Project Deliverable D: Conceptual Design

GNG 1103 – Engineering Design

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Faculty of Engineering
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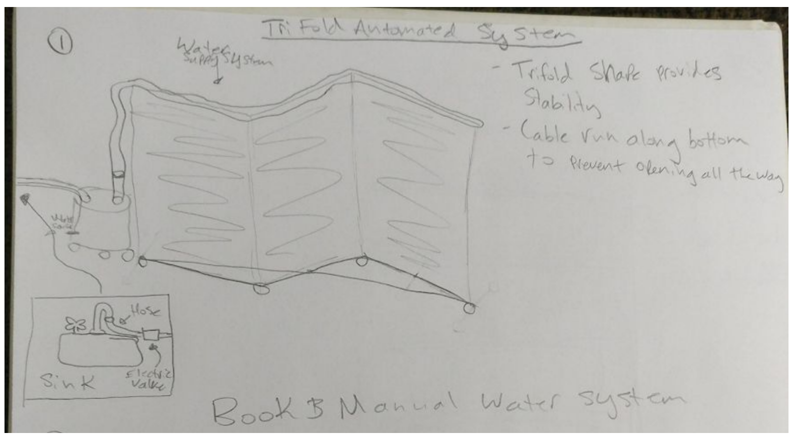
Objective

This document will demonstrate a number of conceptual designs for the hydroponics systems, specifically three from each team member. Next, the team will discuss and refine the designs in order to have three fully functional solutions.

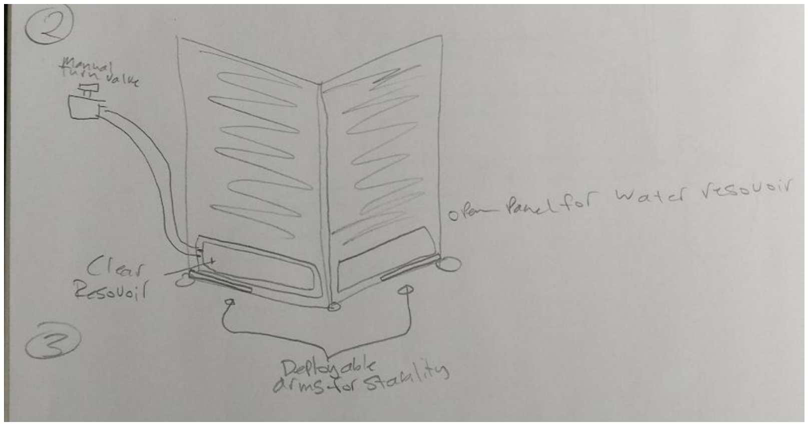
Conceptual Designs

Matthew Forgie's Designs



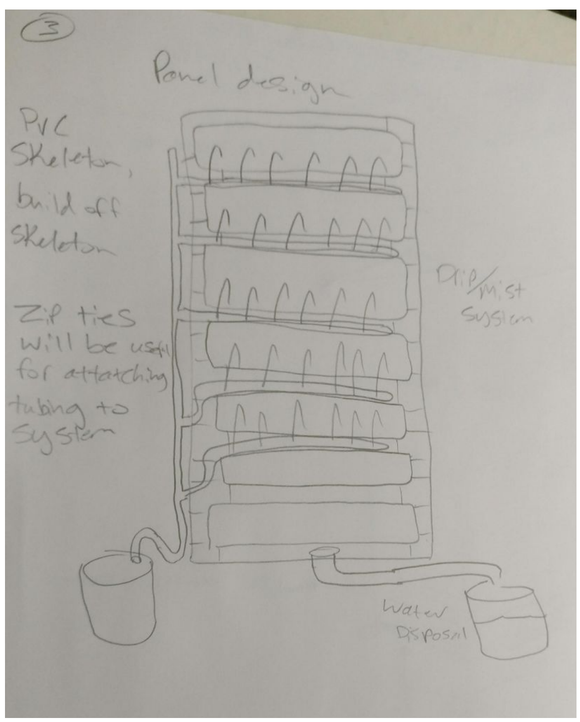
Design 1

Design 1 provides a model that is very space efficient as it utilises a tri fold model, which also gives to the stability of the model when extended, as opposed to a single rectangular wall of plants. This tri fold design may prove difficult to provide sufficient water flow to all 3 panels of the model, and may require additional pumps on either side of the model. This model also has a detachable water reserve on wheels for ease of mobility when filling if done manually. This model however implements an electronic water sensor near the bottom of the barrel, that when the water level of the system lowers below this point, activates an electric valve attached to a nearby sink, and fills the bucket automatically for a set period of time. This addition to the model would probe to be optimal, however would add extra expense to the model.



