

# lab 1

## link7697&溫溼度感應器

### 物聯網概論



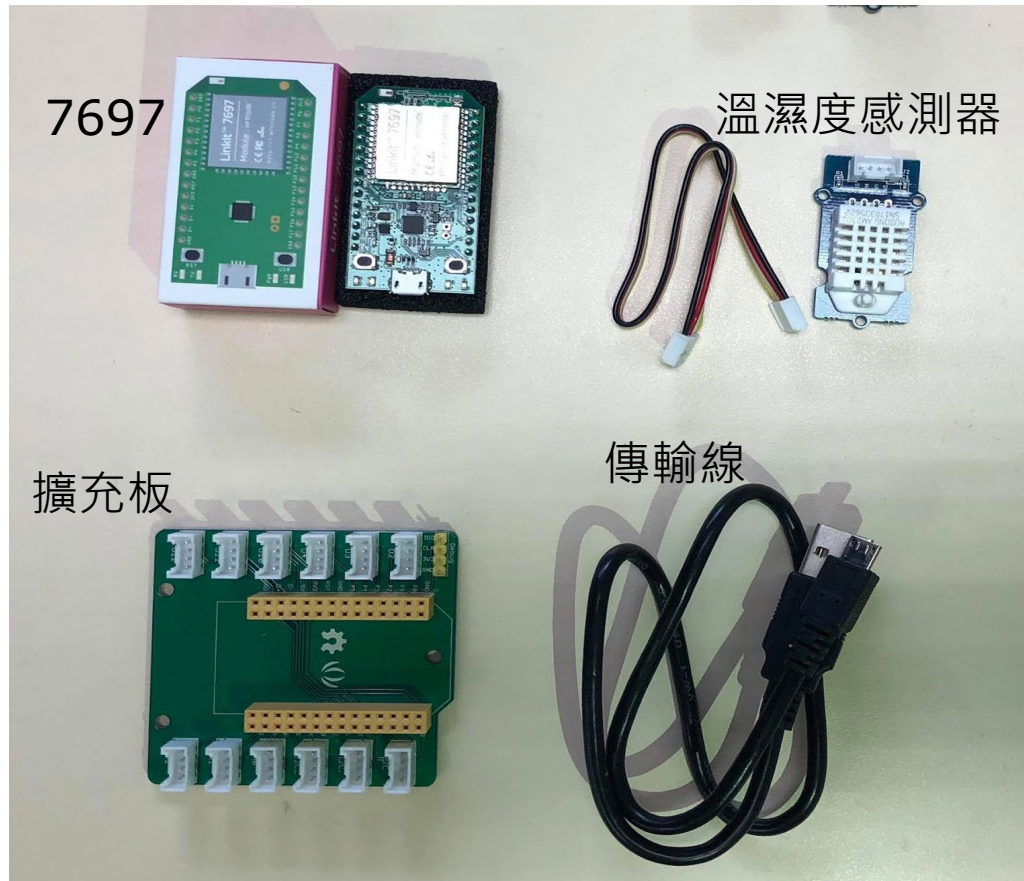
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國立清華大學資訊工程系

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- © (Verdana, 14號字, 粗體)

# 材料清點



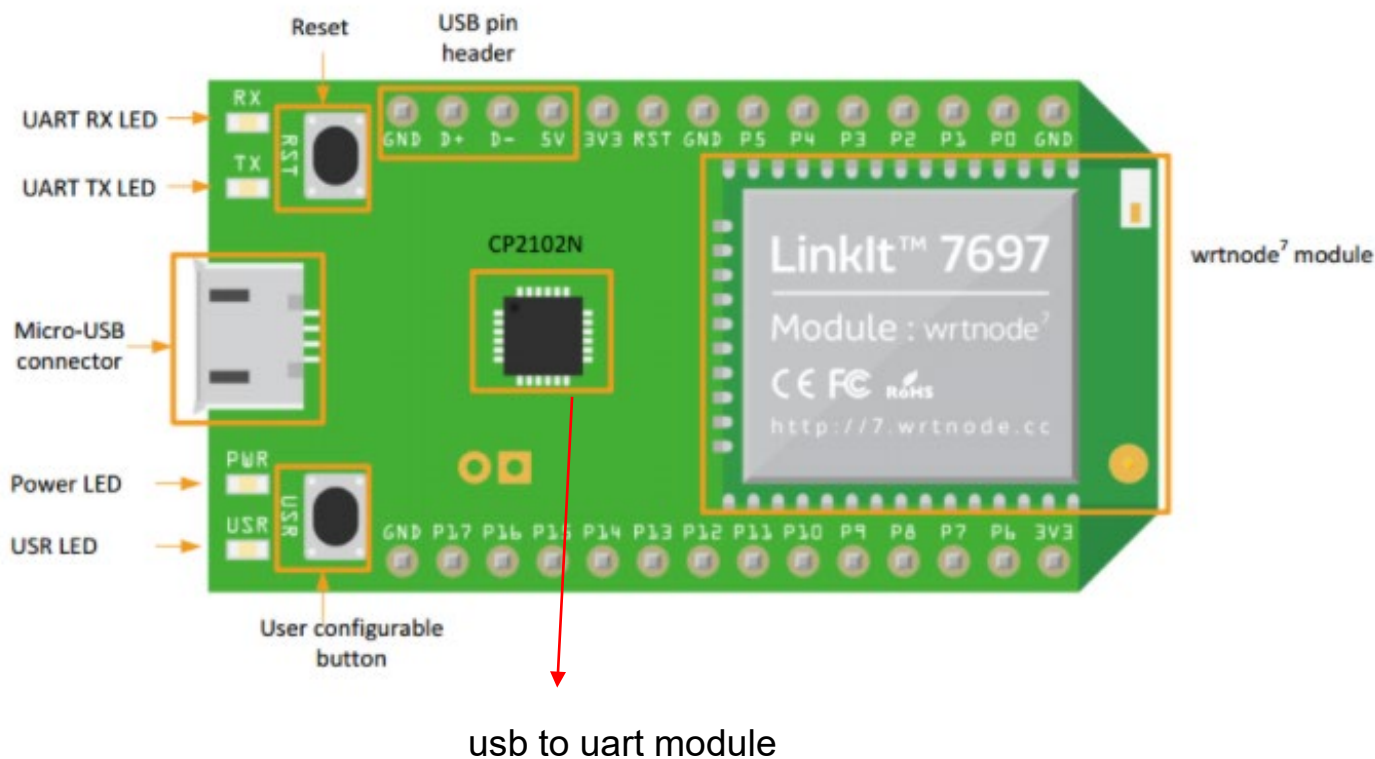
# 大綱

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- LinkIt 7697 & Ardunio 介紹
- lab 1-1 : Arduino 安裝
- lab 1-2:UART
- lab 1-3:GPIO
- lab 1-4:temperature sensor DHT22

# LinkIt 7697

- RST : 重啟鍵
- UART RX LED : 當使用UART0接收資料時會閃爍
- UART TX LED : 當使用UART0傳送資料時會閃爍
- USR BTN : 內鍵按鈕, 連接到 **PIN 7**
- USR LED : 內建LED, 連接到**PIN 6**



