Project Deliverable D: **Conceptual Design**

GNG 1103 – Engineering Design

Faculty of Engineering – University of Ottawa

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Introduction:

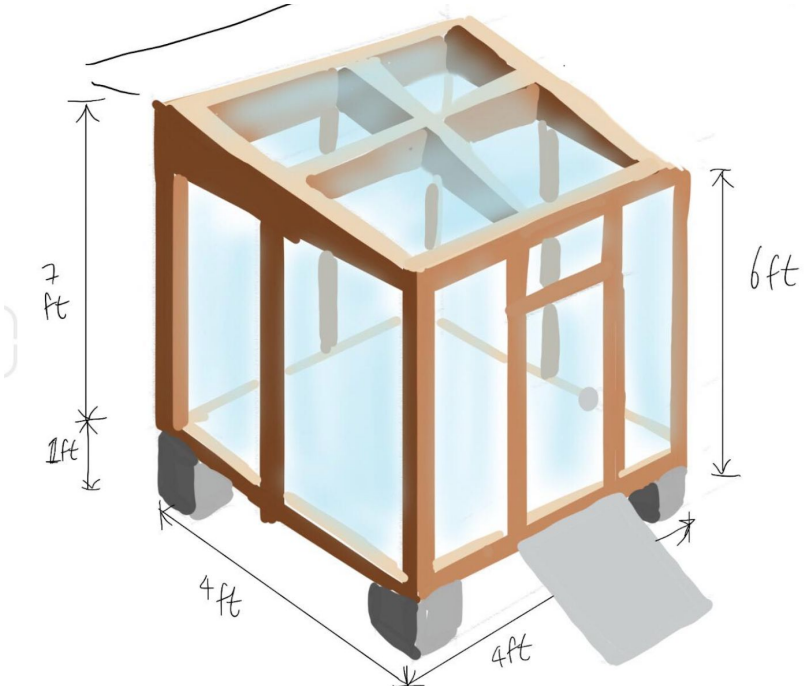
Based on the client interview and team discussion among members, we were able to come up with multiple design ideas to satisfy the design criteria and client needs. The brainstorming of different designs helps us narrow down to what is really best for the client. It gives us a clear idea of what is needed and what can be eliminated. Furthermore, it provides more visualized options to study and showcase it to the Professor. From the talk we had Professor Majeed, we altered our design from the hexagonal shape to the current rectangle design with the sloped roof. From there, we were able to add some finishing touches and designate an area specifically for the solar panel and narrow down a location for the ventilation system.

Original Design:

The original idea was to design a hexagonal greenhouse to maximize light absorption from all directions. The solar panel would be placed on the top to achieve as much power as possible

directly from the sunlight. However while the hexagonal shape is an aesthetically appealing design, difficulties in construction could occur do to its complex design of having many faces. Also, the solar panel being positioned directly on top would block sunlight from entering the greenhouse. Therefore a new design was created.

Modified Design:



Summary:

The figure of the greenhouse will be a cube figure with 4x4 feet dimensions. This design was decided on to keep an effective and simple design. Problems in construction often occur due to complexity during the building phase. To minimize problems during the construction, a cube structure was chosen.

The walls of the greenhouse will be Plexiglass, to allow heat to enter and stay in the greenhouse for the vegetation inside to thrive in a warm climate during the winter. Wooden beams will be used to as structural support of the structure with the Plexiglass attached will clamps.

Roof:

The roof the greenhouse will be similar to the walls as it will have wooden supports with Plexiglass. The roof is slanted at an angle of 15 degrees. This is to maximize the amount of

sunlight that will enter the greenhouse. This means that the beginning of the slant should face East where the sun rises.

