**Project Deliverable Report Instructions**

This document is a template for the project deliverable submissions. Your group will edit this document all semester and submit it each time you have an updated section (new deliverable is done). The goal is to keep everything in one place to be able to refer back to previous work and save you some time formatting a new document for every deliverable. Please keep track changes ON so that the TA can see what has been changed every time it gets submitted. So that it does not become laggy when the document is too large, 2 templates are provided (PD B-D and E-I).

Template conventions:

* Remove all red text, it is only there to guide you
* Remove this page (instructions)
* Replace all instances of <xxx> with the appropriate information for your group, for example you could replace <GROUP NUMBER> by ‘B1.3’

GNG2101

**Design Project Progress Update**

**Nail File assist Group 1.3**

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[4.3 Project plan update 4](https://cac-word-edit.officeapps.live.com/we/wordeditorframe.aspx?new=1&ui=en-US&rs=en-US&wdenableroaming=1&mscc=1&wdodb=1&hid=BE5329A1-300C-5000-84E9-EBEAD248E649.0&uih=sharepointcom&wdlcid=en-US&jsapi=1&jsapiver=v2&corrid=204db96a-17a5-1352-7172-4406de4c2e70&usid=204db96a-17a5-1352-7172-4406de4c2e70&newsession=1&sftc=1&uihit=docaspx&muv=1&cac=1&sams=1&mtf=1&sfp=1&sdp=1&hch=1&hwfh=1&wopisrc=https%3A%2F%2Fuottawa-my.sharepoint.com%2Fpersonal%2Fjguet066_uottawa_ca%2F_vti_bin%2Fwopi.ashx%2Ffiles%2F6c75b106371442888775975d2ae12778&dchat=1&sc=%7B%22pmo%22%3A%22https%3A%2F%2Fuottawa-my.sharepoint.com%22%2C%22pmshare%22%3Atrue%7D&ctp=LeastProtected&rct=Normal&wdorigin=DocLib&wdhostclicktime=1715890751632&wdredirectionreason=Unified_SingleFlush#_Toc155440708)

[5 Conclusions 5](https://cac-word-edit.officeapps.live.com/we/wordeditorframe.aspx?new=1&ui=en-US&rs=en-US&wdenableroaming=1&mscc=1&wdodb=1&hid=BE5329A1-300C-5000-84E9-EBEAD248E649.0&uih=sharepointcom&wdlcid=en-US&jsapi=1&jsapiver=v2&corrid=204db96a-17a5-1352-7172-4406de4c2e70&usid=204db96a-17a5-1352-7172-4406de4c2e70&newsession=1&sftc=1&uihit=docaspx&muv=1&cac=1&sams=1&mtf=1&sfp=1&sdp=1&hch=1&hwfh=1&wopisrc=https%3A%2F%2Fuottawa-my.sharepoint.com%2Fpersonal%2Fjguet066_uottawa_ca%2F_vti_bin%2Fwopi.ashx%2Ffiles%2F6c75b106371442888775975d2ae12778&dchat=1&sc=%7B%22pmo%22%3A%22https%3A%2F%2Fuottawa-my.sharepoint.com%22%2C%22pmshare%22%3Atrue%7D&ctp=LeastProtected&rct=Normal&wdorigin=DocLib&wdhostclicktime=1715890751632&wdredirectionreason=Unified_SingleFlush#_Toc155440709)

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**List of Figures**

Insert your list of figures here (right-click to update this field).

**List of Tables**

[Table 1. Acronyms vi](https://cac-word-edit.officeapps.live.com/we/wordeditorframe.aspx?new=1&ui=en-US&rs=en-US&wdenableroaming=1&mscc=1&wdodb=1&hid=BE5329A1-300C-5000-84E9-EBEAD248E649.0&uih=sharepointcom&wdlcid=en-US&jsapi=1&jsapiver=v2&corrid=204db96a-17a5-1352-7172-4406de4c2e70&usid=204db96a-17a5-1352-7172-4406de4c2e70&newsession=1&sftc=1&uihit=docaspx&muv=1&cac=1&sams=1&mtf=1&sfp=1&sdp=1&hch=1&hwfh=1&wopisrc=https%3A%2F%2Fuottawa-my.sharepoint.com%2Fpersonal%2Fjguet066_uottawa_ca%2F_vti_bin%2Fwopi.ashx%2Ffiles%2F6c75b106371442888775975d2ae12778&dchat=1&sc=%7B%22pmo%22%3A%22https%3A%2F%2Fuottawa-my.sharepoint.com%22%2C%22pmshare%22%3Atrue%7D&ctp=LeastProtected&rct=Normal&wdorigin=DocLib&wdhostclicktime=1715890751632&wdredirectionreason=Unified_SingleFlush#_Toc144997103)

