User's Guide

for the

Wisplet® S2W IOT Engine

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IOT Architecture Group

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WWW.IOTARCHITECTUREGROUP.COM

SILICON ENGINES

3550 W. SALT CREEK LANE, SUITE 105

ARLINGTON HEIGHTS, IL 60005 USA

847-637-1180

I⊙T | ARCHITECTURE® GROUP

CONTENTS

1.   INTRODUCTION

The Wisplet S2W is a small, low-cost, internet connectivity hardware board specifically designed for Internet-of-Things applications.
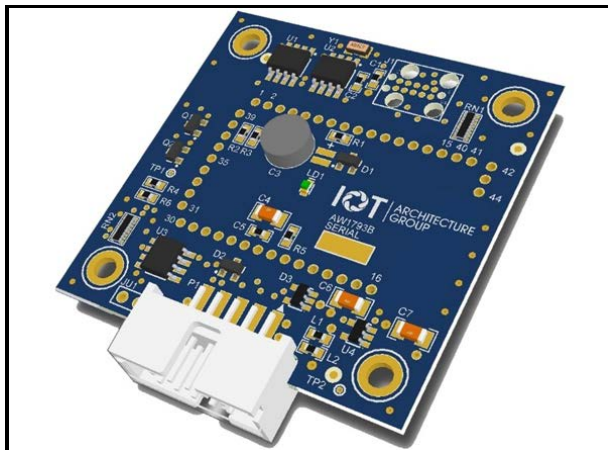
WISPLET S2W HARDWARE MODULE
FIGURE 1.1

The Wisplet S2W provides internet connectivity on one side, and connectivity to a hardware product on the other side, for the purpose of providing a way for that hardware product to connect to a cloud application.
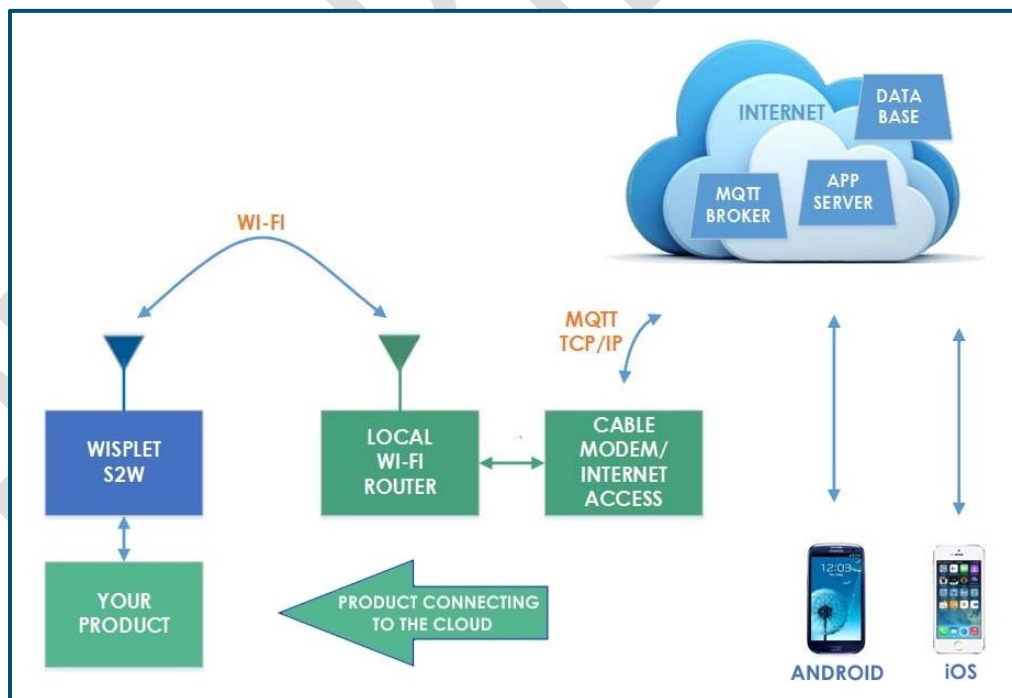
WISPLET S2W CONNECTS YOUR PRODUCT TO THE CLOUD
FIGURE 1.2

In addition to including the necessary radio circuitry for providing internet connectivity, the Wisplet provides an implementation of the MQTT protocol, which is fast becoming the industry standard for Internet-of-Things (IOT) applications.

The Wisplet also performs rules processing, so that it can be configured to understand the various sensors built into the hardware product to which it is attached. The Wisplet can be configured to know which sensor value to report to the cloud at a defined interval in status reports, and can also know which ranges of values for each sensor that should be considered to be a condition that should generate an immediate alert to the cloud.

In addition to being able to report data from the hardware product to the cloud, the Wisplet can also deliver control messages from the cloud to the hardware product. This could be something as simple as telling the hardware product to display a particular value on an LED display on the product, or something more complicated like telling the hardware product to unlock or open a door.

2.   OVERVIEW

The first iteration of the Wisplet is the Serial-to-Wi-Fi (S2W) version. The Wisplet S2W connects via 3.3V UART serial interface (ribbon cable) to the hardware product. On the other side, the Wisplet S2W provides Wi-Fi connectivity.

The Wisplet S2W is available by itself—a single self-contained 50 mm square board that can be mounted inside the hardware product for which it is intended to provide connectivity.

The Wisplet S2W is also available as part of a self-contained Eval Kit that includes a power supply, antenna, and specially designed sensor board. This sensor board is connected to the Wisplet S2W via a 3.3V serial connection over a ribbon cable. The sensor board includes several common sensors: a temperature sensor, a humidity sensor, a visible light sensor, an infrared light sensor, and a voltage potentiometer. This sensor board represents a hardware product that would use a Wisplet for cloud connectivity, and provides a complete hardware system that customers can use to see an entire IOT system end-to-end.
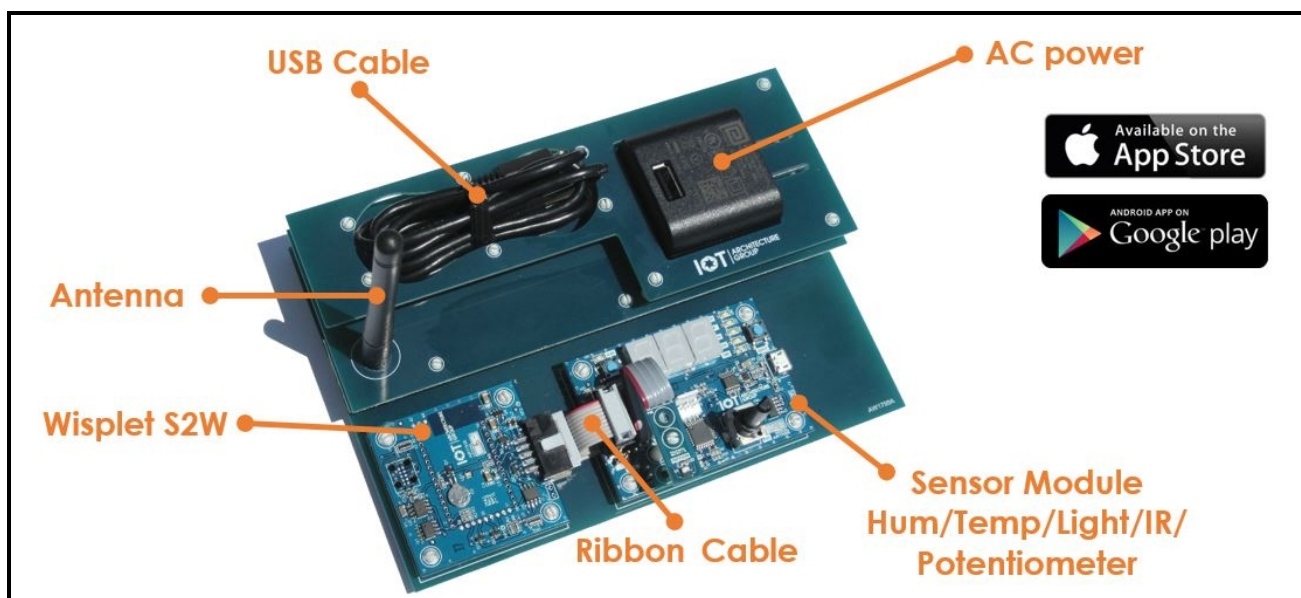
WISPLET S2W EVALUATION KIT
FIGURE 2.1

The Wisplet Eval Kit also comes with access to a cloud-hosted MQTT broker and to the Wisplet server, which provides device management functionality. It associates a Wisplet Eval Kit with a specific user, who can then monitor his or her Wisplet and sensor board via a web browser, or using the free smartphone/tablet apps available for Apple and Android devices from the App Store and Google Play, respectively.

