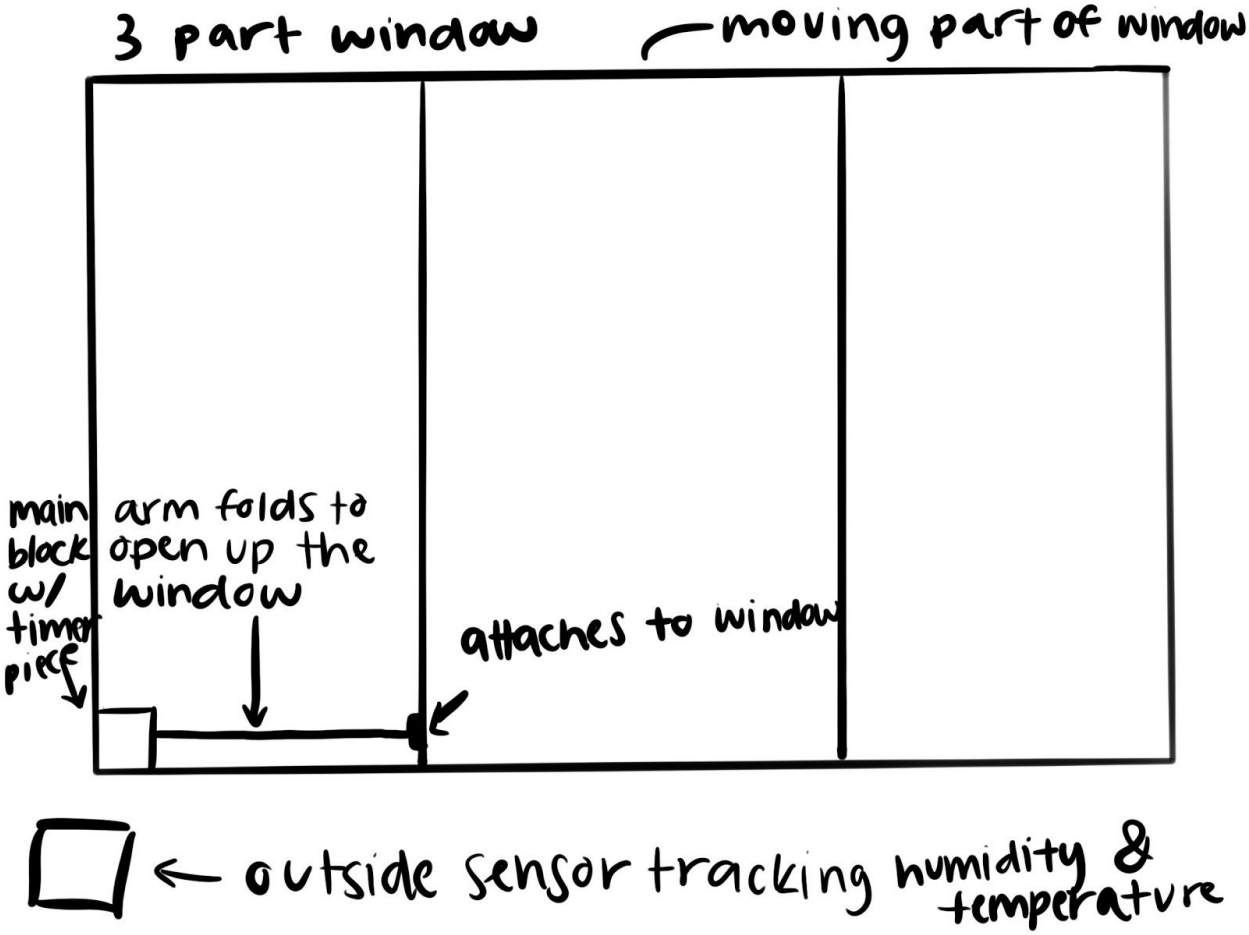
February 4th

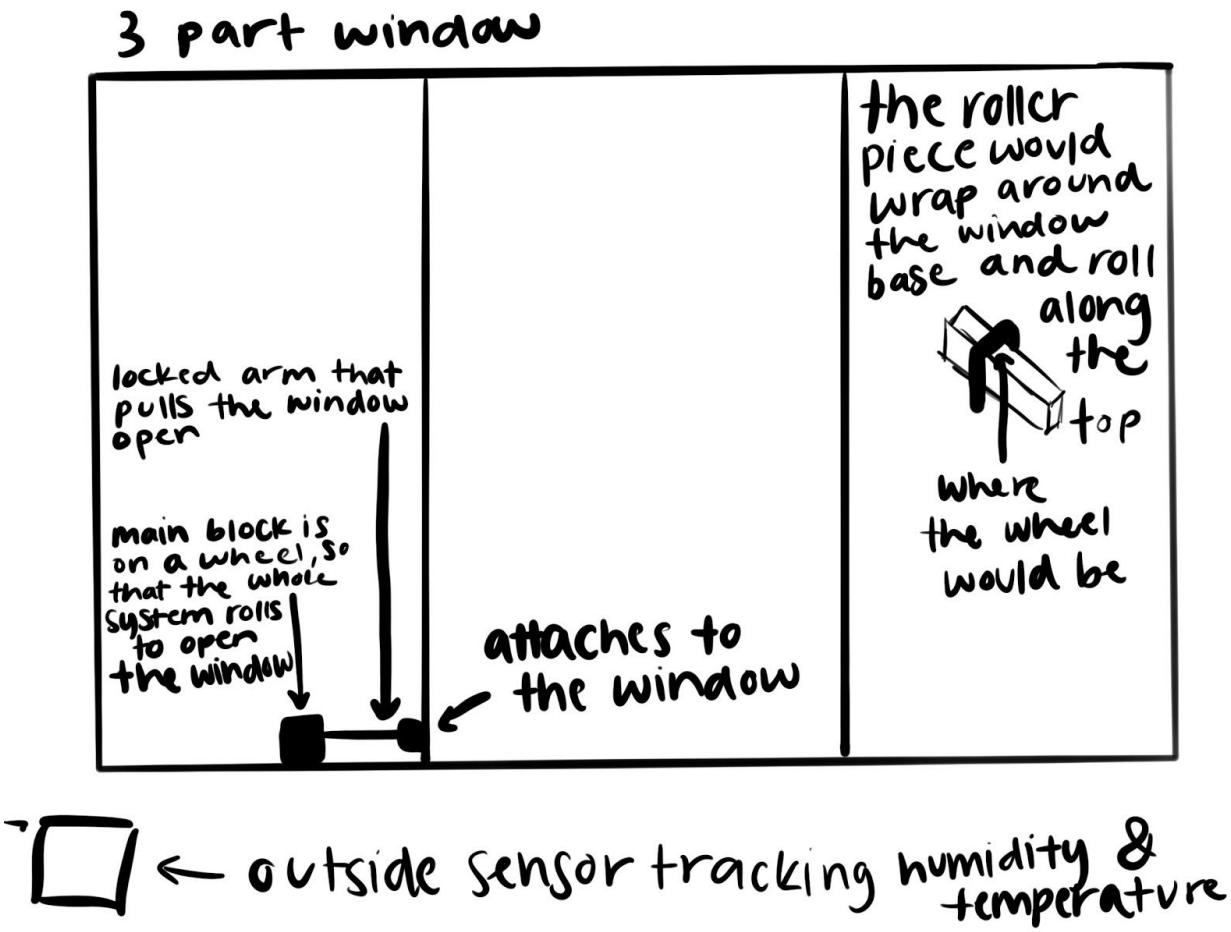
Tasks

1) Select a final idea
    a) I have selected to be creating a system that helps open and close the windows in your house in a way that can help you use your air conditioning and heating system less.
2) Create 3 brainstorm sketches
3) Make a decision matrix
4) Complete the IC Regionals Planning Document

