AoM IoT Bit Setup Guide

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Assembly v2.0, Electronics v2.0, Code v3.0

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You've just picked up one of the most sophisticated and useful LittleBits in the AoM repository of snap electronics. You've made a **fantastic** decision. This is the opportunity of a lifetime – and I can't wait to hear what you think. Below will detail how to make the IoT bit come to life and a few basic example applications.

The IoT bit can either upload ("post") or download ("get") digital values from a cloud on the web. This means that it will be posting/getting values that are either HIGH or LOW, i.e. ON or OFF. This means that the Littlebits that you connect to the IoT Bit should be operated **digitally.** For example, you **will** be able to turn an LED ON or OFF with IoT bit. You will not, however, be able to adjust the brightness of the LED with a PWM signal. This means that you may need to make use of the "threshold" and "latch" bits to digitize analog signals, which can be explored both through the links and through hands-on experimentation.

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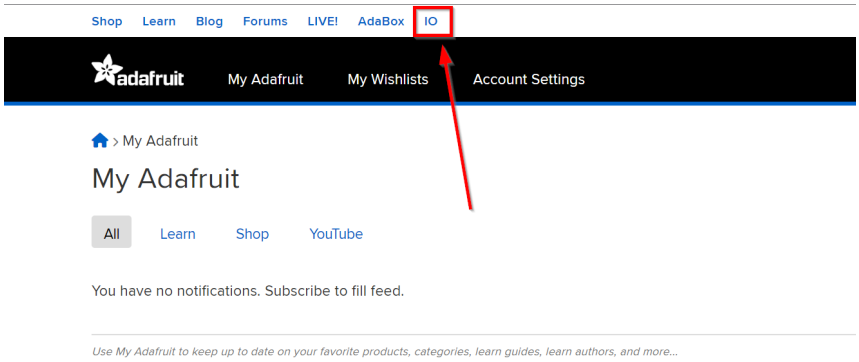
Initialization

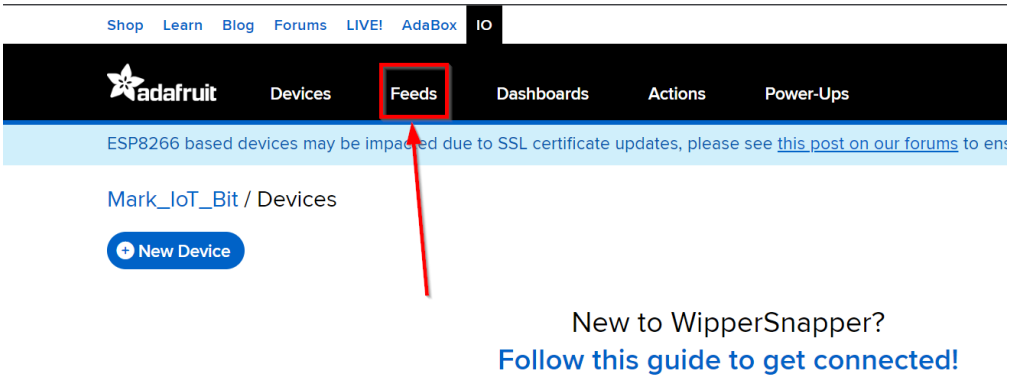
1. Create an account on the Adafruit IO Cloud

We'll start by creating an account on Adafruit IO, which is a **web-based cloud service** where the IoT bit will upload and download data from.

Once you create an account, navigate to the "**IO**" tab.



Next, navigate to the "**Feeds**" tab in IO.

