

# Project 3

## Testing & Prototyping

# Table of Contents

Design Statement	3
Activity 1	4-7
Activity 2	8-11
Final Design	
Process	13-24
Final Form	25-26
Reflection	27-28
Webpage Link	29

# Design Statement

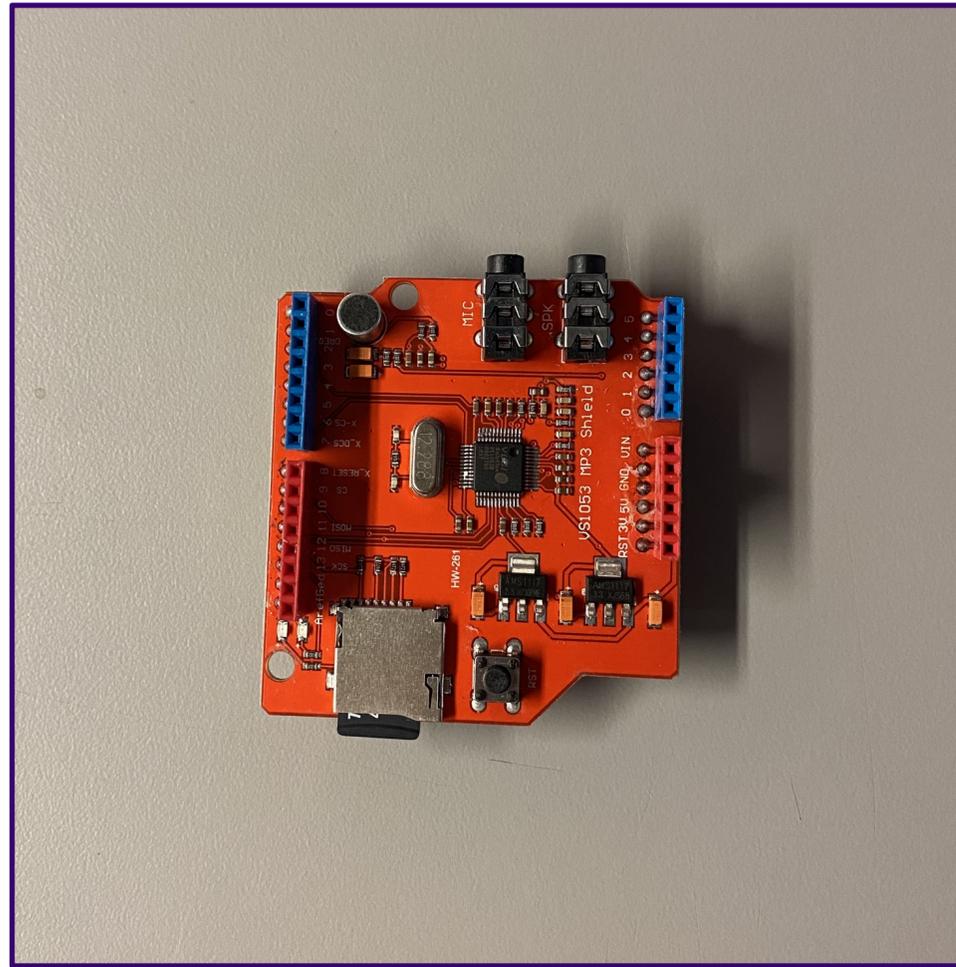
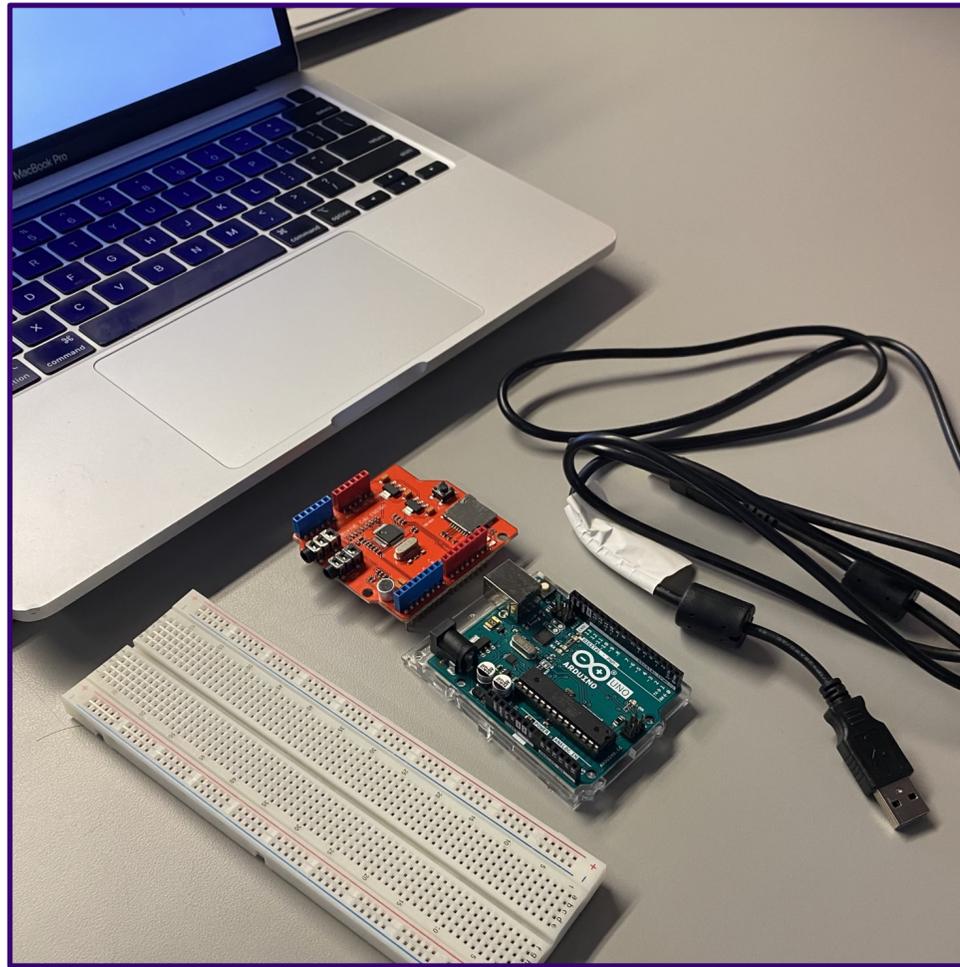
Continuing off of the Arduino exploration in Module 1 involving sensors and code in Arduino IDE, as well as Module 2's development of merging the digital and physical realm, Module 3 brings our scope of our project into the real world. Testing and prototyping products is a vital process in product design, where massive amounts of resources, time, money and energy can be lost. For our final design, we were asked to use testing and prototyping practices taught to us through class lectures on how to properly implemented change to improve a design. Throughout our weekly activities, we were given the final skills and tools we might need to do this, including further practice with SD cards, as well as the use of motors.

Module 3's weekly process assisted us in thoroughly comprehending the scope of our concept, clearly outlining how to achieve a successful final design. From this module, we were able to further develop a real-life affordances through user testing and prototyping, guaranteeing our product would be worth-while if it were to be taken into the manufacturing stage next.

# MP3 Shield Uno Expansion Board

# Activity 1

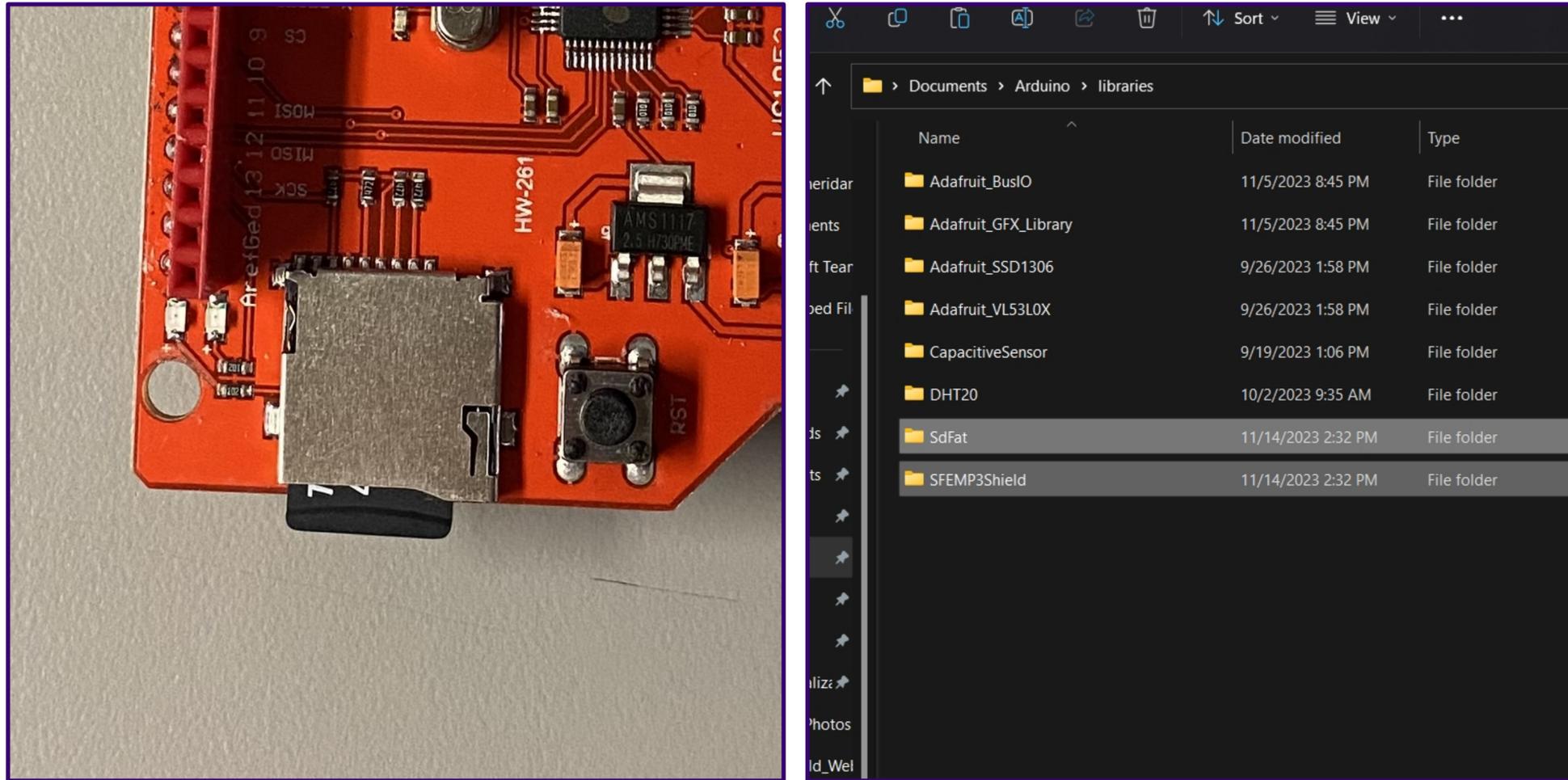
# Activity 1: Introduction to new tools



Beginning our in-class activity 1, we were provided with some new tools including the Arduino Shield. Serving as an expansion board and adaptor for the Arduino UNO, this could help us use all types of different sensors and motors in our projects.

