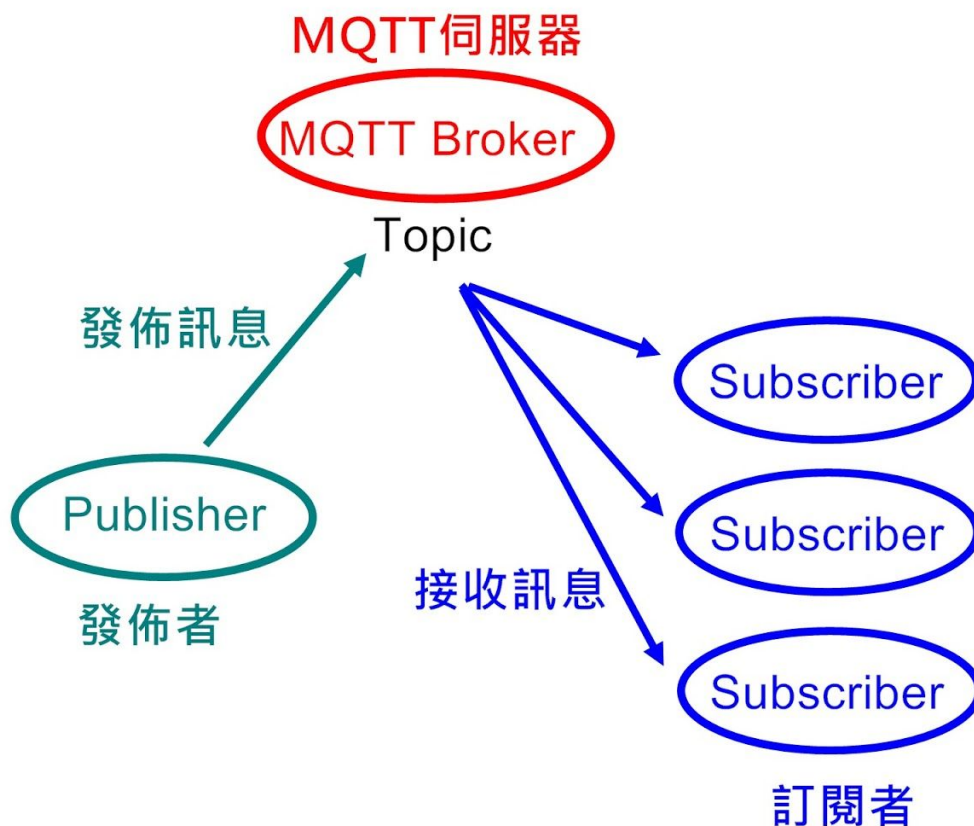


## 壹、什麼是MQTT

MQTT通訊協定(Message Queuing Telemetry Transport), 是為硬體性能較低的遠程設備以及網絡狀況糟糕的情況下而設計的發布/訂閱型消息協議, 因此, 它對網路頻寬與硬體需求非常少, 是極為輕便的通訊協議, 許多IoT的裝置都是走MQTT的協定。micro:bit沒有連上網路的能力, 但是接上WIFI模組後便能透過MQTT協定, 和遠方的伺服器、手機或是電腦雙向溝通訊息, 這次上課WIFI模組是使用DFRobot公司的OBLOQ。

各個IoT裝置, 透過MQTT訂閱同一個Topic, 便可以經由MQTT Broker發佈或接收訊息, 許多智慧家電便是這麼做。另外, 手機中也有許多可實作MQTT通訊的APP, 提供了許多按鈕、開關、指針.....等可視元件, 透過這些元件來控制IoT裝置, 今天會以Virtuino MQTT這個APP實作手機控制IoT智慧家電為例子。



