Deliverable H

# Prototype 3 – Front View



# Prototype 3 – Side View and Water Lines



# Materials:

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| --- | --- | --- |
| **Materials** | **Quantity** | **Total Cost (with tax)** |
| 2x4x104 Top Choice (2x4 Wood) | 5 | $22.49 |
| 300 GPH Fountain Pump | 1 | $27.96 |
| Sterilite Plastic Bin | 1 | $0 |
| ¾ Inch EP Pex Tee | 20 | $0 |
| 1 by ¾ x 10 Clear Pre-Cut Pex Tubing | 1 | $24.85 |
| SHEP 2” Swiv (Wheels) | 4 | $18.85 |
| 3” DWV Cellcore 6 foot | 4 | $0 |
| Screws | 2 | $0 |
| LED Rope Lighting | 1 | $0 |
| Twist ties | 1 bag | $0 |

**Total Cost = $93.87**

# Prototype 3 – Test Plan

* *Water lines and drippers*
  + The main component of this prototype we need to test is the efficiency and functionality of the water pump in conjunction with the water lines and drippers. We will also be looking for leaks in our pipe connections and malfunctions.
  + We plan to run water through the system to see what needs to be improved and what already works well. The stopping criteria for this test will be when water runs through the system without error and meets the requirements of the client.
* *Water absorption of the plants*
  + The second thing we would like to test is how much water we are able to put into the pvc pipes which hold the plants. The pipes are capped off at both ends, which means there is nowhere for the water to go if it were to flood.
  + Once we have perfected our water and drip system, we will run water through the system and into the holes cut in the pipes to observe how much water is necessary to add at one time. We will also test how long it takes for our plant system to absorb one shot of water. Once the plant has absorbed the water or requires more water, we will be able to put the pump on a timer to go off for *x* number of minutes. The stopping criteria for this test will be when we have determined how many minutes it takes for the plants to require more water and how much water we need to let out at each interval.
* *Lighting System*
  + We would like to test how many lumens we would need for our lighting system which will be efficient enough to help the plants grow successfully. We will test this by allowing a small plant to grow under our lighting system and monitor the height of the plant with respect to time. We will also back up our tests with research on how many lumens is required to successfully grow plants with a hydroponic system. The stopping criteria for this test will be when we have successfully determined how many lumens we need to grow the plants efficiently, while keeping the plants healthy.

# Critical Components

* *Frame*
  + The wood frame is one of the critical components of our third prototype and is the most important. The frame holds everything into place and supports everything we have installed including the water lines and the pvc pipes which will house the plants. In our third prototype, we used the same frame we used in the second prototype because of its structural integrity and 1:1 scale of our original design.
* *360 Degree Lockable Wheels*
  + On the bottom of the frame, we have installed four 360-degree lockable wheels to allow the system to be completely portable as requested by the client. You are also able to lock the wheels when you have moved it to your desired location, so it can stay stationary.
* *PVC Pipes* 
  + The black PVC pipes as seen in the picture above, are the housing of the plants. At the tops of the plants are drilled holes 2” in diameter, which will house the biodegradable pots with the plants inside. They also support the water line and drippers directly underneath. There are caps at the ends of each pipe to eliminate water from pouring our either side.
* *Waterlines, Drippers, and Pumps*
  + For the water lines, we used ¾” Pex tubing and for the drippers we used Pex Tees. This is a critical component because it is what transfers the water from the reservoir, to the pump and through the water lines which will exit the drippers (Pex Tees). We have mounted the Pex tubing up the side of the frame and along the bottom of the PVC pipes to allow water to the pipe below it. The pump requires only one plug in.
* *Reservoir Tank*
  + The reservoir tank in this prototype is represented by the plastic bin resting at the bottom of the frame. This tank is capable of holding 100L of water at its recommended maximum. We have designated a maximum water level for this reservoir to minimize the weight of the system, and to restrict the overflow of water if the system should be moved.
* *Lights*
  + For this prototype, we have used LED rope lighting mounted under each of the pipes to illuminate the one beneath it. The lights used in this prototype are not enough lumens needed in our actual design but are efficient enough to display where we want to mount our lighting system. The lights require only one plug in.

\*\*The system requires only two plug-ins, so it can be used at only one outlet\*\*

# How we have worked closer to our overall solution

* *Prototype 1:*
  + For our first prototype, we worked with the materials we had to give the best representation of our design as possible. This prototype did not include any method of transportation, water distribution, or housing for the plants. This prototype was simply a matter of giving the client a general idea of what our future prototypes were going to look like, as well as our final product.
* *Prototype 2:*
  + For our second prototype, we were given the $100 budget to go out and buy the materials we needed. We built this prototype to scale with our actual design, which sits at 5’5” high, 4’ long, and 1 foot wide. This solved one of the issues which was the height of the system being at a reasonable height for the children to be able to reach the plants. Next, we added 360-degree lockable wheels to the bottom of the frame of our system, which eliminated the issue of the system being stationary or fixed to the wall. Now, you are able to move it where ever need be and will be able to lock the wheels to keep the system stationary. After that, we installed our PVC pipes which act as a housing for our plants. This prototype **did not** include our watering system, or our lighting system.
* *Prototype 3:*
  + For our third and final prototype, we used the exact same frame being that it was already a 1:1 scale of our actual design, along with the wheels mounted to the bottom. In this prototype, we changed the mounting of the pipes to a completely level horizontal position, which are supported by a 2x4 underneath it. We did this because we decided it was the most efficient way, and we could not connect the pipes due to budget reasons. For our final prototype, we installed our watering distribution system and drippers. We ran the lines up the side of the frame, and the drippers along the bottom of each pvc pipe to feed the pipe beneath it. We solved the problem of the plants not getting enough water by installing one dripper per plant. By doing this, water will have to be added to the plants for a shorter period of time yet more frequently. Because of this, we decided in our final design that we were going to put our pump on a timer set at the specific time required to keep the plants healthy and watered. The final component we installed was our lighting system. We eliminated the problem of having too high of an electricity cost per month by switching to LED lighting. Each pipe has a row of lighting designated to it, which allows each plant to get a sufficient amount of lighting.

In all, we started off with a system that wasn’t functional and was made from materials found in our homes. As we progressed with our prototypes, we came up with new and improved ideas yet still sticking to our original design which eliminates all of the issues brought up by the client.