LED Masquerade Masks

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https://learn.adafruit.com/led-masquerade-masks

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Overview

Got a costume ball coming up? Learn to adorn masquerade masks with LEDs, three ways! This guide will show you how to make three masks at different difficulty levels:

Super Simple Sequin Mask: A few LED sequins and battery pack, no programming or microcontroller required! Just a little soldering and glueing will get you illuminated accents in under an hour.

NeoPixel GEMMA Mask: If it's color-changing animations you crave, wire up some individual NeoPixels and a GEMMA microcontroller. Use our sample code or write your own animations! 1-4 hours, depending on your soldering experience

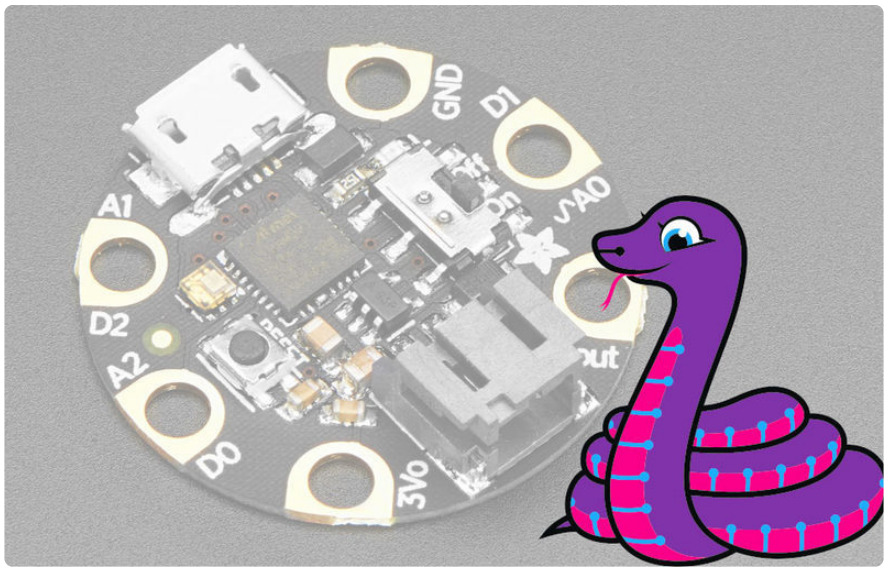
Audio-Reactive Mask: A microphone monitors audio levels and uses loudness to control the brightness of some LED sequins. Use our sample code or mod it up to do something different. 1-4 hours, depending on your soldering experience

Although each mask is made from different electronics components, there are a few tools and supplies that you'll need regardless of design:

- masquerade masks, we got ours at Halloween Adventure (https://adafru.it/iid)
- 30 gauge silicone coated stranded wire (http://adafru.it/2051), in a color to match your mask
- E6000 and Quick Hold adhesives, we grabbed a multipack (https://adafru.it/iie)
- sewing pins for layout/design
- wire strippers (http://adafru.it/527)
- flush snips (http://adafru.it/152)
- soldering iron and tools (https://adafru.it/drl)
- scissors
- Dremel or other rotary tool (optional)
- multimeter (https://adafru.it/dn4)

For the NeoPixel and Audio-Reactive Masks...

This guide was written for the 'original' Gemma board, but can be done with either the original or M0 Gemma. We recommend the Gemma M0 as it is easier to use and is more compatible with modern computers! (The “Super Simple” mask requires no Gemma at all!)



GEMMA M0 boards can run **CircuitPython** — a different approach to programming compared to Arduino sketches. In fact, **CircuitPython comes factory pre-loaded on GEMMA M0**. If you've overwritten it with an Arduino sketch, or just want to learn the basics of setting up and using CircuitPython, this is explained in the **Adafruit GEMMA M0 guide** (https://adafru.it/z1B).

We'll provide sample code for either **CircuitPython** or **Arduino**...use whichever you're more comfortable with!

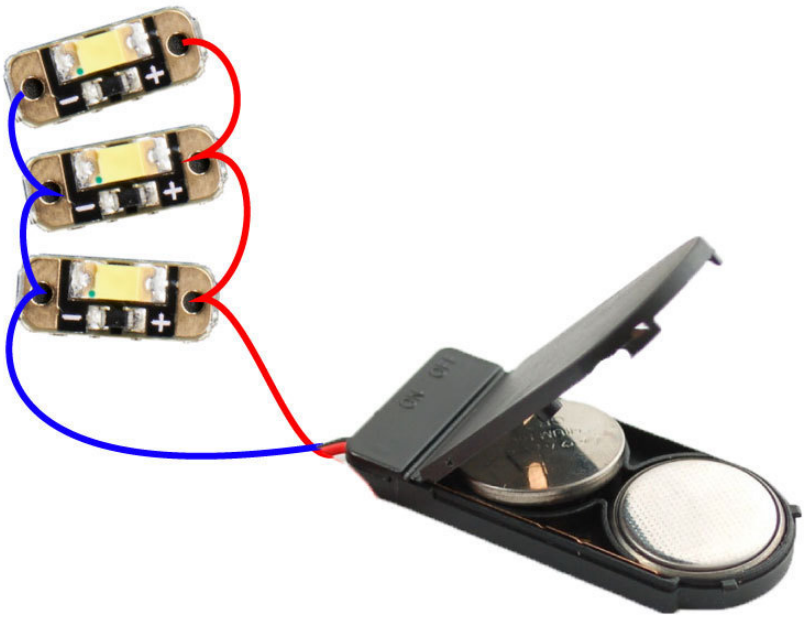
Super Simple Sequin Mask

Ok, let's start with some simple accent lighting! In addition to the supplies listed on the first page, you will need:

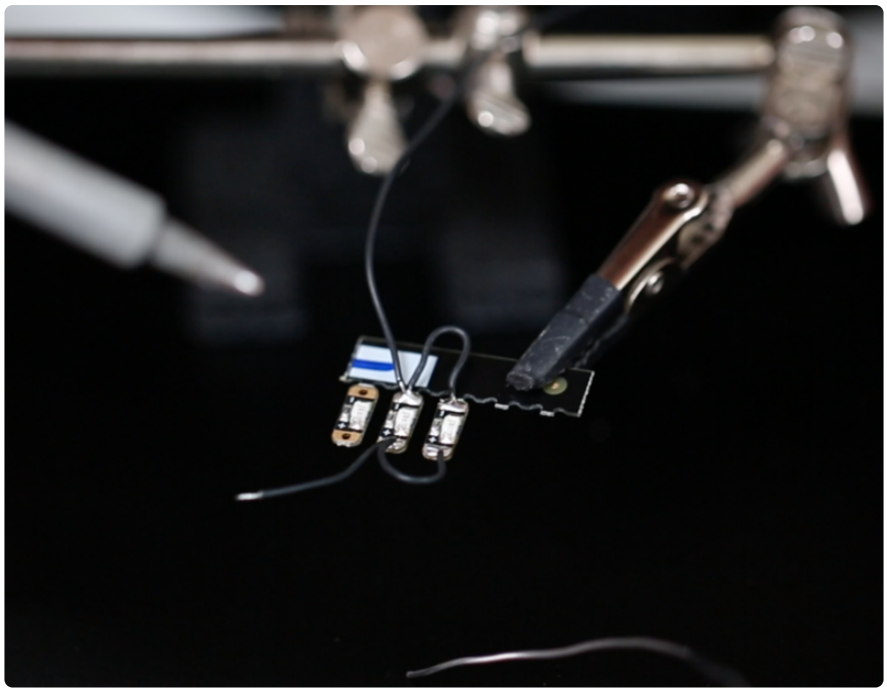
- LED sequins (http://adafru.it/1758) in your favorite color
- CR2032 battery pack with switch (http://adafru.it/783)

- CR2032 batteries (http://adafru.it/654)

This mask has a feather accent that's just begging for LEDs. Decide where your sequins will go, then solder them together with wires in parallel, as shown in the circuit diagram:



Sequins come in sheets of five. If they'll be close together in your design, consider leaving them attached to the sheet as you solder them, since they'll stay put more readily-- you can detach and discard the connecting piece before they go into your mask.



Strip and tin pieces of wire before soldering them them, two at a time in some cases, to your LED sequins. When you get to the end of the chain, repeat with the battery wires, with the red wire connected to the + side of the sequins and the black wire connected to the - (as shown in the circuit diagram).

Heat up your glue gun or find your Quick Hold and glue your sequins into the feather accent.

You can glue the circuit to the outside, or tuck the wires behind the first layer of lace. Power up your battery pack to double check that nothing is blocking the LEDs.

Finally, find a spot for your battery holder. This may be glued inside the forehead of the mask, or in this case, we sandwiched it in between the feather accent and the mask itself using E6000 adhesive (hot glue won't hold here for long). Set it up to dry where it won't slide apart (we balanced our mask on a paper cup), and let it dry for 24 hours.

NeoPixel GEMMA Mask

In addition to the supplies listed on the first page, you will need:

- Individual Flora NeoPixels (http://adafru.it/1260) or Mini NeoPixels (http://adafru.it/1612) to comprise your design
- GEMMA M0 (http://adafru.it/3501) or GEMMA V2 (http://adafru.it/1222) microcontroller
- 150mAh lipoly battery (http://adafru.it/1317) and charger (http://adafru.it/1304)

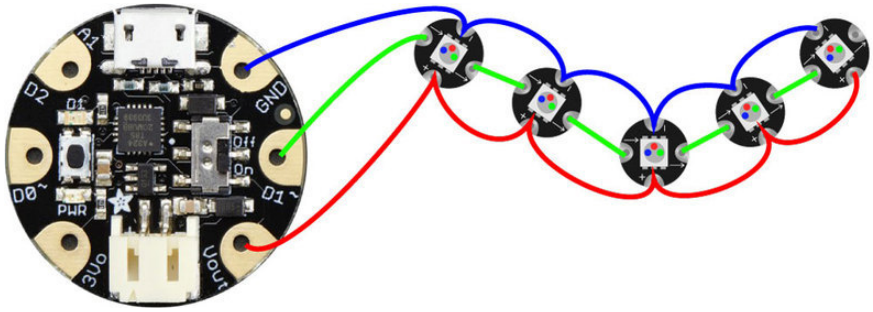
You should also check out the following prerequisite guides:

- Introducing GEMMA M0 (https://adafru.it/yev) or Introducing GEMMA (https://adafru.it/dgH)
- Adafruit NeoPixel Überguide (https://adafru.it/dhw)

and optionally take a look at these projects with nearly identical circuits:

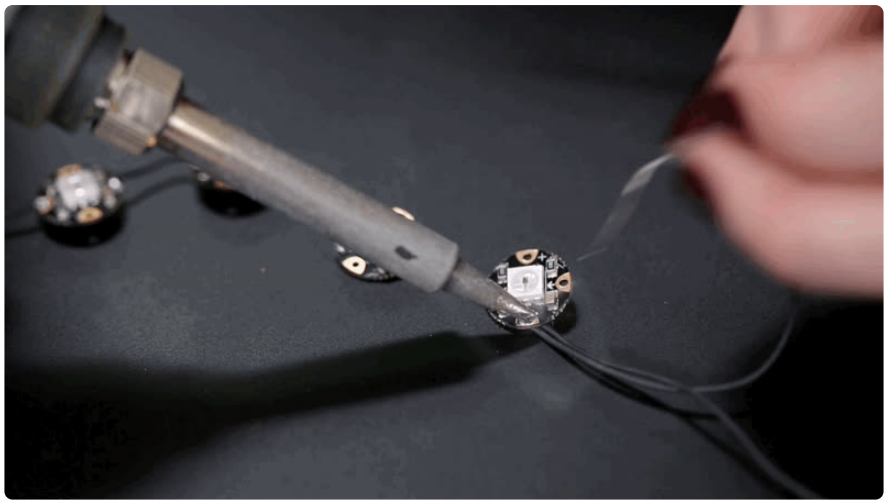
- 3D Printed Unicorn Horn (https://adafru.it/rtb)
- Space Face LED Galaxy Makeup (https://adafru.it/rzd)
- NeoPixel Coat Buttons (https://adafru.it/qze)
- NeoPixel Tiara (https://adafru.it/rza)
- Cyberpunk Spikes (https://adafru.it/tgF)

Use sewing pins to arrange and mock up your design on your mask. Use the circuit diagram below, adding or subtracting NeoPixels to suit your own design.



Wire connections are as follows:

- GEMMA Vout connects to the (+) side of your NeoPixels
- GEMMA D1 connects to the data input of the first pixel
- data output of each pixel connects to data input of next pixel
- GEMMA GND connects to the (-) side of all NeoPixels
- 150mAh (or larger if you prefer) battery plugs in to GEMMA JST port



To ensure you have enough wire slack between pixels for your design, it can be helpful to first solder the data connections, then add the power and ground connections with the circuit in its rough orientation. Don't forget that the power and ground connections need two wires connected at a time, which is easier to do at once instead of separately!

Arduino Code

(CircuitPython code appears further down this page)

Once soldered, plug in your GEMMA to your computer over USB and program it up with the following sample code or any NeoPixel designs you like! Remember that GEMMA's power switch must be in the ON position!

```
// SPDX-FileCopyrightText: 2017 Phillip Burgess for Adafruit Industries
//
// SPDX-License-Identifier: MIT

#include <Adafruit_NeoPixel.h>

#define NUM_LEDS 5 // Number of NeoPixels
#define PIN 1      // DIGITAL pin # where NeoPixels are connected

// IMPORTANT: Avoid connecting on a live circuit...
// if you must, connect GND first.

Adafruit_NeoPixel strip = Adafruit_NeoPixel(NUM_LEDS, PIN);

void setup() {
  strip.begin();
  strip.setBrightness(100); // 100/255 brightness (about 40%)
  strip.show();             // Initialize all pixels to 'off'
}

void loop() {
  for(int j=0; j<256; j++) {
    for(int i=0; i<NUM_LEDS; i++) {
      strip.setPixelColor(i, Wheel((i * 8 + j) & 255));
    }
    strip.show();
```

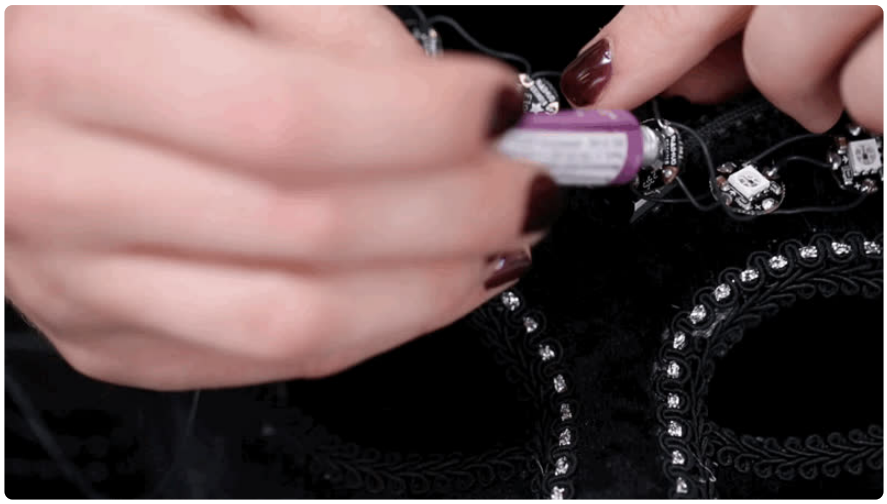
```
    delay(20);
  }
}

// Input a value 0 to 255 to get a color value.
// The colours are a transition r - g - b - back to r.
uint32_t Wheel(byte WheelPos) {
  if(WheelPos < 85) {
    return strip.Color(WheelPos * 3, 255 - WheelPos * 3, 0);
  } else if(WheelPos < 170) {
    WheelPos -= 85;
    return strip.Color(255 - WheelPos * 3, 0, WheelPos * 3);
  } else {
    WheelPos -= 170;
    return strip.Color(0, WheelPos * 3, 255 - WheelPos * 3);
  }
}
```