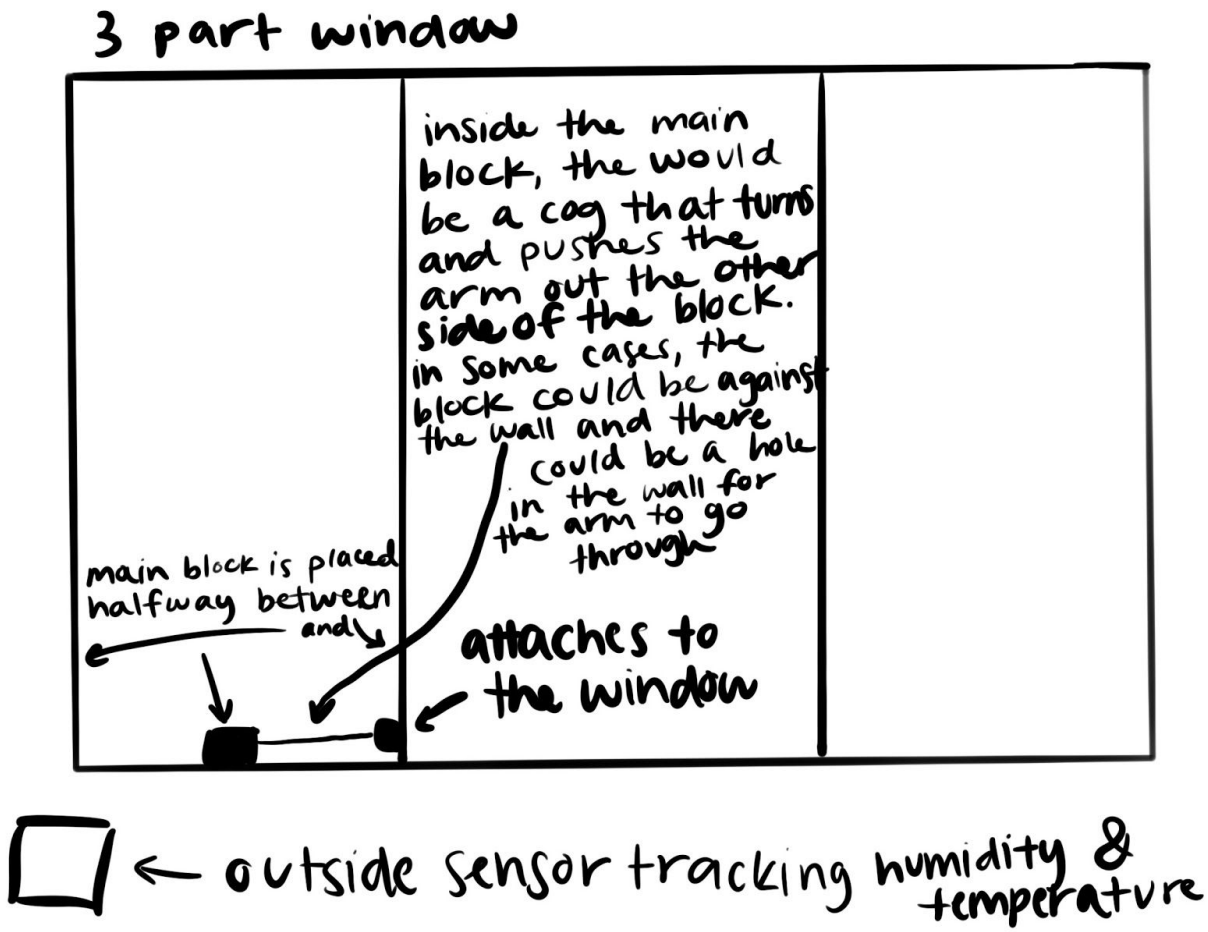
Sketch 1



Sketch 2


3 part window
the roller piece would wrap around the window base and roll along the top
where the wheel would be
locked arm that pulls the window open
main block is on a wheel, so that the whole system rolls to open the window
attaches to the window
← outside sensor tracking humidity & temperature

Sketch 3


3 part window
inside the main block, the would be a cog that turns and pushes the arm out the other side of the block.
in some cases, the block could be against the wall and there could be a hole in the wall for the arm to go through
main block is placed halfway between and
attaches to the window
← outside sensor tracking humidity & temperature

Decision Matrix

Ideas	Criteria: How easy is it to use?	How well will it keep the window locked?	How strong will the arm be?	How much does it allow the window to open?	How useful / successful will it be?	Totals
Idea 1: folding arm that folds into the main block	2	3	3	3	2	13
Idea 2: arm that moves through the main block	2	1	2	2	2	9
Idea 3: main block rolls to open window	1	1	1	1	1	5

Justification/Why: The third idea will be most successful for a couple different reasons. Since it has a hinge, it will be the best at allowing the window to open. It will have the strongest arm because it is attached to something on either end, which will also help it keep the window locked well. All of these factors combine to make it successful and easy to use, giving it the lowest score of 5.

Step by Step Process: Everything was rated on a scale from 1-3. 1 meant the best and 3 three meant the worse, meaning that the total score that is the lowest will be the best idea.

February 8th

Tasks

1) Research
2) Create a project proposal

Research

Air conditioners:

- As of 2009, nearly 90 percent of American homes have air-conditioners, which account for about 6 percent of all the country's residential energy use. All that air-conditioning releases about 100 million tons of carbon dioxide each year.
- In a new paper published in *Nature Communications*, Sue Wing, De Cian, and van Ruijven (now a scientist at the International Institute for Applied Systems Analysis in Laxenburg, Austria), warn that by 2050, even a modest warming of our climate could increase the world's energy needs by as much as 25 percent. And if greenhouse gas emissions continue unabated, we could demand up to 58 percent more energy than would be needed in a stable climate.
- The researchers' calculations project that by 2050, the global demand for energy resulting from socioeconomic development will be two to three times what it is today, growing by a factor of 1.4 to 2.7 in industrialized nations, and by a factor of 2 to 4 in poorer but rapidly developing countries in the tropics. Moderate warming would increase the global baseline amount of energy demands by 11 to 17 percent, while vigorous warming would increase it by 25 to 58 percent.

