PlantMinder

Final Report

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1 Introduction

House plants need to be watered since there is no chance of them getting water from rain. This means that the owner needs to water the plants whenever the soil is dry. However, owners forget to water their plants due to a busy schedule. This project automates the watering process by checking if the soil is dry and the user can easily spot low water levels of the bottle to refill it when needed.

2 Importance of Problem

People care about their plants and become sad when their plants die due to lack of water. This project ensures that plants will always be watered when they are thirsty.

3 Technical Description

3.1 Making the Watering Head

Refer to Figure 1

1. Use SolidWorks or any 3D designing program
2. Make a circle with a diameter of 5 inches
3. Extrude the circle by 1 inch
4. Sketch onto the circle face of the cylinder 5 circles to make multiple rows
5. Make lines to make more open spaces (to make 3D printing faster) and channels between the rows
6. Extrude the rows and channels inwards by 0.8 inches
7. Make small 0.2 inch diameter circles throughout the rows and channels
8. Extrude those circles through the the object to make the watering holes
9. Make a STL file to 3D print

3.2 Making Gears

Refer to Figure 2

1. Use SolidWorks or any 3D designing program

2. Make a circle with a diameter of 5.5 inches
3. Extrude the circle by 5 millimeters
4. Sketch trapezoids around the inner edge of the circle (use mirroring)
5. Extrude between the trapezoids inwards through the circle
6. Laser cut two gears on 5 millimeter plywood

3.3 Make Moisture Sensor

Refer to Figure 3

1. Get 5 millimeter plywood and cut it into a small rectangle
2. Place two long nails/screws into the wood
3. Tape most of the nails except for the bottom
4. Solder on wires to the head of the nails

3.4 Making the Body

You will need wood, a metal pole, tubes, a valve, and 2 continuous servos.

1. Make a base 5 inches long and 4 inches wide (Figure 4)
2. Put the metal pole into one end of the base and a piece of wood of the same height (Figure 5)
3. Attach a servo onto the pole with tape and reinforce it with wood (Figure 6)
4. Place a gear onto the servo on the metal pole (Figure 7)
5. Place the gear through the pole after cutting a hole in the middle
6. Attach the arm to the top of the gear and place a holder wood to ensure that there is no wobble (Figure 8)
7. Create a platform at the top of the two "poles" and attach the valve to the opposite end of the arm (Figure 9)
8. At the top of the platform attach a servo to the end so that it is on top of the valve
9. Create an enclosure for circuitry and a holder for the bottle (Figure 10)

10. Place the watering head under the end of the arm (Figure 11)
11. Place tubes into the two openings of the valve where one goes to the watering head and the other to the top for the water source (Figure 12)
12. Connect bottle to top tube and leave it in the holder

3.5 Circuitry

1. You have inputs for the servos from the arduino that tell the servos which way to turn
2. You have a linear regulator to power the arduino from a 9 V battery
3. One wire from the moisture sensor is connected to a 100 ohm resistor which goes to the arduino
4. The other wire from the moisture sensor goes to the arduino analog pin and a 100 kilohm which goes to the arduino

3.6 How It Works

We send a current through one of the screws of the moisture sensor and measure the resistance of the other. We do this the other way around and average the two values. We do this five times and average them to be more approximate. This value increases when the soil is dry and decreases when the soil is wet. If the soil is dry, we turn the servos to allow water to flow from the source and turn the arm to be above the plant.

4 Lessons Learned

1. We needed to reinforce everything since some parts were resistant; this led to parts breaking off.
2. No plan always works so we always needed to have a backup in mind.
3. More thorough planning would've allowed for an easier time of putting parts together.

5 Future Work

3D printing the main structure would allow for a smoother construction. We could also find better tubes where they are more flexible to allow the arm to move fluidly. We can also change out the valve to be an electrical valve to not rely on our own constructed valve turner (the servo).

