

Individual Lab Report #2

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Wholesome Robotics (Team E)

Teammates: Aman Agarwal, Dung Han Lee, John MacDonald, Aaditya Saraiya

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Individual Progress

In the past week I have worked on a number of smaller tasks, of many different types, related to our project.

I worked as the lead on the Printed Circuit Board Assignment, doing the modelling of all the individual components as well as the synthesis into a circuit board. I created a power distribution board that steps down a 24V bus into 12V, 5V, and 3.3V outputs, with Molex Mini FIT Jr. connectors for all four signals.

I also participated in our team's data labelling party, where we labelled holes and fungus patches of leaves in our training images. This effort was aimed at improving the accuracy of the segmentation algorithm written by Dung Han Lee, so that we could more closely measure the hole and fungus coverage and return more meaningful metrics.

I am also the point person for our teams' purchasing needs. I have been in fairly constant communication with a member of Professor George Kantor's team to specify and order parts that we need both electronically (we have ordered RAM, SSDs, etc.) and mechanically (end effector parts and pieces for the wheel assembly).

I finished wiring the test setup for the drive motor and connected it to the benchtop power supply so that we can begin the software integration. We received the motor and driver board from the Robotanist team. The motor and board are not made by the same company and so correctly wiring them required a careful study of each component's documentation and a bit of hands on work with the connectors.

I also arranged and met with two members of The Phipps Conservatory Horticulture Staff. We discussed the possibility of a partnership for the development of our robot. Specifically, they have offered to grow 3 rows of kale, to our specification in their "Edible Garden" space to give us a test location. Unlike Rivendale Farms, which is 45 miles away from the Newel Simon Highbay, the Edible Garden is within the robots' single charge range (under a ½ mile). This will allow us to schedule small scale tests without needing to secure transport for us and the robot to Rivendale. Of particular interest, we will be able to test mobility, including certain turning scenarios, and also plant monitoring (Phipps also uses only organic methods and they are subject to very similar pest pressures as Rivendale Farms). I have been deemed the point person, as planting season approaches, for communication and scheduling with the Phipps staff.

Finally, I have begun to machine the weeding end effector for our robot's manipulator. I have ordered and received the raw materials necessary for fabrication, and I have generated reference drawings (see figure 1) for the parts, and begun grinding the threaded rods into the sharp tooling that will be ripping up the weeds.

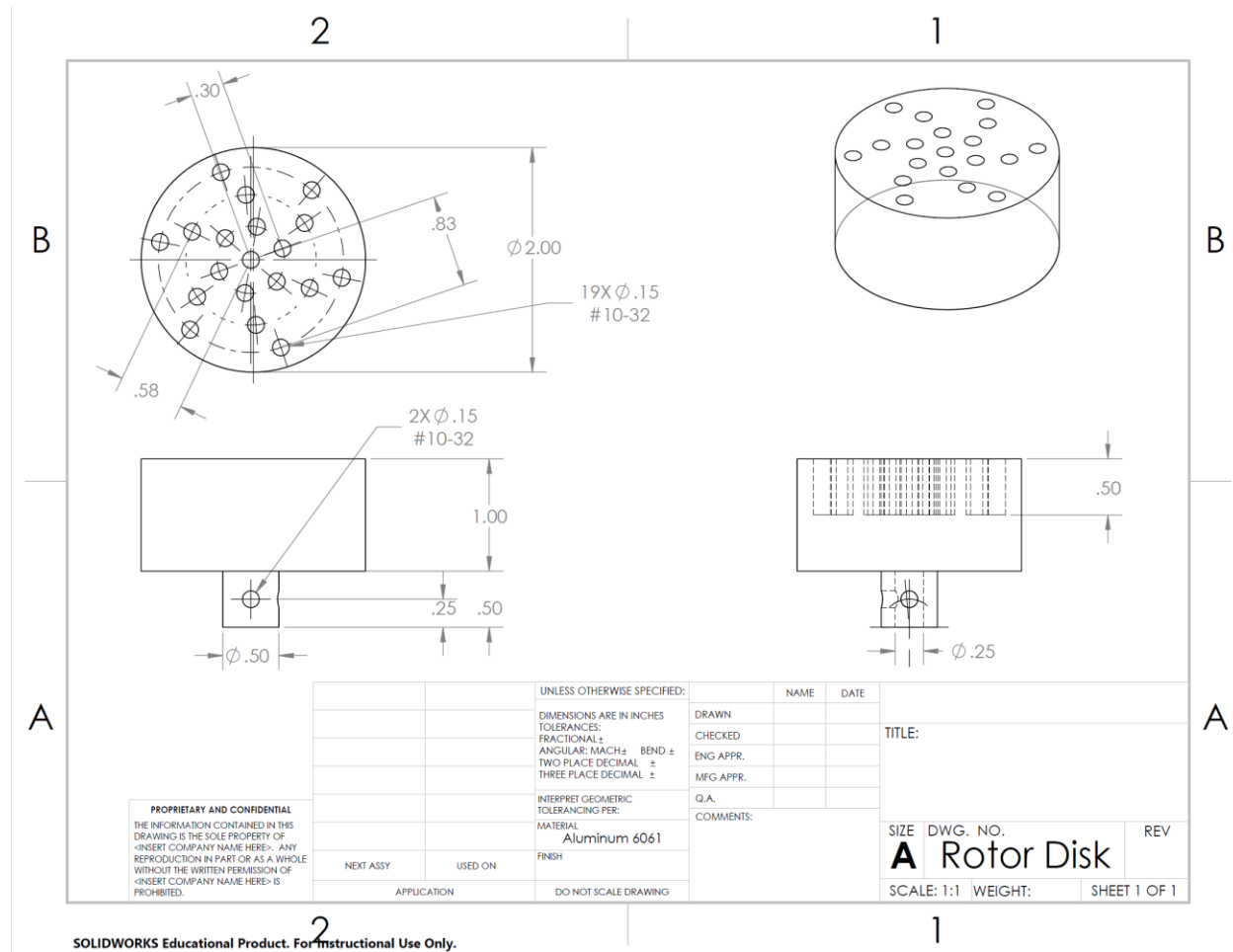


Figure 1 Drawing for the Rotor Disk

Challenges

A key challenge this week was time management. We were given a very large number of tasks to complete this week, in addition to our project work and our other coursework. For that reason, I focused on smaller, “bite-sized” tasks that were necessary steps, but that could be easily compartmentalized and completed in very few sessions.

Another challenge was communicating our needs to the many people who are helping us. For example, expressing in non-technical terms, what we would need at the Phipps Edible Garden in order to make the test location similar enough to Rivendale Farms to be a helpful test site.

Teamwork

Aman has designed blockers for the robot's wheels so that any plant leaves in the row will be brushed aside rather than damaged.

Aaditya has been working on SLAM, particularly beginning to integrate the Lidar.

Dung Han has been working on the perception algorithm for recognizing holes in the plants' leaves.

John has been working on the particle filter for the navigation subsystem.

Future Plans

Wholesome Robotics

In the coming weeks my plan is to complete the first prototype of the weeding end effector and begin testing. I still need to secure a location with unfrozen ground and weed presence. I will likely use an electric drill for the initial tests, gauging visually the effectiveness of the cultivator.

As parts, both electric and mechanical begin to arrive, I am planning on assembling and wiring individual systems. The RAM has arrived for our NUCs so I will begin assembling those and connecting them via network switches. I will also wire the other 3 drive motors upon the completion of our Motor Software Integration task and begin to assemble and connect their peripheral parts (fuses, E-Stops, etc).