

GNG2101
Design Project Progress Update

COZY CAPYBARAS: B1.4

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May 13th, 2024

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List of Acronyms and Glossary

Table 1. Acronyms

Acronym	Definition

Table 2. Glossary

Term	Acronym	Definition

1 Introduction

2 Business Model Canvas and DFX

2.1 Business model and sustainability report

1. Identify and describe your value proposition that would be well suited to commercializing your team's product. Discuss the reasons for your choice.

Our value proposition should be able to provide the customer with information in terms of their benefits in buying our product. It should be a convincing and unique statement as to why our product is the most suitable option for them. In designing a phone bed mount, we have developed and placed more emphasis on certain key features that can demonstrate the product's maximum potential and are essentially our highlighted value propositions.

These propositions that we plan to focus on include designing for qualities such as reliability, comfort and usability. We want to ensure that the product is user-friendly and will have a positive impact on the client's quality of life. It should also be adjustable to a wide range of clients and simple to use to its intended function. We believe that these propositions will be well-suited to commercializing the product as they are important qualities that are crucial for the product's function and are easier to commercialized as clients understand the need for the product to include these design functions.

Our value propositions were made with respect to our target client. The client is an individual that experiences daily mobility challenges, so the commercialized product will focus more on how the device can help the client with phone access in bed. When commercializing, we will make the wording more general and inclusive so that the product feels inclusive to everyone, and not simply those with mobility challenges. By doing so, we enable the targeted client to know that they are not alone in using this product. In our commercialized proposition, we will include the fact that we have done thorough research on the devices' requirements and built upon the advice given by the targeted client. Finally, we intend to include catch phrases to attract the targeted clients to use our product.

Here is an example of how the product could potentially be commercialized to reach our target audience and match our value propositions.

Looking to stay connected and independent from the comfort of your own bed? Introducing Cozy Capybaras, your ultimate companion for accessible device interaction in bed!

Say goodbye to frustrating setups and unreliability! With Cozy Capybaras, you can seamlessly navigate your phone without having to compromise on comfort. Designed with your needs in mind, Cozy Capybaras attaches securely to your bed railing, curving gracefully around your body to provide easy access to your devices. Now, you can effortlessly stay connected, whether you're lounging, relaxing, or winding down for the night.

We understand the importance of flexibility and ease of use, which is why Cozy Capybaras features an intuitive design that allows caregivers to quickly install and remove the holder as needed. Adjustable features will also ensure personalized positioning for maximum comfort and usability.

Don't let mobility challenges hold you back any longer! Join us to reclaim your independence and staying connected effortlessly with Cozy Capybaras. Experience the freedom to live life on your own terms, starting from the comfort of your bed.

2. Fill in a triple bottom line business model canvas by answering the how, what, who and how much of your chosen business model.

Business model canvas.			Cozy Capybaras B1.4	
KEY PARTNERS <ul style="list-style-type: none">• uOttawa Makerspace• CEED• Hospitals• Long-term care facilities• Material suppliers• Government (for grants)	KEY ACTIVITIES <ul style="list-style-type: none">• Product Development• Advertisement	VALUE PROPOSITIONS <p>Problems/needs to be addressed:</p> <ol style="list-style-type: none">1. Help client with no arm mobility to use their phone at anytime2. Eases tasks of caretakers by saving them time and energy3. Smartphone manufacturers are more inclusive and reach a wider customer base <ul style="list-style-type: none">• Cost-effective• High level of adjustability• High level of stability• High level of adaptability	CUSTOMER RELATIONSHIPS <ul style="list-style-type: none">• Client meetings at their house (one-on-one) → direct	CUSTOMER SEGMENTS <p>Value is created for the community of people that do not have the physical ability to use their phone in bed and those that struggle with daily tasks in general</p> <ul style="list-style-type: none">• Clients with limited arm mobility and their families• Hospital staff• Caretakers
	KEY RESOURCES <ul style="list-style-type: none">• CAD software• uOttawa Makerspace for 3D printing, laser cutting, tool access etc.• Materials required (PVC)		CHANNELS <ul style="list-style-type: none">• Personal orders• Delivery services online	
COST STRUCTURE <p>Variable and fixed: production, administrative and labour costs</p>			REVENUE STREAMS <p>Installation fee, delivery fee, product revenue, potential grants and investors</p>	
ENVIRONMENTAL COSTS <ul style="list-style-type: none">• Manufacturing energy• Transportation energy• Material waste/disposal	SOCIETAL COSTS <ul style="list-style-type: none">• Reduces assistance needed → less jobs in healthcare		SOCIETAL BENEFITS <ul style="list-style-type: none">• Accessibility to disabled community• Increases quality of life• Increases mental health	ENVIRONMENTAL BENEFITS <ul style="list-style-type: none">• Low carbon footprint since no electric components involved• Recyclable packaging

3. Describe the core assumptions that you have made in developing your business model canvas and comment on its feasibility. Important: These core assumptions should be based on the business model you have chosen and not your prototype (e.g. what type of clients do you assume your product will attract?).

The first core assumption is that the client will have trouble leaving their homes and are comfortable speaking. We can make this assumption since in our business model canvas under the “customer relationships” section we imply that members of our team will go to the client’s house and perform one-on-one interviews with the client. This will benefit clients that have good communication skills and would have trouble leaving their house.

The second core assumption is that the client, despite having little to no mobility in their arms stated in the “customer segment: section, will have access to the internet from an electronic device to place an online order of the product. In the “channels” section, we state that the customers have the possibility of placing online orders, but this is only an option if they can be connected virtually in the first place.

The third core assumption made is that none of the materials for the design have a carbon footprint (i.e. no use in electricity), as stated in the “environment benefits” section. However, this is only true under the assumption that the materials for the design will also have a zero-carbon footprint.

In terms of the feasibility of the product, most of the time, people with disabilities have a caretaker with them who can help them in purchasing the product online. If the client struggles with communicating their needs, the caretaker will be able to explain the client’s situation to the person conducting the interview, as they will be aware of the client’s needs as well. For the environmental impact, it is unlikely that the materials used in the design will have a zero-carbon footprint as those types of materials are rare and expensive. However, the carbon footprint will still be lower than a product that uses electricity. Therefore, it can indeed be said that the business model canvas is feasible.

4. Provide a sustainability report that reflects on at least two of your product’s major social, environmental, and economic impacts, both positive and negative. Perform a simple analysis of these impacts and use this analysis to help you fill in the triple bottom line of your business model canvas.

As a team, our goal is to find a balance regarding our product’s major social, environmental, and economic impacts. We understand that there will be both positive and negative impacts towards our product, but we plan to limit the negative impacts and increase the positive impacts as much as possible.

The positive impacts of our product include the following:

- Socially, the phone bed mount provides enhanced accessibility for individuals with disabilities. It enables them to use their phones comfortably while lying in bed which allows for their independence and quality of life.
- Environmentally, since the product is not an electrically driven device but rather purely mechanical, its life span will not consume any energy. If this product did not exist in the market, it may be replaced with a more complex medical device that may require energy consumption and will negatively impact the environment. We want to engineer a product with a long-life span; to achieve this, our product will aim to minimize energy consumption
- Economically, because the product is purely mechanical and will be built using cheaper material such as PVC pipes, it facilitates the production and leads to the product being cheaper to manufacture.

The negative impacts of our product include the following:

- Socially, using the product may reduce physical activity. The increased ease of phone use in bed might lead to longer periods of inactivity, which could potentially contribute to a worse lifestyle and increased health risks.
- Environmentally, the transportation energy associated with the product could negatively impact the environment. When trucks make deliveries for the product, the additional pollution resulting from travels has a negative impact on the environment's footprint
- Economically, producing more phone bed mounts could lead to the reduction of the need for in-bed care (caretakers). This could lead to fewer jobs, lowering the total economic spending.

We value sustainability in our final product and will work towards the development of positive social, economic and environmental impacts throughout the design process.

2.2 Design for X

1. Based on your research and what you have heard from your client, list the 5 most important factors in your design. Justify the choice of each of those factors.

The first client meeting was very beneficial, as it enabled us to learn more about the client's personal needs and how we can design a product to assist them and meet these needs. During the client meeting, notes were taken and revised to establish our 5 most important design factors.

