Deliverable -D-

Conceptual Design

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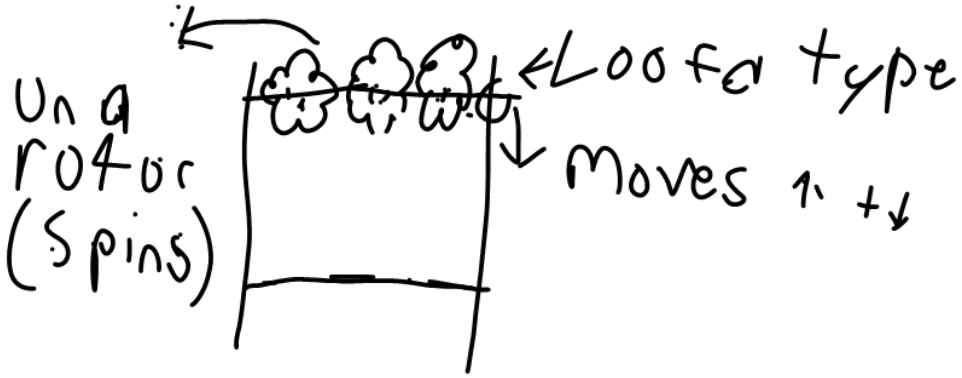
1. Final Functional Solution

1.1. Subsystem 1 - Cleaning

1.1.1. Moving Brushes

Like that of a touch carwash, these brushings will move up left, right, all over the raft, using its bristles to clean inside the gaps and ledges. Sending the broken off algae to the base of the machine to later be drained



1.1.2. Pressure Washer

Pressurized water will be sprayed at the board from both sides, breaking the algae and mold. The water will effectively blast off the algae without damaging the integrity of the board. Sending the broken off algae to the base of the machine to be later drained.

1.1.3. Air Brushing

A high-pressure hose that goes over individual sections of the rafts and blows heated air to loosen and remove built-up algae. Sending the broken off algae to the base of the machine to be later drained.

1.1.4. Air Dry

Like a car wash air dry, a large amount of heated air will be blown onto the rafts, effectively drying them semi-instantaneously.

1.1.5. Heat Drying

Increasing the temperature within the machine to evaporate any excess water left stuck in the corners of the rafts, as well as the heat being able to kill many types of bacteria. Effectively drying and sterilizing the raft in a short amount of time.

1.1.6. Shake Dry

Vibrating the raft inside the machine to remove any excess water on the raft, allowing it to fall into the drainage system below.

1.1.7. Brush

Design a brush that does a circular motion and is operated by a control panel. It should be designed with rollers and a system to stick to the Styrofoam to move from platform to platform.

1.1.8. Clip Brush with Power Washer

Use a system that can clip onto the sides of the boards and brush the sides, but spray water along the top to spray any areas that cannot be reached.

1.2. Subsystem 2 – Automation

Micro Controller

This controller can be programmed to give the user options on the type of clean. For example, boards that may have extra or extreme algae build-up, the controller will give the choice to have a “heavy cycle” which will lead to a deeper and lengthier clean.

- On and Off switch: Switch to turn on or off the washing system and will be controlled by a micro control board (Arduino program). The control board will be wirelessly connected to the cleaning product.

1.3. Subsystem 3 – Safety

1.3.1. Emergency Shut off

A big red button, which when pressed at once, shuts down the device, stopping any mechanical and physical components of the device from coming to a halt. This function can then avoid the danger of someone being caught in the machine and it is inflicting damage.

1.3.2. Keep in a safe location:

The system should be in a specific location on the wall (if its mounted) or stored away (for the actual product) so that it is out of the reach of children and away from any other dangers.

1.3.3. Safety alarm for malfunctions:

If the user wants an automated system, it is highly likely that the user will step away from the system. In the event of danger, if no one is present, there should be an alarm that notifies the user of urgency.

1.3.4. Locking Doors

Once the on button has been pressed and the machine has started the cycle, the doors will now automatically shut; if these doors are opened while the cycle is in progress the machine will automatically shut off, avoiding any injuries.