Using the web interface or smartphone apps, a user can monitor the sensor values on his or her Wisplet unit and can push down a numeric value to be displayed on the three-digit LED display on the sensor board. The user can also configure whether he or she wishes to be notified of alert events via an e-mail message and/or a text message (in addition to being able to view all alerts via web browser or smartphone).

The final piece of the system is a PC-based application called the IOT Architect. The IOT Architect is a crucial tool once a customer is ready to begin integrating the Wisplet with the actual hardware product for which the Wisplet will provide connectivity. The IOT Architect tool allows a developer to define the various parameters, rules, alerts, and control messages that the Wisplet must know about and handle in order to provide connectivity and to control the hardware product for which the Wisplet will provide connectivity. Once defined, these can easily be sent down to the Wisplet via MQTT.

Details on the IOT Architect utility are covered in a separate document, the Wisplet S2W Developer's Manual.

3.   CONNNECTNG TO WI-FI NETWORK

3.1   Wireless Access Point

As with many IOT or Connected Home products, the first step in beginning to use your Wisplet Eval kit is to attach it to your local Wi-Fi network.

To do this you must temporarily put the Wisplet in **Wireless Access Point** mode. In this mode, the Wisplet becomes a Wi-Fi network access point, to which you can then connect from your computer or smartphone. Once connected to the Wisplet as your Wi-Fi access point, you will load a web page served by the Wisplet, which will allow you to choose the actual Wi-Fi network to which you want the Wisplet to attach itself for the purpose of reaching the MQTT broker and the Wisplet server on the general internet.

3.2   Entering Wisplet Wi-Fi Configuration Mode

Once the Wisplet and sensor board have been powered up for at least 5 to 10 seconds, **press and hold** the **CONFIG** button on the sensor board (see photo below) for at least 5 seconds, then release. The Wisplet should restart as a Wireless Access Point. This Access Point is called **IOTAG-Config-xxxxxxxxxxxx** (where xxxxxxxxxxxx is the MAC address of your Wisplet) and it uses WPA2 AES PSK security with passphrase **sileng3550**.
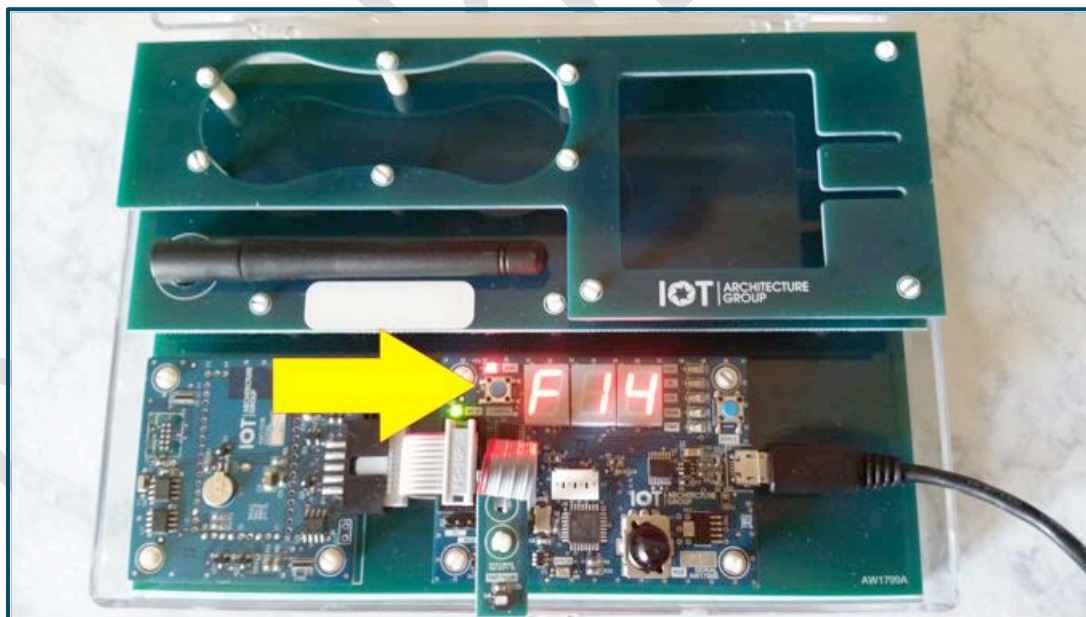
***WIRELESS CONFIG SWITCH ON SENSOR BOARD***
FIGURE 3.2.1

You can connect to the Wisplet when it is in this mode by using any device with Wi-Fi and a web browser. So you can use your laptop, smartphone, or tablet. The

examples below show how to do this using an **iOS** device, an iPhone. The same steps would apply for an **Android** device.

3.3   Detailed Wi-Fi configuration procedure

1.   Open the **Settings** app:
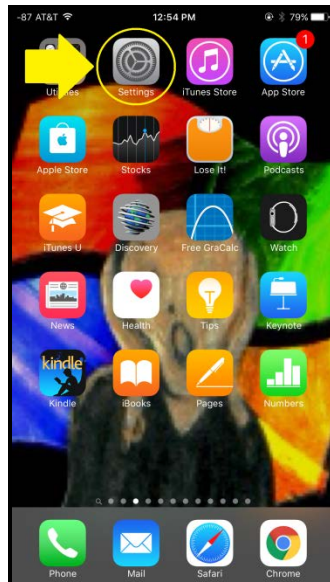
iOS SETTINGS APP
FIGURE 3.3.1

2.   Open the **Wi-Fi** settings app:
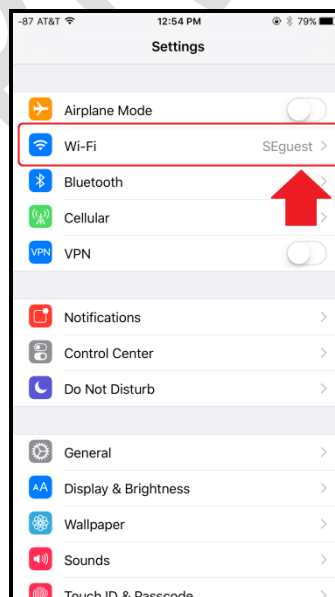
iOS WI-FI SETTINGS APP
FIGURE 3.3.2

3.   You will then see the device scan for Wi-Fi networks (Wireless Access Points) and present a list to choose from. Wait until the network named **IOTAG-Config-xxxxxxxxxxxx** is detected (where xxxxxxxxxxxx is the MAC address of your Wisplet):

