DSI 2598 遠端遙控開關

透過 MQTT 方式達到遙控開關
(例如 LED 的明暗)

設計者 : 曹訓豪

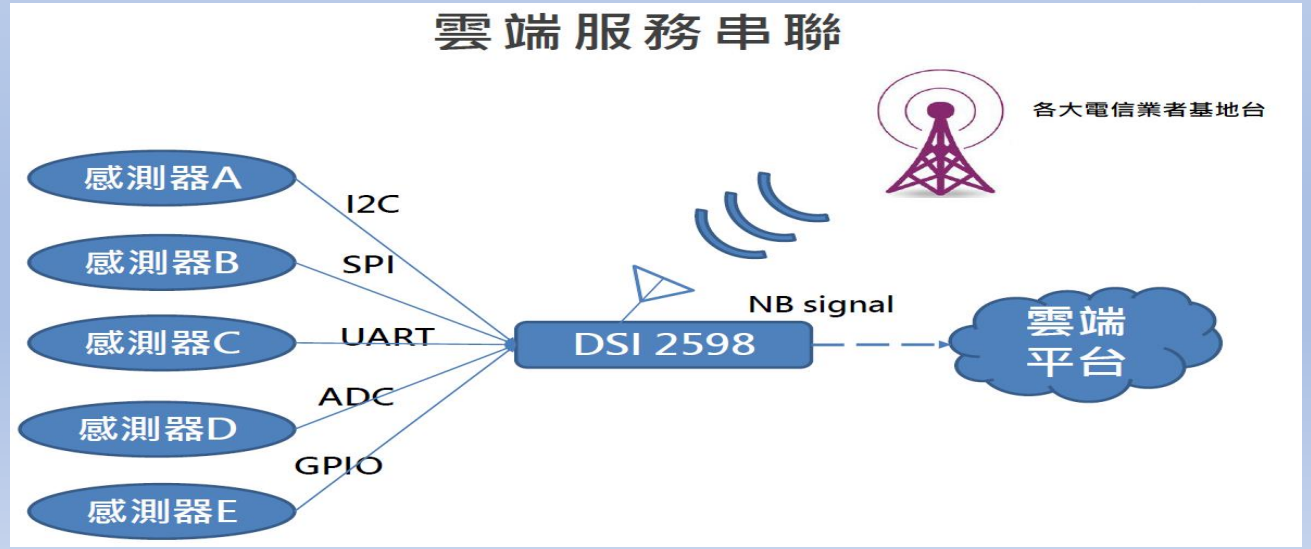
DSI2598 遠端遙控開關

1. 基礎介紹 ：
2. APN 設定 ：
3. MQTT 使用概略 ：
4. 手機 APP 安裝及設定 ：
5. 程式撰寫內容 ：
6. 情境操作 ：

DSI 2598

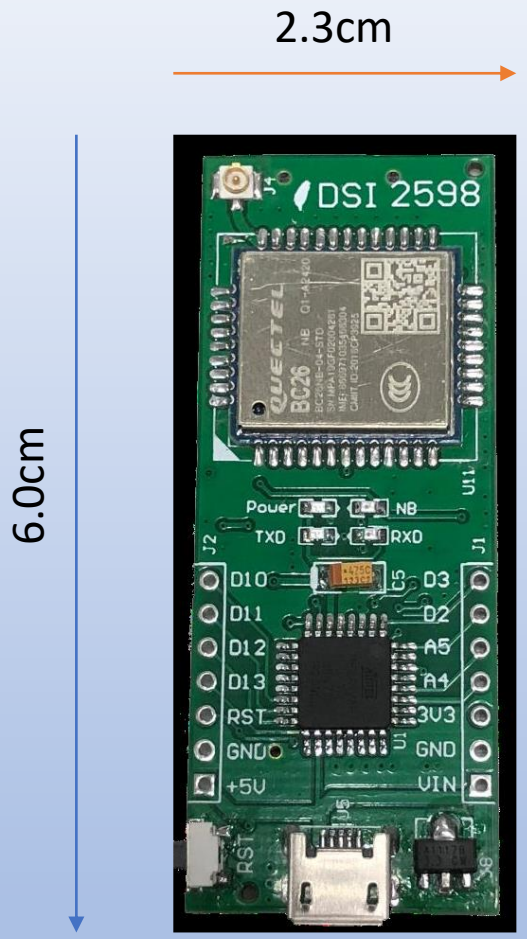
採用MT 2625
全台首款Arduino NB-IoT開發板

DSI2598使用聯發科技NB-IoT晶片-MT2625模組，搭配Arduino原廠MCU-ATMEGA328P，有著PWM、I2C、SPI、ADC、UART等腳位功能，簡單但完整，可讓使用者無縫接軌任何Arduino程式庫，進行各項功能程式開發，是國內第一款NB-IoT開發板。



圖片來源：資策會

外型與尺寸說明



支持NB-IoTR14 的系統單晶片，以超高整合度為大量物聯網設備提供兼具低功耗及成本效益的解決方案，廣泛適用於家庭、城市、工業或行動應用。

高度整合NB-IoT調制解調數字信號處理器、射頻天線及前端模擬基帶，同時結合 ARM Cortex-M 微控制器（MCU）、偽靜態隨機存儲器（PSRAM）、閃存與電源管理單元（PMU）。

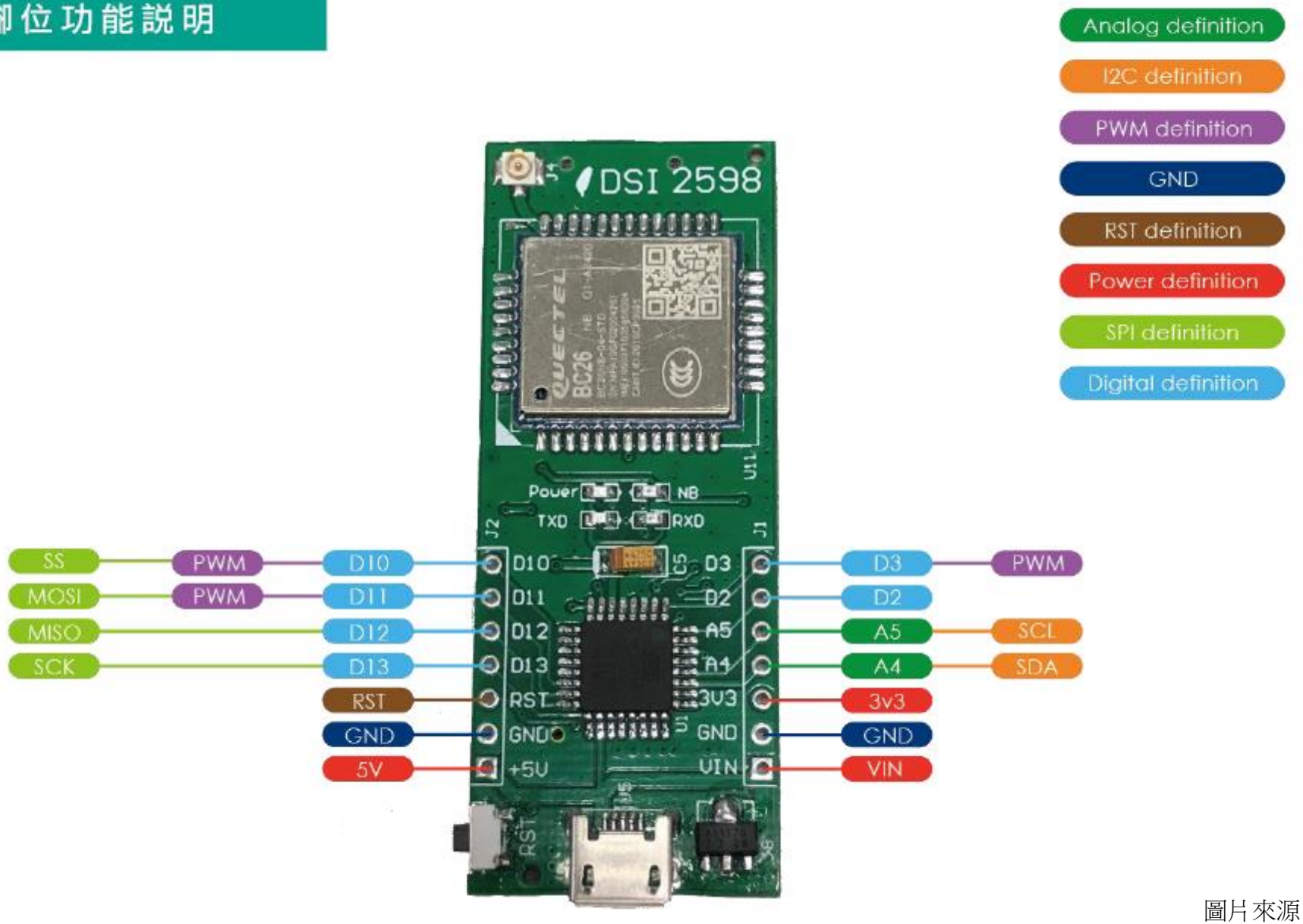
整合一系列豐富的外圍輸入輸出介面，包括安全數字輸入輸出模塊（SDIO）、通用異步收發傳輸器（UART）、I2C 傳輸協議、I2S、序列外圍接口（SPI）及脈衝寬度調制（PWM）。

具備強大功能於小巧的封裝尺寸和少量的管腳數目，滿足物聯網設備對成本及體積的需求，並有助於廠商簡化其產品設計流程。

DSI 2598 基於實時操作系統（RTOS），易於針對各種不同的應用進行客製化，比如家庭自動化、雲信標（cloud beacon）、智慧型電錶及多項物聯網靜態或行動應用。
DSI 2598 的寬頻前端模組支持3GPP R14 規範，涵蓋超低頻/低頻/中頻/四頻的全頻段運作，可滿足全球市場需求，進而降低成本和開發時間。

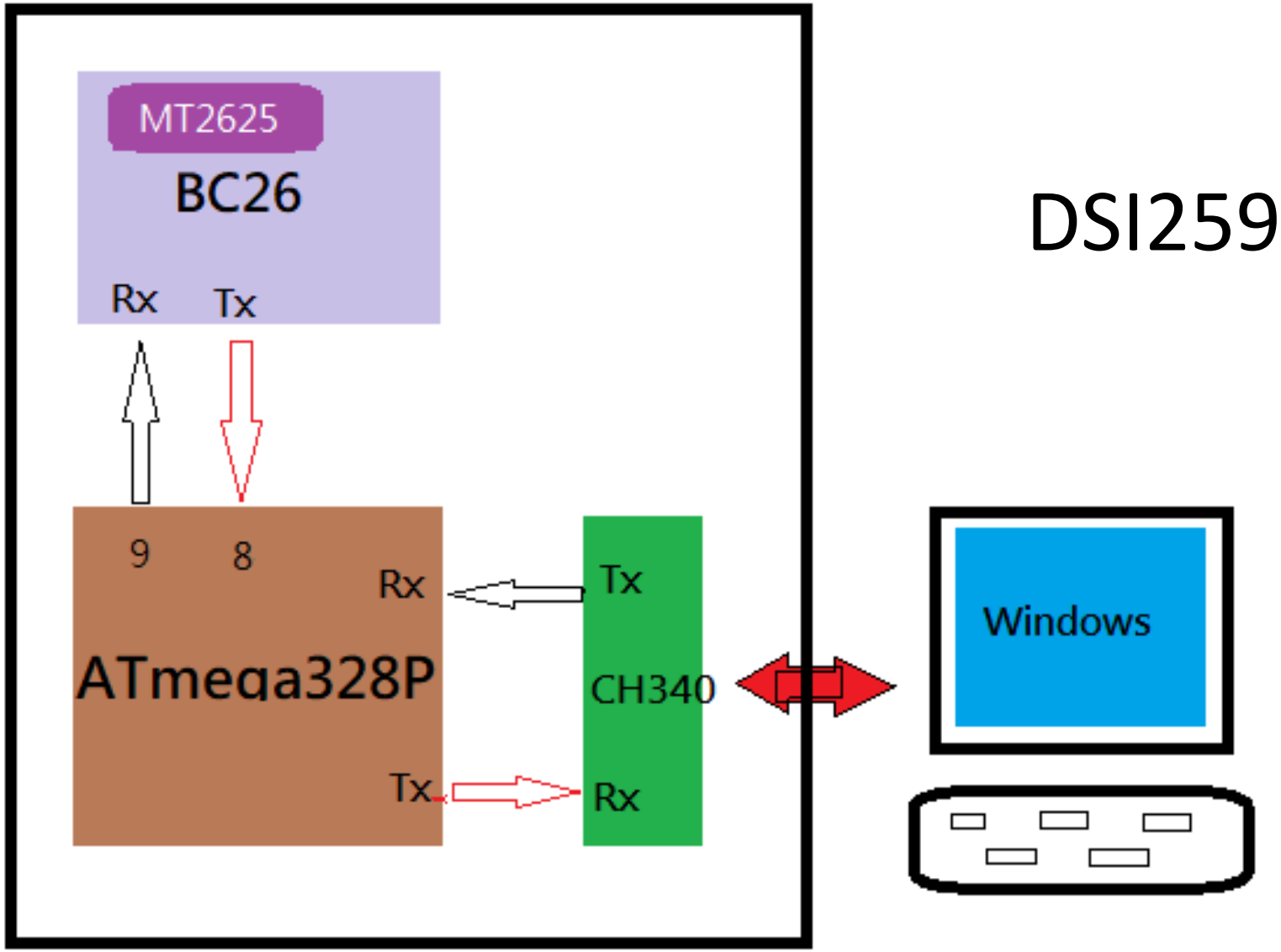
圖片來源 : 資策會

腳位功能說明



圖片來源：資策會

DSI2598內部示意圖



NB-IoT :窄帶物聯網(Narrow Band Internet of Things, NB-IoT)