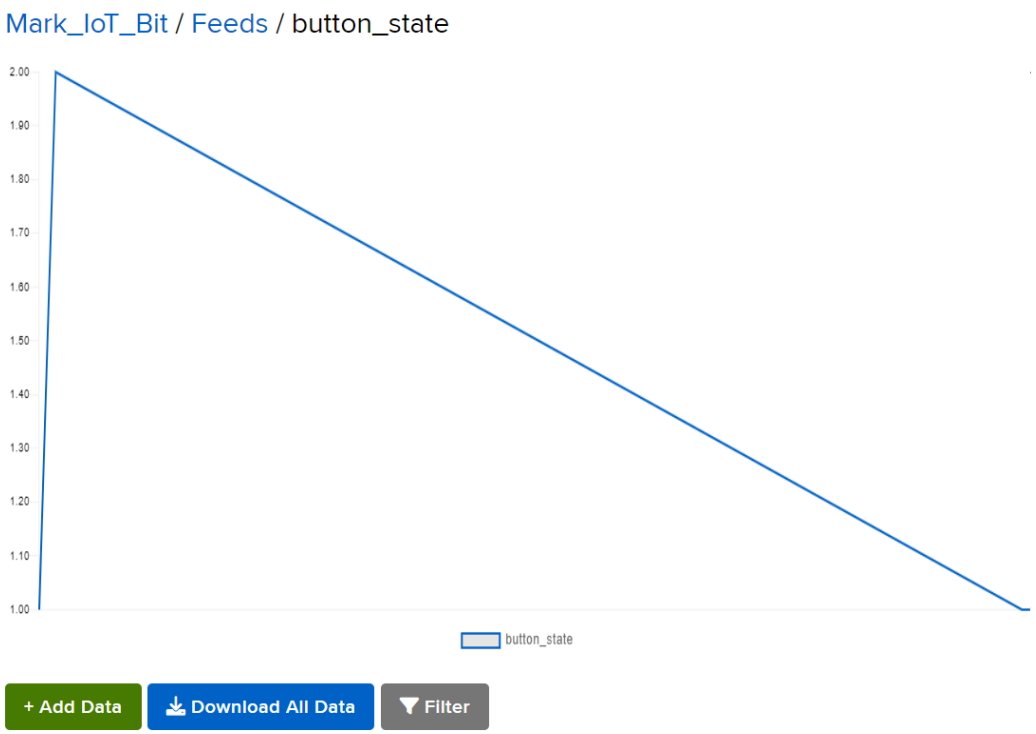


Next, Create a New feed by selecting the 

button. "Feeds" are specific places that the IoT Bit can send data to. Make sure to name your feed so that it corresponds to the data that you'll be sending it. For example, if the feed will be

receiving data about whether a button is on or off, you might name the feed “button_state.”

The feed will be empty because the IoT bit hasn’t uploaded any data to it yet. To get the “ball rolling,” you can manually add data by pressing the + Add Data button. This isn’t very useful to you right now, but it will be soon when we begin to construct circuits. You’ll also notice that the feed has a graph to show the history of values in the feed.



2. Load your WiFi credentials and Adafruit IO information onto the SD card

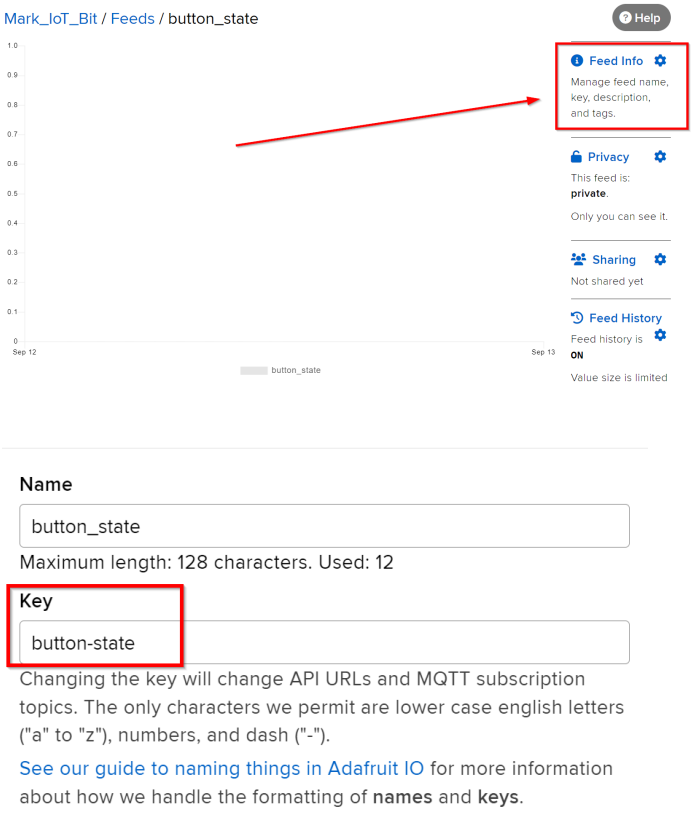
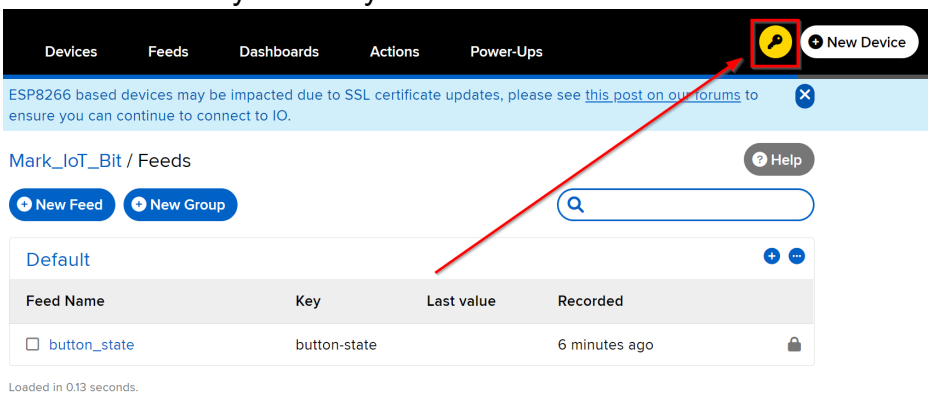
To connect the IoT bit to the feed in Adafruit IO, we'll have to provide the IoT bit with WiFi credentials and some feed information.

