



No-Code IoT Soil Sensor

Created by Ruiz Brothers



<https://learn.adafruit.com/soil-node>

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Overview



You can build your own IoT garden using Adafruit IO and WipperSnapper.

This can help you keep track of your plants by logging data such as the temperature and humidity.

Our sensor node features a batch of Stemma breakouts that keeps track of the air quality and humidity of the soil.

All of the electronics are housed in a 3D printed enclosure that is also water resistant.



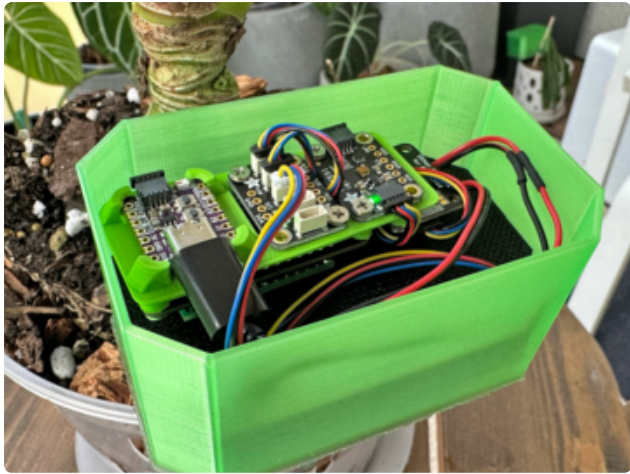


This project is powered by the QT Py ESP32-S2 running WipperSnapper, Adafruit's no-code solution to IOT Projects.

Just stick this in the soil to monitor how wet or dry it is and log that data in a custom dashboard.



With WipperSnapper you can create a beautiful dashboard with gauges and charts so you can visually monitor the health of your garden.



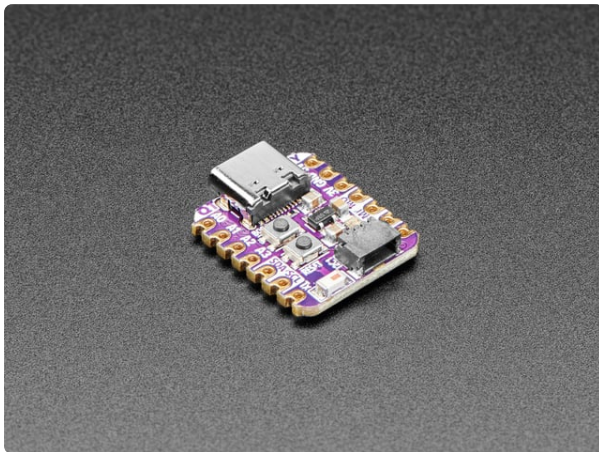
Setting up your Stemma sensors is really simple and easy with WipperSnapper's built in support for I2C devices.

All of the breakouts are daisy chained together making this a solder-free project.

It's free to get started just head over to io.adafruit.com.



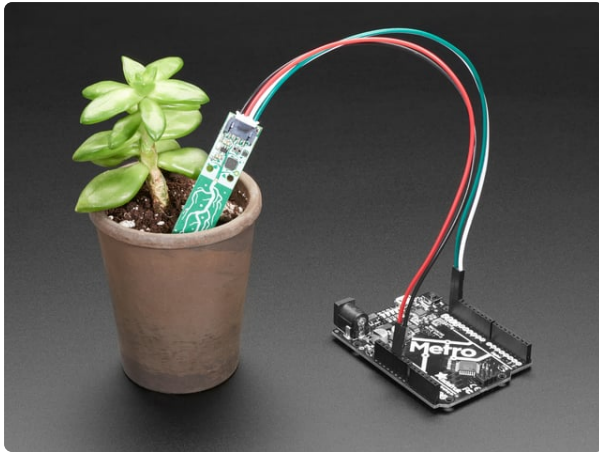
Parts



[Adafruit QT Py ESP32-S2 WiFi Dev Board with STEMMA QT](https://www.adafruit.com/product/5325)

What has your favorite Espressif WiFi microcontroller, comes with our favorite connector - the STEMMA QT, a chainable I2C port, and has...

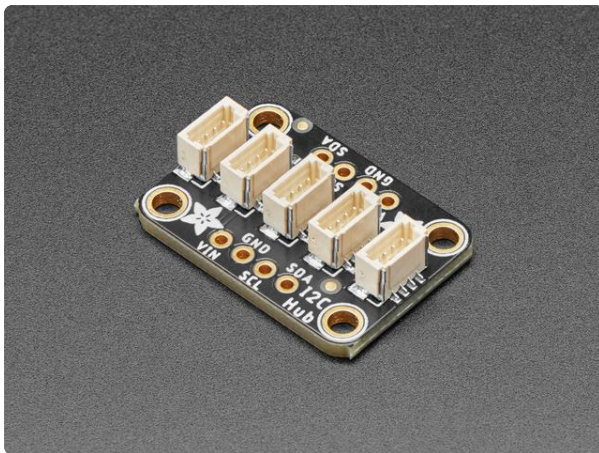
<https://www.adafruit.com/product/5325>



Adafruit STEMMA Soil Sensor - I2C Capacitive Moisture Sensor

Most low cost soil sensors are resistive style, where there's two prongs and the sensor measures the conductivity between the two. These work OK at first, but eventually...