[Table 2. Glossary vi](https://cac-word-edit.officeapps.live.com/we/wordeditorframe.aspx?new=1&ui=en-US&rs=en-US&wdenableroaming=1&mscc=1&wdodb=1&hid=BE5329A1-300C-5000-84E9-EBEAD248E649.0&uih=sharepointcom&wdlcid=en-US&jsapi=1&jsapiver=v2&corrid=204db96a-17a5-1352-7172-4406de4c2e70&usid=204db96a-17a5-1352-7172-4406de4c2e70&newsession=1&sftc=1&uihit=docaspx&muv=1&cac=1&sams=1&mtf=1&sfp=1&sdp=1&hch=1&hwfh=1&wopisrc=https%3A%2F%2Fuottawa-my.sharepoint.com%2Fpersonal%2Fjguet066_uottawa_ca%2F_vti_bin%2Fwopi.ashx%2Ffiles%2F6c75b106371442888775975d2ae12778&dchat=1&sc=%7B%22pmo%22%3A%22https%3A%2F%2Fuottawa-my.sharepoint.com%22%2C%22pmshare%22%3Atrue%7D&ctp=LeastProtected&rct=Normal&wdorigin=DocLib&wdhostclicktime=1715890751632&wdredirectionreason=Unified_SingleFlush#_Toc144997104)

**List of Acronyms and Glossary**

Provide a list of acronyms and associated literal translations used within the document. List the acronyms in alphabetical order using a tabular format as depicted below.

**Table 1. Acronyms**

|  |  |
| --- | --- |
| **Acronym** | **Definition** |
|  |  |
|  |  |
|  |  |
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|  |  |

Provide clear and concise definitions for terms used in this document that may be unfamiliar to readers of the document. Terms are to be listed in alphabetical order.

**Table 2. Glossary**

|  |  |  |
| --- | --- | --- |
| **Term** | **Acronym** | **Definition** |
|  |  |  |
|  |  |  |
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# **1** **Introduction**

Explain the basic context for your work and any assumptions that you have made for your work. Give an overview of the structure of your document (i.e. explain how it is organized) and summarize the purpose of the document and the scope of activities.

In today's dynamic and competitive marketplace, the development and commercialization of innovative products require a thorough understanding of both customer needs and sustainable business practices. This introduction provides an overview of our business model canvas and design considerations for our nail file assist product, emphasizing the integration of value creation with social and environmental responsibility.

Assumptions have been made regarding the convenience of our product, the preference of our customer, the features the customer would like it to have, and pricing strategy. These assumptions are based on our client meeting and analysis conducted by our team. Our team engaged directly with our client to understand their needs, preferences, and pain points, which significantly informed our design and business strategy.

The document is structured into two main sections: the Business Model and Sustainability Report (B.1), and Design for X (B.2).

The purpose of the document is twofold: firstly, to outline a comprehensive business model for commercializing our nail file assist product, considering economic, social, and environmental factors; and secondly, to identify key design considerations essential for optimizing the product's performance, usability, and impact.

