香港天文台
HONG KONG OBSERVATORY

USER GUIDE

ADVANCED ARDUINO TRAINING

(Exercise: Data Communication)

Version	:	**1.0**
Date	:	**September, 2019**
Prepared by	:	**Jeffrey Chang - Intern (R3/F3)**

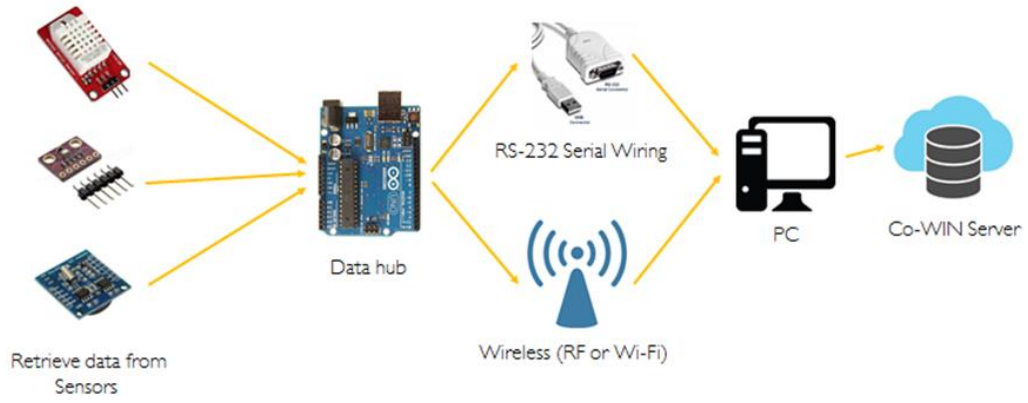
Hong Kong Observatory

TABLE OF CONTENTS

1. INTRODUCTION

Data communication is important in a real-time data monitoring network, for most of the outdoor Automatic Weather Stations, data are transmitted through GPRS (General Packet Radio Service) and 3G to the Cloud server. While the expensive cost and unstable signal receiving add difficulties in network extension, some kinds of new technologies are developed to replace the traditional GPRS and 3G data sending technologies.

Data Flow for Automatic Weather Stations



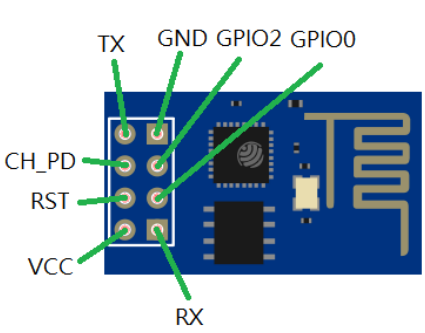
2. WIFI COMMUNICATIONS

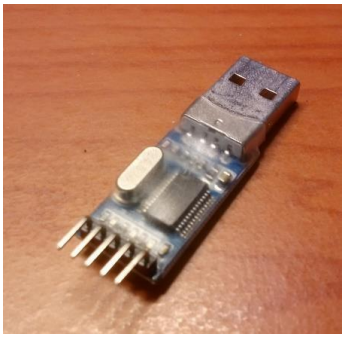
What is WiFi? Wi-Fi is a family of radio technologies commonly used for wireless local area networking (WLAN) of devices. It is based on the IEEE 802.11 family of standards. Wi-Fi technology may be used to provide Internet access to devices that are within the range of a wireless network that is connected to the Internet. The coverage of one or more interconnected access points (hotspots) can extend from an area as small as a few rooms to as large as many square kilometres. Coverage in the larger area may require a group of access points with overlapping coverage.

Many IoT projects nowadays are using Wi-Fi as the communication network, by setting up a WLAN networks, data can be easily transmitting throughout the regions.

i.e. Soil moisture monitoring and plants watering system.
https://www.youtube.com/watch?v=hnVM_9wCTtE
Real-time GPS Tracker using Nodemcu esp8266 “IOT Project”
https://www.youtube.com/watch?v=4UNeRNSSnqQ

