CART360 Tangibile Media

Final Artifact Documentation (This = Then = That)

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Documentation: anieshadesigns.com/cart360/project.html
Github: https://github.com/Aniesha08/cart360/blob/master/Project/Final_Artifact/

Proposal

The coronavirus pandemic has become a life changer for all of us around the world. Quarantine, isolation, lock-down are keywords that we have all become familiar with this year and we have all experienced it to some extent. The first category of people are those who got the coronavirus and are isolated in the hospital. The second category is the people who got the less severe case of coronavirus and only need to isolate themselves at home. The third category is the rest of the people who are forced to work and attend classes from home, not be able to travel and comply with the lockdown rules of their respective city. In these three categories, not being able to see our loved ones as much as we used to and not being able to travel are the common problems that we all share during this pandemic situation. We decided to consider this project through the lens of the second and third category of people who are isolated at home.

As we (Aniesha & Zahra) ourselves are stuck within this isolated environment, we decided to use this project as an opportunity to explore and exploit our current circumstances. By understanding what it truly means to feel disconnected through our personal experiences and research backing, we decided to create a device that will enable us to break the barriers of isolation through a new form of communication which will allow us to embrace the presence of our loved ones and connect with them while we are in our own homes.

In order to start our project, it was necessary for us to think about:

- Project Affordance
    - The importance of our communication devices
    - How is it differerent from other communication devices
- Interaction Strategies
    - How will it communicate?
- Tools & Equipment
    - Evaluation of sensors & its affordances
- Physical Appearance
    - What will it look like?

PROJECT AFFORDANCE & EXPERIENCE

Considering the fact that our artifact idea and concept was stemmed from our current experience, it is supposed to break down the isolation halo and let people have that sensational and tactile connection again. Unlike other communication technologies that provide the user with a multidimensional communication that lets the user have both verbal and visual interaction with other people, their surrounding environment or their society, our artifact brings an exceptional opportunity for the user to connect with their loved ones only through sensorial experiences primarily of touch and visual. Our device lets the users focus all their attention, feelings and thoughts on what they are doing at that moment without being distracted with what is happening in the outside world. Moreover, our device does not eliminate the world of isolation as it's not what it's made for, but it lets the users make this experience of isolation more enjoyable, intimate and positive.

HOW IS IT DIFFERENT?

During this pandemic, our current devices, like our phones, tablets and laptops cannot fulfill our emotional and sensational needs of yearning to be close to our loved ones and have tangible experiences with them.
We definitely feel that our project brings along a feeling of empowerment and hope. At the same time, it will also challenge the users. By having a device that's only purpose is to reinforce being present and establish a link between two users who are isolated, it will enable the users to be in control of the moment because there is no exterior distractions that can hinder the quality of the communication.
We would like our device to consider both the empowering and challenging factors. While the device will attempt to provide comfort and closeness, at the same time, the device's nature is a representation of our adaptation to the new normal lifestyle because of the way in which the users will be interacting with the device. Therefore, we will be experimenting to see if this adaptation of communicating through only sensorial experiences would be a practical and effective solution to this new condition.

INTERACTION DESIGN STRATEGIES

Instead of using words and images to express our emotions, we decided that the interaction between the users should be focused on using sensors that will enable tangible sensations and visual cues to communicate messages between the users.
Through our device, we decided to reinforce the use of our tactile and visual senses which has not been used to their full potential when engaging in a virtual conversation. The users will experience three types of interaction:

1. User to user (psychologically through their feelings & thoughts)
2. User interaction with their device to send a message
3. User 1 device to User 2 device

1. User to User

We see the communication between the users as a Balancing System because both users will be sharing their senses which will balance each other's feelings as well as balance the isolated space between each other. The users will not feel like they are completely in their home nor will they feel like they are completely in the sender's home. They will both be in a shared place that is the outcome of both their presence.

2. User interaction with the device

The user will need to interact with their device in order to choose which sense will be able to effectively convey their message/feeling. This type of interaction can be seen as a Linear System because the device on its own does not produce any output from what the user has sent, instead it reflects on the received message. In other words, it works similar to a Blutooth device.

3. User 1 device to user 2 device

Both devices will be sending signals/ data to each other so that the users will be able to feel each other's input through a sensorial experience. It is based on the output of the devices, that will trigger the conversation between the two users. Therefore, it is similar to the Entertaining System but the difference is that it is the input of the partner device that is making the device work.

EVALUATION OF SENSORS & AFFORDANCES

We decided that our sensors should each represent a feeling/emotion or be used to convey meaningful messages. The following sensors are the sensors that we chose to experiment with to see if they are effective enough to break the barrier between two people who are isolated.

Vibration Motor

The vibration motor can be used to convey a sense of anxiety, stress, discomfort etc. Comfort, love and happiness are not the only emotions that we as humans would like to share with our loved ones. Sometimes we need to share our negative feelings and in return, receive our loved ones' support, attention and sense of empathy. Therefore, we thought to have a vibration motor to represent the negative emotions such as anxiety and stress which is a common feeling that we all share in regards to the uncertainty caused by the pandemic. For example, by changing the value for the vibration motor, the sender can show to what extent they are stressed to the receiver.

Heartbeat (Pulsation) Sensor

While the vibration sensor conveys a sense of anxiety, the pulsation sensor conveys the contrary. The heartbeat sensor will be able to take the pulsation rate of the sender and translate it by the bump pulsing in and out of the device and glow in red colour. By seeing the pulsation rate of the sender, the receiver will feel relaxed that they have someone with them. For example, our assumption is that when one receives a vibration and they send their heartbeat (which is in a calm state) to the other person, the other person might feel more relaxed.

Temperature & Humidity Sensor

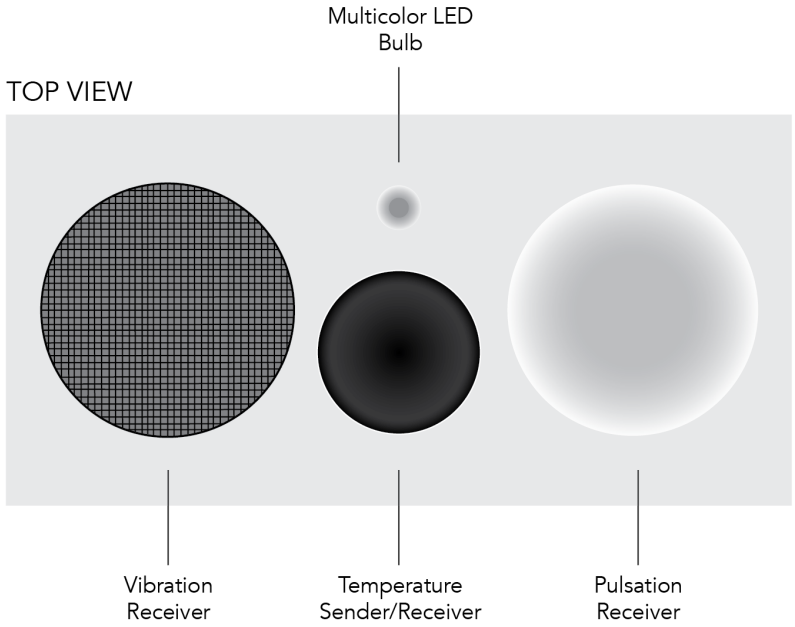
The temperature and humidity sensor can be used to detect the temperature of the home/space of the sender and receiver. Therefore, they can both know what is the room temperature of their sender's home. By being able to sense the room temperature of the other person's home, this makes the user feel as though they are present in the same room as their sender.