In this activity, we used SD cards to upload sounds directly through our Arduino into P5.js.

# Activity 1: Uploading MP3s to our cards



After manually rearranging our libraries, we renamed 2 selected sounds to track001 and track002 to they could be read by our Arduino. Now the sounds were prepped, by typing 1 or 2 into the command board on Arduino IDE we could play either track 1 or 2. This opened the door to creating P5.js projects to have buttons do this for us.

# Activity 1: Making some noise!

```
MP3_Shield_WebSerial_Arduino.ino
1 //include all the library files
2 #include <SPI.h>
3 #include <SdFat.h>
4 #include <SdFatUtil.h>
5 #include <SFEMP3Shield.h>
6
7 //create and name active instances of the library objects
8 SdFat sd;
9 SFEMP3Shield MP3player;
10
11 // declare some variables to hold data
12 byte inData; //declare a variable to hold incoming data as byte data
13 byte playMP3; //declare a second variable to control the sd card and m
14
15 int ledPin = 13; // declare and define the ledpin
16
17 void setup() {
18     Serial.begin(115200); //set the baud rate based on what the MP3 shie
19     pinMode(ledPin, OUTPUT); //set the ledpin to output mode
20
21     playMP3 = sd.begin(SD_SEL, SPI_HALF_SPEED); //boot the SD Card
22     playMP3 = MP3player.begin(); //boot the MP3 Player Shield
23
24     delay(100); // short initial delay to allow everything to load
25
26 }
27
28 void loop() {
29
30
```



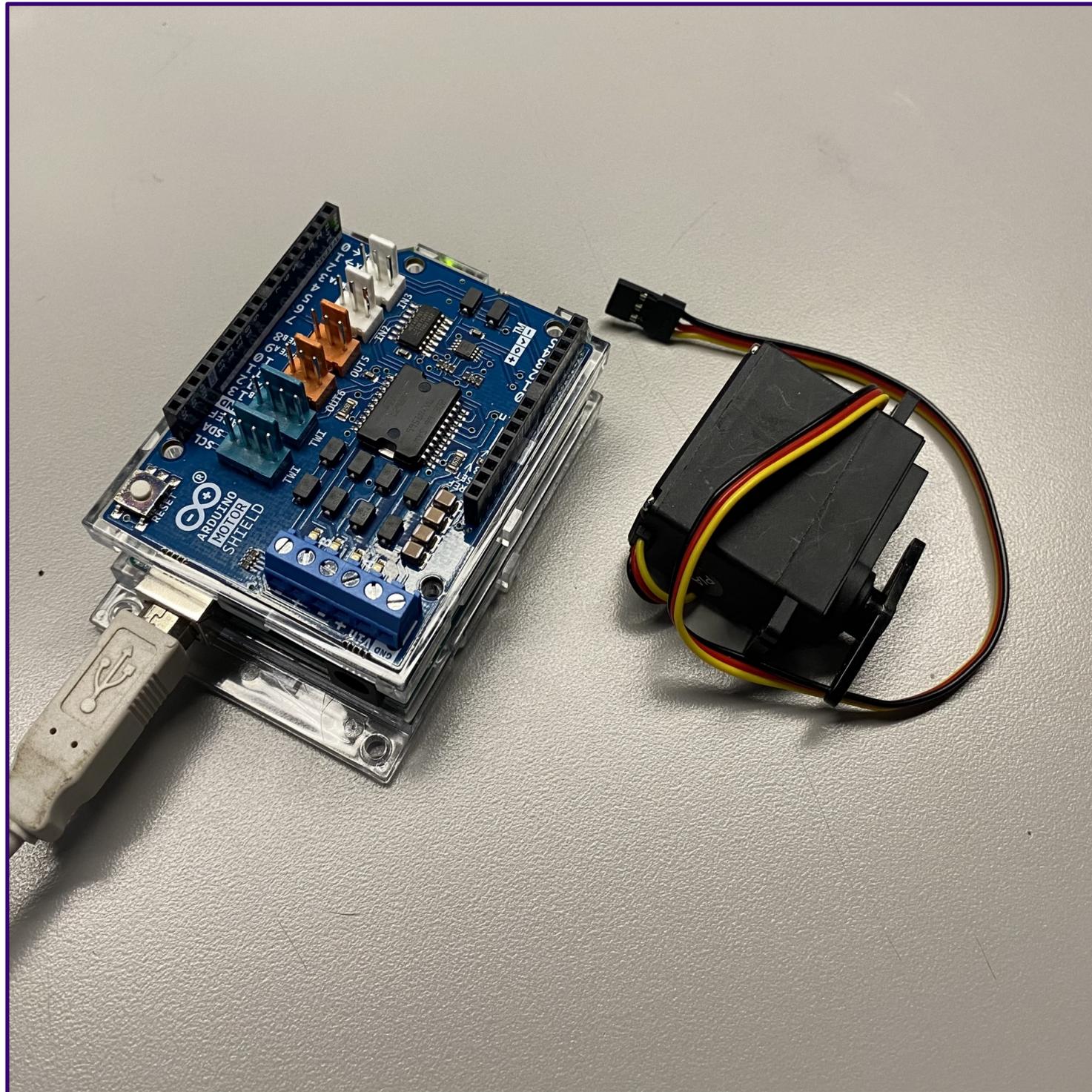
By plugging in a earphones directing into the headset jack, we could hear the tracks play on command by inputting the numbers "1" or "2".

After completing the activity, we had all of the tools required to jump into P5.js and make interfaces involving and calling sounds to play from Arduino IDE and our Arduino Shield expansion.

# Expanding on the Expansion Board

## Activity 2

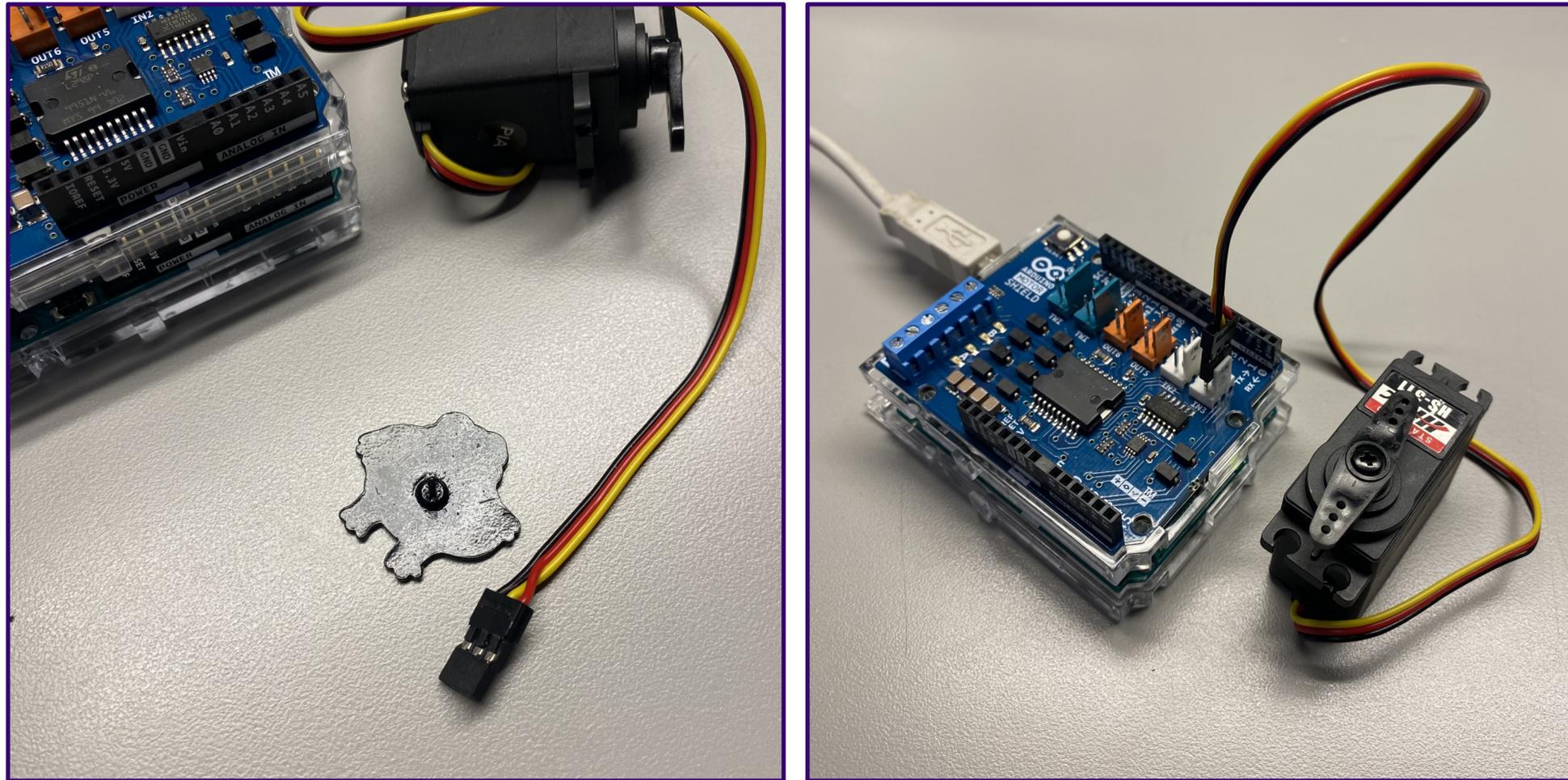
# Activity 2: Expanding on the Expansion Board



In-class activity 2 introduced us into using motors and our first moving component in physical computing. Taking a complete pivot point from activity 1, which used only sound, this further broadened the horizon of opportunities for our module 3 final designs.

