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## ESP8266 WiFi Weather Station with Color TFT Display

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# Overview



## Weather Station

In this project, we'll learn how to make a DIY fully featured weather station using an ESP8266 and a 2.4" TFT touchscreen display. This project pulls weather data using the Wunderground API. It displays the date, time, current weather conditionals, 4-day forecast and even moon phases.

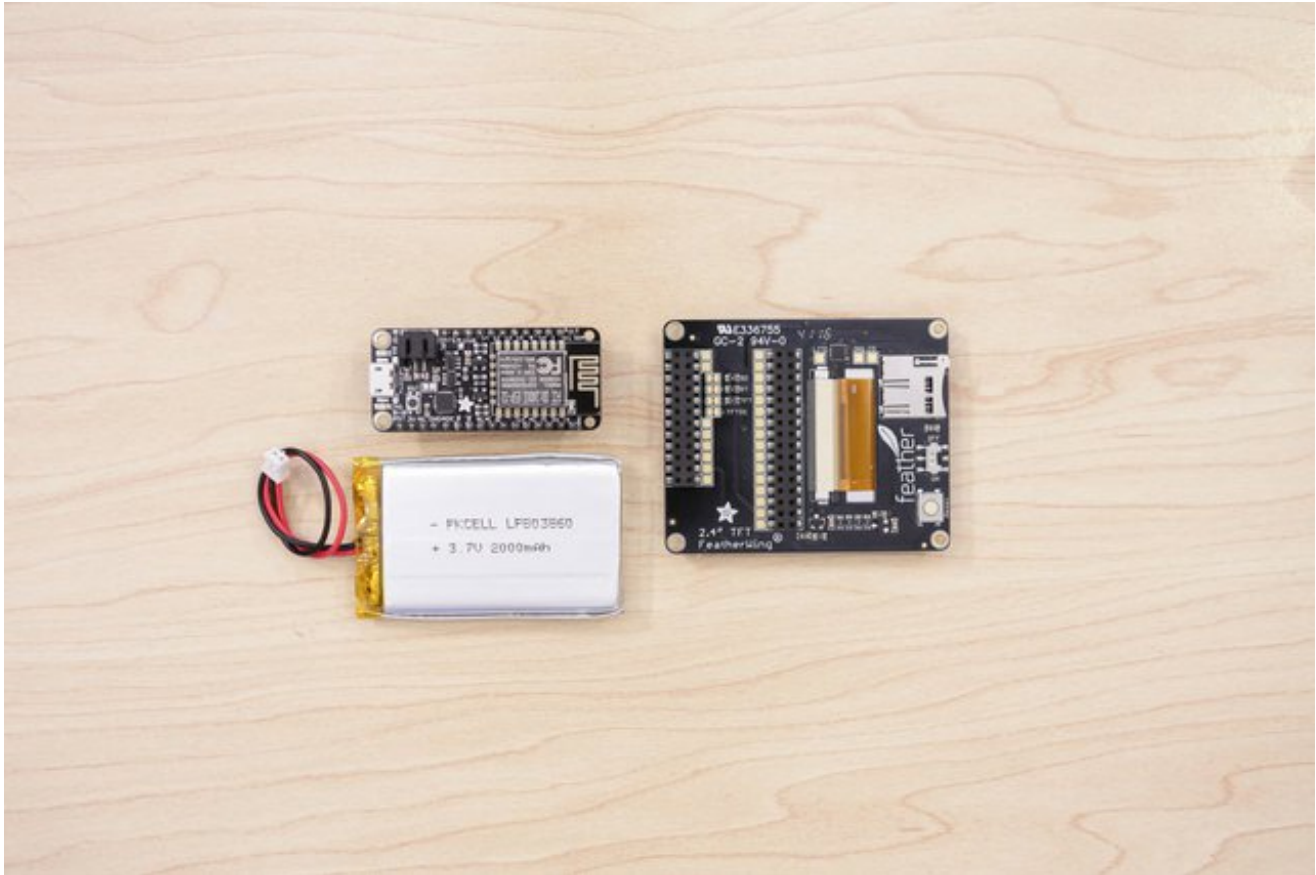
[This great code is by Daniel Eichhorn - we just made a lovely case for it! \(http://adafru.it/sXB\)](http://adafru.it/sXB)



## Prerequisite Guides

We recommend walking through the guides listed here to get a better understanding of the components used in this project.

