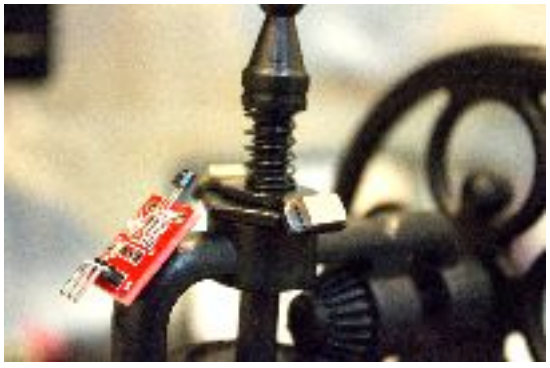
Iteration Documentation

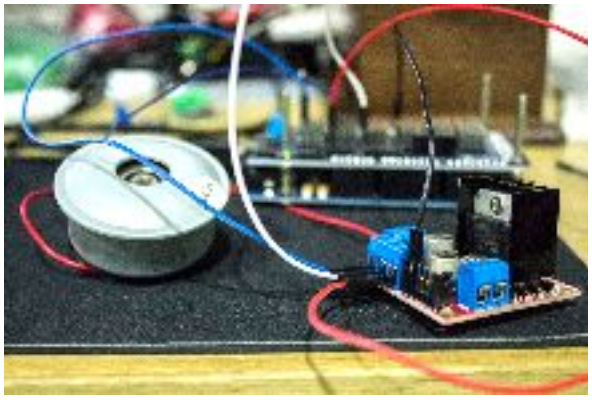
Make Prototypes (4.1)
Due to our relative lack of time to work together on the project due to its physical nature, we had to get feedback and iterate along the way as we were building our first physical prototype.

Our first virtual "prototype" was a concept that I drew out on paper that worked by showing the 'user' graphic diagrams of the product, and letting them imagine how it would work.

Our first physical prototype was built by going section by section. The first section we worked on was the coffee grinder machine itself. I started by fixing the hall effect sensors and the neodymium magnets onto the coffee machine itself.

