SWEET TREAT

CAPSTONE PROJECT PROCESS BOOK

DESIGNED BY TEAM PUZZLING CANDY

A Sponsored Project By Department Of Human Centered Design & Engineering, University Of Washington

HCDE Human Centered Design & Engineering
University of Washington

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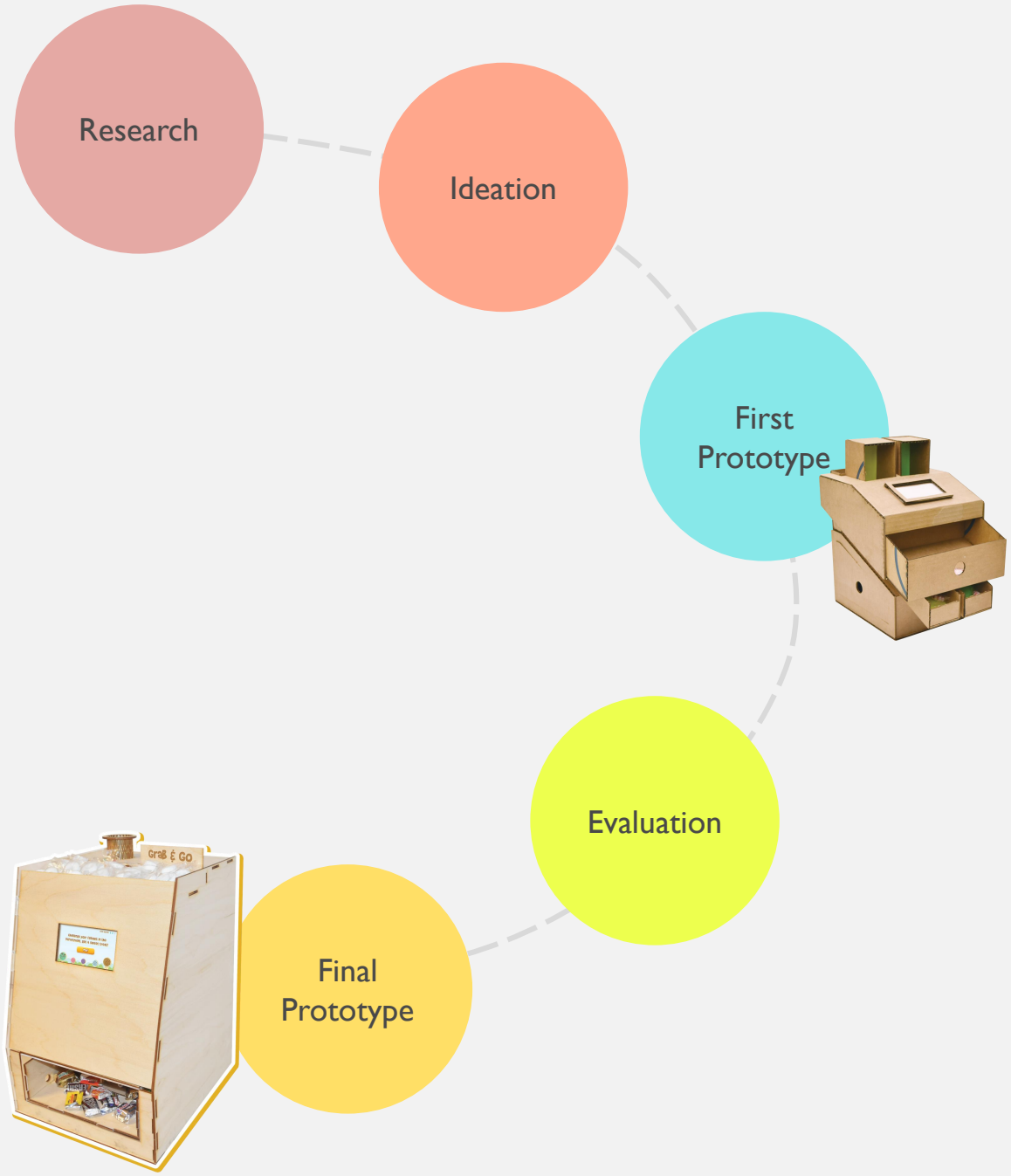


EXECUTIVE SUMMARY

Everyone has come across a candy bowl this is either empty or nearly empty, with only a few remaining pieces of discarded candy at the bottom. This experience is always disappointing, leaving you without the sweet treat you were craving. Enter Sweet Treat, a new candy bowl experience. Over the course of ten weeks, our team set out to design the candy bowl experience, making the bowl easier to refill, increasing the variety of candy in the bowl at any given time, and increasing engagement in the office surrounding it.

Our research developed into three clear findings, which we used to design an initial prototype. We were then able to do some rapid testing on the prototype and get good feedback about what wasn't clear. From there, we created Sweet Treat, a redesigned candy bowl that asks users to complete a challenge in order to earn their candy. Those that don't have time to play the challenge can simply grab a piece of less desirable candy from the tray at the top of the machine. Finally, the auto-refilling drum means that the candy bowl has to be filled less, while extending the variety of candy in the bowl.

MEET THE TEAM

Liz Chen

I'm a designer who like to wear multiple hats at a time: from researcher, designer to prototyper. I hold a B.E. in industrial design, which means I can contribute my 3D modeling and physical product design skills to the capstone project. I also have professional experience at design agencies doing packaging, retail display, consumer electronic, and digital product design. Many of my design proposals had been implemented by clients and launched to the market.

Ankur Agrawal

I'm a Computer Scientist transitioning into Design Technologist. I like to invent technology and design interfaces for it. I mostly focus on designing tangible interfaces to interact with technology digital or otherwise. I feel that most of the people working in UX are biased towards designing screen based solutions (web/mobile), so I try to remain neutral during brainstorming and let the methods guide me to a solution be it non-technology based. Before joining the program I was an entrepreneur in India and also have worked as a software engineer for a startup company.

Chen Ye

With a solid background in Electrical Engineering, I've gained rich experience in physical computing and electronic design. I've been enjoyed building things all the time and now I am actively improving my design skills and gaining experience, which I believe would help me build things in a better way.