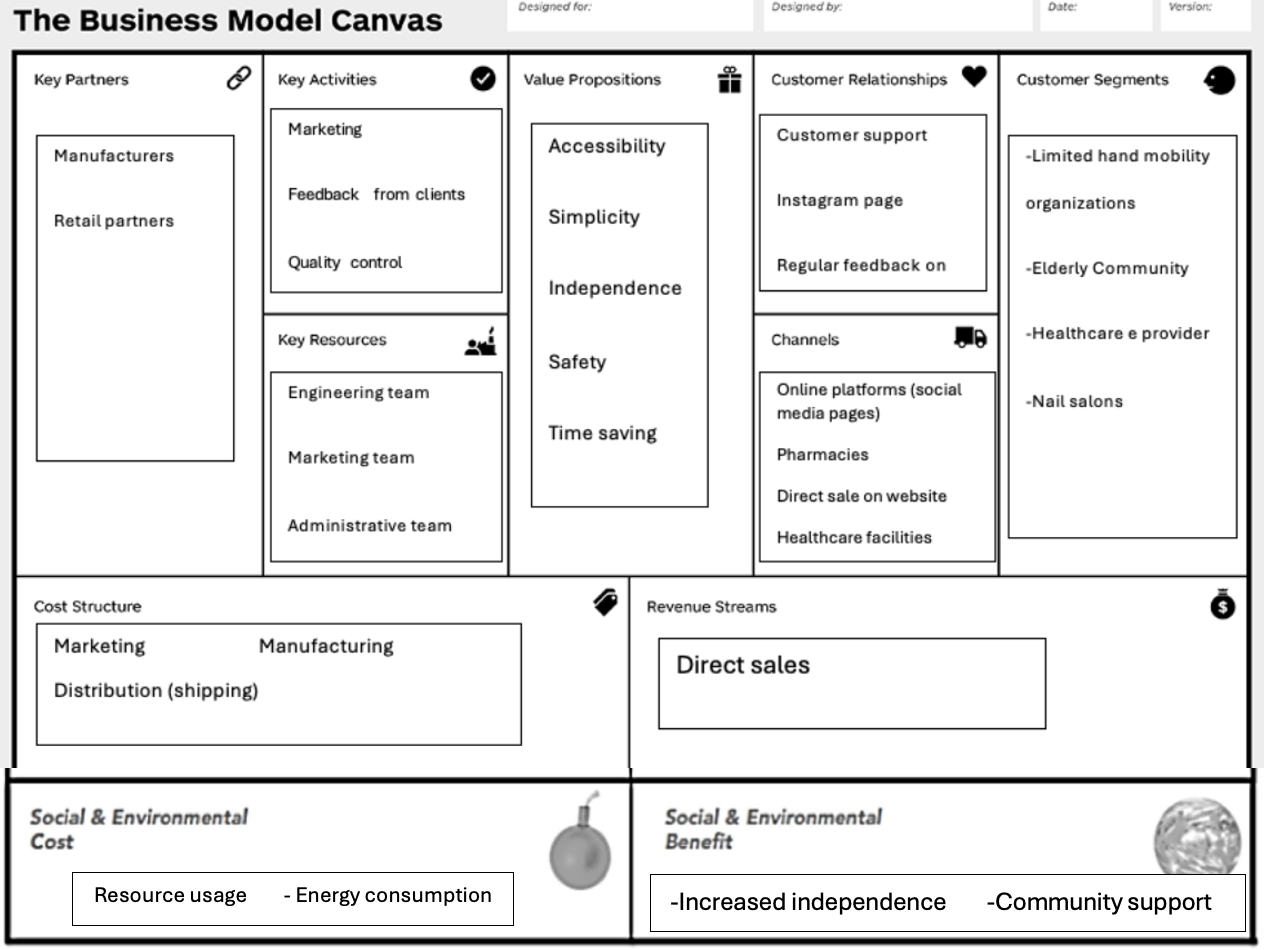
The scope of activities covered in this document includes defining the value proposition, filling out a triple bottom line business model canvas, analyzing the sustainability implications of the product, and identifying important design factors crucial for the success of the product in the market.

Through this document, we aim to demonstrate our commitment to creating not only a commercially successful product but also one that contributes positively to society and the environment.

# **2** **Business Model Canvas and DFX**

## **2.1** **Business model and sustainability report**

**Business model:**



**Value Proposition:**

We provide an easy-to-use nail file assist that enhances the independence of users suffering from mobility loss or dexterity limitations.

**Sustainability report:**

**Social:**

Pros:

Independence is a universally desirable attribute. The Delaware psychological services link an elevated sense of independence with higher self-esteem, reduced stress levels and an increase in overall happiness (2). By enabling our clients to complete a simple task, we would contribute to an increase in independence and potential improvements to their mental health.

Enabling simple tasks for people with disabilities also helps to reduce the workload for their caretakers. Caretaking can range from weekly visits to 24/7 assistance. By reducing the number of smaller tasks required of the caretaker, they can focus on more essential needs to ensure the comfort of their client. If enough progress is made, they might even consider reducing their hours thereby saving the client money.

**Environmental:**

Cons:

In order to reach our target demographic, our product would need to be transported either to retail locations or directly to clients depending on our chosen distribution method. Regardless, the EU states that a quarter of their total greenhouse gas emissions can be linked to the transportation of goods (3).

