

Personal Space: Catherine Weng

<https://github.com/CatWeng/CART360>

Nov. 8th 2019

Why Do We Prototype? & Fidelity Levels

The implicit concerns of *Why Do We Prototype?* Are To understand, To test and improve, To communicate and To advocate. To understand means to know what it is we are attempting to make and to figure out optimal ways in which to do it. In this stage you work out the many unforeseen problems a potential idea may have. With my prototype, I need to understand and to figure out the opening and closing mechanism in my cape. An obstacle to the fundamental part of this project was discovered here- shoulders. Have a cape slide open and closed sounds very simple on paper. In reality, humans are not a perfect cylinder but rather more oblong shaped. So when the cape is retracted all the way, it was a hard time getting around the shoulders and vice versa. Once it's closed, it wants to stay closed. In the next stage, to test and improve, you gain a more in depth understanding now that you've figured out what you want. Some of the things I had to test out included several different materials, where to place the motor for the most efficiency and the smoothest movement and what shape the cape should take. What fabric suits a cape best? What is too heavy for the motor to move? Stretchy and flowy or light and stiff? I ended up settling on a thicker stretchy fabric. The stretchier fabrics felt more cozy to wear as well as fitting better with the body, while the non-stretch had a lot of warping when being pulled along a curved path. The heavier the fabric, the more it tends to get caught on clothes and such underneath but not to a point the motor couldn't handle. Every choice comes with a compromise so here I chose shape over motion. To communicate, having the cape open and close is the whole basis of my project. Everything else relies on that movement functioning, and then refining and playing with the idea of what that movement represents. At its most basic, the movement will correspond to the proximity of the outside world. Get too close, and the cape will close up in an effort to 'protect' the wearer. That is the goal I am trying to reach for this prototype. At first, only one proximity sensor will be present but in the finished piece, having at least 3 or 4 is ideal. That way it can detect proximity from all sides in order to better serve its purpose. As for the *To Advocate* section, I really want to focus on making my wearable, well, wearable. Many wearables are very clunky and impractical due to the nature of the technology

and moving parts. I want to focus on making my design as sleek as possible, and minimize loose parts without losing functionality. I think making a statement with wearables doesn't necessarily need to see which article of clothing is the flashiest, or takes up the most room. I want to see improvement in making technology small enough and reasonably efficient to appear in actual clothing. Accessories and electronics have all sorts of high-tech features nowadays, so why not bring that into actual clothing items?

A Technical Evaluation of Sensors and their associated Affordances

The main sensorial component of this project will be the HC-SR04 Ultrasonic sensor. The datasheet states "**HC-SR04** is an ultrasonic ranging module that provides 2 cm to 400 cm non-contact measurement function. The ranging accuracy can reach to 3mm and effectual angle is $< 15^\circ$. It can be powered from a 5V power supply." The effectual angle is pretty narrow so several sensors will be needed in order to properly detect movement coming from around the wearer. Through testing, the sensor was discovered to be very sensitive to small objects and objects at the edge of its detection range so it's easy to get false positives. To work around that, I can put in either a delay or a state checker that checks to make sure the reading isn't jumping around wildly, or if it is, wait until it stabilizes a bit to take action. The second sensor I would like to add is a Passive Infra-Red or PIR motion sensor. This sensor generates energy when it detects heat and would check that the approaching object is in fact alive, as opposed to, say, a wall the wearer wants to lean against. The effective distance for these sensors is anywhere from 5-12m, although one with a 5m range would be ideal. This way it is close enough to the ultrasonic sensor to minimize accidental detections as both should be active before the cape starts moving. A small stepper motor will be mounted in the clasp of the cape at the front so it can draw the cape open and closed, and elastic in the back will keep it open when the motor isn't active. The circuit will be made through the use of conductive thread, and parts that don't necessarily need to be on the cape itself such as the arduino and a portable power source will be worn directly on the person. Perhaps in a box strapped to the wearer's back, like a small backpack. I would also like to add a manual control to the cape in the form of a simple button. Push the button to close the cape, stop and open the cape, or different detection modes if I am able to integrate even more sensors. The last sensor I'd like to include is a simple temperature sensor such as the NTC thermistor sensor. The NTC thermistor has a range from -50 to 150°C

which is more than enough for ambient temperatures, high accuracy, a quick response time and can be cheaply acquired. With all these in place, the cape can have 3 different modes: Manual, proximity and weather. I think this is the most effective way of integrating all these sensors and giving the wearer some autonomy over the cape. The Personal Space cape should be helpful as a tool, not just an artistic statement or piece with a mind of its own, for lack of a better term. It is a garment meant to help the user and react in accordance with their needs, not just react to anything and everything. The interaction behind this piece is meant to be an interpersonal social interaction but it is also about the interaction between wearer and wearable. It is about harmony between functionality and personal intent.

Initial Project Intent and Change

I think my project's initial intent has changed a little bit, but it remains mostly the same. At first it was about "protecting" the wearer in uncomfortable social situations, but sensors do not differentiate. They will react to certain parameters, regardless of what is triggering them. If someone was wearing the cape and hanging out with friends, for example, you wouldn't necessarily want the cape to be opening and closing all the time. With the change to include different detection modes, the cape offers a bit more autonomy to the wearer. This change came up in part through trying to figure out just how all these sensors would interact together, and how to prioritize conflicting signals from each. If it's really hot, and there's a lot of people, should the cape be open or closed? With this change, it is up to the wearer to decide. It offers a bit more freedom than the original plan and offers another facet of interaction between wearer and garment. This way, it is a bit more attractive to wear as you can actually communicate your intent or even fully take control with a manual mode. It was meant to be a multipurpose object and that part has not changed. Just the way that that function is implemented has changed. Also the same is the idea that wearable should be functionally wearable. There were some unforeseen design obstacles but I still want to stick with the idea of an actually wearable garment that isn't weighed down or made unnecessarily bulky by mechanical parts and complicated inner structures. Simple, elegant and sturdy is still the goal for the project.