Allie Deford

Over the last year and a half, I've been transitioning from a software developer to a user researcher. In my time developing software, I found the developers often failed to consider their users' needs over technical considerations, and that user experience was often tacked onto the end of projects. I thought this seemed backwards, so I began learning about user research so that I could prove there was a better way. More specifically, I'm interested in doing user research for civic technology projects and developer tools; these are both areas that I feel have been neglected.

PROBLEM

For this project, we looked at the candy bowl in the HCDE main office as our test case. The current problem stated by the HCDE office staff is that, even though a wide variety of candy is available, visitors to the candy bowl tend to select only specific types of candy, causing it to run out more quickly and leaving less variety for later visitors. This happens because the candy taker's behavior is motivated by sensation, which drives them to select what they perceive to be the best-tasting candy. Since most people who visit the bowl have the same idea of what candy is the best, this leads to certain types of candy running out quickly. The candy bowl is also a hassle to refill, leaving the candy bowl manger to believe it should be maintained by everyone in the office.

MOTIVATION

- Make the candy bowl sustainable from both aspects of variety and quantity
- Create a fun and collaborative environment around the candy bowl
- Understand the deeper motivation around using an artifact that people take for granted

DESIGN QUESTION

“How do we motivate staff, faculty, and students to change their current behavior of taking candy from the HCDE main office and create a fun and collaborative atmosphere in the office?”

RESEARCH

In order to better understand the problem space and to uncover design opportunities, we performed user research. We started with a literature review to gain an understanding of the psychology around changing people's behavior and to learn about gamification. We interviewed candy bowl managers to gain an understanding of common problems that surround the candy bowl.

LITERATURE REVIEW

In order to better understand the space, we read 10 academic pieces on gamification, motivation, and free food.

MOTIVATION

When changing behavior, it is important to consider how users are being motivated to use the system being redesigned. Extrinsic motivation, or motivation where users are motivated by something outside themselves, can be used to initially motivate. However, for a system to be successful, it must ultimately rely on intrinsic motivation, or motivation that comes from within the user.

GAMIFICATION

When used properly, gamification can be used to make a system interesting and to keep users coming back over time. However, it must be carefully thought out. Our research pointed us to successful gamification frameworks that encouraged us to think about how we were motivating users and how to keep them interested in the system over an extended period of time.

FREE FOOD

Free food can be used as a motivator to get those who wouldn't normally interact with each other to communicate, which can lead to unlikely but effective collaborations. In a case study looking at why Google gives its employees free food, we learned that one of the main reasons is to give those who work near each other but on separate tasks a chance to get communicate with one another, which can often lead to interesting collaborations across work groups.

INTERVIEW

We interviewed 3 candy bowl managers about their experience maintaining the candy bowl as well as to get a better understanding of the culture and common problems surrounding candy bowls. This allowed us to quickly understand the culture around the candy bowl without having to perform hours of observation.

MADELEINE

People who are frequent visitors to the candy bowl feel the need to justify their actions; in this instance, she said they often felt the need to justify the exact reason they were taking a piece of candy. She speculates this is because she sits near the bowl, and people might think she is judging the amount of candy they take. Interestingly, infrequent visitors to the bowl do not seem to suffer from this phenomenon and do not justify their actions, unless they are grabbing a large amount of candy at once.

ALEX

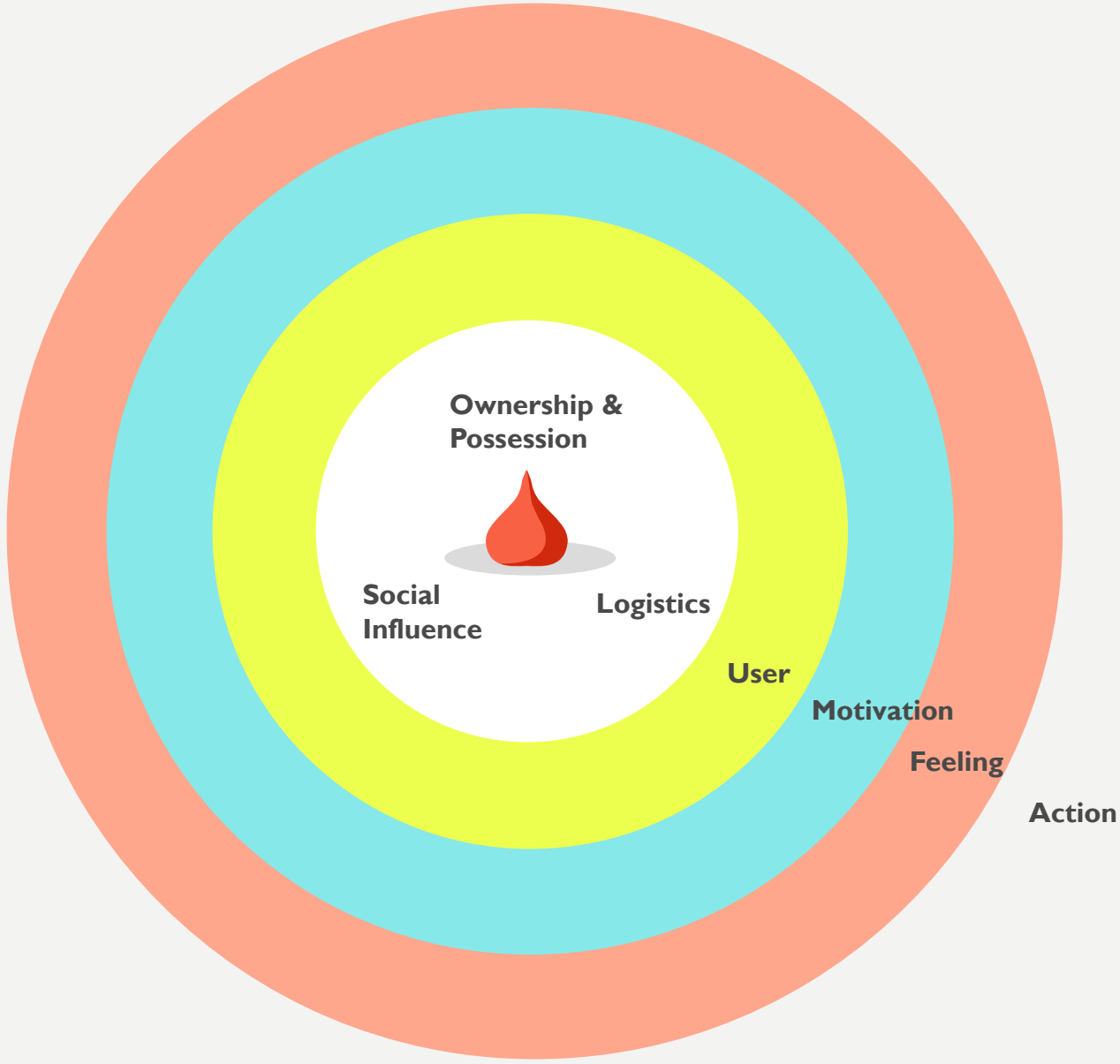
Candy taker's behavior is different when they have to give something, in this case a quarter, in order to obtain candy. We also learned that the candy bowl can serve as a sort of meeting place for a group of people, especially if those people have similar schedules.

