The Travel Safe

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Table of Contents

Executive Summary

In Engineering 1182, Team Q came together to find a problem, brainstorm solutions, and create a refined prototype to solve the problem. Through the search for a problem, the group came together to list their own specific ideas, and finally a problem and user group was finalized. The group decided to focus on a user group that travels. The problem the group came across was the security of important items whilst traveling such as passports, credit cards, and other items that users would want to take along with them while traveling. The team decided to focus on a goal of making a product that would allow users to keep their items in a safe, portable spot, that if was lost, it could immediately be tracked again, while still having a strong locking ability to keep unwarranted people out.

With this goal, the team created multiple prototypes using CAD and utilized an Arduino and MATLAB to code a 4-digit key locking mechanism. The group wanted to make it so that this product would be able to withstand a force of 5 pounds, a drop, and a water spill, still be small enough for portability, but big enough to still fit items. After creating the first prototype, the team wasn't able to test the main locking part of the prototype, but verification testing was done, and the team learned to look at the waterproof testing portion, but overall, the product performed well. From this point, the group worked on adding the locking mechanism.

During final testing, the group tested the functionality of the lock, the strength of the mechanism, the product's ability to withstand water, and if it fits within the measurement descriptions. After testing these parts of the product, the group concluded that the product performed well in every aspect of the verification testing. The product locked and unlocked, while still holding over 5 pounds, keeping the contents secure from water and still within dimensions to fit in someone's pocket.

One big change the group would make in the future is to make the wiring part of the lock box more professional/internal relative to the box, so that a big Arduino would not be required. Overall, the group felt that outside of this change, the lock box does everything it was tasked to do in the beginning of the project.

Problem Definition Review

1. Introduction

The problem identified is dealing with travelers of all kinds. Many lose or misplace some of their most important documents. Such as cash, passport, identification, or other various items. The users identified during interviews were people who travel both domestically and internationally. These people have many different tasks in order to travel safely. However, some people lose or have items stolen from them. Because of this pain while traveling, the idea to reduce this pain and allow our users to have a better experience during tasks is the goal.

2. Problem Definition

a. User Persona

Through discussion of the user interviews, "safety of personal belongings" was one that stood out the most. The problem is that it is almost universal for anyone who travels. This is a general problem for those who do not travel, as well, when they still lack a safe and portable place for their belongings. These belongings that get lost could include a phone, wallet contents, and passports that you will be taking with you abroad. The team wanted to focus on the safety and accessibility of these products for our user group.

A possible user persona that could potentially use a product that would help alleviate the pains was identified. The interviews showed many users, but it was narrowed down to one graphical user persona to give a clear example of a possible user. For example, Justin Russo (Figure 1), is a great example of one of our (Figure 1) users. As someone who travels a lot to combat his remote workstyle, he is an end user that most likely deals with the user pains that will be discussed.

(Figure 1)

b. Pains and Tasks

Many different tasks that the user group may encounter would be applicable for the idea. These tasks are as follows:

- Going through TSA before a flight
- Visiting international tourist locations
- Ensuring you have all original items after traveling back home

Looking into each of these tasks there are pains that are associated with them:

- Going through TSA before a flight
  - Having to repack certain items after going through a metal detector. This could cause people to potentially lose important items.
  - Items being stolen. Although this is not as probably, it still happens, and it is beneficial to have safety and security when traveling.
  - Uncertainty of placement of certain important documents.
- Visiting international tourist locations
  - Losing important items in unknown places may make it harder to find them
  - Items being stolen, especially being in a foreign country can be more difficult for people
    - Needing to cancel cards
    - Losing money
    - Uncertainty about being able to get passport
  - Items can fall out of wallets easily
- Bringing home all items when returning home
  - Finding secure location

- Needing to utilize a safe in a hotel, no one knows the codes or must pay for them
- How to retrieve lost items with unknown locations

3. Research Plan

For this research plan, the focus is on the lack of safety when traveling abroad and in the airport. This would include how many people travel, and of those people how many items are lost. The team included domestic and international travel to show the magnitude of these pains with the associated tasks.

Research Table

Research Questions	**Qualitative Data Collection**	**Quantitative Data Collection**
RQ1: How many people get robbed while traveling abroad? (international)	An Auburn article on theft while traveling abroad [1]. A Rutgers journal/article on employee theft from passengers at U.S airports [2].	
RQ2: How many people travel internationally?		A model and report of people who have traveled between 1950-2023 from the Statista Research Department [3]. UN tourism article establishing that there is an estimated 235 million tourists traveled internationally within the first three months of 2023 [8]
RQ3: What are some common travel necessities?	[10] Article expressing the most important trip essentials and why they are important.	[6] new source listing common travel necessities

Or what valuables will you be carrying?		
RQ4: How many people lost items during travel? (For example, losing a card in an airport)	[7] Washington Post article on commonly lost items	[9] Statistica article showing chart of percentage of people who have had an item lost.
RQ5: How many people travel domestically (US)?		[5] Statistic chart providing the number of travelers for the past 10 years
RQ6: How many people have had lost/stolen items while traveling domestically?	[4] A serial autoethnography of a tourism researcher getting robbed	

Some new insights pulled from these sources are mainly looking at the perspective of a potential user and the threats they face while traveling. The risks stayed consistent in that users still deal with the threat of theft under the broad sense of safety. There were some differences between the number of people who travel and those who lose items during travel. This is going to be obvious, but can cause confusion of the user group, but in the end, the market size should stay as just those who travel, because a solution should be for anyone who travels and not just for users who lost their items and want to be better next time. Another insight was getting an idea of what a potential user brings with them on a trip. For the most part, the types of essential items to bring whilst traveling stayed consistent, as items mentioned included ID documents, money/credit cards, and a cell phone, with a couple additions of o convenient items such as portable phone chargers and travel adapters [10]. For the most part, research sources seemed to cooperate well as they gave a consistent level of similar information. For example, the percentage of people at risk for muggings found from an article was around 5.8% [11] whereas the percentage of people who reported an item stolen during a test trial was just over 4% [12]. Numbers had small differences, but were relatively similar, and the scenarios within the qualitative sources provided similar stories of theft cases/stories.

4. Research Results

a. Creating User Value

i. Gains

The task identified to be focused on is travelling and bringing back all personal items that the person left with. Some pains that go along with this task may include:

- Finding a location for belongings ensures safety and accessibility.

- Being able to retrieve items that are lost and having assurance they won't be stolen. (Ex: losing a credit card after finding wallet)
- Having to fit many different personal belongings of different sizes that all don't fit together.
- Fear of theft, (criminal risk factor) that could push users away from traveling.

Finding a solution to these pains can also induce multiple benefits that are more than just solutions to the user's current pains. Some examples of these solutions may be:

- The overall improvement of one's organization is an example of this. Having a solution that solves all focused pains would also improve a user's organization.
- The number of thefts (specifically in airports, and other travel locations) would decrease. If a solution keeps items safer and more accessible, it is likely that less people will be able to steal items resulting in less crime.
- Users won't have to worry about buying new items to replace their lost ones. (shutting down cards, buying a new wallet). Overall, this solution will save the user money.

ii. User Needs

Observing the users to ensure what needs they have will eliminate the pains that have been discussed. With the number of travelers increasing again, specific needs must be prioritized. Overall, the most important user need for this task is item safety. If someone had been traveling, whether it be domestic or abroad, and lost their wallet it would be difficult to track down. Most likely, by the time the wallet was found, much of the contents could potentially be gone. In an Auburn article about theft while traveling, there was a piece on hotels and their unsafety. In the article it states, "Government and business travelers often report that their belongings have been searched while they were absent from their hotel room. In some cases, they have returned to their room soon after departing, to retrieve a forgotten item, and find persons in their room claiming they are there to repair a broken TV, etc." [1]. Although not everyone is a government official, it is scary to think items could be lost no matter how hard they are kept secure. In an article, written by Penny Simpson, it states, "About 8.6% of all risks noted by respondents were related to property crime, the fifth most mentioned risk of concern to travelers." [11]. 8.6% may seem like a small percentage, but with such a huge number of travelers, this small percentage really means a lot of people are facing this issue. In this article, it also states that "Within this risk category, robbery (49%) and theft (43.3%) were the most often mentioned types of property crime risks." [11]. On top of this, even when it comes to criminal harm, mugging takes a big percentage of interactions between tourists/travelers and criminals. According to this article, although kidnapping, assaults, and

drunk driving took up 27.3% of criminal harm risks, 36.3% of the criminal harm risks were focused on muggings (5.8%) and the overall safety of a human being and their personal belongings (30.5%) [11]. Item safety is the most important need, because if the solution doesn't solve this, there is no pain.

Although item safety is among the most important user needs, recognizing that people can still make mistakes and lost items is the start of understanding the user wholistically. For this reason, trackability is the next most important user need. Ensuring the user to have a peace of mind as to where the belongings are is crucial for establishing user needs against the pains stated. In an autoethnography written by Erik Cohen, a tourism researcher, the author talks about a couple cases when traveling for work purposes, and finds items stolen. One of these specific situations includes a time when the author set down a brief case to engage in a conversation and lost it right after [4]. With some way to learn of his case's location, Erik would be able to track his lost suitcase that carried his passports, ID's and other important papers. A trackable solution would eliminate a good portion of pain because a user would not have to waste money or time to either rebuy their lost item or retrace their steps to locate the item.

When producing a solution, money is an important factor in allowing every person to be able to obtain one. This is why price is the third most important user need. If the cost is too high, then only a small fraction of the original market size will have access to a solution. Making something that is effective is the main goal, but prioritizing price will help make this item more accessible. At some point the user may not find a need in an item if it is too expensive. If the cost of the product outweighs the items it is protecting, it may not be worth it for some users.

