Deliverable H-Final Project Update

University of Ottawa

GNG1103-D03-C5
03/24/2020
Professor Muslim Majeed

Presented by :
Aleksandar Plackoski, 300074474
Joshua Coutinho, 300117908
Carter Ingalls, 300114073
Adrian Fournier, 300062441
Xinyan Jiang, 300049676

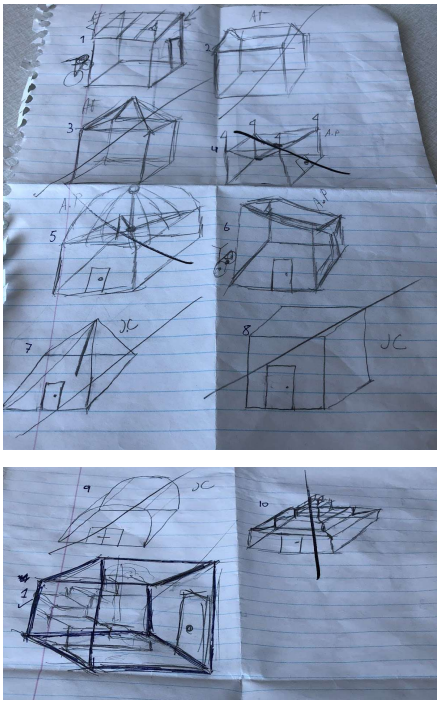
Introduction

For this project, we were tasked with constructing a sturdy greenhouse that would be able to withstand anything the weather throws at it. Our client, who lives in a rural northern community, asked us to construct a greenhouse that would be able to grow crops all year given that access to food isn't always easy and is hard to cultivate due to very sandy soil and unpredictable weather. Through working with the client, we were able to generate ideas, create and test our designs to manufacture the best possible greenhouse for their needs. These needs include a transportable, weather-resistant greenhouse that can feed up to five people while needing minimal maintenance, being self-powered, and automatically watered. The greenhouse should be low-cost while remaining easy to use. In this report, we will outline in great detail our designs, design process, prototypes, construction process, and our next steps for future improvements.

Design

Conceptual Design

We started off with coming up with many creative designs to fulfill the needs that were required. After brainstorming ideas we ended up coming with 10 designs that we could use as our greenhouse.



Figures : Conceptual Designs

After looking over all 10 of the designs we narrowed it down to two designs; these being the one with that slanted roof and the castle with flags. We ended up going with the design with the slanted roof, as the other design had some possibly problematic flaws, such as the roof holding too much rain causing it to leak or collapse. The slanted roof design allowed for easy water collection, easier building and required less material compared to the castle with flags.

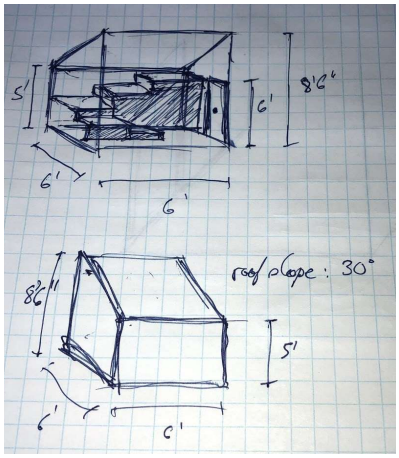


Figure : Sketches of greenhouse with slanted roof

Prototype I

After choosing the design, a prototype was created to better communicate and understand our chosen design. We created our first prototype with paper to give a very general idea of the shape of our greenhouse while making it easy and inexpensive to reproduce.

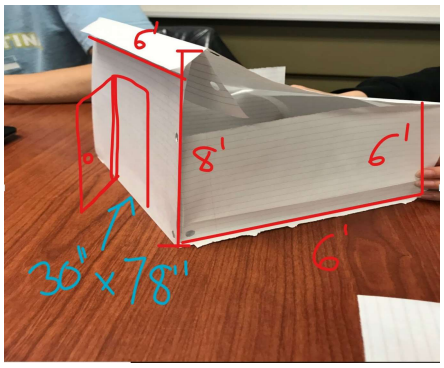


Figure : Prototype I

With the prototype we can see the general shape of our design and make changes to the design based on what we fit. However, after seeing our prototype we decided to continue on with our original design as at this point we had already started the construction of our greenhouse.

Prototype II

For prototype II we took the design from prototype I and made a more accurate prototype with cardboard. With this prototype we can more easily see what we expect our final greenhouse to look like and modify what we see fit.