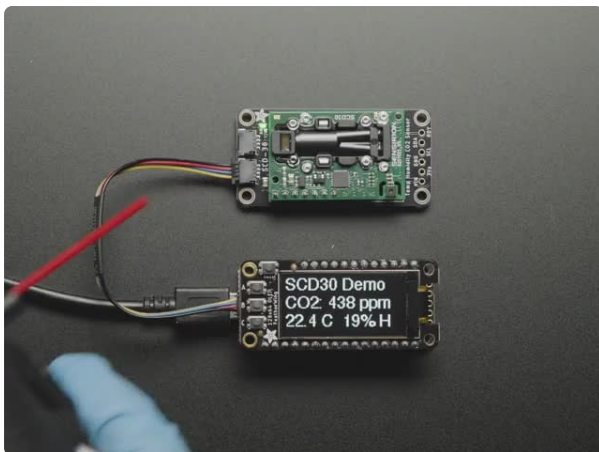
<https://www.adafruit.com/product/4026>



Adafruit Qwiic / Stemma QT 5 Port Hub

Qwiic, or STEMMA QT, is a very efficient way to quickly prototype an idea, but a lot of...

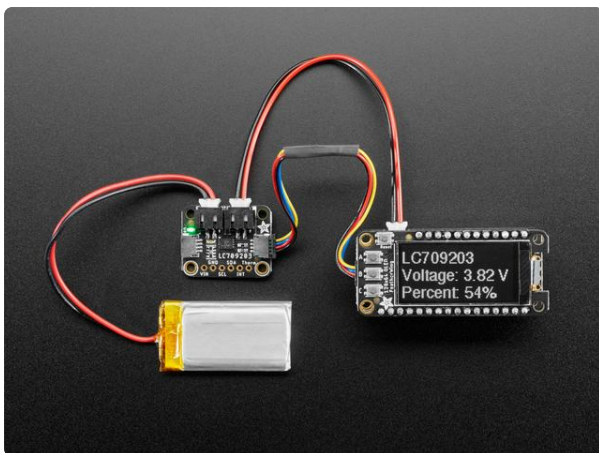
<https://www.adafruit.com/product/5625>



Adafruit SCD-30 - NDIR CO2 Temperature and Humidity Sensor

Take a deep breath in...now slowly breathe out. Mmm isn't it wonderful? All that air around us, which we bring into our lungs, extracts oxygen from and then breathes out carbon...

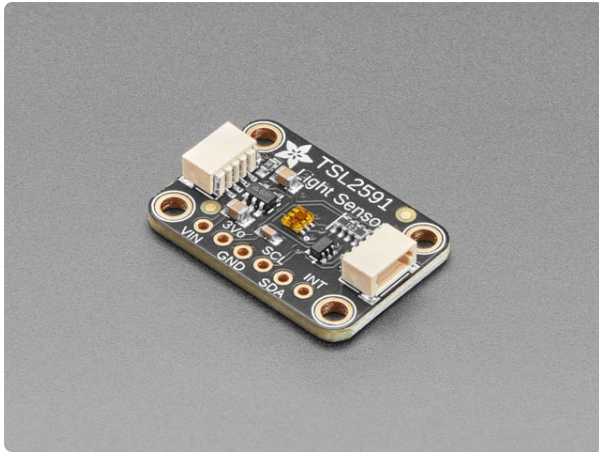
<https://www.adafruit.com/product/4867>



Adafruit LC709203F LiPoly / Lilon Fuel Gauge and Battery Monitor

Low cost Lithium Polymer batteries have revolutionized electronics - they're thin, they're light, they can be regulated down to 3.3V and they're easy to charge. On your...

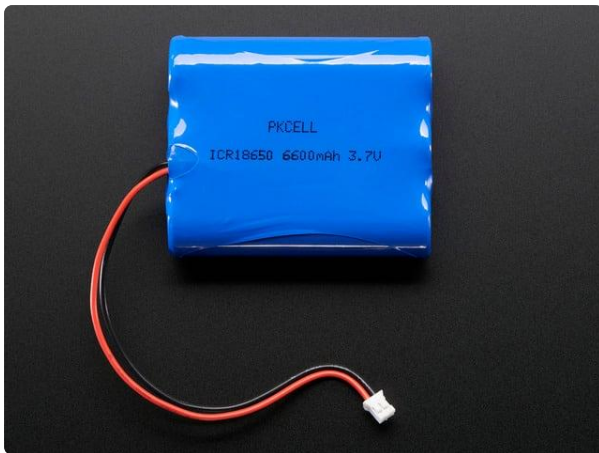
<https://www.adafruit.com/product/4712>



Adafruit TSL2591 High Dynamic Range Digital Light Sensor

When the future is dazzlingly-bright, this ultra-high-range luminosity sensor will help you measure it. The TSL2591 luminosity sensor is an advanced digital light sensor, ideal for use...

<https://www.adafruit.com/product/1980>



Lithium Ion Battery Pack - 3.7V 6600mAh

Need a massive battery for your project? This lithium-ion pack is made of 3 balanced 2200mAh cells for a total of 6600mAh capacity! The cells are connected in parallel and spot-welded...

