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PROTOTYPE: THIS = THEN = THAT by Sol Paul and Melissa Lim

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Prototype Progress Report

To make the physical prototype, we started making the stroke sensor which felt like it would take more time. We were given a wide variety of fabric to be used for the stroke sensor. For testing, we used conductive thread, normal (non-conductive) thread, white felt-like fabric, pink cotton fabric, copper conductive fabric, and a rubber-like material to be a non-conductive surface at the back. After finishing making the sensor, we realized that the rubber was not totally non-conductive as the test LED would light up a tiny light even when the conductive threads on the stroke sensor weren't connected. However, that doesn't affect the digitalRead() function results. But still, as a precaution for the second test, we will be using upholstery material that is similar to neoprene as non-conductive material instead of the rubber material. This first prototype also made us realize that the ratio of transparent base to thermochromic pigment used was off, we used too much base so the result of the pigment came out too pale on the white fabric (it was more grey than black) so it allows us to adjust the ratio for the final version. Using the heating pad made us aware of the limitations of the heating surface, thus making us adjust in the future the size of the areas that we want to affect and maybe adding more heating pads to the system to heat up different areas. Also, working on the Etudes inspired us to use similar functions to make lights and sound output as we liked to create a mood system for the plush companion. We were also lent a 9DOF (3axis Gyroscope, Accelerometer, and Compass module) IMU (Inertial Measurement Unit) to test but we had trouble making it work so its usage is going to be determined if we are able to make it work. Making the prototype made us determined to make an online connectivity system work between two artifacts using Particle Photon to allow the user to get attached to their companion but also sharing that connectivity with a friend but we couldn't integrate it in this prototype because of shipping delays.

The prototype was necessary to test the affordance of the sensors and the cohesion of the concepts. It made us adapt or even completely change our ideas around the physical limitations of the material we end up using (addressed in the "Changes in Project's Initial Intention" section below). It is there to be the first version of our artifact and from there, our future version will be an improvement from the last. Since we now know how to make a stroke sensor, we can adjust it both technically so that it works better and visually so that it's aligned to look better. Making the prototype made us communicate as a team about what our preferences and limitations were, but also communicate with other people to get their suggestions or opinions on the prototype.
The prototype we made seems to be of low fidelity, mostly because it was made disassembled. It was not made as a complete item and the sensors were tested individually, using the breadboard to test out the circuits. However, the material used to construct the plush worked well, therefore would be considered for the final artifact. The possibility of using fake fur would fit better but we are limited by the amount of accessible material.

Technical Evaluation of Sensors and Affordances

The stroke sensor is functional, it works as intended. But it is limited by its appearance and the behavior is a bit different than we expected. The conductive threads connect easier than we thought. If one was to press on the sensor and leave it as it is, if the threads remain connected, the input will remain positive and it's not desirable. But for the interactivity it brings, we believe it was worth using. It is pleasant to pet and there's something soothing about it. The sensitivity can be adjusted by cutting the threads shorter or by adding distance between the conductive layers.

Thermochromic pigment mixed with transparent base for screen printing is applied on fabric. A heating pad is used underneath to heat up the pigments making the black color become transparent. The pigment itself was lighter than expected when applied (it is a user error since it's my first time using both of these ingredients the ratio of base to pigment was off). It had more of a grey tone but it still fulfilled its purpose correctly. We also had to work around the fact that it went from black to transparent when heated up. There are limitations in the area of the heating pad being 5x10cm. It made us realize that we need more than one because of the size of the plush and the areas that need to be heated to interact with the pigment. The feeling of the plush getting warmer fulfills its interactive purpose of bringing comfort and visual feedback.

With the accelerometer, gyroscope, and magnetometer we plan to read the motion and such of the plushie and have the mood parameters reflect that. As well, the sensor stick which is smaller but has the same functions has yet to be implemented. Although with the first sensor chip the library has been included and after hooking up and running the example there was nothing seemingly running.

As for the lights and the piezo at their current implementation, it is largely inspired by the LoopyLooper Etude. The values are applied differently over time and with some randomness. Although in a final version there would be more chords, and maybe specific tunes to signify moods or something like that.

Changes in Project's Initial Intention

There were adjustments made in terms of appearance. In our prototype sketches, it had bunny-like features while the actual prototype was made to resemble a panda. The reason why lies in the use of thermochromic pigment that we purchased. It's a black pigment that turns transparent when heated. It felt more in theme with the appearance of a panda that could reveal itself to be a polar bear in disguise if it is completely heated up. It gives it a sense of hidden identity, the more you hold it and take care of it, it's mask disappears and it becomes more of its real self.

From our initial prototype, we were given the suggestion of using thermochromic ink to display the time instead of a digital clock. The heating pad would be programmed to heat up gradually during the day to make the pigment change colors as well to give a sense of time changing. It was a difficult concept to work with as we had to decide if it would heat up during the night or cool down during the night and what to demonstrate with the black pigment disappearing with heat. That's why we came up with the theme of the panda revealing its identity the more you spend time with it. If we go with the idea of it heating up throughout the day, it could also end up being a heated plush that could be held to help fall asleep. However, it brought up the idea of another possibility: making the heating pad react to the mood system of the plush instead of the time of the day. It will be a functionality to be tested in our final artifact.

We also intended to use Particle Photon for our prototype to give a sense of connectivity between two of our plush artifacts but we were limited by the online shipping time. However. we still intend on adding this feature in our final artifact.