Design 2

In design 2, we can see a more cost effective model that would operate in a similar manner to design 1, except with a different water reserve model. This reserve model would be clear to allow for constant monitoring of the water levels, and a hose attached to it with a manual valve that could be activated and deactivated to fill when needed.

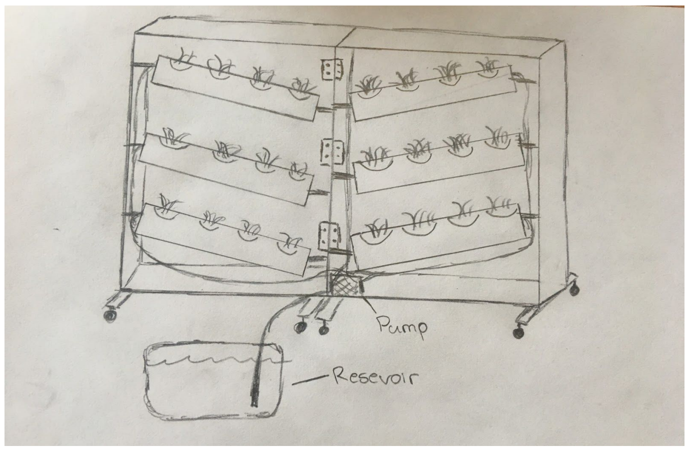


Design 3

The third and final design is that of the actual panel itself, which shows the implementation of the water pumping system to all the different levels of the system. There would be a number of rubber tubes or hozing attached with zip ties to the main skeleton frame.

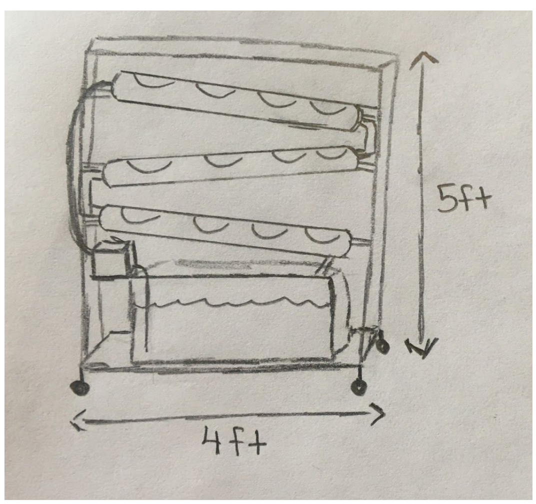
This system would be efficient at bringing the water to where it needed to go, but a system of water disposal/recycling would have to be looked into.

Jonathan Kanopoulos' Designs



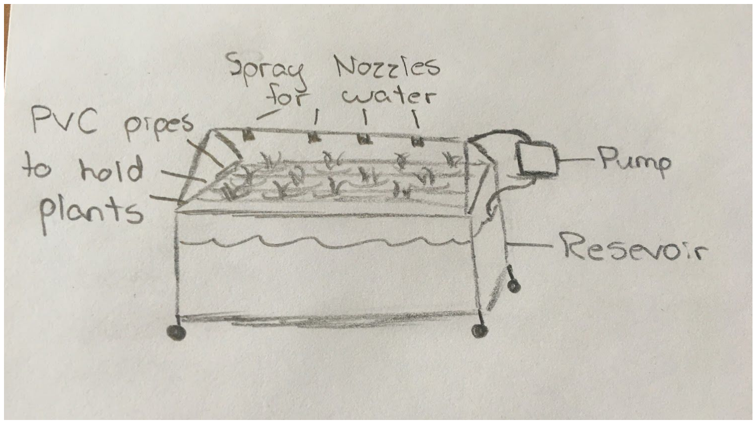
Design 1

Design 1 is a very efficient design, having a folding section so that you can save space, while having twice the amount of plants growing at a time. The only drawback of this model is the lack of any kind of system to fill the water reservoir.



