Deliverable E

Project Plan and Cost Estimate

GNG1103 Lab Section D02

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1. Intro

For this project, we are piecing together the design plan for the grow wall, we are taking the elements discussed by our client and considering some changes to the design to please the indigenous community entirely. Firstly, we are creating a project plan which will include the sketching of the first prototype and the 3D Model of it. We will continue looking for the required materials and an estimated cost for the materials. Furthermore, we will gather the list of equipment necessary for the building of the structure. Additionally, we will create a procedure with the methods of building the grow wall, including all the prototypes, and set up a detailed timeline. Lastly, we will classify the project risks and prepare the tests to consider those factors.

2. Project Plan

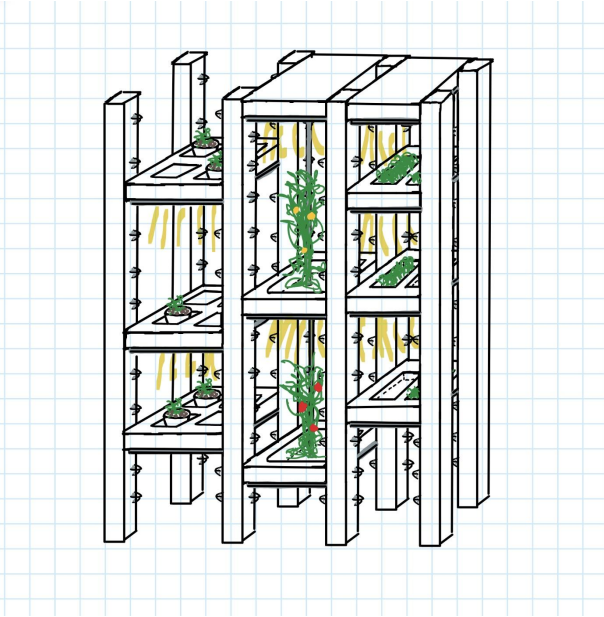
The concept chosen after discussing with the client was the “Modular Garden Shelf”. The clever modular construction of this idea is why it was selected. The following Sketch and 3D Models serve the purpose of giving a rough idea of the future prototype to

2.1. Sketch

The following sketch represents the chosen concept. It consists of multiple wooden beams supporting the main structure.

Nonetheless, the multiple mounting used to hold up the shelves can be seen. There are multiple attaching lugs at different heights over the supporting beams to permit the user to easily modify the height of the shelves to accommodate various plant heights.

To add to the modular shelves, extra supports are added to maintain the growing plants such as vines and various other greenery that need added support.



2.2. 3D Model

3. Cost of Materials

3. 1 Prototype 1 - 3D Printing

Company	Product	Quantity	Unit Cost (CAD)	Total Cost (CAD)	Measurement	Link
N/A	PLA	N/A	N/A	N/A	N/A	N/A

Total Cost : $0

3. 2 Prototype 2 - Laser Cutting

Company	Product	Quantity	Unit Cost (CAD)	Total Cost (CAD)	Measurement	Link
Alexandria Moulding	Hardboard	1 sheet	$13.86	$13.86	⅛” x 4’ x 4’	https://www.homedepot.ca/product/alexandria-moulding-1-8-inch-x-48-inch-x-48-inch-hardboard-panel/1000132235?rrec=true

Total Cost : $15.66

3.3 Prototype 3 - Final Design

Company	Product	Quantity	Unit Cost (CAD)	Total Cost (CAD)	Measurement	Link
Paulin	Hex Head Cap screw	16	$2.51	$40.16	⅜ x 4½”	https://www.homedepot.ca/product/paulin-3-8-inch-x-4-1-2-inch-hex-head-cap-screw-zinc-plated-grade-5-unc/1000123502
Paulin	Hanger Bolt	44	$0.31	$13.64	3/16 x 2”	https://www.homedepot.ca/product/paulin-3-16-inch-x-2-inch-hanger-bolt-carbon-steel/1000150440
Paulin	Fender washer	32	$0.59	$18.88	⅜”	https://www.homedepot.ca/product/paulin-3-8-inch-fender-washers-zinc-plated/1000132228
Paulin	Flat Head Square Screw (500 pc)	1	$20.87	$20.87	6 x 1⅝”	https://www.homedepot.ca/product/paulin--6-x-1-5-8-inch-flat-head-square-drive-construction-screws-in-yellow-zinc-500pcs/1000174531
Everbilt	4 Hole Corner Brace (80 pc)	2	$25.21	$50.42	1 - ½ ”	https://www.homedepot.ca/product/everbilt-1-1-2-inch-zinc-corner-brace-80-pack-/1000773660
Paulin	Hex Nuts	16	$0.26	$4.16	⅜ - 16”	https://www.homedepot.ca/product/paulin-3-8-inch-16-finished-hex-nut-zinc-plated-grade-5-unc/1000123459
Norbord	OSB	2	$17.48	$34.96	7/16” x 4x8’	https://www.homedepot.ca/product/thd-7-16-4x8-oriented-strand-board/1000108771
MicroPro Sienna	Pressure Treated Cedar	8	$17.62	$140.96	4” x 4” x 8’	https://www.homedepot.ca/product/micropro-sienna-4-x-4-x-8-pressure-treated-wood-post-suitable-for-ground-contact-/1000790178
DAP	Dynaflex Ultra Exterior Sealant (300ml)	1	$11.27	$11.27	N/A	https://www.homedepot.ca/product/dap-dynaflex-ultra-advanced-exterior-sealant-brown/1001523845
MicroPro Sienna	Pressure Treated Cedar	5	$14.32	$71.60	2” x 4” x 12’	https://www.homedepot.ca/product/micropro-sienna-2-x-4-x-12-pressure-treated-wood-above-ground-use-only-/1000789775