SCANNING FOR NETWORKS
FIGURE 3.3.3

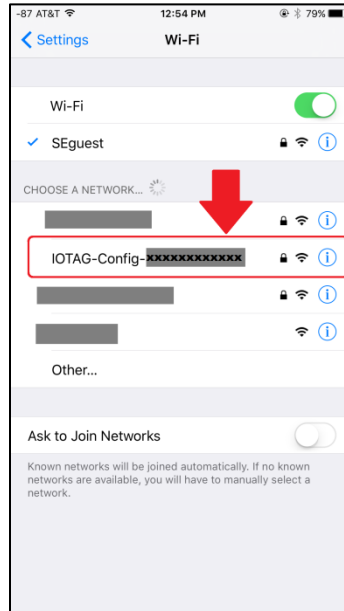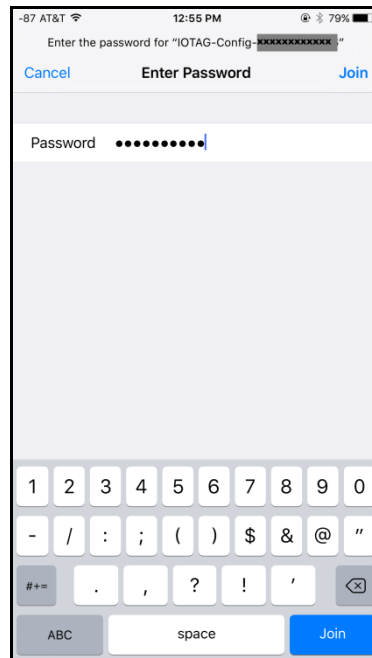4.   Tap on the access point named **IOTAG-Config-xxxxxxxxxxxx** and enter password sileng3550

LOG INTO IOTAG-CONFIG AP
FIGURE 3.3.4

5.   Your smartphone/tablet/computer should now be connected to the Wisplet as your Wi-Fi access point. At this point, any Wi-Fi traffic generated from your smartphone will attempt to route to the internet through the Wisplet. Your smartphone thinks that the Wisplet is its route to the internet. This is not really the case though—the Wisplet has only begun operating in this mode in order for you to connect to it, for the sole purpose of attaching the Wisplet to a real Wi-Fi access point that is running at your location.

6.   Now open your smartphone's web browser and load the URL http://device.config (*If that does not work then you can try http://172.18.0.1 or http://172.18.0.1/config/landing_page.html*)

Note: This may not work with iOS Safari. If you are attempting to configure the Wisplet using an iPhone or iPad and are having trouble, please try a different browser such as Google Chrome or Mozilla FireFox. You will need to download and install these from the app store to your device, if they are not already installed.
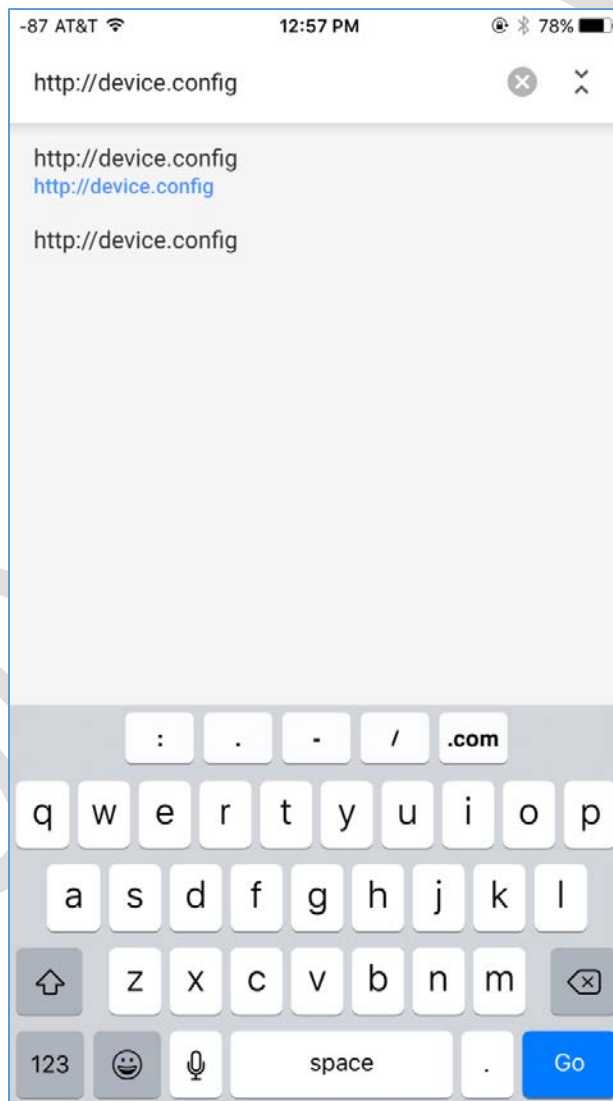
URL ENTRY
FIGURE 3.3.5

7.   You will see a web page that looks like this example:
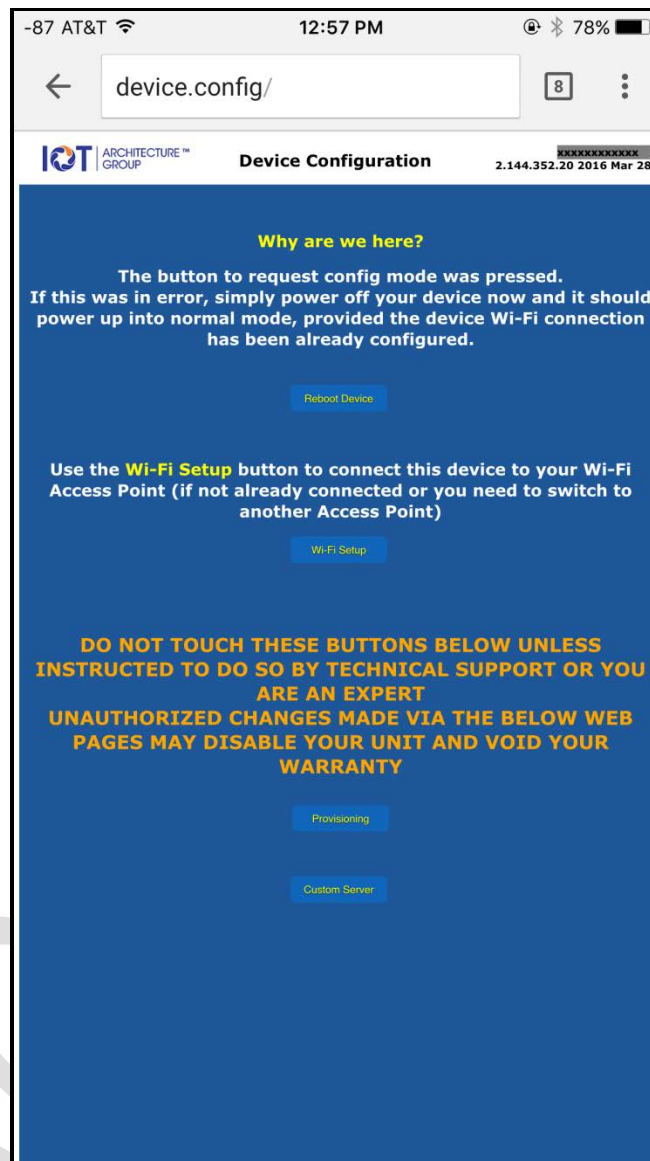
WISPLET DEVICE CONFIGURATION SCREEN
FIGURE 3.3.6

8.   The only option we need to use at this time is the **Wi-Fi Setup** button. The other options are more advanced and we should ignore them at this time.