1.3.5. Passcode to turn on

To start the cycle, the user must enter a passcode, which then allows the user to edit the settings as well as start the cycle. This will minimize the chances that an untrained or untrained user will have access to the machine. This will in turn stop the chance of improper use which can lead to damage and injuries.

1.4. Subsystem 4 – Compact

1.4.1. Foldable

If the product is capable of folding to be stored and occupies less area space, this will allow the functionality of the machine to not be overlooked by the potential size. As the cleaning is a once-a-week task, the machine is only needed for 1 of the 7 days, therefore if it can be folded the space used will be much less

1.4.2. Portable

If this device is portable and can be easily moved from one place to another. It may be possible that this device is stored in a separate building and then brought to the GrowGrowercer unit for the day you will be cleaning the rafts.

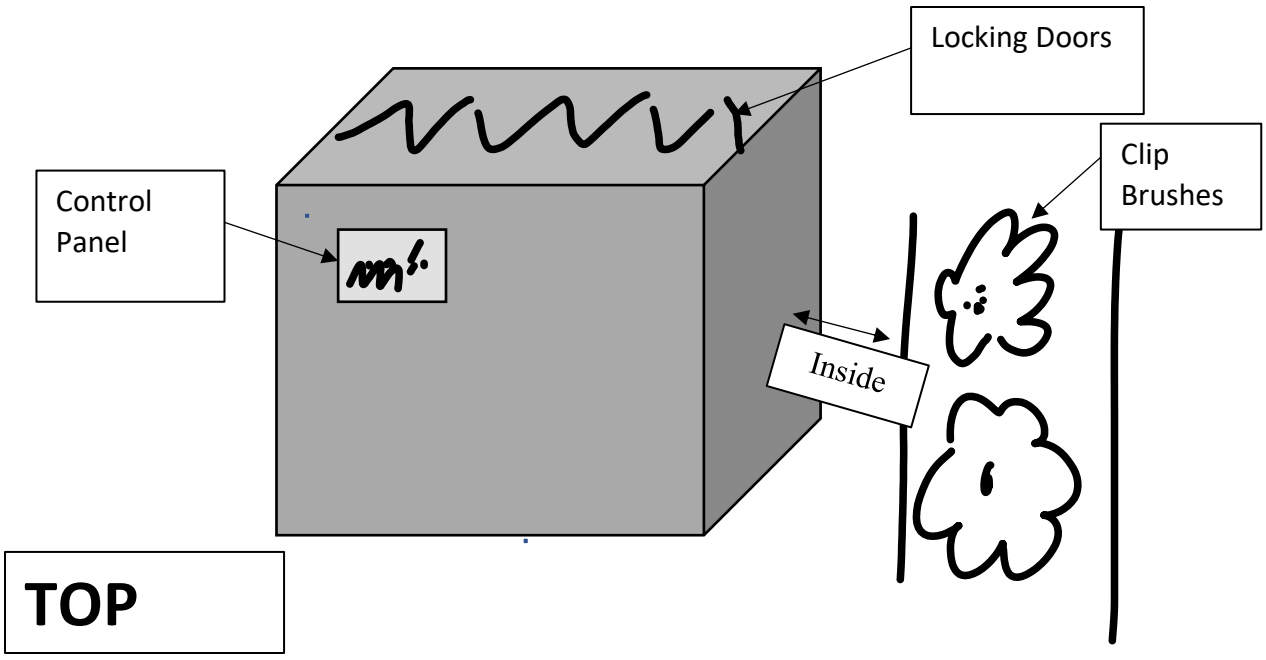
2. Concept Generation

Using a random number generator, each team member randomly selects 1 subsystem from each category. From this, each member will create a unique and different concept, which will be chosen from.

1.5. Concept 1 - Owen

8, 1, 2, 1: Clip Brush + Micro Controller + Locking Doors + Foldable

Main idea: Brushes that clip onto the side of the boards will be automatically controlled by the micro controller that is wirelessly connected to control the intensity and length of the cycle. Once this micro controller is started and the cycle has begun, the doors will now be locked and if they are opened at any point, the machine will completely stop. At accessible joints, the machine will be connected via a hinge, which will allow the machine to be easily foldable.