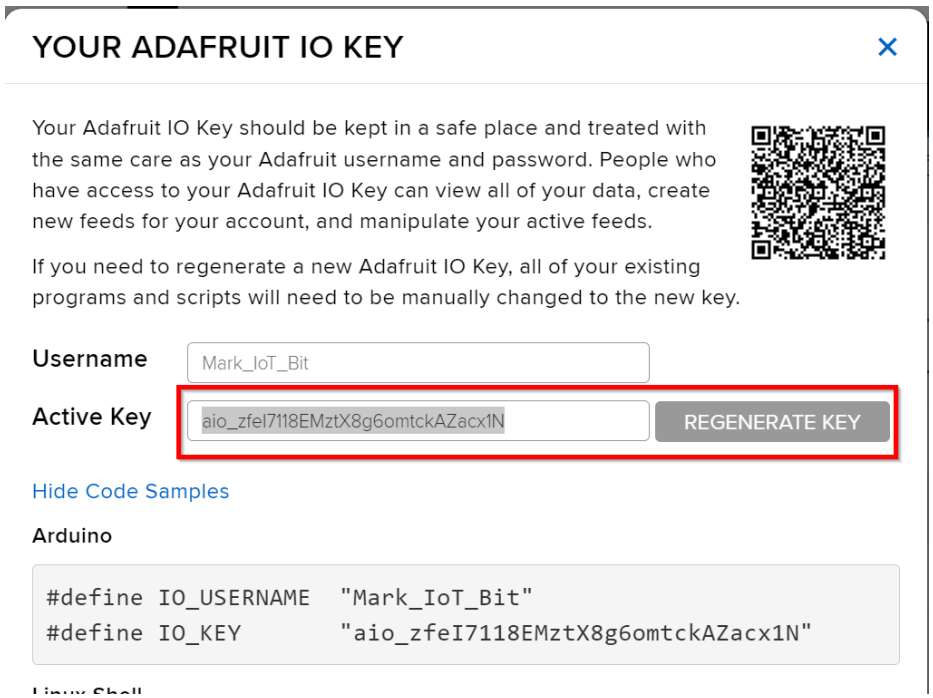
Remove the MicroSD card from the IoT Bit and connect it to your computer (via an adapter, if necessary. If you do not have an adapter, ask a TA for one.) When you open the secrets.txt file on the SD card, you'll see the contents of 7 variables, separated by semicolons:

```
REQUEST_RATE_SEC;SECRET_SSID;SECRET_PASS;IO_USERNAME;IO_GROUP;IO_FEED_KEY;IO_KEY
```

Here's what all of those variables mean:

REQUEST_RATE_SEC	The number of seconds in between each request the IoT Bit makes to the cloud. There is a request limit per minute with the free version, so leave at **2** seconds.
SECRET_SSID	The SSID of your WiFi network, i.e. the name. If you are using a phone as a mobile hotspot, it will be the name of your phone. Note that you cannot use WIRELESS_PITTNET as a WiFi network.
SECRET_PASS	The password of your WiFi network/hotspot. Keep the SSID and password a secret!
IO_USERNAME	The username of your Adafruit **IO** account, **not** necessarily the name of your general Adafruit account.
IO_GROUP	The name of the group that the feed you will post to/get from resides in. Feeds will typically be created in the "default" group.
IO_FEED_KEY	The feed's key is the "password" that gives the IoT bit permission to get data from and post data to the feed. The feed key can be found in the "feed info" widget.