9.   You will see a web page like the one shown below. This web page shows you the actual Wi-Fi networks that the Wisplet has detected in its vicinity. It also indicates the MAC address for each access point (greyed out here for privacy), the channel it is operating on, whether they are password-protected and the signal strength of each Wi-Fi network.
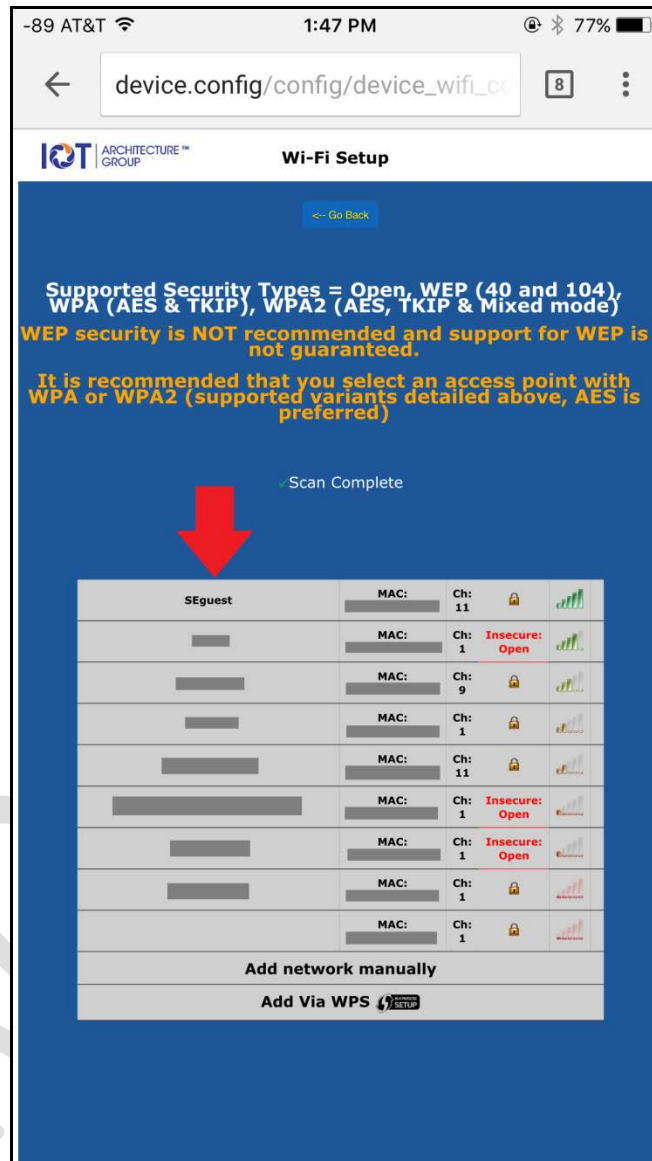
LIST OF DETECTED NETWORKS
FIGURE 3.3.7

10.   Tap on the Wi-Fi network to which you want the Wisplet to attach itself. For example, the Wi-Fi network called **SEguest**.

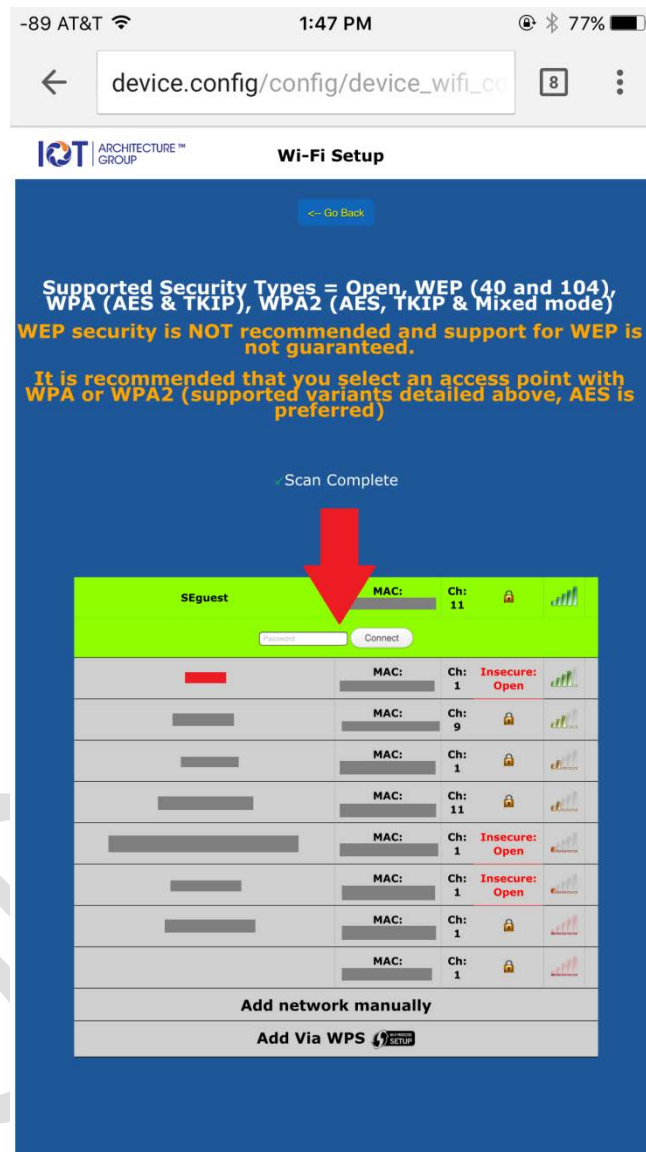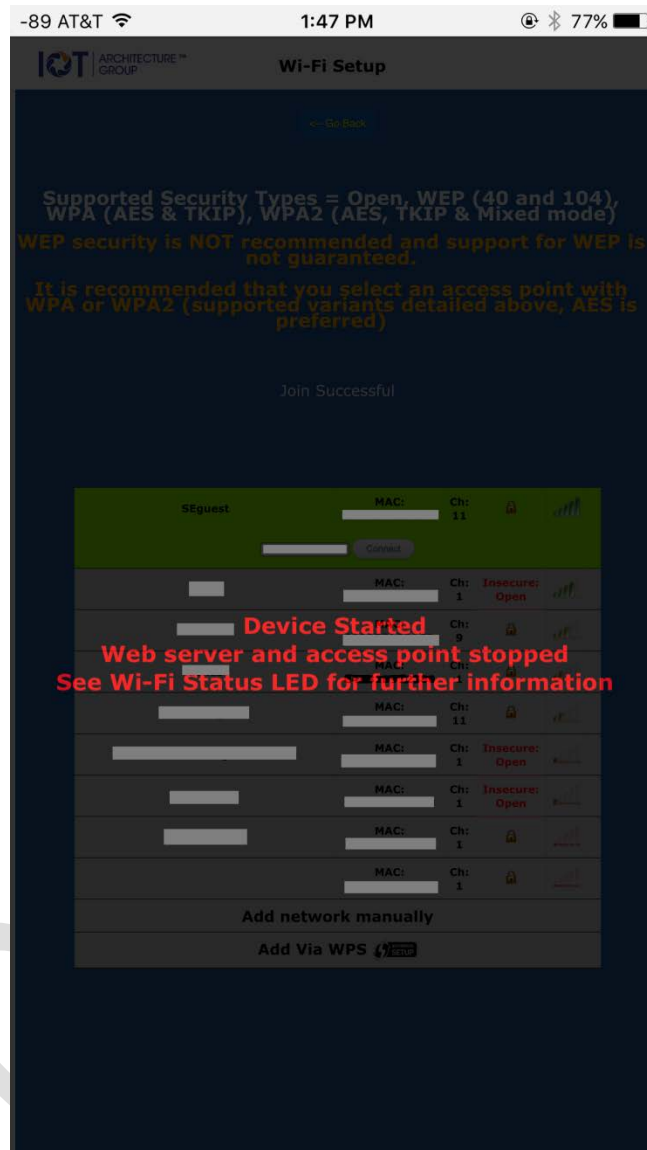11.   You will be prompted for that network's password (if that particular Wi-Fi network is password-protected). Enter in the passphrase (if needed) and then press the connect button.

LIST OF DETECTED NETWORKS
FIGURE 3.3.8

12. The Wisplet will then stop operating as a Wi-Fi access point and will attempt to connect to the Wi-Fi network you just specified.

