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Soft Fabrication Skills
Final Project Proposal
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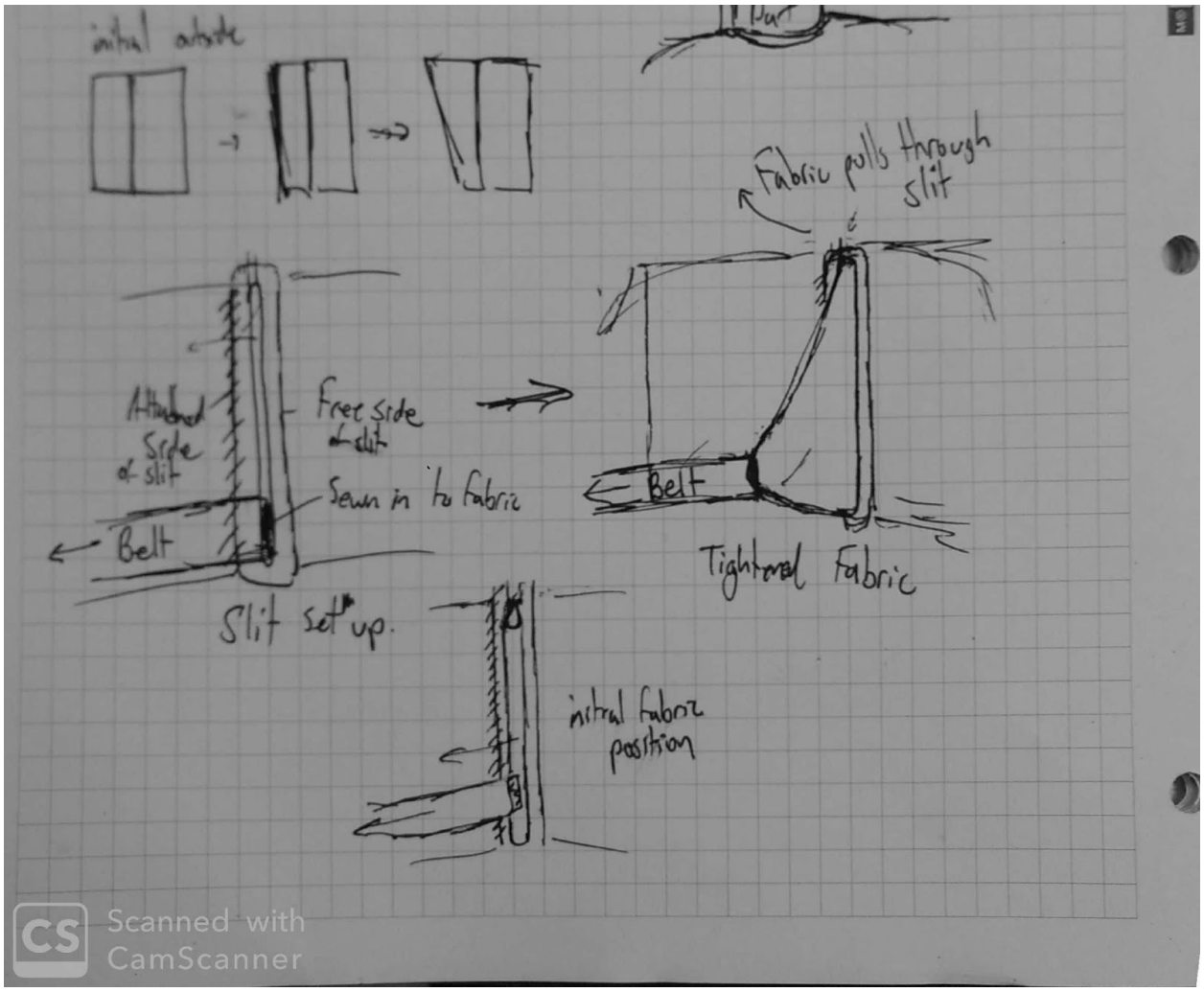
The Self-Fitting Coat