ROBIN

Candy taker's behavior is different when they have to give something, in this case a quarter, in order to obtain candy. We also learned that the candy bowl can serve as a sort of meeting place for a group of people, especially if those people have similar schedules.

INSIGHTS

From our research, we pulled out three key insights that drove our design efforts.



INSIGHT 1

Free candy in the office provides a place for people to interact with others. However, some less positive social interactions happen when people sitting near the bowl are frequently interrupted by candy takers who feel the need to justify their actions.

> “I sit next to the candy bowl, so people talk to me when they‘re taking candy. They comment on how many they’re taking, especially if they’re taking more than one” - p1

> "people don't comment about guilt, but they have to pay for the candy, which makes a difference. They don't feel like they're getting it for free." -p2

Design Opportunity

Enrich positive social interactions among HCDE staff, faculty and students.

INSIGHT 2

The department thinks the bowl belongs to everyone in the office, with the burden of buying and refilling candy being shared by everyone in the office. But people only take candy from it, and complain to the office manager when the bowl is empty.

> “If it runs out then people starts complaining to me. Now the new administrator will go out and buy candy to bring in as well. So, the task is no longer all mine, I don’t own it anymore. It’s kind of like whoever wants to bring in candy, can.
> The responsibility, I have decided, I am disowning that responsibility. Now it’s like whoever decides or remembers to pick up some candy, they can do it.
> I will go get some, I just don’t do it all the time, I am trying to empower other people to bring in the candy –p3”

Design Opportunity

Encourage all staff in the office to refill the candy bowl, and foster the collective sense of responsibility.

INSIGHT 3

The bowl is usually filled with a variety of candy at first. But some types of candy run out more quickly than others because people tend to pick the same types of candy. This leaves the less desirable ones at the bottom of the bowl for a long time before they are finally selected.

“Red and pink go fast, and everyone leaves the orange and yellow without fail. People search through to get to the ones they want.” -p1

"It’s all babe ruth and 3 musketeers [left in the bowl], which happen to have the same color packaging." -p2

"They pick something that they can see, but something they like" -p2”

Design Opportunity

Make the candy bowl consumption sustainable, in both speed of consumption and diversity of choice.

IDEATION

Out of the 3 key insights and resulting design opportunities, we brainstormed a wide variety of systems that could meet the needs we uncovered. Finally, the ideas were narrowed down to a single physical form, with 3 possible digital interactions.

FIRST PROTOTYPE

We then created a mockup of the physical form using cardboard and created a simple website to host our 3 digital interactions.

FIRST PROTOTYPE: PHYSICAL

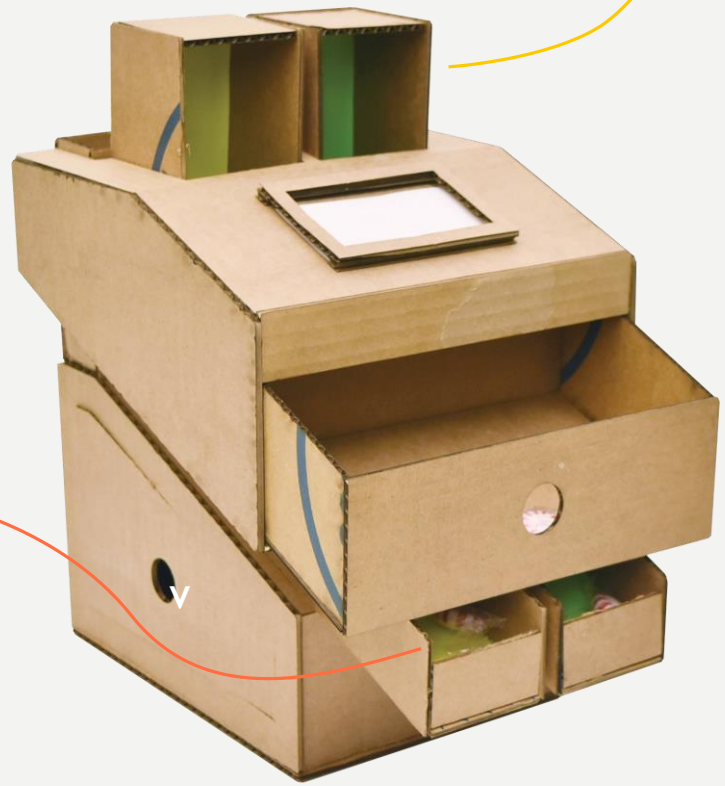
TWO DIFFERENT USER GROUPS

There are two different reasons users take candy: getting a quick sugar rush by quickly grabbing a candy and going, versus using it as a way to take time to have fun, relax, and social with others. For the later instance, the candy machine provides higher quality candy, and requires users to take part in certain challenge or collaborative activity in order to get the candy. For the former, the candy machine provides ordinary candy or candy donated from other users in the trays at the bottom.