WISPLET STOPS ACTING AS WIRELESS ACCESS POINT
FIGURE 3.3.9

13. Your smartphone, tablet, or computer you used to configure the Wisplet should (once the Wisplet Wi-Fi access point has disappeared) fall back to connecting to a real Wi-Fi access point.

14. After a few seconds the Wisplet should connect to the Wi-Fi access point you chose for it, and should be connected to the MQTT broker and the Wisplet server. This may take as long as 1 minute under some circumstances. Watch the Wi-Fi Status LED and wait for it to turn green to indicate a connection to the cloud. If it stays off or red, then you will need

to repeat the Wisplet as an access point and Wi-Fi selection process again because your Wisplet is not connecting to your AP and getting online. In this case you need to make sure that your AP is not blocking the Wisplet, like MAC address filtering, and it is serving it an IP address. If the LED is amber (red+green) then your Wisplet has connected to your AP but still has not connected to the cloud. A green Wi-Fi status LED means that you are connected to the cloud broker and the Wisplet is online and ready.

15. If you have created an account on the Wisplet server and created the Wisplet device under that account, you should be able to log into that account via the Wisplet server web interface at http://wisplet.net (or via the iOS or Android app), and you should see that Wisplet's connection status as GREEN.

16. If you have not yet created an account on the Wisplet server, proceed to the next steps listed below.

4.   CREATE A WISPLET ACCOUNT

4.1   Function of Wisplet server

The Wisplet server is what associates a specific Wisplet device with a specific person. So the first step in doing this is creating an account on the Wisplet server.

4.2   Web browser or app

You can either use the web-browser interface from your computer, or you can install the **Wisplet app** for either Apple devices or Android devices.
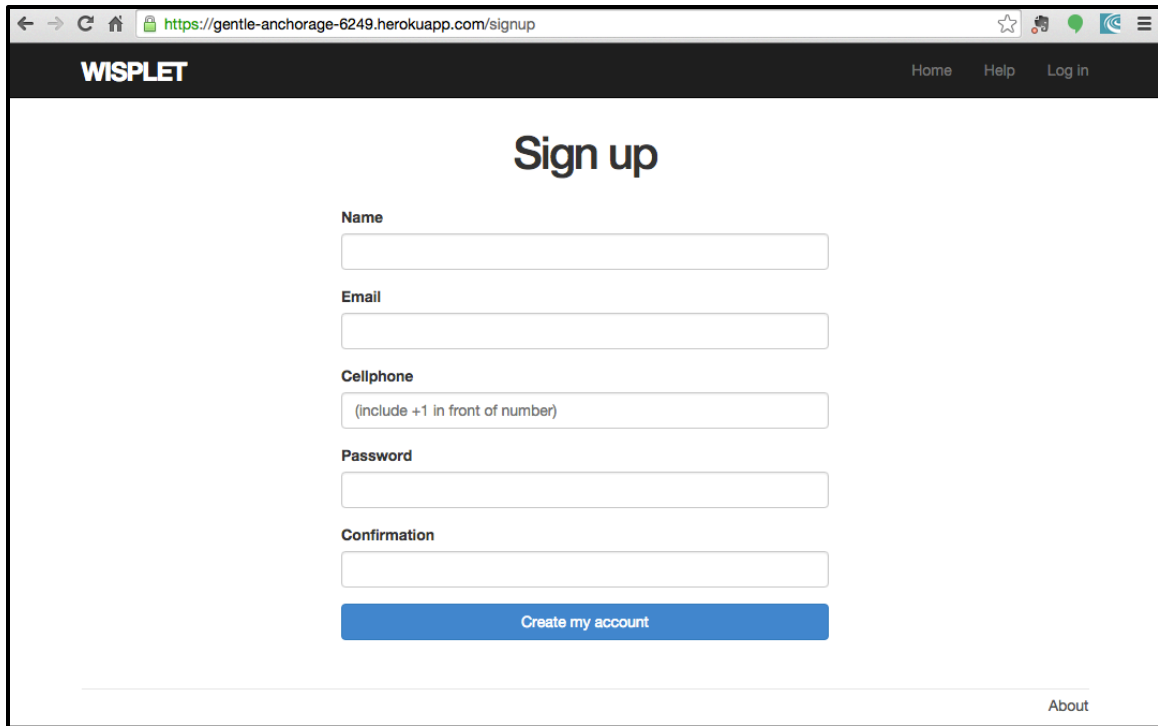
4.3   Web browser access to Wisplet Server
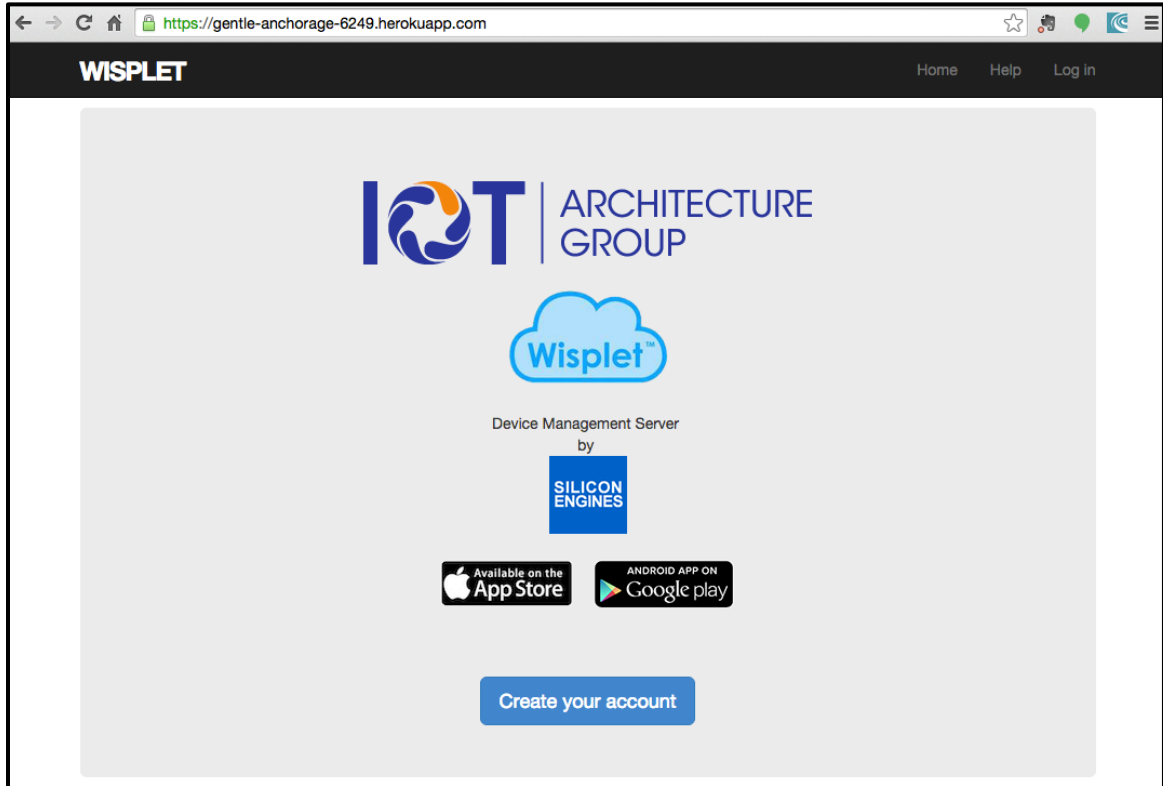
WISPLET DEVICE MANAGEMENT SERVER PAGE
FIGURE 4.3.1

To create your account through the web interface, click the **Create my account** button and submit the following form:

WISPLET DEVICE SIGN-UP PAGE ON WEBSITE
FIGURE 4.3.2

4.4   Access to Wisplet server through mobile apps

You can also install the Wisplet app for either Apple or Android devices by searching the **App Store** or **Google Play** using the search term **WISPLET**.