3. ESP8266 WIFI MODULE (EXERCISE: THINGSPEAK)



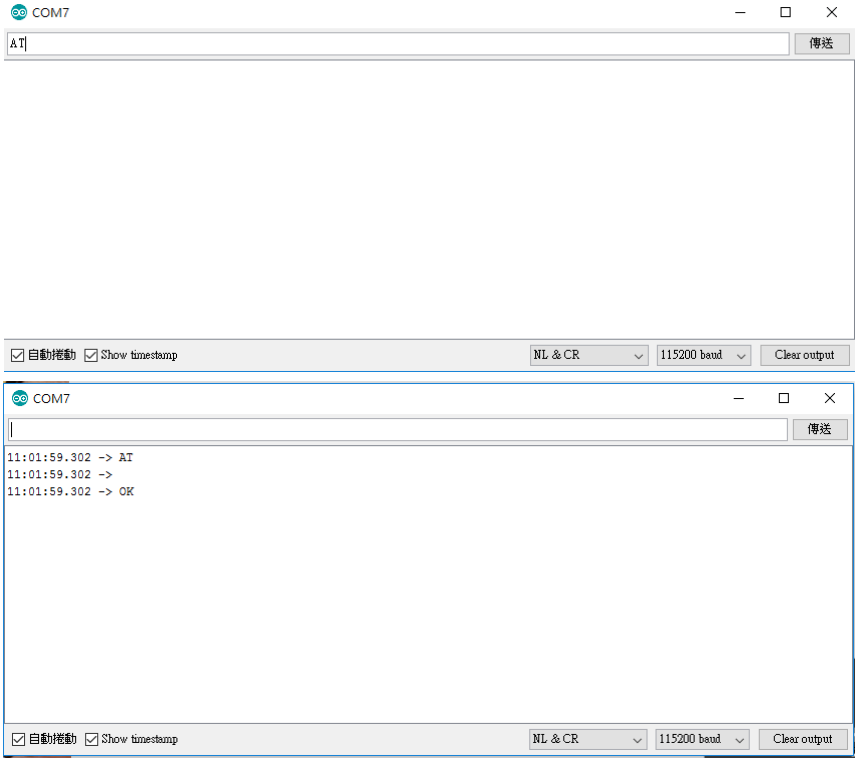


There are in total 8 pins on ESP8266 Wi-Fi modules. In this project, only 5 pins will be used for the connection, including VCC**(3.3V)**, CH_PD, GND, RX, TX. In this exercise, Arduino UNO is highly advised due to the high current availability in UNO module.

3.1 Step 1: Testing of ESP8266 Module

At first, connect the pins with USB to TTL stick and start “Arduino” serial monitor. Set baud rate to 115200 baud and “NL & CR” for the monitor.
(Remarks: Connect TX of ESP8266 to RX of UNO and vice versa)

➔ Type “AT” in the sending bar, and “OK” will be received if the connection is success.



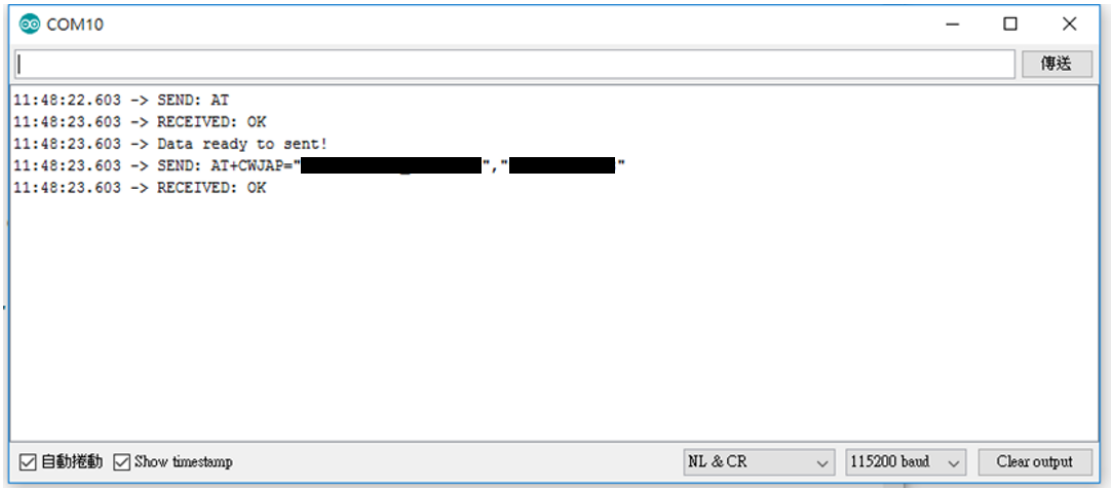
3.2 Step 2: Connect ESP8266 with Arduino UNO

RX pin of ESP8266 → UNO pin 4
TX pin of ESP8266 → UNO pin 5
VCC & CH_PD → UNO 3.3V
GND → UNO GND

```
//*-- IoT Information
#define SSID "xxxxx" //Fill in your WiFi SSID
#define PASS "xxxxx" //Fill in your WiFi password
```

