



# 物聯網連結智慧生活 環境監控與智慧家電的開發與應用

報告者：曹永忠（曹建國）

@TCN創客基地

日期：2021年8月14日



# 大綱

- 前言
- 環境監控
- 環境監控平台
- 分散式顯示裝置開發
- Ameba空氣盒子
- ESP32智慧燈泡
- 日光燈源開發
- 虛擬開關
- 結論



# 環境監控



## 實施場域

- 台中市清水區吳厝國小
- 新北市新店區新和國小



# 新和國小 氣象監控站

# 材料清單

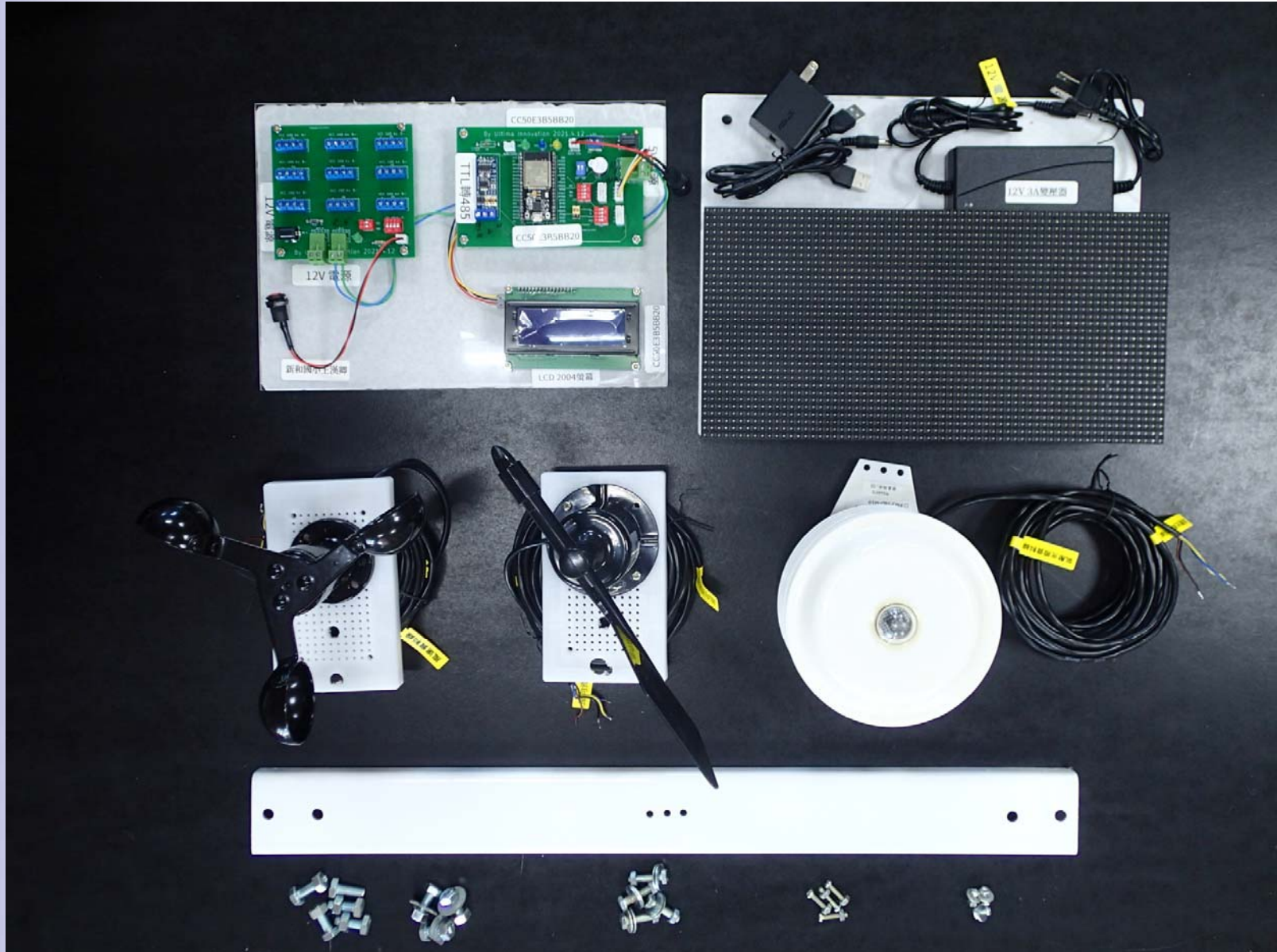




# 安裝地點

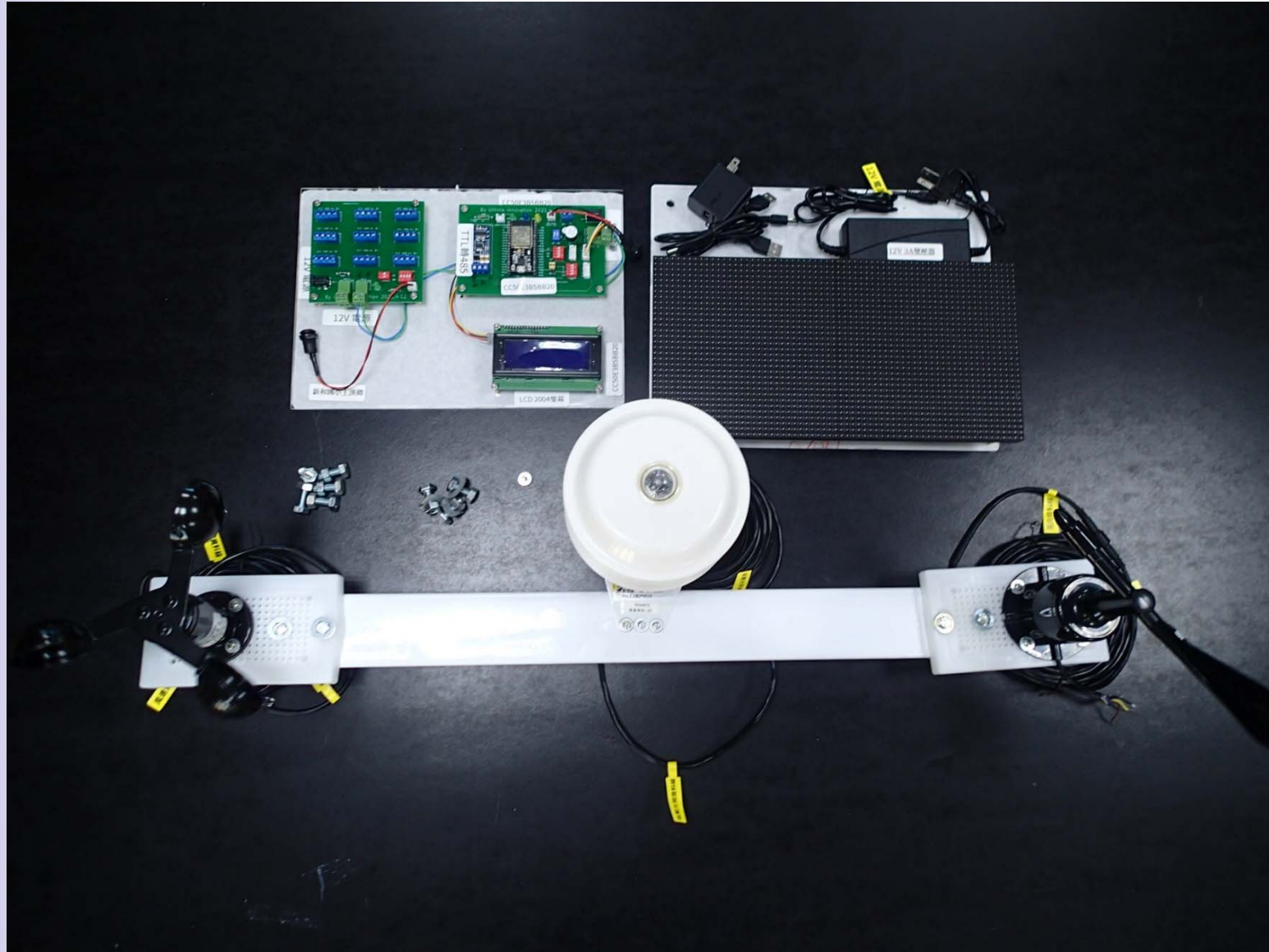


# 感測器組立





# 感測器組立



# 感測器組立



# 感測器組立





# 感測器組立





# 感測器組立

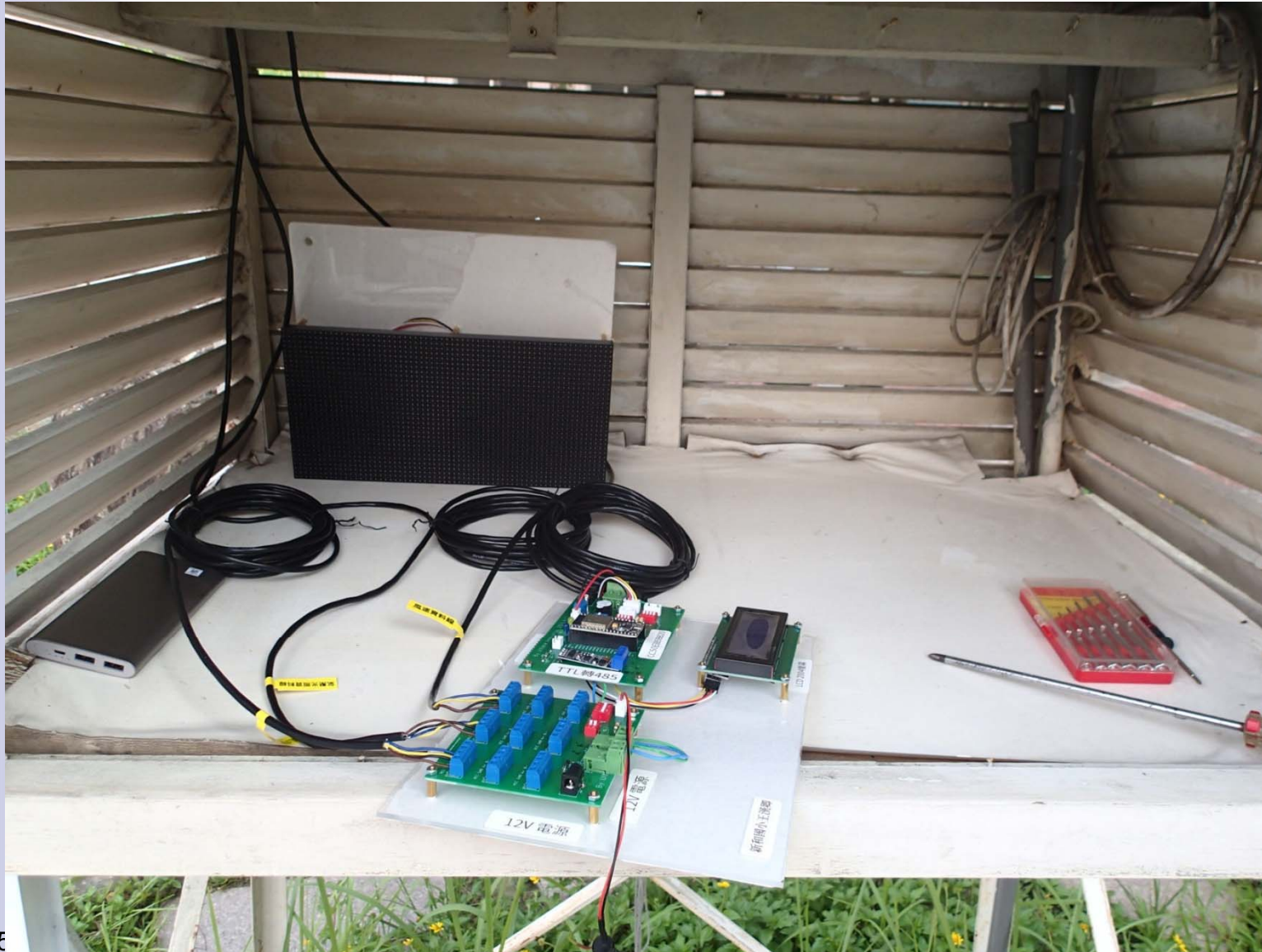




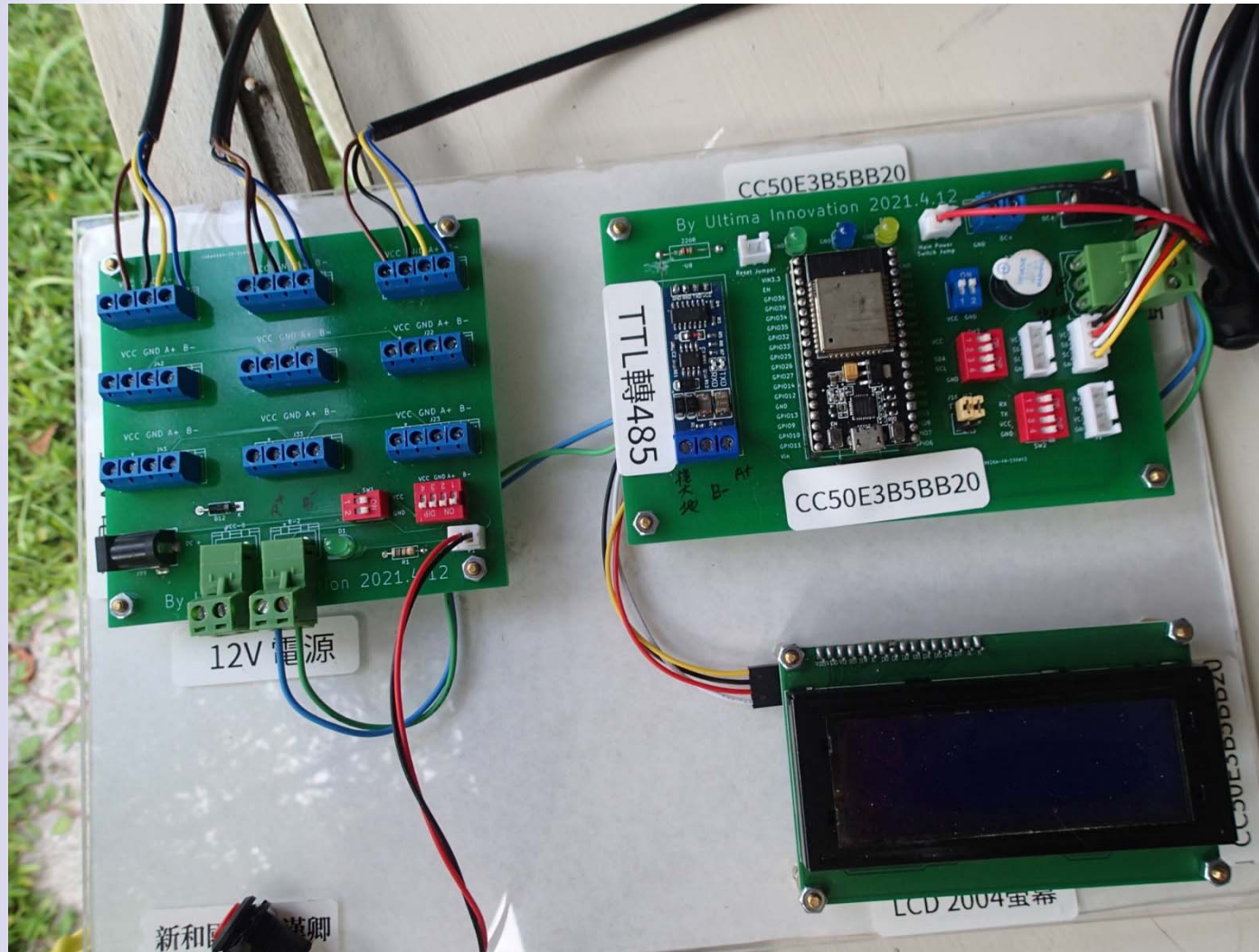
# 感測器組立



# 感測器組立

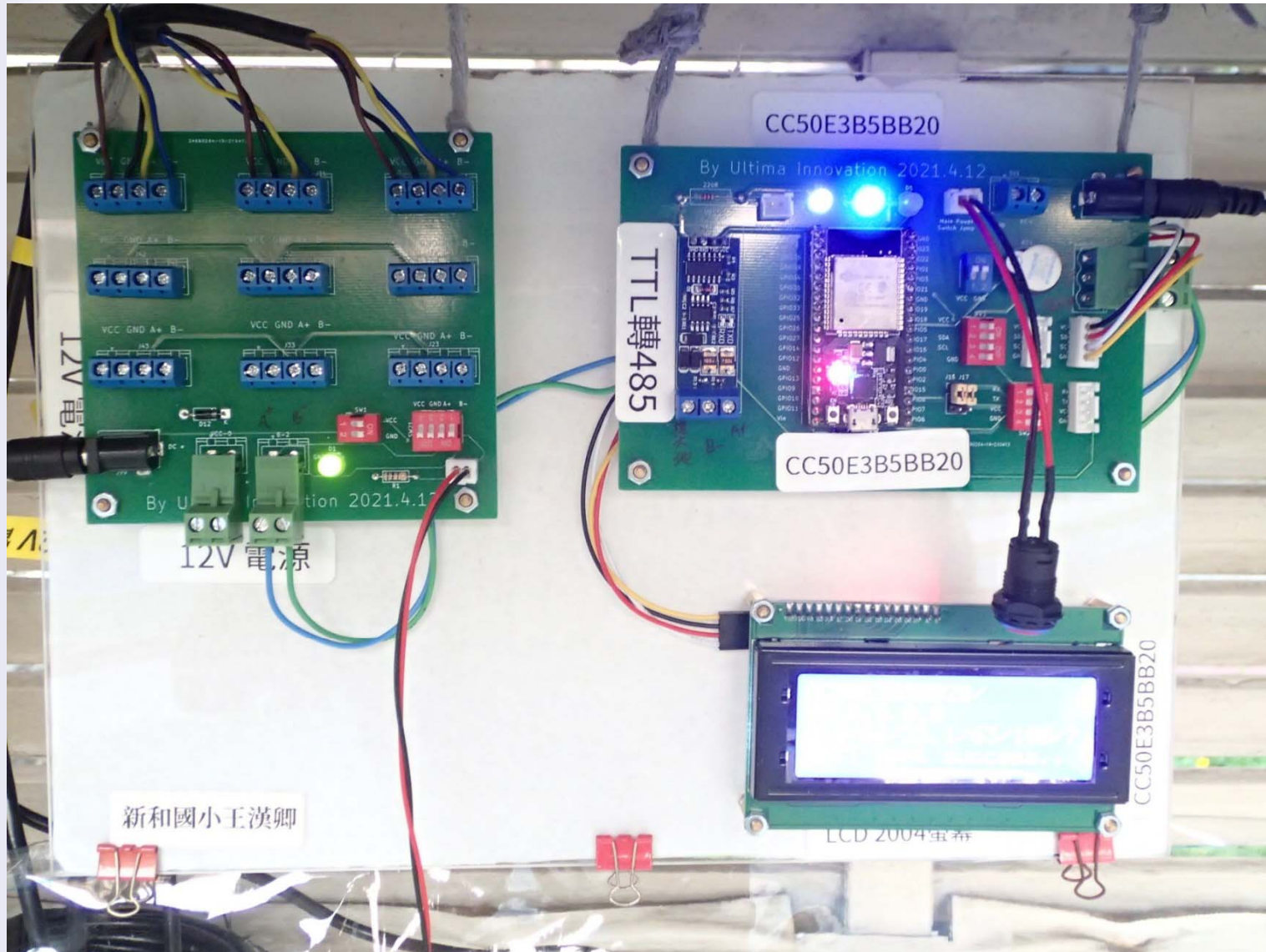


# 感測器組立

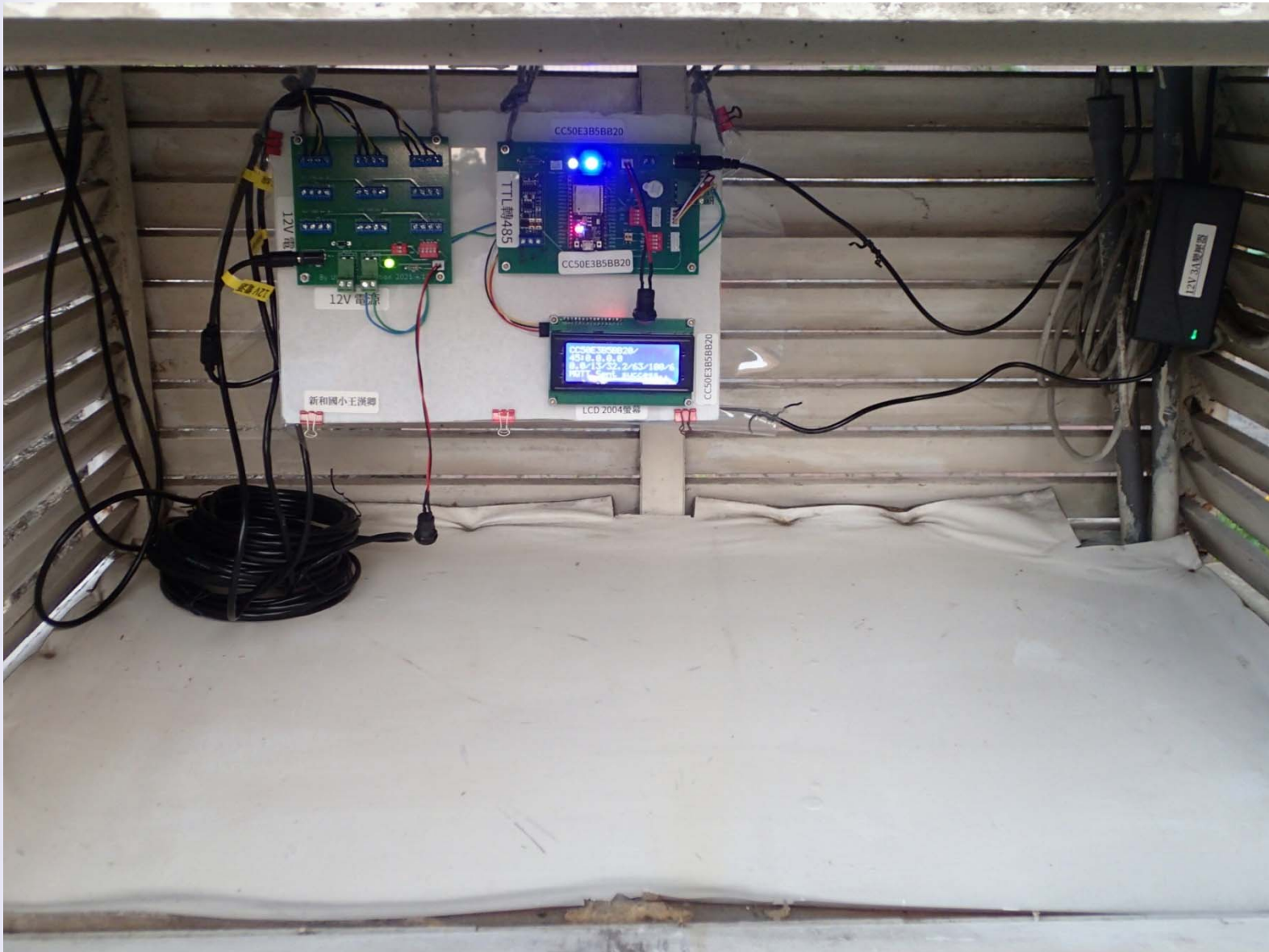




# 感測器組立



# 感測器組立





# 感測器組立





# 感測器組立





# 感測器組立





# 運轉影片





# 長官處裝置顯示器





# 長官處裝置顯示器







# 長官處裝置顯示器





# 測試顯示裝置



# 公眾裝置



# 顯示學校



# 資訊站顯示



# 溫度顯示



# 濕度顯示



# 亮度顯示





# 風向顯示



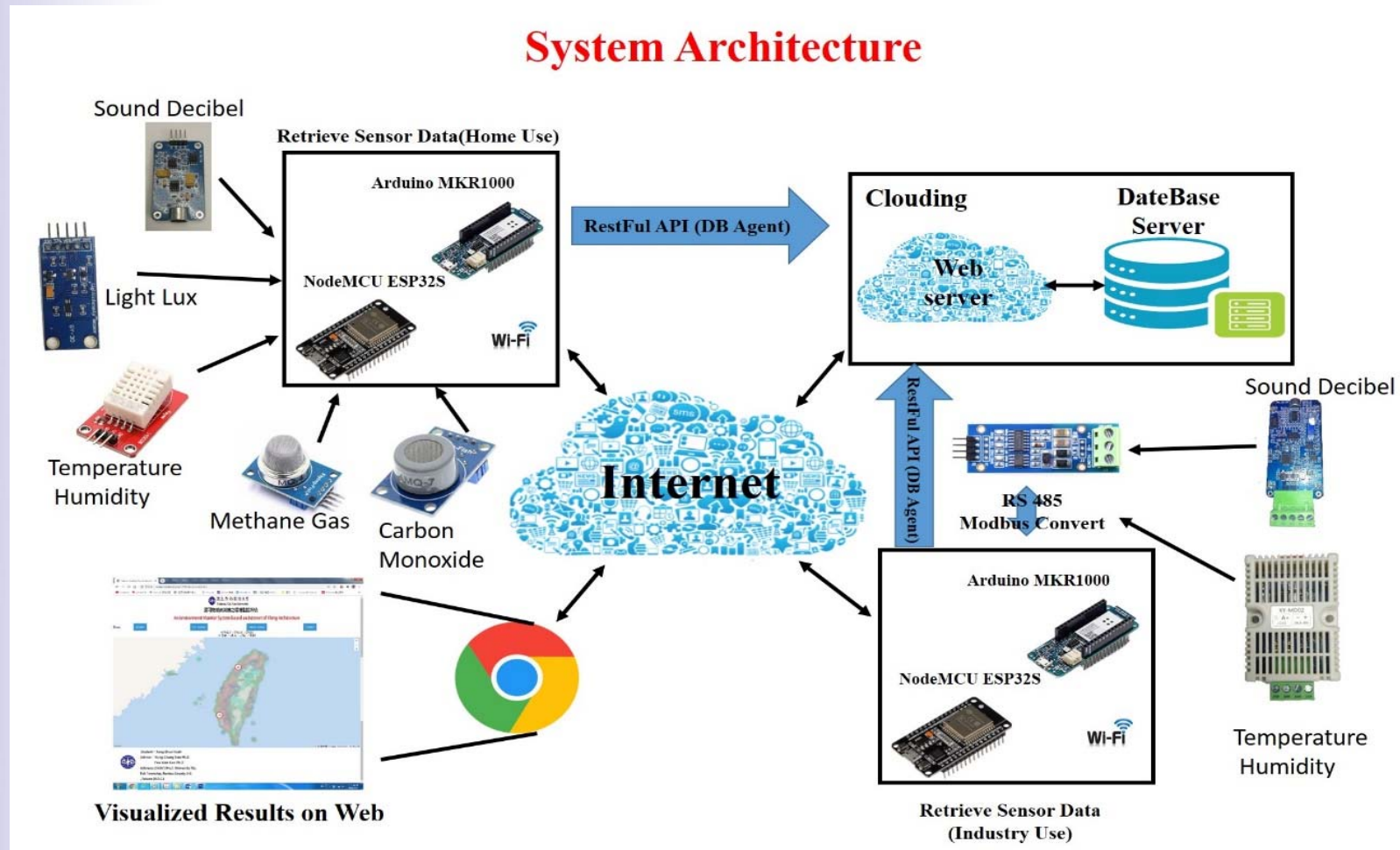
# 氣壓顯示





# 環境監控平台

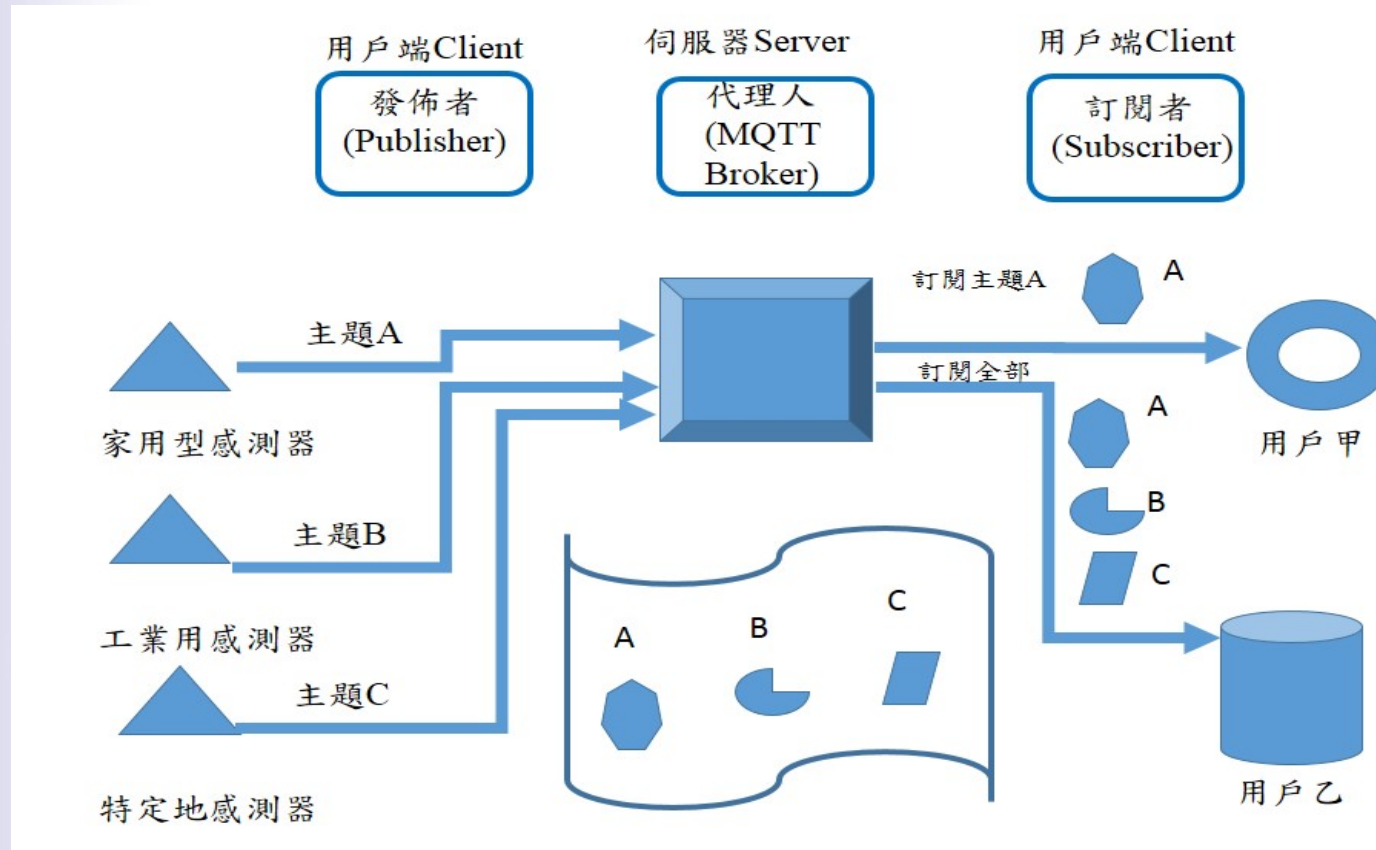
# 物聯網為基礎之系統架構



系統實體架構圖

資料來源: 本研究整理

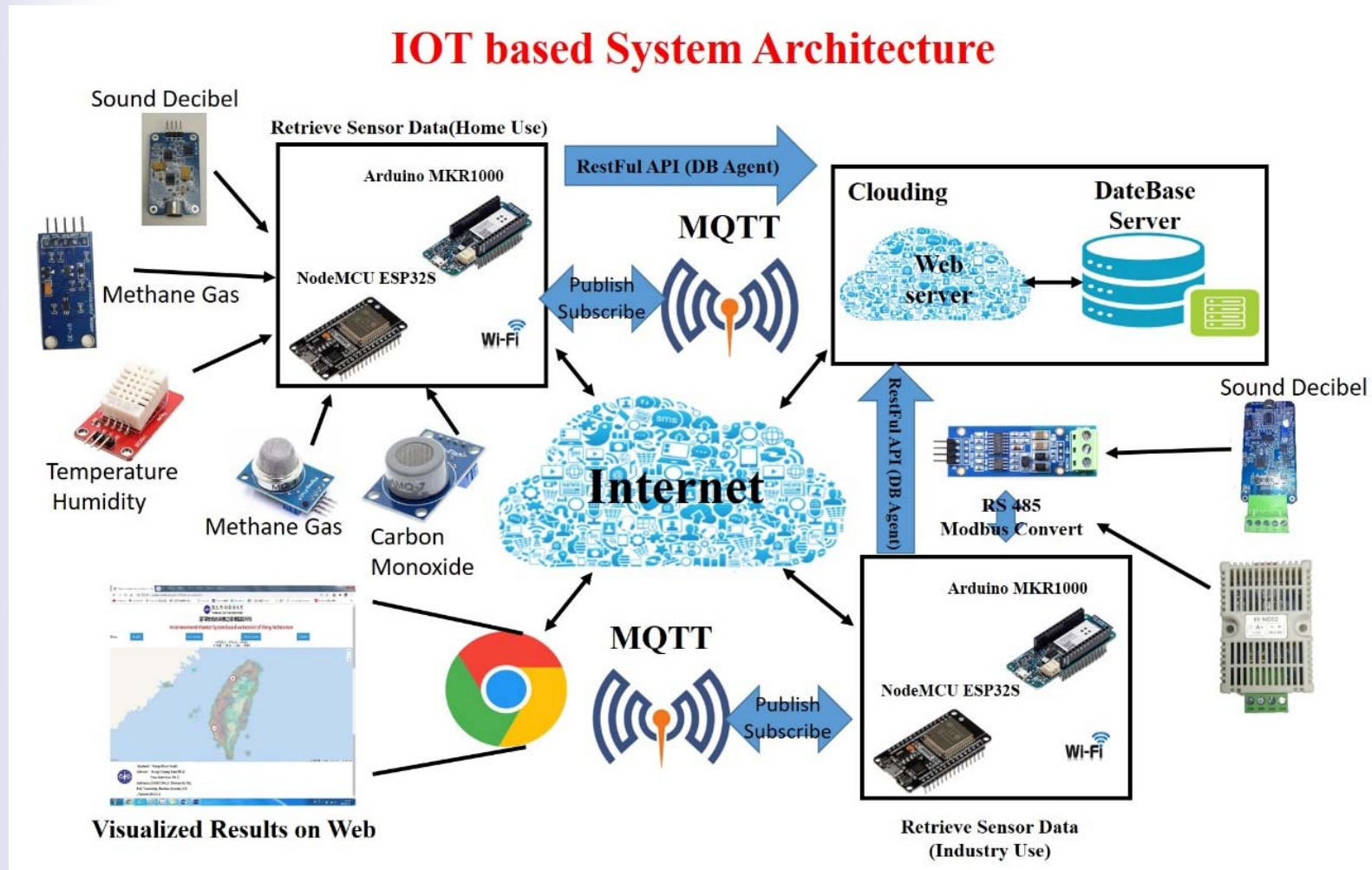
# 物聯網為基礎之系統架構



MQTT運作示意圖 資料來源: 本研究整理

# 物聯網為基礎之系統架構

## IOT based System Architecture



物聯網為基礎之系統架構圖

資料來源: 本研究整理



# 系統展示

- 監控系統平台首頁
- 系統功能選項
- 工業型裝置選項
- 家用型裝置選項

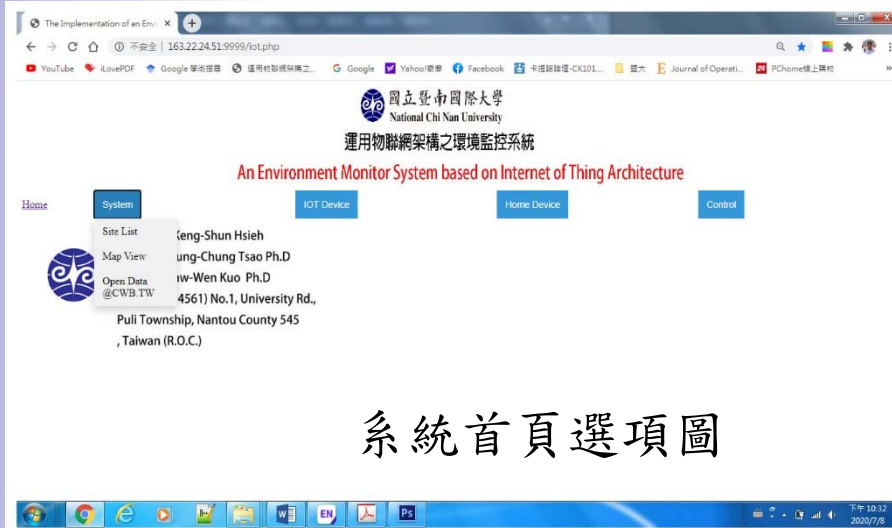
# 監控系統平台首頁

The screenshot shows a web browser window with the following content:

- Browser address bar: [ncnu.arduino.org.tw:9999/iot.php](http://ncnu.arduino.org.tw:9999/iot.php)
- Navigation menu: Home, System, IOT Device, Home Device, Control
- Text content:
  - 國立暨南國際大學  
National Chi Nan University
  - 運用物聯網架構之環境監控系統
  - An Environment Monitor System based on Internet of Thing Architecture
  - Student : Keng-Shun Hsieh
  - Advisor : Yung-Chung Tsao Ph.D  
Yaw-Wen Kuo Ph.D
  - Address:(54561) No.1, University Rd.,  
Puli Township, Nantou County 545  
, Taiwan (R.O.C.)



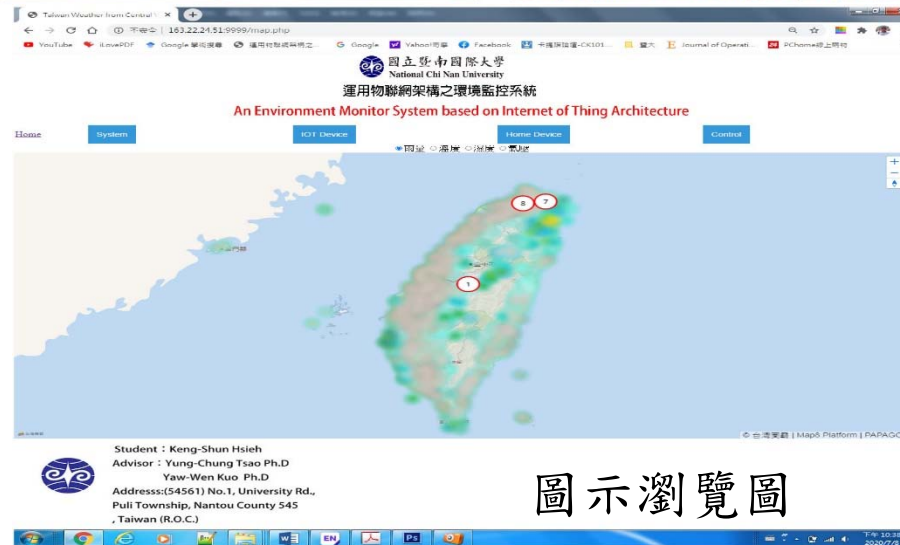
# 系統功能選項



系統首頁選項圖

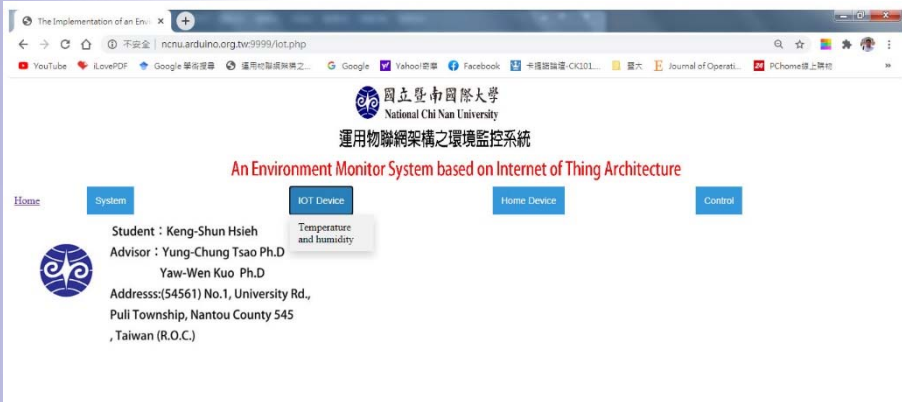


監控站台建置列示圖

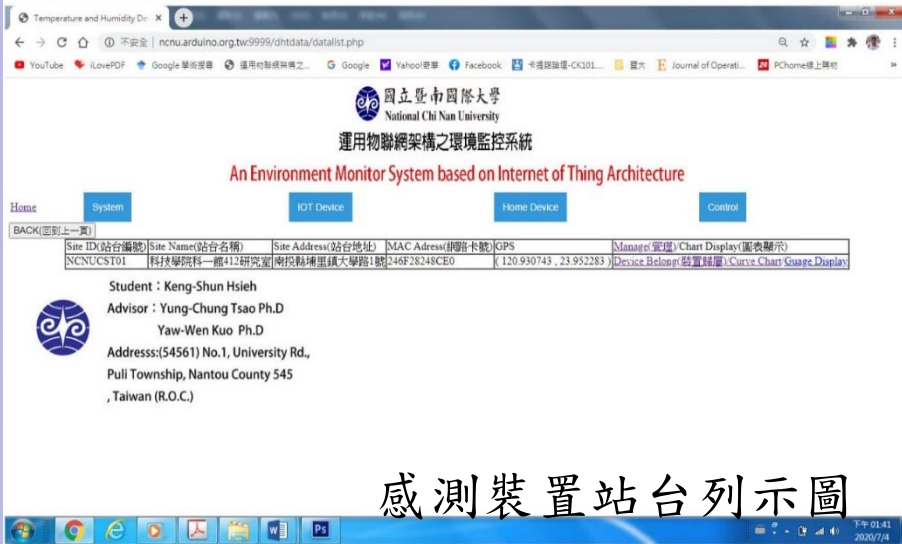


圖示瀏覽圖

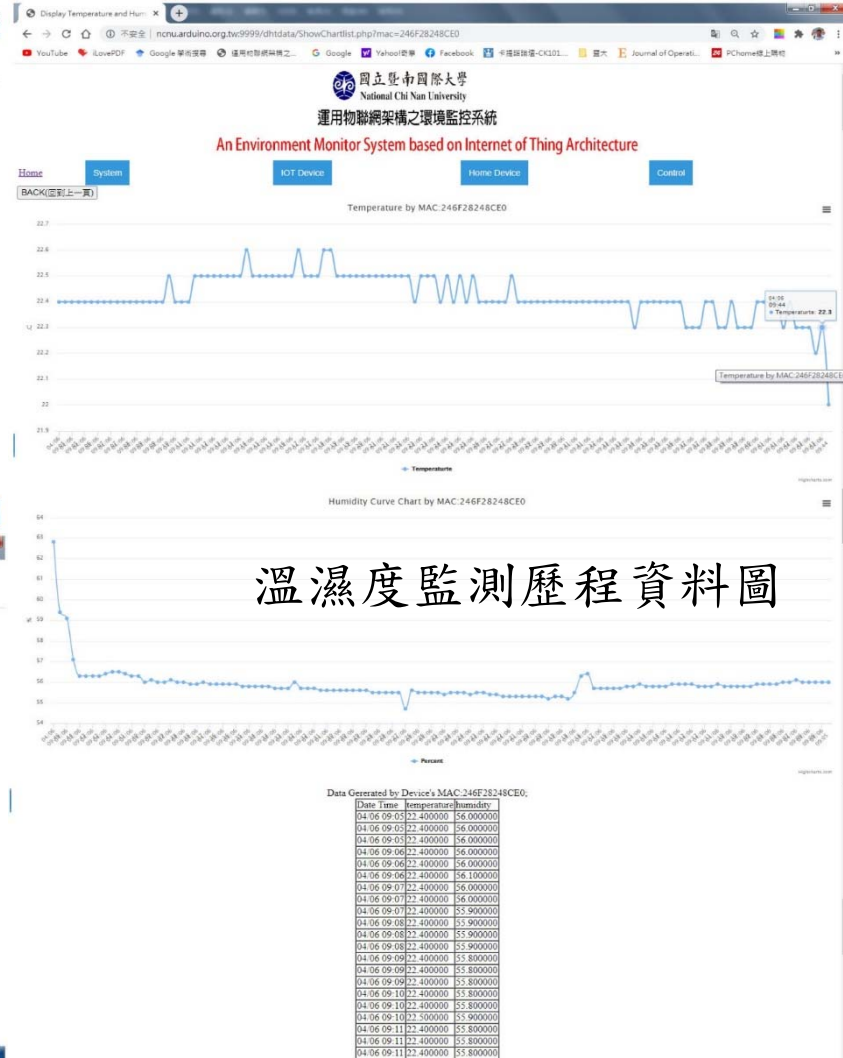
# 工業型裝置選項



工業型裝置首頁選項圖



感測裝置站台列示圖



溫濕度監測歷程資料圖

# 工業型裝置選項

04/08/09/11/22/400000	55/800000
04/08/09/12/22/500000	55/900000
04/08/09/13/22/500000	55/900000
04/08/09/14/22/500000	55/900000
04/08/09/15/22/500000	55/900000
04/08/09/16/22/500000	55/900000
04/08/09/17/22/500000	55/900000
04/08/09/18/22/500000	55/800000
04/08/09/19/22/500000	55/800000
04/08/09/20/22/500000	55/800000
04/08/09/21/22/500000	55/800000
04/08/09/22/22/500000	55/800000
04/08/09/23/22/500000	55/800000
04/08/09/24/22/500000	55/800000
04/08/09/25/22/500000	55/800000
04/08/09/26/22/500000	55/800000
