Project Deliverable D: Conceptual Design

GNG 1103 – Engineering Design

Faculty of Engineering – University of Ottawa

Group 20

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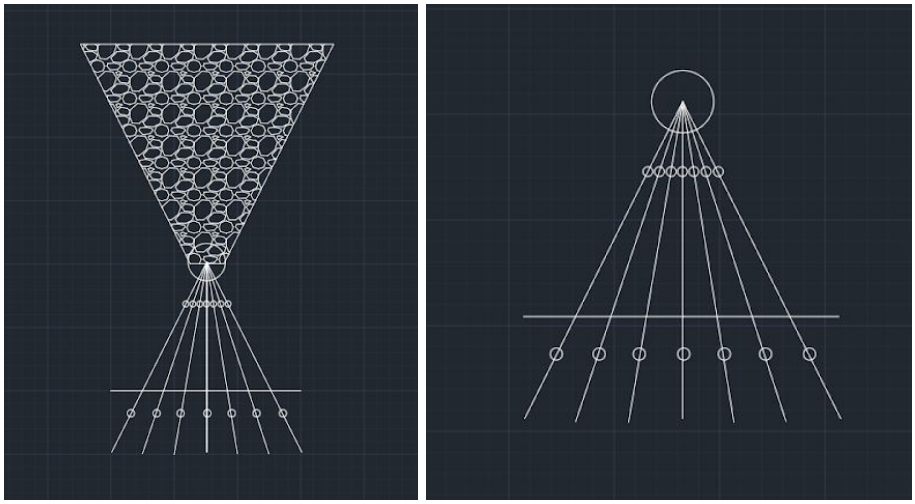
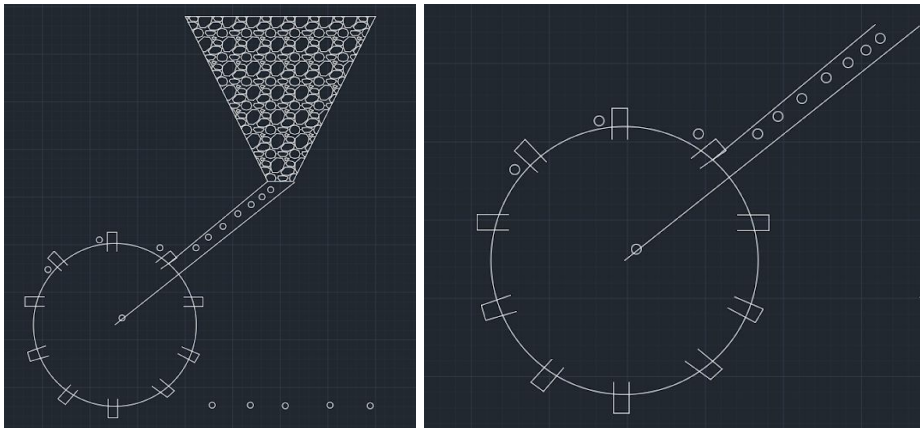
This document describes concepts based on our team's problem statement, benchmarking and our list of prioritized design criteria. Our main goal with this deliverable is to reconvene as a team and discuss these concepts in order to filter the less appealing ideas and focus on well structured ideas for further development. Each concept contains a general sketch with a descriptive text explaining its functionality, use and specifications.

Concept 1 (Justin Mahfoud):