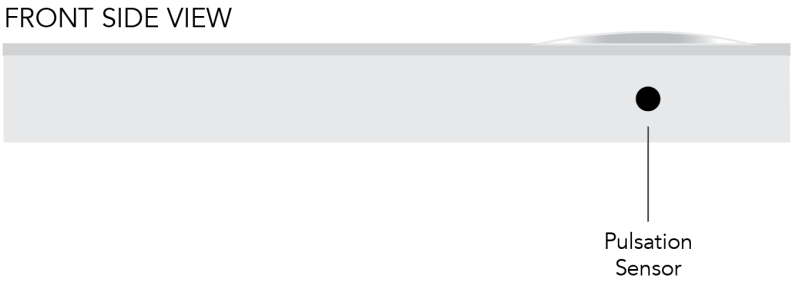
Sound Sensor to LED

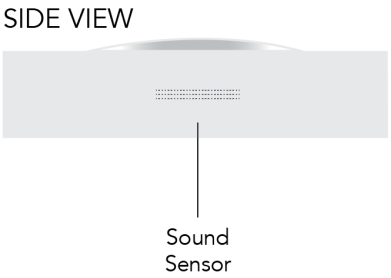
The sound sensor can be used for the users to send messages using their voice which will then be converted to LED light for the message receiver. Through the use of a multicolour LED light, if the user says a specific preset sentence, the LED light of the receiver's device will reflect the color that is associated with the expression. The preset sentences are:

I miss you = Blue
I love you = Red
I empathize with you = Yellow
Get well soon = Orange
I am feeling depressed = Purple
I feel lonely = Gree

OUR INITIAL IDEA OF THE OBJECT'S APPEARANCE & INTERACTION





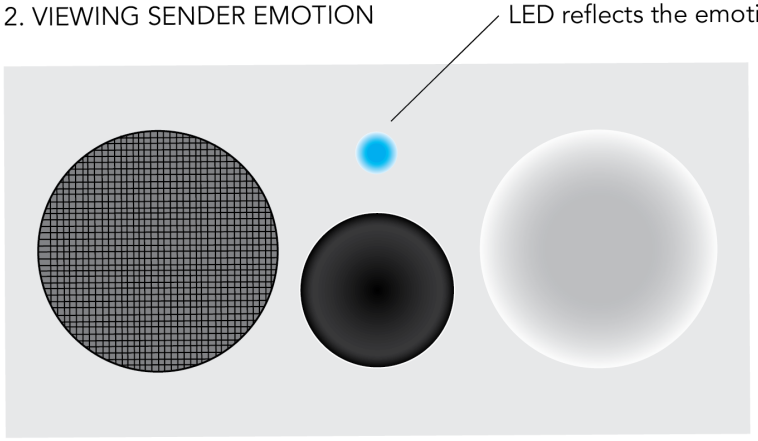


Interaction:

1. SEND EMOTION VIA SOUND

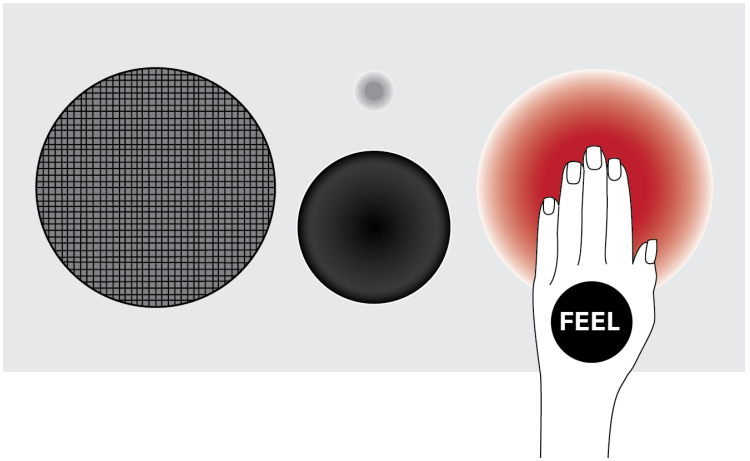
User says the preset sentence:
“I miss you”

2. VIEWING SENDER EMOTION

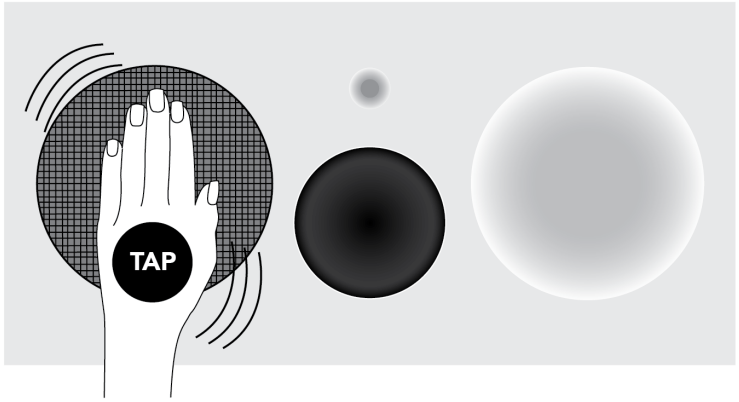


3. SENDING PULSATION
By sending our pulsation, the user who is feeling sad can feel our presence.

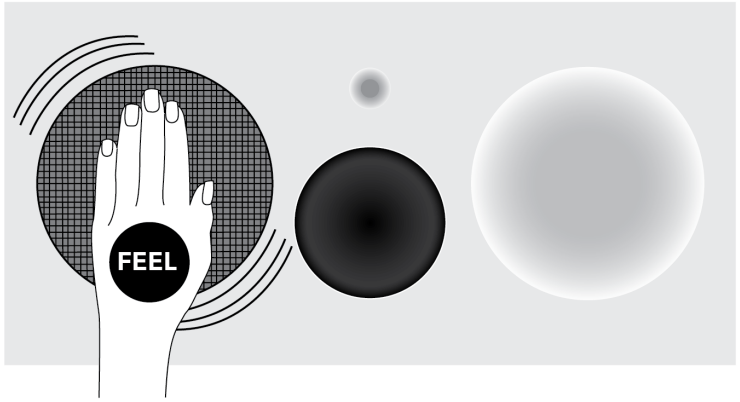
4. RECEIVING PULSATION



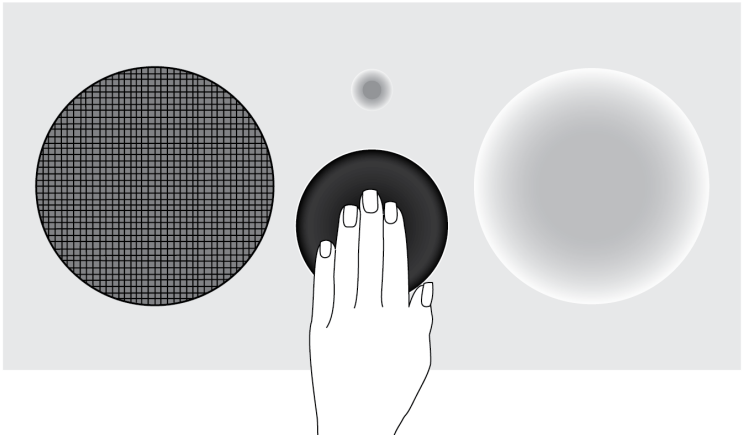
5. SENDING A VIBRATION
The sender still feels anxious so sends a vibration to convey their feeling



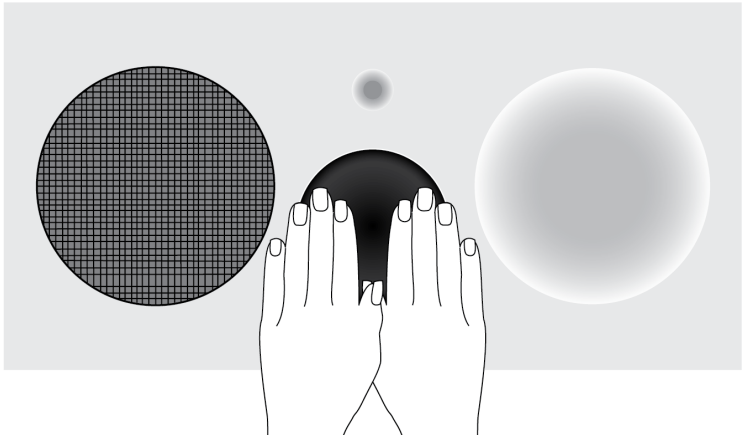
6. RECEIVING A VIBRATION
The receiver feels the anxiousness of the sender



7. SENDING THEIR TEMPURATURE
The user sends their tempurature to show to sender that they are with them and to not worry



8. RECEIVING A VIBRATION
The receiver puts their hands together over the tempurature hole to feel the sender's tempurature and this calms them down.