# LinkIt 7697 pin

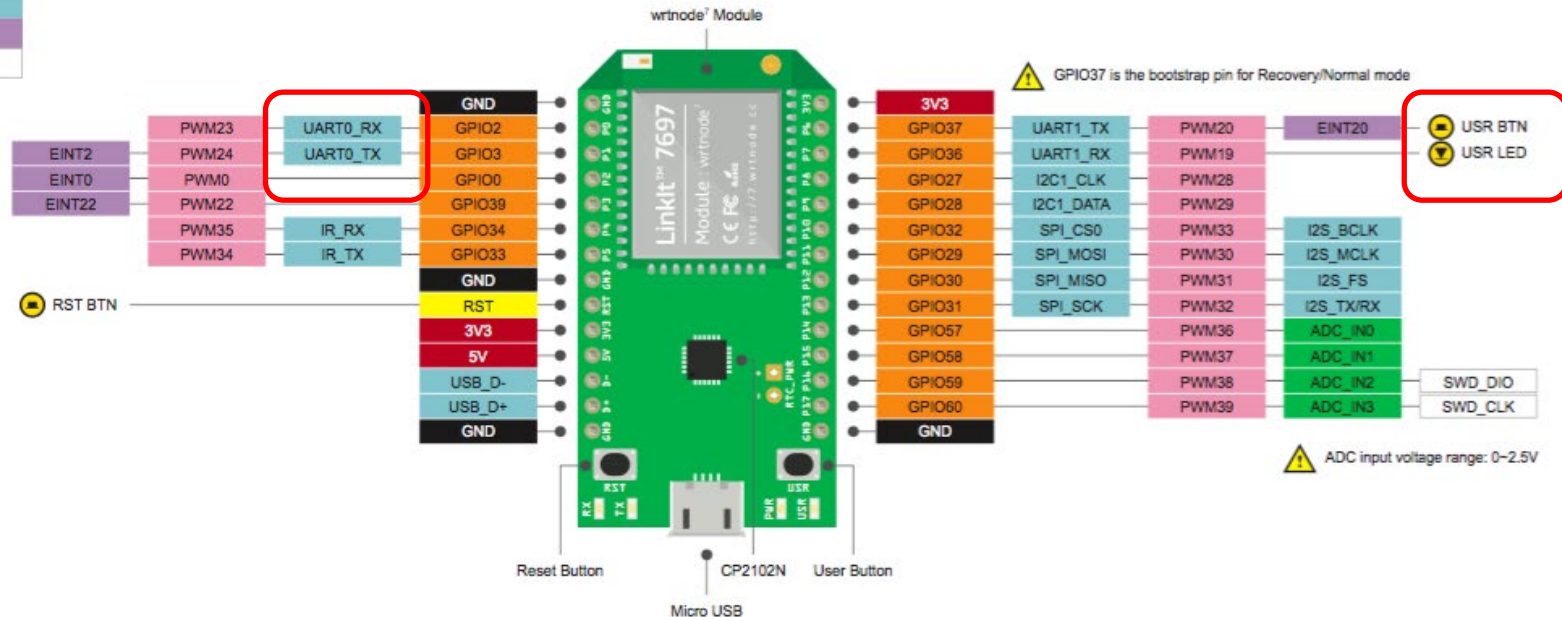
## LinkIt™ 7697

seeed

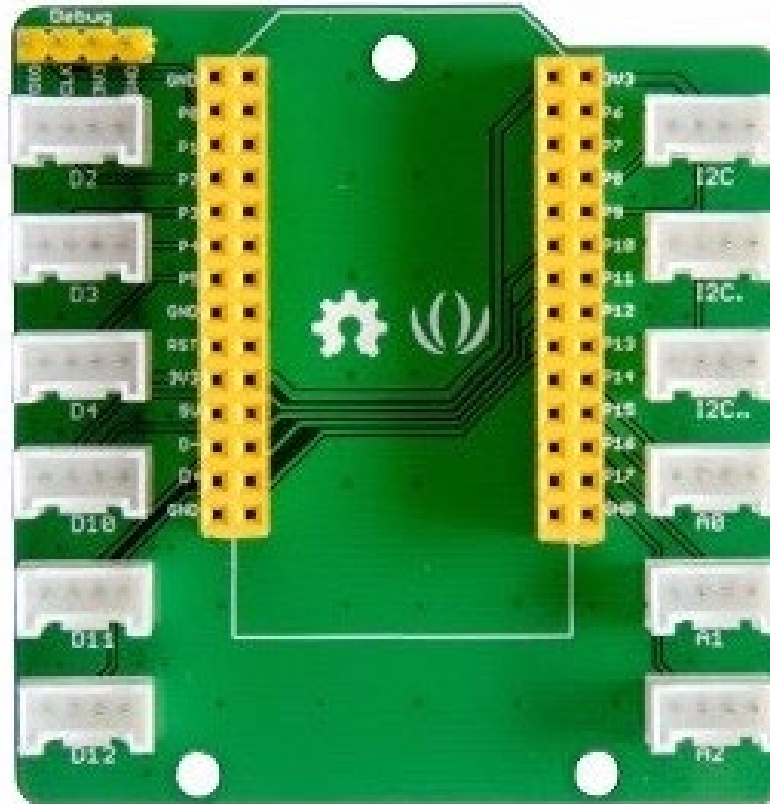
wrtnode

MEDIATEK  
labs

GND
POWER
CONTROL
DIGITAL
ANALOG
PWM
SERIAL
INTERRUPT
DEBUG



# Analog I/O pins on base shield



# Arduino 優點

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- 不僅軟體是開放原始碼，硬體也是開放的。
  - 開發軟體用的 IDE 可免費下載
  - 電路設計圖也可以從網路上下載。
- 資源豐富
  - 很多人都樂於分享他們的作品

# Arduino

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- Language reference:<https://www.arduino.cc/reference/en/>
- Built in library:<https://www.arduino.cc/reference/en/libraries/>



# lab 1-1

- 請到 Arduino 官網

(<https://www.arduino.cc/en/software>)中的

Download下載Arduino IDE,請務必下載**1.8.16**版本

- 步驟1

Legacy IDE (1.8.X)



Arduino IDE 1.8.19

The open-source Arduino Software (IDE) makes it easy to write code and upload it to the board. This software can be used with any Arduino board.

Refer to the [Getting Started](#) page for Installation instructions.

#### SOURCE CODE

Active development of the Arduino software is [hosted by GitHub](#). See the instructions for [building the code](#). Latest release source code archives are available [here](#). The archives are PGP-signed so they can be verified using [this](#) gpg key.

#### DOWNLOAD OPTIONS

**Windows** Win 7 and newer

**Windows** ZIP file

**Windows app** Win 8.1 or 10



**Linux** 32 bits

**Linux** 64 bits

**Linux** ARM 32 bits

**Linux** ARM 64 bits

**Mac OS X** 10.10 or newer

[Release Notes](#)

[Checksums \(sha512\)](#)

#### Previous Releases

Download the previous version of the current release, the classic 1.0.x, or old beta releases.

#### DOWNLOAD OPTIONS

[Previous Release 1.8.18](#)

[Arduino 1.0.x](#)

[Arduino 1.5.x beta](#)

點選這邊可以找到1.8.16版本

# lab 1-1

## ● 步驟2

### Previous Releases

Download the previous version of the current release, the classic 1.0.x, or old beta releases.

#### DOWNLOAD OPTIONS

**Previous Release 1.8.18**

**Arduino 1.0.x**

**Arduino 1.5.x beta**

## ● 步驟3 請務必下載1.8.16版本,否則將無法連接7697

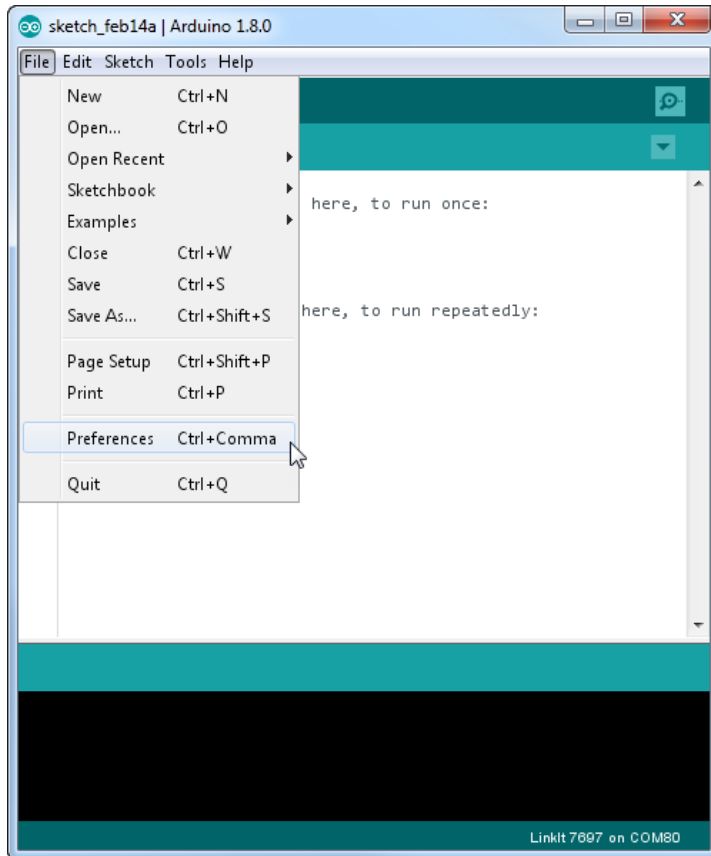
Arduino 1.8.16

Arduino IDE that can be used with any Arduino board, including the Arduino Yún and Arduino DUE. Refer to the [Getting Started](#) page for Installation instructions. [See the release notes.](#)