Especially in the context of prototyping, a tangible and moving component of a project would require even more testing and fixing to make the requirement movement from point A to point B exactly as planned.

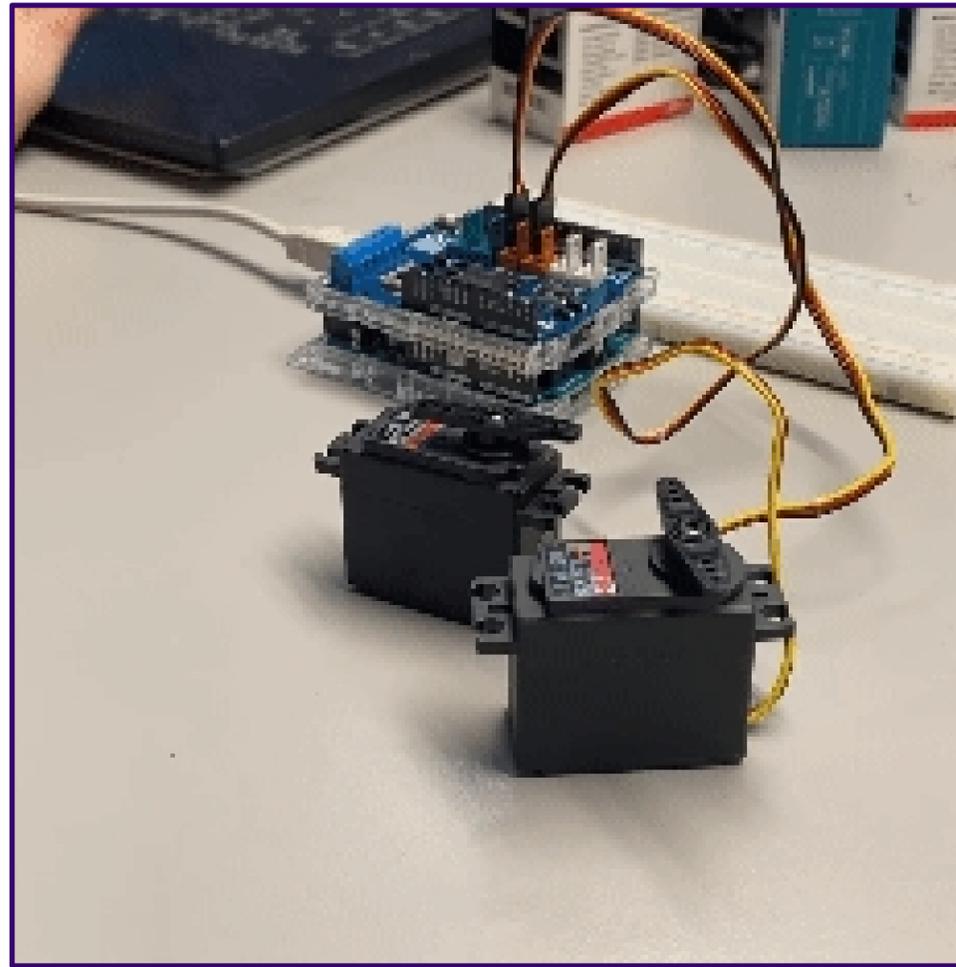
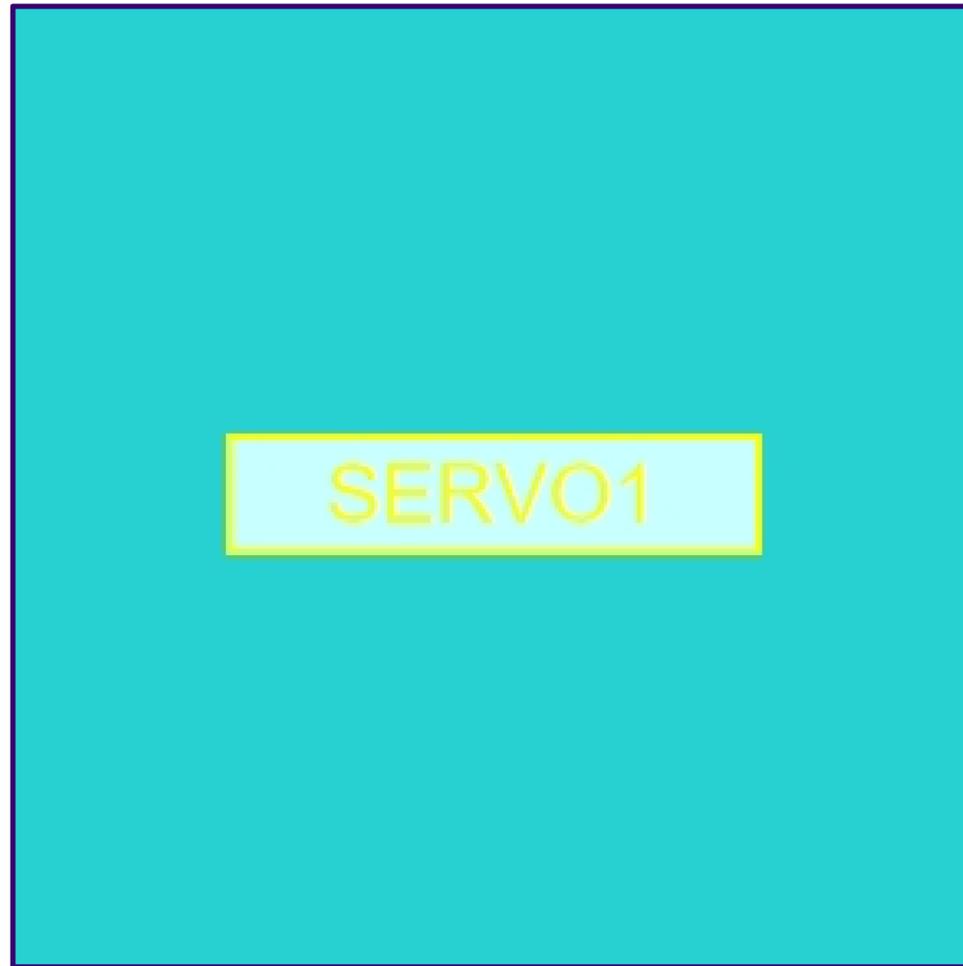
# Activity 2: Expanding on the Expansion Board



Explained to us in class, we had to rearrange 2 of the 3 wires which connect the motors to the shields. This is because of the pin prong placement and the code provided. Physically changing the wires was the simplest solution to this issue.

In my case, I used the small pointy back of a pin to flip up the clamp and move the wires. I was able to fix both of my motors in just a few minutes.

# Activity 2: Expanding on the Expansion Board



Once I had both motor wires rearranged, I plugged in the motors to my shield and opened Arduino IDE. With the use of provided P5.js files, holding the SERVO1 button would rotate the motor fins to make a complete rotation.

# DHT20 I2C: Humidity & Temperature Sensor

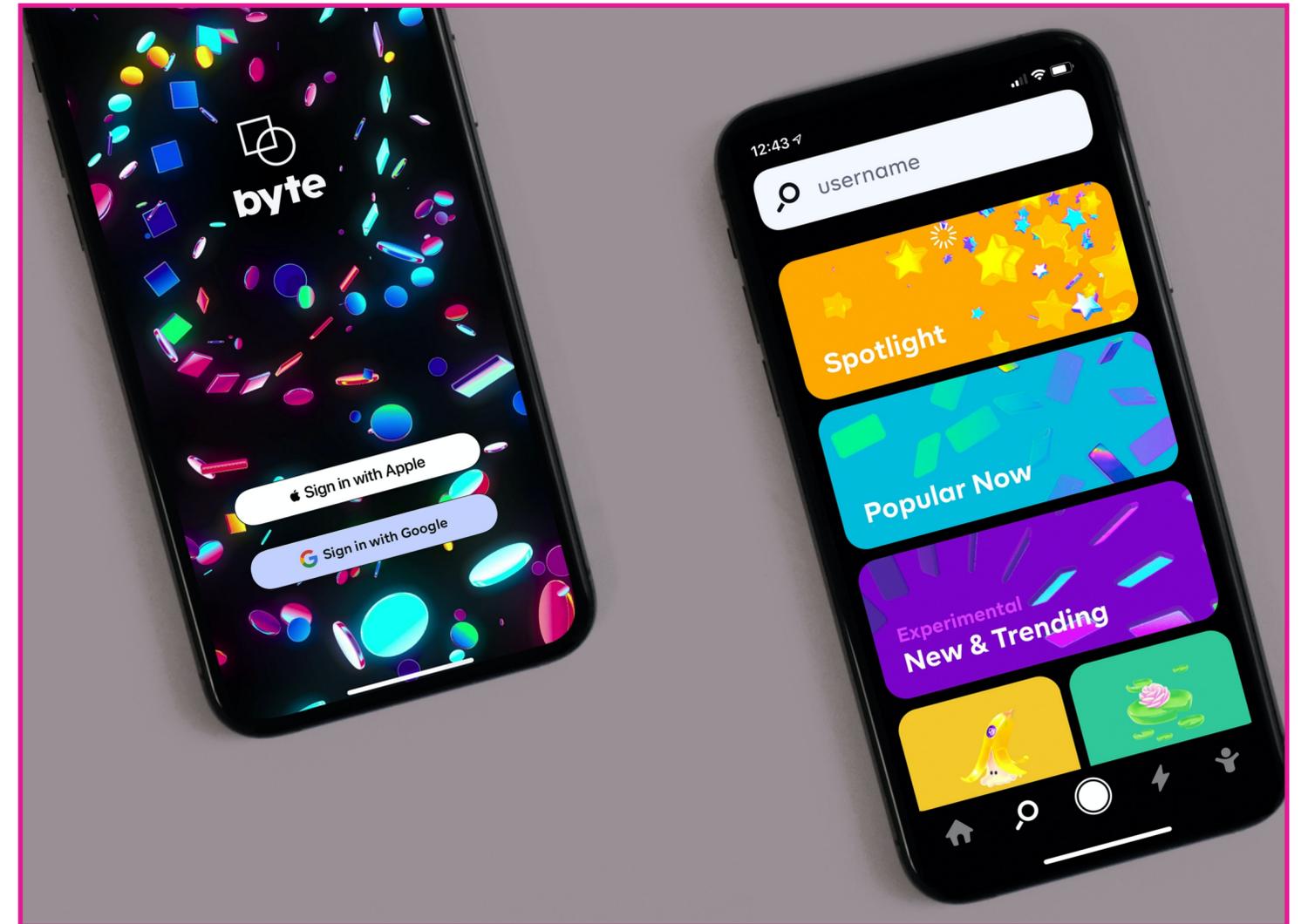
# Final Design

# Final Process: Concept

After the completion of the two weekly activities from module 3, and keeping in mind the teachings from in-class lectures on prototyping and testing using different methods, I wanted to finally wrap up my original concept on my humidity and temperature sensor. As my idea has already developed so much throughout the semester, I felt that the true final form that was required would be a mobile app or interface.