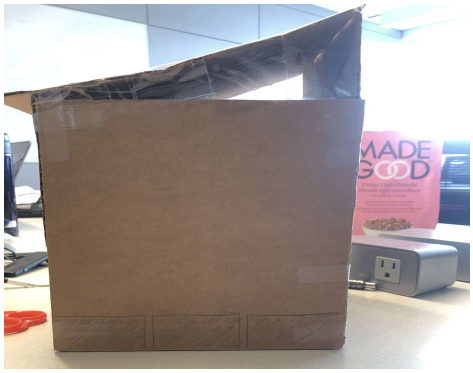


Figure : Prototype II

On this prototype we also added our possible rodent protection, which can be seen along the base of the prototype. The possible rodent protection was to add concrete slabs along the base to prevent the rodents from chewing into the structure. For prototype II we also created a model of the greenhouse in Solidworks to give a very accurate representation of what our final greenhouse would look like.

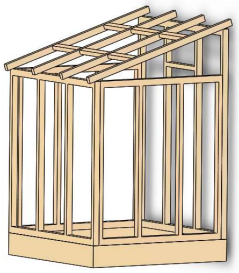


Figure : Side view

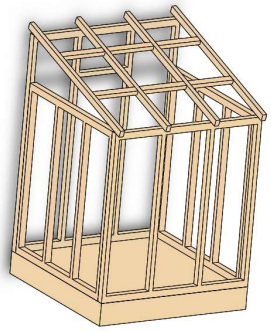


Figure : Back view

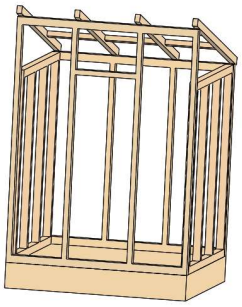


Figure : Front view

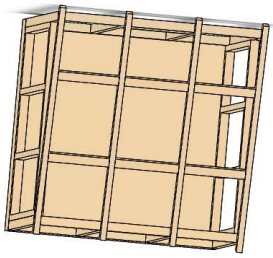


Figure : Top view

Construction Process

After exploring potential designs for our greenhouse, we decided to go with a slanted roof, with the water collecting on the opposite side of the door. We decided to use spruce for the structure, and construct three walls of the same height, with the roof leaning on the structure, rather than having three different types of wall heights. We spent the first few weeks building the base, the walls and the roof. After this was complete, we noticed that our structure was not very sturdy, so we decided to cut triangles of OSB and add them to the corners, which made our greenhouse much stronger. Next, we added the walls, which were clear PCT vinyl, which allowed for maximum sunlight to enter our greenhouse while protecting from debris, snow and rain. We then added the door (one with the uOttawa logo) and realized that it was too big for our frame, so we had to remove one of the supports, creating a gap, which can be seen below. We also decided to cut a few sections from the door so we could maximize the amount of sunlight that can be used.

Next Steps

While our team came very close to completing the project, due to the outbreak of the coronavirus pandemic, the greenhouse's construction could not be completed. What follows is a list of steps needed to be taken in order to complete the greenhouse.

1. Stay in touch with the hydroponics team while awaiting further instructions from university administration regarding access to school laboratories.
2. Once it is safe to access relevant facilities, schedule a time for team members to complete the remaining tasks.
3. Replace the frame around the door, originally removed to allow the door to fit (See figure below).

Figure : Greenhouse with door frame completed

4. Finish stapling the vinyl sheets to the exterior of the greenhouse, including the openings in the door.
5. Screw the corrugated clear plastic to the roof, weather-proofing the structure.
6. Complete the water collection system.
    a. Screw gutters to the top of the rear wall.
    b. Feed the gutters through a cut-out in the rear vinyl sheet while sealing it with duct tape, the spout terminating in the reservoir inside the greenhouse.
    c. Cut a hole into the top of the reservoir with a pipe leading outside the greenhouse to avoid spillage and to empty excess water outside the greenhouse.
    d. Screw a wire mesh to the outside of the pipe to ensure no rodents can use it as an entry point.
7. Wrap wire mesh around the base of the greenhouse, preventing small rodents from clawing at the vinyl and breaking in.
8. Help the hydroponic team with their construction process wherever needed.
9. Deliver the completed greenhouse to the client.

Conclusion

In conclusion, our design for our greenhouse and the whole process went smoothly and our client really enjoyed what was going to be our final product. For our design we started off really simple and ended up sticking to the simple design as we thought it was the optimal option. For the prototyping process, we went with a 3 prototype plan due to time constraints, among other factors.They were mainly used to give us an idea of what we were thinking at the time and help us with the proof of concept. Our construction process was pretty seamless, everything went very well and was going very smoothly until the emergence of COVID-19 resulting in a global pandemic hit us and shut us down. As far as next steps for our greenhouse, everything highlighted above will be taken into consideration to help us improve for our next projects in the future.