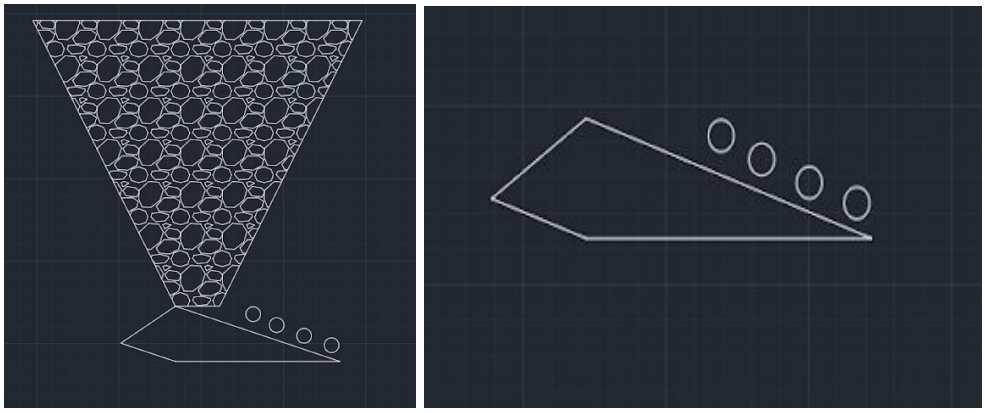
The sketches above illustrate the front view of this concept. This concept functions similarly like a rake. This attachment will be placed on Bowie's rear end and will be dragged along the soil creating lines in the ground. These lines will be filled with the seeds. This concept consists of a cone shaped container containing all the seeds, while Bowie is in motion, these seeds will be dropped in cylinder tubs connected to the bottom of the container, where each tube is dropping a seed at a constant rate. This mechanism is able to cover a much larger area since it has multiple drop point, allowing quick and efficient planting. This device can be easily 3D printed and will be able to operate automatically while attached to Bowie. Also it will be easily attachable and detachable from Bowie since it will be place on the robot via a hook and a clip. It is very cost efficient since it contains thin tubes which will be dropping the seeds. This device satisfies the conditions of a 120x120x120 mm measurement constraint.

Concept 2 (Justin Mahfoud):



The sketches above illustrate a side view of this concept. This concept functions using a rotating disc which will create a singular line in the soil. As the disc rotates, seeds will be dropped in compartment on the disc. When this compartment is facing downwards, the seed will drop with the help of gravity. Each compartment will allow a single seed only and this will be monitored with the help of sensors (to be developed later on). There will be a container in the shape of a cone containing all the seeds and is connected to a tube that will drop the seeds onto the disc at a proper rate. This rate is determined using the speed of Bowie. The quicker Bowie moves, the more seeds will be dropped. This concept will respect the conditions of functioning in the sand, snow and dirt while dispersing seeds without any problem in these conditions. It will be automated and detachable with a product life of more than 5 years.

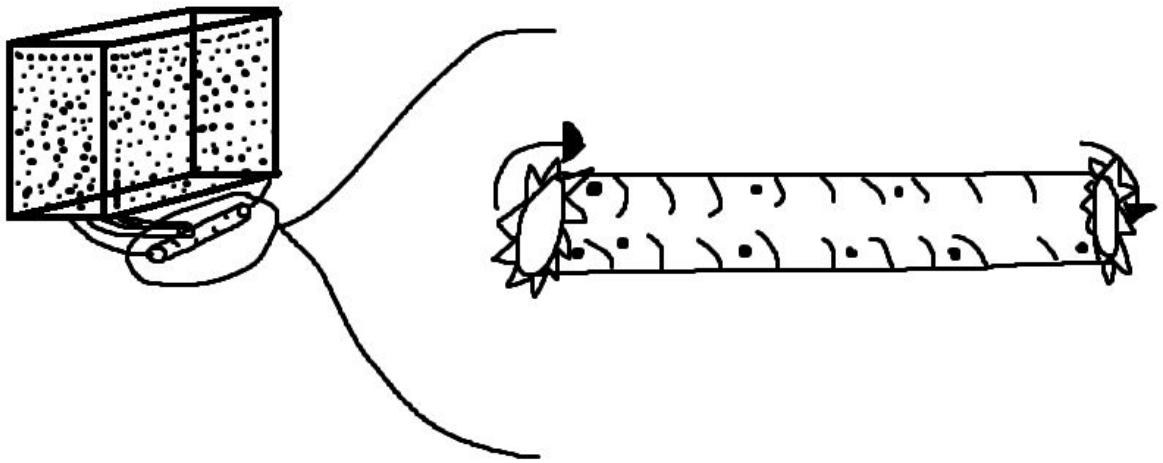
Concept 3 (Justin Mahfoud):