	
IO_KEY	Your account's IO key is like the feed key, but associated with your entire Adafruit IO key, as opposed to a single feed. It can be found within the yellow key icon: 



If your key becomes compromised, you can regenerate a character string to keep the hackers off of your trail.

Here's an example of what a secrets.txt file might look like with your data replacing the variable names:

2;Mark_iPhone;MarkPassword;AOMUser1;AOMGroupA;AOMGroupAFeed1;AoMIoKeYsEcReT123

Careful - These variables are ***case sensitive!***

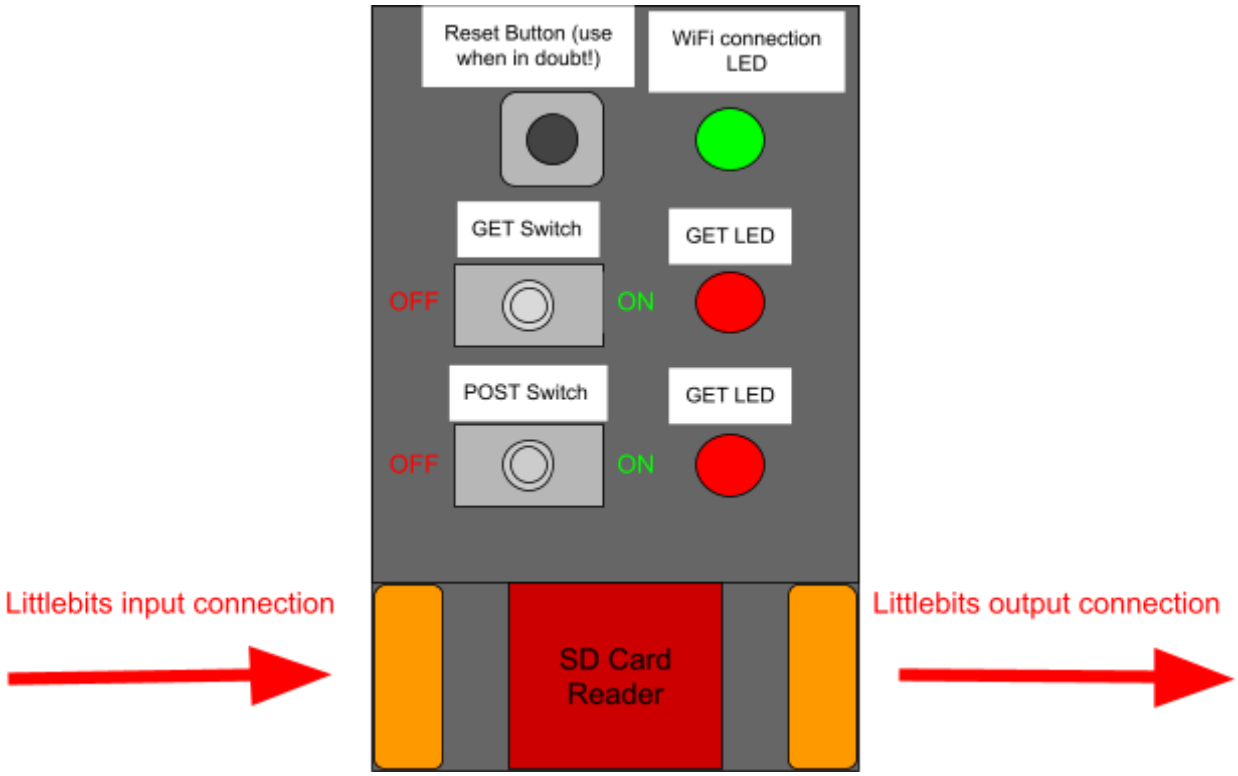
Important: If you are using a mobile hotspot, be sure to turn on the "Maximize Compatibility" option in the hotspot configuration, or the IoT bit will not be able to connect. If you don't have a "Maximize Compatibility" option, ignore this warning.