4.5   Mobile app screens

The mobile app screens will look like this:

MOBILE APP SIGN-UP SCREENS
FIGURE 4.5.1

4.6   E-mail to validate sign-up

After you successfully submit the account creation form, you will receive an e-mail with a confirmation link. After you confirm your e-mail address by clicking the link, you will be able to log in via the web interface or the mobile app, using the password you chose.

4.7   Confirmation e-mail

Successful account confirmation (shown in web browser):
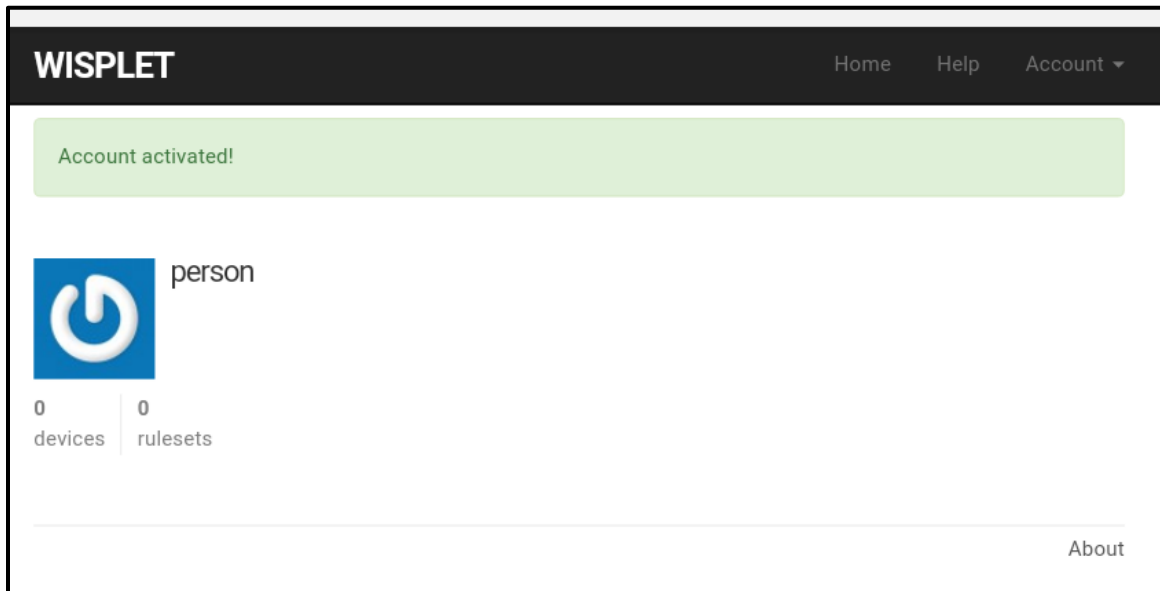
CONFIRMATION OF ACCOUNT IN WEB BROWSER
FIGURE 4.7.1

5.   CREATE YOUR DEVICE ON THE SERVER

5.1   Zero devices defined

After logging in to your new account, you will see that you have zero devices defined. Here is a screenshot of the app for Apple devices:

ZERO DEVICES SO FAR (APPLE VERSION)
FIGURE 5.1.1

5.2   Menu

Tap the icon in the upper left corner to reveal the menu:
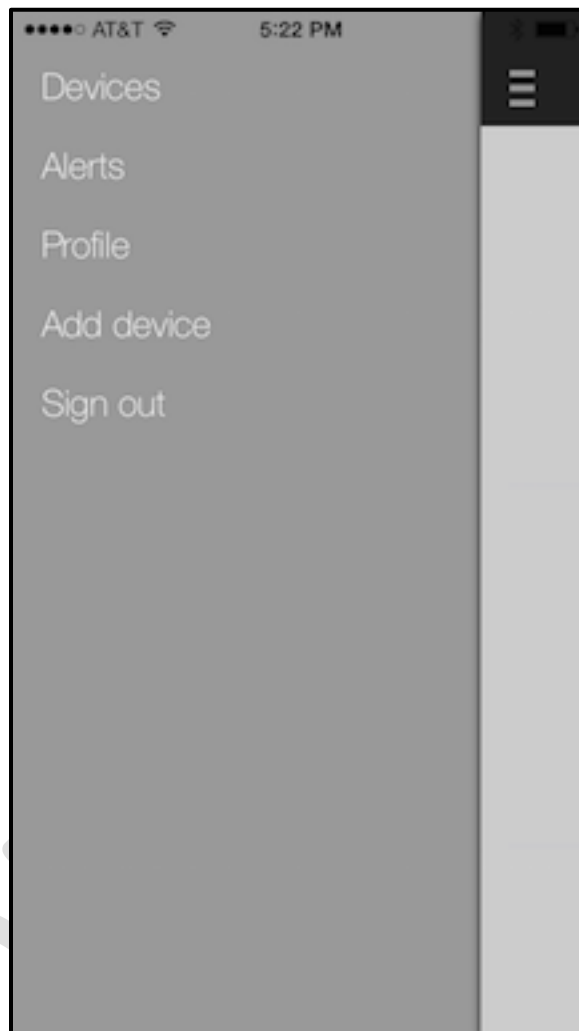
MENU SCREEN
FIGURE 5.2.1

5.3   Add a Wisplet device

Then choose **Add device** and a form will appear on the screen.

5.4   Defining your Wisplet device

DEFINE DEVICE SCREEN
FIGURE 5.4.1

1.   **Device ID:** You need to enter the Device ID for your specific Wisplet. Every Wisplet is assigned a unique MAC address, a 12-character hexadecimal value, which is printed on a sticker on the evaluation kit.

2.   **Device Name:** You need to assign a convenient, easy to remember name to this Wisplet, something like "My Wisplet Eval Kit" for example.

3.   **Alert messages:** You can also enable or disable whether you wish to receive e-mails or text messages whenever an alert condition occurs on the sensor board. Note that you can change these values later.

5.5   Devices appear on screen

Once you have completed the form, you should see the device or devices you've defined, in the Devices screen:
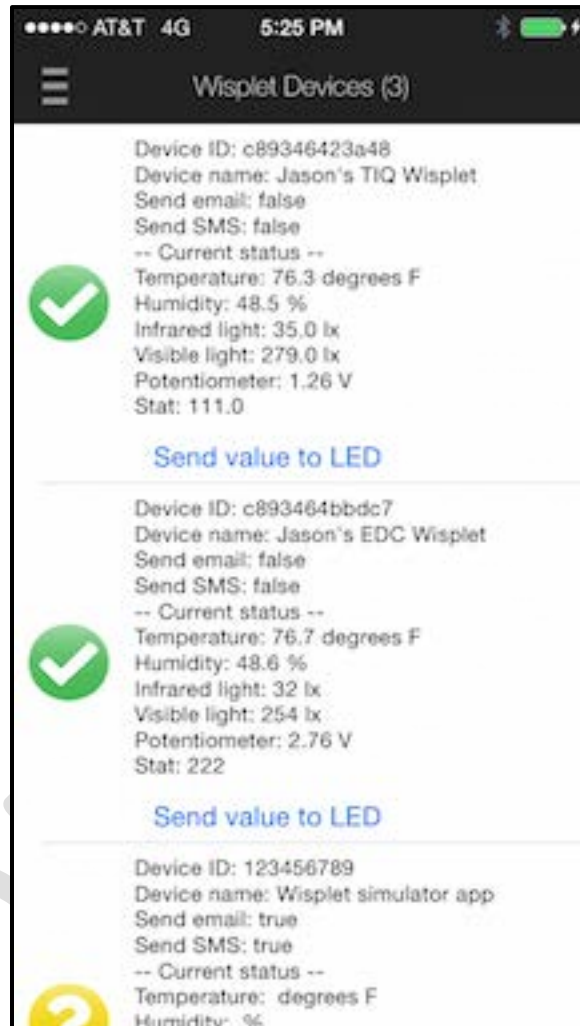
WISPLET DEVICES NOW APPEAR
FIGURE 5.5.1

5.6   Troubleshooting

If you do not see the connection status for your newly-entered device become GREEN after a minute or so, the possible causes could be:

- The Wi-Fi network password you entered when attaching your Wisplet to your Wi-Fi network was incorrect.
- The MAC address you entered when defining the Wisplet in your account on the Wisplet server is incorrect.

