Team A22

Deliverable F - Prototype 1 and Customer Feedback

Engineering Design - GNG1103

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Abstract

The previous deliverable provided a cost estimate for our final prototype and the rest of this project collectively. Deliverable F will outline the features of our final conceptual design and the feedback received from the clients at Greener hydroponics. Overall the feedback from the clients was very positive and a first prototype has been developed on CAD combining our ideas and some of the client recommendations.

Introduction

For our first prototype our group decided that making a detailed CAD model on solidworks was the best way to illustrate to the client what direction we were heading. As stated in the previous deliverable our prototype will rely on a 2 step process to clean the boards. The first being a wipe or soak in a sanitol solution. The second being the use of high pressure water emitted from overhead nozzles (See images below). The information gathered from the creation of our prototype in solidworks will enable us to build a second physical prototype knowing the exact dimensions as well as provide a visual aide during the building process.

Feedback

The feedback obtained from the third client meeting was very insightful. We were able to both present our ideas to the client, and also compare our ideas to those of our peers. The overall feedback from the client was constructive, and so we will be taking their words into consideration. To start, they mentioned our design was extremely simple, which is a good aspect to have. They then went on to mention that a level of automation through drag wheels or another such method would be a great addition, as that would not put the farmer's hand in the way of the water. Other classmates had incredibly complex designs that likely stretch the term 'budget' out quite a bit. We learned that we should include a method in our system to clean the sides of the boards as well, and will take that into consideration for further prototypes.

Bill of Materials & Cost

Material	Cost/ Unit	Quantity	Cost Total
PVC Pipe	11.49	1	11.49
Base Board	8.58	1	8.58
Bearings	11.99	1	11.99
PVC 90 degree bends	0.59	1	0.59
PVC End Cap	1.19	1	1.19
Nozzles	3.93	4	15.72
Framing wood	5.45	1	5.45
PVC T Joints (threaded)	0.85	4	3.4
Connectors	4.67	4	18.68

