



# 物聯網於環境氣象監控的開發與應用

演講者：曹永忠 博士

@慈明高中

日期：2022年10月05日

# 大綱

- ▶ 前言
- ▶ 環境監控
- ▶ 環境監控平台
- ▶ 分散式顯示裝置開發
- ▶ 結論

# 環境監控

2022/1  
0/12

3

# 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

2022/1  
0/12

5

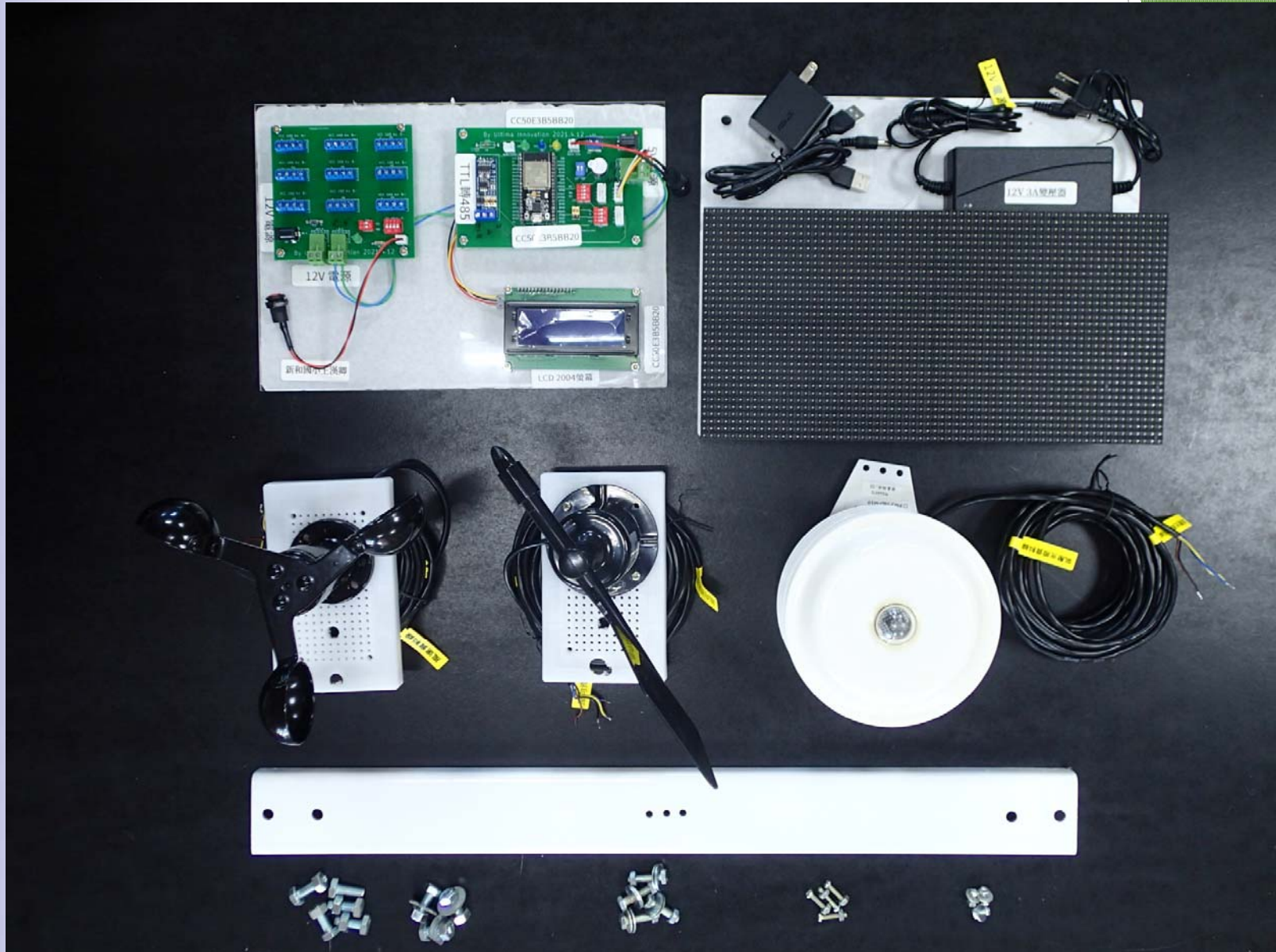
# 材料清單



# 安裝地點

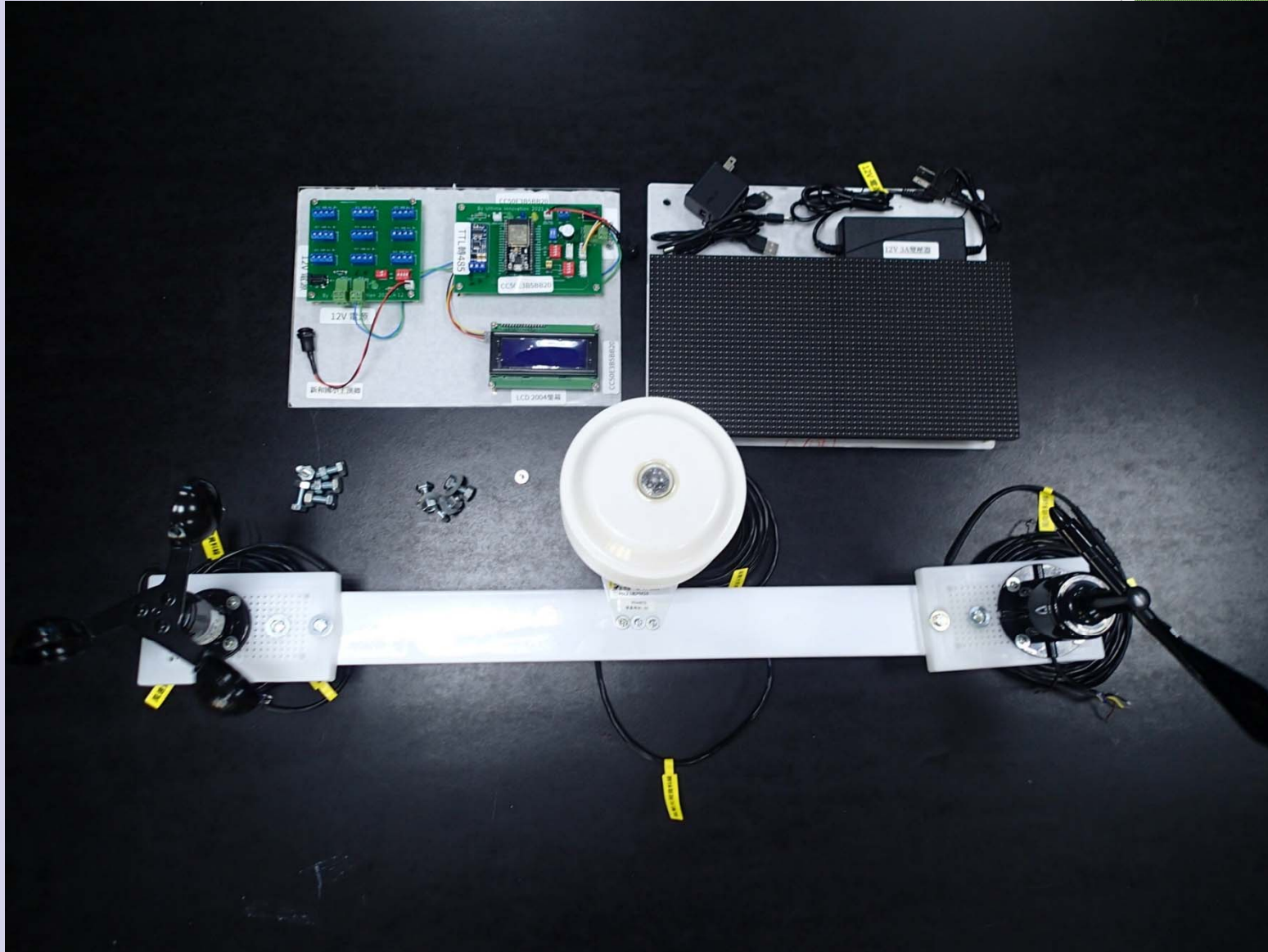


# 感測器組立





# 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

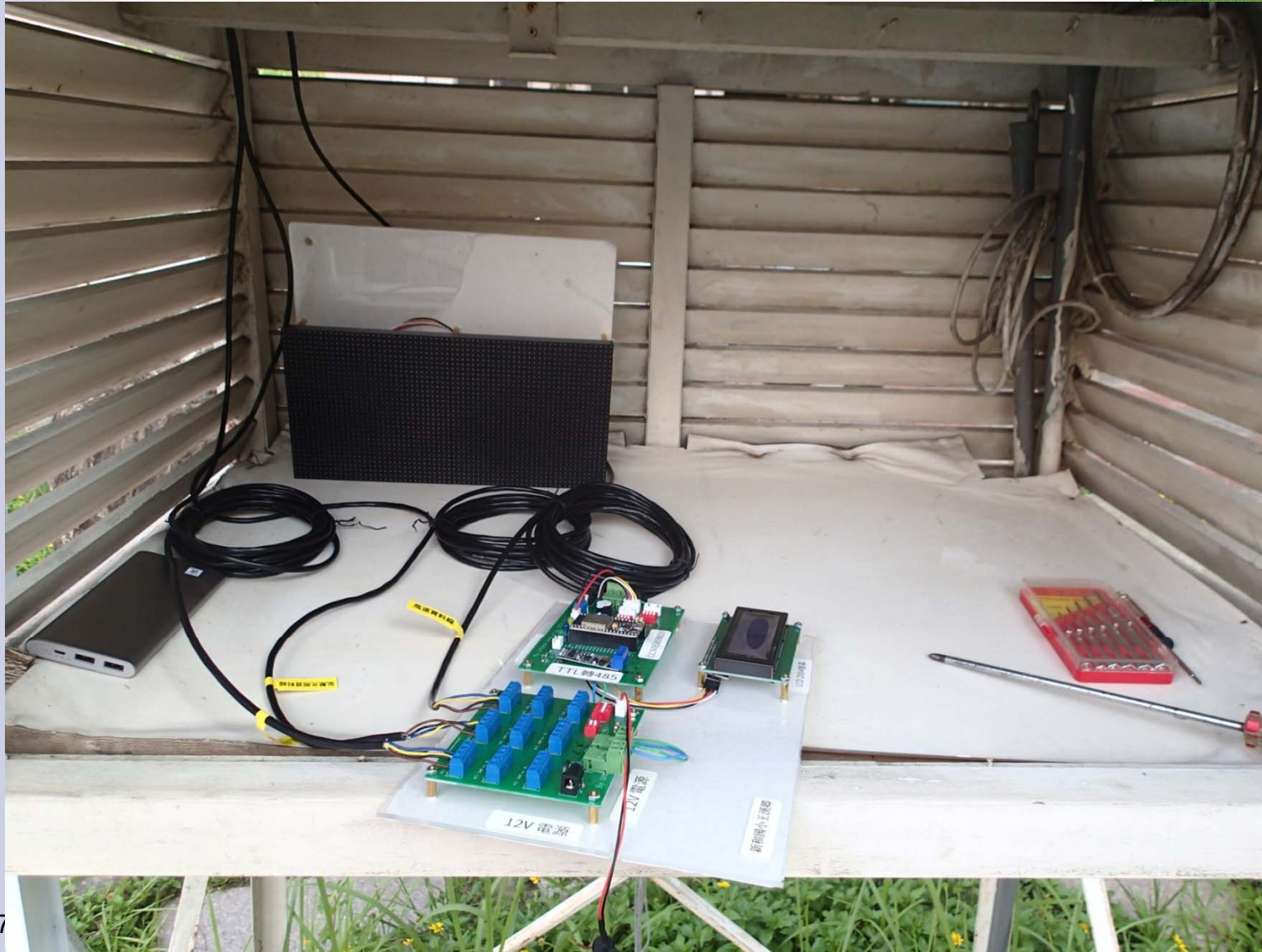


