Starlight Groove Tutu – Sound-Reactive LED Skirt

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https://learn.adafruit.com/starlight-groove-tutu-sound-reactive-led-skirt

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Overview

Bring a little magic to the dance floor with the **Starlight Groove Tutu**—a twinkling, sound-reactive skirt that turns music into light. This project uses two strands of star-shaped NeoPixels to create a constellation of color that sparkles, pulses, and dances along with every beat. Whether you're heading to a festival, lighting up a performance, or creating something special for your favorite little ballerina, this tutu will make you shine.

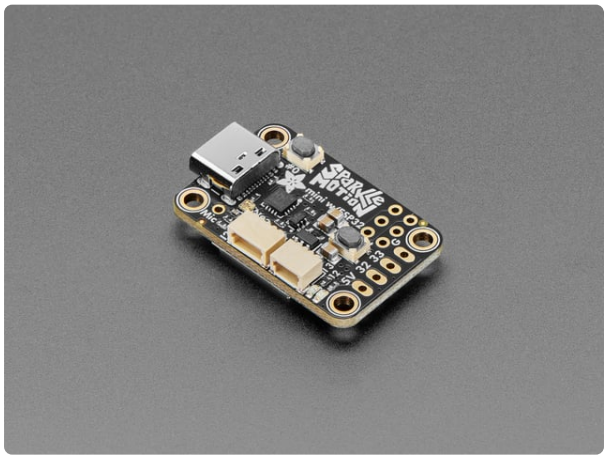
The build is beginner-friendly and designed to be approachable even if you’re new to wearable electronics. A **Mini Sparkle Motion** controller and a simple USB battery pack keep things compact and easy to power, all tucked neatly into a small case. If you choose to use the Mini Sparkle Motion board with a screw terminal, there’s no soldering required, and the wiring is straightforward—most of the work is just a bit of sewing to attach the pixels securely to your tutu.

This project uses the Mini Sparkle Motion ESP32 board as the light controller, and it comes in two versions: one with screw terminals and one with solderable pins to connect the pixels. If you don't want to solder, choose the screw terminal version -- though for wearables that get wiggled around a lot, I've found I get a better, more stable connection when using the solder holes.

This board is fantastic for beginner LED projects because it will run WLED, a free, open-source LED control program that's easy to install and easy to use with no

coding. This program will tap in to the Sparkle Motion's onboard microphone, giving you sound reactive modes that work right away, without having to hook up an external microphone. And it works over WiFi, so you can control your lights from your smart phone!

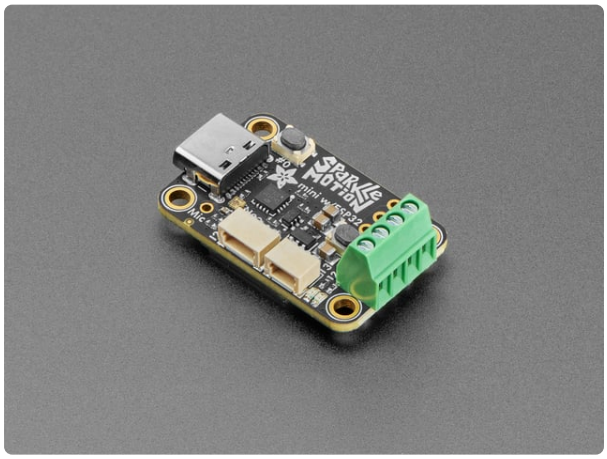
Parts



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



Mini Sparkle Motion with Pre-soldered Terminal Block

The Adafruit Sparkle Motion Mini is part of our series of "Sparkle Motion" boards, which are our attempt to make the best...

https://www.adafruit.com/product/6314

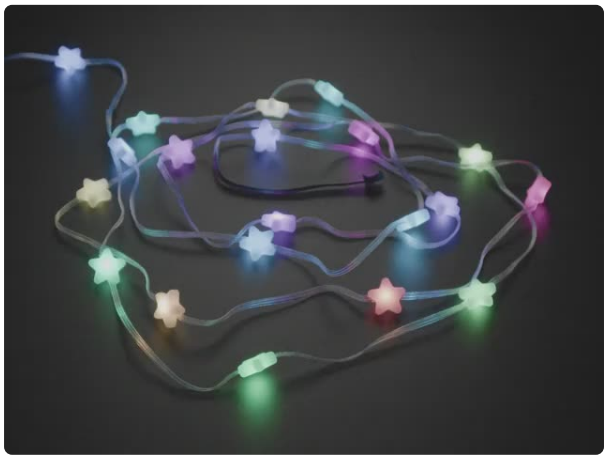
For wearable projects, this snap-on enclosure is a must. It will protect your board and connections and make it more likely that your tutu will sparkle all night long with no broken wires.