SOCIAL GIFTING

Social Gifting refers to the benefit or reward that can only be obtained from social relationships. This is utilized in the 'Shared by Others' tray, which is designed to be the place where people have the chance to grab higher quality candy shared by previous users who were able to complete the challenges without any extra effort.

FIRST PROTOTYPE: PHYSICAL



EMPHASIS ON REFILLING FORM FACTORS

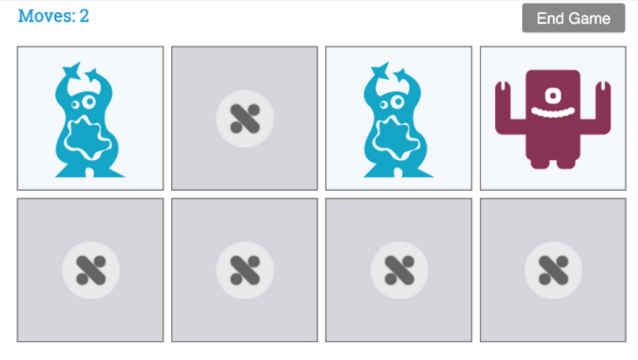
The two tubs at the top are designed for refilling the two trays at the bottom. By emphasizing the two tubs with color, textual hints, and eye-catching form, the design aims to encourage users to refill and share candy.

UTILIZING FORM TO CONTROL PICKING

By shrinking the size of the two trays at the bottom, the design reduces the chance that a user will pick only their favorite candies from the available candy, since they are able to see fewer options.

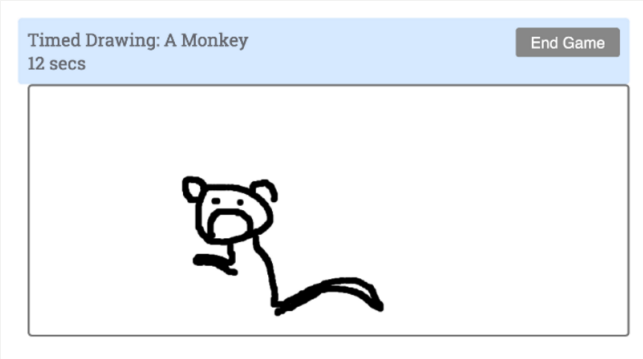
FIRST PROTOTYPE: DIGITAL

We created 3 possible digital interactions for the final system, which we called Challenges.



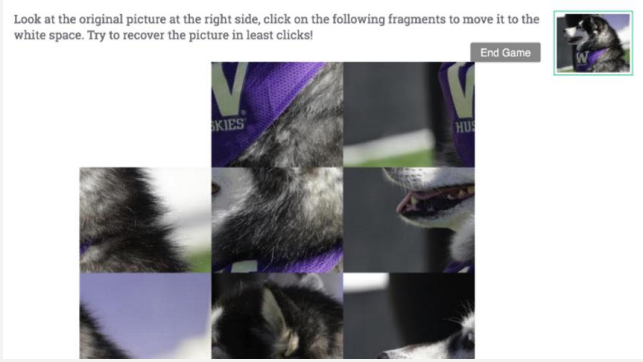
MEMORY TESTING

The objective of this Memory Testing game is to flip over pairs of cards and match all the turned-down cards in as few moves as possible.
We choose this game for its simplicity, fun, and good fit for screens with small size. The choices of the pictures can add another layer of fun, as we can use pictures related to the people in the department.



CO-DRAWING

The idea behind Co-drawing is to encourage social interaction inside the department by providing a way for people to have fun drawing together. The users will be provided with incomplete drawings started by previous users, and continue drawing for 30 seconds based upon the partially finished drawing.
This challenge was chosen for it's attention to collaboration and group interaction.



SLIDING PUZZLE

Sliding puzzle is a game that challenges the players to move pieces which are stuck in a fixed frame around in the right sequence to recreate the original picture.
We are aware that this challenge is more complex than the previous ones. We choose it to help us determine how much effort users will willing to put forth to earn candy.

EVALUATION

Our main goal was to gather feedback on the 3 potential digital challenges and the overall physical design.

Our testing was completed one afternoon in Sieg Hall. The prototype was placed in a public place where students, staff, and faculty would pass by. A researcher stood with the prototype. Participants were those who walked and took a few minutes to explore the prototype. They were directed to explore the prototype, and after they were done, the researcher asked them about their experience using the prototype and for any feedback they might have.

Ultimately, we had 7 participants complete our study, and we uncovered a variety of information. Their feedback uncovered several key usability issues.

KEY FINDINGS

THE PURPOSE OF THE CHARITY BOX AND THE SUGAR RUSH BOX IS UNCLEAR.

Until participants played the game that instructed them to open the drawer to get a higher quality candy, they were unsure how the candy would be different from the candy in the two boxes.

IT IS UNCLEAR THE THE DRAWER CONTAINS DIFFERENT CANDY.

In this prototype, the drawer containing the winning candy was solid, leaving participants unsure what they would be getting by completing the challenge.

THE SLIDING GAME IS TOO TIME CONSUMING.

When completing games, users want to be able to quickly complete the challenge in order to earn candy. However, a participant who played the sliding game thought it was too complicated to achieve that goal.

THE BUTTONS ARE HARD TO SELECT DUE TO THEIR SIZE.