My rough plan going into the project would use prototyping and testing to develop an app to display all of the information a user would or could require to manage an enclosed space that needs a precise temperature or humidity(or both!). I could display the history of readings. throughout a selected time, the current and expected temperature and humidity, as well as the ability to control the humidifier, heater, fans, and lights.

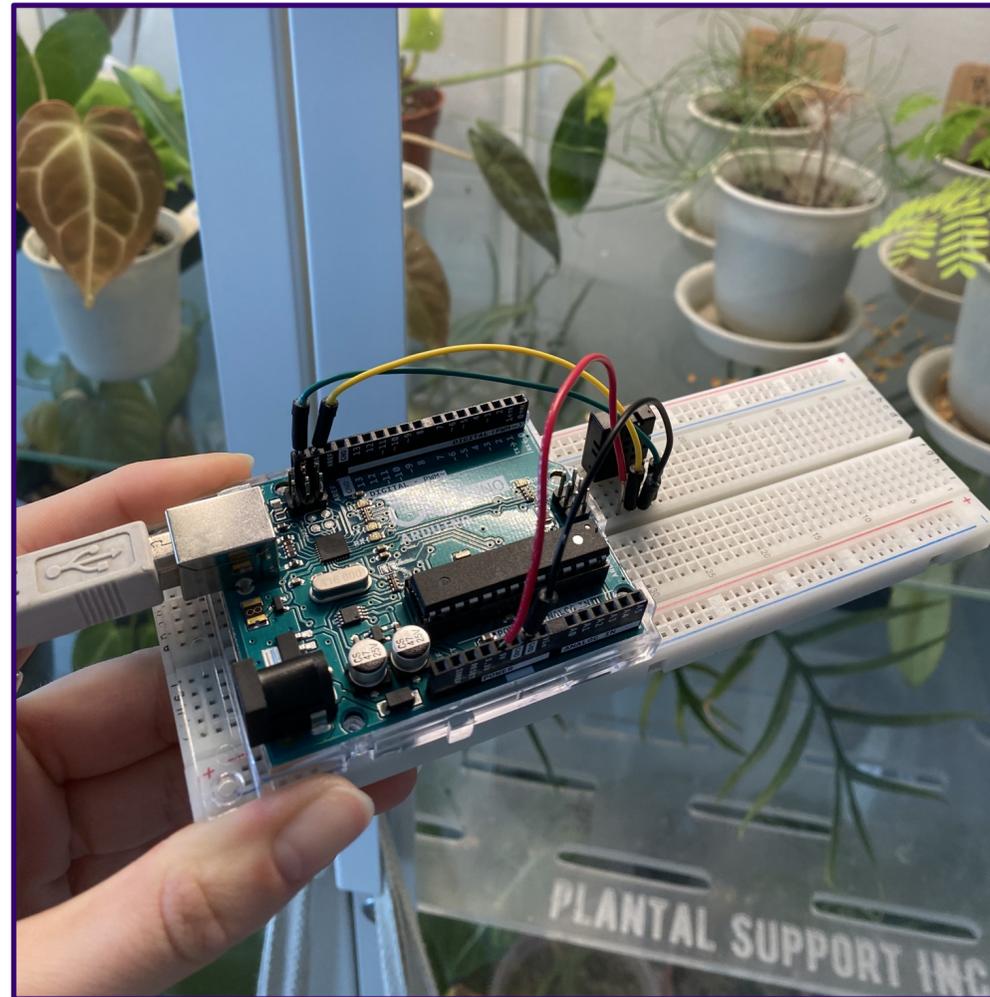
Again, I planned to use my own houseplant cabinet to exemplify how this could function. This app would be a product that would be incredibly useful to me personally, as I could be away from home and still control and upkeep the parameters of my plant cabinet.



# Final Process: The Final Expansion



Module 1 Final Tangible Product



Module 2 Final Tangible Product



Module 3 Final Tangible Product

My final step for this project would push the user experience for my concept, and take it from a rough product that is not optimized, into an app that has real-world use and has been expanded and tested thoroughly enough to make into a real app.

# Final Process: Research - UbiBot



Before my product development, I wanted to research on other examples in the real world. One example which I encountered was UbiBot, a brand that markets itself as a manufacturer of WIFI environment sensors. They sell a range of sensors including general smart sensors, and other sensors for air quality, motion, leak detector, and general "multi-sensors" that read parameters such as temperature, humidity, light level, and pH.

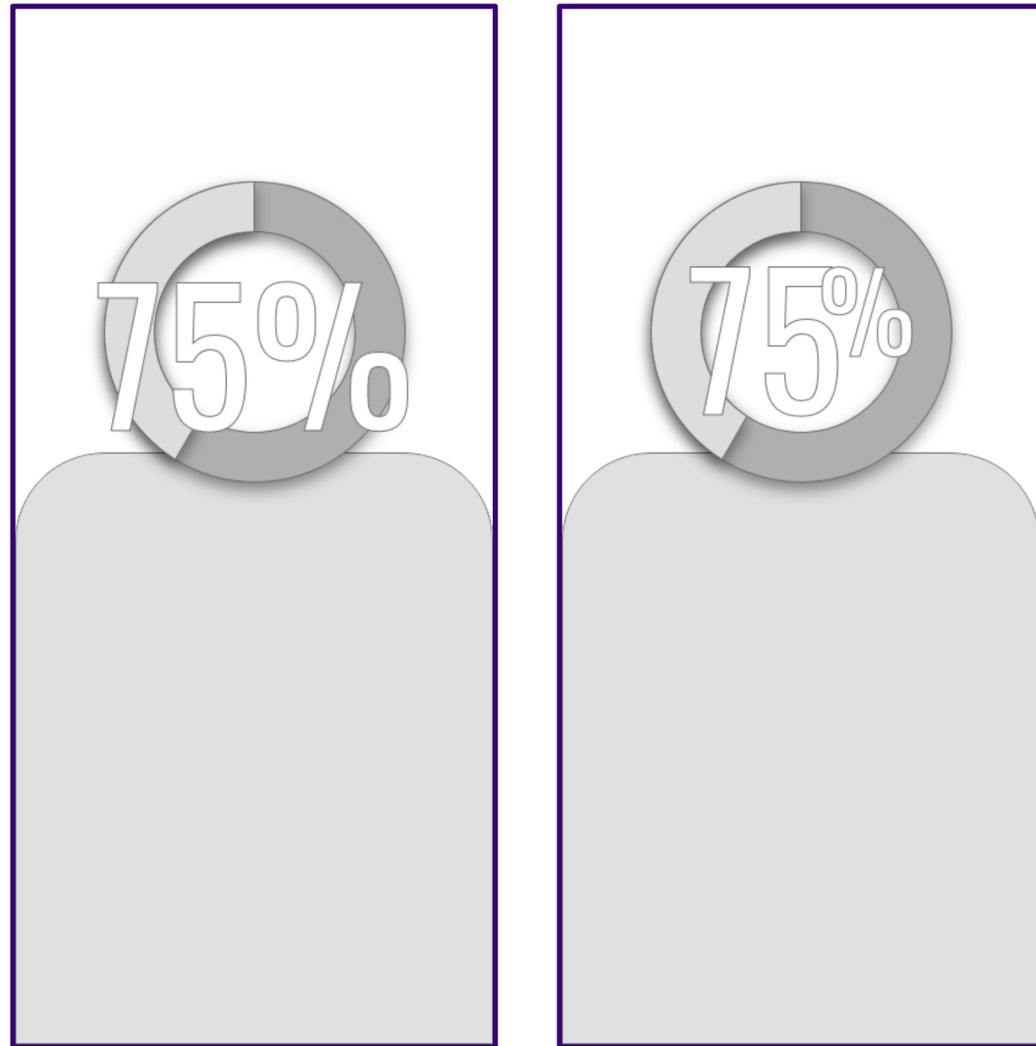
Along with providing and selling physical sensors, they have an app as well which you can connect remotely to from anywhere around the world.

On their website, they mention multiple use cases for example, the article talking about "knowing your pet's/reptiles living environment remotely".

