Electronic Demon Costume

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Guide Contents

Hello!

Spark the demon isn't really a bad guy, he's just got a job to do: tangling the cord on those phone/MP3 earbuds in your backpack or pocket. His old job was mangling tapes in car audio systems, but there's so little call for that anymore that the rare case is just handed off to a minion.
 (https://adafru.it/cab)

Two of my favorite things are electronics and Halloween...why not combine them? Spark came together through a series of Adafruit tutorials and postings leading up to Halloween 2012. The costume features an Arduino-based voice changer, an animated LED matrix face and glowing EL wire wings and horns. He debuted on the weekly Google+ Show & Tell hangout, but has since made other appearances including **Maker Faire Bay Area 2013**.
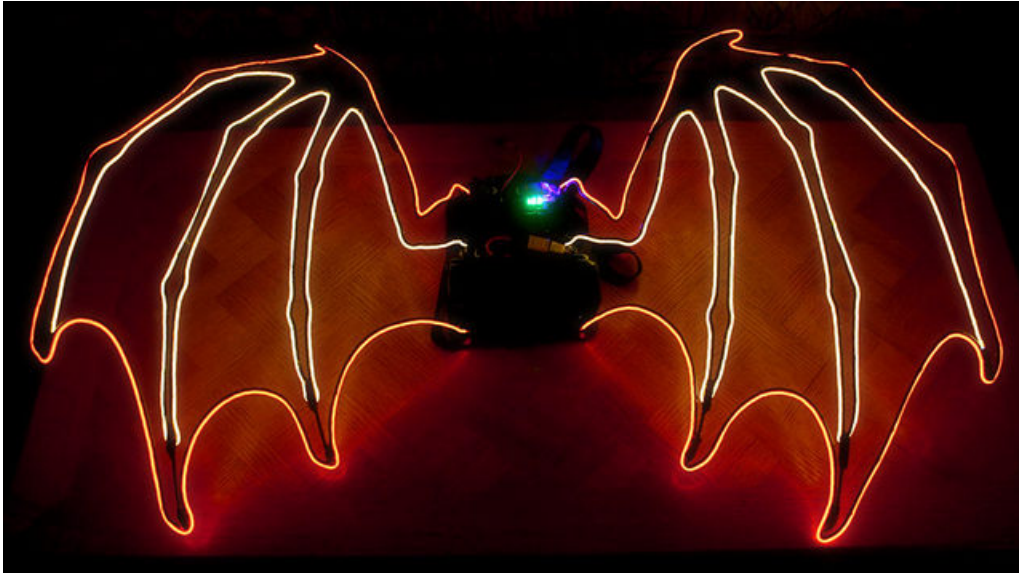
Two ideas we hope you'll take away from this:

- The costume *wasn't* carefully planned, it was improvised and upgraded in steps. Electronics doesn't need to be a daunting, formal thing — don't be afraid to experiment and play when developing your own Halloween or cosplay ideas. I *still* pull it out and add new things occasionally.
- The software we wrote is all open source…you can take it apart, remix it, use a little or a lot, improve or adapt it to your own projects (which we hope you'll share!)

We don't have a step-by-step "walk through" tutorial for Spark's complete costume, but nearly all of the electronic elements are derived from other guides…

Relevant Tutorials

- **Animating Multiple LED Backpacks** (https://adafru.it/aQF) (and the prerequisite **Adafruit LED Backpacks** (https://adafru.it/aOV) guide). This illustrates the wiring for the LED matrices that make up the face. The idea of combining this with a Wave Shield (for playing back prerecorded sounds) is touched on here.
- **Wave Shield Voice Changer (https://adafru.it/aW9)** (and the prerequisite **Wave Shield guide (https://adafru.it/cl8)**). This shows how to combine the Wave Shield with a microphone to alter one's voice. There are two example programs for this tutorial: "adavoice" is the voice changer alone, while **"adavoice_face" also adds the LED backpack face animation**…the latter code is what the demon is using.
- **Working with (https://adafru.it/aJF)EL Wire (https://adafru.it/aJF)**
- **EL Wire Animal Masks** (https://adafru.it/cQD) (similar construction techniques were used for Spark's wings and horns)
- **Firewalker LED Sneakers (https://adafru.it/cDk)**

This video summarizes an early iteration of the costume and electronics:

Maker Faire post-mortem: the video and voice changer guide both already mention this, but it bears repeating: the electronics need to be protected from moisture, especially condensed breath. The most common trouble spot encountered at Maker Faire was the microphone amplifier board. This new tiny wired mic (http://adafru.it/1935), if soldered in place of the microphone on the amplifier board, might assist in moving the amp board further away from dampness. (The mic itself will still need some waterproofing, perhaps sealed in a tiny Ziploc baggie or a deflated balloon.)

Frequently-Asked Questions

Is the computer tracking your own eyes?

Nope! But a simple programming trick makes their movement seem natural: instead of repeating the same loop of actions (which our brains pick up very quickly), all the parameters are randomly generated: where the eyes are looking, how long they fixate in one position and the time between blinks. If they seem to be reacting to the conversation, that's through coincidence and imagination.

Are you selling kits?

Not exactly. We're *giving away the plans,* with many of the parts available through our shop. This way every monster is unique: yours might have just one eye, or three, or have them on eyestalks like a crab. Go wild with it!

That's all just one Arduino?

It's a tight squeeze, and had to break a few rules...but yes,**one Arduino runs the whole show!** You can look through the source code (adavoice_face, included with the voice changer software) to see how this works.

How do you see? Is there a hidden camera?

The LED eyes sit slightly *above* the wearer's own eyes, while the sheer fabric of the "morph suit" passes just enough light for limited vision inside. There's no camera.

If vision and safety are a concern, or if you're just not keen on spandex, you could build atop a bike helmet with a robot or alien face that sits <u>above</u> your own head. The EL Wire Animal Masks tutorial shows some great examples of this style!

Why use an Arduino? Why not [other microcontroller board]? It's better!

The goal was not to produce the *highest-tech* costume, it was to create a project that *inspires learning and creativity.* Arduino is extremely easy to learn, widely available and offers lots of compatible add-ons like our Wave Shield. "Power users" can adapt the ideas here to their own device of choice.

How did you make the glowing rib cage?

The chest piece (which holds the speakers) was cut and formed from Sintra (a.k.a. foamed PVC), an easily-worked thermoplastic. One or two red LEDs are installed behind each rib.

The breathing effect was achieved using a PWM output on the Arduino (the analogWrite() function), connected to a power MOSFET to drive all the LEDs. It's similar to the code and wiring used in this RGB LED Strip guide, but using discrete LEDs in parallel instead.

How does the voice changer work? Is there a Fourier transform involved?

It's much, much simpler than that. It's a variant on a technique called *granular synthesis.* Basically, a short audio sample (about 10 milliseconds) is continually being recorded in a loop. It's simultaneously being played back *at a different speed,* either duplicating or ignoring small sections of the data to maintain the timing. It's explained in a little more detail in the Wave Shield Voice Changer tutorial. Even a modest Arduino can handle this, whereas an FFT would require a significantly more potent processor.

How'd you create that texture on the body?

Several colors of T-shirt puff paint from a local craft store. Low tech and cheap!

For other questions not covered here, you can search or ask in the Adafruit Customer Support Forums (https://adafru.it/cer). Try the "Wearables" or "Glowy Things" sub-categories.