04/08/09/27/22/500000	55/800000
04/08/09/28/22/500000	55/800000
04/08/09/29/22/500000	55/800000
04/08/09/30/22/500000	55/800000
04/08/09/31/22/500000	55/800000
04/08/09/32/22/500000	55/800000
04/08/09/33/22/500000	55/800000
04/08/09/34/22/500000	55/800000
04/08/09/35/22/500000	55/800000
04/08/09/36/22/500000	55/800000
04/08/09/37/22/500000	55/800000
04/08/09/38/22/500000	55/800000
04/08/09/39/22/500000	55/800000
04/08/09/40/22/500000	55/800000
04/08/09/41/22/500000	55/800000
04/08/09/42/22/500000	55/800000
04/08/09/43/22/500000	55/800000
04/08/09/44/22/500000	55/800000
04/08/09/45/22/500000	55/800000
04/08/09/46/22/500000	55/800000

Student : Keng-Shun Hsieh  
Advisor : Yung-Chung Tsao Ph.D  
Yaw-Wen Kuo Ph.D  
Address:(54561) No.1, University Rd.,  
Puli Township, Nantou County 545  
, Taiwan (R.O.C.)

## 溫濕度監測歷程資料圖

國立暨南國際大學  
National Chi Nan University  
運用物聯網架構之環境監控系統  
An Environment Monitor System based on Internet of Thing Architecture

Temperature by MAC:246F28248CE0 at 04/06 09:46  
Humidity by MAC:246F28248CE0 at 04/06 09:46

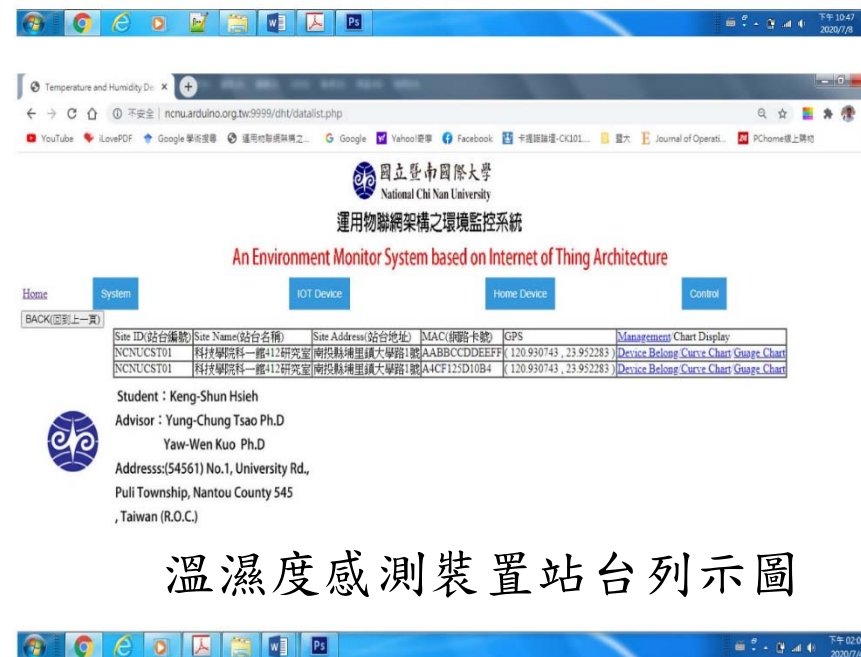
Student : Keng-Shun Hsieh  
Advisor : Yung-Chung Tsao Ph.D  
Yaw-Wen Kuo Ph.D  
Address:(54561) No.1, University Rd.,  
Puli Township, Nantou County 545  
, Taiwan (R.O.C.)

### 溫濕度監測值圖

# 家用型裝置選項-溫濕度

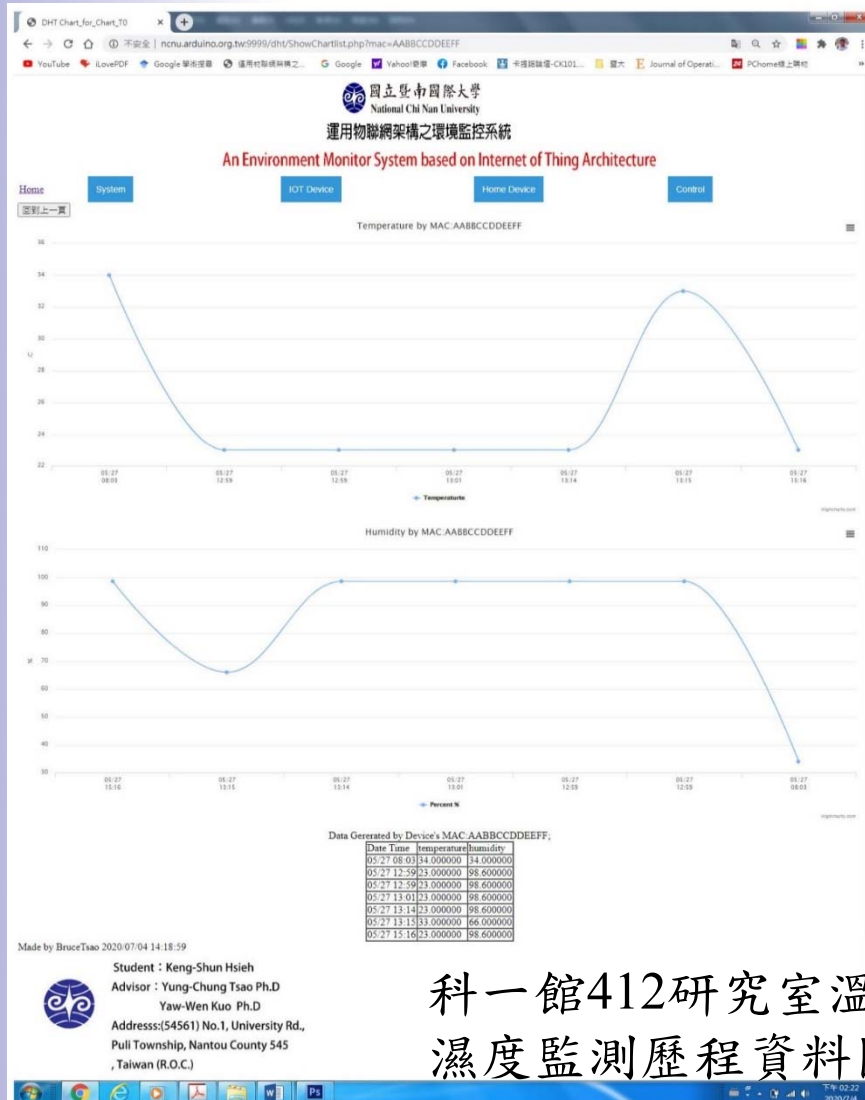


家用型裝置首頁圖



溫濕度感測裝置站台列示圖

# 家用型裝置選項-溫濕度



科一館412研究室溫  
濕度監測歷程資料圖



科一館412研究室監控站台  
溫濕度監測值指針錶表示圖

# 家用型裝置選項-光照度

國立暨南國際大學  
National Chi Nan University  
運用物聯網架構之環境監控系統  
An Environment Monitor System based on Internet of Thing Architecture

Home System IOT Device Home Device Control

Site ID(站台編號)	Site Name(站台名稱)	Site Address(站台地址)	MAC(網路卡號)	GPS	Management Curve Chart
NCNUCST01	材料學研究所一館412研究室	南投縣埔里鎮大學路1號	A4CF125D10B4	( 120.930743, 23.952283 )	<a href="#">Device Belong Curve Chart</a> <a href="#">Gauge Chart</a>
LABOR	新北市勞工大學	新北市三重區新北大道一段9號	4C11AE77F2B8	( 121.498315806, 25.0828540007 )	<a href="#">Device Belong Curve Chart</a> <a href="#">Gauge Chart</a>
KL.SHL1B01	基隆高中國書館	基隆市瑞華區瑞華路20號	246F28A76514	( 121.732934279, 25.1077091798 )	<a href="#">Device Belong Curve Chart</a> <a href="#">Gauge Chart</a>

Student : Keng-Shun Hsieh  
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光照度監測裝置站台列示圖

國立暨南國際大學  
National Chi Nan University  
運用物聯網架構之環境監控系統  
An Environment Monitor System based on Internet of Thing Architecture

Home System IOT Device Home Device Control

Light Lux by MAC:A4CF125D10B4

Light Lux by MAC:A4CF125D10B4

科一館412研究室光照度監測歷程資料圖

Data Generated by Device's MAC: A4CF125D10B4:

Date Time	Light Lux
05/27 15:20	505.830000
05/27 15:21	505.000000
05/27 15:21	504.170000
05/27 15:22	504.170000
05/27 15:22	504.170000
05/27 15:23	500.830000
05/27 15:23	500.830000
05/27 15:24	506.670000
05/27 15:25	506.670000
05/27 15:25	501.670000
05/27 15:26	507.500000
05/27 15:26	506.670000
05/27 15:27	503.830000
05/27 15:27	503.330000
05/27 15:29	503.830000
05/27 15:29	503.830000
05/27 15:30	503.830000
05/27 15:30	503.830000
05/27 15:31	503.830000
05/27 15:31	503.000000
05/27 15:32	503.830000
05/27 15:32	503.830000
05/27 15:33	507.500000
05/27 15:33	501.670000

# 家用型裝置選項-光照度

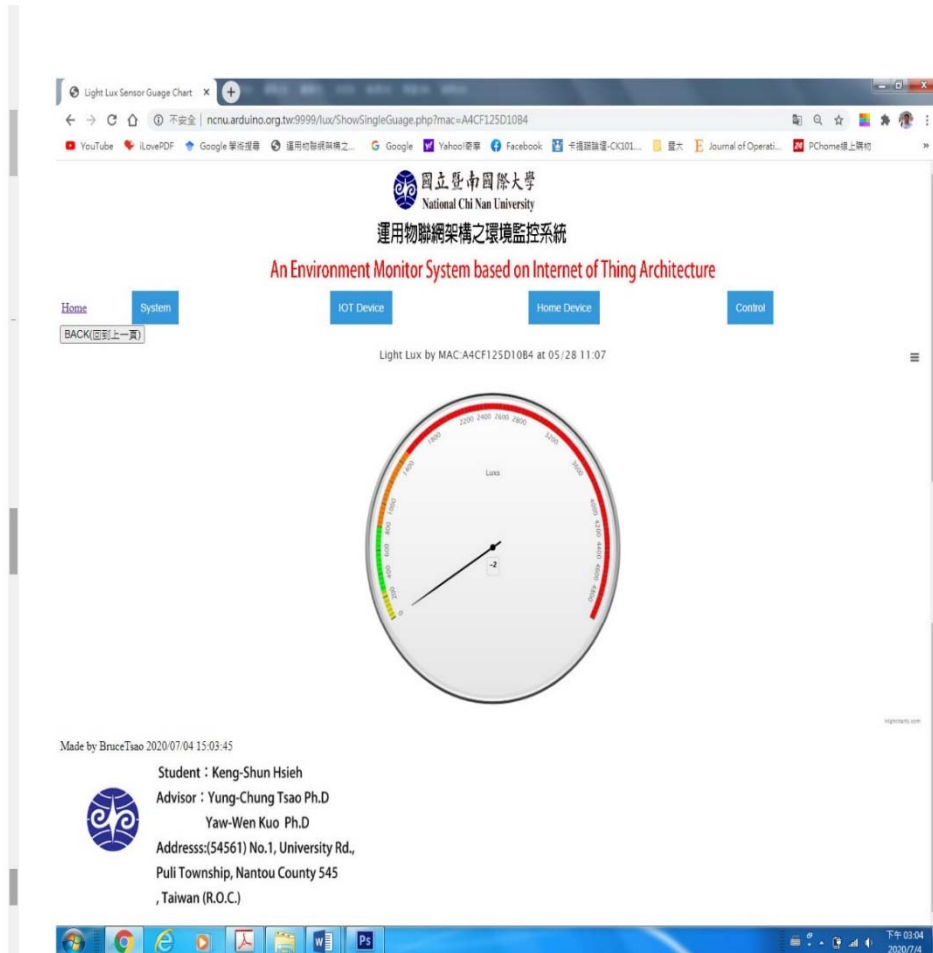
05/27 15:34	505.000000
05/27 15:34	503.330000
05/27 15:35	503.330000
05/27 15:35	503.330000
05/27 15:36	500.000000
05/27 15:36	503.330000
05/27 15:37	502.000000
05/27 15:37	502.000000
05/27 15:38	503.330000
05/27 15:38	502.000000
05/27 15:39	503.330000
05/27 15:39	503.330000
05/27 15:40	503.330000
05/27 15:40	503.330000
05/27 15:40	503.330000
05/27 15:41	504.170000
05/27 15:41	502.000000
05/27 15:42	505.000000
05/27 15:42	503.330000
05/27 15:43	503.330000
05/27 15:43	505.000000
05/27 15:44	504.170000
05/27 15:44	505.000000
05/27 15:45	504.170000
05/27 15:45	505.000000
05/27 15:46	505.000000
05/27 15:46	505.000000
05/27 15:47	505.000000
05/27 15:47	505.000000
05/27 15:48	504.170000
05/27 15:48	504.170000
05/27 15:48	488.330000
05/27 15:49	493.330000
05/27 15:49	506.670000
05/27 15:50	501.670000
05/27 15:50	503.330000
05/27 15:51	505.830000
05/27 15:52	505.000000
05/27 15:52	505.830000
05/27 15:53	503.330000
05/27 15:53	505.830000
05/27 15:54	505.000000
05/27 15:55	505.000000
05/27 15:55	504.170000
05/27 15:56	501.670000
05/27 15:56	491.670000
05/27 15:57	497.500000
05/27 15:57	505.000000
05/27 15:58	505.830000
05/27 15:58	505.000000
05/27 15:58	505.000000
05/27 15:59	506.670000
05/27 15:59	503.330000
05/27 16:00	505.000000
05/27 16:00	493.330000
05/27 16:01	500.830000
05/27 16:01	500.830000
05/27 16:02	503.330000
05/27 16:02	507.500000
05/27 16:03	496.670000
05/27 16:04	499.170000
05/27 16:04	497.500000
05/27 16:05	507.500000
05/27 16:05	505.000000
05/27 16:06	505.000000
05/27 16:06	504.170000
05/27 16:07	500.000000
05/27 16:07	500.000000
05/27 16:08	500.000000
05/27 16:08	501.670000
05/27 16:09	493.330000
05/27 16:09	494.170000
05/27 16:10	500.830000
05/27 16:10	501.670000
05/27 16:11	500.830000
05/27 16:11	500.830000
05/27 16:12	500.830000
05/27 16:12	500.000000
05/27 16:13	498.330000
05/27 16:13	495.830000
05/27 16:14	496.670000
05/27 16:14	498.330000
05/27 16:15	480.830000
05/28 11:05	-2.000000
05/28 11:06	-2.000000
05/28 11:07	-2.000000

Made by BruceTsao 2020/07/04 15:00:10



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科一館412研究室光照  
度監測歷程資料圖  
示圖



科一館412研究室光照度監測值指針錶表  
示圖

# 家用型裝置選項-甲烷氣體濃度

Methane Gas Sensor (MQ4) D: x

ncnu.arduino.org.tw/9999/mq4/datalist.php

國立暨南國際大學  
National Chi Nan University  
運用物聯網架構之環境監控系統  
An Environment Monitor System based on Internet of Thing Architecture

Home System IOT Device Home Device Control

Site ID(站台編號)	Site Name(站台名稱)	Site Address(站台地址)	MAC(網卡號)	GPS	Management(管理)	Visualized Chart Display
NCNUCST01	科技學院科一館412研究室	南院新樓重鎮大學路1號	AABBCDDDEEFF	(120.930743, 23.952283)	Device Belong	Curve Chart Gauge Chart

Student : Keng-Shun Hsieh  
Advisor : Yung-Chung Tsao Ph.D  
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Address:(54561) No.1, University Rd.,  
Puli Township, Nantou County 545  
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Methane Gas Sensor (MQ4) by MAC:AABBCDDDEEFF at 05/31 15:01

Made by BruceTsao 2020/07/04 15:38:55

Student : Keng-Shun Hsieh  
Advisor : Yung-Chung Tsao Ph.D  
Yaw-Wen Kuo Ph.D  
Address:(54561) No.1, University Rd.,  
Puli Township, Nantou County 545  
, Taiwan (R.O.C.)

甲烷氣體濃度監測裝置站台列示圖

甲烷氣體濃度監測  
值指針錶表示圖

Methane Gas Sensor (MQ4) C: x

ncnu.arduino.org.tw/9999/mq4/ShowChartlist.php?mac=AABBCDDDEEFF

國立暨南國際大學  
National Chi Nan University  
運用物聯網架構之環境監控系統  
An Environment Monitor System based on Internet of Thing Architecture

Home System IOT Device Home Device Control

MQ4 Sensor Query by MAC:AABBCDDDEEFF

650  
600  
550  
500  
450  
400  
350  
300  
250  
200

05:28 11:40  
05:28 11:46  
05:29 20:06  
05:29 20:07  
05:29 20:07

MQ4 Sensor Data

Date Time	MQ Sensor
05:28 11:40	600
05:28 11:46	569
05:29 20:06	569
05:29 20:07	534
05:29 20:07	234

Data Generated by Device's MAC:AABBCDDDEEFF;

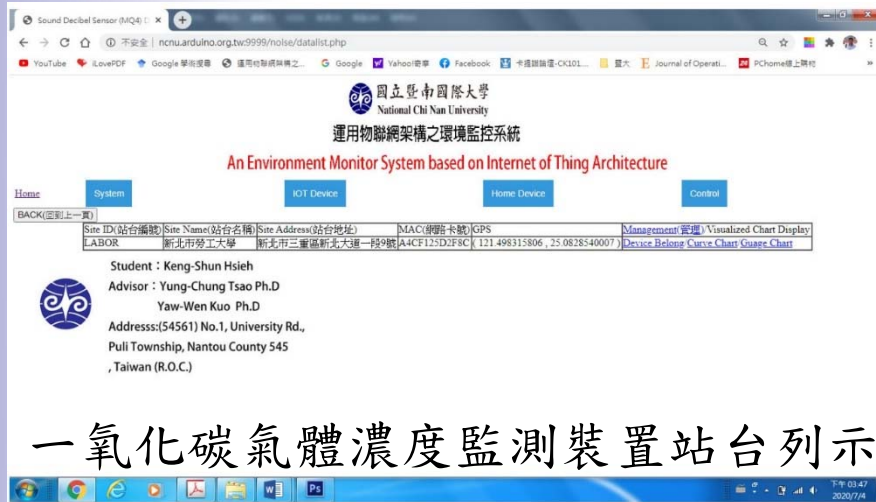
Made by BruceTsao 2020/07/04 15:35:56

Student : Keng-Shun Hsieh  
Advisor : Yung-Chung Tsao Ph.D  
Yaw-Wen Kuo Ph.D  
Address:(54561) No.1, University Rd.,  
Puli Township, Nantou County 545  
, Taiwan (R.O.C.)

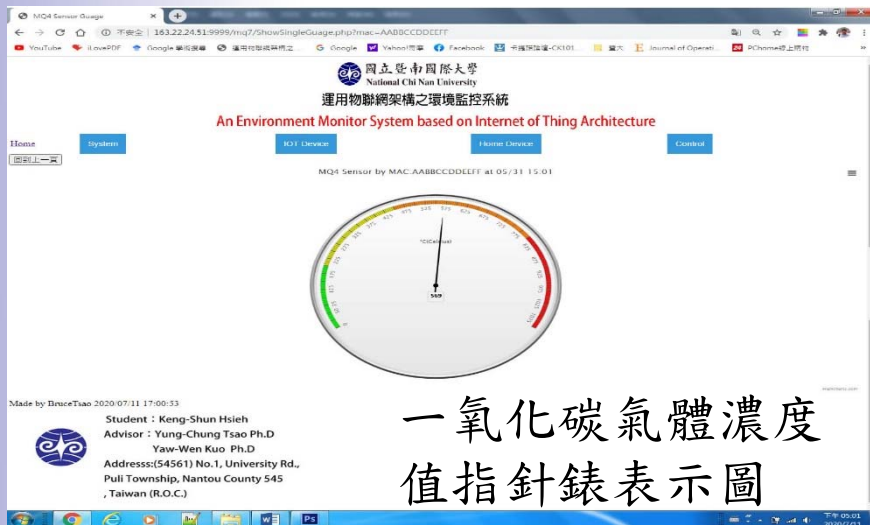
科一館412研究室甲烷  
氣體濃度監測歷程資料  
圖



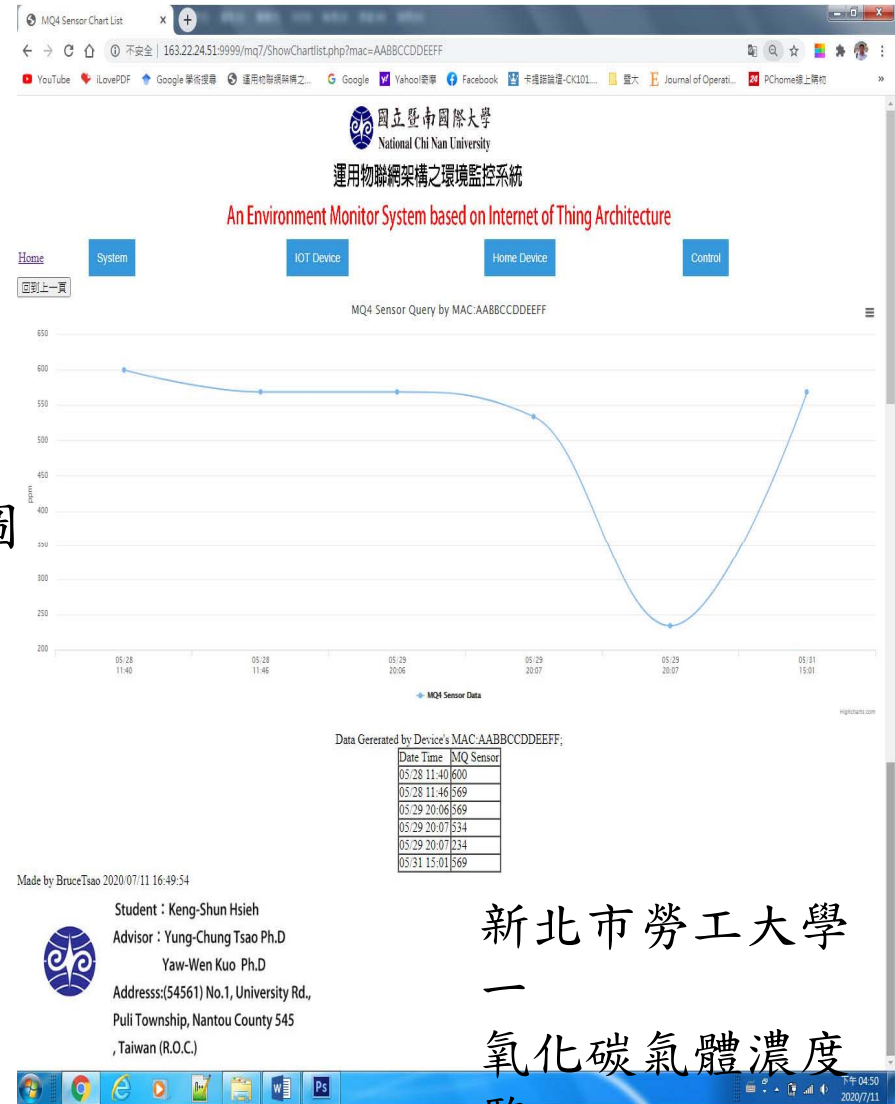
# 家用型裝置選項-一氧化碳氣體濃度



一氧化碳氣體濃度監測裝置站台列示圖



一氧化碳氣體濃度  
值指針錶表示圖



Made by BruceTsao 2020 07/11 16:49:54

Student : Keng-Shun Hsieh  
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Yaw-Wen Kuo Ph.D  
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Puli Township, Nantou County 545  
, Taiwan (R.O.C.)

新北市勞工大學  
一  
氧化碳氣體濃度  
監  
測歷程資料圖

# 家用型裝置選項-噪音

國立暨南國際大學  
National Chi Nan University  
運用物聯網架構之環境監控系統  
An Environment Monitor System based on Internet of Thing Architecture

Home System IOT Device Home Device Control

BACK(回到上一頁)

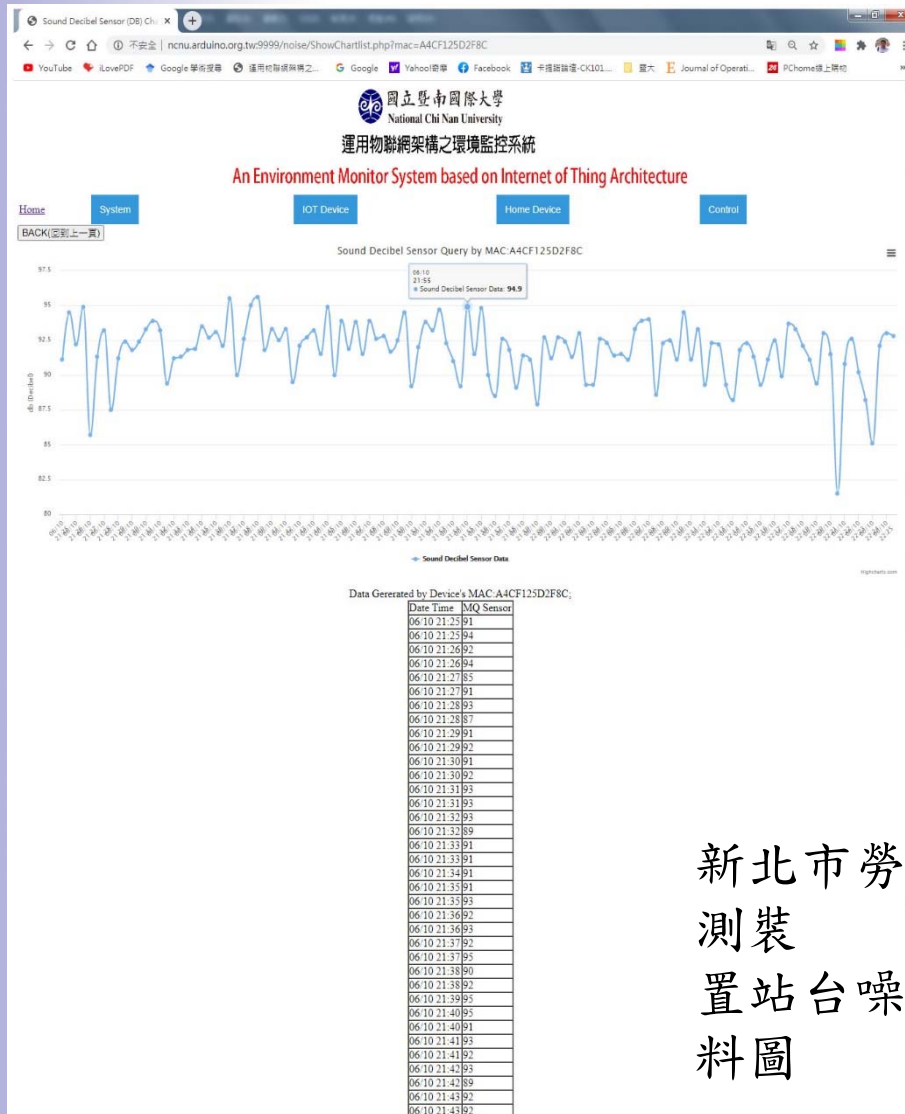
Site ID(站台編號)	Site Name(站台名稱)	Site Address(站台地址)	MAC(網路卡號)	GPS	Management(管理)
LABOR	新北市勞工大學	新北市三重區新北大道一段9號	A4CF125D2F8C	(121.498315806, 25.0828540007)	Visualized Chart Display Device Belong/ Curve Chart/ Guage Chart

Student : Keng-Shun Hsieh  
Advisor : Yung-Chung Tsao Ph.D  
Yaw-Wen Kuo Ph.D  
Address:(54561) No.1, University Rd.,  
Puli Township, Nantou County 545  
, Taiwan (R.O.C.)

下午 03:47  
2020/7/4

噪音監測裝置站台列示圖

# 家用型裝置選項-噪音

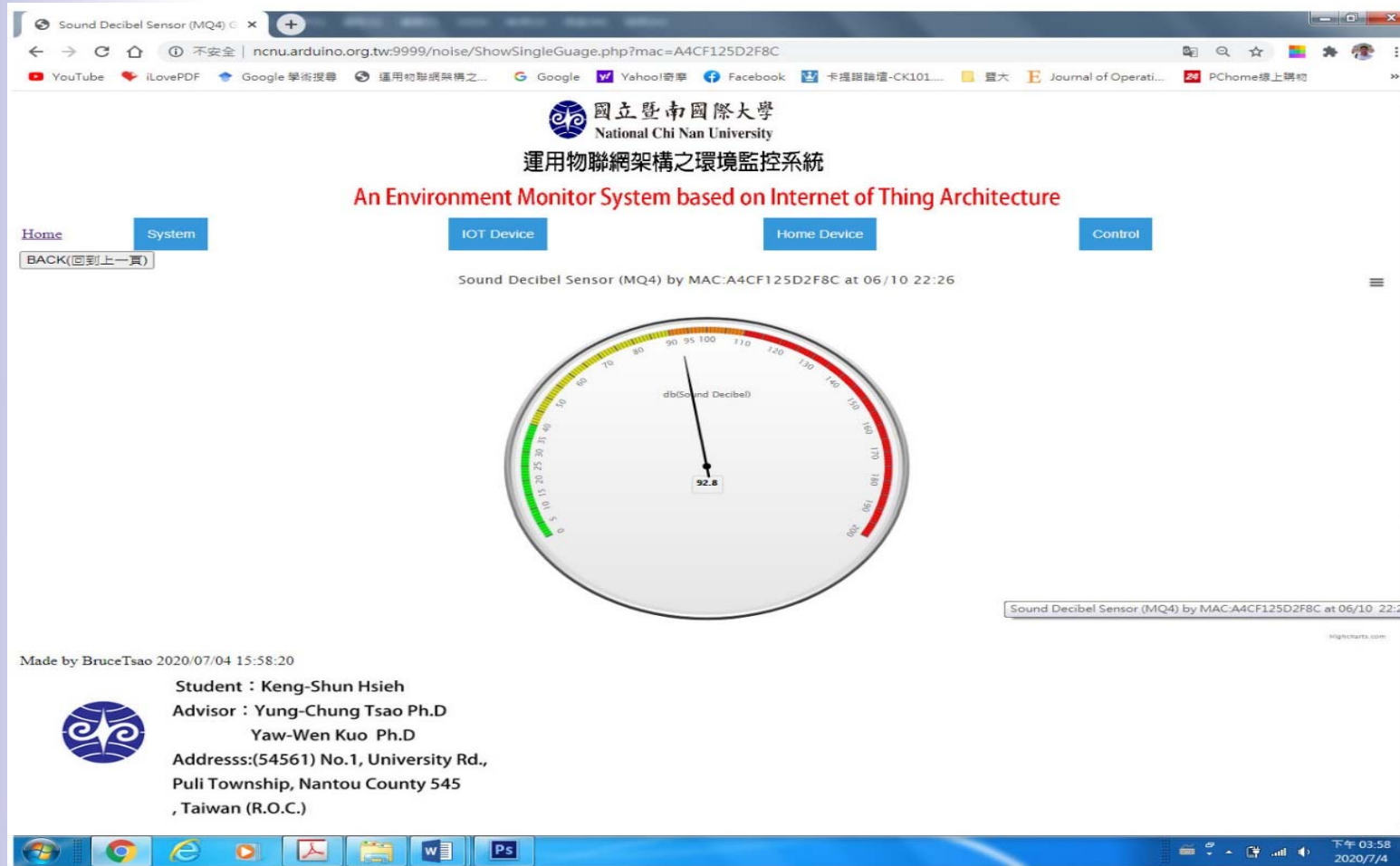


06-10-21-43:03
06-10-21-43:02
06-10-21-44:03
06-10-21-44:01
06-10-21-45:04
06-10-21-45:00
06-10-21-46:03
06-10-21-46:01
06-10-21-47:03
06-10-21-47:01
06-10-21-48:03
06-10-21-48:02
06-10-21-49:03
06-10-21-49:01
06-10-21-50:02
06-10-21-50:04
06-10-21-51:00
06-10-21-51:02
06-10-21-52:03
06-10-21-52:03
06-10-21-53:04
06-10-21-53:02
06-10-21-54:01
06-10-21-54:09
06-10-21-55:04
06-10-21-55:01
06-10-21-56:01
06-10-21-56:00
06-10-21-57:08
06-10-21-58:02
06-10-21-58:01
06-10-21-59:09
06-10-21-59:01
06-10-22-00:01
06-10-22-00:01
06-10-22-00:02
06-10-22-01:01
06-10-22-02:02
06-10-22-02:02
06-10-22-02:02
06-10-22-03:01
06-10-22-03:05
06-10-22-04:09
06-10-22-04:09
06-10-22-05:02
06-10-22-05:02
06-10-22-06:01
06-10-22-06:01
06-10-22-07:01
06-10-22-07:02
06-10-22-08:03
06-10-22-08:04
06-10-22-09:02
06-10-22-10:02
06-10-22-10:01
06-10-22-11:04
06-10-22-11:01
06-10-22-12:03
06-10-22-12:09
06-10-22-13:02
06-10-22-13:02
06-10-22-14:09
06-10-22-14:08
06-10-22-15:01
06-10-22-15:02
06-10-22-16:01
06-10-22-16:09
06-10-22-17:01
06-10-22-17:02
06-10-22-18:09
06-10-22-18:01
06-10-22-19:03
06-10-22-19:02
06-10-22-20:01
06-10-22-20:09
06-10-22-21:03
06-10-22-21:01
06-10-22-22:01
06-10-22-22:00
06-10-22-23:00
06-10-22-23:02
06-10-22-23:00
06-10-22-24:08
06-10-22-24:03
06-10-22-24:02
06-10-22-25:03
06-10-22-26:02

新北市勞工大學噪音監  
測裝  
置站台噪音監測歷程資  
料圖

Advisor: Yung-Chung Tsao Ph.D  
Yaw-Wen Kuo Ph.D  
Address: (S4561) No.1, University Rd.,  
Puli Township, Nantou County 545  
, Taiwan (R.O.C.)