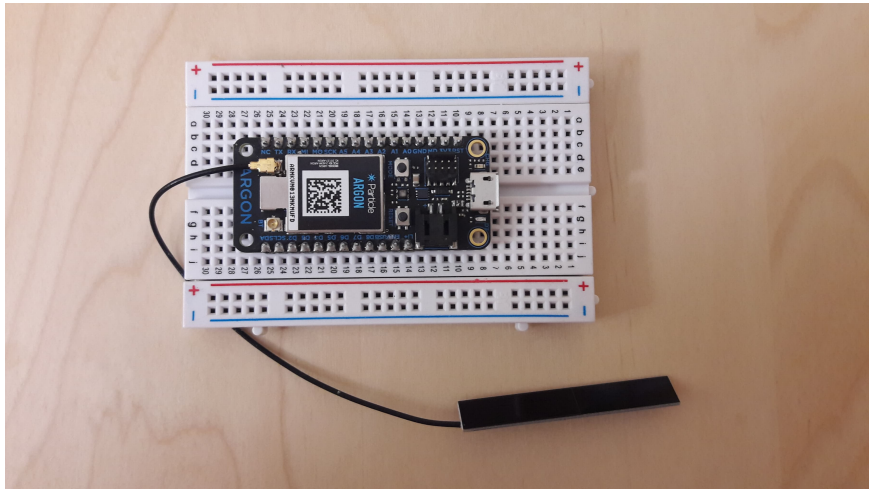


Prototype

Prototyping is an important step when working on any project. It is at the prototyping stage that one can determine the problems within the idea/object and find other ways to lead the direction of the project to better suit the project's goal. Our project's initial intention and meaning has not changed over the course of implementing our physical prototype.

We began by reviewing the appearance design of our device and the storyboard of the user interaction. It is there that we have found a few issues that enabled us to refine the appearance and interaction. Initially, we had thought of having our device in the shape of a rectangle (shoe-box like). With the placement of the sensors, it almost looked like a speaker/ radio. After our proposal meeting, we had realized that the modular structure of the device does not really align well with the feeling that we are trying to emphasize for the users, nor the meaning. We later decided that our communication device can take the form of a pillow. The pillow itself has a symbolic meaning of comfort due to it's soft texture. In terms of interaction with the pillow, we decided to use the affordances already embedded in the pillow to our advantage. For example, we have thought of incorporating a new interaction where the user will need to hug the pillow in order to let the other user know (blinking green LED in pillow) that they are trying to connect with them. When they both are present, the pillow LED will light up in solid green. We are also thinking of having notification lights that will enable the user to know if they have missed a connection. For this, we thought of placing a condition where if the user has not connected within 5 mins, then only to activate the notification. Missed pulsation: RED, Missed vibration = WHITE and Missed temperature = BLUE. We have thought about not giving the user the opportunity to replay the missed sensation because the intention of our device is to find the moment to connect and be present together. Our next step was to research on the sensors and the tools that would help us achieve our project. Once we have found the right ones, we purchased them and began our prototype.

SENSORS SELECTION & INTERACTION PAIRING



Argon from Particle

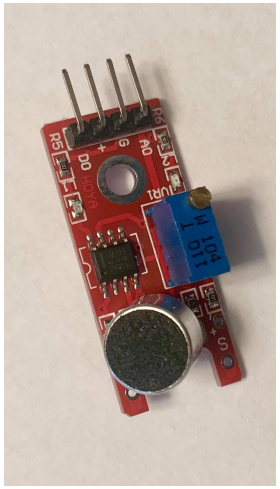
Argon is a Wi-Fi development kit from Particle that will enable the device to hold memory and help us send information from one device to another through wifi so that the devices can communicate with each other. The Argon is the heart of our pillow as the communication between the users is dependent on the data that is sent/received. For example, through the use of the Argon, we will be able to make one sensor from one pillow react to another sensor from the partner's pillow. As we will be working with the Argon instead of Arduino, it is important that we select sensors that are compatible with it

Vibration

Input: High Sensitivity Microphone Audio Amplifier
This sensor will listen to the sounds created by the user.

Output: Vibration Motor Module
The sound received from the microphone will then be converted into values that will be used to vibrate the vibration motor.

Interaction: Sound can be used to convey a sense of anxiety, stress, discomfort etc. The amount of sound created by the sender will be output to vibration and will convey to the user the intensity of their loved ones anxiety.

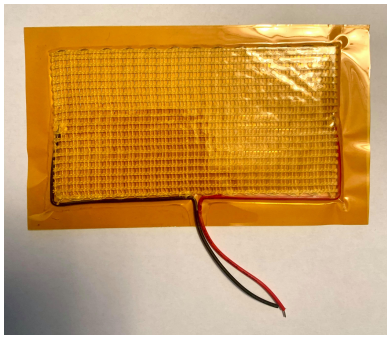


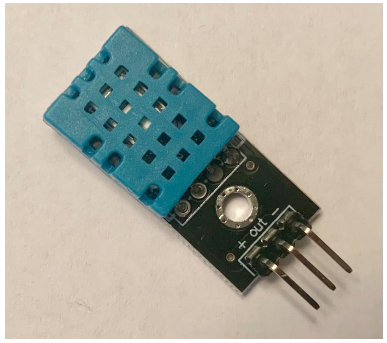
Humidity

Input: DHT11 Temperature Humidity Sensor by KeeYees
This sensor is able to record both temperature and humidity. It is compatible with different microcontrollers and operates between 3.3V and 5V.

Output: Heating Pad 5x10cm
This flexible heating pad is great to put inside the pillow. “These heating pads are constructed using a mesh of Polyester filament and Micro Metal Conductive Fiber folded into a protective Polyimide Film” (Elmwood Electronics). This enables the heating pad to heat.

Interaction: User 1 will send their temperature/humidity to User 2 using the temperature sensor and user 2 will be able to feel user 1’s temperature by feeling the designated spot for the temperature output which will make them feel a sense of relief and comfort that their loved one is present with them.