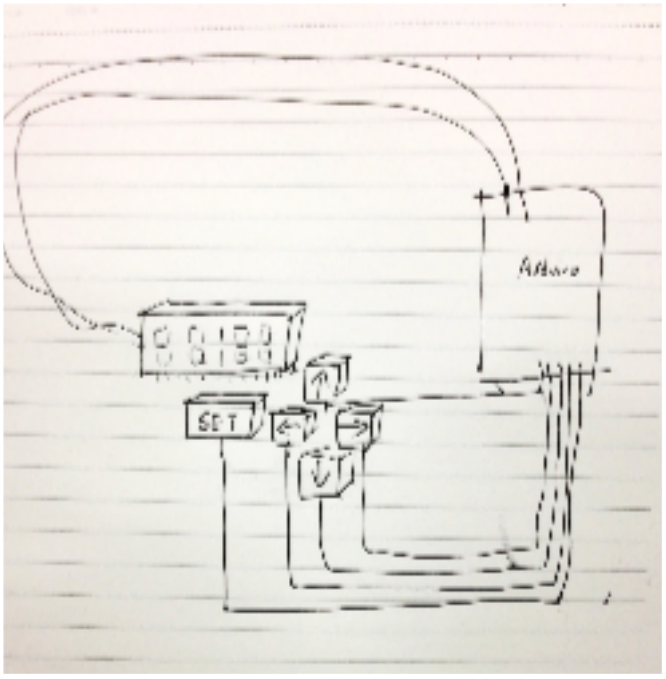


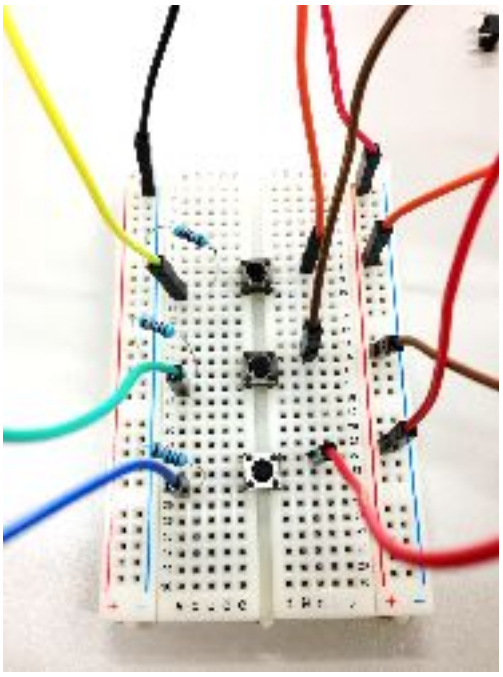
Gluing a piece of flat plastic onto a round surface was difficult, but I managed to do it thanks to epoxy magic. Next, I tested out the buzzer that we are going to use to make sure it is functioning properly before I glue it on (with epoxy). Next, I glued on a right angle metal support to the body of the coffee machine and glued the buzzer on top of it. The coffee machine section was finished.



For the second section, we are building a separate box that contains the main controller as well as the vital electronic components. It will also have a time display and buttons for the user to set the alarm time. I wired the clock module and the display module by directly using the protoshield. The main challenge here would be programming the clock, but that will be

worked on after the majority of the physical components are finished. Next, I set up a button system on a breadboard after discussing potential button functions with Daniel.





Since all necessary physical components for debugging/testing as we prepare the program was ready we decided to try to finish the main program. Through much difficulty and Googling, we got the clock module to accurately keep time and the display module to display and update time. The display module was particularly confusing because it had an IC to control the display through analog signal instead of the usual 8 pins. After that, we wrote the program for reading the button inputs to set the time, which was relatively simple. We also got the buzzer to successfully ring at the set time, which means our prototype can now function as a standard digital alarm clock.

Our second prototype is the one where I describe below in section 4.3.
I built a black plastic case for our electronics to be housed in, making our product look safer as well as more durable.

Test/Submit for Feedback (4.2)

We showed Mr.Riley our first virtual prototype on paper and asked for his input. He suggested that we measure the amount of beans grinded by rotations instead of by weight.

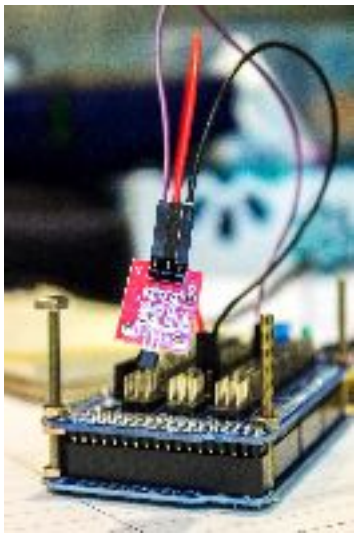
As Mr.Manning and Mr.Riley checked on our progress in class, we received feedback about the unsafe looking bundle of cables and modules as well as potentially setting the buzzer sound into the tune of a song.

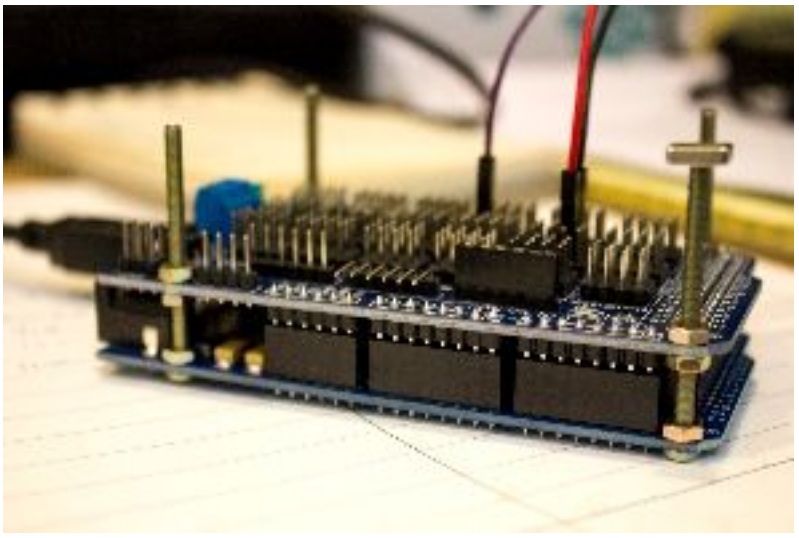
I interviewed Ms.Markis for her feedback on our prototype. This was initially a couple simple questions:
“Would you buy this product if it was sold on the market?” A: Yes, if pricing is reasonable