Design 2

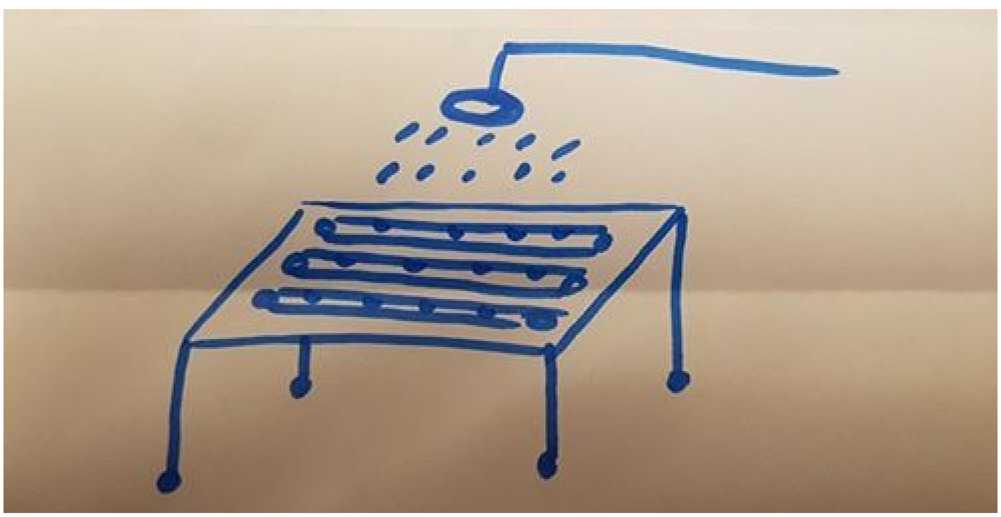
Design 2 is a good base design if we decide to go with a more vertical approach. It effectively supplies water to its plants and utilises gravity to dispose of any waste water, and recycles it to be used once more to maintain and efficient system.



Design 3

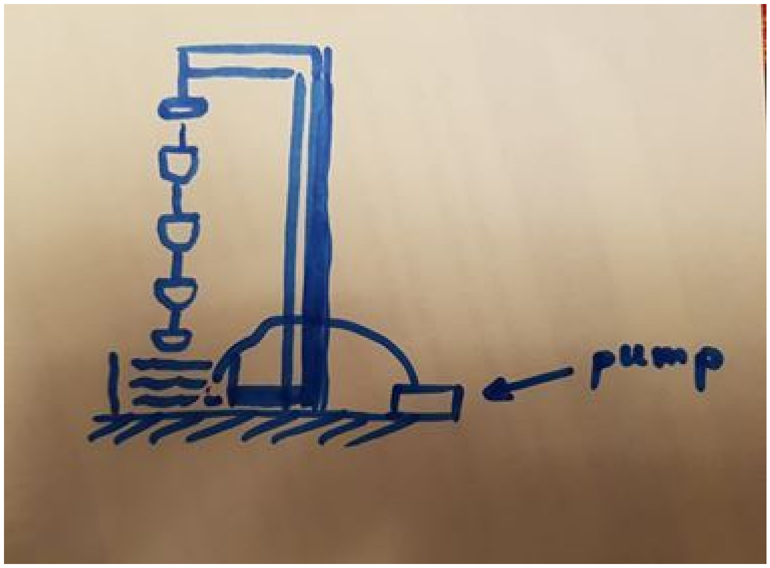
Design 3 is an interesting design, can possibly supply water to all plants more effectively than the drip system model. It however is lacking in the possible amount of plants, as it is more of a horizontal model vs the other more vertical models.

