Transforming Movement into Light Through Wireless Communication: Explanation of the Prototyping Process for Reflection

https://mathi330.github.io/cart360/Project/index.html

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ABSTRACT

This paper goes over the progress thus far of the project Reflection. It covers the process of making this prototype, the elements we had to learn, what worked and didn't work as well as how we worked with that. We will also discuss how far we are compared to the project we want to create, and how our intentions have changed during this process.

IDEATION

The idea for this project came from a person's physical self and their way of being. We wanted to transform those small and unnoticed things into a visual environment. For this we thought about using a dark room and projectors connected wirelessly to a device worn by the user to get data from them. We decided that the wearable device would be a wristband because of the simplicity, size and convenience of putting on a wristband at the beginning of the experience. We also thought of the different sensors we could use that would give us interesting data. We settled with accelerometer, heartbeat sensor, temperature sensor, and sound sensor. For the wireless communication device, we researched and asked about devices that we could use other than Bluetooth. We learned about Xbees which are compatible with the Arduinos we use. For the room and the lights, we learned about theater lights and the fact that they can be programed with DMX and that it is possible to get them to communicate with Arduino and therefore the data we would send from the wristband.

We also had to look more into design interactions to guide the user into the piece and make them want to stay. We thought of having a starting point like a single light inviting the user to sit in the middle of the room, and only after that first guiding element have the data from the wristband be used.

ITERATION

Before starting to make the prototype, we experimented with the sensors we were interested in to see how relevant they could be. We learned very quickly that the heartbeat sensor was not usable because of the amount of noise in the data and that it would barely get a heartbeat. Since the sensor was too inconsistent, we decided not to use it. We experimented with the accelerometer (Figure 1) and got interesting data that led us to keep this sensor. We also learned about the Xbee and looked at how to do the circuit and how to code it (Figures 2 and 3). We tried the temperature and humidity sensor. The let down of this sensor is that it is very slow; we can

only get data every 2 seconds which means that we will have to learn how to store data to use it in an interesting way. We did not have the time to cover the sound sensor.

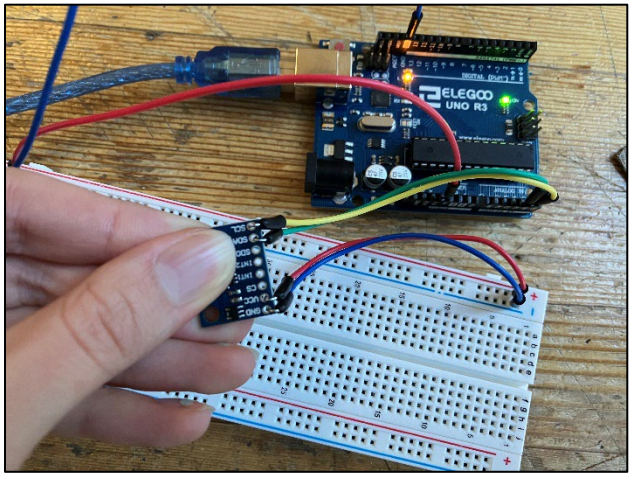

Figure 1: Accelerometer connected to the Arduino.

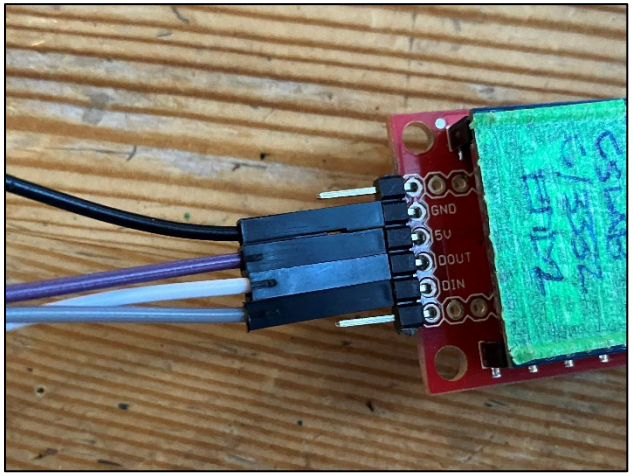

Figure 2: Wires connected to Xbee, black is ground, purple is 5V, white is digital out which can be connected to the RX port of the Arduino and grey is digital in connected to the TX port.