# 感測器組立

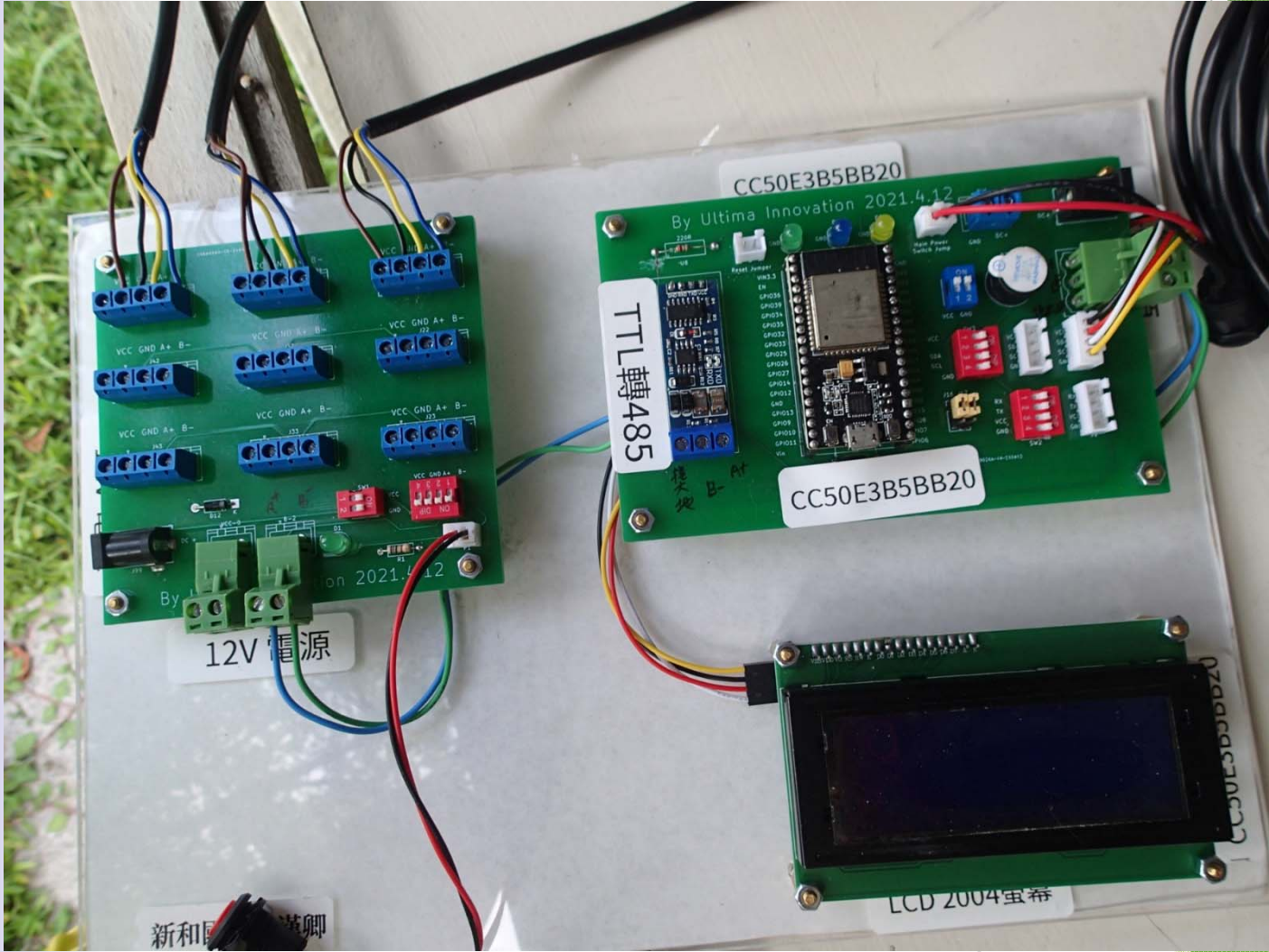




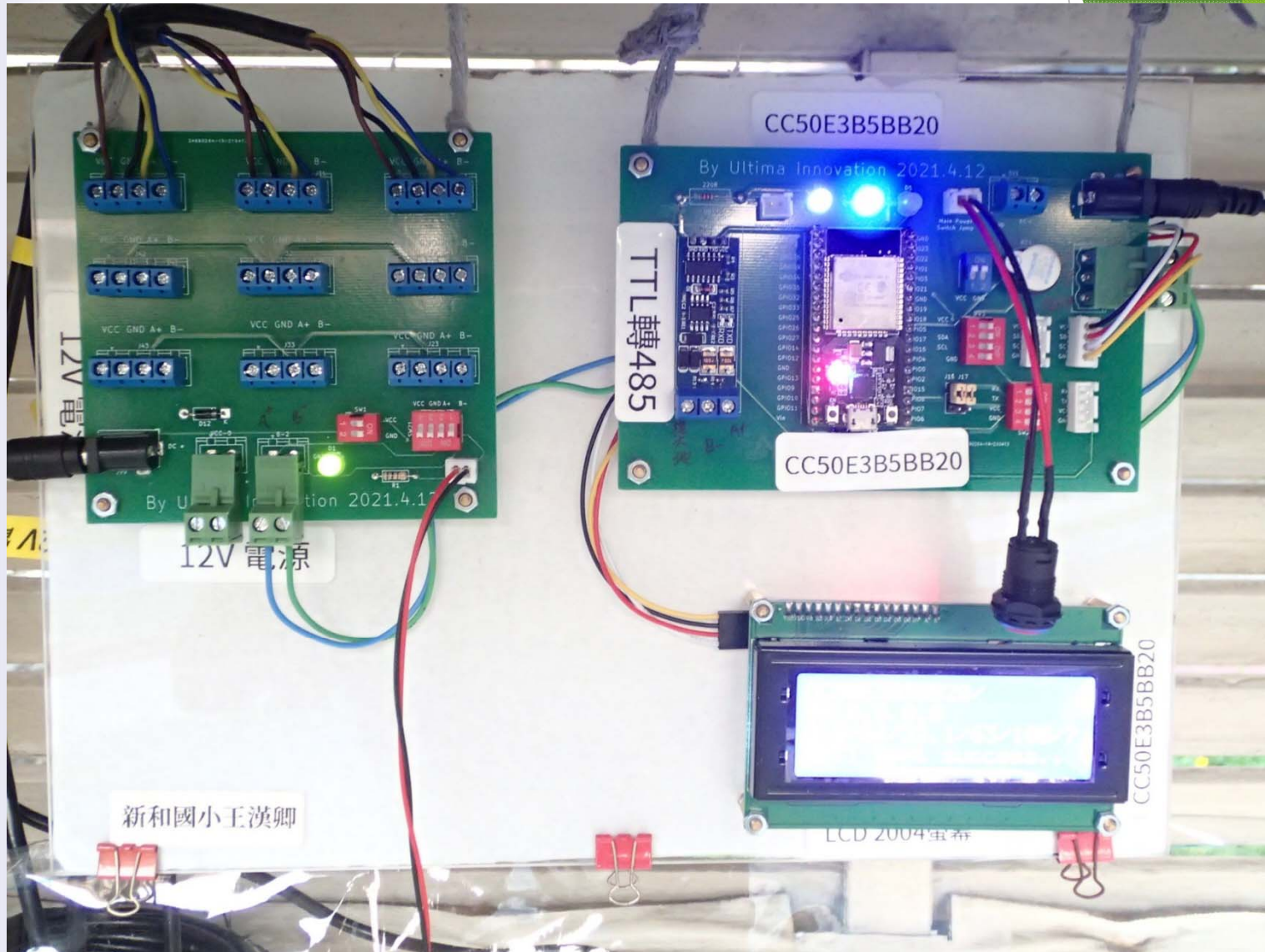
# 感測器組立



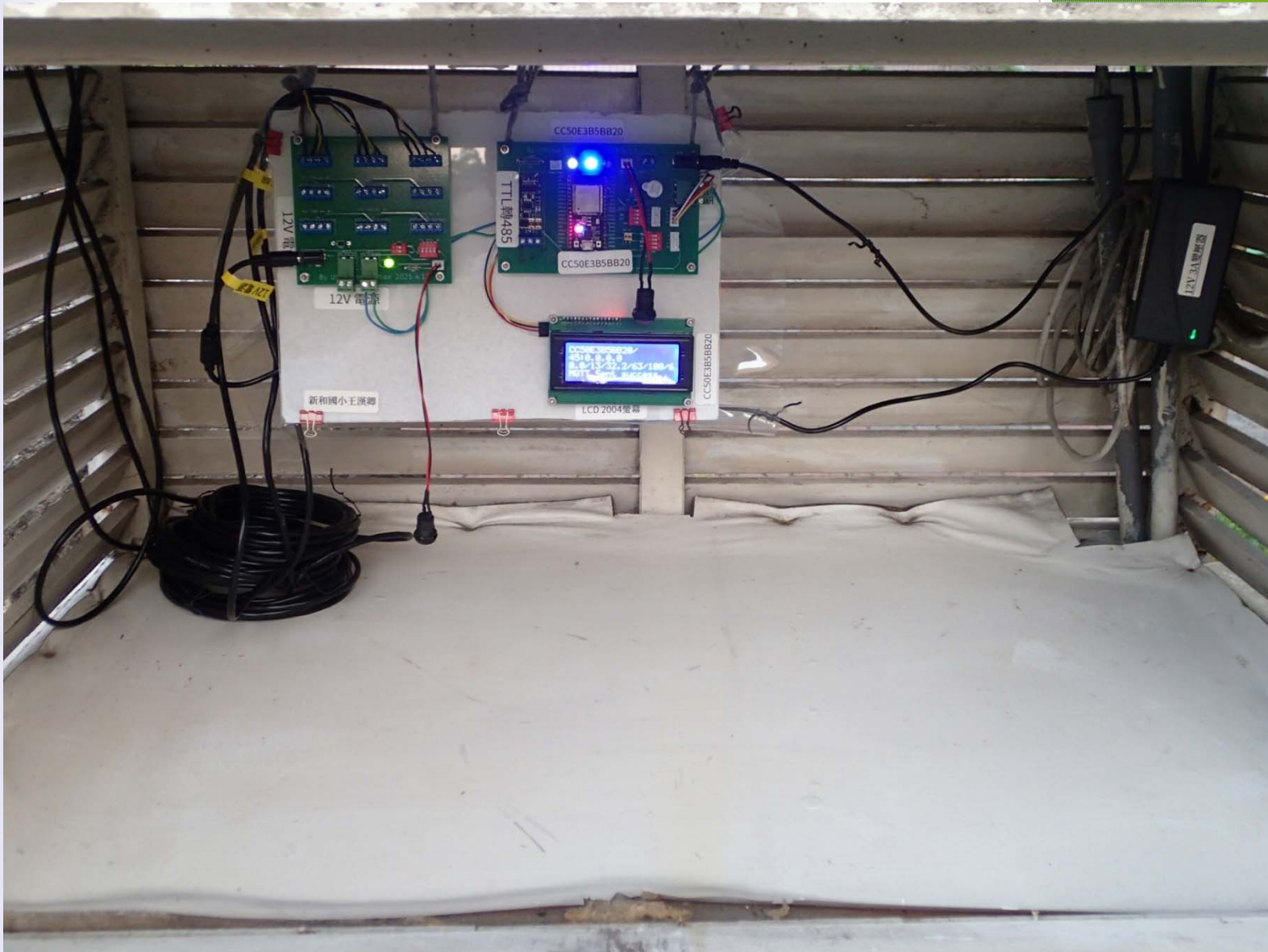
# 感測器組立



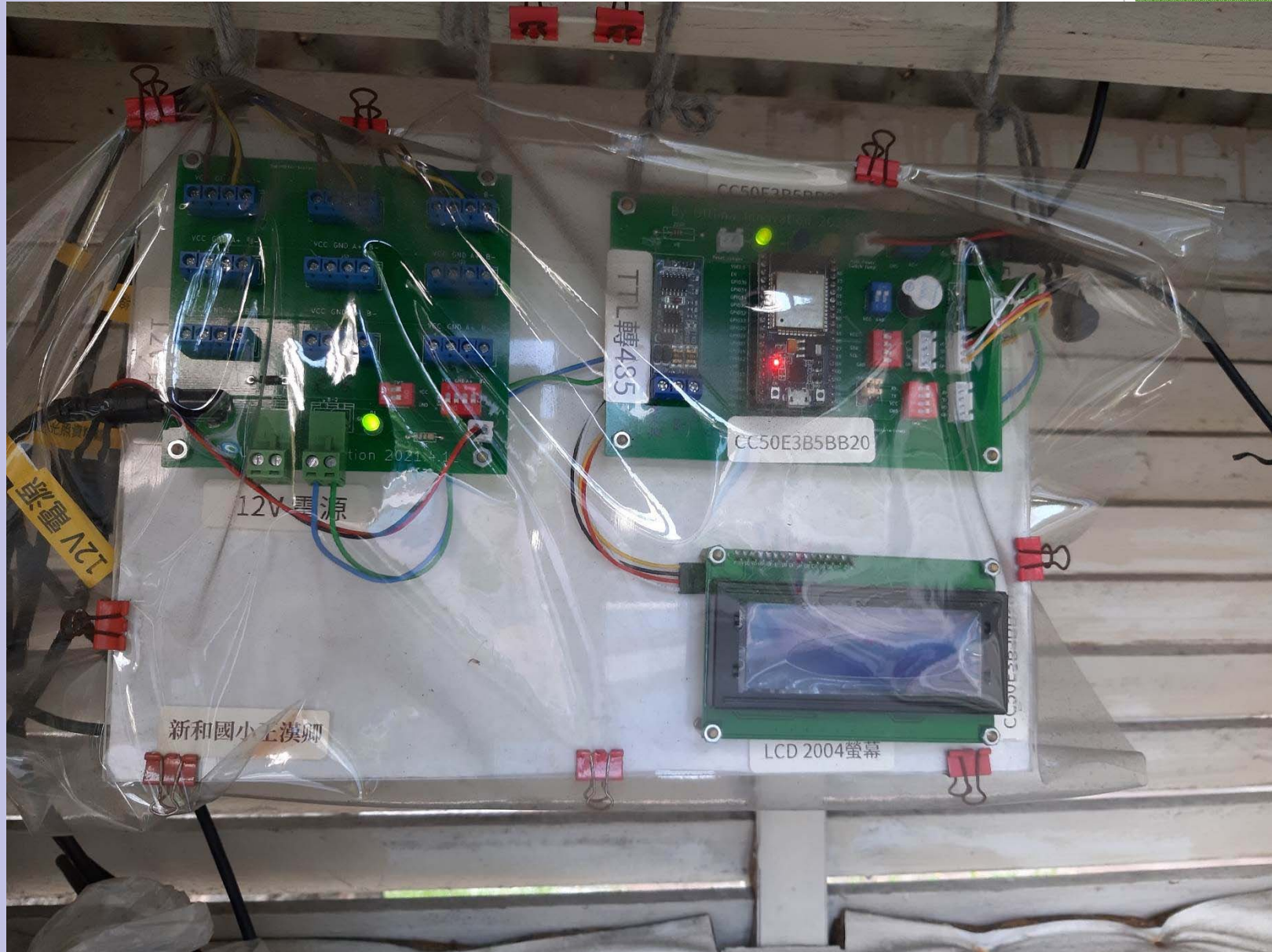
# 感測器組立



# 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



# 新和國小 氣象顯示器

2022/1  
0/12

26