Alternatives to air conditioners:

- There really are no alternatives to air conditioners that do not use electricity and/or are environmentally friendly
- Some alternatives include:
    - Geothermal systems
    - Fans
    - Window air conditioners
    - other alternatives that use electricity

Alternatives to heating systems

- There are alternatives that use propane or gas, but that is not incredibly environmentally friendly either
- These include:
    - Gas heaters
    - Some space heaters
    - Etc
- Most alternatives in terms of heating are about what types of heating you can use when you lose power in your house, which are not long tern heating solutions, and they are also not necessarily environmentally friendly

Project Proposal

In 2009, about 90% of American homes had air conditioning, accounting for 6% of the country's residential energy use, releasing about 100 million tons of carbon dioxide every year. It is also warned that by 2050, a slight warming of the planet could lead to a 25% increase in the world's energy needs. So, without a decrease in greenhouse gas emissions, we could demand up to 58% more energy than what would be needed in a stable climate.

For this project, I plant to create a device that will lower our carbon footprint. I am interested in how we can use our windows more efficiently in order to use our air conditioner and heating systems less. The main way that this will work is as follows:

There will be a sensor that sits outside of the house, keeping track of the temperature and humidity outside. Additionally, there will be a “arm” that is connected to the window on the inside of the house. Consisting of a wheel at the bottom, the arm will be able to roll along the window to open and close it. If we flip this over, we see a more zoomed in view of the basic drawing. We see that the wheel is rolling on the small ledge the window sits on, and that there is also a hing at the place where “arm” attaches to the window. This allows for someone to lift up, lay it along here, and open the window themselve all the way if they wanted to.

The device will come already programmed to detect certain temperatures and open and close the window accordingly, however, users will be able to change those restrictions as they wish in order to create an comfortable environment inside of their home. The ability to change these restrictions will also allow the product to be attractive to people living all over the world, in both warm and cold climates.

I am going to be bringing my idea to life by continuing to thoroughly research the problem as well as the construction of each component. Then, I will begin to make some iterations of models, making modifications as I go, until I reach my final product. Overall, I am excited to enhance my knowledge on this topic in order to create an amazing product.

February 10th

1) Film project proposal video
2) Research

February 11th

Tasks

1) Research
2) Begin the first piece of the working illusion

Research

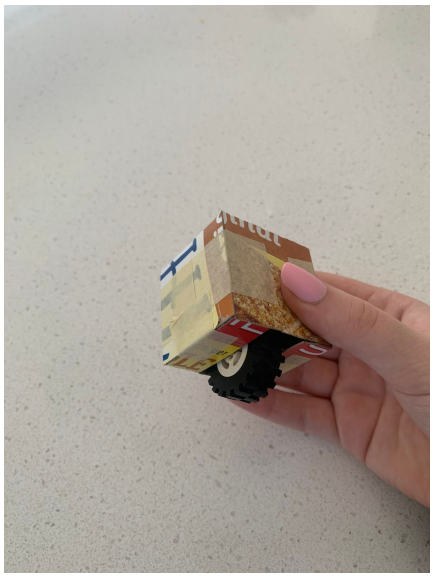
Hydraulics:

- You can compress a liquid, so the idea is that you push the liquid in order to create a force
- Input: large force, slow speed → output: small force, high speed
- Input: small force, large distance → output: large force, small distance
- Pascal’s principle: because the liquid in the pipe is incompressible, the pressure must stay constant all the way through it, even when you're pushing it hard at one end or the other

First Piece of the Working Illusion

For this iteration, I want to try to use hydraulics as a way to power the box main block and allow it to move easily. I started off by grabbing a lego wheel and some cardboard. I created a small box and used a toothpick as an axle for the wheel. I did this process twice because when I did it the first time, the box was too large, meaning the wheel was not able to rest on the ledge. The first box looked like this:

Below is the second version of the box:



I then used the second box to create a working illusion of the system. I ordered large syringes and the cables that connect them and created a hydraulics system. I started off working simply with air, and then switched to water. This system worked, however it did not work in a way that was going to effectively open the window. In order to use a hydraulics system in an effective way, it would require the system to be significantly larger than the original plan, which will begin to make the product less attractive. People are not going to want to buy a product that its going to ruin aesthetic or style of their homes. However, this iteration was still really helpful because it helped me organize my thoughts in terms of how large I can make the device. I learned that there can only be 1.5 centimeters of “block” between the window and the

wheel, otherwise the wheel will not run on the “track”. In this iteration, I made the main block a square, but in the future, I am going to need to make it bigger in order for it to hold a wheel and motor than can actually obtain the goal of opening the window, and be strong enough to do so.