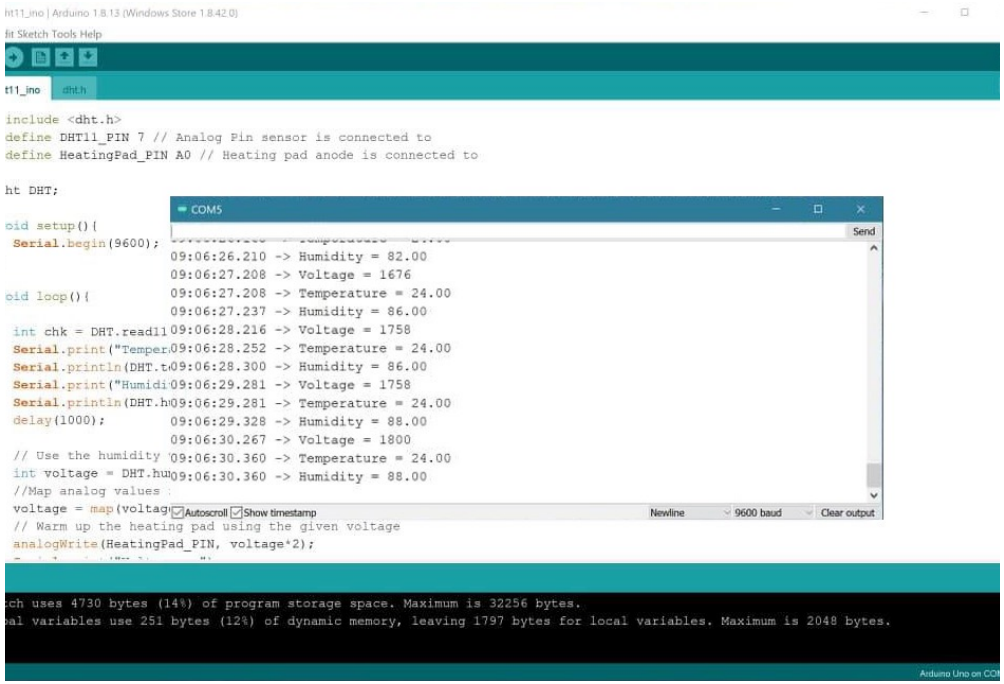


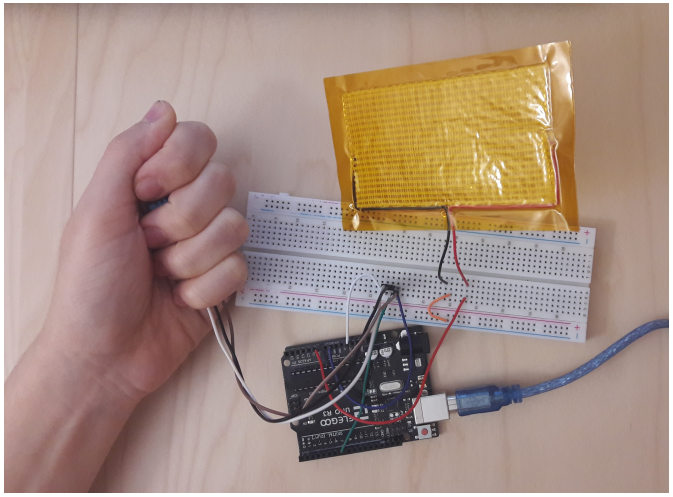


LOW FIDELITY PROTOTYPE

Next, we started making low fidelity prototypes where we experimented with mini circuits for each sensor in order to understand how the sensors work individually and how they capture data. We were able to get the data of the humidity and temperature using the temperature sensor. We were also able to make the microphone capture the sound of a clap and output it through an LED (for the purpose of testing). Due to the time constraints, we decided to not use the heartbeat sensors. We also decided that we would not have the time to create the memory in which the user will be able to see the notification of the missed sensations.

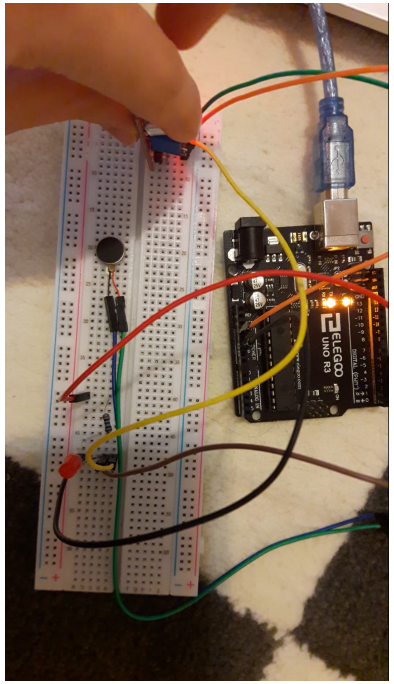
Temperature Code & Circuit

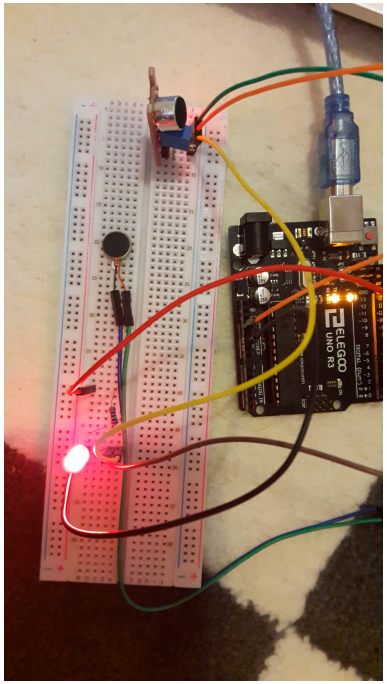


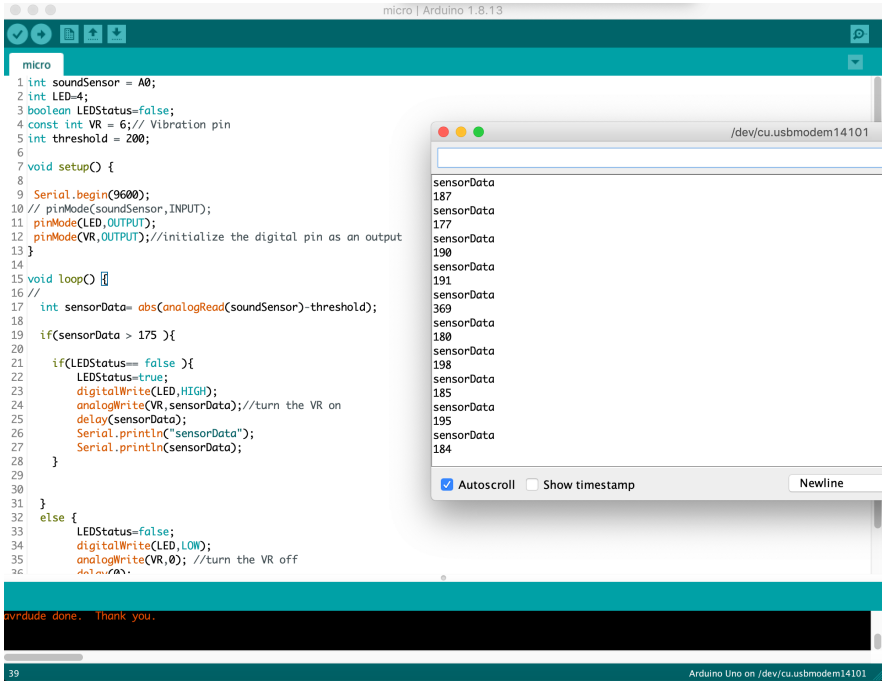


In this circuit, the heating pad does not heat up to its full potential because we are not using a battery to give the extra power that the heating pad needs. When the temperature sensor is held, it is evident in the serial monitor that the humidity is increasing.

Microphone Code & Circuit







In this level of our prototype, the microphone works with the user's touch and sound. As shown in the serial monitor, once the user touches the microphone, the values of the frequency increases.