Another important user need is portability. The solution must be portable because the target audience is for people who travel. If a solution is not portable, the user group cannot use it. For this reason, portability is the next most important solution.

A solution that can handle large drops, hammer smashing, different natural elements, and any thief willing to do whatever it takes to get to a user's personal belongings, points to durability. Knowing the solution will survive getting hit by a hammer will be great for the user's piece of mind, but is not as important as trackability or portability, which is why durability is ranked lower.

A solution would be considered adaptable if it could handle different situations and be used in different scenarios. For example, a fanny pack is an adaptable alternative for this solution, because it can be worn in different ways. It can be worn around the waist and across the body. Adaptability is an important need, but it is outmatched and almost solved by focusing on parts of the other needs.

After more research, convenience is also a user need that should be prioritized. When looking at a user and their motivations to use a good, convenience ranks high, and this is consistent with traveling. For example, a user is more likely to bring a wallet of their important information than another backpack because a wallet is smaller and easier to move around with while still providing some level of security (more convenient). Having a solution that is convenient for this user group is important because they go through a lot of tasks on travel day and lightening that burden can really make a difference.

Having compatibility with a type of technology is important too. In an article, written about crime science, by Stijn Ruiter and Wim Bernasco, the authors use a smartphone app to test the risk of criminal victimization and to see if it is higher when traveling [12]. Outside of using this idea to gather information, this article inspires the user need for making a solution that can work with technology in some way, whether it is through an app to report theft or simply having a tracking device within the solution. Tech compatibility is a user need to focus on because it plays a great role in the lives of the user group.

iii. Pairwise Comparison Chart

Table 1: Pairwise Comparison Chart of User Needs

	Safety	Portability	Adaptability	Trackability	Cost	Durability	Total	Normalized	Predicted
Safety		1	1	1	1	1	5	**5.0**	5
Portability	0		1	0	0	1	2	**2.0**	2
Adaptability	0	0		0	0	1	1	**1.0**	1
Trackability	0	1	1		1	1	4	**4.0**	4
Cost	0	1	1	0		1	3	**3.0**	3
Durability	0	0	0	0	0		0	**-**	1

The predicted most important user need was safety, and from this pairwise comparison chart it can be observed that safety is more important than all others. After safety, trackability is the next most important user need. The point of this product is to keep track of all the user's important documents and that would include the ability to track these items. After safety and trackability, cost, portability, durability, and adaptability fall in line in this order. Overall, the predicted outcomes for user needs are comparable to what the pairwise chart provided. The results are consistent with what the team would find most valuable to the users.

b. Market Character

iv. Stakeholders

TSA (agency/ customer support), material manufacturers, collaborators (Masterlock, Capitol Industries inc., etc.), distributors (TJX companies Walmart, Dicks Sporting Goods, etc.), assembly management

Each of the groups listed above is taking some inherent risk while, participation in the production of a new safety product. TSA would benefit with the use of this product allowing passengers to keep all necessary documents in the same location, speeding up the time it takes to get through security. In turn the lock could then become TSA approved and available for sale through more verified venues. Material Manufacturers run the risk of losing their reputation if the product ever fails outside of the locking mechanism. With faulty material, they risk other products being assumed to be weak and replaced in all major deals. The collaborators of this product would include lock manufacturers, they run the risk of the lock being pickable, or brittle and easy to break. For them that is detrimental and could lead to severe profit loss along with unsold products. The distributors of this deal would be major retailers, and if any other part of the deal goes wrong, they are left with a product that no one wants, and it'll be stuck on the shelves holding up space in inventory.

v. Market Size

A user group is identified, but how big is it? According to the Statista Research Development, "global inbound tourist arrivals showed strong signs of recovery in the following years, totaling just under 1.3 billion in 2023." [3]. During the Covid epidemic, there was a major decline in travel, but now, the market size will only increase as travel numbers start to recover and these are just the numbers within airports. People who travel, whether it be domestically or abroad fit in the user group, because they all match the consistent task. For that reason, a deeper dive was taken on the number of those driving within the U.S. According to another study done by the Statista Research Department, the number of domestic tourists/visitors within the United States was an estimate of two billion people [5]. Except epidemics and other uncommon occurrences that affect travel, there will always be many people that need to get from point A to point B. Overall, the market size for this solution is large and a solution to the user's task would greatly impact those who travel and it is important that the entire group of "travelers" is focused on and not just those who lose items whilst traveling because the solution is something that should prevent for everyone rather than just fix for a select few.

vi. Current Alternatives

There are many different alternatives the users could use to keep personal belongings safe while traveling. One of the main alternatives is a simple wallet where people can store their cards, IDs, pocket change, and many other items.

Another alternative researched was the fanny pack. Fanny packs are another way travelers have kept their items/materials on their person. They provide security and they are very portable. Although they have these benefits, they do have their shortcomings. If someone were to steal a fanny pack, they would have no trouble getting into the fanny pack.

One alternative that is utilized was no alternative. Focusing on users who just place items loosely or in their pockets was an angle felt was crucial to take. Some people do not feel a need to place items anywhere else except on their person. So, these items are left loosely in pockets.

Like having items loosely in a pocket. Some people may opt to place certain important documents in their carry-on bag or even their suitcase. Again, these items are then just loosely in a space, and can sometimes get lost within the bag. This might make people have to pull out everything in their bag or suitcase to find their passport, money, or identification.

A safe is a good option for protection. However, a safe is not portable nor is it an alternative that can go on flights with a person. It would not be appropriate for someone to bring a safe for an international flight or even a domestic flight.

Similar to a safe, a lockbox is another alternative, but a lockbox is a little bit more portable. This alternative is something that people might notice and if someone wanted to steal information from someone, they would know exactly what to grab. A lockbox is still bulkier than some might want to have and will take up space, may cost more for the person to bring on a flight.

Table 2: Partial Competitive Matrix

User Need	Wallet	Fanny Pack	Loose Items	Bag	Safe	Lockbox
Safety	x	x	x	x	*	*
Durability	x	x	x	x	*	*
Adaptability	x	*	x	*	x	x
Trackability	x	x	x	x	x	x
Portability	*	*	x	*	x	x

Cost	*	*	*	*	x	x

(Green cells with stars indicate the need is met by the alternative. Red cells with an x indicate the need is not met by the alternative)

As shown in table 2, each different alternative does not fully fill in every need. The closest to filling every need would be the fanny pack or a bag. However, the most important need is safety along with trackability. No alternative has trackability and the only two alternatives with safety are the safe or lockbox. The safe and lockbox cannot be portable or adaptable for their environments, such as flying. This creates a huge problem for the user because currently there is no alternative that does offer safety and trackability along with being able to bring that alternative item on a plane.

5. Value Proposition

Travel is the process of going from one place to another. This product is built for travelers, whether they be domestic or international. The team started this idea with the idea of travelling safely and returning home with all important travel documents and personal items. First the total amount of tourists had to be found, the population used was tourists entering the US [3]. With the target population being as broad a group as people who travel there is a market of users in the billions. It's not enough for people to travel in groups to guarantee the safety of their belongings [12]. Team Q has not only made safety in numbers a viable option again but has also made travelling alone a little less stressful. With proper sizing, the worry of limited space is eliminated. Travel is now more secure and less stressful than ever.

6. Design Focus

Research states that there is a great number of people who travel who must deal with the possibility of getting their items stolen or lost. The Statista Research Department states that, even with the spread of covid, over 400 million people still took the air [3] and that does not include the millions of those who traveled domestically that same year [5].

Prioritizing safety and portability are a must to beat out the main alternatives people use today. The main alternatives seen on those who travel include wallets, bags, fanny packs, etc... All these alternatives do provide some benefits, but they are lacking in areas that would greatly satisfy the user's needs.

For a successful design, the product must meet these user needs

- Securely hold important items belonging to a user
- Be light enough for portable use
- Utilize some sort of technology to enhance/utilize tracking
- Be cost effective, affordable/accessible for everyone

The successful design must beat out the current alternatives by;

- Providing a lock system so only the user and trusted individuals can get in. (unlike any alternative that isn't a safe or a lock box)
- Being durable enough to withstand drops, the natural elements, and possible theft. (unlike a wallet, fanny pack, or any bag with zipper)
- Being big enough to carry passports, IDs, maybe even phones, but small enough to still be portable (unlike a safe).

Overall, the research phase provided an idea of how great the number of people in the market is. Hundreds of millions to billions of people travel every year and a big percentage of them worry about the safety of their personal belongings. A user's focus is to get to their destination and whatever they may be doing at that location. They should not have to worry about a missing credit card, or stolen passport. A user wants to be able to take what they need/want to where they want to go and be able to come back home how they left. The first key feature that had to be decided was the rough size of the product. After the size was determined the team was tasked with brainstorming other features that would be beneficial for the user. Once the brainstorm phase was complete each member was to put the features into concept sketch to show the implicated use. The last step to working toward a place to start product development was for the team to decide on a concept that best fit the user needs.

Concept Development Review

7. Concept Brainstorming and Ideation

a. Process Description

When brainstorming potential solutions, the group made sure to consider user pains and concept constraints. For the most part, the user needs identified are more material based rather than sketch/concept based. For example, one crucial user need is durability, and this is something that can still somewhat be designed, but most of this need is picking a strong material. One of the main users' needs the group is focused on includes portability and how this is used within the brainstorming was to focus on a smaller product. Another user need that plays a crucial role within the concept designs is safety. This user need was incorporated into our final design by adding a lock system to keep the user's items safe. After getting an understanding of the users' needs and finding a way to input different solutions, the team looked at current alternatives and came up with a general idea to how have a small lock box design. From there, the team split to add individual ideas to the general prototype of what kind of locks to add and other details.

b. Brainstorming Results

After developing/brainstorming some possible solutions, the group came up with a couple of design sketches.

