Deliverable G

Prototype 2 and Test Plan

GNG 1103 Lab Section 8

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Table of Contents

1. Introduction

For this project our team will be working on the development of the second grow wall prototype. With the valuable feedback and input from our client on the first prototype, we aim to create a more refined and effective solution. To bring the concept to life and ensure its feasibility, we have opted for hand-drawing the prototype design. We are thoroughly examining each component of the prototype to meet and exceed our client's expectations. To accurately assess the prototype's performance, we have focused on a specific area of the greenhouse and are meticulously recording our observations and measurements. Our objective is to deliver a functional and optimized grow wall prototype that meets the highest standards of quality and efficiency.

2. Prototyping

2.1. Prototype 1 Results

Following the test plan for prototype 2, we concluded many results. Firstly, when we added weight to the structure the brackets did not hold properly and the beams on the box buckled under the test. The test did not last more than a few seconds which is a sign that it is not a strong structure. Here are the testing pictures.

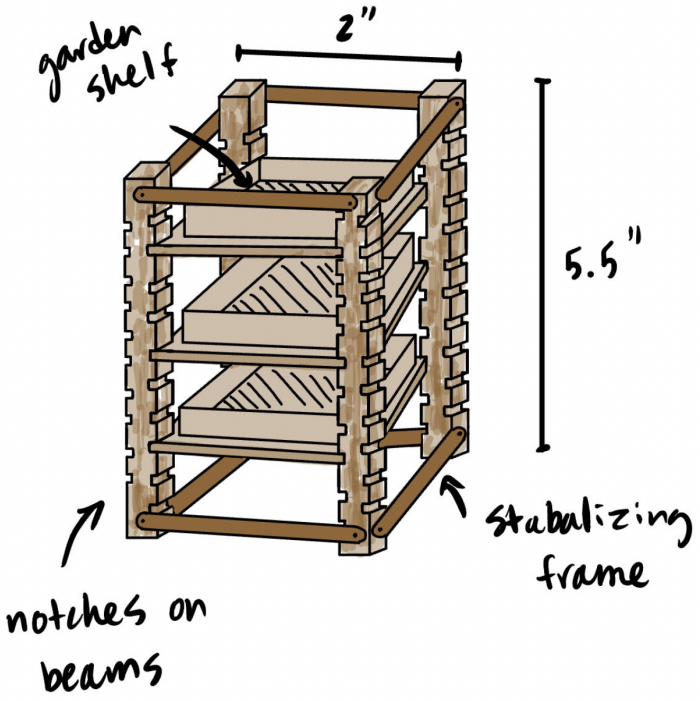
Table 1: Prototype 1 Test Results

Before Test	After test	After test
		

It is evident that we need to redesign the connection of the shelf to the beams because we need the structure to last at least 10 years in the community centre. We also want to ensure that the structure will not break and harm anyone in the centre.

2.2. Prototype 2 Sketch

For our next prototype we are planning to create a staggered slot system for increased user accessibility and increased strength. Prior to this new design, we were going to use bolts to screw in the plant shelves which is a hassle to remove and re-adjust the height. It has also proved to be a weak connection therefore we need to engineer a new plan.



2.3. Prototype Plan

The plan for prototype 2 includes the construction of a full-size section of the shelf as depicted above in section 2.2. There will be four beams and we will construct notches in the beams to allow the shelves to be supported without hardware.

After speaking with our professor he suggested that sawing notches into 4x4' beams is not advisable. It will ruin the structural integrity of the beams so we brainstormed with him to create a new idea.

We will instead use 2x4 wood beams and stagger equal drilled segments of wood with space in between that will fit a garden box. The beams will be secured together by a frame at the top and bottom of the structure. Here is why this idea is improved from our last prototype:

- Upgraded user accessibility
- Increased safety measures
- Longevity of design
- Using more widespread materials (2x4 beams are easier to replace than 4x4)