February 18th

Tasks

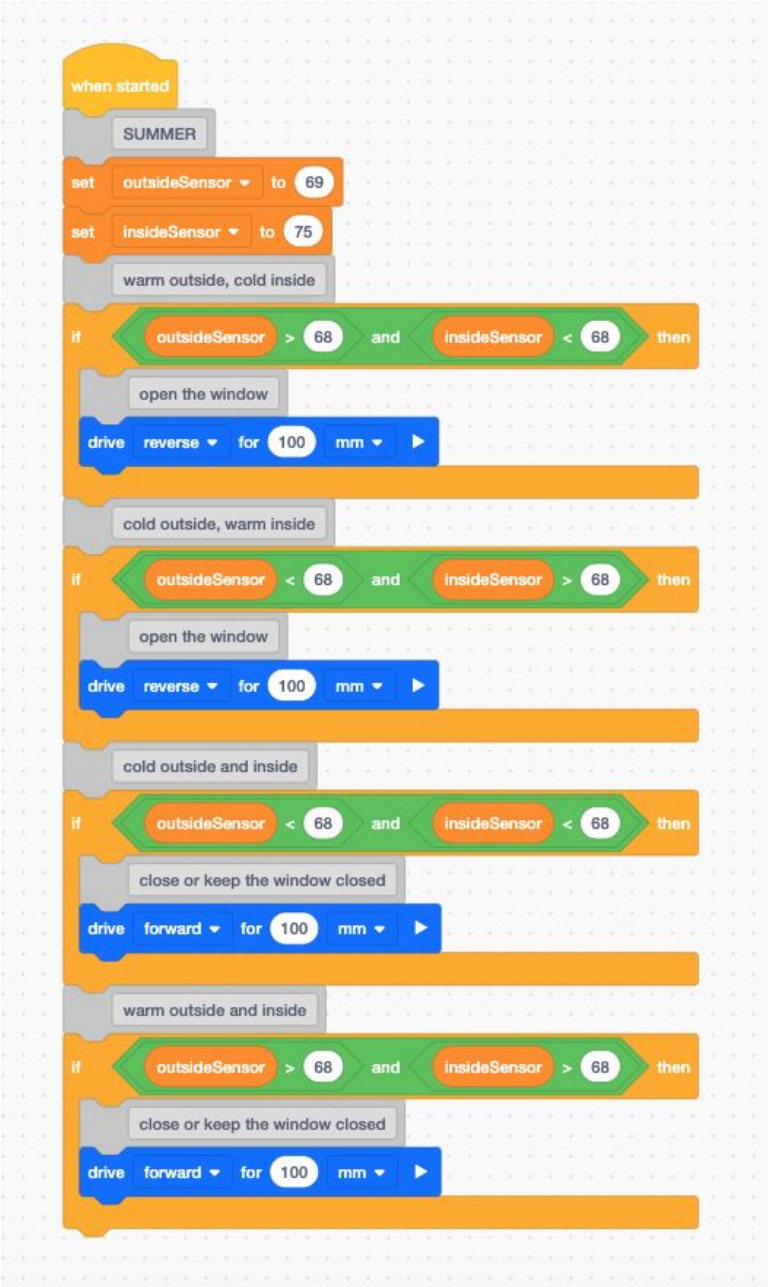
1) Research
2) Begin the second piece of the working illusion

Research

House Temperatures:

- The World Health Organization (WHO) recommends indoor temperatures of at least 64°F (you can drop that down to 62°F at night if you're really looking to save on your heating bill). But if you have infants, sick or elderly people in your household, then it's recommended that you keep the thermostat set at 70°F.
- The basics that are recommended overall online range between about 65-78 degrees Fahrenheit

Second Piece of the Working Illusion (part 1)



February 19th

Tasks

1) Finish the second piece of the working illusion

Second Piece of the working Illusion (Part 2)

Going into this iteration, I knew that I wanted to create a basic version of the coding that I am going to be using for my machine. As I developed the idea more, I realized that I was going to need to have 2 sensors detecting temperature, one inside the house and one outside. Those two sensors are shown in the coding as “outsideSensor” and “insideSensor” and are written as variables. The reason they are written as variables is because their value is going to change. Obviously, in the real situation, the value will not have to be entered in by a human to be identified as different, however, I wanted to be able to control the temperatures myself for now. Based on my research about the temperatures of houses and what temperatures are the safest, I decided to stick to a range of 68-78, 68 in the summer and 78 in the winter. Of course, people will be able to change the temperatures restrictions to their own personal preference using the app that I am going to be starting to design in the next iteration.