**IoT上的每一個裝置, 都可以同時是發佈者以及訂閱者  
只要訂閱同一個Topic, 便可以接收到所有發佈的訊息**

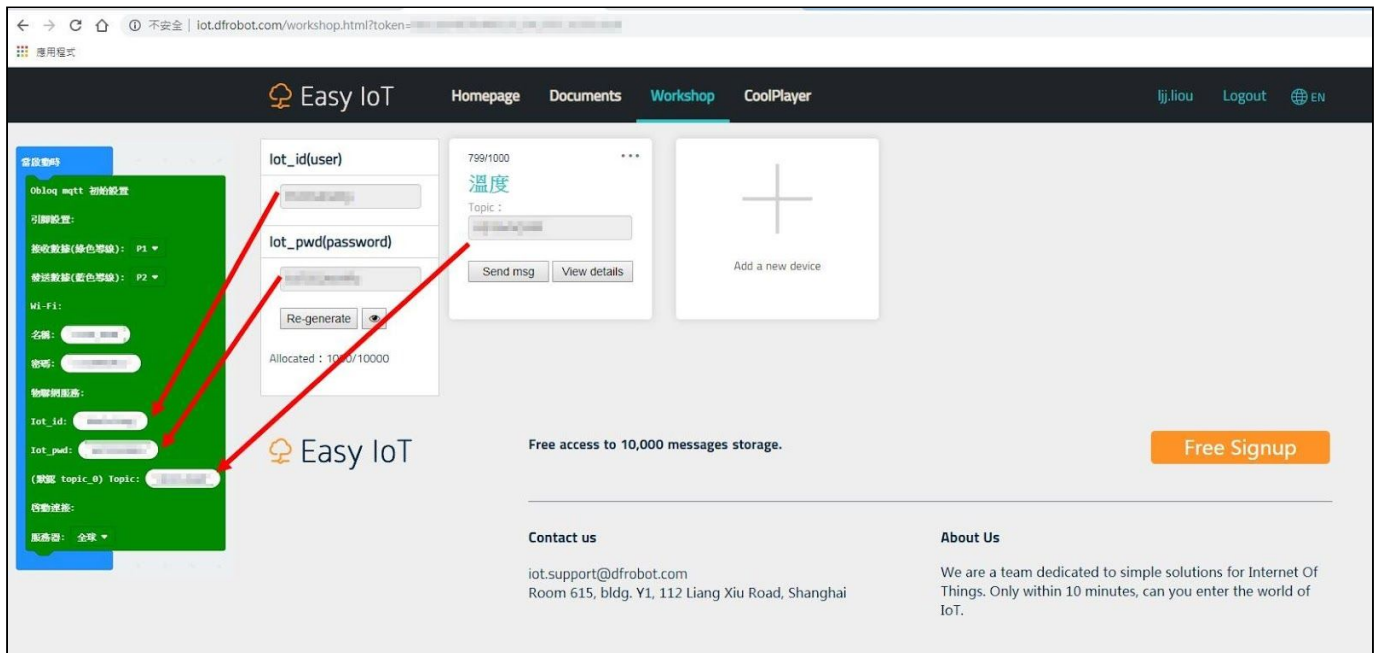
## 貳、DFRobot物聯網MQTT網站的使用

### 一、iot.dfrobot.com註冊帳號

註冊網址：<https://iot.dfrobot.com>

### 二、IoT帳密及Topic資料的取得：

註冊好認證通過，登入後便會看到lot\_id(user)以及lot\_pwd(password)，請把它記下，這是micro:bit要登入這個網站需要使用到的帳密。接下來請按下「add a new device」按鈕，便會新增一個可以連線的裝置，每個裝置是一個Topic，記下Topic名稱，所有IoT裝置便能利用這個Topic互相溝通。下圖為lot\_id以及lot\_pwd及Topic在積木程式中需要設定的位置。



The screenshot displays the Easy IoT web interface. On the left, a sidebar menu is visible, with a green box highlighting the 'Obloq mqtt 初始設置' (Obloq mqtt initial settings) section. Red arrows point from this section to the 'lot\_id(user)', 'lot\_pwd(password)', and '(號碼 topic\_0) Topic:' fields in the main content area. The main content area shows a user profile with 'lot\_id: 7991000' and 'lot\_pwd: 溫度'. Below the profile, there is a 'Add a new device' button. The footer contains contact information and an 'About Us' section.

