GNG2101

Design Project Progress Update

SwitchCraft group F2.5

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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

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

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.

2 Business Model Canvas and DFX

2.1 Business model and sustainability report

The Adapted Nintendo Switch is a product designed to give users more freedom to play the games they love. This product aims to provide accessibility to users who find it difficult to use game controllers in their purchased state.

Value Propositions:

Simplicity: Our product is designed in a way that makes it very easy to put on and take off our adapter. This ensures that charging the Nintendo switch is just as easy as it was before, since charging must occur between each use.

Enhanced Use: The Adapter allows the user to interact with all buttons on the Nintendo Switch with ease, this is important so that users can enjoy their gaming experience to the fullest.

Modularity: Our Adapter is made in a way to easy assemble and take apart. We did this to allow you to replace parts in case any small part breaks or if you have different needs with your controller. Modularity will also help with the remote removal to allow you to charge your device easily.

Cost effective: We aim to provide the best quality adapter we can for an affordable price using cost-effective materials. We know that customers value the affordability of our product due to their situations and thus this is an important goal for us.

Key Partners:

Our business needs to partner with Nintendo to function. Nintendo needs to continue supporting the Switch for us to maintain a steady customer base. Our product consists of mainly 3D printed components. Manufacturing for our company would be outsourced to a 3D printing company. They would also be an important partner. Our company would also require web hosting services to provide us with a platform to sell our product.

Key Activities:

Our company will strive to constantly innovate our product and improve it. In the future, we will look to expand our product base into different accessibility controllers.

Key Resources:

Our company would require a 3D modelling software such as SolidWorks to allow us to innovate and improve our adapted Nintendo Switch design. We would also need SolidWorks to design different adapters for a Nintendo Switch to enable anyone to be able to enjoy their switch. Since there isn't a large population of our target audience, we would have an online store to allow people to buy these adapters. We then need an online platform which will be a key resource to the company.

Value Propositions:

Our company provides a way for people with a disability to enjoy gaming on a Nintendo Switch. Currently there is a problem where people with disabilities can't enjoy the same hobbies as others. Controllers are not built with the intention of being easy to use for everyone and our company strives to change that. The main elements our company values are simplicity, enhanced use, modularity, and cost effectiveness.

Customer Relationships:

Our company will have a close relationship with our customers. In the future, we plan to expand into different devices for various disabilities. This would require us to conduct focus groups and receive feedback from our customers to improve our product. Our company believes that having a connection with our customers will ensure that our products work and are useful to our customers. Everyone's situation can be different, so some customers might require additional support.

Customer Segments:

Our company will be focusing on gamers with disabilities that prohibit them from enjoying games. To start with, our most important customers would be customers who play games without using their hands. Our main products would provide value to those customers.

Channels:

Our product will be available to purchase and view online. After a purchase customers will recieve the product in the mail. Each product will be shipped with installation and usage instructions. Upon request we may also provide customers with video instructions on how to use the product they purchased.

Cost Structure:

Web Hosting Costs

Product development (3D printing)

Marketing

General and Administrative

Salaries of Engineers developing products

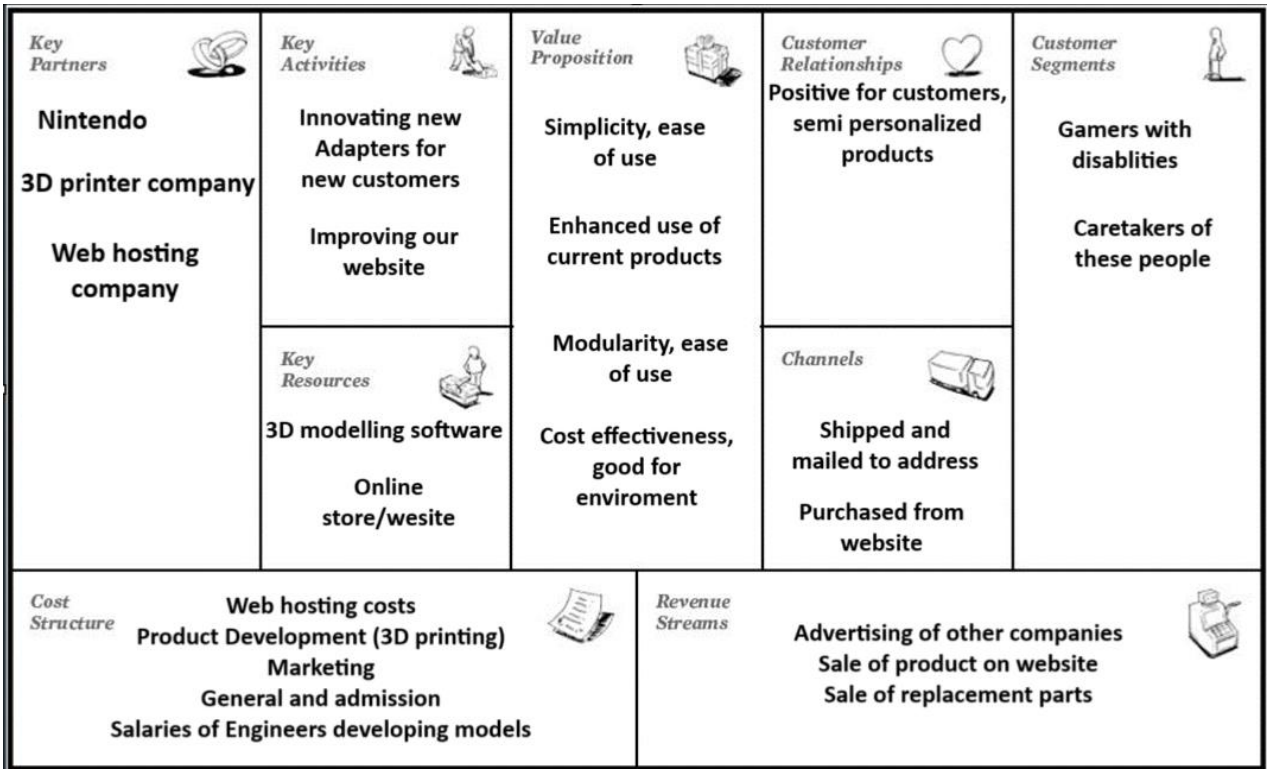
Revenue Streams:

Advertising of other companies on our website

Sale of product from website

Sale of replacement parts

Business Model Canvas:



Sustainability report reflects on at least 2 social environmental and economic background.

Environmental impact: This product should have a positive impact on the environment due to our device being made from 3D printed materials. 3D printed materials can be recycles so using these will greatly reduce the bad impact on the environment from the disposal of the product.

Social impact: The adapters for the Nintendo Switch will have a good social impact because our product is made in a way to make disabled peoples lives much better. This product allows people to play the games to the best of their abilities.

2.2 Design for X

Throughout the first client meeting, we understood several conditions and factors that must be considered to satisfy our client's expectations. Here at the five most important factors based of the notes from the interview.

- Prefer soft materials so it does not hurt.
- Observation: controllers block the view.
- Willing to try voice control.
- Plays for a long time in one sitting until her body cannot handle it anymore.
- Mario Party is the next target.

From the above statement, we can conclude that DFX is material logistics, usability, multi-manipulability, reliability, and reuse. Because of the texture of the controller, such as rough material damming the nose and hard material harming the quality when playing video games, material logistics must be maintained for the client's experience. Usability is critical; during the client's demonstration, hitting the bottom buttons on the Nintendo Switch obscured her view. We want to create a controller that provides functionality while remaining visible. One remarkable characteristic is its multi-manipulability; when we inquired about the client's willingness to attempt voice control, she expressed interest in the concept. However, the vocal control must work effectively. For example, walking in a straight line in a game requires pressing the same button.

Controlling vocally requires ensuring the magnitude and desired motion. As a result, multi-manipulability allows the client to choose whether to control by nose or voice. Reliability is also important, since constant performance is essential for a pleasurable gaming experience. Our goal is to allow our client to exert less effort and continue playing Disney Dreamland Valley for as long as she wishes. Finally, the reuse feature underlines the controller's versatility and lifespan, making it a long-term solution for the customer who intends to play Mario Party in the future. This revolutionary design not only improves accessibility, but it also establishes a new benchmark for adaptable gaming technology.

3 Problem Definition, Concept Development, and Project Plan

3.1 Problem definition

3.1.1 Controller Accessibility:

The side buttons and the recessed buttons are harder to press.

The triggers are difficult to press, affecting gameplay.

Jams of view caused by the controller during gameplay

Control Method:

Use nose exclusively for gaming operations.

might be worked for voice control with hold feature.

Comfort level:

The controller should be made of soft material and feels comfortable in nose.

Be open to prototype testing to ensure comfort and functionality.

Proposed Solution:

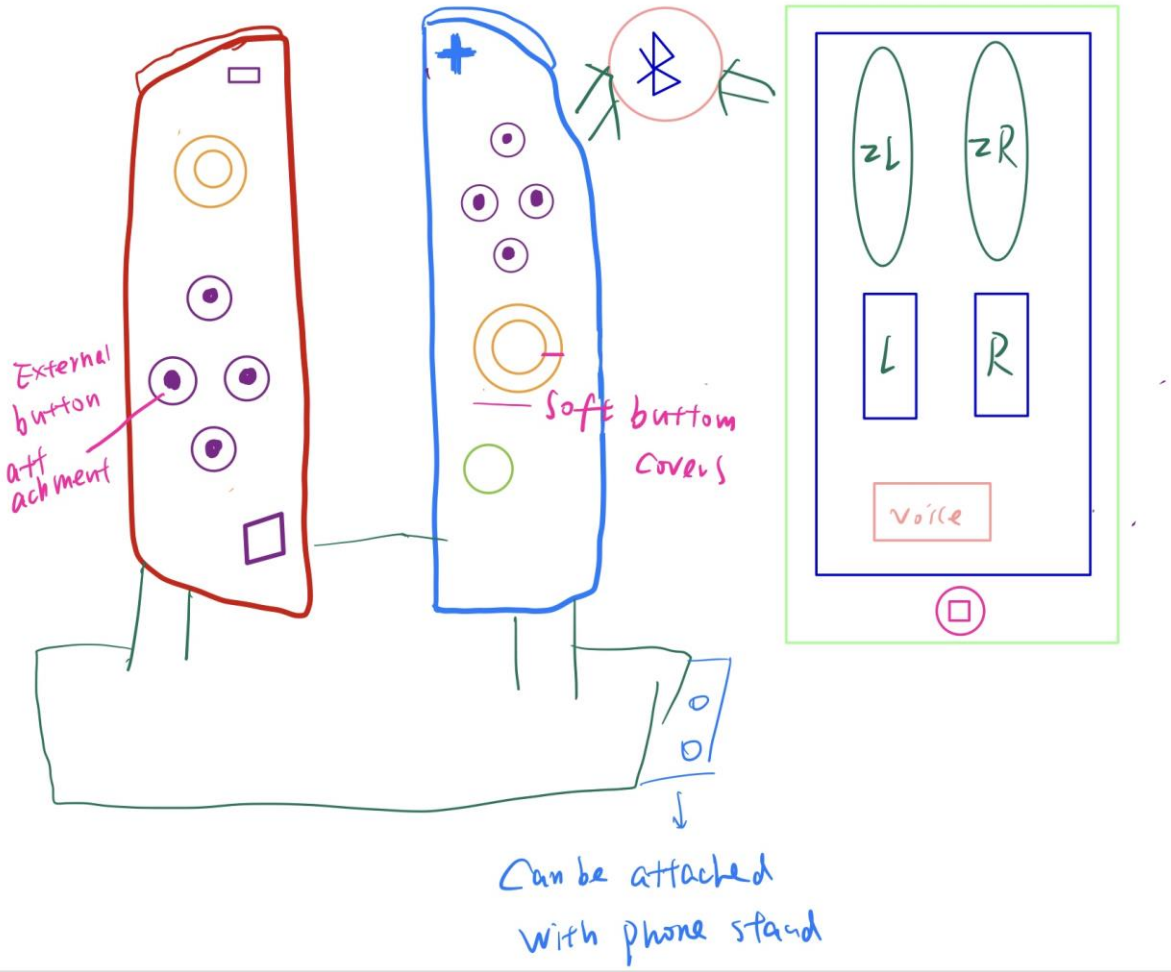
Soft Buttons and Materials: designed with soft, easy-to-press buttons for increased comfort during long gaming sessions.
Controller design minimizes line of sight obstruction, ensuring unobstructed vision during gaming.
Backup bottoms.

3.1.2 Our client is a 23-year-old young girl who loves to play games, especially Disney Dreamland Valley. Due to the physical inconvenience, the nose is the client's primary means of operating game features. But while playing games on her Nintendo console, she often faced challenges with some of the side buttons, recessed buttons (+, -, Home, Capture) and triggers (L, R, ZL, ZR) being difficult to access. Even during gameplay, the view is obstructed.

3.2 Concept development

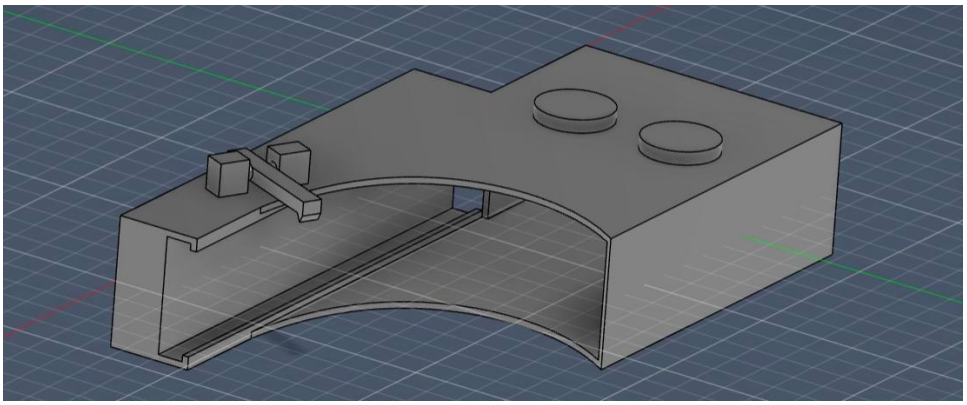
1. The main problem our client is facing is that it is hard to press the side buttons on the controller. We came up with an idea to use a keyboard in combination with a controller. We would develop a 3D printed stand which would house the controllers and a keyboard. These would be spaced conveniently making it easy to access all the buttons that are required. The game has built-in keyboard functionality. Since all the buttons on a keyboard are on the front face our client would not have to face the difficulty of pressing and holding the side buttons on the conroller. This concept would meet the design criteria set by our company and solve the customers problem.

2.