Snap-on Enclosure for Adafruit Mini Sparkle Motion

Here is a cute and minimal enclosure for your Mini Sparkle Motion - WLED-friendly ESP32 NeoPixel LED Driver to keep it safe...

https://www.adafruit.com/product/6299

Star pixels make this tutu twinkle and shine! Take a look in the shop -- these also come in little ball (http://adafru.it/5984) shapes or heart (http://adafru.it/5983) shapes, so choose the ones your heart is yearning for.



Adafruit NeoPixel LED Star Shape Pixel Strand - 20 LEDs

Attaching NeoPixel strips to your costume can be a struggle as the flexible PCBs can crack when bent too much. So how to add little shooting stars of color? Use these stranded NeoPixel...

https://www.adafruit.com/product/5982

We'll power this project with a USB battery, so this USB power switch will plug right in -- and it's chunky enough that it's easy to find in the tutu -- you can feel it right through the skirt.

USB Cable with Switch

Add a power switch to any USB-powered project simply by plugging this between the USB power port and the USB cable. This is the most useful thing you never knew you needed! You'll...

https://www.adafruit.com/product/1620

To plug from the switch into the board, you can use a USB C to A adapter (https://adafru.it/1aDi) (I like this one since it has a right-angle connector), or get this short USB-C to USB-A cable for more placement flexibility and reach.

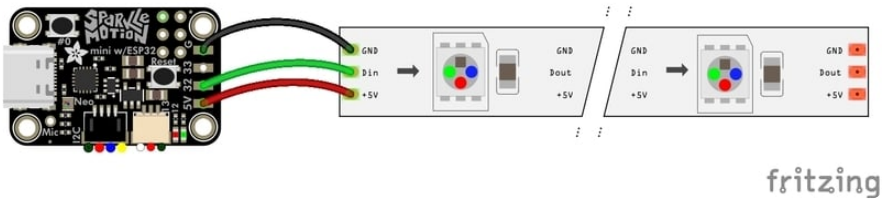
1 x USB A to C Cable https://www.adafruit.com/product/4472

USB Type A to Type C Cable - 6" long

You'll Also Need

- A tutu! I ordered this Rainbow Tutu from Amazon (https://adafru.it/1aDj)
- A USB Battery pack - this one is my favorite (https://adafru.it/1aDk)
- A small piece of fabric to make a battery pocket
- A needle and thread
- Sewing pins
- A sewing machine (helpful but not necessary)
- If you're using the screw terminal version of the Sparkle Motion, you'll need a tiny flathead screwdriver (http://adafru.it/424)
- If not, you'll need a soldering iron & accessories
- A pair of wire cutters / strippers (http://adafru.it/527)

Wiring Diagram



The three wires from the star light strand will connect to the three pins on the Mini Sparkle Motion as follows:

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

The project will be powered through the USB port on the Sparkle Motion -- plug in your USB C/A adapter, then your switch, then your battery.

WLED Installation

This page will guide you through how to install WLED on the Mini Sparkle Motion.

The Mini Sparkle Motion has a USB to serial chip which may need a driver installed before you can install WLED. Head over to the How to Install Drivers for WCH USB to Serial Chips (https://adafru.it/-f8) tutorial, and download and install the new driver.

Install WLED

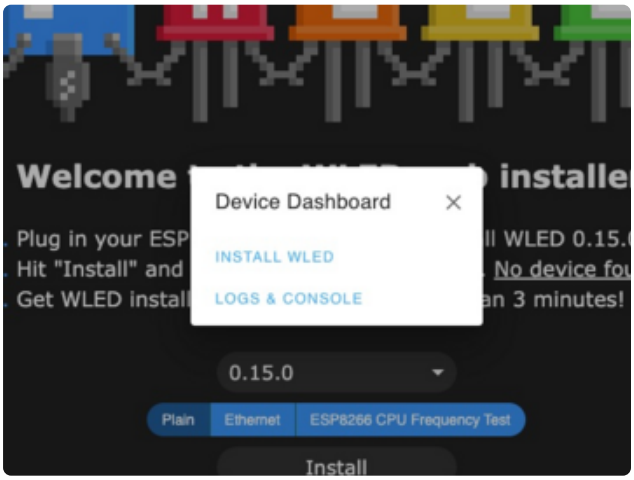
These next steps require a **Web Serial-compatible browser**. As of this writing, that means **Google Chrome**, **Microsoft Edge** or **Opera** “desktop” browsers. Other browsers (Safari, Firefox, Explorer and anything mobile) won’t work.