If you suspect that you may have entered the Wi-Fi network password incorrectly, simply hold down the CONFIG button on the Wisplet device to put it into Access Point again, and repeat the steps above.

You should also ensure that the real Wi-Fi network to which you attached the Wisplet can really connect to the general internet, so the Wisplet can route to the MQTT broker and Wisplet server.

6.   SYSTEM DEMO WITH THE EVAL KIT

6.1   Overview of the Wisplet Eval Kit

The Wisplet S2W Eval Kit contains a Wisplet S2W IOT Engine board, together with a Sensor Board developed specifically for the Eval Kit.
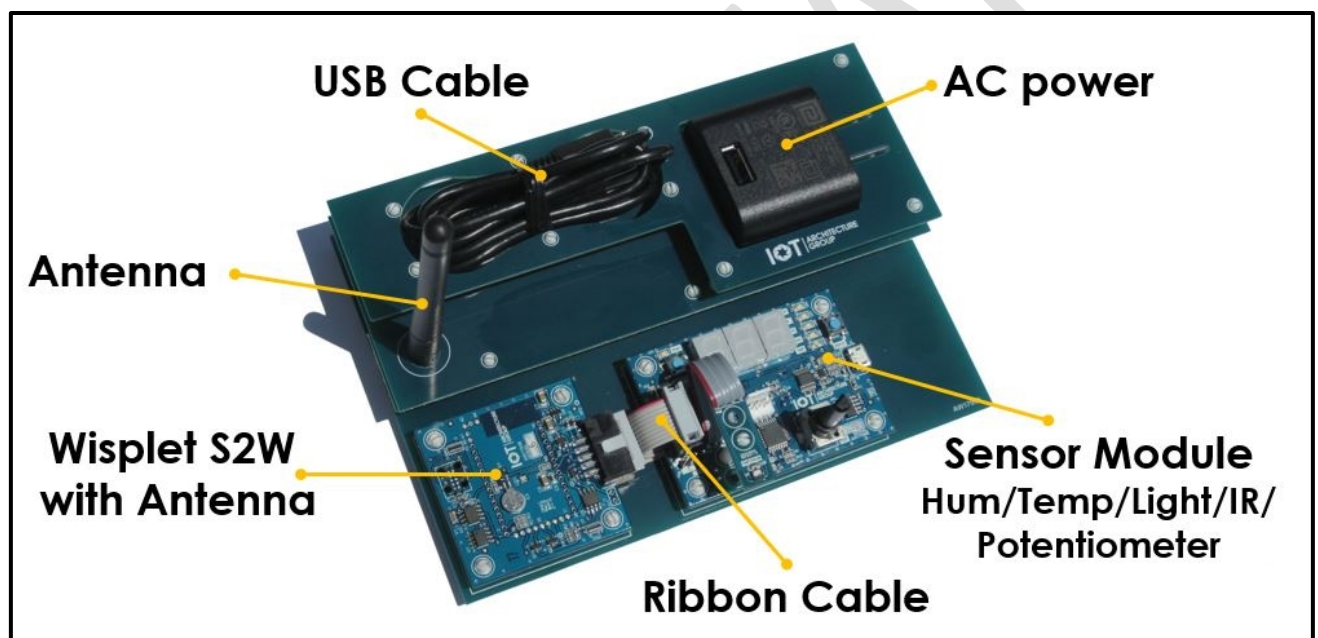
WISPLET S2W EVALUATION KIT
FIGURE 6.1.1

6.2   Applying power

1.   **AC power plug:** Remove the AC power plug from its storage position in the kit.
2.   **USB cable:** Remove the USB cable from its storage position in the kit. Remove and set aside the twisty. Plug the USB A side of the cable into the AC power plug. Plug the micro USB side of the cable into the micro USB connector on the right side of the Sensor Board.
3.   **Plug in:** Plug the AC power plug into a 120V AC receptacle.

4.   **Lighting up:** The three-digit LED display should light up.

6.3   Sensors provided

The Sensor Board provides the following five sensors:

- Temperature sensor.
- Humidity sensor.
- Visible light sensor.
- Infrared light sensor.
- Potentiometer voltage sensor.

The Sensor Board has an STM8 microcontroller that polls these sensors and makes their values available to the Wisplet S2W board over a 3.3V serial interface that travels along the gray ribbon cable.

6.4   Sensors and controls on Sensor Board

The Sensor Board has a three-digit LED display that shows the current value of just one sensor.

The DSPLY button selects which sensor is currently displayed. An LED lights up to show the selected sensor.

Successively pushing the DSPLY button causes the display to switch sequentially through the sensors—TEMPERATURE, HUMIDITY, VISIBLE LIGHT, INFRARED LIGHT, and POT—as well as STATUS.
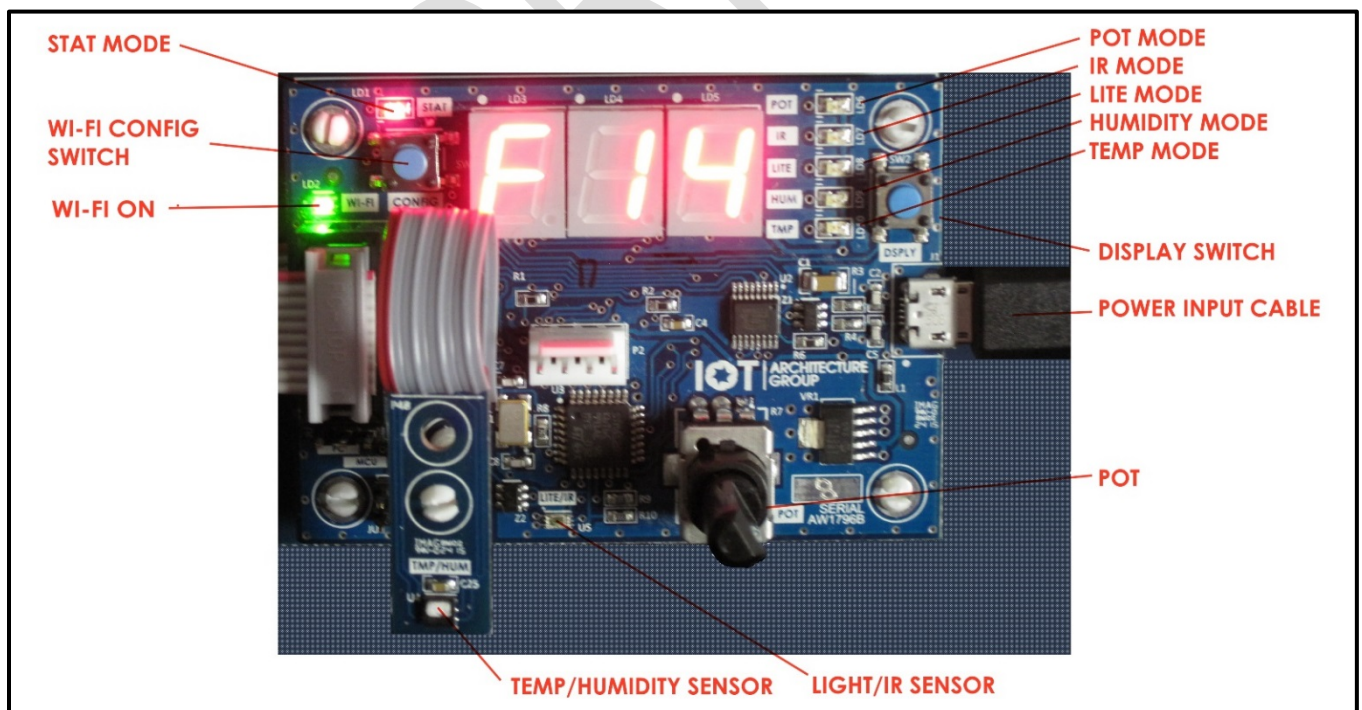
SENSORS AND CONTROLS

FIGURE 6.4.1

6.5   Sensor values

1. **Temperature sensor.** Displays in degrees Fahrenheit. The temperature will move upwards if you place your finger on the sensor.