A Parts of the Construction

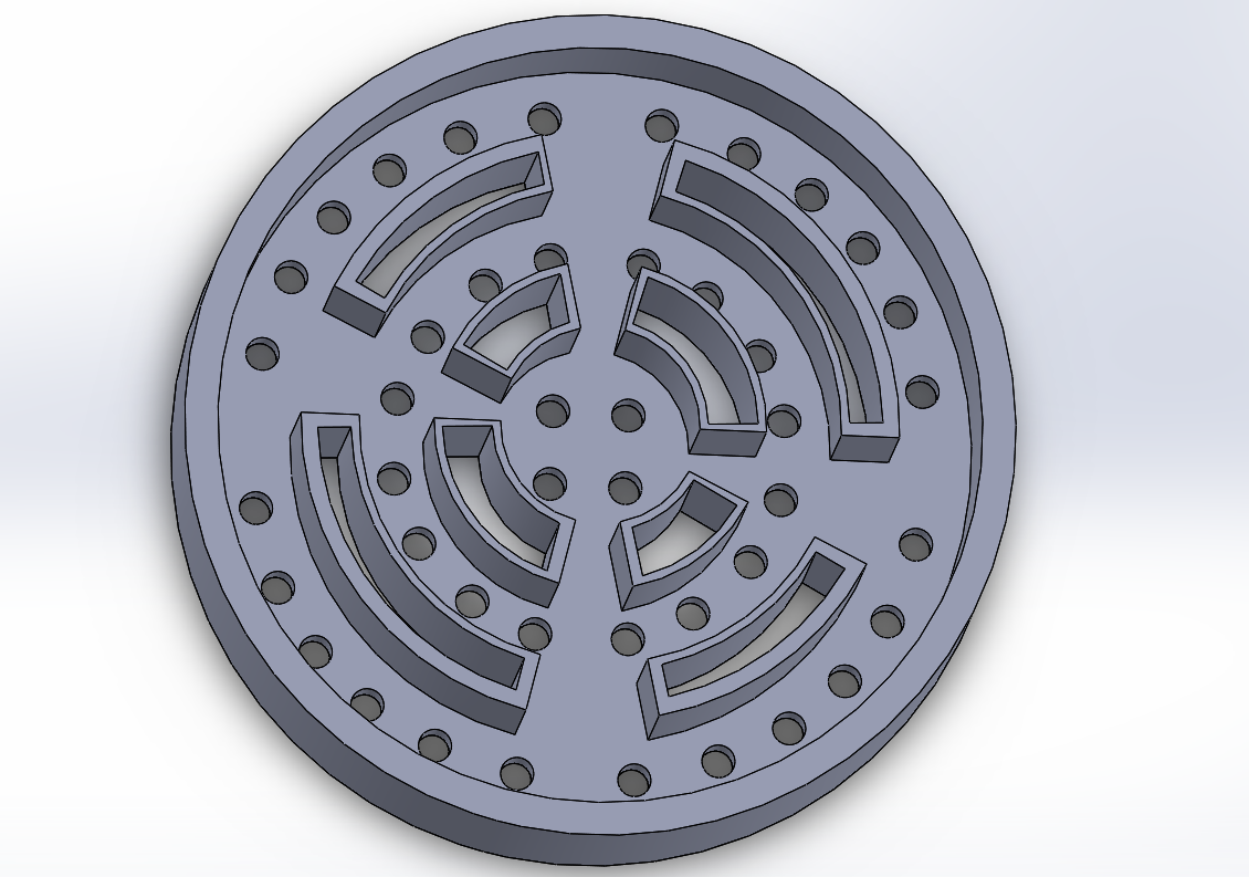

Figure 1: Watering Head - SolidWorks View