Another idea for conceptual design is shown above. By connecting the app we are developing in the future. The four buttons on the side can now be controlled by simply tapping the four icons shown in the picture. On the other hand, we could 3D print a phone stand to combine two controllers with the phone easier for our client to play with. Furthermore, the stand will be attached to a telescopic stick to create extra flexibility and convenience for spacing.

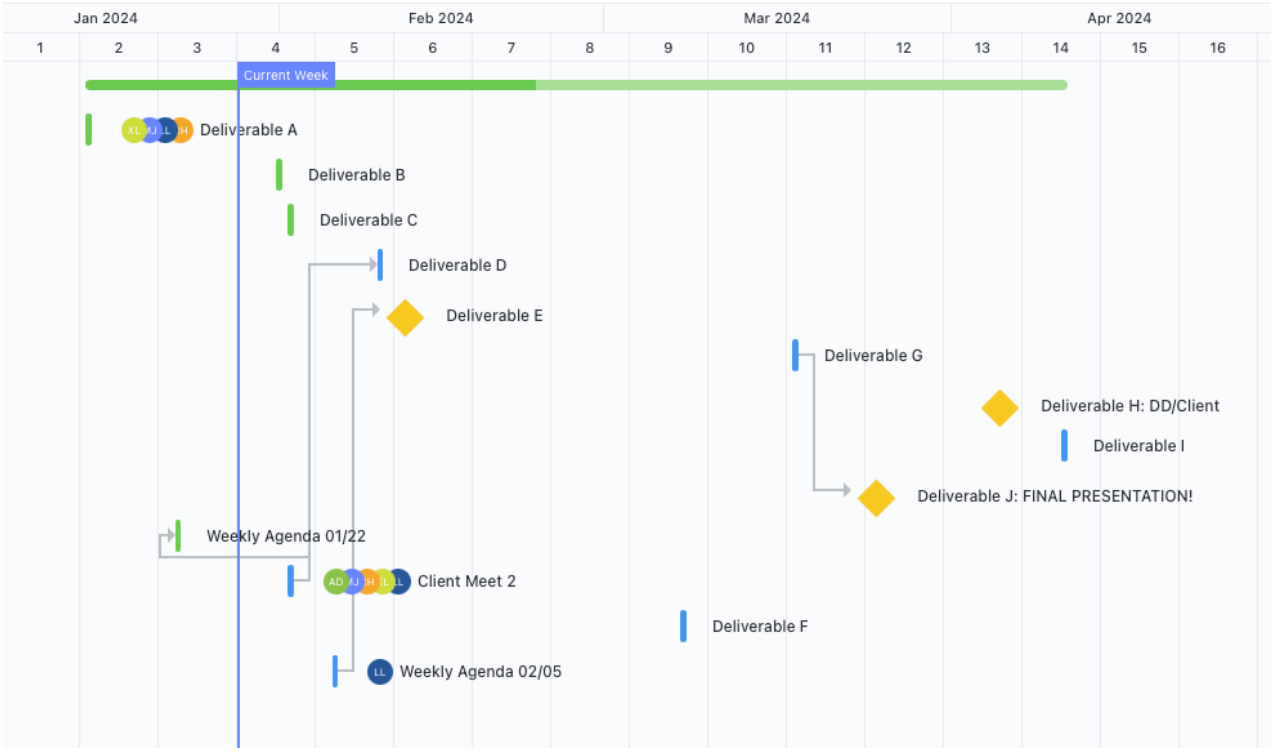
The final idea we have developed would be to create a purely mechanical based adapter which either mounts to the device or slides on and off using the built-in rails on the joycon. This would allow buttons to be placed that would interact with some sort of hinge, lever, linkage etc. Which would press the button on the controller. A rough sketch of this solution is presented below.



Comparing to our target specifications, the last model obtains the highest score as it will be able to be manufactured as per our criteria and as it will be mostly assembled from 3D printed parts, will be a low cost solution. The runner-up that we may present to the client would be the first idea of a modified keyboard attachment as many of the challenges are already solved with that but would also be much more expensive.

Since the goal of this project is to develop our own product and not go above budget, this last solution will be the one pursued.

Project plan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16
Current Week
Deliverable A
Deliverable B
Deliverable C
Deliverable D
Deliverable E
Deliverable G
Deliverable H: DD/Client
Deliverable I
Deliverable J: FINAL PRESENTATION!
Weekly Agenda 01/22
Client Meet 2
Deliverable F
Weekly Agenda 02/05

4 Detailed Design and BOM

4.1 Detailed design

1. Client Feedback Summary

Scuff Idea:

The buttons must be low profile, so that they are easy to press. If the buttons are high profile it will be hard to press the existing buttons on the controller and the joysticks

Sometimes when the joysticks are being moved they dont move the character exactly as intended.

Phone Screen Idea:

Does not have an andriod phone

Had one in the past and it was too confusing to use and really really disliked android

Keyboard Idea:

Could be easier to control due to the joysticks malfunctioning.