CircuitPython Code

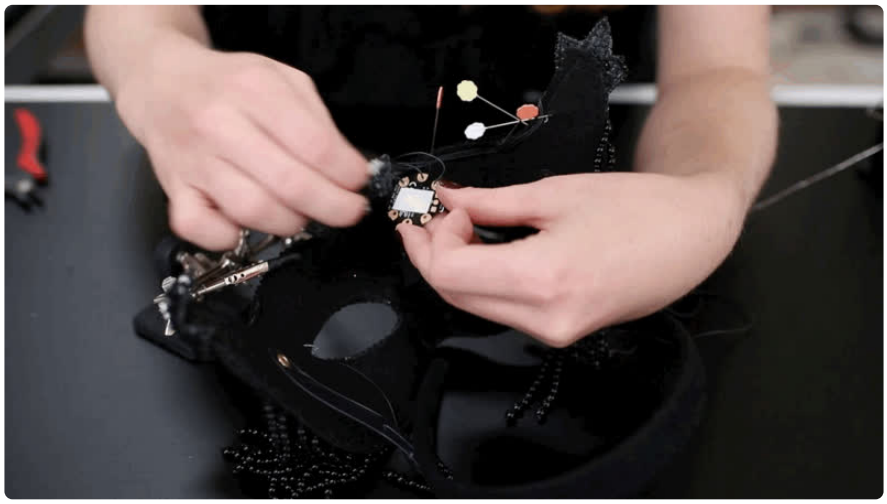
Below is CircuitPython code that works similarly to the Arduino sketch shown above. To use this, plug the GEMMA M0 into USB...it should show up on your computer as a small **flash drive**...then edit the file "**main.py**" with your text editor of choice. Select and copy the code below and paste it into that file, **entirely replacing its contents** (don't mix it in with lingering bits of old code). When you save the file, the code should **start running almost immediately** (if not, see notes at the bottom of this page).

If GEMMA M0 doesn't show up as a drive, follow the Introducing GEMMA M0 guide link above to prepare the board for CircuitPython.

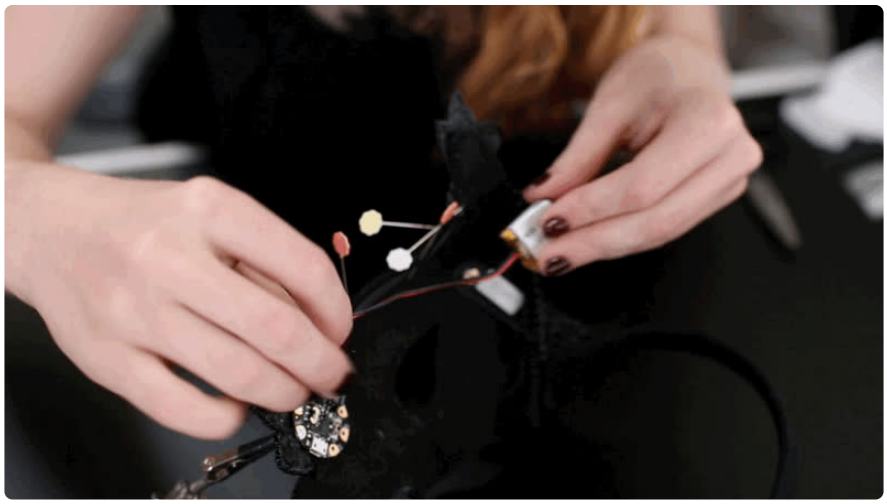
```
# SPDX-FileCopyrightText: 2017 Phillip Burgess for Adafruit Industries
#
# SPDX-License-Identifier: MIT

import time
from rainbowio import colorwheel
import board
import neopixel

numpix = 5  # Number of NeoPixels
pixpin = board.D1  # Pin where NeoPixels are connected
hue = 0  # Starting color
strip = neopixel.NeoPixel(pixpin, numpix, brightness=0.4)

while True:  # Loop forever...
    for i in range(numpix):
        strip[i] = colorwheel((hue + i * 8) & 255)
    strip.write()
    time.sleep(0.02)  # 20 ms = ~50 fps
    hue = (hue + 1) & 255  # Increment hue and 'wrap around' at 255
```



