Sparkle Motion Skirt with 2D Mapping

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https://learn.adafruit.com/sparkle-motion-skirt-with-2d-mapping

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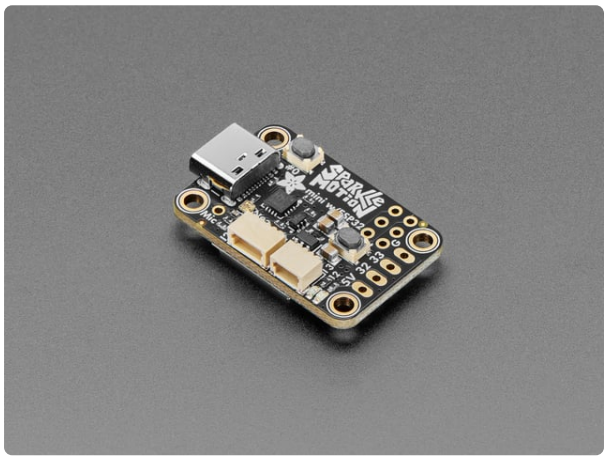
Overview

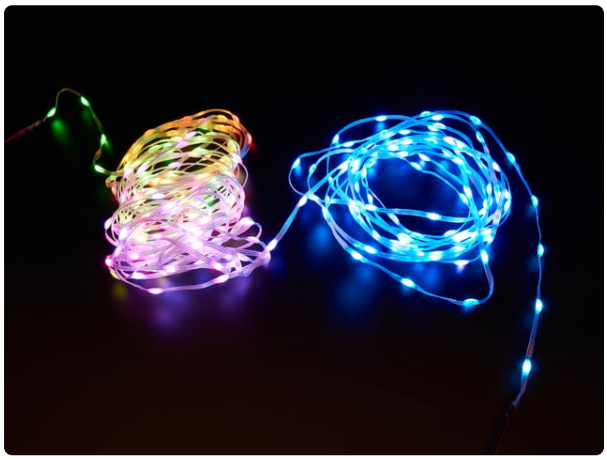
Dress yourself in lights using Pebble Pixel LEDs and a Sparkle Motion Mini running WLED. This project is fairly easy if you've got some crafting skills: it requires a little bit of sewing, some soldering and some software installation and setup, but no coding is required. WLED has a fantastic library of animations and effects that can be customized to create your dream dress.

This LED skirt is built onto a slip that goes under your fancy dress, so it can be worn under multiple costumes and quickly programmed and controlled with any WiFi-enabled smartphone or device. Sleeping Beauty changing from blue to pink while you twirl? Katniss' fire dress? Rainbow Fairy Princess? All are possible, and rolled into just one project!

Parts



Mini Sparkle Motion - WLED-friendly ESP32 NeoPixel LED Driver
The Adafruit Sparkle Motion Mini is part of our series of "Sparkle Motion" boards, that are our attempt to make the best...
https://www.adafruit.com/product/6160



Adafruit NeoPixel Pebble / Seed LED Strand - 300 LEDs - 2" Pitch
We have all sorts of LED strips for a wide range of needs. Chonky strips? We got those!
https://www.adafruit.com/product/6023

USB Battery Pack for Raspberry Pi - 10000mAh - 2 x 5V outputs
A large-sized rechargeable battery pack for your Raspberry Pi (or Arduino, or
https://www.adafruit.com/product/1566

This skirt is controllable by any WiFi-enabled device. Sometimes you don't want to fumble around with your phone in order to set your skirt to a specific mode, and the easiest way to do this is via a button. This is optional, but nice to have.

Tactile Switch Buttons (12mm square, 6mm tall) x 10 pack

Medium-sized clicky momentary switches are standard input "buttons" on electronic projects. These work best in a PCB but https://www.adafruit.com/product/1119

1 x JST-PH 3 Pin to Female Socket Connector https://www.adafruit.com/product/5765

JST SH 1mm Pitch 3 Pin to Socket Headers Cable - 100mm long

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1 x JST Connectors https://www.adafruit.com/product/1663

3-pin JST SM Plug + Receptacle Cable Set

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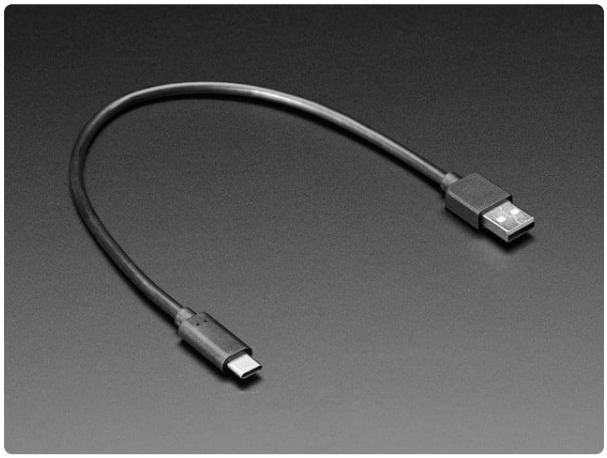
1 x Heat Shrink https://www.adafruit.com/product/344

Heat Shrink Pack



USB Type A to Type C Cable - 1ft - 0.3 meter

As technology changes and adapts, so does Adafruit. This USB Type A to Type C cable will help you with the transition to USB C, even if you're still... https://www.adafruit.com/product/4473

You'll also need a USB C cable to plug the battery into the Sparkle Motion Mini. The one above works great, or if you'd like to have an inline power switch you can use a **power switch tail** instead. I like these because they're chunky enough that I can feel them through the skirt without having to unzip and feel around to turn my skirt on or off.

Just be sure you have the correct USB connectors on each end: you'll need a USB C to plug into the Sparkle Motion board, and a USB A or micro for the recommended battery. Or you can find a battery with a USB C port online.

I love these batteries since they'll also charge my phone: if I'm out an event and taking pictures all night I can still call my Uber to get home.

USB C Male-Male power switch tail (https://adafru.it/1adX)
USB C Battery Pack (https://adafru.it/1adY)

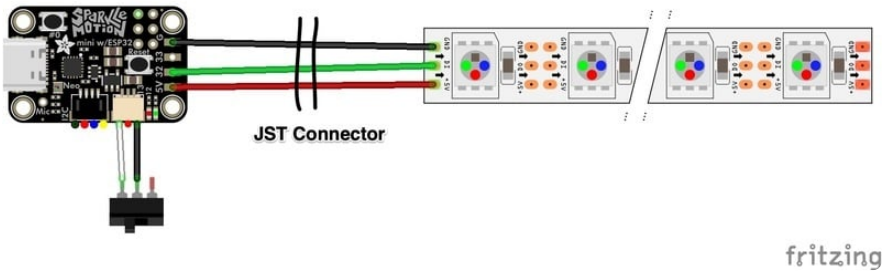
Tools Needed

- Flush diagonal cutters (http://adafru.it/152) (perhaps my favorite tool in the whole world)
- Good Wire Strippers (http://adafru.it/527)
- Alligator Clips (http://adafru.it/4100) for testing
- Soldering Iron & Accessories
- Hot Glue Gun
- Sewing machine or needle & thread
- Measuring tape

Materials Needed

- Pencil skirt or slim-fitting slip, or breathable fabric to make your own
- Fabric to make a battery pocket
- Crinoline or hoop skirt for diffusion

Wiring Diagram



Connect your lights to the Sparkle Motion Mini board as shown:

- **DI** to **GPIO 32:** Remember this number for the Config step
- **+5v** to **5v**
- **G** to **G**

I also added a control switch to my skirt. This switch can be set up to change modes or colors, or turn all the lights on or off at the opportune moment without having to fiddle with your phone. It's not needed for the project to work, but can add a lot of magic to your cosplay.

Connect the two legs of the switch to the white & black wires of the smaller Stemma port. Either leg can connect to either wire.

I made my project a little more complicated by adding a 3-pin JST connector (http://adafru.it/1663) between the board and the lights. This makes it easy to pull the board out of the project so I can wash the skirt without worrying about damaging it.

We can power the project through the USB port on the Sparkle Motion Mini. It will support up to a 4A draw, which is different from a lot of microcontrollers: if you did this with the QT Py Pico (http://adafru.it/5395) it could fry your board. The Sparkle Motion Mini is designed for this kind of project, so can power a lot of LEDs.

WLED Software

Board Choices

WLED runs on several different boards in Adafruit's collection. There are different benefits to each, but the installation process is largely the same. This page contains instructions for multiple boards -- be sure to use the pinouts and installation instructions for the one you're using,

Sparkle Motion

This is our flagship ESP32 board, designed with WLED and Xlights in mind. It has 4 outputs and is set up to drive either 5v, 12v or 24v pixels. It's a workhorse of a board and for larger projects it's the clear winner. It has an onboard microphone for instant sound-reactive support, and an IR sensor built in, to make it easy to control your project with an infrared remote. It also has a couple stemma ports so you can add your own sensors or peripherals.

Sparkle Motion Mini

The Sparkle Motion Mini is a smaller version of the Sparkle Motion board. It has two LED outputs, a microphone, and two stemma ports that make it easy to add an IR sensor or other peripherals. It's got an onboard NeoPixel and a small footprint, making it perfect for wearables or smaller projects. It will power a whole lot of pixels through the onboard USB port: it's safe to draw up to 4A through this port, giving you plenty of power for most wearable projects.

At this time, the Sparkle Motion Mini works best with WLED 0.15.1 -- the extra GPIO for the microphone pins are not supported in WLED 0.15.0. This should be fixed with the release of version 16.