Inspired by the apparel featured in works such as *Spiderman: Homecoming* and *Back to the Future*, as well as real-life creations like the Tjacket, I decided to look into ways to comfortably fit the form of a garment onto whichever body it is placed on. Simply button a shirt, zip up a jacket, or close a clasp and the garment comes to life, tightening around the user's body until it looks as if it was tailor-made for them. Instead of simply making material from form fitting fabric, I was looking for a design that could work with any fabric one chose to work with and was robust enough to fit onto a wide range of shapes and sizes.

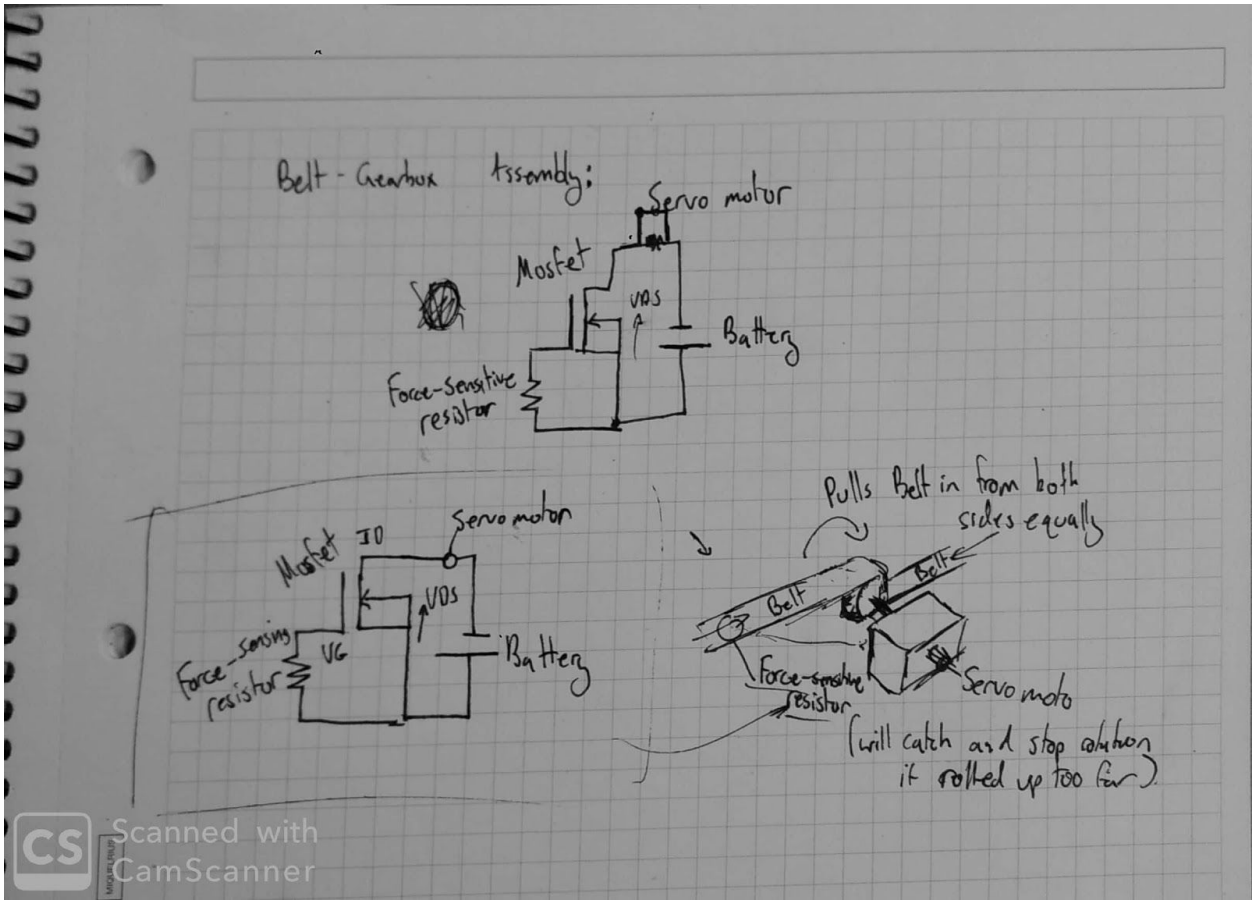
The core idea is to have a garment that, once fastened, completes a circuit and actuates a motion that would fit the form. Some designs, like the Tjacket, employ air pressure in order to press against the body. This would make the interior of the garment fit to the user but it would likely be too bulky on the outside to achieve the purpose of the project. Shape memory alloys would also have been a way to achieve a change in form, but they would require a constant current running through them during use in order to maintain fit. This would draw an unnecessary amount of power and could also cause potential loss of function over time due to fatigue. Another simple option would be to use internal lacing, similar to a corset. However, this would leave unsightly folding along the areas of containing the lace. The design required a method of tightening with relative mechanical simplicity and minimal energy requirements without sacrificing form. For these reasons, I chose to use tightening belts to achieve two different effects: 1) expanding darts and 2) peacoat fitting.

