



# **USER GUIDE**

## **ADVANCED ARDUINO TRAINING**

### **(Exercise: Data Communication)**

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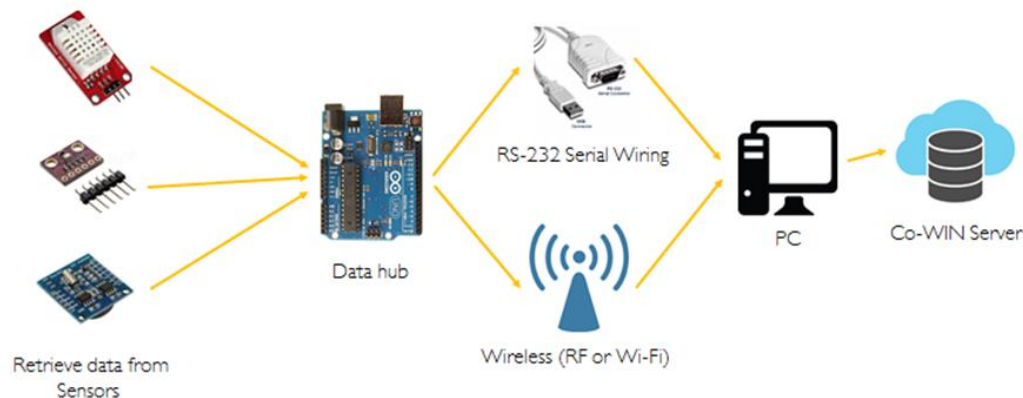
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## **1. INTRODUCTION**

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.

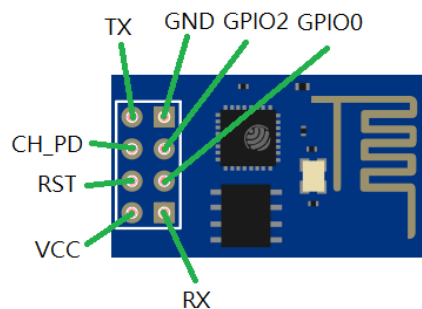
Many IoT projects nowadays are using Wi-Fi as the communication network, by setting up a WLAN networks, data can be easily transmitting throughout the regions. i.e. Soil moisture monitoring and plants watering system.

[https://www.youtube.com/watch?v=hnVM\\_9wCTtE](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)



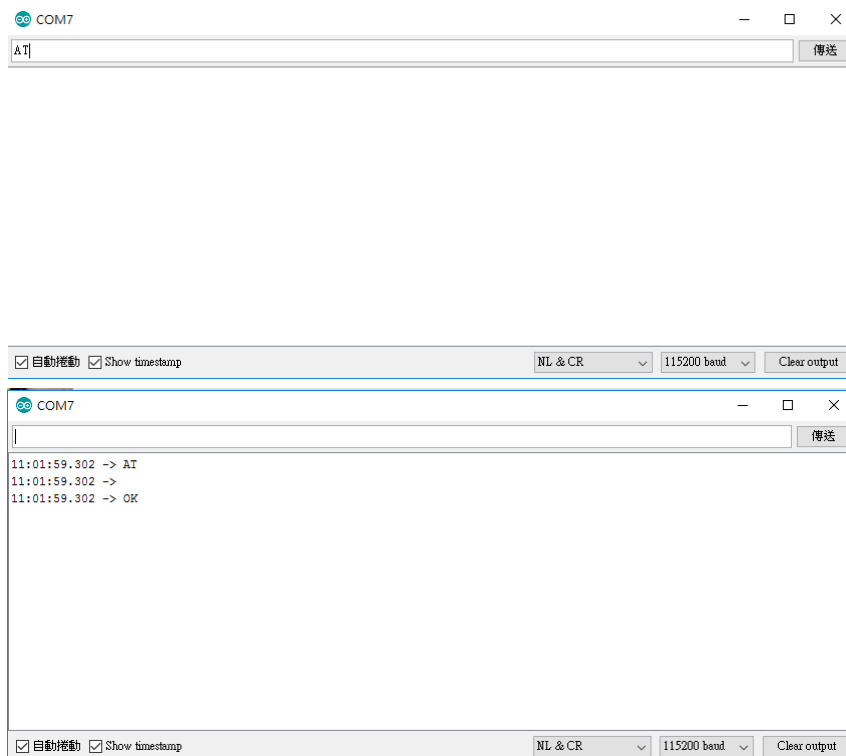
There are in total 8 pins on ESP8266 Wi-Fi modules. In this project, only 5 pins will be used for the connection, including VCC(**3.3V**), CH\_PD, GND, RX, TX. In this exercise, Arduino UNO is highly advised due to the high current availability in UNO module.