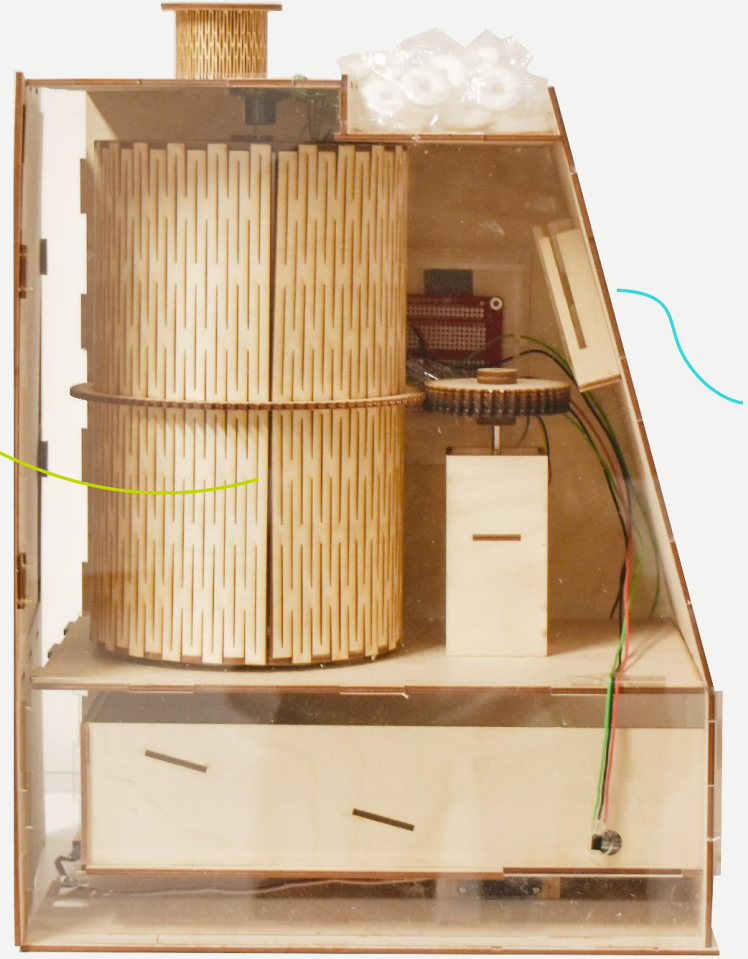
Participants commented that the buttons, which are required to advance through the system, were hard to select using their finger due to their small size.

FINAL PROTOTYPE

As a result of the findings from our testing, we made modifications to the design of both the physical and digital parts of the prototype. We then incorporated those changes into a final prototype, which was built from significantly higher quality materials than the first prototype. We primarily used laser cutting on acrylic sheets and birch boards for all of the components.

The final prototype is a complete system with three individual parts: the physical design, the electronics system design, and the digital interaction design.

PHYSICAL DESIGN



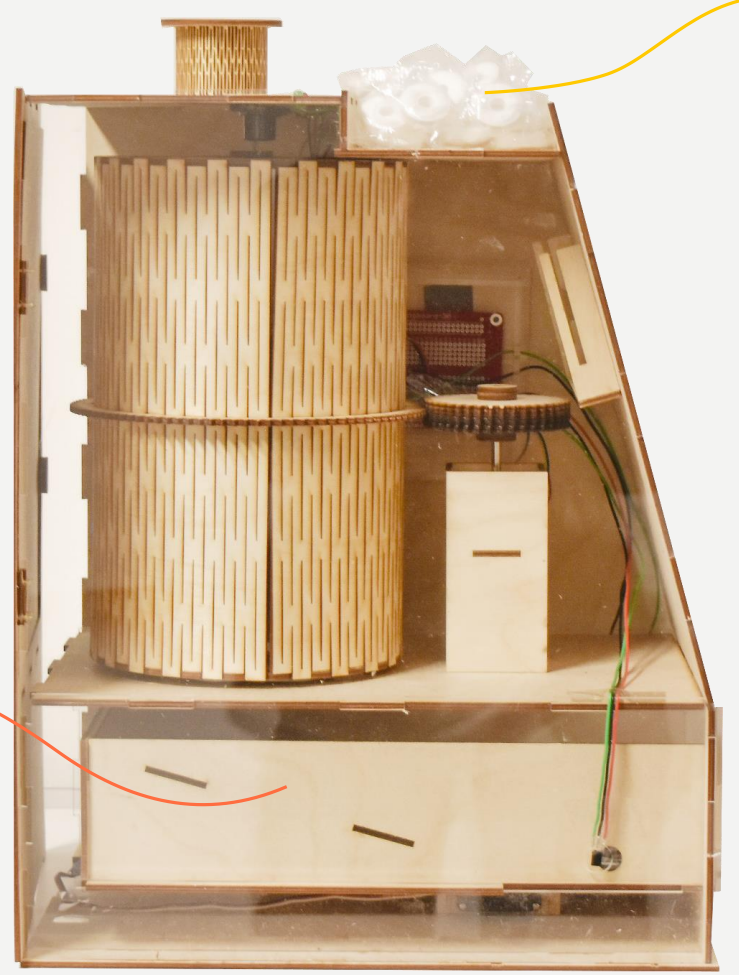
THE REFILL DRUM

To create this specific shape of cylinder with laser cutter which is normally for manufacturing 2d shapes, we adopted a design method called kerf bending plywood. For the smooth rotation, we bought a pair of ball bearings from hardware store, which made it easier to fix the axis of the drum and reduced the friction.

Display

The current screen is a smartphone, so we designed an removable frame to embed the phone inside which make it easy to remove.

PHYSICAL DESIGN



GRAB & GO

We designed this section on the top of Sweet Treat to be obvious enough to drive user's attention and for them to easily grab a piece of candy as if it was a normal candy bowl. This will initially be filled with less desirable and cheaper candy than the candy in the drawer.

DRAWER

The drawer of the machine has a transparent front panel so people can see the candy inside. It also has a slanted platform to make the candy slide forward. We couldn't find an existing drawer slider with the right size for our system, so we designed a similar structure, with different materials to minimize the friction.