In our DFX list, we have chosen cost to be one of our primary concerns, in order to respect both our budget and the budget of our potential users. Since environmentally friendly materials tend to be more expensive, we will likely be limited to using cheaper less eco-friendly materials such as plastics. Plastics are un-sustainable both in the way they are produced and their disposal. Many plastics can take up to 1000 years to break down, meaning they accumulate in the environment (4).

**Economic:**

Pros:

Our product could also be enjoyed by people suffering from arthritis or other fine motor impairments. From 2019 to 2021, roughly 21.2% of US adults reported an arthritis diagnosis (1). Our nail file assistant could open an untapped market for nail assist devices as well as broaden the pre-existing market of nail file users. Therefore, companies who produce nail files would be incentivized to invest or partner with our company and provide financial backing.

## **2.2** **Design for X**

Design for:

1. **Functionality + User experience**

The client requires the device to stabilize the nail file and hold her hand steady, especially her right hand, which wobbles and tends to curl back in. The device should allow for quality nail filing, using both the rough and smooth side of the file, which she values for keeping her nails short and smooth. Additionally, including a feature for pushing back cuticles would enhance her experience and meet her additional needs. By addressing these functional needs, the device will significantly improve her user experience.

1. **Ease of use**

The client has mobility issues on her right side, making it difficult to use both hands simultaneously. She has trouble fidgeting and finds it challenging to keep her right hand steady. Therefore, the design should allow single hand operation, with features that facilitate her left-hand movements. Simplifying the setup and usage processes will accommodate her limited dexterity and reduce the physical effort required.

1. **Reliability**

The client uses the nail file regularly and needs a device that is durable and dependable. Since she prefers to keep her nails short and smooth, the device must withstand frequent use without breaking down or requiring constant maintenance. Additionally, the client’s sense of touch and ability to feel is highly limited so the device needs to be reliable enough to avoid cutting the client’s skin. Materials should be chosen for their durability and resistance to wear and tear, ensuring performance over time. A reliable device will give her confidence and make the task of nail filing less frustrating and more manageable.

1. **Portability**

The client mentioned the importance of portability, as she doesn’t want the device to be restricted to the kitchen counter. She needs to be able to move the device around the house or take it with her as needed. Also, she mentioned that it would be more comfortable for her to do the nail filing action from her knees. Knowing this, this calls for a lightweight and compact design that is easy to transport and setup in different locations. Portability will enhance her independence and flexibility, allowing her to perform nail care wherever she feels comfortable.

1. **Cost**

The client purchases replacement nail files from Walmart, indicating a preference for affordable, readily available items. The design should avoid expensive modifications or components that could make it costly to replace. Not forgetting that all the materials and features need to fall in the budget of 50$.

# **3** **Problem Definition, Concept Development, and Project Plan**

## **3.1** **Problem definition**

Many individuals with significant hand mobility loss find it challenging to perform personal care tasks such as nail filing, which typically require fine motor skills and dexterity. These tasks can often be frustrating or impossible, leading to a dependency on others and a decrease in personal autonomy and self-esteem.

This problem primarily affects individuals who have lost a significant degree of hand mobility due to conditions like arthritis, muscular dystrophy, injuries, or neurological disorders. In this specific case, our client is one such individual.

Client Needs:

Accessibility: The nail file should be easy to grip and use with limited hand mobility.

Safety: The device must be designed to minimize the risk of injury, considering the user's limited ability to make precise movements.

Efficiency: The tool should still perform its primary function effectively, despite adaptations for mobility issues.

Comfort: The client doesn't care about hand comfort as she doesn't have any feeling in both hands

Durability: The tool should be robust, as the user might depend on unconventional methods to handle it.

Relevant Known Information:

The client has lost 90% of their hand mobility.

Standard nail files require dexterity and fine motor skills for effective use.

Ergonomic designs exist for other tools to assist those with limited hand mobility.

3. Need-Inspired Metrics and Benchmarking

To define the problem and establish the requirements for our nail file assist product, we conducted a thorough analysis of the needs and preferences of our target users. Based on our client meetings and market research, we identified the following need-inspired metrics. We then benchmarked these metrics against similar solutions available in the market.