<https://www.adafruit.com/product/353>

4 x STEMMA QT / Qwiic JST SH 4-Pin Cable

<https://www.adafruit.com/product/4399>

STEMMA QT / Qwiic JST SH 4-Pin Cable - 50mm Long

1 x STEMMA QT / Qwiic JST SH 4-Pin Cable

<https://www.adafruit.com/product/4210>

STEMMA QT / Qwiic JST SH 4-Pin Cable - 100mm Long

1 x 4-pin JST PH to JST SH Cable

<https://www.adafruit.com/product/4424>

STEMMA to QT / Qwiic - 200mm long

16 x M2.5x5mm Screws

[https://](https://www.albanycountyfasteners.com/2-5-MM-x-45-Phillips-Flat-Head-Machine-Screw-p/1011-1002.htm)

M2.5x5mm Screws

www.albanycountyfasteners.com/2-5-MM-x-45-Phillips-Flat-Head-Machine-Screw-p/1011-1002.htm

2 x M2.5x6mm long screws

[https://](https://www.albanycountyfasteners.com/2-5-MM-x-45-Phillips-Flat-Head-Machine-Screw-p/1011-1002.htm)

M2.5x6mm long screws

www.albanycountyfasteners.com/2-5-MM-x-45-Phillips-Flat-Head-Machine-Screw-p/1011-1002.htm

Type C USB-C Male OTG Host Type 5.1k Resistor Adapter with Black Housing Cover

1 x [Type C USB-C Male OTG Host Type 5.1k Resistor Adapter with Black Housing Cover](#)

<https://amzn.to/3UiQStk>

Type C USB-C Male OTG Host Type 5.1k Resistor Adapter with Black Housing Cover



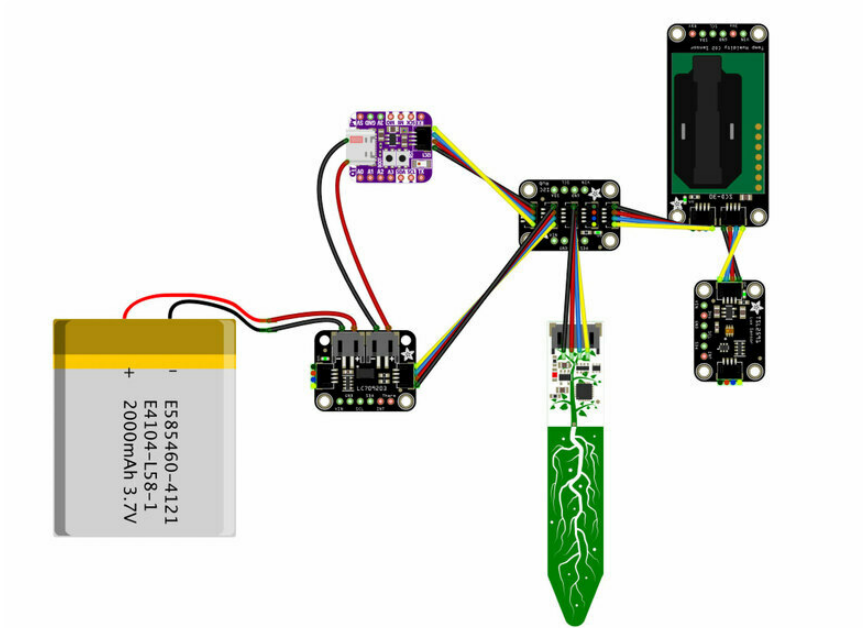
Circuit Diagram

Circuit Diagram

[Save \(https://adafru.it/11Aq\)](https://adafru.it/11Aq) [Subscribe \(https://adafru.it/11Ar\)](https://adafru.it/11Ar)

The wiring diagram below provides a visual reference for connecting the components. It is not true to scale, it is just meant to be used as reference. This diagrams was created using the [Fritzing software package \(https://adafru.it/oEP\)](https://adafru.it/oEP).

Take a moment to review the components in the circuit diagram. This illustration is meant for referencing wired connections - the length of wire, position and size of components are not exact.



3D Printing



Parts List

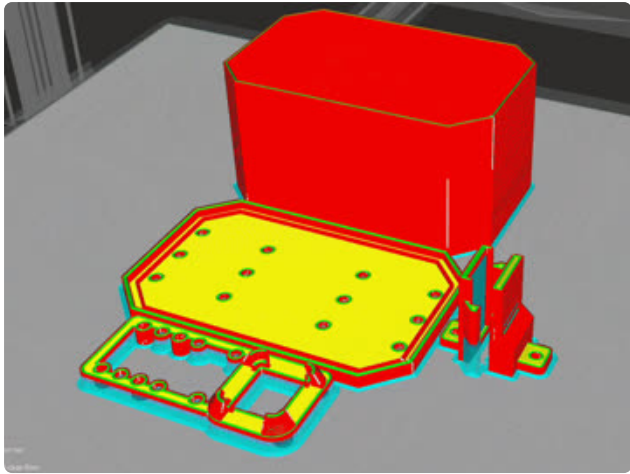
STL files for 3D printing are oriented to print "as-is" on FDM style machines. Parts are designed to 3D print without any support material. Original design source may be downloaded using the links below.

[Edit Soil Sensor Node Case](#)

<https://adafru.it/11As>

[Download STLs](#)

<https://adafru.it/18aD>



Slice with settings for PLA material

The parts were sliced using CURA using the slice settings below.

PLA filament 220c extruder

0.2 layer height

10% gyroid infill

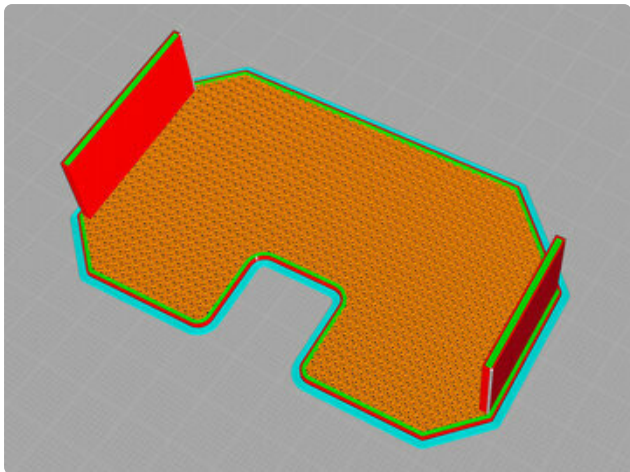
60mm/s print speed

60c heated bed

Soil Case Roof

0 Top + Bottom Layers

50% gyroid infill



Supports

- Support Extrusion Width: .2
- Support Density: 4%
- Support Overhang Angle: 50
- Support Z Height: .21
- Interface: On
- Support Roof: On
- Support Pattern: Zig Zag

Build Plate Adhesion

- Type: brim
- Line Count: 8

WipperSnapper Setup

The WipperSnapper firmware and ecosystem are in BETA and are actively being developed to add functionality, more boards, more sensors, and fix bugs. We encourage you to try out WipperSnapper with the understanding that it is not final release software and is still in development.