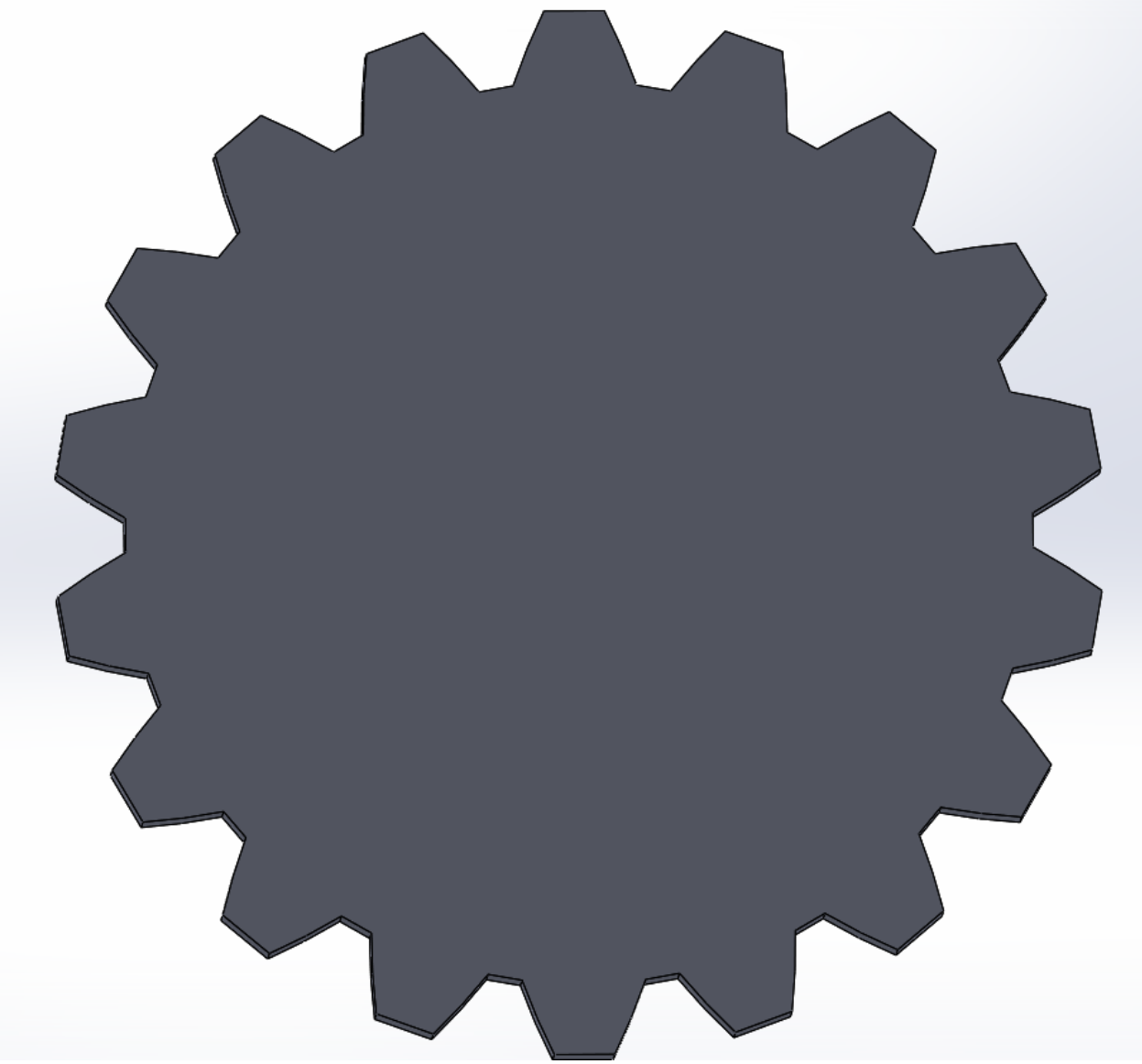

Figure 2: Gears - SolidWorks View

Figure 3: Moisture Sensor