1. 構建於蜂窩網絡，只消耗大約180KHz的帶寬，可直接部署於GSM網絡、UMTS網絡或LTE網絡。

2. 是IoT領域一個新興的技術，支持低功耗設備在廣域網的蜂窩數據連接，也被叫作低功耗廣域網(LPWAN)。

3. 待機時間長、設備電池壽命提高至少5年以上。

4. 可透過各大電信業者提供的 NB-IoT / SIM 卡 , 利用電信基地台連到網際網路。

5. 其特性可增加覆蓋範圍提升 20dB , 使原本透過 4G LTE網路收不到的地方(如地下室、地下管道等)也能收到訊號 。

NB-IoT 與 WiFi 之差異：

1. WiFi 透過無線基地台連上網際網路，NB-IoT 利用電信基地台連上網際網路 。
2. WiFi 適用傳輸大量資料的訊息，NB-IoT 適用小資料量傳輸。
3. WiFi 連接無線基地台的距離較短，NB-IoT 由於全台基地台涵蓋率夠高，幾乎無死角。
4. WiFi 晶片耗用功率較高 , NB-IoT 採用低功率晶片， 使用一般 AA 電池可達 3-5 年以上。
5. WiFi 連網較易取得真實IP 位址 , 而NB-IoT使用的電信基地台提供的IP 位址大都為 虛擬 IP 網段。

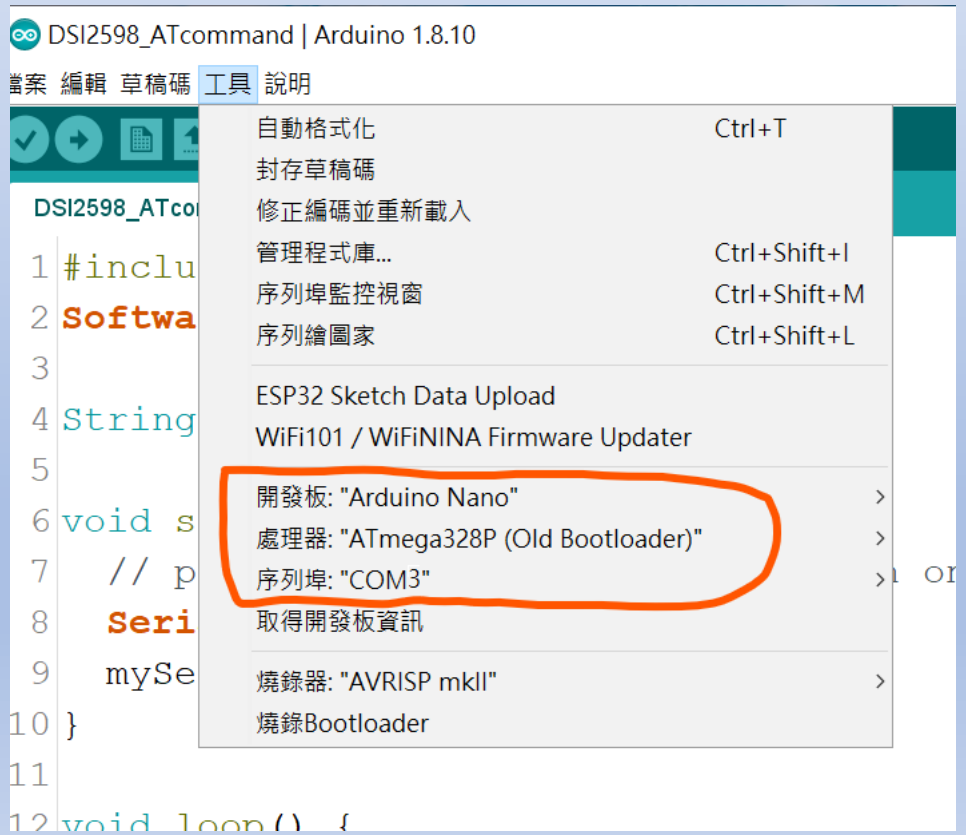
APN 設定

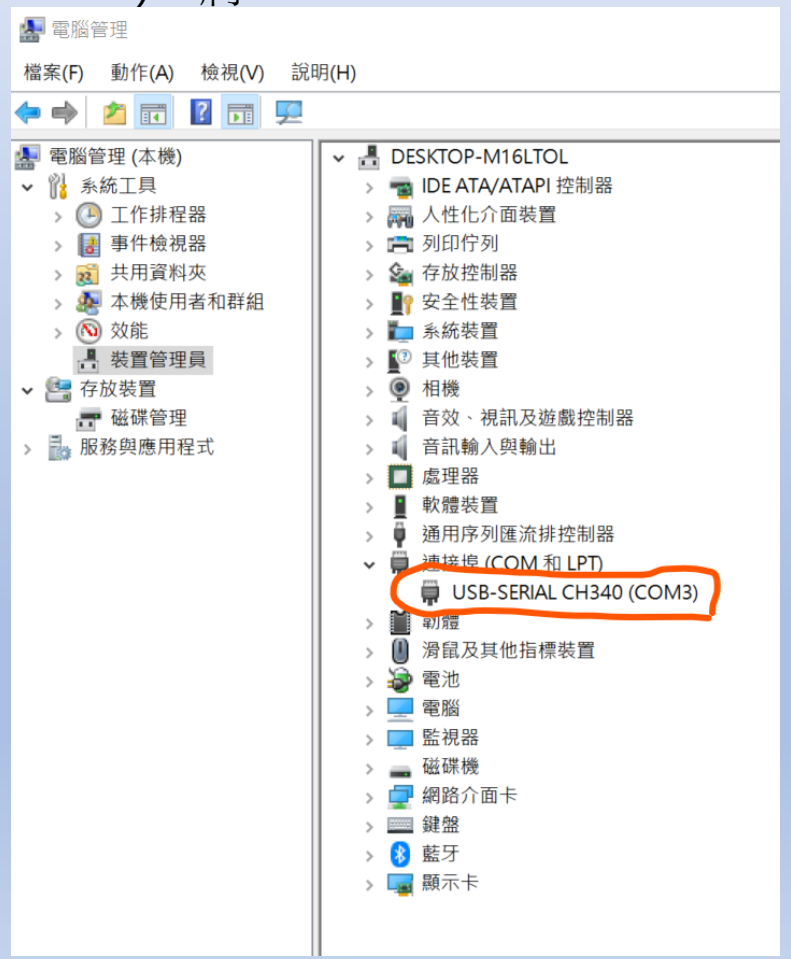
程式碼下載: t.ly/DKkB2

資料來源：資策會

STEP 1：打開DSI2598_ATcommand.ino，並至Arduino的工具->序列埠中找到USB模組的COM PORT編號，可至控制台確認。

STEP 2：選擇 工具 ->開發板->Arduino Nano，然後按下 上傳 (Ctrl+U)，將程式燒錄進去。

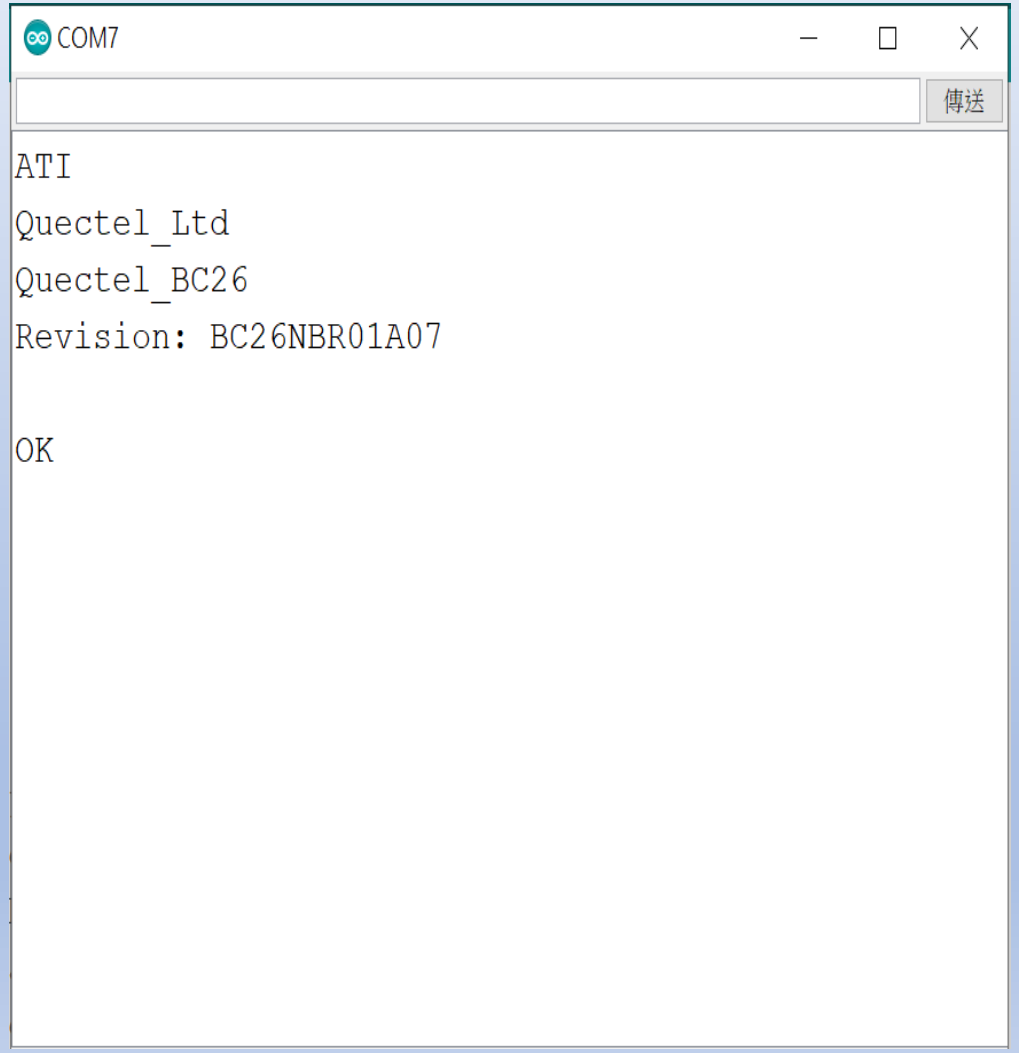


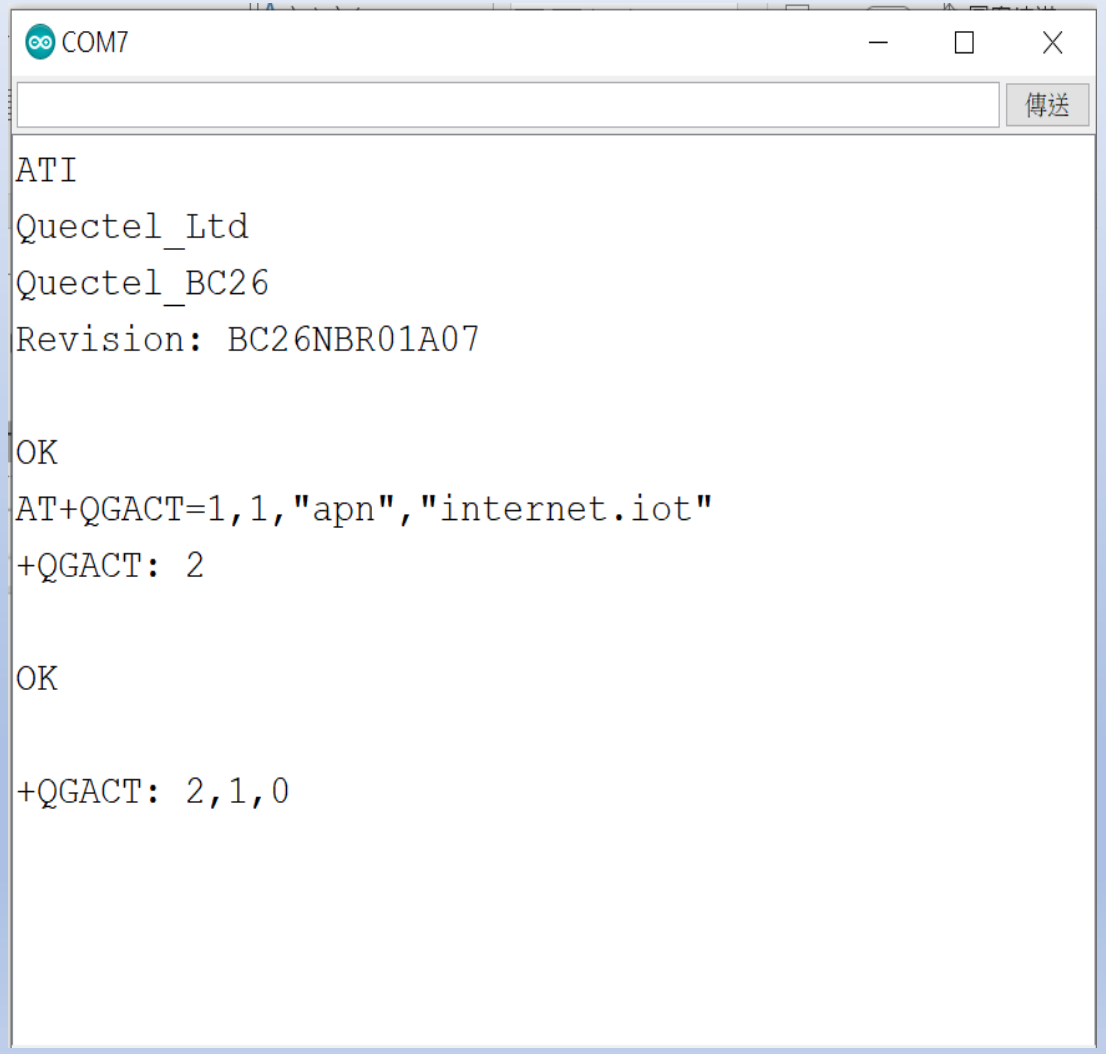


STEP 3：打開 序列埠監控視窗，在上方輸入欄中輸入ATI 指令，可先輸入「ATI」，查看模組是否有回覆版本訊息。

資料來源：資策會

STEP 4：啟用APN： AT+QGACT=1,1,"apn","internet.iot"