Duy Pham's Designs



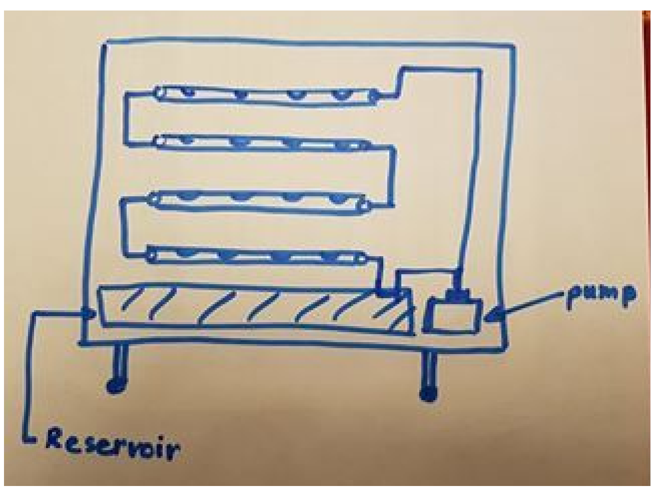
Design 1

Design 1 is a very portable model, however it lacks lower levels to be used by smaller students and clients since the system is on top of a cart. This model also lacks vertical growing space as it is a laid out on a cart, and it requires a misting nozzle to be suspended above the plants below.



Design 2

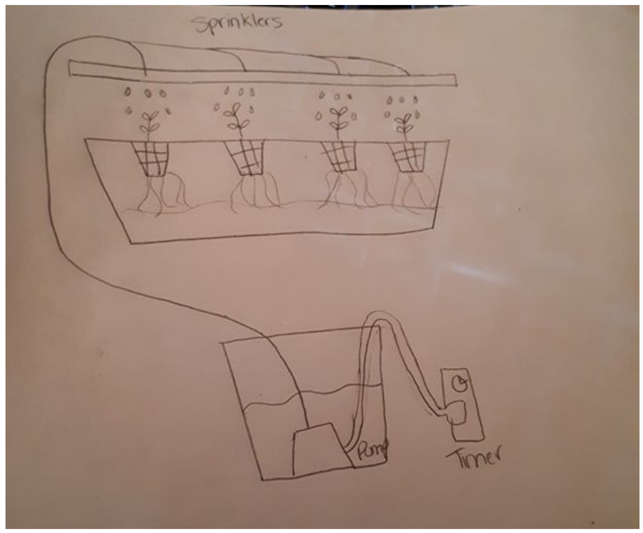
Design 2 is a space-saving design and it is able to reuse the water as well. However, it will be hard to move the entire structure around. Furthermore, since there will be about 20 plants, having one pump for a whole system is not going to be enough. If more pumps were to be added, the extra material and maintenance costs would become a problem.



Design 3

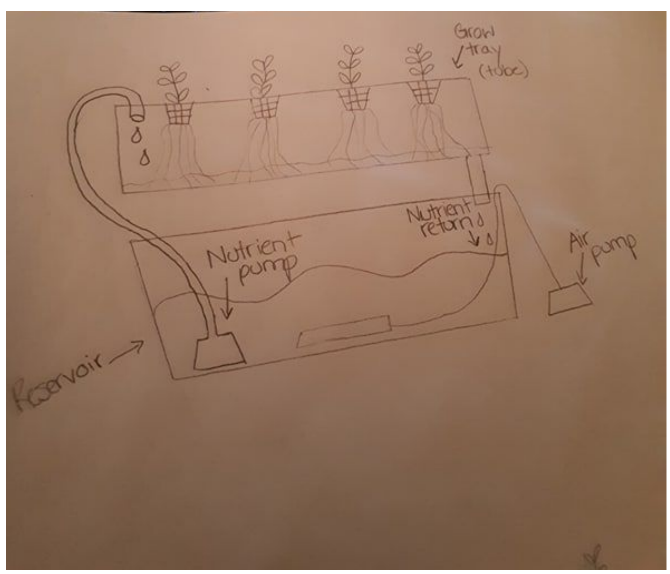
The third design is similar to some of the designs from the other members. It is able to reuse water and is easy to relocate. Thus, this is a good base model.