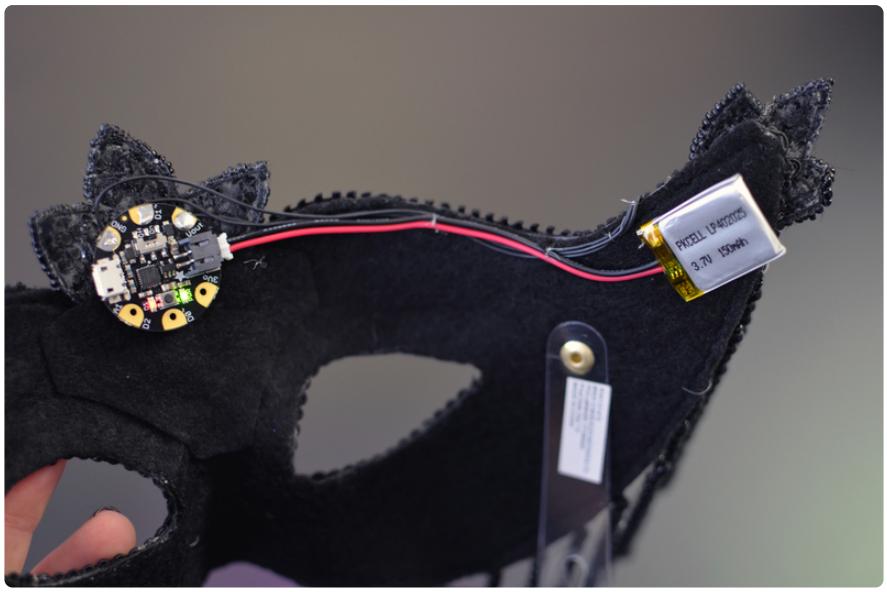
Once you've verified your circuit works, glue it up to your mask and route the GEMMA wires around to the back.



Use more glue or foam/velcro tape to put GEMMA in place.

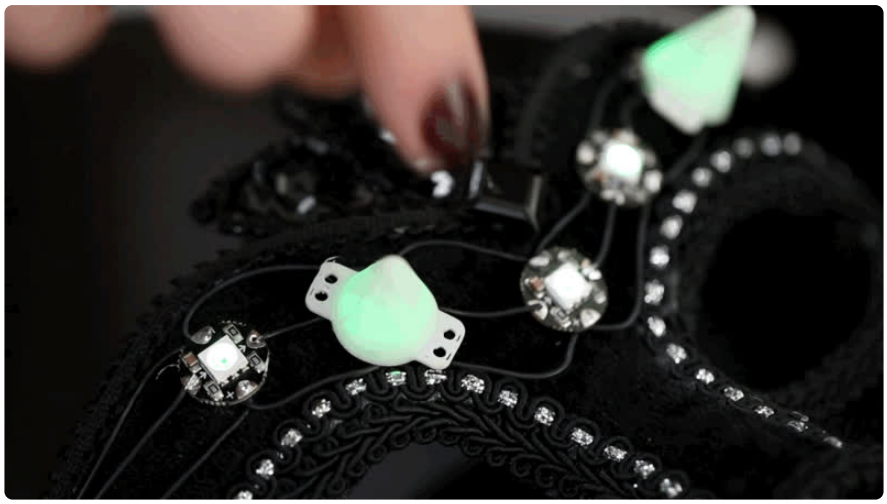


Velcro tape is best for securing the battery, so that you can remove it for charging (GEMMA does not have onboard lipoly charging for your safety).



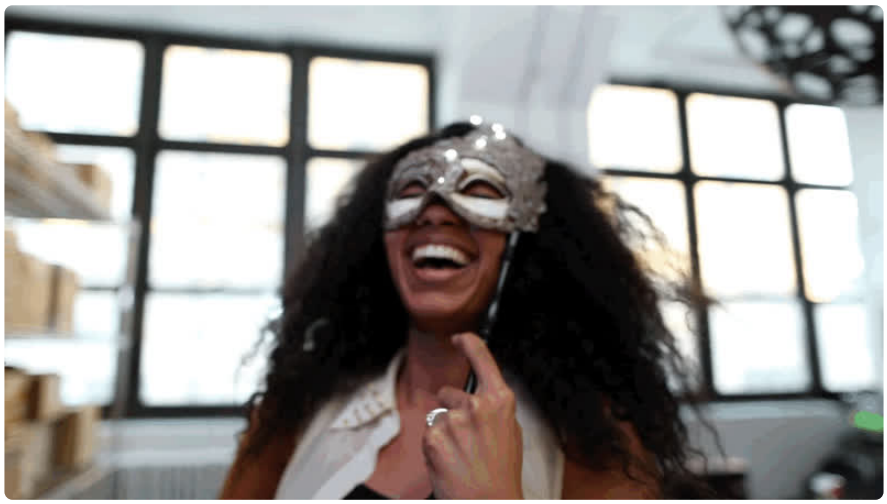
Use clear or color-coordinging thread to tack the wires to the mask for a clean finish.

You can optionally use 3D printed diffusers to deck out your NeoPixels even further! Browse our Thingiverse page (https://adafru.it/iiA) for multiple available designs.



Learn more in our NinjaFlex guide (https://adafru.it/tEB).