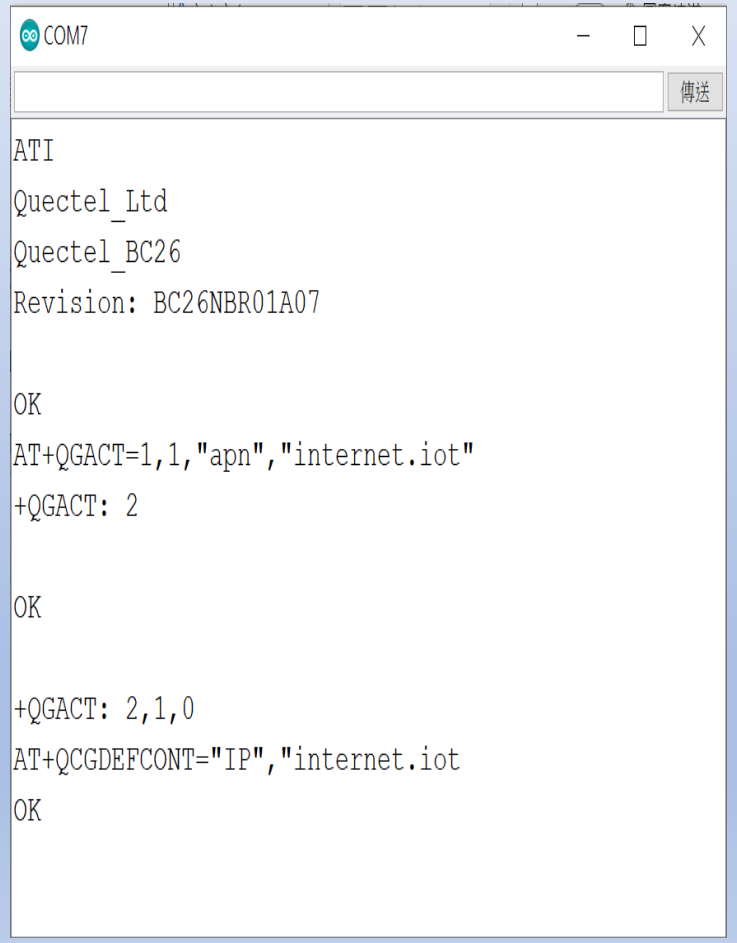


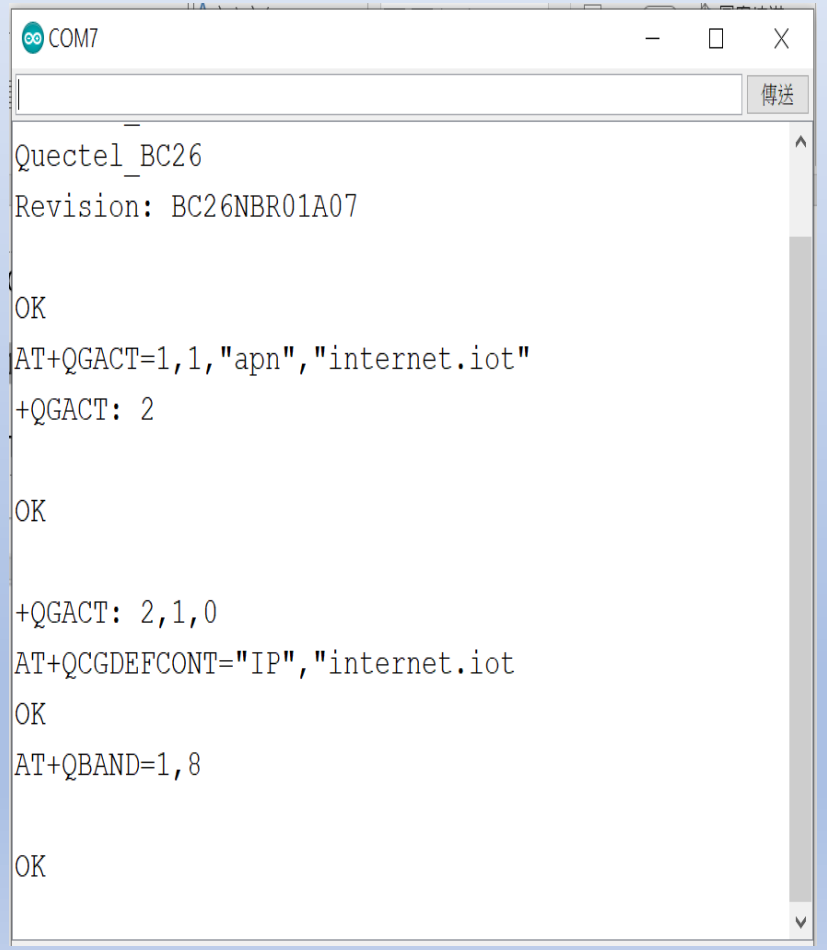
STEP 5：註冊APN：AT+QCGDEFCONT="IP","internet.iot“

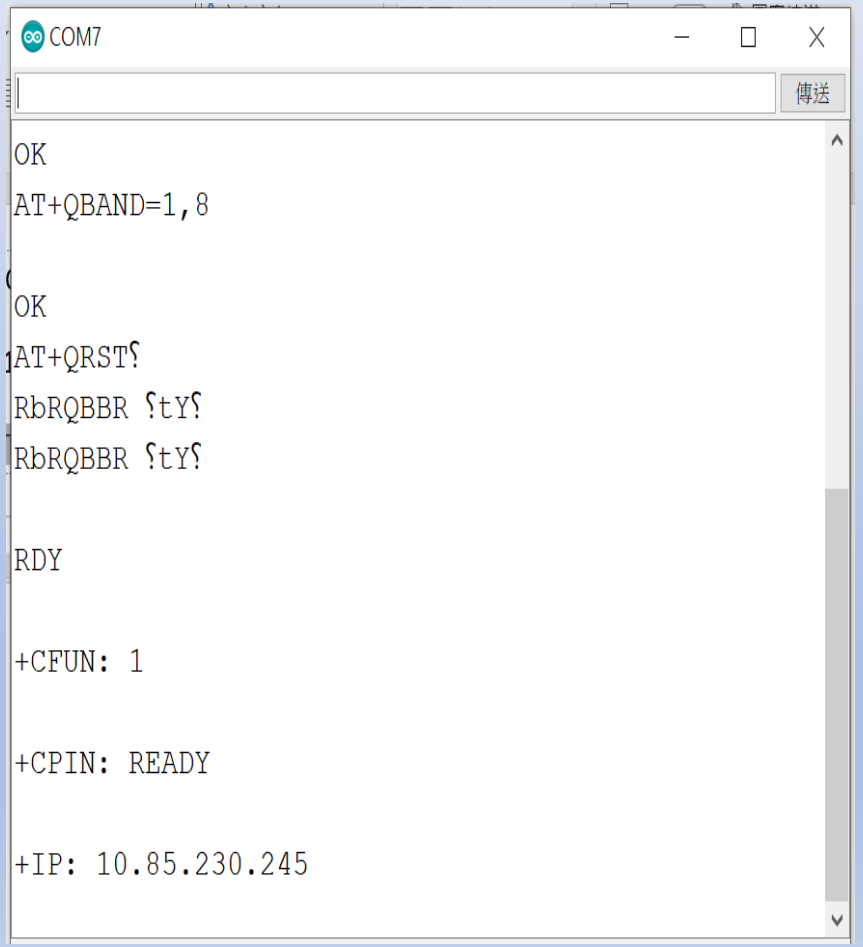
資料來源：資策會

STEP 6：頻寬設定：AT+QBAND=1,8

STEP 7：重新啟動模組：AT+QRST=1







MQTT 說明 : (請參考網路上他人分享的資訊)

https://swf.com.tw/?p=1002

https://oranwind.org/-broker-ren-shi-mqtt/

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簡易說明 : 利用 MQTT Broker 設定 (publisher)發佈 / (subscriber) 訂閱 方式 來傳遞訊息

MQTT Server 架設 :

可由官方網站下載http://mosquitto.org/download/ ，下載32位元的安裝程式自行架設

免費的 MQTT 網站 :

Server	Broker	Port	Websocket
mqtt.eclipse.org	Mosquitto	1883 / 8883	n/a
broker.hivemq.com	HiveMQ	1883	8000
test.mosquitto.org	Mosquitto	1883 / 8883 / 8884	8080 / 8081
test.mosca.io	mosca	1883	80
broker.mqttdashboard.com	HiveMQ	1883	

3.2.2. AT+QMTOPEN Open a Network for MQTT Client

The command is used to open a network for MQTT client.

AT+QMTOPEN Open a Network for MQTT Client	
Test Command **AT+QMTOPEN=?**	Response **+QMTOPEN:** (list of supported **<tcpconnectID>**s),**"<host_name>"**,(list of supported **<port>**s) **OK**
Read Command **AT+QMTOPEN?**	Response **[+QMTOPEN: <tcpconnectID>,"<host_name>",<port>]** **OK**
Write Command **AT+QMTOPEN=<tcpconnectID>,"<host_name>",<port>**	Response **OK** **+QMTOPEN: <tcpconnectID>,<result>** If there is an error related to ME functionality: **+CME ERROR: <err>**
Maximum Response Time	75s, determined by network

3.2.4. AT+QMTCONN Connect a Client to MQTT Server

The command is used when a client requests a connection to MQTT server. When a TCP/IP socket connection is established from a client to a server, a protocol level session must be created using a CONNECT flow.

AT+QMTCONN Connect a Client to MQTT Server	
Test Command **AT+QMTCONN=?**	Response **+QMTCONN:** (list of supported **<tcpconnectID>**s),**"<clientID>"[,"<username>"[,"<password>"]]** **OK**
Read Command **AT+QMTCONN?**	Response **[+QMTCONN: <tcpconnectID>,<state>]** **OK**
Write Command **AT+QMTCONN=<tcpconnectID>,"<clientID>"[,"<username>"[,"<password>"]]**	Response **OK** **+QMTCONN: <tcpconnectID>,<result>[,<ret_code>]** If there is an error related to ME functionality: **+CME ERROR: <err>**
Maximum Response Time	**<pkt_timeout>** (default 10s), determined by network

3.2.6. AT+QMTSUB Subscribe to Topics

The command is used to subscribe to one or more topics. A SUBSCRIBE message is sent by a client to register an interest in one or more topic names with the server. Messages published to these topics are delivered from the server to the client as PUBLISH messages.

AT+QMTSUB Subscribe to Topics	
Test Command **AT+QMTSUB=?**	Response **+QMTSUB:** (list of supported **<tcpconnectID>**s),(list of supported **<msgID>**s),**"<topic>"**,(list of supported **<qos>**s) **OK**
Write Command **AT+QMTSUB=<tcpconnectID>,<msgID>,"<topic1>",<qos1>[,"<topic2>",<qos2>…]**	Response **OK** **+QMTSUB: <tcpconnectID>,<msgID>,<result>[,<value>]** If there is an error related to ME functionality: **+CME ERROR: <err>**
Maximum Response Time	**<pkt_timeout>** * **<retry_times>** (default 40s), determined by network

3.2.8. AT+QMTPUB Publish Messages

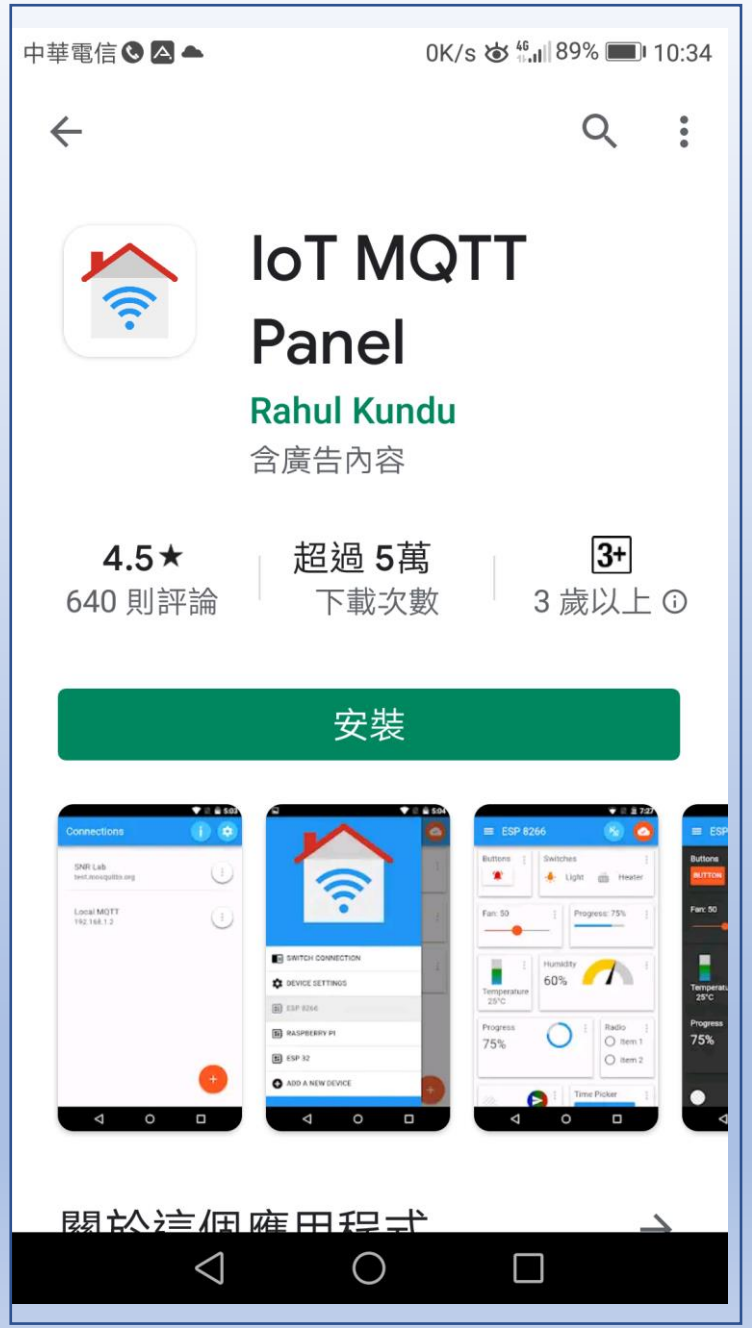
The command is used to publish messages by a client to a server for distribution to interested subscribers. Each PUBLISH message is associated with a topic name. If a client subscribes to one or more topics, any message published to those topics are sent by the server to the client as a PUBLISH message.