List of Need-Inspired Metrics:

1. Stability
   * Metric: Degree of stability during use
   * Unit: No tipping (Binary: Yes/No)
2. Ease of Use
   * Metric: Time taken to set up and use
   * Unit: Minutes
3. Ergonomics
   * Metric: Comfort rating based on user feedback
   * Unit: Scale from 1 to 10
4. Durability
   * Metric: Number of uses before showing signs of wear
   * Unit: Uses
5. Portability
   * Metric: Weight
   * Unit: Grams
6. Cost
   * Metric: Production cost
   * Unit: Dollars ($)

**Benchmarking:** We compared our product concept against existing solutions in the market, such as electric nail files, manual nail files with ergonomic grips, and nail clippers with stabilization features.

* **Electric Nail Files**:
  + **Stability**: Generally stable due to electronic control (Yes)
  + **Ease of Use**: Moderate; requires some setup (5 minutes)
  + **Ergonomics**: Comfortable with vibration control (8/10)
  + **Durability**: High, typically lasts several years (500+ uses)
  + **Portability**: Moderate, requires power source (200 grams)
  + **Cost**: Higher, around $50
* **Manual Nail Files with Ergonomic Grips**:
  + **Stability**: Low; manual control can be unstable (No)
  + **Ease of Use**: High; simple to use (1 minute)
  + **Ergonomics**: Moderate; basic comfort (6/10)
  + **Durability**: Moderate; wears out over time (200 uses)
  + **Portability**: High; very lightweight (50 grams)
  + **Cost**: Low, around $5

**Descriptions and Pictures:**

* **Electric Nail File:**
  + Description: An electronic device with various speed settings and attachments for filing nails.
  + Picture: 
* **Manual Nail File with Ergonomic Grip:**
  + Description: A traditional nail file with a contoured handle for better grip and comfort.
  + Picture: 

**4. Target Specifications**

Based on our benchmarking and the specific needs of our client, we developed the following target specifications for our nail file assist product. These specifications include both ideal and marginally acceptable values, ensuring that we have clear goals to meet during the development process.

**Target Specifications:**

* **Stability**
  + **Ideal**: No tipping (Yes)
  + **Marginally Acceptable**: Minimal tipping that does not affect use (Yes/No)
* **Ease of Use**
  + **Ideal**: Quick setup and use within 1 minute
  + **Marginally Acceptable**: Setup and use within 3 minutes
* **Ergonomics**
  + **Ideal**: Comfort rating of 9/10
  + **Marginally Acceptable**: Comfort rating of 7/10
* **Durability**
  + **Ideal**: Lasts for 500 uses
  + **Marginally Acceptable**: Lasts for 300 uses
* **Portability**
  + **Ideal**: Weight less than 100 grams
  + **Marginally Acceptable**: Weight less than 150 grams
* **Cost**
  + **Ideal**: Production cost of $15
  + **Marginally Acceptable**: Production cost of $20

**Reasons for Choices:**

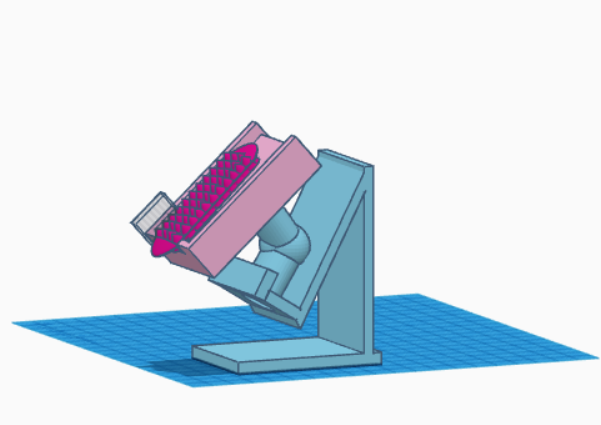
* **Stability**: Ensuring the product remains stable during use is critical for our client with limited dexterity. The ideal value aims for absolute stability, while the marginal value allows for minor movement that does not hinder usability.
* **Ease of Use**: Quick setup is essential for client’s convenience, particularly for those with limited mobility. The ideal value targets the quickest setup time, while the marginal value provides a reasonable timeframe.
* **Ergonomics**: High comfort is crucial for the client’s satisfaction. The ideal rating aims for near-perfect comfort, while the marginal value ensures it remains acceptable.
* **Durability**: Long-lasting products provide better value for user. The ideal value ensures maximum durability, while the marginal value still offers significant longevity.
* **Portability**: A lightweight design enhances usability and convenience. The ideal weight is minimal, while the marginal weight remains manageable.
* **Cost**: Keeping production costs low ensures affordability for user. The ideal cost aims for the lowest possible, while the marginal cost remains within an acceptable range for the target market.