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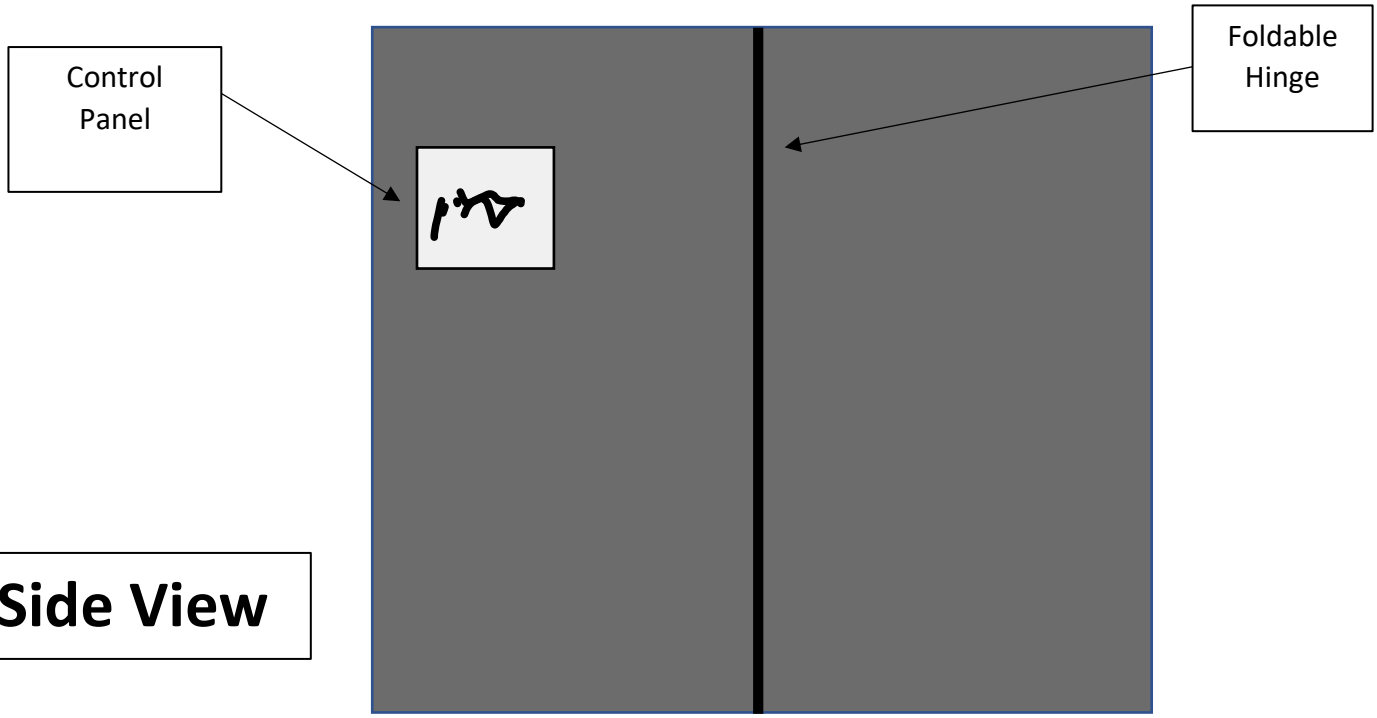
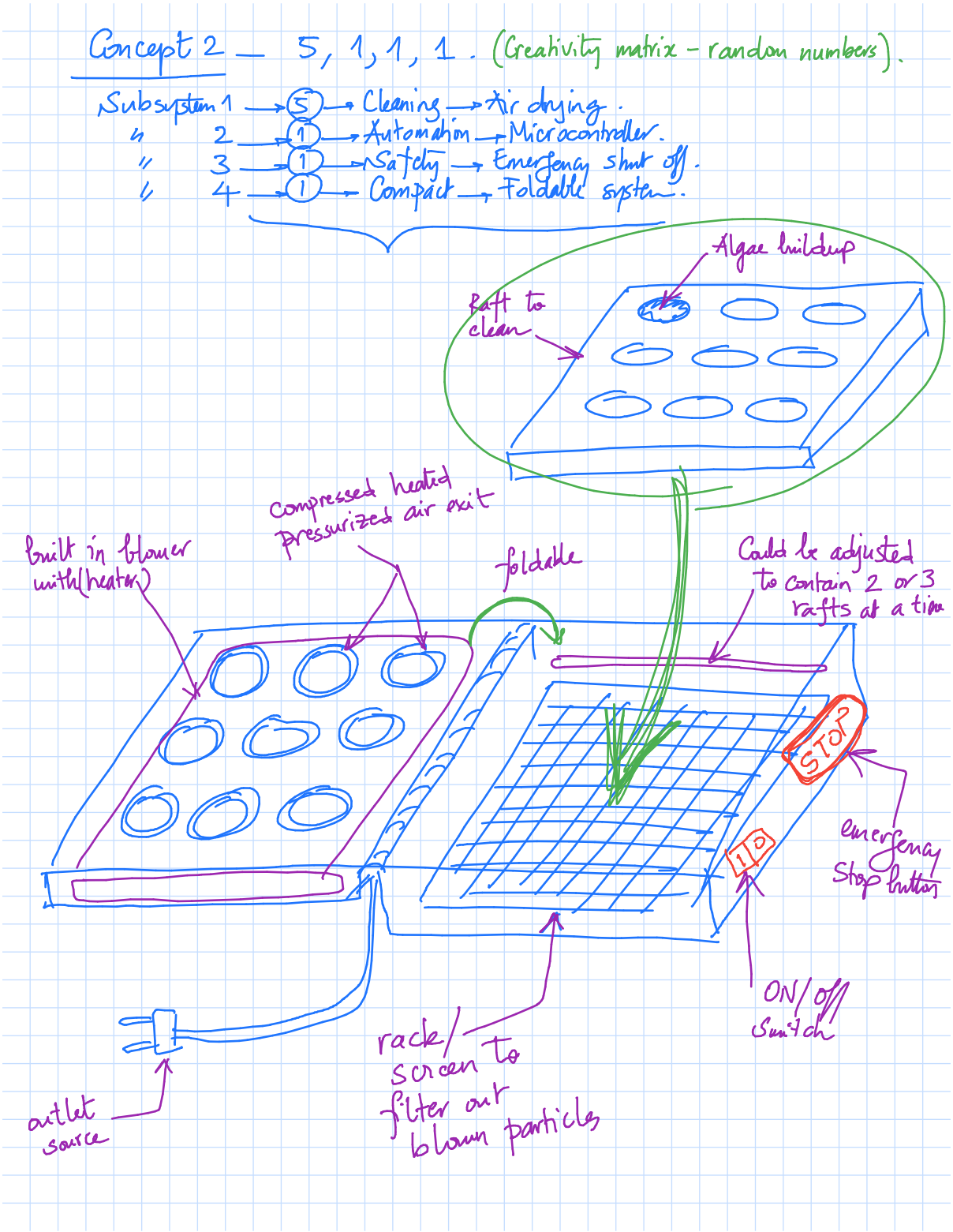