- [Adafruit Feather HUZZAH with ESP8266](http://adafru.it/nEN) (<http://adafru.it/nEN>)
- [Adafruit 2.4" TFT Feather Wing](http://adafru.it/sXC) (<http://adafru.it/sXC>)
- [Collin's Lab: Soldering](http://adafru.it/sXD) (<http://adafru.it/sXD>)



## Parts

You'll need the following parts to build this project.

- 2.4" TFT Feather Wing 320x240 Touchscreen
- [Adafruit Feather HUZZAH with ESP8266 WiFi](http://adafru.it/2821) (<http://adafru.it/2821>)
- [2000mAh Rechargeable Battery](http://adafru.it/2011) (<http://adafru.it/2011>) (Optional)
- [Slide Switch](http://adafru.it/805) (<http://adafru.it/805>) (Optional)



## Tools & Supplies

- Soldering Iron & Solder
- 3D Printer & Filament
- microUSB Data Cable
- 30AWG Silicone Coated Stranded Wire





# Software

## Adafruit Feather Huzzah with EPS8266 Arduino Libraries

If you're new to the Adafruit Feather Huzzah EPS8266, you'll need to install the board and libraries in order to compile and upload code to it using the Arduino IDE. Follow the guide below to install the board and libraries, then come back here once you've successfully installed it.

The guide walks you through installing the Arduino IDE as well.

[Follow Adafruit Huzzah EPS8266 Arduino Guide](http://adafru.it/IRC)  
<http://adafru.it/IRC>

## Download & Install Arduino Libraries

You'll need to download and install a few libraries in order to compile the sketch. You can manually install them by downloading the direct links below, or use the Library Manager in the Arduino IDE to search and install them.

- [Download Adafruit GFX Library](http://adafru.it/aJa) (<http://adafru.it/aJa>)
- [Download Adafruit ILI9341 Library](http://adafru.it/d4d) (<http://adafru.it/d4d>)
- [Download Adafruit STMPE610](http://adafru.it/d4f) (<http://adafru.it/d4f>)
- [Download WiFiManager for ESP8266](http://adafru.it/t7C) (<http://adafru.it/t7C>)
- [Download ESP8266 Weather Station Library](http://adafru.it/t7D) (<http://adafru.it/t7D>)
- [Download JSON Streaming Parser](http://adafru.it/t7E) (<http://adafru.it/t7E>)

## Arduino Sketch

Download the Arduino Sketch by clicking the green button below.

The original software was written by Daniel Eichhorn @ <http://blog.squix.ch> we made some changes to make it plug-n-play with this setup!

[weather\\_station\\_color.zip](http://adafru.it/vBP)  
<http://adafru.it/vBP>

## Obtain Wunderground API Key

The arduino sketch uses the Wunderground API to pull weather data. You'll need to sign up and register an account with [Wunderground.com](http://wunderground.com) (<http://adafru.it/sXF>) It's completely free. Once registered and logged in, go to the [API section](http://adafru.it/sYa) (<http://adafru.it/sYa>) of the site and create an API key. Copy it to your clipboard and save it. It will need to be pasted in the **settings.h** file.

## Register Account

Goto the [registration page](http://adafru.it/sYB) (<http://adafru.it/sYB>) and enter your email, desired username, password and agree to the terms of service.

## Get Your API Key

Once registered, goto the [API developer page](http://adafru.it/sYC) (<http://adafru.it/sYC>) and choose the Stratus Plan (it's free). Then, click on the "Purchase Key" button to continue.

Please complete the following questions to receive your API Key:

\*All fields are required

Contact Name  
Pedro Ruiz

Project Contact Email  
apex@business.com

Project Name  
ESP Weather Station

Project Website  
http://projectwebsite.com

Website Name cannot be blank.