“Would this wake you up and motivate you?” A: Yes
Some questions and concerns we received:
“How much ground bean is enough?”
“Beans prepared differently have different grinding properties, how is that adjustable?”
“Will the alarm noise keep ringing while grinding or will it stop when grinding starts and continue beeping if grinding stops?”
“That looks like a bomb”

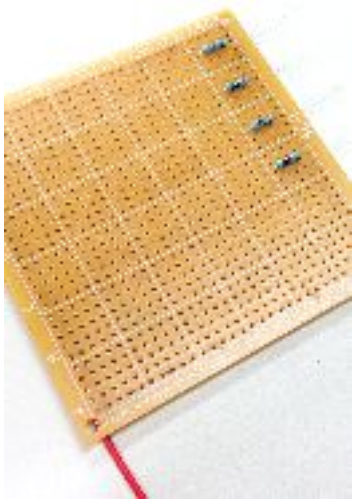
Integrate Feedback (4.3)

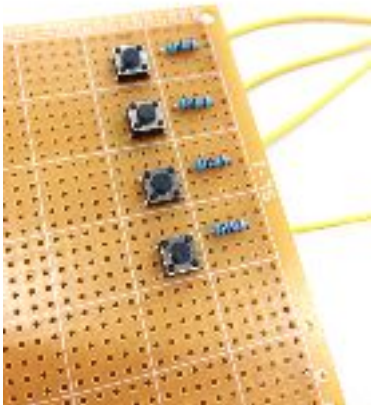
Mr.Riley’s suggestion to count grinder handle rotations instead of weight was technologically sound. After researching on how I could implement a method to count rotations, I compared the components and their requirements; it was much easier to use a cheap hall effect sensor to measure rotations rather than using an expensive and inaccurate weight sensor. I then created a small proof-of-concept setup to confirm that Mr.Riley’s method works. (click for video)



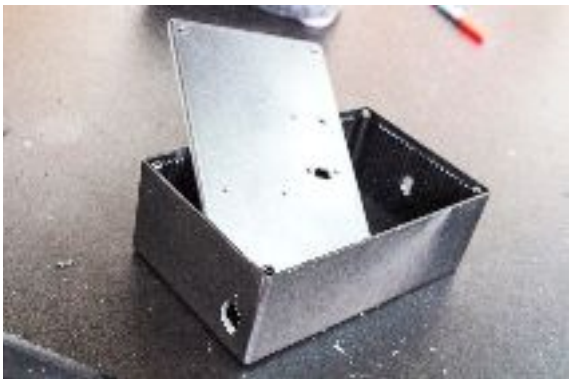


In response to the feedback that we should house our product in a nice looking package so that the wires don’t show too much and so that it looks safe, I went to the shop and bought a plastic box for the project. Then I decided to move the button circuit from the breadboard to my own circuit board by soldering components on a blank board. The result was a much cleaner input interface. The next step is to install this onto the new plastic box.