To get mic support now, the following combined .bin file can be used. Get it by downloading this zip file:

esp32_bootloader_v4_WLED_0.16.0-alpha_ESP32.zip

https://adafru.it/1adL

To install, extract the .bin file from the zip and then follow the same ESB Web Flasher process used for installing CircuitPython (https://adafru.it/1adF). At the "Programming the Board" step, choose the .bin file and leave offset as 0x0.

QT Py Pico ESP32

The QT Py Pico (http://adafru.it/5395) is small and affordable, so usually my go-to for smaller costumes or wearables. It also has a range of BFF add-on boards that add functionality. Here's a guide with more QT Py info (https://adafru.it/1abD). The QT Py will drive up to around 30 pixels through the onboard USB port, so if you have more LEDs than that you may want to consider the Sparkle Motion Mini instead, or you can power the board through the +5v pin.

Note: WLED works on the QT Py Pico but NOT on the S2 or S3 versions, at the time of writing.

Feather Huzzah ESP32

The Feather Huzzah ESP32 (http://adafru.it/3405) the top of the line. It's a great choice for projects where you want to add sensors, interaction, or drive a whole lot of LEDs. It's the most reliable as well -- I've run these for two months straight with no power cycling and they just keep on truckin. Adafruit has a very wide selection of Feather Wing boards that connect to the Feather microcontroller line. The sky is the limit with these boards.

It also comes in a version with a high-powered WiFi range extender! If you're trying to sync multiple instances across distance, check this one out. Feather Huzzah ESP32 V2 w.FL Antenna (http://adafru.it/5438)

Feather Huzzah ESP8266

The Feather Huzzah ESP8266 (http://adafru.it/2821) will run WLED as well, but won't drive as many pixels: the ESP32 limit on WLED is around 1000 pixels per input, but the ESP8266 tops out at around 500. It's about $5 cheaper though, so for smaller projects it's a great way to save a little money and still have access to all the Featherwing options in the Adafruit store.

Driver Update

Some versions of our controllers have a new serial chip which needs a driver installed before we can install WLED. Head over to our How to Install Drivers for WCH USB to Serial Chips (https://adafru.it/-f8) tutorial, and download and install the new driver.

If you have an older QT Py with CP2102 USB-to-Serial bridge, use SiLabs' driver instead (https://adafru.it/11em).

Install WLED

These next steps require a **Web Serial-compatible browser**. As of this writing, that means **Google Chrome**, **Microsoft Edge** or **Opera** "desktop" browsers. Other browsers (Safari, Firefox, Explorer and anything mobile) won't work.

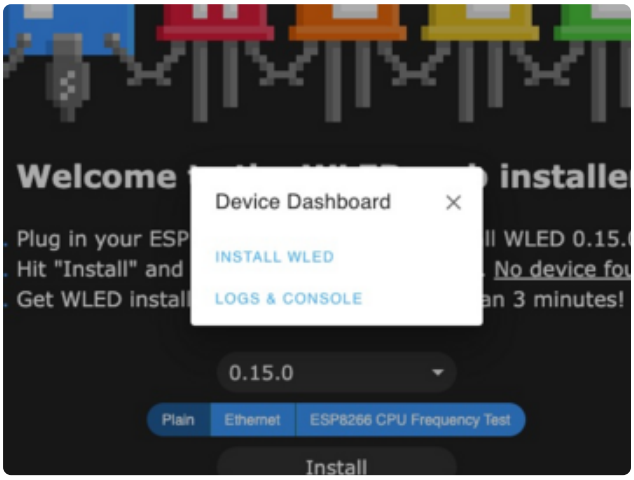
Visit https://install.wled.me/ (https://adafru.it/11dL)

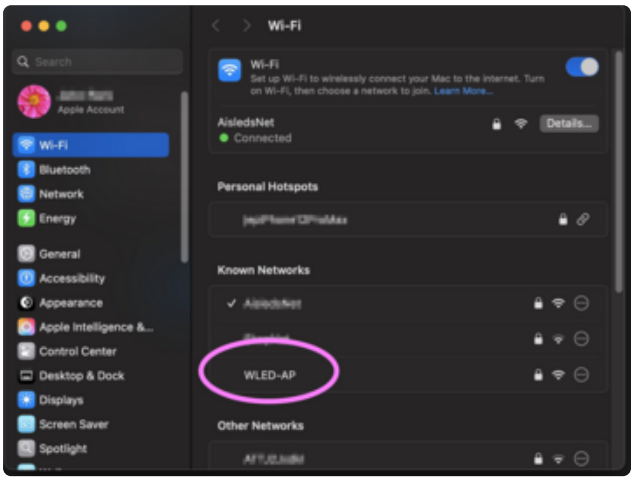
Plug your microcontroller into your computer with a known good USB cable. Click "Install" and select the port for your board.

Depending on the USB-to-serial bridge chip on the board, you might see one or two serial ports. On Mac, for instance, there might be both "/dev/cu.usbmodem[number]" and "/dev/cu.wchusbserial[number]". Use the "**wchusbserial**" one.

After successful installation, enter your WiFi network name and password when prompted. This must be a **2.4 GHz** WiFi network; ESP32 does not support 5 GHz networks. If it can't connect, then as a fallback WLED will create its own 2.4 GHz WiFi access point.

Sometimes the "Connect to Wi-Fi" prompt doesn't show up. Don't panic, just see the step below on connecting your computer or mobile device to the WLED-AP access point created on the microcontroller itself!





If you don't see the "Connect to Wi-Fi" prompt, you'll need to set up your WiFi network using AP (access point) mode. Open up your WiFi settings and look for a WiFi network called `WLED-AP`. (Note, this access point can take up to 30 seconds to appear sometimes.) Connect to this network using the default password `wled1234`. The WLED interface will pop up in its own captive browser window.

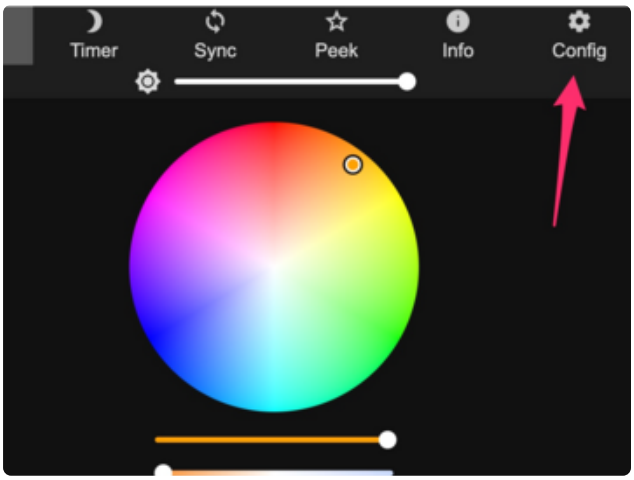
From here, go into **Config/Wifi Settings** and enter your WiFi credentials for the access point you normally use near the top.

Give your project a name in the mDNS field a little further down the page. Now you can type in "projectname.local" (where "projectname" is your mDNS name) into any web browser on the same wifi network to access your microcontroller.

You can also scan the QR code below to open access point mode.

For more help and troubleshooting tips visit the [Getting Started page on the WLED knowledge base.](https://adafru.it/1acu) (https://adafru.it/1acu)

Setup & Preferences



WiFi Setup

Head to the **WiFi Setup** screen under Config and create a good URL so you can control your project from any web-enabled device. Call it something you'll remember, that's easy to type into any web browser on your WiFi network in order to connect to your project.

In Safari or Chrome on your phone or computer, type in this web address to access the WLED interface: http://projectname.local (https://adafru.it/1acs) (where "projectname" is whatever you put into this field).

Check out the Additional Settings page for more info on accessing your project. WLED has an "access point mode" that doesn't require a WiFi network for when you're out on the go. It's also helpful to download one of the WLED apps to help manage and organize your projects.

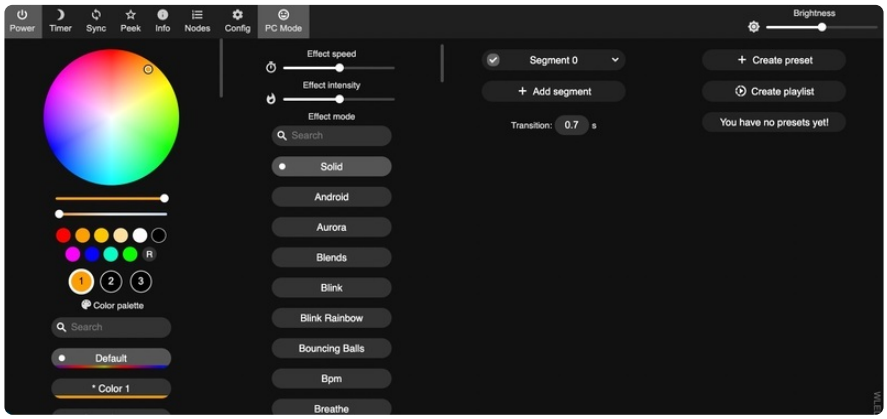
LED Preferences

Next, head to the **LED Preferences** tab under the Config menu.

Scroll down to **Hardware Setup**. Put your total number of LEDs into the "Length" field, and change GPIO to the pin number associated with the pin you soldered to. Check the pinout diagram for the board you're using (it's the number in yellow).

[Sparkle Motion Pinout](https://adafru.it/1acD) (https://adafru.it/1acD)
[Sparkle Motion Mini Pinout](https://adafru.it/1acE) (https://adafru.it/1acE)
[QT Py Pico Pinout](https://adafru.it/11dK) (https://adafru.it/11dK)
[Feather Huzzah ESP8266 Pinout](https://adafru.it/1a53) (https://adafru.it/1a53)
[Feather Huzzah ESP32 Pinout](https://adafru.it/1aaj) (https://adafru.it/1aaj)

Use It



Now you can use any computer or handheld device to control your LEDs.

