99：找不到訊號



```
COM7
+CPIN: READY

+IP: 10.85.230.245
AT+CPIN?
+CPIN: READY

OK
AT+CEREG?
+CEREG: 0,1

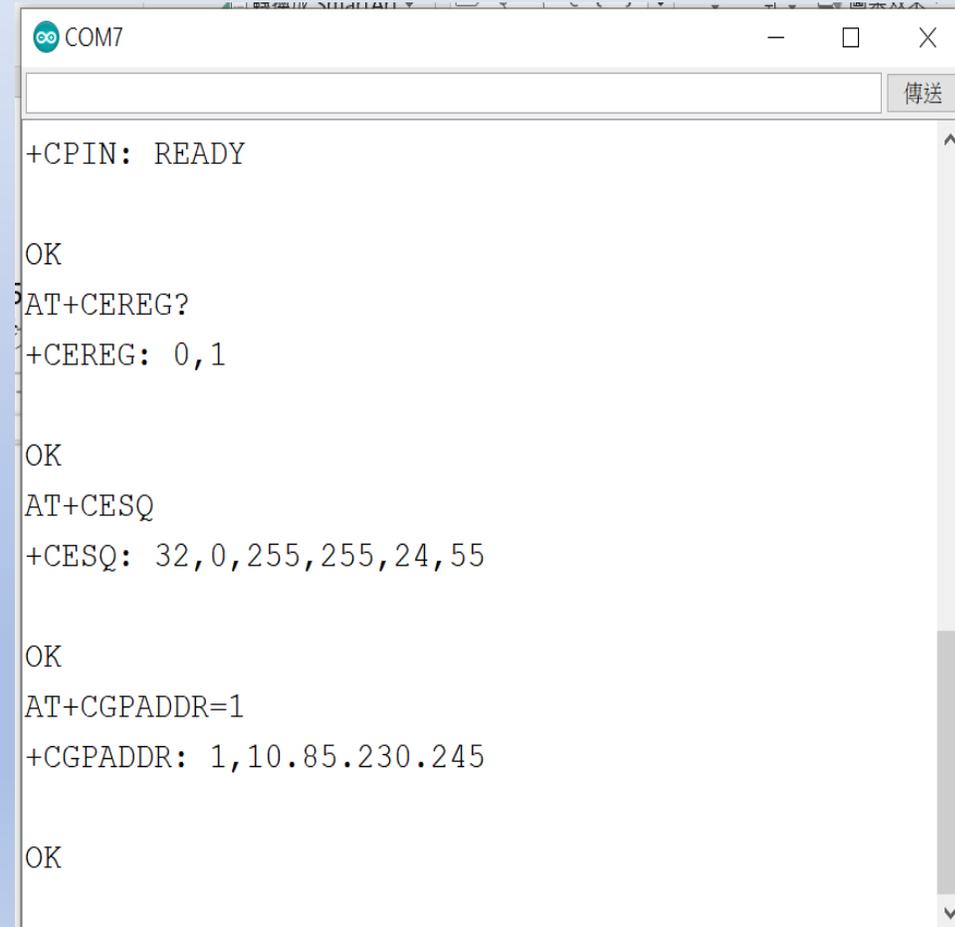
OK
AT+CESQ
+CESQ: 32,0,255,255,24,55

OK
```

STEP 4 :