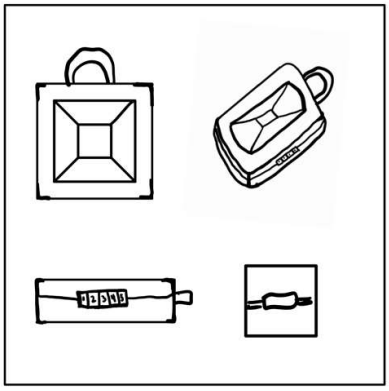


Figure 1: Concept Sketch 1

This concept sketch is very similar to a lockbox, but it has a latch on it to connect to backpacks and contains a see-through window for a user to easily see that is within their wallet without having to go through the process of having to unlock it.

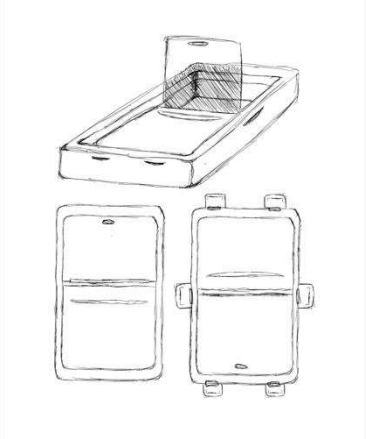


Figure 2: Concept Sketch 2

The inspiration behind this design was a safety deposit box. There is a pull tab for opening the large storage compartment which would contain lager items such as passports. On top of each storage compartment there is an elastic pouch for quick and easy access to smaller items such as cash Identification, and even small tracking devices. There are foldable latches for a snug and secure seal. No other locking Mechanism has been added in this iteration.

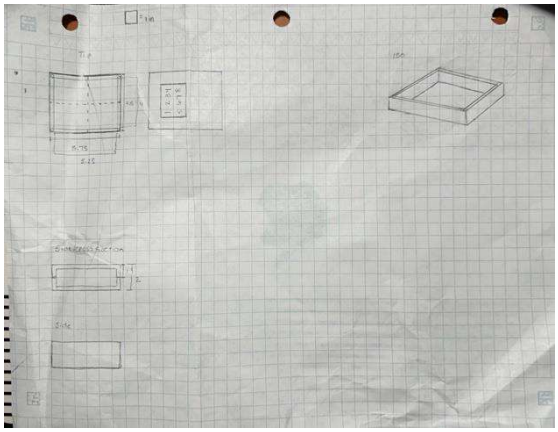


Figure 3: Concept Sketch 3

This design was made to mimic a small safe around the size of an oversized wallet. This includes two boxes that come together and have metal rods that are connected to an electromagnetic locking mechanism. This is to ensure that it is something that will not be easily opened unless it is unlocked with a number sequence. The inside is big enough to house a passport, cash, other important documents, and a tracking device.

8. Concept Selection

a. Down-Selecting to Two Concepts

After receiving end-user feedback, the group wanted to focus on the concept sketches that best solved the user needs of safety, portability, and trackability. A question that was asked during feedback was how the product would be trackable if a thief were to just take out the corresponding tracking device. A solution to this response was just having a design with a lock to eliminate the idea of losing a tracking device. A change that could be made is adding some type of security within the second concept sketch, Figure 2, to make the locking mechanism more secure. Overall, Figure 2 and Figure 3 were the most optimal sketches because they introduced mechanisms that best excelled in safety, portability, and trackability.

b. Pugh Scoring Matrix

Figure 4: Wallet (Wikipedia image [13])

The current reference competitor would be a simple wallet. The wallet can hold money, and other important items such as debit/credit cards, or personal identification. However, most wallets are not big enough to be able to hold a passport. A wallet also does not have the feature

of being able to lock, so the rating for the user need, safety, is low.

Figure 5: Pugh Scoring Matrix

		Reference		Concept 1		Concept 2	
User Needs	Weight (1-5)	Rating	Weighted Score	Rating	Weighted Score	Rating	Weighted Score
Safety	5	2	10	3	15	5	25
Durability	4	4	16	4	16	4	16
Adaptability	3	5	15	5	15	5	15
Trackability	2	2	4	5	10	5	10
Portability	1	5	5	5	5	5	5
TOTAL			50		61		71

Final Concept Selection

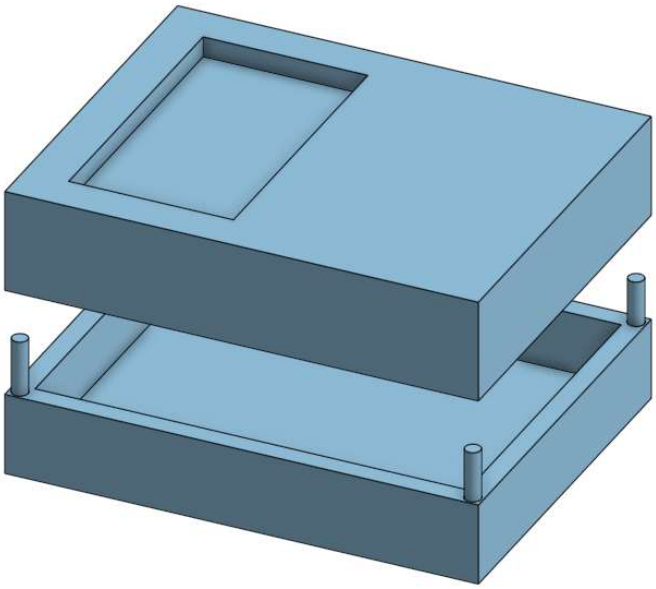


Figure 6: CAD render

Based on the scoring from the Pugh scoring matrix, the concept chosen to be the final is Concept 2 (refer to *Figure 3: Concept Sketch 3*). The user feedback that was given to the team mentioned the necessity of a locking mechanism to ensure safety of user property. The rods protruding from each of the four corners will be magnetized to the end of the countersunk holes on the lid, allowing it to close almost seamlessly. Due to customer concerns about the size of the product, they were reassured that it would be big enough to hold a passport, while remaining slim and mobile. Possible future improvements include an individual compartment for the placing of a tracking device of the user's choice, granted it is smaller than a passport.

Grand Concept Design

Loosely based off the designs of current personal security options (safe deposit boxes, combination safes, etc.), the team decided to adopt that idea of keeping important things safe, on the go. Instead of relying on a hotel safe (where staff may have the override code) to store documents while traveling, it can be kept in a personal bag or held in hand when necessary.

After looking at many alternatives, creating different possible solutions, and getting feedback, the group decided to create a lockbox system, with a passcode-magnet locking system to protect the users' goods. The CAD rendering (Figure 6) provides a clear example of how the locking mechanism will work. For the main security mechanism, there will be magnetic rods on all four corners of the lockbox. For the box to be opened a security code is required. Once the code is entered, the magnetic lock will be disabled, dropping the rods, allowing for access into the lockbox.

What makes this design unique is that it covers the spread where other alternatives won't. It will provide the portability a safe doesn't have to offer, and it will also provide the safety and security a mere wallet cannot offer. The lockbox will also have a technology feature in its passcode system, to almost give a smartphone lock feeling, but simple enough for all users to understand.

Because the product will be made to be better than the alternatives, there will be some challenges. One challenge with the design is figuring out a way to connect the lock system with the actual lock. Figure 6 shows a visual CAD render of what the proposed solution will look like, and the current challenge is finding a way that when the correct code is entered, the magnets detach enough to where the lock can be opened. A smaller challenge is the overall organization of the lock and how its components will be spaced for a seamless fit on the top of the lockbox while still providing proper functionality. Improvements to the current design could include a backup mechanism to get into the box, in case of an electronic failure.

9. Prototyping Design

Description of Prototype

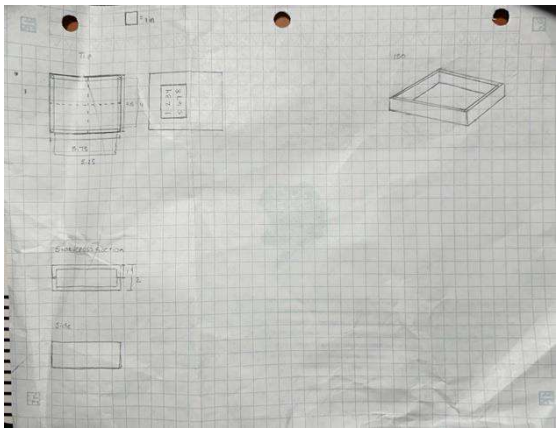


Figure 3: Concept Sketch 3

The final prototype will follow the sketch and 3D rendering of the CAD model in Figure 6. The team plans to prototype the lock box's body and use magnetic rods by placing them around the box's corners.

One of the main takeaways is that the lock is heavily dependent on the magnet system. Utilizing divots along the magnets will provide true security to make sure the magnets stay in place along the corners of the box to prevent those who don't have a code from getting in.

The lock can be powered by a combination pad. Once the correct set of numbers is pressed the electromagnets will turn off allowing the top to slide off from the bottom. When the top is placed back on, and the lock is initialized the electromagnets will turn on and the rods will prevent the top from coming off.

Prototype Design Requirements

When trying to find a way to improve the prototype design, the group came up with some design requirements that the prototype should meet. These requirements include...