PHYSICAL DESIGN

DRUM REFILLING ENTRANCE

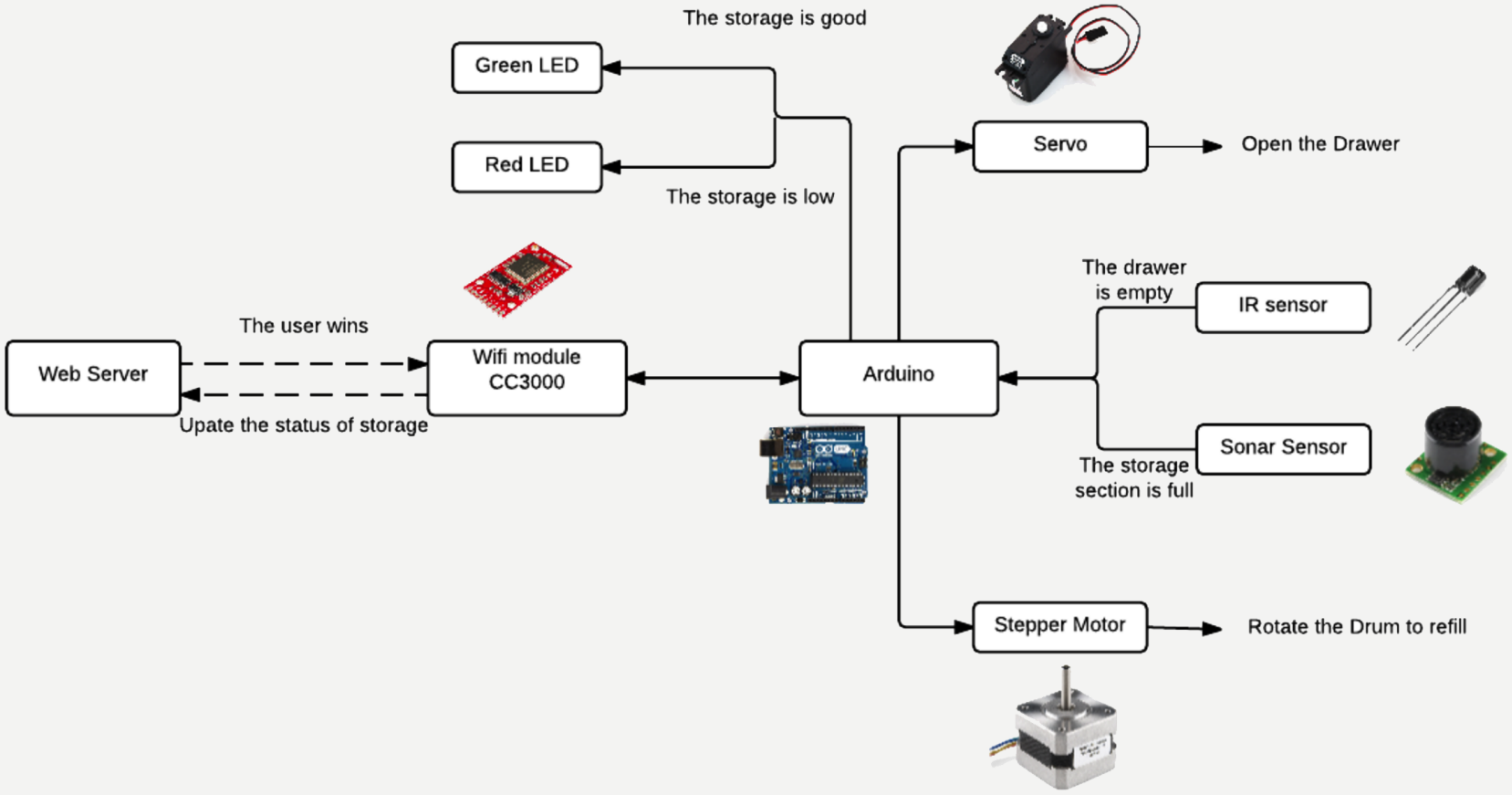
On the top there is an opening which is connected to the drum for refilling Sweet Treat. We also put two LED indicators right in front of the opening to report the level of candy in the current section of the drum.

DOOR HINGE FOR EASY MAINTENANCE

No matter how well they are designed, sometimes machines break and we wanted to keep that in mind by making it easy to access the system components. We applied the hinge structure on the back door so that it can be easily opened and give people easy access to the inner structure if any problem occurs. The same consideration is applied on the bottom panel for fixing the motors.