Design for Installability

The product should have an easy set-up procedure for the caretaker as this is a device that the client will be using frequently in a day. Ideally, it should be ready to function to its intended purpose as soon as it is delivered to the client. If installing the phone bed mount takes too long, it could serve as an inconvenience to both the client and the caretaker, leading to less time spent tending to the client's needs.

To design for instability, we plan to use Velcro as a strap that holds the phone in place with the mount. This method was recommended by the client as well, as it is a strong material and will be less likely to fall off the mount and potentially injure the client. For the mounting mechanism, the caretaker should be able to install the phone mount to the bed with limited fasteners (example: clamp) for simplicity.

Design for Safety

Safety is one of our most important design factors, as safety is always the priority. If a potential design concept has even a slight risk towards the client's safety, we will

avoid it immediately. We want to ensure that the client can safely use our product, especially since our client has limited mobility and control in her left arm.

To ensure that the client is safe when using the product, we will take precautions such as avoid rough surfaces and sharp corners. If these types of components are unavoidable, we will include guards and coverings to protect the clients.

Design for Reliability

One of the main issues that our client was concerned about regarding their previous bed mount was that it was unreliable in times of needs. Sometimes, due to its lack in strength and looseness, it would collapse. The client explicitly mentioned that they wanted to avoid a situation in which the phone would fall on them again, which is what happened with a previous product that they use. Our product needs to be strong, especially since it is movable from one side of the bed to the other.

To resolve these issues, we plan to use resistant and durable material, as a product of frequent use can be subjected to constant strain until it fails. We will ensure that the material selected will not deform and can withstand frequent installation and removal.

Design for Adjustability

The phone bed mount should be adjustable to any movements that the client does. The client stated in the client meeting that it should be able to move at any angle depending on their position in bed.

To ensure adjustability, we will use material that requires less force to be moved in place by the client. Furthermore, we will ensure that the friction between various parts of the phone bed mount is limited to make it easier for the client to use the device.

Design for Usability

When designing this product, we need to be considerate of our client and which actions they can do in order to improve upon the usability of the product. The client proposed ensuring that the mount was easy to install and that the phone could be attached with Velcro, as mentioned above. Overall, there should be no prior knowledge required in order to properly use the device.

3 Problem Definition, Concept Development, and Project Plan

3.1 Problem definition

To establish an accurate problem statement, we need to have a proper understanding of the client's needs. Therefore, we gathered raw data from our client and interpreted the data in terms of client needs. Then, we organized these needs in terms of priority to establish relative importance.

For this project, there is a key difference between the users and the customers of the product. The user is our client, Charlotte, but the customer is the person purchasing the product. The customer could be the client's family, a caretaker or even a hospital, if the product is purchased in bulk.

Table 1: Translation of Client Statements to Interpreted Client Needs and Prioritization

Client Statements	Interpreted Client Needs	Priority
"Previous designs were not strong enough to be clamped onto the bed rail"	The phone bed mount has some degree of strength to be supported by the bed rail and attached securely.	3
"Previous designs kept falling on top of me"	The phone bed mount has some degree of stability and is relatively safe.	3
"The mount should be flexible to my position"	The phone bed mound has some degree of adjustability with respect to the user's position and reaches from one side of the bed to another by attaching to the railing on the right side of the bed.	3

“I would prefer the use of Velcro to hold the phone”	The strap holding the phone on the mount in place should be designed using Velcro to hold the phone securely.	2
“I like red”	The phone bed mount is aesthetically pleasing and red.	1
“I am only comfortable with using my nose to navigate my phone”	The phone bed mount should be able to reach a distance proximal to the user’s nose.	3
“My caretaker will set up the phone bed mount”	The phone bed mount should be easy to install and uninstall in a time-efficient manner.	2
“It would be nice to have a tightening feature to hold the phone in place”	The phone bed mount should include a tightening feature such as a knob to ensure that the mount stays in place.	2
“I want to be able to use it easily and push it aside when I’m not using it”	The phone bed mount is lightweight and made of material that is swingable with a low applied force which eases the ability to use the device.	2

These client needs are based on the information gathered during the first client meeting and on the Maker Repo website. Once client needs are established, they can be prioritized in order of

importance. A ranking scale of 1-3 was chosen, with 1 being “least important” and 3 being “most important”. Different colors were used to make the rankings easier to visualize and comprehend.

If asked, the interpreted user needs could be further classified as design criteria which can be divided into function requirements, non-functional requirements and constraints. However, in this deliverable, we only need the interpreted user needs to form our problem statement.

It would be useful to have more information regarding the sturdiness of the bed rail and more precise measurements of the bed rail so that the phone bed mount can be designed to be compatible with the rail. This information can be collected during the second client meeting.

Problem Statement

Our client needs a phone bed mount that is attachable to the right side of their bed railing and reaches to the left side. The phone bed mount should be adjustable, lightweight, structurally stable and easy to install and uninstall by the caretaker. It should be held in place with a Velcro attachment and straightforward and safe for the client to use.

Metrics

Table 2: Target Metrics

Need	Metric
Phone Mount Arm Length	<90 cm
Phone Mount Arm Height	20cm-40cm
Phone Mount Arm Width	<10cm
Length	~10cm
Weight	<5kg
Amount of weight of resistance force	200g-500g
Weight of “push-away” force	<1.5kg
Degree of tilting movement	± 5degree
Number of Axes of Freedom	3
Time to Install/Remove	5s

Benchmarking

Table 3: Benchmarking Products

Product	Link	Advantages	Disadvantages
Phone Holder Bed Gooseneck Mount (Lamicall)	Phone Holder Bed Gooseneck Mount - Lamicall Cell Phone Stand Clamp Clip for Desk, Flexible Lazy Long Arm Headboard Bedside for iPhone 12 13 14 15 Pro Max Mini Plus, S22 S23 S24 Ultra, 4-7" Smartphones : Amazon.ca: Electronics	<ul style="list-style-type: none"> • Arm is flexible and easy to adjust by the user • Holds phone tight • 85 cm arm • Wraps around the client's body • Durability 	<ul style="list-style-type: none"> • Might be too easy to move away • Clamps are not that stable
Phone Holder from Car Cupholder (JSAUX)	JSAUX Car Cup Holder Phone Mount, Metal Long-Arm Ultra Stable Phone Holder for Car Cupholders - Adjustable for iPhones, Samsung Galaxy, Google Pixel : Amazon.ca: Electronics	<ul style="list-style-type: none"> • Arm is strong and adjustable • Stable • Phone holder is strong • Wraps around the client's body • Durability 	<ul style="list-style-type: none"> • Clamps are for car cup holders, so modification needed • May not be easy to move away by the client
Phone Holder Bed Mount (WANBY)	WANBY Phone Holder Bed Gooseneck Mount Mobile Phone Holder Table Stand Flexible 360° Rotation Cell Phone Clip Holder Lazy Bracket Mount for All Smart Phone Microphone : Amazon.ca: Electronics	<ul style="list-style-type: none"> • Arm is flexible and easy to adjust by the user • Holds phone tight • 80 cm arm • Adjustable clamps • Gooseneck arm is relatively thick 	<ul style="list-style-type: none"> • Might be too easy to move away • Clamps are not that stable

		<ul style="list-style-type: none"> • Wraps around the client's body • Durability 	
Phone Bed Holder (Temu)	Phone Stand Holder Tablet Gooseneck Cell Phone Bed Holder - Temu Canada	<ul style="list-style-type: none"> • Arm is strong • Stable • Can rotate and tilt • Adjustable • Wraps around the client's body 	<ul style="list-style-type: none"> • Over 5 kg • Strong push away force • Does not meet the length requirement • Will not attach onto a bed railing
Previous Year Phone Bed Mount (Maker Repo)	GNG2101 Phone Bed Mount MakerRepo (makerepo.com)	<ul style="list-style-type: none"> • Wraps around the client's body • Holds the phone strong 	<ul style="list-style-type: none"> • Unstable clamp • Not stable enough for client to use • Moves during client use

Target Specifications

Target specifications were developed based on benchmarking other products and client needs. For each benchmarked product, the specific features were analyzed to determine which to keep and which to avoid, as illustrated in Table 4.