The sketches above illustrate a side view of this concept. This concept functions using a sharp end of a material to carve lines in the ground, releasing seeds behind it, placing them in the lines

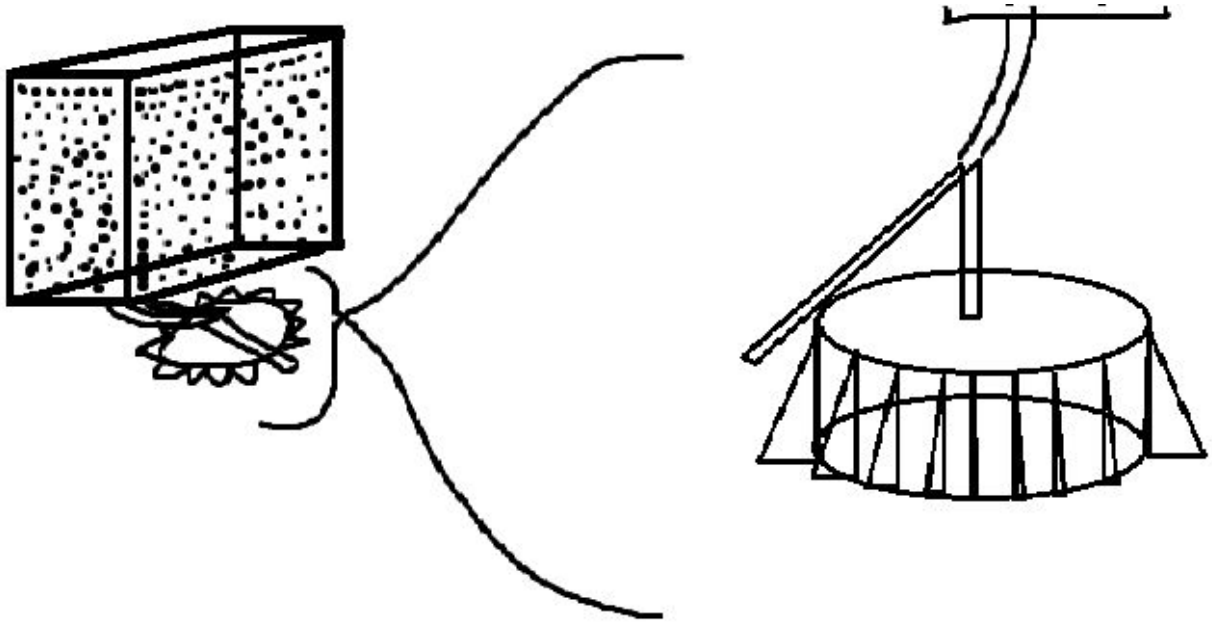
it has carved. The seeds that will be dropped in the back of this sharp carving material will be dropped at a accrding rate to Bowie's speed. There will be a container in the shape of a cone containing all the seeds that will drop the seeds onto the rear of this shape, allowing the seeds to slide down. This concept will respect the conditions if an easy to control concept, being a very simple idea with a build that respects our cost range of under 100$. Also our container can hold more than 300 cubic centimeter of seeds. Although it is a very cost efficient concept, its life span might not respect our specification of surviving more than 5 years.