Sitting close to the tv wouldnt be an issue, because client already sits close enough to the TV to plug in the keybaord

Currently uses laptop to play some games

Would not be able to use a mouse

2. Updated Design Concept

The design concept we chose was the Scuff idea. This design features a bike brake style mechanism to easily press the triggers on the side of the controller. The part is made out of 3D printed parts. To make the minus, plus, home and screenshot button easy to press 3D printed parts will be double sided taped or glued to the controller to make them very easy to press. A render of the current design is included in the submission along with part drawings and a Bill of Materials.

3. Skills/Resources

With multiple different majors in the group, there are many strengths available. Anmol and Mikael are profficient in 3D design having experience from their courses and other personal projects. This will be especially useful for the design of the components that will make up our solution. As there is budget of 100$ for the final prototype, making the most of 3D printing will enable us to use this budget elsewhere. The rest of the group will learn how to navigate the Solidworks software with minimum proficiency to able to analyze the product and offer critiques and other ideas that would be implemented by the more proficient members.

4. Time Estimate

For the remaining time to actually implement the design, we had to complete each of our prototypes before design day. Until then we can do the following:

1- Break Down Tasks – 1 day

2 – Summary of finalizing ideas and conceptualization – 2 days

3 – Design and Prototyping – 3.5 days to evaluate our prototype functionality, and user friendliness.

4 – Design Perfection – 2-3 weeks after design and prototyping is complete. During this period, all necessary adjustments should be made based on test results.

5– Final Design and Documentation: 3 weeks to prepare final design documentation and specifications

5. Product Assumptions

In the process of implementing our product, we recognize key assumptions are made that can affect the ability to implement our design; assumption includes:

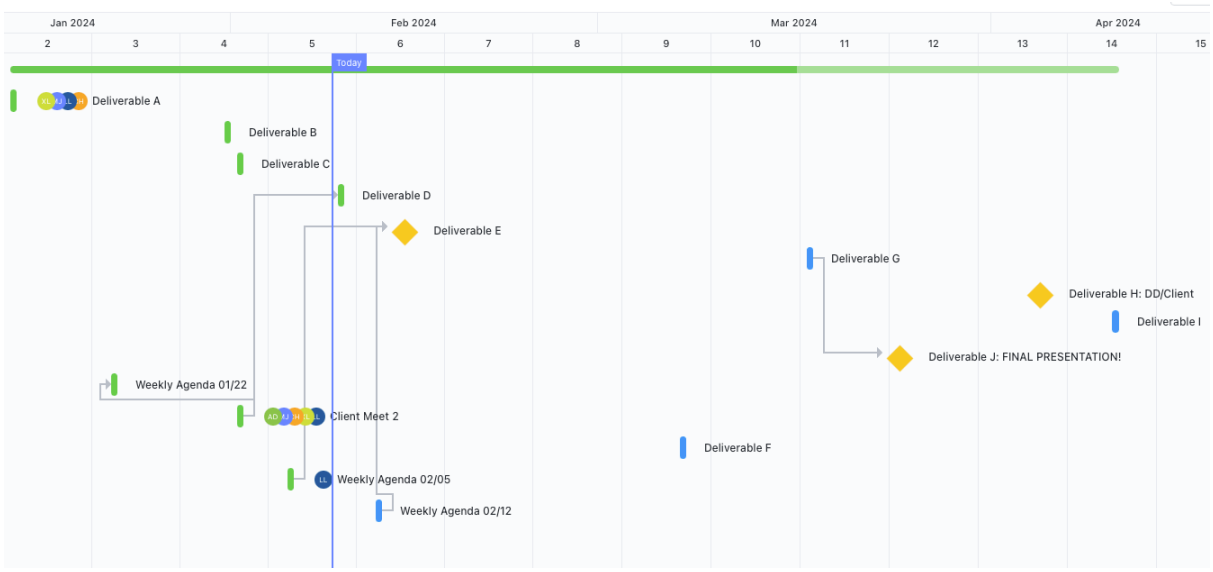
- Supervision: When the client is using our design and playing with Nintendo Switch, ensure assistance is on sight in case the brake on the design isn't working properly or stuck at a certain angle and the assistant is able to adjust the newly designed controller.
- Batteries Life: When the client is using our design, the device is charged before playing with the Nintendo Switch. The client will not be interrupted due to insufficient battery life.

- Safety: The controller's use involves close and prolonged contact with the face, a sensitive area; the design must ensure all materials are safe and non-irritating, with no sharp edges or corners that could cause injury.

6. Bill of Materialsa

Included in Submission as seperate file

7. Project Plan Update



BOM

Project plan update

Add a screenshot of your ClickUp gantt chart.

Non-Functional Constraints:

The first non-functional constraint that will be added to our design is adding soft material on the surface where the user will interact with the controller. Several reasons for choosing soft material include reducing harmfulness to skin, increasing comfort, and increasing grip and control. Continuous pressing on skin, especially the sensitive area like nose, may lead to abrasion and pressure sores. Soft material is less likely to cause these issues due to its gentleness and the ability to spread the pressure evenly on the surface. Comfort is essential when it comes to user interface. Soft material can enhance user experience by providing a more pleasant touch, encourage the use of longer periods without discomfort, and gradually allow user to play with the controller as long as she wishes. Last but not least, soft material offers better grip and control. They can conform to the user's unique way of handling the controller, providing stability and reducing slippage.