Table 4: Determination of Target Specifications through Benchmarking

Features to Keep (Target Specs)	Features to Avoid
<ul style="list-style-type: none"> • Tight phone holder • Strong and long arm that wraps around the client's body 	<ul style="list-style-type: none"> • Single thin gooseneck that is too easy to move • Too rigid that the client cannot adjust the arm • Short durability

<ul style="list-style-type: none"> • Flexible arm • Adjustable mount 	<ul style="list-style-type: none"> • Weak arm • Weak clamps • Instability
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Final Target Specifications

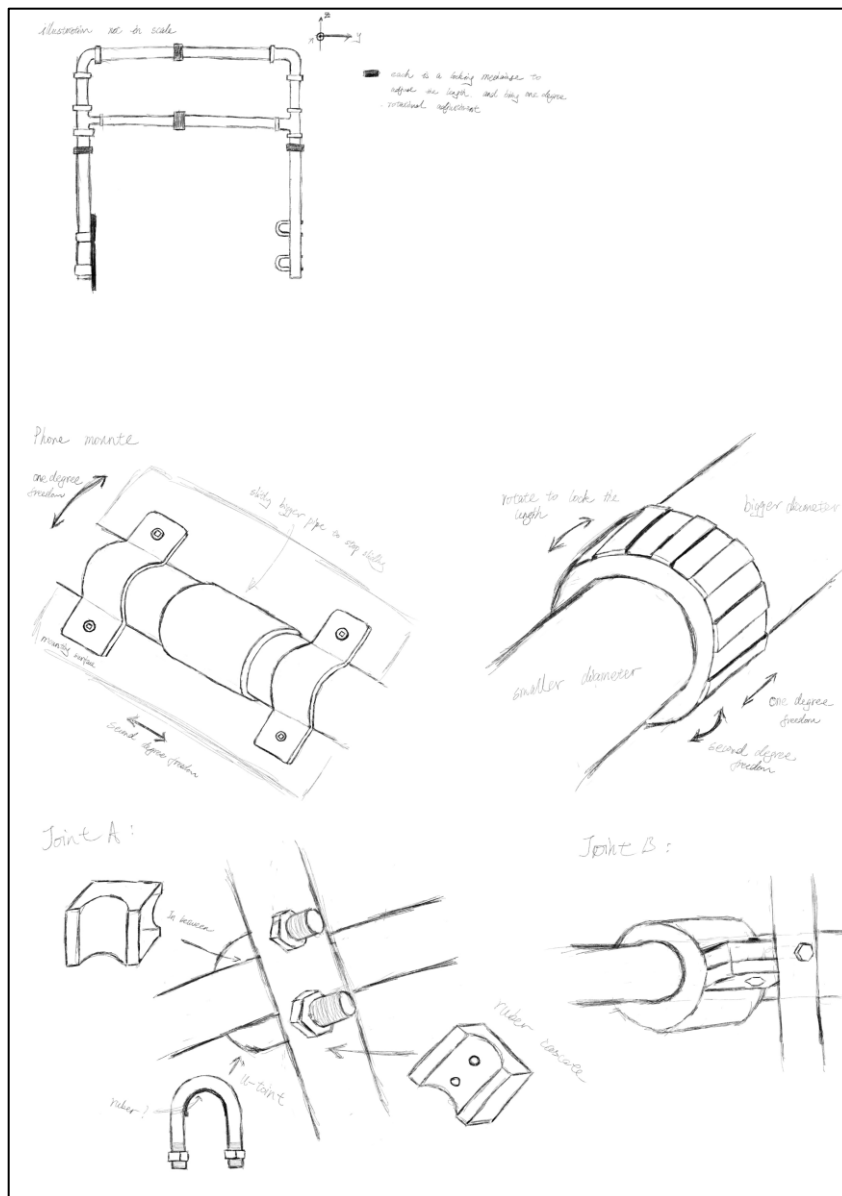
Based on benchmarking and client needs, we believe that a successful phone bed mount should include the following attributes. We were able to determine our final target specification which will ensure that our product meets both our client's expectations and the expectations of our team. These target specifications will be used as selection criteria later in our decision matrix to determine which concept to choose as our final global concept.

- Flexible arm
- Strong and long arm
- Adjustable mount
- Tight phone holder using Velcro
- Secure attachment to right-side bed rail
- Easy to install/uninstall
- Easy to swing
- Mount-tightening feature
- Lightweight

3.2 Concept development

Based on the problem statement, final prototype concepts were developed for each sub-system, as well as the entire assembled system.

Concept #1: Jonas

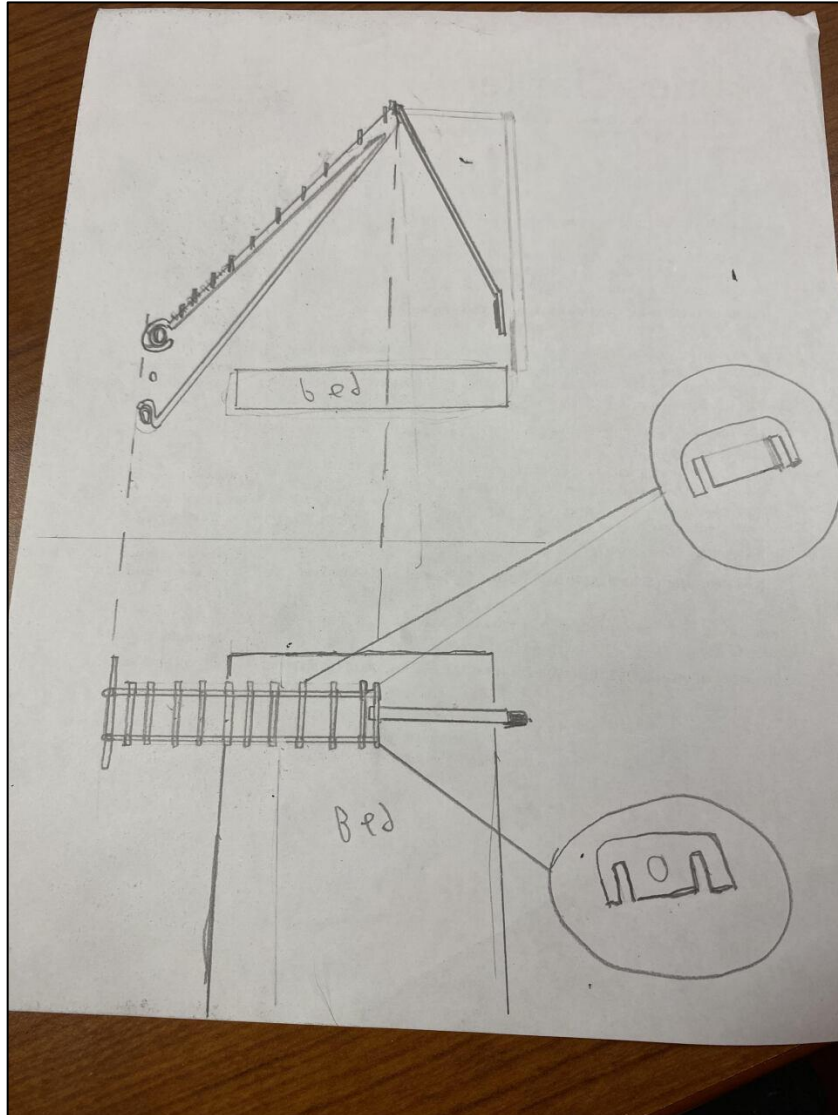


The design mainly uses two PVC pipe diameters to create a simple structure for holding the phone in bed. The T-joint and 90-degree joint are commercial parts that can be purchased from Hardware stores. Two horizontal pipelines on the top side are for strength, so when clients use the structure in bed, the phone will not be pushed away. A U-bolt will be used to secure the structure on the bed rail. Phone holding structure is also constructed using pipe holding on the market with a slightly wider portion to ensure the holder will not detach from the pipe. And give the holder some rotation freedom so the client can adjust.

The pros are that all parts of the structure are made from commercially available parts. The design is simple and easy to make, PVC is strong, and the structure can hold in place effortlessly. The con

is that the structure cannot be raised up simply; it can only rotate at the U-bolt section, so the client can only move the structure circularly away from her.

