Report of Prototype 3

GNG 1103-A01

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Table of Contents

Introduction

This document outlines the groups creation of prototype three and the associated tests and design changes. Prototype 3 is the final prototype and includes all key components of the design. The group used previous prototypes and client feedback to improve the working design and finish the complete solution with a physical prototype showcasing the groups work thus far.

Prototype 3

Critical components

For the physical prototype, its construction was intended to be a faithful interpretation of the software models. Yet, there were some material constraints, such as finding a way to mimic the tempered panels of the greenhouse. Nonetheless, this was where the creative liberty we discussed in the previous analysis played its part. We settled on assuming the empty spaces between the frames could just act as “panels”. Moreover, with a physical prototype we were able to incorporate finer details such as popsicle sticks on the walls to imitate what would be wooden texture on the actual building. Although, a constraint that was out of our reach had to do with the 3D printing of the furniture and appliances. Evidently the choice for these vibrant colors may seem like an inconsistency with reality within the building, but we had to make do with the limited color

Client feedback

Client feedback that would have changed the prototype layout has been mostly scarce, which informs us that our prototype has effectively met a serviceable standard. However, one suggestion was that we opt for a dehydrator as opposed to a dehumidifier, and thus we proceeded to expedite its inclusion into our physical prototype.

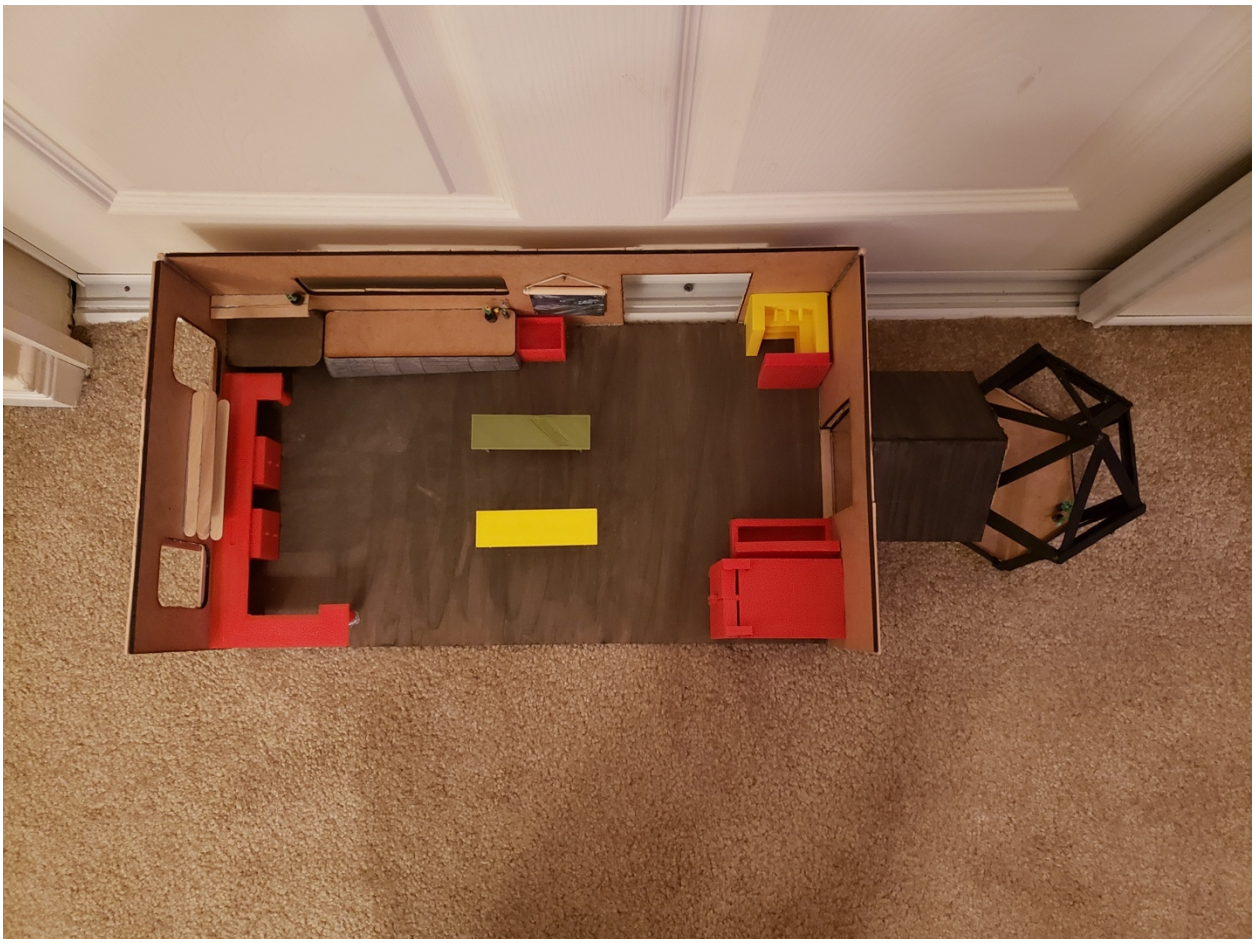
Design updates

Based on the client feedback, the group decided to add a space for a dehydrator. It was also decided that the roof should be made slanted to accommodate for the weather, and to create a less industrial-like appearance for the exterior design. These were the only changes made to the design at this point.