Fatima Rashid’s Designs



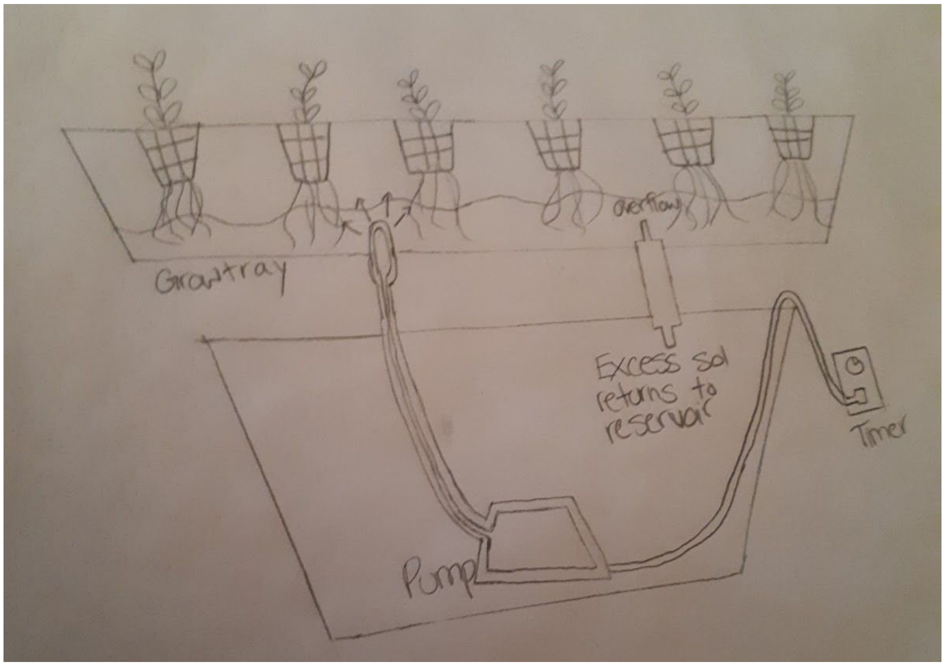
Design 1

The first design with the sprinkler system provides an effective way to spread water and nutrients to a large surface area and number of plants. This system however may prove to be messy and may possibly spill water outside of the system.



Design 2

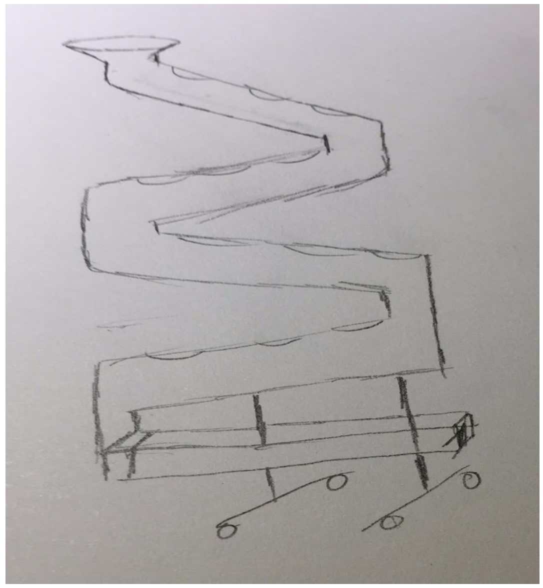
The second design with the grow table however seems to be very efficient with its water usage as a very small amount would ever be wasted. This system would require however for a larger volume of water to be being pumped consistently, and would maybe require more or stronger pumps to implement.



Design 3

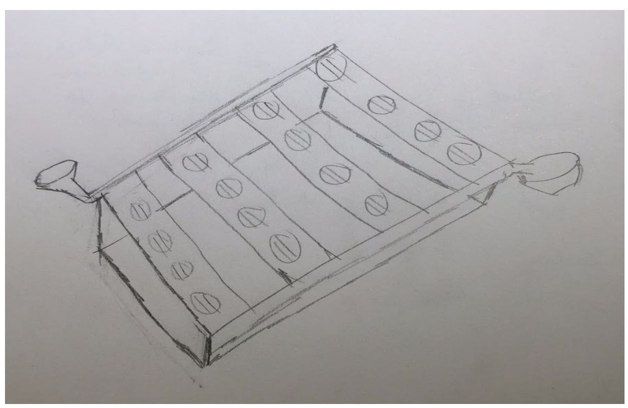
The third design with the water infuser and overflow pump seems like one of the most efficient models, with the use of specialised water input and outtake systems, this may prove to be one of the most difficult to implement. This is because each row of plans would require its own overflow valve, as opposed to other connected systems where all of the output is connected and flows together.