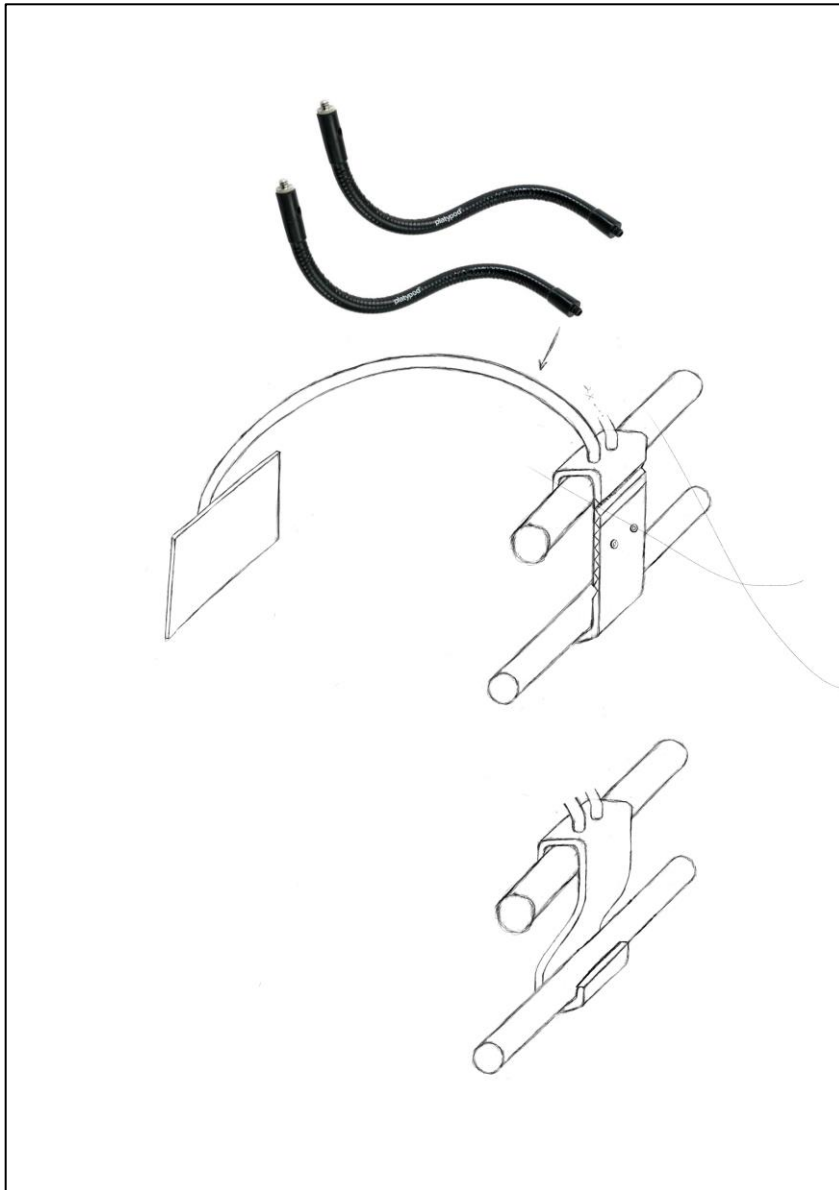
Concept #2: James

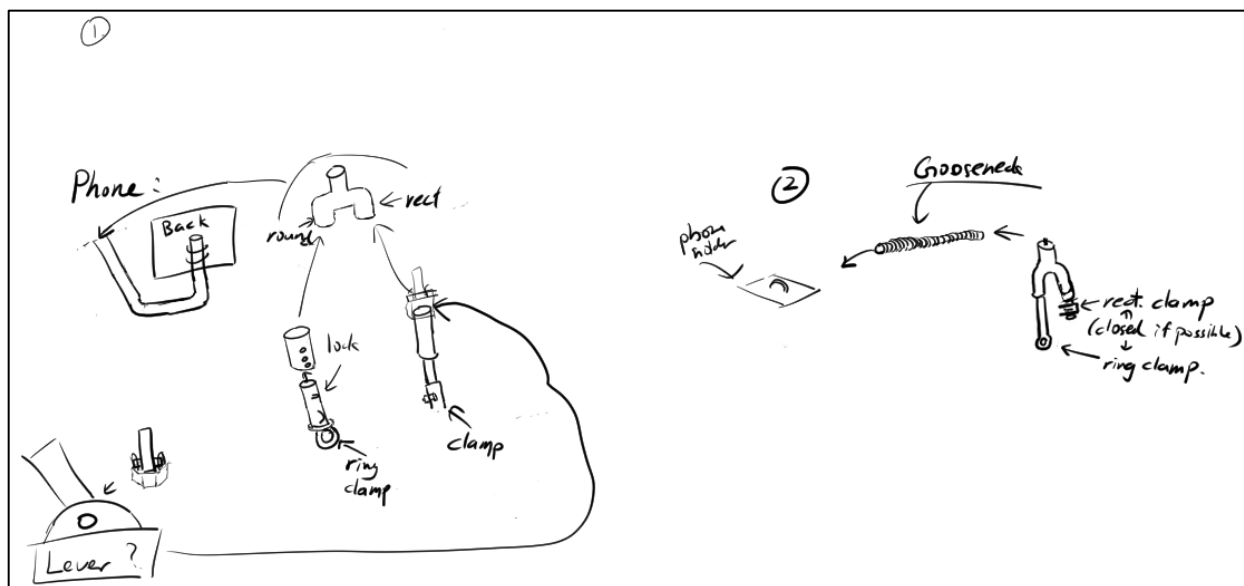


This prototype for a phone bed mount is made up of two sections. The first section consists of two parallel laser-cut pieces of acrylic that have hooks on the bottom keeping it in place. It has multiple subsections of acrylic cut stabilizing cross section pieces that keep the two parallel pieces together. The second section of this prototype is a pipe on the end of the final subsection piece of acrylic. This piece hangs down over the client's face, where the phone will be held with Velcro.

The pros of this design are that it is very sturdy and easy to set up. The cons are that the client cannot push the phone away from her face when she is finished using her phone. The client cannot rotate the phone screen. Furthermore, if the client pushes the device by accident, the hooks may come loose leading to the entire device collapsing on the client, which is a safety risk.

Concept #3: Trevor





Concepts Summary for Clamps and Arms in Concept #3 (Both pictures)

For the clamps, there are two types of clamps we are considering. The first one is a C-shaped clamp to clamp onto both bars of the bed railing. The second one is a Z-shaped clamp which can also be clamped onto both bars of the bed railing, which is theoretically more stable for the client.

For the arm, there are also two types of arm concepts. The first concept is similar to Jonas' concept (concept #1), but it would be only with one PVC pipe and would include the function of releasing or locking the PVC to extend or shorten the arm length and controlling the direction. The second concept for the arm is merely made up of two thick goosenecks that are strong and long enough for the client to navigate the phone with her nose, which is simple but effective.

Table 5: Advantages and Disadvantages of Clamp and Arm Concepts

Concepts	Advantages	Disadvantages
C-shaped clamp	Easy to build (3)	Not stable enough for the client to navigate with her nose (5)

Z-shaped clamp	More stable than C-shaped clamp (5)	Harder to build (3)
First Arm Concept	Adjustable arm (4) Rigid (5) Client can push arm away (4)	Phone holder is not adjustable (3) Hard to build (3)
Second Arm Concept	Adjustable arm and phone mount (5) Rigid and flexible if the gooseneck is of higher quality Client can push away the arm (4) Easy to build (3)	Could be over the budget (5) Cheaper gooseneck is not rigid and strong enough that may cause safety issues (5)

In table 5 above, features for the arms and clamps were ranked with a number ranging from 1 to 5. The important features were ranked as 5 and the least important features were ranked as 1.

Now, we need to evaluate all the concepts against the defined target specifications. To complete this process, we used a simple decision matrix. The matrix will include the concept options as well as the selection criteria. A scale ranging from 1 to 5 was used and weighting factors were omitted for the time being as most of the criteria were of approximately equal importance. Our decision matrix prioritizes the client needs linked to the design to give the appropriate ratings.