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.



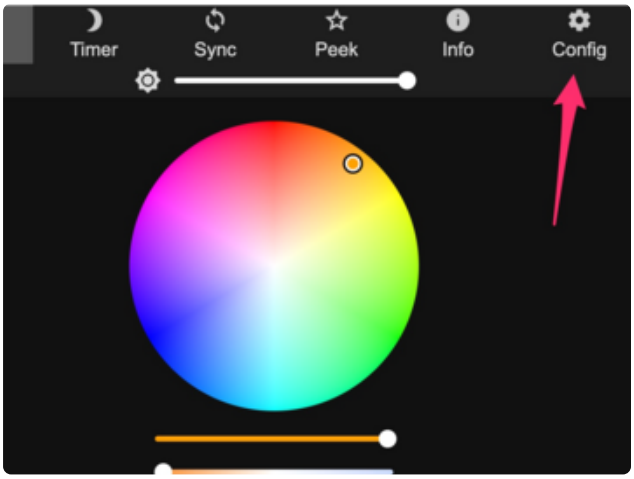
If you don't see the "Connect to Wi-Fi" prompt, you'll need to set up your WiFi network using AP (access point) mode. Open up your WiFi settings and look for a WiFi network called `WLED-AP`. Connect to this network using the default password `wled1234`. The WLED interface will pop up in its own browser.

From here, go into Config/Wifi Settings and enter your WiFi credentials 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

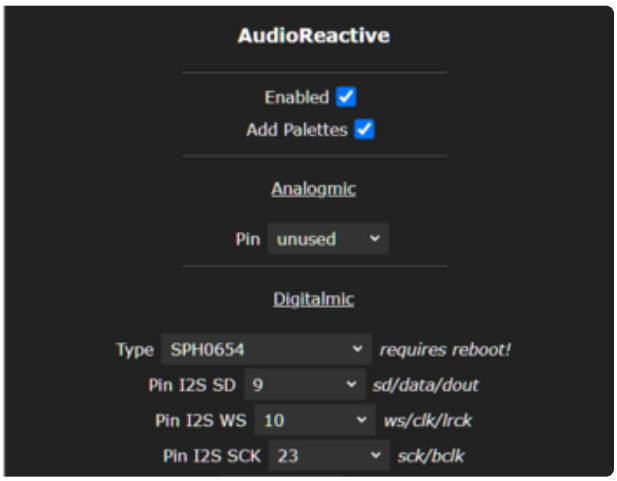
Head to the **WiFi Setup** screen under Config and create a good URL so you can control your project from any web-enabled device. Call it something you'll remember, that's easy to type into any web browser on your WiFi network in order to connect to your project.

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.

Enable AudioReactive Mode

Do this first before setting up your LED preferences with your GPIO number.



Click on "config" and head to the **USERMODS** tab. Scroll down a bit and you'll find the **AudioReactive** section.

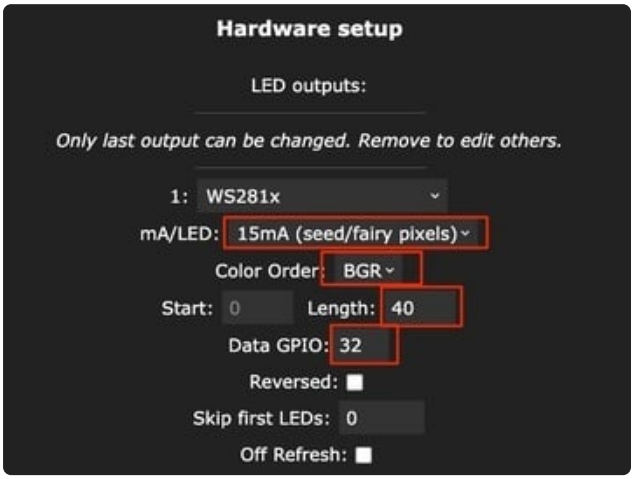
Click the box to enable, then enter the settings and the Digitalmic section as follows:

Type: **SPH0654**
Pin I2S SD: **9**
Pin I2S WS: **10**
Pin I2S SCK: **23**

The other pins are unused.