Where will the API be used?  
☐ Website ☐ Mobile ☒ Both ☐ Other

Will the API be used for commercial use?  
☐ Yes ☒ No

Will the API be used for manufacturing mobile chip processing?  
☐ Yes ☒ No

What country are you or your company based in?  
 United States

Please give a brief description of how you will be using our API (250 character max length)

☒ I understand that usage of the Weather Underground API requires proper attribution  
☒ I agree to the [Terms of Service](#)

[Purchase Key](#)

## Register Your API Key

Now you'll need to fill out the form by entering your credentials and agreeing to the terms of service. Click, Purchase Key when you're finished.

**WU UNDERGROUND**

**GET YOUR API KEY**

Analytics Key Settings Featured Applications Documentation Forums

Select a Key to Customize: [ESP Weather Station](#)

**Success!** You have successfully subscribed to billing plan: Status Developer

**Edit API Key**

Key ID  
WUNDERGROUND

Project Name  
ESP Weather Station

Company Website  
http://adafruit.com

Contact Phone

Contact Email  
apex@business.com

[Update](#)

[Create a New Key](#)

**Regenerate API Key**

Has your key been compromised? You can generate a new key.

**Consequences**

- You will need to change your apps to use the new key.
- Your statistics will be reset.
- This action cannot be undone.

☐ I understand the consequences.

[Regenerate Key](#)

**Billing Information**

View your billing information:

- Modify
- Upgrade
- Downgrade
- Cancel

[View Billing](#)

**TOTAL:** \$0 USD per month

[Purchase Key](#)

Customize a plan that suits your needs:

## Retrieve API Key

You'll be presented with your API Key. Copy and save it somewhere safe – You can always login and retrieve your API key.

## Settings

You'll need to manually adjust a few settings in order to properly display weather conditions from your area. In the **settings.h** file, look for the **"Wunderground Underground"** section. Here, you'll need to enter your **Wunderground API key**, desired language, country, and city. The format of the city includes the state, so reference the sample code below.

```
// Wunderground Settings
const boolean IS_METRIC = false;
const String WUNDERGROUND_API_KEY = "api_key_here";
const String WUNDERGROUND_LANGUAGE = "EN";
const String WUNDERGROUND_COUNTRY = "US";
const String WUNDERGROUND_CITY = "FL/Royal_Palm_Beach";
```

## Sleep / Power Conservation

The display is programmed to turn off after 10 seconds. When the display is tapped, it will automatically turn back on. You can adjust the "awake" time by adjust the delay value in the code (found in the **weather\_station\_color.ino** file).

```
// for AWAKE_TIME seconds we'll hang out and wait for OTA updates
for (uint16_t i=0; i<AWAKE_TIME; i++ ) {
  // Handle OTA update requests
  ArduinoOTA.handle();
  delay(10000);
  yield();
}
```

## Uploading Sketch to Adafruit HUZZAH with ESP8266

Once your adjustments have been made, you can upload the sketch to the board. Before you do, goto **Tools > Board** and select **Adafruit HUZZAH ESP8266**. Then, check the varies options below:

- CPU Frequency: 80 MHz
- Flash Size: 4M (3M SPIFFS)
- Upload Speed: 115200

Plug in a microUSB data cable into the board and connect it to a USB port on your computer. Under the **Port** section, in the **Tools** menu, you should see the board listed. (If you're on a Mac, it will be listed as **/dev/cu.SLAB\_USBtoUART**.)

With those options selection, you can now upload the code to the board by clicking the upload button. You'll see the status of the upload in the black window on the bottom of the Arduino IDE.

## Initial Startup



The first time the Arduino Sketch runs, it will turn the ESP8266 into an access point. The display will instruct you to connect to the ESP8266 WiFi access point.



## Connect to ESP8266

You should see the ESP8266 listed in your available WiFi network. Select "**ESP8962600**". No password is needed.

## Configure WiFi

Once connected, your computer will automatically launch a Join WiFi login page. You'll have the option to scan for available WiFi networks or enter it manually.

## ESP8962600

Join "ESP8962600"

<a href="#">CBCI-29CC-2.4</a>	100%
<a href="#">xfinitywifi</a>	100%
<a href="#">XFINITY</a>	100%
<a href="#">Studio</a>	100%
<a href="#">HOME-SBC2</a>	50%
<a href="#">dlink</a>	36%
<a href="#">Angela 2.4</a>	28%
<a href="#">HOME-0C87-2.4</a>	22%
<a href="#">JKP5</a>	18%

save

Scan

## Enter WiFi Credentials

Choose your preferred WiFi network and enter your password. Then click on the save button.