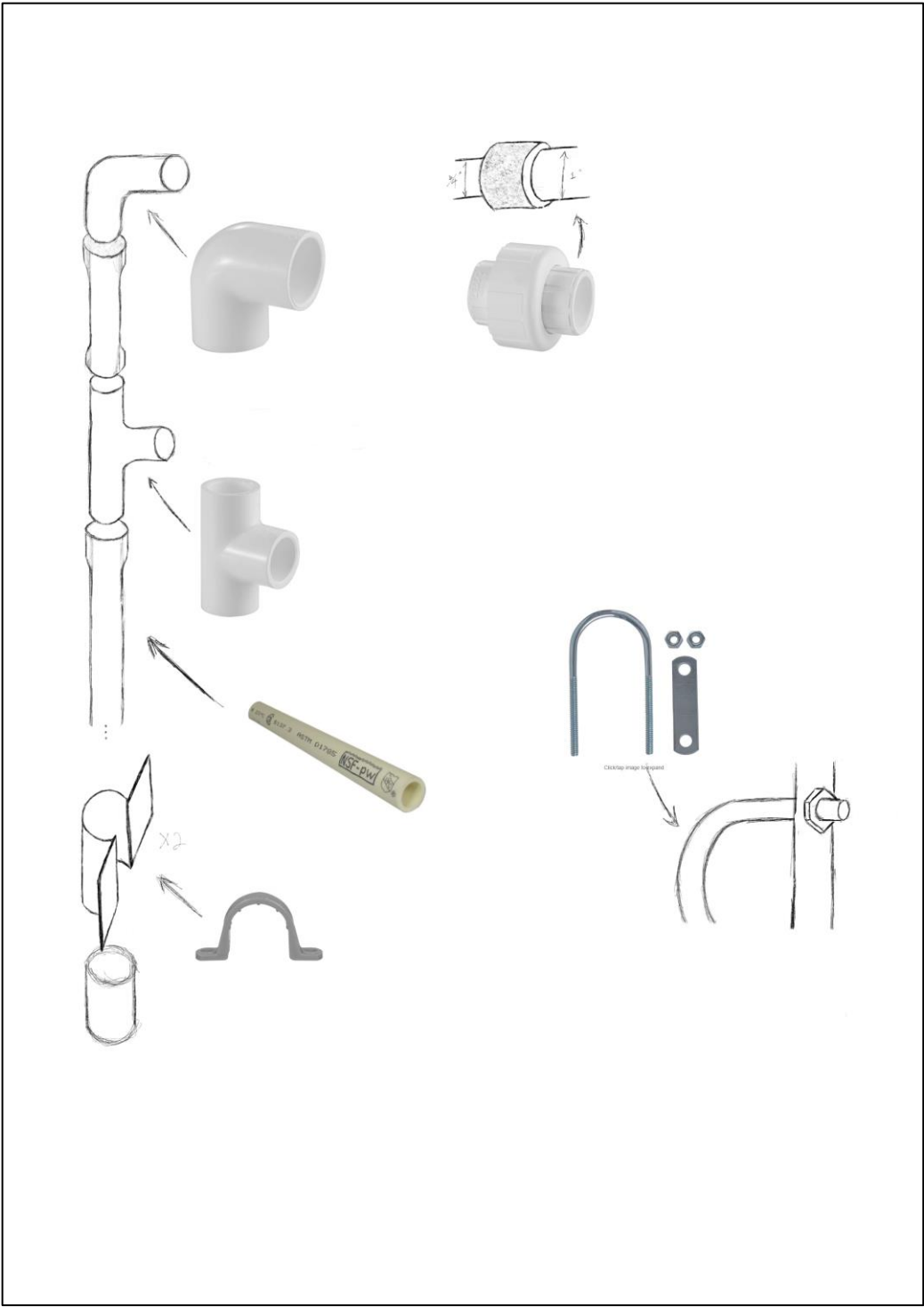
Table 6: Decision Matrix

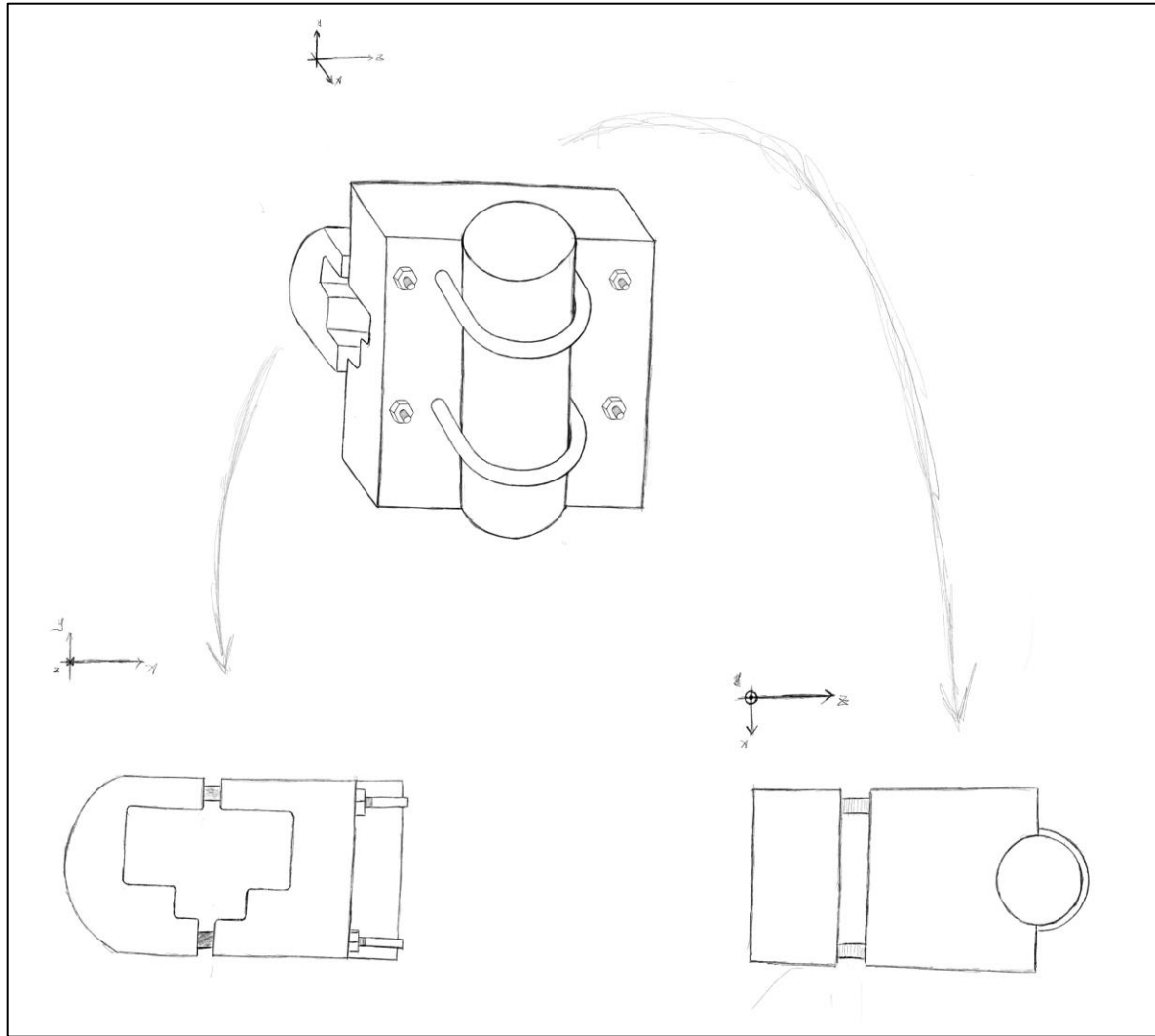
Selection Criteria	Concept #1 (Jonas)	Concept #2 (James)	Concept #3 (Trevor)
Flexible Arm	6	N/A	5
Strong/Long Arms	6	4	5

Adjustable Mount	5	4	N/A
Phone Mount Holder	N/A	4	N/A
Secure Rail Attachment	7	4	6
Easy to Install/Uninstall	6	4	5
Easy to Swing	6	4	5
Mount-tightening Feature	5	4	N/A
Lightweight	4	4	4
Total Score	45	32	30