Windows	MAC	Linux	Source
<a href="#">Windows Installer</a> <a href="#">Windows ZIP file for non admin install</a>	<a href="#">MAC OS 10.8 Mountain Lion or newer</a>	<a href="#">Linux 32 bits</a> <a href="#">Linux 64 bits</a> <a href="#">Linux ARM 32</a> <a href="#">Linux ARM 64</a>	<a href="#">Source</a>

# lab 1-1

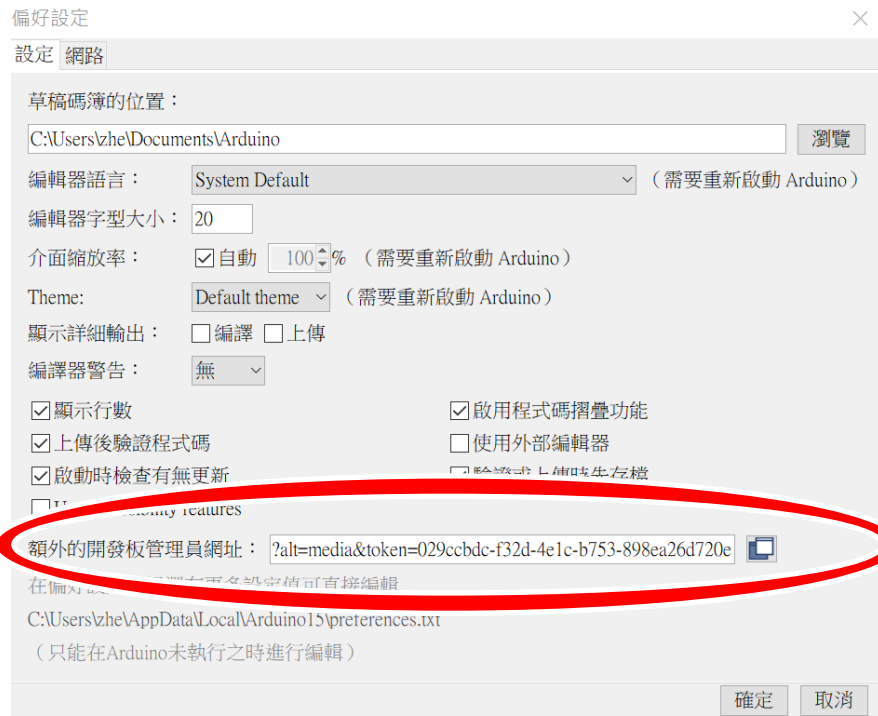
- 打開Arduino IDE，File > Preferences，如圖所示



左圖為Windows介面，右圖為OSX介面

# lab 1-1

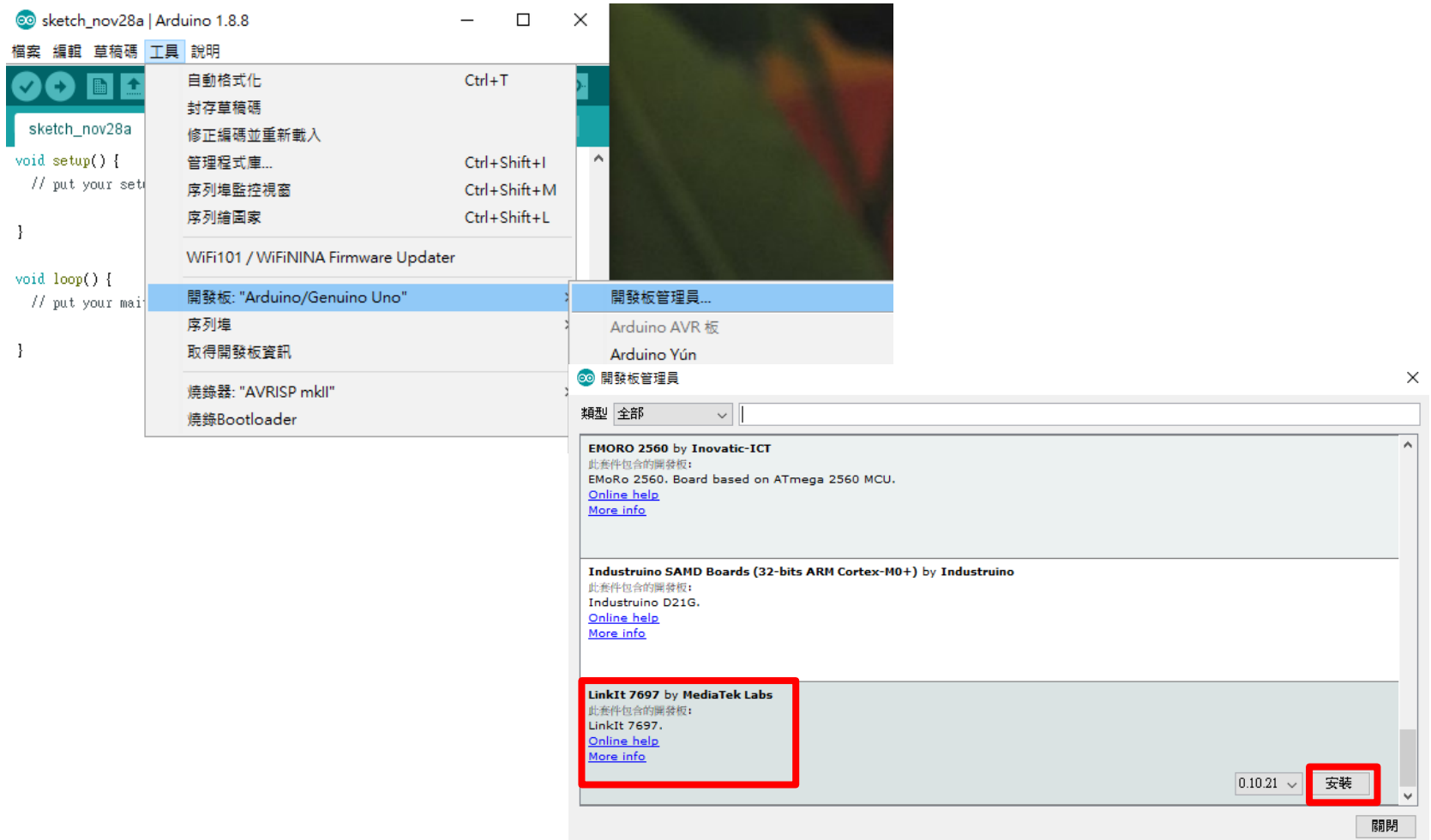
- 輸入以下資訊：
- [https://files.gitbook.com/v0/b/gitbook-x-prod.appspot.com/o/spaces%2FY4gduUSLWOCI23CXUWej%2Fuploads%2FfDIyZSO3WxvVYeZFhkSQ%2Fpackage\\_mtk\\_linkit\\_7697\\_index.json?alt=media&token=029ccbd-c-f32d-4e1c-b753-898ea26d720e](https://files.gitbook.com/v0/b/gitbook-x-prod.appspot.com/o/spaces%2FY4gduUSLWOCI23CXUWej%2Fuploads%2FfDIyZSO3WxvVYeZFhkSQ%2Fpackage_mtk_linkit_7697_index.json?alt=media&token=029ccbd-c-f32d-4e1c-b753-898ea26d720e)



請不要直接從pdf上複製網址,不然會複製到一些隱藏空白跟字元,可以點開網址後從瀏覽器上方的網址欄位做複製

# lab 1-1

- 安裝SDK，選擇最新版本(講義是0.10.21)



