A VISUAL DANCE LIGHT SHOW

ID 4510 : ID 8900 WEARABLE PRODUCT DESIGN

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INTRODUCTION

Our project idea at the core is a new way of experiencing dance as a visual art piece. The end result will be a visual light show in WebVR, build off of the movement from performers wearing our product.

Uzsers will be able to enjoy the dance as a standalone performance piece, and later on through the fundamental elements of the dance through our visualization.

DESIGN GOALS

Our project can be split into four main areas:

THE TECH

We plan to use Arduino technology and sensors to capture the essence of a dancer's form and movement through force flex sensors, speedometers, accelerometers, and more.

THE WEARABLE

We'll present two concept designs for capturing a dancer's movement: either an armband or a shoe accessory. This will involve creating a comfortable arm wrap/warmer or a two piece shoe accessory to capture the movement. We focus on the movements in the joints of the users with their wrists and elbows, or their heels and toes.

THE PERFORMANCE

We'd like to visualization many different forms of dance, that all have their own unique styles and forms. Ideally we'd gather users who can perform ballet, tap, tutting, hip hop, or contemporary to perform small segments that we will then capture and transform.

THE VISUALIZATION

Our visualization of the dances will involve transforming the speed, movement, and force of their motions into light. High speed movements can be displayed as heat, force can be captured by the size of the light, and movement will be captured through the 3D rendering or Virtual Reality nugget. This was the dancer's movement across a space will also be captured and users can 'follow' along.

RESEARCH

We began by looking at applications involving dance that used the information of movement in space.
We searched for inspirations that gave visuals and evoked emotions through the dance performance whether that be by light or graphic elements.
We found interesting applications for sensors and other electronics in designs that transforms the performance into powerful visuals.
Finally, we researched applications in all the different types of wearables.

THE DANCE



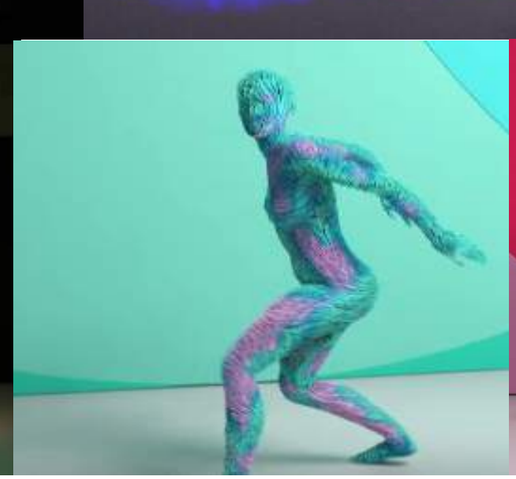
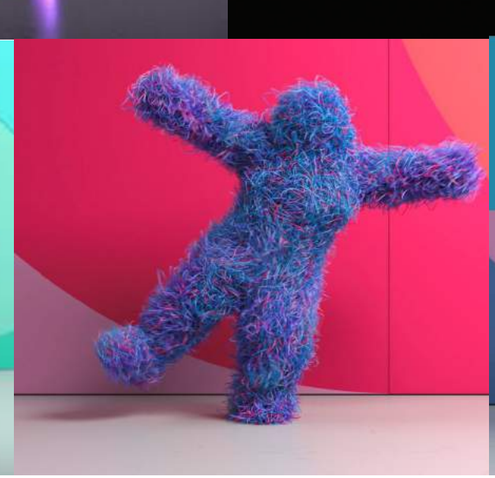
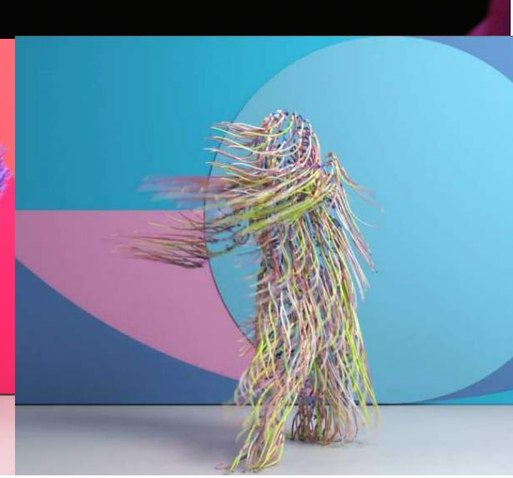

Dance was, and is, a unique and essential human activity that connects us to the musical rhythms of life. Dance, like lyrical or contemporary or jazz or hip hop, that's an art form. It's speaking without words. It is knowing how to move one's body and cause an emotional reaction to what you do. It's telling a story. Every movement means something, and expresses something.

PERFORMANCE



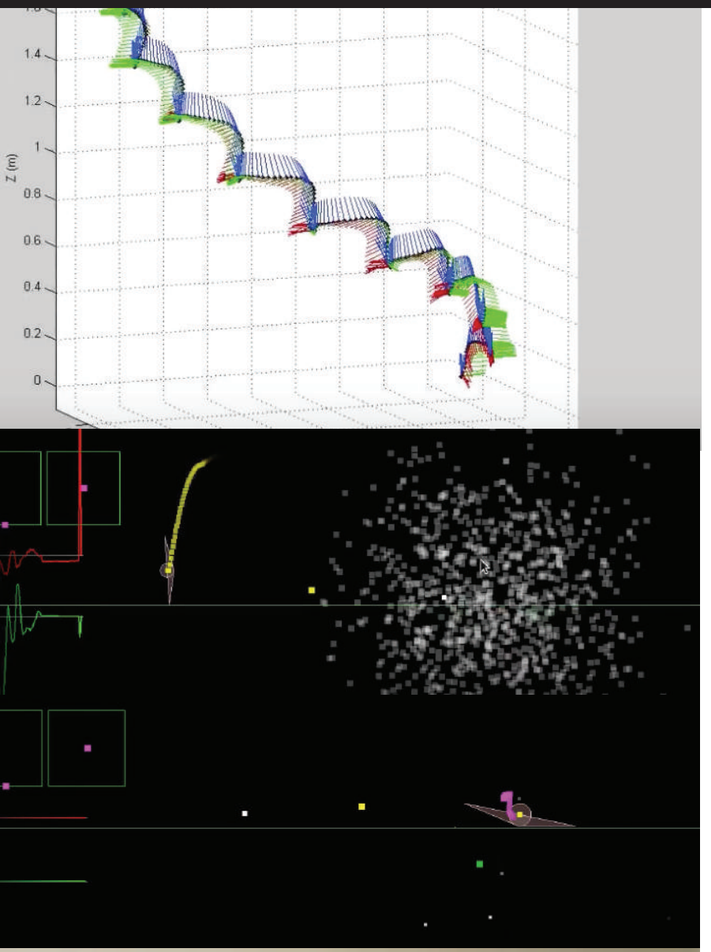




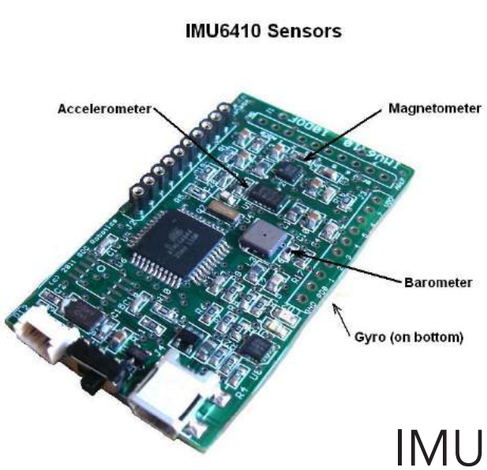
These are just a few ways to insert visual choreography into your routines. By sticking to the basics of choreography, the possibilities are endless. Your routine does not have to be extremely difficult or challenging in order for it to be visual; all you have to do is invent creative ways for your performance to showcase your

TECHNOLOGY & SENSORS



This demonstrates an algorithm that enables tracking in 6DOF using only an IMU. The algorithm uses assumptions of gait overcome the problems with obtaining a position through the double integration of acceleration.

