Current Criteria for Hydroponics Towers' Portability

GNG1103 - Engineering Design

Deliverable C - Design Criteria

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Introduction

This document outlines the specific design criteria that is related primarily to the issues regarding the portability of the Growing Futures hydroponics tower. To elaborate, the areas that are to be modified are the overall physical aspects of the apparatus, such as those that are outlined on Table 1. These specifications are based off of the initial presentation from the Growing Futures team, as well as the research and analyses done by design team C13 based on that information.

This document starts with the design criteria (see Table 1) with the functional specifications, which are needed to ensure that the apparatus performs as intended. Essentially, a certain number of plants need to be grown properly, and are then distributed by the Growing Futures team. So, the functional requirements ensure that this can happen appropriately and to the fullest and most efficient potential. Following this is the constraints section, which outlines the challenges that need to be overcome if the tower is to perform adequately. Following this are the non-functional specifications, which, while not related to the actual intended task done by the tower, are still important and must be considered for the overall mission and vision of the project.

Next is the design criteria (see Table 2), in which sample benchmarking has been done based on research from other models of various companies, such as the following: Zipgrow, Juiceplus, Nutritower, and Project Sucseed. This provides an overall picture of the type of models that can be expected, which are currently on the market, and provides an idea for improvements upon these pre-existing products. This will also provide an idea of what to further expect in terms of material costs, designs, and other practicalities, when designing and building the improved tower for Growing Futures.

Table 1

Outlines the design criteria based and provides details regarding their quantifications and verifications.

	Design Criteria	**Relation (=, <, >)**	**Value**	**Units**	**Verification Method**
	Functional Specifications				
1	Portable: On Wheels	=	yes	n/a	Prototype
2	Number of Plants	>=	20	Plants	Analysis, Prototype, Testing
3	Top Off Tank Capacity	>	3.25	Gallons	Analysis, Prototype
4	Lighting System:Light Intensity	>	300	Lumens/Square Foot	Analysis, Prototype
5	Real-time Monitoring for PH and Water Levels	=	yes	n/a	Prototype, Testing
	Constraints				
1	Weight of Column (Filled)	<	20	Lbs	Prototype, Testing
2	Cost	<	100	Dollars	Estimation
3	Collapsed Length (Column)	<	80	Inches	Analysis
	Non-Functional Specifications				
1	Operating Lifetime	>	10	years	Analysis, Prototype
2	Branding: Marketable?	=	yes	n/a	Analysis, Prototype
3	Reliability: Operate without need of repair	=	yes	n/a	Prototype
4	Safety: Structural soundness and lack of sharp edges	=	yes	n/a	Prototype

5	Aesthetics: Aesthetically pleasing	=	yes	n/a	Prototype

Table 2

Outlines the benchmarking based on tower models from other companies.

Company	**Zipgrow Farm wall**	**Nutritower**	**Juice Plus**	**Project Sucseed**
Cost (CAN $)	$1199.00	$1225.00	$617.00	$349.99
Weight	230+ lbs (Full unit)	68 lbs (Full unit)	N/A	N/A
Height	103 in	89 in	62 in	20 in
Width	0.47 in	25in	30 in	15 in
Length	80 in	N/A	30 in	29 in
Maximum Reservoir capacity	3.25 Gal	3.5Gal-13.2L (Main bucket)	N/A	102 L
LED System	Yes	Yes	YES (Not include in the fees)	YES
Maximum number of plants	N/A	N/A	20	N/A
Number of net pods	N/A	24	20	12
pH check	Manual	Manual	Manual	Manual
Materials	Plastic	Base (Mild steel construction) Columns (Aluminum Construction)	Plastic	Plastic
Wheels	No	No	Accessible (Not include in the fees)	No

Conclusion

As seen in Table 1, there are several shortcomings which, unfortunately, cannot be solved at the moment. To begin, the precise dimensions of the elevator are not known. The only information that was provided was that the new towers must fit the elevator. The only aspect provided was an anecdotal 7-feet approximation for the height of the elevator, which, while helpful for brainstorming, is not a reliable statistic for accurate designing of a prototype.

Furthermore, a key detail missing is the weight of the towers at the moment; while a general statistic of the combined weight of the tower apparatus reaching 230+ lbs was provided, the specific weights of the towers and columns are not accessible at the moment. This does not provide an accurate picture of the current situation; for example, what exactly does the Growing Futures team consider to be too heavy when taking down the towers? Having specific measurements for attributes, like weight, will allow for a more accurate brainstorm for this design project. Specifically, what is the current weight of each column with the plants? What weight is considered to be too heavy for the young individuals who are taking down the tower and carrying it around to distribute the plants?

Another detail that should be considered are the exact mapping of the plants on the apparatus. The specific plants and their locations are currently not known, which leads to a number of questions: are all of the kale plants located on one side? Is there an even distribution of water spread throughout the entire apparatus? How close are the plants compared to each other? If the towers were foldable, would it affect the plants? Which plants would it affect and why? These types of questions are necessary to answer in order to have a thorough and well-thought design to fix their functional requirements, but the mapping details missing, such designing could likely lead to errors.

These such details are necessary to have a proper prototype that satisfies the various aspects that surround the portability of the apparatus. Without them, it is likely that the prototype will meet some requirements, but not other critical ones, since they were not accounted for in the initial measurements. That being said, the current information provides a significant background for progressing with the improved designs for this project. By combining the information from this document with further meetings with Growing Futures, the current informational gaps will be closed and lead to the successful implementation of an improved hydroponic system.

References

Juice Plus (2015, March 23). Retrieved from http://www.towergarden.ca/shop

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