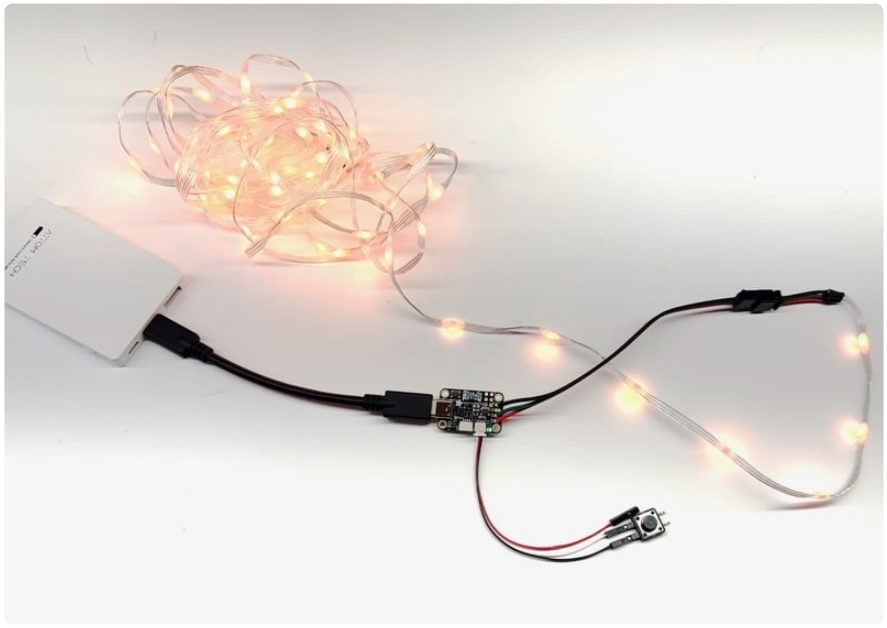
Make sure your device is on the same WiFi network as your board. Navigate to your custom URL (projectname.local/) in a web browser. You'll see a color picker above a whole bunch of color palette choices.

Choose a color, choose an effect, and watch your lights animate and glow!

Save your favorite combinations as presets, create playlists, control the speed and intensity of the animations, and lots more. This web app is incredibly intuitive and easy to use.

Head over to the WLED wiki at https://kno.wled.ge/ (https://adafru.it/11dN) to delve into all the particulars.

Electronics Assembly



Pebble Pixels, also know as Seed Pixels, are a fantastic innovation in smart pixel technology. They're affordable and really robust. With silicone coated wire and resin coated pixels, you'll find that it's very hard to break these things, which makes them perfect for cosplay projects. They aren't as bright as "standard" pixel strips but they're affordable enough that you can pack a whole lot of pixels into your project, and I've found they're plenty bright enough for most dark environments.

They can be a little tricky to solder to, so take a deep breath and give yourself plenty of time.

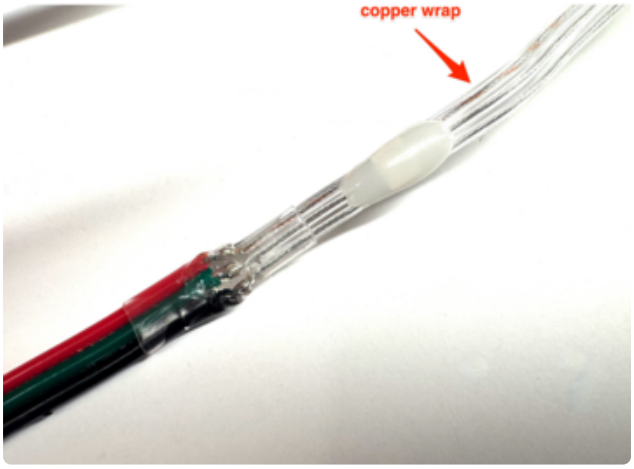
Which Wire is Which?

Take a look at your NeoPixel strand. It ships with a male connector on one end an a female on the other, but no markings telling you which wire is which or how to hook it up. Also, this stuff comes in long strands and you may want to use it for more than one project. You can cut between any two pixels and connect a controller, but that means soldering to these tiny, tricky wires.

NeoPixel strips and strands are directional. There is a data IN end and a data OUT end. The red and black wires could connect at either end, or somewhere in the

middle, and the strip will work fine, but that data wire must be connected at IN end or the pixels won't light up.

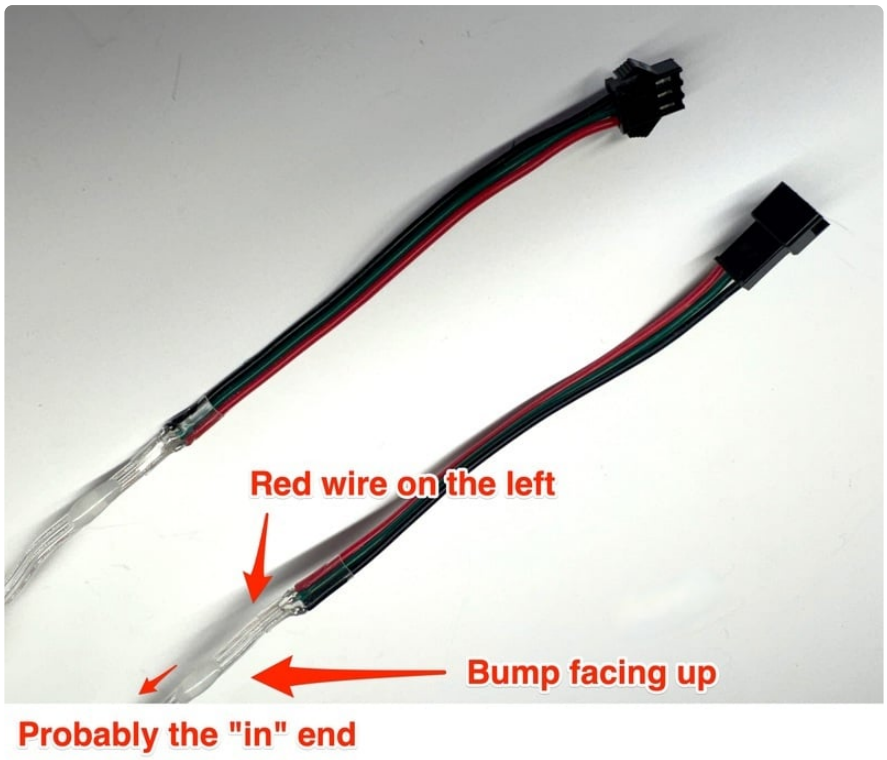
There's no industry standard for which connector comes on the IN end. Some strands of pixels have male on the IN, some have female. This is kind of annoying, since it means we've got a 50/50 chance of guessing right. Here's how to improve those odds.



Step 1: Find the +5V wire. Look closely and you'll see that one of these wires is marked. There's a copper coil, or sometimes some little copper dots, all along one of the wires. This is your +5v wire. It's going to connect to your red wire on the connector, and then to 5v on the Sparkle Motion Mini.

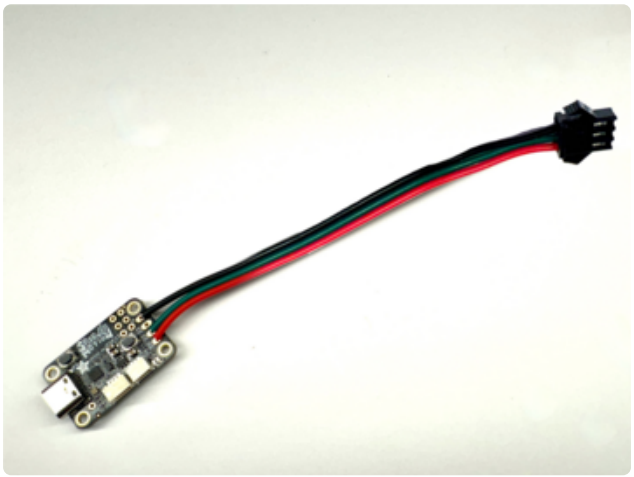
Step 2: Find the data wire and determine the IN end. The data wire is nearly always in the middle of the 3 wires. This is the tricky one, since if you connect to the wrong end the pixels won't work. These pixel strands are all different, and different lots from the same factory are not consistent either.

Here's a good first-guess: with the connector pointing up, arrange the strand so the resin bump is facing you. Find the end that has the striped (5v) wire on the left. This is very likely the "in" end.



For this strand I'm going to guess that my male connector is the "in" connector. Based on this guess, I'll cut off the female connector at the other end of the strand and solder it to my Sparkle Motion board.