LED Array 8x7



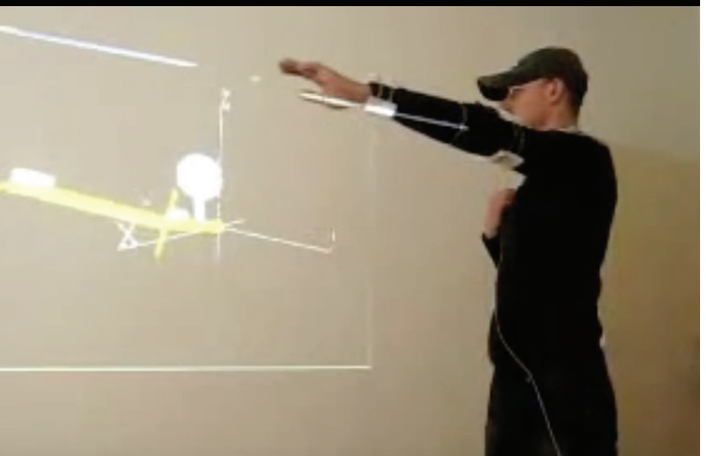
IMU

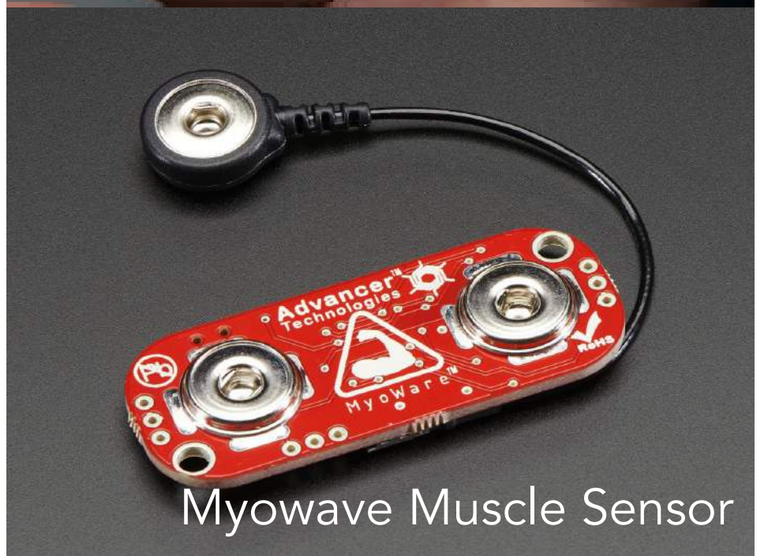
Kalman filter test for sensor fusion (GPS + accelerometer)

Flex Sensor 2.2″ / 4.5″

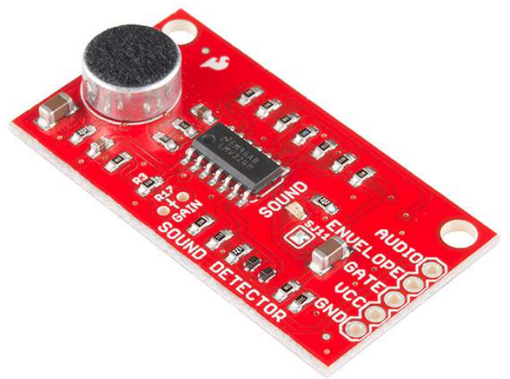
Force Sensitive Sensor

Amature project. Gyros, accelerometers, magnet field sensors and Arduino used.





Myowave Muscle Sensor



Sparkfun Sound Detector

INITIAL CONCEPTS

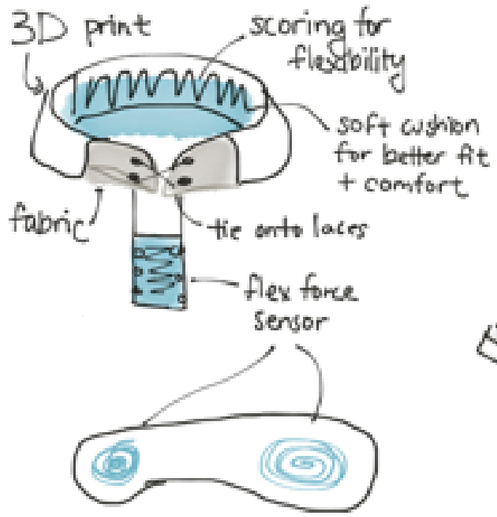
The following concepts are personal wearables that will track the motion of a dancer and records the information through motion sensors to enable artists and performers to express themselves in a whole new way.

CONCEPT ONE

Shoe Attachment

This concept is designed for a group of dancers or for an individual dancer. The user wears attachments that will strap/wrap around the shoe. At the bottom of the shoe attachment would be flex sensors or force sensors and at the top, is the inertial measurement unit (IMU) that measures and reports a specific force, angular rate and using combination of accelerometers and gyroscopes. This will record the speed, movement, and force of the dancers motions and transform them into light. High-speed movements can be displayed as heat (red to blue; slow to fast), force can be captured by the size of the light, and movement will be captured through the 3D rendering.

For manufacturing the attachment material must be snug to the shoe and light to allow ease of movement. Once the material/fabric is made the technology will then be attached or glued onto the attachment pieces.



A shoe insert + accessory on top!

3D

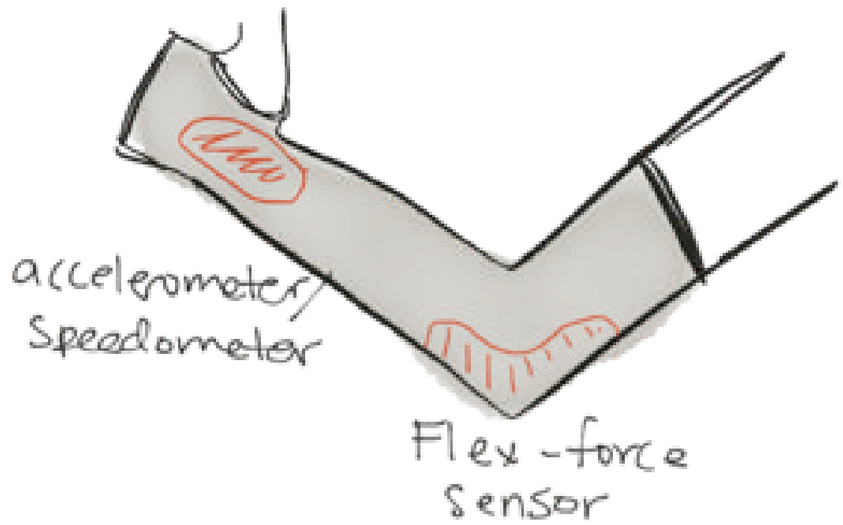
- Stores accelerometer
  Speedometer
- can fit other arduino pieces

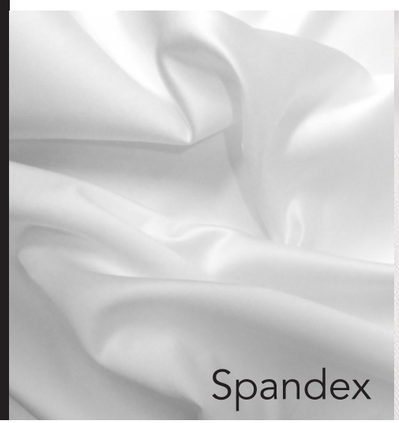
SHOE ACCS

CONCEPT TWO

Arm Band

In this Concept, we were thinking to design an arm-band that would be geared toward individual dancers. The armband would consist of flex and muscle sensors because the fabric would be snug on the skin allowing tracking the different muscle reaction from the move-ments of the dancer. Along with the flex-force sensors would be an accelerator and speedometer sensor. All these information would then be transferred into graphics (lights). High-speed movements can be dis-played as heat (red to blue; slow to fast), muscle use can be captured by the size of the light, and move-ment will be captured through the 3D rendering.