Spike Kuang's Designs



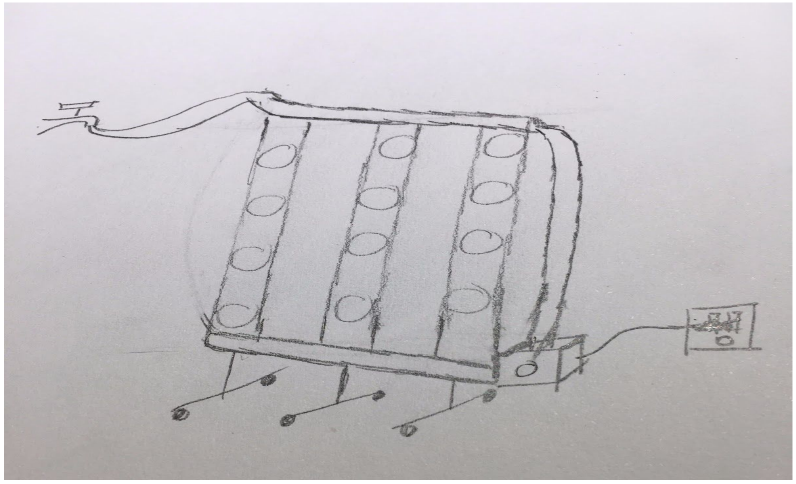
Design 1

The first design is basically a normal design, but uses different shape of pipes to make the water flow down into a tank that is used to recycle the water.



Design 2

The second one contains several columns to make a incline which is about 45° above the ground. And also, it uses the gravity to let the water flow down.

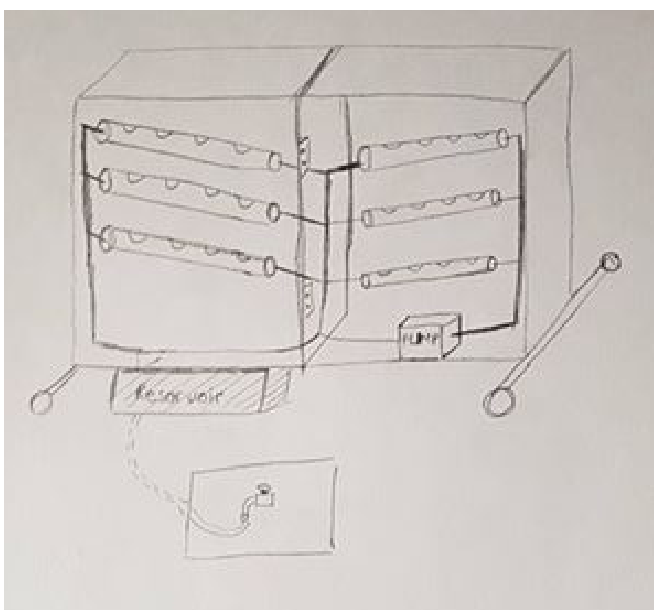


Design 3

The third design the automatic way to recycle the water which uses the pump in order to give the machine enough pressure. Also, the columns became vertical.

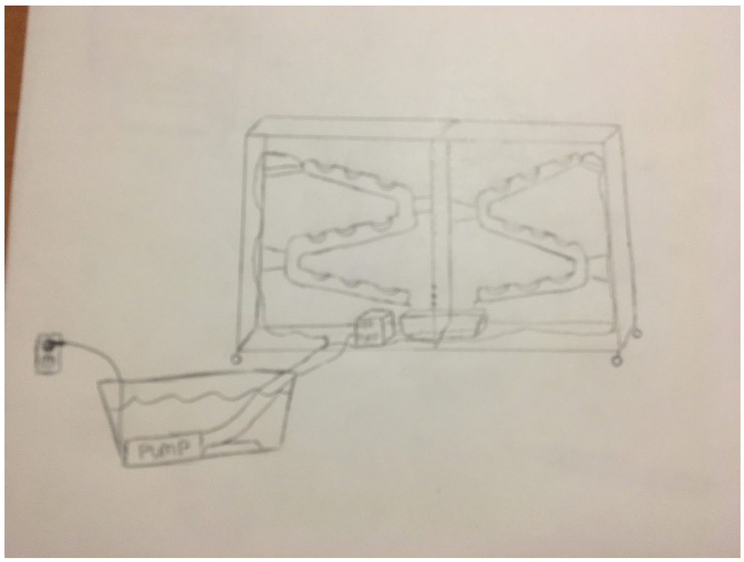
Functional Designs

After a thorough discussion, the team has come down to three possible functional designs.