## Connected ESP8266 WiFi

The ESP8266 will then automatically download the assets (weather condition icons) to the board. Once it's finished, it'll automatically display the date, time, weather, and moon phases. Pretty cool, huh? :-)

# 3D Printing



## Design Files

You can download the files below.

[Download STLs on Thingiverse](http://adafru.it/sYb)

<http://adafru.it/sYb>

[Download STLs on Pinshape](http://adafru.it/sYc)

<http://adafru.it/sYc>

[Download STLs on YouMagine](http://adafru.it/sYd)

<http://adafru.it/sYd>

## Slice Settings

Depending on your 3D printer, you may need to adjust the slice settings. We tested the enclosure on a Sigma BCN3D, Deltaprintr Go and a Printrbot Play. They do not require any

support material and are oriented to print "as is".

- Nozzle: 0.4mm
- Extrusion Multiplier: 1.0
- Extrusion Width: 0.48mm
- Layer Height: 0.2mm
- Nozzle Temperature: 220c

## Fusion 360 Design Archive

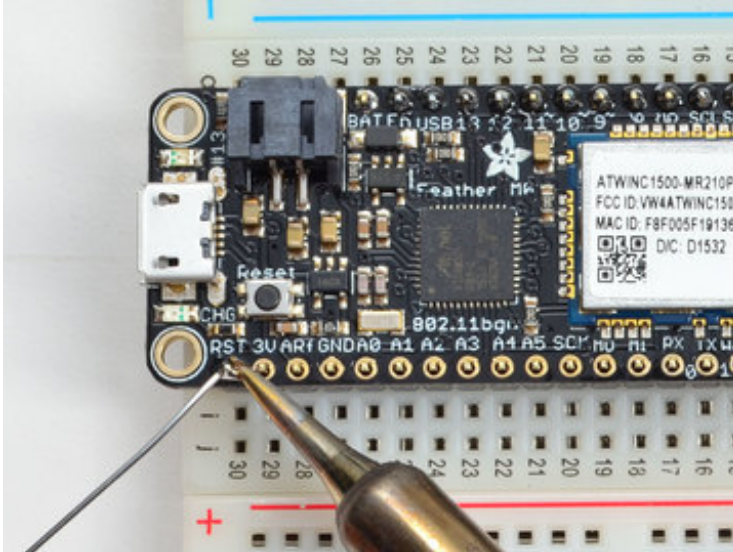
You can remix the design if you'd like to make any adjustments or reuse components.

[Download F360 Archive](#)