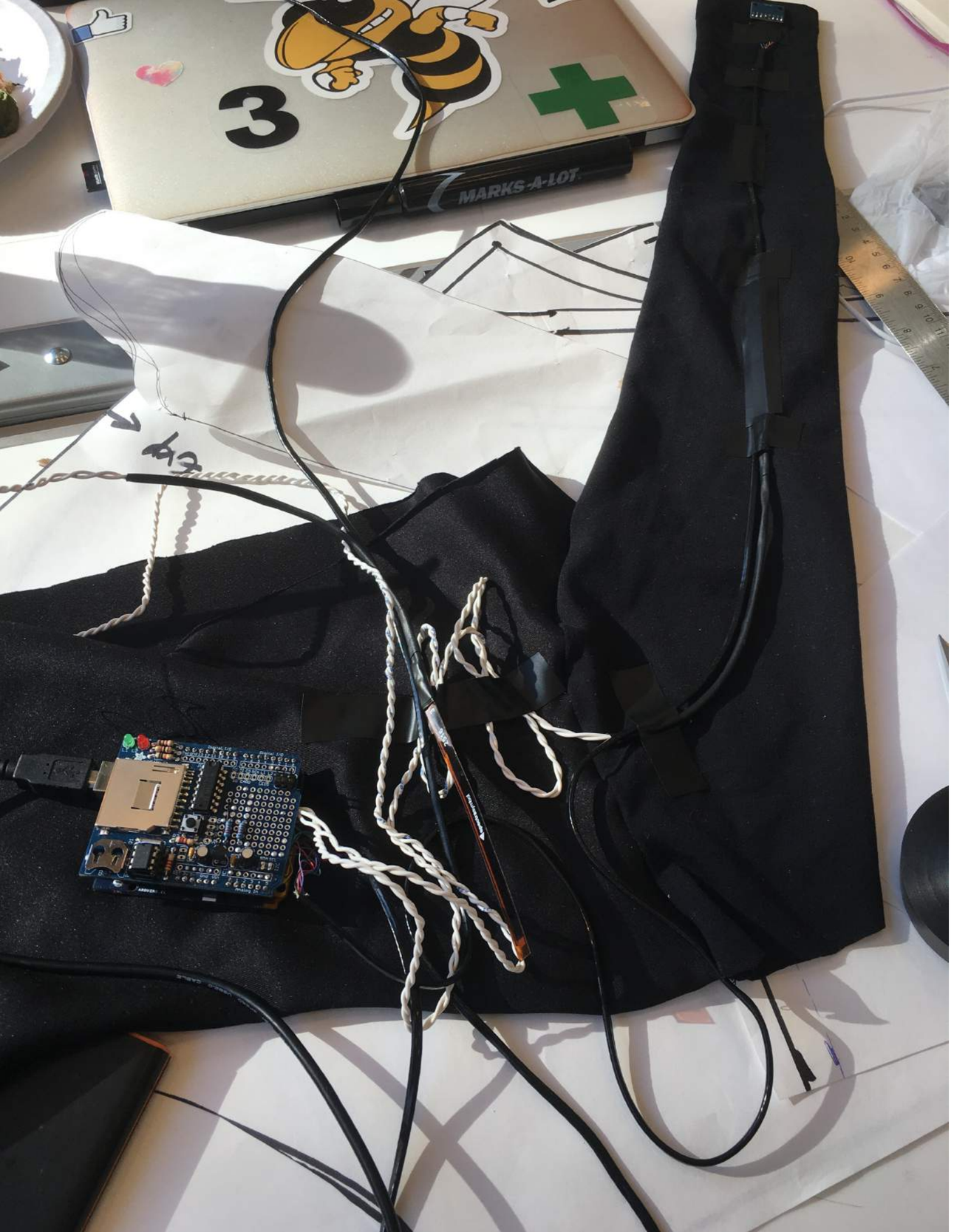

Spandex


BAMBOO


Polypropylene fabric

CONCEPT REFINEMENT

With our research we tried to effectively capture a style that was clean and simple, inspired by the 1 Million Dance Studios fashion. We wanted to successfully create something that would not only look good but incorporate the electronics in a subtle way. After some thought of material and cost we came to a point where we agreed to go with the sleeves.



THE TECH

There are two parts to the tech

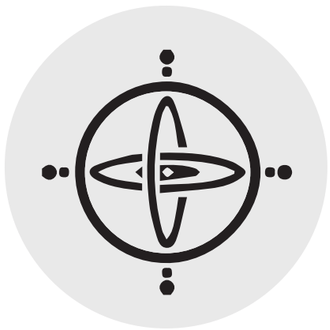
ARDUINO

Arduino was used to generate
the code to get the sensors to work.

WEB VR

This processed data then went into a
WebVR application, built in javascript
using ThreeJS. This was a visualization
of each hands and arm's movements.

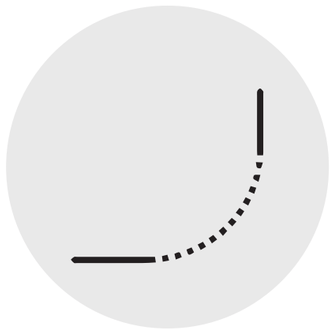
ARDUINO



IMU

Two of the IMU (6 axis Gyroscope + Accelerometer) were used:
One for the left wrist and one for the right wrist

While the accelerometer is able to determine the orientation of the sensor, the gyroscope measures the angular velocity of the sensor. Together, the accelerometer and the gyroscope form an Inertial Monitoring Unit (IMU), which can be used to precisely identify the orientation of the dancer's wrist.



FLEX

Two of the flex sensors were used: one for the left elbow and one for the right elbow

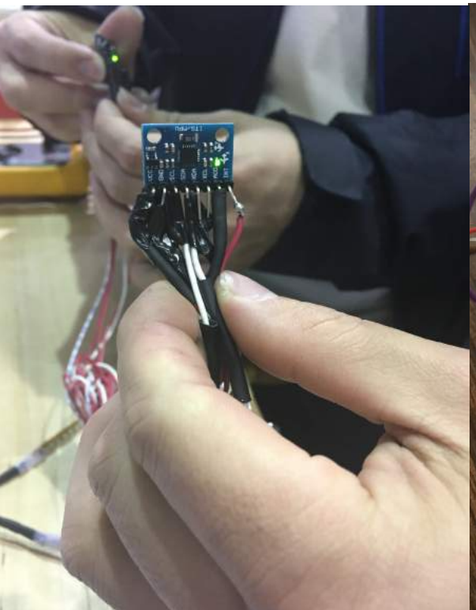
As the sensor is flexed, the resistance across the sensor increases. Each sensor measures how much the dancer's elbow is bent during the dance.

MICRO SD

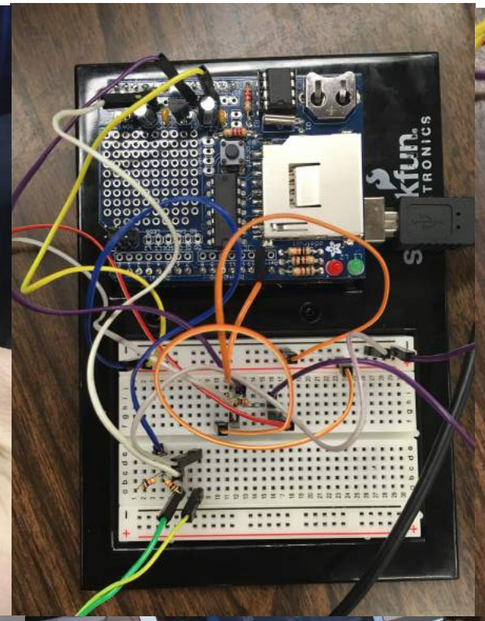
A micro SD card was used to store the numerical values measured from the sensors while the dancer dances.
This code generates two separate files on the SD card: one is called "Left" and the other one is called "Right."
Each file has the measured time, flex value, accelerometer value x, y, z, gyroscope value x,y,z.