User Needs	**Design Requirements**
Safety	Locking Capability (The product will either be able to lock, not lock, or show some signs of locking without fully)
Durability	Force Withstanding Ability (Can withstand up to 5 lbs. of weight)
Adaptability	Waterproof

	(If someone were to drop the product into a lake or body of water, can the product protect the items inside with no damage, minimal damage, or serious damage)
Trackability	Has Space To Fit Items (Does the item have room for tracking items)
Portability	Able to Fit Dimensions Of Average Backpack/Jean Pocket Final Dimensions will be (5.3 x 3.8 x 1.1 inches with one inch for varying before the dimensions are off)
Cost	Cost plays a big part in almost all of these requirements but because there is already a budget, the team decided not to add an extra requirement.

Figure 8: Design Requirements

When deciding on these requirements, utilizing the user needs was crucial in understanding which requirements outweighed others. In Figure 9, the team made a table/matrix to compare the requirements with each other and how much impact they had on the user needs. After completing the matrix, the group found that locking capability was the most important design requirement, and this made sense. The overarching purpose of the lockbox is to lock so it is understandable that locking capability is a major part of the product's success.

Testing Methodology and Verification Plan

Testing can be done in many ways. Here are the selected few...

- Durability testing to be tested with 5 – 10lbs of weight onto the lockbox to see if it will stand it. A scale and a timer will be used to measure weight and time.
- To test waterproofing, the lockbox will be submerged in water for 5 seconds (timer). Results will be determined (pass/ fail) by whether the contents are wet or not.
- Dimensions will be measured with a ruler and/or digital caliper and compared to requirement standards.

Correlation Matrix and Verification Scorecard

Figure 1: User Needs Correlation Matrix

	Locking Capability	Withstanding Force	Waterproof	Fits Dimensions	Space To Fit Items	User Need Weight
Safety	9					5
Durability	3	9	3			2
Adaptability	1	3	9	3		1
Trackability				3		4
Portability				9	9	3
Cost	3	3	3	3	3	1
Importance ->	55	24	18	45	30	

Figure 9: Correlation Matrix Between User Needs and Design Requirements

Using the correlation matrix, the team got a representation of which design requirements held the most weight in relation to one another. The matrix shows that the product's locking capability is the most important design requirement because it holds the most weight among the user needs. The most critical requirement to the team's success is the product's locking capability, but having durability, and being able to withstand great force are all added bonuses. Using these requirements, the group created a scorecard (Figure 10) to judge the final prototype.

Scorecard

Requirement	Range	Score Rubric	Score
Locking Capabilities	Does it lock?	(If doesn't lock -8, sort of locks -4, locks - 0)	8
Withstanding Force	Withstands 5 lbs. of force	0.25 points off if less than 5 lbs.	3
Water resistant	Can be dropped in water and picked up with no damage	all damaged -3pts, minimal -1.5 points, none -0pts	3
Fits Dimensions	5.3 x 3.8 x 1.1 inches (1 in for varying)	off by dimensions (0.5 pt per .5 inch off)	7
Space To Fit Items	Room for a tracking device, Yes/No	Yes/No If not (-4 points)	4

Figure 10: Scorecard

Protype Preliminary Design and Mock-up

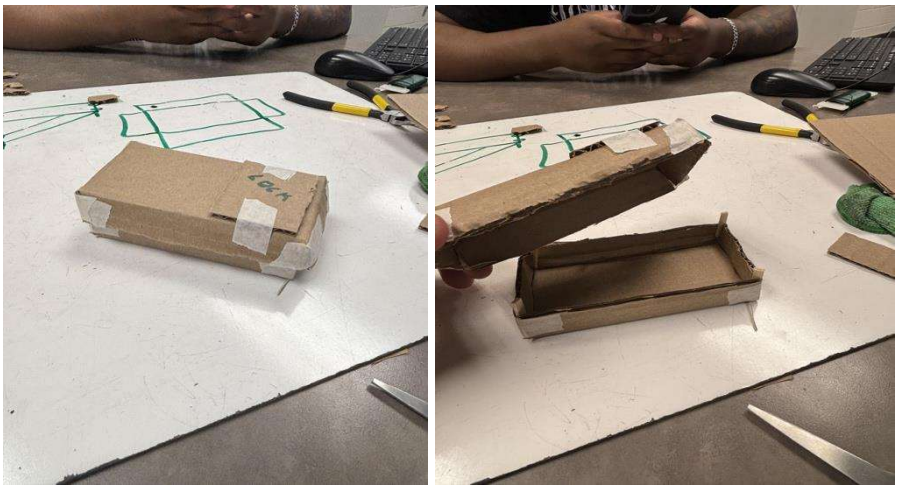


Figure 7 (First Iteration of Prototype, Mockup, Closed and Open View)

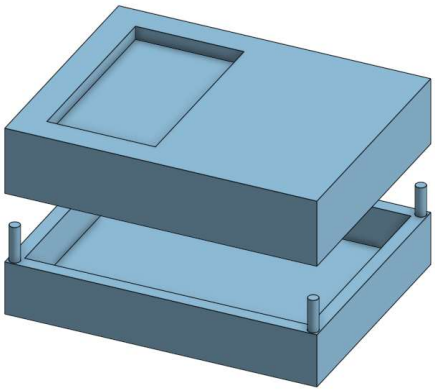


Figure 6 (CAD Rendering of Proposed Prototype)

Figure 7 shows a representation of what the future prototype will look like. The first mock simulates 2 open boxes connected to each other. In Figure 7, attached to the box is a piece of cardboard labeled “lock”. This represents where the lock system will be placed. This can also be seen in the Onshape CAD rendering (Figure 6) where the pieces on the corners will unlock after the lock system is bypassed. The lock system discussed within the group were different types ranging from safe locks, fingerprint locks, to button locks. Overall, the group decided to focus on a button lock system, for more security.

Final Prototyping Plan

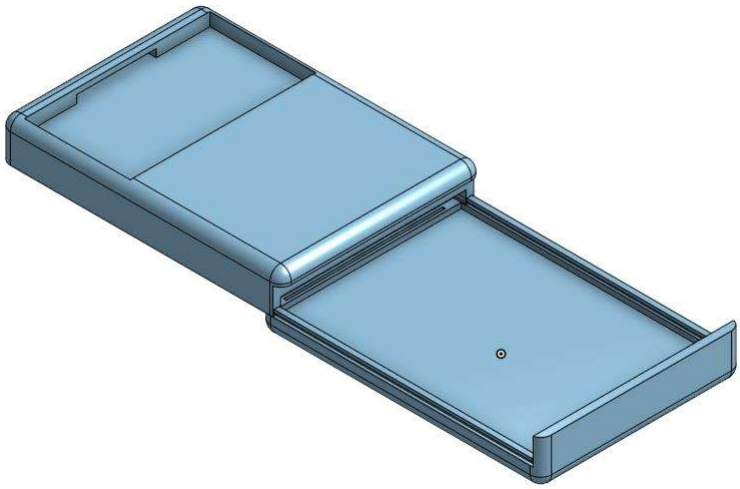


Figure 11: Final Prototype Before First Tests

After receiving feedback and looking through the design requirements, the team made some changes to the design for the prototype. The current prototype design takes the group's original idea and changes the locking mechanism to a sliding technique. The final prototype design includes a top and a bottom. The top has insertion grooves that the bottom slides into. The lock moves a bar that will prevent the two pieces from sliding out. This revision was made because the rods became impractical, and the sliding allowed the prototype to be smaller. The group will continue to use the 4-digit key lock, but differently. The utilization of this lock will allow the box to be slid open once the lock is passed through. Some major limitations include the size of the lock for it to fit comfortably in the user pockets and the weight of the lockbox so that it is strong enough to withstand force, but not too heavy where it would be an inconvenience to the user.

The team's current plan includes going through these steps...

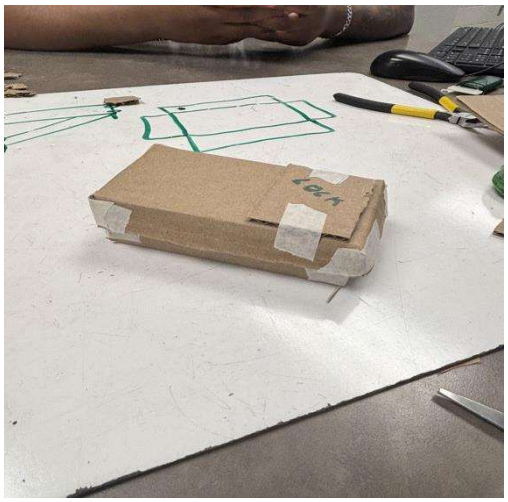
- CAD top and bottom part of lockbox
    - getting part printed
- Coding the 4 - digit key
- Connecting 4 - digit key lock to the box through circuit system
- Running tests on the 1st iteration of the prototype
    - analyze the results and feedback
- Redo code and 3-D based on the feedback and past results

Detailed Design Review

10.Prototype Fabrication and Evolution

Prototype Fabrication and Evolution

Before creating the final product, the team went through multiple iterations of the product, with many CAD designs, prints, and mockups. The beginning of this product started with a couple designs that ultimately led to the mockup.



This mockup was created when the group's plan was still to make a box that locks with magnets on all four corners. There are some parts that are still being used in terms of the mockup. For example, the group will still be utilizing a the 4-digit key onto the lock. Later, the team moved from the magnet locking system to a sliding technique lock mechanism.

Figure 12: 3D Printed Slide Lock Prototype 1

This improved prototype works with a sliding technique that has a card spot to keep it locked. When the user places the card item in the front of the lock, the user

will not be able to easily slide the prototype open. One thing this prototype lacked was that it didn't have as much room for items, and this was considered for the next major prototype.