# 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

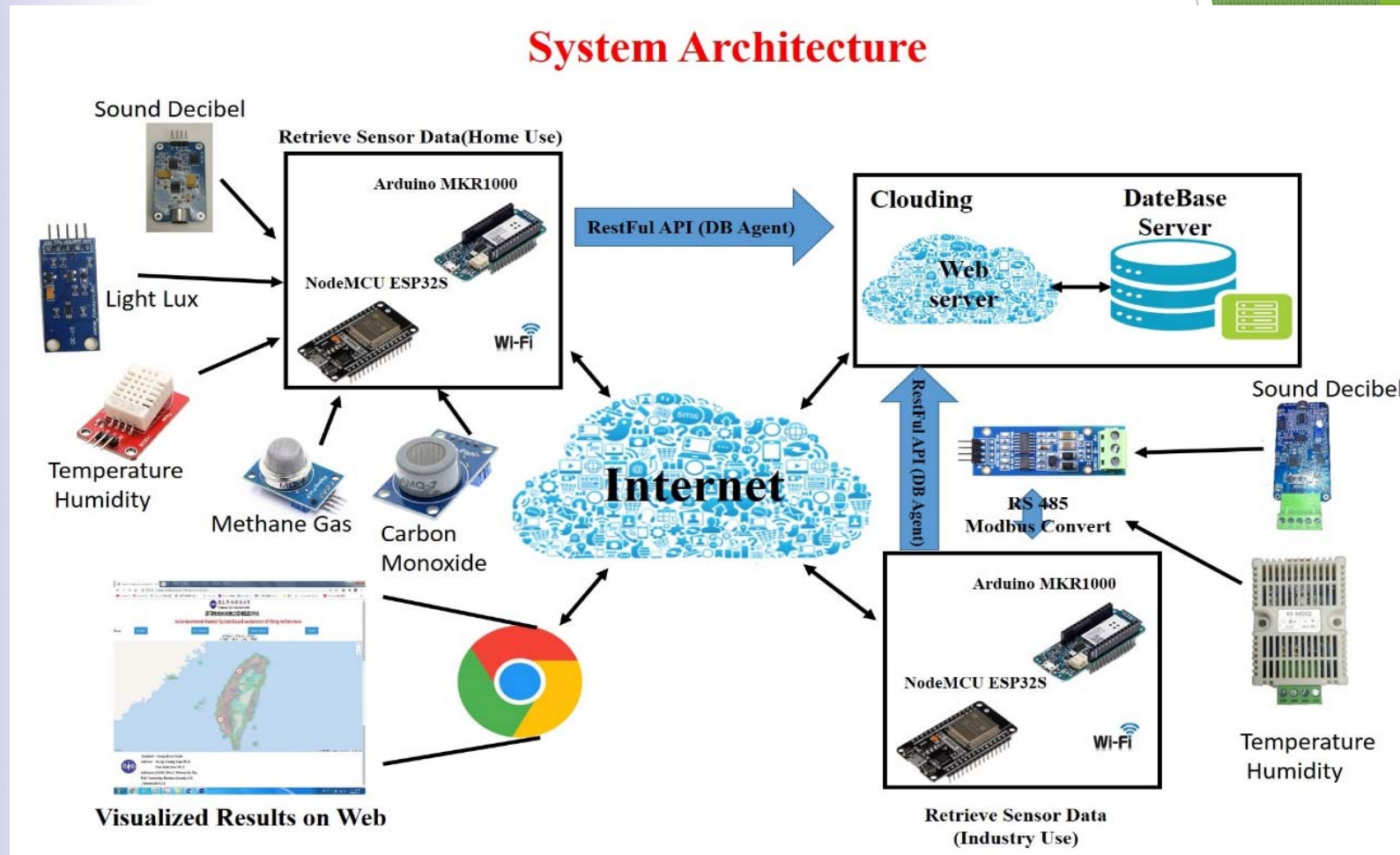


# 環境監控平台

2022/1  
0/12

39

# 物聯網為基礎之系統架構

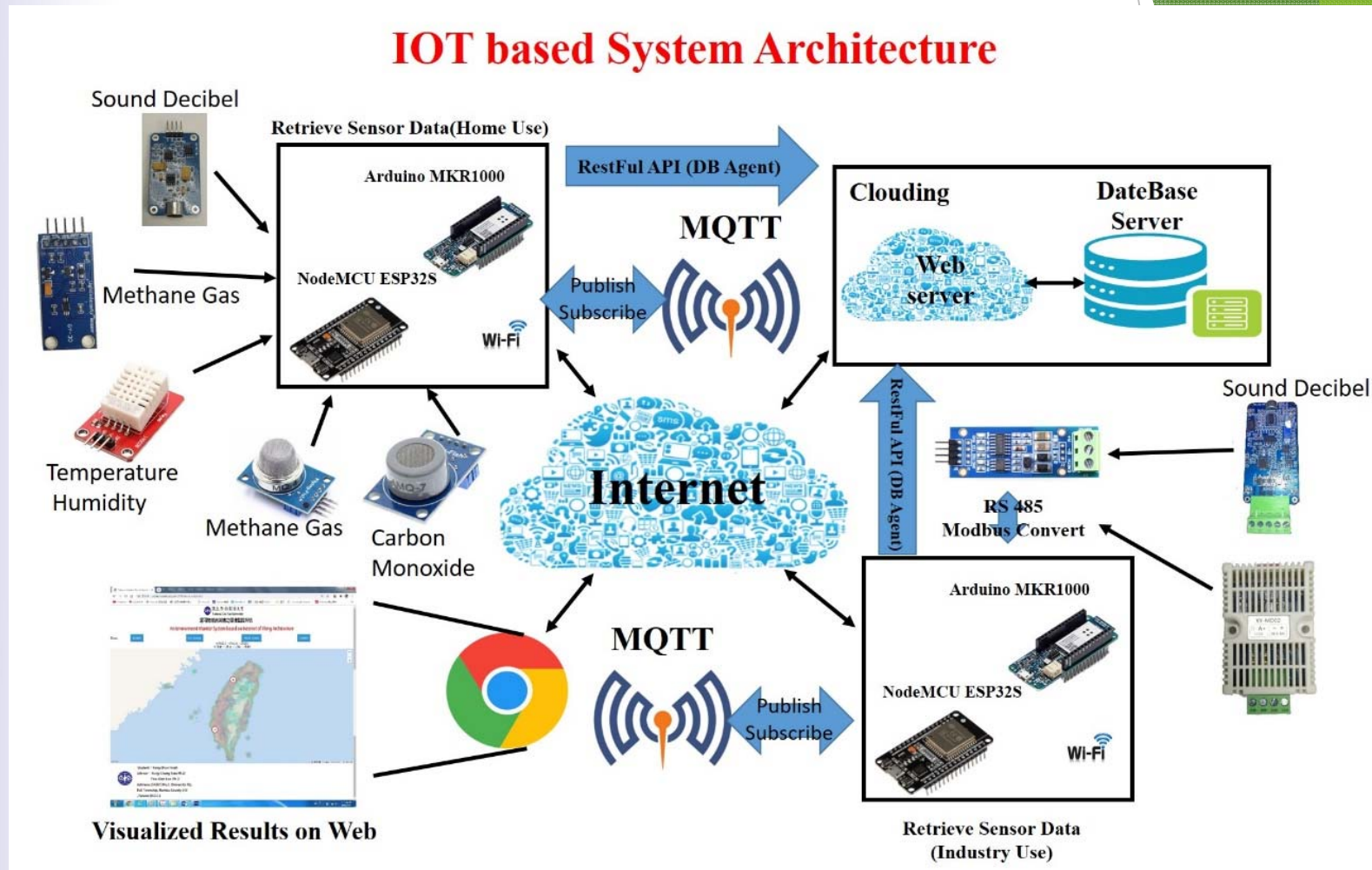


系統實體架構圖

資料來源: 本研究整理



# 物聯網為基礎之系統架構



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 Implementation of an Envi x

← → ↻ 🏠 不安全 | ncnu.arduino.org.tw:9999/iot.php

YouTube iLovePDF Google 學術搜尋 通用物聯網架構之... Google Yahoo!奇摩 Facebook 卡提諾論壇-CK101... 暨大 Journal of Operati... PChome線上購物