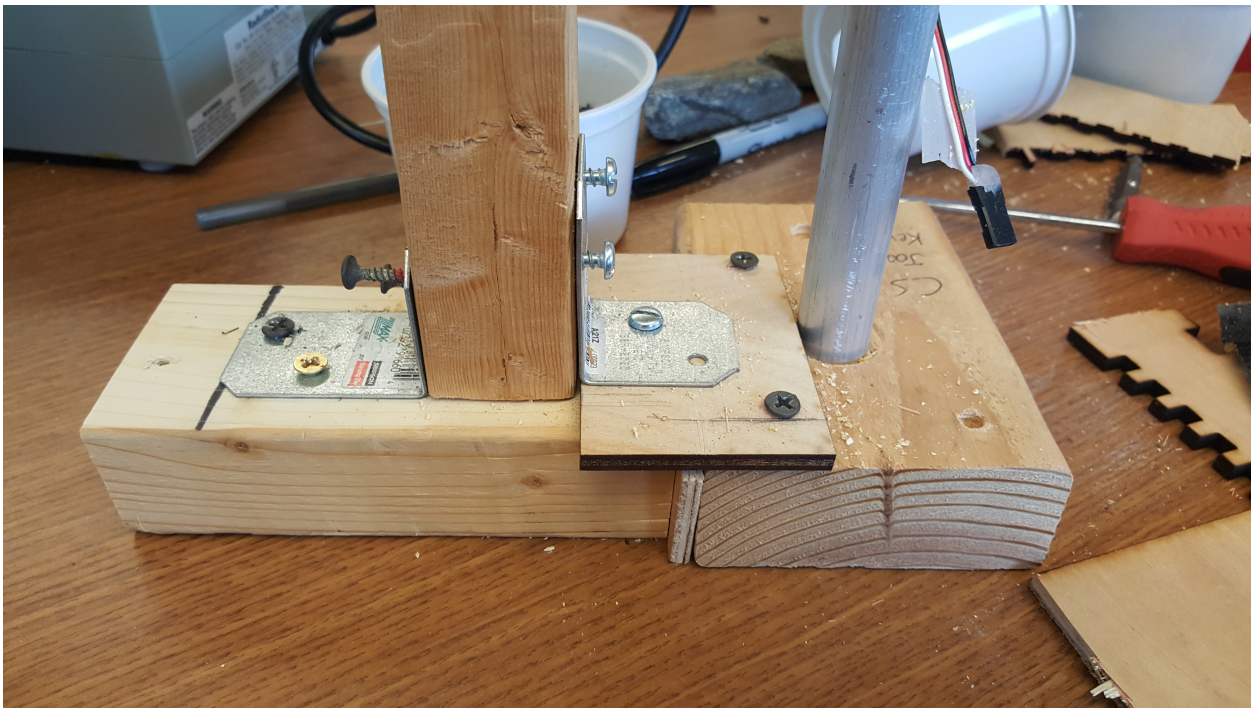

Figure 4: Base

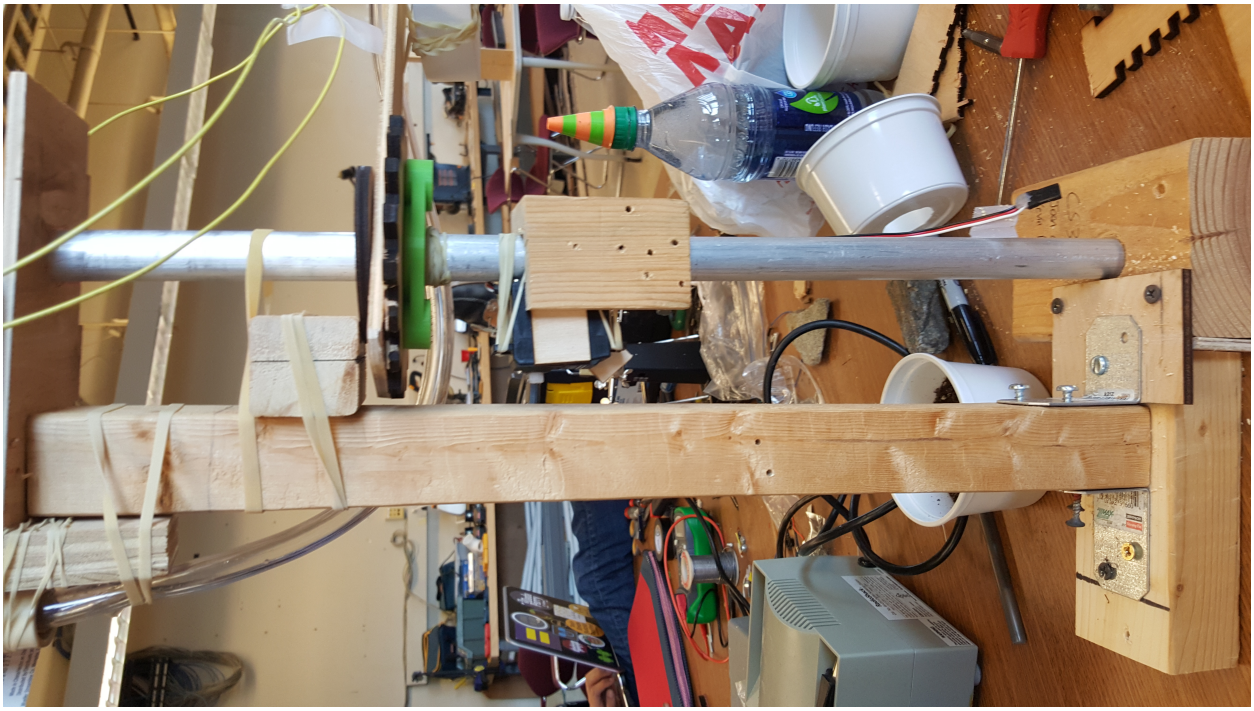

Figure 5: Poles