Sparkle Motion Board Setup

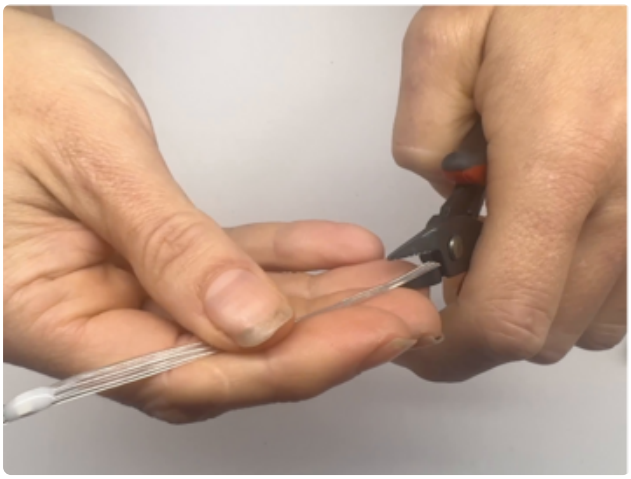


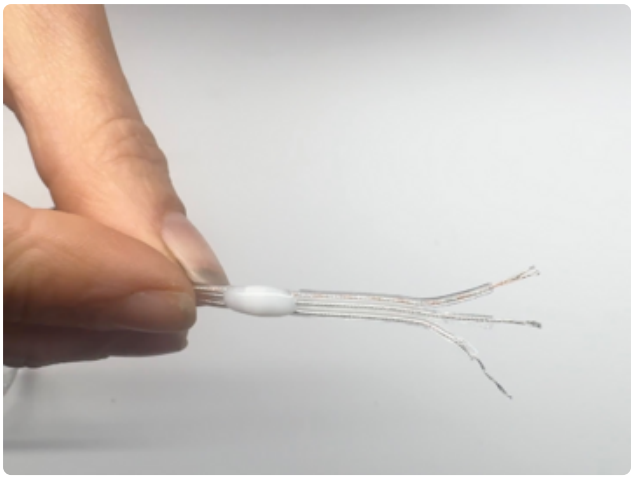
Cut the female connector off the "out" end and solder it to your Sparkle Motion Mini board as shown:

Black wire to **G**
Green wire to **32**
Red wire to **+5v**

If you're using a brand-new strand, you're ready to go. Plug the female connector into the male connector on the strip and move on to the next step.

If your strip doesn't have a connector on the "in" end or if you've cut it off for another project, here's how to solder directly to the wires.



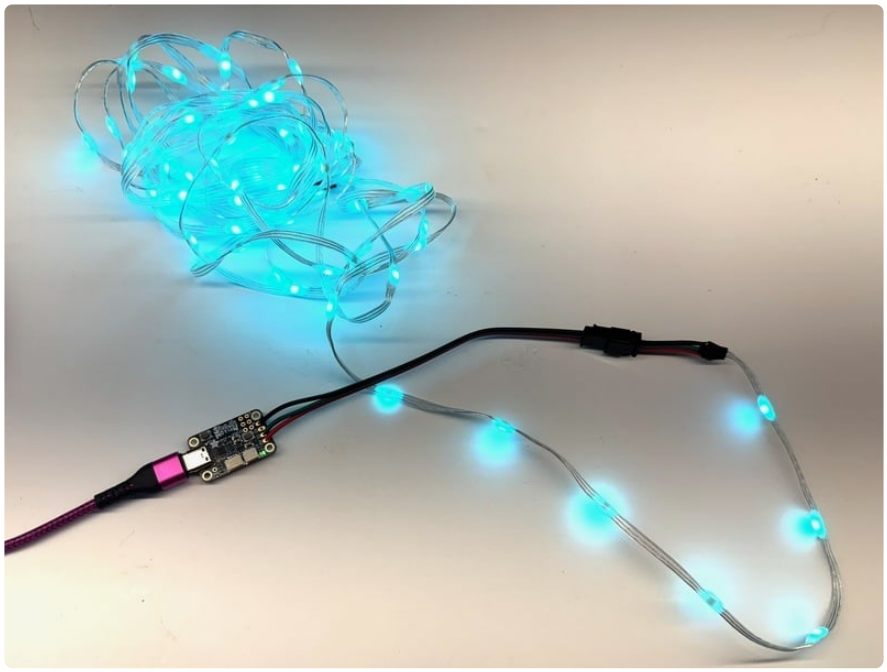


Cut your LED strand right behind one of the pixels to give yourself as much wire to work with as possible. Separate the 3 wires. This is harder than it seems: these wires are solidly stuck together. I found it easiest to use a pair of flush cutters (http://adafru.it/152) to carefully snip in between the 3 wires. These are easily one of my favorite tools!

Then, use a good pair of wire strippers (http://adafru.it/527) to strip about 1/4 of shielding off all three wires.

Strip about 1/4 inch of shielding from your male connector. Slide some heat shrink onto each of your 3 connector wires.

Splice the copper-wrapped wire to the red wire, the middle wire to the green wire, and the third wire to black.



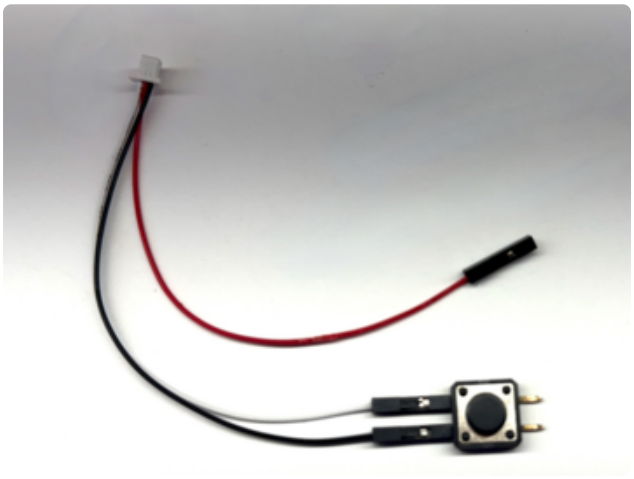
Plug your board into power. It comes pre-loaded with a rainbow animation for your pixels, so if your wiring is correct, your lights should come on. Hooray!

Troubleshooting

If your lights didn't come on, here are a few things to try:

1. Check your wiring! Be sure you soldered to the IN end of the LED strip. These strips can be inconsistent so this is a pretty common problem. Use an alligator clip to try the data wire on the other end.
2. If it won't work with this setup from either end of the strip, try switching the data and ground wires. Then try that from the other end.
3. Make sure nothing is shorting: no bare wires or alligator clips are touching any other bare wires, and there's no solder bridge between the solder pins.
4. You may have a board that doesn't have pre-loaded software. Go through the software install process for WLED and set up pin 32 in LED Settings, then see if the lights work. You need to power the pixels through the board, hooking a battery to the pixels to test for "light up" doesn't work as you need the data streaming also for smart pixels.

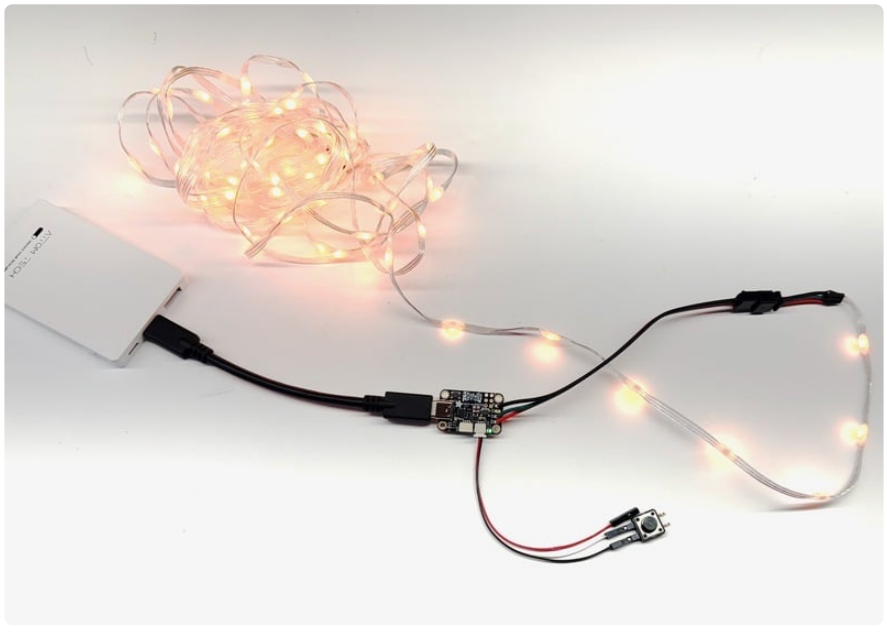
Mode Switch Button



I've added a 12mm momentary switch button to give me some immediate control over my costume. I ended up switching to a panel-mounted rocker switch (https://adafru.it/1acF) for the final build, since it's easier to feel through a few layers of clothing. But this one is easy to set up for testing, and the wiring is the same for either switch.

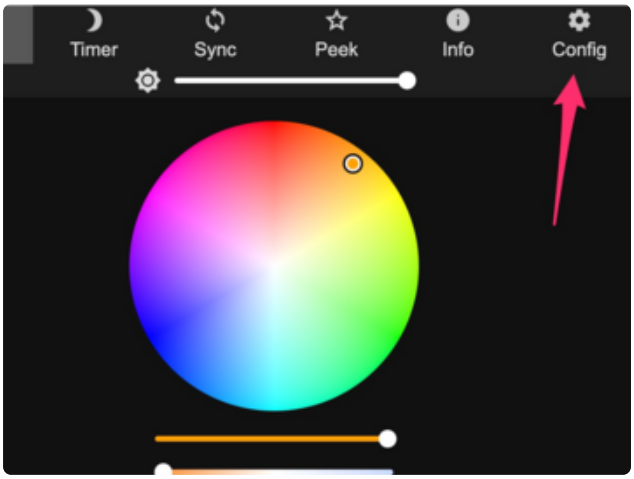
Find your 3-pin mini Stemma connector. Use some pliers to straighten out the legs of your button. If your connector has female sockets, you can just slip the button legs in. Connect one leg of your switch to white and one to black. It doesn't matter which leg goes to which wire, but be sure to use the legs on the same side (the ones going straight across are connected inside, so are really the same leg).

For the final build, we'll cut off the connectors and solder the switch to the project. But for the prototyping phase, this simple setup will work just fine.



WLED Config

Next we'll tell WLED about our physical setup. We'll give our project a name and easy-to-remember URL, and tell the software how many LEDs we have set up on each pin.



WiFi Setup

Head to the **WiFi Setup** screen under Config. This is where your network credentials live, so you can change them if needed. Scroll down to the mDNS field and create a good URL so you can control your project from any web-enabled device. Call it something you'll remember, that's easy to type into any web browser on your WiFi network in order to connect to your project.