For the coding, I have the system set up as though it is the summer, and the users want their house to be 68 degrees Fahrenheit. Then, you can see that there are 4 things that can happen:

1) It is warm outside and cold inside
2) It is cold outside and warm inside
3) It is cold outside and inside
4) It is warm outside and inside

I set up operators so that the machine detects the temperatures both outside and inside for all 4 categories and acts accordingly. Since the house has a goal of being at 68 degrees Fahrenheit, the number that is put in the operator alongside the variable is 68. For each of the above categories, the coding will have to be different:

1) The window needs to open to cool off the house
2) The window needs to open to warm up the house
3) The window needs to be closed or stay closed
4) The window needs to be closed or stay closed

The reason that the machina cannot do anything for numbers 3 and 4 is because it will not be of any use to open or close the windows when it is too cold or too warm in BOTH areas. At this point, the user would have to shy away form using their windows, and simply start their air conditioning or heating system.

February 21st

Tasks

1) Research
2) Start and finish the third piece of the working illusion

Research

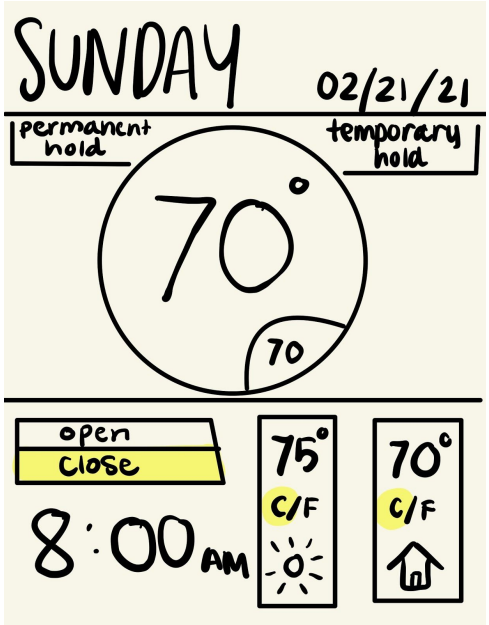
UI design principles:

- Structure:

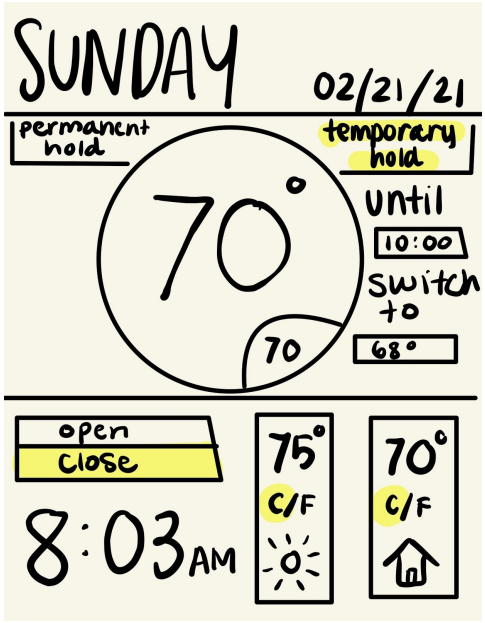
    - Everything is organized is a way that makes sense
    - Related things are together and unrelated things are separated
- Simplicity:
    - Want to make simple, common tasks easy
    - Communicates simply and clearly
    - Provides good shortcuts to otherwise long procedures
- Visibility:
    - Needed options and materials are visible
    - There are no distractions
    - Does not overwhelm users with unnecessary information
- Feedback:
    - Keeps users informed of actions, interpretations, changes of state or condition, and errors relevant/of interest to the user
    - Clear and concise
- Tolerance:
    - Flexible and tolerant
    - Reduce cost of mistakes and misuse
    - Be able to undo and redo things
- Reuse:
    - Reuse internal and external components and behaviors