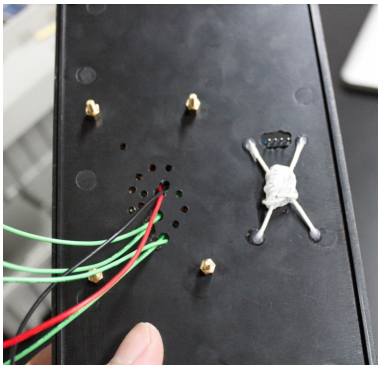
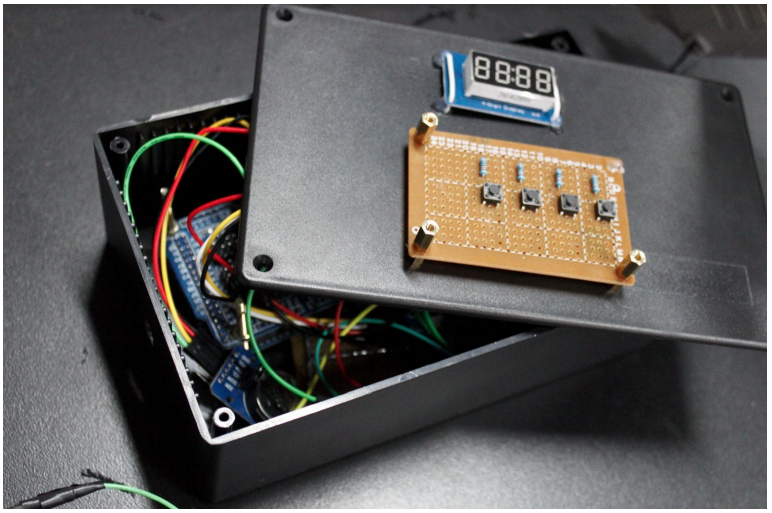




I used a Foredom to drill holes in the box for the display and the input buttons to be screwed on, as well as holes for the power cable and the wires that go to the coffee grinder itself.

After the holes were ready, I fitted and fixed each component into their respective positions. It looked like this after I pulled the cables through the cover to the inside.

I believe this made our product look much safer and approachable (still debatable) since all the ugly wires are stowed into the box. Our components were also better protected inside the box. The only downside that we saw from our new box was that it resembles one of those bombs in action movies where they had to call the bomb squad. At this stage in our

development, utility is still more important than form so we will deal with its bomb-like appearance later.

As for the sound of the speaker, we decided to try playing tones instead of a standard "buzz" noise. We found out that our current buzzer's volume drops significantly when playing a tone instead of a buzz. I decided to resolve this the fastest way possible by buying a new and better speaker and replacing the old one. This is where we also made the decision to also house the speaker inside the box, not on the coffee machine, as it can get too loud sometimes, and the box is good insulation. Daniel also changed the tune so that it sounds like a song from an anime that he watched. I have a demonstration video here. (click for video)

When two different people mention the same issue, you know its a problem. In our case, a pretty serious one. I have not found a way to make the clock box look less like a bomb yet, and I will consult the art students for help once everything is functional. As for the different beans and different grinding properties that Ms.Markis mentioned, I did some research and it turns out that the difference in ground volume isn't big enough to affect a cup of coffee. For the alarm noise issue, we reprogrammed the alarm so that it is muted for a minute as long as the handle is turning. Once the handle stops turning before completing the required rotation count, it will wait a minute before bleeping again.

Reiterate (4.4)
My Feedback and Integrate Feedback section shows this. For each feedback-iteration sequence I changed the color of the text.

Reflection

1. Describe. What happened?
    a. We designed and built prototypes while using feedback to guide the development of our product. This entire document describes what I did and what happened.
2. Think and Feel. What were you thinking and feeling?
    a. At first I felt like there was a lot of work to be done and it felt like we wouldn't have enough time to finish it all.
3. Evaluate. What was good and bad about the experience? Why?
    a. It was good that we effectively made use of our time to build our prototype and made changes based on feedback. I felt like we could've been a little more efficient but I guess I'll just live through with whatever we have right now.
4. Envision. What else could you have done?
    a. We could've made sure that the code was well documented on Github.
5. Plan. What would you do different next time?
    a. If there was code to be involved next time, I will make sure everyone makes use of Github properly. Because our issue was that we didn't take snapshots of the code frequently enough and that made it hard to troubleshoot the code.