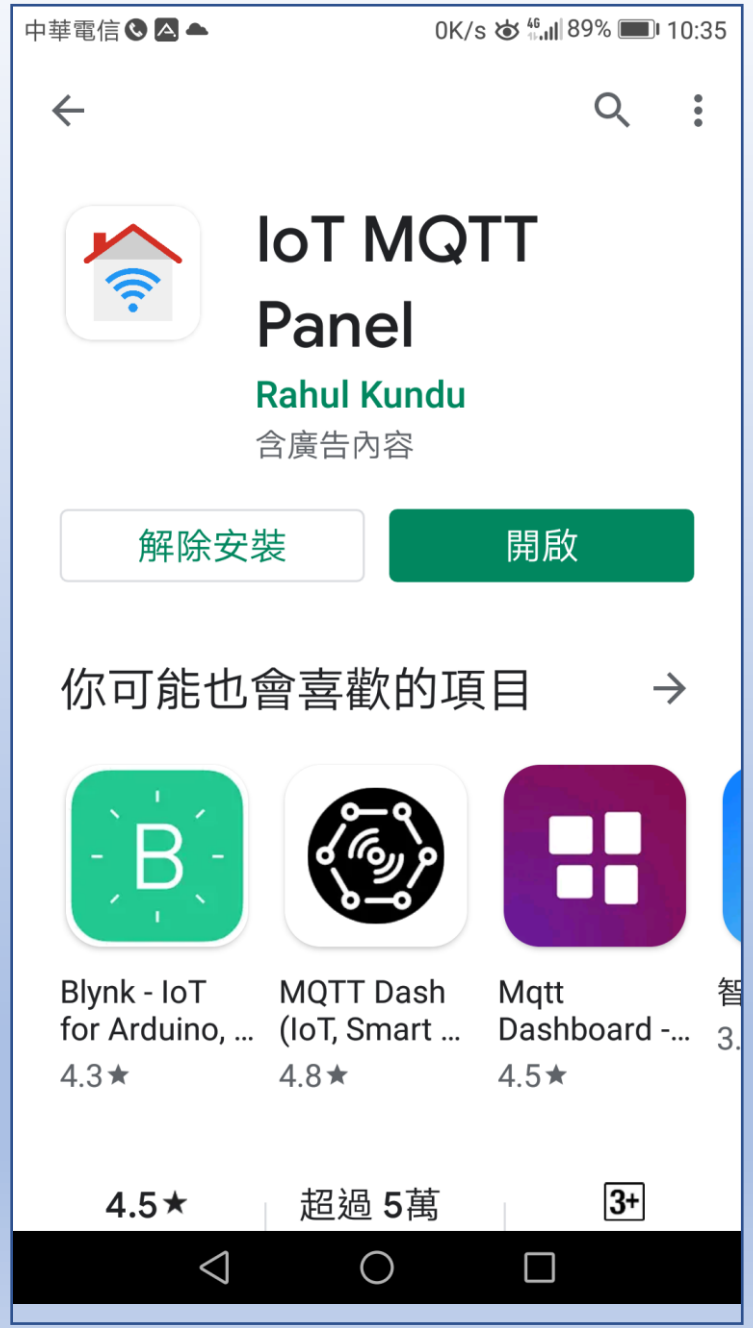
AT+QMTPUB Publish Messages	
Test Command **AT+QMTPUB=?**	Response **+QMTPUB:** (list of supported **<tcpconnectID>**s),(list of supported **<msgID>**s),(list of supported **<qos>**s),(list of supported **<retain>**s),**"<topic>","<msg>"** **OK**
Write Command **AT+QMTPUB=<tcpconnectID>,<msgID>,<qos>,<retain>,"<topic>","<msg>"**	Response **OK** **+QMTPUB: <tcpconnectID>,<msgID>,<result>[,<value>]** If there is an error related to ME functionality: **+CME ERROR: <err>**
Maximum Response Time	**<pkt_timeout>** * **<retry_times>** (default 40s), determined by network

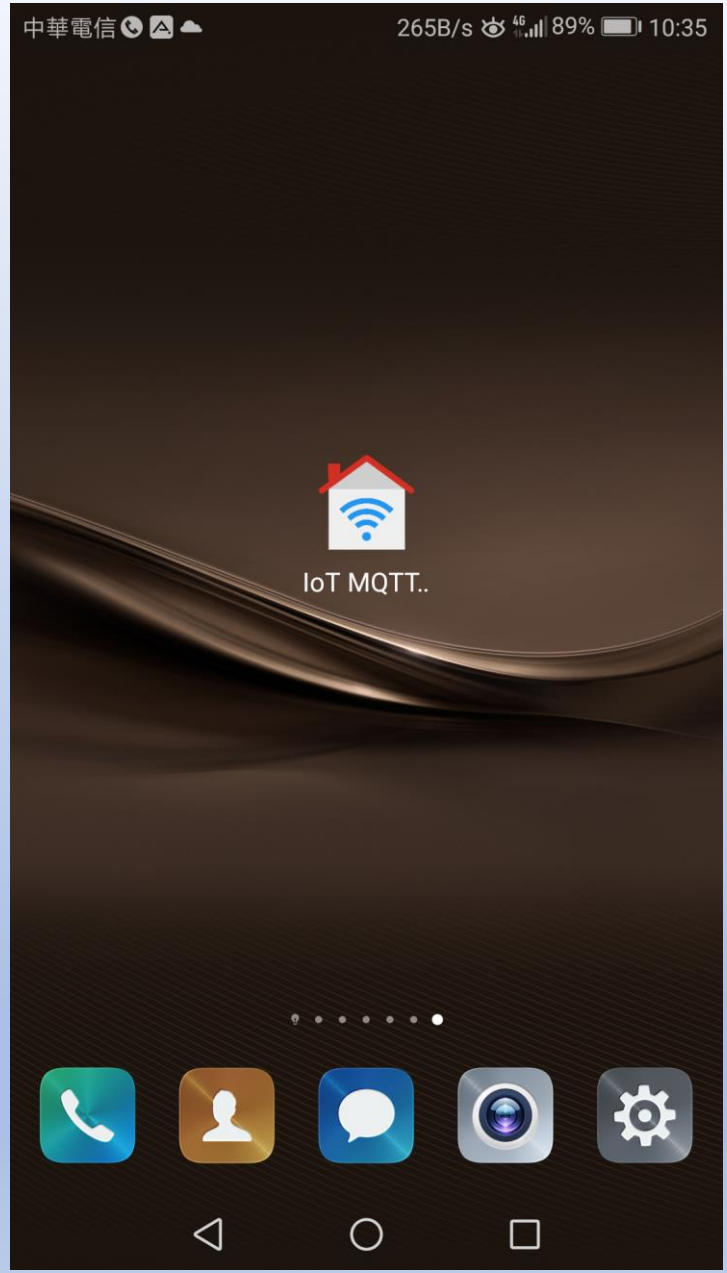
3.2.3. AT+QMTCLOSE Close a Network for MQTT Client

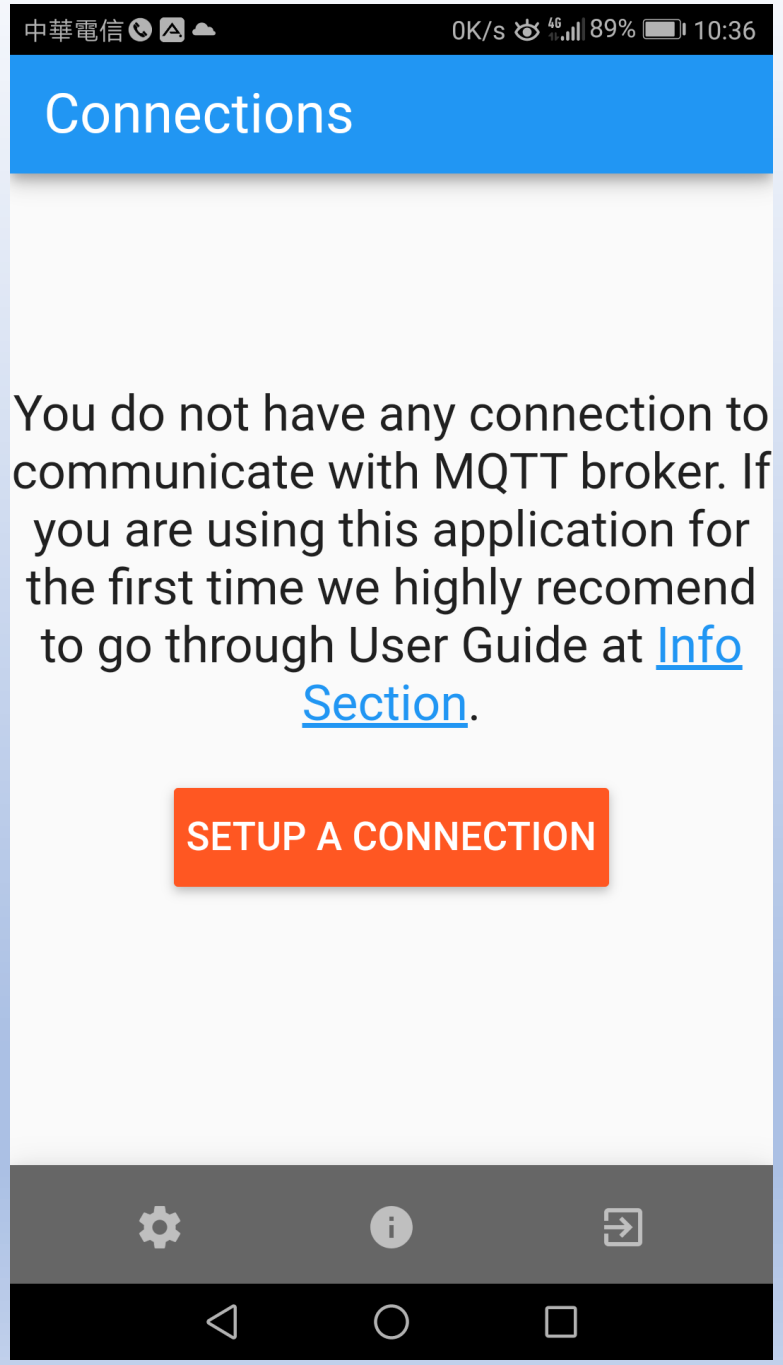
The command is used to close a network for MQTT client.

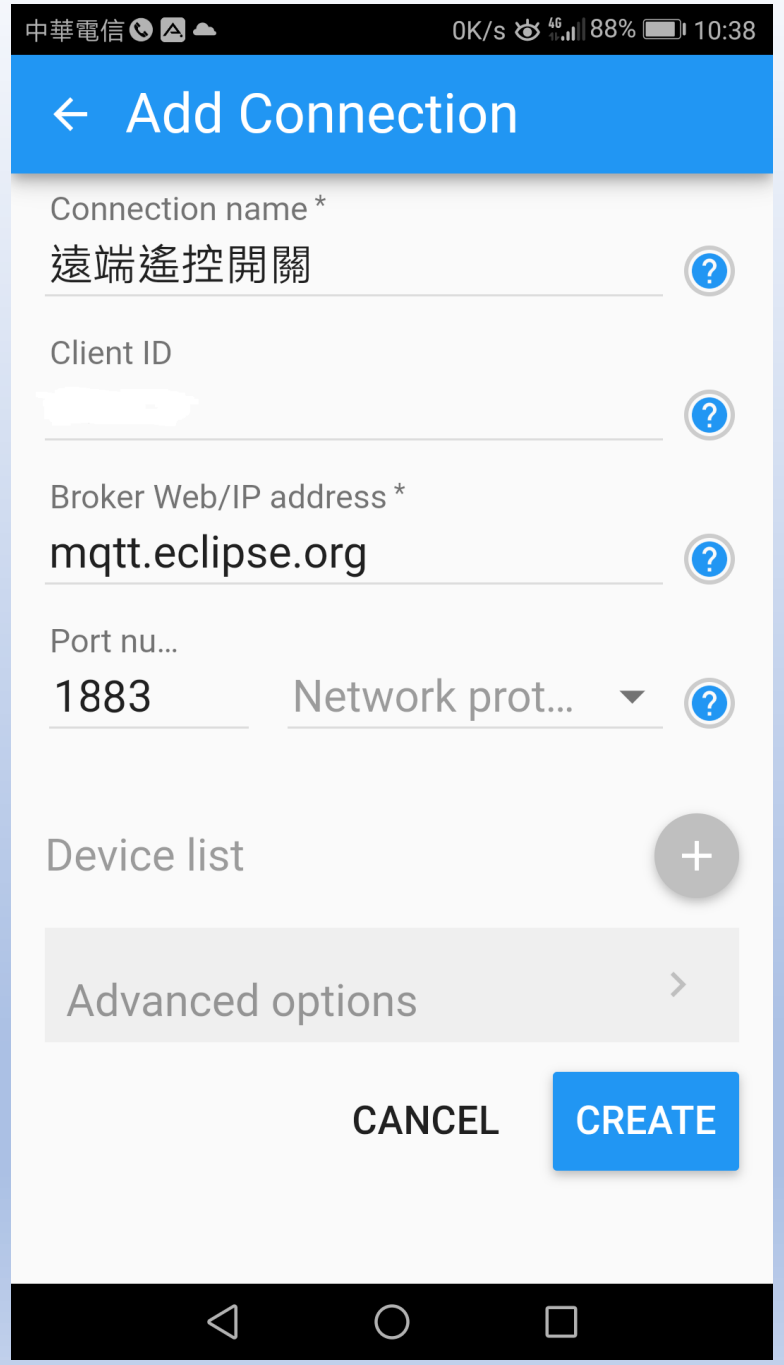
AT+QMTCLOSE Close a Network for MQTT Client	
Test Command **AT+QMTCLOSE=?**	Response **+QMTCLOSE:** (list of supported **<tcpconnectID>**s) **OK**
Write Command **AT+QMTCLOSE=<tcpconnectID>**	Response **OK** **+QMTCLOSE: <tcpconnectID>,<result>** If there is an error related to ME functionality: **+CME ERROR: <err>**
Maximum Response Time	300ms