### 三、簡單測試訊息溝通

在開始寫程式前，必須先安裝擴展積木，

官方的擴展積木位址：<https://github.com/DFRobot/pxt-ObloqV1>

我改寫的擴展積木位址：<https://github.com/liouji/pxt-Obloq>

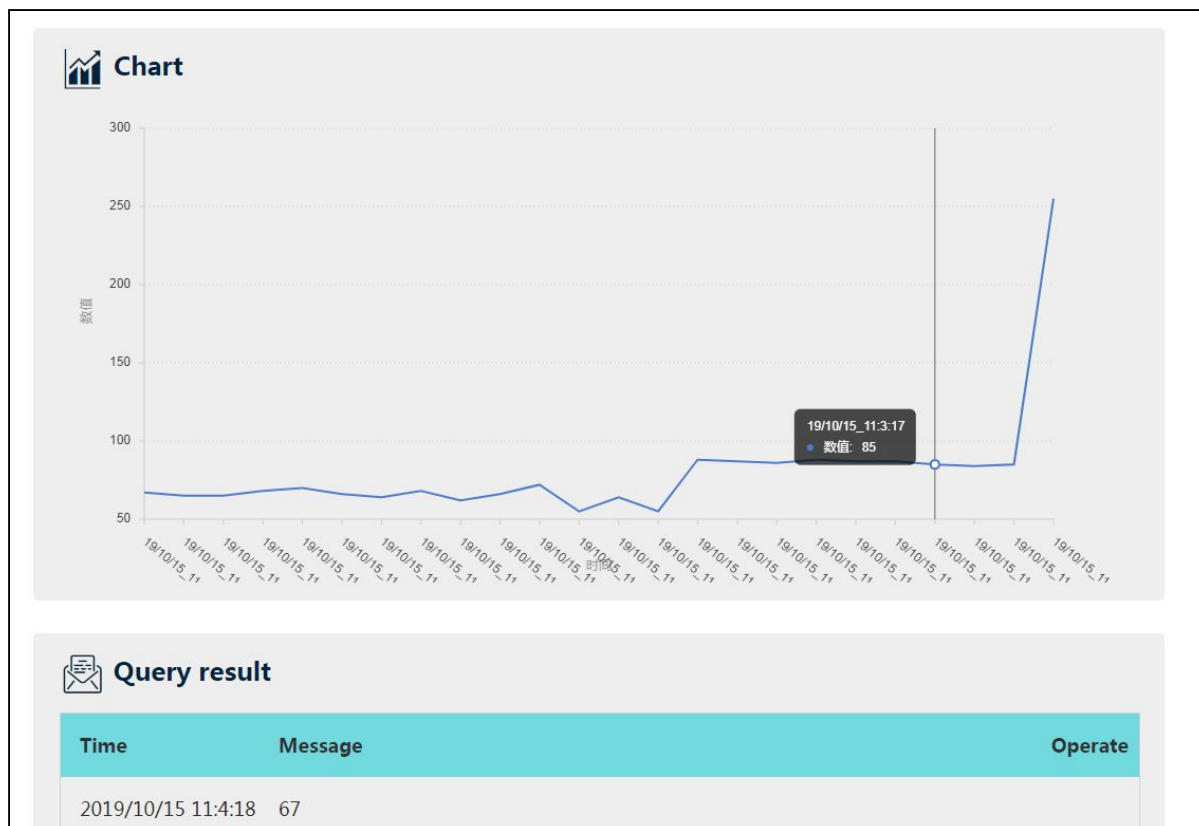
範例程式：

### 1. 傳送亮度：將偵測到的亮度資訊傳送到IoT網站

The screenshot shows a Node-RED flow with two main blocks:

- Obloq mqtt 初始設置 (Initial Settings):** A large green block containing configuration for an MQTT client. It includes fields for:
  - 引腳設置 (Pin Settings): 接收數據 (綠色導線) (P1) and 發送數據 (藍色導線) (P2).
  - Wi-Fi: 名稱 (jms) and 密碼 (ms123456789).
  - 物聯網服務 (IoT Service): Iot\_id (ms123456789), Iot\_pwd (ms123456789), and (默認 topic\_0) Topic (DATA\_1111).
  - 啓動連接 (Start Connection): 服務器 (全球) (Global).
- 重復無限次 (Repeat Infinite):** A blue loop block containing:
  - 發送消息 (Send Message): 轉換 (光線感測值) (Convert Light Sensor Value) 成文字型別 (to text) 至 topic\_0 (to topic\_0).
  - 暫停 (Pause): 3000 毫秒 (3000 ms).

呈現在網站上的結果：



## 2.同時傳送亮度及溫度：IoT網站必須建立二個Topic，程式積木也必須訂閱二個Topic

The image shows a Scratch-like block editor interface with two main sections:

- 當啟動時 (When Started):** A large green block titled "Obloq mqtt 初始設置" (Obloq mqtt Initial Setup). It contains several sub-sections:
  - 引腳設置 (Pin Settings):** "接收數據(綠色導線): P1" and "發送數據(藍色導線): P2".
  - Wi-Fi:** Fields for "名稱:" and "密碼:".
  - 物聯網服務 (IoT Service):** Fields for "Iot\_id:", "Iot\_pwd:", and "(默認 topic\_0) Topic:".
  - 啓動連接 (Start Connection):** A "服務器:" dropdown menu set to "全球".
  - 新增訂閱 (Add Subscription):** A dropdown menu set to "topic\_1" followed by a field containing a key.
- 重複無限次 (Repeat Indefinitely):** A blue block containing two "發送消息" (Send Message) blocks:
  - The first block converts "光線感測值" (Light sensor value) to a text type and sends it to "topic\_0".
  - The second block converts "溫度感測值 (°C)" (Temperature sensor value in °C) to a text type and sends it to "topic\_1".A "暫停" (Pause) block is set to "3000" milliseconds.

3.雙向訊息傳遞：網站傳送heart、happy、sad到micro:bit, micro:bit會出現愛心、微笑及悲傷圖案。

The image displays a Scratch script for an Obloq MQTT setup and message handling. The script is organized into several sections:

- 當啟動時 (When started):** A blue block containing the initial configuration for the Obloq MQTT module.
- Obloq mqtt 初始設置 (Obloq mqtt initial settings):** A green block with the following settings:
  - 引腳設置 (Pin settings):
    - 接收數據(綠色導線): P1 (Receive data (green wire): P1)
    - 發送數據(藍色導線): P2 (Send data (blue wire): P2)
  - Wi-Fi (Wi-Fi):
    - 名稱 (Name): [Redacted]
    - 密碼 (Password): [Redacted]
  - 物聯網服務 (IoT service):
    - Iot\_id: [Redacted]
    - Iot\_pwd: [Redacted]
    - (默認 topic\_0) Topic: [Redacted]
  - 啟動連接 (Start connection):
    - 服務器 (Server): 全球 (Global)
- 在 topic\_0 收到消息時運行 (When message received on topic\_0):** A green block containing three conditional logic blocks:
  - 如果 message = "heart" 那麼 (If message = "heart" then):
    - 顯示 圖示 (Show icon): [Heart icon]
  - 否則如果 message = "happy" 那麼 (Otherwise if message = "happy" then):
    - 顯示 圖示 (Show icon): [Smiley face icon]
  - 否則如果 message = "sad" 那麼 (Otherwise if message = "sad" then):
    - 顯示 圖示 (Show icon): [Sad face icon]
- 當按鈕 A 被按下 (When button A is pressed):** A purple block containing:
  - 發送消息 "message from A" 至 topic\_0 (Send message "message from A" to topic\_0)
- 當按鈕 B 被按下 (When button B is pressed):** A purple block containing:
  - 發送消息 "message from B" 至 topic\_0 (Send message "message from B" to topic\_0)