Reboot your Sparkle Motion Mini for changes to take effect.

LED Setup

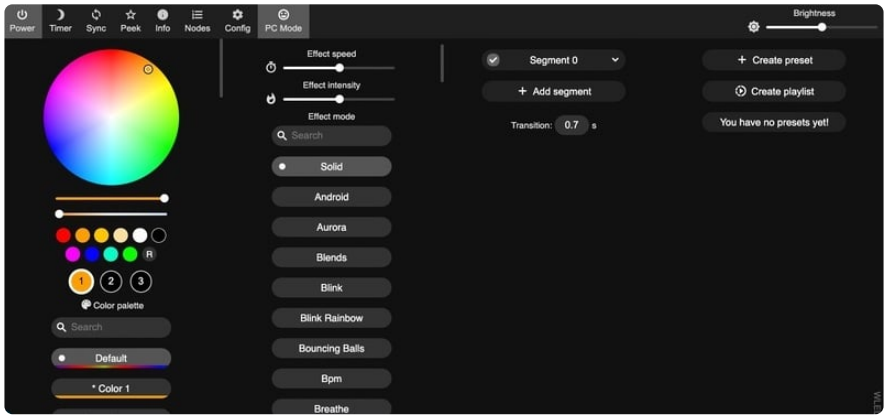


Next, head to the **LED Preferences** tab under the **Config menu**.

Scroll down to **Hardware Setup**. Put your total number of LEDs into the **Length** field (one star strand has 20, so if you're using two, put in 40), and change GPIO to pin **32,** the GPIO NUMBER associated with the LED data pin on your Mini Sparkle Motion. Make sure to select the correct **Color Order** for your LEDs as well. These star-shaped pixels have a color order of **BGR**. You know you've got it right when your pixels come on in a warm yellow.

If the GPIO number appears in red and won't let you select it, check the previous step: this board is configured with pin 32 assigned to the microphone, so you need to change it there before you can set it up as your LED GPIO.

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.

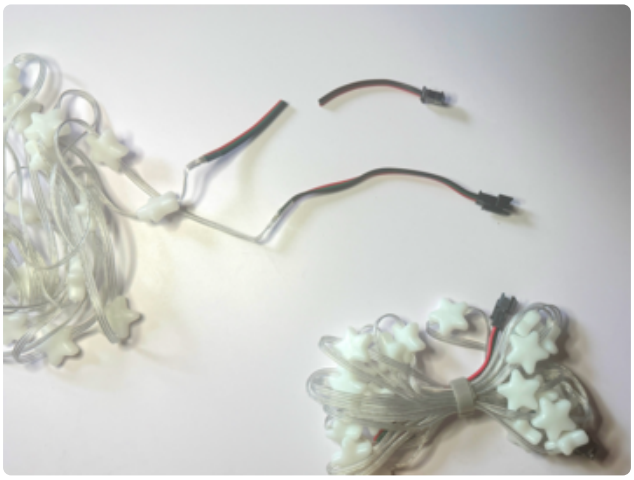
Head over to the WLED wiki at https://kno.wled.ge/ (https://adafru.it/11dN) to delve into all the particulars.

Troubleshooting

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

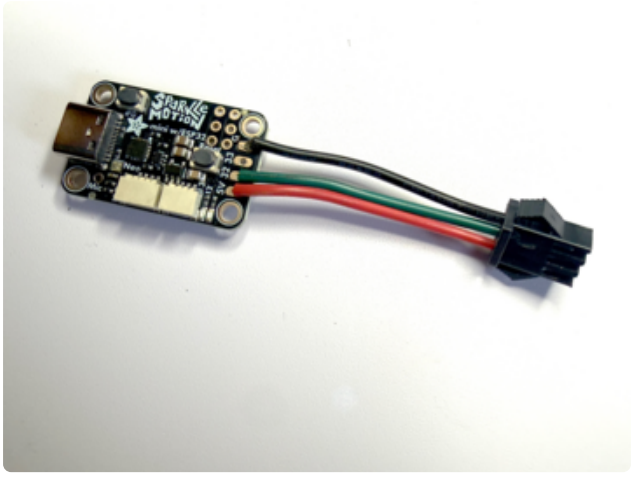
1. Head back to WLED and check your pinout configuration under LED Preferences. Be sure the pin number is the correct GPIO for the attachment point you used.
2. Check your wiring! Be sure you connected to the IN end of the LED strip. These strips can be inconsistent so this is a pretty common problem. 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.