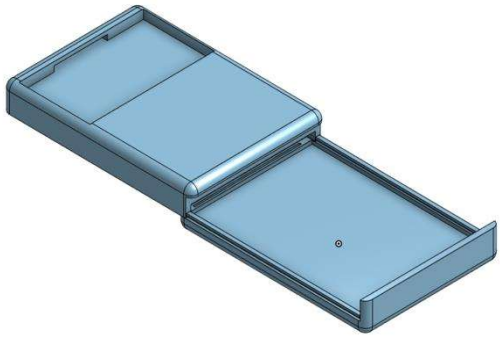


Figure 13: Most Updated Iteration of Prototype With CAD

This updated prototype has practically the same features as the earlier iteration, but it contains a room that is chunked out from the inside to fit credit cards, cash and tracking devices. The group was able to test the product through these specific verification testing requirements.

Scorecard

Requirement	Range	Score Rubric	Score
Locking Capabilities	Does it lock?	(If doesn't lock -8, sort of locks -4, locks - 0)	8
Withstanding Force	Withstands 5 lbs. of force	0.25 points off if less than 5 lbs.	3
Water resistant	Can be dropped in water and picked up with no damage	all damaged -3pts, minimal -1.5 points, none -0pts	3
Fits Dimensions	5.3 x 3.8 x 1.1 inches (1 in for varying)	off by dimensions (0.5 pt per .5 inch off)	7
Space To Fit Items	Room for a tracking device, Yes/No	Yes/No If not (-4 points)	4

Figure 15: Verification Testing

Figure 15 represents what the team used to test the prototype. Major tests included lock functionality and testing the strength of the prototype. The prototype passed the strength test and fit all the measurement requirements but did not perform well in the lock functionality test, due to lack of parts.

11.Detailed Design

a. Final Prototype Design

Final Prototype Design

The final prototype (Figure 13) the team decided to go with the sliding technique lock mechanism with the inside room for the passport and other items (including tracking items). The research findings provided that the product needed to be strong, lighter weight, portable and secure, so the group focused on these specific details.

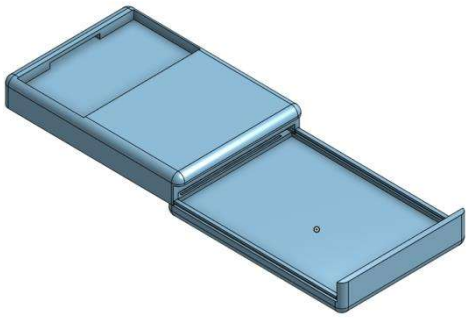


Figure 16: Full Assembly

Using the research findings, the team brainstormed and created this assembly prototype. Most of this prototype is non-standard part as it has been 3D printed, but the part that is standard is the lock, where the team used an Arduino, along with wiring, and a servo to work alongside with the chip to prevent sliding.

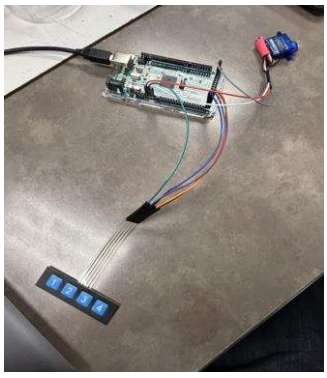


Figure 17: Standard Parts Used

One of the major future design considerations is the improvement of the locking attachment that connects the servo motor to the lock strap at the front of the lock box. In the current prototype, the latch is too small and weak to make the connector move up to unlock the box, so for the final

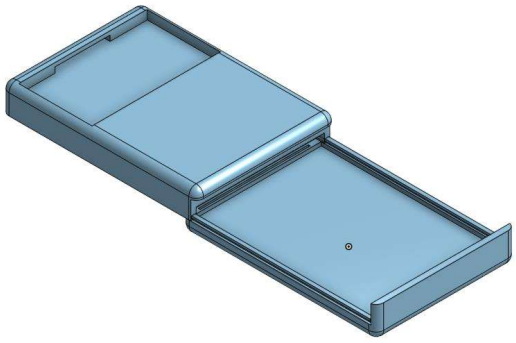
prototype, the group will make a bigger, and stronger latch so that the connector moves up when the servo moves up.

b. Grand Concept Design

The grand concept design for this product utilizes the 3D print version of the CAD design. This has a hole at the top of the CAD design to insert the hardware. The hardware includes the Arduino board, a servo motor, and a 4-digit keypad membrane. A developed code will be programmed onto the Arduino board that will control the servo motor once a pin is made. The pin once pushed into the 4-pin membrane, will initiate the servo motor to rotate and being connected to a bar that is in between the top and bottom of the design, will lift that bar up, allowing the top and the bottom to slide apart. Once the top and bottom are slid back into place, resubmitting the 4-digit pin will initiate the motor to return to the original starting place, inserting the bar in-between the top and bottom and preventing the two parts from sliding apart.

Revised Grand Concept

Through the design and development process of the prototype, the group took away a lot of details and ideas from each of the mockups. One thing that the group took away from the very first mockup was the overall body for the prototype. The first mockup still had the same rectangular prism style, and this was kept with the addition of the sliding technique from the second iteration of the prototype to make the final.



Final CAD Design

c. Final Prototype Verification

After the creation of all iterations of the prototype, the final prototype went through some final testing. The prototype parts tested include locking functionality, strength, waterproof, measurement requirements, and its ability to fit items within. The prototype passed the locking functionality by being able to unlock and lock by the press of the code. One of its major strengths was that it

could withstand the 5-pound force the group designed it to with ease, while keeping the contents dry after a water spill. The only weakness the prototype had was that the buttons were not very responsive, and this made it harder to get past the password code, even though the software written was correct.

d. User Validation

User validation is meant for the group to get actual customer feedback on the product and make changes accordingly. Once the changes are made, the goal is for customers to say they have improved the product's functionality. This goal will be reached by addressing the top user needs and customer feedback.

Top 3 User Needs

The team's priority when it comes to user satisfaction is the safety of the product. Meaning that the device has adequate locking capabilities, keeping all internal items in one secure location. At the beginning of the design process, we started with 3D modeling to get the locking mechanisms properly designed situated. And 3D printed to ensure the designs are doing the job properly.

The second priority is trackability. Though the trackers won't be built in, there needs to be ample space for a variety of personal trackers to be placed inside. This space also needs to account for the personal items that the user wishes to keep in a safe environment.

And the third of the top 3 is cost. Though the prototypes are relatively cheap to produce the final product needs to be the price range of the users without compromising its quality

Validation Methodology

For user feedback, the plan is to first demonstrate the current prototype and its features. The people in this demonstration will be called back to participate in another later. This will allow users to see exactly what stage the product is at as far as prototyping. They would be able to open/close, place items inside, test locking, and have a feel for it in their pockets.

After the demonstration there will be an open-ended survey that allows them to provide feedback on what they like, didn't like, and potential changes they would like to see.

Validation Results

The results will be based off the feedback from the survey. There will be a second demonstration with the same people to see if the changes they recommended help improve their thoughts on the product. They will be allotted the same freedoms as the first demonstration as far as physically testing the product.

... (Talk about the actual results of the survey/ methodology once tested)

e. Value and Impact

	Value Categories	
Stakeholders	**Economic**	**Social**
End Users	***Positive:*** *Overall number of missing items will decrease* ***Negative:*** *Possible overlooking of items while packing due to comfortability of the product*	***Positive:*** *They will be able to spread the helpfulness of the product* ***Negative:*** *Would have to share the password with people who need access*
Investors	***Positive:*** *Will be known for making wise investment decisions* ***Negative:*** *There will be greater competition and potential loss of profits*	***Positive:*** *They will be approached by younger investors for success on choosing investment opportunities* ***Negative:*** *There will be competition when it comes to profits to be made*
Distributors	***Positive:*** *Will be approached by more salespeople hoping to partner* ***Negative:*** *Will have to drop smaller contracts for larger opportunities*	***Positive:*** *Will be known for carrying successful products* ***Negative:*** *Will have to keep products in stock to deter customers from going somewhere else*
TSA	***Positive:*** *ID checking and security check points will move faster* ***Negative:*** *Assumptions can be made based on socioeconomic status.*	***Positive:*** *Work lives will become less stressful with passengers having all needed documentation* ***Negative:*** *Bag pick up will become more crowded due to the influx of Identification speed*

Value Matrix table: Displays stakeholders on the far left along with both the economic and social impacts might face

Economic Impact

Positive and negative impacts could potentially happen once the product is released. A positive impact could be that this product would have the potential of being self-sustaining. Using poly carbon fiber for the material, manufacturing costs for the product's development, and the electronics component would be relatively inexpensive. When comparing to other items that are like this product, selling for 100-150 dollars would be comparable and reasonable. This would allow the product to be self-sustaining. However, a negative economic impact could be that the product, once it became popular, would require an expansion of the company that will then be unable to self-sustain. With the addition of customer feedback and potential upgrades, there may need to be other products that help sustain the company and the product.

Social Impact

When the solution to is implemented, there will be some social impacts, even positive and negative ones. Positive impacts could be that individuals who use the product would see a decrease in thefts or losses of their personal items. This would help the individual people from having to spend money on unnecessary replacements. This also includes the decrease of risk towards identity theft if individual personal items are not being stolen. A negative social impact that could

happen would be an increase in racial disparities during TSA checks. Individuals who carry our product during TSA might be selected based on race to have the product checked. People could see an increase in racial discrimination from our product if there becomes a pattern of TSA agents requiring individuals to unlock and have the product searched.