In this example, I'd go to my web browser on my phone, ipad, or computer, and type in "http://projectname.local" to open up the WLED interface on my screen. Your device must be on the same WiFi network as your board.

LED Preferences

Next, head to the **LED Preferences** tab under the Config menu.

Scroll down to **Hardware Setup**. The Sparkle Motion Mini board has 2 outputs to attach LED strips: GPIO pins 32 and 33.

WLED allows up to 3 strips to be connected at once. The strips can be of different types, lengths, and color order. Select your LED type, length, and GPIO pin. If you have multiple strips connected, click the + button and enter the additional strips in the same way.

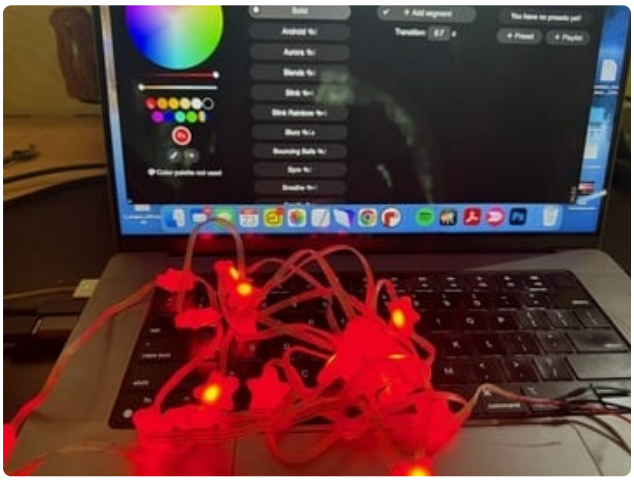
Click "save" and if you've done everything correctly, your light strands should come on in a warm, cheerful yellow color. Success! Time to start making pretty light animations.

Troubleshooting

If your lights didn't come on, here are a few things to try:

1. Head back to WLED and check your pinout configuration under LED Preferences. Be sure the pin number is the correct GPIO for the attachment point you used.
2. Check your wiring! Be sure you connected to the IN end of the LED strip. These strips can be inconsistent so this is a pretty common problem. Use an alligator clip (http://adafru.it/1008) to try connecting the data wire on the other end (the power and ground wires should work from either end).
3. Try re-uploading the WLED software.
4. If the lights come on but you can't control them: i.e. you type in "projectname.local" into your browser and it won't connect, make sure you're on the correct WiFi network. If you're on a different network than the one you set up the sofware on, you won't see the WLED connection.
5. If your lights came on in blue or green instead of yellow, your color order is wrong. See below to fix.
6. If only half your lights came on, be sure you've got the correct number in the "length" field under LED preferences.
7. If your lights came on in a variety of weird colors and looking like a 1950s diner interior, you may have the wrong LED strip type selected. RGBW strips and RGB strips are not the same, so be sure you've got the correct strip type or you'll get very odd behavior.
8. If your microcontroller hangs or keeps rebooting, or gets really hot, you may have the power and ground lines switched. Unplug right away and check: this is a fast way to brick your controller.

Color Order



If your lights have come on in any color other than a warm yellow, there's one more setting to change. LED strips and pixels are not all standardized, and sometimes the red, green, and blue LEDs inside are connected in a different order.

In the main interface window, choose "solid" as your effect and red as your color from the color picker.

If your lights come on in any color other than red, your color order is set incorrectly. This is an easy fix. Head back to the LED settings tab and find the Hardware Setup section (this is where you set up your pin number earlier). Choose BRG from the dropdown, click save, and see if your pixel colors match your color picker now. If not, try another combo until the lights look correct.

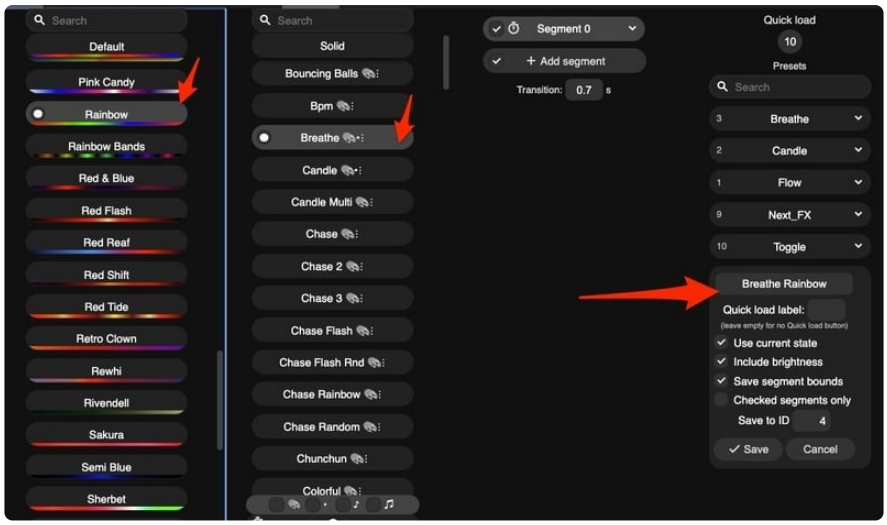
Create Presets

Animation Presets

Once your lights are working, it's time for the fun part: creating light animations using WLED presets. This is easy and intuitive in WLED. Choose a color palette and an effect, then play with the sliders at the bottom of the Effect Mode column to customize the effect.

When you find something you like, click the +Preset button in the Presets tab and give your preset a name, then save it. You can reorder them using the "Save to ID" field.

You can create hundreds of presets using the preprogrammed effects, so take some time to play around and see what looks good on your LED strip.



Create at least 3 presets, and be sure they are saved to ID numbers 1-3. Our next step will be to set up the switch to toggle between these presets.

Control Presets

The WLED preset interface can also be used to send control commands to the LED strip. Once you've set up a button or switch, it can be used for a wide variety of control functions: change modes, change brightness, toggle the lights on and off, or a whole host of other features.

Each button function in WLED has 3 options: a short press, a long press, or a double press. I want my lights to cycle through presets with a short press, and to turn on or off with a long press. Here's how I set up a control preset for each of these features.

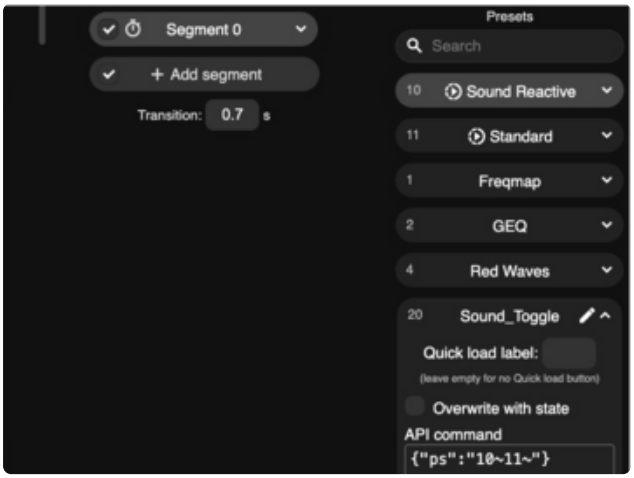
Cycle through Presets

Click +Preset and then uncheck the "Use current state" checkbox. This will open up an API command window within the preset module.

Call the effect "Next_FX" and type {"ps":"1~3~"} into the API command box. This tells WLED to cycle through presets 1-3. If you'd like to cycle through more presets, change the 3 to the number of presets you have.

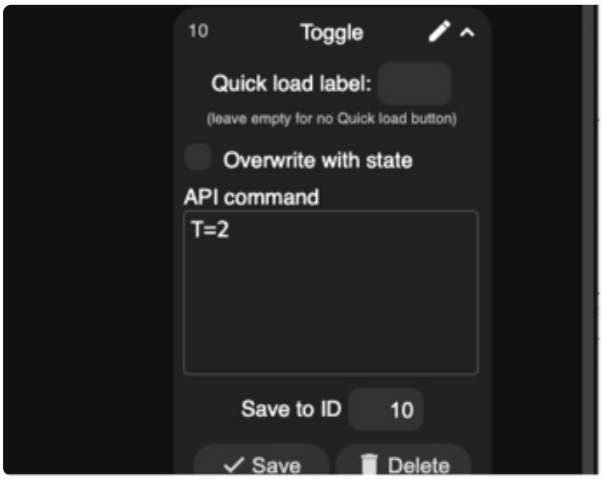
Be sure your preset IDs include all the numbers -- skipping a number will break this command.

Give your preset an ID number that's above the range of your preset numbers -- I called mine 9.



It's also possible to cycle between playlists. I made a playlist of sound reactive effects and a separate playlist of "standard" effects. I set up a preset that toggles between the two playlists -- effectively turning "sound reactive" mode on and off.

Toggle On/Off



Create another preset and call it "Toggle". Uncheck the "use current state" checkbox and enter **T=2** into the API command box. This will tell the LEDs to toggle between on and off. Save this one to ID 10.

On the next page we'll connect these control presets to our button.