Format: time x/flex x/accelerometer x/ accelerometer y/ accelerometer z/ gyroscope x/ gyroscope y/ gyroscope z

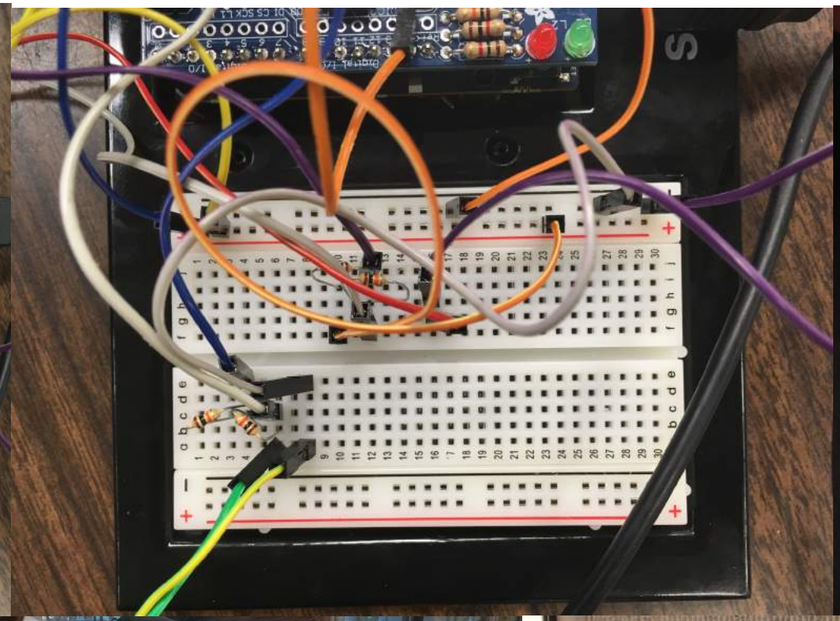
HOW IT WORKS



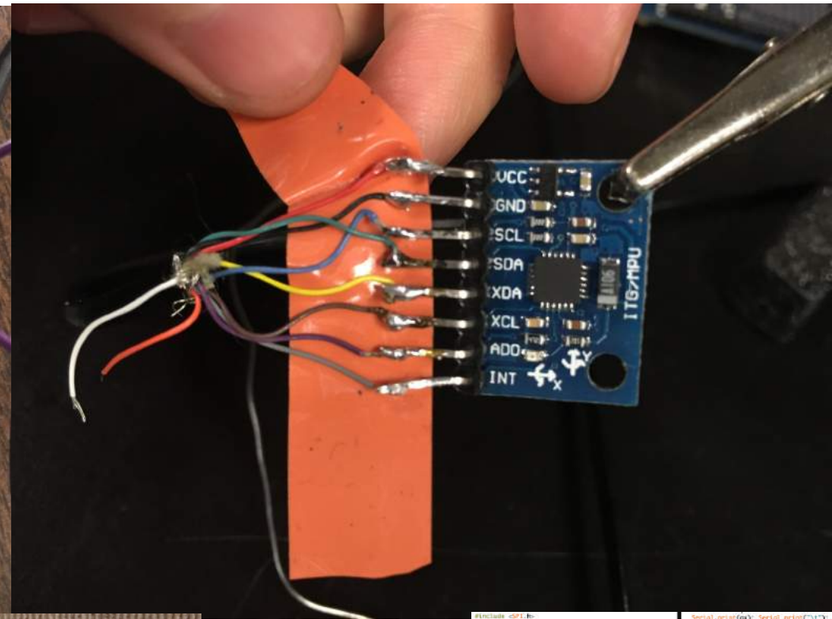
1. Connect the board to a computer to upload the code.



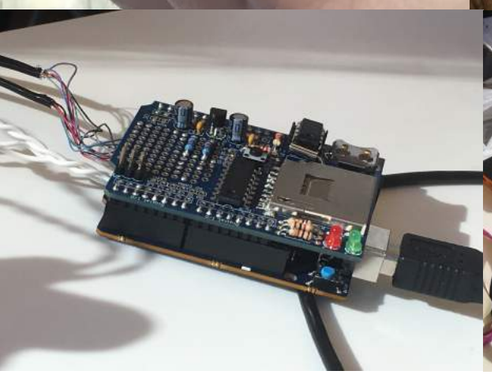
2. Disconnect the board from a computer and connect to a power supply



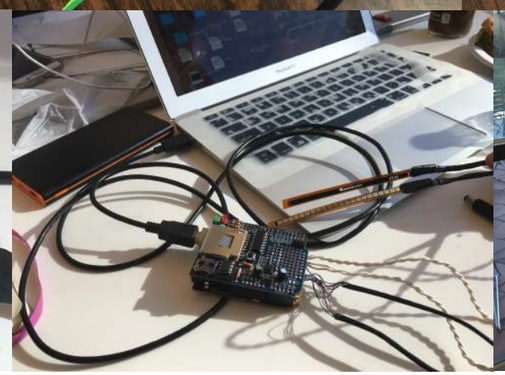
3. The sensors start to measure the values



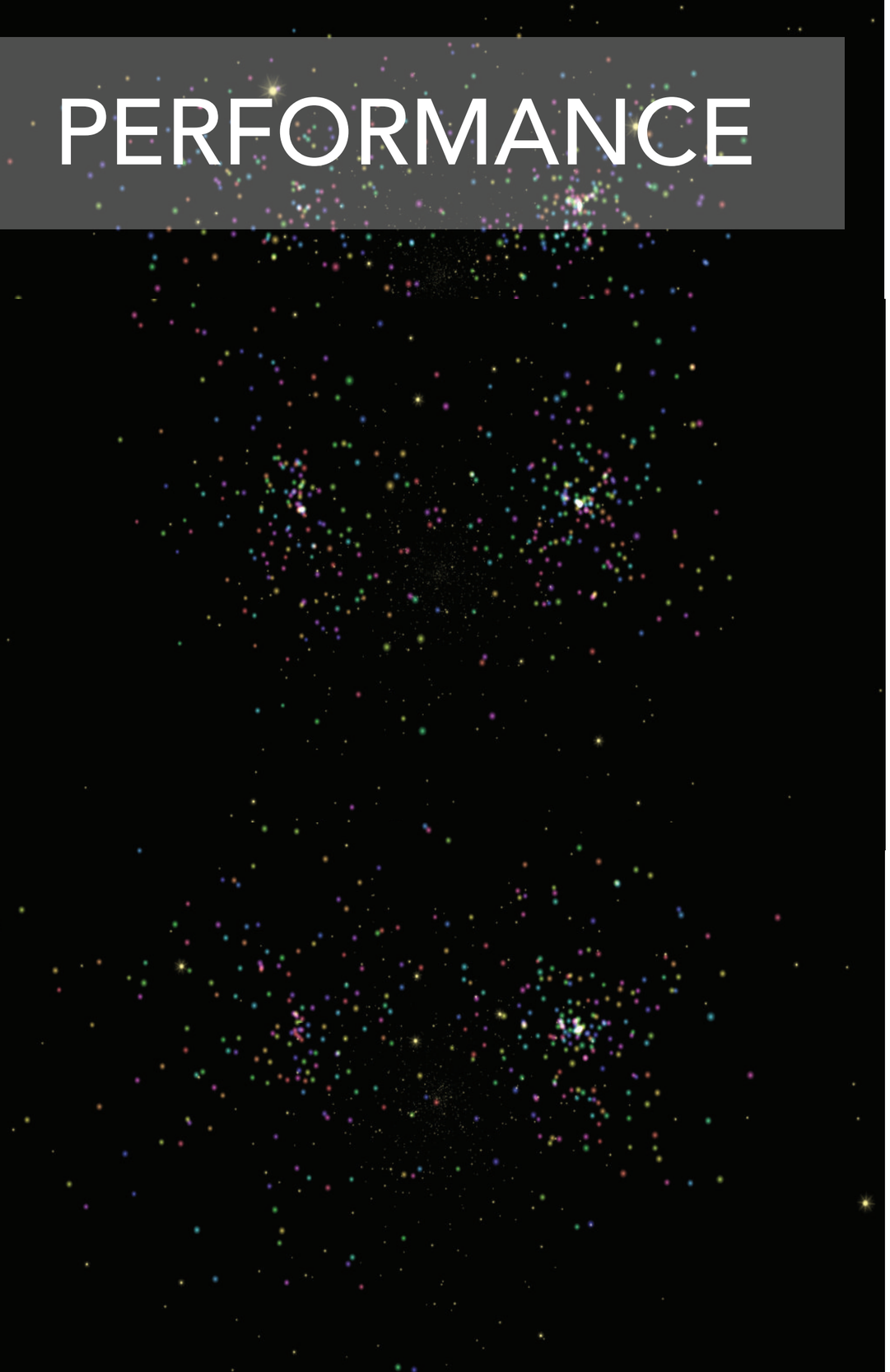
4. Dancer dances with the sensor costume on



5.After the dance is over, pull out the SD card from the shield



6.Check the files from the SD card and use the values for the VR to work



MAIN IDEA

Showcase the movement of a dance performance through a visual light show, where the motion is represented through groups of light.