## **3.2** **Concept development**

1. Prototype Concepts Development

Based on our problem statement, we have developed final prototype concepts for each subsystem, as well as the entire assembled system required to solve the problem.

**Concept 1:**



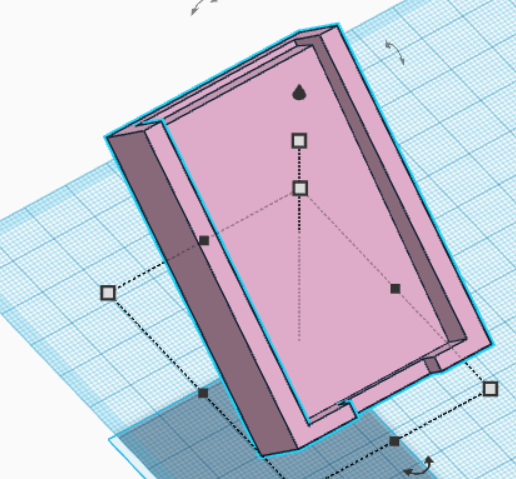
**Global Concept Description:**

The final prototype is a nail filer with a dual-sided surface—one side is rough, and the other is smooth. It includes a phone holder-like device that can be easily resized to fit smaller objects.

**Subsystem Concepts:**

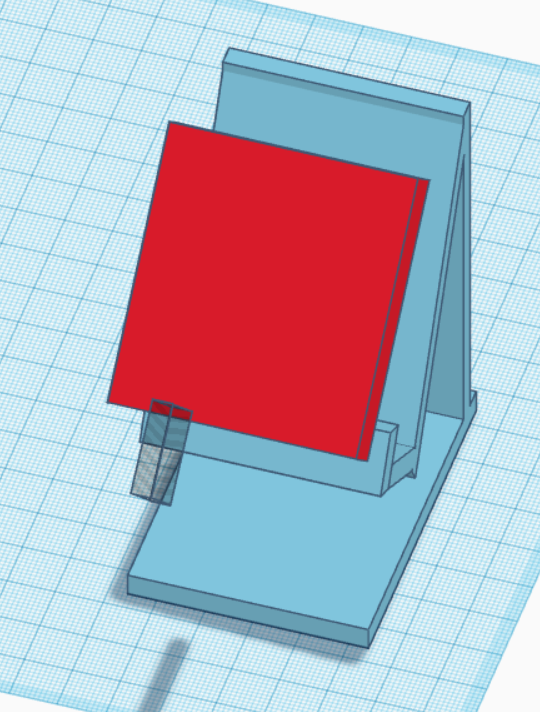
- Handle:

The handle contains a slot where the nail filer will be placed. It is designed to be easily adjustable, allowing it to accommodate different nail filer dimensions (weight, height, and length).



- Placement Mechanism:

This is a movable holder designed to be mounted on the edge of a kitchen table, where the client prefers to do her filings. It provides stability, eliminating the need to use the less dominant hand, and allowing the client to focus on filing. The holder can be clamped to the table edge with magnets for easy and secure placement.



Additional Features:

- We aim to develop a pulley mechanism that can be stretched out for the client’s use.

- We are also considering making the holder automatic, allowing it to adjust itself to fit different nail filers.

# 2. Analysis and Evaluation

We analyzed and evaluated all concepts against the target specifications we defined. The following methods were used for analysis and evaluation:

- Dimensional Fit: Simple measurements and calculations were made to ensure the handle and placement mechanism fit the client's preferred nail filer dimensions and table edge.

- Stability and Ease of Use: Simulations and physical tests were conducted to ensure that the placement mechanism provides the required stability and can be easily clamped to the table.

- Adjustability: Evaluations were done to confirm that the handle can be adjusted to accommodate various nail filer sizes and that the placement mechanism can be easily moved and clamped.

- Pulley and Automation Feasibility: Preliminary calculations and concept sketches were used to assess the feasibility of incorporating a pulley system and automatic holder adjustment.