If you encounter any bugs, glitches, or difficulties during the beta period, or with this guide, please contact us via <http://io.adafruit.com/support>

What is WipperSnapper

WipperSnapper is a firmware designed to turn any WiFi-capable board into an Internet-of-Things device without programming a single line of code. WipperSnapper connects to [Adafruit IO \(https://adafru.it/fsU\)](https://adafru.it/fsU), a web platform designed ([by Adafruit! \(https://adafru.it/Bo5\)](https://adafru.it/Bo5)) to display, respond, and interact with your project's data.

Simply load the WipperSnapper firmware onto your board, add credentials, and plug it into power. Your board will automatically register itself with your Adafruit IO account.

From there, you can add components to your board such as buttons, switches, potentiometers, sensors, and more! Components are dynamically added to hardware, so you can immediately start interacting, logging, and streaming the data your projects produce without writing code.

Sign up for Adafruit.io

You will need an Adafruit IO account to use WipperSnapper on your board. If you do not already have one, head over to [io.adafruit.com \(https://adafru.it/fsU\)](https://adafru.it/fsU) to create a free account.

Install USB Driver

Install CP2104 / CP2102N USB Driver

Many ESP32 boards have a USB-to-Serial converter that talks to the chip itself, and will need a driver on your computer's operating system. The driver is available for Mac, Windows, and Linux.

Click here to download the CP2104/
CP2102N driver

<https://adafru.it/vrf>

Install CH9102 / CH34X USB Driver

Newer ESP32 boards have a different USB-to-serial converter that talks to the chip itself, and will need a driver on your computer's operating system. The driver is available for Mac and Windows. It is already built into Linux.

If you would like more detail, check out [the guide on installing these drivers \(https://adafru.it/-f8\)](https://adafru.it/-f8).

Click here to download the
Windows driver

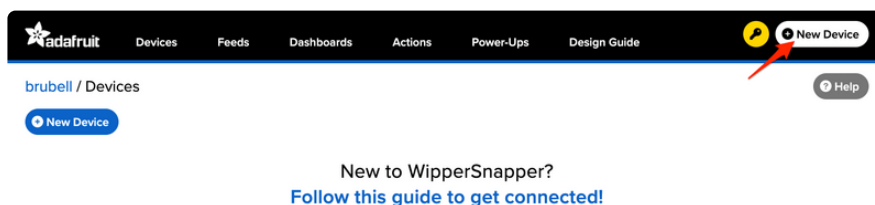
<https://adafru.it/-f9>

Click here to download the Mac
driver

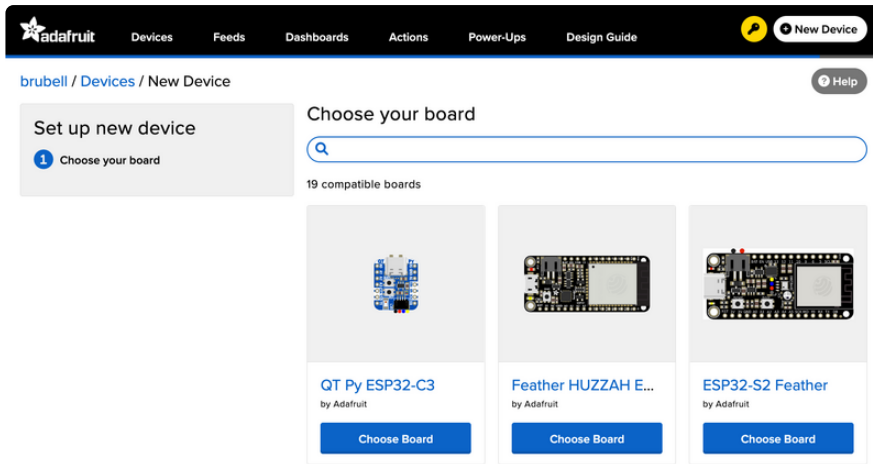
<https://adafru.it/-ed>

Add a New Device to Adafruit IO

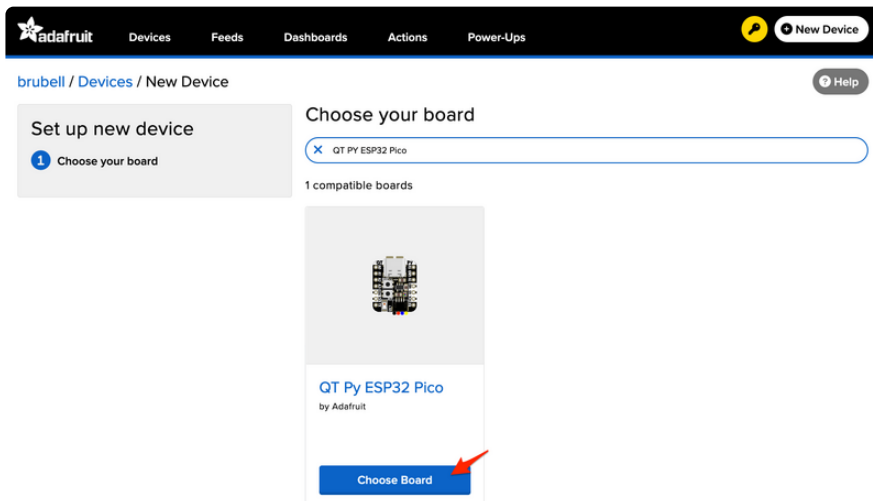
Log into your [Adafruit IO \(https://adafru.it/fsU\)](https://adafru.it/fsU) account. Click the New Device button at the top of the page.