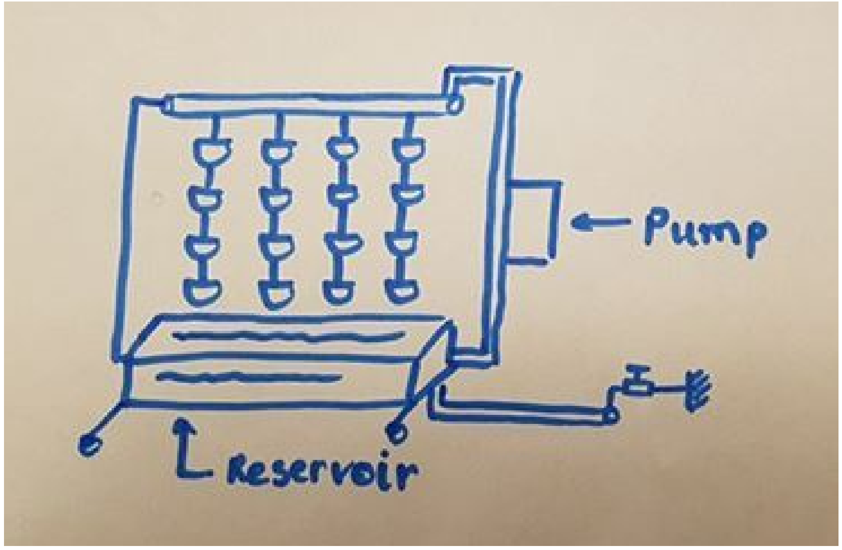
Design 1

The first functional design was featured a few times in our conceptual designs but this time, with some modifications. As shown in the picture above, the design consists of two foldable parts, each contains three tubes to hold the plants. We choose this design because it is not only big enough to hold upto 24 plants but also compact enough to transport and store. In addition, the tubes are arranged in such a way that they utilize gravity to drain the residual water down to the reservoir, thus reusing the water. The reservoir is also connected directly to the water hose, allowing easy refilling without the need to bring the water bucket back and forth.



Design 2

This design incorporates the idea of opening of the folding option to be moved to different rooms and if possible a tri fold system could be implemented. This whole system is also on wheels and can be moved around very easily. The reservoir on this is external rather than on the system to be easier transported back and forth to the sink to be filled up. The pump system consists of a nutrient pump plugged into the wall that is connected to air pump located on the frame. The pump easily moves water to both side of the system and has the water flow down pipes in a snake formation and any excess is collected into a drip tank that can be easily dumped out.



Design 3

The third design features a hanging layout where the plants, placed in several pots with holes at the bottom, are hung one after another. This way, the water is reused every time it drips from the top to the reservoir. In addition, to minimize the effort whenever the user refills the water, a hose is attached directly to the reservoir. The design in general does save space and allows young students to easily manipulate.

Final Concept

After reviewing, comparing, and contrasting from our designs, it was decided that our hydroponics system will be made of 2 separate parts, one being the system itself, and the other being the water reservoir system. This is to maximize the mobility and convenience of the system. They will be able to be attached and detached by threading attached to the hoses running along the model and out of the reserve. In this reserve, we will implement (if costs allow) the use of a water level sensor, in unison with a solenoid valve to allow for the automatic replenishment of water to the reserve. The unit itself will be using a system similar to the design outlined by Fatima Rashid in her 2nd design, with water being flown into the trough with roots at one end and draining out the other. This allows for a simpler flow of water through the system to all parts. The water will be pumped to all levels of the model through the use of one main pump located on or within the water reserve through a main tube running up the length of the model, with a number of branches along the model.