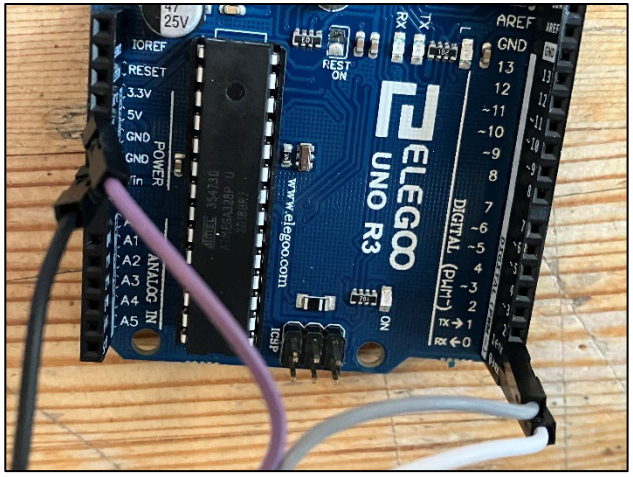

Figure 3: Wires connected to the Xbee on the Arduino.

PROTOTYPE

Once every sensor was tested on their own, we assembled them with the Xbee on the Arduino (Figure 4) and started the code for everything together by combining the individual codes. The hardest part here was with the Xbee. When sending data in the Serial monitor, we had unrelated symbols appearing in the monitors of both sender Xbee (coordinator) and receiver Xbee (End2). Through research, we realized that the problem came from the fact that the Serial monitor was trying to send the data to the monitors of the sender and receiver at the same time. We resolved the problem by using the SoftwareSerial library from the Xbee. Once the code was correctly sent over to the receiver Xbee, we put the circuit in the wristband (Figures 5-8).

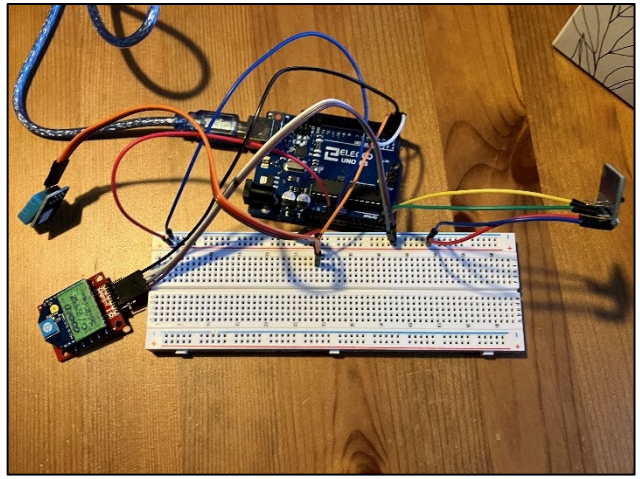

Figure 4: From left to right, temperature and humidity sensor, Xbee, Arduino, and accelerometer.

Figure 5: Cut an opening in the wristband.

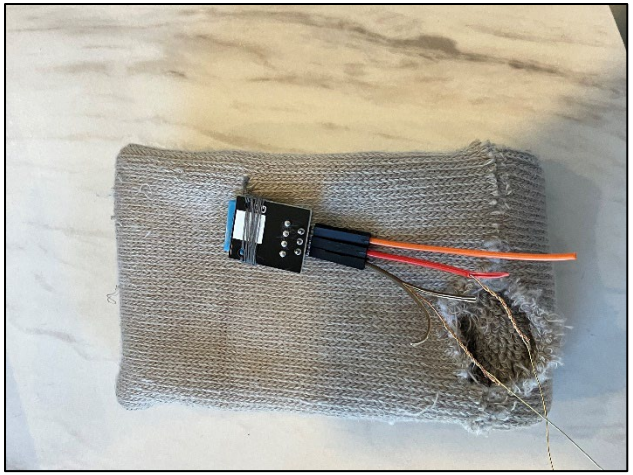

Figure 6: Temperature and humidity sensor attached to the inside of the wristband.