# 參、智慧家電實作：

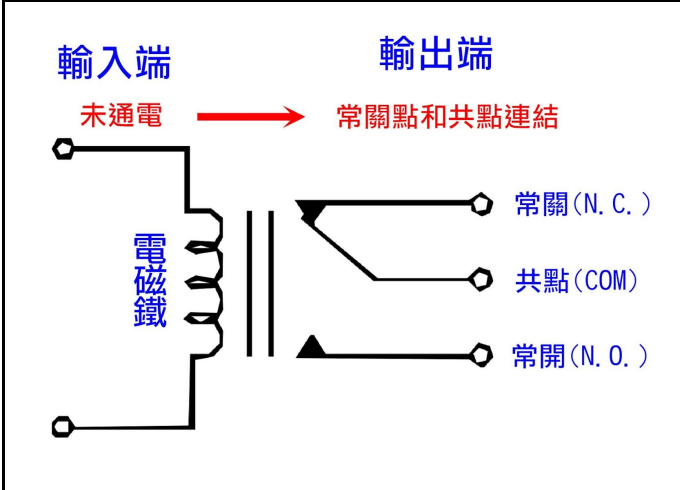
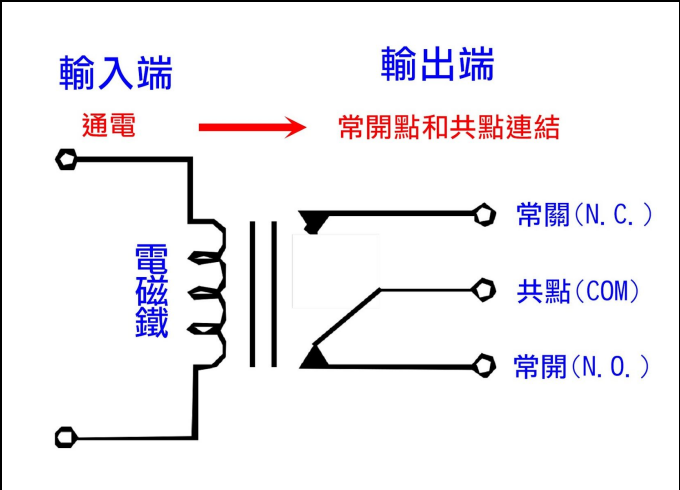