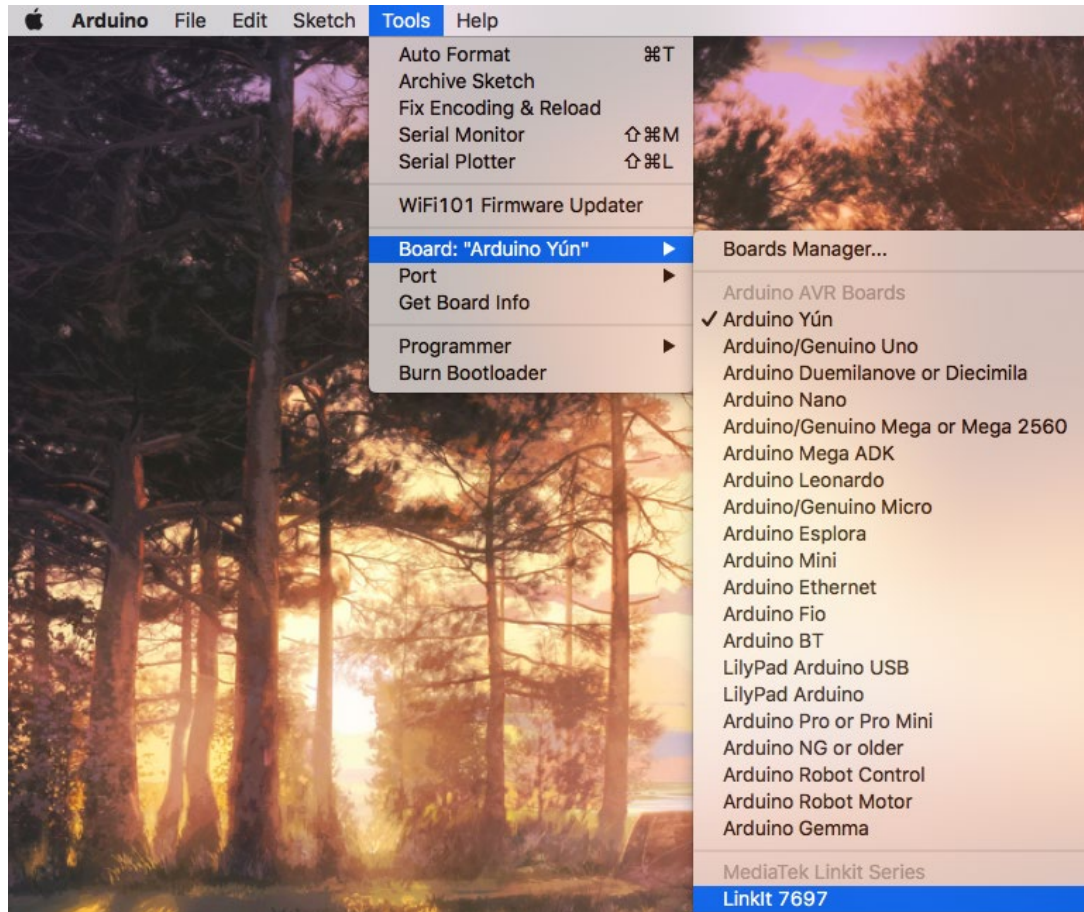
# lab 1-1

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- 由此連結選擇適合自己電腦版本的USB Driver
- <http://www.silabs.com/products/development-tools/software/usb-to-uart-bridge-vcp-drivers>
- 安裝完成之後電腦才能讀到7697

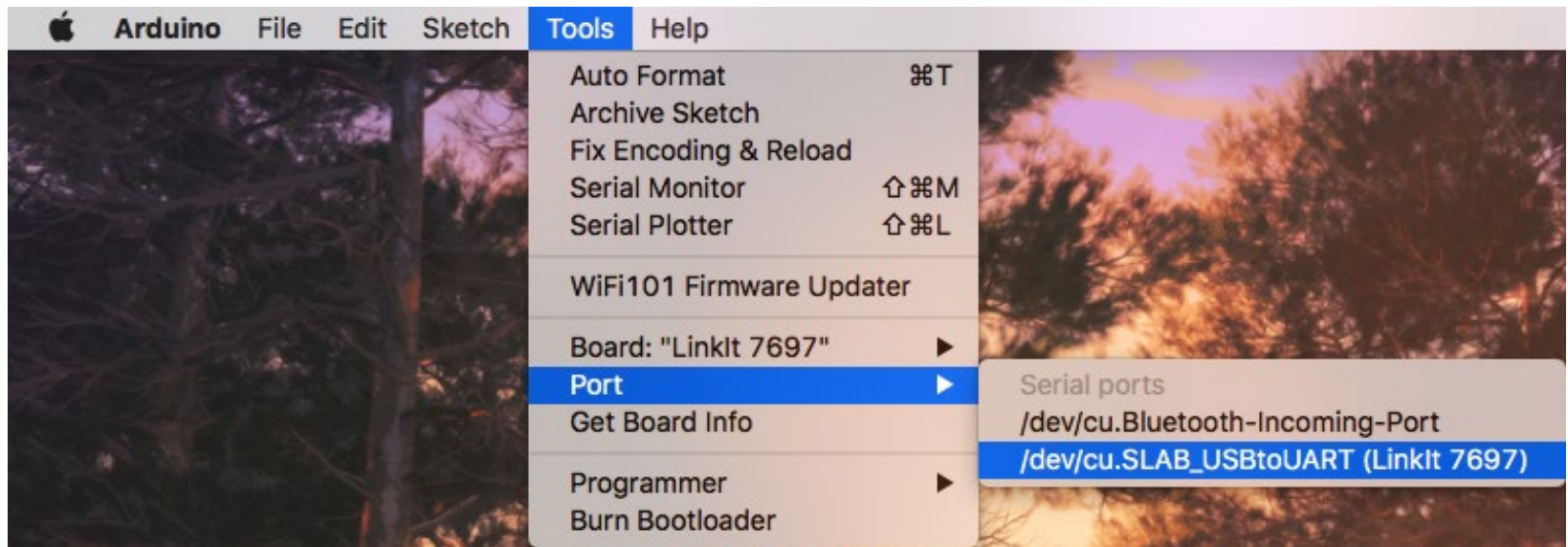
# lab 1-1

- 這時候在 Tools > Board，應該可以看到Linkit 7697



# lab 1-1

- 安裝好Driver，並將 LinkIt 7697 連接到電腦之後，請由此路徑 Tools > Port 選擇 7697，如圖





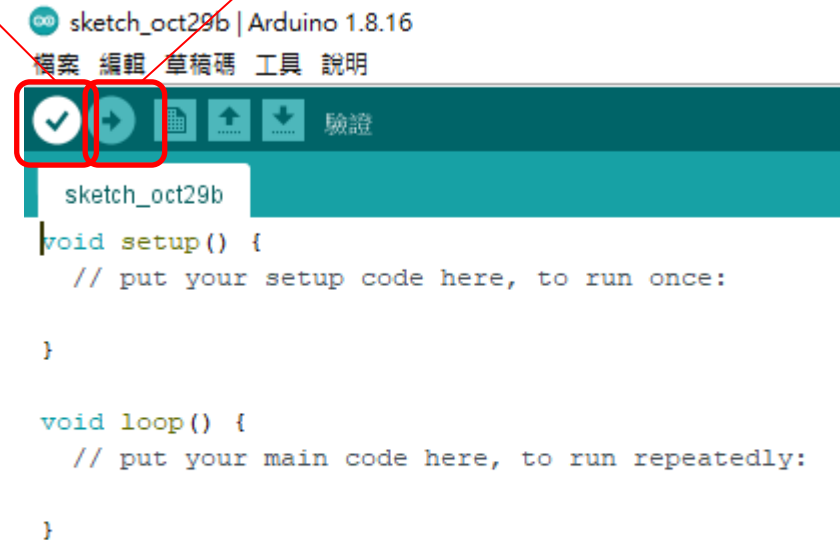
# 開發環境

- setup:在系統第一次開啟時會執行該function
- loop:會無限執行裡面的程式碼

點選此按鈕可compile

點選此按鈕可將程式燒入板子

```
void setup() {  
  // put your setup code here, to run once:  
}  
  
void loop() {  
  // put your main code here, to run repeatedly:  
}
```