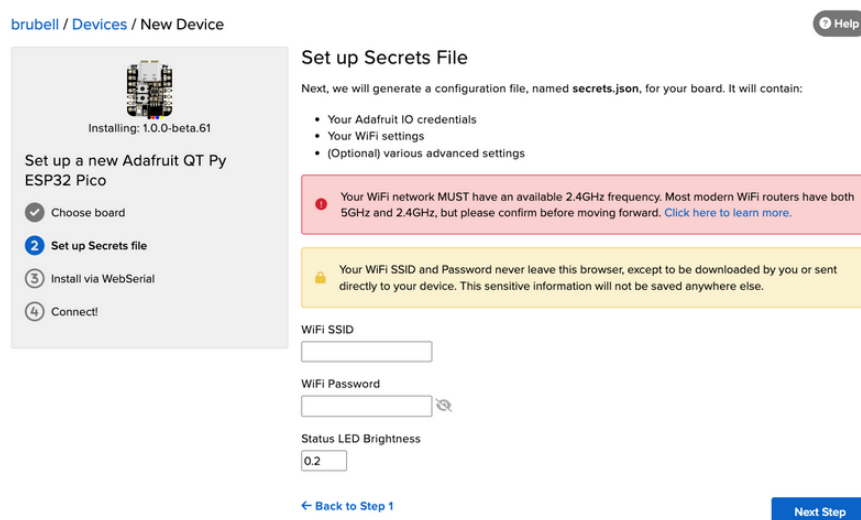
After clicking New Device, you should be on the board selector page. This page displays every board that is compatible with the WipperSnapper firmware.



In the board selector page's search bar, search for the QT Py ESP32 Pico. Once you've located the board you'd like to install WipperSnapper on, click the Choose Board button to bring you to the self-guided installation wizard.



Follow the step-by-step instructions on the page to install Wippersnapper on your device and connect it to Adafruit IO.



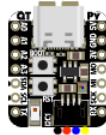
If the installation was successful, a popover should appear displaying that your board has successfully been detected by Adafruit IO.

Give your board a name and click "Continue to Device Page".

New Device Detected!



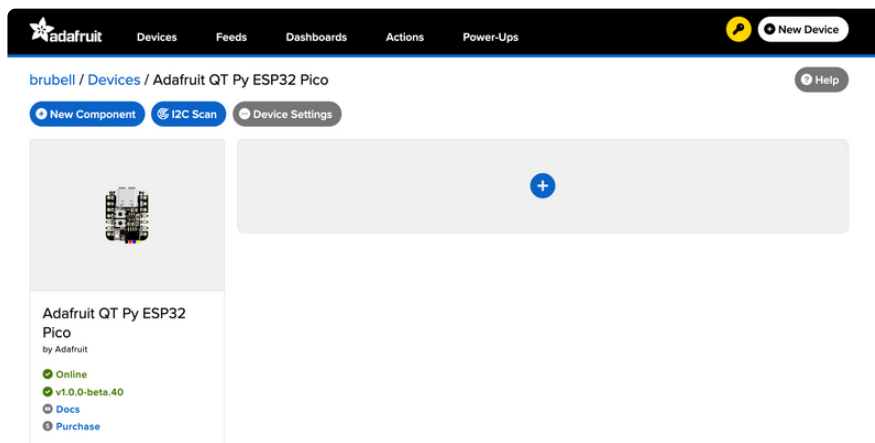
You have successfully connected a new **qtpy-esp32** device to Adafruit IO. It is already set up and submitting data. You can name the device here, and set up components on the device page.



Device Name

You should be brought to your board's device page.

Next, Visit this guide's **WipperSnapper Essentials** pages to learn how to interact with your board using Adafruit IO.



Feedback

Adafruit.io WipperSnapper is in **beta** and you can help improve it!

If you have suggestions or general feedback about the installation process - visit <https://io.adafruit.com/support> (<https://adafru.it/Sgb>), click "Contact Adafruit IO Support" and select "I have feedback or suggestions for the WipperSnapper Beta".

Troubleshooting

If you encountered an issue during installation, please try the steps below first.

If you're still unable to resolve the issue, or if your issue is not listed below, get in touch with us directly at <https://io.adafruit.com/support> (<https://adafru.it/Sgb>). Make sure to click "Contact Adafruit IO Support" and select "There is an issue with WipperSnapper. Something is broken!"

I don't see my board on Adafruit IO, it is stuck connecting to WiFi

First, make sure that you selected the correct board on the board selector.

Next, please make sure that you entered your WiFi credentials properly, there are no spaces/special characters in either your network name (SSID) or password, and that you are connected to a 2.4GHz wireless network.

If you're still unable to connect your board to WiFi, please [make a new post on the WipperSnapper technical support forum with the error you're experiencing, the LED colors which are blinking, and the board you're using. \(https://adafru.it/V6a\)](https://adafru.it/V6a)

I don't see my board on Adafruit IO, it is stuck "Registering with Adafruit IO"

Try hard-resetting your board by unplugging it from USB power and plugging it back in.

