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Hydroponics 5
GNG1103[D]
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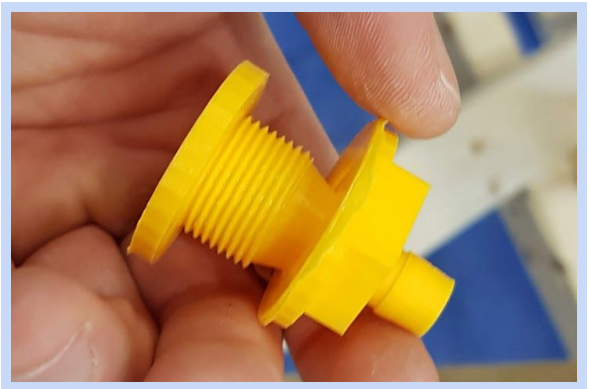
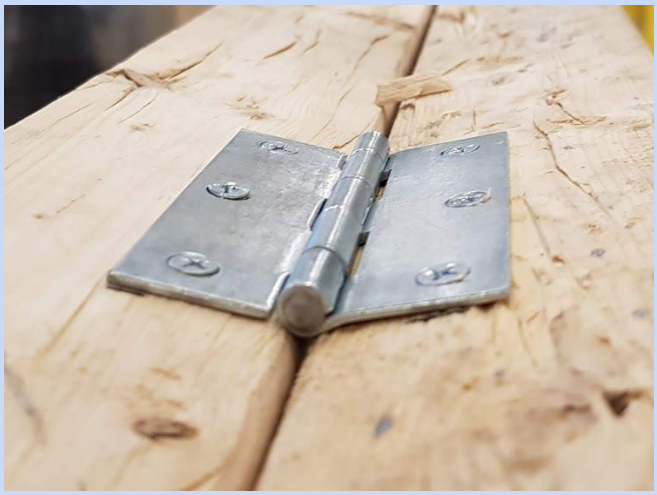
Project Deliverable H: Status Update and Planned Execution

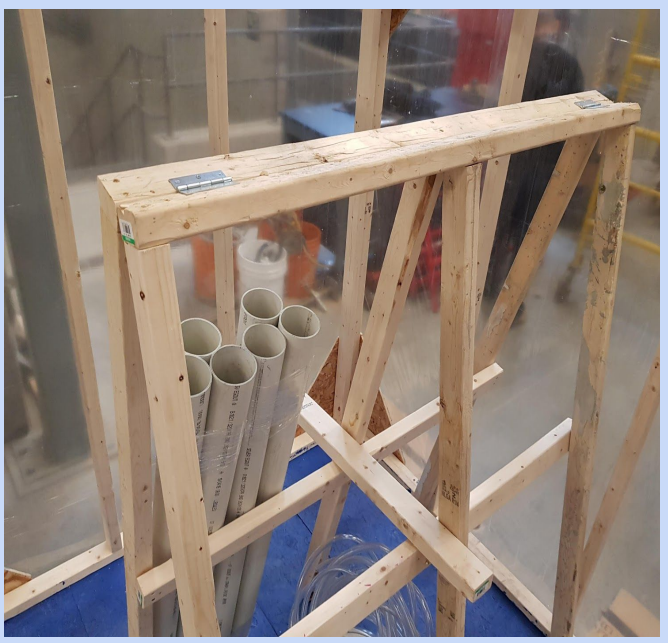
Introduction

Due to the Coronavirus situation, we are unable to build the final prototype of our system and complete the existing remaining tasks. Therefore, this deliverable will explain the current status of our final prototype and the remaining tasks that we would have done under normal circumstances.

Final Prototype Status Update:







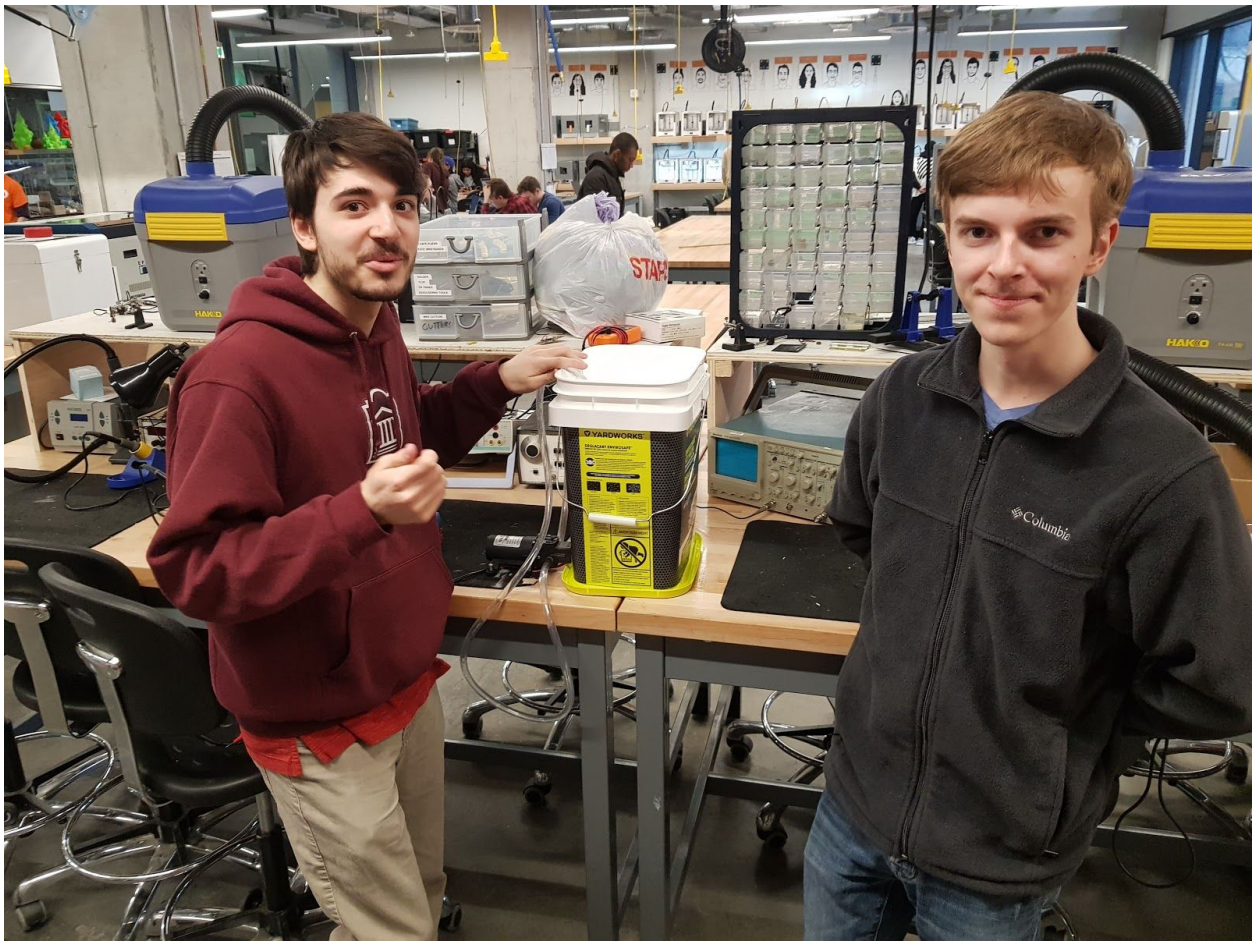
Our frame holding the pipes was built, we tested the pump and it worked and we 3D printed some fittings for the PVC pipes to tubing. We had all the materials we needed to finish building our final prototype: reservoir, end caps, tubing, PVC pipes, fittings, pump, wood to hold the pipes on the frame and the solar panel was provided by Dr. Majeed. There were a few tasks left to do which will be documented in the second part below.

Our system's purpose is to implement the nutrient film technique to grow plants without the need of soil. Our system is set up on a frame that holds everything in place. It uses a solar panel which supplies power to the pump that will bring up the water to the top pipe. From there, the slightly inclined pipes will let gravity do its job and the water will slide down the pipe going through the perforated cups which hold the plants. Once it reaches the end of the pipe, the water will go through a fitting sealed with a

rubber ring that will guide it to the tubing part of our system that leads the water to the next pipe or, if it is the last pipe, back to the reservoir. There is no micro controller or battery in our system so the pump will only run when there is enough sun for the solar panel which we reviewed was easily enough time for our plants to grow.

Once the prototype is delivered and assembled at location, the client can plant their plant of choice in the perforated cups, and insert these cups into the slots in the PVC pipes. The reservoir must be filled to capacity with water plus a nutrient mix appropriate for the plant chosen. The pump is wired directly to the solar panel, and will begin to cycle fluid as the panel produces energy; there is no need to attend to the system throughout the day. Occasionally, the reservoir may need to be topped up with the water plus nutrient solution as the solution is consumed by the plants and/or evaporates.