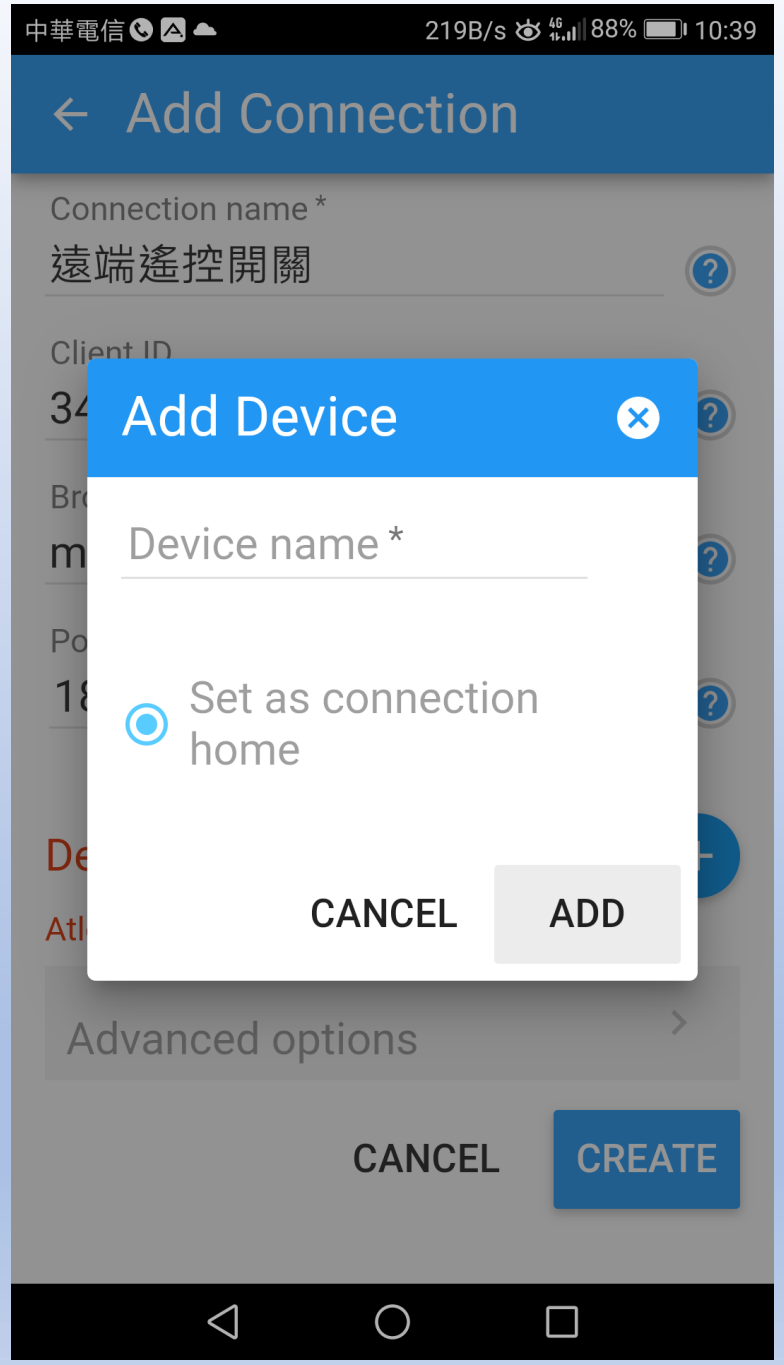

中華電信
0K/s 89% 10:34
IoT MQTT Panel
Rahul Kundu
含廣告內容
4.5★
640 則評論
超過 5萬
下載次數
3+
3 歲以上
安裝

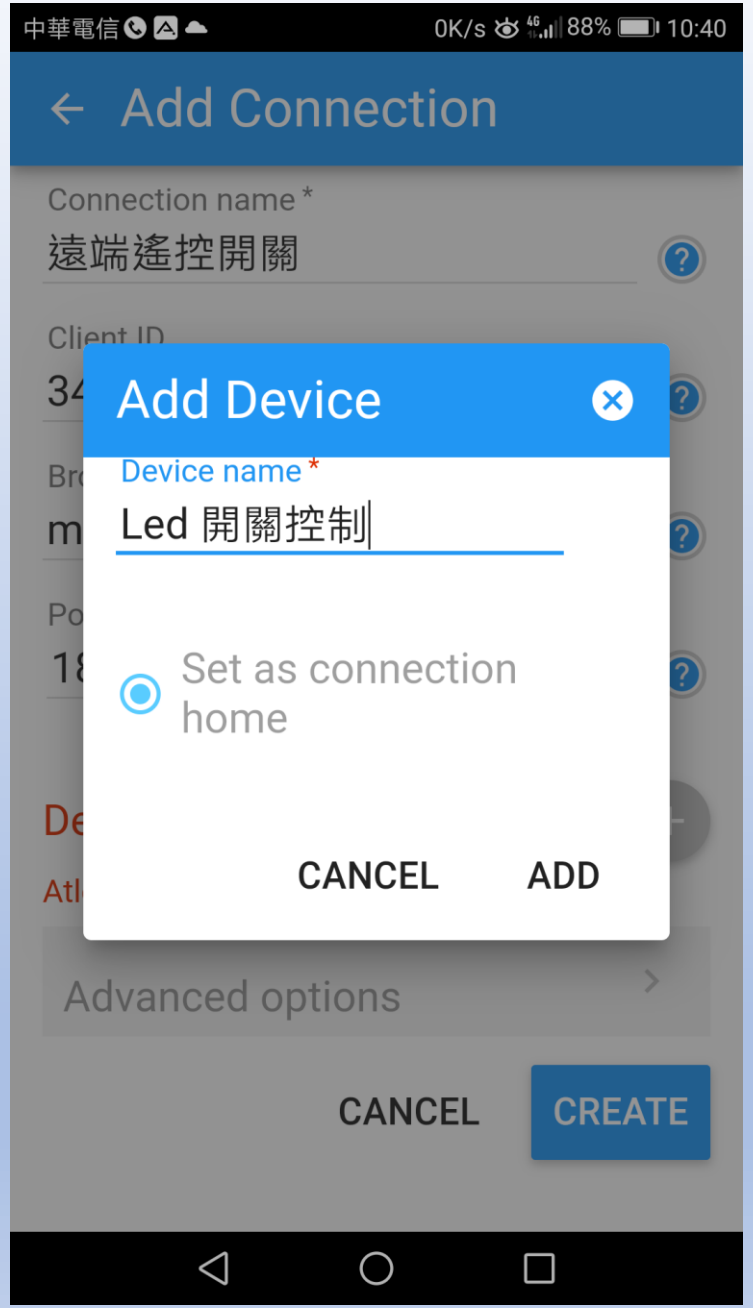

中華電信
0K/s 89% 10:35
IoT MQTT Panel
Rahul Kundu
含廣告內容
解除安裝
開啟
你可能也會喜歡的項目
Blynk - IoT for Arduino, ...
4.3★
MQTT Dash (IoT, Smart ...
4.8★
Mqtt Dashboard -...
4.5★
4.5★
超過 5萬
3+

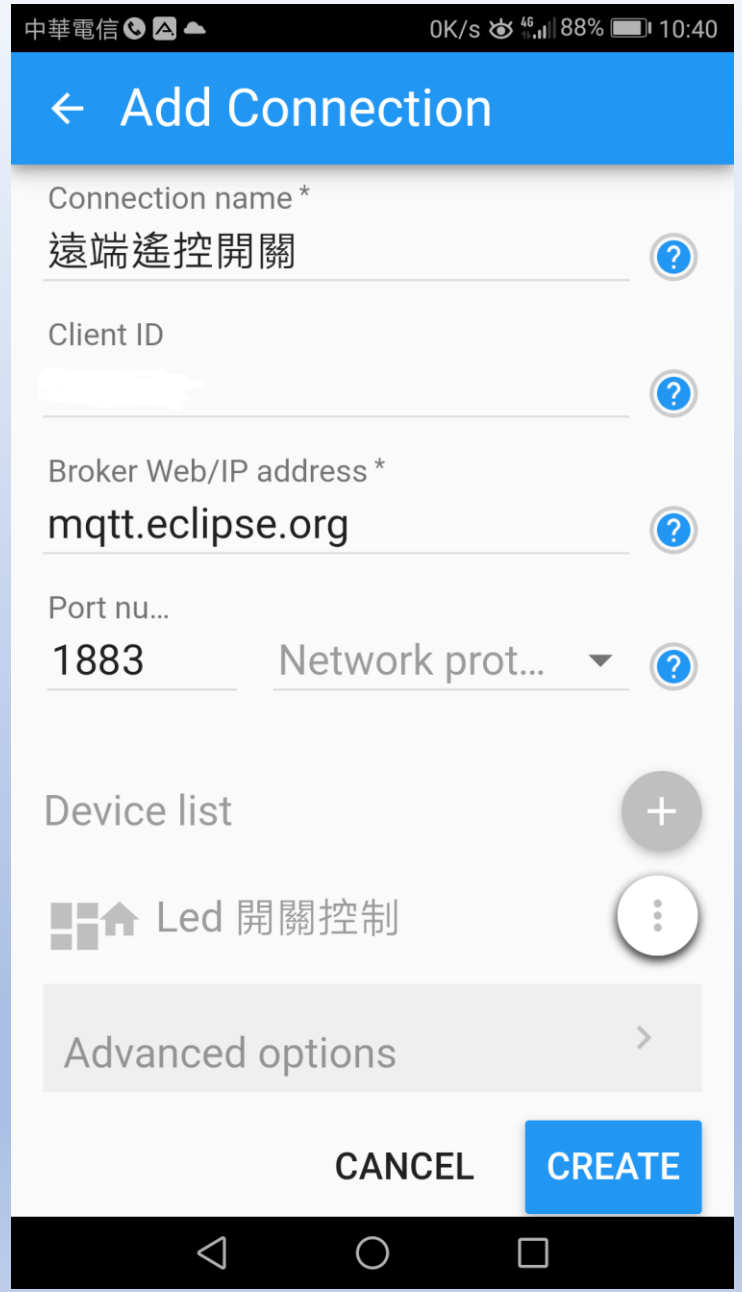

中華電信
265B/s 89% 10:35
IoT MQTT..

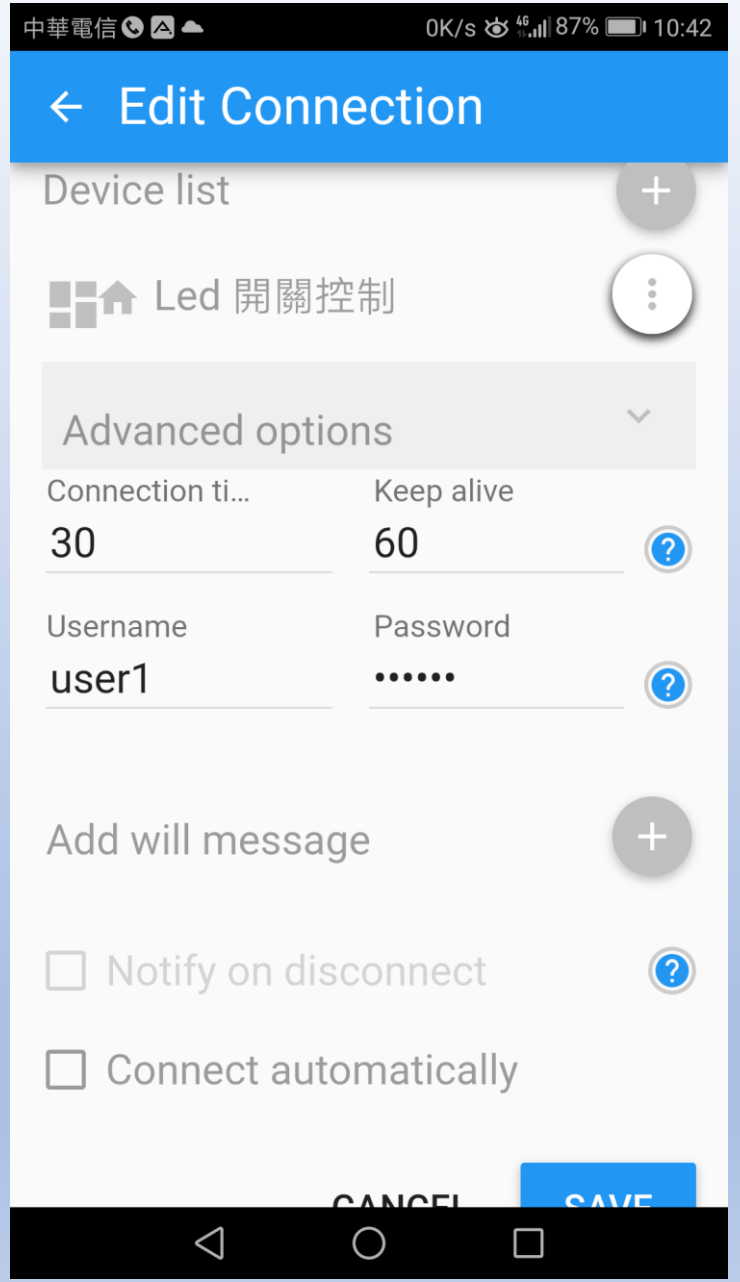

中華電信 0K/s 89% 10:36
Connections
You do not have any connection to communicate with MQTT broker. If you are using this application for the first time we highly recomend to go through User Guide at Info Section.
SETUP A CONNECTION

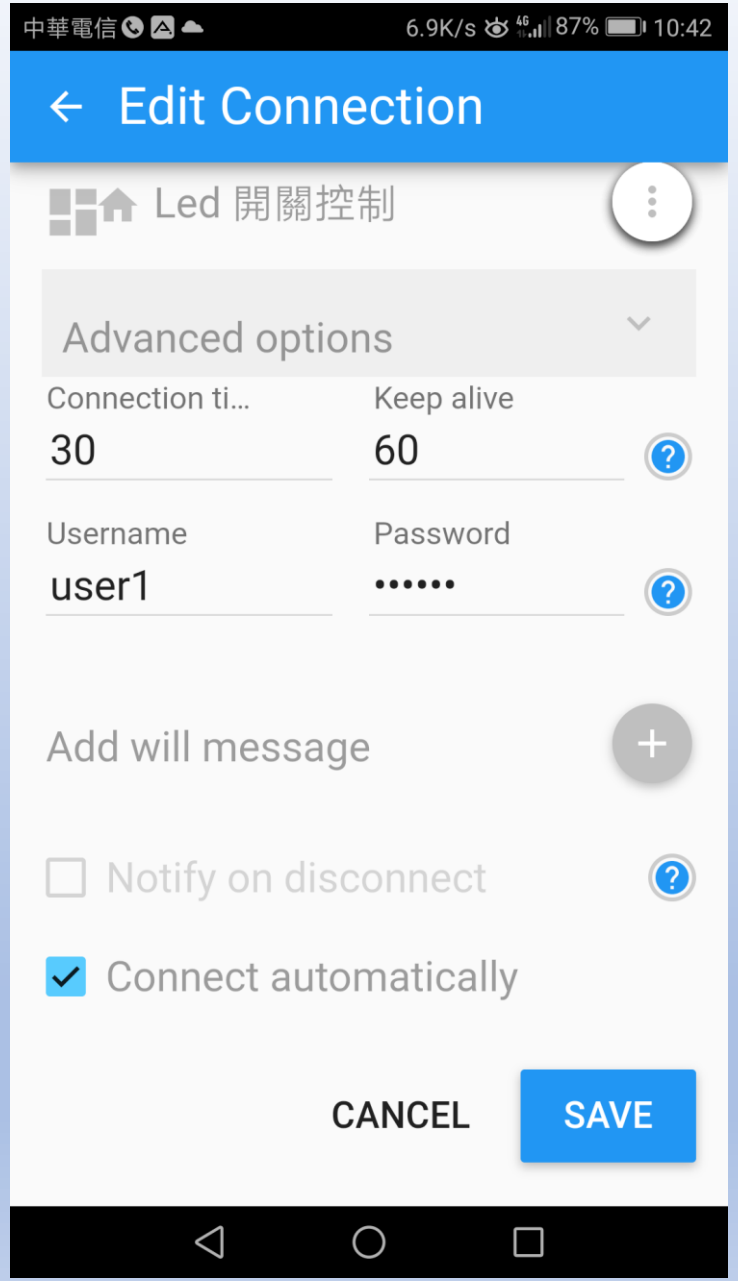

中華電信 0K/s 88% 10:38
Add Connection
Connection name *
遠端遙控開關
Client ID
Broker Web/IP address *
mqtt.eclipse.org
Port nu...
1883
Network prot...
Device list
Advanced options
CANCEL
CREATE