**Article Link:**

<https://www.ubibot.com/news/3448/know-your-petsreptiles-living-environment-remotely-on-the-ubibot-app/>

# Final Process: Wireframe Development

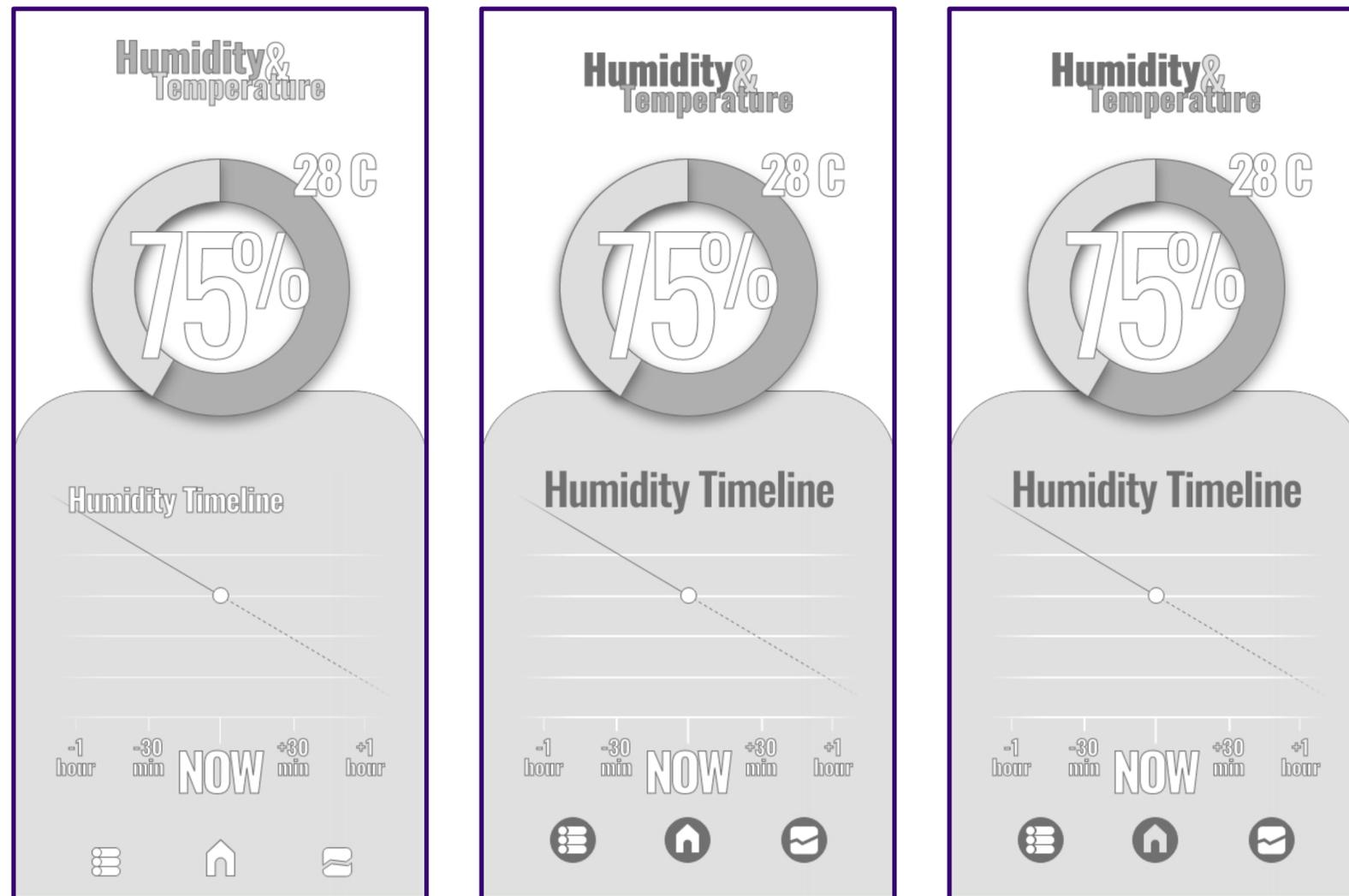


Considering the parameters of the sensor I've been focusing on throughout the semester modules (humidity and temperature), I wanted to make these current readings the most accessible and legible information displayed upon opening the application.

To do this, I started to develop a rough idea of a visual display of humidity, both in text and a charted form (pie chart layered behind).

In these first examples I experimented with character spacing and font size. I found that the percentage symbol had no reason to be as large as the reading text itself, as it is very recognizable from farther away (smaller size as well).

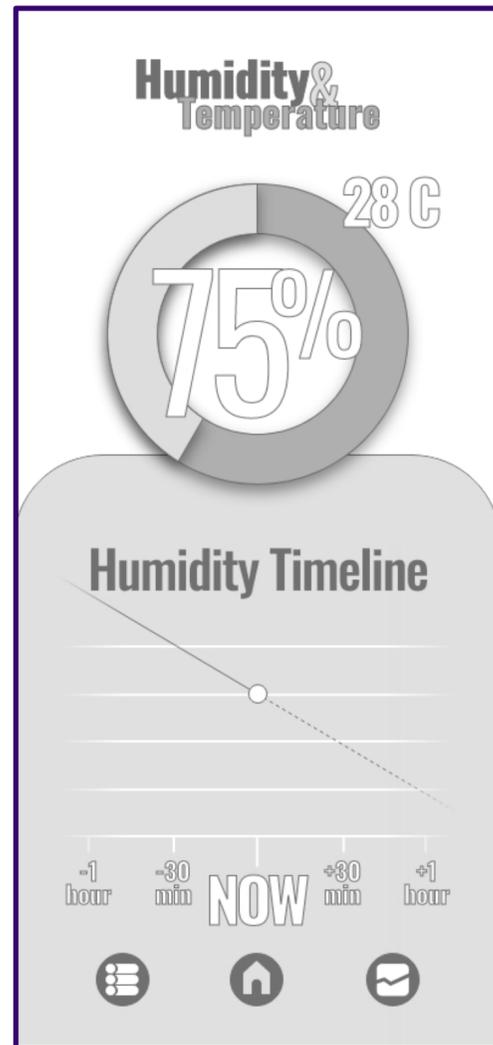
# Final Process: Wireframe Development



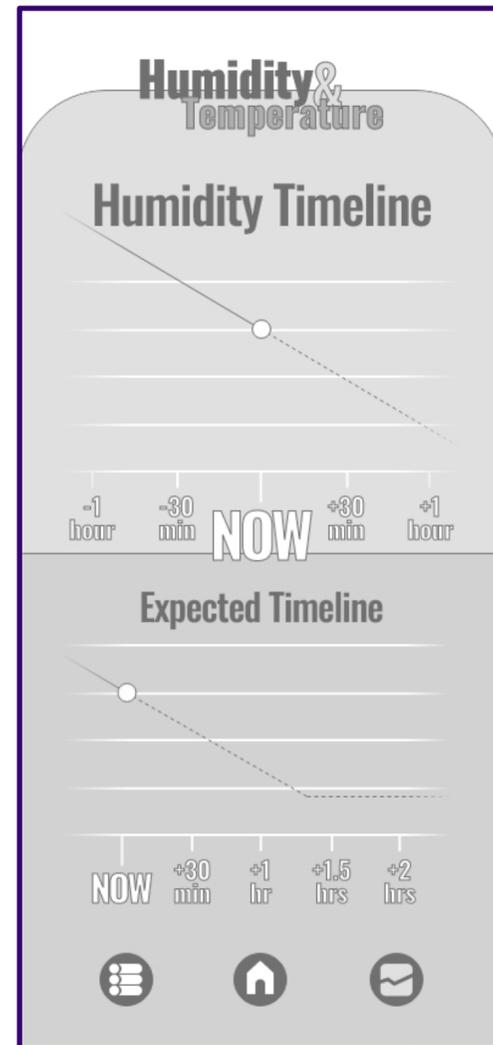
I added more elements to my wireframes including the current temperature reading (nearby the humidity so they are related by proximity), a wordmark for the app, a chart below displaying the last hour and expected following hour of readings, and 3 icons to lead users to other pages on the app.

In these wireframes, I changed font colour and weight to determine which creates the strongest hierarchy for the homepage.

# Final Process: Mid Fidelity Wireframes



Homepage



Timeline Charts

The "Records" wireframe features a header with "Humidity & Temperature" and a table titled "Records". The table has three columns: "Date", "Avg H", and "Avg T". The data rows are as follows:

Date	Avg H	Avg T
11/29	52%	27 C
11/30	47%↓	25 C
12/1	41%↓	24 C
12/2	72%↑	32 C
12/3	63%↓	28 C
12/4	58%↓	25 C
12/5	50%↓	21 C
12/6	83%↑	34 C
12/7	78%↓	32 C

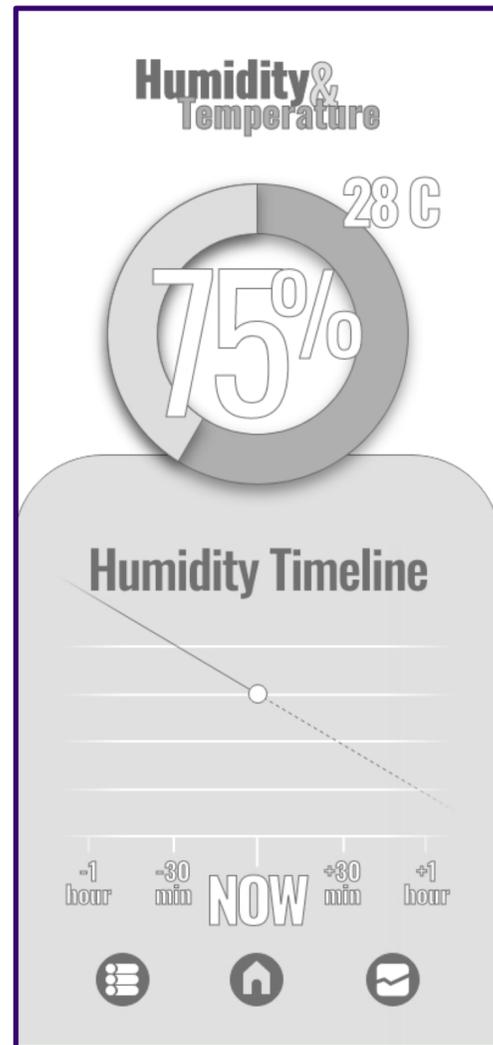
At the bottom, there is a navigation bar with three icons: a list, a home, and a message icon.