Concept 4 (Michael Saber):



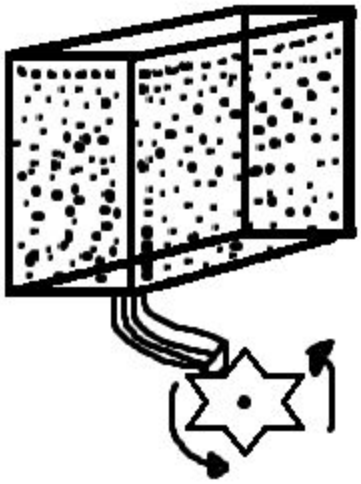
This concept functions using a hollow cube to store the seeds with a funnel at the bottom that leads to a cylindrical roller with gears to make it turn. The cylinder has grooves which will limit the amount of seeds that are dropped. The cylinder will turn using gears which will be attached to the axis which holds the wheels. The faster the wheels turn the faster the cylinder turns which in turn increases the amount of seeds dropped. An advantage is that the faster Bowie moves the faster seeds are dropped and when Bowie is stopped seeds will not be dropped so that no seeds are wasted because we don't want many seeds in one small spot.This whole system will be 3D printable and inexpensive to create. It will also fit within our required dimensions of 120x120x120 mm. This system should last a couple years before needing replacement because the material that will be used will be good quality. Depending on how often the system is used and in what conditions there is a risk that it won't survive as long as we expect.

Concept 5 (Michael Saber):



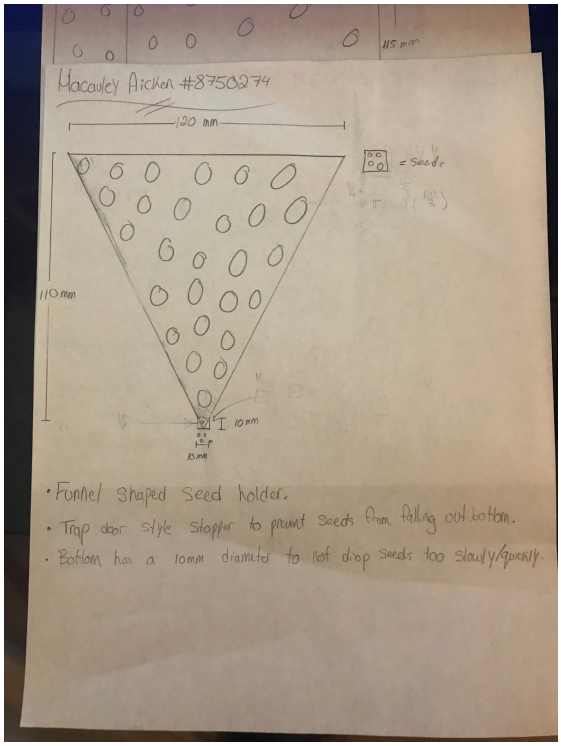
This concept also functions using a hollow cube to store the seeds. In this concept there is a gear below the funnel with a “slide” that will spin as the gear spins. This allows to disperse the seeds in a 360 degree direction. An advantage to this is that we can cover a greater surface area thanks to the spinning mechanism but a drawback is that it may be harder to implement because the gear would have to be attached to the container and due to the placement of the gear this may be difficult.. This whole system will be 3D printable and inexpensive to create. It will also fit within our required dimensions of 120x120x120 mm. Depending on the material we use, the system should last a couple of years until needing replacement. Again, due to wear and tear and any other mishaps, the system can always run the risk of not surviving as long as we expect it to.

Concept 6 (Michael Saber):