Electronics Assembly



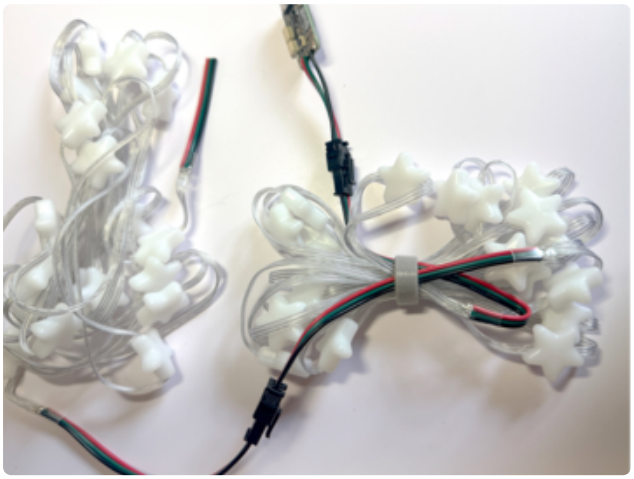
These lights have a male connector on the IN end and a female connector on the OUT end. The strands are directional -- they won't work if you hook up the wrong end.

Cut the female connector (from the OUT end) off one of your light strands, leaving a couple inches of wire attached. This will attach to the connector on the Mini Sparkle Motion to can plug the lights in using the IN end / male connector.



Strip a little bit of shielding from the three wires on your connector and attach them to the Mini Sparkle Motion as shown: red to **+5v**, green to **32**, and black to **G**.

If you have the screw terminal version the connections are the same -- hook them up using your tiny screwdriver.



Plug the Mini Sparkle Motion into your other light strand -- the one that still has both connectors intact. Plug the first strand into the OUT / female plug attached to this strand. The cut off wires will be at the end of the line.

Plug in your USB battery and see if your lights come on. If you've already installed the software and all goes well, they will come on in a warm yellow color. If they come on in a different color, head back to the previous page and find the instructions for fixing the Color Order.

Troubleshooting

If your lights don't come on or behave the way you expect, here are a few things to try:

- Try re-uploading the software
- Make sure your GPIO pin is set correctly in LED Settings -- it should be 32. If you don't reboot the board after setting up the audio reactive stuff, sometimes this won't get saved even if you set it up right.
- Check to be sure you actually connected to pin 32. If you connected to 33, change the number in the software to reflect that.
- If the lights still don't come on, your strand may be wired a different way. Sometimes these strands come with the male on the OUT end and female on the IN. Try switching the connectors around to plug in the other end of the strand.

Sew It Together

Use a small piece of fabric to make a pocket for the battery. Make it big enough that it's easy to get the battery out but not so big that the battery falls out on its own all the time.

Use a sewing machine or a needle and thread to sew the battery pocket to the inside of the skirt's lining, near one of the seams. Sew down three sides, leaving the pocket flap open at the top.

We want the battery and controller and switch on the inside of the tutu lining so it can't be seen, and the lights will go on the outside. Make a hole for the light connector to pass through the skirt near the battery pocket.

I used the buttonhole foot on my machine to make a buttonhole to keep the skirt from ripping around the hole. You can also use a dab of fray check or fabric glue, if buttonhole-stitching is scary. (But .. here's your chance to learn!)

Put your Mini Sparkle Motion inside its case. Plug it in to the switch using your short USB cable or USB C/A adapter. Plug the switch in, and plug the other end into the battery. Plug the lights in to the Mini Sparkle Motion, going through the buttonhole with the connector.

Use a needle and thread or a bar tack setting on your machine to secure the switch and Mini Sparkle Motion enclosure down to the skirt lining.

If you're worried about wires pulling out -- like if this is for a kid -- you can sew another piece of fabric to the lining to cover everything up. Just make sure you can get the battery out for charging.