Third Piece of the Working Illusion

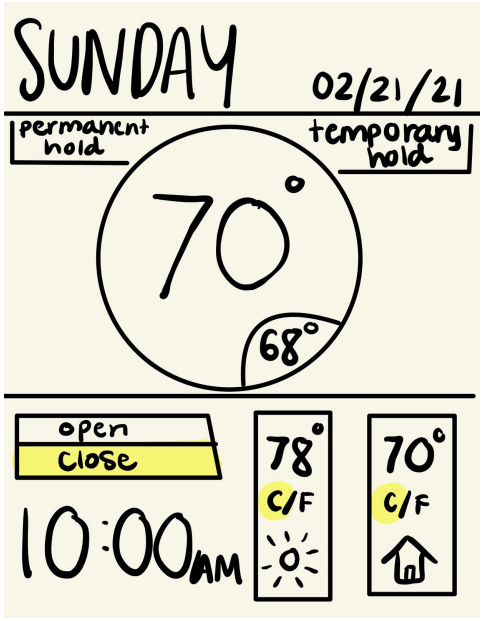
For this iteration, I decided to start working on the basic design of the app that works along side the machine. The goal of the app is to allow the user to be able to have complete control over the temperature of their homes. Below is a VERY basic picture of what I want the first screen to look like when you open up the app.



You see here in the photo that there is a very simple layout when you open the app. The first thing you notice is that it has the date at the top. Then, there is an area with the current temperature inside the house. We see that in this specific example, it is 70 degrees Fahrenheit in the house. On the side of that main circle, there is a half circle, in which it says the temperature that you want the house to be at. In this example, we see that the house is at the temperature that it is supposed to be at. Beside the main circle, you see a section that says temporary hold and permanent hold. This lets you control whether you want the temperature you set for the house to change later or not. The next thing you see is that there is a box that says open on top and close on the bottom. This shows you whether the window is currently opened or closed, and allows you to open it if u want to (althought it may mess with the way the machine is heating or cooling the house). Beside that, you see 2 areas, one with a sun and one with a house. These represent the sensors. The one with the sun is the outside sensor, and the one with the house is the inside sensor. You have control over whether you see these temperatures in celsius or fahrenheit. The primary function of this is to be able to see the temperatures inside and outside of the house. The last thing on the screen is the time at the bottom, which will be useful when you are setting things on temporary hold. In this example, we are going to select temporary hold.



After selecting temporary hold, we see that you are required to enter some information about how long you want it to hold that temperature for and what temperature you want it to change to after. Here we see that this person thinks that it is going to be hotter outside as the day goes on, so they want to cool off their house a little bit.



Now that it is 10, the goal temperature has changed and the so has the outdoor temperature. The user will get a notification on their phone that the temperature has changed as requested, and will be asked to set it at temporary or permanent hold.

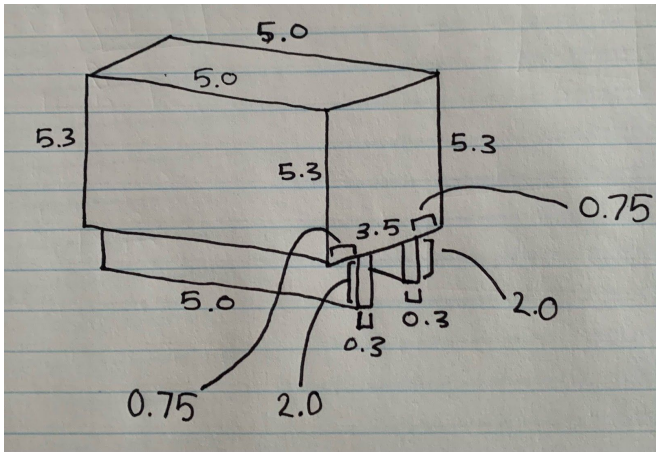
February 22nd

Tasks

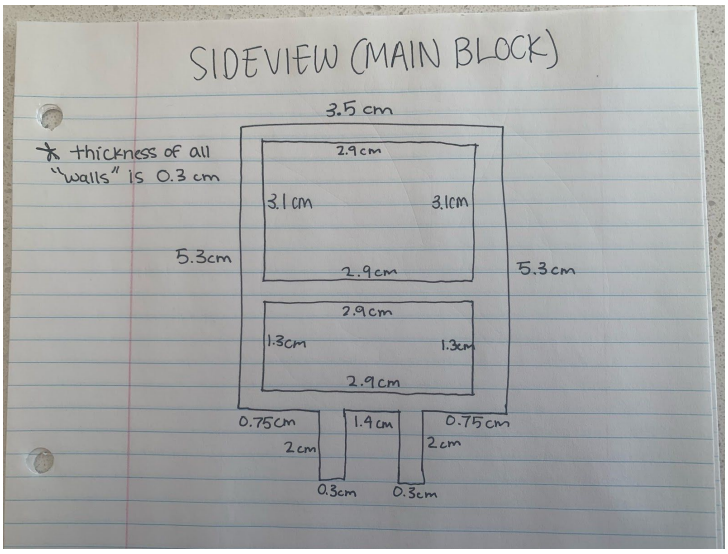
1) Complete photo consent form
2) Final Sketches

