Project Deliverable G: **Prototype II and Customer Feedback**

GNG 1103 – Engineering Design

Faculty of Engineering – University of Ottawa

Divine Ciroma-(300110246)
John Zhou-(300066864)
Omolola Omowa-(300130234)
Magd Abdelmelek-(300068369)
Saad Rana-(300137756)
Brian Zhau-(300128528)

Vedashri Patil

GNG1103(D): Winter 2020

15-03-2020

Table of Content

Abstract

This deliverable focuses on the prototype II test plan based on the outline provided in "Lecture 11 – Prototyping Test Plan", and it shows our justifications and reasoning for this prototype, which include a short description of our results from prototype 1 and how our second prototype continues to improve our solution. The report will present some standard objectives which will make sure whether or not the test plan is achieved. Furthermore, the objectives will include feedback from the client, establishing feasibility, analyzing critical subsystems or reducing risk and uncertainty, and defining a stopping criterion on prototype 2.

Introduction

Prototyping is the most essential part of any designing project. It allowed us to incorporate solidifying ideas in the first test plan, which ended up being a success, and it also helped us to figure out what did not work and what was required by the client to make the project a favourable outcome. This deliverable would present how the team has been able to make alterations to the preceding prototyping test plan and how we developed it to help us achieve the objectives we needed.

Prototype 2

Some improvements that were made to prototype I includes a design that accurately displays the pieces of the greenhouse. While constructing prototype 1, we realized that there should be more structural support in the walls and roof. We were considering, based on the prototype to

keep the gambrel roof design in order to help reduce the risk of the roof collapsing under snow weight and reduce the budget since we are reusing the wood that has been cut off from the walls. In order to fully visualize the second prototype, shown in *figure 1* below; we used more popsicle sticks at the roof and cardboard at the bottom of the wall that had already been glued together to show the support that needed to stabilize our structure. Moreover, we used a small transparent plastic bag to show that the material we chose to use for our roof and walls will be translucent, which allows sunlight to easily enter our greenhouse.

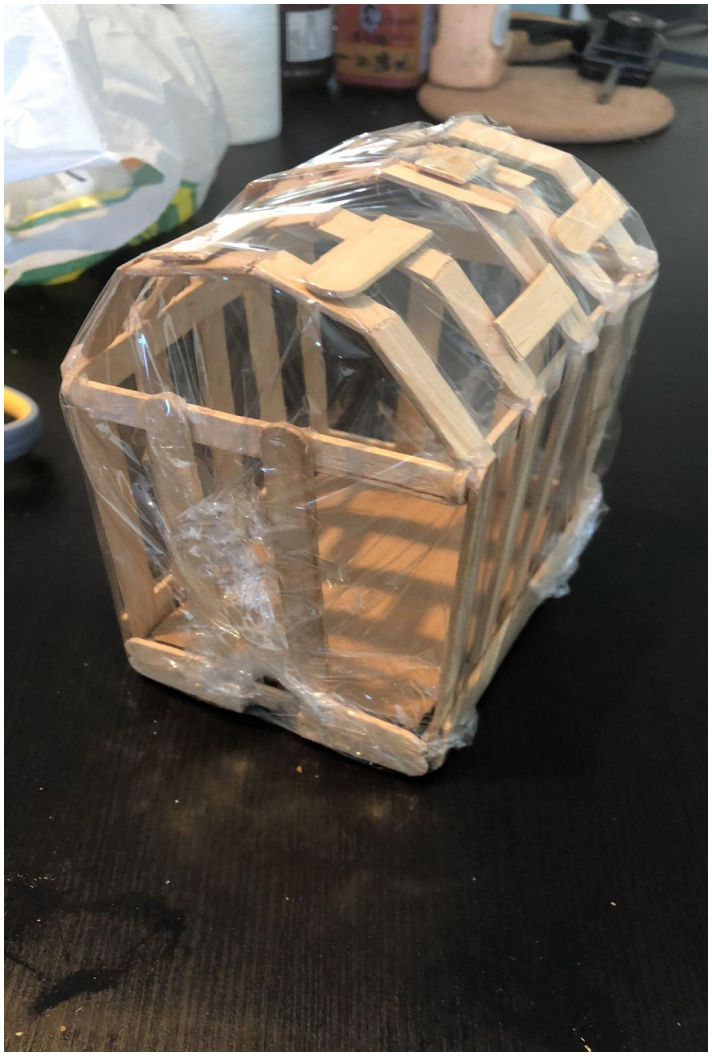

Figure 1: Front View of Prototype 2

The limitation of this prototype was proposed by the oversimplified materials used and the small scale at which it was constructed. Some of the limits include a lack of representation of all materials included in the actual design, the structural reinforcements that will be included in the final design, and the hydroponic system that includes the gutters. Constructing a scaled prototype of our design gave us a much better understanding of the greenhouse, and it helped us to realize a few aspects of our design that could use some refining.