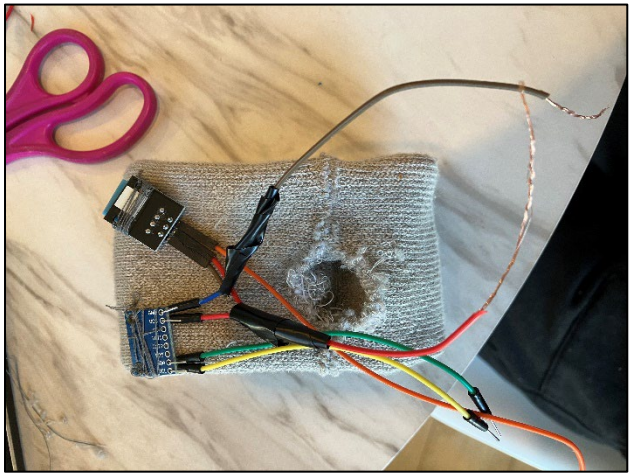

Figure 7: Accelerometer attached to the inside of the wristband.

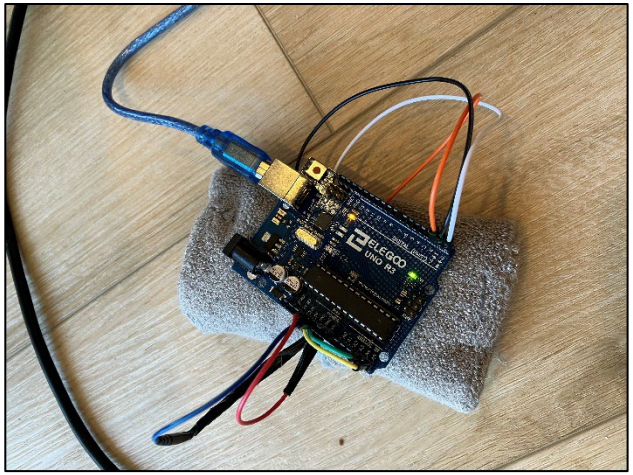

Figure 8: Arduino positioned on top of the wristband, connected to the sensors and Xbee.

Once the wristband was completed, we decided to create a simple reception circuit to give a better idea of what the final piece will do. For that, we simply connected the Xbee receiver to another Arduino and add an RGB LED to the circuit (Figure 9) and get the color of the LED to change with the wristband's data.

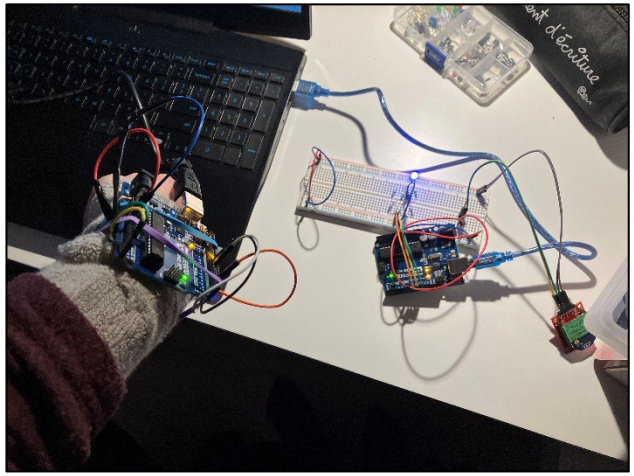

Figure 9.1: Setup with wristband and reception circuit.

CHANGES

During the prototyping phase, we realized that we were too ambitious for the time and knowledge we had. We were able to complete the first part of the project with the wristband and the wireless communication, however, for the rest of the project that will be to use that data on a bigger scale, we decided to change the way the environment will be. Instead of theater lights using DMX that neither of us know how to use, we will use LED strips that we can program with Arduino and place them into paper lanterns. We would like to look into RSSI with the Xbee to have the lantern closest to the person light up with the LED strips, creating a position-based interaction on top of our sensors. According to our research so far, LED strips coding is a little different from one RGB LED on its own, however, it should not be as hard as learning a completely new program like DMX in a couple of weeks. Otherwise, this new idea should not be too different from the prototype of the reception that we have now. Because of those changes, we also have to adjust our Design Strategies. We still want that one thing that attracts the user into the space and make them want to stay. What we can do using the idea of the lanterns, is that one lantern can be flickering as if trying to call the user. Once they are close enough to the lantern, the experience can start.