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

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.)

Windows taskbar: 下午 01:35 2020/7/4

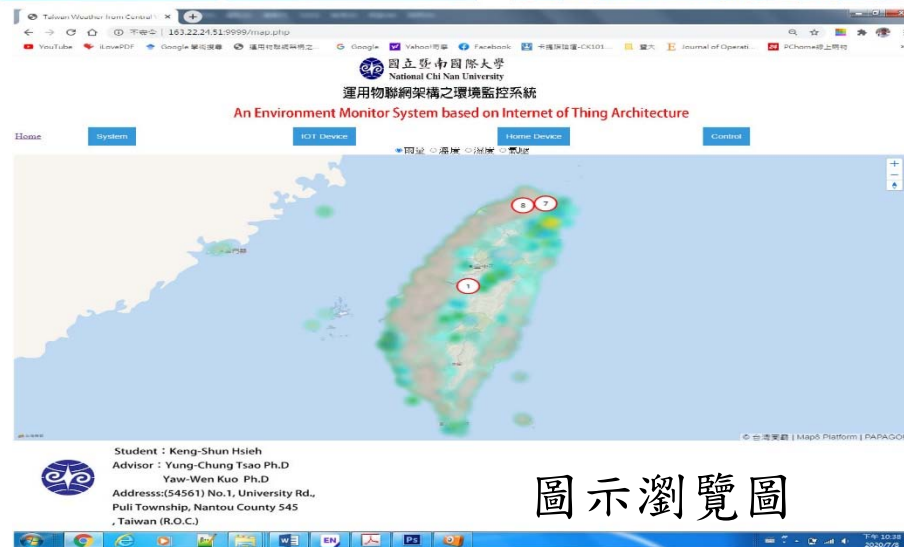
# 系統功能選項



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

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	55.800000
04/08/09/17/22/500000	55.800000