Find out more about creating these control presets here:

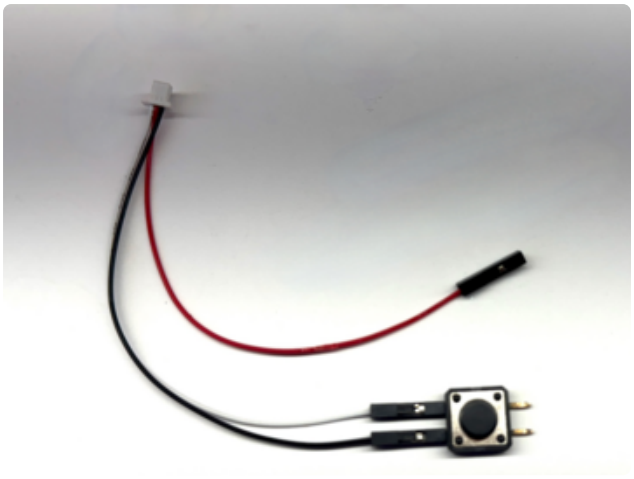
https://kno.wled.ge/features/presets/ (https://adafru.it/1a4F)

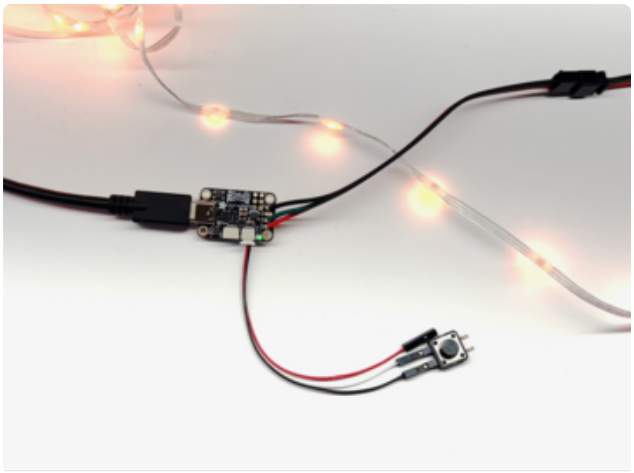
You can enter either JSON commands or HTTP commands into this command box, giving you a lot of control over your WLED project.

https://kno.wled.ge/interfaces/json-api/ (https://adafru.it/1a4G)

WLED Button Setup

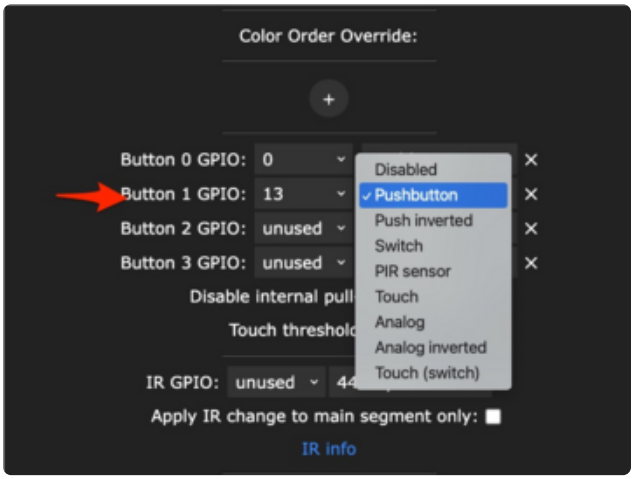
I've added a 12mm momentary switch button (http://adafru.it/1119) connected to a STEMMA JST PH 2mm 3-Pin connector with female sockets (http://adafru.it/3894) to give me some immediate control over my costume. I ended up switching to a panel-mounted rocker switch (https://adafru.it/1acF) for the final build, since it's easier to feel through a few layers of clothing. But this one is easy to set up for testing, and the wiring is the same for either switch.





Find your 3-pin mini Stemma connector. Use some pliers to straighten out the legs of your button. If your connector has female sockets, you can just slip the button legs in. Connect one leg of your switch to white and one to black. It doesn't matter which leg goes to which wire, but be sure to use the legs on the same side (the ones going straight across are connected inside, so are really the same leg).

For the final build, we'll cut off the connectors and solder the switch to the project, but for the prototyping phase this simple setup will work just fine.



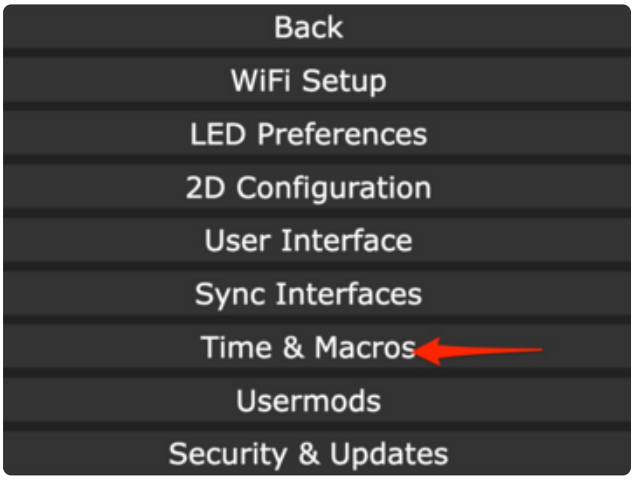
Open up the LED settings screen in WLED under "Config". Scroll to the button setup section and set button 1 to use pin 13, with the type set as "Pushbutton" if you're using a momentary switch. Note that there are a lot of different control methods available here as well: many of these can be connected in the same way.

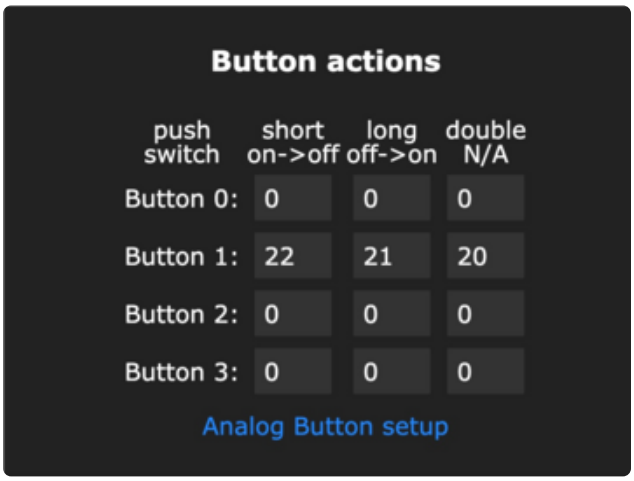
Click save. Try pressing your button and see if your effects change. The default behavior for button 1 is to cycle through effects, but we can change this and set up the button for any number of behaviors using the Presets panel.

I advise against using button 0. WLED's buttons have some default behaviors written in, and one of button 0's default behaviors is that when it's pressed for more than a few seconds, it resets your microcontroller to factory settings. I originally had button 0

selected, and I held the button down a bit too long while I was sewing it onto my project, and .. POOF. All my settings and presets were wiped out.

Check out the "Backup" section under the Additional Settings page to learn to back up your configuration and presets, in case this kind of thing happens to you.





Next, head to the **Time & Macros** config screen. Scroll down to the Button actions area.

For button 1, enter the number assigned to the two control presets you made on the last page. My Next_FX preset is number 22, so I entered 22 under "short press", and my Toggle preset is number 21, so I've got that set up as a "long press".

I also added my playlist toggle to preset 20, so a double-click of my button will turn sound reactive mode on or off.

Troubleshooting

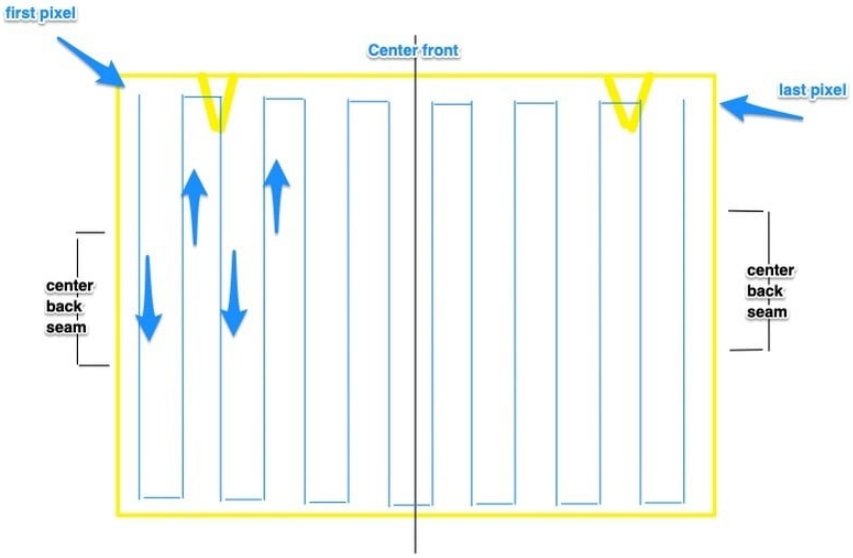
If your button isn't working, here are some things to try:

1. Double check both the LED preferences page and the Time & Macros page to be sure your settings are correct, and have saved. Button 1 should be set up on Pin 13, as a pushbutton.
2. Be sure your presets are correctly numbered. WLED gets confused if the presets have non-sequential IDs (so make sure they're numbered 1, 2, 3 rather than 2, 5, 7).
3. Be sure you're connected to the correct legs on your button. You want the legs on the same side (facing the same way), rather than connecting to the two top legs or the two bottom legs. Those pins are connected together inside the button so won't work when the switch is activated.

Build the Skirt

The LED lights and electronics all attach to an underskirt or slip that can be worn underneath your costume dress. I like this setup because it adds so much versatility: all this hard work can pay off with an unlimited number of dresses, and it's easy to change the colors or programming to match.