# 家用型裝置選項-噪音



新北市勞工大學噪音監測值指針錶表示圖

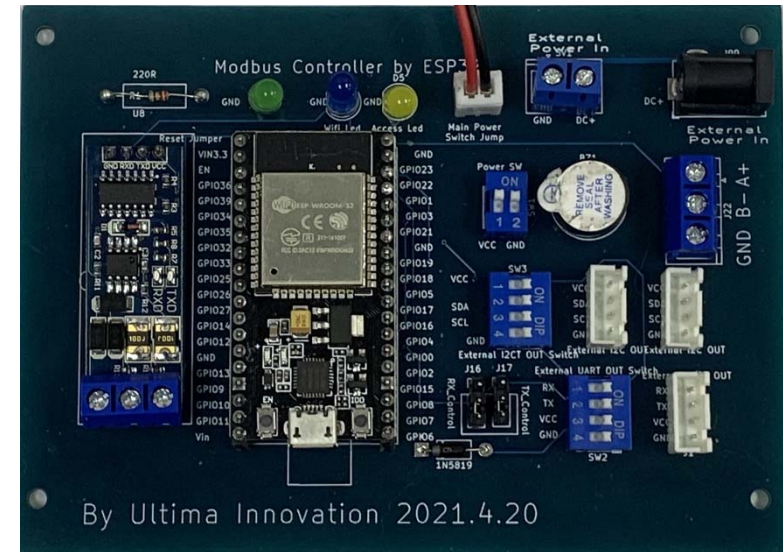


# 分散式顯示裝置開發



# 點陣式大型螢幕

# We Design







# DATA Collector



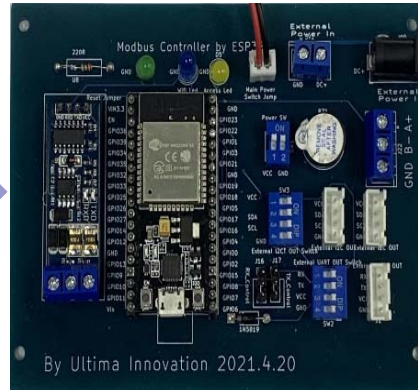
Wind speed



Wind direction



Temperature & humidity



Controller

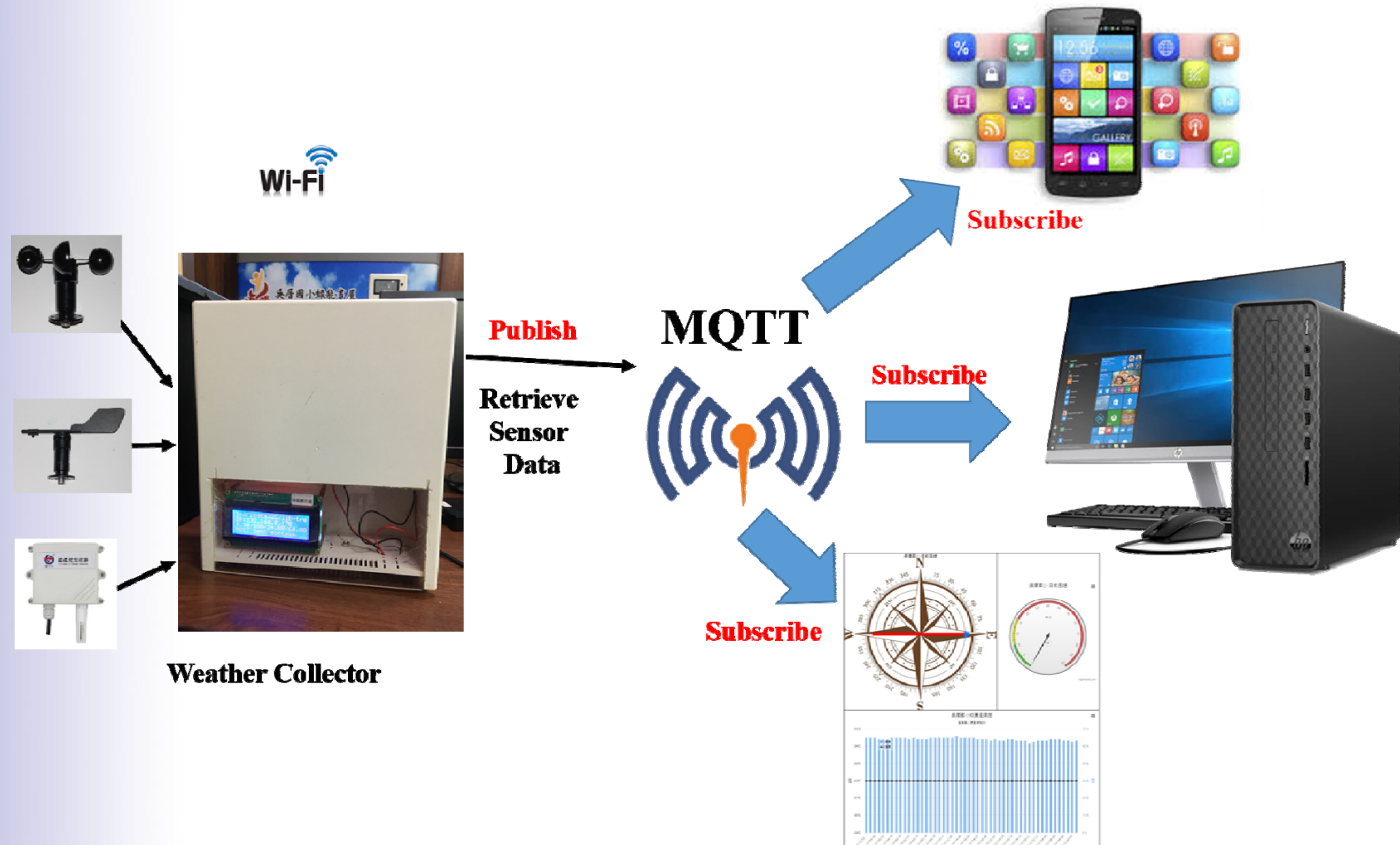


RS-485 hub



Control box

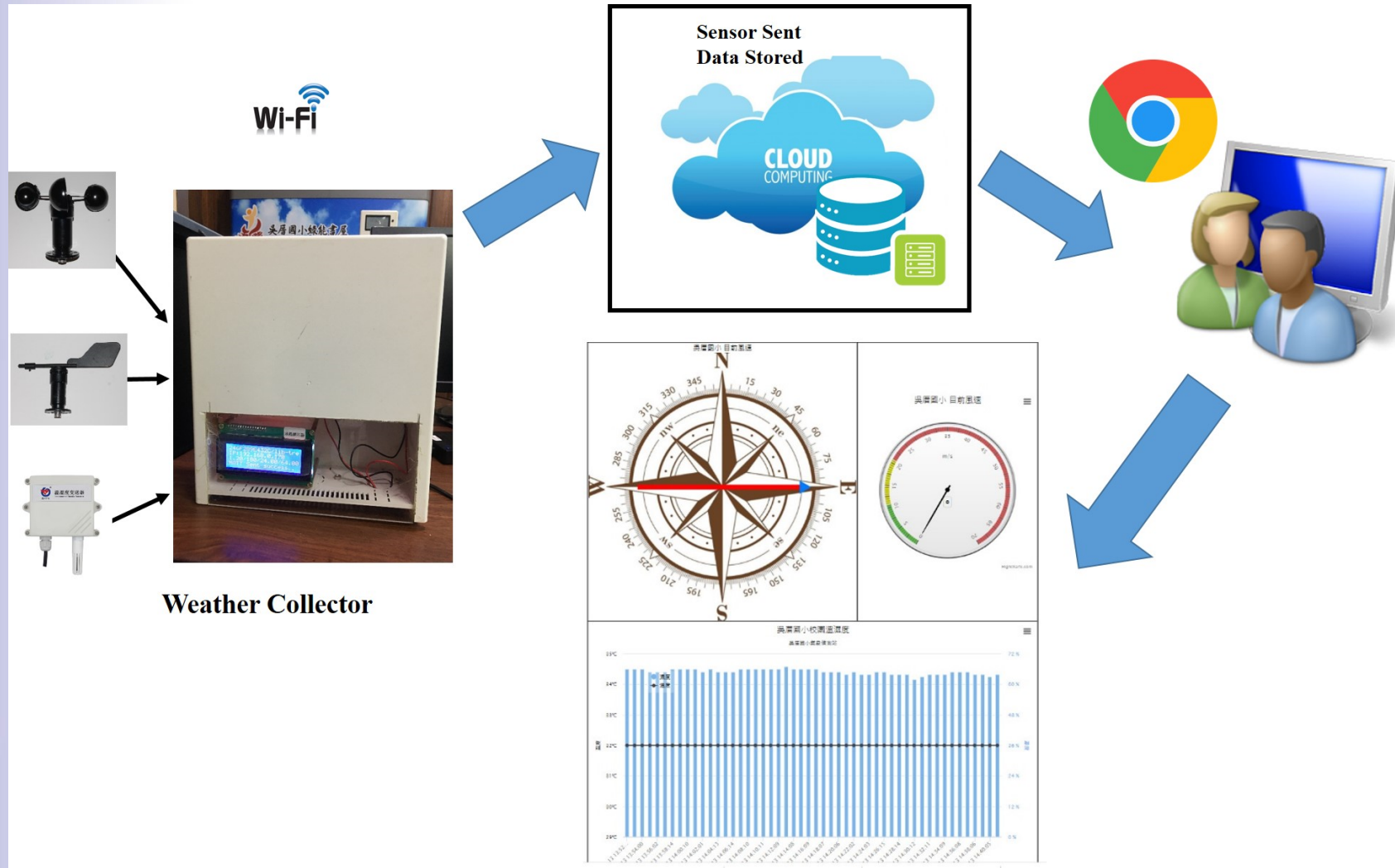
# MQTT Broker



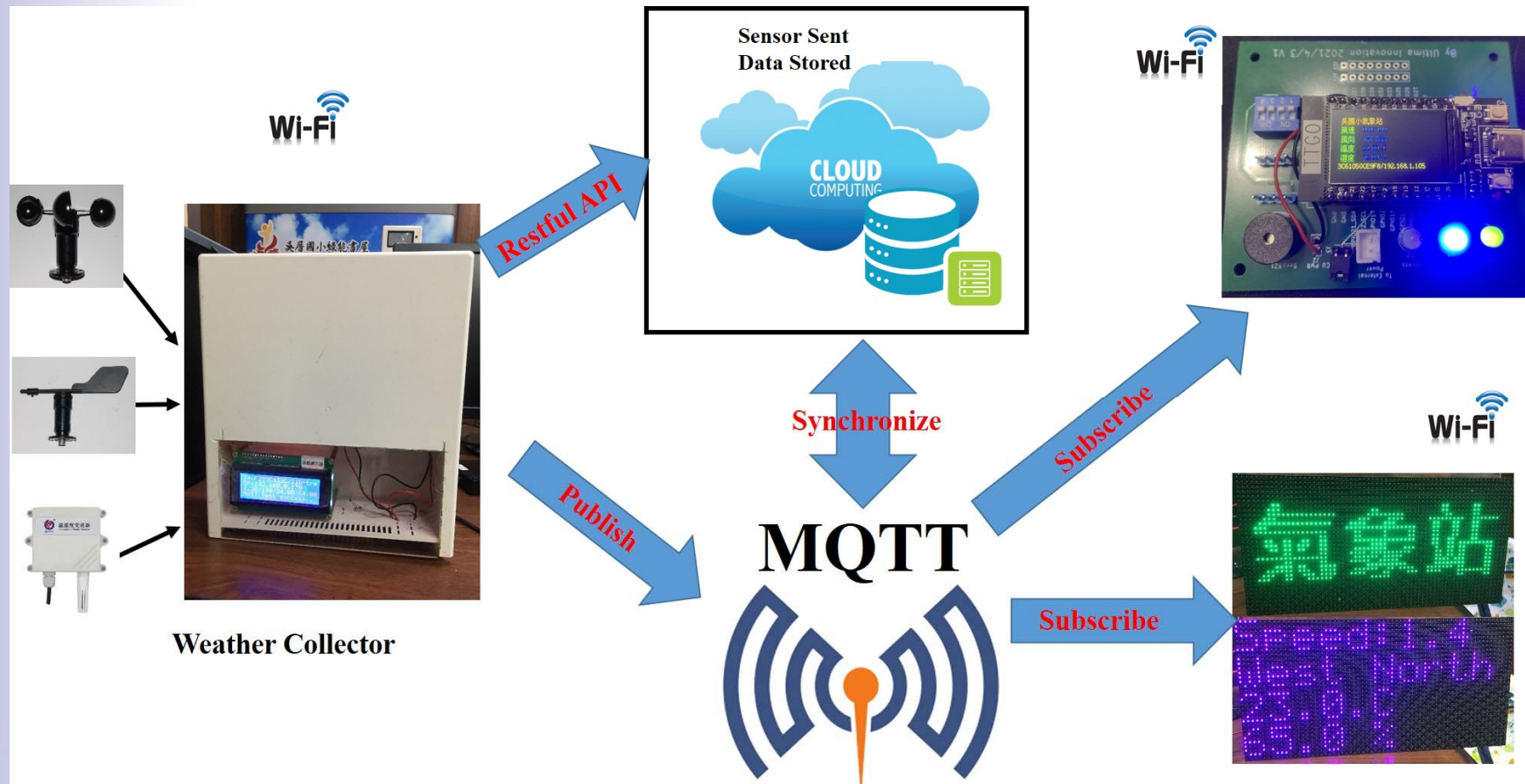


# ■ System Design

# Original System Architecture



# IOT-based System Architecture



## Comparison

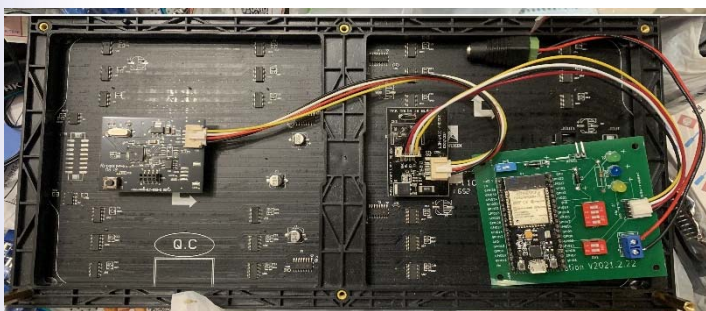
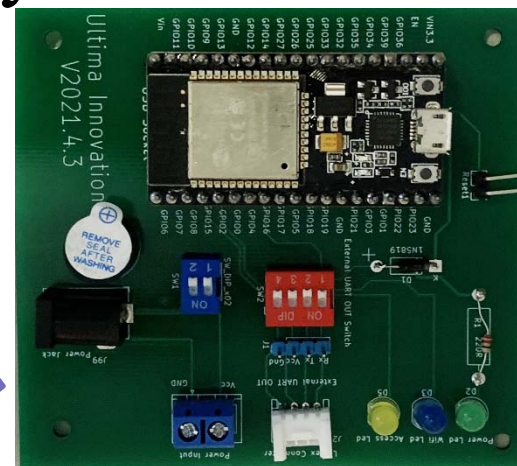
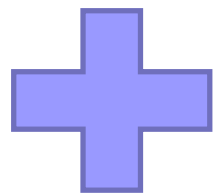
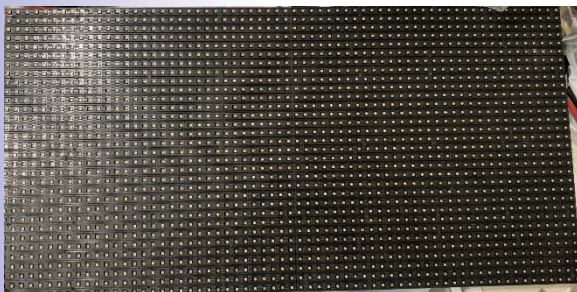
	<b>Advantages</b>	<b>Disadvantages</b>
<b>Original System Architecture</b>	Users can use any internet-based equipment via Internet to access web-site and query sensor data with browsers in passive way	Those information still can't be delivered to users who hope to get such information with initiative and automatic way.
<b>IOT-based System Architecture</b>	Under the above-mentioned architecture, all information transmission become very transparent and quick-response to other independent devices without any PC or browsers supporting.	<ul style="list-style-type: none"><li>◆ Requires more processing power and more memory.</li><li>◆ Limits the scalability as each client devices.</li><li>◆ Centralized broker limits the scalability as each client devices</li></ul>



# ■ Implementation System

## Large Size Display Design

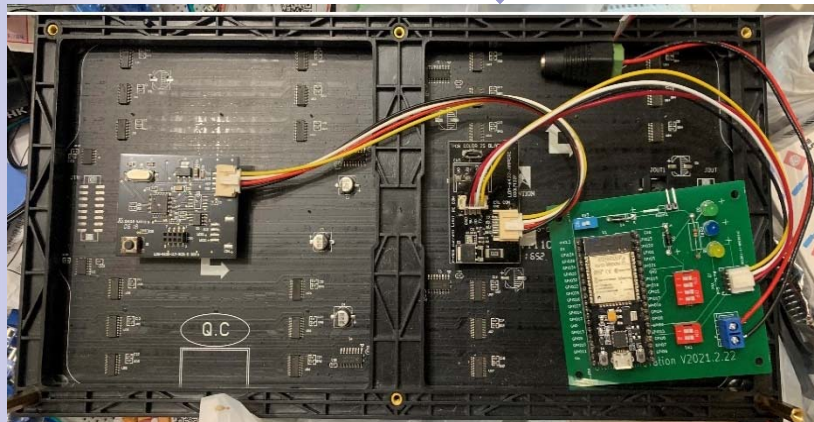
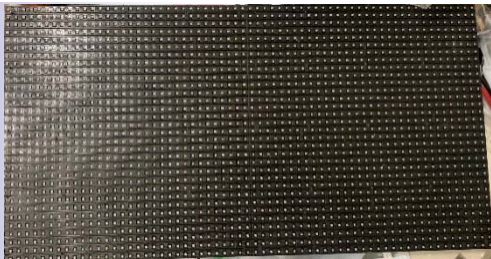
- The study integrates the proposed visualized large-size display based on RGB led dot matrix and proposed controller as shown in Fig 9 to enhance original system





# Large Size Display Design

RGB LED Dot Matrix Display    Proposed Controller

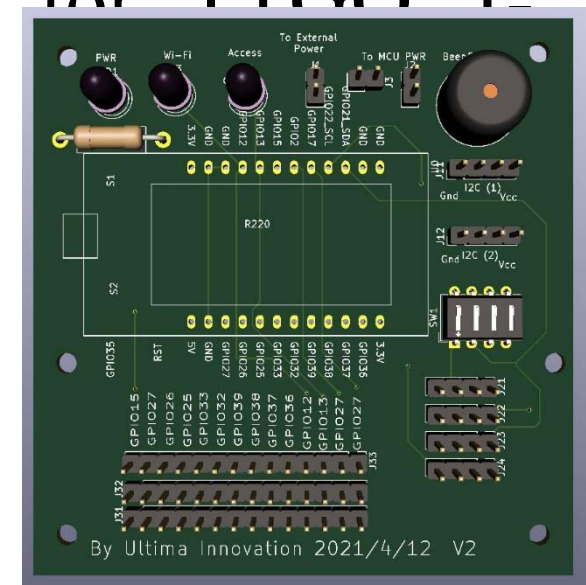
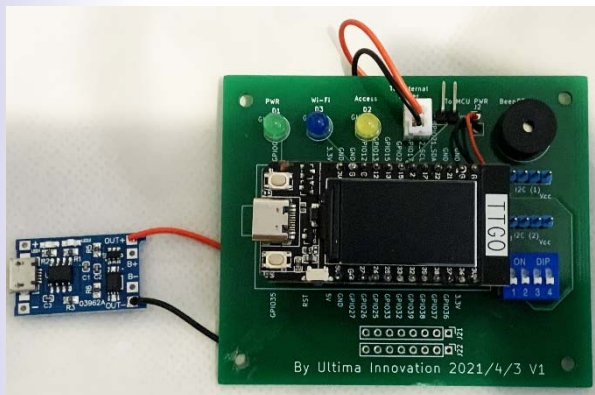
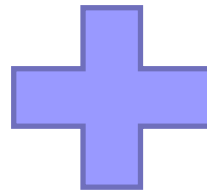
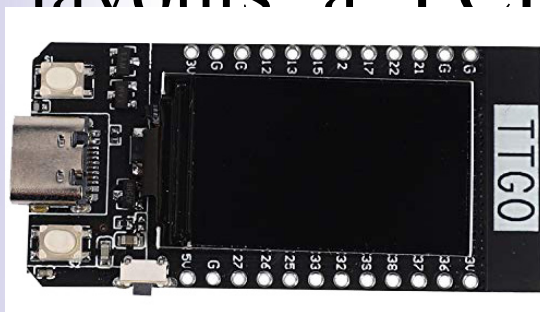


Integrate Controller with RGB led dot matrix display

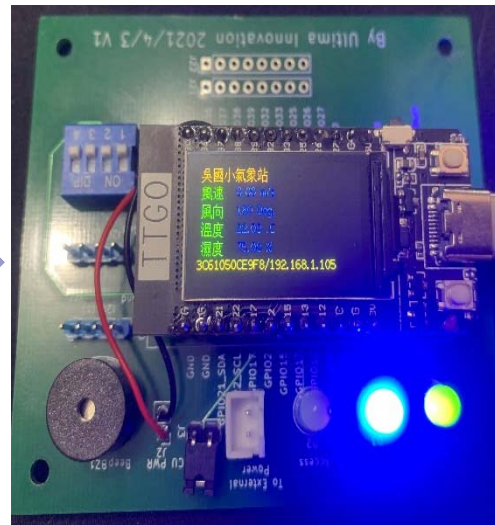
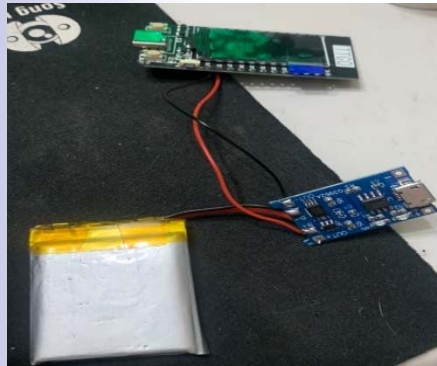
Integration Weather Station with Dot Matrix Display

# Large Size Display Design

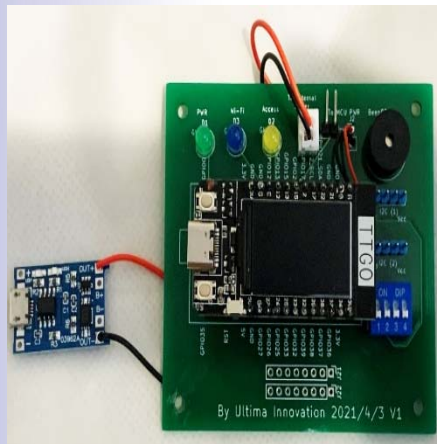
- use uses LILYGO ® TTGO T-Display as MCU and TFT as mini display.
- Designs and Implementations a circuit and layouts a PCB as a shield for TTGO T-



# Portable Display Design



Running of the Portable Display Design



RS-485 HUB Circuit and PCB Layout



Advanced Version of the Portable Display Design



# 開放式資料界街架構



# 研究平台



# 雲端站台

ncnu.arduino.org.tw:9999/iot.php

國立暨南國際大學  
National Chi Nan University

運用物聯網架構之環境監控系統  
An Environment Monitor System based on Internet of Thing Architecture

Home System IOT Device Home Device Control

Developed by : Yung-Chung Tsao Ph.D  
Yaw-Wen Kuo Ph.D  
Address:(54561) No.1, University Rd.,  
Puli Township, Nantou County 545  
, Taiwan (R.O.C.)  
Email: prgbruce@gmail.com

開發者：曹永忠 博士  
郭耀文 博士  
54561 南投縣埔里鎮大學路1號  
電子郵件：prgbruce@gmail.com

台新銀行綜合對帳...pdf The Internet of T...pdf S1389128610001...ris scholar (19).enw scholar (18).enw IARJSET7.pdf Geomatics for S...pdf

在這裡輸入文字來搜尋

29°C 上午 10:48 2021/8/14



# 開放性資料介面

```
{ "site": "xinheES", "sitename": "新店區新和國小", "address": "新北市新店區安和路三段100號", "areaid": "NEWTPE", "areaname": "新北市", "GPS": { "lon": "121.518435", "lat": "24.985529" }, "sensor": [ { "sensortype": "01", "sensorname": "Temperature and humidity", "sensordata": [ { "datetime": "20210814104841", "type": "Temperature", "unit": ".C", "value": "33.6" }, { "datetime": "20210814104841", "type": "Humidity", "unit": "Percent", "value": "55.8" } ] }, { "sensortype": "12", "sensorname": "Light Lux", "sensordata": [ { "datetime": "20210814104841", "type": "Lux", "unit": "lux", "value": "78962.0" } ] }, { "sensortype": "31", "sensorname": "Wind Speed & Direction", "sensordata": [ { "datetime": "202108141048", "type": "Wind Speed", "unit": "m/s", "value": "0.000" }, { "datetime": "202108141048", "type": "Wind Direction", "unit": "Deg", "value": "64" }, { "datetime": "202108141048", "type": "Temperature", "unit": ".C", "value": "33.6" }, { "datetime": "202108141048", "type": "Humidity", "unit": "Percent", "value": "55.8" } ] }, { "sensortype": "32", "sensorname": "Air Pressure", "sensordata": [ { "datetime": "20210814104841", "type": "Air Pressure", "unit": "hPa", "value": "1006.0" } ] } ] }
```



# JSON 資料格式

The screenshot shows the JSON Formatter website interface. The left pane displays the original JSON data, and the right pane shows the formatted and minified versions. The central panel contains various utility buttons.

```
1 {
2   "site": "xinhES",
3   "sitename": "新店區新和國小",
4   "address": "新北市新店區安和路三段100號",
5   "areaid": "NEWTPE",
6   "areaname": "新北市",
7   "GPS": {
8     "lon": "121.518435",
9     "lat": "24.985529"
10  },
11  "sensor": [
12    {
13      "sensortype": "01",
14      "sensorname": "Temperature and humidity",
15      "sensordata": [
16        {
17          "datetime": "20210814104943",
18          "type": "Temperature",
19          "unit": ".C",
20          "value": "34.2"
21        },
22        {
23          "datetime": "20210814104943",
24          "type": "Humidity",
25          "unit": "Percent",
26          "value": "55.3"
27        }
28      ]
29    }
30  ]
31 }
```

Buttons in the center panel: Upload Data, Validate, Format / Beautify (with download and PDF icons), Minify / Compact, Convert JSON to-, Download.