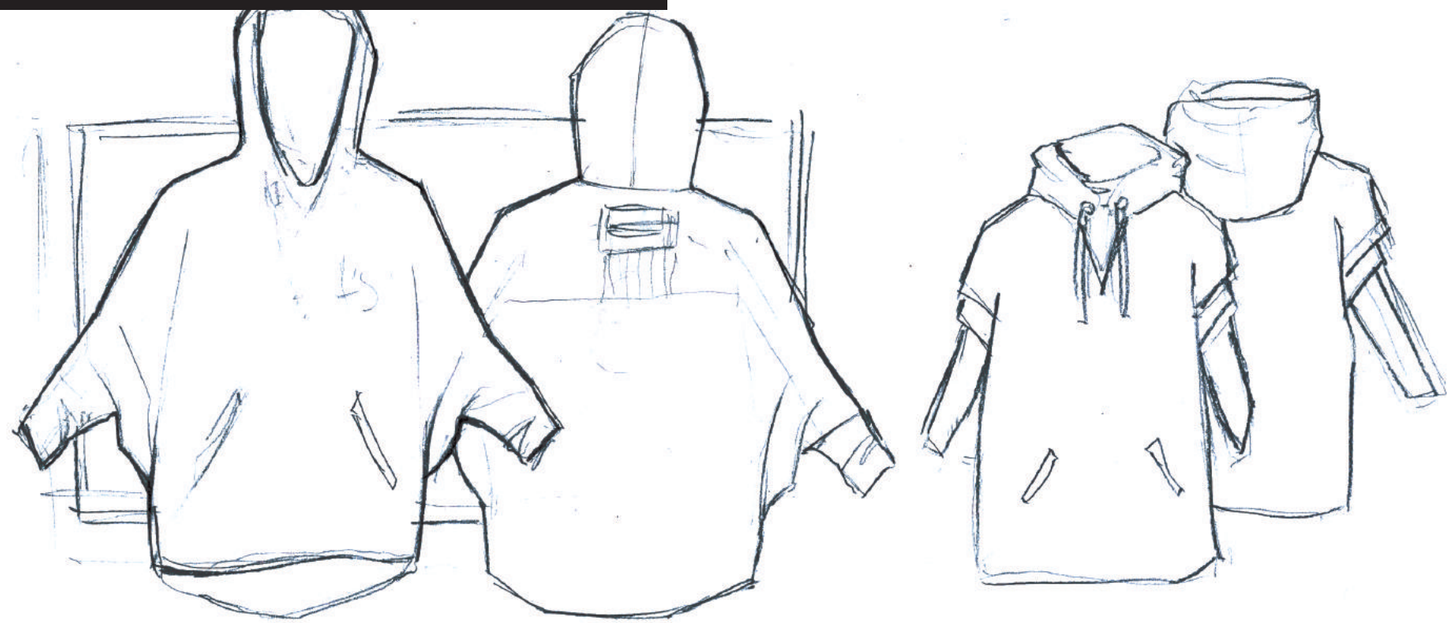
HOW IT WORKS

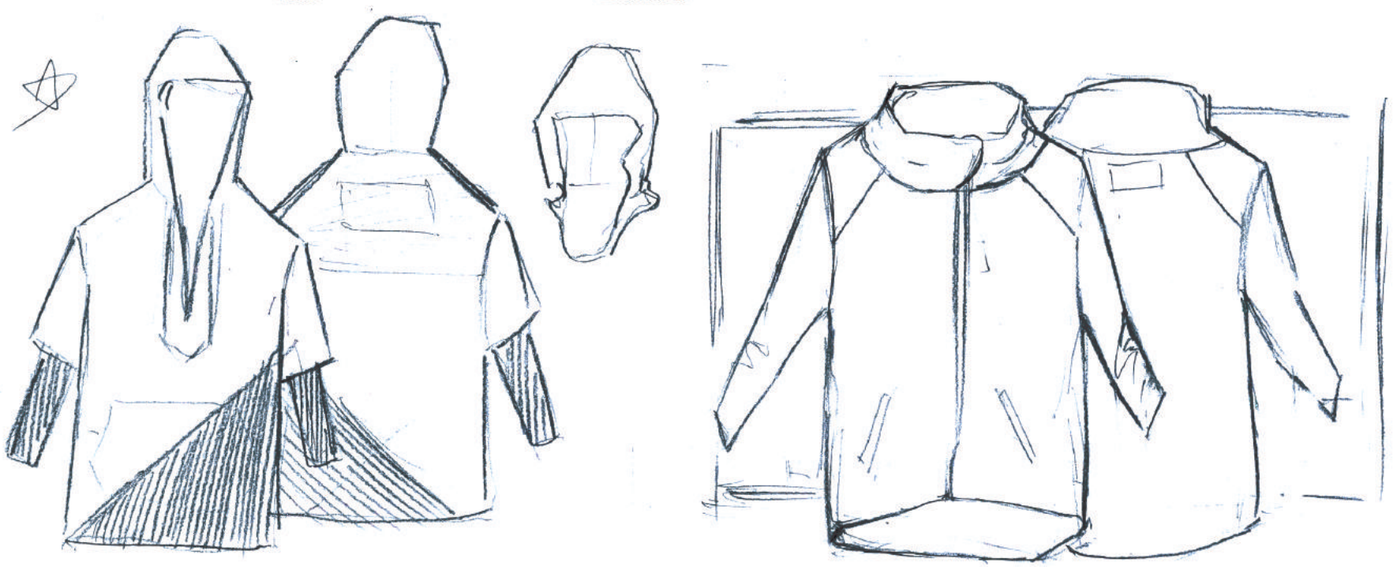
We took data from a flex sensor and accelerometer from each hand and arm. First, processing the data:
processing only the changes in movement in x y and z axis and flex-data.
for example, if changed in x and y but not z, and the changes in x was right and y was up, then we would record (-1, 1, 0). + or - 1 for the change in direction on each axis.

for flex data, we processed the minimum and maximum values and split the movement into thirds, and processed data into groups (small, medium, and high) force.

This processed data then went into a WebVR application, built in javascript using ThreeJS. This was a visualization of each hands and arm's movements. The two hands are each a ball of light, surrounded by smaller colorful lights that represent the movement. The for every shift in the hand movement, we shift the light by a pusle factor depending on the positive or negative direction of motion. For the flex motion, we rotate each x,y,and z direction for the whole groups and changed the scale of the particle groups as well.

THE WEARABLE





THE LOOKS

We wanted to create a casual look that was stylish yet comfortable. We also took in the account that the arduino and sensors have to be attached with the sweater, so we made a pocket on the back for easy access of the SD card.