<http://adafru.it/sYe>

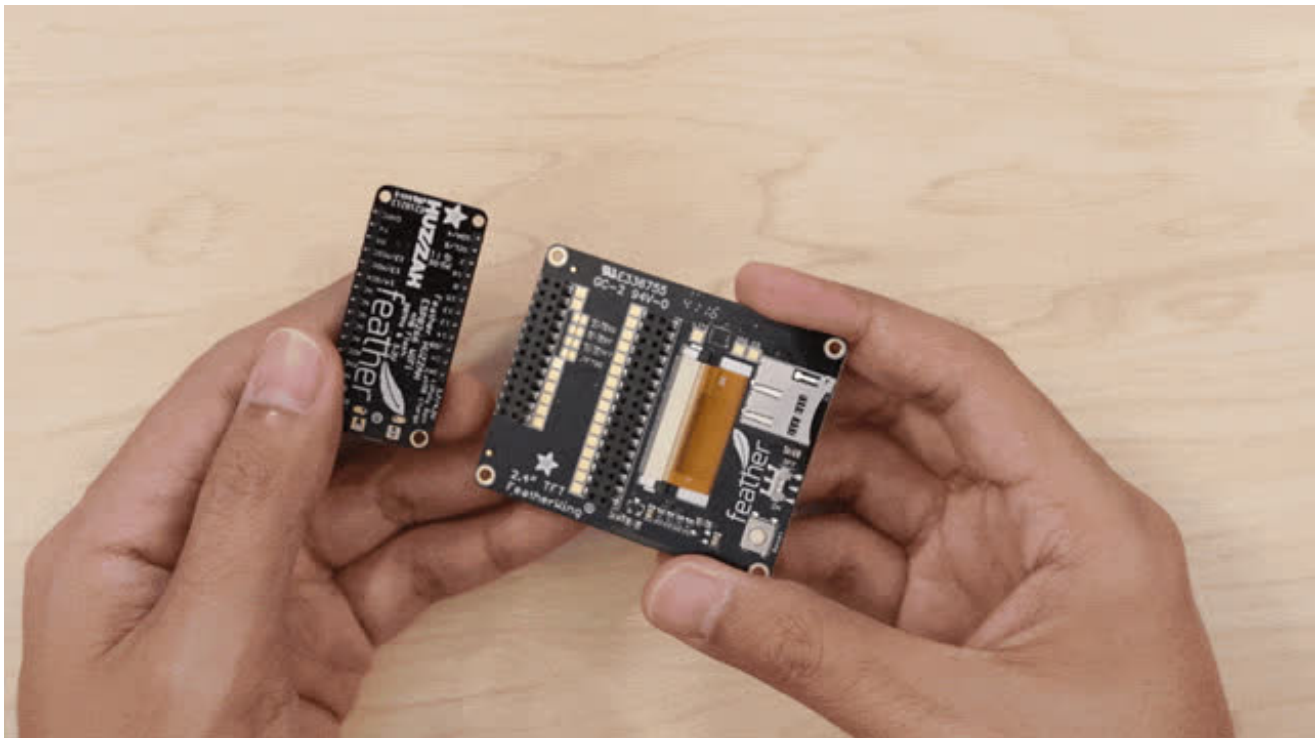


# Assembly



## Solder Headers onto Adafruit Feather HUZZAH

First, we'll need to solder on plain male headers onto the pins of the Adafruit Feather HUZZAH. You can follow the detailed instructions on the [Adafruit Feather HUZZAH guide](http://adafru.it/sYf) (<http://adafru.it/sYf>).