If you are having trouble connecting to a mobile hotspot, make sure that your mobile hotspot screen is pulled up on your phone.

3. Connect

You're now equipped to let your IoT Bit talk to the world! Eject the SD card and place it back in the IoT Bit. Before we get to examples, let's learn how the IoT bit functions.

Here's a diagram of the interface's functionality:



When you soon snap your IoT bit in series with (powered) Littlebits, you'll see the IoT bit configure itself through these steps:

1. **All 3 LEDs will blink 3 times quickly** - This indicates that the IoT bit is going to attempt to read from the SD card. This flashing will repeat every ~5 seconds until the IoT Bit reads the SD card's data successfully.
2. **All 3 LEDs will blink for a full second** - This indicates that the IoT bit has successfully read from the SD card and is ready to connect to the cloud.
3. From here, the IoT bit will enter a loop **depending on the state of the switches.** Below are the 4 operations:
    a. **No switches are turned on** - disconnect from WiFi and remain idle.
    b. **The GET Switch is turned on** - if the IoT bit is disconnected from WiFi, it will attempt to connect and illuminate the green LED when it has succeeded. It will then "get" the latest value from the cloud. If the latest value in the cloud is "HIGH," the IoT bit will output a HIGH electrical signal. If the latest value in the cloud is "LOW," the IoT bit will output a LOW electrical signal.
    c. **The POST Switch is turned on** - if the IoT bit is disconnected from WiFi, it will attempt to connect and illuminate the green LED when it has succeeded. It will then detect the digital input signal to the IoT bit and "post" it to the cloud every time there is a change in the input value. If the IoT Bit's electrical input signal value changes to "HIGH," the IoT bit will post a HIGH value to the cloud. If the IoT Bit's electrical input signal value changes to "LOW," the IoT bit will post a LOW value to the cloud.
    d. **The GET switch and POST switch are both turned on** - the IoT bit will both POST the incoming signal to Adafruit IO **and** GET the signal back from the cloud. Use this if you want to upload a value to the cloud as well as send that signal through the IoT bit to sequential LittleBits.

Be patient when connecting to WiFi - a secure connection (indicated by the illuminated green LED on the IoT Bit) can take ~10 seconds to establish.

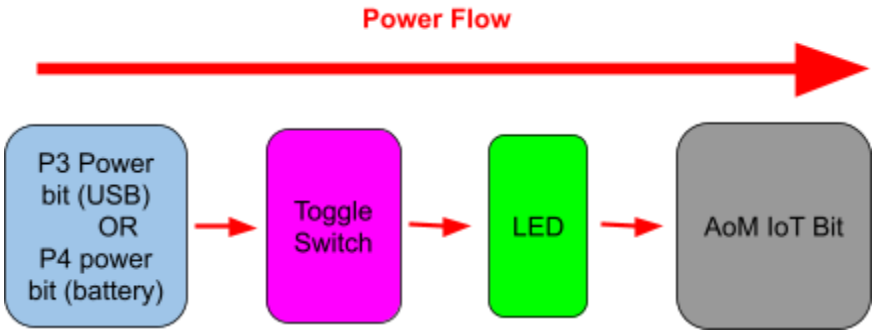
“Hello, World” Applications

1. Post to IO

You will need:

- Littlebits p4 power bit (1)
- Littlebits toggle switch, flipped to the off position (1)
- Littlebits LED (1)
- AoM IoT Bit (1)

a. Build the circuit as shown below:



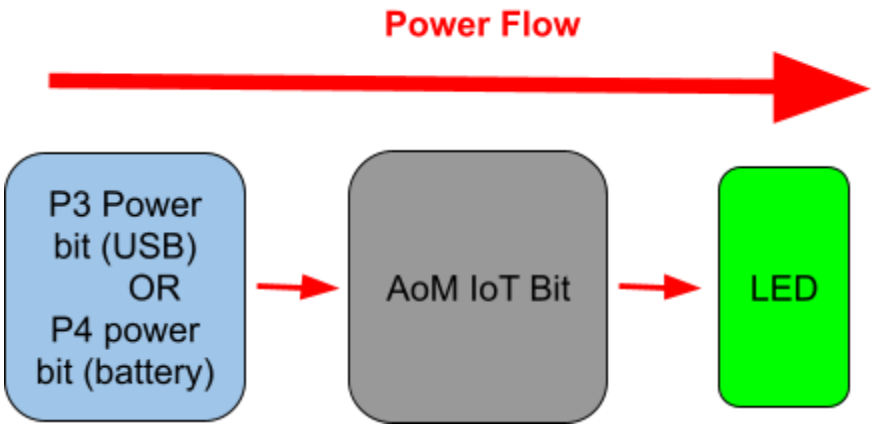
b. Once the IoT Bit is powered, flip the “post” switch from left to right to the “ON” position.
c. Once the green LED on the IoT Bit illuminates to indicate a WiFi connection, flip the Littlebits toggle switch state from off to on. The littlebits LED should illuminate, and the post LED will pulse to indicate a successful upload. Check the data stream on your Adafruit IO feed - you should see a new “HIGH” value uploaded to the feed. The IoT Bit will upload the IoT bit’s input signal to the cloud every time that input signal changes from LOW to HIGH or HIGH to LOW.
d. Flip the “post” switch back to “OFF” before proceeding to “Hello, World” application 2.

2. Get from IO

You will need:

- Littlebits p4 power bit (1)
- Littlebits LED (1)
- AoM IoT Bit (1)

a. Build the circuit as shown below:

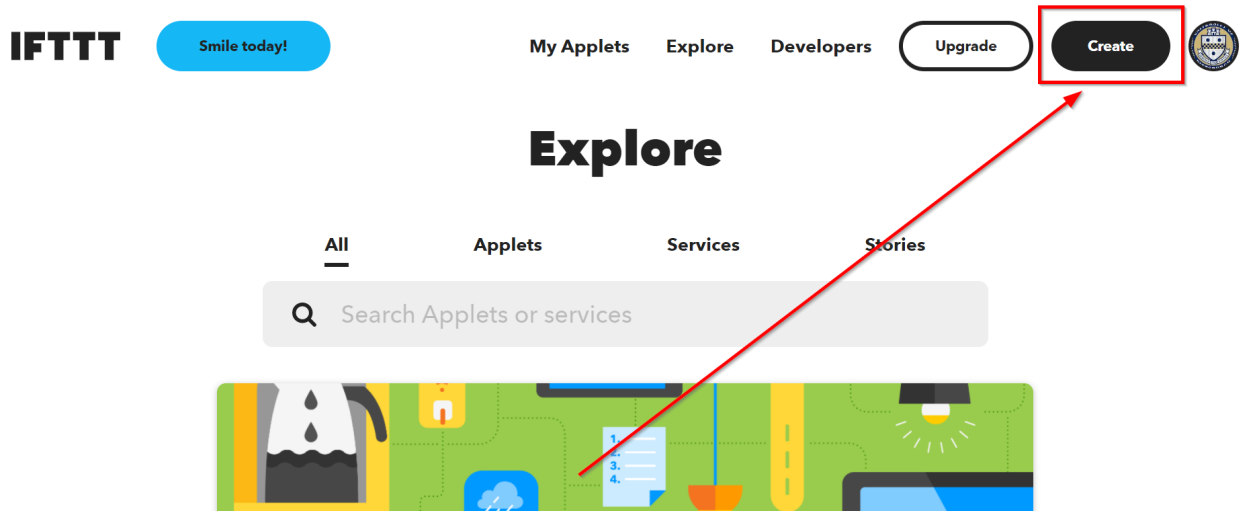


b. Once the IoT Bit is powered, flip the “get ” switch from left to right to the “ON” position.