Taskbar: 台新銀行綜合對帳...pdf, The Internet of T...pdf, S1389128610001...ris, scholar (19).enw, scholar (18).enw, IARJSE7.pdf, Geomatics for S...pdf, Advertisement

System tray: 29°C, 上午 10:51, 2021/8/14





# 標準 J s o n 資料格式

```
C:\Users\BruceTsao\Downloads\jsonformatter.txt - Notepad++
檔案(F) 編輯(E) 搜尋(S) 檢視(V) 編碼(C) 語言(L) 設定(O) 工具(T) 巨集(M) 執行(R) 外掛(P) 視窗(W) CSS Lint Grep Includes JSHint Run Smart Highlighter Tests XML Zen Coding ?
Rowid's Manager20190522.txt new 4 new 6 new 1 jsonformatter.txt
1 {
2   "site": "xinheES",
3   "sitename": "新店區新和國小",
4   "address": "新北市新店區安和路三段100號",
5   "areaid": "NEWTPE",
6   "areaname": "新北市",
7   "GPS": {
8     "lon": "121.518435",
9     "lat": "24.985529"
10  },
11  "sensor": [
12    {
13      "sensortype": "01",
14      "sensorname": "Temperature and humidity",
15      "sensordata": [
16        {
17          "datetime": "20210814104943",
18          "type": "Temperature",
19          "unit": ".C",
20          "value": "34.2"
```

Normal text file length: 1,836 lines: 85 Ln: 1 Col: 1 Sel: 1,792 | 85 Unix (LF) UTF-8-BOM INS  
在 這裡輸入文字來搜尋 29°C 上午 10:53 2021/8/14



# Ameba空氣盒子

# 空汙盒子開發

- 使用RealTek設計開發的Ameba 8195AM



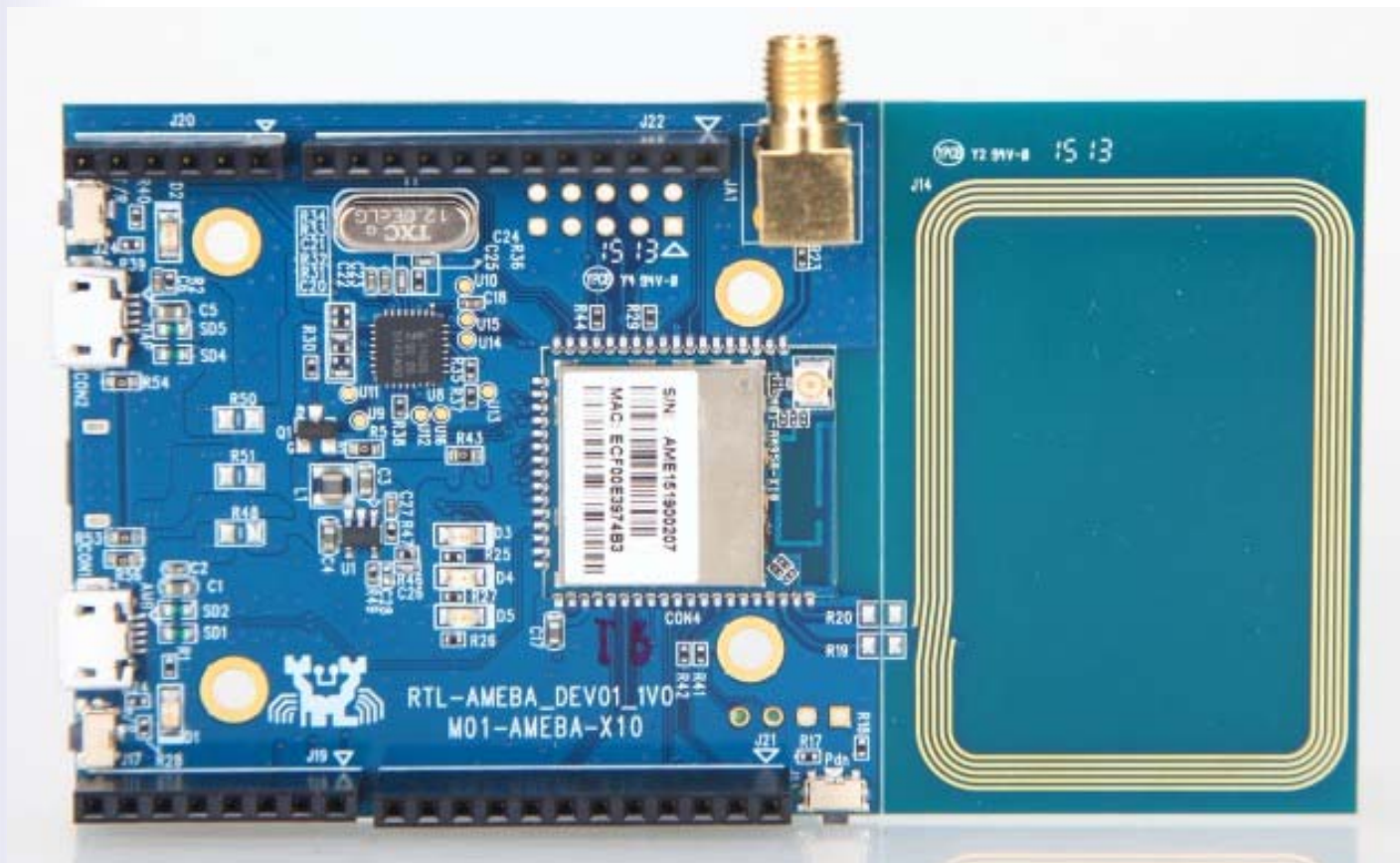
# 組裝零件一覽(1/6)

(a). 偵測空氣懸浮粒子感測器



# 組裝零件一覽(2/6)

( ). Realtek 阿米巴開發版



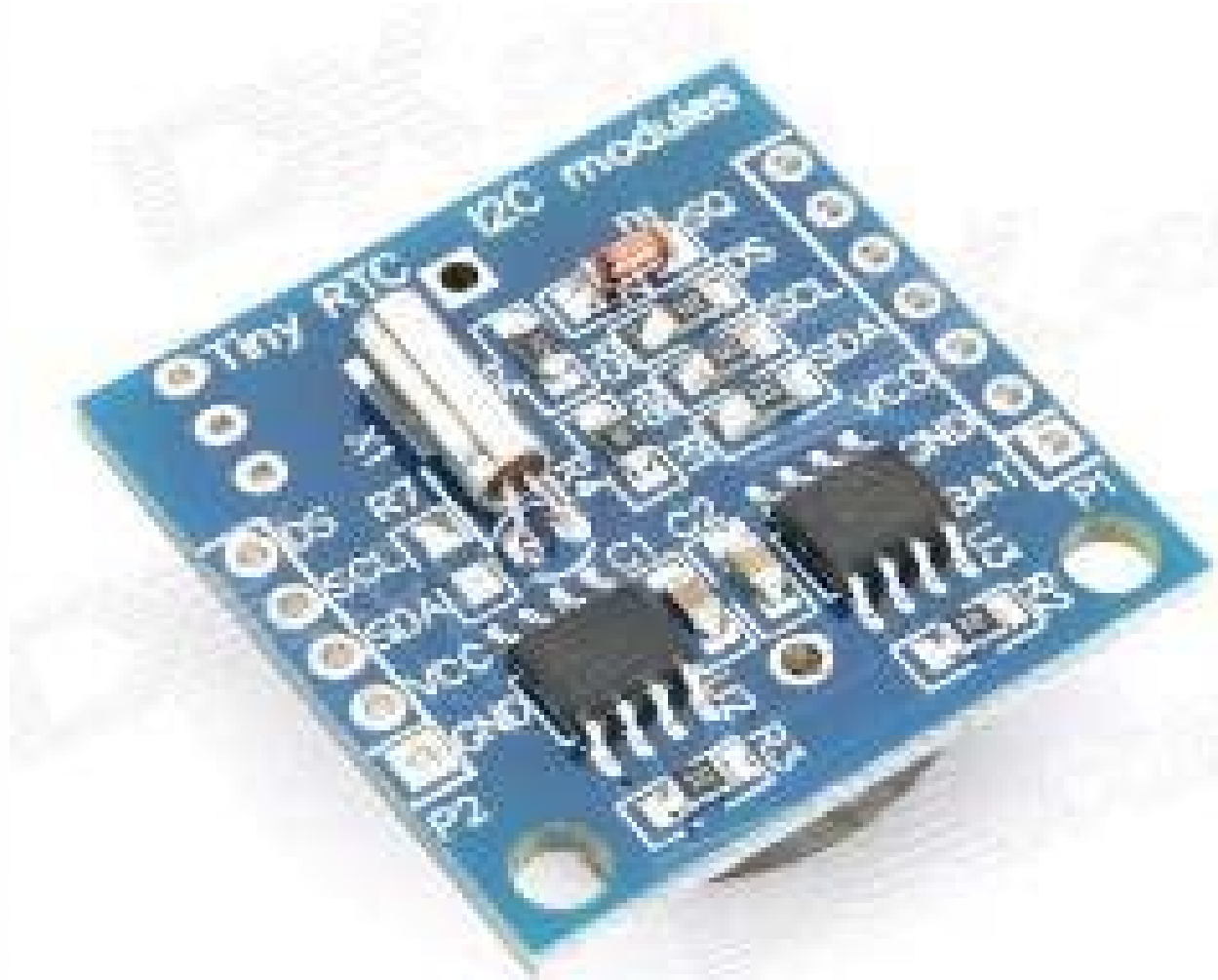
# 組裝零件一覽(3/6)

(c). 顯示模組



# 組裝零件一覽(4/6)

(d). DS1307 I2C RTC組



# 組裝零件一覽(5/6)

(e). DHT22



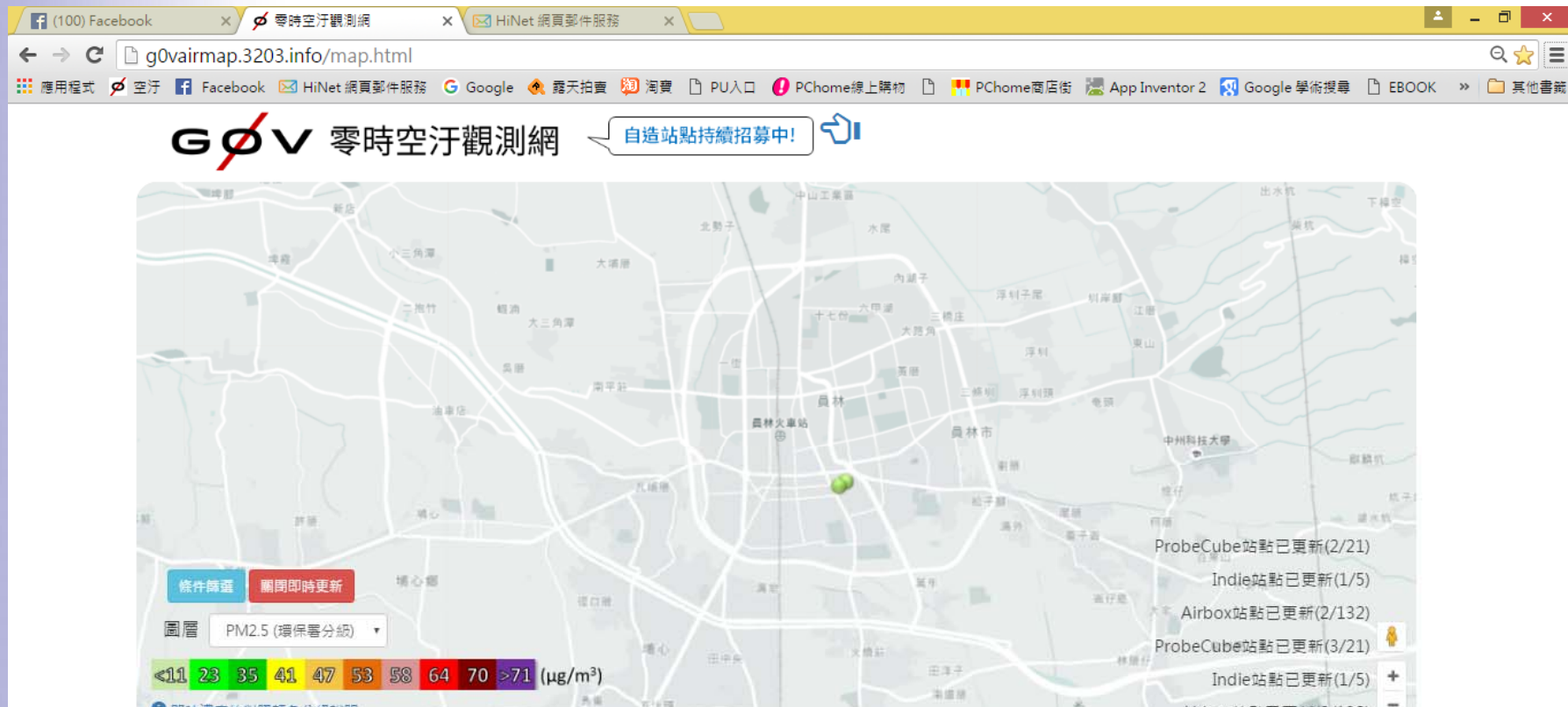


# 使用地圖模式查看裝置

The screenshot shows a web browser window displaying the GOV Zero Time Air Pollution Monitoring Network (GOV 零時空汙觀測網). The browser's address bar shows the URL [g0vairmap.3203.info/map.html](http://g0vairmap.3203.info/map.html). The website features a map of Taiwan with numerous colored markers representing air quality monitoring stations. A legend at the bottom left indicates the color scale for PM2.5 concentrations in  $\mu\text{g}/\text{m}^3$ , ranging from <11 (green) to >71 (purple). The website also displays statistics: 47 LASS stations, 132 Airbox stations, and 1 Indie station. The browser's taskbar at the bottom shows various application icons and the system clock set to 2016/5/25.

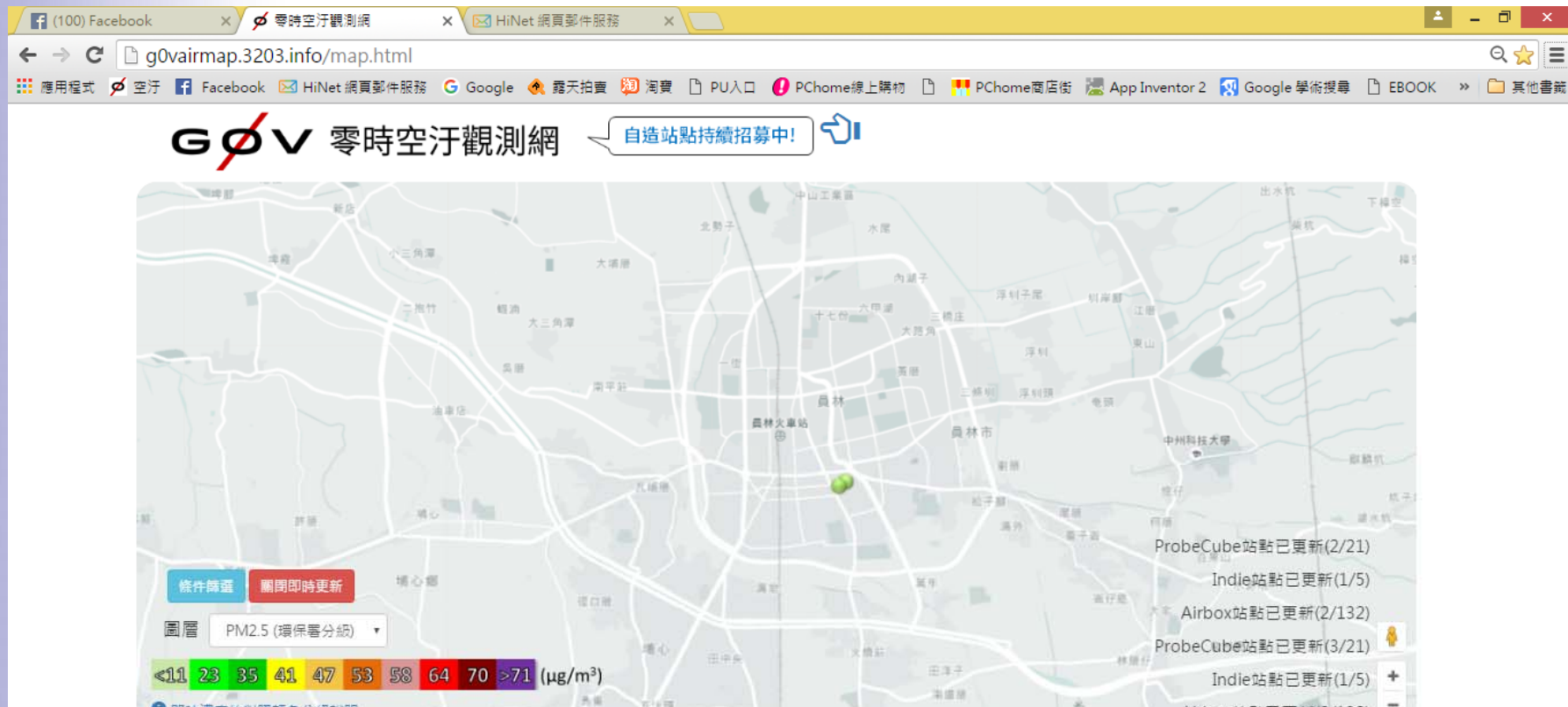
<http://g0vairmap.3203.info/map.html>

# 使用地圖模式查看裝置



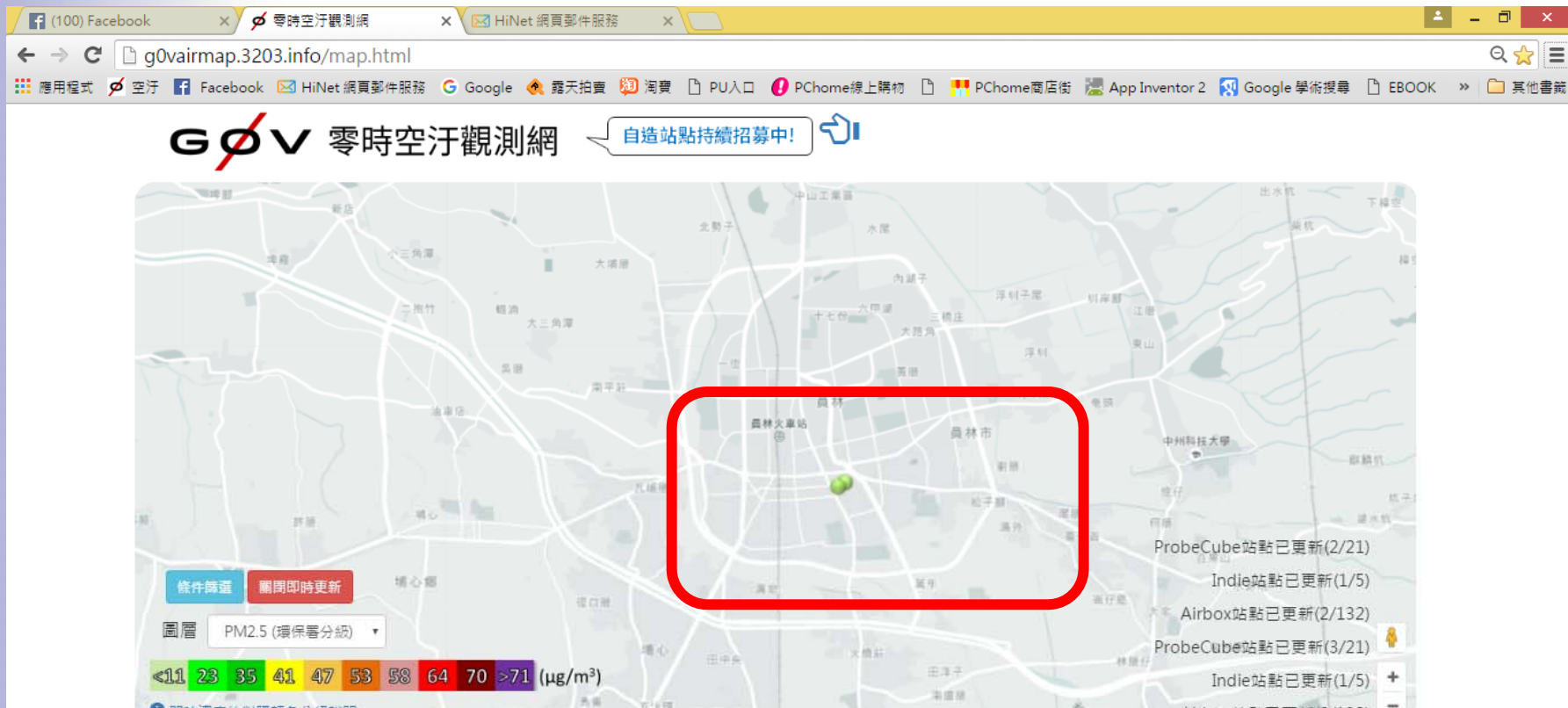
可用滑鼠滾輪上下調整地圖大小

# 使用地圖模式查看裝置



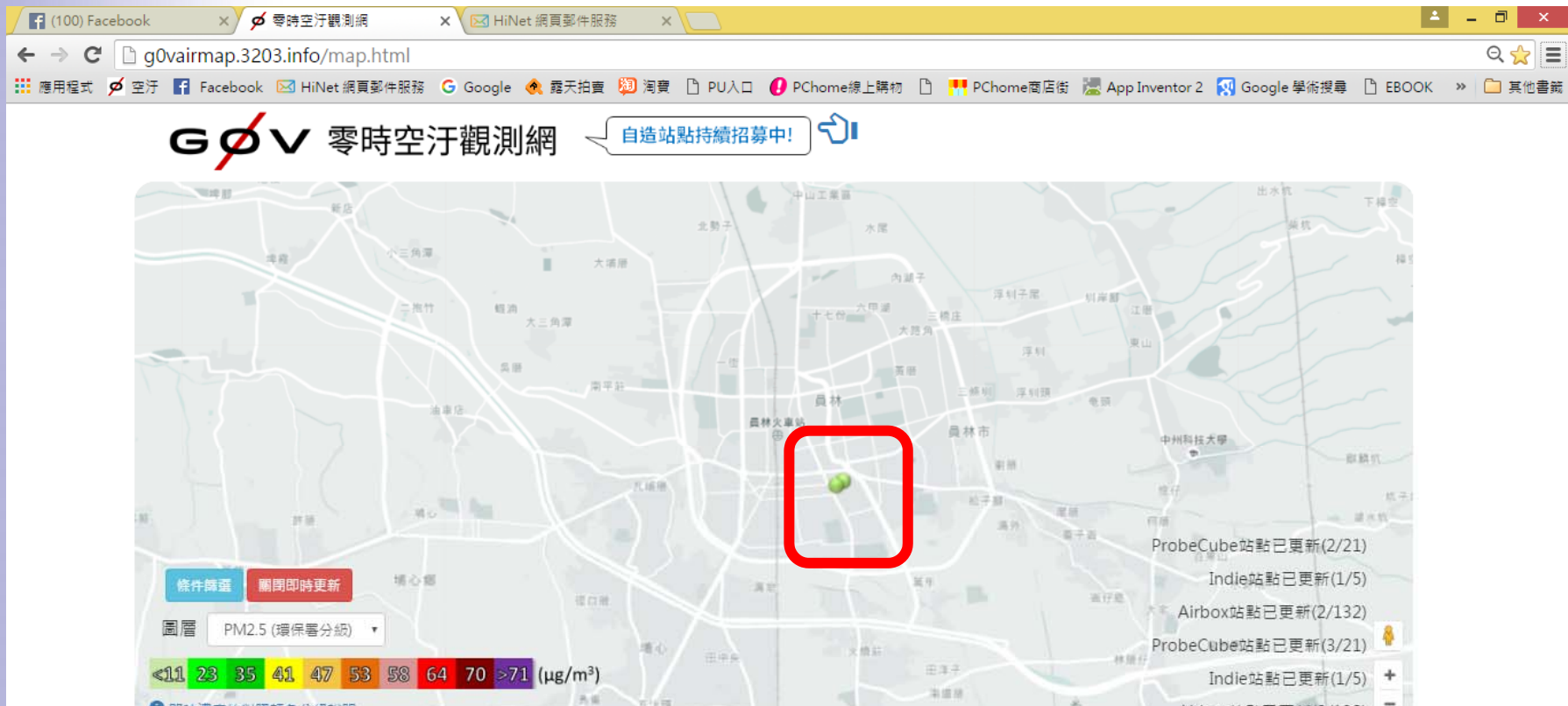
可用按下滑鼠左鍵平移地圖位置

# 使用地圖模式查看裝置



選到您的裝置盒子的GPS位置

# 使用GPS查看裝置



## 點選您的裝置



# 查看裝置資料

**GOV 零時空汙觀測網** 自造站點持續招募中!

**FT1\_07551**  
LASS

空氣溫度: 25.0 °C  
相對濕度: 65 %  
PM2.5: 22 µg/m<sup>3</sup>

細懸浮微粒PM2.5

Date	PM2.5 (µg/m <sup>3</sup> )
16:00	20.25
16:15	21.00
16:30	21.75
16:45	22.50
17:00	23.25

圖層: PM2.5 (環保署分級)

即時濃度值對照顏色分級說明

本零時空汙觀測網僅彙整公開資料提供視覺化參考，並不對資料數據提供保證，實際測值以各資料來源為準。  
本網站由gov零時空汙觀測專案專案小組開發維護，專案詳情請見hackholdr，原始碼公開於Github-immortal mice。

# 檢核網路資料-點選裝置

GOV 零時空汙觀測網 自造站點持續招募!

FT1\_07551  
LASS

空氣溫度 25.0 °C  
相對濕度 65 %  
PM2.5 22 µg/m³

原始資料 2小時前更新 歷史資料

細懸浮微粒PM2.5

Date	PM2.5 (µg/m³)
16:00	20.3
16:15	21.0
16:30	21.5
16:45	21.8
17:00	21.6

Airbox站點已更新(2/132)  
ProbeCube站點已更新(3/21)  
Airbox站點已更新(2/132)  
ProbeCube站點已更新(2/21)  
Indie站點已更新(2/5)  
Airbox站點已更新(2/132)

本零時空汙觀測網僅彙整公開資料提供視覺化參考，並不對資料數據提供保證，實際測值以各資料來源為準。  
本網站由gov零時空汙觀測專案專案小組開發維護，專案詳情請見hackholdr，原始碼公開於Github-immortal mice。

# 檢核網路資料-視覺化資料





# 檢核網路資料-查看歷史資料

GOV 零時空汙觀測網 自造站點持續招募中!