Given these considerations, a suitable material for our design is silicone rubber. It is renowned for its softness, sustainability and flexibility. It is hypoallergenic, which reduces the risk of allergic reactions, and can be easily cleaned, an important aspect for devices in close contact with the skin. Moreover, silicone has excellent tactile properties, providing a comfortable and secure grip without being too sticky or slippery.

To accommodate the use of silicone rubber, several changes would be necessary on the present prototype, such as ergonomic shaping and sensitivity escalation. The controller's surface where the nose will interact should have a shallow depression to guide and comfortably fit the

nose, reducing the need for excessive pressure or awkward angles. On the other hand, the buttons should be more sensitive so that applying light pressure is enough for controlling, ensuring any discomfort or soreness happens.

To validate the effectiveness of these changes, we plan to do simulation and user feedback. Inserting the pressure distribution and force exertion when the nose interacts with the controller and building the model in simulation while considering the factor in reality, determine its feasibility. Other than that, engage the prototype to the client; gather the feedback in terms of comfort, durability and overall experience. This is most effective to discover areas for improvement and validate soft material features for intended need.

2.

Constraint:
Given our client's physical limitations, extended use of the controller may result in nasal discomfort or fatigue due to inadequate support or uneven pressure distribution. Moreover, existing controller designs could potentially feel cumbersome or unbalanced, contributing to discomfort and inefficiency during prolonged use.
Change Needed:
Taking these factors into account, silicone rubber emerges as an ideal material for our design. Widely known for its softness, sustainability, and flexibility, silicone rubber offers numerous advantages. Notably, it is hypoallergenic, minimizing the risk of allergic reactions, and its ease of cleaning is crucial for devices in direct contact with the skin. Additionally, silicone boasts exceptional tactile properties, ensuring a comfortable and secure grip without being overly sticky or slippery

Proof:

Collect feedback from clients regarding any discomfort or irritation experienced during prolonged usage. Evaluate pressure points and contact areas on the nose, and conduct usability testing with clients to gather insights.

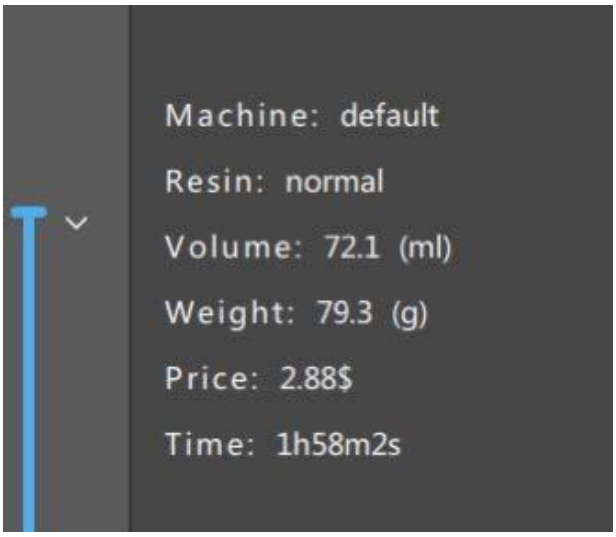
Update:

Integrate soft cushioning materials or contours that conform to the client's nose into the nose pad area of the controller to reduce pressure and friction. Ensure sufficient padding to mitigate discomfort during extended gaming sessions. Furthermore, we have redesigned internal components and adjusted the overall shape and dimensions of the controller for optimal weight distribution.

5

Deliverable G

.1 Economics Report



With the given information from the software, this indicates the volume, mass and estimated price to print every component in our product. The production time is also shown below.

	Material	Labour	Expenses
Direct	Resin, fishing line	Salaries	3D printers
Indirect			Marketing, electricity, overhead,
Fixed			Marketing, electricity, 3D printers
Variable	Resin, fishing line	salaries	
Semi-variable			overhead

3D printers: 4 * 72.5 = $290

Marketing: $15,000

Electricity: $5,000

Overhead: $3,000

1.2 Income Statement:

First year

- Resin: 72ml * 10,000 / 1000 * 67.79 = $48,809
- Fishing line: 0.1 * 10,000 / 475 * 19.66 = $41.4
- Salaries: $120,000

Revenue		20 * 10,000 = $200,000
Cost of goods sold	Reisin	$48,809
	Fishing line	$41.4
	3D printers	$290
Gross Profit		$150,859.6
Operating expenses	Marketing	$15,000
	Electricity	$5,000
	Salary	$120,000
	Overhead	$3,000
Operating Income		$7,859.6

Second year

- Resin: 72ml * 25,000 / 1000 * 67.79 = $122,022.5
- Fishing line: 0.1 * 25,000 / 475 * 19.66 = $103.5
- Salaries: $160,000

Revenue		20 * 25,000 = $500,000
Cost of goods sold	Reisin	$122,022.5
	Fishing line	$103.5
Gross Profit		$377,874
Operating expenses	Marketing	$15,000
	Electricity	$5,000
	Salary	$160,000
	Overhead	$3,000
Operating Income		$194,874