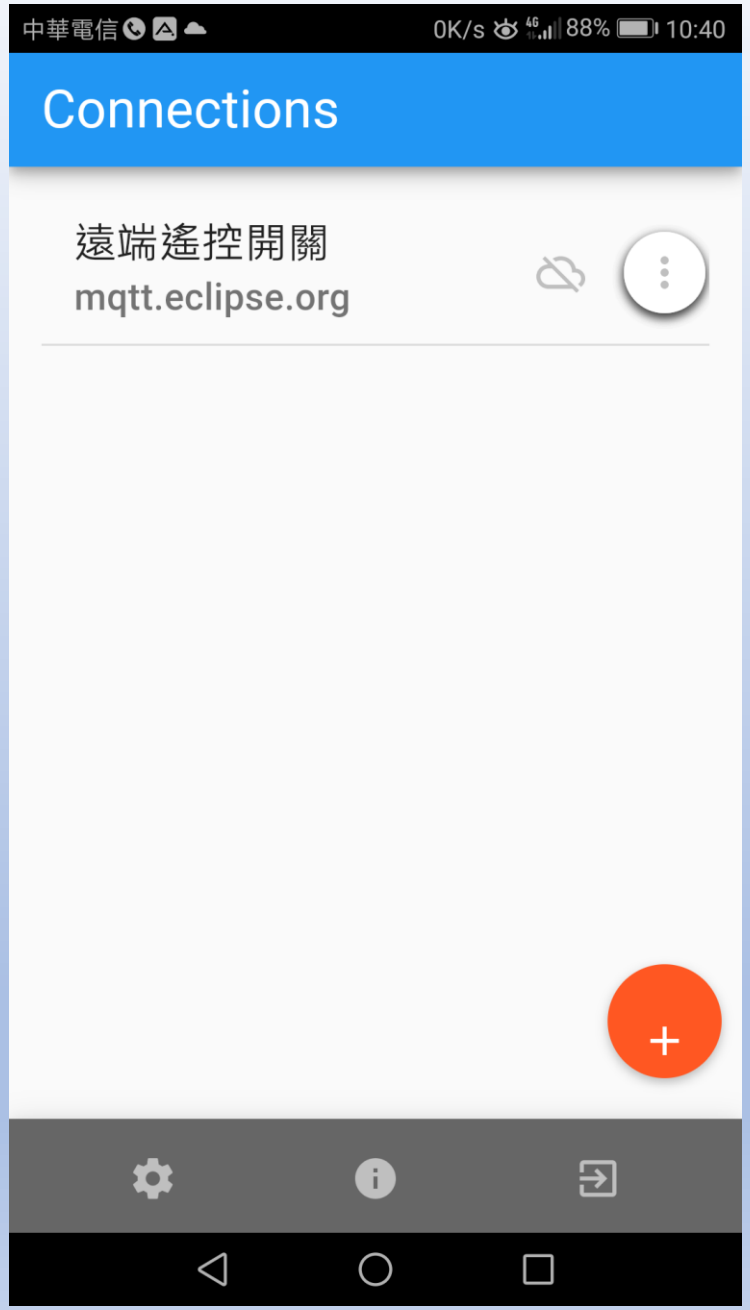

中華電信 219B/s 88% 10:39
Add Connection
Connection name *
遠端遙控開關
Add Device
Device name *
Set as connection home
CANCEL
ADD
Advanced options
CANCEL
CREATE

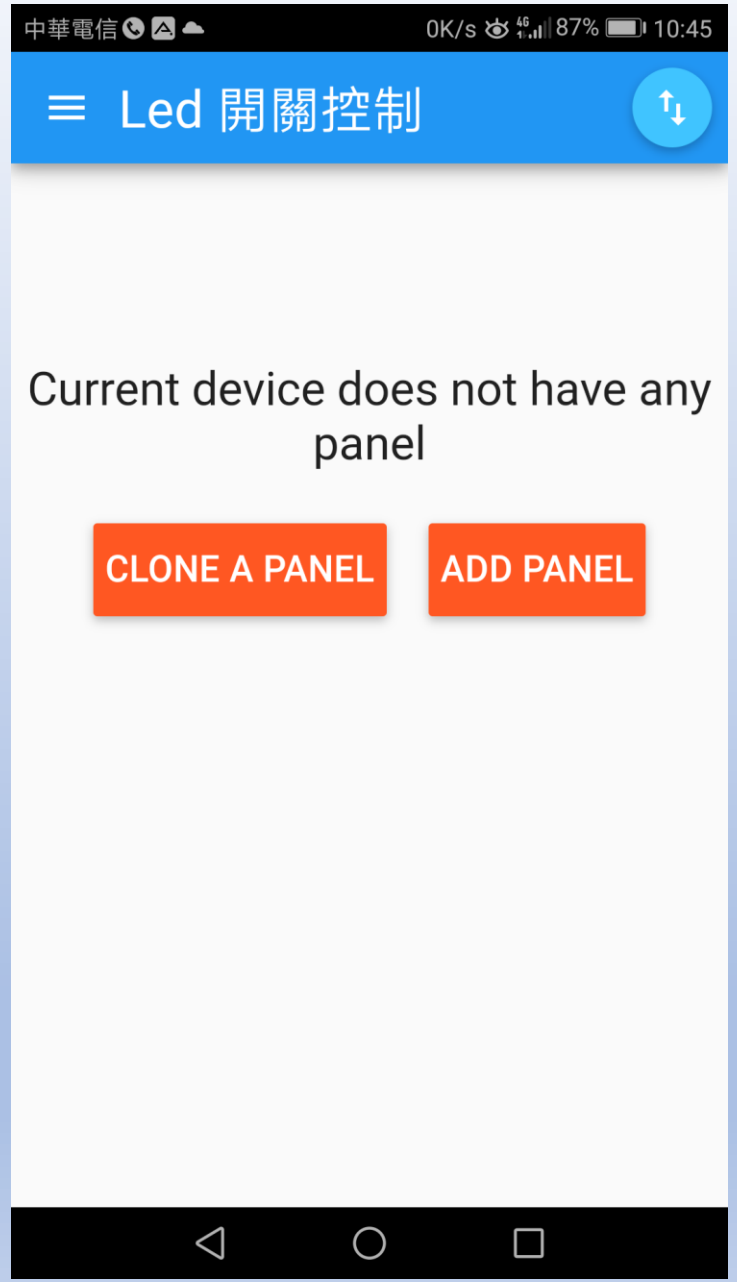

中華電信 0K/s 88% 10:40
Add Connection
Connection name *
遠端遙控開關
Client ID
Add Device
Device name *
Led 開關控制
Set as connection home
CANCEL
ADD
Advanced options
CANCEL
CREATE

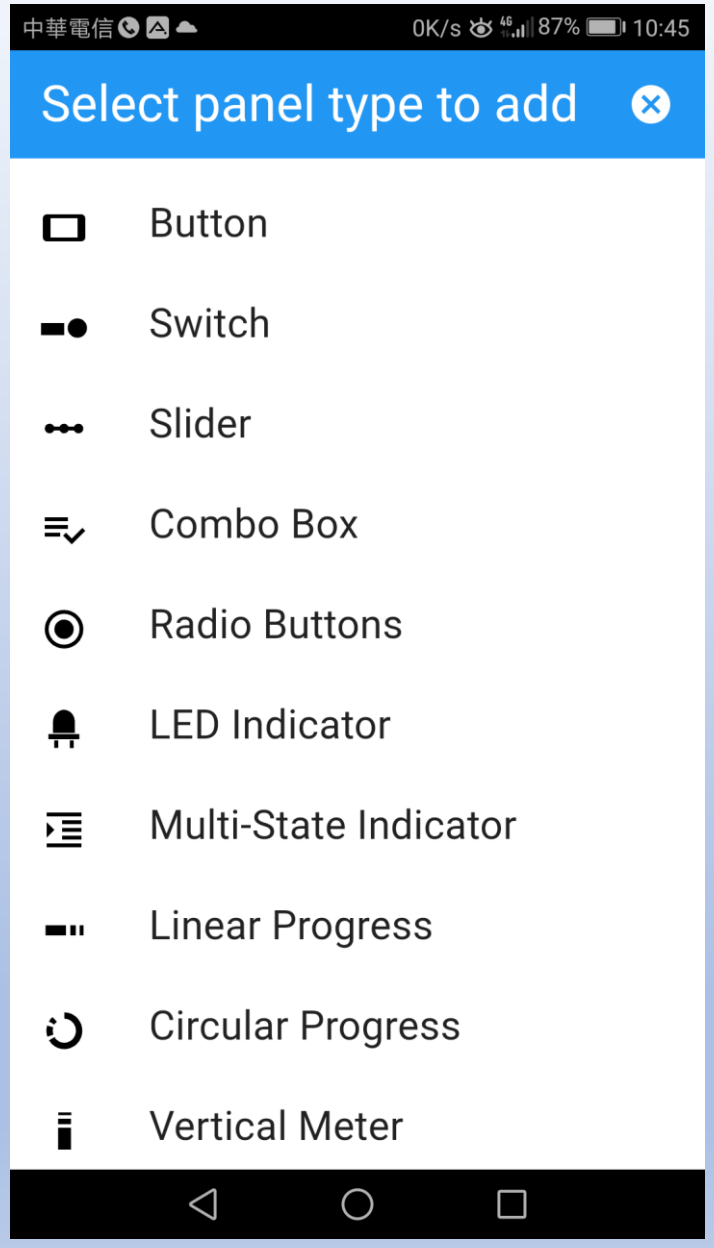

中華電信 0K/s 88% 10:40
Add Connection
Connection name *
遠端遙控開關
Client ID
Broker Web/IP address *
mqtt.eclipse.org
Port nu...
1883
Network prot...
Device list
Led 開關控制
Advanced options
CANCEL
CREATE

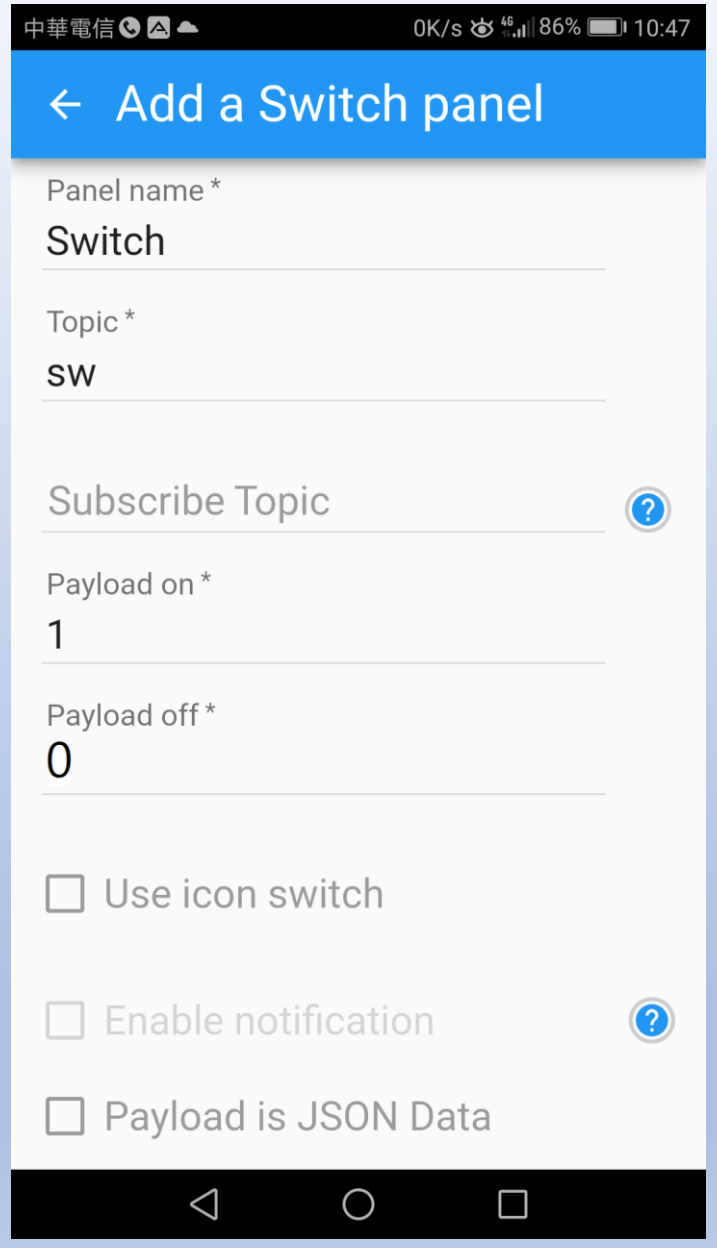

中華電信 0K/s 87% 10:42
Edit Connection
Device list
Led 開關控制
Advanced options
Connection ti...
30
Keep alive
60
Username
user1
Password
Add will message
Notify on disconnect
Connect automatically