# 3. Selection of Promising Solutions

Based on our evaluation, we have chosen the following promising solutions to develop further:

1. Adjustable Handle and Placement Mechanism: This solution meets the client’s needs for stability and ease of use, ensuring the nail filer can be securely held and easily adjusted.

2. Magnetic Clamping System: The use of magnets for clamping the placement mechanism to the table edge is both practical and user-friendly.

3. Pulley System: We will further develop the pulley mechanism for ease of stretching and use by the client.

4. Automatic Holder Adjustment: We will explore the feasibility of an automatic adjustment feature for the holder to enhance user convenience.

These selected solutions will be refined and developed into a final prototype, ensuring they meet the client's requirements and specifications.

**Concept 2:**

**Global design description:**

The global design concept combines the solutions of an adjustable handle, the magnetic clamping system, and a modified placement mechanism. This design ensures that all the DFXs are taken into consideration alongside the client’s main needs. The adjustable handle and placement mechanism allow secure use with minimal effort. The magnetic clamping system simplifies setup and movement, enhancing user experience. Durable and robust design will be needed to ensure reliability and longevity. The compact, lightweight design makes it easy to transport and use anywhere and cost efficiency is achieved by using affordable materials.

A drawing of a bag

Description automatically generated

Most of the target specifications are respected by the concepts, some will need further testing but can be guessed. The stand and the magnets offer optimal stability, especially if the magnets are activated, they will allow the stand to be kept in place. From the design the concepts can be visually evaluated as easy to use as there is an entrance for the arm that helps to put it in place to prepare it for the nail filling. Comfort is taken into consideration with the addition of cushions on the inside of the arm stabilizer, enhancing user experience. Also, portability is respected as the concept is lightweight and easily movable.

**Benefits**:

* Optimal for user independence
* Ease of use
* Portability
* Comfort
* Ability to adjust to different arm sizes with the straps

**Drawbacks**

* Limited high-end features
* Magnets won’t be activated on any surface

**Concept 3:**

This concept features a rigid metal sheet integrated with a gel-filled silicone sphere designed to conform to the shape of the client’s hand. This metal sheet includes a strap system that securely attaches a second identical metal sheet, also equipped with a silicone sphere. The straps ensure the client's hand remains immobilized comfortably. Additionally, the device can be used on the leg, providing versatility.

**Benefits:**

* **Custom Fit**: The gel-filled silicone sphere adapts to the client's hand shape, ensuring a precise and comfortable fit.
* **Secure Immobilization**: The dual-sheet design and robust strap system prevent any unwanted hand movement, enhancing stability.
* **Comfort**: The silicone spheres provide cushioning, making prolonged use more comfortable.
* **Portability**: Lightweight and easy to transport, allowing for convenient use anywhere.

**Une image contenant texte, écriture manuscrite, encre, ordinateur portable

Description générée automatiquement**This concept is designed to offer a secure, comfortable, and versatile solution to immobilize the hand.

**Concept 4:**

This holder features a unique design where the hand is positioned at an angle towards the ground, ensuring a natural and relaxed posture during use. The holder is equipped with a secure strap that gently wraps around the hand, stabilizing it without restricting movement. At the base, the nail file is firmly placed, allowing for precise control and effective filing.

Benefits of the Ergonomic Nail File Holder include:

1. Comfort and Ease of Use: The angled hand placement reduces wrist strain and fatigue, making it comfortable for prolonged use.

2. Stability: The secure strap ensures that the hand remains steady, providing more accuracy and efficiency in nail filing.

3. Improved Nail Care: With enhanced control over the file, users can achieve a smoother and more uniform nail edge, reducing the risk of nicks or uneven surfaces.

4. Adaptable and Versatile: Suitable for individuals with limited mobility or dexterity, as the holder provides the additional support needed to maintain grip and control over the nail file.

5.Portability: it is very easy portable because of size and weight

This product is perfect for both professional salon use and at-home manicures, offering a practical solution for anyone seeking a more comfortable and controlled nail filing experience.

## 

**Concept 5:**

**Global Concept Description:**

This concept is composed of 2 main systems. The first is the hand support system to stabilize the client’s right hand. It is a sandwich system to meet the rigidity required to keep the client’s hand pried open. The second system is the nail file holder. It is equipped with a mug like grip which the client stated is comfortable in their hand.