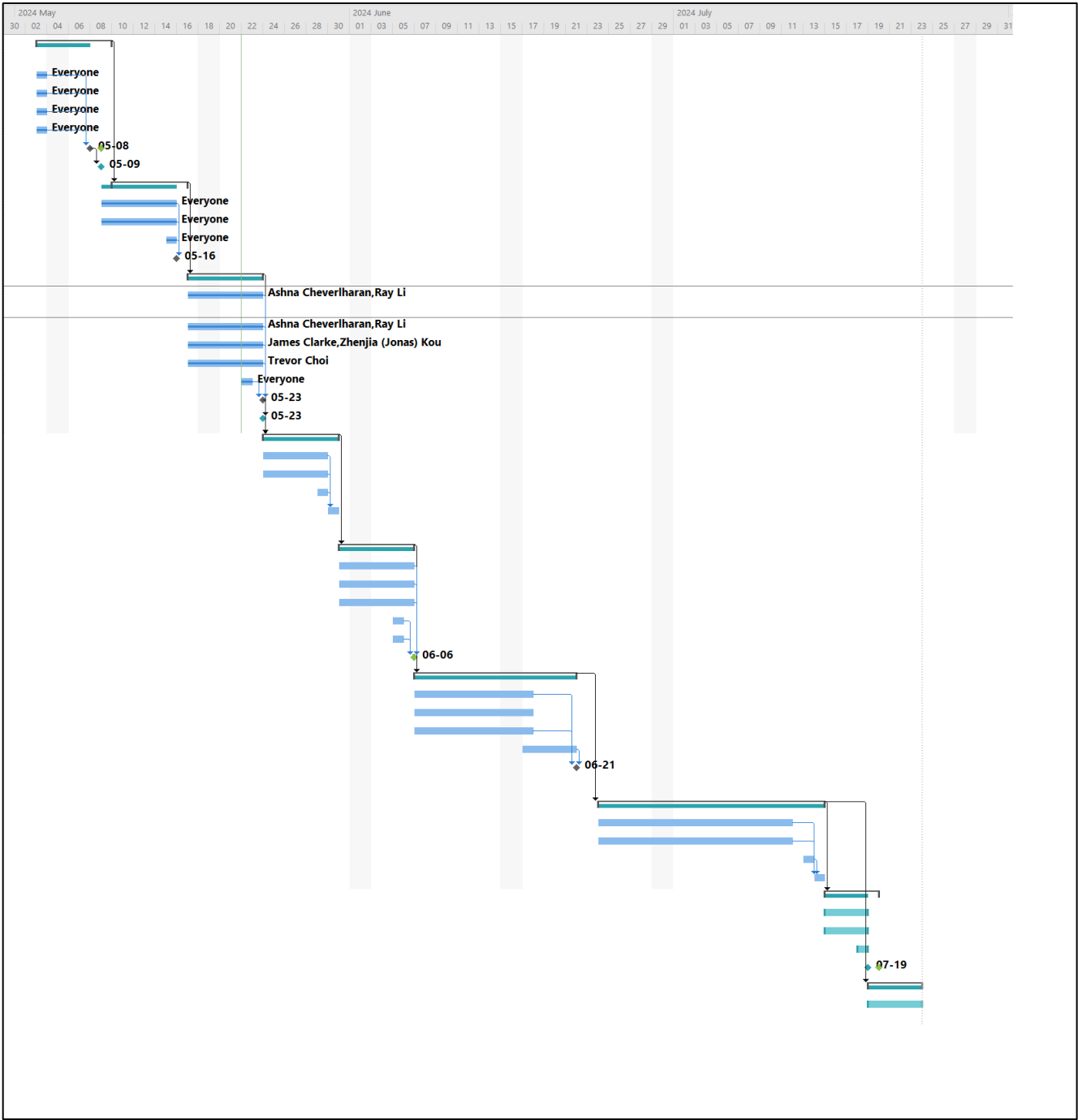
Note that if a cell says N/A, the feature is yet to be included in the design. Based on the overall score, we collectively decided to develop our design based on **concept #1**, which Jonas designed.

Global Design Concept





3.3 Project plan



4 Detailed Design and BOM

4.1 Detailed design

Client Meeting II Feedback

In our second client meeting, we first asked some clarification questions that we had regarding the design and its mechanism. Once those questions were clarified, we were able to gain feedback pertaining to our designs that we had prepared prior to the design meeting. We received a lot of feedback and now are aware of what needs to be changed or improved in our design. We also took measurements of the bed and the railing, as our initial measurements were not accurate enough.

Since **concept #1** met most of our target specifications and was our **global concept**, we decided to present that design first. Upon our client meeting, it was very clear that the client preferred our global design concept. The client had a very positive reaction pertaining to that design compared to the remaining three concepts.

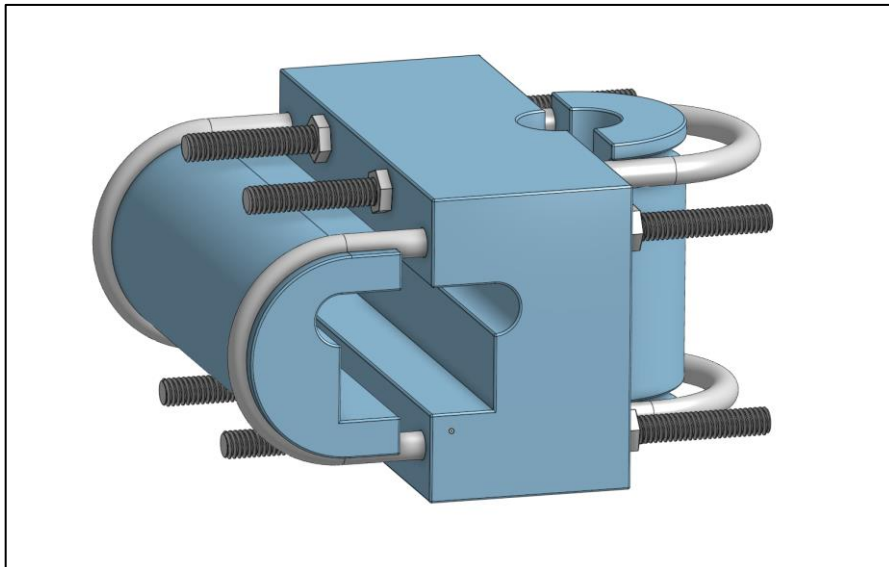
The client really liked the fact that we were planning on using PVC for the piping around the bed frame. However, we were told to avoid using gooseneck as a component as the client feels that it is too stiff of a component and had some bad experiences from using it previously. We told the client that we planned to use Velcro for the bed mount, an idea that she was very pleased to hear as it would ensure that the bed mount attachment remains stable. Furthermore, we wanted to ensure that we could attach anything to the board of the bed as it is part of our global concept. Naturally, we were given permission to use the bed's board if needed. The client also had a position reaction regarding the level of adjustability and mobility.

To improve the design further, the client emphasized the need to ensure that the mount moves horizontally. Also, the client suggested we find ways to securely tighten the mount, so that it does not fall when setting up as well as ensuring that the mount is easily removable. We will keep this feedback in mind when building our prototypes.

Updated Detail Design

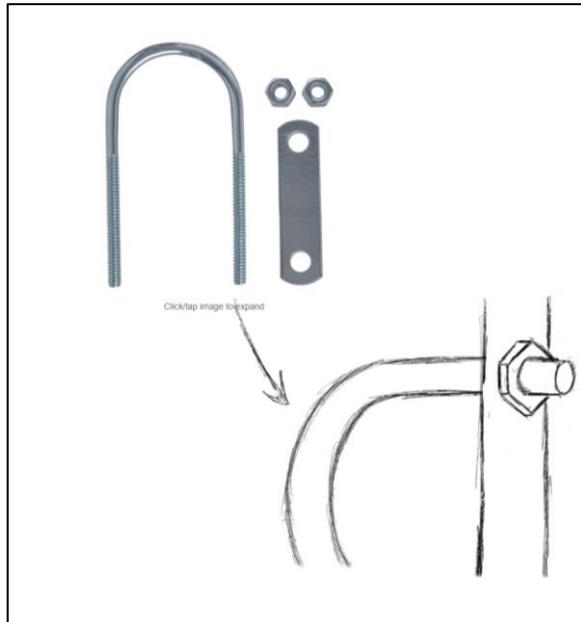
The following figures show depictions of our prototype's construction and its subsystems.