Side View

1.6. Concept 2 – Mohammed

5,1,1,1: Air Drying + Micro Controller + Emergency Shut-Off + Foldable System



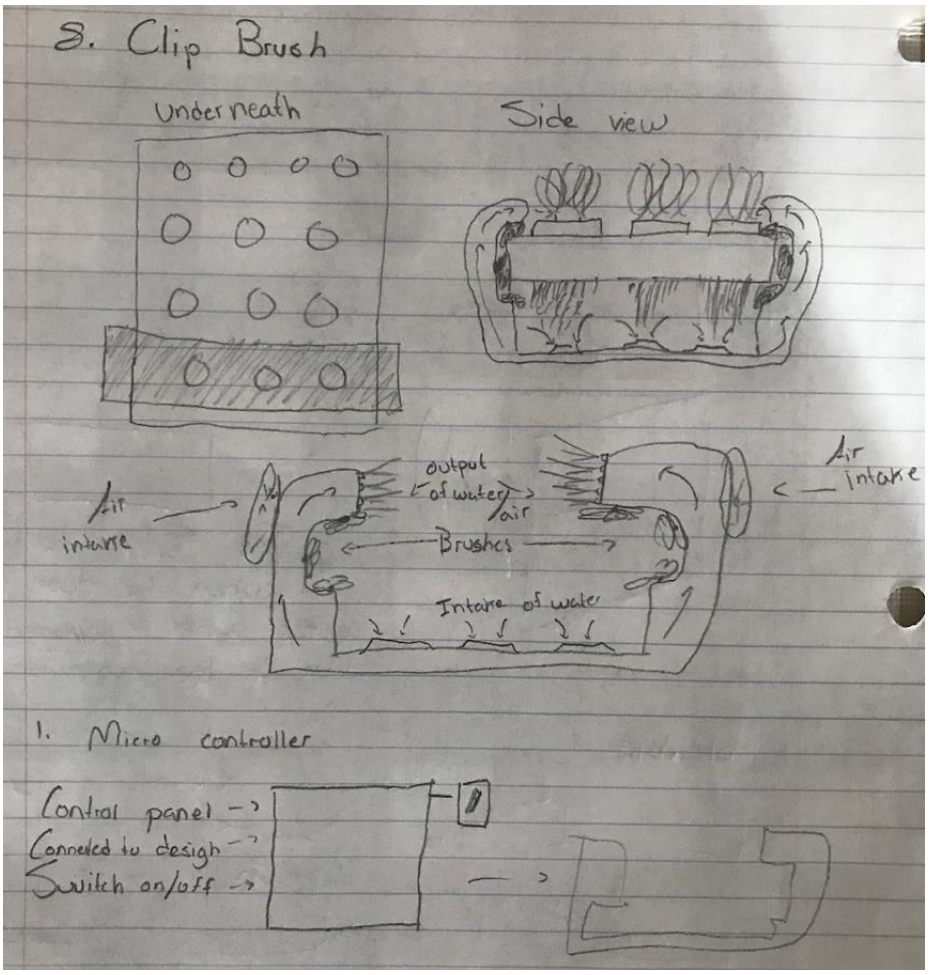