Records

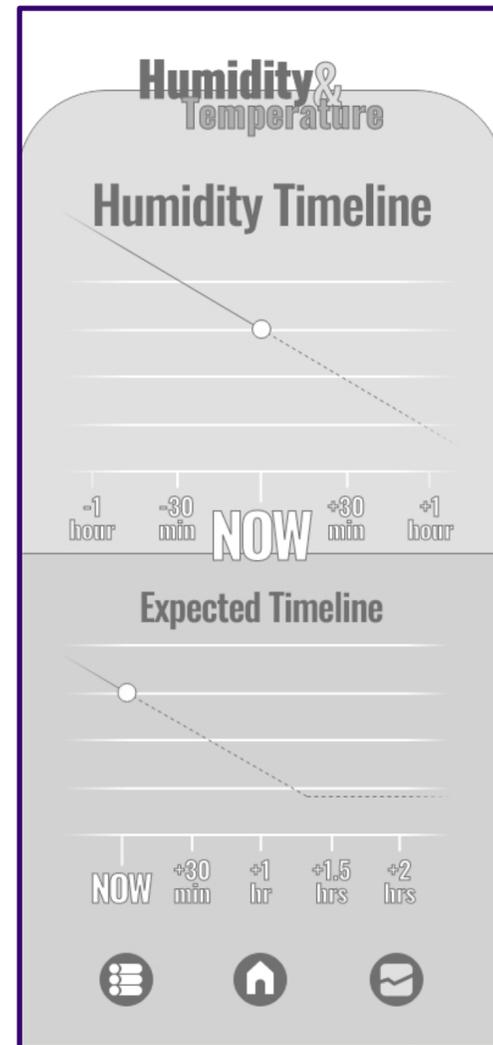
My mid fidelity wireframes included the final expected 3 pages of my app, including the homepage, timeline charts, and records page.

This was the first stage which I presented to my user testers, where I would focus on specific elements of my design for critique; **color and visual hierarchy**.

# Final Process: Mid-Fi Wireframes - User Testing #1



Homepage



Timeline Charts

The wireframe for the "Records" section features a header "Humidity & Temperature" and a table with the following data:

Date	Avg H	Avg T
11/29	52%	27 C
11/30	47%↓	25 C
12/1	41%↓	24 C
12/2	72%↑	32 C
12/3	63%↓	28 C
12/4	58%↓	25 C
12/5	50%↓	21 C
12/6	83%↑	34 C
12/7	78%↓	32 C

The navigation bar at the bottom includes menu, home, and messages icons.

Records

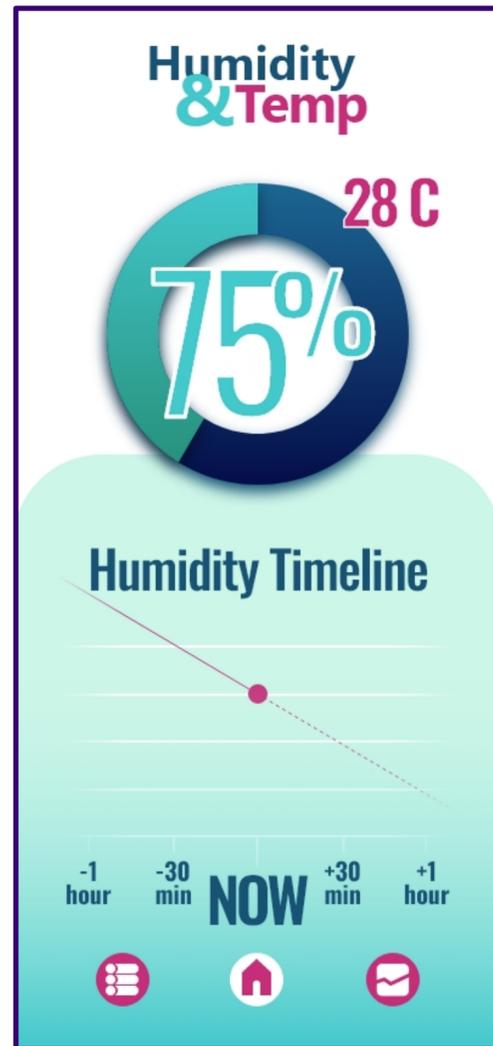
Going into testing, I made it clear to my two testers that I was asking for feedback focused on color and visual hierarchy. I asked my testers "What colours would you visualize this app having if it didn't have a black and white filter?".

Summarizing the transcript, both testers agreed that they pictured cool colours, specifically with blue and green. The word "mint" was also used in their descriptions multiple times.

They mentioned that warm colours "didn't make sense" in the given context, in their options.

My expectation is that their views on the design were effected knowing the context that this app would be used to track enclosures like houseplant cabinets(our association with plants being green).

# Final Process: First Hi-Fi Wireframes



Homepage



Timeline Charts

Humidity & Temp

Records

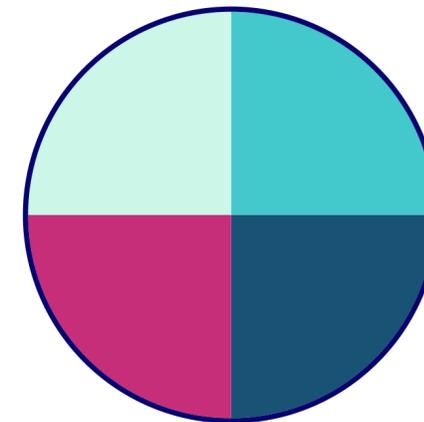
Date	Avg H	Avg T
11/29	52%	27 C
11/30	47%↓	25 C
12/1	41%↓	24 C
12/2	72%↑	32 C
12/3	63%↓	28 C
12/4	58%↓	25 C
12/5	50%↓	21 C
12/6	83%↑	34 C
12/7	78%↓	32 C

Navigation icons: menu, home, notifications

Records

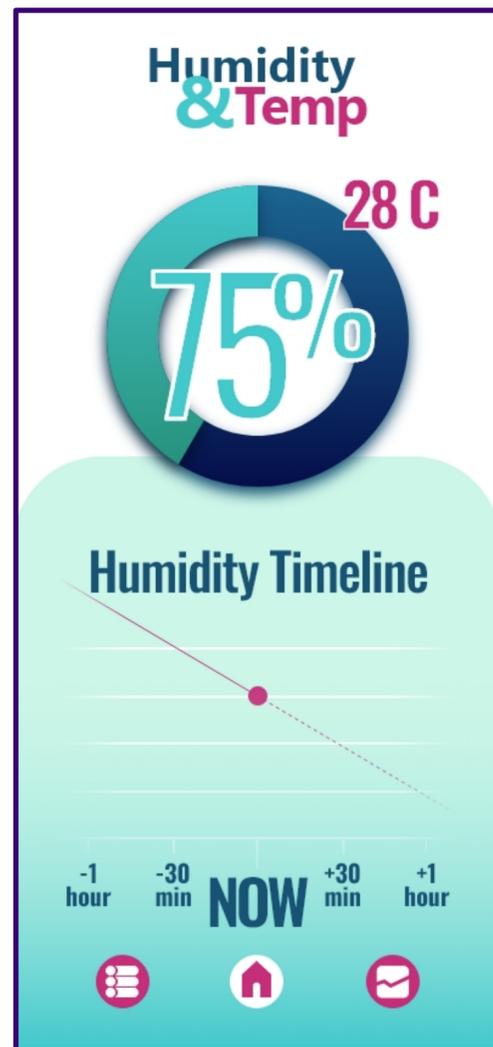
Considering the first round of feedback provided by my 2 user testers, I implemented their feedback using my own design lens. I chose a **dark blue**, 2 saturated accent colours including **magenta** and **cyan**, and a **mint** intended to add more interest to the page

I used these colours in a way which helped boost the association of magenta to temperature, and cyan to humidity (on the homepage).



Colour Palette

# Final Process: Hi-Fi Wireframes - User Testing #2



Homepage



Timeline Charts

The "Records" wireframe has a header with "Humidity & Temp". It features a table with the following data:

Date	Avg H	Avg T
11/29	52%	27 C
11/30	47%↓	25 C
12/1	41%↓	24 C
12/2	72%↑	32 C
12/3	63%↓	28 C
12/4	58%↓	25 C
12/5	50%↓	21 C
12/6	83%↑	34 C
12/7	78%↓	32 C

At the bottom, there are three navigation icons: a menu icon, a home icon, and a notification icon.

Records

The second round of user testing involved the overall improvement of the app visual hierarchy and layout.

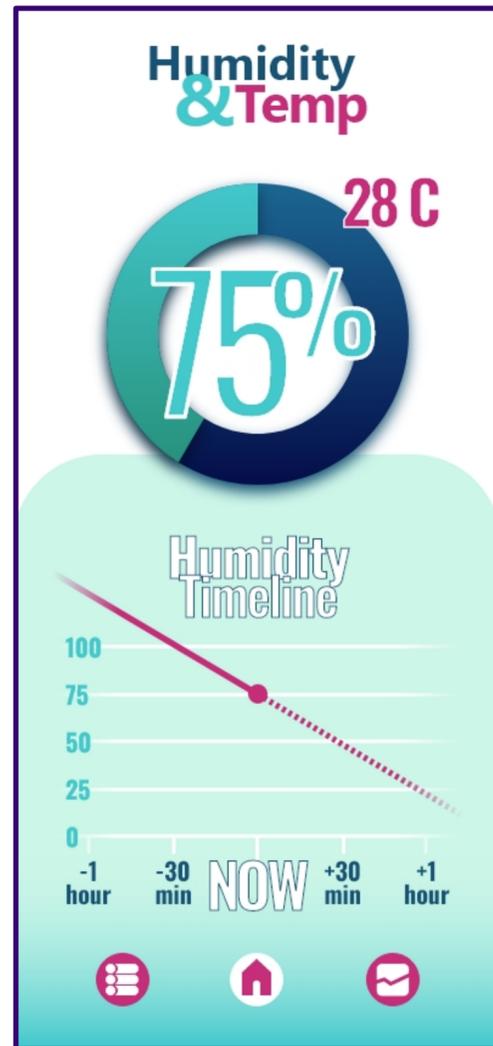
After the reveal of the first high fidelity wireframes to the tester, they expressed their appreciation of my use of colour. They mentioned how it brought life into the design, and helped further clarify how to understand the content.

There were points in the design which they saw needed improvement. The humidity timelines overall felt "weak" and confusing, especially with the absence of y-axis labels.