IP查詢：AT+CGPADDR=1回覆：OK：尚未找到IP

回覆：：+CGPADDR: 1,IP(四位)：表示已有IP說明：若設定期間連上網路會自動回傳IP位址+IP：IP位址



```
COM7
+CPIN: READY

OK
AT+CEREG?
+CEREG: 0,1

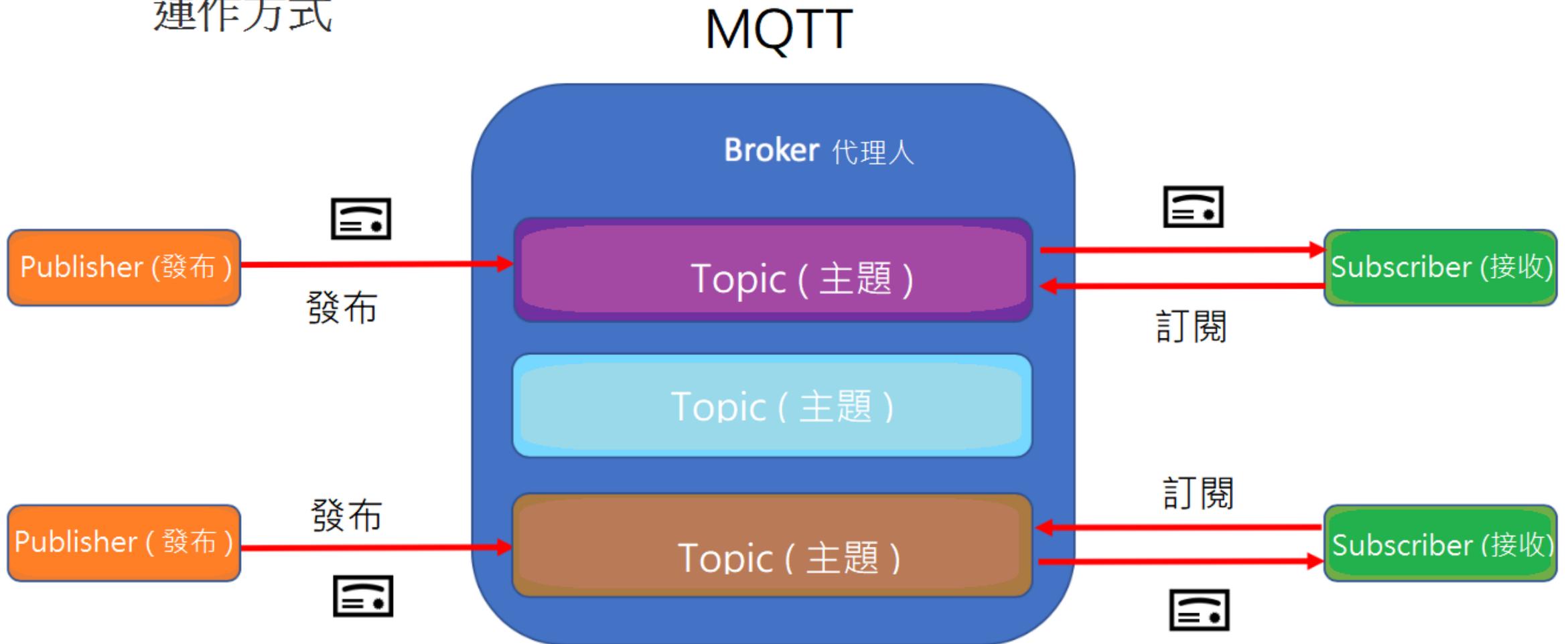
OK
AT+CESQ
+CESQ: 32,0,255,255,24,55

OK
AT+CGPADDR=1
+CGPADDR: 1,10.85.230.245

OK
```

MQTT 基本傳輸圖示

運作方式



MQTT 說明 : (請參考網路上他人分享的資訊)

<https://swf.com.tw/?p=1002>

簡易說明 : 利用 MQTT Broker 設定 (publisher) 發佈 / (subscriber) 訂閱 方式 來傳遞訊息

MQTT Server 架設 :

可由官方網站下載 <http://mosquitto.org/download/> , 下載32位元的安裝程式自行架設

	Server	Broker	Port	Websocket
免費的 MQTT 網站 :	mqtt.eclipse.org	Mosquitto	1883 / 8883	n/a
	broker.hivemq.com	HiveMQ	1883	8000
	test.mosquitto.org	Mosquitto	1883 / 8883 / 8884	8080 / 8081
	test.mosca.io	mosca	1883	80
	broker.mqttdashboard.com	HiveMQ	1883	
	broker.emqx.io	Emqx	1883	

3.2.2. AT+QMTOPEN Open a Network for MQTT Client

The command is used to open a network for MQTT client.