FT1\_07551  
LASS  
空氣溫度 25.0 °C  
相對濕度 65 %  
PM2.5 22  $\mu\text{g}/\text{m}^3$

細懸浮微粒PM2.5

Date	PM2.5 ( $\mu\text{g}/\text{m}^3$ )
16:00	20.25
16:15	20.5
16:30	21.0
16:45	21.5
17:00	22.0

歷史資料

即時濃度值對照顏色分級說明

本零時空汙觀測網僅彙整公開資料提供視覺化參考，並不對資料數據提供保證，實際測值以各資料來源為準。  
本網站由gov零時空汙觀測專案專案小組開發維護，專案詳情請見hackholdr，原始碼公開於Github-immortal mice。

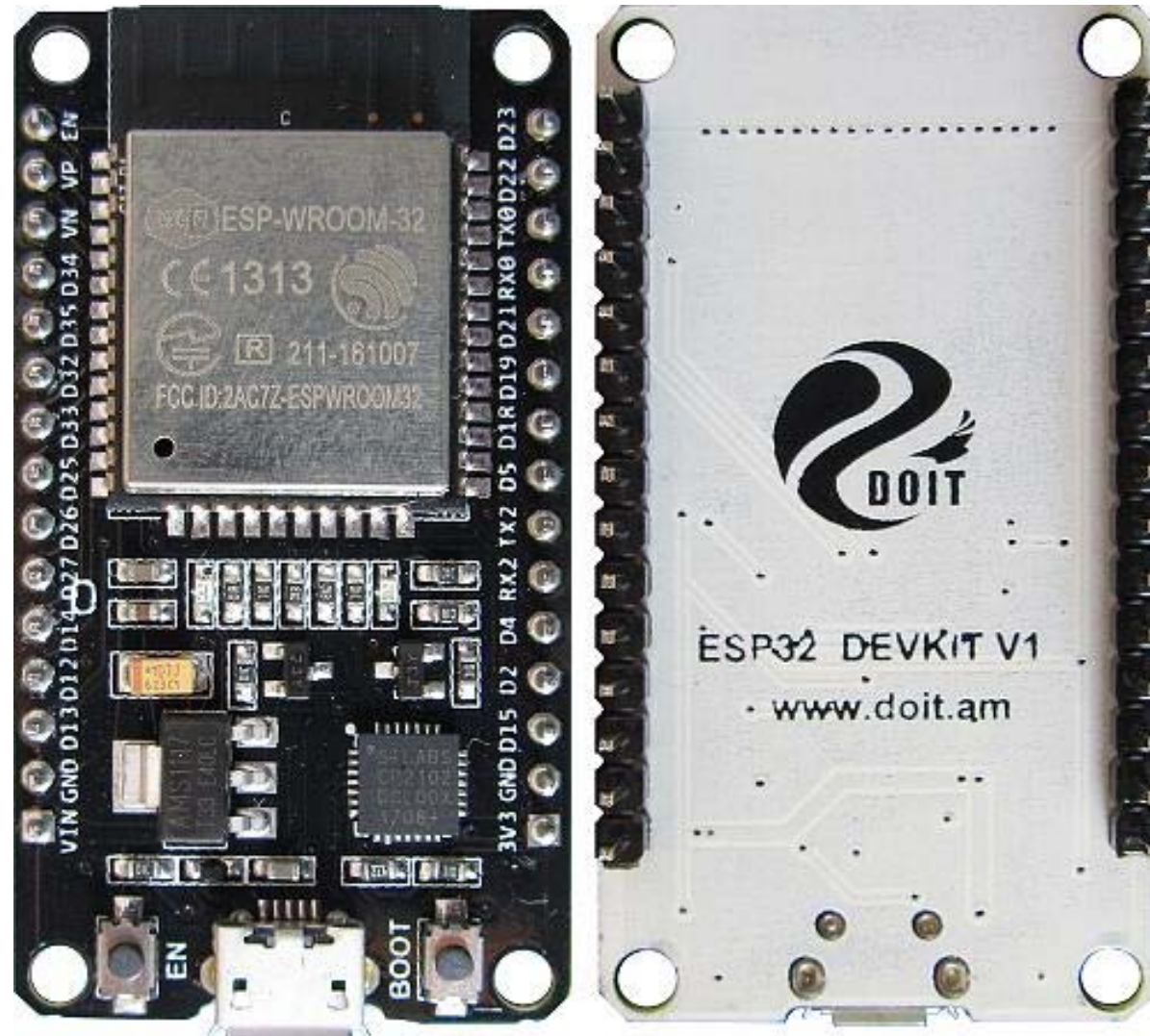
# 檢核網路資料：歷史資料





# ESP 32 智慧燈泡

# ESP 32





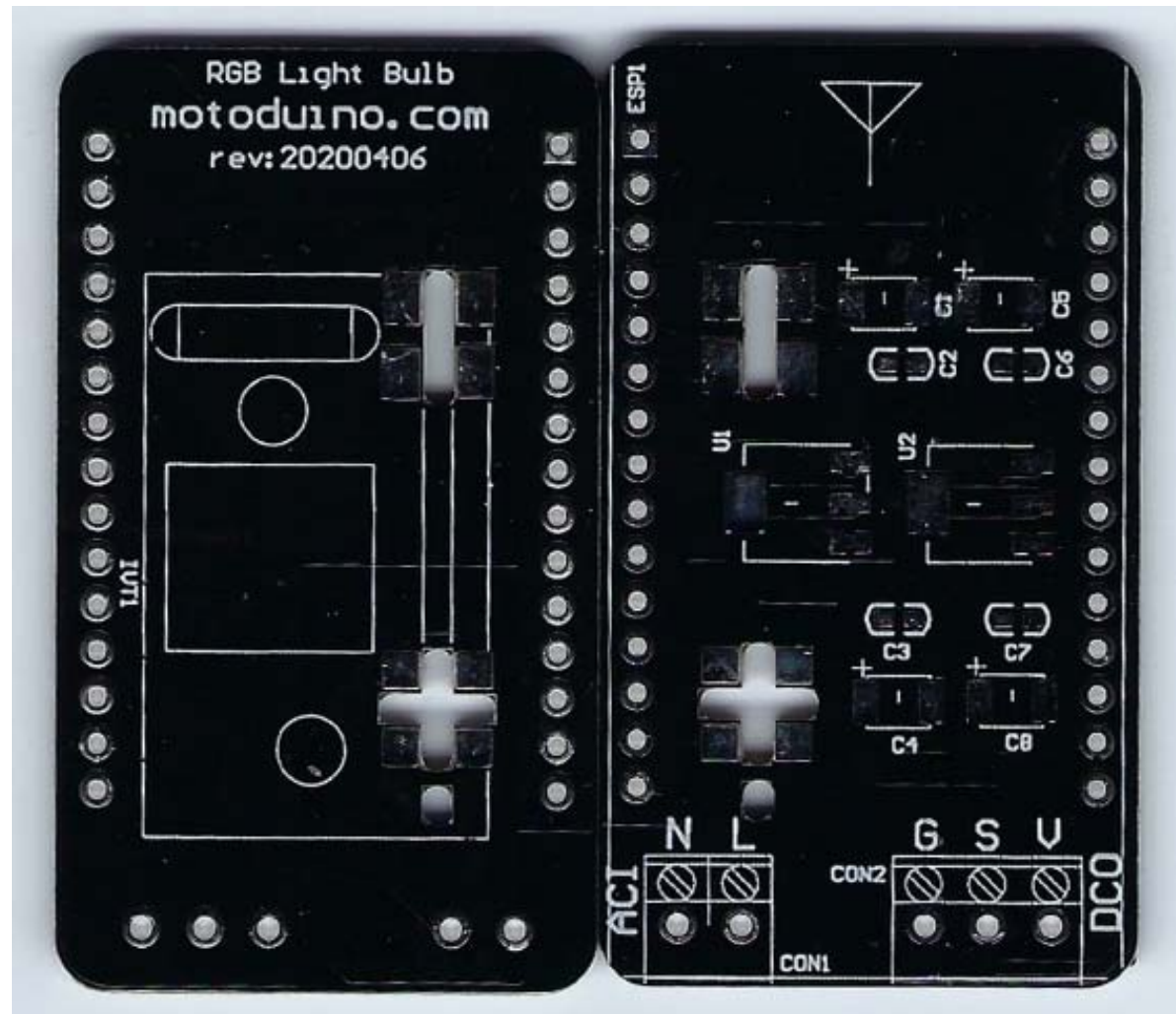
# Mini USB 線



# WS2812B



# 燈泡底板



# Power(AC ~ 5V)



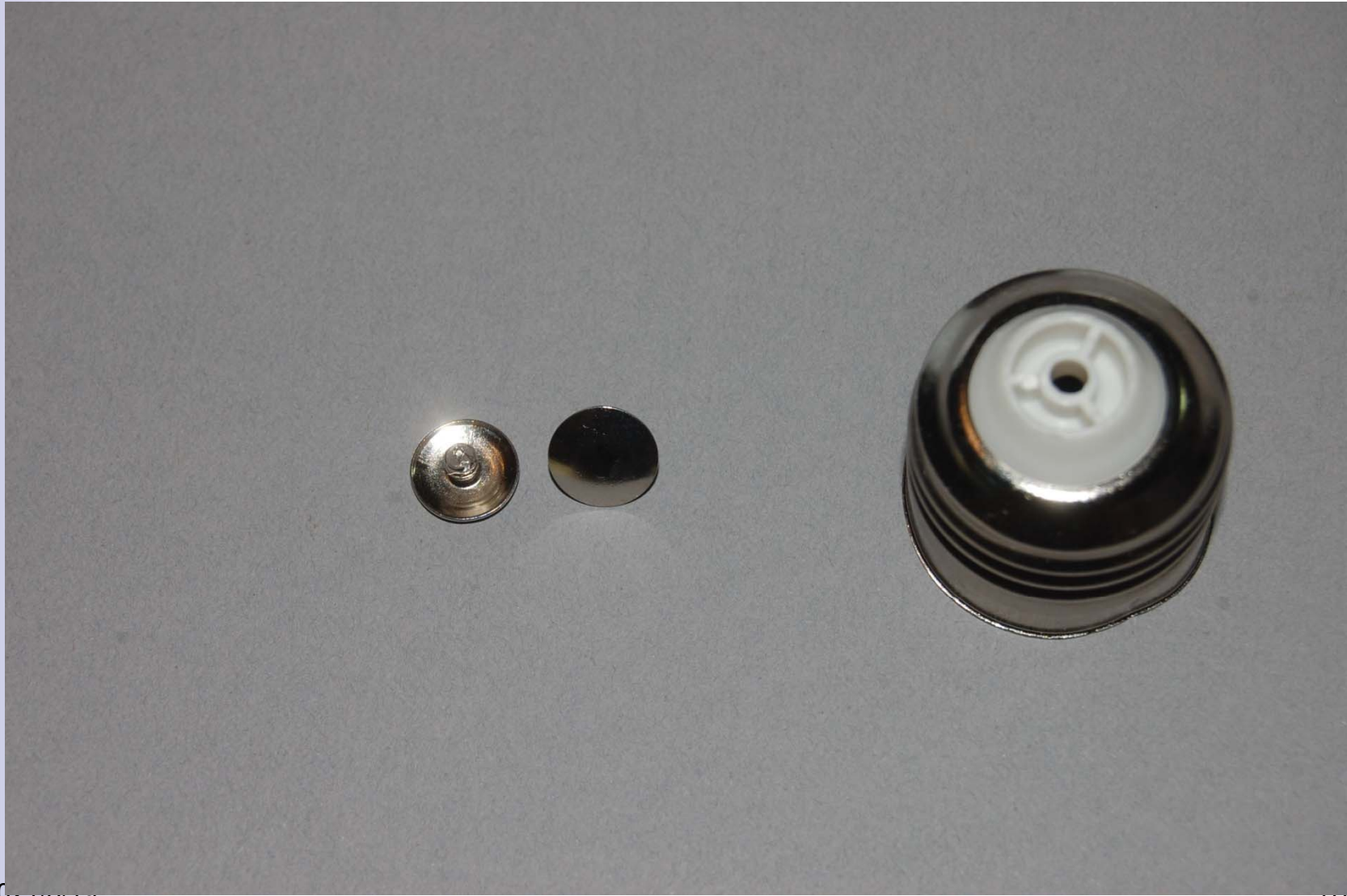




# 燈殼上方與燈蓋



# 燈底與電源頭





# 實測畫面一





# 實測畫面二

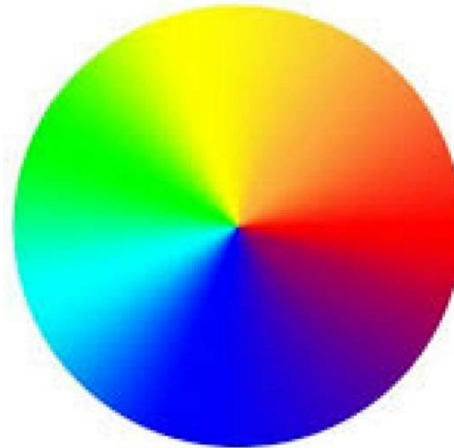




# 行動裝置操控



# 軟體主畫面一



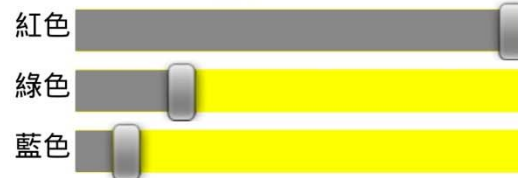
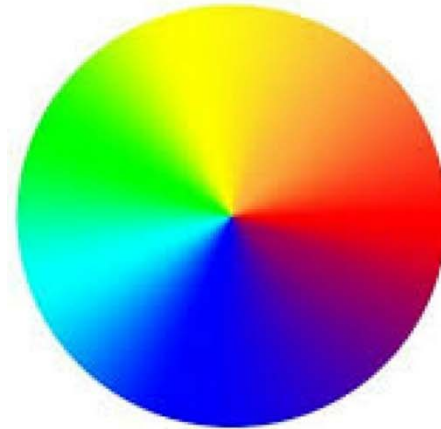
即時改變燈泡顏色