Total Cost (Tax included (13%)): $459.82

4. List of Equipment

Below is a list of the necessary equipment for the construction of the structure depending on each prototype:

4.1. Prototype 1: 3D printed Model

- Solid works/On shape program
- Computer
- 3D printer

4.2. Prototype 2: Laser Cut Model

- Laser Cutter
- Inkscape
- PPE

4.3. Prototype 3: Final Project

- Panel saw
- Miter saw
- Drill
- Chisel
- Basic tool set
- Garden shovel
- Chalk Line
- Tape measure
- Carpenter's Level
- PPE

5. Grow Wall Prototype Instructions

5.1. Prototype 1: 3D Printed

The first prototype will be 3D printed out of PLA. This version of our grow wall will be similar to our design but on a smaller scale. Here are the steps we will take to create the mini grow wall:

1. Design a 3D model of grow wall on On-Shape or Solidworks referring to the final design sketch.
2. Download the file as STL onto a USB

3. Upload the USB file to a 3D printer and set fill to 50% fill.
4. After the mini grow wall is printed use a file to sand off any sharp edges.

5.2. Prototype 2: Laser Cut

After modifying the original sketch/design, we will create a new prototype using materials closer to what the final project will look like. We will use thin hardboard to resemble the final design, which will be a medium size, approximately a foot in length. The steps to completing the prototype are as follows:

1. Sketch the dimensions for each part of the grow wall including the frame, supports, shelves and boxes on paper.
2. Draw the finalized sketch on Inkscape, all the parts must be on one page so they can be printed all at the same time.
3. Download the file as an SVG to a USB
4. Upload USB to laser cutting computer.
5. Follow laser cutting instructions to set up the job.
6. After parts have been cut, assemble with wood glue and let dry overnight.