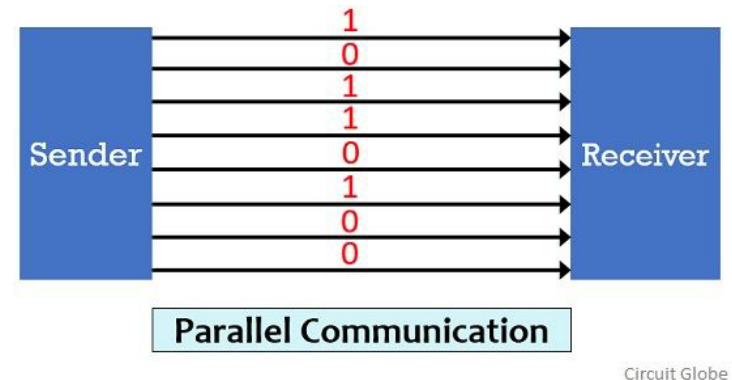
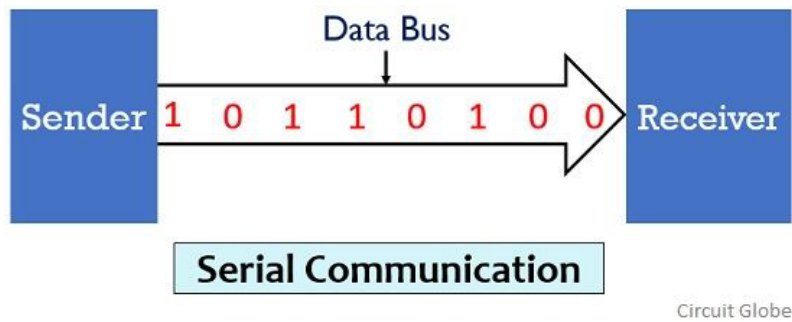
# 大綱

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- lab 1-1 : Arduino 安裝
- **lab 1-2:UART**
- lab 1-3:GPIO
- lab 1-4:temperature sensor DHT22

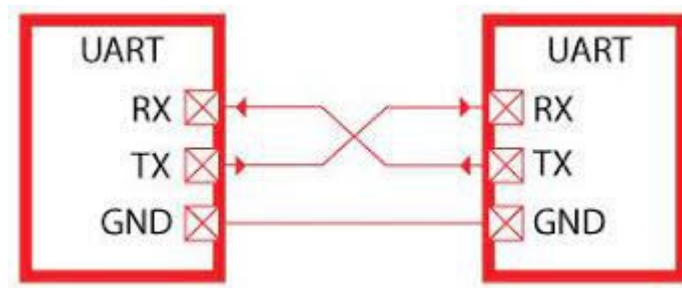
# communication protocol

- Serial communication protocol:
  - UART
  - I2C
  - SPI
  - USB
- communicate between MCU



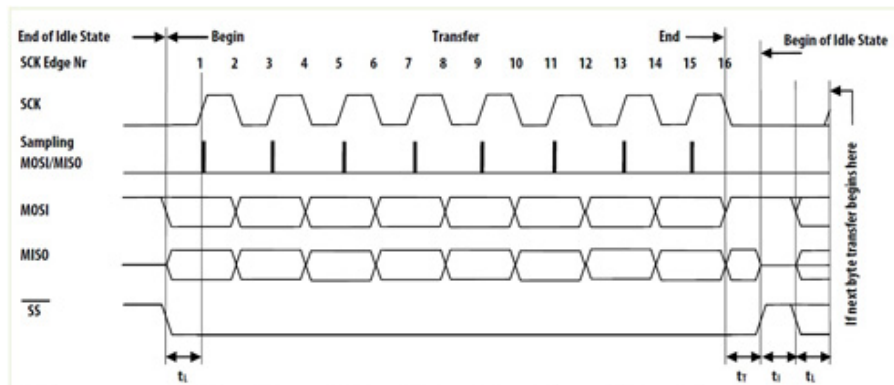
# UART

- Universal Asynchronous Receiver/Transmitter
- full-duplex(SPI,SATA,PCIe,USB3.0)
- 1 to 1
- Asynchronous: dont need clock signal, transmit with prearranged baud rate
- TX connect to RX

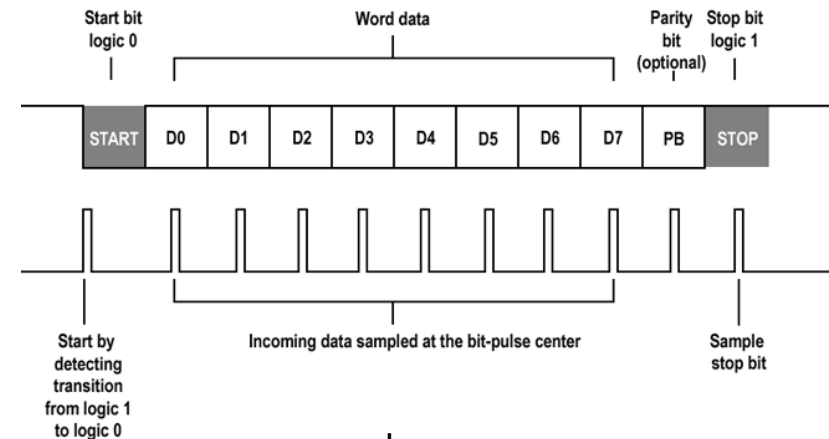


# UART

- Universal Asynchronous Receiver/Transmitter
- 全雙工:full-duplex(SPI,SATA,PCIe,USB3.0)
- 1 to 1
- Asynchronous:
  - 沒有clock signal,
  - transmit with prearranged baud rate



synchronous



asynchronous

# UART with Arduino

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- built-in function:

<https://www.arduino.cc/reference/en/language/functions/communication/serial/>

- Serial0代表接在UART0接口,Serial1代表UART1接口(依此類推)

# LinkIt 7697 pin

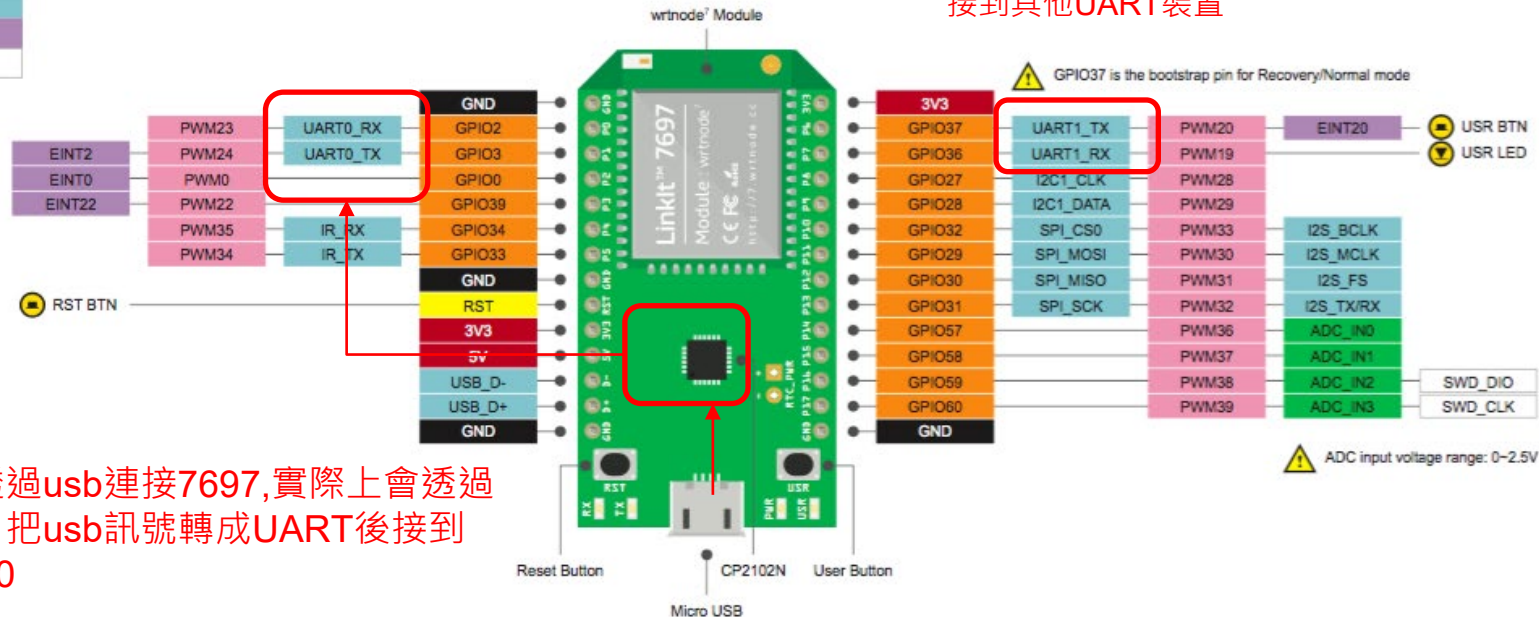
## LinkIt™ 7697

seeed

wrtnode

MEDIATEK  
labs

GND
POWER
CONTROL
DIGITAL
ANALOG
PWM
SERIAL
INTERRUPT
DEBUG



因此若用USB連接電腦,我們就只剩下UART1可以接到其他UART裝置

如果透過usb連接7697,實際上會透過此晶片把usb訊號轉成UART後接到UART0

# UART with Arduino

- built-in function:

<https://www.arduino.cc/reference/en/language/functions/communication/serial/>

- Serial0代表接在UART0接口,Serial1代表UART1接口(依此類推)
- sample code

```
void setup() {  
  Serial.begin(9600);  
  Serial1.begin(9600);  
}
```

setup時須先設定UART要使用的baud rate

```
while(!Serial.available()); //wait for data  
//read the data out
```

```
String s;  
while(Serial.available()) {  
  s+=(char)Serial.read();  
}
```

```
Serial.print(data); //can transmit number,string,byte  
Serial.println(data); //will auto add \n at the end of the line
```

傳輸資料



# UART with PC

sketch\_oct29c | Arduino 1.8.16

檔案 編輯 草稿碼 工具 說明

sketch\_oct29c \$

```
Avoid setup() {  
  // put your setup code here, to run once:  
}  
  
void loop() {  
  // put your main code here, to run repeatedly:  
}
```

點這個按鈕可以跳出監控視窗

這邊可以輸入想要傳給MCU的東西,點選傳送後就會用傳過去

從MCU傳來的東西會顯示在這邊

設定要使用的baud rate

傳送時是否要在最後幫忙加上換行符號(\n)

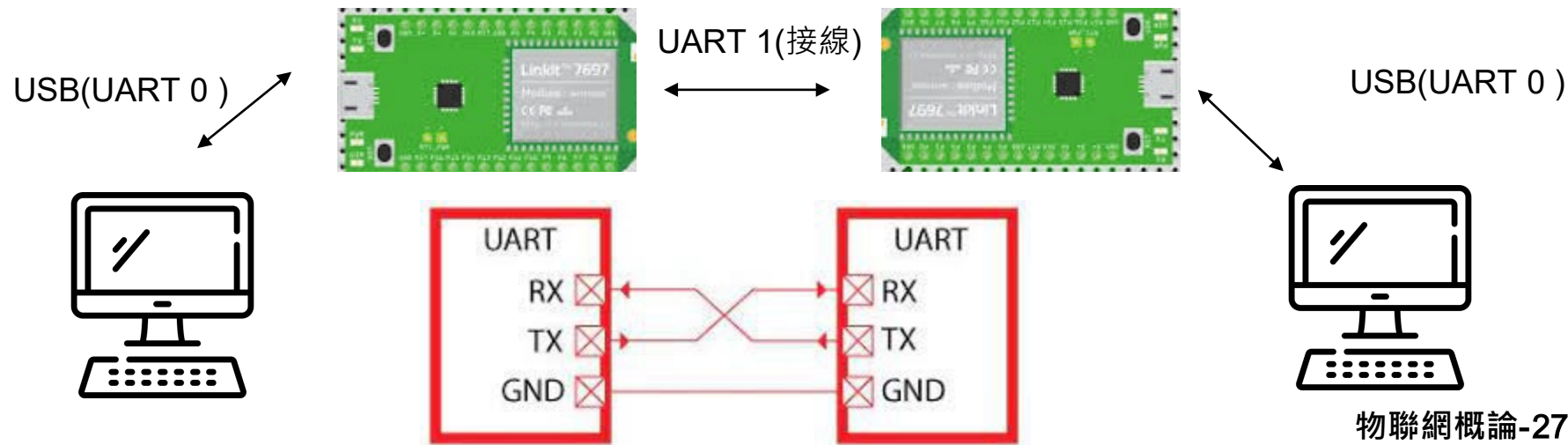
COM4

傳送

自動捲動 Show timestamp NL(newline) 9600 baud Clear output

# lab 1-2

- Task 1: write a code to let your pc can send string to 7696, and 7696 will convert the string to all capital letter and send back to your pc (and display on the serial monitor)
- Task 2: 兩兩一組, 連接彼此的7697並且使其能互相傳遞資料



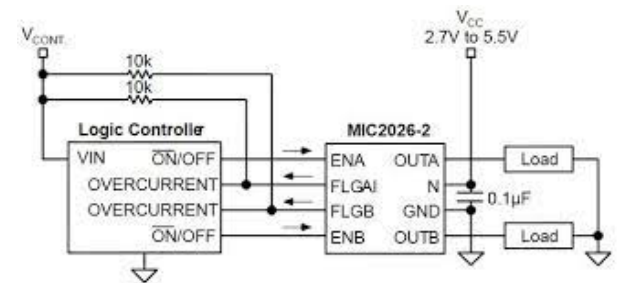
# 大綱

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# GPIO

- General Purpose Input/Output
- two status:
  - HIGH(VCC:1.8v/3.3v/5.0v)
  - LOW(GND:0v)
- usage
  - output:control LED,enable pin
  - input:state or interrupt



# GPIO

- 常用function:

- pinMode(PIN,MODE):設定pin腳要作為input或output
- digitalWrite(PIN,HIGH/LOW):把output pin設為高/低電位
- delay(s):程式暫停執行s毫秒
- LED\_BUILTIN/HIGH/LOW:arduion定義好的常數

```
// initialize digital pin LED_BUILTIN as an output.  
pinMode(LED_BUILTIN, OUTPUT);
```

## Constants

HIGH | LOW

INPUT | OUTPUT | INPUT\_PULLUP

LED\_BUILTIN

true | false

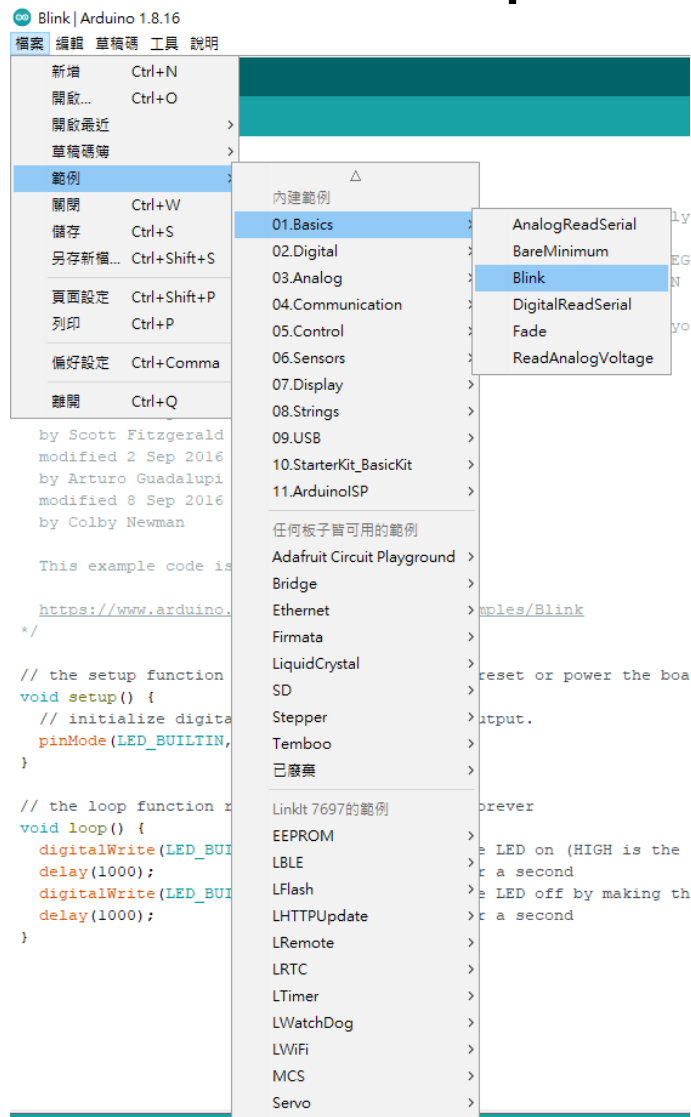
Floating Point Constants

Integer Constants

```
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
```

# sample code

- arduino提供了許多內建的sample code可以供大家參考跟使用



# lab 1-3

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- 讓7696 built in LED在按下built in button時發光,其他時間不發光
- Hint:可以找找看sample code有沒有能用的