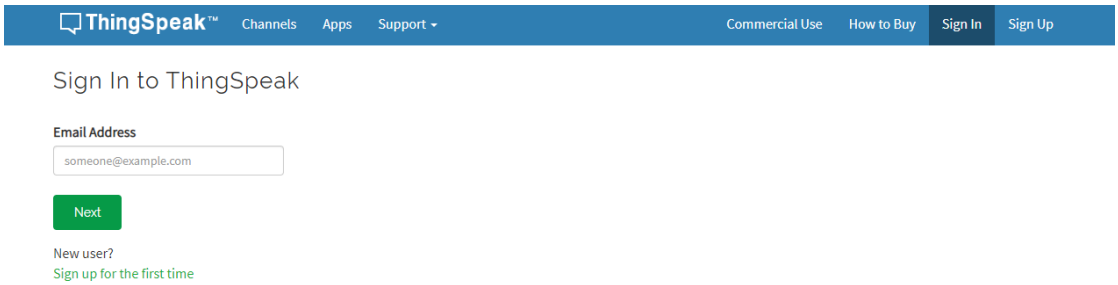
Download ***WiFi_ESP8266_ConnectWiFi.ino*** from Co_WIN Github's **Train-the-Trainer-Materials** repository: https://github.com/hkocowin/Train-the-Trainer-Materials

Compile ***WiFi_ESP8266_ConnectWiFi.ino*** with UNO and open serial monitor.
If the Wi-Fi successfully connected, "RECEIVED: OK" will show on monitor, else "NO RESPONSE" will be received.

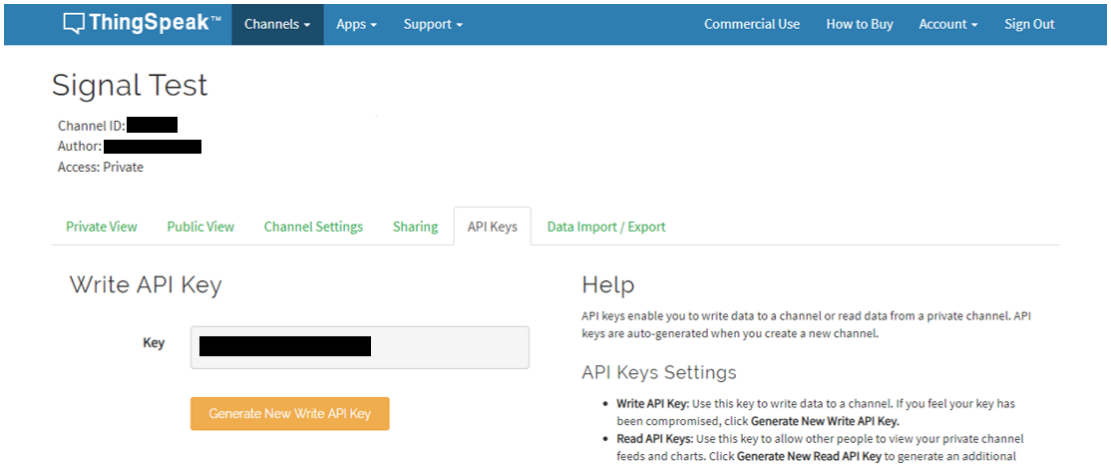


3.3 Step 3: Create Free ThingSpeak Account

Access to ThingSpeak webpage to create a new account for your data upload.
https://thingspeak.com/login



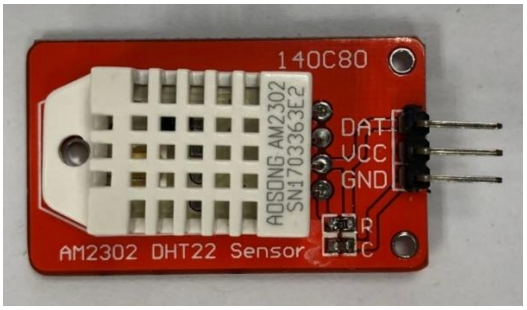
After creating your own account, you will receive a channel ID and an API key. The API Key will be used for your data upload through ESP8266 to the internet.



3.4 Step 4: Connect DHT22 to the system

As the same exercise did in Basic Arduino User Guide, connect the DHT22 temperature and humidity sensor to Arduino UNO board.