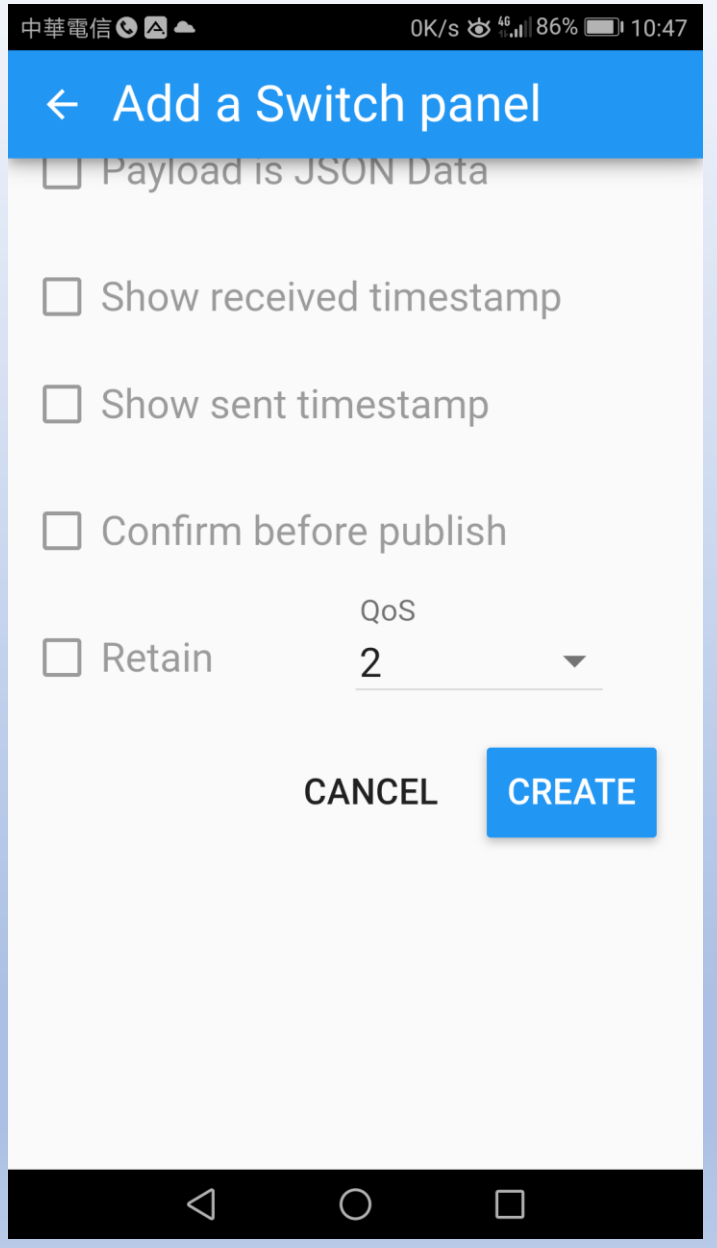

中華電信 6.9K/s 87% 10:42
Edit Connection
Led 開關控制
Advanced options
Connection ti...
30
Keep alive
60
Username
user1
Password
••••••
Add will message
Notify on disconnect
Connect automatically
CANCEL
SAVE

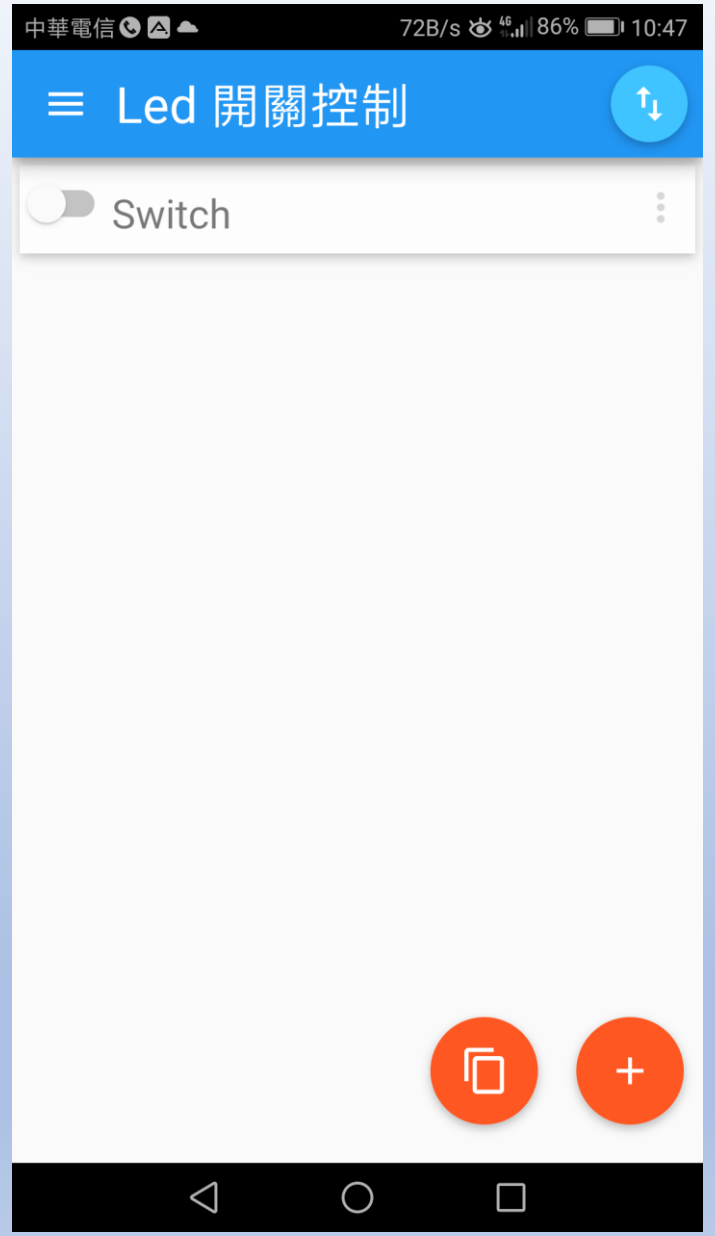

中華電信 0K/s 88% 10:40
Connections
遠端遙控開關
mqtt.eclipse.org

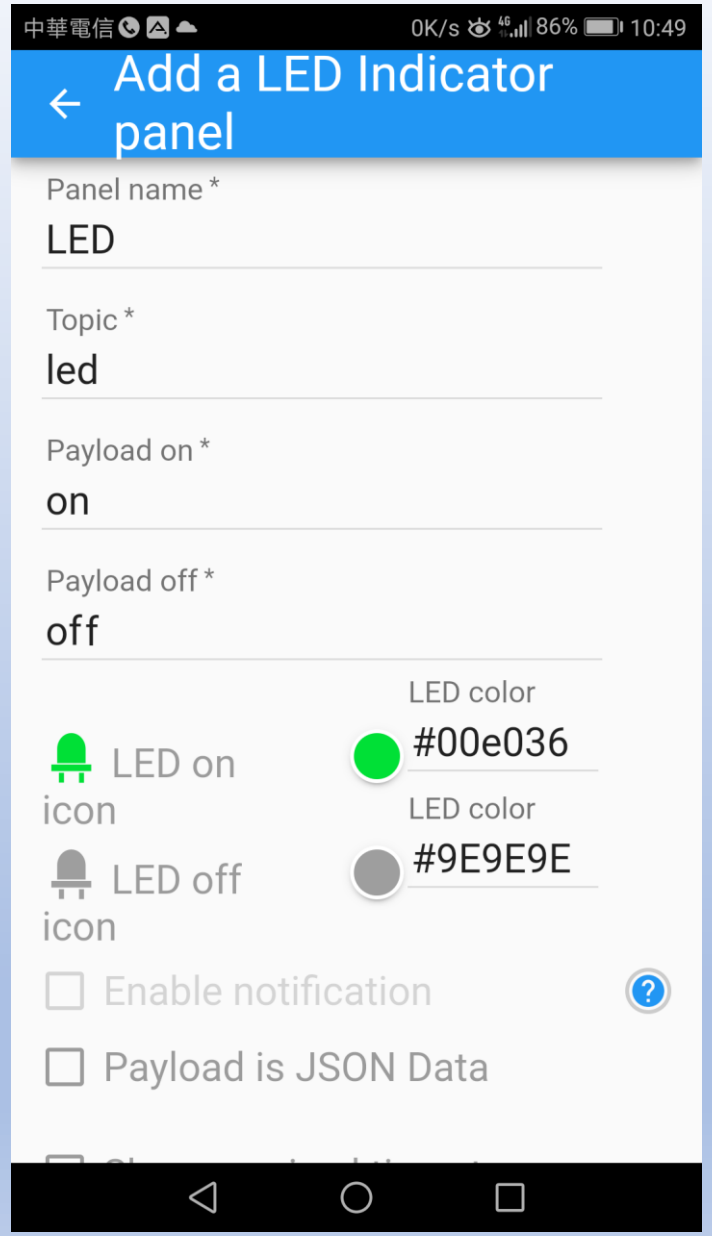

中華電信 0K/s 87% 10:45
Led 開關控制
Current device does not have any panel
CLONE A PANEL
ADD PANEL

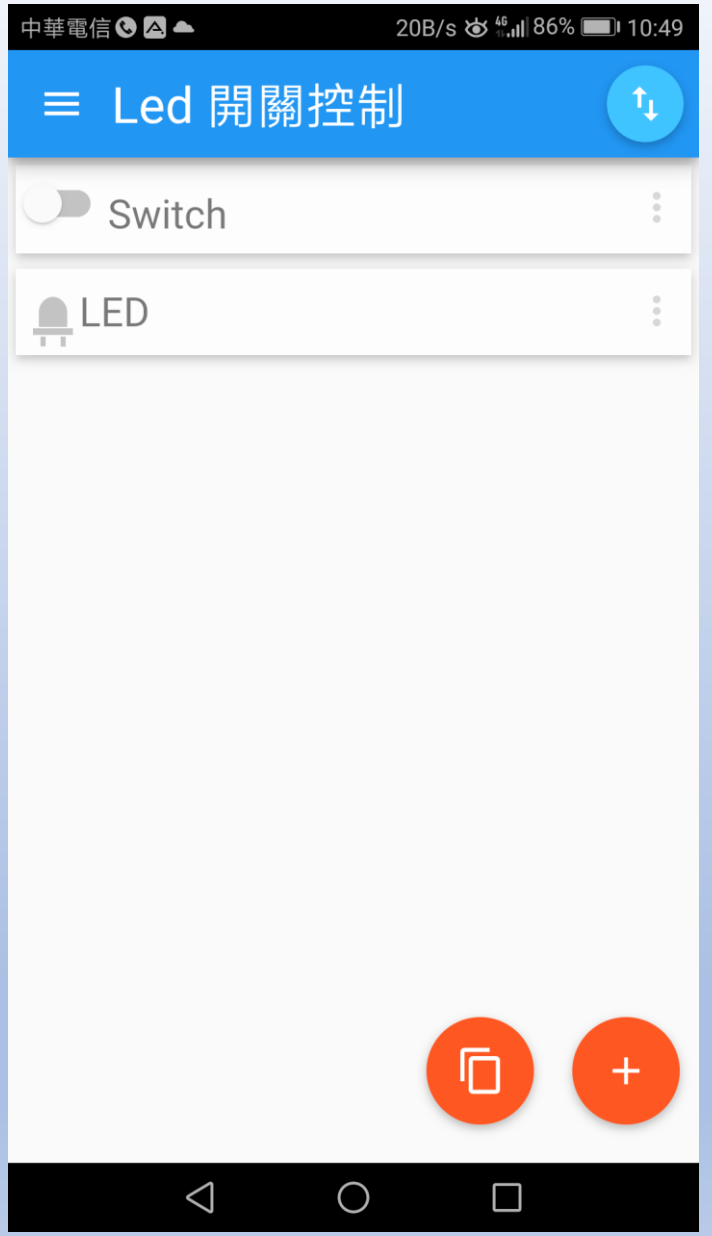

中華電信 0K/s 87% 10:45
Select panel type to add
Button
Switch
Slider
Combo Box
Radio Buttons
LED Indicator
Multi-State Indicator
Linear Progress
Circular Progress
Vertical Meter


中華電信 0K/s 86% 10:47
Add a Switch panel
Panel name *
Switch
Topic *
sw
Subscribe Topic
Payload on *
1
Payload off *
0
Use icon switch
Enable notification
Payload is JSON Data


中華電信 0K/s 86% 10:47
Add a Switch panel
Payload is JSON Data
Show received timestamp
Show sent timestamp
Confirm before publish
Retain
QoS
2
CANCEL
CREATE


中華電信 72B/s 86% 10:47
Led 開關控制
Switch


中華電信 0K/s 86% 10:49
Add a LED Indicator panel
Panel name *
LED
Topic *
led
Payload on *
on
Payload off *
off
LED on icon
LED color
#00e036
LED off icon
LED color
#9E9E9E
Enable notification
Payload is JSON Data


中華電信 20B/s 86% 10:49
Led 開關控制
Switch
LED

iPhone IOS 可使用的免費軟體

App Store Preview

This app is available only on the App Store for iPhone and iPad.