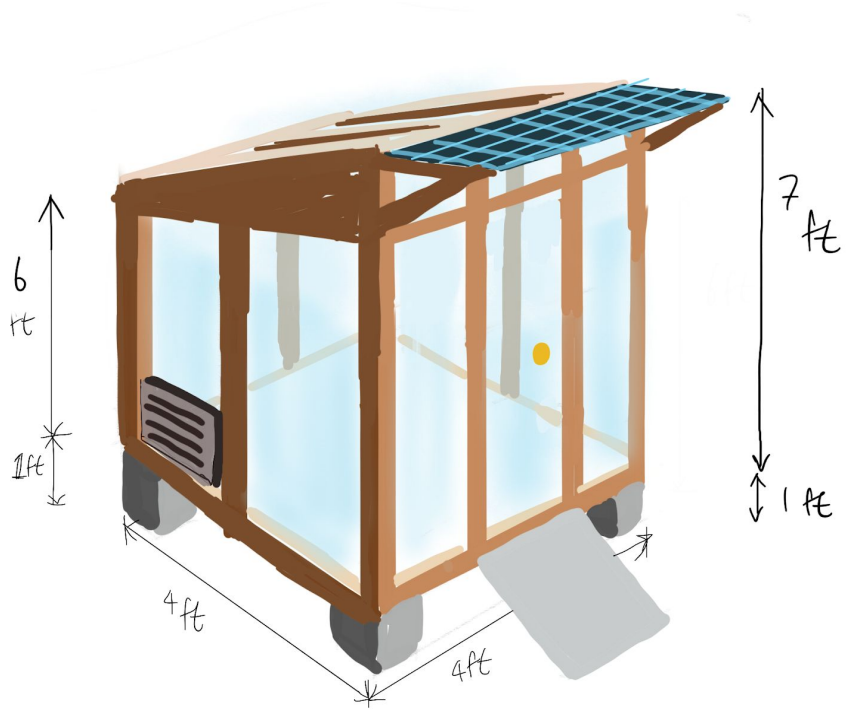
Door:
A wooden door frame measuring 6 feet tall and 2 feet wide will be used to enter the greenhouse. The door itself will be Plexiglass to further enhance the greenhouse effect. A suction lining will be used to ensure that the door closes as tight as possible to not allow heat to escape. Door hinges will be used to have the door open towards the outside to not intrude on the space inside.

Legs:
Four concrete legs at each corner will be used to support the greenhouse 1 foot off the ground. This was decided to avoid problems with the permafrost of the earth below. This will result in heat being retained better for the greenhouse.

Floor:
The floor will be insulated with insulation in order to retain heat from escaping from this surface area.

Ramp:
A ramp will be used to reach the doorway from the 1 foot incline from the ground. The ramp is low priority as the specifics don't have a serious impact on the rest of the design. Therefore specific design will be determined at a later date.

Final Design



Summary:
The final design is heavily based on the modified design with some small features and improvements. The main features added are the solar panels and ventilation. The overall design was also altered to accommodate for these changes.

Solar Panels:
Solar panels will be attached on the heightened area of the roof. The purpose of the location is to allow optimal position of the solar panel to gain power but also not blocking any sunlight from the greenhouse itself.

Vent:
A vent will be positioned on both the left and right sides to achieve air flow in the greenhouse. Because hot air rises, the vents are positioned at the floor of the greenhouse to have as minimal hot air leaving. The size of the vents will be determined upon purchasing.

Door:
The door has been moved to the opposite side to be on the high wall side instead of the short wall side. This allows the solar panel to act as a small roof cover over the door. The dimensions

for the door remain the same as 6 feet tall and 2 feet wide. The design of the door also remains the same as the previous design.

Selection Matrix

Specifications\Greenhouses	Slanted Roof Cube Greenhouse (Chosen design)	Hoop Design (Benchmark)	Complex Design (Benchmark)
Cost	Budget is $250	$50-$100	$100-200
Material	Plexiglass, Wooden beams, insulation	PVC pipe, wooden frame, plastic sheets	Wooden frame, glass windows
Size	4ft x 4ft x 7 ft	15 ft x 11 ft x 7.5 ft	10 ft x 8 ft x 8.6 ft
Features	Solar panel, ventilation system, ramp, front door, insulated floor, slanted roof	Sloped roof, cheaper alternative,	Larger structure, able to withstand harsh winter climates
Greenhouse Shape	Cube	Rounded	Rectangle
Reusability	Yes	Yes	Yes
Times Scale	2 months	2-3 days	1 month
Ease of Assembly	Yes	Yes	
Aesthetics	Yes	No	Yes
Durability	High	Low	High

Conclusion:

Since our initial brainstorming session back in September, we were able to come up with multiple design to fit our customer specification and needs. From techniques we learned in class and benchmarking with current product on the market, we were able to study the pros and cons of each design and adjust our final chosen concept to make it more perfect. The selection matrix helped breakdown the specification of each design and we were able to narrow down what each of the benchmarking design was lacking. Furthermore, we had to incorporate our design to fit with the hypotonic team and make it accessible for them to install their part as well. We think the current design will be very suitable for the environment the client is requesting and the solar panel as well the ventilation system will definitely benefit the growing process inside the greenhouse.