AT+QMTOPEN Open a Network for MQTT Client

Test Command AT+QMTOPEN=?	Response +QMTOPEN: (list of supported <tcpconnectID>s),“ <host_name> ”,(list of supported <port>s) OK
Read Command AT+QMTOPEN?	Response [+QMTOPEN: <tcpconnectID>,”<host_name>”,<port>] OK
Write Command AT+QMTOPEN=<tcpconnectID>,”<host_name>”,<port>	Response OK +QMTOPEN: <tcpconnectID>,<result> If there is an error related to ME functionality: +CME ERROR: <err>
Maximum Response Time	75s, determined by network

3.2.4. AT+QMTCONN Connect a Client to MQTT Server

The command is used when a client requests a connection to MQTT server. When a TCP/IP socket connection is established from a client to a server, a protocol level session must be created using a CONNECT flow.

AT+QMTCONN Connect a Client to MQTT Server	
Test Command AT+QMTCONN=?	Response +QMTCONN: (list of supported <tcpconnectID>s), “<clientID>” [, “<username>”][, “<password>”] OK
Read Command AT+QMTCONN?	Response [+QMTCONN: <tcpconnectID>,<state>] OK
Write Command AT+QMTCONN=<tcpconnectID>,”<clientID>” [, “<username>”][, “<password>”] >”]	Response OK +QMTCONN: <tcpconnectID>,<result>[,<ret_code>] If there is an error related to ME functionality: +CME ERROR: <err>
Maximum Response Time	<pkt_timeout> (default 10s), determined by network

3.2.6. AT+QMTSUB Subscribe to Topics

The command is used to subscribe to one or more topics. A SUBSCRIBE message is sent by a client to register an interest in one or more topic names with the server. Messages published to these topics are delivered from the server to the client as PUBLISH messages.

AT+QMTSUB Subscribe to Topics

Test Command
AT+QMTSUB=?

Response

+QMTSUB: (list of supported <tcpconnectID>s),(list of supported <msgID>s),“<topic>”,(list of supported <qos>s)

OK

Write Command
AT+QMTSUB=<tcpconnectID>,<msgID>,”<topic1>”,<qos1>[,”<topic2>”,<qos2>...]

Response

OK

+QMTSUB: <tcpconnectID>,<msgID>,<result>[,<value>]

If there is an error related to ME functionality:

+CME ERROR: <err>

Maximum Response Time

<pkt_timeout> * <retry_times> (default 40s), determined by network

3.2.8. AT+QMTPUB Publish Messages

The command is used to publish messages by a client to a server for distribution to interested subscribers. Each PUBLISH message is associated with a topic name. If a client subscribes to one or more topics, any message published to those topics are sent by the server to the client as a PUBLISH message.

AT+QMTPUB Publish Messages

Test Command
AT+QMTPUB=?

Response

+QMTPUB: (list of supported <tcpconnectID>s),(list of supported <msgID>s),(list of supported <qos>s),(list of supported <retain>s),“<topic>”,“<msg>”

OK

Write Command
AT+QMTPUB=<tcpconnectID>,<msgID>,<qos>,<retain>,”<topic>”,“<msg>”

Response

OK

+QMTPUB: <tcpconnectID>,<msgID>,<result>[,<value>]

If there is an error related to ME functionality:

+CME ERROR: <err>

Maximum Response Time

<pkt_timeout> * <retry_times> (default 40s), determined by network

3.2.3. AT+QMTCLOSE Close a Network for MQTT Client

The command is used to close a network for MQTT client.

AT+QMTCLOSE Close a Network for MQTT Client

Test Command

AT+QMTCLOSE=?