#### 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

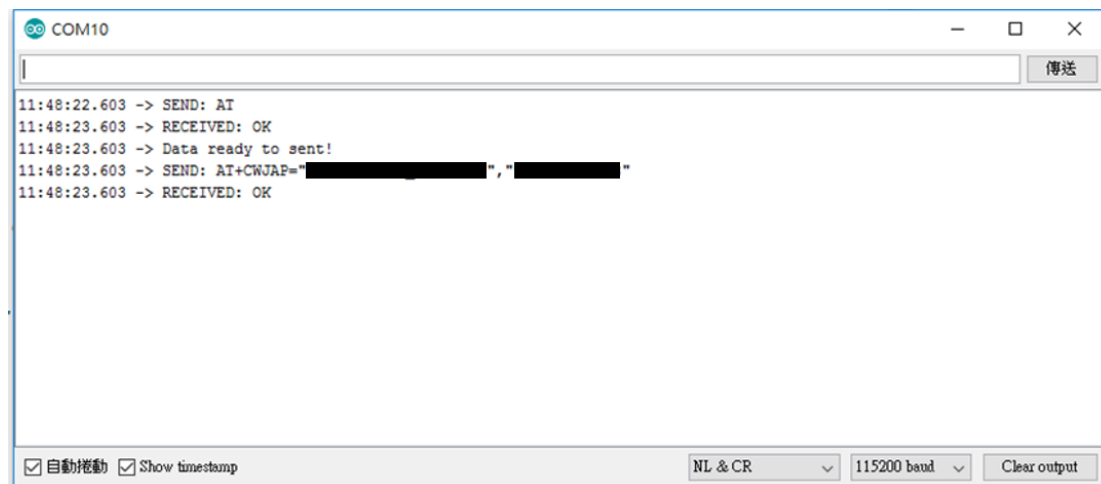
```
/*-- IoT Information
```

```
#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>

ThingSpeak™ Channels Apps Support ▾ Commercial Use How to Buy Sign In Sign Up

Sign In to ThingSpeak

Email Address  
someone@example.com

Next

New user?  
[Sign up for the first time](#)

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.

ThingSpeak™ Channels ▾ Apps ▾ Support ▾ Commercial Use How to Buy Account ▾ Sign Out

Signal Test

Channel ID: [REDACTED]  
Author: [REDACTED]  
Access: Private

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

Write API Key

Key [REDACTED]