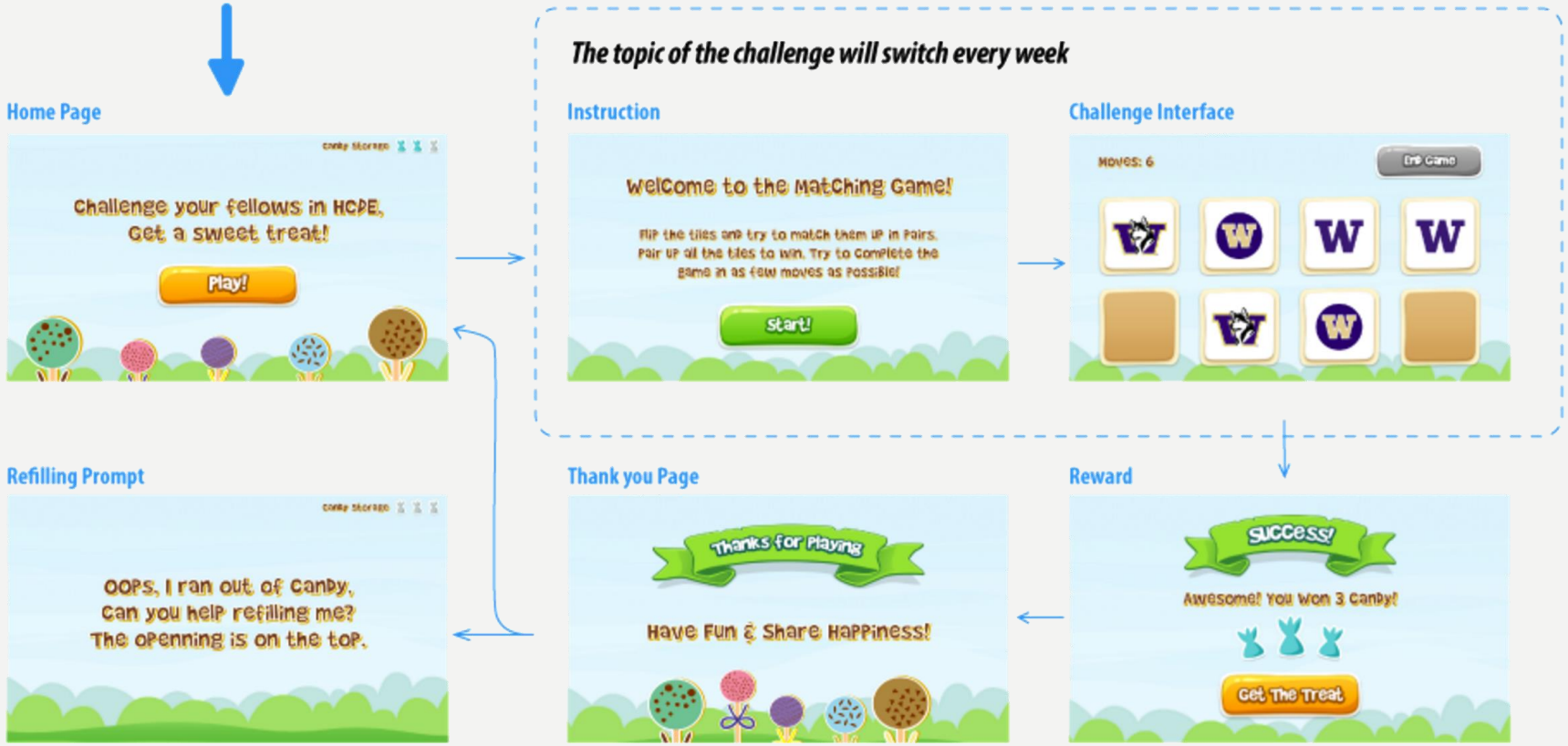
ELECTRONICS SYSTEM DESIGN

We designed and implemented a control system that would run the mechanics of the prototype. The core controller is Arduino Uno, which talks to different sensors and modules. The components work together as the following chart shows.



DIGITAL INTERACTION DESIGN

Digital Interaction of Sweet Treat primarily includes the challenges that users must complete in order to earn higher quality candies. Compared with the user flow we designed, we decided to only provide the user one challenge at a time, so the user isn't be able to pick between different challenges. Instead, the challenge will rotate every week, which helps keep the experience fresh for an extended amount of time.



INTERACTIVE CHALLENGE

In order to make candy consumption sustainable, we needed to limit the user's ability to get to the good candy. To do this, we designed a digital challenge which users must complete in order to earn the candy. To better show off what they would earn by completing the challenge, we made the drawer containing the better candy transparent; this will encourage them to play the challenge in order to earn the better reward.

This system enhances sustainable candy consumption by limiting the number of types of candy that users can choose from. Social elements added in the challenge, such as leaderboard and co-creation process, will also promote a social atmosphere in the office centered around the candy machine.

KEY FEATURE 1

GRAB AND GO

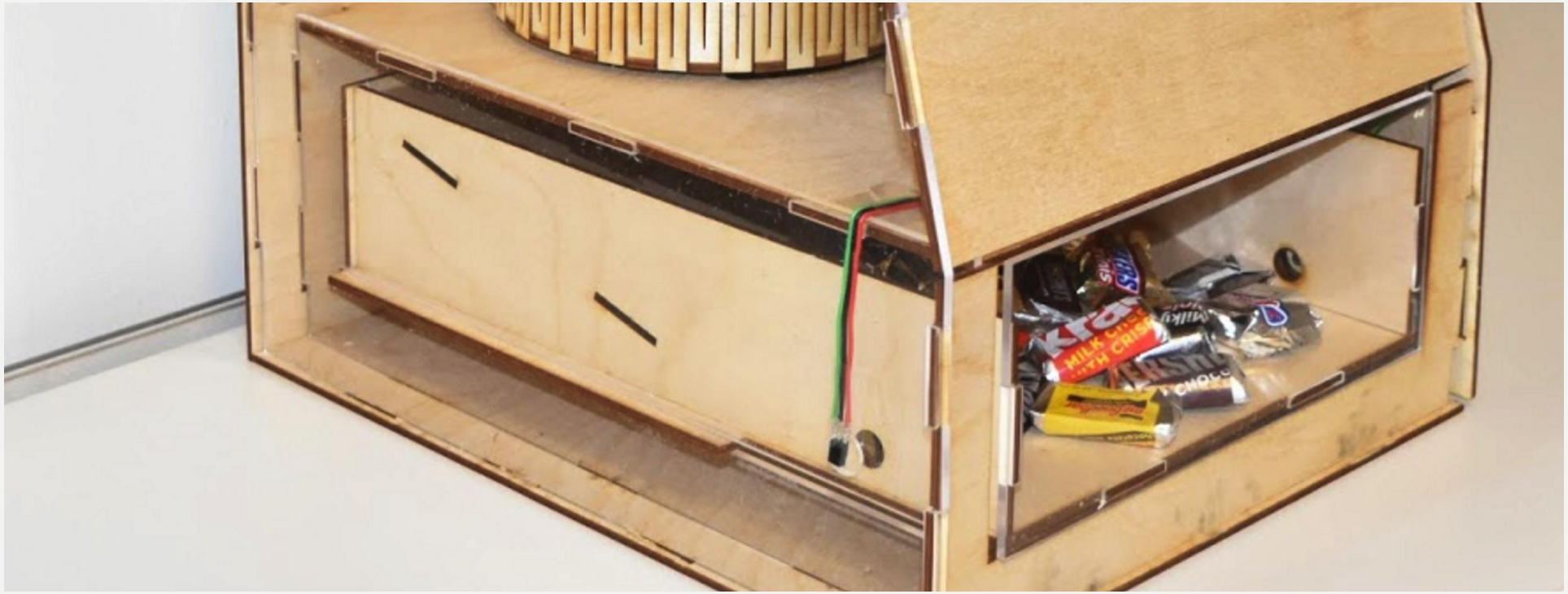
In order to meet the needs of those who just need a quick fix, we designed a tray at the top of the machine where users can grab a piece of candy without completing a challenge. This section will initially be filled with less desirable and cheaper candy than the candy in the drawer, but can be added to by users who want to share extra candy they earned by playing games, as encouraged by prompts on the screen.
Moreover, we believe sharing candy in this manner will increase a positive environment and promote a cooperative and helping nature in the office.