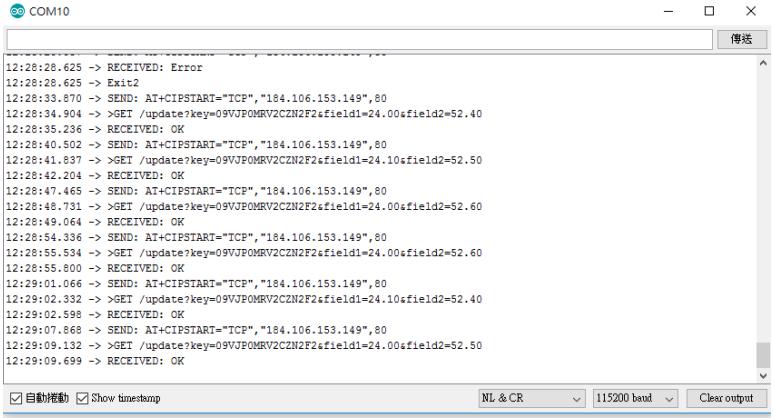
GND → UNO GND
VCC → UNO 3.3V
DAT → UNO A0



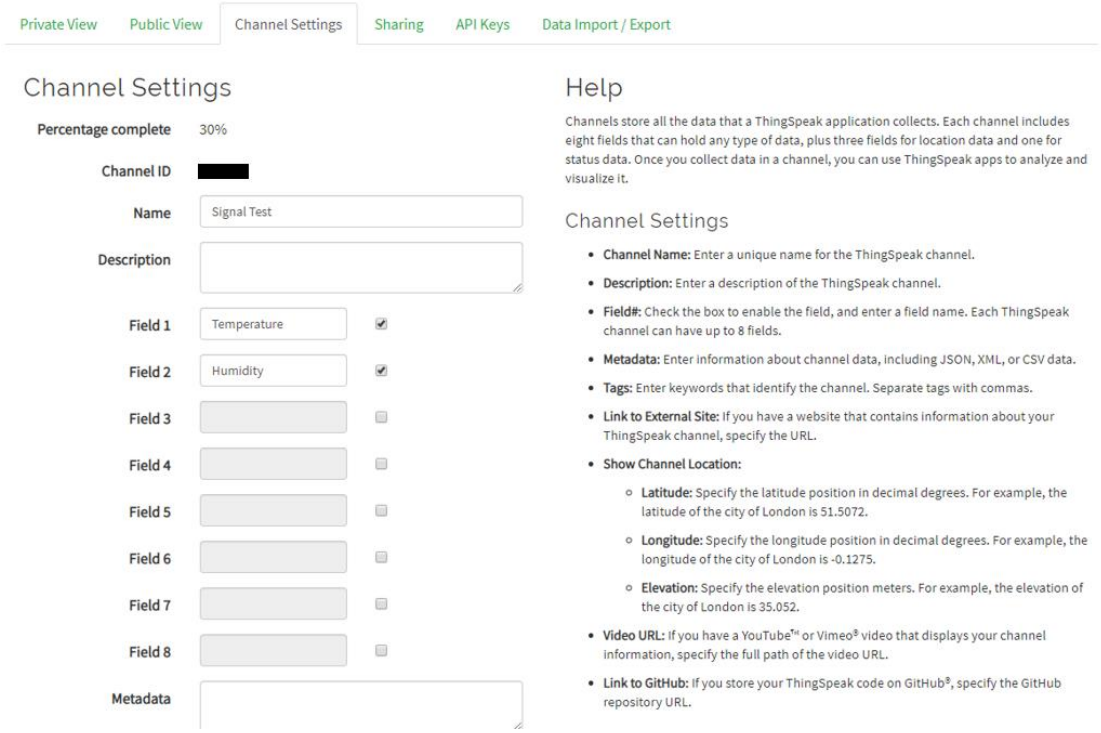
3.5 Step 5: Upload sensors data to ThingSpeak

Download ***WiFi_ESP8266_ThingSpeak.ino*** from Co_WIN Github's **Train-the-Trainer-Materials** repository: https://github.com/hkocowin/Train-the-Trainer-Materials

Compile ***WiFi_ESP8266_ThingSpeak.ino*** with UNO and open serial monitor.
If data sending success, "SEND: AT+CIPSTART=……" will be shown, and HTTP GET command will execute to push the data to ThingSpeak's server. While if error exist in data sending process, "RECEIVED: Error" will be shown.



Once the data successfully pushed to the server, go the "Channel Settings" in ThingSpeak to tick and enter the column title for receiving data.



After selecting the columns, data will be automatically plotted on the charts.