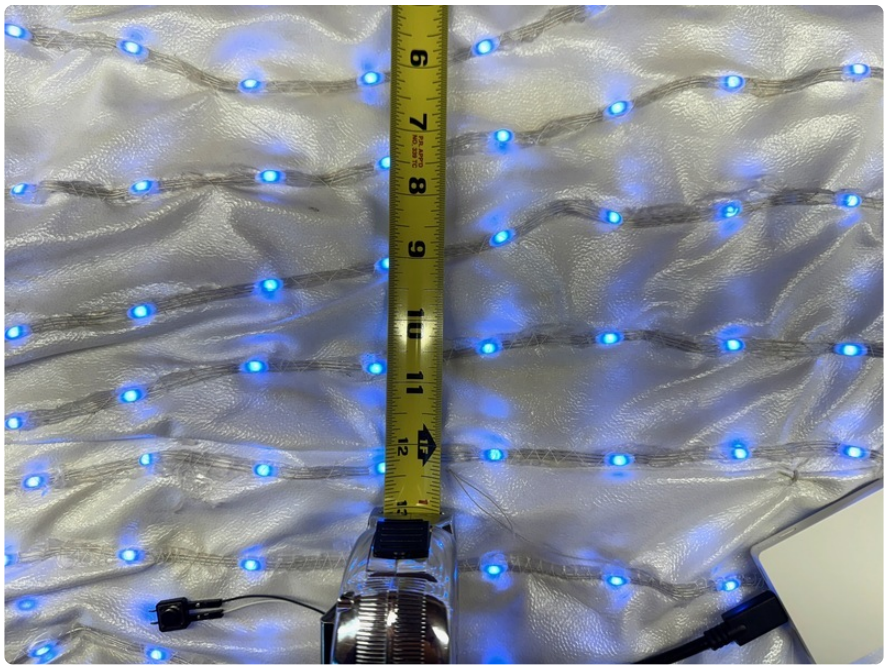
I started with a long pencil skirt that I made myself out of some leftover fabric. There are a lot of simple sewing patterns available online. You can also find already-made pencil skirts on a lot of inexpensive clothing web sites. Look for one with a seam in the center back. I recommend cotton or linen, or another non-stretch, breathable fabric. My skirt is a non-breathable polyester and I really regret this choice when I'm sweating through three diffusion layers.



Sew the skirt together but leave the back seam completely open from top to bottom, to make it easier to lay out and attach the pixels. Or, if you're using a premade skirt or

slip, use a seam ripper to completely separate the back seam. This will enable the skirt to lay (relatively) flat on your table so you can see all sides at once.

Starting in the upper left corner of the skirt (the back center), start to lay out the pixels in a serpentine grid. I used a hot glue gun to temporarily attach the strands down to the skirt. This worked great while I was getting everything laid out.



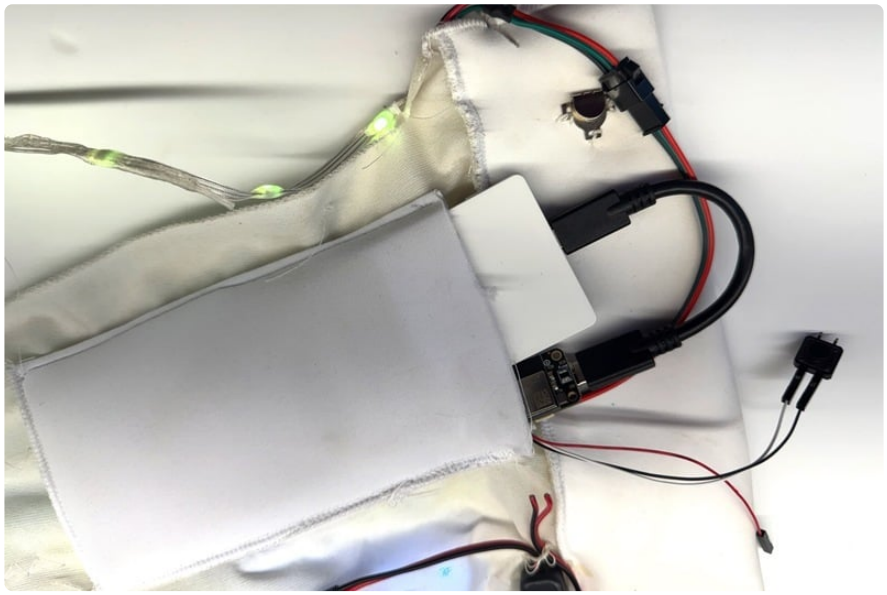
You can make your grid any size. Mine ended up with 19 vertical columns and 20 rows of pixels. This is easy to change and configure in the software so let your costume vision determine the correct number of pixels.

However, you want to get as close to an evenly-spaced grid as possible. These strands have 5cm spacing in between the lights, so I placed the strips 5cm apart on the skirt, so that any four LEDs make a perfect square.

The fabric will move and shift, so you don't need to get this 100% perfect -- it will still look amazing if you're not laser-precise -- but the more evenly spaced you can get the lights, the more options you'll have for really cool animations.

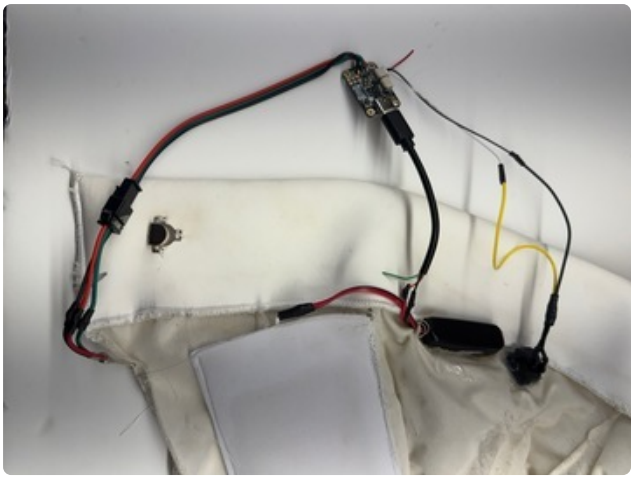
Pay attention to both the vertical and horizontal lines created by the lights. When you get to the top and bottom you'll need to pull the strands around a bit to keep the spacing even on the longer runs. Don't worry about this too much. It's the lights in the center that really matter the most so concentrate on getting those lined up as perfectly as possible.

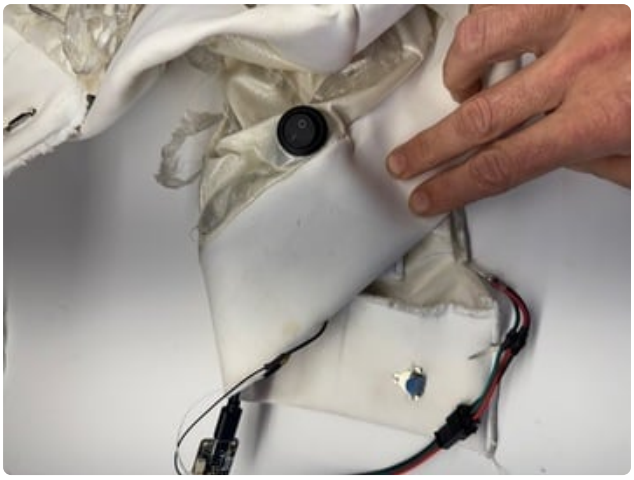
Once you're happy with the layout, use a sewing machine with a wide zigzag stitch to permanently attach the lights to the fabric. You can also use embellishing glue or silicone glue if you aren't a sewer, but glue never holds quite as well as a good ol' needle & thread.



Make a pocket for the battery and microcontroller on the inside of the skirt. I used thick fabric with a little stretch to protect this stuff and keep it from moving around.

I added an elastic waistband with a large hook & eye closure and then sewed up the back seam, leaving the top foot or so open. You can add a zipper or closure here if you'd like.





Costumes break easily, so I wanted to add a more robust mode-switching button, and also an on/off switch that's chunky enough that I can feel it through three layers of costume.

I changed out this rocker switch from Digikey (https://adafru.it/1acF) for the mode-switching button. Since it's an on/off switch instead of a momentary switch, it works a little differently -- if you go this route, select "switch" from the button setup menu instead of "pushbutton".

I also added an on/off switch with a clicky button. I cut my mini USB C cable (http://adafru.it/4472) in half and soldered the red & black wires to the two wires coming from each side of the switch.

Diffusion

This skirt looks great as a grid, but sometimes you want the lights to blend together a bit more. The best way to do this is to add a diffusion layer. I tried a few different options. My favorite is a fluffy tulle crinoline skirt layered with an overskirt. The tulle adds space and good diffusion between the lights and the costume, without adding dark bands the way a hoop skirt does.

Crinolines come in all different lengths and shapes, so do some web searching to find just the right one.

The hoop skirt worked well too, but back-lighting the steel hoops leaves a few black shadow lines in the middle of the light field, which wasn't the look I was going for.

I layered a white ruffled skirt over the top of the crinoline and got a gorgeous diffused look.

For another look, I layered a butterfly wing cape over the crinoline, giving my dress a glowing, pulsing butterfly wing skirt. I also made a "fire" mode on the skirt using WLED's Fire2012 effect and twirled around like Katniss from Hunger Games -- this dress will do that look too. There are endless possibilities!