12.Project Recommendations and Next Steps

As the journey of the first-generation LockBox model comes to an end, the team is very satisfied with the result. It has had its twists and turns, but the goal was never lost. User satisfaction was always the focus, but like most things in life, room for improvement was found. One of the improvements that is on the docket to be added to the next generation is improvement upon the ergonomic grip. To put this into action the friction on the surface of the product needs to be increased by either adding small ridges and/or finger grooves that allow it to sit flush in the grip of the user. The next and arguably the most important improvement needed is an integrated locking mechanism. Adding this feature will allow the LockBox to maintain its streamline design and improve the convenience factor. For this to be achieved, investments in more compact lightweight components are necessary. Another idea that has been thought of was the addition of a utility clip that allows for other transportation methods. With the addition of the utility clip there'd be more ways to comfortably carry the lock box, whether it be clipped on a belt or secured with a sling. The future for this product has no true ceiling, the only limiting factor is the team's creative capacity.

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New Citations:

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[12] Ruiter, S., & Bernasco, W. (2018, September 5). *Is travel actually risky? A study of situational causes of victimization - crime science*. BioMed Central. https://crimesciencejournal.biomedcentral.com/articles/10.1186/s40163-018-0084-6

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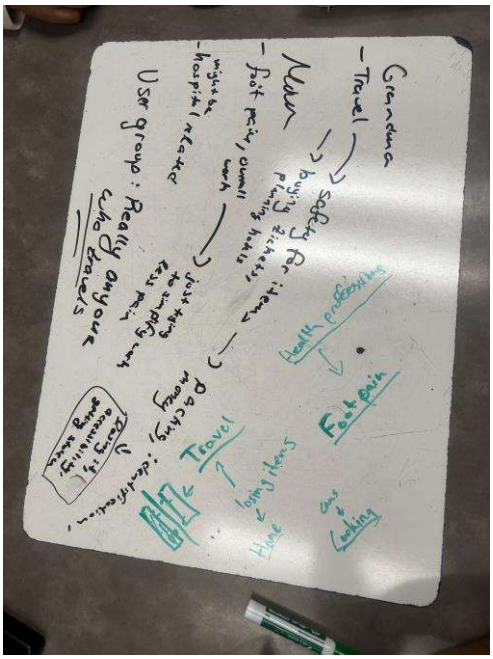
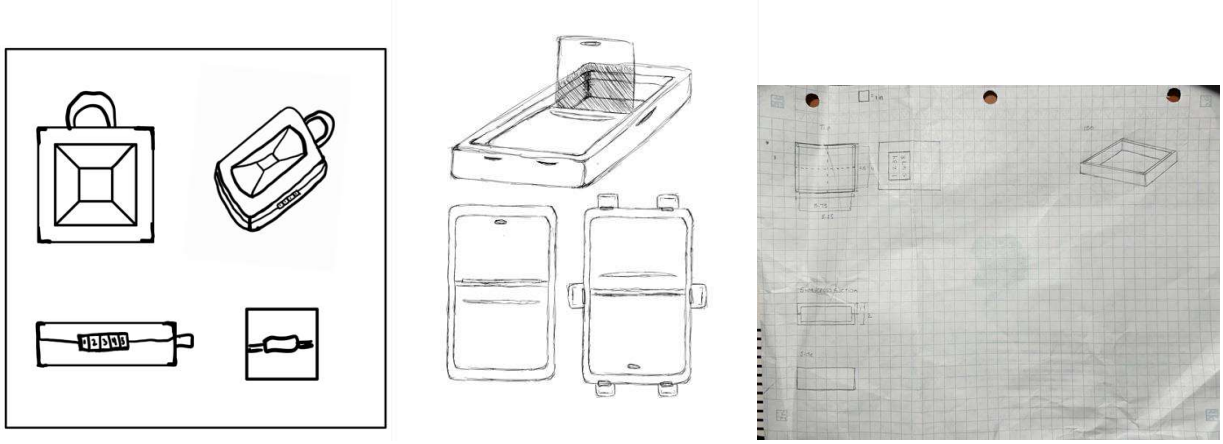
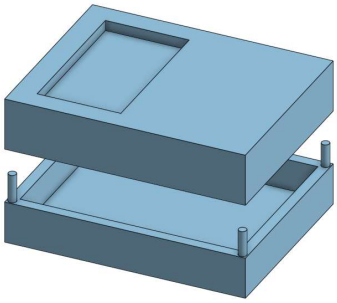
Appendix A. Evidence of Brainstorming



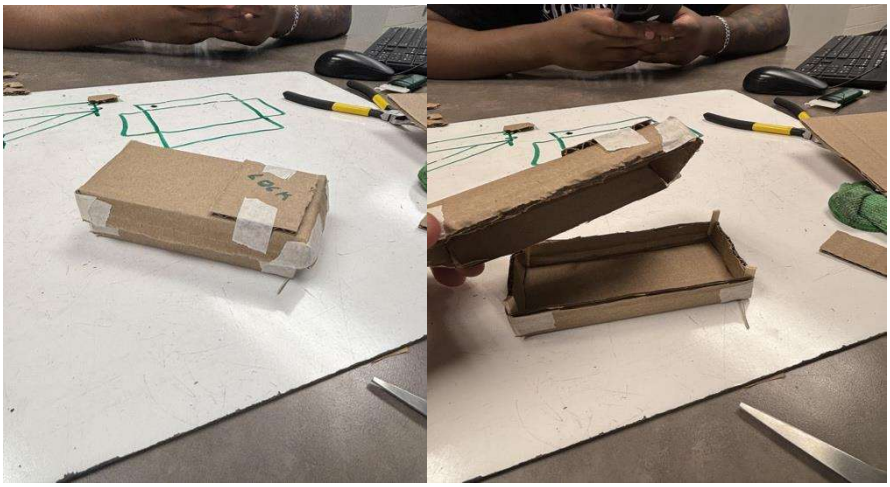
Flow chart from the team deciding how to start the project



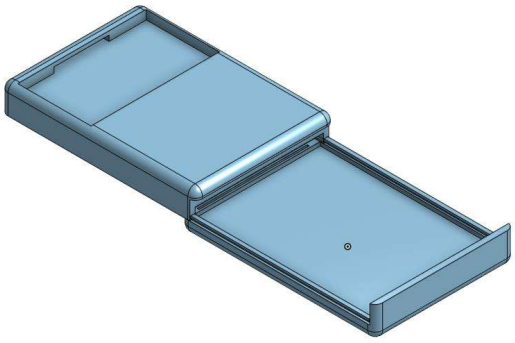
Group Concept sketches after topic was confirmed



Initial CAD draft



First physical mockup



Final CAD draft

First 3D print attempt

Appendix B. Research Methodologies

The initial research conducted to complete this project was done by scouring the internet to find out what travelers were struggling with. One of the most brought up things was the loss of personal items. The team then came up with scenarios in which things were often lost while travelling. Those scenarios being theft, misplacement, and bodies of water. To combat these common struggles, the team wanted to make sure that the product was able to make these occurrences less likely to happen.

Keeping all personal items in a place where they would always be found was the focus while developing the product, as this task has allowed for a multitude of design features and characteristics. The first obstacle conquered was keeping all items in the same general location, this was achieved by making sure that the product was able to fit the dimensions of a passport along with space to fit more personal items. With theft being a problem while travelling the added space fits the dimensions of popular tracking devices with the addition of a lock to ensure it can't be opened by anyone without the correct password. And the last problem being water damage, the product was made to keep water out.

Durability was also a crucial element to the success of the product. The durability was tested by stacking laptops on the product to ensure the Lockbox didn't fail under the desired weight capacities. This was a pass/fail test, meaning it would either withstand the weight and pass or become structurally compromised and fail. The water-resistance test was conducted by putting a US passport into the LockBox and dousing it with water. The scoring for this test was determined based off the perceived water damage, and as expected the product passed with flying colors, keeping all internal contents dry. Another test was the testing of the locking mechanism. For the product to pass the test it had to be able to fully lock and unlock, which it did. The last two tests were the product fit overall dimension standards and having the ability to fit a personal tracker, both of which were passed.

Appendix C. Prototype Working Drawing Packet

Appendix D. Software Code

```
clc
clear


% setup arduino
a = arduino('COM3','Mega2560');

% configure the pins
configurePin(a,'D53','Pullup');
configurePin(a,'D52','Pullup');
configurePin(a,'D51','Pullup');
configurePin(a,'D50','Pullup');

% configure servo
s = servo(a,'D22');


disp('When you want to unlock, put in password')

pressedNumbers = {};

% Prompt the user to press each button one at a time
while(true)
    firstNumber1 = readDigitalPin(a, 'D52'); %reads in 0 if 1 is pressed.
    secondNumber1 = readDigitalPin(a, 'D53'); % reads in 0 if 2 is pressed.
    thirdNumber1 = readDigitalPin(a, 'D50'); % reads in 0 if 3 is pressed.
    fourthNumber1 = readDigitalPin(a, 'D51'); % reads in 0 if 4 is pressed.

    % Check if any of the pins are read as 0
    if firstNumber1 == 0 || secondNumber1 == 0 || thirdNumber1 == 0 || fourthNumber1 == 0
        if firstNumber1 == 0
            pressedNumbers{end + 1} = 11;
        elseif secondNumber1 == 0
            pressedNumbers{end + 1} = 12;
        elseif thirdNumber1 == 0
            pressedNumbers{end + 1} = 13;
        elseif fourthNumber1 == 0
            pressedNumbers{end + 1} = 14;
        end
        break; % Break out of the loop if any pin reads as 0
    end
end
```