KEY FEATURE 2

AUTO REFILLING

KEY FEATURE 3

We designed the refilling drum, which is divided into 4 sections, to be the main candy storage. It can refill the drawer 4 times by rotating itself when the drawer is almost empty. As soon as the IR sensors detects the drawer is empty or almost empty, it sends a signal to controller to rotate the drum, which refills the drawer.
We designed this because we heard that refilling the candy bowl is a hassle to candy bowl managers. So, we designed Sweet Treat to have a large candy storage area and the ability to refill itself, which reduces the frequency of refilling.

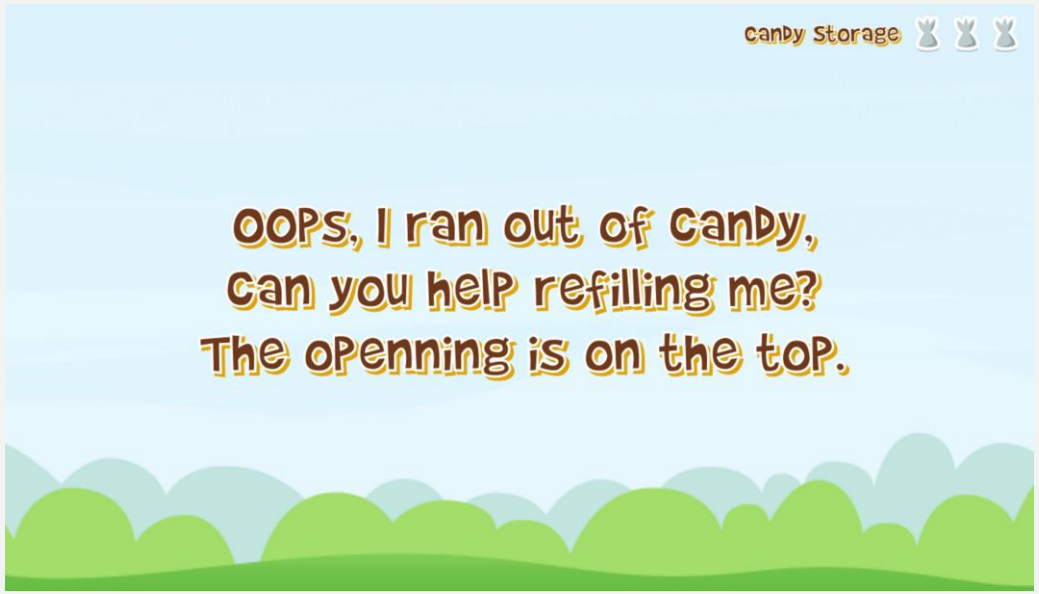


ENCOURAGE COLLECTIVE REFILLING

KEY FEATURE 4

While the drum is able to refill the drawer several times, occasionally the drum needs to be refilled. When the drum is empty, we show prompts on the screen to encourage people to refill it from the refill spout. We put two LEDs near the refilling entrance to indicate the drum is full or not to help users know when the drum needs refilling.

We learned from our research in HCDE office that the burden of filling the bowl should belong to everyone who uses it. This feature encourages collective responsibility by making Sweet Treat easy and fun to fill.



FUTURE WORK

In a perfect world, we could continue iterating and working on the design for much longer. However, that is not the case. If we were able to continue working on the design, we would focus on the following areas:

DIGITAL EXPERIENCE

Instead of running the digital interaction on a phone, using a real touch screen would be an ideal solution for the system. This would also require a more advanced microcontroller or processor.

DRAWER STRUCTURE

Although the servo is able to push the current drawer open and closed, we think a structure like a normal drawer slider with ball bearings would make the mechanical transmission much smoother.

REFILLING STRUCTURE

The current refilling entrance is relatively small, because we had to shrink it to leave space for the sonar sensor. In the future, we think pressure sensing would be useful here. Pressure sensors can be easily stuck on the bottom of each storage section, so that the controller could know how full the storage is by measuring the weight of the candy.

POWER CONSUMPTION

Power consumption is always important to consider when it comes to design a real industrial production. We haven't really had time to improve our system on this aspect but we did think about it. The core microcontroller should be able to enter power-saving mode automatically after a certain period of time without user's input, until the next round of user interaction starts.

REFLECTION

This process was a fascinating experience, and we're proud of the work that we did over the course of the quarter. That being said, there are of course things that we would change if we were able to complete this project again.

ENGINEERING PROCESS

Firstly, we would have begun the engineering process sooner. While we gave ourselves two weeks to turn the 3-D mockup and work flows into a final prototype, the process could have taken much longer than that. Had we had more time, completing the final prototype was very stressful, and some of that stress could have been reduced and the electronics could have been firmed up if we had more time.

MORE TESTING

Finally, we would have had another round of usability testing on the final prototype to make sure we were on the right track. We had initially planned on completing this second round of testing. However, the engineering process took much longer than we initially anticipated, and we weren't able to complete the testing. This data would have allowed us to continue to improve on the prototype and make it even better.

INITIAL RESEARCH

Second, we would have done our initial research differently. We spent the majority of our time in the research phase reading academic articles, but this process ultimately turned out not to be that practical and helpful during the rest of the project. We ended up relying heavily on the three interviews with candy bowl managers to form the basis of our insights and eventual design. Had we known that, we would have spent less time reading the academic articles and more time doing interviews, which would have allowed us to complete more of them.

LINKS TO ADDITIONAL RESOURCES

PRODUCT USAGE SCENARIO VIDEO
https://vimeo.com/158676987

PROJECT PROCESS VIDEO: HOW WE MADE SWEET TREAT
https://youtu.be/P3kTBk0FmaE

THANK YOU

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