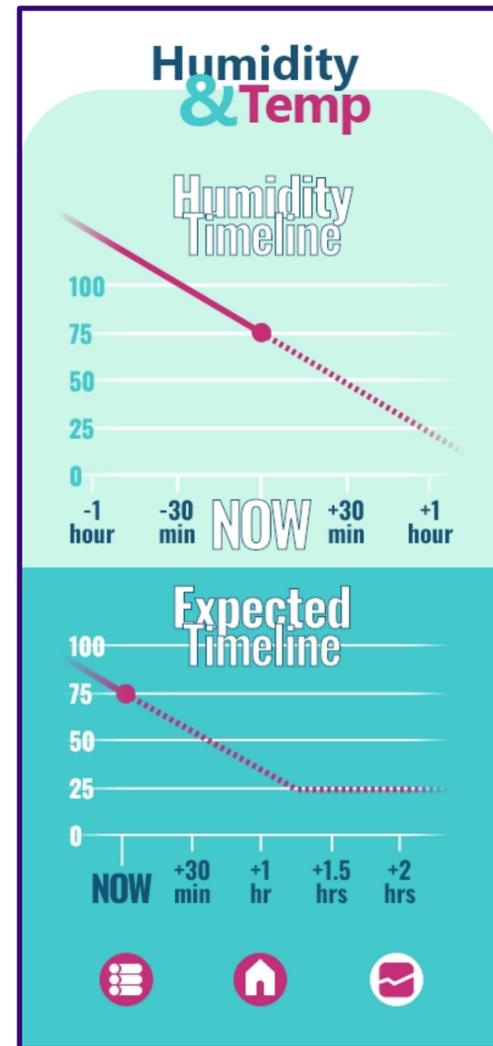
This was an oversight during my design process, and their advice gave me inspiration to raise the readability of the app.

They stated that the records page felt strong overall, suggesting it needed the least amount of revisions.

# Final Process: Second Hi-Fi Wireframes



Homepage



Timeline Charts



Records

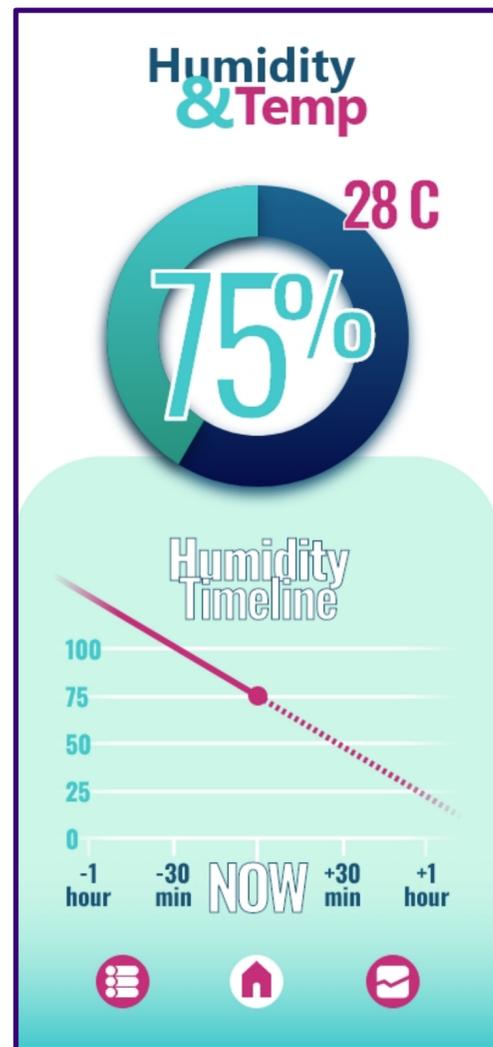
In my second series of edits for the high-fidelity wireframes, I focused on clarifying my information and making sure each section was distinguishable from surrounding sections. This was most important for the timeline charts page, as I felt that the current timeline and expected timeline didn't feel separated enough in previous versions.

As for the charts themselves, I added a y-axis, thickened line weights, and changed some colours to prioritize the current reading.

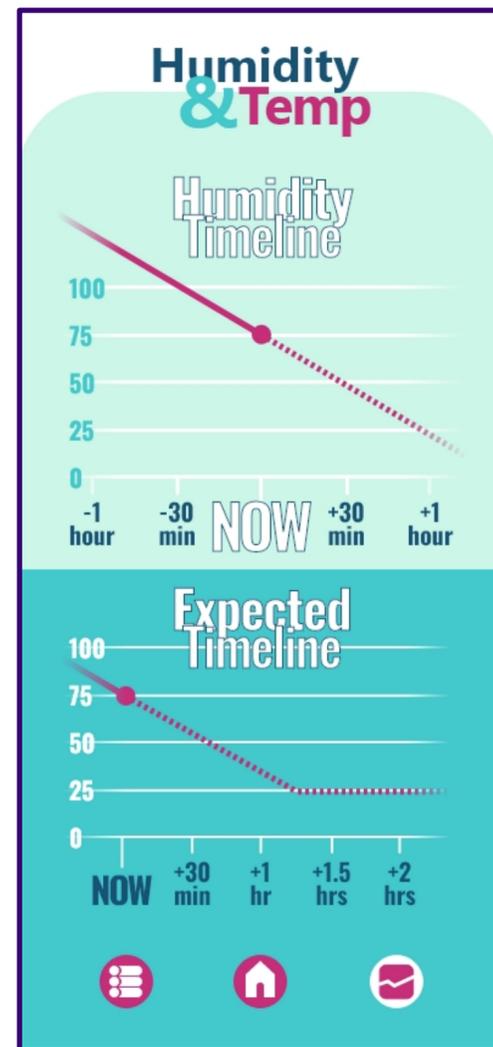
I changed the y-axis label colours depending on the background colour to guarantee the legibility of the content.

I also made the title text be white with a dark blue border.

# Final Process: Hi-Fi Wireframes - User Testing #3



Homepage



Timeline Charts



Records

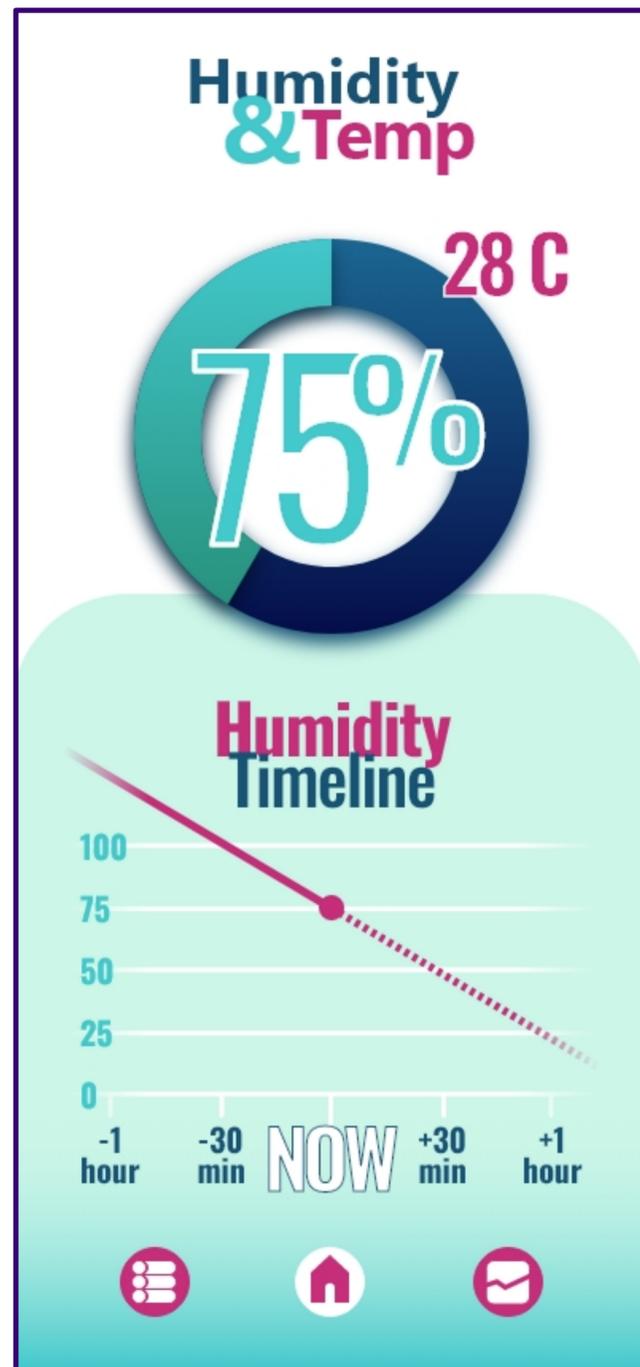
The third and final series of user testing was a great success. Both of my user testers expressed obvious improvement from the previous wireframes, hyper-focusing on the charts.

They did not notice my change to the records page, where I changed the fill colour of the arrows where the parameters were raised again.

Both testers agreed on one final point where I needed to improve, which were the chart titles. They said that especially since I overlap the text, the thin border weight combined with the low-contrast colour of the mint background colour made it hard to view when looking at a phone screen.

I agreed that this was a weak point and said it would be fixed in my next revision.

# Final Process: Final Hi-Fi Wireframes



Homepage



Timeline Charts

**Humidity & Temp**

**Records**

Date	Avg H	Avg T
11/29	52%	27 C
11/30	47% ↓	25 C ↓
12/1	41% ↓	24 C ↓
12/2	72% ↑	32 C ↑
12/3	63% ↓	28 C ↓
12/4	58% ↓	25 C ↓
12/5	50% ↓	21 C ↓
12/6	83% ↑	34 C ↑
12/7	78% ↓	32 C ↓