Flip the skirt around to right-side-out. All the electronics should now be hidden, and just the star strand will be showing.

I found it helpful to have my sewing mannequin, Betty, wear the skirt while I figured out the placement of the stars.

Use sewing pins to pin the strands to the outside of the tutu lining. I used an up-and-down pattern, with three lights going up and three going back down again in a staggered zigzag around the skirt. Get them even by placing the connector between the strands at the other side seam, so you have one full strand across the front and one across the back.

Also note that the stars themselves are directional. The whole star glows but one side glows a little brighter since it's got the face of the LED on that side. I tried to place all the brighter sides facing outwards.

Now it's time to sew the stars in place. First: turn the strand off using the switch and/or unplug the battery. It's fine if you hit the wires with your machine accidentally -- it will still work with a few piercings through the wire, but you don't want your needle to accidentally cause a short circuit by hitting two wires at once. Sew while it's turned off.

I set my sewing machine to a 6mm wide bar tack, which is just wide enough to sew back and forth across the three wire strand without hitting the wires. Place a bar tack everywhere you have a pin, and anywhere else that's needed to keep the wires tight against the skirt.

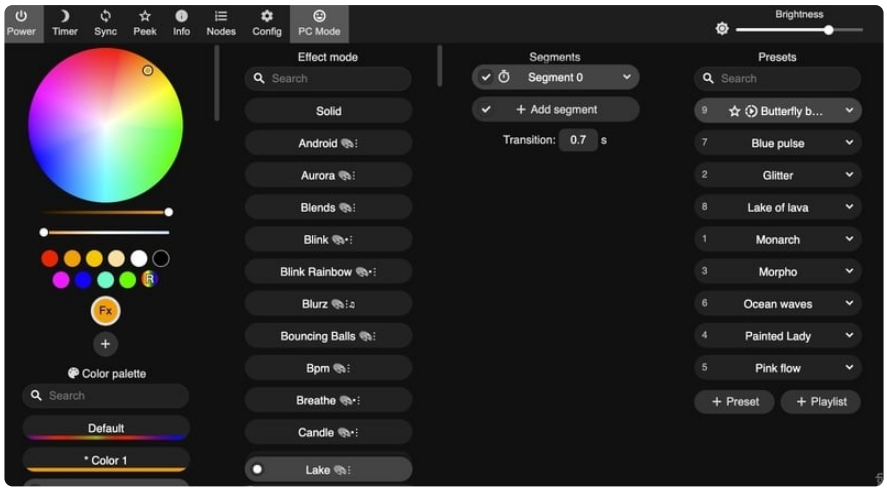
This is also easy to do by hand if you don't have a machine, though it's definitely a bit more time consuming.

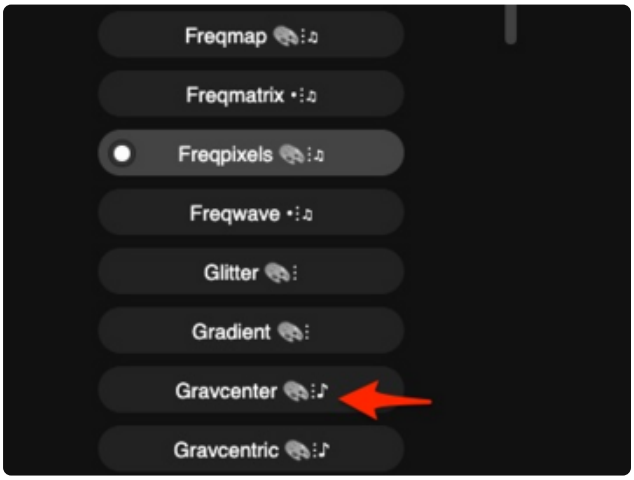
Make sure all your pins are out, flip the switch, and watch your lights glow!

Animations

Creating animations with WLED is fun and easy. I made about a dozen animations using different modes and colors, and created a playlist that cycles through them automatically when I turn the tutu on.

Choose a color palette and an effect and then mess around with the speed sliders until you've got something that looks beautiful on your tutu. I used the "flow" effect a lot with different color palettes for this project.