If the error is still occurring, please [make a new post on the WipperSnapper technical support forum with information about what you're experiencing, the LED colors which are blinking \(if applicable\), and the board you're using. \(https://adafru.it/V6a\)](https://adafru.it/V6a)

"Uninstalling" WipperSnapper

WipperSnapper firmware is an application that is loaded onto your board. There is nothing to "uninstall". However, you may want to "move" your board from running

WipperSnapper to running Arduino or CircuitPython. You also may need to restore your board to the state it was shipped to you from the Adafruit factory.

Moving from WipperSnapper to CircuitPython

Follow the steps on the [Installing CircuitPython page \(https://adafru.it/Amd\)](https://adafru.it/Amd) to install CircuitPython on your board running WipperSnapper.

- If you are unable to double-tap the RST button to enter the UF2 bootloader, follow the "Factory Resetting a WipperSnapper Board" instructions below.

Uploading this sketch will overwrite WipperSnapper. If you want to re-install WipperSnapper, follow the instructions at the top of this page.

Moving from WipperSnapper to Arduino

If you want to use your board with Arduino, you will use the Arduino IDE to load any sketch onto your board.

First, follow the page below to set up your Arduino IDE environment for use with your board.

Arduino IDE Setup

<https://adafru.it/10aQ>

Then, follow the page below to upload the "Arduino Blink" sketch to your board.

Upload Arduino "Blink" Sketch

<https://adafru.it/10aR>

Uploading this sketch will overwrite WipperSnapper. If you want to re-install WipperSnapper, follow the instructions at the top of this page.

Factory Resetting a WipperSnapper Board

Sometimes, hardware gets into a state that requires it to be "restored" to the original state it shipped in. If you'd like to get your board back to its original factory state, follow the guide below.

Factory Reset Adafruit QT Py ESP32 Pico

<https://adafru.it/10aS>

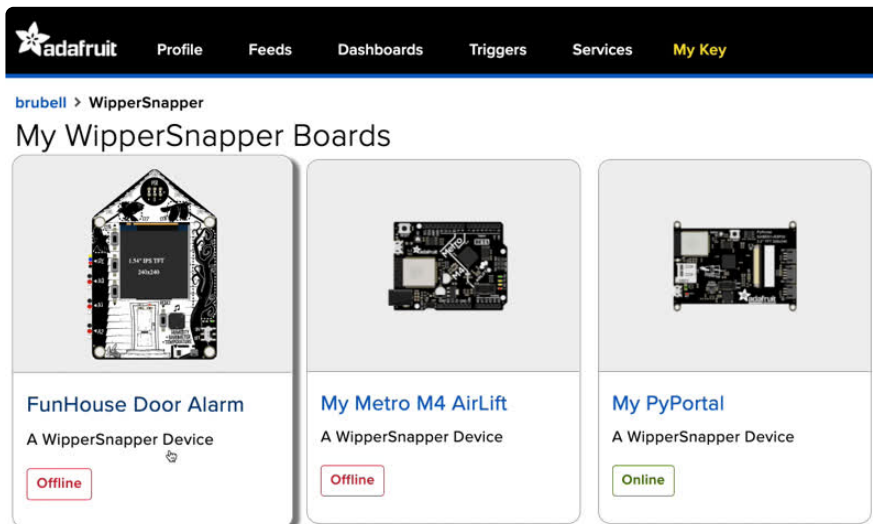
WipperSnapper Overview



Ok - you've connected your board to WipperSnapper. Now what?

This page will give you a quick tour of Adafruit IO WipperSnapper and its core features.

WipperSnapper Device List

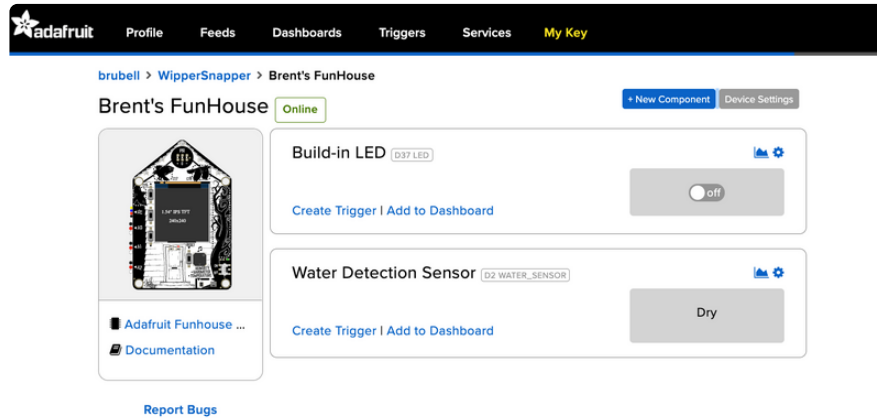


The Device List page provides a list of the devices you've connected to Adafruit IO WipperSnapper along with their connection status.

Think of it as a virtual inventory for your boards!

You can visit this page at any time by navigating to <https://io.adafruit.com/wippersnapper> (<https://adafru.it/TAu>).

Wippersnapper Device Page



Clicking on a device from the Devices List page will bring you to its device page. This page is an interface to configure and interact with anything physically connected to your device.

You may think of it as the state of your device at any given time.

When you register a device for the first time, this page will be empty, it's a clean slate!

WipperSnapper Components

New Component



Which component would you like to set up?



