Team A22

Deliverable H - Prototype III and Customer Feedback

Engineering Design - GNG1103

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November 29, 2022

Abstract

The purpose of this deliverable is to summarize the changes made in Prototype III, which is our final prototype that we will be presenting to the client Growcer hydroponics. New ideas were generated on how to further improve the product, and a final product was assembled.

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1. Introduction

During the previous deliverable, our second prototype covered the framing aspect of our product, and was tested to assure it could handle the needs of the client. The purpose of this deliverable is to our third prototype, which includes the plumbing systems. This deliverable will be split into three parts; discussing the systems implemented in prototype III, complications in the design and feedback, and the final aspects of our project.

2. Prototype III

The main priority when designing prototype III was to add in the requested method of moving the boards across the device automatically, as well as to add in the plumbing systems. Now that the design is nearing completion, only a few small changes remain before design day.

2.1. Plumbing Systems

The idea behind the plumbing system has been left largely unchanged. The measurements we expected worked perfectly into the real world design, with the only hiccup being the accruement of only 3 nozzles. The water input attaches to the nozzle mounts which fan the water onto the boards to remove the grime quickly and efficiently. Pictured below is the simple model of the piping we had assumed we would need.

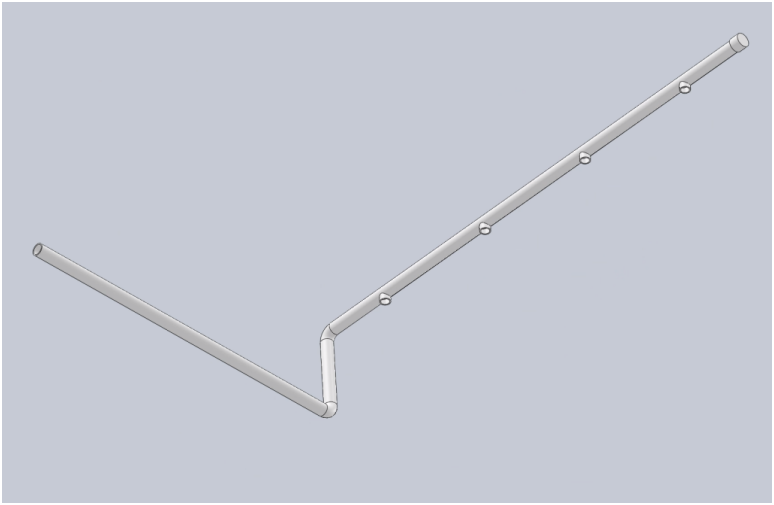

Figure 1. 3D Model of Piping

The system was successfully added to the framework, and functions exactly as expected, however we faced a challenge in creating enough pressure to allow the nozzles to run functionally. In order to test the plumbing subsystems functionality, it was removed from the prototype and water was run through a faucet with a hand covering the gap. This allowed for some water pressure to be retained and for water to run through the system as expected.

Figure 2: Functional Water Jets

Further testing is being planned for the Design Day presentation; Our prototype was moved to someone's house in order to test with additional water pressure using a proper threaded connection to a garden hose. From this testing, a board with dirt/mud on it was run through the system and was cleaned quite effectively.

Figure 3: Before and After Cleaning

2.2. Functional Rollers

Rollers were added to our design to reduce friction and allow for the hydroponic boards to pass through our pressure washing system easier. The rollers allow for either a future mechanical system involving a motor and gear combination or for a simple gravity based feeding system. Blocks were also added to both keep the rollers in place, keep them off the base and to separate and distinguish the cleaning area from where the power jets would be located on the side framing.

Figure 4: Rollers and Blocks

2.3. Framing

The framing of our prototype was already stress tested and handled “roughly” (as our clients implied these systems may be treated) in order to test the structural integrity and rigidity of the system. During this prototype iteration, we tested the systems ability to handle large amounts of water, and concurrently checked to see if the system was enclosed enough so that water wouldn’t spray everywhere in the hydroponic unit. Our prototype successfully kept most of the water within the system, any excess water was drained out of the holes in our base and the system was able to withstand pressurized water jets.

Figure 5: Prototype 3 Structure after Water Test

3. Feedback

3.1. Feedback

Overall feedback for our prototype has been mostly positive. The overall sturdiness of the design and the entire system being enclosed were well received. The clients also acknowledged and liked the idea of us only designing/perfecting the top pressure jet component which would be replicated in theory in order to clean the sides. One note to make is that the clients want a more automated transport of the boards through the system, we have taken this feedback into consideration and are looking into a mechanical/gravity based solution.

4. Conclusion

For our final prototype, we managed to implement most of our design goals and build a fully, to scale functional prototype which is able to clean dirt off of a board. All of our subsystems were combined together in a way that maximizes usability and performance of the system. While there are a few mechanical systems (like a motor/gear system) which could have been implemented, our design maintained our focus on simplicity and having the fewest number of mechanical systems which could break down.