## 一、插座改裝

請參考另一份插座的講義

## 二、使用繼電器

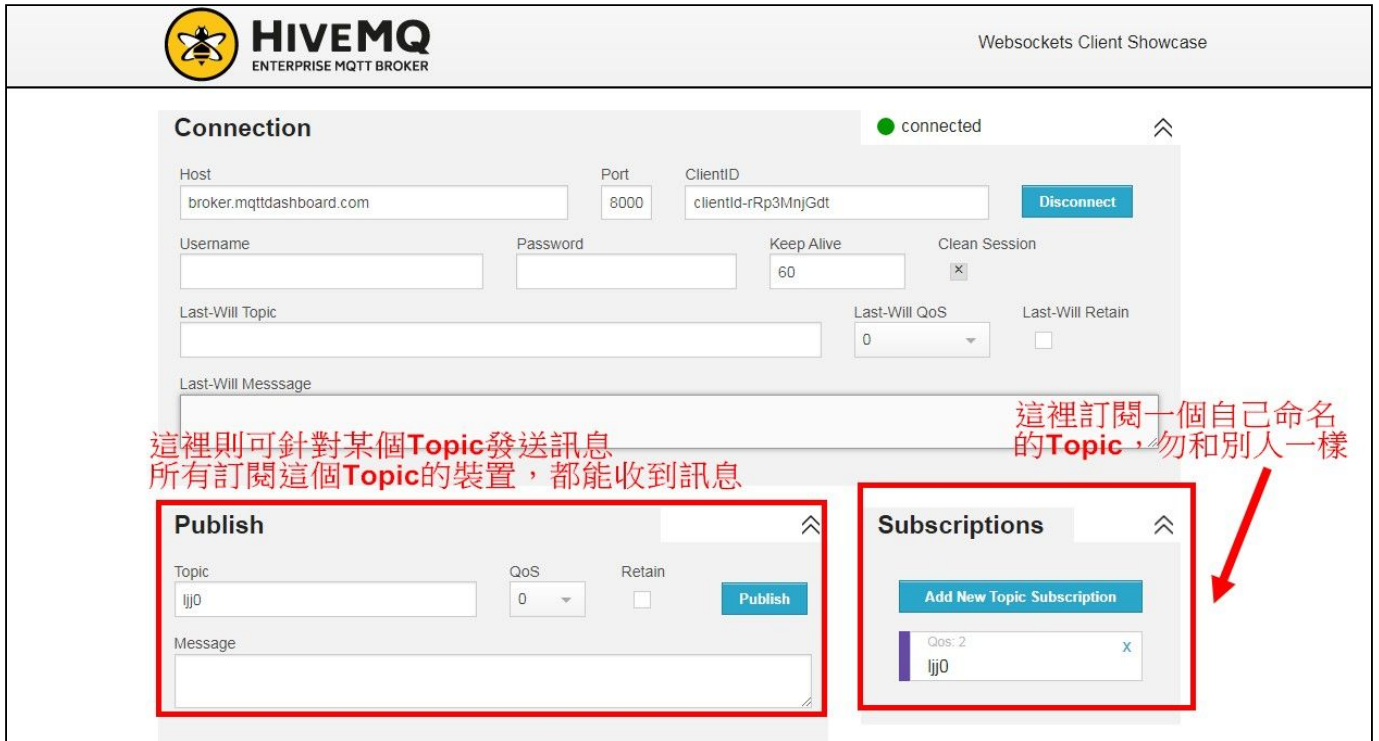
繼電器的原理

繼電器是一種透過小電流的流通(micro:bit供電)，導致另一個電路導通的一個裝置，常用在用電壓小的裝置控制大電壓裝置的應用上。繼電器的輸入部分為一組電磁鐵，當電磁鐵通過電流時，產生磁性，就吸引著輸出接點閉合或斷開，當輸入端的電流消失後輸出接點又回復到原始狀態，於是透過輸入端的電路開或關，便能控制輸出端的開或關。請將繼電器的「常開(N.O)」連接到micro:bit的P8，「共點(COM)」則連接到micro:bit的GND。

	
<p>輸入端未通電時或電力消失時，輸出端的「常關點」與「共點」連結</p>	<p>輸入端通電時，電磁鐵的磁性將端點吸往「常開點」，於是「常開點」與「共點」連結</p>
	
<p>繼電器輸入端，標準GVS接頭。輸入端要和micro:bit連接。</p>	<p>繼電器輸出端，有三點接點，NC、COM以及NO。輸出端要和我們想控制的家電連接。</p>

### 三、hivemq網站的使用，瀏覽器也能控制IoT裝置

hivemq是個免費提供MQTT服務的網站，而且不需經過任何註冊認證的程序便能隨時使用，網站：<http://www.mqtt-dashboard.com/>。而且這個網站還提供了瀏覽器便可訂閱MQTT的服務，所以可以測試瀏覽器和micro:bit透過MQTT溝通，<http://www.hivemq.com/demos/websocket-client/>



The screenshot shows the Hivemq MQTT dashboard interface. At the top left is the Hivemq logo and the text "HIVEMQ ENTERPRISE MQTT BROKER". At the top right is "Websockets Client Showcase". The main interface is divided into several sections:

- Connection:** Shows a "connected" status. Fields include Host (broker.mqttdashboard.com), Port (8000), ClientID (clientid-rRp3MnjGdt), Username, Password, Keep Alive (60), Clean Session (checked), Last-Will Topic, Last-Will QoS (0), and Last-Will Retain (unchecked). A "Disconnect" button is present.
- Publish:** A section for sending messages. It has a "Topic" field (ljj0), a "QoS" dropdown (0), a "Retain" checkbox (unchecked), and a "Publish" button. Below is a "Message" text area.
- Subscriptions:** A section for managing subscriptions. It has an "Add New Topic Subscription" button. Below, a subscription for "ljj0" with "Qos: 2" is listed, with a close button (x).

Red annotations are present:

- Red text: "這裡則可針對某個Topic發送訊息 所有訂閱這個Topic的裝置，都能收到訊息" (Here you can send messages to a specific Topic. All devices subscribed to this Topic will receive the message). This text is positioned between the Connection and Publish sections.
- Red text: "這裡訂閱一個自己命名的Topic，勿和別人一樣" (Here you subscribe to a Topic with your own name, don't be like others). This text is positioned between the Connection and Subscriptions sections.
- A red arrow points from the Subscriptions section towards the right.

## 四、micro:bit端的MQTT程式

OBLOQ的設定，MQTT的位址為broker.hivemq.com，Topic則請設定為上面第三步驟所訂閱的Topic名稱。透過第三步驟，在瀏覽器傳送1，便能將家中電器打開；傳送0，便可以關閉電器。

The image shows the Obloq MQTT configuration and logic programming interface. On the left, the configuration panel is titled "Obloq mqtt 初始設置" and includes the following settings:

- 引腳設置:
  - 接收數據(綠色導線): P1
  - 發送數據(藍色導線): P2
- Wi-Fi:
  - 名稱: [Redacted]
  - 密碼: [Redacted]
- 物聯網服務:
  - 位址: "broker.hivemq.com"
  - 通訊埠: 1883
  - Iot\_id: [Redacted]
  - Iot\_pwd: [Redacted]
  - (默認 topic\_0) Topic: "ljj0"

At the top left, a blue block labeled "當啟動時" contains a "數位信號寫入 引腳" block with "P8" selected and "數字" set to "0".