LED



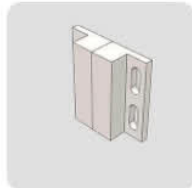
Push Button



Toggle Switch



Potentiometer



Reed Switch



PIR Sensor



Light Sensor



Beam Sensor



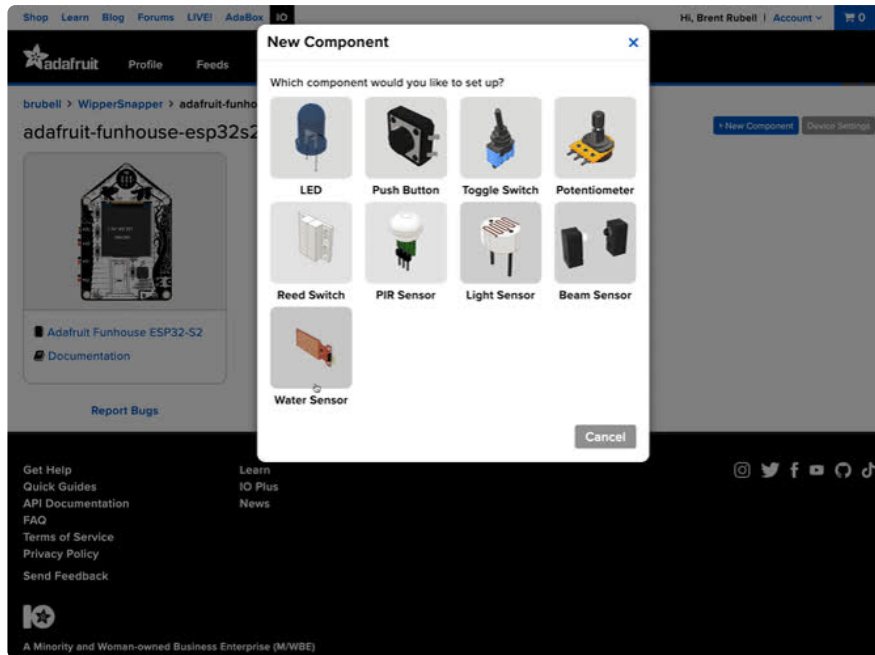
Water Sensor

A "component" in WipperSnapper denotes anything which is physically connected to your hardware.

This can include sensors, buttons, LEDs, NeoPixels, displays, and more!

When you click **New Component**, your hardware will automatically connect to and configure the component using the settings you specified. No coding required!

Additionally, a component also sets up a unique [Adafruit IO feed \(https://adafru.it/ioA\)](https://adafru.it/ioA) to store the component's data stream on the web.



Do I need to set up my components every time I use WipperSnapper?

Nope! WipperSnapper remembers each component's configuration for each of your boards. The "state" of your board's configuration is saved to its device page.

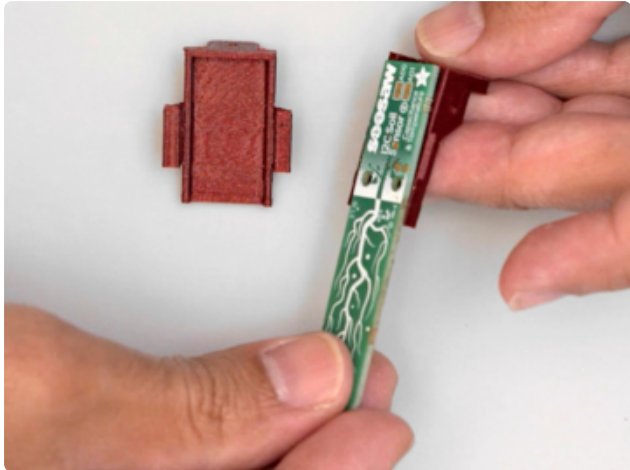
When you re-connect a board to WipperSnapper, it will automatically re-configure every component listed on the Device Page. The most recent value stored on each component's feed will be sent to the device.

I do not see my the component I want to use listed in the component picker pop-up

We're actively working towards adding more components and component types to Adafruit Wippersnapper.

We also gladly take community contributions to Adafruit IO - [You can add your own component by following this guide.](https://adafru.it/Zbr) (<https://adafru.it/Zbr>)

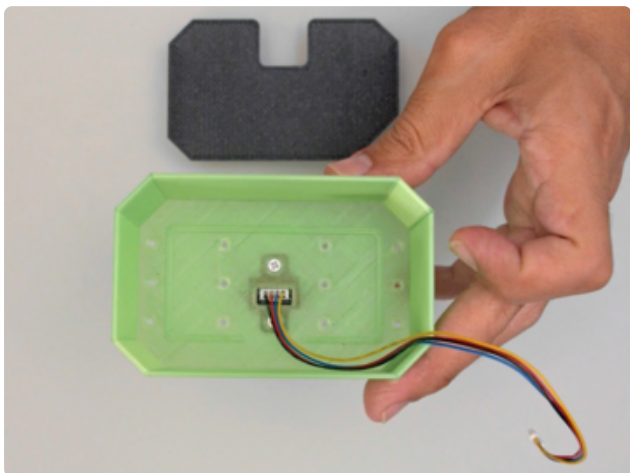
Assemble



Soil Sensor Assemble

We made a special case for the Stemma soil sensor to keep the circuitry compact.