Subsystem 1: Clamp Subsystem

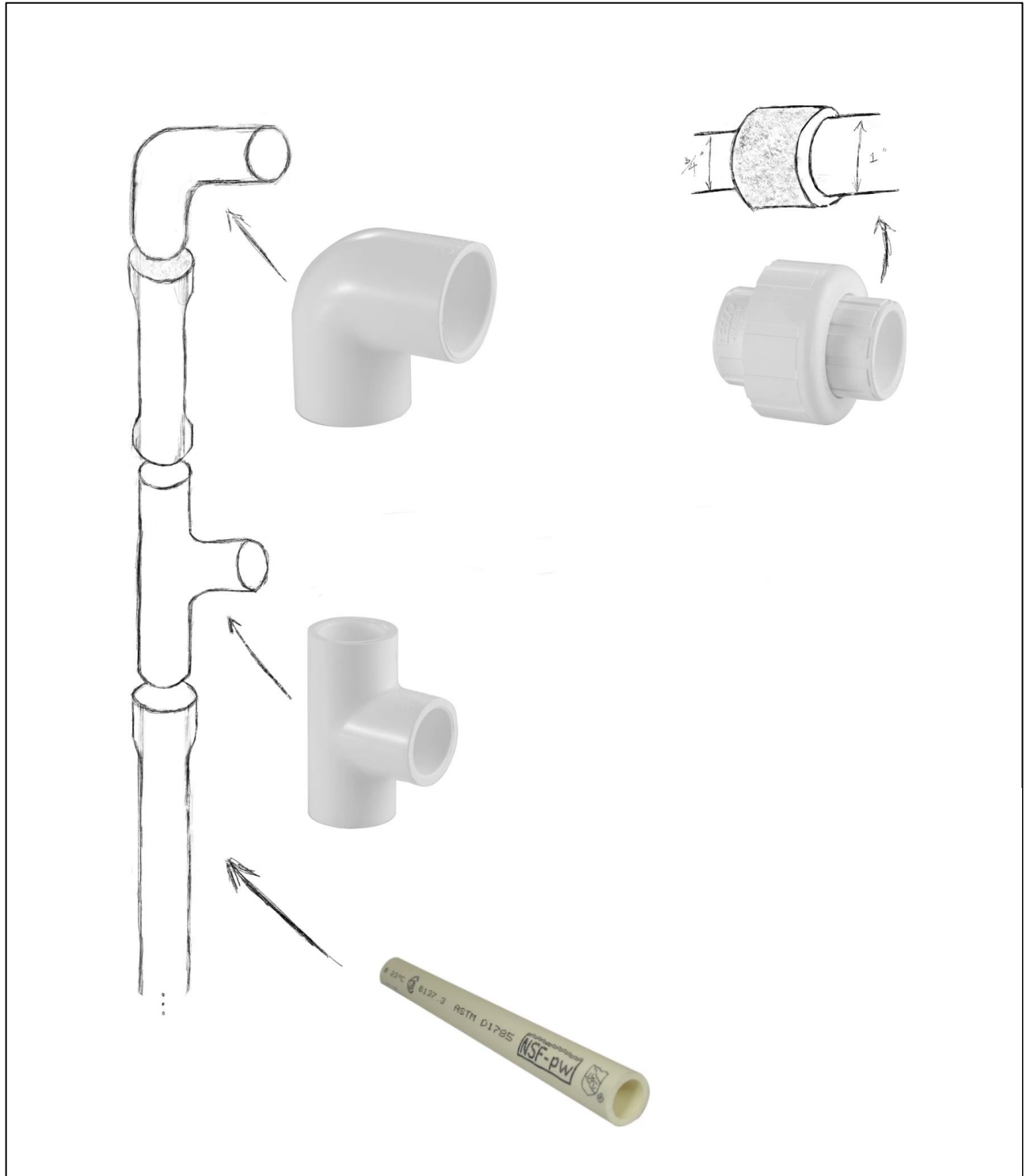


Based on the client's feedback, we decided to improve our clamping machine; the new design will be along the upper part of the structure to be removed without unscrewing the U-bolt.

Subsystem of Subsystem 1: U-Bolt

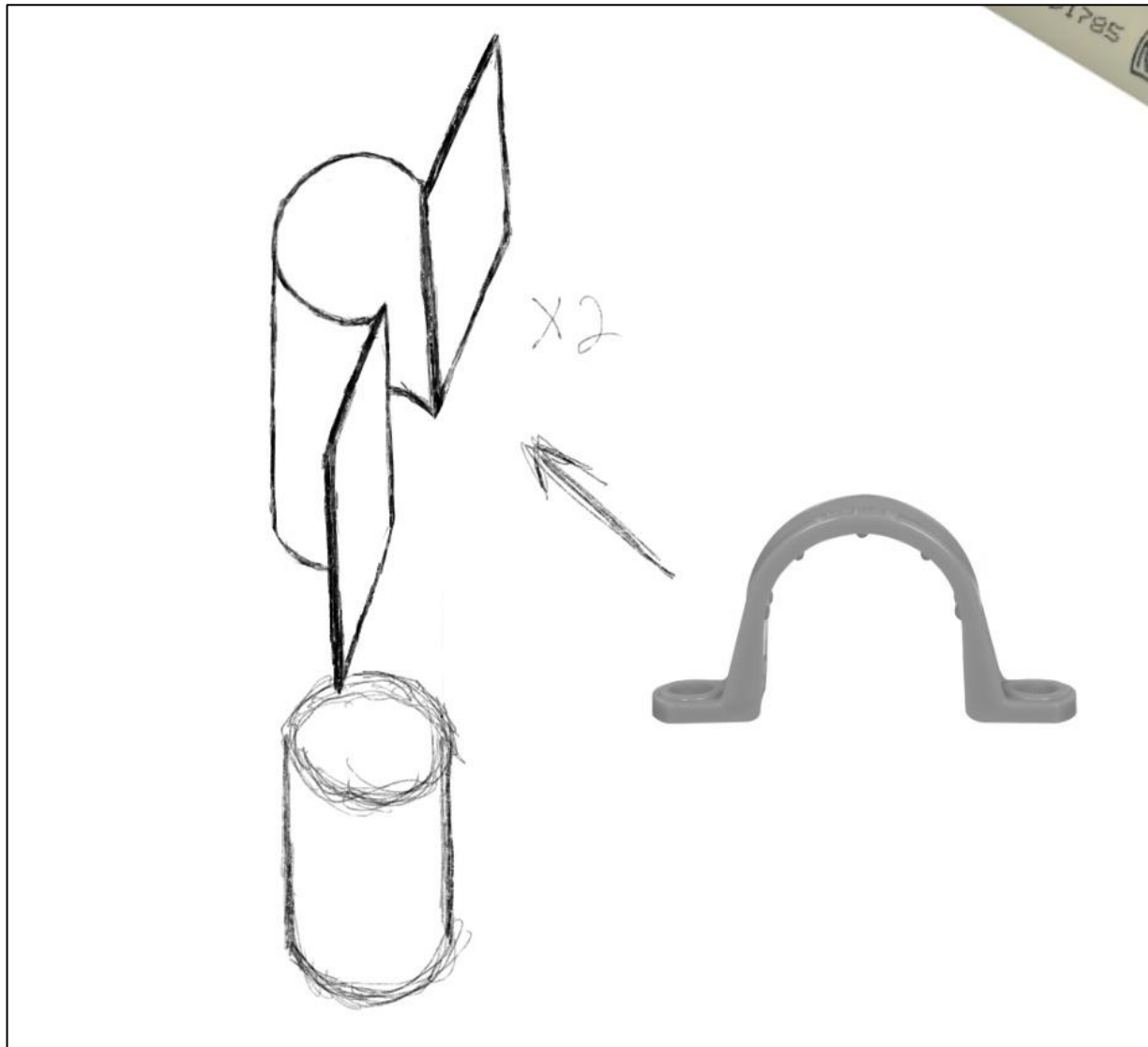


Subsystem 2: Bar Subsystem



Note that due to bar symmetry, the full bar design was not replicated. See deliverable C for more details of how the final bar will look like.