Third year

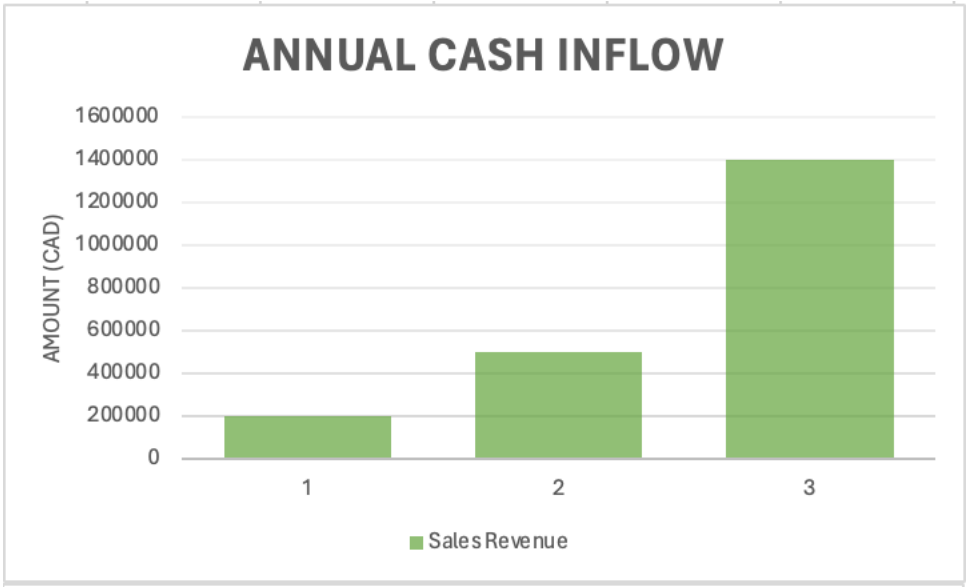
- Resin: 72ml * 70,000 / 1000 * 67.79 = $122,022.5
- Fishing line: 0.1 * 70,000 / 475 * 19.66 = $289.8
- Salaries: $210,000

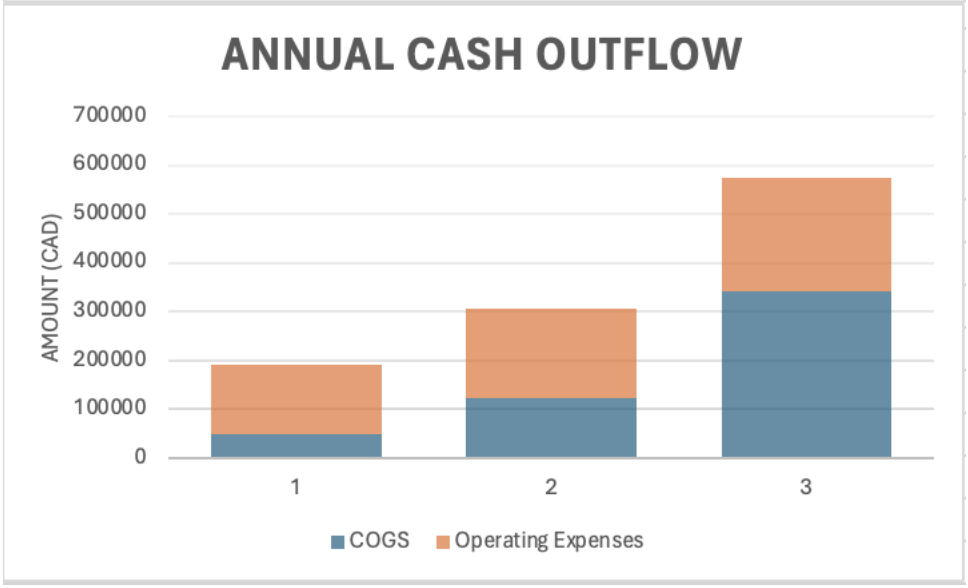
Revenue		20 * 70,000 = $1,400,000
Cost of goods sold	Reisin	$341,663
	Fishing line	$289.8

Gross Profit		$1,058,047.2
Operating expenses	Marketing	$15,000
	Electricity	$5,000
	Salary	$210,000
	Overhead	$3,000
Operating Income		$825,047.2

1.3

Cash Flow Diagram





	first year	second year	third year
Revenue	200000	500000	1400000
COGS	49140.4	122126	341952.8
Operating Expenses	143000	183000	233000
	57000	317000	1167000

Our team brought an adapted Nintendo Switch simulation of our design to market and used NPV (net present value) analysis to evaluate its profitability. Our projects may not initially generate positive cash flows due to the large initial costs involved, but a net present value analysis is critical to assessing their long-term profitability.

With net present value analysis, we can assess the feasibility of an investment by considering the time value of money and discounting future cash flows to their present value. This allows us to make informed decisions about the financial viability of a project and determine the best strategy for achieving long-term profitability.