Audio-Reactive Mask



This mask reacts to sound! Five LED sequins are wired up to a GEMMA and microphone. In addition to the supplies listed on the first page, you will need:

- LED sequins (http://adafru.it/1758) in your favorite color
- GEMMA M0 (http://adafru.it/3501) or GEMMA v2 (http://adafru.it/1222) microcontroller
- MAX 9814 (http://adafru.it/1713) or MAX4466 (http://adafru.it/1063) electret microphone amplifier

You should also check out the following prerequisite guides:

- Introducing Gemma M0 (https://adafru.it/yev) or Introducing GEMMA (https://adafru.it/dgH)

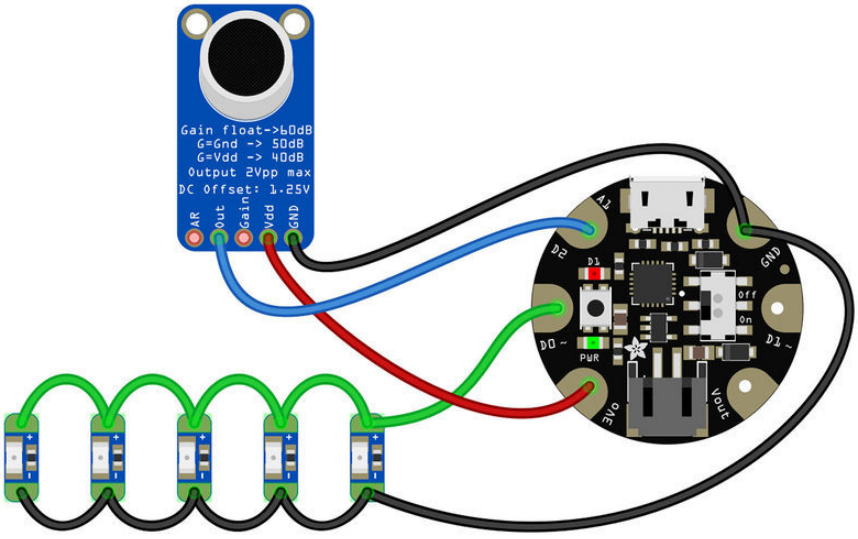
- Adafruit LED Sequins (https://adafru.it/iSf)
- Adafruit Microphone Amplifier Breakout (https://adafru.it/rdr)
- Adafruit AGC Electret Microphone Amplifier - MAX9814 (https://adafru.it/Cgb)

and optionally take a look at these similar projects for inspiration:

- Ursula Seashell Necklace (https://adafru.it/tgE)
- VU Meter Baseball Hat (https://adafru.it/tha)
- 3D Printed LED Microphone Flag (https://adafru.it/Cgc)
- Sound Reactive Drums (https://adafru.it/Cgd)

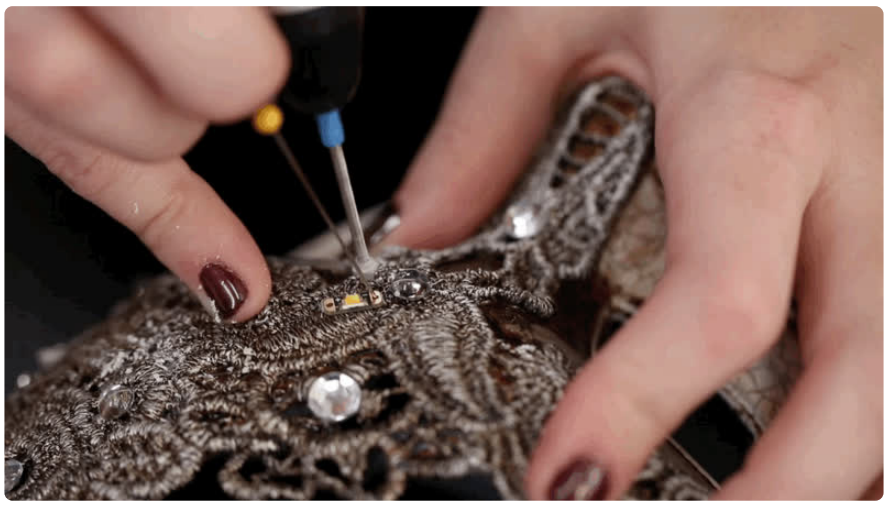
By measuring audio levels in the room, we can use that measurement to control the brightness of the LEDs, giving a pulse-with-the-music effect! Use sewing pins to mock up your sequin design on the mask:

Check out the circuit diagram to get an idea of how the sequins can be arranged-- the positive sides (+) should all face the same way:

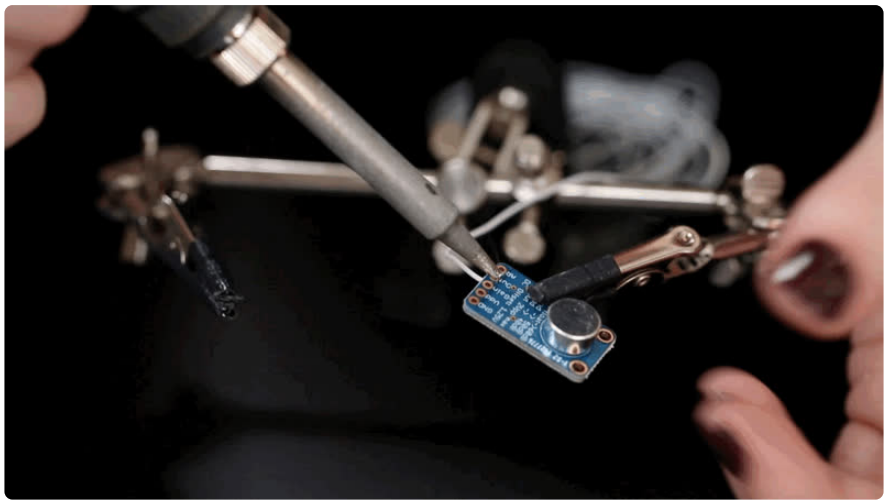


Wire connections are as follows:

- GEMMA GND to sequins (-)
- GEMMA D0 to sequins (+)
- Microphone GND to GEMMA GND
- Microphone Vdd to GEMMA 3V
- Microphone output to GEMMA A1
- 150mAh (or larger if desired) battery plugs in to GEMMA's JST port

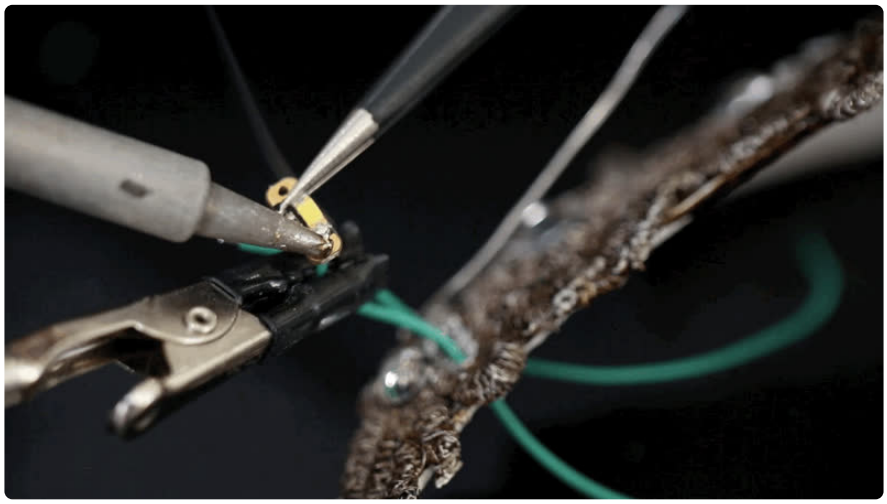


You can run the wires over the front of the mask, like on the previous page, or you can run the wires on the back of the mask by punching or drilling holes for the wires to pass through. Remove the pinned sequins and drill two holes that match up with the hole spacing on the sequins.



Prep your microphone by tinning and soldering wires to the Vdd, GND, and outout pins.

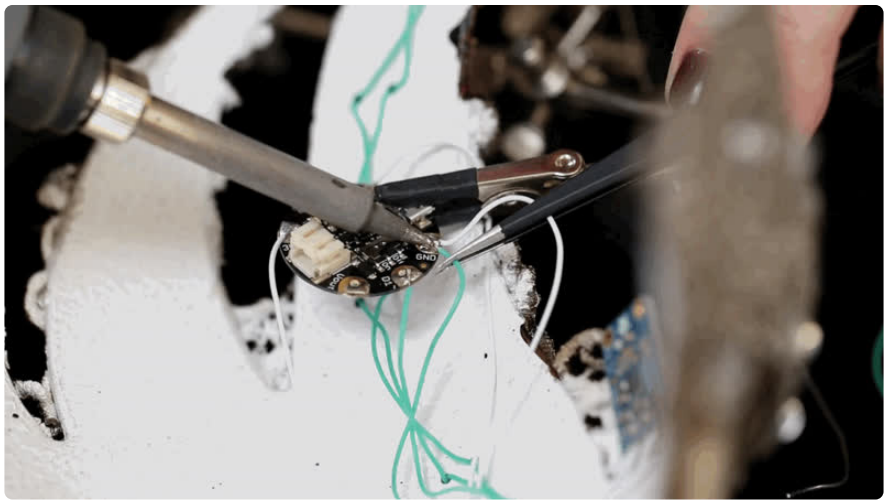
pass wires through the holes of the mask, then strip and tin them before soldering to the sequins:



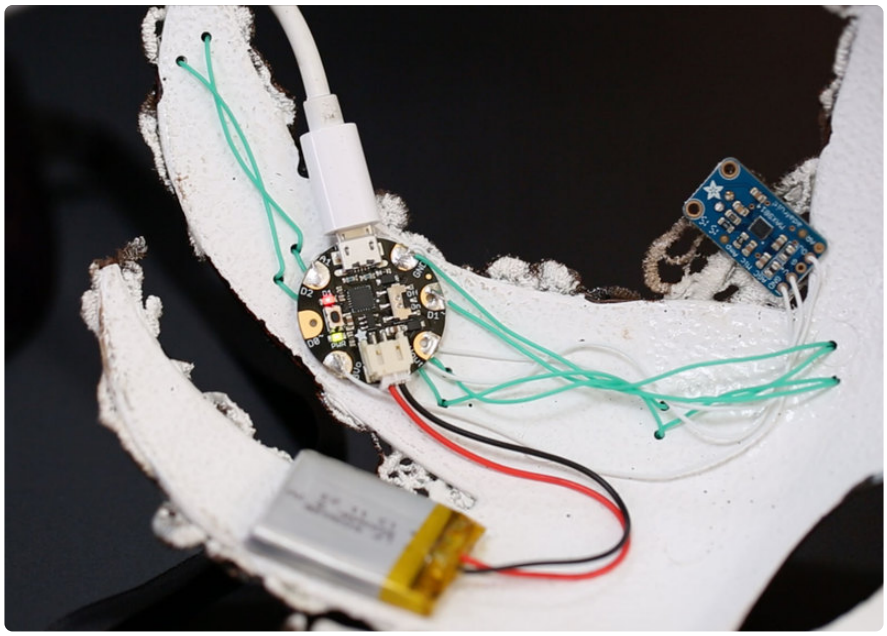
Once both positive and negative sides are soldered, pull the wires from the back so the sequin sits flush, then clip the leads with flush snips.

Find a place to put the microphone, which will be different on every mask. We found ajn opening in the fabric lace near the forehead that worked perfectly, but you could put it on the inside facing the wearer's mouth, or anywhere you like.

Solder the sequins and microphone up to GEMMA according to the circuit diagram.



Install a battery using velcro tape. Plug in GEMMA to your computer with a USB cable and make sure GEMMA's power switch is set to the ON position.



Arduino Code

(CircuitPython code appears further down this page)

Load up this sample code using the Arduino software to get you started:

```
// SPDX-FileCopyrightText: 2017 Phillip Burgess for Adafruit Industries
//
// SPDX-License-Identifier: MIT

// Sound level sketch for Adafruit microphone amplifier.
// For the GEMMA sequin masquerade mask.

#define SAMPLE_WINDOW 33 // Sample window width in mS (33 mS = ~30 Hz)
#define LED_PIN        0 // DIGITAL pin # where LEDs are connected
#define MIC_PIN       A1 // ANALOG pin # where microphone "OUT" is connected

void setup() {
  pinMode(LED_PIN, OUTPUT);
}

void loop() {
  // Listen to mic for short interval, recording min & max signal
  unsigned int signalMin = 1023, signalMax = 0;
  unsigned long startTime = millis();
  while((millis() - startTime) < SAMPLE_WINDOW) {
    int sample = analogRead(MIC_PIN);
    if(sample < signalMin) signalMin = sample;
    if(sample > signalMax) signalMax = sample;
  }
  int peakToPeak = signalMax - signalMin; // Max - min = peak-peak amplitude
  int n = (peakToPeak - 10) / 4;          // Remove low-level noise, lower gain
  if(n > 255)    n = 255;                 // Limit to valid PWM range
  else if(n < 0) n = 0;
  analogWrite(LED_PIN, n);                // And send to LEDs as PWM level
}
```

CircuitPython Code

Below is CircuitPython code that works similarly to the Arduino sketch shown above. To use this, plug the GEMMA M0 into USB...it should show up on your computer as a small **flash drive**...then edit the file "**main.py**" with your text editor of choice. Select and copy the code below and paste it into that file, **entirely replacing its contents** (don't mix it in with lingering bits of old code). When you save the file, the code should **start running almost immediately** (if not, see notes at the bottom of this page).

If GEMMA M0 doesn't show up as a drive, follow the Introducing GEMMA M0 guide link above to prepare the board for CircuitPython.

This code requires version 2.1 or later of CircuitPython. Earlier versions didn't yet support PWM output. The "Introducing Gemma M0" guide explains how to load or update CircuitPython if needed.

```
# SPDX-FileCopyrightText: 2017 Phillip Burgess for Adafruit Industries
#
# SPDX-License-Identifier: MIT

import time

import analogio
import board
import pwmio

sampleWindow = 0.033  # Sample window width (0.033 sec = 33 mS = ~30 Hz)
ledPin = board.D0  # Pin where LEDs are connected (PWM not avail on D1)
micPin = board.A1  # Microphone 'OUT' is connected here

mic = analogio.AnalogIn(micPin)
pwm = pwmio.PWMOut(ledPin, frequency=1000, duty_cycle=0)

while True:
    # Listen to mic for short interval, recording min & max signal
    signalMin = 65535
    signalMax = 0
    startTime = time.monotonic()
    while (time.monotonic() - startTime) < sampleWindow:
        signal = mic.value
        if signal < signalMin:
            signalMin = signal
        if signal > signalMax:
            signalMax = signal

    peakToPeak = signalMax - signalMin  # Audio amplitude
    n = (peakToPeak - 250) * 4  # Remove low-level noise, boost
    if n > 65535:
        n = 65535  # Limit to valid PWM range
    elif n < 0:
        n = 0
    pwm.duty_cycle = n  # And send to LED as PWM level
```

Now talk or play music for your mask, and see the LEDs change brightness with the volume!

Wear 'em!

Enjoy your costume masks! These are fun to make in groups and are sure to be a hit at Mardi Gras or Halloween. Treat your mask with care and don't wear it in the rain!