The main logic programming area is titled "在 topic\_0 收到消息時運行 message". It contains two conditional blocks:

- 如果 message = "1" 那麼**
  - 數位信號寫入 引腳 P8 數字 1
  - 顯示 圖示 [LED Matrix]
- 否則如果 message = "0" 那麼**
  - 數位信號寫入 引腳 P8 數字 0
  - 顯示 圖示 [LED Matrix]

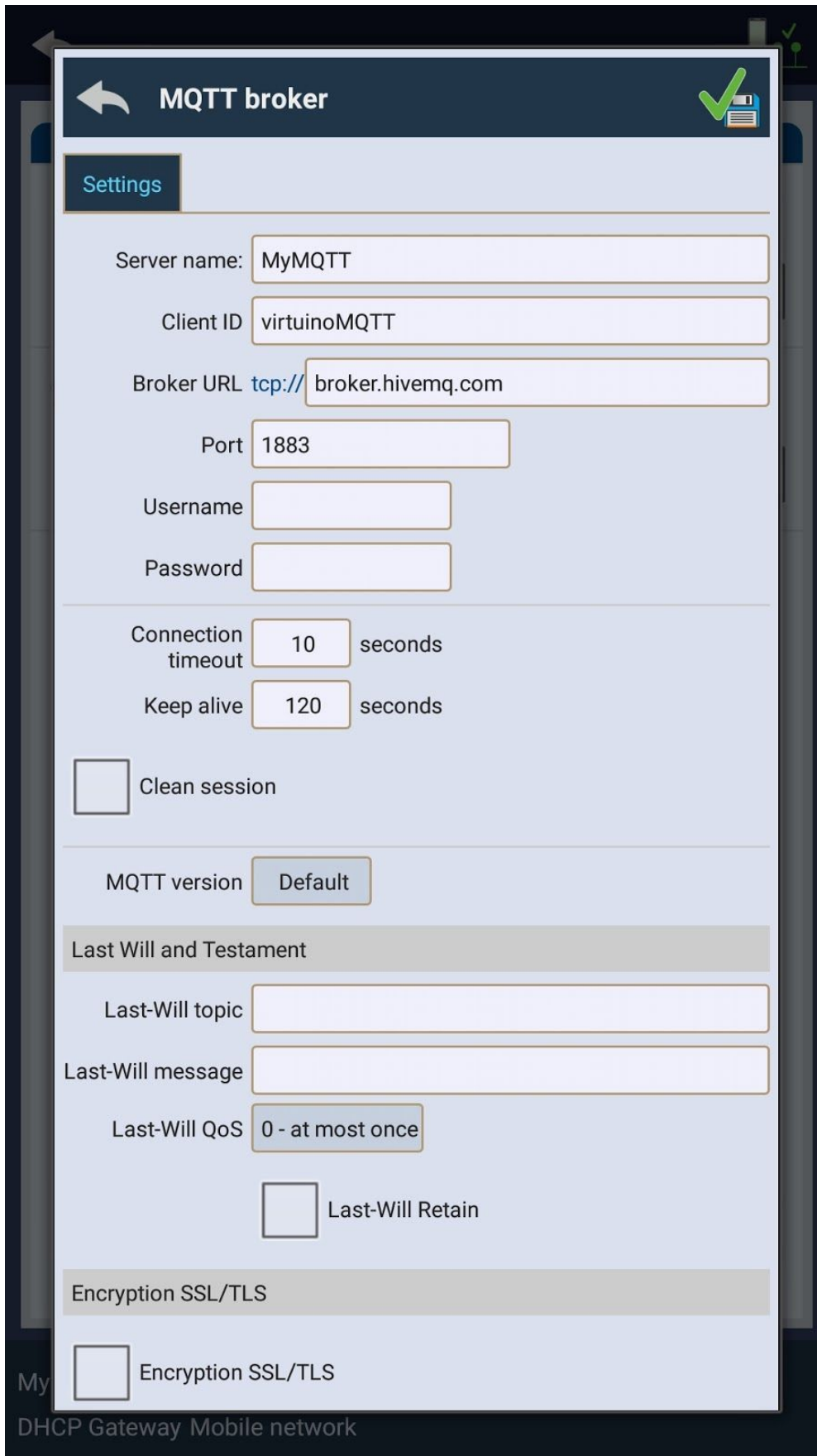
On the right side, there are two button event blocks:

- 當按鈕 A 被按下** → 發送消息 "1" 至 topic\_0
- 當按鈕 B 被按下** → 發送消息 "0" 至 topic\_0



## 五、手機遙控家電(for Android)

1.手機安裝Virtuino MQTT，伺服器端的設定，Server name請自行設定一個名稱(自訂)，Client ID，則請隨便設一個，但不要和micro:bit上設定的ID重複；伺服器URL，broker.hivemq.com；Port 1883；username和password不用設。