Total Before Tax			77.09
Total After Tax			87.11

Photos

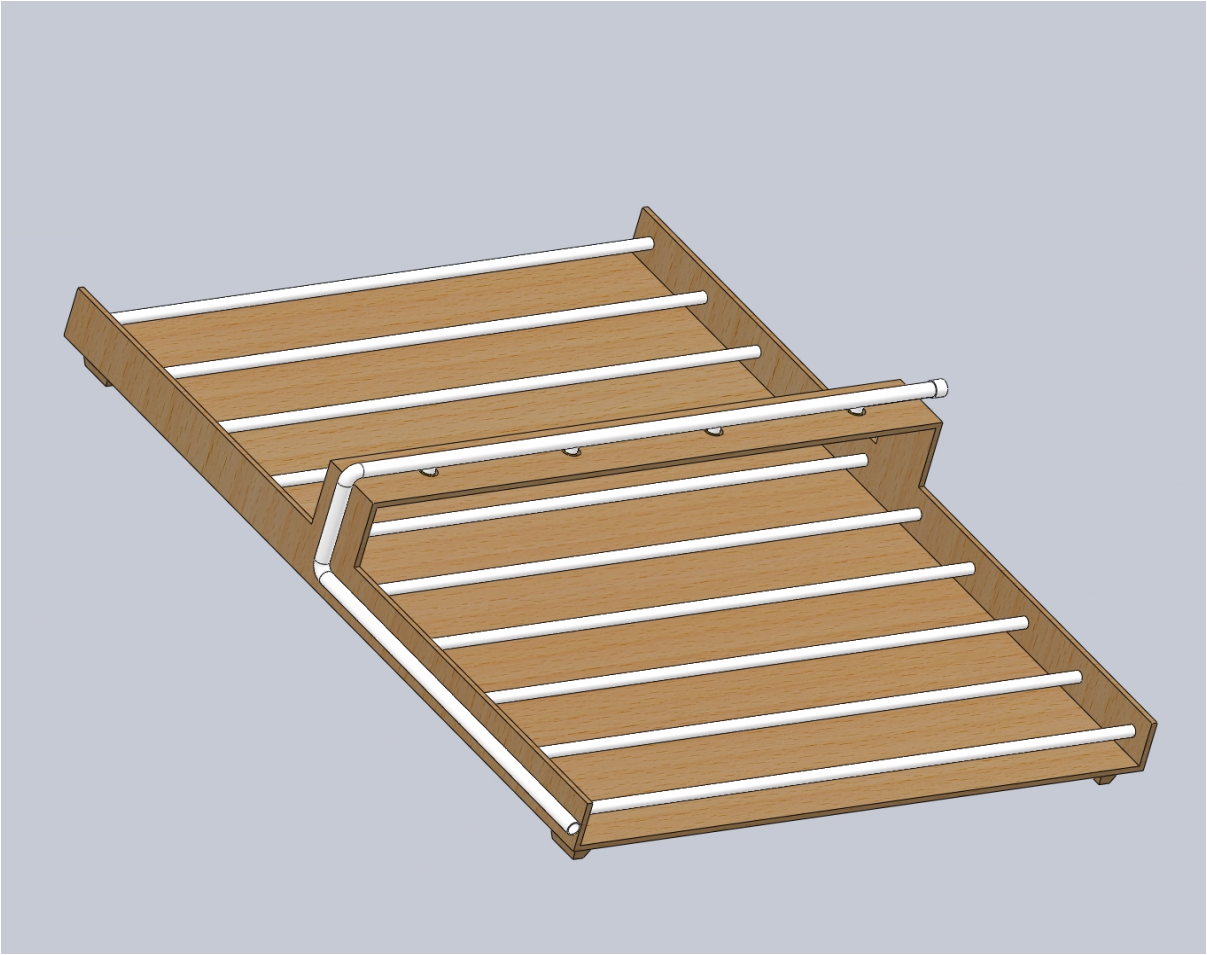

Figure 1: Top view of table mount pressure cleaner

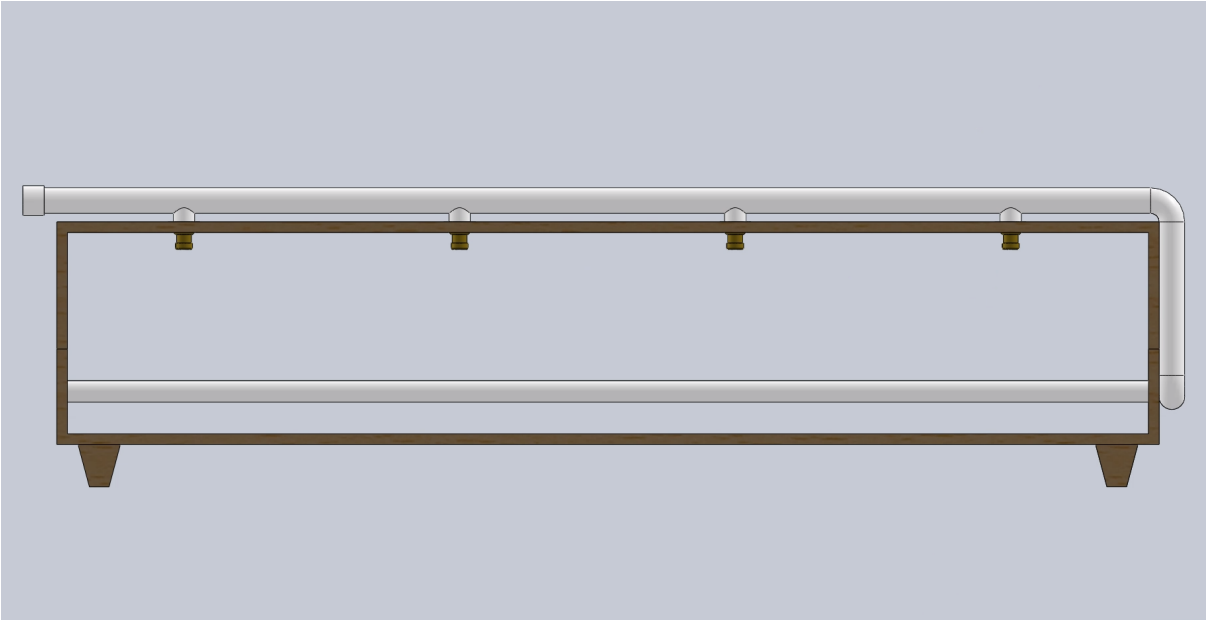

Figure 2: Cross section view of the pressure cleaner

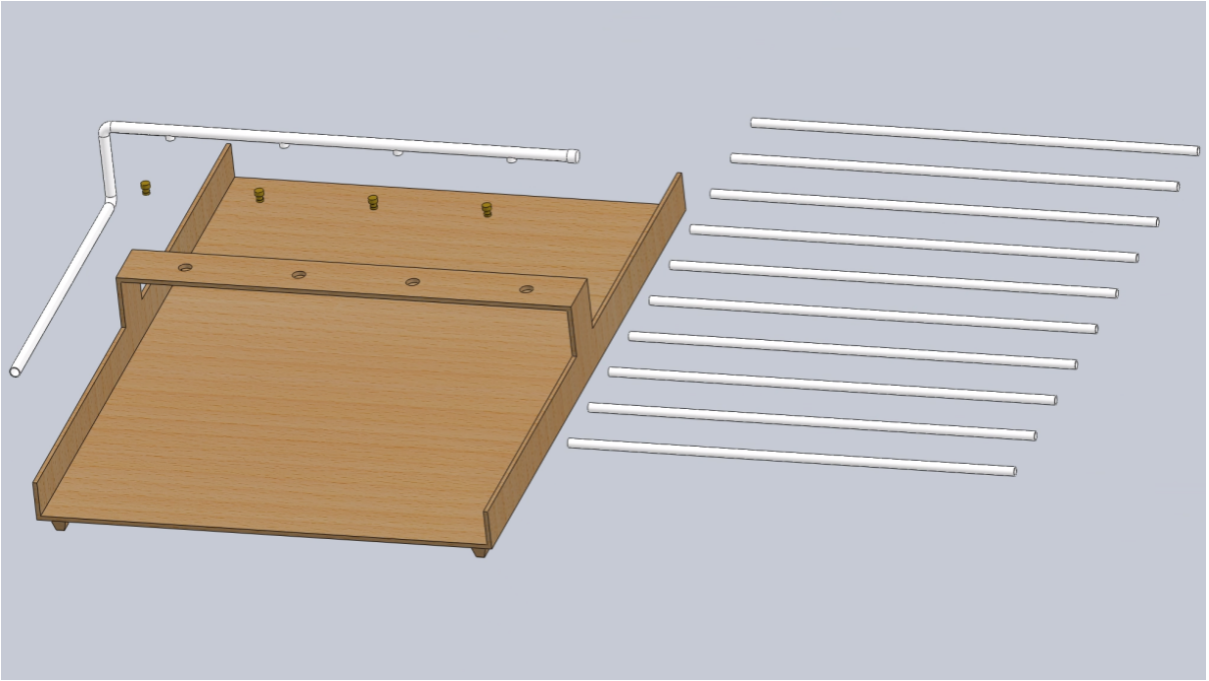

Figure 3: All subsystems separated

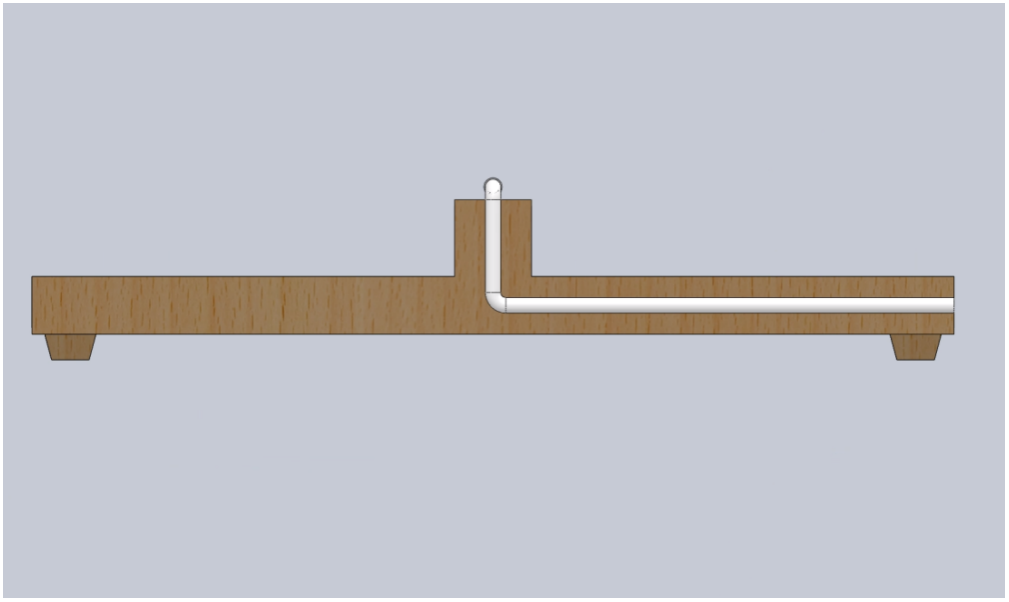

Figure 4: Side view of pressure cleaner

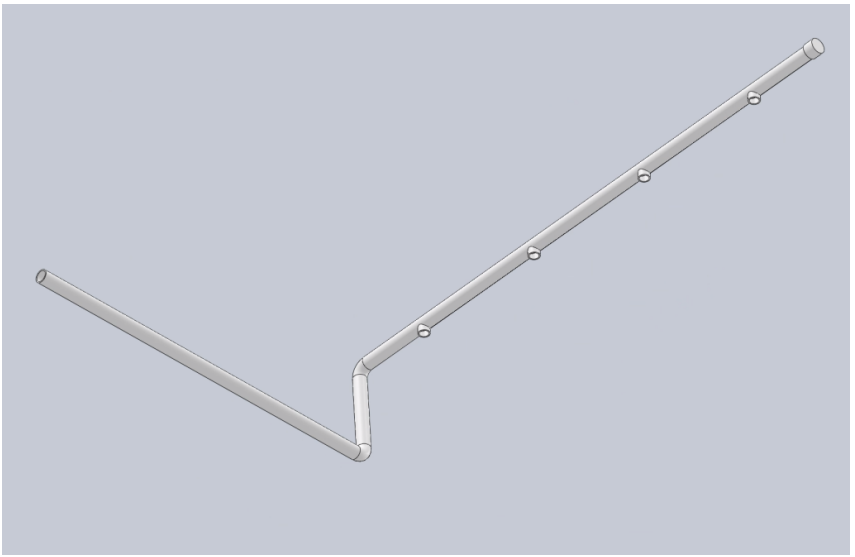

Figure 5: PVC connection schematic

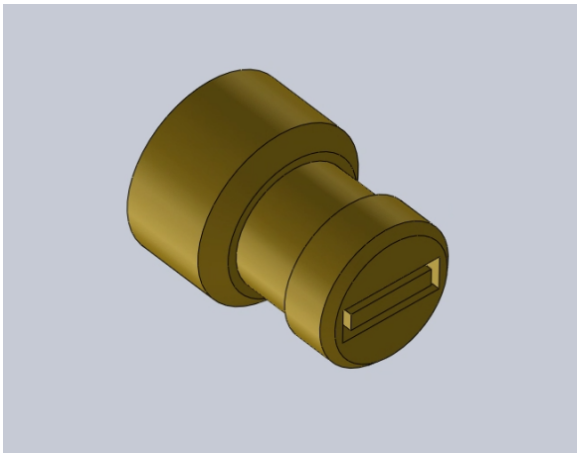

Figure 6: Pressure Nozzle

Analysis of Critical Components

The most critical component of our design is the plumbing system. To ensure that water pressure can remain constant for any reasonable period of time our team will need to ensure that a tight connection is made between the nozzles and PVC tubing. In addition to this a good connection to the external water supply will also need to be made. Somewhat less critical compared to the plumbing but still relevant even though this is a prototype is the waterproofing of the structural elements of the build. To address this issue our current plan is to apply some kind of waterproof coating.

Structural Components