This portion of the code represents the locking process. The code waits for one of the 4 buttons to be pressed and adds a number corresponding to that button into the array. It does this for every one of the 4 buttons that's pressed. Every time one of the 4 buttons is pressed; a corresponding number will be placed into the array.

```
correctCode = {14,22,31,43}
if (isequal(pressedNumbers,correctCode) == true) % if 4,2,1,3 is pressed
    writePosition(s, 0.6)
    disp('correct code: unlocked')


    % focusing on the locking mechanism
% once the user presses one, then the locking phase will begin
 disp('When you want to lock, put in password again')

% start lock
lockpressedNumbers = {};

% Prompt the user to press each button one at a time
while(true)
    lockfirstNumber1 = readDigitalPin(a, 'D52'); %reads in 0 if 1 is pressed.
    locksecondNumber1 = readDigitalPin(a, 'D53'); % reads in 0 if 2 is pressed.
    lockthirdNumber1 = readDigitalPin(a, 'D50'); % reads in 0 if 3 is pressed.
    lockfourthNumber1 = readDigitalPin(a, 'D51'); % reads in 0 if 4 is pressed.

    % Check if any of the pins are read as 0
    if lockfirstNumber1 == 0 || locksecondNumber1 == 0 || lockthirdNumber1 == 0 || lockfourthNumber1 == 0
        if lockfirstNumber1 == 0
            lockpressedNumbers{end + 1} = 11;
        elseif locksecondNumber1 == 0
            lockpressedNumbers{end + 1} = 12;
        elseif lockthirdNumber1 == 0
            lockpressedNumbers{end + 1} = 13;
        elseif lockfourthNumber1 == 0
            lockpressedNumbers{end + 1} = 14;
        end
        break; % Break out of the loop if any pin reads as 0
    end
end
```

After all the 4 buttons are pressed and 4 numbers are in an array, the array is compared to another array with the correct code, and if it is correct, the code will work to make the servo move enough to unlock the lock. Finally, after this process, the user will have to put the same code in, and the exact same process will occur to lock the box again.

Appendix E. Additional Raw Data

The data in this project was purely qualitative, as all the tests conducted were looking for qualitative answers.

Appendix F. Project Management Schedule and Meeting Minutes

Identifying Major Deliverables

A major goal for the team in terms of deliverables is having a project that will show a locking mechanism. Some other deliverables the team wants the final product to include are signs of strength (more focused on design so a final will not be as strong as a design made of metal, the team is currently using 3D printing for the prototype), and an ability to protect the items inside the lockbox. If the overall product can perform through these requirements, the team would consider the product a success.

Creating A Schedule

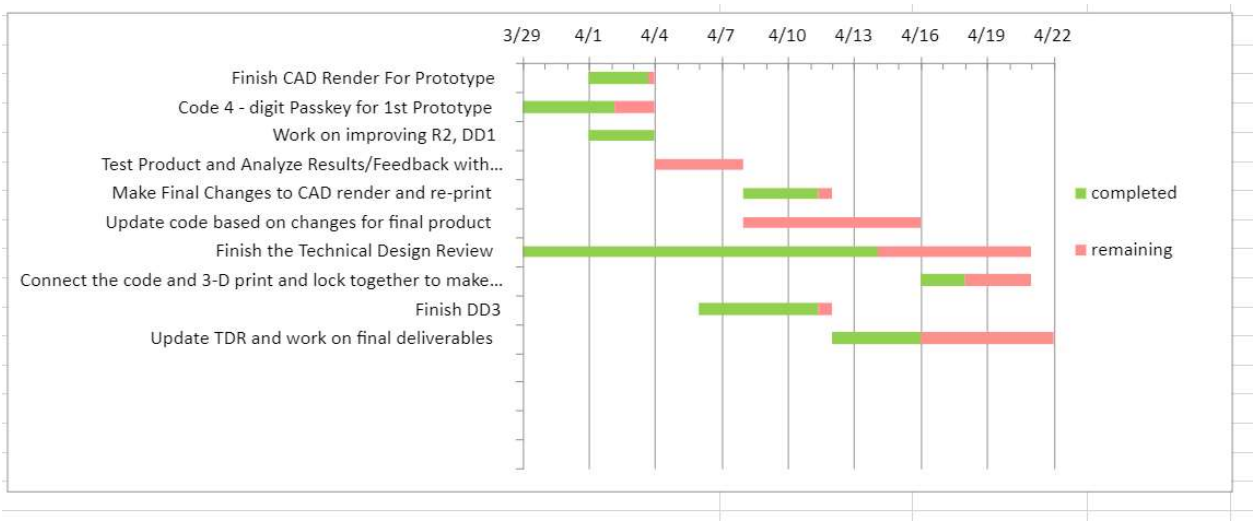


Figure 14: Gantt Chart (Schedule)

In the team's current schedule, there are a couple major deadlines. Two of the major deadlines coming up soon include finishing the CAD render and coding the 4-digit key for the prototype. These are important because the team needs to run tests to make sure that there is some functionality within the first iteration of the prototype. From there, the team will use this feedback to better the product for the final stage. As a group, responsibilities will be given to the members with strengths in that specific field, for example, the member who is most confident in their CAD skills will work on the design of the lock, and the member who will code the 4-digit key will be the one who is most confident in their ability to use MATLAB.

13.Project Schedule

14.Prototyping Workday 1 Meeting Minutes

Meeting Minutes:
Header — 4/1/2024 12:40-1:35 Hitchcock 308

Objective statement — The purpose of this meeting it to establish a solid timeline for the completion of our product. As well as working towards the prototyping design of our product.

Completed tasks :

- Worked on Onshape design –Tobi

  Onshape completed

- Started coding in Matlab for product – Emanuel

  Coding started, began to develop the code to initiate the 4-digit pin with the motors, pseudocode skeleton using comments is completed.

- Grab materials ordered from the FE shop

- Begin to look at R2, P2, and DD1

  Establish who will work on each assignment and with what

  Started an outline for DD2 – Emanuel

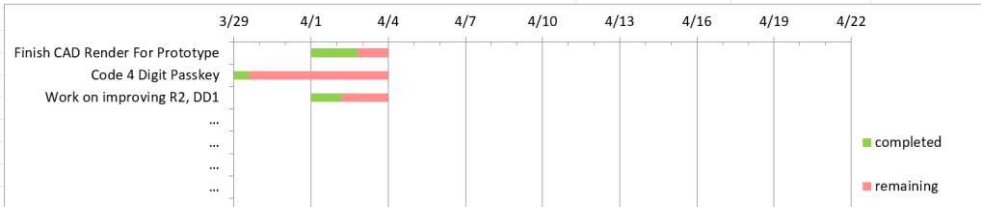
Current Status: The team got some needed work in with the writing portions of the project and came to a final consensus on the locking mechanism of the prototype.

Tasks to be completed:

- Make progress on coding with MATLAB (still need the standard parts from the shop to effectively do this. - (Emanuel)
- Print out 3D part and connect with key lock, and motor - (Whole Group)

- Make final changes to R2 - (Whole Group)

Project timeline:



Here are some major upcoming deadlines from the GANTT chart. Some of these major milestones include…

- CAD- ing the new part
- Coding the lock into the prototype
- Finish written portions

Decisions:

- **The group decided to change the locking mechanism to use sliding instead of the magnet locking mechanism.**

15.Prototyping Workday 2 Meeting Minutes

<u>Meeting Minutes:</u>
Header — 4/12/2024 12:40-1:35 Hitchcock 308

Objective statement — The purpose of this meeting was to really test the code in relation to the lock and make changes to the CAD design while also making additions to DD3.

Completed tasks:

- Debugged code - All team
- Made progress in completion of DD3 – Markell
- Updated CAD - Tobi

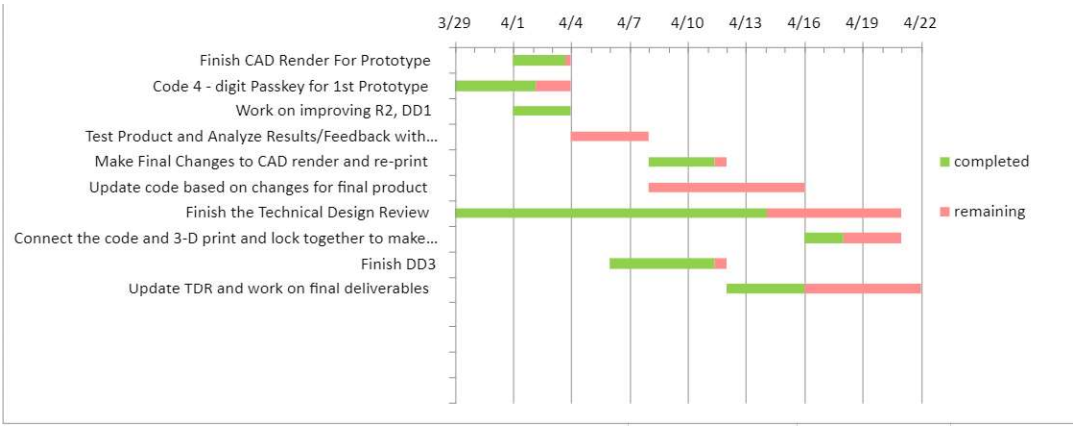
Current Status: After getting feedback from our tests, we are making changes to our prototype verification, in the waterproof area. The team is continuing to add to the DD3 assignment and make more adjustments to our prototype as needed. Data we still need to

collect includes user data for validation.

Tasks to be completed:

- Finish DD3 – All members
- Connect 4- digit key to the lockbox - Tobi
- Make more updates to CAD and print - Tobi
- Work on getting User Validation - All members

Project timeline:



Decisions:

The group decided to continue working on DD3 and start focusing on the different final deliverables.