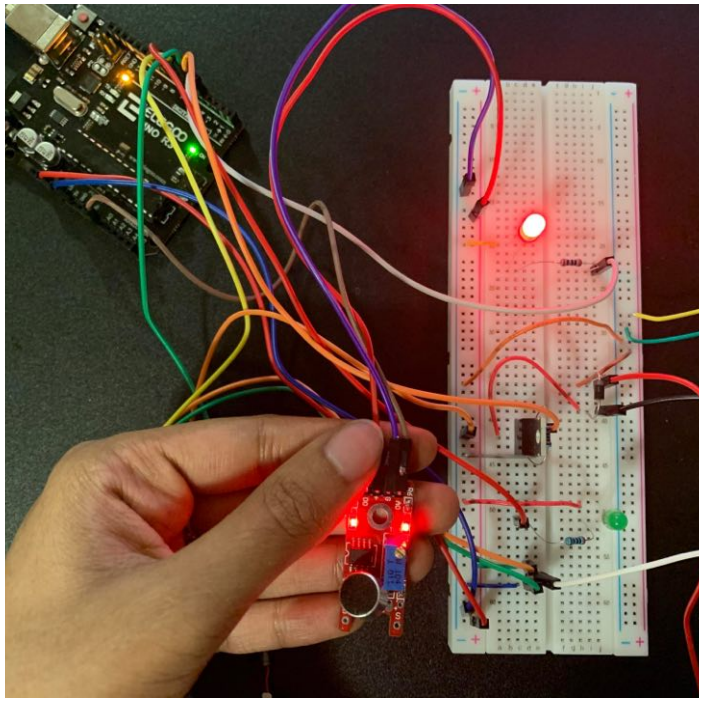
Final Artifact & Observations

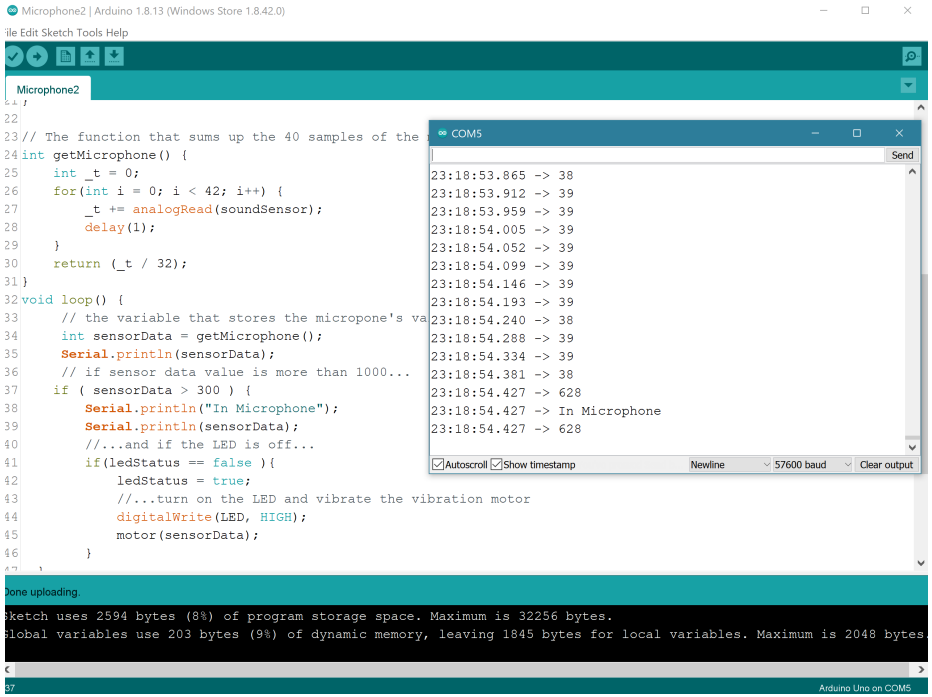
For the final prototype, we started to take the sensors and pair them with their reactive partners. Initially we started working with the Arduino microcontroller and then later, since the experience is dependant on the interaction between the two devices, the Cloud was necessary for us to achieve this. So, we moved our code to the Particle Argon which is a Wi-Fi development kit.

STEP 1: ARDUINO EXPERIMENTATION

Sound Sensor to Vibration Motor

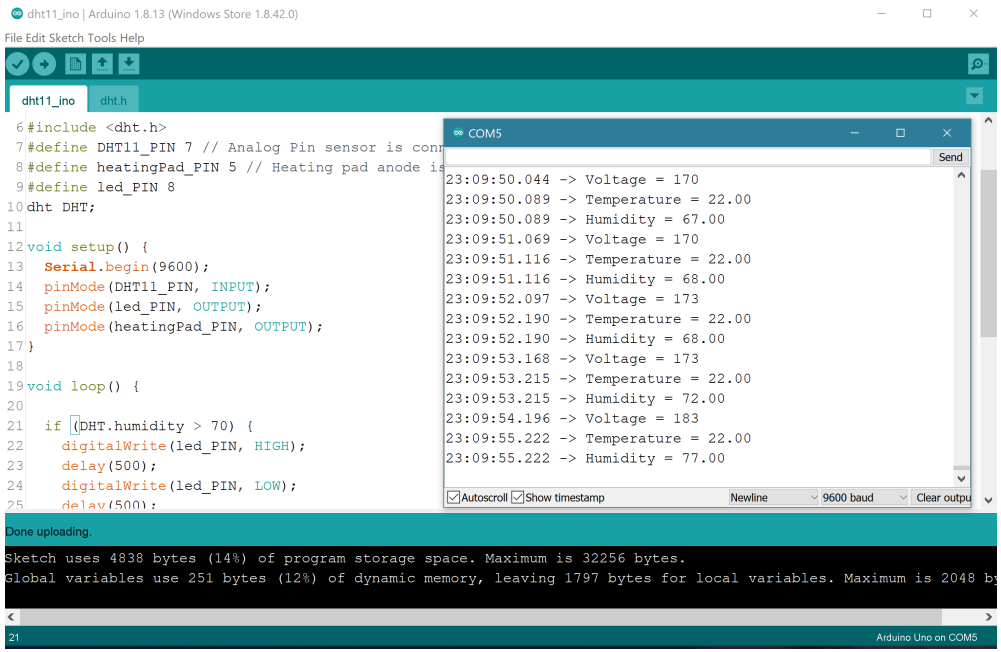
After testing the sound sensor code in our first low fidelity prototype, we learned about how we can achieve the required frequency from the microphone. Then, we combined the code with the code that we had for the vibration motor and through an if statement, we gave the condition that if the frequency reaches a certain level, then to make the vibration motor vibrate and turn on the red LED light.

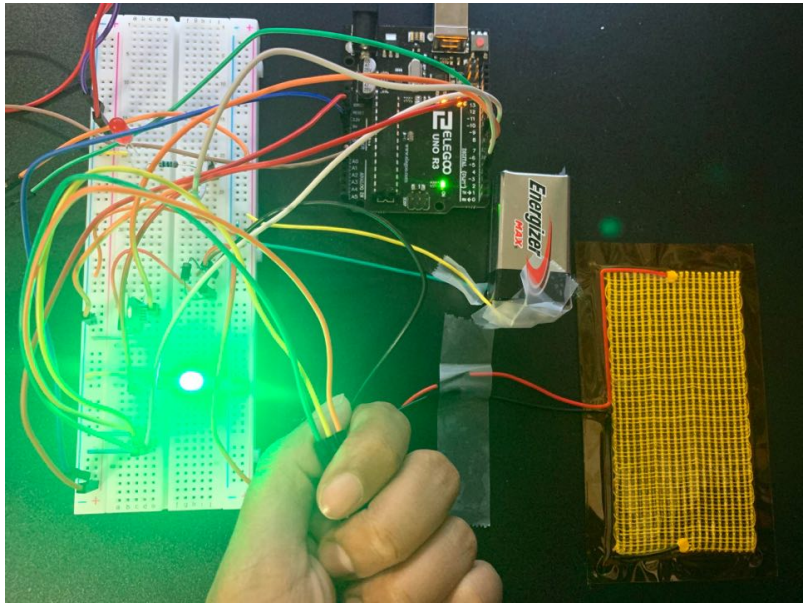




Humidity Sensor to Heating Pad

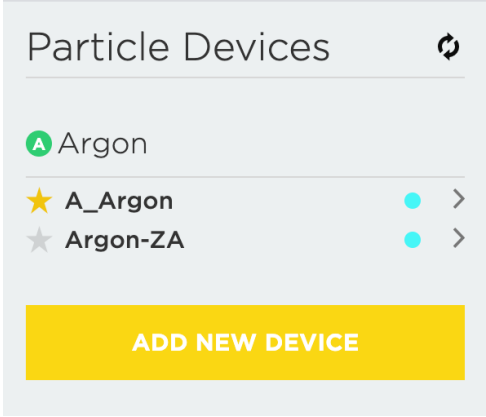
After testing the humidity sensor code in our first low fidelity prototype, we combined the code to react with the heating pad. In this stage, we modified our circuit in a way that we could add a mosfet, a diode and a 9V battery to make the heating pad reach its heating potential. Once humidity value goes over a certain level, the green LED starts blinking.