Response

+QMTCLOSE: (list of supported <tcpconnectID>s)

OK

Write Command

AT+QMTCLOSE=<tcpconnectID>

Response

OK

+QMTCLOSE: <tcpconnectID>,<result>

If there is an error related to ME functionality:

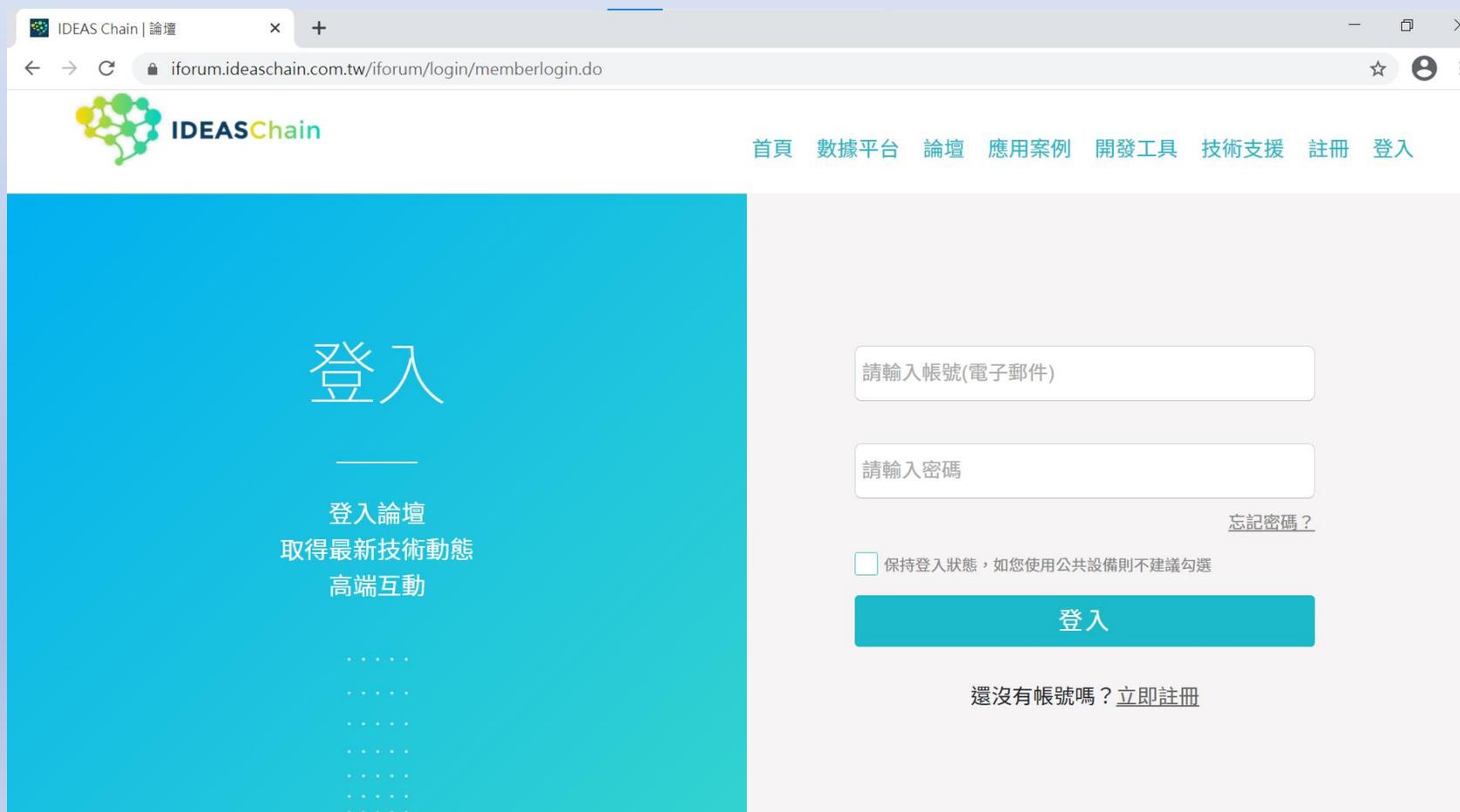
+CME ERROR: <err>

Maximum Response Time

300ms

Ideaschain 網站的平台設定與 API 使用教學 請參考下列網址：
<https://iforum.ideaschain.com.tw/iforum/devtool/board.do?board=3>