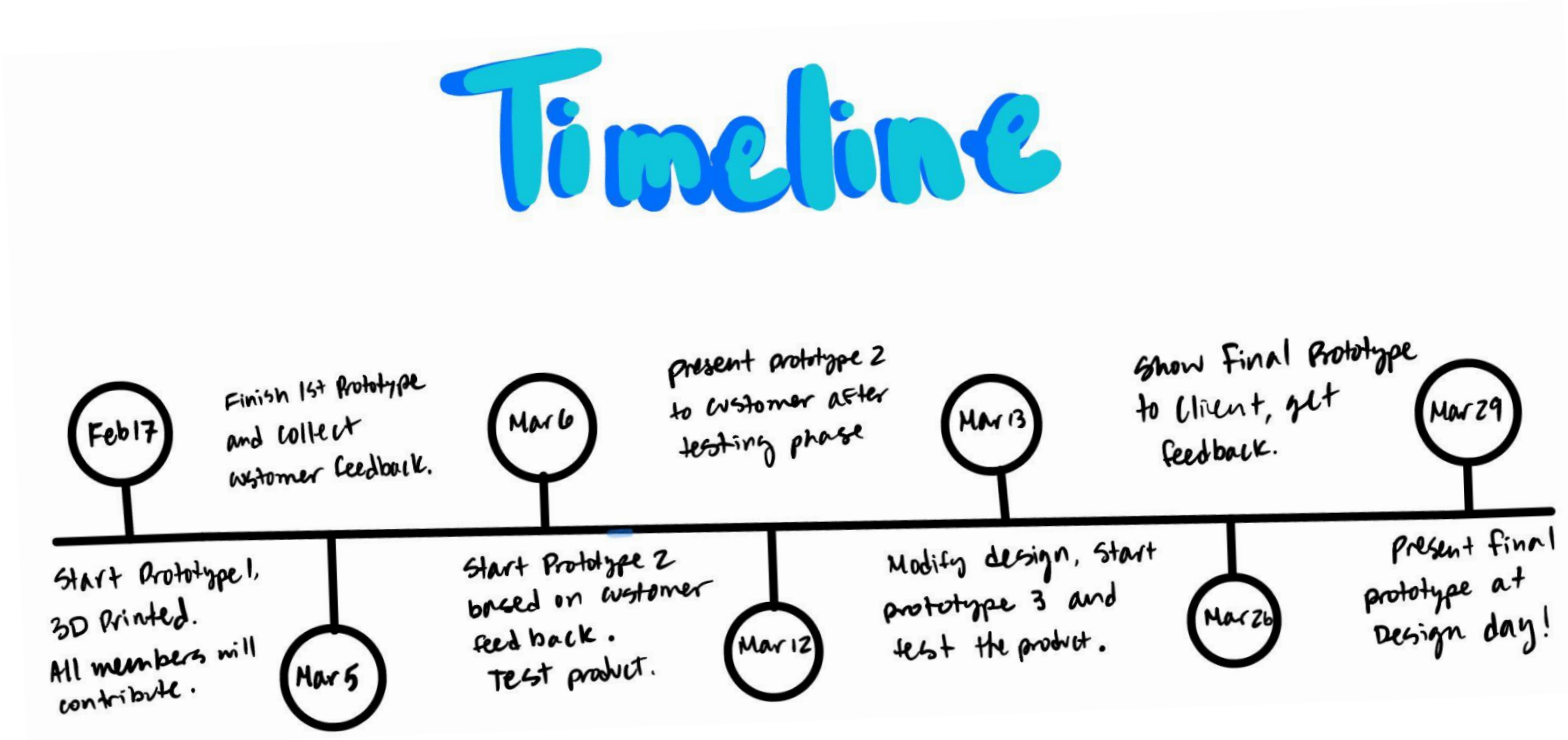
5.3. Prototype 3: Final Full-Size Wood

The final prototype will be life size which is 6x8 ft. The project will be made out of wood, and the list of materials can be seen in Section 3.3 as seen above.

1. Gather materials and personal protection equipment (PPE).
2. Cut the 16 beams to size.
3. Drill holes for lap joint
4. Mark where brackets will be placed
5. Screw brackets into post
6. Cut wood for shelves
7. Drill cut planks together into a square using L brackets
8. Screw the plywood of the sides into the bottom of the box with a hand drill.
9. Mount shelves onto beams.

6. Project Timeline

In order to stay on track with our project we will follow the timeline below. Everyone is responsible for a piece of the project so we will work together to make the project come together properly.



7. Project Risk

We will include all critical risks and solutions for our design. The critical risks will include the risks and possible issues involved in building that design. The solutions will provide possible solutions in case of a need when those issues occur. Starting from prototype one, all the way to the final prototype.

7.1 Critical Risks

7.1.1. Prototype 1: 3D printer design

#	**Risk**	**Explanation**
1	Malfunction of equipment	The 3D printer does not work correctly and some input or output item does not work as intended.
2	Incorrect Design input	The Input Design is incorrect in size or proportion.
3	Equipment Failure	The mechanics of the platform breaks and breaks down the 3D printer.

7.1.2. Prototype 2: Laser Cutting Design

#	**Risk**	**Explanation**
1	Malfunction of equipment	The laser cutter does not work correctly and some input or output item does not work as intended.
2	Incorrect Design input	The Input Design is incorrect in size or proportion.
3	Equipment Failure	The laser malfunctions and goes rogue. Burns material.

7.1.3. Prototype 3: Final Design

#	**Risk**	**Explanation**
1	Malfunction of equipment	The mitre saws do not work correctly and some item does not work as intended.
2	Equipment Failure	The mitre saw machine breaks and shards fly everywhere
3	Equipment management	The huge poles can be difficult to manage and can harm the person in use.

7.2. Contingency Plan

7.2.1. Prototype 1: 3D printer design

#	**Solution**	**Explanation**
1	Equipment check	Check prior to using the equipment to make sure all parts are working perfectly and there are no possibilities of errors.
2	Confirming Design	Double check the design prior to having the 3D printer building process begin.
3	Safety Precautions	Have safety gear on at all times and make sure an expert is in the vicinity to reach out in an emergency.

7.2.2. Prototype 2: Laser Cutting Design

#	**Risk**	**Explanation**
1	Equipment check	Check prior to using the equipment to make sure all parts are working perfectly and there are no possibilities of errors.
2	Confirming Design	Watch as the laser cutting process occurs to make sure that the design is being inputted correctly and that there are no errors.
3	Safety Precautions	Have safety gear on at all times and make sure an expert is in the vicinity to reach out in an emergency.

7.2.3. Prototype 3: Final Design

#	**Solution**	**Explanation**
1	Equipment check	Check prior to using the equipment to make sure all parts are working perfectly and there are no possibilities of errors.
2	Safety Precautions	Have PPE on at all times while in the lab and have a supervisor around at all times in case of an emergency.
3	Safety transportation system	Whenever working with larger materials, always work with for another person and prioritize safety at all times.

8. Conclusion

To summarize this project, the first prototype is due on the 5th of March and will mainly be built using a detailed design and a 3D Printer to create the model. This method is super cost–effective, which is ideal for a first prototype. After this, depending on the client's feedback and satisfaction, the proper changes will be made to ensure the proper design criteria is met and the creation of the final design is successful.