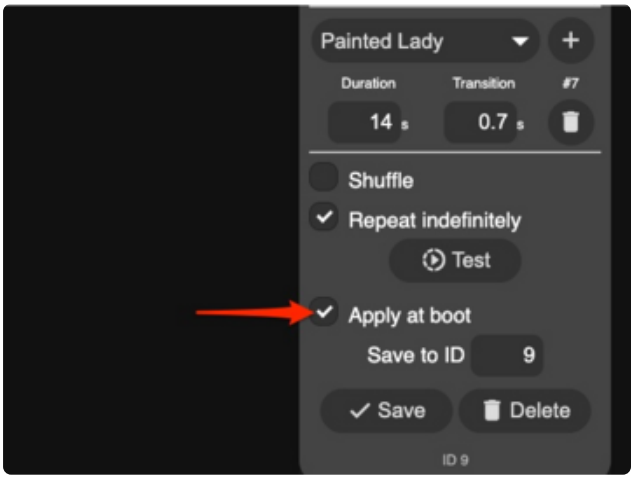




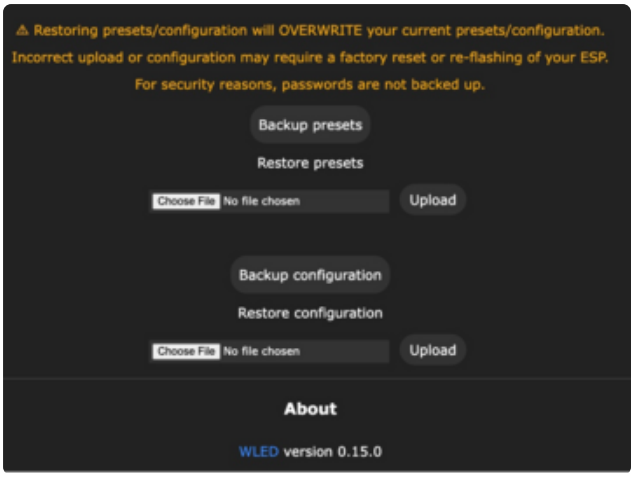
AudioReactive Presets

To use AudioReactive mode, select one of the effects that has a music note next to the name. WLED has a handful of audio-enabled effects you can play with. Try them with different speeds and colors, and try them in different audio environments as well. Some work better at a piano recital and some work better at a noisy festival.

If it doesn't seem to be working, head over to the WLED AudioReactive Settings page to make sure you've got everything set up right.



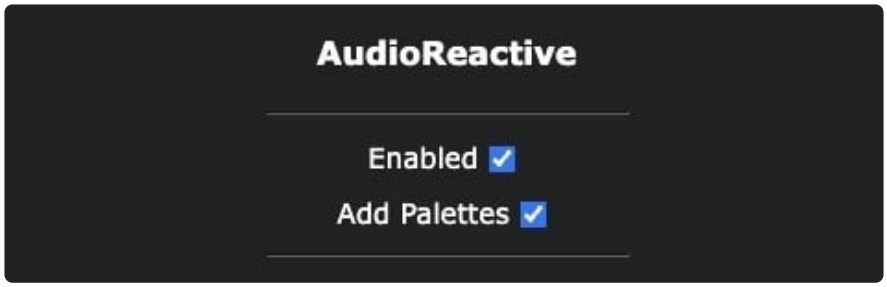
Save your presets into a playlist. You can tweak the amount of time each animation plays for, and change the duration of the transition too. Once you're happy with it, check the "Apply at Boot" checkbox. This will make your playlist start up automatically when the tutu is powered up.