Generate New Write 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

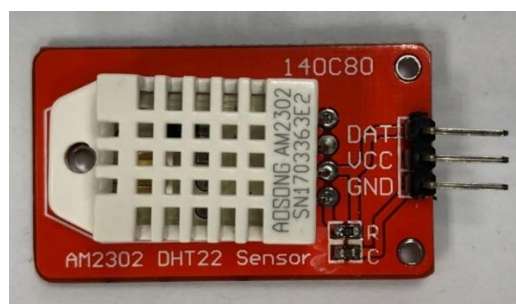
### 3.4 Step 4: Connect DHT22 to the system

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

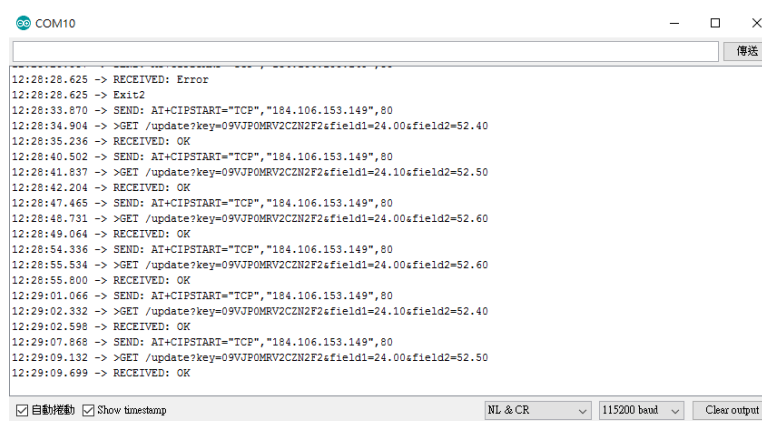
DAT → UNO A0



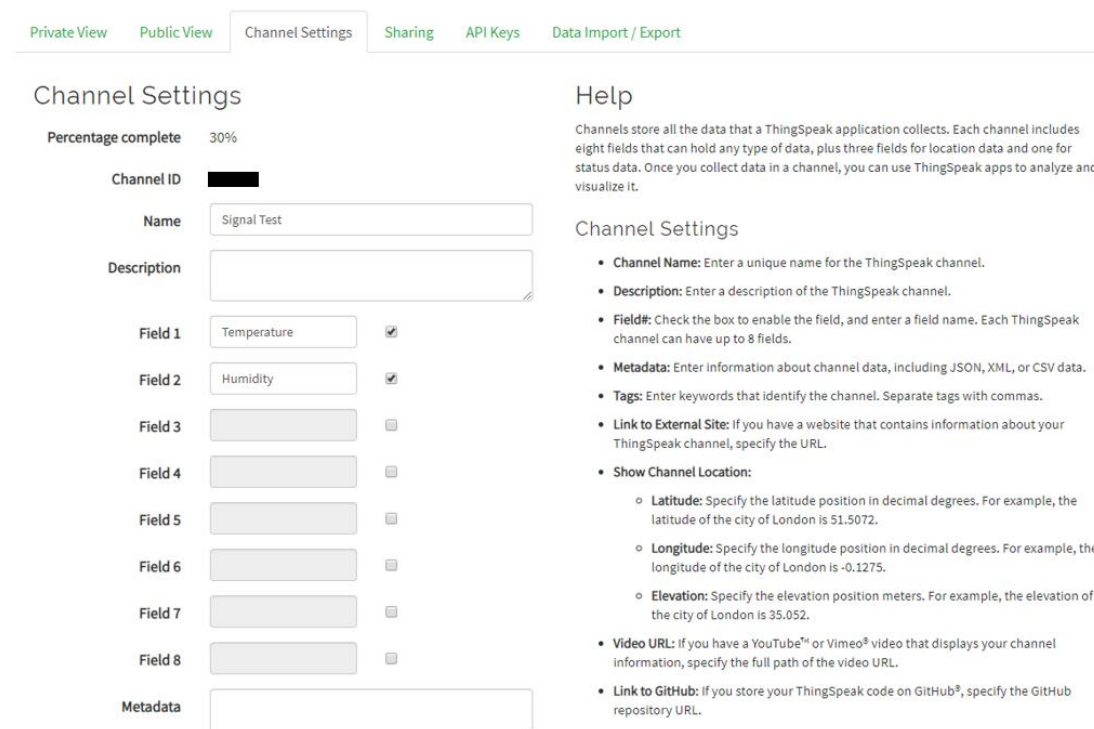
### 3.5 Step 5: Upload sensors data to ThingSpeak

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.

Private View

Public View

Channel Settings

Sharing

API Keys

Data Import / Export

Add Visualizations

Add Widgets

Export recent data

MATLAB Analysis

MATLAB Visualization

Channel 2 of 2 < >

Channel Stats

Created: 2 months ago  
Last entry: less than a minute ago  
Entries: 14