3. Analysis and Feedback

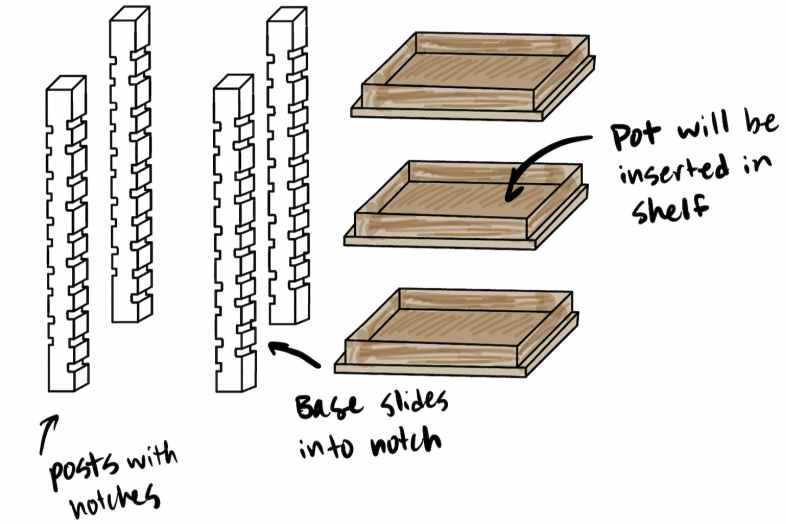
3.1. Analysis

After having performed our planned tests for prototype 1 as well as being able to present more ideas to our client, we have most definitely learned some things in regard to our outlined plan for this project. Firstly, making our smaller 3d prototype did allow us to envision our project but it did not help much with problem identification. Although, we did learn much during our shelf strength test. It was discovered that when different weights were added on top of the shelves, the brackets would begin to fail and cause the shelf to fail out of place from the post. It was initially assumed that this would not be the case and therefore it was concluded that the brackets were not strong enough and needed to be replaced. The wood of the shelves did succeed as assumed, having no signs of deformation or breakage. It was concluded that since the wood performed efficiently and also is within the scope of our budget, it will be used in our next and final prototype.

3.2. Customer Feedback

Our team recently spoke with the client at our client meeting. We went over each aspect of prototype 1 which was our comprehensive model of the 3D plant shelf that we had made. We also explained the test plan that we had put together and have executed as of now. The test results are in section 2.2. She was impressed with the progress we had made and is excited about the next prototype.

We showed her our projected design for prototype 2, which can be seen below.



The client was impressed by our aptitude for user accessibility and thought this was a great idea to implement. She gave us some more feedback about how great the design will be for the community center and that the sliding shelves will be perfect for the growing wall. We will stick to the same idea of sliding shelves but the beams will look slightly different since we will be using stacked 2x4s as concluded in section 2.3 of the prototype 3 plan.

4. Test Plan

Having completed the production of our first prototypes as well as their respective tests, we have obtained knowledge on successful and unsuccessful ideas from the trial that will be cut and/or adjusted for our next prototype. The following is a list of tests stemming from the successes and failures of our previous prototype that will be used in our 2nd prototype.

Test ID	Test objective	Prototype and test method	Results to be recorded and use	Test duration and start date
1	Evaluate if the new mounting system is efficient and strong enough to support design.	The prototype used will be a physical, fully functional, scaled shelving subsystem from the final prototype. Each shelf will be slid in and out of each slot between the posts. The movement will be done slowly then once the shelf is in, it will be slid back and forth before being removed.	The results to be recorded will be whether or not the shelves slide easily into the different slots. The overall smoothness of the fit as well the moveability in the slot will be recorded. In hopes of having a balance between smooth sliding and rigid holding once in place, the results will be used to tailor the shelves and the slots to meet these requirements.	Test date will commence once fully scaled shelving subsystem is built. Test duration is from 1 - 1.5 hours
2	Evaluate the strength capacity of combined shelf, mounting and post components to view overall efficiency.	The prototype used will be the scaled shelving system. Different shelving combinations will be slid into the subsystem and with each combination, varying weights will be placed on the edges and centers of each shelf as well in varying combinations. This ensures that the maximum numbers of cases are tested.	The results to be recorded will be the failure of any shelves if failure occurs. Each combination will be visually analyzed for about 1 min. The test will stop at the first step of deformation of any area on the structure or when the time duration is met. The results will be used to pinpoint possible inefficient combinations and make potential adjustments to specific areas / components of the design.	Test date will commence once fully scaled shelving subsystem is built and **Test ID 1** is performed. Test duration is from 2 - 2.5 hours

4. 1 Mathematical Capacity

Following shown is the mathematics for the estimated weight on the shelf subsystem.
Values with a star (*) are ones that have been calculated in previous deliverables.