2. **Humidity sensor.** Displays in percent relative humidity. The humidity will move upwards if you breathe on the sensor.

3. **Visible light sensor.** The displayed value will drop if you block the sensor momentarily with your finger.

4. **Infrared light sensor.** The displayed value will drop if the sensor is blocked.

5. **Potentiometer voltage sensor.** Displays in volts, from 0.0 to 3.3 VDC. This value will move up and down when you rotate the shaft of the potentiometer.

6. **Status value.** The numeric value shown in the picture above is a default value when the system is first turned on—indicating the firmware build number. Using the Wisplet app, you can change this value from a cell phone or tablet—as described below. At the time this document was written the current firmware version is F19.

6.6   View device status remotely

In the app or web interface, you will see the current connection status, in the form or icons on the left—green checkmark, red X, or yellow question mark icon.
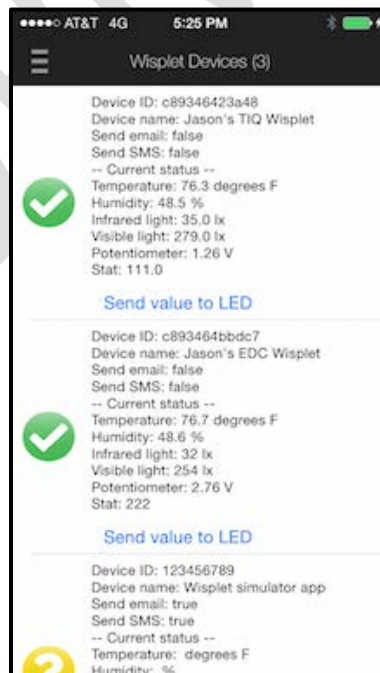
VIEWING STATUS REMOTELY

FIGURE 6.6.1

Note that this screen does not automatically update continuously—if some time has elapsed, and you wish to pull the latest status down from the server, simply pull down the main portion of the Devices screen. The content will be refreshed.

6.7   Sending a STAT value from app to LED display

From the Wisplet Devices screen you can push a control message down to your Wisplet. The example of a control message that the Eval Kit supports is the ability to push a number down to the LED display on the Wisplet.

You can do this by tapping on **Send to LED** on the Wisplet app. You then enter a number (up to three digits long) in the form that appears:
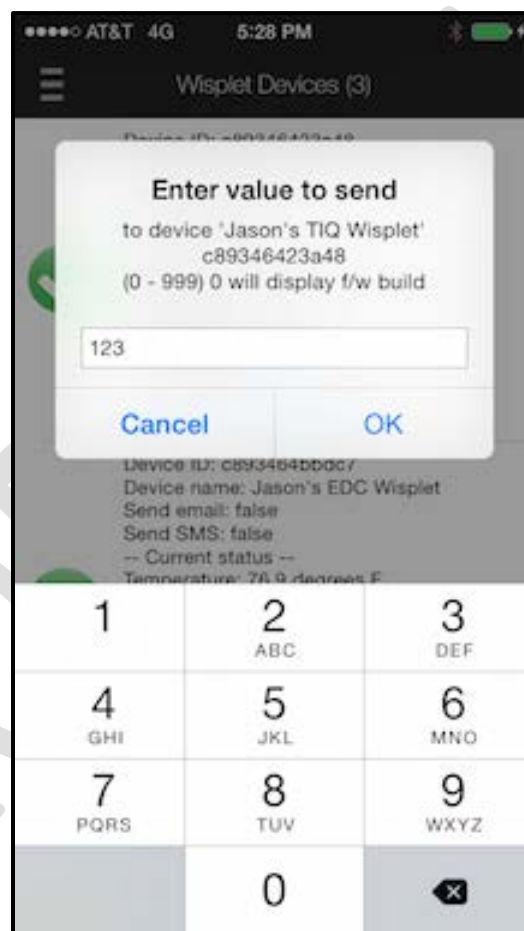
SENDING A STATUS VALUE FROM THE APP TO THE WISPLET
FIGURE 6.7.1

The number you just entered should then appear on the LED display of your Wisplet device.

APP HAS JUST SENT "789" STATUS MESSAGE TO THE WISPLET
FIGURE 6.7.2

6.8   Triggering and viewing alerts

From the main side-bar menu in the app, you can view all alerts from all of your Wisplet devices:

VIEWING WISPLET ALERTS IN THE MOBILE APP
FIGURE 6.8.1

You can delete alerts by swiping left on an alert and pressing **DELETE** (Apple version), or by pressing and holding on an alert and choosing **DELETE** (Android app).

The Wisplet Eval Kit comes pre-configured with ranges of values for the various sensors such that you may get alerts when the temperature or light levels (visible and infrared) change under normal circumstances.

But you can also manually trigger an alert by turning the voltage potentiometer knob all the way to the left or right (see first two alerts in the above screen shot).

As with the Devices screen, content in the Alert screen is not automatically updated, so to refresh the content, pull the main screen area down.

If you have enabled e-mail and/or text messages on alerts, you should not only see new alerts in the app or web interface, but you should also receive an e-mail and/or text message (as appropriate) on each new alert.

If you wish to change whether you receive e-mails and/or text messages, you may do this at any time by going to the Devices screen and then tapping on the device for which you wish to change the configuration.

Note that the e-mail address and phone number to which these notifications will be sent are those associated with your account on the Wisplet server. To change the phone number, choose **PROFILE** from the side-bar menu, then tap on your profile information to edit the phone number. The phone number must start with +1 in order for text messages to be sent successfully. Note that the e-mail address cannot be changed in the app, as it is also used as the username for your account on the Wisplet server.

7.   WISPLET IOT RULES ENGINE

7.1   Default rules

The Wisplet Eval Kit comes with a set of default IOT Rules for generating alerts.

7.2   Programming new rules

New IOT Rules for the Sensor Board in the Wisplet Eval Kit can be developed rapidly by filling out table entries using the **IOT Architect** utility. The resulting IOT Rules are then loaded into the Wisplet unit.

The IOT Architect Utility also supports the definition of rules for your custom target circuit board—which of course may have a completely different set of sensors. No changes to the Wisplet firmware are required—just changes to the IOT Rules table, which is compiled by the IOT Architect utility.

Your custom target circuit board must support a 3.3V serial interface that sends sensor values to the Wisplet device when requested.

For further information on how to connect your target system to the Wisplet, please refer to the **Wisplet S2W Hardware Interface Guide.** That document gives technical details on the signals in the 10-pin header.

The **Wisplet S2W Software Interface Guide** gives example serial firmware for a custom target circuit board.

The **Wisplet S2W IOT Rule Designer Guide** gives more information on how to set up rules for your application.

Please contact your IOT Architecture Group sales representative for more information.

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8.   REVISION HISTORY

8.1   Rev. A

First release

8.2   Rev. B

1. Updated block diagram in Figure 1.2.

8.3   Rev. C

Updated screen captures for new Wisplet hosted web pages