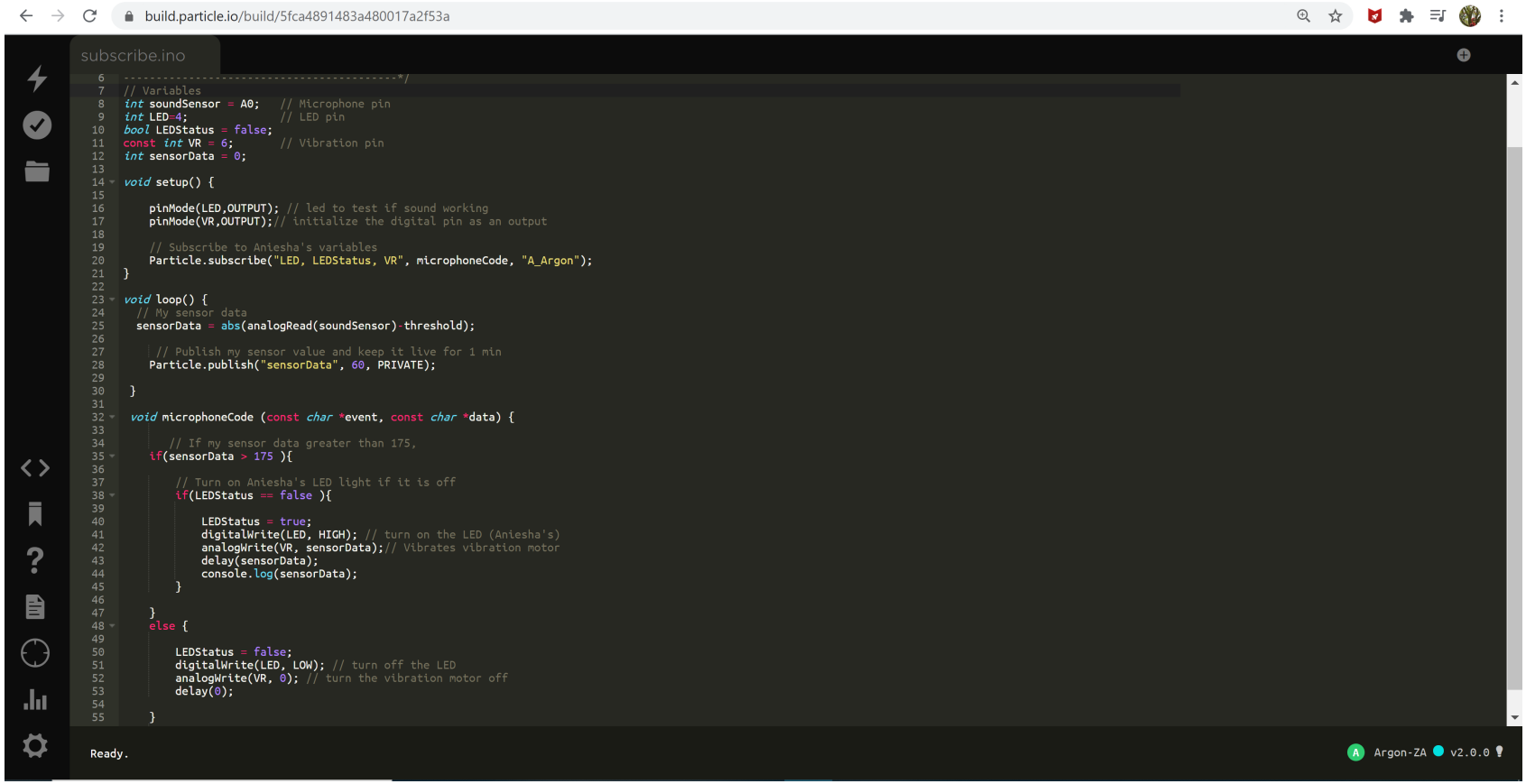


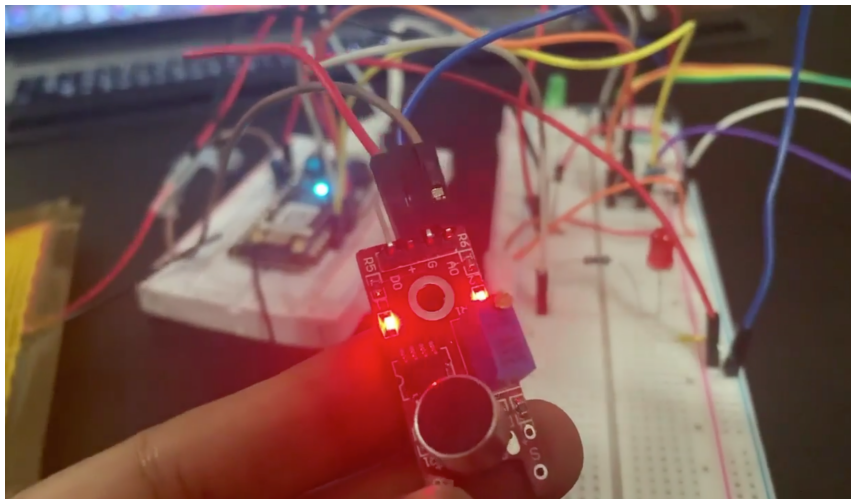


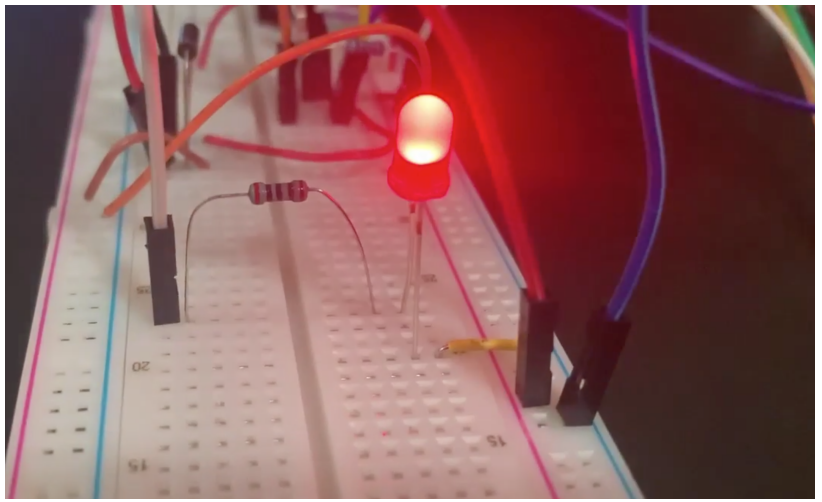
STEP 2: ARGON EXPERIMENTATION

Our next step was to reconfigure our circuit so that it is connected to the Particle Argon. Next, we paired our devices under the same network using our phones and wifi connection to the Particle Cloud in order for us to share our code using Web IDE and the publish/subscribe function for the sensors to react with each other. In this step, we first made sure that the code we had in the Arduino is compatible with the Particle Argon since the programming language is a little different as Particle has its own framework. We attempted to use the pubish/subscribe function to make our devices interact but unfortunately we couldn't go further because we couldn't find similar examples that shows how we can send data as characters (char) and recieve it as interger value.