於網站內先行設定下列資訊：第一步驟



IDEAS Chain | 論壇

iforum.ideaschain.com.tw/iforum/login/memberlogin.do

IDEASChain

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請輸入密碼

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DHT11-PH12

裝置詳細信息

詳細信息 屬性 最新遙測 警告 事件 關聯 稽核日誌

公開

指派給客戶

管理認證

刪除裝置

複製裝置ID

複製存取權杖

名稱*

DHT11-PH12

裝置類型*

Sensor

是閘道

裝置存取權杖已複製到剪貼板

關閉

PH12.ino 程式概略講解：BC26-STM32.h

讀取收到的字元，組成一個字串

```
1  #include <ArduinoJson.h>
2
3  byte Rset_Count=0;           // 系統重新啟動計時器宣告
4  int waitingTime = 30000;    // 等候 30 秒的回覆。
5
6  String Check_RevData()      // 讀取收到的每一字元資料，彙整成一個字串
7  {
8      String data= "";
9      while (Serial1.available())
10     {
11         data=Serial1.readStringUntil('\n');
12         //Serial.println(data);
13         break;
14     }
15     return data;
16 }
```

開啟程式與 MQTT broker 的網路連接

```
83  bool connect_MQTT(String Serverx,String port,String user,String pass) // 建立 MQTT 連線通道
84  {
85  String S_temp;
86  String S_imei;
87  String Send_check="";
88  Long StartTime=millis();
89  S_temp="AT+CGSN=1";
90  //Serial.println(S_temp);
91  BC26_Serial.println(S_temp);
92  while (!Send_check.startsWith("+CGSN:"))
93  {
94  //Serial.println("Wait ...");
95  Send_check=Check_RevData();
96  //if (Send_check.startsWith("+")) Serial.println(Send_check);
97  if ((StartTime+waitingTime) < millis()) return false;
98  //delay (50);
99  }
100 S_imei=Send_check.substring(7,22);
101 //Serial.println(S_imei);
102
103 S_temp = "\"" + Serverx + "\"" + "," + port;
104 S_temp="AT+QMTOPEN=0," + S_temp;
105 //Serial.println(S_temp);
106 if (Send_ATcommand(S_temp,10)==99)
107 {
108 S_temp= "\"" + S_imei + "\"" + "," + "\"" + user + "\"" + "," + "\"" + pass + "\"";
109 S_temp="AT+QMTCONN=0," + S_temp;
110 //Serial.println(S_temp);
111 delay(50);
112 if (Send_ATcommand(S_temp,11)==99)
113 {
114 // delay(50);
115 return true;
116 }
117 S_temp="AT+QMTCLOSE=0";
118 Send_ATcommand(S_temp,15);
119 }
120 return false;
121 }
```

發布資料於 MQTT broker 網站

```
106  bool Publish_MQTT(String topic, String message) // 發佈資料
107  {
108      String S_temp;
109      S_temp = "\"" + topic + "\"" + "," + message ;
110      S_temp = "AT+QMQTPUB=0,0,0,0," + S_temp ;
111      //Serial.println(S_temp);
112      if (Send_ATcommand(S_temp,12)!=99) return false;
113      //delay(100);
114      return true;
115  }
116
```

訂閱並取得主題資料

```
145 String Sub_MQTT_Data (String topic)
146 {
147     String S_temp;
148     String S_SubData;
149     String Send_check="";
150     Long StartTime=millis();
151     S_temp = "\" + topic + "\" + "," + "2";
152     S_temp = "AT+QMTSUB=0,1," + S_temp;
153     Serial.println(S_temp);
154     BC26_Serial.println(S_temp);
155     while (!Send_check.startsWith("+QMTRECV"))
156     {
157         //Serial.println("Wait ...");
158         //delay (100);
159         Send_check=Check_RevData();
160         if (Send_check.startsWith("+")) Serial.println(Send_check);
161         if (Send_check.startsWith("+QMTSUB: 0,1,0")) break;
162         if ((StartTime+waitingTime) < millis()) return "ERROR";
163     }
164     S_SubData=Send_check.substring(15+topic.length()+3,15+topic.length()+3+2);
165     //Serial.println(S_SubData);
166     return S_SubData;
167 }
```

關閉與 MQTT 網站的聯繫

```
128  bool Close_MQTT() // 關閉連線
129  {
130      String S_temp;
131      S_temp="AT+QMQTCLOSE=0";
132      if (Send_ATcommand(S_temp,15)!=99) return false;
133      //delay(100);
134      return true;
135  }
```