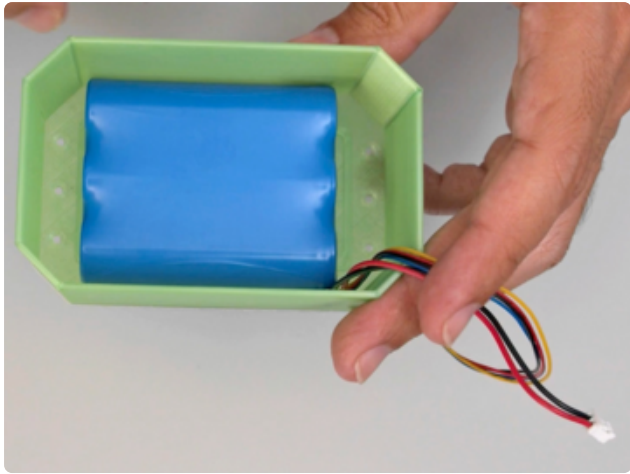
The two halves snap fit together and feature slots for ventilation.



Attach Soil Sensor

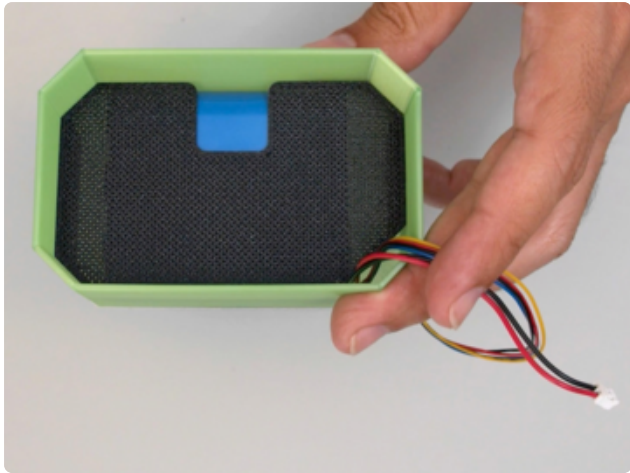
The tabs on the soil sensor case are aligned to the screw holes on the case and secured with two M2.5x6mm long screws.

Position the wire between the raised outline inside the case to insure the wires don't get bent.

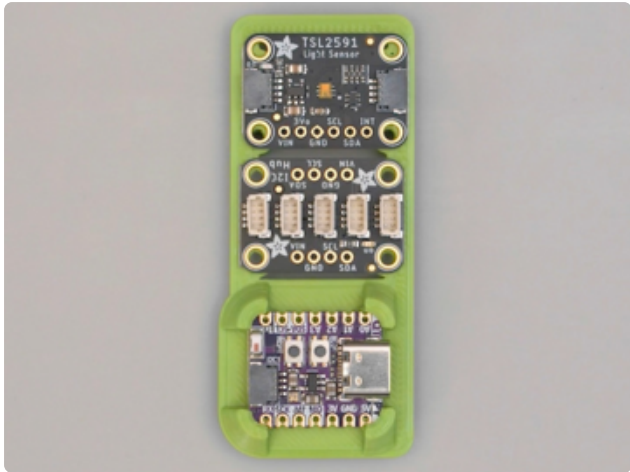


Mount Battery

A 6600mAh lipo battery is placed at the bottom of the case.



The battery roof part press fits over the battery. One corner is smaller to allow the wires to pass through.



Mount QT Py

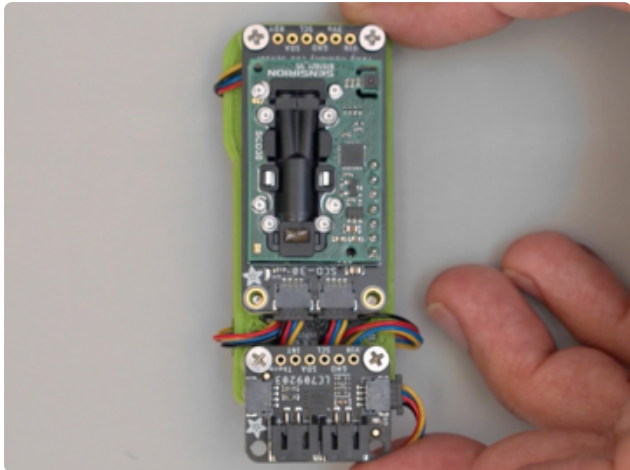
Angle one side of the QT Py board at an angle. The board snap fits into the corners.

Attach sensors

Use M2.5x5mm screws to attach the sensors.

The SCD-30 Air quality sensor can be mounted to the bottom making a compact and modular circuit sandwich.

To monitor the power we're using an additional Lipo Battery Monitor so we can be notified when it's time to recharge.





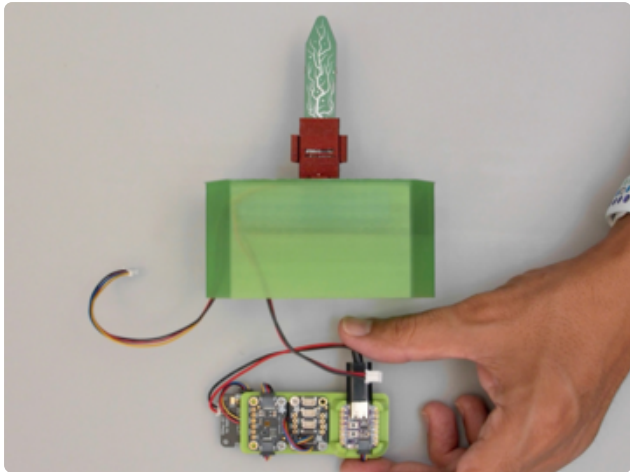
Battery Gauge

This USB-C connector is wired up to a JST cable so we can easily power the QT Py from the battery monitor.



Identify the pads for power and ground connections on the PCB.

Thread the wires through the USB shell before soldering the connections together.



Mount boards

Now we can connect all of the Stemma breakouts together and start logging some data!

Carefully coil the wires and place the sensors inside the case.

Angle the lid over the case and press each side into place.