Subsystem 3: Phone Mount



The phone mount will include two phone mount clamps and a surface where the phone will be held in place. The surface holding the phone will be made from Velcro.

Skills and Resources to Create Design

There are many skills and resources that will enable us to create our design. Our team brings many skills to the table that will allow us to successfully complete the project. These skills include our creativity, innovation and communication skills as well as our critical thinking skills, technical skills and our ability to generate iterative designs for the client.

Having enhanced **creativity skills** will increase the possibility of developing different creative initial concepts which can be built off later to create designs that can fully satisfy our client's needs. It also allows us to generate a wide range of possible solutions to the problem and enables us to explore the problem from many different angles.

Innovation skills will allow us to make unique and improved designs based on the failure of other past designs. This will allow us to continuously build better prototypes that fully satisfy the client once the project is completed.

Having **communication skills** is especially important, in terms of maintaining continuous communication with our TA/PM as well as our client. Communicating clearly with our TA, PM and client will ensure that we are on the right track towards successfully completing our project.

Naturally, **critical thinking skills** are crucial for this project. Having this skill will allow us to view the problem from different point of views. For instance, how should the phone be built to satisfy

all the conditions given by the client, the conditions being that the mount must be adjustable to different angles of the bed, must be able to hold the phone tightly and the client must be able to control the phone using her nose within a short distance? To answer questions like this, having critical thinking skills is essential.

Technical skills will enable us to directly build our prototypes. We will need to make use of our ability to use CAD software such as SolidWorks to properly design the prototypes. To print our prototypes, we will need to have access to the uOttawa Maker Space and Brunsfield Center to use the 3D printers and other resources, such as mill/lathe and laser cutting, if necessary.

Finally, it is important to have a **strong ability to generate iterative designs**. This will allow us to refine our designs more and more based on the feedback received from the client. We can then test the designs which will eventually help us generate more effective prototypes after each flaw is found in the design.

Time Assessment

Table 7: Task vs Time Spent Analysis

Tasks	Time Spent (h)
Shopping	3

Measuring/cutting/3d printing	17
Construction	4
Additional Concerns	6
TOTAL	30

Based on our previous experiences in GNG1103, we established that it took us around 25 hours on average to complete our projects. This is, however, only an estimate since we all had different projects in the past, where some happened to be more time consuming than others. For this project, since we are already on the right track, we do not think it should take us any more than 30 hours to complete the project.

In terms of the time that we have at our disposal, we have the 3-hour lab sessions dedicated to project work, although they are not weekly. We also have our 1.5-hour team meetings every Monday after our lectures. If we utilize these times effectively and complete our assigned tasks in a timely manner, we strongly believe that we will have sufficient time to implement our design and complete all the deliverables before Design Day.

Critical Product Assumptions

Some critical product assumption that need to be considered could be the following:

1. We need to consider acceptable values for the weight, length, rigidity and adjustability of the arm. We assumed that the weight is to be less than 5kg, with an arm's length of around 60cm while maintaining to be rigid yet adjustable. However, we are unsure of how we can achieve all these circumstances with the PVC pipes provided until we start building the prototypes
2. Ability to obtain PVC pipes, glue and connective components and other crucial components that are compatible with our design and are within our budget of \$50
3. Bed railing that holds the clamp needs to be stable enough that even if the client moves and controls the phone, that it doesn't shake significantly enough to affect the client's experience
4. The bed railing will be able to support the designed product
5. The three degrees of freedom will be sufficient for the client
6. The measurements taken for the bed mount will be applicable to the client and other users as well

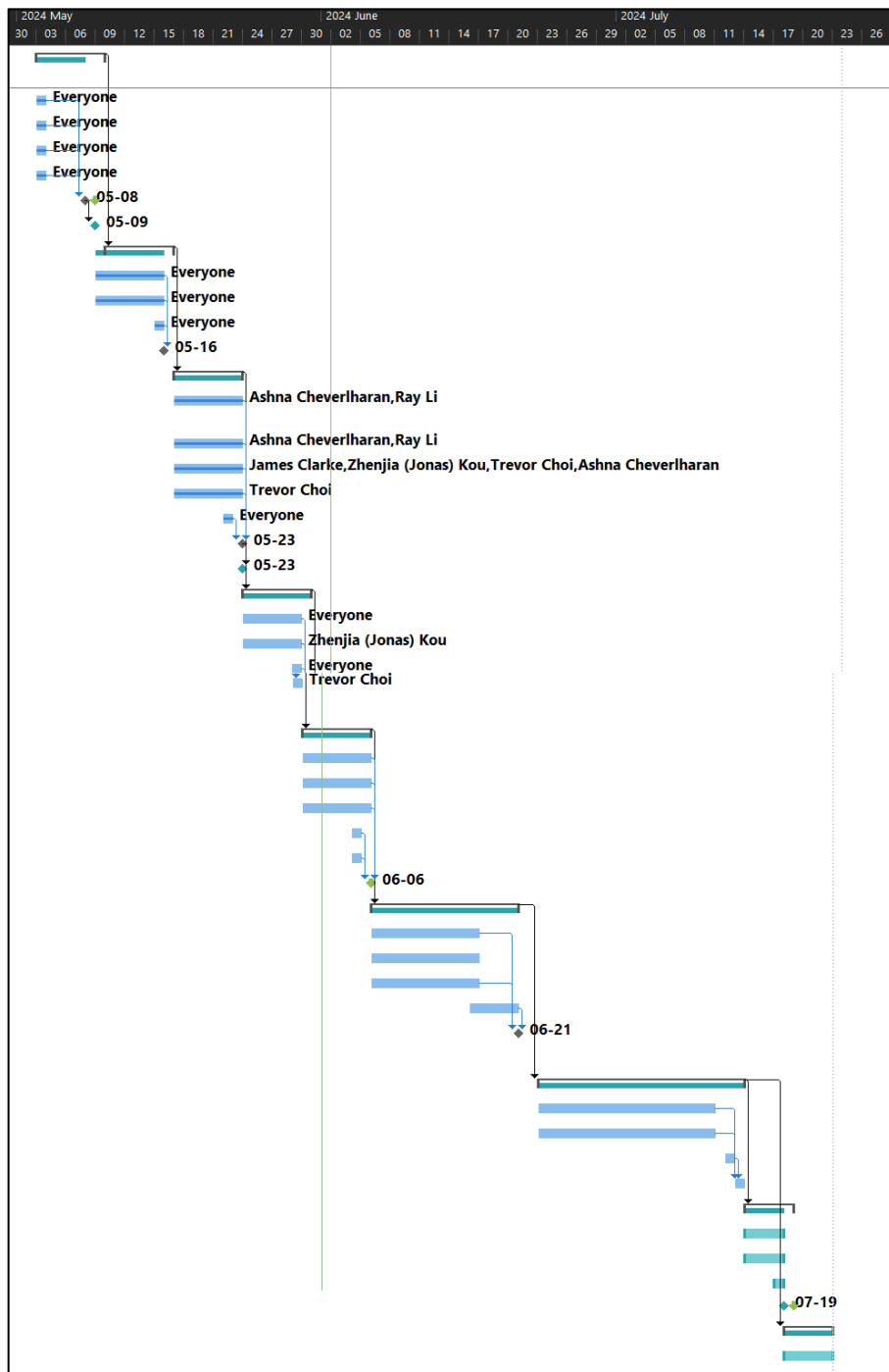
4.2 Bill of Materials

Table 8: Initial Bill of Materials

Item Name	Quantity	Price (\$)
¾ Inch pipe	1	10.8
90-degree connector	2	1.99
T-connector	2	1.87
U-bolt	4	3.23
Pipe holder	2	8.97
3D-printed parts	3	TBD
PVC glue	1	8.17
Total		48.68

Links were not included in the bill of materials as all products can be found at Home Depot or the resources at the Maker Space. The product pricing is calculated based on pricing at Home Depot on June-1-2024.

4.3 Project plan update



5 Conclusions

6 Bibliography

Insert your list of references here.