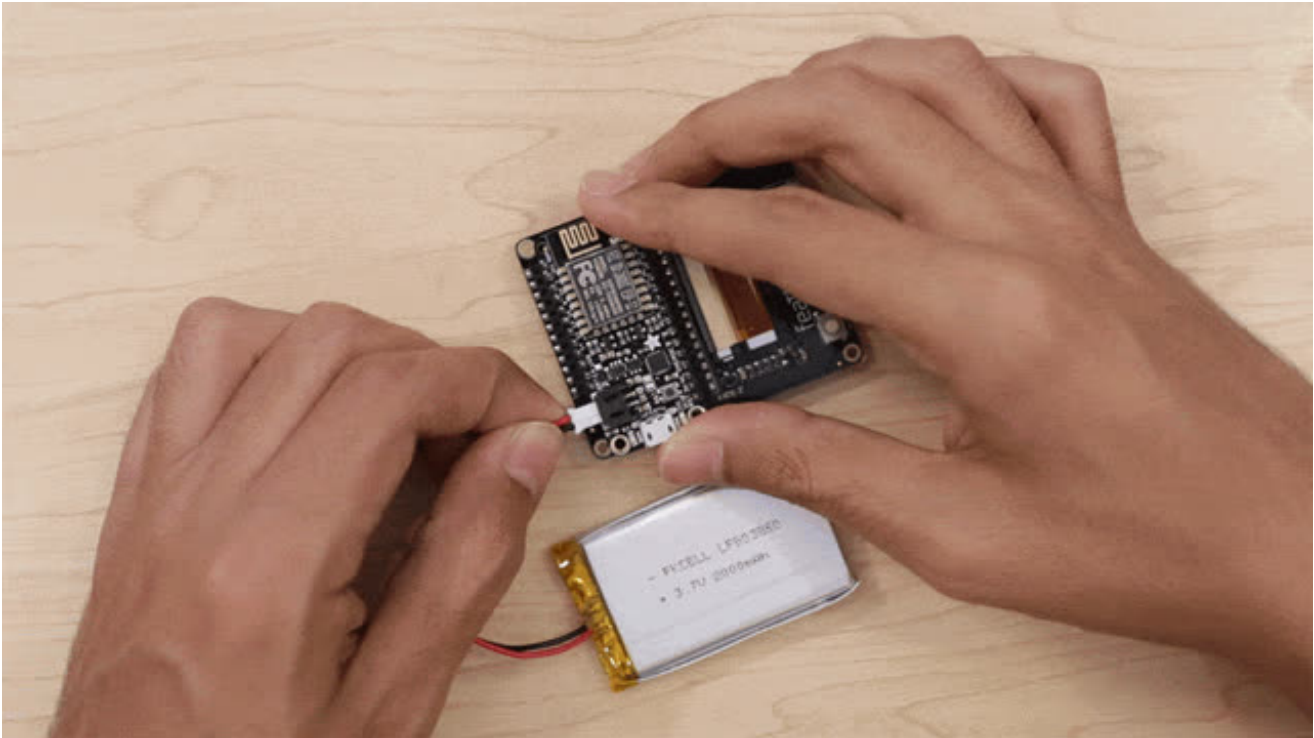


## Mount 2.4" TFT Display to Adafruit Feather HUZZAH ESP8266

With the male headers now soldered to the Adafruit Feather HUZZAH, we can mount it to the back of 2.4" TFT FeatherWing. Line up the pins with the header and press them together until they're fully seated.

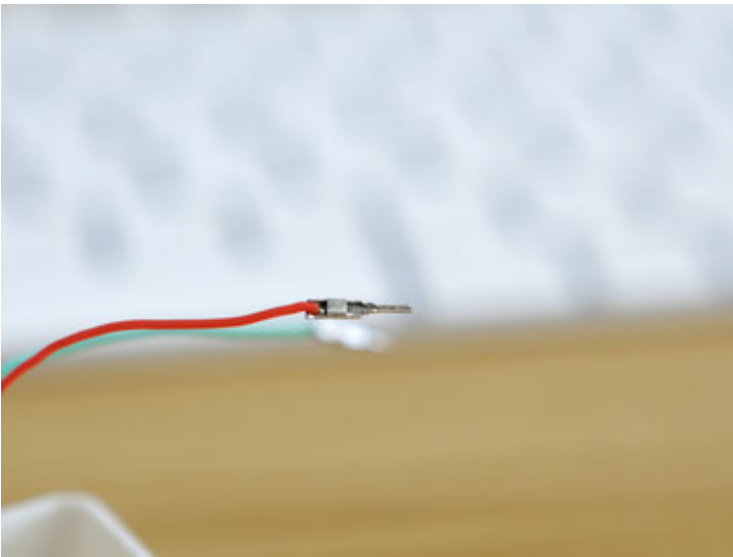
## Turn on TFT Display

You'll need to set the slide switch on the back of the display to ON.