From the cash flow diagram we get, cash flow is positive and profitable. This result emphasizes the importance of thorough financial analysis in project evaluation.

1.4

Assumptions:

- We assume that our annual sales will follow a very steady growth trajectory over the next three years, starting from 10,000 units in the first year, to 25,000 units in the second year, and to 70,000 units in the third year. This growth forecast is primarily based on market research and expected consumer demand for our products.
- We assume there will be no significant inflation over the next three years, which allows us to maintain stable pricing for our products. This assumption not only simplifies our financial forecasts but also ensures consistency in our cost calculations and revenue forecasts.
- Our production facility is located in one of our teammates' basements, allowing us to significantly reduce overhead costs such as rent and utilities. This cost-saving measure helps us allocate more resources.
- Salaries for production engineers and administrative representatives are included in our financial forecasts. These wages are based on market rates.

- We anticipate that maintenance costs for our production facilities and equipment will be negligible. This assumption is based on our use of quality materials and reliable machinery, coupled with regular preventive maintenance practices to minimize downtime and repair costs.
- Our marketing budget includes expenses related to web development, advertising campaigns, promotional activities and other initiatives designed to promote our products and expand our customer base. By consolidating these expenses into your marketing budget, we can simplify financial planning and optimize marketing strategy for maximum impact.

2 Intellectual Property Report

2.1/2.2

Intellectual Property 1: Patent

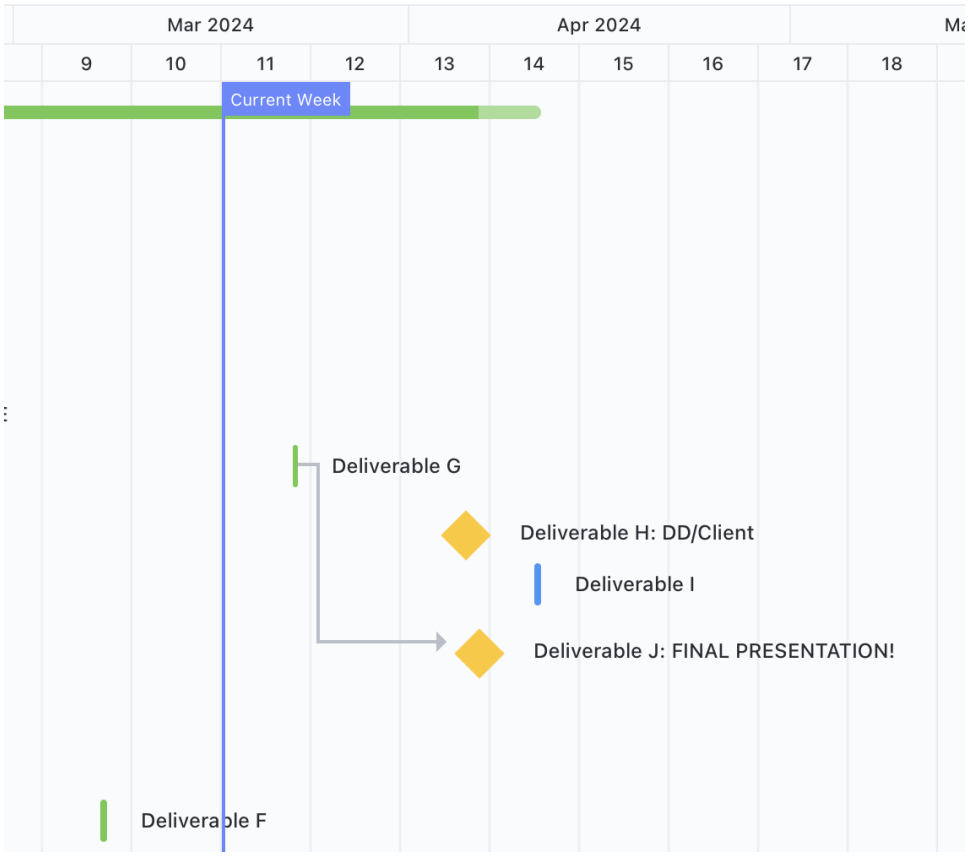
The two common 3D printing machines use either a plastic filament which is extruded and follows a set path or a tub of resin that cures whole layers at a time, for this project we decided to use the latter due to the superior strength of the component. Using a resin 3D printer requires the use of specific resin formulas which can be used in the printer that cure (solidify) in additive layers to form the part. Such a resin requires specific chemical engineering to achieve the proper behaviour at certain wavelengths to be compatible with the printer. Such engineering has already been performed by various firms to develop these resins so it would be suitable for our company to avoid that and rather focus on the product itself rather than the material science.

Intellectual Property 2: Copyright

Once we create a 3D model, our company would hold copyright of that model. This would allow us to have the unique rights to the use of said model and pursue legally any other company who

tries to use our model. This would however not stop other companies from taking our model and making sufficient changes to it so that is classified as a separate identity to ours. So to make the most of our model we should aim to create the best model possible such that any changes made to it would make the product inferior.

.3 Project Plan Update



Conclusions

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

Bibliography

Insert your list of references here.