25/0/219





# 軟體主畫面二



即時改變燈泡顏色

252/53/20

改變燈的顏色

關燈

離開系統

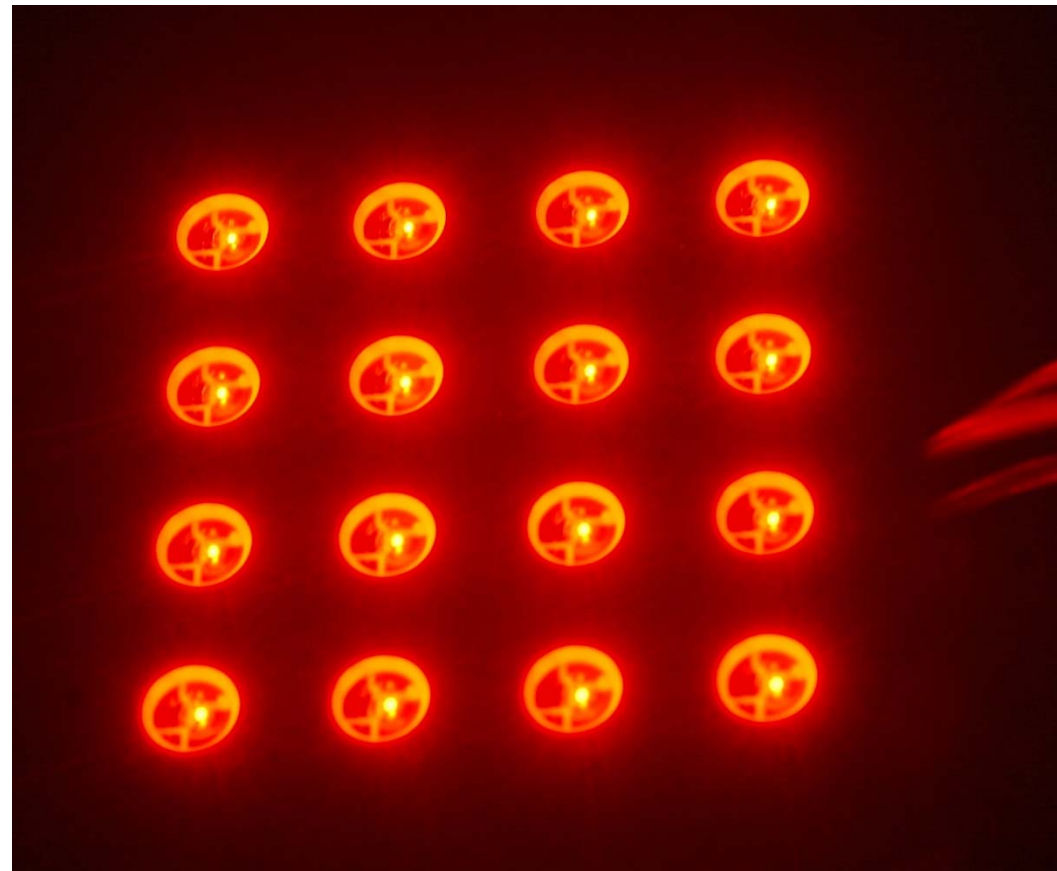
@252053020#





# 進行測試一

@255000000#

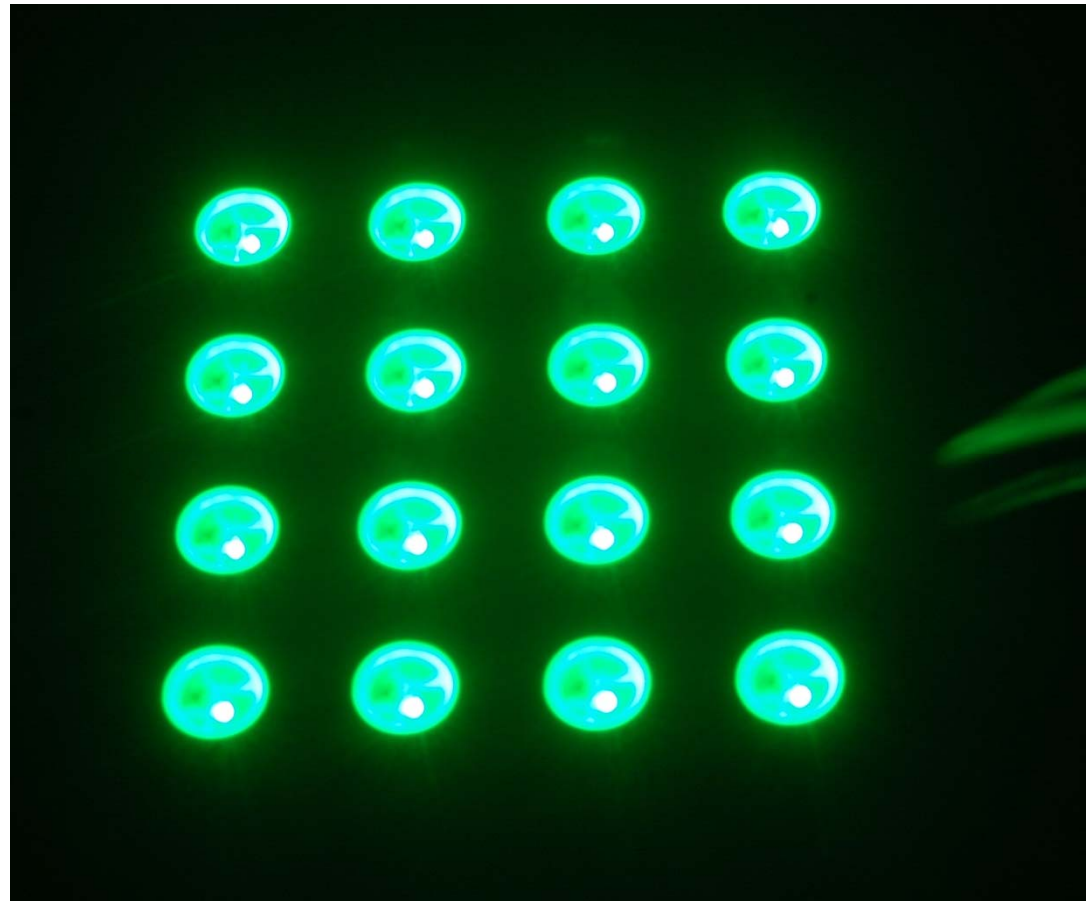






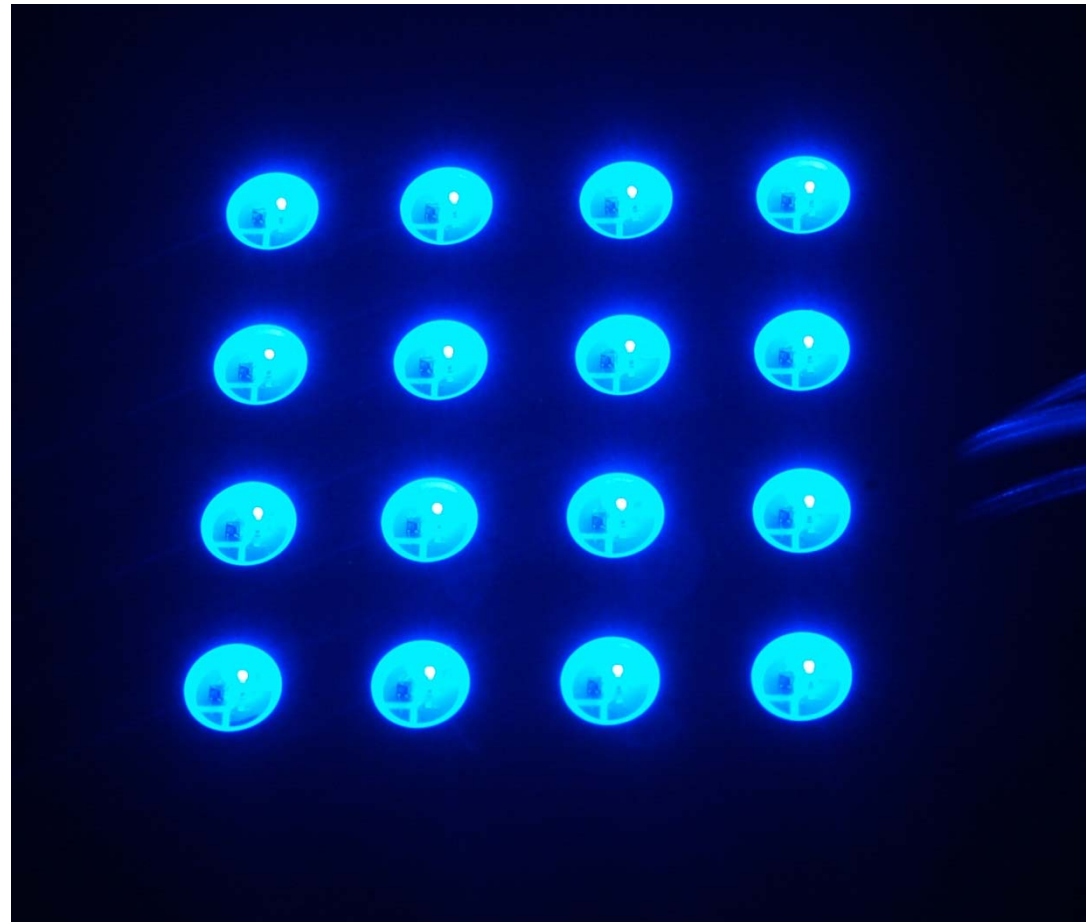
# 進行測試二

@000255000#



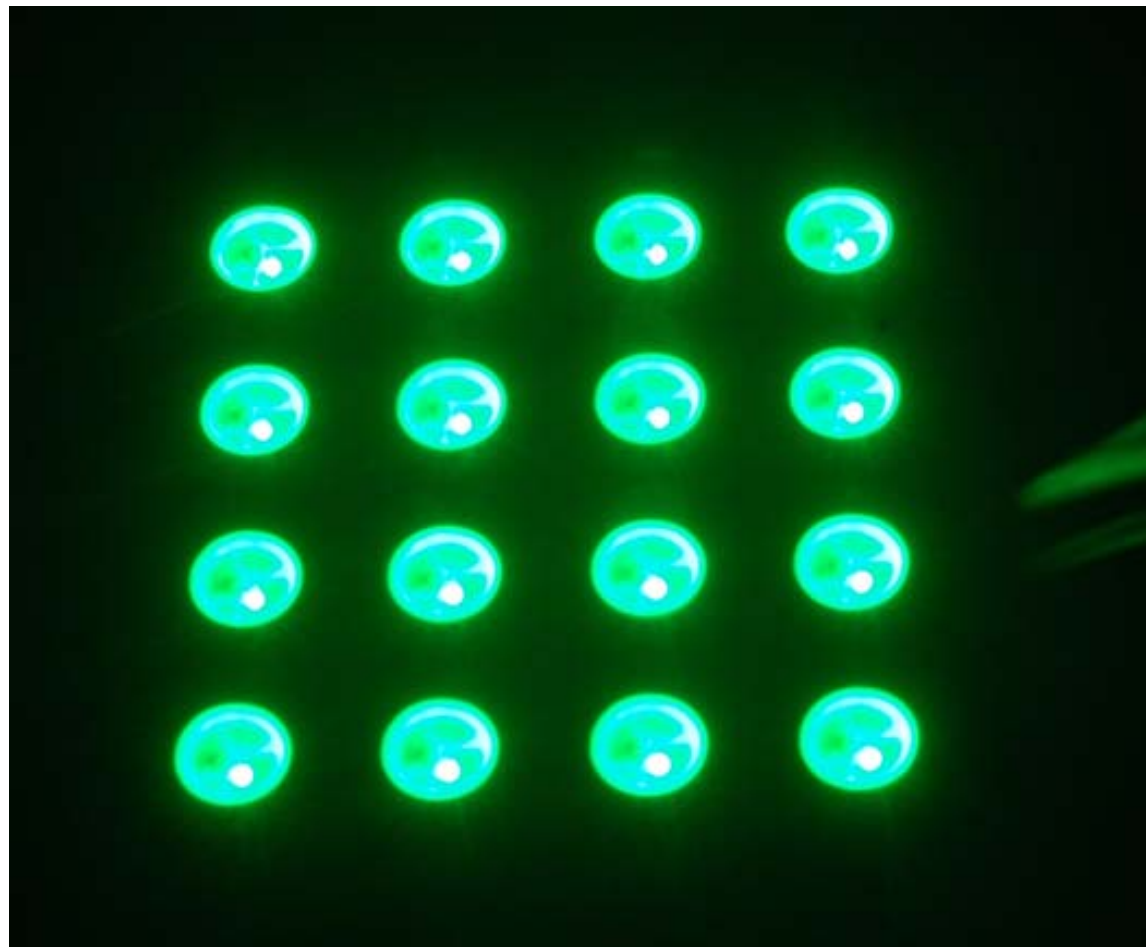
# 進行測試三

@000000255#



# 進行測試四

@128000128#



# 燈泡畫面





# 燈泡畫面





# 燈泡畫面



# 燈泡畫面

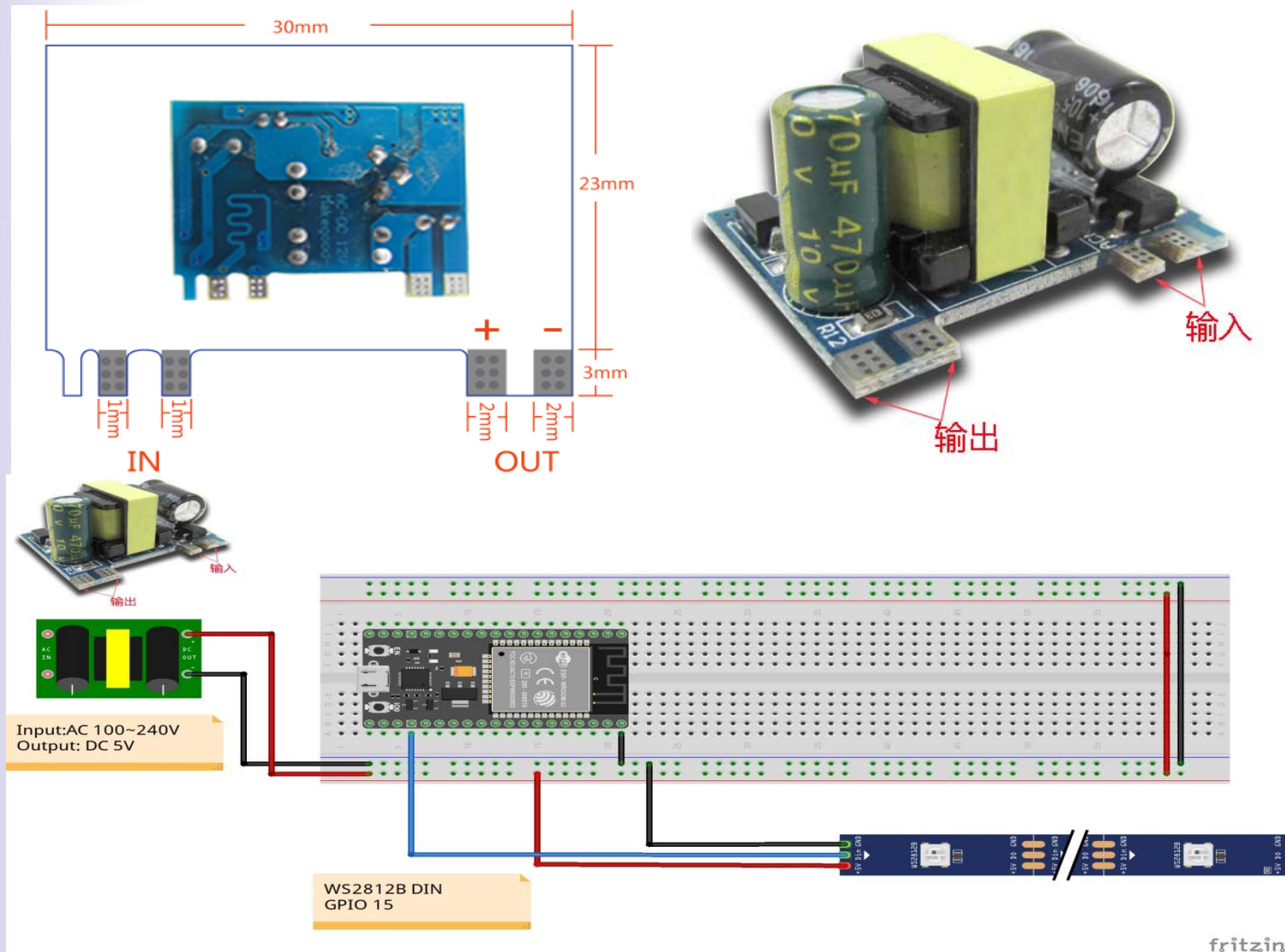




# 日光燈源開發



# 系統架構(續)



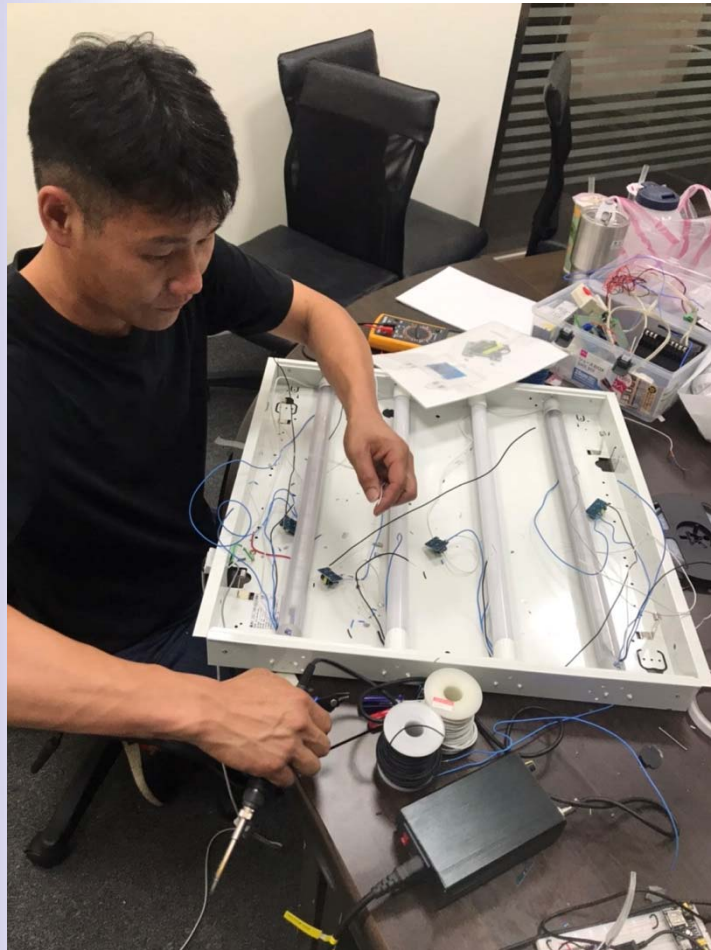


# 研究過程





# 研究過程



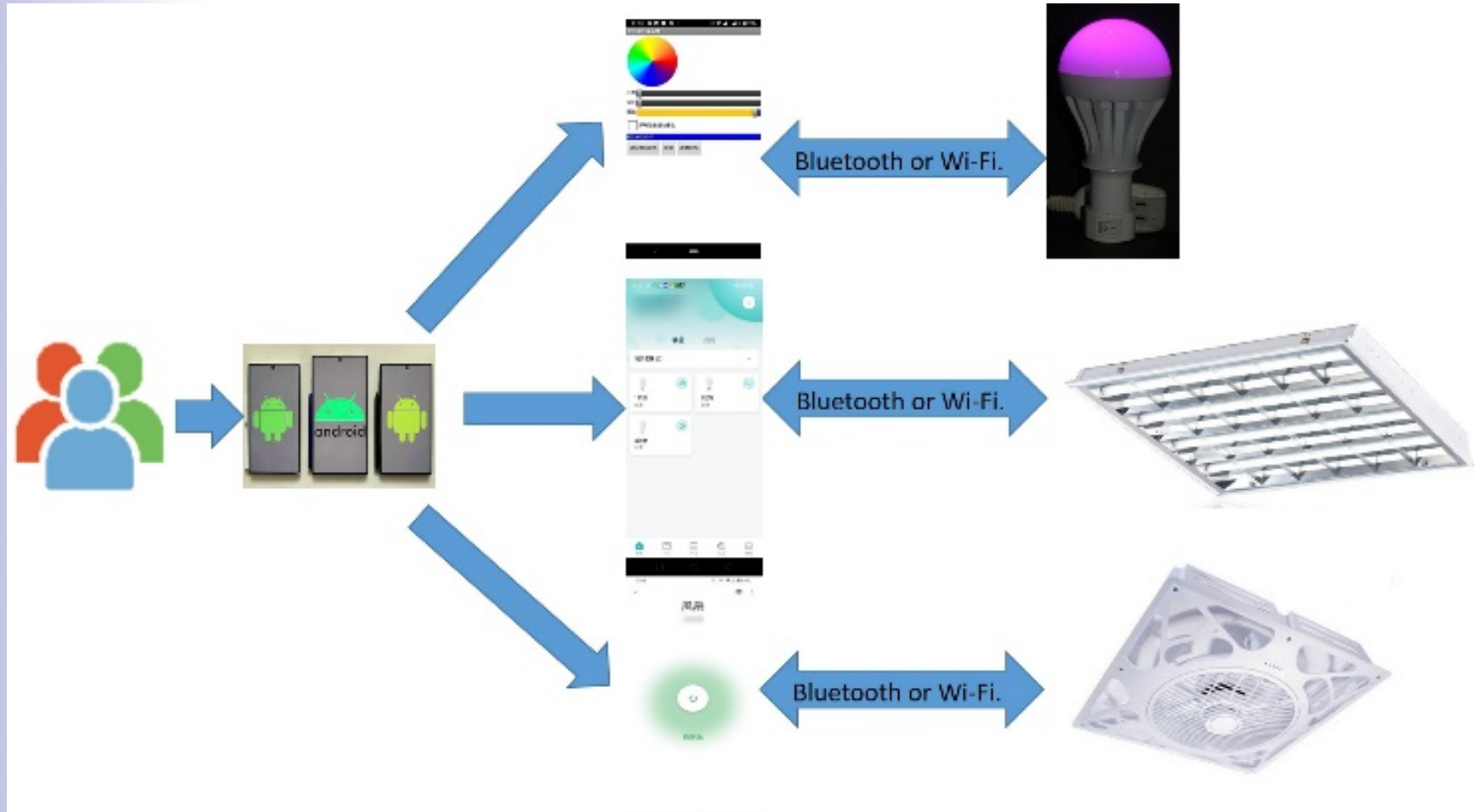
# 討論





# 虛擬開關

# Background





## Motivation

- **Although voice input like Amazon Alexa, Google Home , Apple Siri, etc. can integrate many electronic devices into their home series to be waited to be controlled, but those applications are not open-system for the study targets, so commercial revenue may block a win-win situation at all**



## Motivation

- **Although voice input like Amazon Alexa, Google Home , Apple Siri, etc. can integrate many electronic devices into their home series to be waited to be controlled, but those applications are not open-system for the study targets, so commercial revenue may block a win-win situation at all**

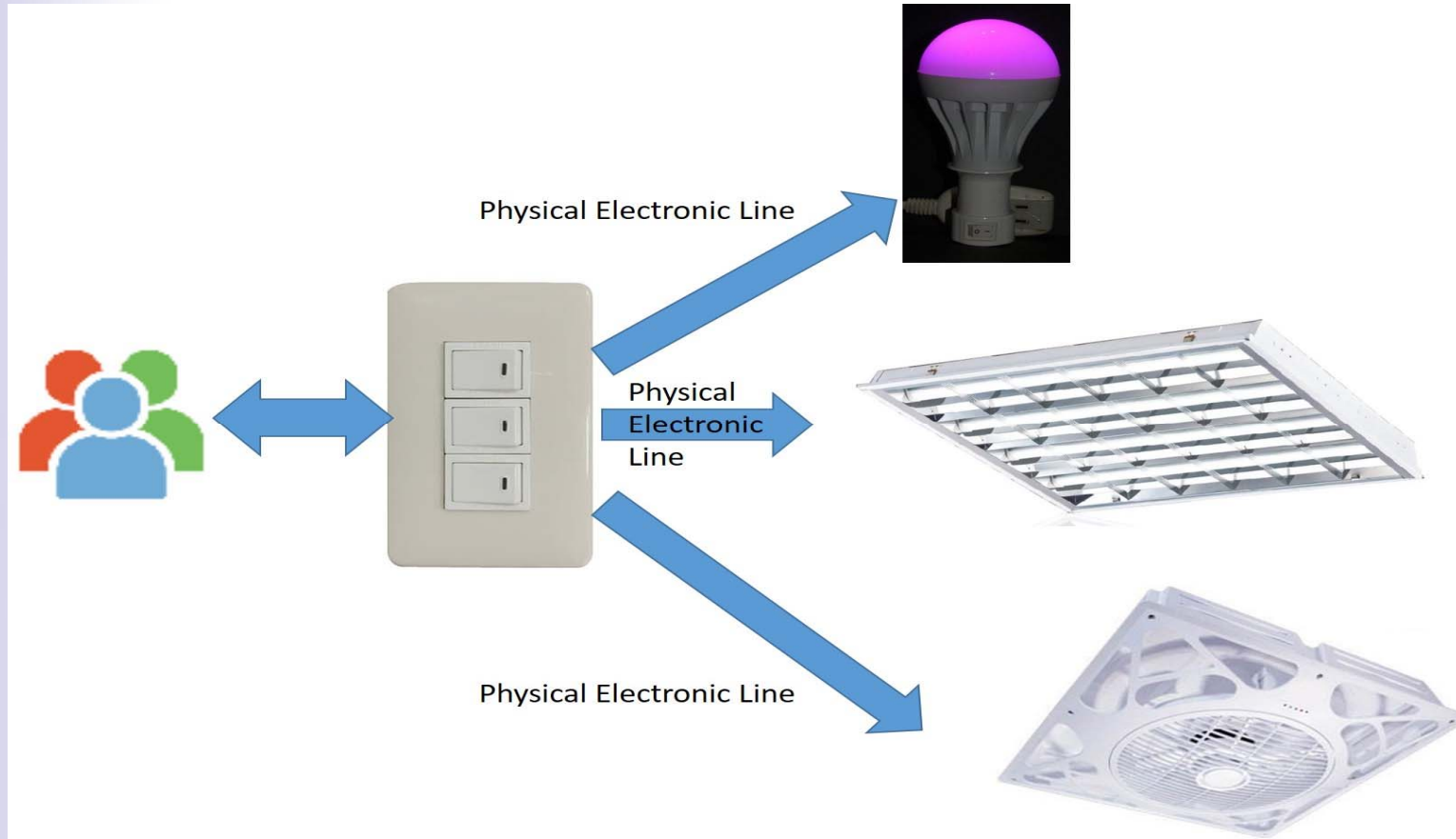




## Motivation

- **The most critical problems which is the fully replacement of those power switches in families, become impossible mission in spite of high-expense and influence by migration and up-gradation of traditional power-line cabling deployments. If the study can develop some mechanisms which can communicate with those power switches and electronic products to co-work together to up-grade the traditional electronic products painless fully, the home appliance of smart and intelligent home will take over the traditional ones without any revolutionary life-style change.**

# Motivation





## Constraint

- The electronic led bulbs and tubes are main research targets in this study.
- The on-line web system and physical controlling panel are the implementation in this study.
- The development of device is based on NodeMCU-32 Lua WiFi



# ■ Literature Survey

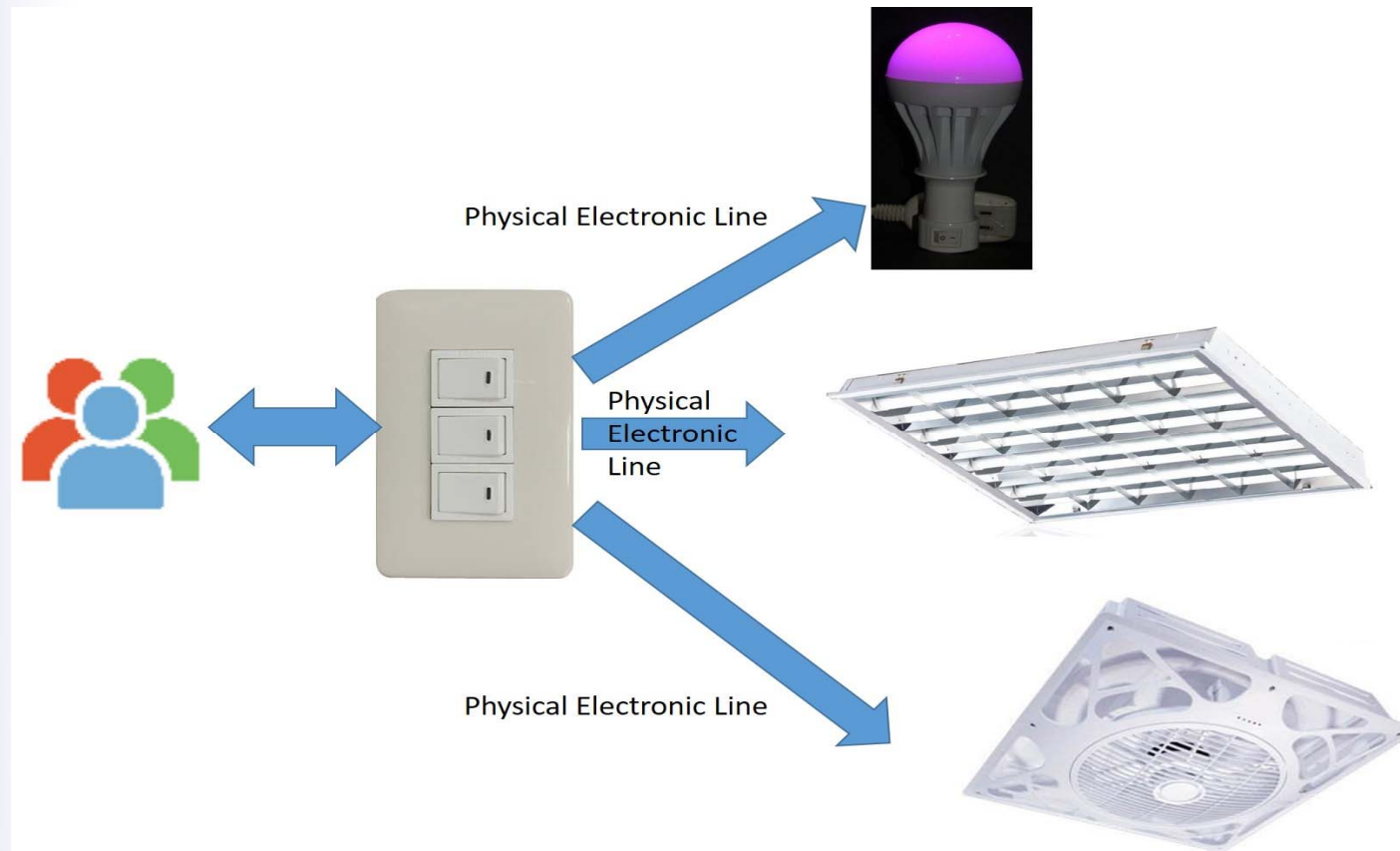


## ■ The traditional power line cabling deployment

- The power line cabling of the building and rooms are still a fixed fitment and any changes will spend much expense and time-consuming. Because those power-cabling-line for light-sockets , power-sockets, power-switches usually were buried in the wall and ceiling due to the beautiful consideratio



# The traditional power line cabling deployment

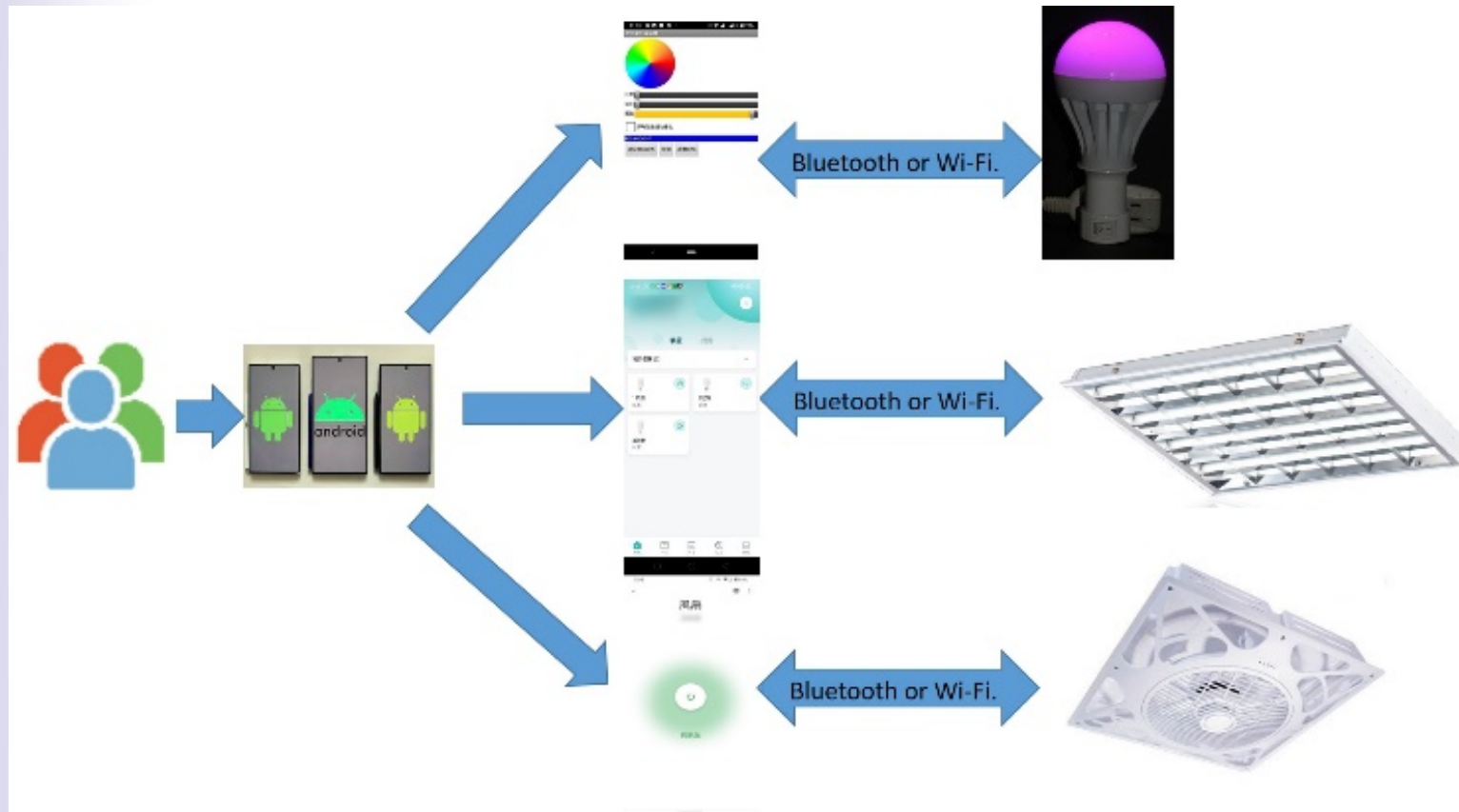




# Mobile Device Control the Electronic Devices

- Mobile Device Control the Electronic Devices
- Most of those device were designed to be one-to-one & bi-direction communication one time and the mobile devices are not so many as traditional power-switches on the walls

# Mobile Device Control the Electronic Devices

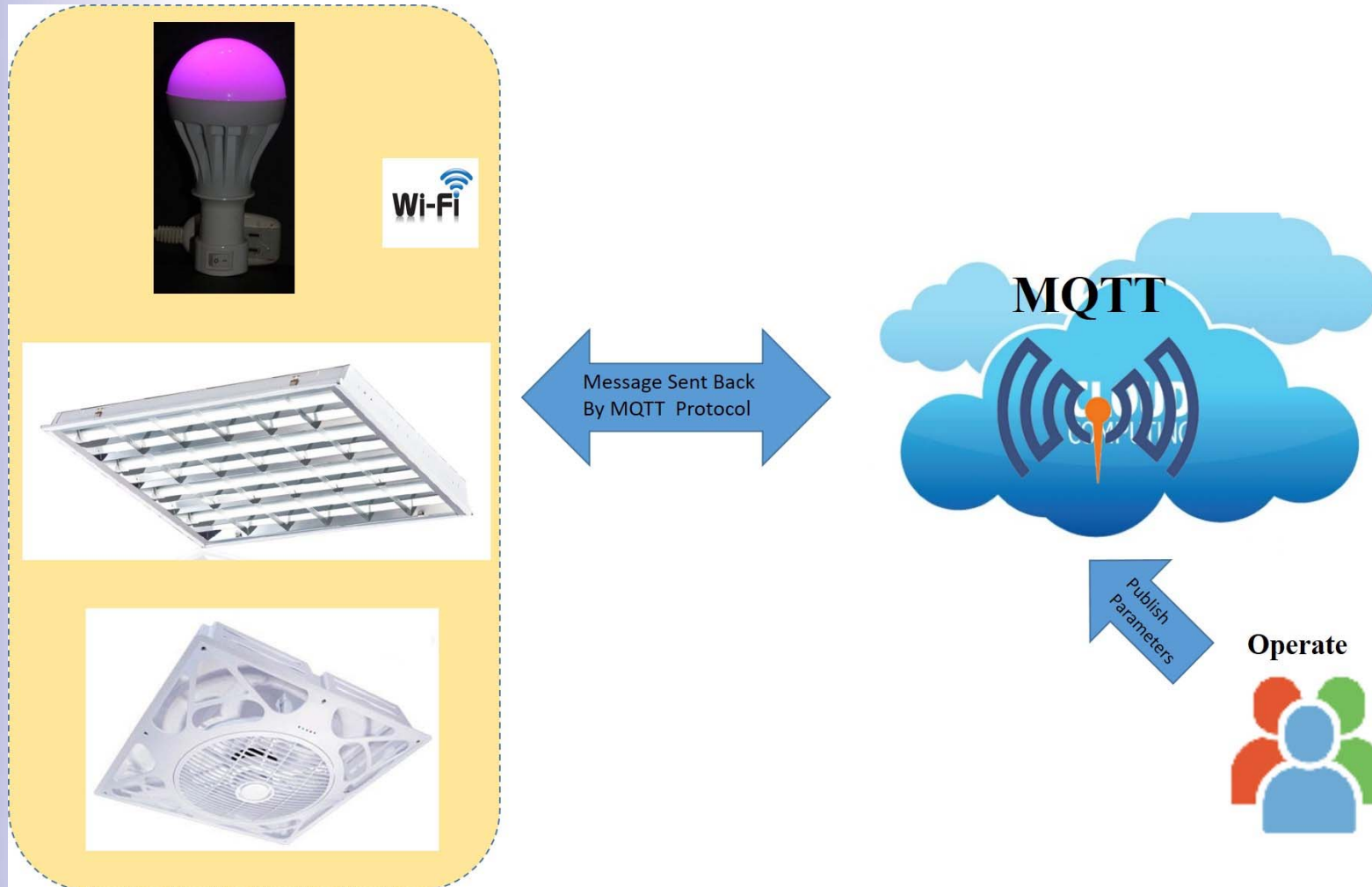




# IOT based System Architecture

- For achieving the instant and bi-direction communication between controllers and be-controlled devices, the study adds MQTT broker into the proposed IOT-based architecture
- the functions of MQTT broker extracts the all information into pure and public information hub on Internet and receiving all information for any devices or information only need to subscribe the topic, which the any controllers publish their controlling commands as publishing information to, to get instant controlling commands as subscribing information to do their jobs indecently