Creation of the prototype

Prototype 3 was created in separate components, which were then pulled together to create the fully functioning prototype. The floor, walls, and roof were laser cut using MDF, and then popsicle sticks were used to imitate exposed lumbar for the exterior design. The greenhouse was also made with popsicle sticks. The inside components were a combination of 3D printing, the use of construction paper, and paint. The shingles on the roof were also made with construction paper. The group decided to use glue to pull the component together as the MDF is too thin to allow the use of nails, and there was limited access to other materials.
It was decided by the group to exclude one wall to allow easy visualisation of the interior components of the building. A detachable roof was also included to allow this.

Visuals of Prototype 3



Testing Prototype 3

Test plan for prototype 3

ID	Design Specification	Verification method
1	Exterior of building is aesthetically appealing	Survey
2	Interior of building is aesthetically appealing	Survey
3	Building is usable	Usability heuristics
4	Building meets basic safety standards	comparative

After the completion of the prototype, the group showed it to 5 people, and took a survey to assess the overall design.

The following questions were asked, based on the visuals of prototype 3 shown above:

1. On a scale of 1 to 5 (5 being the highest), how much resemblance does the exterior of the building share with a typical industrial building?
2. On a scale of 1 to 5 (5 being the highest), is the exterior design of the building aesthetically pleasing, from a point of view which values connection to nature?
3. On a scale of 1 to 5 (5 being the highest), is the interior layout of the building easy to navigate for people with low lab experience?
4. On a scale of 1 to 5 (5 being the highest), does the building look like it has enough space for three people to comfortably work?

Our results from the surveys were favourable, with an average rating of 3.5-4 overall. This demonstrated to the group that the building design fit the criteria and needs of the client regarding physical appearance.

Usability analysis

User analysis

Users	Usage	Lab experience
Guardians	High	Intermediate
General Public	Low	Low
Owner	Intermediate	Intermediate

Analysis of components being used

Building component	Level of Usage
Tables	High
Storage	High
Doors (including garage)	High
Greenhouse	Intermediate
Computer stations	Intermediate

Usability Heuristics

ID	Usability Heuristic	Criteria met	Building Components
1	Visibility	yes	all
2	Similarity	yes	Floor plan is easy to navigate, has similarity to 'typical' lab floorplans
3	Control & Freedom	yes	Mobile tables, counterspace, open spaces
4	Error Prevention	yes	Safety standards
5	Error Handling	yes	Safety standards
6	Consistency	n/a	
7	Recognition & Recall	n/a	
8	Flexibility & Efficiency	yes	Mobile tables, storage spaces
9	Aesthetic & Minimalist	yes	Exterior and interior designs are simple
10	User Help	n/a	

Results of usability analysis

Based on usability the analysis, the guardians will be the main users of the building, and the main components used will be the tables and storage spaces. As such, these components have been optimised to fit their frequent use. Based on the client information, the group assumed that all the users will have intermediate or low lab experience, and analysed the design based on this assumption. It was concluded that the floor plan was simple and easy to navigate, and that the exits were in open areas which allow quick use in the event of an emergency.

Failure Analysis

Component	Possible failure	Results of failure	Failure prevention method
Storage	May not have enough, not large enough	No place to store equipment, specimens, etc.	A wide range of storage spaces, including many different sizes, were added
Freezer and fridge	May stop working, may not be large enough	If they stop working, items stored inside may soil. If they are not large enough, items cannot be properly stored and may soil	New freezer and fridge will be purchased from reliable company
Garage opening	May allow too much water into the building	Flooding, water exposure to equipment/objects in lab	Drain in the floor
Tables	May not move when needed	Personnel will have trouble moving table	Table wheels will be chosen such that they can support the necessary load

Conclusion

Overall, prototype 3 was a success for the group. The prototype was finished on time, and all critical components and design specifications were included. The previous prototypes aided a great deal in the construction for this prototype. The first prototype was an online 3D model of the finished product, which helped the group visualise what the final building should look like. The second prototype was a skeletal model of the building, which allowed scaling to be tested, as well as testing for area size, and building layout. The final prototype (prototype 3) is the culmination of these prototypes and tests and continues to develop the groups solution to a plant processing building through a deeper understanding of the client, and continuously improving design.