Expanding Darts:

The first idea takes what we learned about darting fabrics and attempts to create a version with a dart that has controllable dimensions. This design will tighten equally from both sides and so is most useful on thin garments that need to be centered in the front of your body, like button-down shirts. Essentially to create a dart, I had to create a triangle of material with variable width and pull the excess material into the inside of the garment so that the edges of the triangle can create a neat seam on the outside. Originally, I was going to use strings attached to a motor to create a dart similar to how they are made manually, but I quickly realized this would simply be a poor attempt at lacing and would have much of the same problems. The challenge here was to create the seam such that it always looks neat from the outside. To achieve this, I devised a system to keep the seam together with an attached slit and pull on the fold created by the dart to tighten. See the figure below:

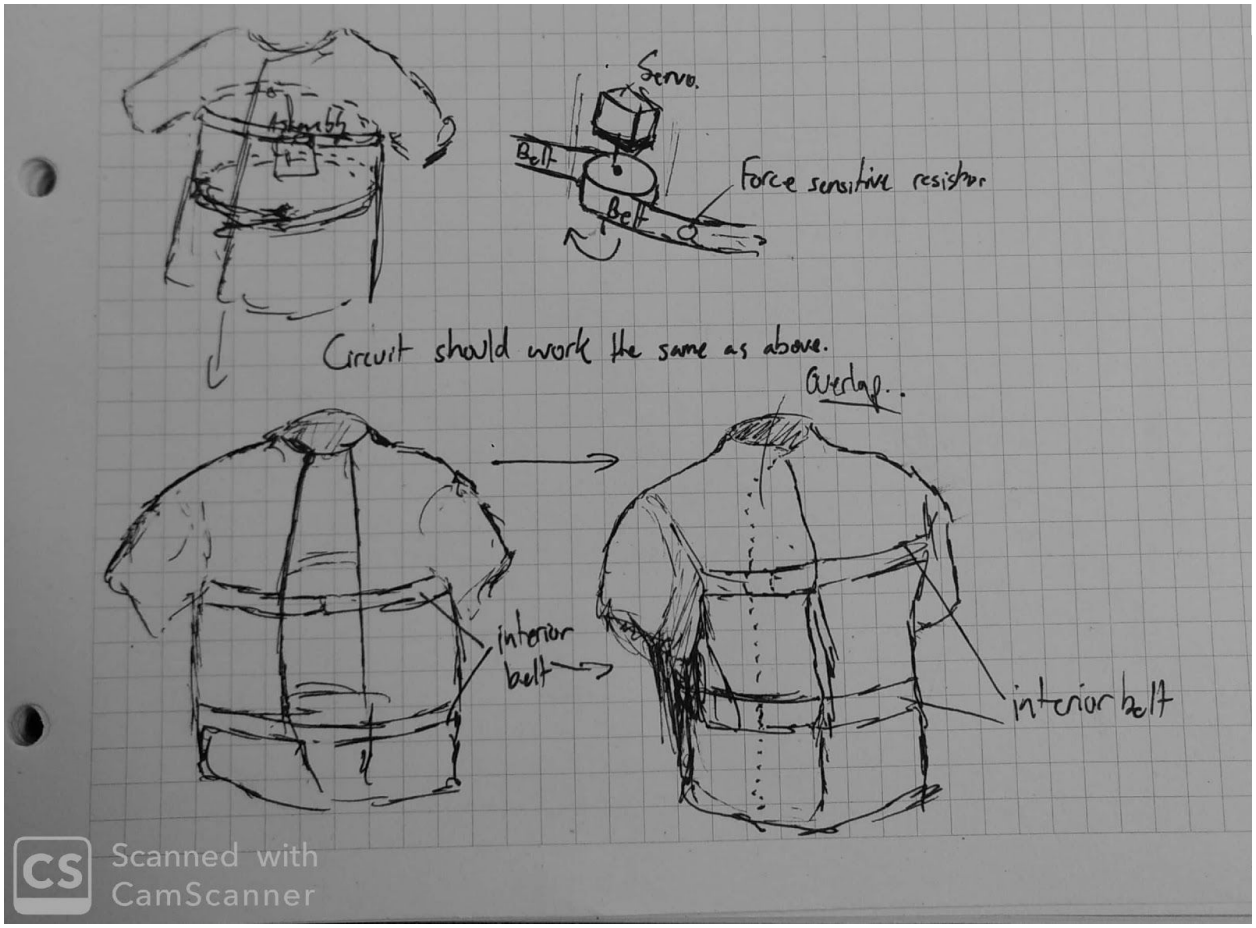


The main issue here is how to fasten the slit such that it is flexible, but remains in place without bunching the fabric. Ideas for how to implement this are still being explored. The benefit of this design is that the belt can be pulled from both sides equally using a servo that pulls in the belt until a force-sensitive resistor on the interior of the fabric experiences a certain level of tightness, and then it stops. A brake is applied at this point in order to hold the fabric in place without needing to draw power and the fabric should be darted to the correct dimensions. See the figure below for a schematic of the belt-gearbox assembly worn at the spine.



Peacoat Fitting:

If we are dealing with a garment where we don't care about hiding excess fabric, we can employ tightening belts to achieve a proper level of fit around whatever object we need. In the context of a coat, this would result in a jacket overlapping on itself at the front until it is fitted enough, similar to how a peacoat jacket is worn. The goal in this design is to use belts as two circumferential rings in a jacket around the chest and waist to create a fit around those areas. However, this design can be extended to use as many belts as necessary and can be used to a garment with an open end onto almost any form (e.g. feet, heads, animals, pet rocks). Once again, a belt-gearbox assembly is used along the spine to apply the force and a force-sensitive resistor is used to gauge the tightness of the fit. See the figure below.



The excess material on the outside of the garment may be secured using a fastener or even magnets on the exterior of the belt and inside the fabric. This should achieve a tight fit without loose clothing flopping about. This design could employ more belts for a closer fit and it could even achieve a similar effect using a singular belt around the waist and a clasp around the waist.

Hopefully these proof of concepts show more than just how to get a piece of clothing that fits well but also offers an avenue upon which the fit of a garment can be changed and interacted with. The original goal was to have these garments activate when a button is buttoned or if a zipper reaches a certain height (through conductive thread completing a circuit), but it's possible to input different sensors to change the fit in response to a variety of stimuli. For example: loosen the garment when seated or warm, or tighten it when standing, in a windy environment, or even when the user is stressed. An electronic avenue for users interacting with their own fit and comfort is something I find really exciting and I hope this offers some insight down that road.