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

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, 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

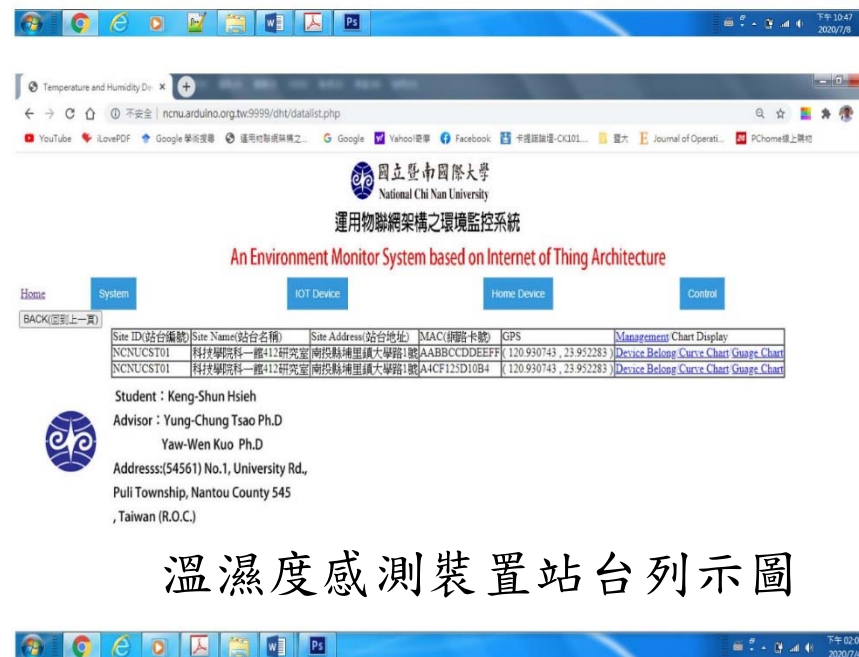
Student : Keng-Shun Hsieh  
Advisor : Yung-Chung Tsao Ph.D  
Yaw-Wen Kuo Ph.D  
Address:(S4561) No.1, University Rd.,  
Puli Township, Nantou County 545  
, Taiwan (R.O.C.)