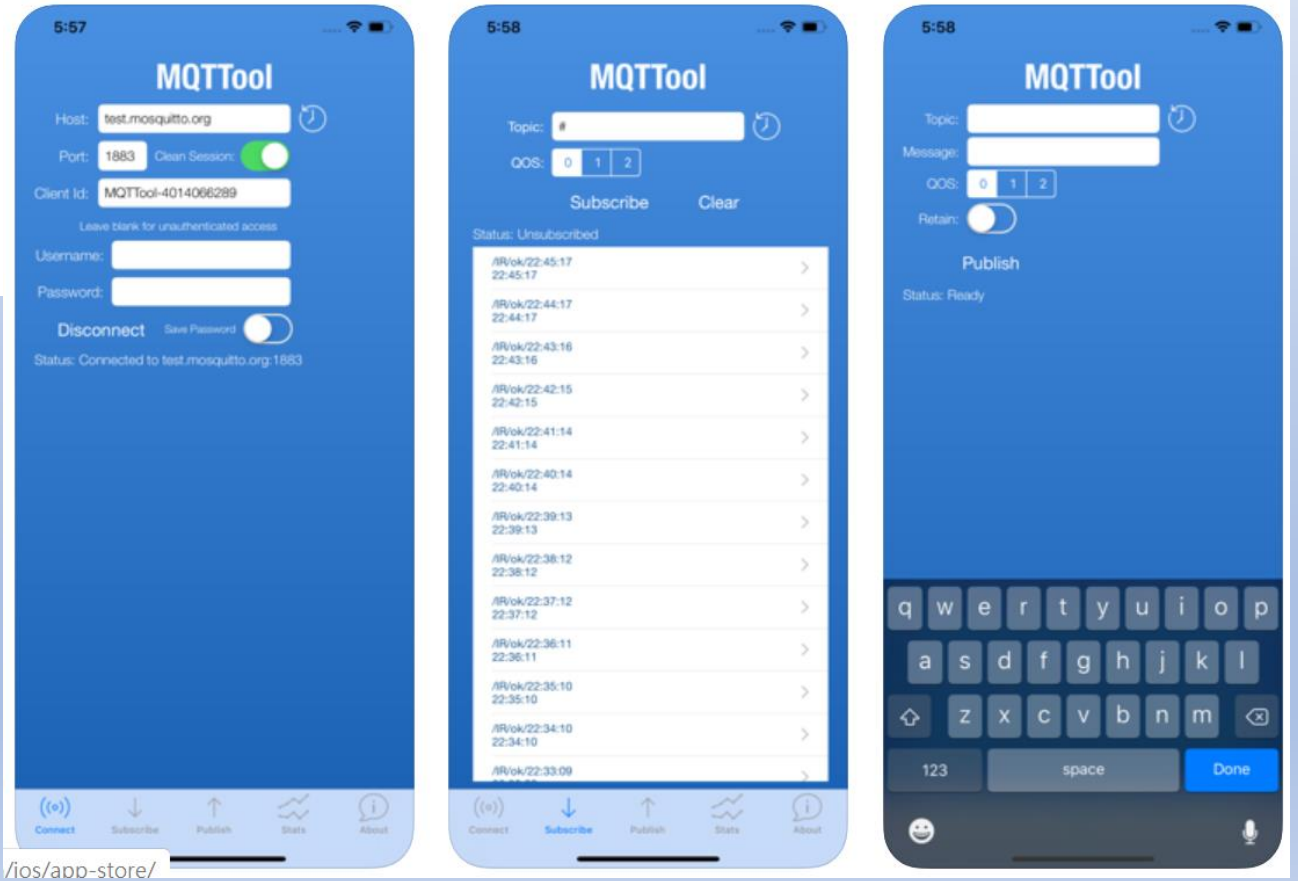
MQTTool 4+

Brent Petit

4.5, 21 Ratings

Free

Screenshots iPhone iPad



/ios/app-store/

程式區分為二個檔案：

函式檔：BC26Init.h

主程式：MQTTPushSub.ino

BC26Inint.h

BC26Init.h MQTT-PushSub.ino

```
1  #include <SoftwareSerial.h>
2
3  SoftwareSerial mySerial(8, 9); // ATMega328P 跟 BC26 固定使用的溝通腳位
4
5  void(* resetFunc) (void) = 0; // 宣告系統重置參數
6  int waitingTime = 10000; // 等候 10 秒的回覆.
7
```

BC26Init.h | MQTT-PushSub.ino

```
7
8  String Check_RevData(int z)  // 讀取收到的每一字元資料 ， 彙整成一個字串
9  {
10  String data= "";
11  char c;
12  long int StartTime=millis();
13  while (!mySerial.available())
14  {
15        Serial.print(".");
16        delay(100);
17        if ((StartTime+waitingTime) < millis() && z==0)
18        {
19          Serial.println("No response.");
20          resetFunc();
21          break;
22        }
23   }
24   Serial.println();
25    while (mySerial.available())
26   {
27     delay(100);
28     c = mySerial.read(); //Conduct a serial read
29     if (c=='\n' || c=='\r') continue;
30     data+=c; //Shorthand for data = data + c
31   }
32   return data;
33 }
```

由於資料接收是屬於串列方式，因此透過該函式Check_RevData將資料做整理

BC26Init.h × MQTT-PushSub.ino ×

```
34
35  bool Send_ATcommand(String msg,byte stepnum) // 傳送 AT command , 並加以判斷
36  {
37   String Showmsg="";
38   mySerial.println(msg);
39   Showmsg=Check_RevData(0);
40   Serial.println(Showmsg);
41    switch (stepnum)
42    {
43      case 0:          // Reset BC26
44      case 1:          // Close show message
45           break;
46      case 2:          // Check IPAddress
47           if (!Showmsg.startsWith("+CGPADDR:")) return false;
48           break;
49      case 4:          // Other Data
50           if (!Showmsg.startsWith("OK")) return false;
51           break;
52
53      case 10:  // build MQTT Server
54           if (Showmsg.startsWith("OK+QMTOPEN: 0,0")) return true;
55           if (Showmsg.startsWith("OK"))
56           {
57            Showmsg=Check_RevData(0);
58            if (!Showmsg.startsWith("+QMTOPEN: 0,0")) return false;
59           }
60           break;
```

Send_ATcommand

(第一部分)

Send_ATcommand (第二部分)

BC26Init.h MQTT-PushSub.ino

```
61        case 11: // Connect to MQTT server by username and password
62              if (Showmsg.startsWith("OK+QMTCONN: 0,0,0")) return true;
63              if (Showmsg.startsWith("OK"))
64              {
65               Showmsg=Check_RevData(0);
66               if (!Showmsg.startsWith("+QMTCONN: 0,0,0")) return false;
67              }
68              break;
69        case 12: // Publisher MQTT Data
70              if (!Showmsg.startsWith("OK+QMTPUB: 0,0,0")) return false;
71              break;
72     }
73    return true;
74  }
```

初始化 DSI2598 BC26Init() 及 連線 MQTT Server 的 connetc_MQTT() 函式

BC26Init.h | MQTT-PushSub.ino

```
76  bool BC26init()  // 初始化 BC26
77  {
78   Send_ATcommand("AT+QRST=1",0);
79   Send_ATcommand("ATE0",1);
80   if (!Send_ATcommand("AT+CGPADDR=1",2)) return false;
81   if (!Send_ATcommand("AT+IPR=9600",4)) return false;
82   return true;
83  }
84
85  bool connect_MQTT(String IP, String port,String user,String pass) // 建立 MQTT 連線通道
86  {
87   String S_temp="";
88   S_temp="AT+QMTOPEN=0," + IP + "," + port;
89   Serial.println(S_temp);
90   if (!Send_ATcommand(S_temp,10)) return false;
91   //delay (100);
92   S_temp="";
93   S_temp="AT+QMTCONN=0," + user + "," + pass;
94   Serial.println(S_temp);
95   if (!Send_ATcommand(S_temp,11)) return false;
96   //delay(100);
97   return true;
98  }
```

發佈資料 Publish_MQTT () 及 訂閱資料 Sub_MQTT () 函式

BC26Init.h | MQTT-PushSub.ino

```
100  bool Publish_MQTT(String topic, String message) // 發佈資料
101  {
102   String S_temp="";
103   S_temp="AT+QMTPUB=0,0,0,0," + topic + "," + message;
104   if (!Send_ATcommand(S_temp,12)) return false;
105   delay(100);
106   return true;
107  }
108
109  bool Sub_MQTT(String topic) // 訂閱資料
110  {
111   String S_temp="";
112   String Send_check="";
113   S_temp="AT+QMTSUB=0,1," + topic + "," + "2";  // Qos 2
114   mySerial.println(S_temp);
115   delay(100);
116   return true;
117  }
```

主程式 : MQTT-PushSub.ino
設定 :
燈號腳位 (紅色 10) (綠色 11)
MQTT Server 的 IP 位址 ， 帳號 、密碼 及 路徑 (話題)

BC26Init.h × MQTT-PushSub.ino ×

```
1  #include "BC26Init.h"
2
3  #define Init_led 10 //初始化狀態燈號腳位
4  #define Send_led 11 //被控端的狀態燈號腳位
5
6  String MQTT_Server="\"mqtt.eclipse.org\"";  //MQTT Server 的 IP 位址
7  String MQTT_Port="1883";                    //MQTT 使用的埠
8  String MQTT_user="\"user1\"";               //使用者名稱
9  String MQTT_pass="\"123456\"";              //使用者密碼
10 String MQTTtopic_SW="sw";                     //Switch 路徑 (話題)
11 String MQTTtopic_LED="led";                    //Led 路徑 (話題)
12 String MQTTmessage="";                      //訊息
```

設定通訊協定及腳位狀況 ，初始化 BC26 及連線 MQTT Server ，並發佈目前開關及 LED燈號狀況

```
14  void setup()
15  {
16    // put your setup code here, to run once:
17    Serial.begin(9600);
18    mySerial.begin(9600);
19
20    pinMode(Init_led, OUTPUT);
21    pinMode(Send_led, OUTPUT);
22
23    digitalWrite(Init_led, HIGH);
24    digitalWrite(Send_led, LOW);
25
26    while(!BC26init()) delay(5000);
27    delay(5000);
28    if (!connect_MQTT(MQTT_Server,MQTT_Port,MQTT_user,MQTT_pass)) resetFunc();
29    if (!Publish_MQTT(MQTTtopic_SW,"0")) resetFunc();
30    delay(1000);
31    if (!Publish_MQTT(MQTTtopic_LED,"off")) resetFunc();
32    digitalWrite(Init_led, LOW);
33    Serial.println("Start Loop Program ...");
34  }
```

BC26Init.h | MQTT-PushSub.ino

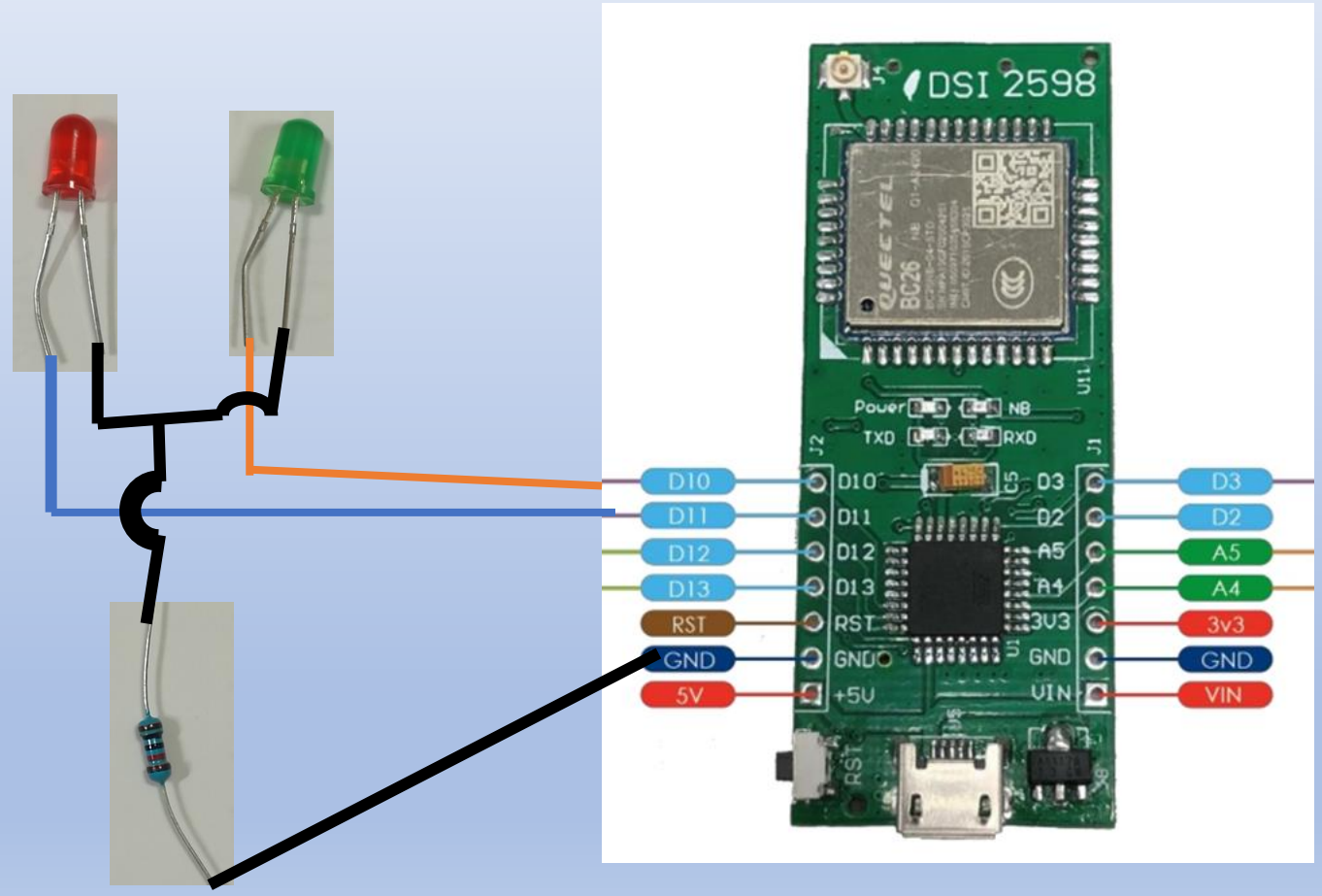
```
36  void loop()
37  {
38   String data= "";
39   String subdata= "";
40   char c_value="";
41   char c;
42   Sub_MQTT(MQTTtopic_SW);
43   while (!mySerial.available()) delay (1000);
44   while (mySerial.available())
45   {
46    delay(100);
47    c = mySerial.read(); //Conduct a serial read
48    if (c=='\n' || c=='\r') continue;
49    data+=c; //Shorthand for data = data + c
50   }
51   if (data!="")
52   {
53    int j=0;
54    for (int i=0;i<data.length();i++)
55    {
56     if (data[i]=='\"')
57     {
58      j=i+1;
59      while(data[j]!='\"')
60      {
61       subdata+=data[j];
62       j++;
```

透過訂閱方式讀取目前狀態判斷是否變更LED 燈號 ，並將狀況發佈至 MQTT Server (第一部分)

透過訂閱方式讀取目前狀態判斷是否變更LED 燈號 ，並將狀況發佈至 MQTT Server (第二部分)

```
63        }
64        if (subdata==MQTTtopic_SW)
65        {
66         c_value=data[j+3];
67         switch (c_value)
68         {
69          case '0':
70                        Serial.println("led off");
71                        digitalWrite(Send_led, LOW);
72                        while (!Publish_MQTT(MQTTtopic_LED,"off")) delay (100);
73                        break;
74          case '1':
75                        Serial.println("led on");
76                        digitalWrite(Send_led, HIGH);
77                        while(!Publish_MQTT(MQTTtopic_LED,"on")) delay (100);
78                        break;
79         }
80        }
81       }
82      }
83     }
84    }
```

電路示意圖


DSI 2598
BC26
Power
NB
TXD
RXD
J2
J1
D10
D11
D12
D13
RST
GND
5V
+5V
D3
D2
A5
A4
3V3
GND
VIN
D10
D11
D12
D13
RST
GND
D3
D2
A5
A4
3v3
GND
VIN

情境操作：