1.7. Concept 3 – Jacob

8, 1, 4, 1: Clip Brush + Micro Controller + Locking Door + Foldable.

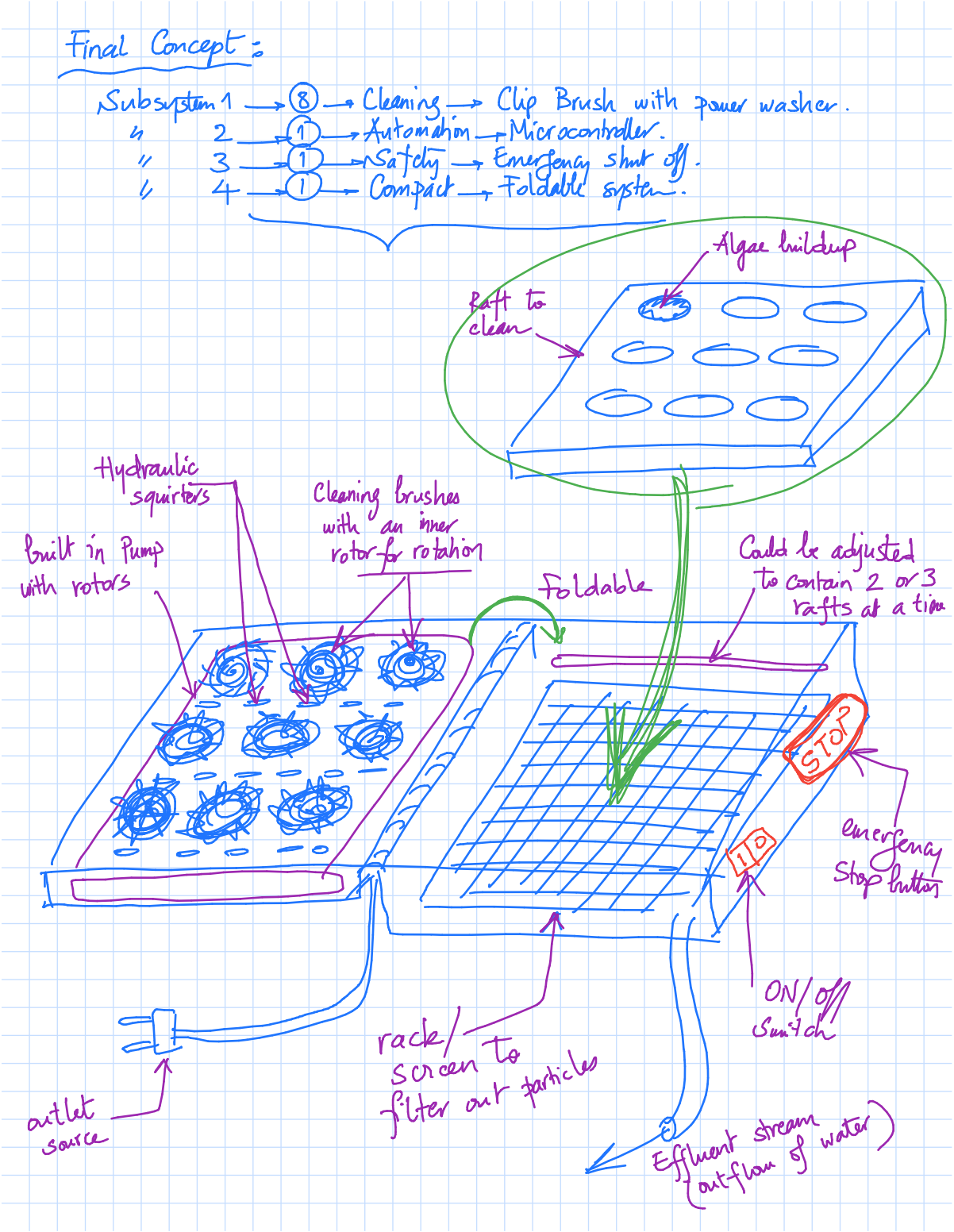
General idea and commentary:

- This design will adhere to the sides of the board and pass through the bottom of the plants. The general idea is that the brushes will scrape the algae off the sides and reach some cracks and crevices, while not harming the plants. Underneath, the bar connecting the two ends will have a vacuum to suck in and filter the water to recycle it and use it to spray the top of the platform. When the first clean is done, the product will stop the water and instead use an air intake to dry the moisture as to reduce the risk of algae growth.
- This device will be controlled by a micro controller programmed to clean and dry to prevent algae build up. This micro controller will be mounted to a wall to prevent occupation and allow easy access. A switch will also be connected to allow the user to easily manipulate this design.
- Because this design has a panel mounted to the wall, in case of emergencies, when the panel is opened while the machine is still working it will signal the product to stop its progress to prevent injury or harm to the user or any surrounding plants.
- As stated by the client, the design must be compact. The solution will be to create a foldable product so that it can be stored without effort. A locking hinge in the middle of this design will suffice to make this possible.

Drawings (with number references):


3. Clip Brush
Underneath
Side view
Air intake
output of water/air
Air intake
Brushes
Intake of water
1. Micro controller
Control panel ->
Connected to design ->
Switch on/off ->
4. Locking doors
Tell machine to turn off when the door to the access panel is opened or the door to the container.
1. foldable

3. Best Global Concept (mix of subsystems by preference)



4. Project Management

For this week's deliverable, we saw a lot more individual and serial/parallel work. As much of the brainstorming and the idea creation had to be done separately but at the same time. As a group we divided ourselves, and each team member created a couple of ideas for each subsystem based on the problem statement and the previous benchmarking.

This deliverable did not have too many dependencies but required more meeting time to discuss and choose the final concept. On Wrike this is shown as for many of the objectives (tasks) are assigned to multiple people as everyone must do it on their own. This week's assignment was much more up to group interpretation, which required more meetings but less parallel work.

5. Conclusion

During the week before our team meeting, we separately worked on and drafted some potential functional solutions. When we believed that we had enough ideas to work with, we got together with our team members and decided that it was in our best interest to use a creative way to create concepts by using a random number generator. We assigned each member a concept, and with a random generated idea we worked separately before coming back together to discuss which design was best. After we chose our main concept, we contributed to refining our concept by speaking openly with each other to create what we believe to be the best possible design given our ideas.

6. References

Jason Foster. 2019. “GNG 1103 – Engineering Design Lecture Notes” uOttawa.