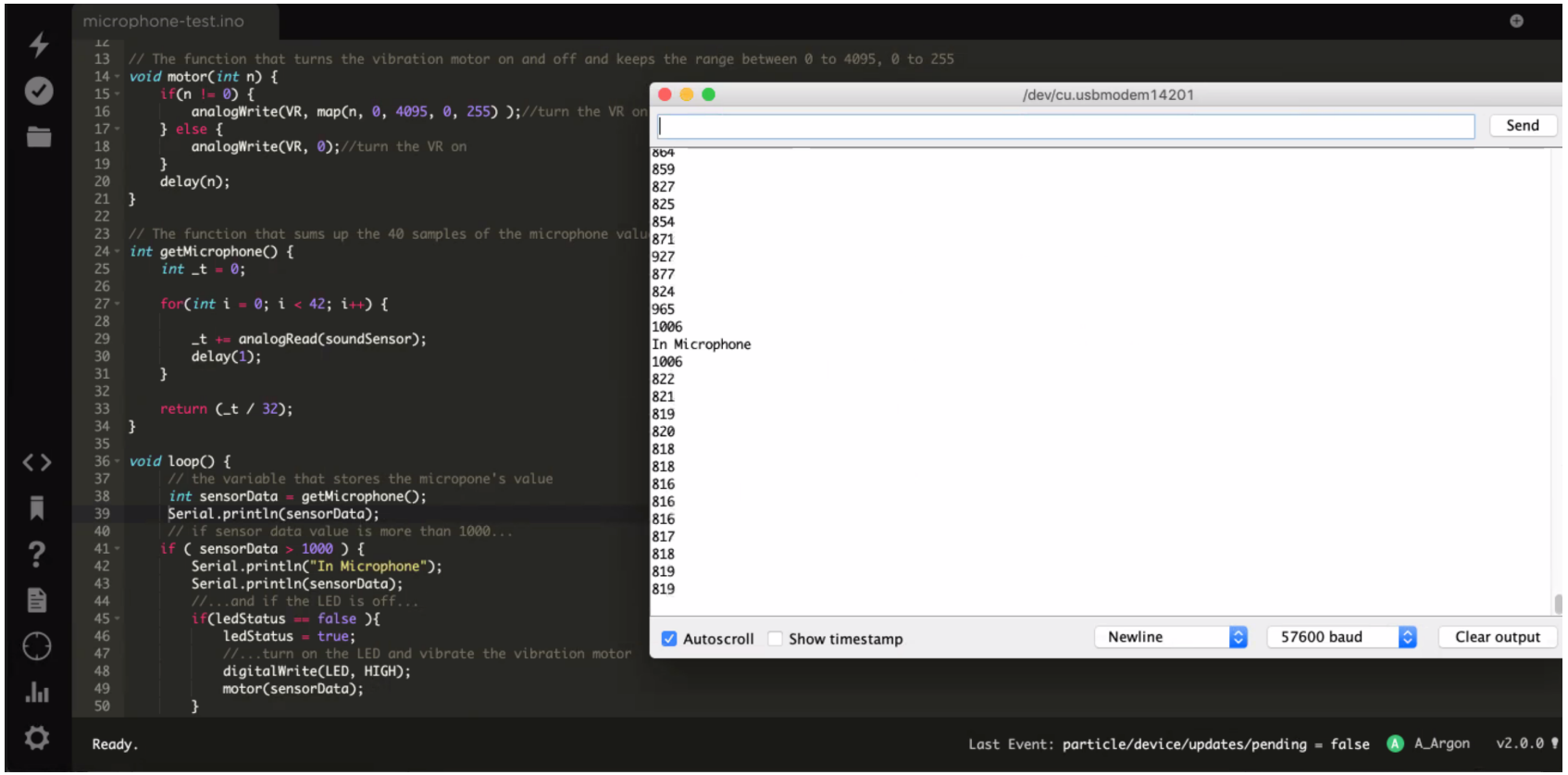






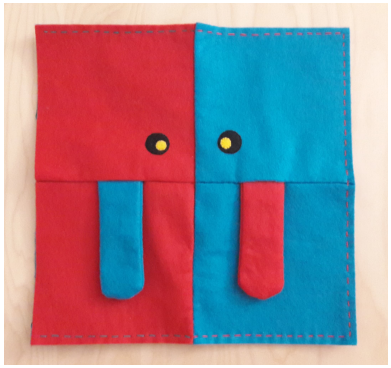
Fortunately, we could make the microphone and vibration sensor work together independantly using the Argon but we faced two problems. In Aniesha's circuit, the microphone works well with the red LED however, the generated value does not vibrate her vibration motor. On Zahra's circuit, the microphone potentiometer broke in our final test and she was obliged to replace it with a 5V microphone that does not have the same performance as the 3V microphone had.

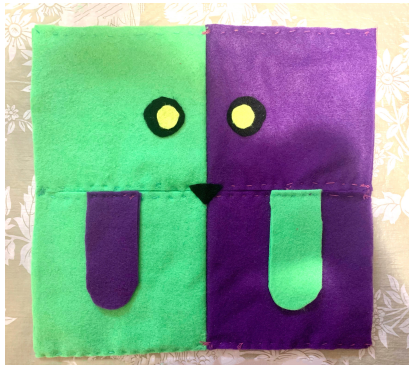
For the temperature sensor, since we are using a library named DHT, we faced with some problems once we ran the code.


microphone-test.ino
// The function that turns the vibration motor on and off and keeps the range between 0 to 4095, 0 to 255
void motor(int n) {
if(n != 0) {
analogWrite(VR, map(n, 0, 4095, 0, 255));//turn the VR on
} else {
analogWrite(VR, 0);//turn the VR on
}
delay(n);
}
// The function that sums up the 40 samples of the microphone valu
int getMicrophone() {
int _t = 0;
for(int i = 0; i < 42; i++) {
_t += analogRead(soundSensor);
delay(1);
}
return (_t / 32);
}
void loop() {
// the variable that stores the micropone's value
int sensorData = getMicrophone();
Serial.println(sensorData);
// if sensor data value is more than 1000...
if (sensorData > 1000) {
Serial.println("In Microphone");
Serial.println(sensorData);
//...and if the LED is off...
if(ledStatus == false){
ledStatus = true;
//...turn on the LED and vibrate the vibration motor
digitalWrite(LED, HIGH);
motor(sensorData);
}
/dev/cu.usbmodem14201
Send
859
827
825
854
871
927
877
824
965
1006
In Microphone
1006
822
821
819
820
818
818
816
816
816
817
818
819
819
Autoscroll
Show timestamp
Newline
57600 baud
Clear output
Ready.
Last Event: particle/device/updates/pending = false
A_Argon
v2.0.0

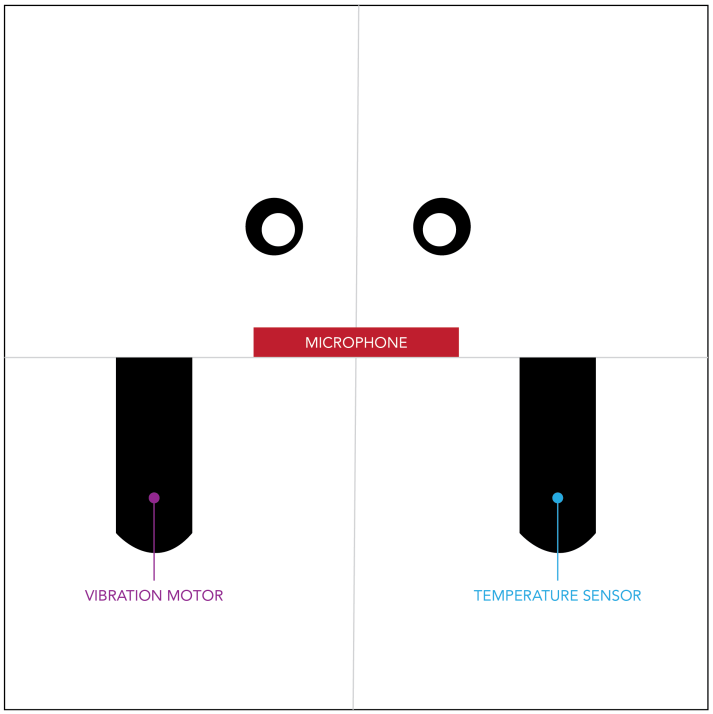
STEP 3: DEVICES APPEARANCE

During our prototype feedback, we recieved a lot of feedback in which people misunderstood and thought that our device pillow would be used also for sleeping and this raises a lot of doubts and questions for our peers. In reality, that was not our intention. We wanted our pillow to be used only for this communication purpose and during the rest of the time, it can be a decoration prop for the home. We chose a felt material for our pillow as because it is soft in texture and it brings comfort. For it's appearance we wanted to make it look like a cute buddy.