In this coming week, we will focus heavily on physically testing the building as a whole; including the foundation, the transparent material wrapped around the house would also be tested to make sure it is airtight, the copper mesh added of the base will be tested to make sure it is safe for children and rodent protected. Moreover, we would ensure that the hydroponics team design works perfectly well, the roof would be tested for any leakage and the Gantt chart would be updated to show more precision in the tasks we completed and the ones we are yet to complete.

Prototype Test Plan

What:

The second prototype was built using popsicle sticks and cardboard bought from the dollarama store and put together using adhesive, which all cost 25 dollars. The purpose of the second was to test our concept indepthly and provide further evidence on the overall structure. The design represents what the actual design would eventually look like as much as possible. In this case, our focus is on the stability of the walls and roof, so we observed the material by using our hand to apply force on the roof, and our observation shows that adding small popsicle sticks on our

greenhouse give more stability. The prototype II is a miniature scale design compared to the final greenhouse that would determine if we need more support to our greenhouse, which will be presented on design day because it helps to visualize better and gives a clearer picture of what the structure would look like after the project is completed.

Why:

In the winter, the roof must be able handle heavy snow. We should make sure the structure is strong enough. One of the most critical features we wanted to test was how stable the gambrel roof design and the walls were to hold the weight of the snow and also to ensure that the snow and water will slide off the roof instead of staying and covering the ceiling. During the construction, we added more wood between each frame of the roof, as shown in *figure 2* below, to make sure that weather resistant roofs are able to withstand extreme weather conditions such as extremely strong winds.

Using our Engineering knowledge, Some general rules about structural stability: the lower the center of gravity, the more difficult it is to make a structure topple over and the base wider, then the more stable the structure is. Moreover, since the gambrel roofs provide excellent drainage because of its steeper slope design, it can easily manage the rainfall the best, as the water simply runs off of the side of the building without getting captured. The greenhouse should be looked after, with extra care as any serious issues with the foundations can lead to a permanent damage of the design. Therefore, the plan right now is to improve the structure, so as to save a lot of expenditure in the long run.

Figure 2: Top View of Prototype 2

When:

The second prototype was built one 13th March, 2020; two weeks before the design day of the main physical greenhouse in the structure lab. The prototype allowed us to clearly adjust our main design and decrease any risk or uncertainty during *design day*. With this Prototype II

complete, we now have a clearer view of what we are designing with no unexpected interior measurements.

Stopping Criteria:

The stopping criteria helped us to acknowledge when was the right time to stop (i.e when our target was successful enough), to when was the right time to stop. To be completely satisfied with the testing objective we would carry out a strength test to examine if there is enough stability in the gambrel roof design and walls to make sure that our greenhouse is fully functional. Once we have applied enough force to our roof and walls, we can conclude that the testing objectives were achieved, then record down the weight of the force needed and finally stick the roof permanently to the rest of the greenhouse.

Feedback

On the 13th of March 2020, we met again with the client to discuss the construction of the greenhouse. We were able to show the client some pictures of our design, which we have accomplished so far and ask for her opinion and feedback. The client shared with us potential improvements and liked the material we used, shown in figure 3 below, to stop the rodents from entering the greenhouse, which was adding plywood on the bottom with copper mesh all around the base of the greenhouse. Copper mesh is a wire mesh-like barring material that is used as a physical barrier to prevent rodents from entering through tight spaces around it. Also, our client encouraged us to have gutters for rain removal, precisely from the roof.

Figure 3: Side View of Prototype 2

Conclusion

Prototype II fills in as an enhanced disposable model made to comprehend the fundamentals of the design before the plan continues further. As it were, prototyping is a task trial. It is a significant part that would ensure our customer the best accomplishment toward the

finished project. The primary goal of this project is to make our client cheerful and keep her fulfilled; we will guarantee this by constantly including her with all the perplexing subtleties of the proposition. With the model, our customer had the opportunity to see and cooperate with a working model of the task, give her prompt input, demand venture changes, and modify model particulars. Taking everything into account, the model helped us to decide early what precisely the customer needs and what we have to alter in our plan with quicker and design specifications. In conclusion, the modified prototype has helped us detect problems earlier and know what exactly the client requires to be adjusted in the design specifications.