# 大綱

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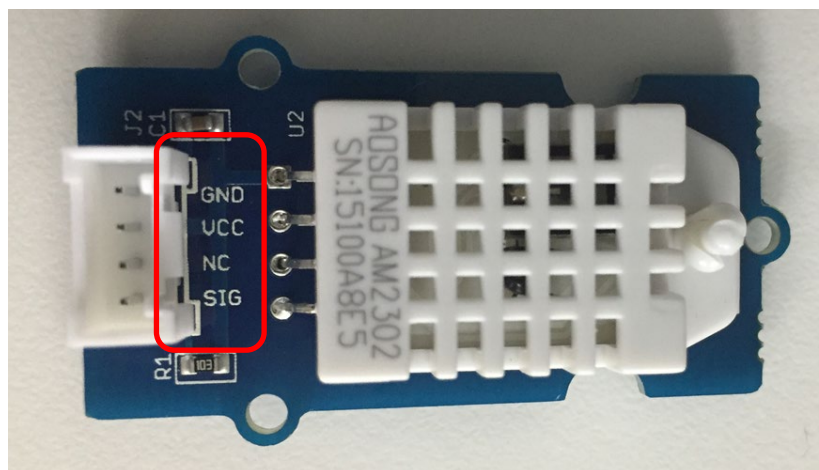
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- lab 1-4:temperature sensor DHT22



# 溫溼度感應器DHT22

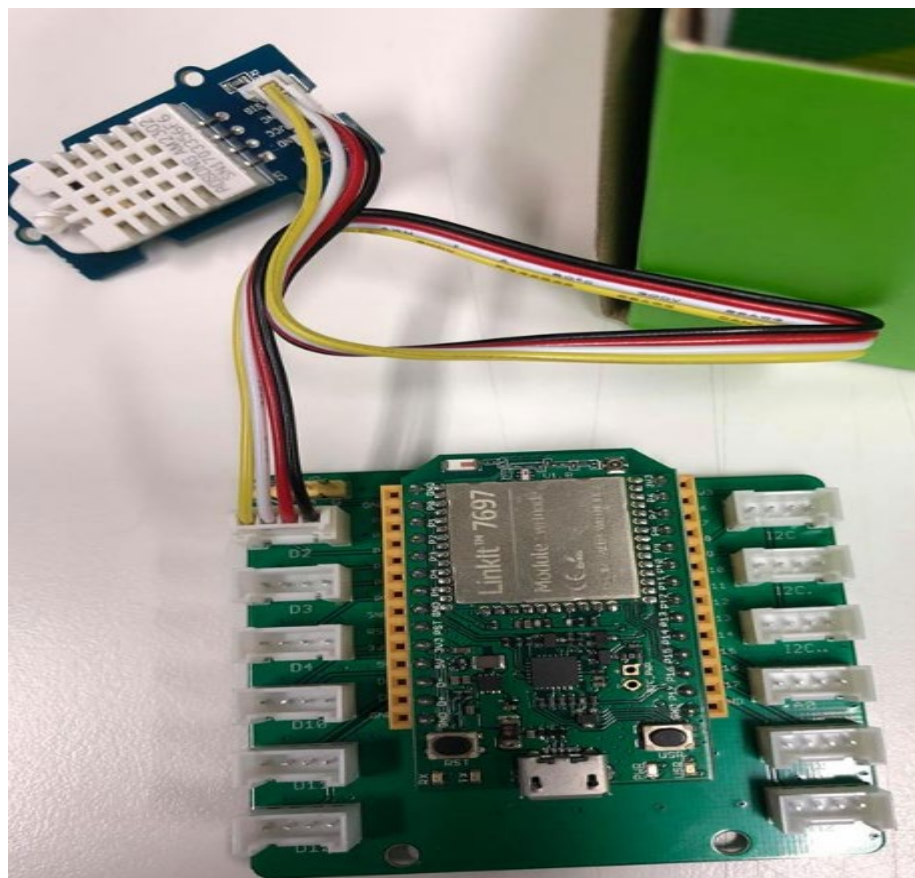
- 溫度 (Temperature)
- 濕度 (Humidity)
- 相對溼度 (Relative Humidity, RH)
- Aosong AM2302 (wired DHT22)
- 請接在Digital Input(GPIO pin)
- data sheet:[連結](#)

NC pin代表no function



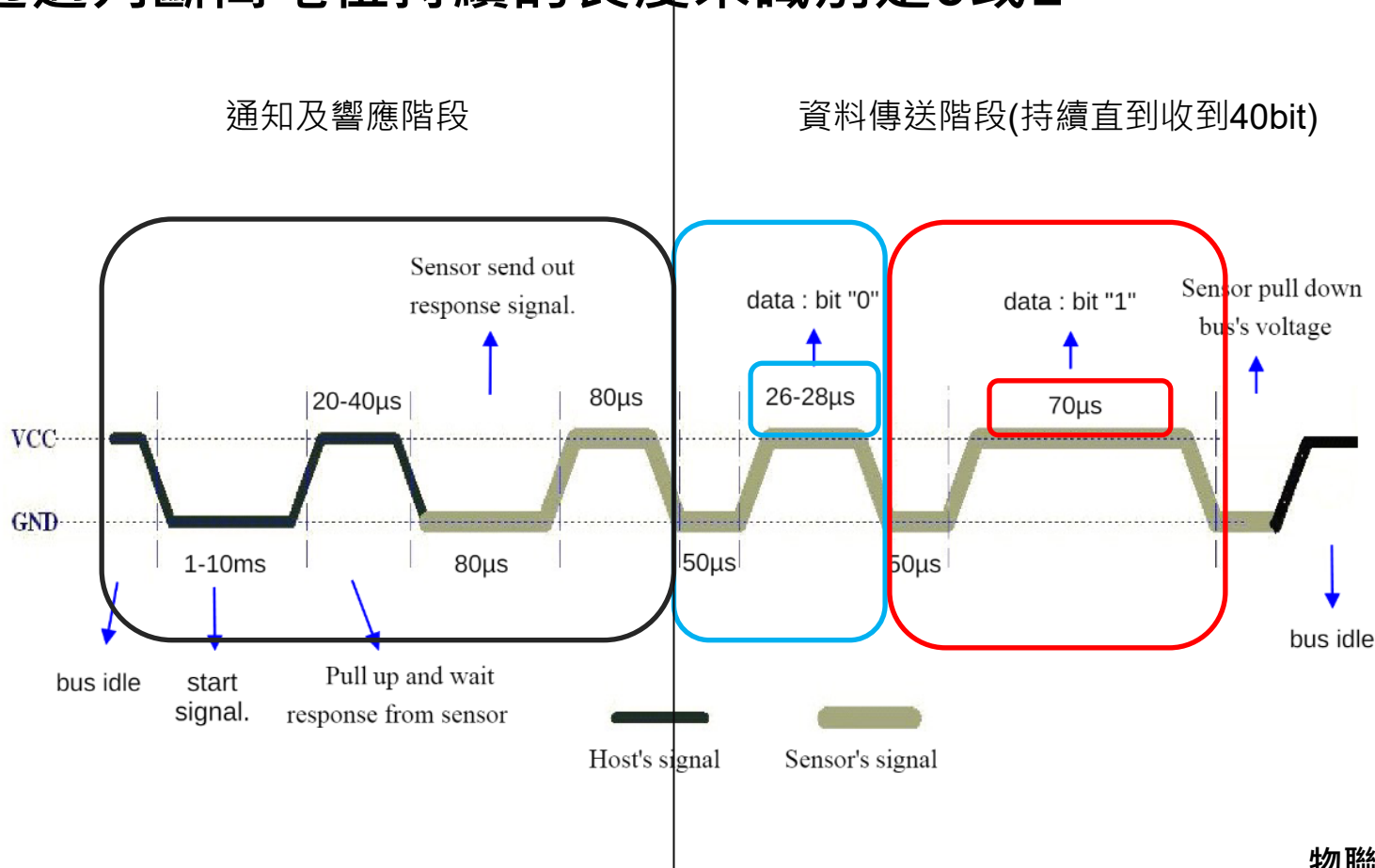
# 溫溼度感應器DHT22

- Linkit 7697組裝(記得組裝方向要正確)
  - 將Linkit 7697 安裝在擴充版上
  - 溫溼度感應器 (連接 D2)