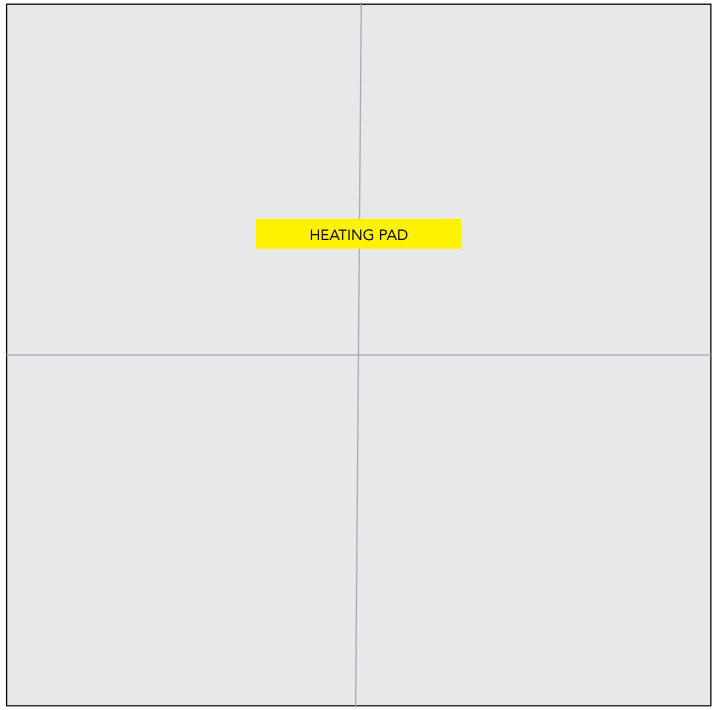




Front sensors placement

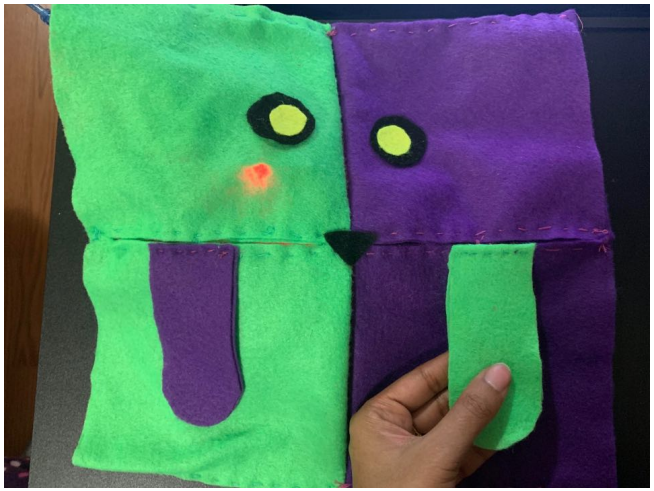


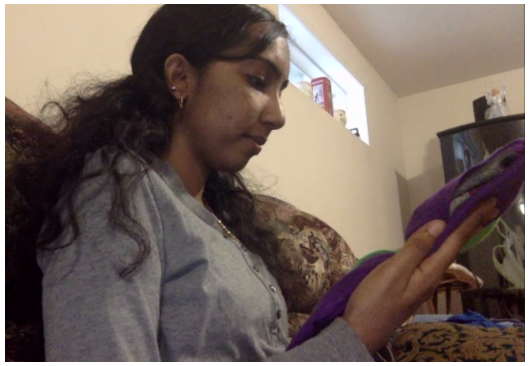
Back sensors placement

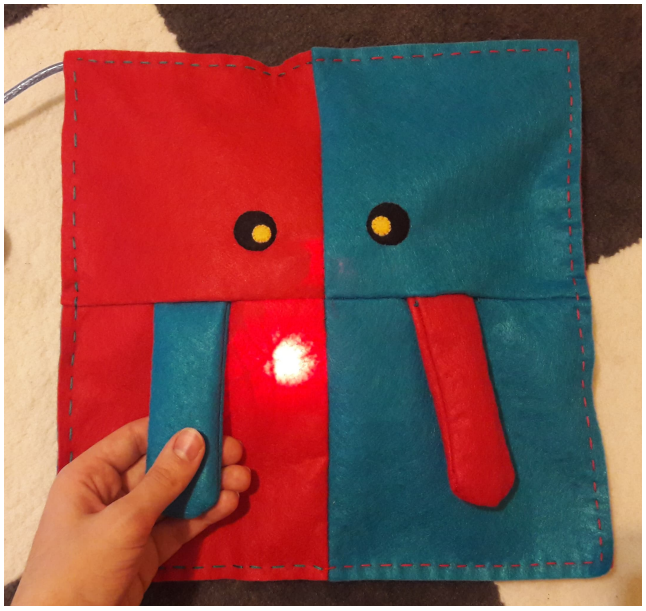


STEP 4: INTERACTION

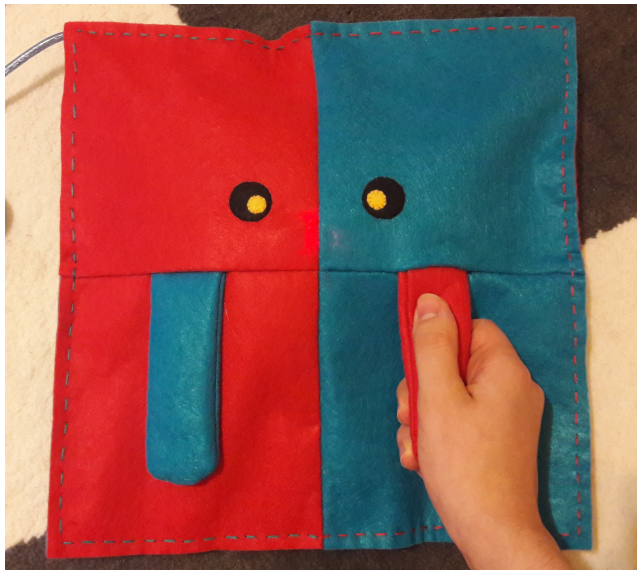
Sound to Vibration Interaction:







Heating Pad to Temperature Interaction:



Future

We believe that we are still in the prototyping stage where we will need to continue to test between our (Zahra & Aniesha's) isolated spaces for a certain period of time to see its effectiveness. Up to the current stage of our project, we would definitely like to stick to our idea of using our experience to further research on if our device has the potential to be used effectively in different spaces of isolation such as hospitals, nursing homes, orphanages, etc. We believe that our device has the potential to be expanded and to be turned into a more complex communication device. For example, instead of sending simple sounds, perhaps the user can share a song through the microphone which will be able to play the song through the vibration output. We would still like to have the user recieve the notifications of the sensations that we missed and incorporate the pulsation sensor.