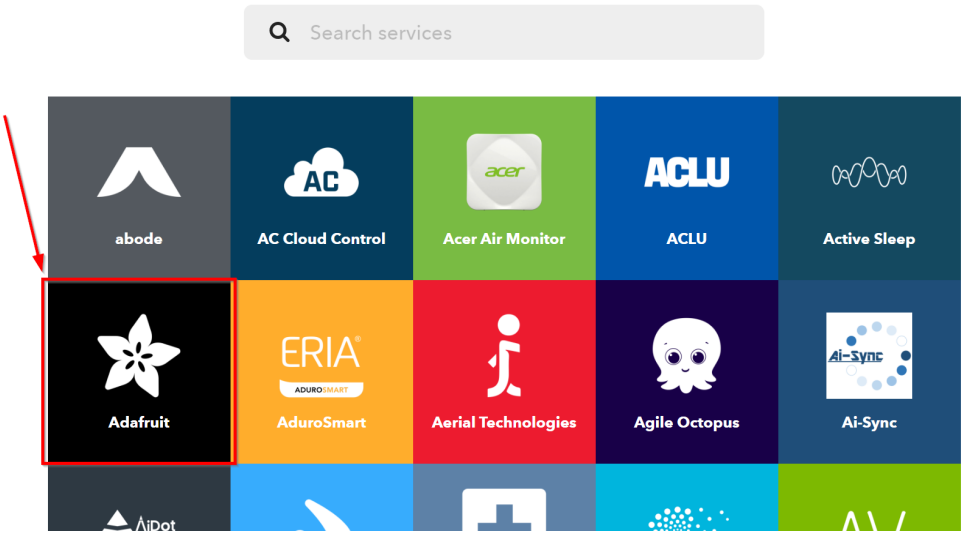
c. Once the green LED illuminates to indicate a WiFi connection, the GET switch will begin to pulse, indicating that the output of the IoT bit is reflecting the data in the cloud - i.e. if the most recent data point in the cloud is HIGH, the IoT bit will output a HIGH signal. If the most recent data point in the cloud is LOW, the IoT bit will output a LOW signal. This behavior will be reflected by the LED.

3. Bonus - Connect your IoT bit to the Wonderful World of **IFTTT**

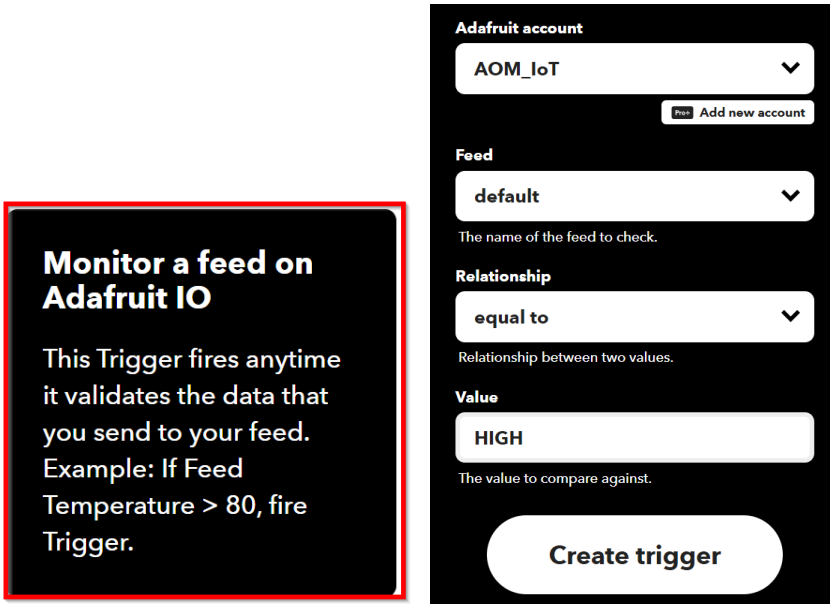
Create an account on IFTTT and navigate to the “create” button:



This will prompt you to create an “applet.” In the “If this” field of the applet, select “Add” and select the Adafruit IO service, as shown:



Select “Monitor a feed on Adafruit IO” as your trigger. Add your Adafruit IO username, feed name, set the relationship and “equal to,” and select “HIGH” as the value. This will trigger the “If this” portion of the widget any time the IoT bit uploads a HIGH value to Adafruit IO.



In the “Then That” field of the widget, select any web service that you want to interface to - it’s up to you! A simple “Hello World” test is the Google Tasks service, which allows you to create a task every time the Adafruit IO cloud receives a high value. But you’re only limited by your imagination - and the limits of the free IFTTT account, of course.

You’ve (hopefully) mastered the very basics of the proprietary AoM IoT bit. If you’d like, be sure to copy and remove your credentials from the SD card before returning the IoT bit to the Littlebits wall. Congratulations - the control of an infinite number of objects is now possible with the flip of a switch, from **anywhere** that can connect to WiFi. Don’t let the power get to your head - but go out and make incredible devices. However, I simply must emphasize this once more:

This was created with design thinking and is a work in progress. The technology is snazzy and fancy, and that is all well and good, but what is most important is your experience. Which means that you should give us (honest!) user feedback - what works? What doesn’t? What’s awful? DON’T hesitate to reach out to me!