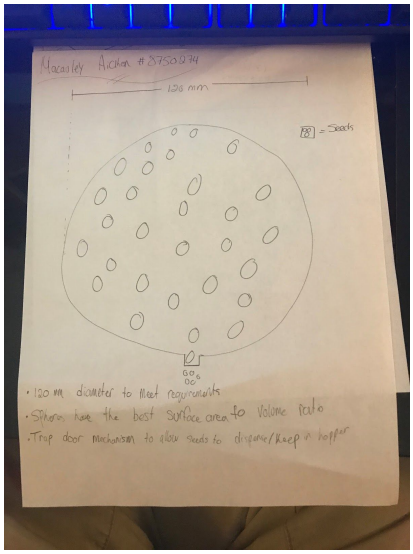
This concept features the same container but the seed dispensary method is different. In this concept we use a gear placed perpendicular to the funnel in a way that the teeth of the gear will block and unblock the funnel. The goal of this is to make it so the gear allows us to limit the amount of seeds dropped depending on the speed of Bowie (the gear is connected to the axis which holds Bowie's wheels) As Bowie's speed increases so will the rotational speed of the gear which will make it so the funnel gets unblocked and blocked faster meaning more seeds will drop. A disadvantage to this system is that it is possible that when Bowie stops moving the funnel is left in the open state and the seeds will keep dropping even while Bowie has halted its movement. This whole system will be 3D printable and inexpensive to create. It will also fit within our required dimensions of 120x120x120 mm.

Concept 7 (Macauley Aicken):



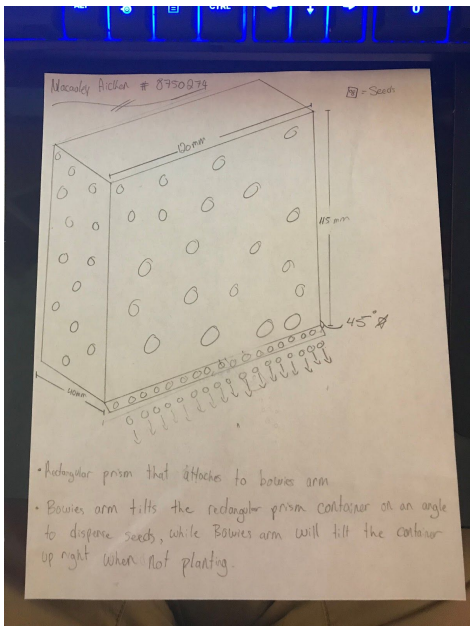
This concept features a classic funnel style seed dispenser with a trap door type mechanism that will be used to dispense or simply keep the seeds stored in Bowie. The trapdoor mechanism will open more or less depending on how quickly bowie is moving in order to not drop too many/few seeds at a given speed. This concept will be 3D printable, and will fit inside our dimension boundaries of 120x120x120 mm, as well as being able to hold > 300 cm3 in the funnel.

Concept 8 (Macauley Aicken):



This concept is fairly similar to the previous one. Both concepts use a funnel style dispenser with a trapdoor mechanism to dispense/store the seeds. The two concepts have very similar pros/cons, however, one pro the spherical hopper has over the classic funnel style is that spheres have the best surface area to volume ratio, therefore it will be able to contain more seeds than the classic funnel. This concept will also fit inside our dimension boundaries of 120x120x120 mm, as well as being able to hold > 300 cm3 in the hopper.

Concept 9 (Macauley Aicken):



Concept 9 is a fairly simple one since it just makes use of Bowie's arm in order to tilt the container. The container will be attached to Bowie's arm, and the user will move Bowie's arm to tilt the container to an angle where the seeds will fall out of the bottom slot on the container. The disadvantage to using this concept would be that it leaves more room for user error than the others, since in the other concepts the dispensing speed was determined by Bowie's rolling speed and in this one the user determines the rate at which the seeds will dispense. As well, this concept will fit inside our dimension boundaries of 120x120x120 mm, and be able to hold > 300 cm3 in the container.

Conclusion :

After inspecting all our concepts and analyzing their advantages and disadvantages, we have decided to go further with concept number two. Although instead of using a cone shape we have decided to go with a more cubic shape to be able to store as many seeds as possible. We feel that the use of the rotating disk (gear) to dispense the seeds and limit the amount being dropped is one of the best methods that there is. It is efficient and not impossible to implement. This also comes with the advantage of being able to mirror Bowie's speed. This means that as Bowie speeds up so will the dispensary of seeds. When Bowie comes to a halt, the seeds will also stop being dropped. This concept respects most criterias mentioned in deliverable C.