### 溫濕度監測值圖

# 家用型裝置選項-溫濕度

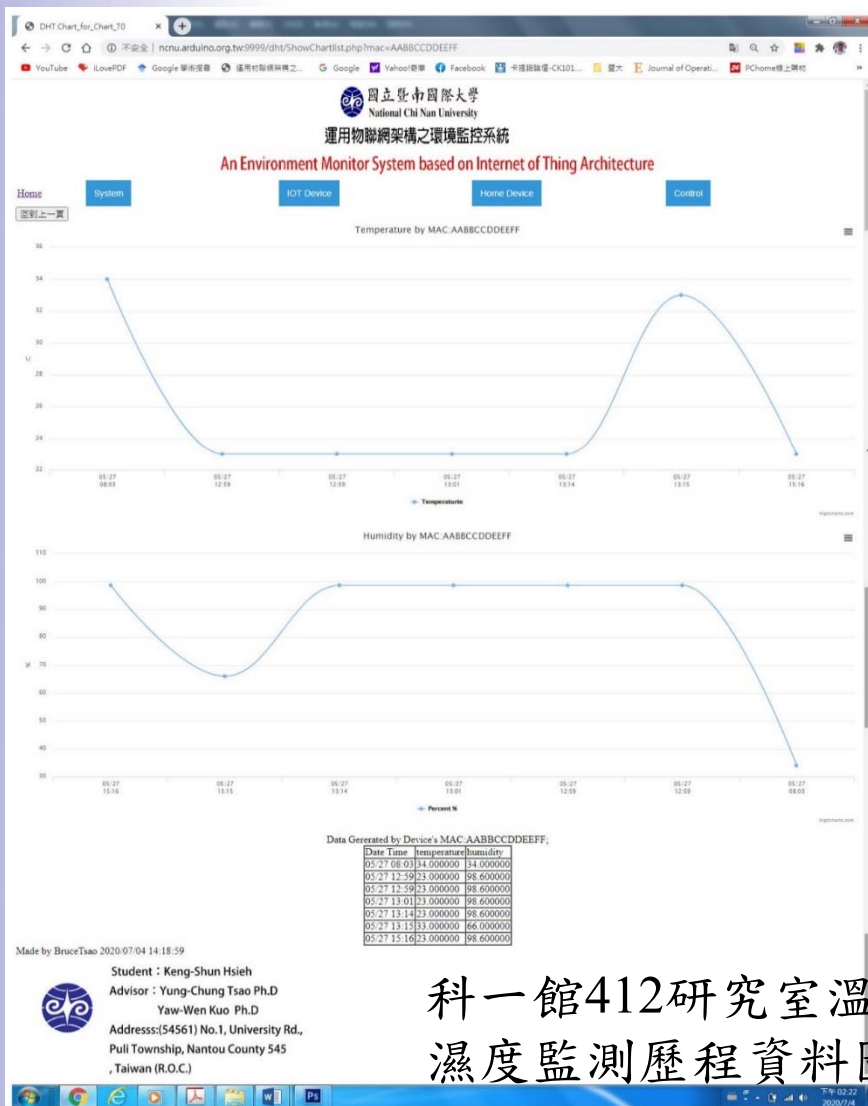


家用型裝置首頁圖

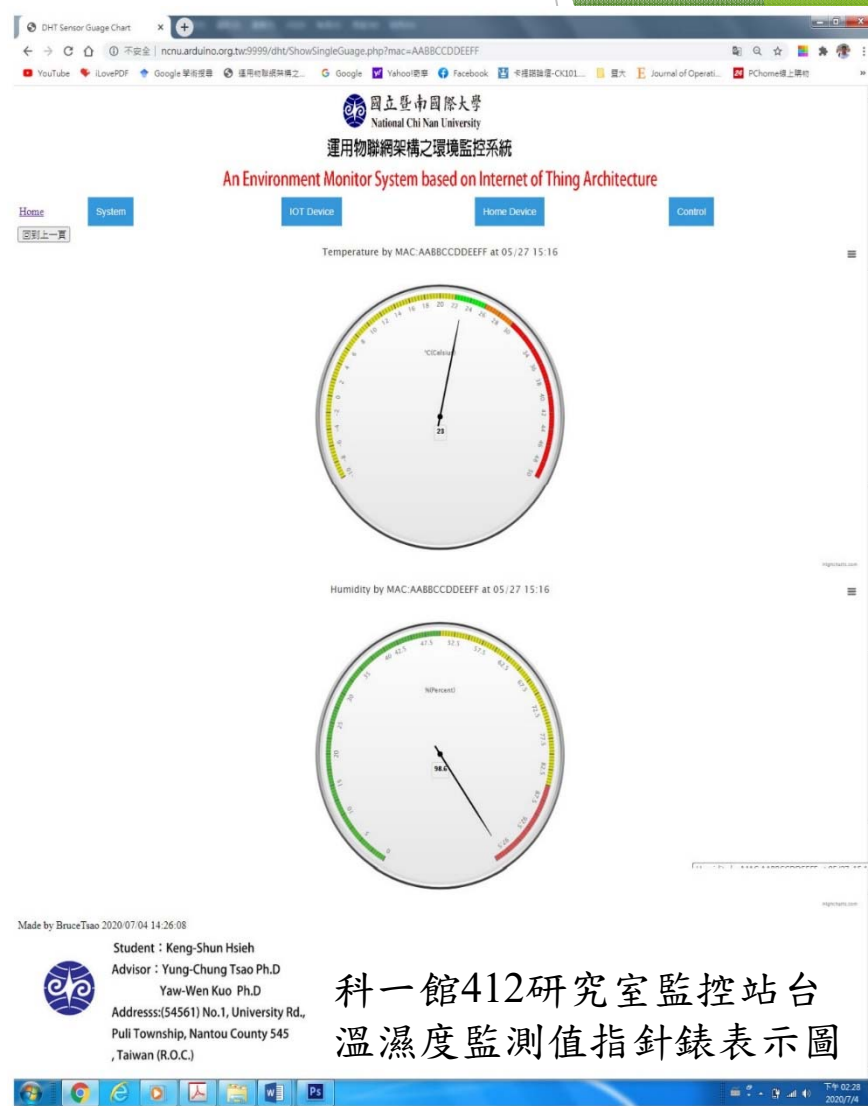


溫濕度感測裝置站台列示圖

# 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

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-龍412研究室	南投縣埔里鎮大學路1號	A4CF125D10B4 ( 120.930743, 23.952283 )		<a href="#">Device Belong</a> <a href="#">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</a> <a href="#">Curve Chart</a> <a href="#">Gauge Chart</a>
KL.SHLIB01	基隆市新橋區, 華港路20號	246F28A76514 ( 121.732934279, 25.1077091798 )		<a href="#">Device Belong</a> <a href="#">Curve Chart</a> <a href="#">Gauge Chart</a>	

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 Advisor : Yung-Chung Tsao Ph.D  
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 , Taiwan (R.O.C.)

光照度監測裝置站台列示圖

Light Lux by MAC:A4CF125D10B4

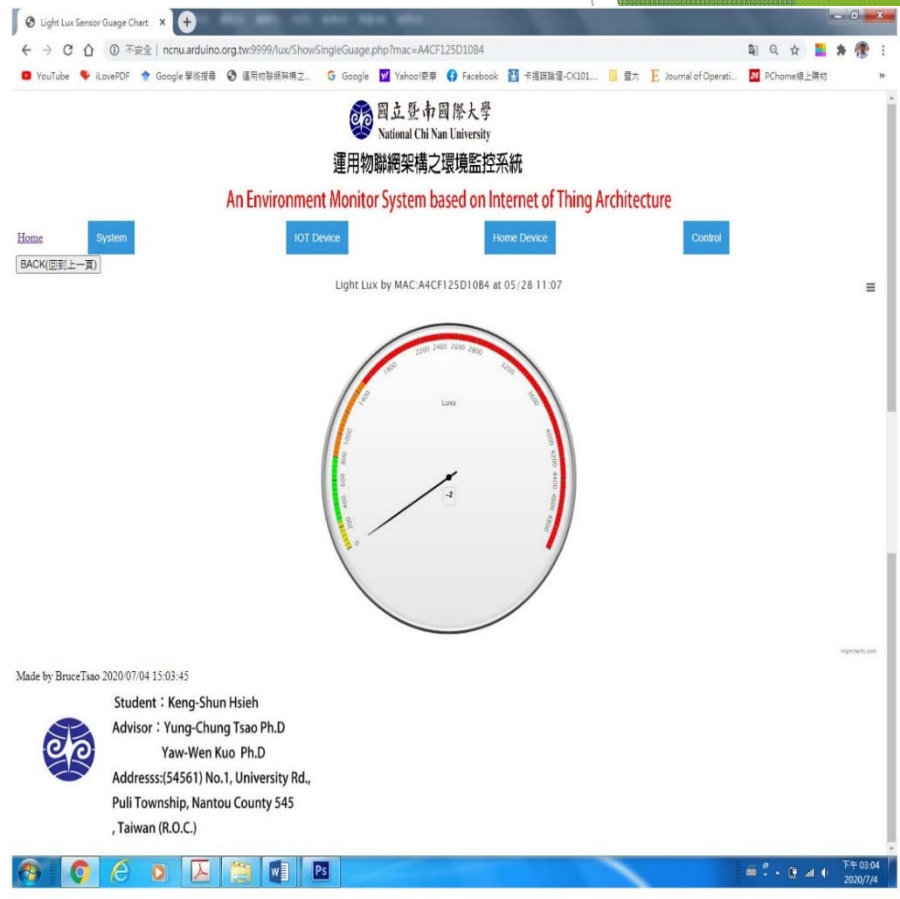
Date Time	Light Lux
05/27 15:20	505.830000
05/27 15:21	505.000000
05/27 15:21	504.170000
05/27 15:22	504.170000
05/27 15:22	504.170000
05/27 15:23	500.830000
05/27 15:23	500.830000
05/27 15:24	506.670000
05/27 15:25	501.670000
05/27 15:25	501.670000
05/27 15:26	507.500000
05/27 15:26	506.670000
05/27 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

科一館412研究室光照度監測歷程資料圖

# 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
05:27:15:35	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
05:27:15:41	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	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	503.330000
05:27:15:53	503.330000
05:27:15:53	505.830000
05:27:15:54	505.000000
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	505.830000
05:27:16:00	505.000000
05:27:16:00	495.830000
05:27:16:01	493.330000
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  
 Student : Keng-Shun Hsieh  
 Advisor : Yung-Chung Tsao Ph.D  
 Yaw-Wen Kuo Ph.D  
 Address:(54561) No.1, University Rd.,  
 Pull Township, Nantou County 545  
 , Taiwan (R.O.C.)