PH12.ino 程式概略講解：

PH12API.h

```
1  /* 雷捷電子 PH12 毫米波雷達感測模組1T2R FW:2.1.1
2  1.使用 UART 方式溝通
3  2.設定變數(PH12_Serial), 例如: #define PH12_Serial Serial3
4  3.設定溝通速率 115200
5  4.使用 Get_PH12Data() 函式處理, 回傳 PH12Info 結構
6  */
7
8  byte PH12_inData[14]={0x55,0xAA,0x31,0x15,0x08,0x00,0x01,0xFF,0xFF,0xFF,0xFF,0xFF,0xFF};
9  byte PH12_rbuf[8];
10
11  struct PH12Info
12  {
13  byte Angle;
14  int Distance;
15  }PH12Data;
16
17  bool Get_PH12Data()
18  {
19  byte i;
20  bool flag=false;
21  while(!PH12_Serial.available()) return false;
22  for (i=0;i<4;i++)
23  {
24  PH12_Serial.readBytes(PH12_rbuf,1);
25  if (PH12_rbuf[0] !=PH12_inData[i]) {i=0;flag=false;continue;}
26  flag=true;
27  }
28  if (flag)
29  {
30  PH12_Serial.readBytes(PH12_rbuf,8);
31  if (PH12_rbuf[5]>1)
32  {
33  if (PH12_rbuf[1]<2)
34  PH12Data.Angle=PH12_rbuf[2]+90;
35  if (PH12_rbuf[1]==128)
36  PH12Data.Angle=90-PH12_rbuf[2];
37  PH12Data.Distance=PH12_rbuf[6]*0x100+PH12_rbuf[5];
38  return true;
39  }
40  }
41  return false;
42  }
```

PH12.ino 程式概略講解：設定連結 IdeasChain 網站的資料及定義

```
1 #define BC26_Serial Serial1 // PA9:TX PA10:RX
2 #define PH12_Serial Serial3 // PB10:TX PB11:RX
3 #include <MapleFreeRTOS900.h>
4 #include "BC26-STM32.h" // BC26 (MT2625) 函式
5 #include "PH12API.h" // PH12 函式
6 #include "SimpleDHT.h" // DHT11 函式
7
8 #define Builtin_LED PB12 // DSI 2598+ 內建的 LED 腳位
9 #define Blue_LED PA0 // 三色 LED 的藍燈腳位
10 #define Green_LED PA1 // 三色 LED 的綠燈腳位
11 #define Red_LED PA2 // 三色 LED 的紅燈腳位
12
13 String MQTT_Server="iiot.ideaschain.com.tw"; //MQTT Broker 的 IP 位址
14 String MQTT_Port="1883"; //MQTT 使用的埠
15 String MQTT_Access_token="*****"; //使用者密碼 ==> IDEAS Chain存取權杖
16 String MQTTtopic="v1/devices/me/telemetry"; //固定路徑 IDEAS Chain
17
18 const int pinDHT11 = PB1; // DHT11 溫溼度傳感器 使用 PB1 腳位
19 SimpleDHT11 dht11(pinDHT11);
20 int err = SimpleDHTErrSuccess;
21
22 int LedON=0;
23 int LedOFF=1;
24 bool Flag_DHT11=false;
25
26 String Sensor1="Temperature"; // 溫度的 Key
27 String Sensor2="Humidity"; // 溼度的 Key
28 String DHTtemp,DHTumi;
29
30 String MQTTmessage;
```