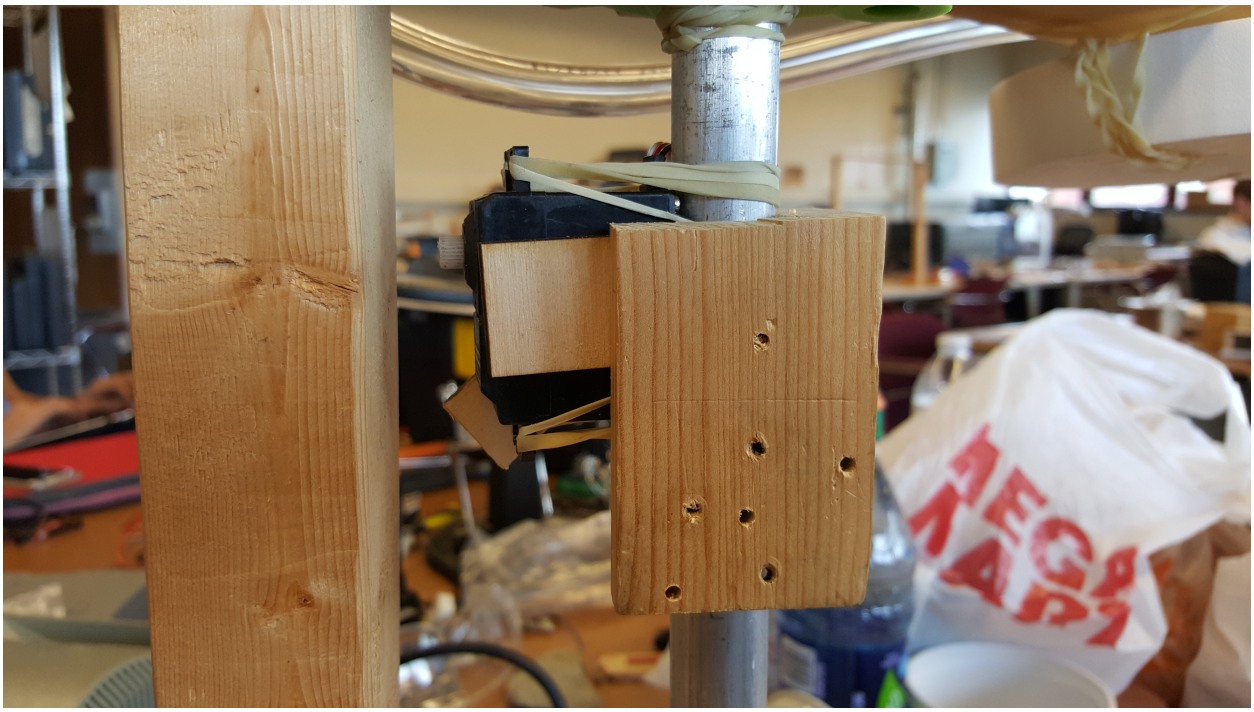

Figure 6: Servo on Pole

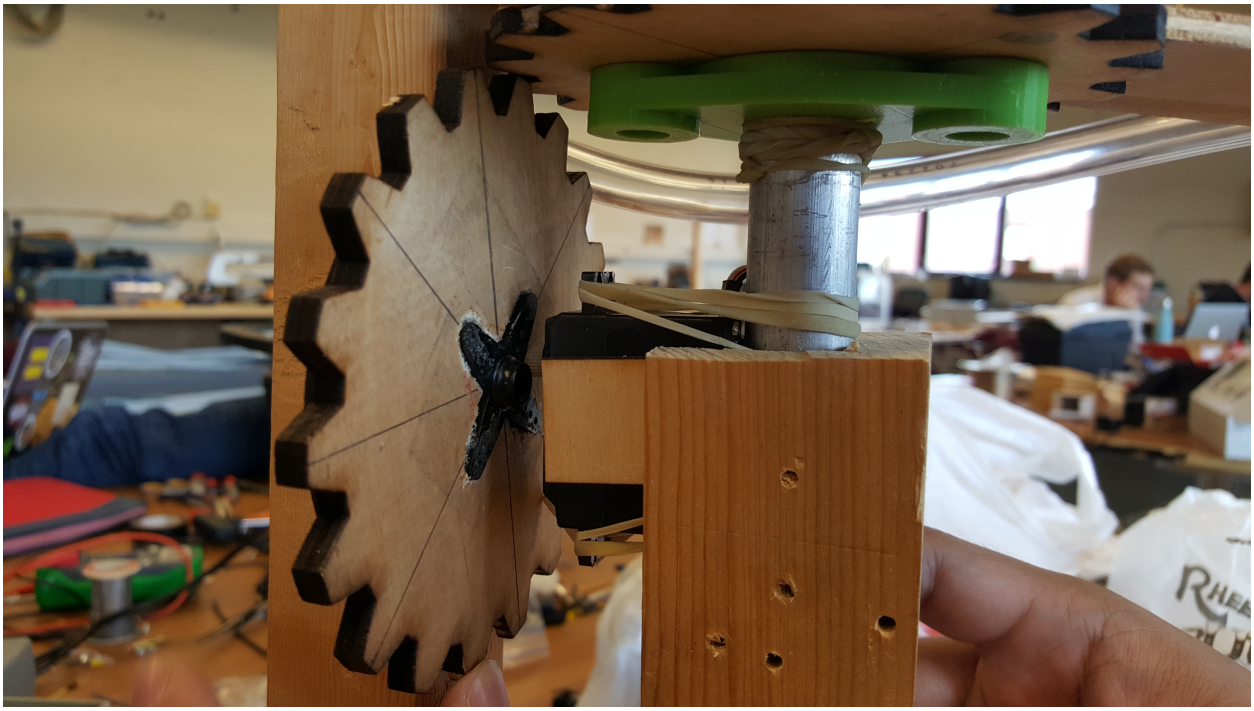