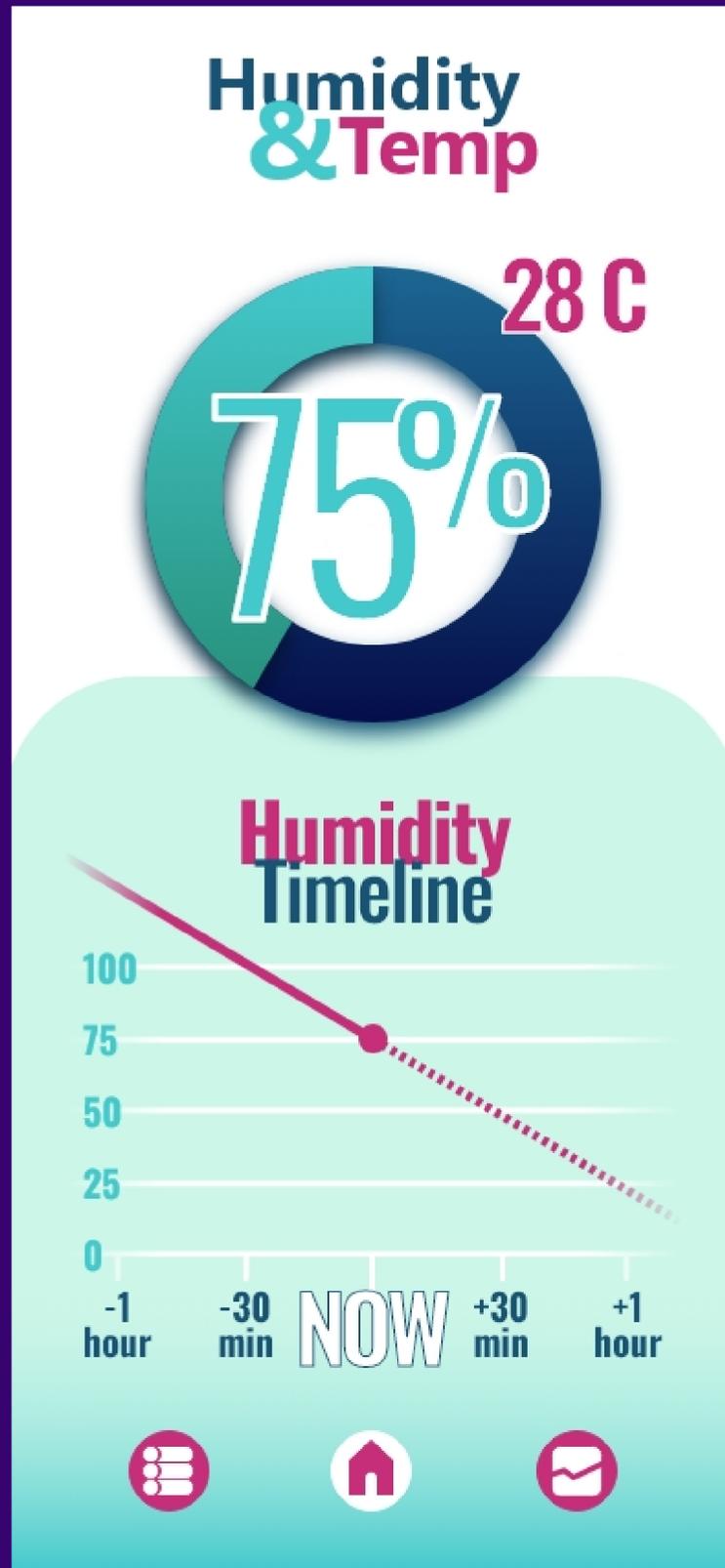
Records

My final high-fidelity wireframes were the result of multiple series of user texting, where I asked for both focused and broad feedback depending on the stage of prototyping.

This process was incredibly beneficial for me, as it eliminated the tunnel vision I tend to get when creating designs.

After completing the final high-fidelity wireframes and presenting them back to my user testers, they stated how they would gladly download the app and use it if it were real.

This was great news!



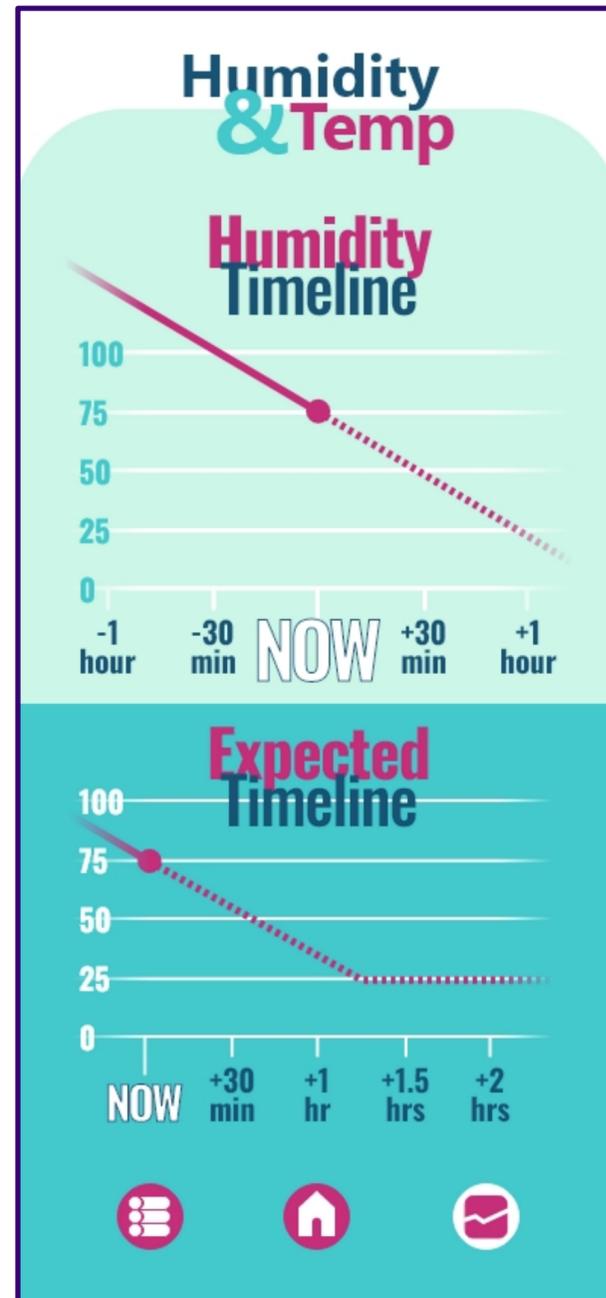
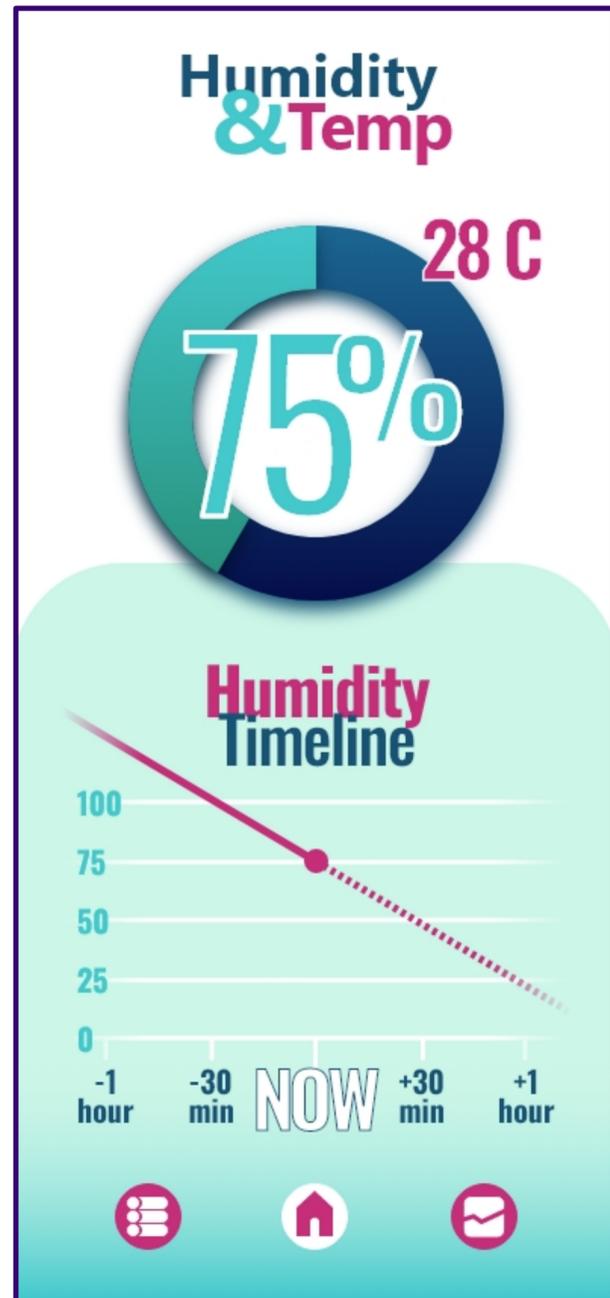
### Humidity & Temp

#### Records

Date	Avg H	Avg T
11/29	52%	27 C
11/30	47% ↓	25 C ↓
12/1	41% ↓	24 C ↓
12/2	72% ↑	32 C ↑
12/3	63% ↓	28 C ↓
12/4	58% ↓	25 C ↓
12/5	50% ↓	21 C ↓
12/6	83% ↑	34 C ↑
12/7	78% ↓	32 C ↓

☰ 🏠 ✉

# Final Design: App Overview



**Humidity & Temp**

**Records**

Date	Avg H	Avg T
11/29	52%	27 C
11/30	47% ↓	25 C ↓
12/1	41% ↓	24 C ↓
12/2	72% ↑	32 C ↑
12/3	63% ↓	28 C ↓
12/4	58% ↓	25 C ↓
12/5	50% ↓	21 C ↓
12/6	83% ↑	34 C ↑
12/7	78% ↓	32 C ↓

The purpose of my app would be to remotely connect sensors and tools located in someone's home to their smart devices. In my specific use case, I aimed to allow people who need a controlled environment (specifically temperature and humidity) to track these parameters on the go. This would be useful for reptile keepers, plant collectors, and anything that requires specific humidity and temperature.

# Reflection

# Final Design

# Module 3: Reflection

Module 3 felt like the final step of my concept that helped bridge the gap between physical computing and relevant UX work I could connect to my own future career path. Despite module 3 only being a series of high-fidelity wireframes which have no coded functionality, my learnings from the first two modules prove that with longer timeline I would be able to create a functioning version of this final app concept.

Overall, this semester helped me appreciate circuitry and physical computing more than I ever have before. The scope of the modules depended completely on us(our skill level and direction), letting me use this opportunity to insert topics which were very personal and interesting to me, and felt relevant in the realm of interaction design and the future of my career in the program.

I deeply appreciated the way you went about explaining the modules and considering our thought-process over our previous knowledge of physical computing itself. From this semester, I learned an incredibly diverse set of skills ranging from soldering, health and safety in a lab, and more complex circuitry. I also took away a completely new perspective on the thought process on project themselves, and practicing balancing my priorities in a project.

Thank you for an amazing semester, see you next year!

[http://  
ixd618.phoenix.sheridanc.on.ca/  
Year%203/Project%203/](http://ixd618.phoenix.sheridanc.on.ca/Year%203/Project%203/)

**Website Link**