Made by BruceTsao 2020/07/04 15:03:45  
 Student : Keng-Shun Hsieh  
 Advisor : Yung-Chung Tsao Ph.D  
 Yaw-Wen Kuo Ph.D  
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 Pull Township, Nantou County 545  
 , Taiwan (R.O.C.)

科一館412研究室光照度監測歷程資料圖  
 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

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(網卡號)	GPS	Management(管理)	Visualized Chart Display
NCNUCST01	科技學院科一館412研究室	南院路1號	AABBCDDDEEFF	(120.930743, 23.952283)	Device Belong	Curve Chart Gauge 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.)

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) 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

BACK(回到上一頁)

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

Data Generated by Device's MAC:AABBCDDDEEFF:

Date Time	MQ4 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	

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

Student : Keng-Shun Hsieh  
Advisor : Yung-Chung Tsao Ph.D  
Yaw-Wen Kuo Ph.D  
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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

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)
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	Device Belong Curve Chart Gauge 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.)

一氧化碳氣體濃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

MQ4 Sensor by MAC:AABBCCDDEEFF at 05/31 15:01

一氧化碳氣體濃度  
值指針錶表示圖

Made by BruceTsao 2020 07/11 17:00:53

Student : Keng-Shun Hsieh  
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Yaw-Wen Kuo Ph.D  
Address:(54561) No.1, University Rd.,  
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, Taiwan (R.O.C.)

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:AABBCCDDEEFF

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
05/31 15:01	569

Data Generated by Device's MAC:AABBCCDDEEFF;

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

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.)

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)

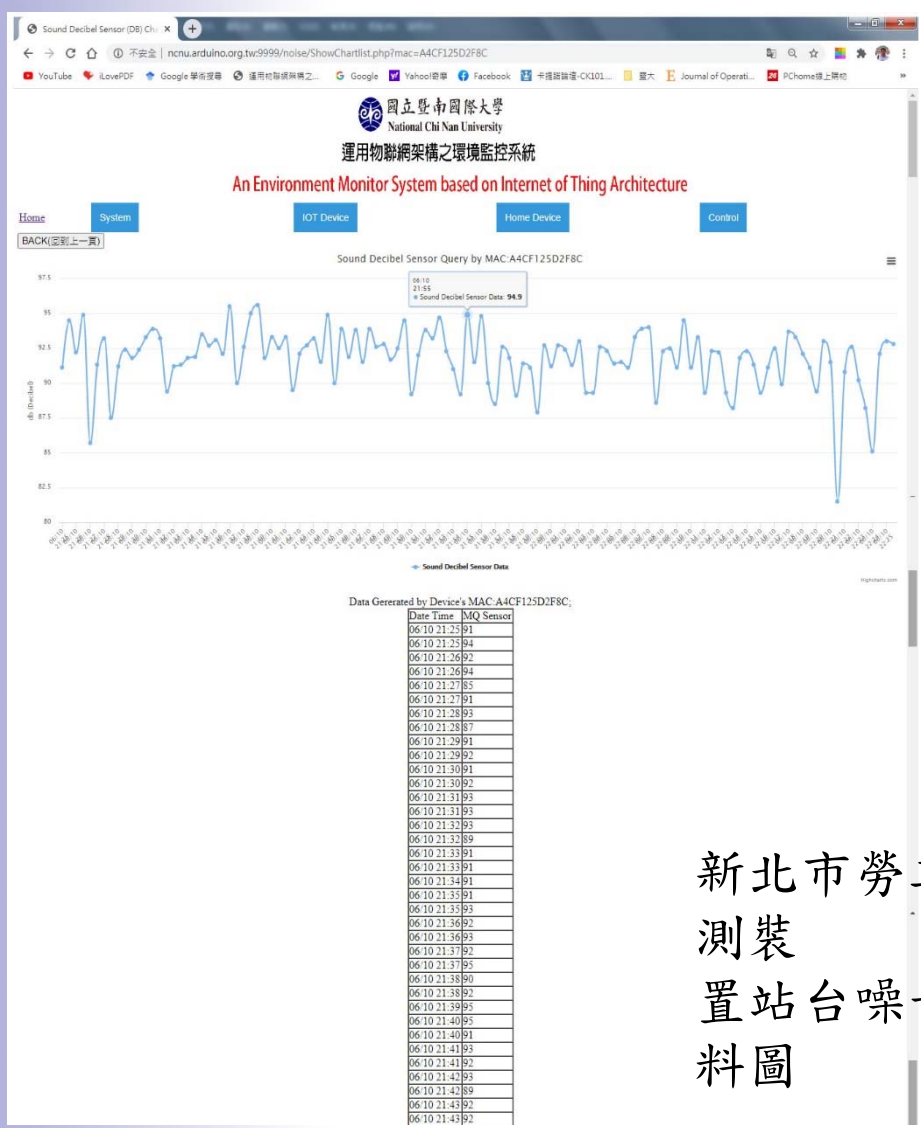
Site ID(站台編號)	Site Name(站台名稱)	Site Address(站台地址)	MAC(網路卡號)	GPS	Management(管理)
LABOR	新北市勞工大學	新北市三重區新北大道一段9號	A4CF125D2F8C	( 121.498315806 , 25.0828540007 )	Visualized Chart Display Device Belong / Curve Chart / Guage Chart

Student : Keng-Shun Hsieh  
 Advisor : Yung-Chung Tsao Ph.D  
 Yaw-Wen Kuo Ph.D  
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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