Our design consists of a plywood base for the cleaning device along with wood framing to hold in place the important functional and plumbing components which comprise our design. The structure will be coated using a waterproof stain/paint and the plywood base will have holes drilled in it for water drainage.

Functional Components

Our current design uses manual force as a key aspect for functionality and movement of the polyurethane boards through our device. In order to aid with this movement the bottom of the structure will be lined with PVC tubing which are going to be repurposed as rollers to allow the boards to easily pass through our system.

Plumbing Components

The most critical component of our design is the plumbing system which consists mostly of PVC piping and pressure nozzles to create enough force in the water to clean the boards. The PVC piping will run from the water source, along the side of the frame (more rigidity) and up onto the upper framing of the spray system. Here the piping will be split using a splitter to allow for water to pass through all 4 pressure nozzles. Holes will be cut in the top framing to hold the nozzles in place pointed at the board.

It should be noted that currently there is no subsystem in place to clean the sides of the polyurethane boards, this is actually done on purpose. In theory, the plumbing system used to clean the top of the boards is completely replicable and transferable as a system to place on the side of the framing. Essentially all the same components could be used to clean the sides. Doing so however, would be very expensive and the cost of the extra PVC piping and nozzles would put us well over budget. As such, we have decided to focus on making our plumbing system work as well as possible and have it simply be noted that this system would need to be duplicated for a final design. This idea was run by the clients and they thought it was a clever way of staying under buf=dget while still being able to eventually deliver a final proof of concept prototype.

Conclusion

From the client's feedback obtained in our third meeting, the reached conclusion is that our prototype is functional. A few changes are necessary to the final design, including a method of automatically pulling the boards forwards, and a method of cleaning the sides of the boards. We are pleased with the outcome of the meeting and look forward to designing an even better product.