16. Prototyping Workday 3 Meeting Minutes

<u>Meeting Minutes:</u>

Header — 4/15/2024 12:40-1:35 Hitchcock 308

Objective statement — The purpose of this meeting was to test the 3-D printed lever to see if it will fit the servo motor and continue making updates to the Technical Design Review.

Completed tasks:

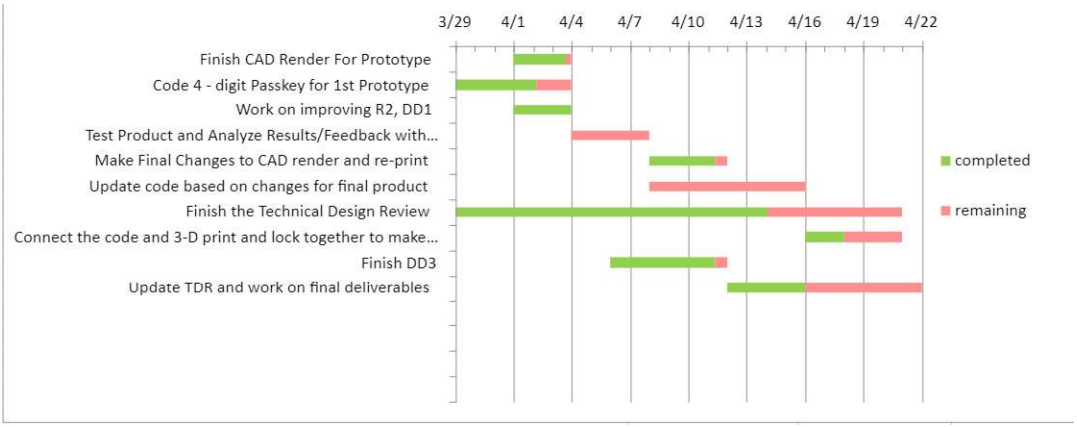
- Analyzed code along with servo connector lever – All members
- Continued updating TDR – All members

Current Status: Currently we are making final touches to the prototype and making the final additions and polishes to the TDR.

Tasks to be completed:

- Finish TDR
- Set up slides for presentations
- Working drawing packets

Project timeline:



Decisions:

The group decided to continue working on the TDR and do separate work among the different final deliverable assignments.

17. Prototyping Workday 4 Meeting Minutes

Meeting Minutes:

Header – 4/18/2024 14:40-2:05 Hitchcock Hall 308

Objective Statement - This meeting's purpose is to finalize the design and prepare the prototype for final verification testing.

Completed Tasks:

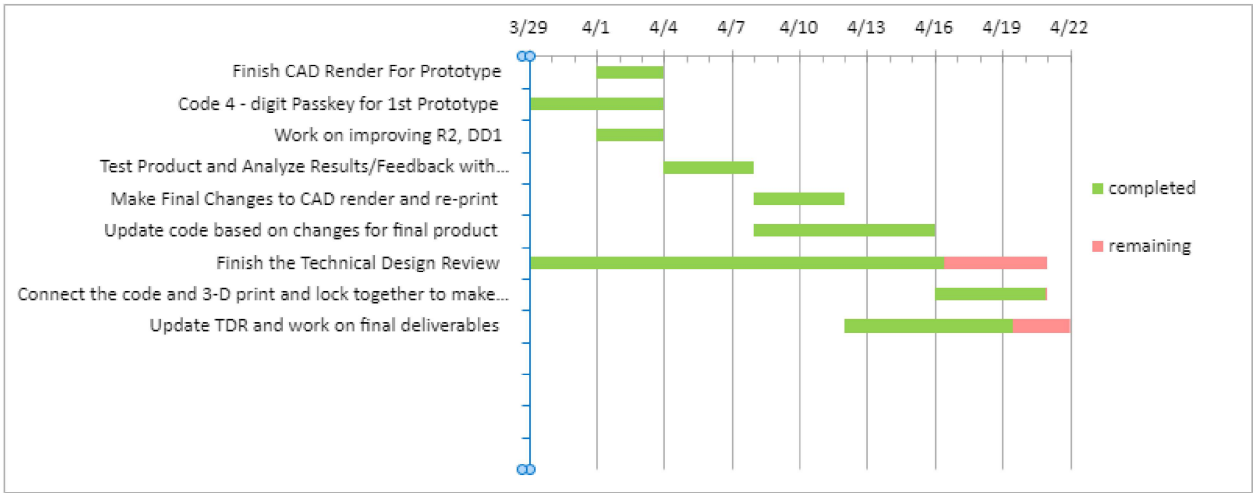
- Reviewed the code and locking mechanism – Tobi and Emanuel
- Revised the propeller on onshape – Tobi
- Began looking into upcoming assignments – Markell
- Started drawing packet – Tobi
- Went over testing verification – Tobi, Markell, Emanuel

Current Status: The team is prepared to test the final prototype and is working towards finishing the writing portions of the project.

Tasks to be completed:

- At home water resistance testing before Friday
- Put prototype together before testing
-

Project Timeline:



Some important upcoming deadlines from the GANNT chart are going to be completing the TDR and working on wrapping the whole project up.

Decisions:
The team is following through with final design and bringing that together as our completed prototype.

Appendix G. Team Working Agreement

Team Working Agreement

Term: Spring 2024
Revised Date: April 23, 2024

1. Team Information

Course Section # **8132**
Team Designation **Q**
Instructor and GTA **Chante Vines, Simon Pusateri**
Team Name (Optional)

Contact Information:

Name	Email Address	Phone Number
Tobi Petty	Petty.179@osu.edu	(740)973-0287
Emanuel Messele	Messele.2@osu.edu	937-986-7209
Markell Green	Green.2641@osu.edu	678-665-4246

2. Team Values & Goal

Our team's top five values are....

1) Family/Friends
2) Honesty/Integrity
3) Respect
4) Collaboration
5) Communication

Our team has set the expectation to have the best of our ability quality of work. This means, during an assignment we will attempt to have the best level of work unless for some reason we are unable to for that assignment, but we are going to communicate that with the group.

One goal regarding psychological safety is that we want each member to feel okay enough to do an assignment.

3. Communication and Meetings

Our group has the preferred method of the text group chat we have made as a means of communication. As well as the Microsoft teams we have made to go through assignments.

We agree to meet once a week, however this is expected to change if there is an assignment due that week or the following weeks, we have agreed to assess the need for meeting a second time before an assignment is due.

We have agreed to meet on zoom or in person. If we are meeting in person, we will meet either at Thompson Library or in Hitchcock Hall.

Tobi petty is going to be in charge of meeting minutes. The meeting minutes will be stored in the collaborative teams in the 'Meeting Minutes' doc.

4. General Expectations and Group Norms

As a group, we agree to treat each other and other classmates with respect during class/lab periods. Some group norms include...

- giving each team member respect when communicating
    - give them time to get their point across
    - respect their opinions whether we agree or disagree
- respecting each other's values

Team member expectations for attendance are that team members should come to class if they have no outside priorities that outweigh the class (being sick, taking care of family, etc...). If a team member cannot make it to class, the member should try to communicate with the team through the group chat.

Team members will work on any assignment the team needs done for the next class between classes. This could be lab prep/class prep, and even work for the project. To stay on track, team members will communicate with each other in class to keep each other accountable and see whether further work is necessary outside of class.

Document sharing will be held through Microsoft Teams and team members should work to complete their portion 1-2 days before the due date for review. If there is any sign of struggling from a team member, they should try to communicate their struggles with the group as soon as possible.

5. Individual Team Member Responsibilities

Determining who is assigned to what task will differ depending on the assignment. We have all agreed that we will discuss the roles that need to be assigned before working on each assignment and go over who is the most comfortable with what part. This will allow us to debrief the previous assignments and make new assignments and talk about what each member was most comfortable working on versus what they were least comfortable working on.

Some roles, such as uploading pages into teams, or setting up meetings can be grouped into one person. For this, the administration member is going to be Tobi. This will change about halfway through the semester and another group member will take charge of the administration work.

Roles will rotate, and each group member will have an opportunity to do a different role at least once throughout the semester. Figuring out which role is discussed within the group before the start of each assignment, so each member knows what is expected of them.

6. Conflict Resolution

After speaking collectively as a group, we have all agreed that any conflicts that may arise from any team member can be discussed in an open conversation. These discussions may be expressed when one team member has not been holding up to the agreed terms of this group. Such as not reaching out when missing class, missing group meetings (which are discussed in the text group chat), and not helping on any assignments. This could also include disrespectful behavior towards other group members.

Discussions about disagreements can be held, and after hearing each team member's response from these discussions, a vote can be held to determine how to proceed from there. If a team member is not actively participating with the group, this group will collectively talk to that member. If this persists, the member not participating and helping to complete an assignment will not be included in the assignment. Any work that was left by the member that has not been participating will be split up and distributed to the other group members. After this, there will be a discussion with the GTA or TA about the group member that has not participated.

Any behaviors that are threatening to the group will not be tolerated. This will be immediately met with a discussion to help change this behavior. If the behavior persists, the GTA or TA will be notified.

Any unmentioned behaviors or expectations that come up will be discussed with the group accordingly. The goals, expectations, or responsibilities can change throughout the semester as we, as a group, deem necessary.

Open and honest communication is one of the main goals and values of this group, and that will be the main way we follow up on conflict resolution.

7. Expectations of Faculty and GTAs

If a team member fails to live up to this agreement, the situation may be reported to the staff, but the team will still be responsible for submitting a completed assignment. Staff will be available to meet with teams to resolve issues.

8. Team Signatures

Name: Tobi Petty

Name: Emanuel Messele

Name: Markell Green