取得 PH12的資料

搭配 三色 LED 的燈號及
亮度明暗顯示距離及角度

```
34  static void Get_PH12_Info( void *pvParameters )
35  {
36      int val;
37      for (;;)
38      {
39          vTaskDelay(10);
40          if (Get_PH12Data())
41          {
42              val=PH12Data.Distance;
43              if (PH12Data.Angle<80)
44              {
45                  analogWrite(Red_LED,val);
46                  analogWrite(Green_LED,0);
47                  analogWrite(Blue_LED,0);
48              }
49              if (PH12Data.Angle>80 && PH12Data.Angle<120)
50              {
51                  analogWrite(Red_LED,0);
52                  analogWrite(Green_LED,val);
53                  analogWrite(Blue_LED,0);
54              }
55              if (PH12Data.Angle>120)
56              {
57                  analogWrite(Red_LED,0);
58                  analogWrite(Green_LED,0);
59                  analogWrite(Blue_LED,val);
60              }
61              Serial.print(PH12Data.Angle,DEC);
62              Serial.print(" 角度 ");
63              Serial.print(PH12Data.Distance,DEC);
64              Serial.print(" 距離");
65              Serial.println();
66          }
67      }
68  }
```

取得 DHT11 的溫溼度資料

```
70 static void Get_DHT11(void *pvParameters)
71 {
72     for (;;)
73     {
74         float temperature, humidity;
75         float CorrectionTEMP = 0; // 溫度校正值
76         float CorrectionHUMI = 0; // 溼度校正值
77         int err = SimpleDHTErrSuccess;
78         Serial.println("溫溼度模組 DHT11 資料讀取中....");
79         while ((err = dht11.read2(&temperature, &humidity, NULL)) != SimpleDHTErrSuccess)
80         {
81             //Serial.println("溫溼度資料讀取錯誤,錯誤碼:" + String (err));
82             Flag_DHT11=false;
83             vTaskDelay(2000);
84         }
85         DHTtemp = String(temperature - CorrectionTEMP);
86         DHTumi = String(humidity - CorrectionHUMI);
87         Serial.print("攝氏溫度:");Serial.print(DHTtemp); Serial.println(" °C");
88         Serial.print("環境溼度:");Serial.print(DHTumi); Serial.println(" %");
89         MQTTmessage="\{"\" + Sensor1 + "\":\" + DHTtemp + "\",\" + \"\" + Sensor2 + "\":\" + DHTumi + "\}\\"";
90         Flag_DHT11=true;
91         vTaskDelay(5000);
92     }
93 }
```

將DHT11讀取到的溫溼度資料傳送至 IdeasChain 網站

```
93  static void IdeasChain ( void *pvParameters )
94  ▼ {
95      int Delay_time;
96      for (;;)
97      {
98          while (!Flag_DHT11) vTaskDelay(1000);
99          digitalWrite(Builtin_LED, LedON);
100         if (connect_MQTT(MQTT_Server, MQTT_Port, MQTT_Access_token, MQTT_Access_token))
101         ▼ {
102             if (Publish_MQTT(MQTTtopic, MQTTmessage)) Close_MQTT();
103             digitalWrite(Builtin_LED, LedOFF);
104             Delay_time=30;
105             Serial.println("暫停 " + (String)Delay_time + " 秒後再傳送 !!");
106             Delay_time=Delay_time*1000;
107             vTaskDelay(Delay_time);
108         }
109     }
110 }
```

PH12.ino 主程式：使用 FreeRTOS 機制，撰寫程式多工處理

```
114 void setup()
115 {
116   Serial.begin(115200);
117   BC26_Serial.begin(115200);
118   PH12_Serial.begin(115200);
119   pinMode (Builtin_LED,OUTPUT);           // 內建 STM32 LED 燈腳位 設為程式執行時的確認燈號
120   pinMode (Red_LED,OUTPUT);               // 角度為 0-80 度時的燈號
121   pinMode (Green_LED,OUTPUT);            // 角度為 80-120 度時的燈號
122   pinMode (Blue_LED,OUTPUT);             // 角度為 120-190 度時的燈號
123   digitalWrite(Builtin_LED, LedON);      // 打開內建的LED 燈
124   delay (5000);
125   Serial.println("程式啟動中 .....");
126   delay (3000);
127   while (Send_ATcommand("AT+CGPADDR=1",2)!=99) delay (10000);
128   Serial.println("電信基地台網路連線成功 !!");
129   Serial.println("=====");
130   delay (1000);
131   digitalWrite(Builtin_LED, LedOFF);
132   xTaskCreate(Get_PH12_Info,"Task1",512,NULL,tskIDLE_PRIORITY + 3,NULL);
133   xTaskCreate(Get_DHT11,"Task2",256,NULL,tskIDLE_PRIORITY + 2,NULL);
134   xTaskCreate(IdeasChain,"Task3",512,NULL,tskIDLE_PRIORITY + 1,NULL);
135   vTaskStartScheduler();
136 }
137
138 void loop(){}

```


溫溼度模組 DHT11 資料讀取中.....