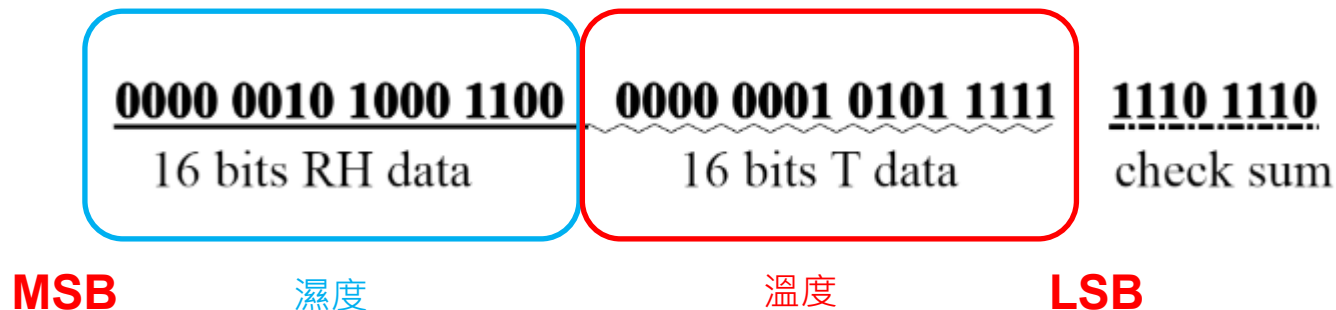
# 資料傳送方式

- 類似UART,但是是透過GPIO的digital port用serial方式傳送
- 透過判斷高電位持續的長度來識別是0或1



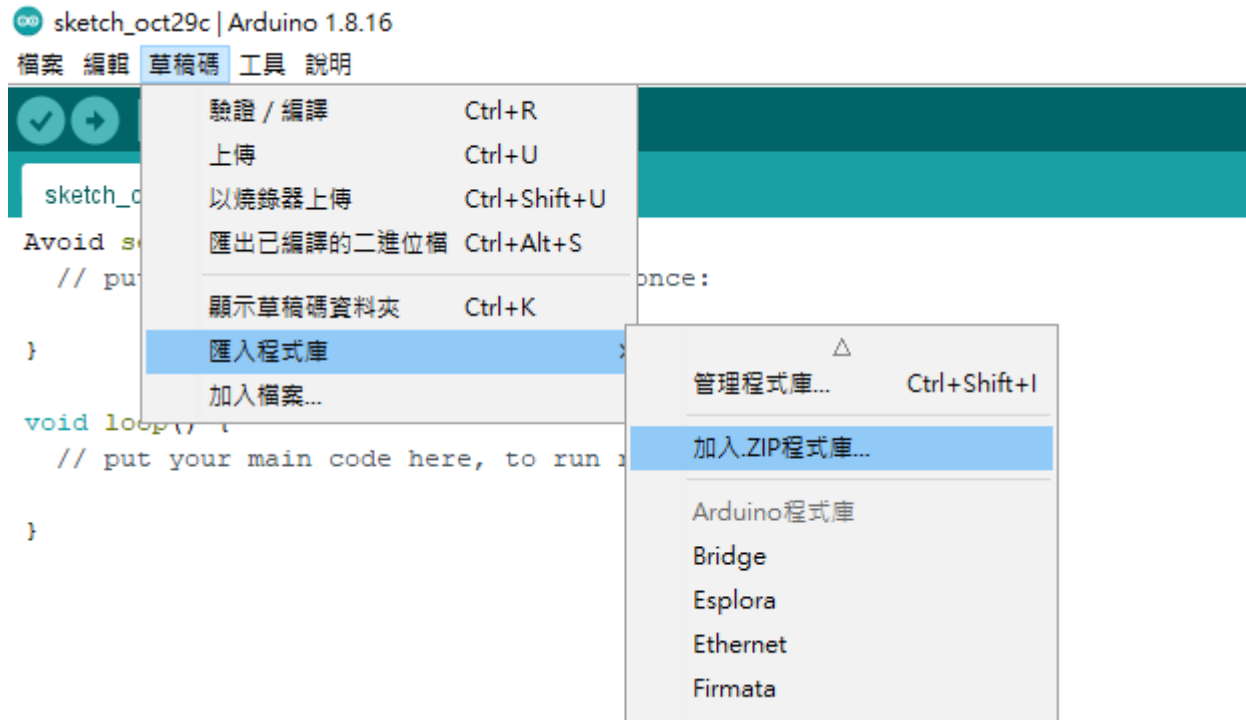
# receive data structure

- 一次傳輸會收到40bit的資料
    - 前16bit:濕度(為實際值乘以10後的值,單位為%)
    - 中間16bit:溫度(為實際值乘以10後的值,單位為攝氏度)
    - 後8bit:checksum,用來檢查是否有傳輸錯誤
- 4  $\text{checksum} = \text{RH}[7:0] + \text{RH}[15:8] + \text{T}[7:0] + \text{T}[15:8]$



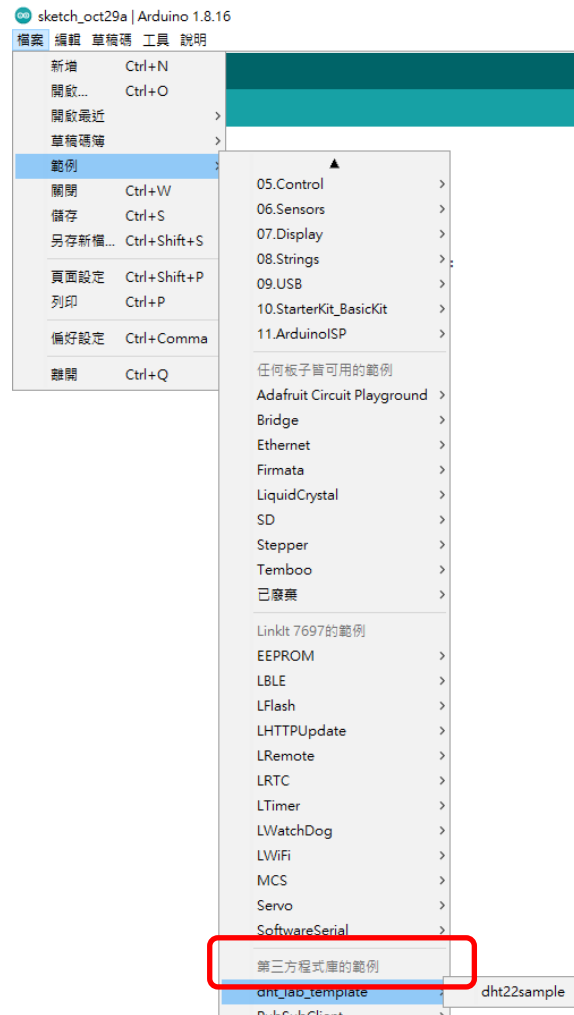
# import library

- 可以使用別人製作的library,避免重複製造輪子
- 點擊草稿碼>匯入程式庫>加入.ZIP程式庫,然後把助教提供的library匯入
- library載點請點我



# extra template

- 多數library都會提供範例code,可以在匯入library後去看一下有沒有範例可以參考



# lab 1-4

- 請修改助教提供的library中的sample code,完成裡面的getHumidity()跟getTemperature() function
- Hint:
  - 如何儲存16bit的數字? 使用int16\_t這個類型
  - 如何快速取出變數的特定位置或區間的bit? bitwise operator
  - 記得最後要除以10.0才是正確的資料

```
bool valid = dht22.readFromSensor();//read data and return whether read success or not
if(!valid) return 0;
```

```
uint64_t rawData = dht22.getRawData();
String rawStr = dht22.getRawStrData();
```

```
//finish the following code to parse the raw byte data of humidity to float
```

會拿到64bit 的raw data(只有後40bit有用,前24bit資料沒有意義)

可以拿到已經幫忙轉成 string 類型的raw data



[illegible]