Final Sketches

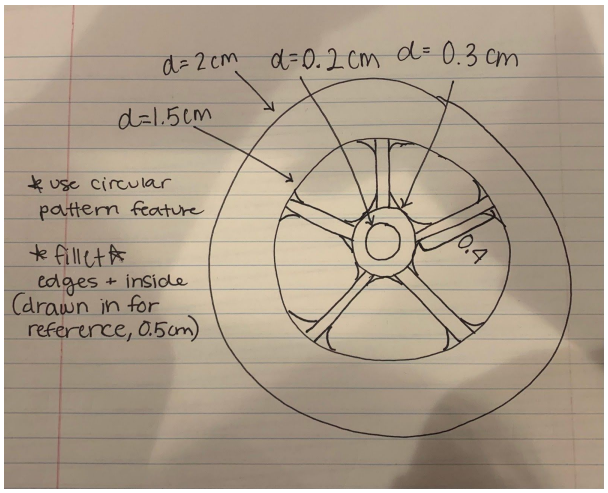
Main block



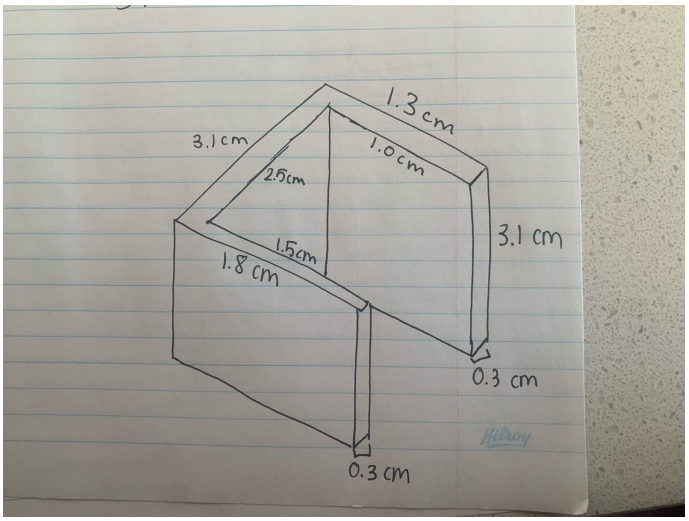
Side view of main block



Wheel



Window attachment

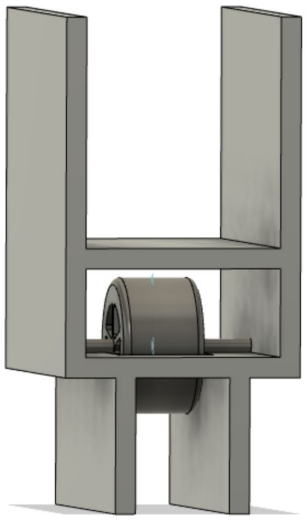


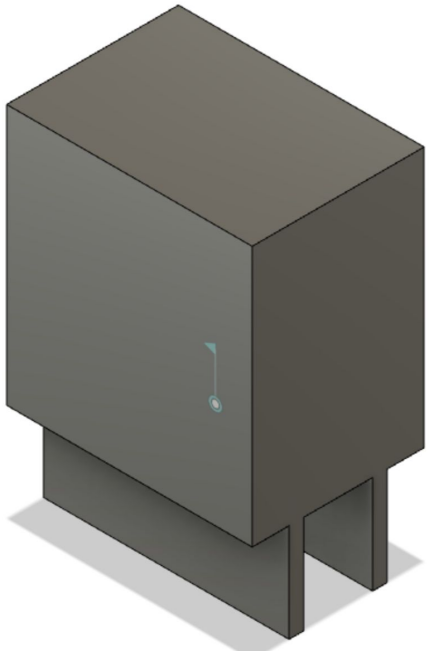
February 23

Tasks

1) Start CAD

CAD (part 1)





February 24

Tasks

1) Finish CAD

CAD (part 2)