攝氏溫度：28.00 °C

環境溼度：88.00 %

66 角度 33 距離

62 角度 31 距離

62 角度 29 距離

63 角度 29 距離

68 角度 28 距離

70 角度 25 距離

76 角度 21 距離

76 角度 20 距離

77 角度 28 距離

77 角度 28 距離

79 角度 35 距離

79 角度 34 距離

79 角度 33 距離

79 角度 32 距離

78 角度 31 距離

78 角度 30 距離



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DSI2598P
SENSOR



DHT11-PH12

裝置詳細信息

詳細信息 屬性 最新遙測 警告 事件 關聯 稽核日誌

最新遙測

<input type="checkbox"/>	最後更新時間	鍵 ↑	值
<input type="checkbox"/>	2022-10-31 15:57:00	Humidity	88.0
<input type="checkbox"/>	2022-10-31 15:57:00	Temperature	28.0



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DHT11

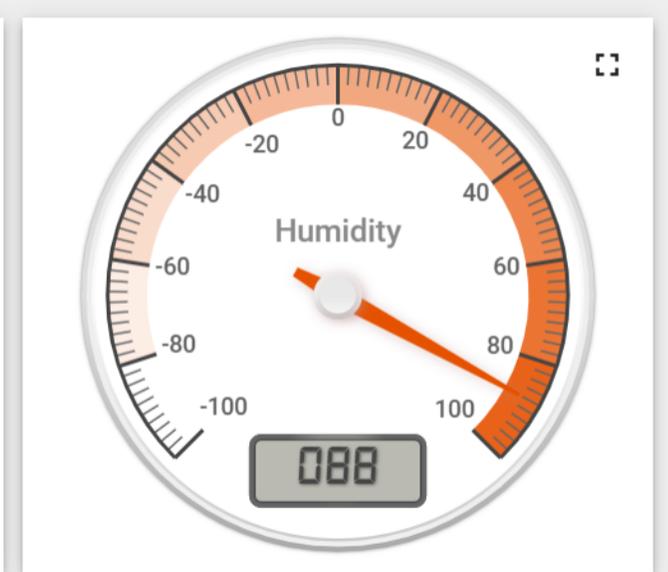
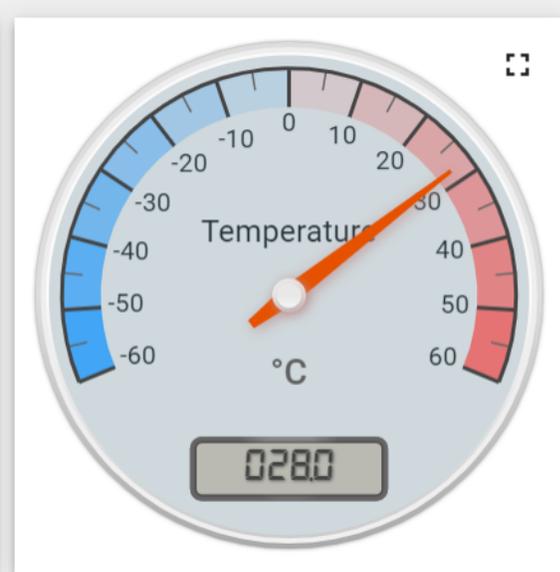


DHT11 DHT11 📺 DHT11-PH12 🕒 即時 - 最後分 ⬇️ 🗄️

Timeseries table 🔍 🗄️

🕒 歷史 - 最後 30 分

Timestamp	Humidity ↑	Temperature
2022-10-31 15:57:00	88	28
2022-10-31 15:56:28	89	28
2022-10-31 15:55:24	90	28



Q & A