Figure 7: Gear on Servo on Pole

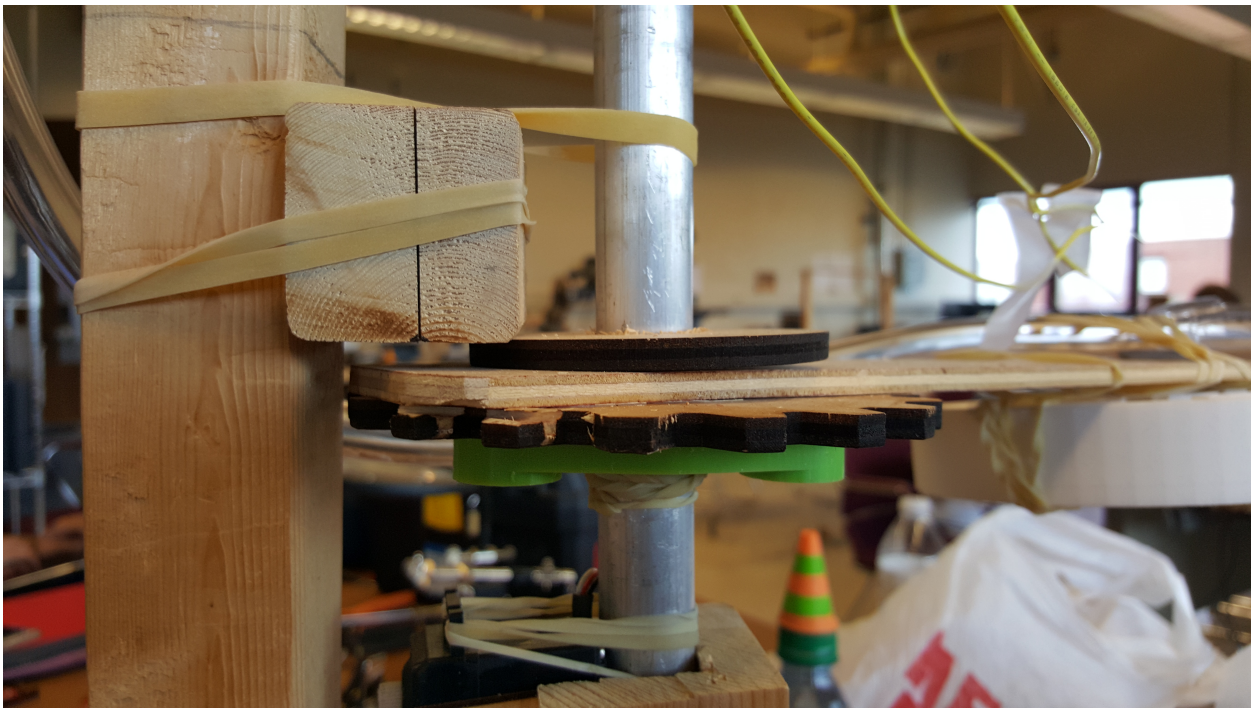

Figure 8: Gear Placed Through