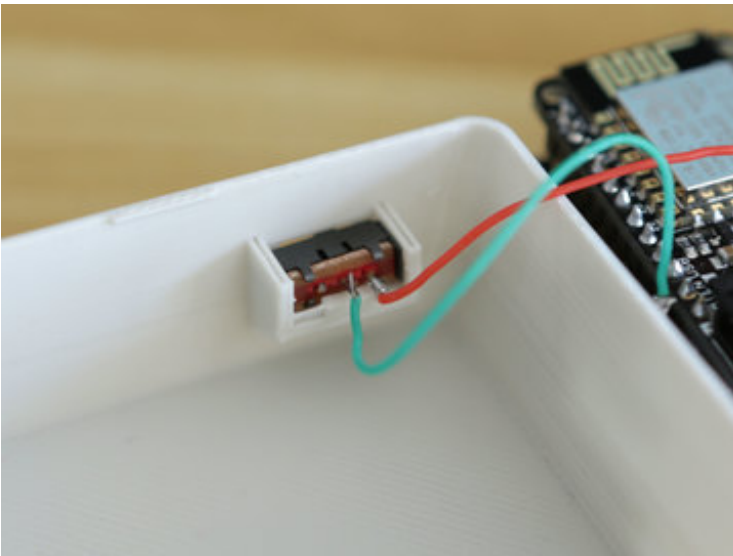


## Connect Battery (Optional)

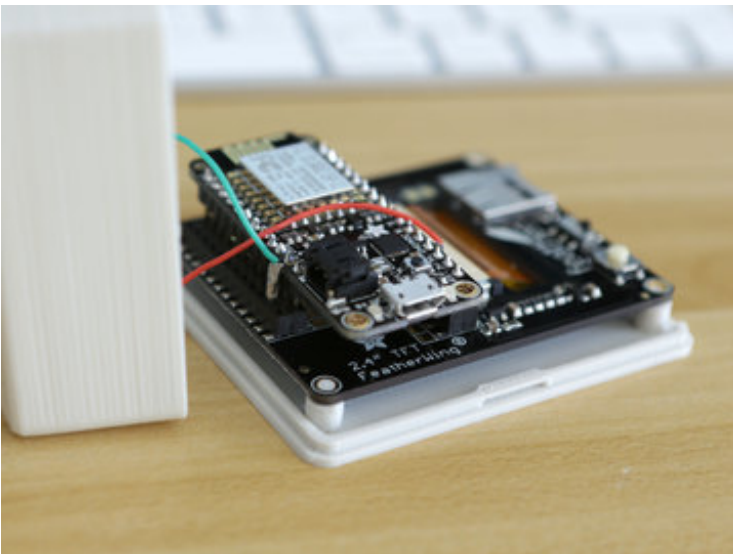
If you'd like the Weather Station to be portable, you can connect a battery. Here, we have a 2000mAh lithium ion battery. Plug in the male JST connector to the female JST port on the Adafruit Feather HUZZAH.



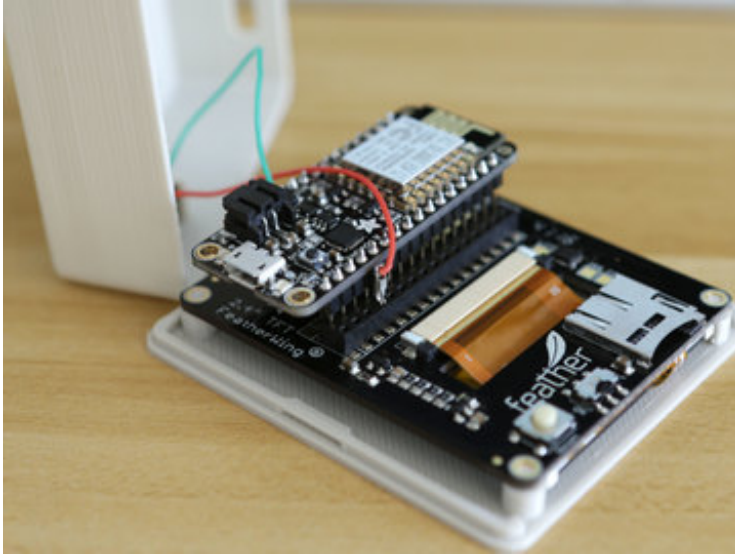
## Connect Slide Switch (Optional)



If you'd like to turn off the circuit without having to remove the display from the case, you can break out the slide switch. You'll need to wire up a slide switch. It will need to connect to the **EN** and **GND** labeled pins on the 2.4" TFT FeatherWing. Here, we connected the terminals of slide switch to jumper cables. The jumpers can plug into the female headers on the 2.4" display.



I used the tips from male jump cables to create a "slim" version by removing the plastic housing and trimming it short. Then, I soldered the tips to pieces of wire – This way, I can easily plug into the female header on the TFT display.



## Install TFT Display to Enclosure Cover

The enclosure cover has four standoffs that match up with the mounting holes on the 2.4" display. Orient the display and the cover so the side with black strip lines up with the opening in the lip.





## Install Cover to Case

If you added a battery, place it in the enclosure. Notice the two openings in the enclosure. They're for the microUSB port and the microSD card. Orient the Adafruit Feather HUZZAH so the ports line up with the openings on enclosure. Lay the cover over the enclosure and press the two together. The case has two little nubs on the edge that will click into the dimples on the lip of the cover.

## Finished Assembly!

And thats it! You can mount the case in all sorts of ways. For example, you can attach a magnet to the back to stick it on metal surfaces such as your refridgerator.