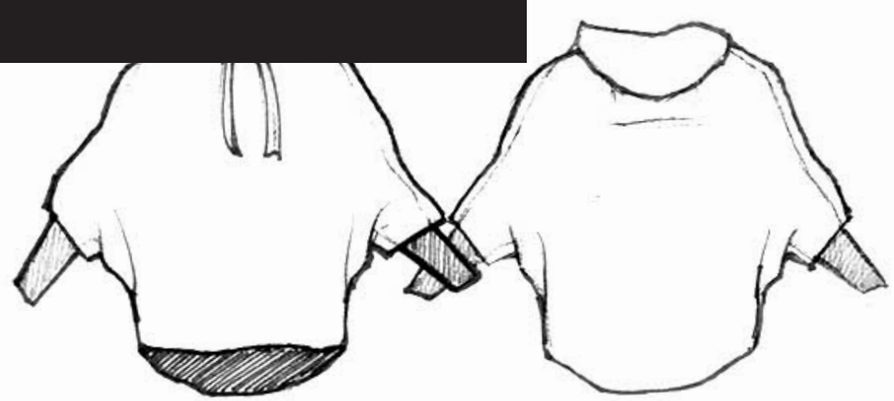
MOODBOARD

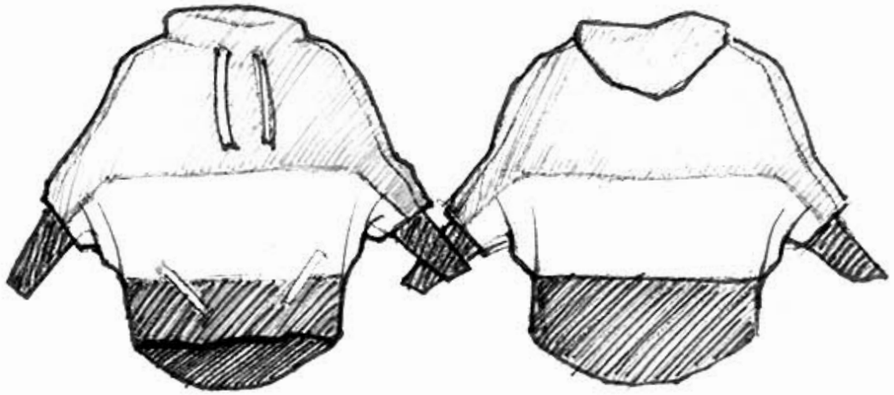
IM
1MILLION

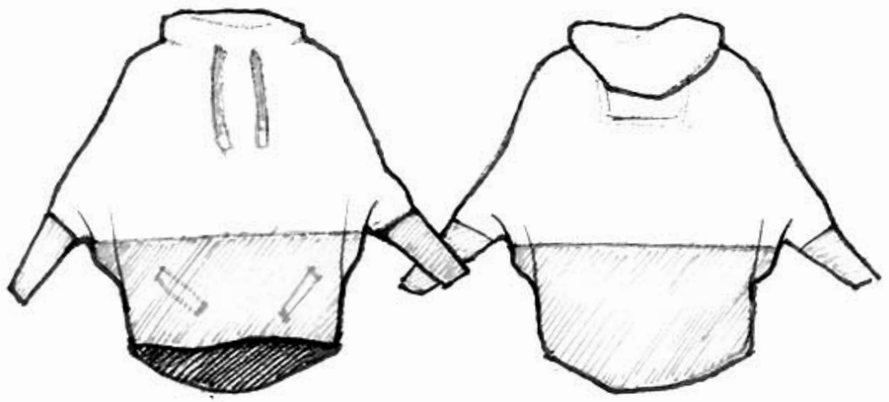
adidas

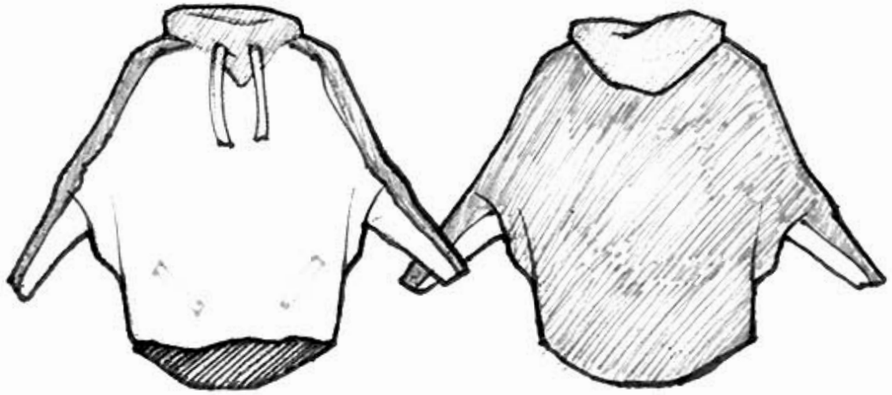
adidas

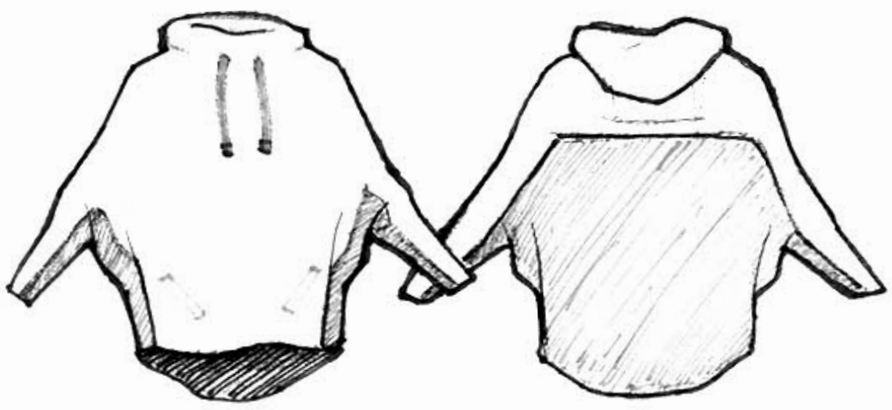
PATTERNS

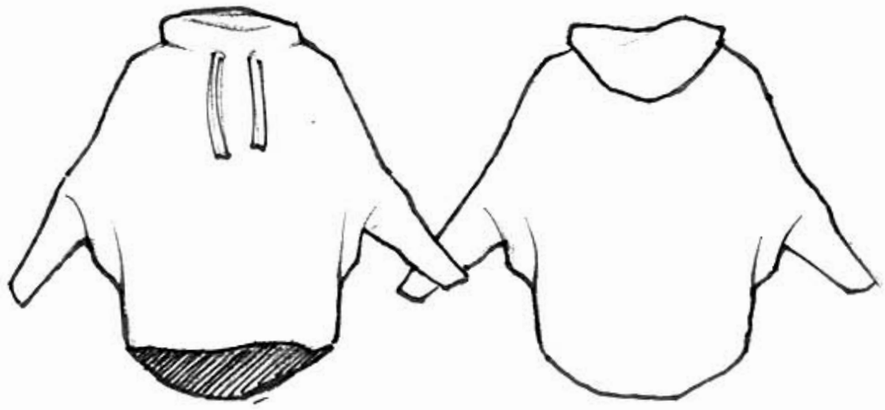












MATERIAL

When selecting the fabric we wanted to pick materials that would look good for streetwear and casual wear.

We chose Cotton Jersey knit for the main part of the sweater because of the soft texture and flexibility. We also added a black cotton/polyester that acts as a color break.