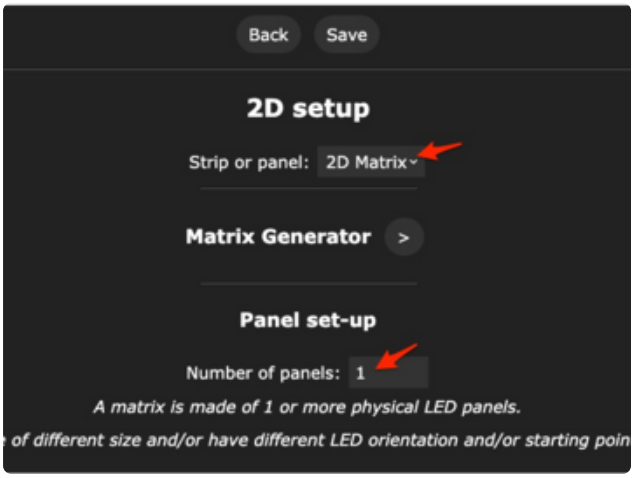
WLED 2d Matrix

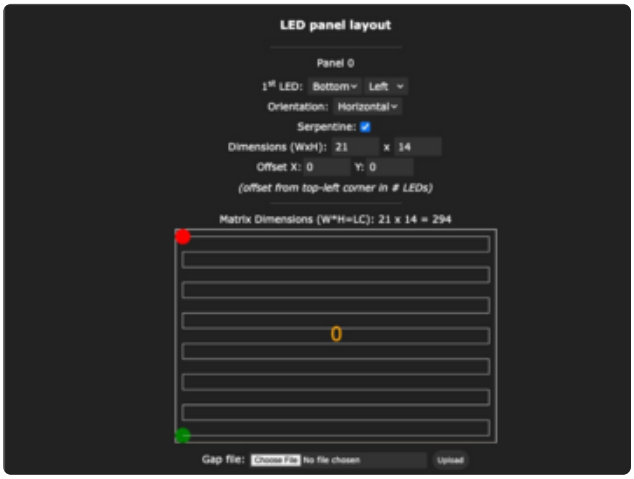
If you're using a 2-d matrix such as an LED curtain or net, WLED has a handy 2d-matrix setup feature that will take care of the mapping for you. Head to Config and choose the **2D Configuration** tab.

Check out these tutorials for more about 2d mapping with WLED:

- Monster Matrix (https://adafru.it/19Kf)

- LED Festival Coat (https://adafru.it/1abX)
- Sound Reactive Top Hat (https://adafru.it/1abY)
- Sparkle Skirt 2D (https://adafru.it/1adD)



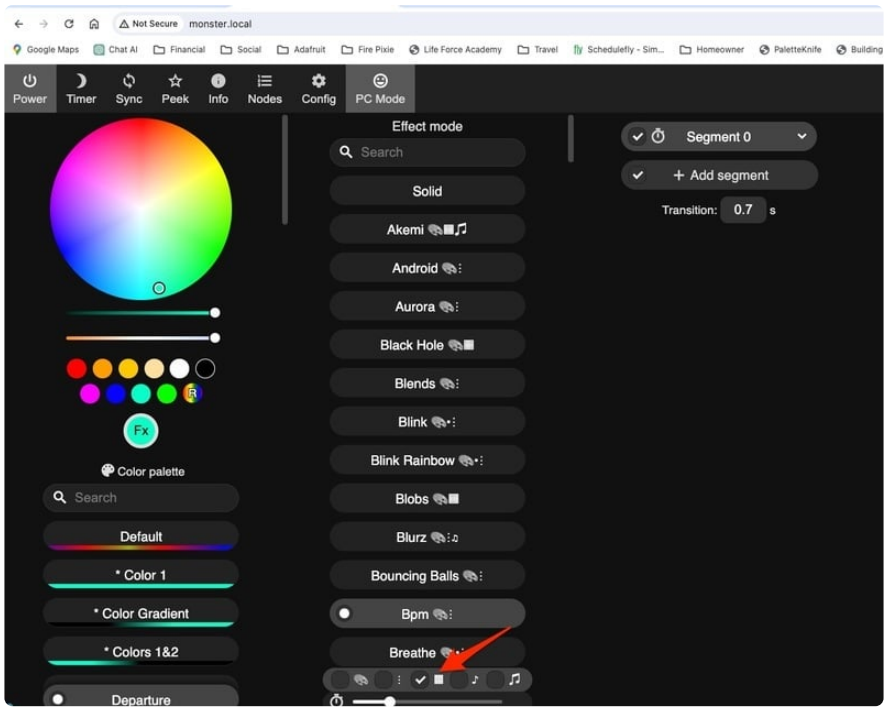


Change the dropdown to read 2d Matrix, and additional options will appear. If you want to sync more than one panel, you can do it here.

Set up your layout numbers to match the number of rows and columns in your project. You can also change orientation here - my pixels start in the lower left corner and finish in the upper right.

Matrix Effects

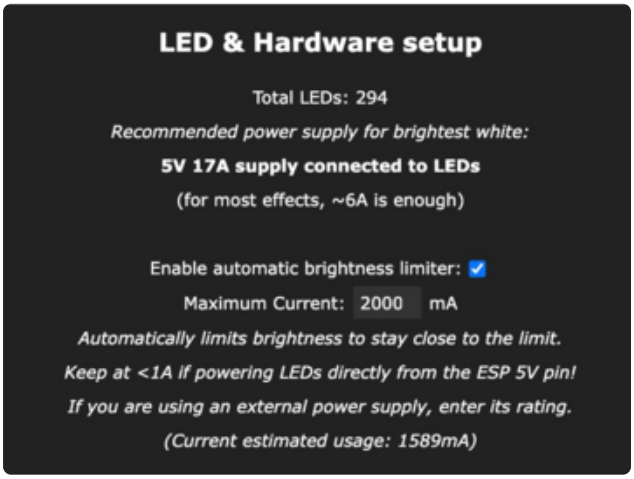
WLED has a hefty number of matrix effects that appear in the list when you've got your 2d matrix set up. Many of them can be customized with speed and intensity sliders, or different color palettes. Go wild!



WLED Additional Settings

Brightness Limiter

Find this on the LED Settings screen.

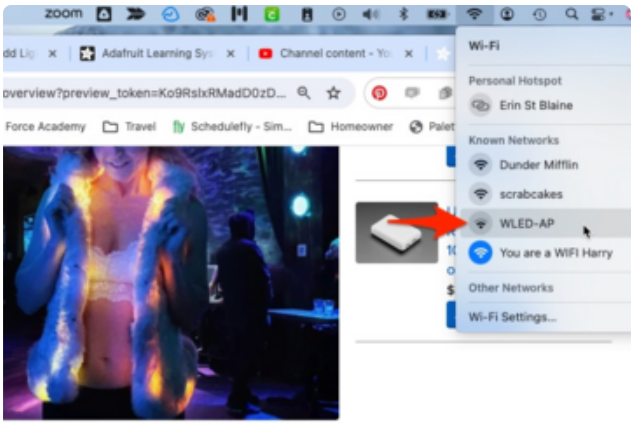


WLED automatically limits the brightness of your project so your power supply doesn't get over-taxed. The default amperage is 850mA, which is a little low for most power supplies.

For some projects, especially battery-powered projects, having the limiter turned on is a good idea. But if you're not getting the brightness you expect, try adjusting this number to match the amperage of your power supply or battery pack.

Access Point (AP) Mode

While you're home, it's easy to control your project over your local WiFi network. But when you're out at a festival you probably don't have WiFi access. It's still possible to connect to your project and control it using WLED's Access Point Mode.



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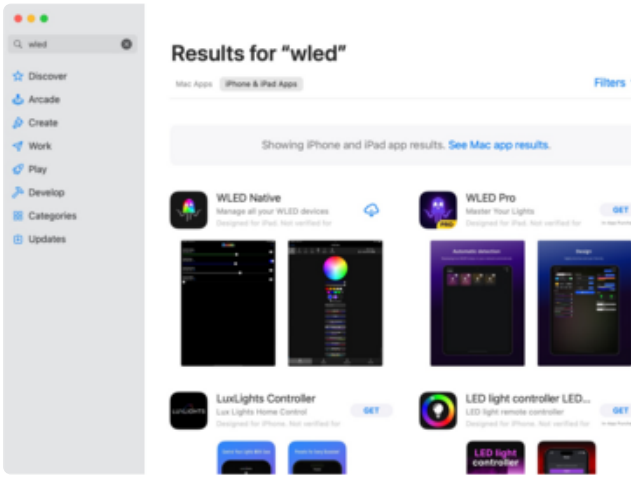
Turn your project on and give it a minute or two to start broadcasting. Look in your WiFi networks and find **WLED-AP** - this is a mini WiFi network being broadcast by the Feather. Connect to it - the default password is "wled123". An instance of WLED will automatically pop up and you can control your project from anywhere.

If you're putting your lights up in public, it's a good idea to change the AP Mode default password so strangers can't log in and control your lights. This could be a security risk.

AP Mode only broadcasts for a few minutes after you boot up the board so if you don't see the WLED-AP network try rebooting.

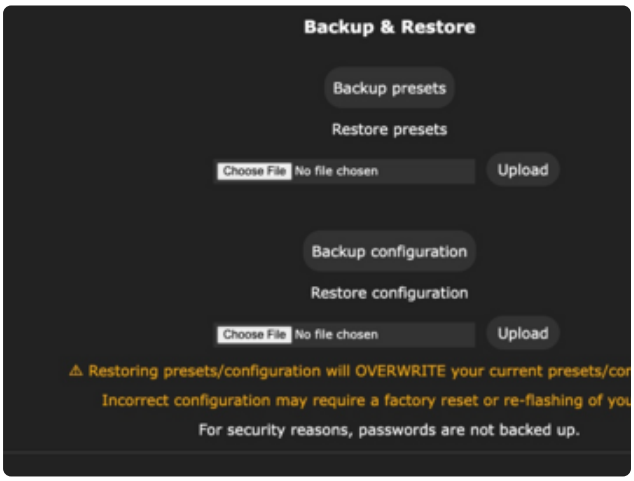
WLED App



There are a couple different apps available to manage your WLED projects. Name and organize your projects, and find them quickly without having to type in a URL. Check the Apple or Android store for downloads.

My favorite is "WLED Native". It allows you to organize multiple instances and easily switch between devices without having to remember any URLs.

Backup Config & Presets



Under Config / Security & Updates you will find a place to back up your data. It's a good idea to back up your config file as soon as you're happy with the settings. Save it as a .json file on your computer. Now you can prototype and experiment to your heart's content, and if everything breaks, just re-upload this file. Or, if you're doing another build you can use this feature to copy all your settings from one board to another.