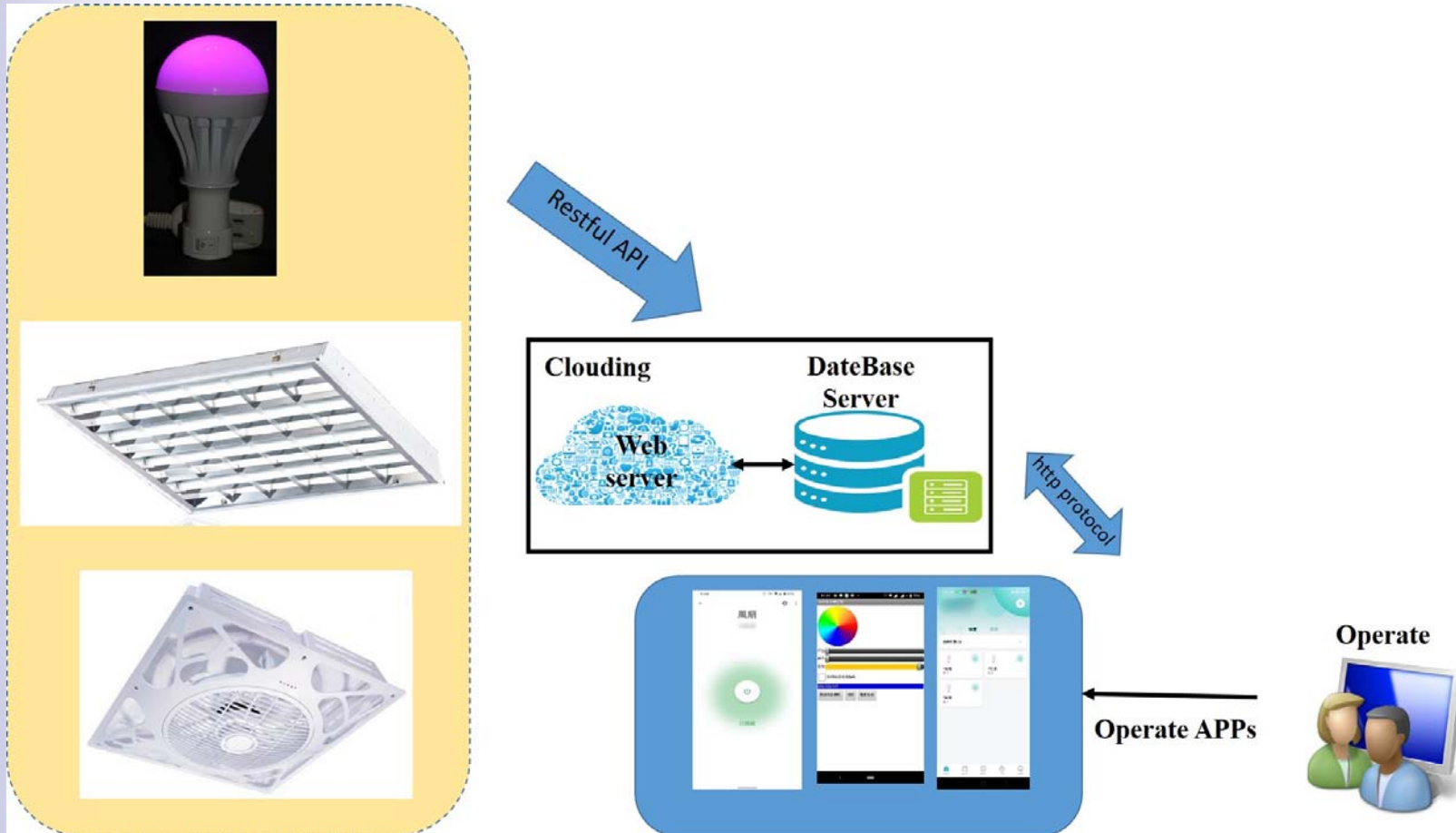
# IOT based System Architecture



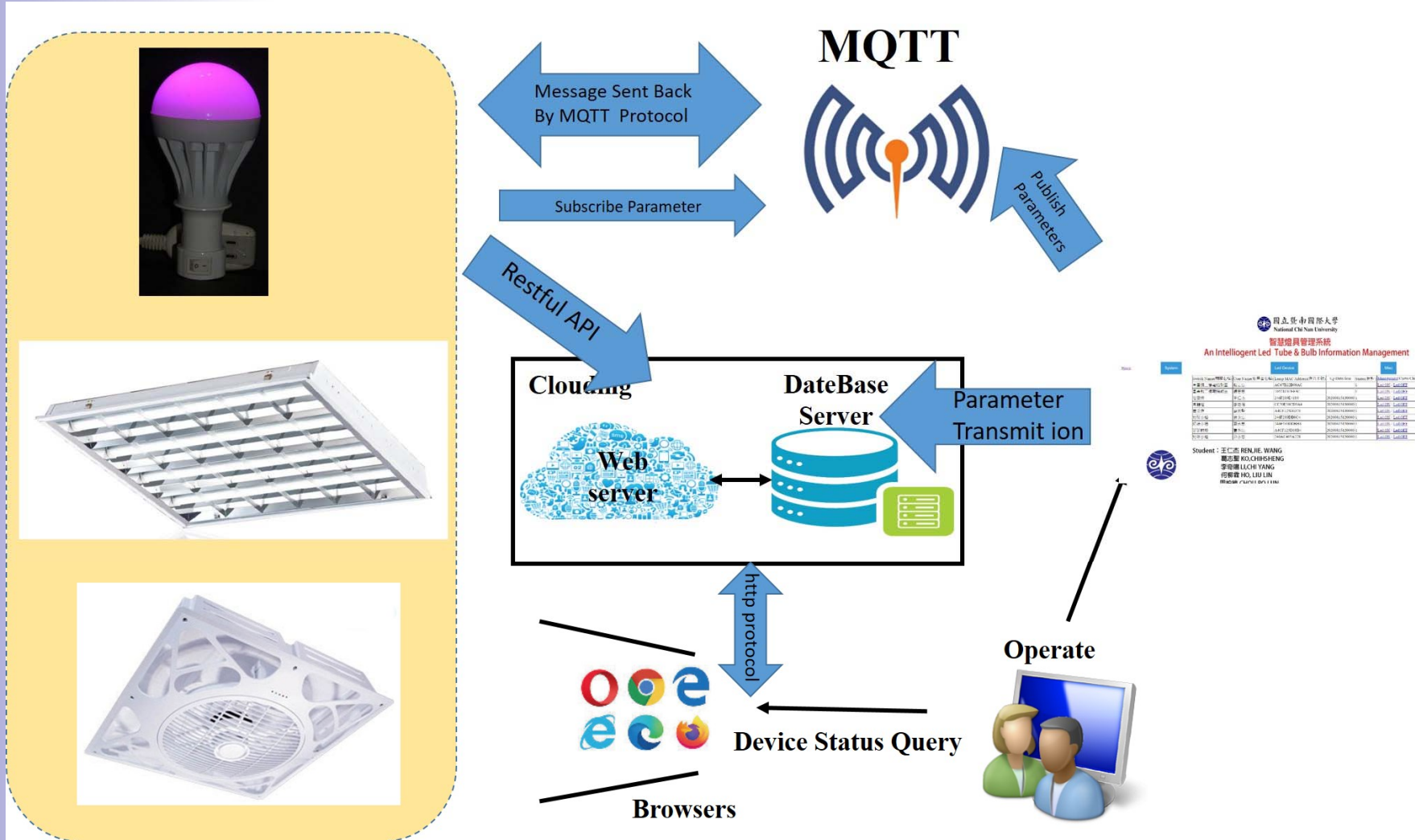


# ■ System Design

# Original System Architecture



# IOT-based System Architecture



## Comparison

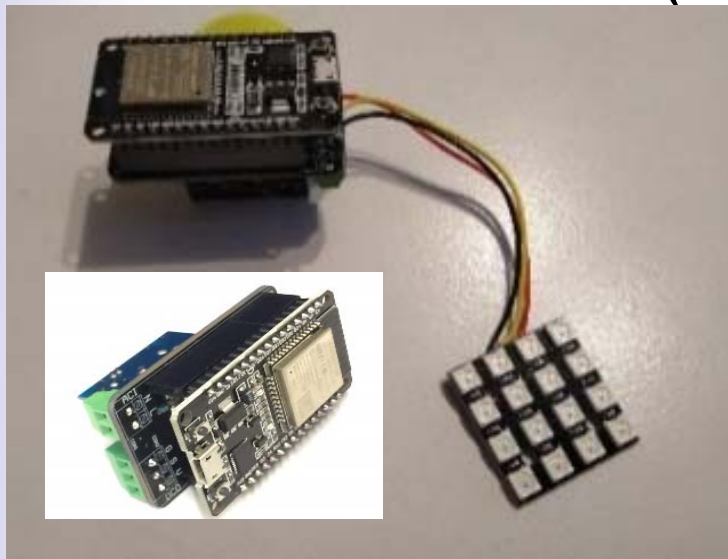
	<b>Advantages</b>	<b>Disadvantages</b>
<b>Original System Architecture</b>	Users can use any internet-based equipment via Internet to access web-site and query sensor data with browsers in passive way	Those information still can't be delivered to users who hope to get such information with initiative and automatic way.
<b>IOT-based System Architecture</b>	Under the above-mentioned architecture, all information transmission become very transparent and quick-response to other independent devices without any PC or browsers supporting.	<ul style="list-style-type: none"><li>◆ Requires more processing power and more memory.</li><li>◆ Limits the scalability as each client devices.</li><li>◆ Centralized broker limits the scalability as each client devices</li></ul>



# ■ Implementation System

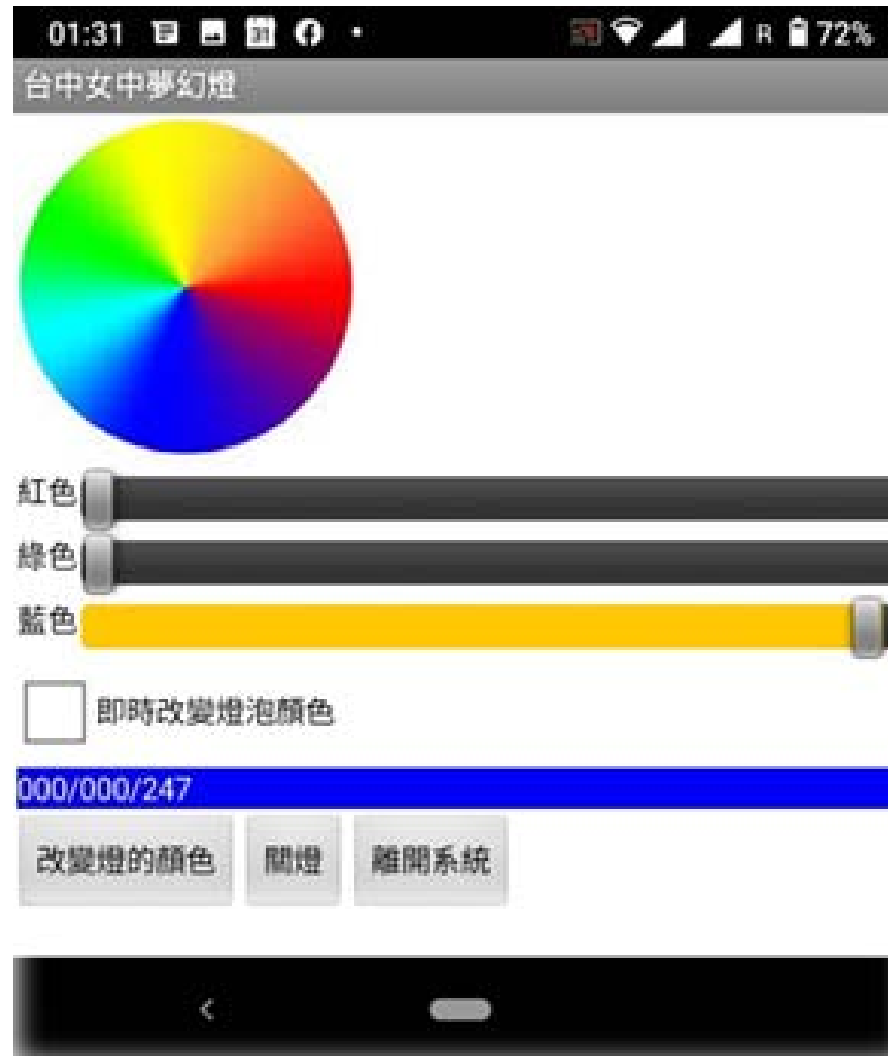
## ■ Eltronic Light Buld Design

- implementations a circuit and layouts a PCB for the proposed device as shown in Fig 6.(a) & (b). This PCB uses NodeMCU-32 as CPU to control Led modules(WS2812B) bind to AC-DC converter (AC100-240V to DC 5V)





# Eltronic Light Bulb Design



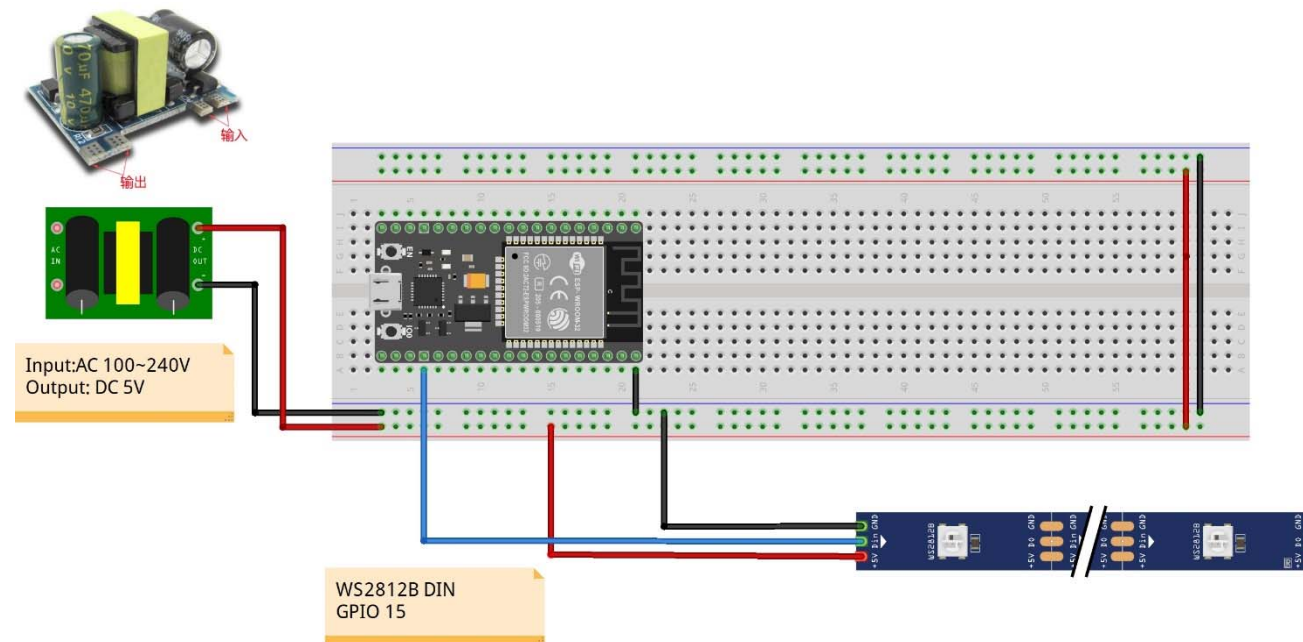


# Eltronic Light Buld Design

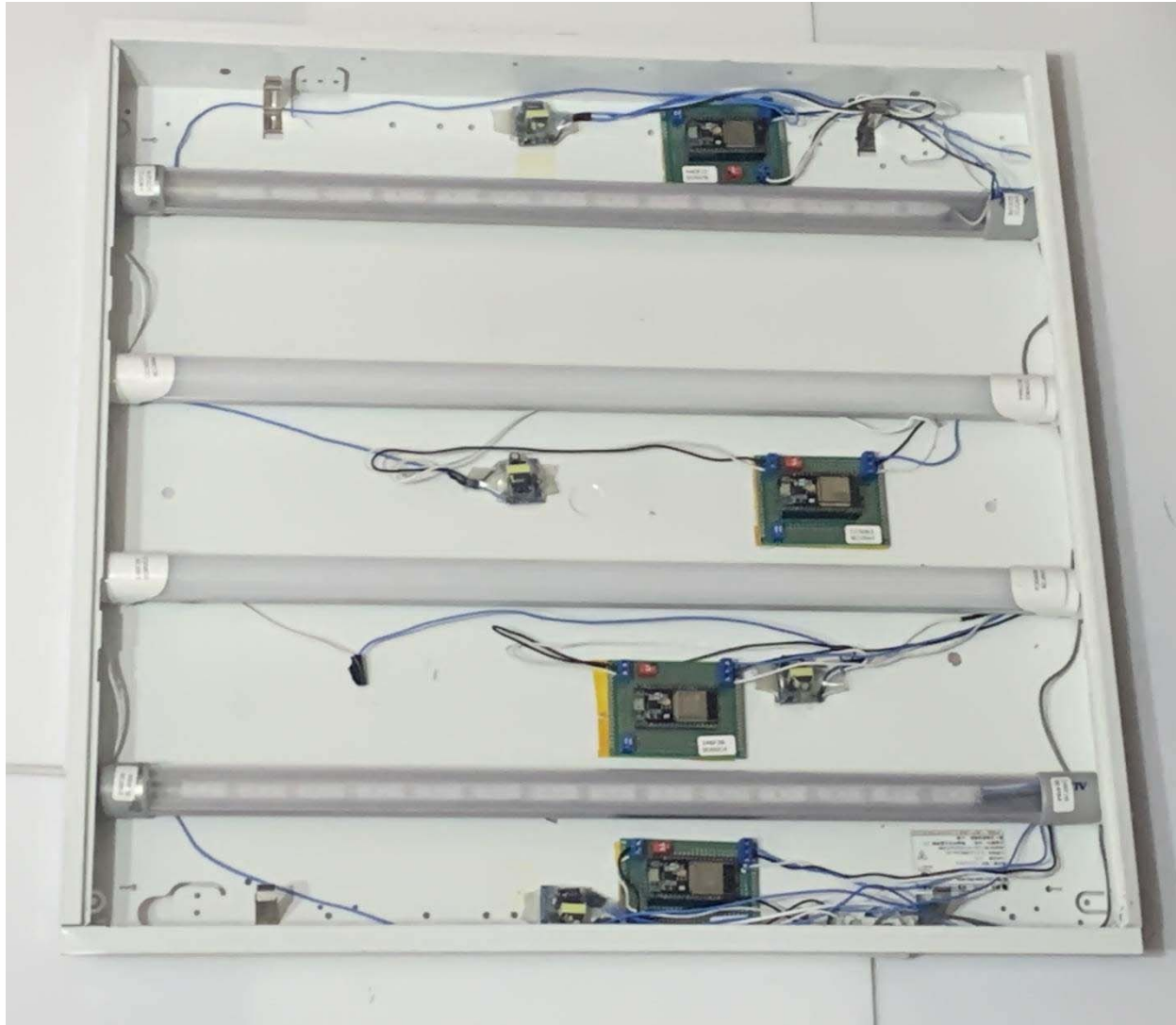


# ■ Electronic Light Tube Design

- Electronic led light tube is the ceiling light equipment based on the circuit. The study uses AC 100-240V to DC 5V convert to be AC power input without any extra power-convert indeed



# Eltronic Light Buld Design





## ■ Communication Protocol

{

"Device": "246F289DB0C4",

"NO": 1,

"Command": "ON",

"Mode": "BW",

"Color": "FF0000"

}



## ■ Clouding Platform Design

- The clouding platform located in URL:  
<http://ncnu.arduino.org.tw:9999/led.php>
- If registered electronic devices on the homepage, users can identify, whom virtual-switches belong to, to click linked-text: LedON/LedOFF to turn on/off the physical electronic led light



# Clouding Platform Design



## 智慧燈具管理系統

### An Intelligient Led Tube & Bulb Information Management

Home

System

Led Device

Misc

Switch Name(開關名稱)	User Name(使用者名稱)	Led Name(燈泡名稱)	MAC Address(燈泡卡號)	Status(狀態)	Management/ Curve Chart
圖書館二樓電腦教室	楊志忠	黃淑珠	10521C67EF3C	1	<a href="#">Led ON</a> / <a href="#">Led OFF</a>
圖書館二樓電腦教室	楊志忠	楊博的燈	AC67B22B09AC	1	<a href="#">Led ON</a> / <a href="#">Led OFF</a>
浴室燈	王仁杰	王仁杰的燈泡	246F289E4184	1	<a href="#">Led ON</a> / <a href="#">Led OFF</a>
客廳燈	李奇陽	李奇陽的燈泡	CC50E38CD9A4	1	<a href="#">Led ON</a> / <a href="#">Led OFF</a>
書桌燈	葛志聖	葛志聖的燈泡	A4CF125D3378	1	<a href="#">Led ON</a> / <a href="#">Led OFF</a>
夢夢的燈	曹永忠	曹老師的燈泡	A4CF125D10B4	1	<a href="#">Led ON</a> / <a href="#">Led OFF</a>
奶味小燈	曹永忠	my BedRoom Ceiling Light(臥室頂燈)	240AC405A228	1	<a href="#">Led ON</a> / <a href="#">Led OFF</a>
奶味小燈	曹永忠	aaaaaaaaa	246F289DB0C4	1	<a href="#">Led ON</a> / <a href="#">Led OFF</a>



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Address:(54561) No.1, University Rd., Puli Township,



## ■ Clouding Platform Design

- The registered user-list from user-list menu as shown in Next Slide.
- And users can add their room for locating the power-switches here.





# Clouding Platform Design



National Chi Nan University

智慧燈具管理系統

An Intellignet Led Tube & Bulb Information Management

[Home](#)

[System](#)

[Led Device](#)

[Misc](#)

ID(主鍵)	User ID(使用者編號)	User Name(使用者名稱)	UpdateTime(最後更新時間)	Management(管理動作)
6	amos	楊志忠	20201028151735	<a href="#">Add Room(新增房間)</a>
1	brucetsao	曹永忠	20200815120000	<a href="#">Add Room(新增房間)</a>
5	daniel	何柳霖	20200815130000	<a href="#">Add Room(新增房間)</a>
2	tony	葛志聖	20200815130000	<a href="#">Add Room(新增房間)</a>
4	wang	王仁杰	20200815130000	<a href="#">Add Room(新增房間)</a>
3	youn	李奇陽	20200815130000	<a href="#">Add Room(新增房間)</a>

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ncnu.arduino.org.tw:9999/leduser/roomadd.php?sid=1



## ■ Clouding Platform Design

- The clouding platform also offer adding new room in webpage as shown in Next Slide
- by click linked text: Add Room to add their room

# Clouding Platform Design

國立暨南國際大學  
National Chi Nan University

智慧燈具管理系統  
An Intelligient Led Tube & Bulb Information Management

Home System Led Device Misc

新增	清除
User ID & Name (使用者)	曹永忠 (tsaoyung)
Room Name (房間名稱)	
Room Address (房間地址)	<input type="text"/>
Latitude (房間緯度)	<input type="text"/>
Longitude (房間經度)	<input type="text"/>
Reset 重設	Submit 送出



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李奇陽 LI,CHI YANG  
何柳霖 HO, LIU LIN  
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## ■ Clouding Platform Design

- The clouding platform also offer configured room lists from room-list menu as shown in Next Slide
- User can check how many rooms were added



# Clouding Platform Design



國立暨南國際大學  
National Chi Nan University

智慧燈具管理系統

An Intelligont Led Tube & Bulb Information Management

[Home](#)

[System](#)

[Led Device](#)

[Misc](#)

User ID(使用者編號)	User Name(使用者名稱)	Room Name(房間名稱)	Room Address(房間住址)	Room FPS(房間座標)	Management(管理動作)
amos	楊志忠	基隆高中圖書館	基隆市暖暖區源遠路20號	(25.107803 , 121.732841 )	<a href="#">Add Switch(新增房間開關)</a>
brucetsao	曹永忠	夢夢的房間	臺北市羅斯福路四段一號	(25.017771 , 121.539749 )	<a href="#">Add Switch(新增房間開關)</a>
daniel	何柳霖	何柳霖的房間	臺中市南區興大路145號	(24.123752 , 120.676937 )	<a href="#">Add Switch(新增房間開關)</a>
tony	葛志聖	葛志聖的房間	811高雄市楠梓區高雄大學路700號	(22.734410 , 120.284474 )	<a href="#">Add Switch(新增房間開關)</a>
wang	王仁杰	王仁杰的房間	892金門縣金寧鄉大學路1號	(24.448121 , 118.322535 )	<a href="#">Add Switch(新增房間開關)</a>
youn	李奇陽	李奇陽的房間	701台南市東區大學路1號	(22.999191 , 120.219601 )	<a href="#">Add Switch(新增房間開關)</a>

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## ■ Clouding Platform Design

- The clouding platform also offer adding new switch in webpage as shown in Next Slide
- User can click linked text: Add Switch to add new power-switches

# Clouding Platform Design




國立暨南國際大學  
National Chi Nan University

## 智慧燈具管理系統 An Intelligent Led Tube & Bulb Information Management

HomeSystemLed DeviceMisc

返回上一頁

UserID & Name(使用者)	曹永忠(broccetsno1)
Room Name(房間名稱)	靜宜的房間
Room Address(房間地址)	臺北市羅斯福路四段一號
Switch Name(開關名稱)	<input type="text"/>
Result(查詢)	Submit(送出)



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Advisor : 曹永忠 博士 Yung-Chung Tsao Ph.D



## ■ Clouding Platform Design

- The clouding platform also offer configured switch lists from switch-list menu as shown in Next Slide
- User also can check how many switches were added in their room.



# Clouding Platform Design



## 智慧燈具管理系統

### An Intelligient Led Tube & Bulb Information Management

[Home](#)

System

Led Device

Misc

Operation(動作)	User Name(房間主人名稱)	Room Name(房間名稱)	Switch Name(開關名稱)	Room Address(房間住址)	UpdateTime(最後更新時間)
<a href="#">Add Led</a>	曹永忠	夢夢的房間	夢夢的燈	臺北市羅斯福路四段一號	20200815120000
<a href="#">Add Led</a>	曹永忠	夢夢的房間	奶咪小燈	臺北市羅斯福路四段一號	20200815120000
<a href="#">Add Led</a>	楊志忠	基隆高中圖書館	圖書館二樓電腦教室	基隆市暖暖區源遠路20號	20201028151735
<a href="#">Add Led</a>	王仁杰	王仁杰的房間	浴室燈	892金門縣金寧鄉大學路1號	20200815130000

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## ■ Clouding Platform Design

- All electronic devices, which will register their MAC address into clouding platform's DB system, whenever those electronic devices are new or old. In other word, any one creates any electronic devices based on the proposed mechanism as shown in Next Slide



# Clouding Platform Design



國立暨南國際大學  
National Chi Nan University

智慧燈具管理系統

An Intelligient Led Tube & Bulb Information Management

[Home](#)

[System](#)

[Led Device](#)

[Misc](#)

[回到上一頁](#)

User Name(使用者)	曹永忠
Room Name(房間名稱)	夢夢的房間
Switch Name(開關名稱)	奶咪小燈
Led MAC(燈泡網卡)	240AC405A228(20200826131149) ▾
Led Name(燈泡名稱)	my BedRoom Ceiling Light(臥室頂燈)
Reset(重設)	Submit(送出)



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## ■ Clouding Platform Design

- User also can click the geographical site to open the pop menu, which mechanism as shown in Next Slide for all electronic devices,
- User also turn on/off the belonged virtual switches as shown in Next Slide .

# Clouding Platform Design



國立暨南國際大學  
National Chi Nan University

智慧燈具管理系統

An Intelligont Led Tube & Bulb Information Management

Home

System

Led Device

Misc



# 討論

國立暨南國際大學  
National Chi Nan University

## 智慧燈具管理系統 An Intelligient Led Tube & Bulb Information Management

Home System Led Device Misc

Switch Name(開關名稱)	User Name(使用者名稱)	Led Name(燈泡名稱)	MAC Address(燈泡卡號)	Status(狀態)	Management/ Curve Chart
圖書館二樓電腦教室	楊志忠	黃淑珠	10521C67EF3C	1	<a href="#">Led ON</a> / <a href="#">Led OFF</a>
圖書館二樓電腦教室	楊志忠	楊博的燈	AC67B22B09AC	1	<a href="#">Led ON</a> / <a href="#">Led OFF</a>
浴室燈	王仁杰	王仁杰的燈泡	246F289E4184	1	<a href="#">Led ON</a> / <a href="#">Led OFF</a>
客廳燈	李奇陽	李奇陽的燈泡	CC50E38CD9A4	1	<a href="#">Led ON</a> / <a href="#">Led OFF</a>
書桌燈	葛志聖	葛志聖的燈泡	A4CF125D3378	1	<a href="#">Led ON</a> / <a href="#">Led OFF</a>
夢夢的燈	曹永忠	曹老師的燈泡	A4CF125D10B4	1	<a href="#">Led ON</a> / <a href="#">Led OFF</a>
奶咪小燈	曹永忠	my BedRoom Ceiling Light(臥室頂燈)	240AC405A228	1	<a href="#">Led ON</a> / <a href="#">Led OFF</a>
奶咪小燈	曹永忠	aaaaaaaaa	246F289DB0C4	1	<a href="#">Led ON</a> / <a href="#">Led OFF</a>

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 何柳霖 HO, LIU LIN  
 周柏綸 CHOU, PO LUN



# 結論



# 討論、結論與未來展望

- 討論
- 結論



## 討論

- 一. 環境監控能否即時化、普及化與高精確性，或許目前人類能否安居樂業的關鍵要因。基於物聯網興起，感測器技術、網際網路與雲端運算極大數據技術的發展進步，分散式架構改變了感測物件與系統之建置的架構，物聯網技術為大量與多類型感測物件之不確定性提供了許多解決方案。
- 二. 運用物聯網的架構，將感測器物件化，並建立標準的通訊標準界面連接監控雲端平台，透過物聯網的架構將感測物件與平台建立動態連結技術，建立更具彈性的環境監控系統。

## 結論

- 一. 本研究提出運用物聯網系統架構之環境監控系統之設計與開發，不同於過去環境監控系統的建置，大部分的資訊系統都是事先規劃站點與每一個站點的感測裝置數量與類別，方才開發、建置資訊系統。而在環境監控系統在運行後，才發現系統變更、升級都需要大量的時間與成本，不但耗時且不符合經濟效益。
- 二. 透過實際操作建立原型系統進行測試與驗證，針對監測點環境提供了執行環境中監測，透過大量感測裝置進行測試，經由傳送至本研究的雲端平台，可實際上线且持續運作並更新環境數據。

## 結論

- 三. 經本研究原型系統實證上證明，基於物聯網系統架構未來將可以提供更具彈性且低成本建置環境監控系統，能夠簡單性、可擴充性及即時回應相對環境條件，同步監測與控制對應環境達到預警、安全與節能整體效益。
- 四. 在物聯網架構的環境監控系統下，所有的感測物件可以進行動態調節，監控站亦可動態顯示多類別與不同數量的感測資訊，本研究並結合e化政府中央氣象局開放資料平台，即時將四百餘筆氣象監控站資料整合到雲端平台，並整合台灣圖霸地圖平台圖資技術，讓本環境監控系統可用縮放地圖顯示方式顯示所有監控站。



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# Q & A



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