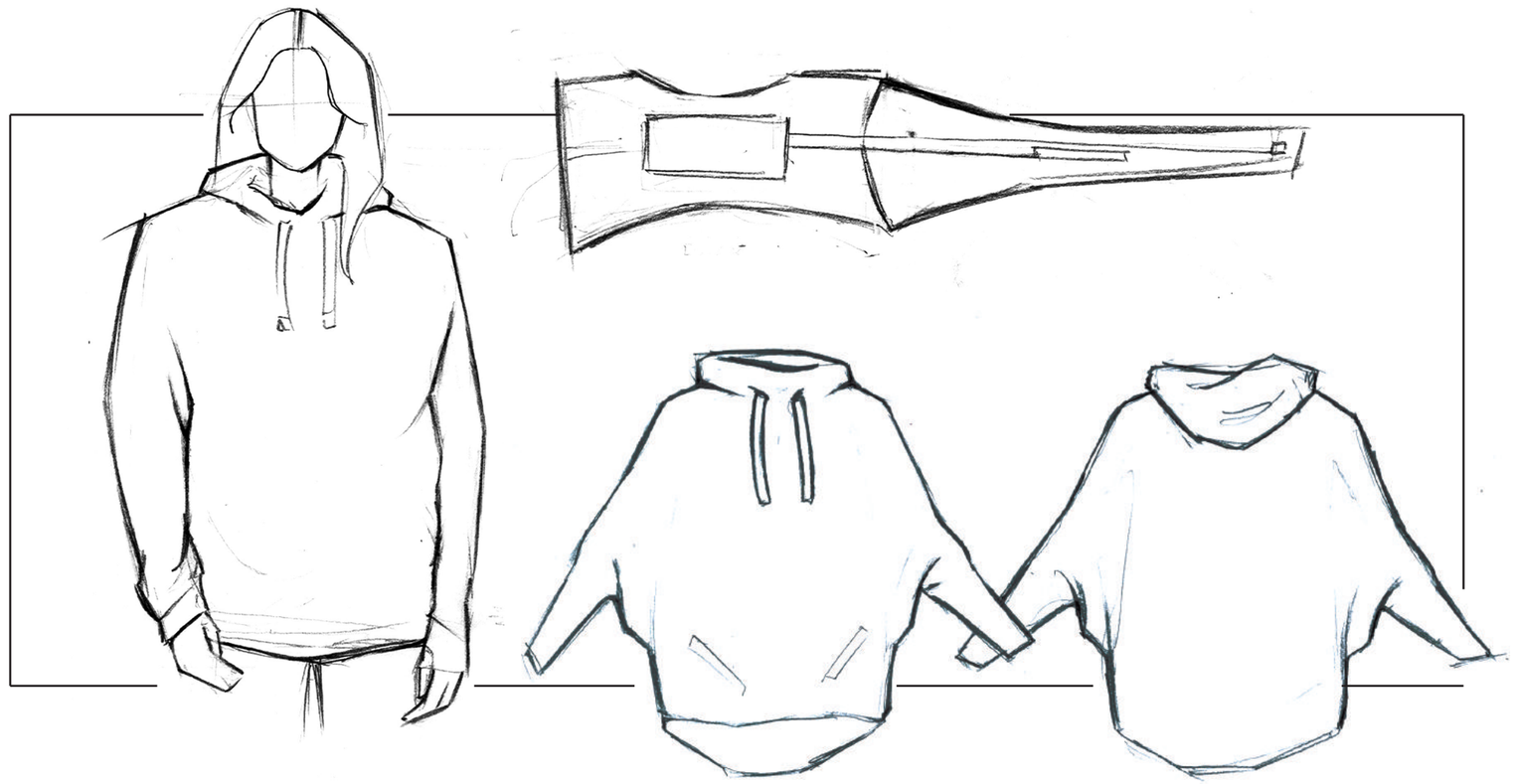
A solid black polyester elastin fabric was chosen for the inner portion of the sweater for the stretchy quality. We needed the garment to be able to be snug to the body, giving acurate measurements to the movent of the dancer.
The slight shine gives a nice look and contrast against the the soft cotton/polyester blend. The black string are just a basic color that contrast with the upper grey material to tie everything together.

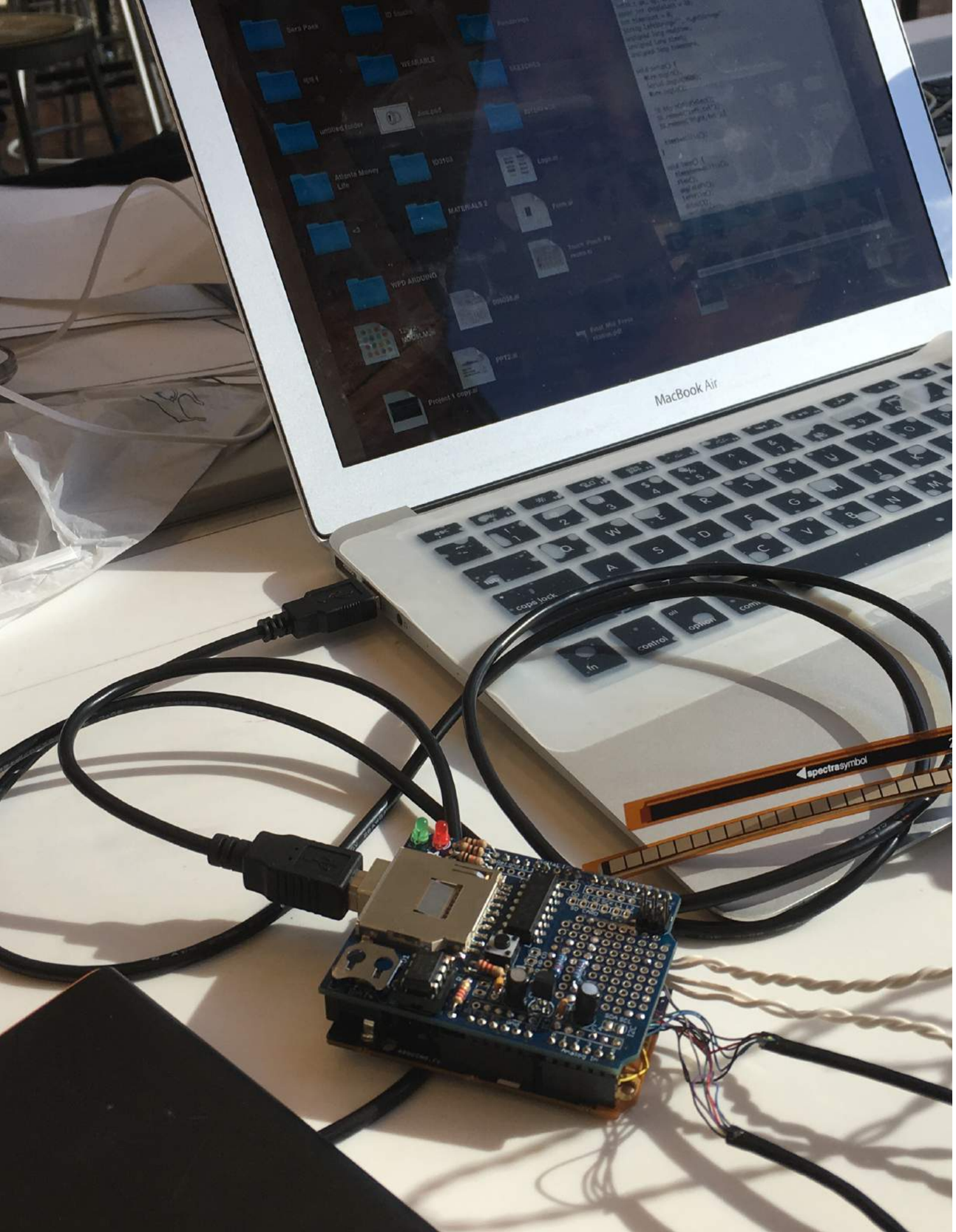

Cotton Jersey Knit


Polyester Elastin

THE WEARABLE

TWO PARTS

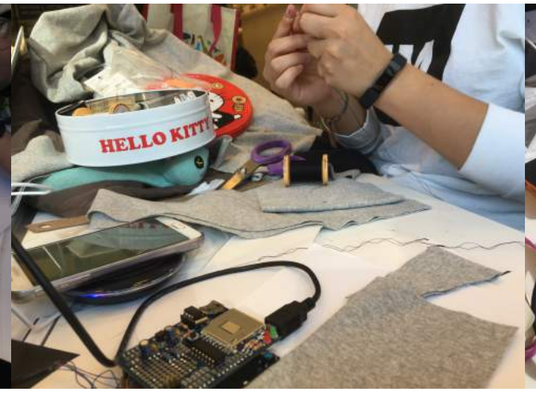


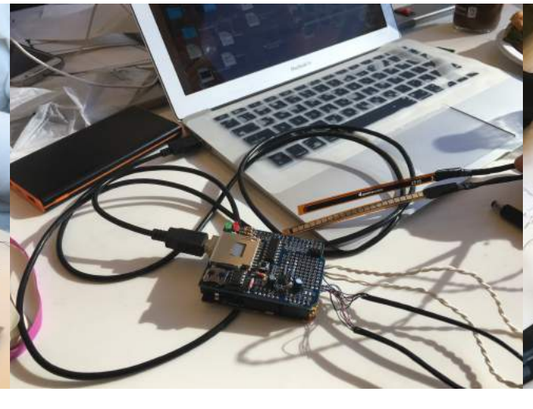


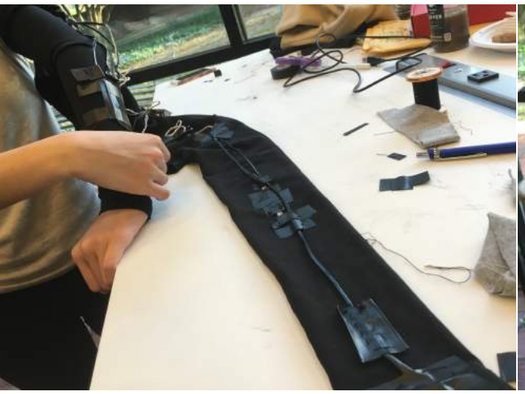
TESTING

After getting all the tech to work and with the finished garment, we began to attach the sensors onto the sweater and test it ourselves. After performing with the sweater we took the sd card that record-ed the information and transfered it into the Web VR.