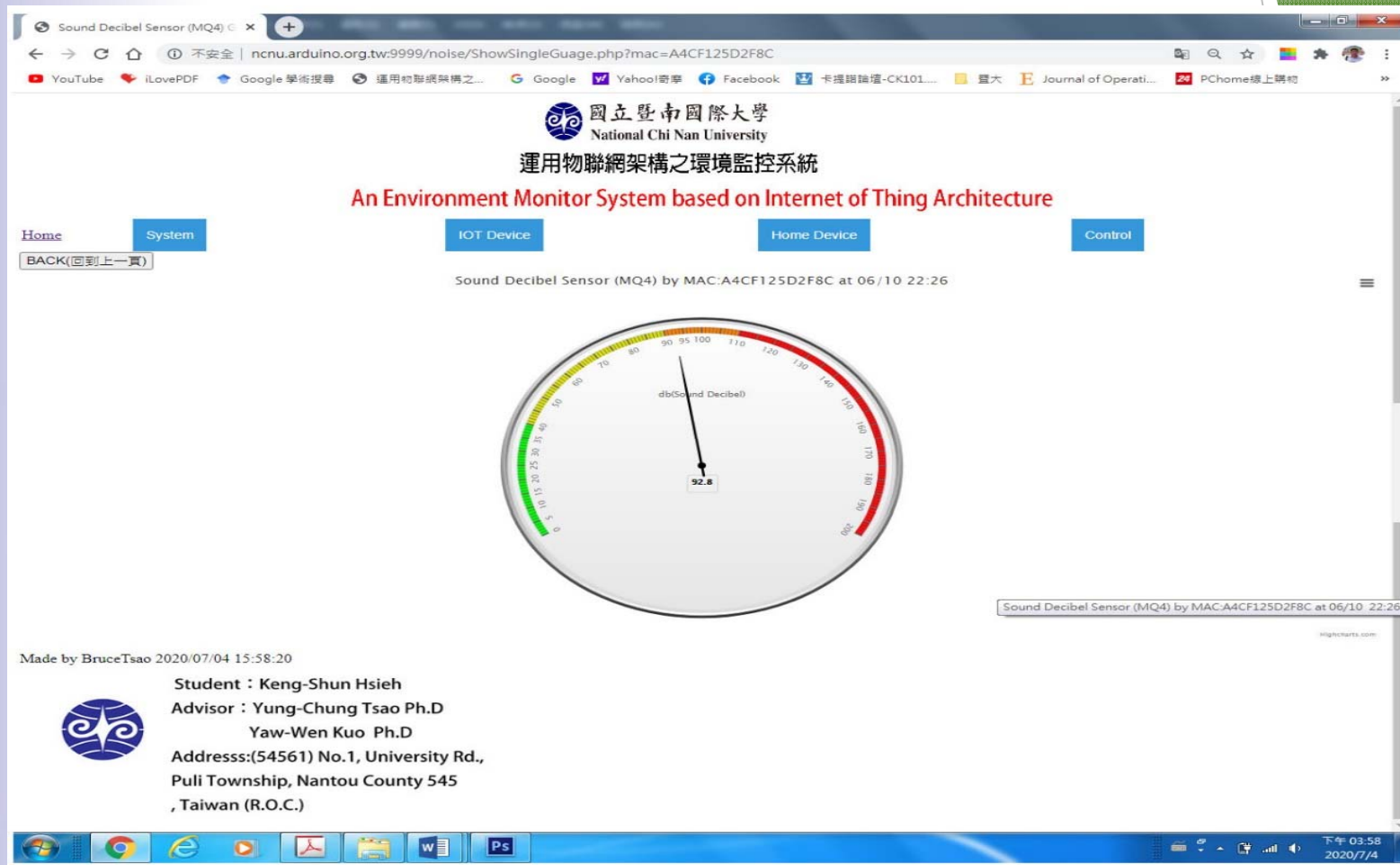


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06:10:22:02:92
06:10:22:02:92
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06:10:22:26:92

新北市勞工大學噪音監測裝置台噪音監測歷程資料圖

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# 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

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0/12

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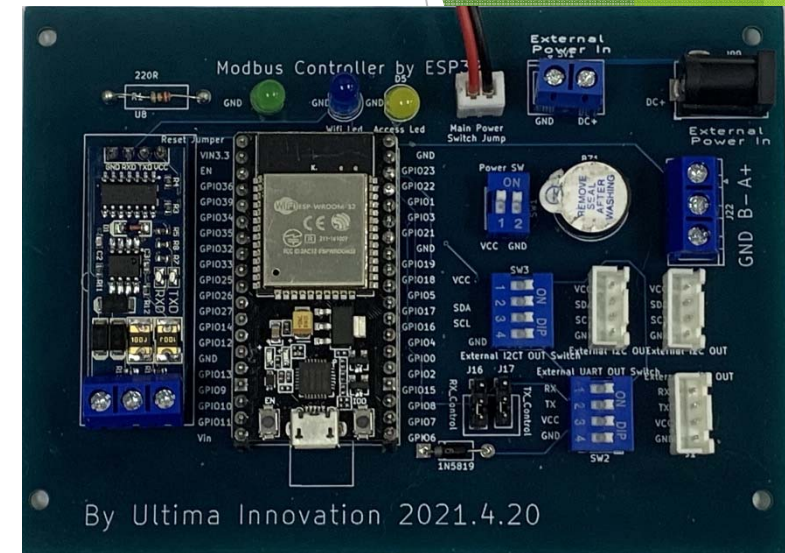


# 點陣式大型螢幕

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0/12

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# We Design





# DATA Collector



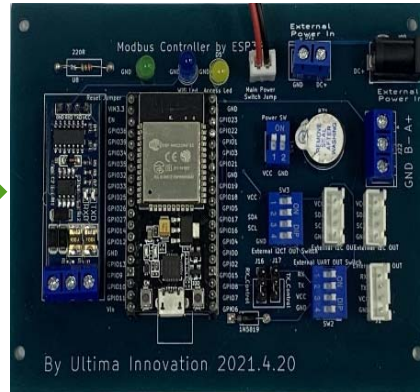
Wind speed



Wind direction



Temperature & humidity



Controller

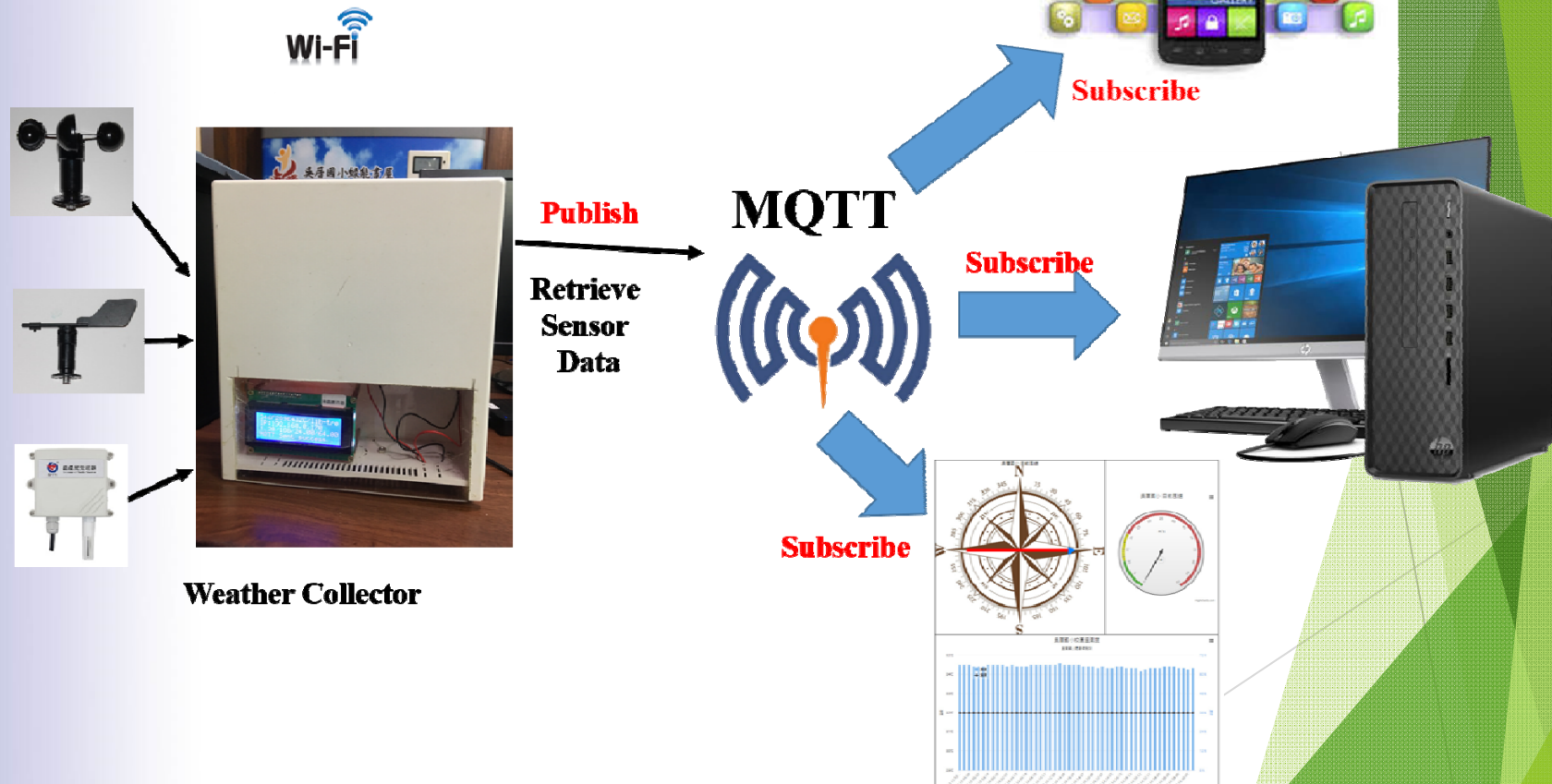


RS-485 hub



Control box

# MQTT Broker



# 結論

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# 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，可實際上線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。





感謝聆聽  
恭請指教



## 曹永忠 (Yung-Chung Tsao) 博士，

國立中央大學資訊管理學系博士，目前在國立暨南國際大學電機工程學系與應用材料及光電工程學系擔任兼任助理教授、國立高雄大學電機工程學系擔任兼任助理教授、靜宜大資訊工程學擔任兼任助理教授，並且為自由作家，於軟體工程、軟體開發與設計、物件導向程式設計、物聯網系統開發、**Arduino**開發、嵌入式系統開發。長期投入資訊系統設計與開發、企業應用系統開發、軟體工程、物聯網系統開發、軟硬體技術整合等領域，並持續發表作品及相關專業著作，並通過台灣圖霸的專家認證。



台灣圖霸  
專家認證