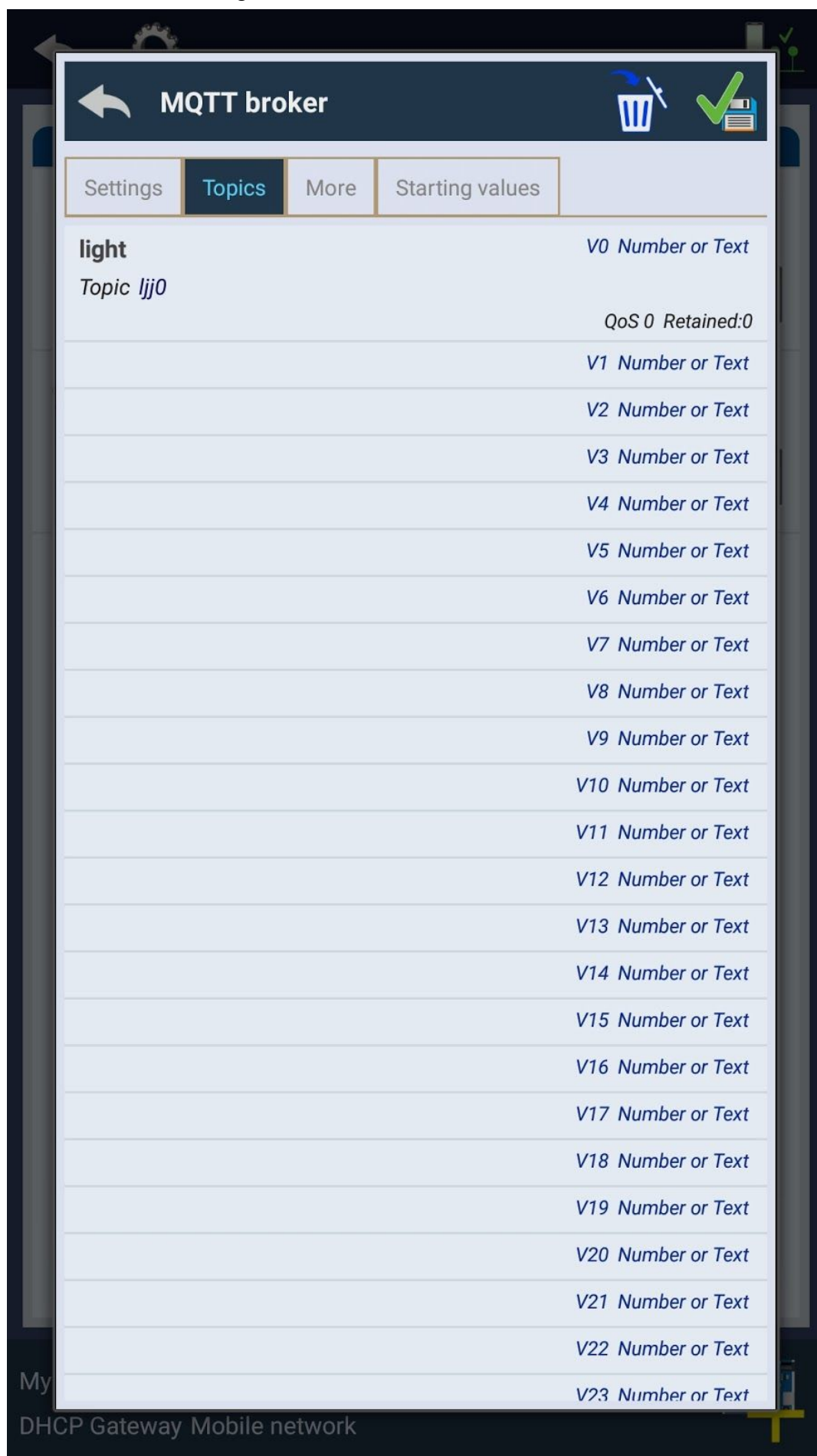


The screenshot shows the 'MQTT broker' settings screen. At the top, there is a title bar with a back arrow and a checkmark icon. Below the title bar, there is a 'Settings' tab. The main content area contains several input fields and checkboxes:

- Server name:** MyMQTT
- Client ID:** virtuinoMQTT
- Broker URL:** tcp:// broker.hivemq.com
- Port:** 1883
- Username:** (empty field)
- Password:** (empty field)
- Connection timeout:** 10 seconds
- Keep alive:** 120 seconds
- Clean session
- MQTT version:** Default
- Last Will and Testament:**
  - Last-Will topic:** (empty field)
  - Last-Will message:** (empty field)
  - Last-Will QoS:** 0 - at most once
  - Last-Will Retain
- Encryption SSL/TLS:**
  - Encryption SSL/TLS

