

STEM for Dance Technical Costume Proposal | Daniel Wai & Karina Chow

We have two different approaches to incorporating programmable LEDs into dance performances. One is to introduce sensors into the dancers' accessories and have them design their sequences around these interactions. If we heard correctly, this is what STEM for Dance currently does. The other is to create a centralized timeline system that synchronizes the LED animations on all the dancers' wearables. After talking to a couple dancers, it seemed like this was the preferred solution.

Our plan is to create a centralized control panel that acts as the source of truth for all wearables on the dance team. Choreographers will program the dance sequence through Arduino and upload the code to the costumes. The centralized control panel will then be used to play the programmed sequences on the outfits. To do this, we will create a local area network (LAN) to which the costumes will connect to. This would activate the written code uploaded to the costumes at the same time allowing for precise timings in the performance.

We also plan to create a simple API so that staff and students can program the pieces using in-built functions that synchronize LED animations to timestamps or measures and beats. Here's is what it *might* look like:

```
// Instantiate a section to inform future animations
setSong(nameOfSong, bpm, startTimeInSeconds, durationInSeconds);

// Animation functions
chaseAnimation(timeInSeconds, duration, color1InHex, color2InHex);
solidColor(timeInSeconds, duration, colorInHex);
```

Interactivity

As mentioned, we can also include sensors onto the costumes for live interactivity. We can work on this as well, but preferably our main focus is on the wireless communication and synchronization of the LEDs. Some sensors we plan on using to record performer's movements are touch sensors, tilt sensors, contact microphones, and force sensors placed on footwear. By using a multitude of sensors connected to the lighting system, we want to allow performers to incorporate them into their choreography.

Electronic Components

For the costumes we plan on using Adafruit HUZZAH ESP8266 microcontrollers to program the LEDs. These microcontrollers cost around **\$10** each and have built-in Wifi capabilities allowing for remote control. They are also easily programmable allowing students to create their own animations. For power we plan on using **\$6** rechargeable lithium batteries as the power source of the costumes. They will require a specific charger that costs around **\$5** each but still uses usb to charge. These should be lightweight enough so that the final costumes will not be too heavy but will still last throughout the duration of a performance. The LEDs prices will vary depending on the amount per meter, but for clothing and performances we recommend something with a higher density for better visuals and so that it will look less spott. 60 LED per/meter strips will cost **\$25** per meter.

Costume Design

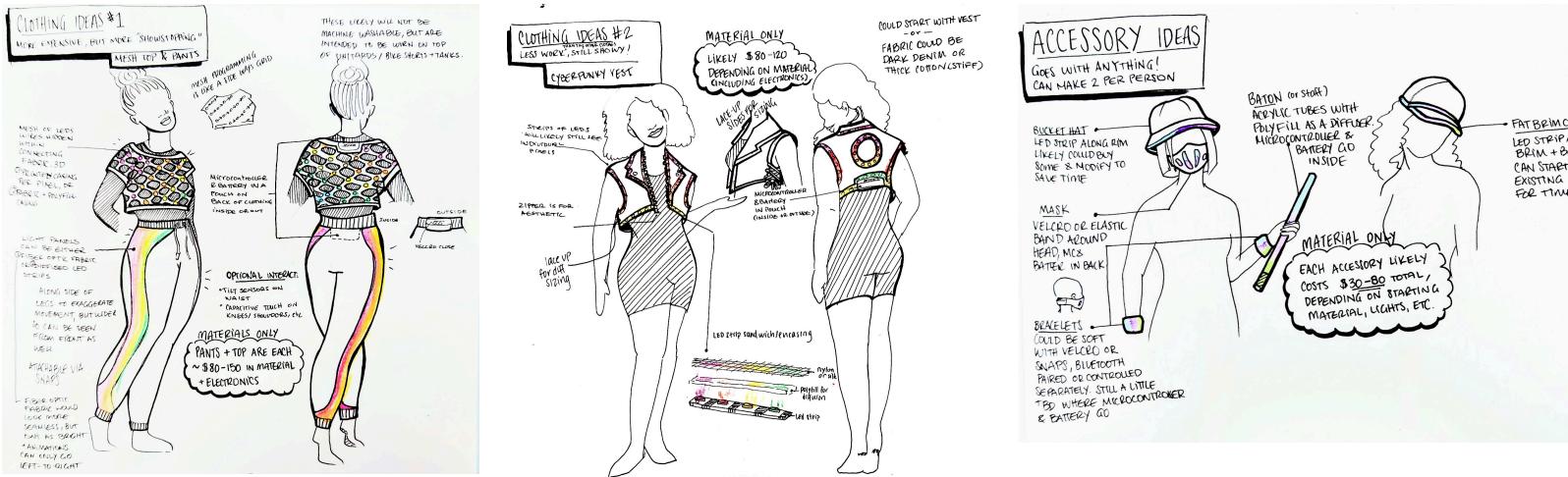
In terms of the actual pieces, we have two potential proposals:

- Either **one piece of clothing**, choosing between a mesh top, sweatpants, or a vest or
- **Two accessories**, choosing among a bucket hat, fat brimmed hat, baton, mask, or bracelets.

Clothing pieces have more of a that show stopping power because of their uniqueness, but will take more time and will cost more than accessories.

- The sweatpants can be either made
 - As a full piece made with a light soft cotton and polyfill fiber sheets for light diffusion with the intention of being worn on top of leggings (so the leggings will be washed). This option would cost \$80-15/ea for materials and electronics.
 - As strips to be attached on to existing sweatpants with snaps. In this case, the fit can be bought or better customized per dancer and the electronics can be removed for washing, but will not look as seamless. This would cost \$60-120/ea for materials and electronics..
- The mesh top and vest will likely be a little less between \$60-100/ea for materials and electronics. and will most likely be made of cotton with layers of polyfill fiber and/or organza for light diffusion.
 - The mesh top will **not** be machine washable. It will have to be worn on top of a long sleeve shirt or unitard.
 - The vest can be made to have detachable LED strips.

Accessories are quicker to fabricate and will be much cheaper at \$30-80 a piece, depending on chosen materials. The advantage is that they can be statement pieces for existing costumes and do not suffer from sizing constraints.



Labor

We estimate that architecting the system, complete with networking and a friendly API for the dancers to use, will take 50-75 hours. Interactivity features would likely take an additional 20-30 hours. Alternatively, we could also only do interactivity without the central control system. Costume fabrication for any of the clothing pieces would likely take 12-20 hours per piece, including adding microcontrollers and lights. Accessories will likely take 5-10 hours per piece. If possible, we would appreciate help with costume fabrication. Outside help is included in this labor estimate. We'd also suspect investing 5-15 hours in coming to STEM for dance to test the system with the dancers and incorporating their feedback.

All in all, we estimate this project to take from **135** to **300** hours, depending on the parameters above.

Total Price

At a rate of \$50/hr, that means this project will cost between **\$6,750** and **\$15,000**.