We couldn't take a video of our final prototype in action but here is a picture of us testing our pump



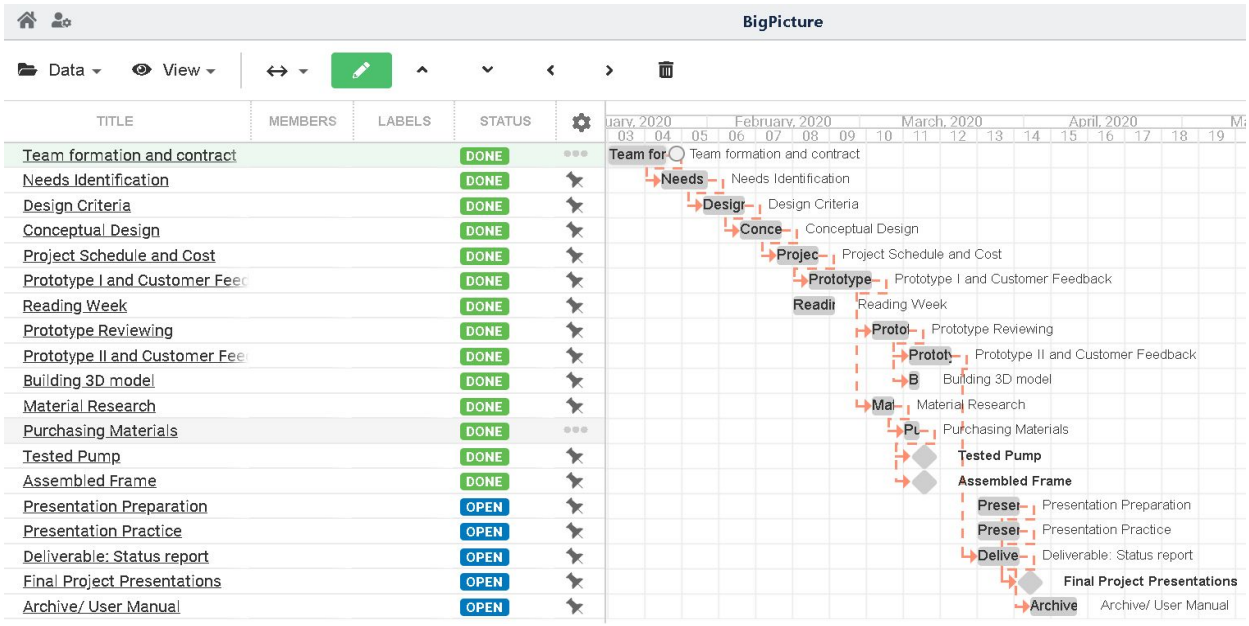
Unfortunately, we were not able to carry out our final testing for our prototype since it is not fully constructed.

Planned Execution under Normal Conditions:

The last lab before the closure, we were able to establish the pump's functionality, build the A-frame for the tubing, and plan out the drilling that needed to be done on the PVC tubes to create the holes for the plant cups. We also did some test 3D-printing of end fittings that looked promising. However we were not able to test them, as the university shut down.

The main aspects that were incomplete as of the shutdown were the vinyl tubing system, the fitting printing and testing, the PVC drilling, and the final assembly onto the A-frame. As such, our prototype is incomplete and non-functional. We would estimate that the prototype reached about 50% completion before the shutdown occurred, which considering we had two more lab sessions planned after our first lab session, indicates we could have completed the prototype with time to spare for testing and fixing.

The plan to finish the project goes as follows: we would have tested the 3D printed fittings and drilled the holes for the cups in the PVC pipes which were tasks that could have been done simultaneously. The next step would have been to drill the holes in the end caps and install the fittings if they were showing no sign of leaking. After that, the next lab would have given us the time to assemble the vinyl tubing connecting the PVC pipes, hook up the pump to the system, and mount the assembly onto the A-frame. From there we would have done testing to ensure the system is functioning as expected, and correct any design or assembly flaws that could arise (leaks, flow problem, etc).



Before assembling the whole system, we would have tested the 3D printed fittings on a panel made by a material similar to PVC to make sure they are not leaking. We would have drilled a whole about the size of the fitting in the panel then insert a rubber ring in the screwing part of the fitting and push the screwing part through the drilled hole and then screw the other part of the fitting and insert the tubing in the other end. We would have then spilled a generous amount of water on the panel and check if water was leaking through the fitting. Once this test was done and the rest of the system was assembled, we would have been ready to test our final prototype as a whole.

Testing our final prototype:

Test Specification	Test Description	Test Method	Target Result
Water Efficiency	No significant loss of water either by evaporation or leaking.	Running system continuously for 3 hours and measuring final water volume vs initial water volume	No identifiable leaks Negligible loss of water
Plant Saturation	Ensuring each plant gets a sufficient amount of water to prosper.	Sponge/absorbent material placed in plant cups and system turned on	All cups containing sponge/absorbent material remain damp/saturated through the entire test cycle.
Exposure to sunlight	The amount of sunlight that the solar panel gets.	Putting the solar panel at different places on the greenhouse to find the best spot to fix it	Maximum amount identified

Conclusion

Due to the situation, we adapted our work and thoroughly described the current status of our prototype and painstakingly made a plan of what we would have done under normal circumstances to finish the project. The next and final step of this project is User Manual which will describe the whole process of this project in enough detail to give the possibility of making this project on their own to others.