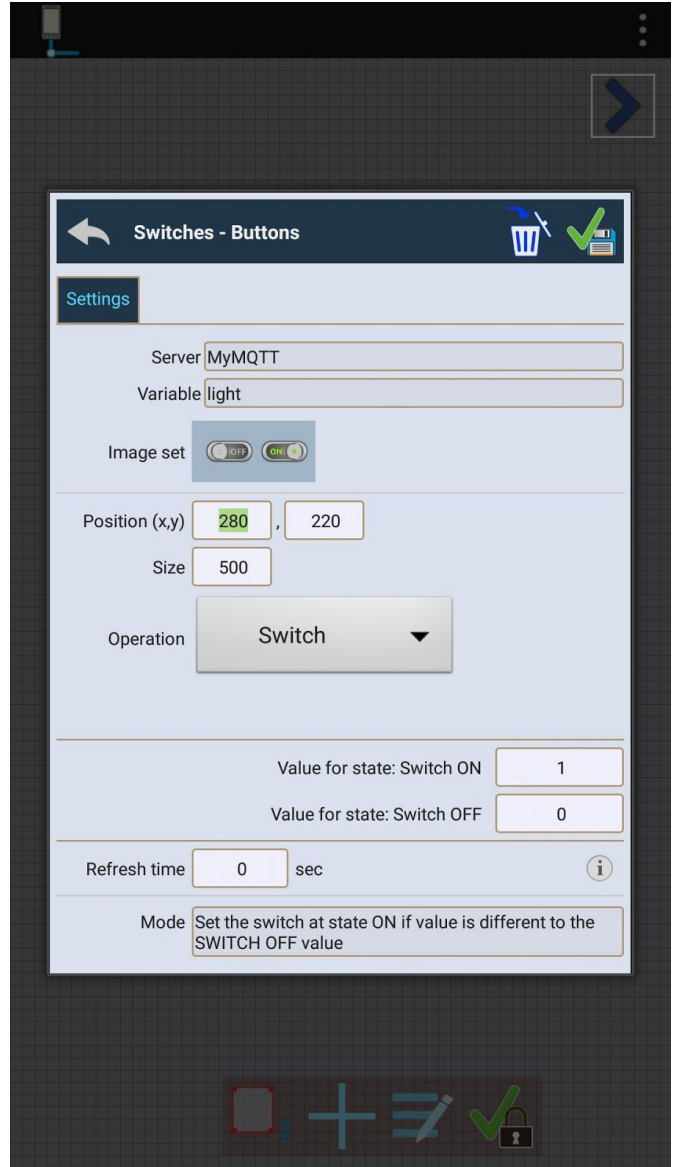
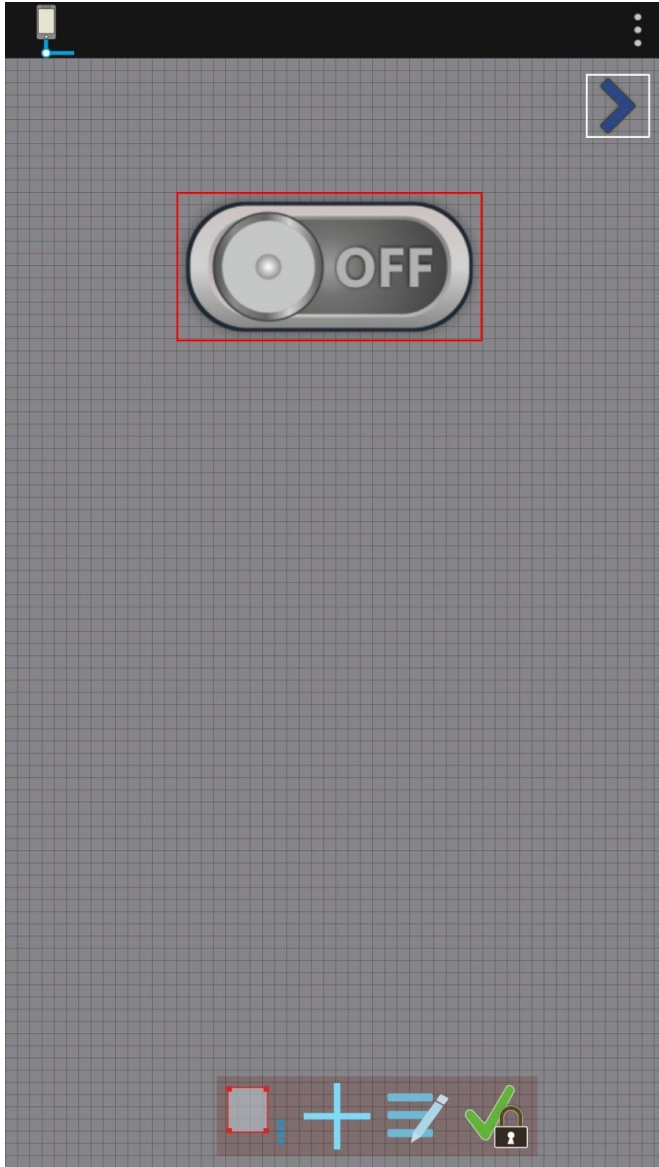
At the bottom left, there is a status bar with the text 'My DHCP Gateway Mobile network'.

2.在Topic的選單，設定之前已訂閱的Topic名稱；另外，因為這個是要控制家電的電燈，所以名稱簡單取個名稱叫：light。



3.新增一個Switch元件， Server設定為第1步驟所建立的Server Name； Variable則設定為第2步驟所建立的名稱， light。 Value for state:Switch ON設定為1； Value for state:Switch OFF設定為0。設定好之後， 接下下方綠色的勾， 這時， 瀏覽器、手機以及micro:bit便可以互相溝通， 並且可以用手機或瀏覽器控制電燈開或是關， 便達到了控制家中電器的功能。

影片：<https://www.youtube.com/watch?v=Ce1LJQTHuE8>



## 肆、相關網址：

一、吉哥의分享：

<https://sites.google.com/jes.mlc.edu.tw/ljj/>

二、我的micro:bit相關影片

<https://www.youtube.com/user/liounet/videos>

三、OBLOQ官方積木

<https://github.com/DFRobot/pxt-ObloqV1>

四、我改寫的OBLOQ的MQTT積木

<https://github.com/lioujj/pxt-Obloq>

揪團研習問卷調查

<https://forms.gle/Fxmv5wM8TDk7btYY7>