PROTOTYPE TESTING

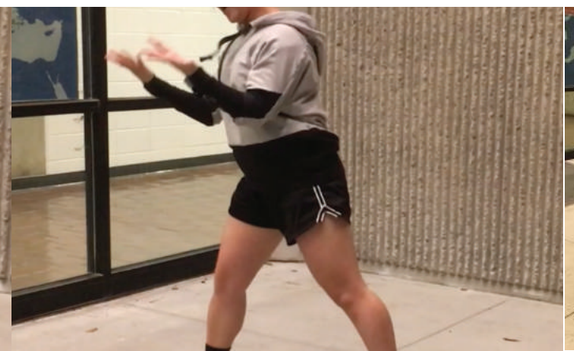






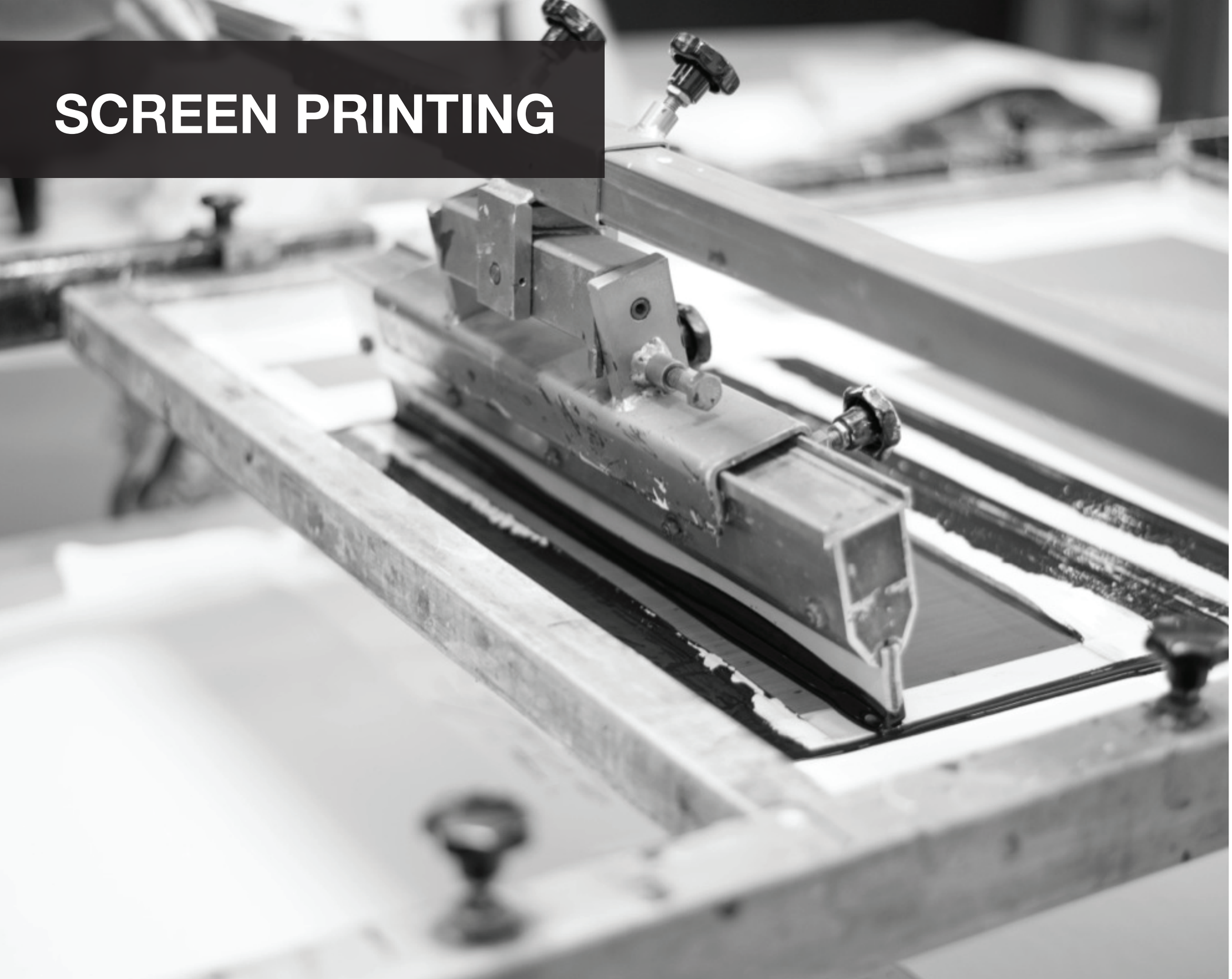





BRAND LOGO

MOVEMENT + OPTICS = MOVOPS

SCREEN PRINTING



BURN COATED SCREENS

SET-UP & PRINT

DRY & CURE INK

DONE!

SCREEN PRINTING

THE PROCESS

BURN COATED SCREENS

Take transparency and place on outside of screen, right side down, with clear tape. Place screen in exposure unit or in direct light to expose emulsion. After emulsion has been exposed, remove transparency and take to wash out sink. Here gently rinse out entire screen- the emulsion where the image was will completely wash away as well as any excess emulsion that could run into image while drying. After rinse set screen aside to dry.

SET-UP & PRINT

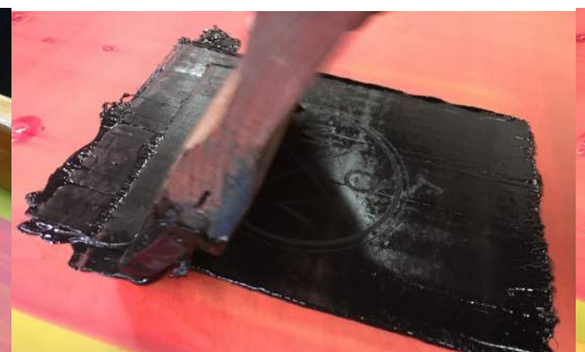
Take screen to press, set in, line up center and screw in.

Take desired ink and spread across screen below image. Take squeegee and pull ink through screen. A test pull should be done first to check for any discrepancies etc. Take textile and place on platen for desired placement and continue with print.

DRY & CURE INK

Depending on type of ink used, curing processes will differ. Be careful removing textile from platen as ink will still be wet. Set to dry or heat cure. Curing pvc (plastisol) ink generally takes 30 seconds at 320 degrees.

DONE!



FINAL PRODUCT

Our group is pretty relaxed, but also willing to work hard. Deciding a project topic proved difficult at first, but through conversation, we meshed Lanssie's knowledge of interactivity and computer science with the rest of our group's knowledge of the design process. We knew from the start we wanted to do something active, but over time it was narrowed down to dance as the specific activity.

Movops is a wearable technology sweater that helps dancers and performers visualize and display their expression not only through movement but also by visuals.

FUTURE DEVELOPEMENT

In “The Computer for the 21st Century,” Mark Weiser suggested that “the most pro- found technologies are those that disappear. They weave themselves into the fabric of everyday life,” If we were given more time we would have tried to integrate the technology into the fabric as if it wasn’t there. However having the tech exposed was nice to see because it shows the sweater was not just a piece of clothing but much more.

For future developement, we wish to explore more where this wearable technology can apply such as in medical devices or space wear. By using this tracking system to record and gain information on a person we can expand this idea of visualizing movement.

THANK YOU!