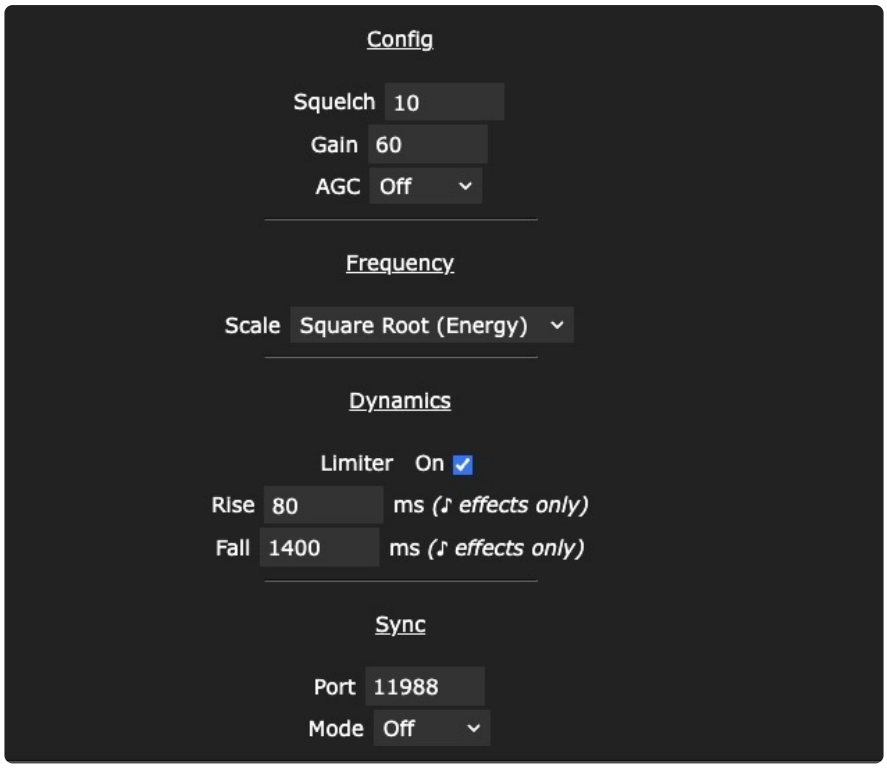
It's a good idea to back up your presets once you're happy with them, in case the board needs a re-install for any reason. Go to config > Security & Updates to find the backup screen.

WLED Audioreactive Settings

Head back to Config / User mods and scroll to the AudioReactive section. To use AudioReactive mode, make sure the **Enabled** box is checked, and check the **Add Palettes** box to make your animations more colorful.



Below the pin setup section you'll find a few more settings you can use to adjust how well your project reacts to sounds in different environments. A few small tweaks can make a big difference in how responsive, smooth, or dramatic your animations feel.



Config

Squelch
This sets the minimum sound level required to trigger a response.

- Lower values = more sensitive (reacts to quiet sounds, but may flicker in silence)
- Higher values = ignores background noise
  Start around **8–12**. If your tutu is glowing when the room is quiet, raise this value.

Gain
This controls how strongly the microphone signal is amplified.

- Lower = subtle response
- Higher = bigger, more dramatic reactions
  A good starting point is **50–70**. If your lights barely react, increase this. If everything is maxed out all the time, lower it.

AGC (Automatic Gain Control)
Automatically adjusts sensitivity based on ambient sound levels.

- **Off** = consistent behavior (best for controlled environments)

- **On** = adapts to quiet vs loud spaces
  For wearable projects, **Off** often feels more predictable, but try turning it on for crowded festivals.

Frequency

Scale
This determines how sound energy is interpreted.

- Square Root (Energy) (recommended): smooth, natural-looking response
- Other modes may feel more reactive or more linear depending on the effect

For most builds, just leave this on **Square Root (Energy)**.

Dynamics

These settings shape how quickly your lights react to sound changes.

Limiter
Prevents sudden spikes from blowing out your brightness.

- **On** = smoother, more controlled visuals
- **Off** = raw, sometimes chaotic response
  Leave this **On** for wearables.

Rise (ms)
How quickly the lights respond to new sounds (like a beat).

- Lower = snappier, more responsive
- Higher = softer, slower ramp-up
  Try **50–100 ms** for a punchy feel.

Fall (ms)
How long it takes for the lights to fade after the sound drops.

- Lower = quick flicker
- Higher = smooth, trailing glow
  Try **1000–1500 ms** for a flowing, magical effect.

Sync

Port
Used for syncing multiple WLED devices together over the network.
You can leave this at the default unless you're running multiple costumes or props.

Mode
Controls whether this device sends or receives sync data.

- **Off** = standalone (most common)
- Other modes = sync multiple devices

Tuning Tips

- For **kids' parties or subtle sparkle**:
  Lower Gain, higher Fall → soft, twinkly glow
- For **festival / dance floor energy**:
  Higher Gain, lower Rise → fast, punchy reactions
- If things feel too chaotic:
  Turn **Limiter On** and increase **Fall**
- If it's not reacting enough:
  Increase **Gain** and lower **Squelch**

Once you dial this in, your tutu will feel less like a light and more like a performer—moving and glowing right along with the music.