DATA	CALCULATIONS
Mass Capacity / Shelf * = 28.3168 kg	Mass Capacity for full frame (m) :
Mass of Hydroponics System* = 18 kg	3 x 28.3168 kg = 84.9504 kg
Number of Shelves / frame = 3	
Safety / error adjustment = 1.25%	

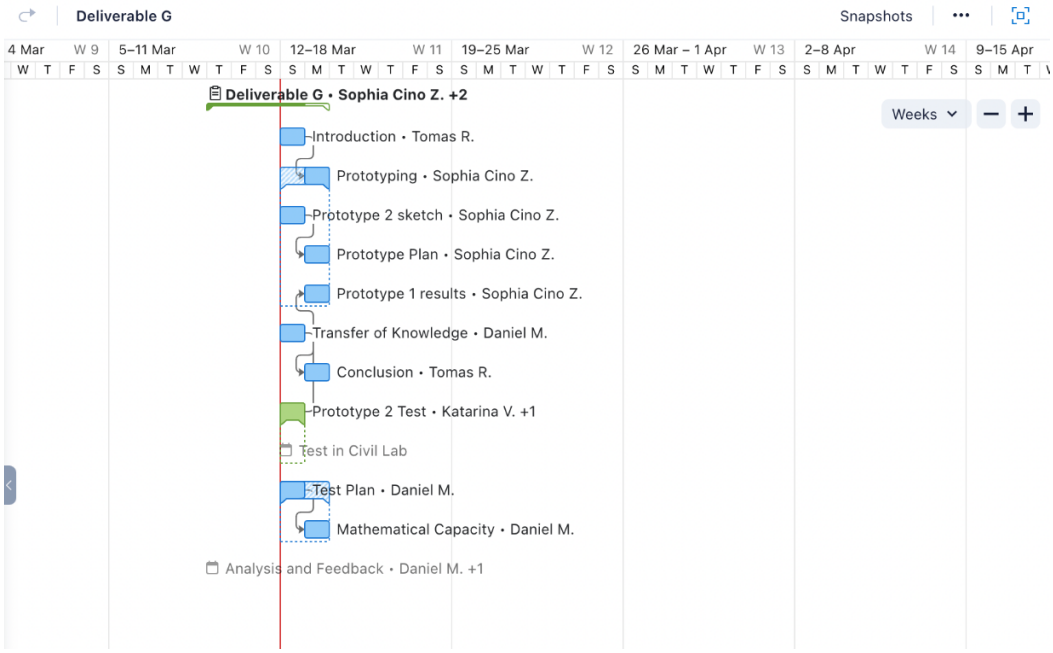
Total estimated mass on frame subsystem : (84.9504 kg + 18 kg) x 1.25% safety = 128.688 kg

- We can therefore conclude an estimated load of at most 129.688 kg on each singular subsystem frame

5. Transfer of Knowledge

Having been able to learn from previous deliverables as well as completed tests from our first prototypes, we have been able to use our experiences and knowledge to begin construction on our 2nd phase of production: Our 2nd prototype. Through testing and trialing, we have been able to further refine our skills in problem-solving, generating ideas, and communication with ourselves and the client.
Using these skills have allowed us to develop an even more focused test, and production plan all towards the creation of our 2nd prototype.

6. Wrike Plan



Here is the Wrike link for this week's group work:
https://www.wrike.com/frontend/ganttchart/index.html?snapshotId=v0HdcA0Ha9qL8h1ZpVgsFuhfaDTzCovi%7CIE2DSNZVHA2DELSTGIYA

7. Conclusion

In conclusion, our team is committed to delivering a high-quality and optimized grow wall prototype for our project. With the feedback from our client, we took all necessary steps to ensure that the second prototype is a refined and effective solution. Our focus on building the prototype design and thoroughly examining each component helped us bring the concept to life and ensure its reliability. Our objective is to deliver a functional and optimized grow wall that meets the highest standards of quality and efficiency, and we are committed to achieving this goal. Overall, we are progressing with our project and getting prepared for the final outcome of our efforts.