Une image contenant croquis, dessin, diagramme, Dessin au trait

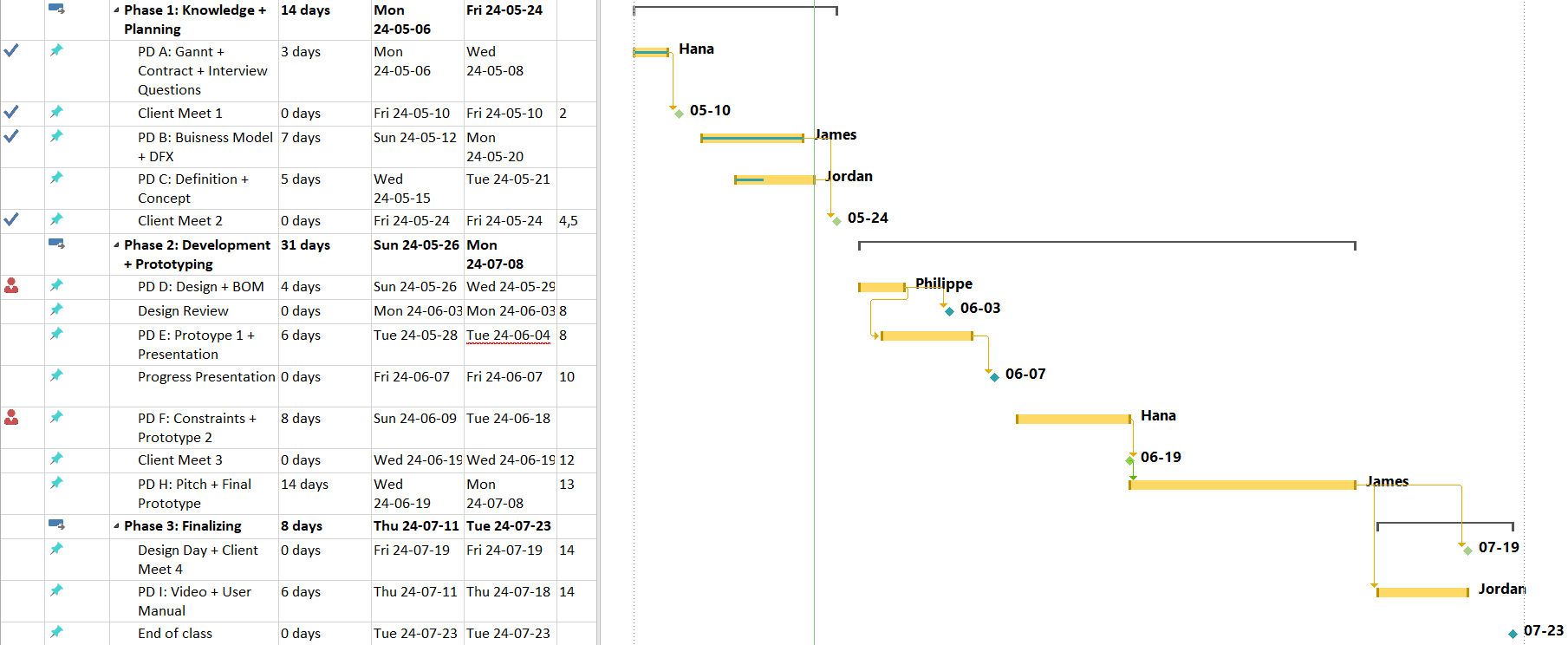
Description générée automatiquement

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Description générée automatiquement

## **3.3** **Project plan**

Deliverable (B):



Modifications from original chart:

- Deliverable B duration extended to allow proper formatting

- Deliverable B 100% complete

- Deliverable C 50% complete

Deliverable (C):

Une image contenant texte, capture d’écran, nombre, ligne

Description générée automatiquement

Modifications from previous chart:

- Overlap between deliverables B and C to allow more time to work on deliverable C

- Deliverable C 100% complete

Deliverable (D):

Une image contenant texte, capture d’écran, nombre, diagramme

Description générée automatiquement

Modifications from previous chart:

* + - Deliverable D extended because BOM was unclear until we had completed our first prototype (Therefore finished D at same time as E)

# **4** **Detailed Design and BOM**

## **4.1** **Detailed design**

## **4.2** **BOM**

## **4.3** **Project plan update**

Add a screenshot of your gantt chart.

# **5** **Conclusions**

Summarize your lessons learned and your work related to your project. Discuss any outstanding issues or implications for the project.

# **6** **Bibliography**

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