Pole with Arm and Holder

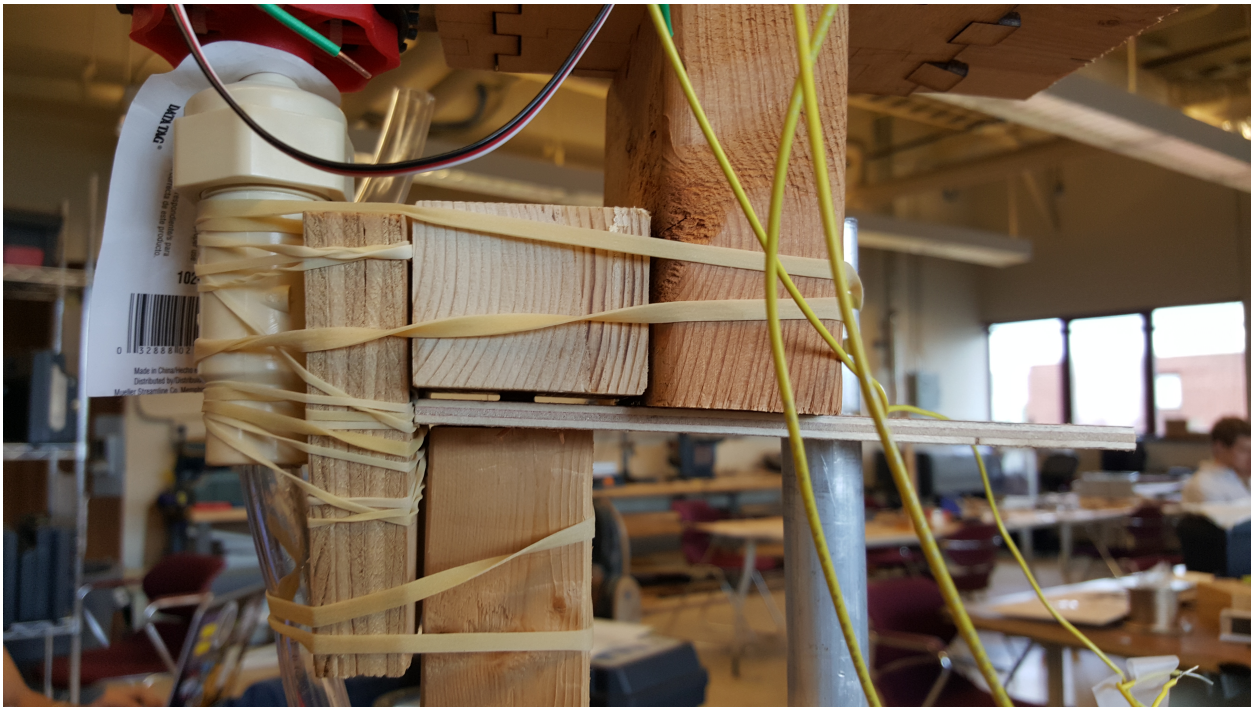

Figure 9: Platform at Top with Valve

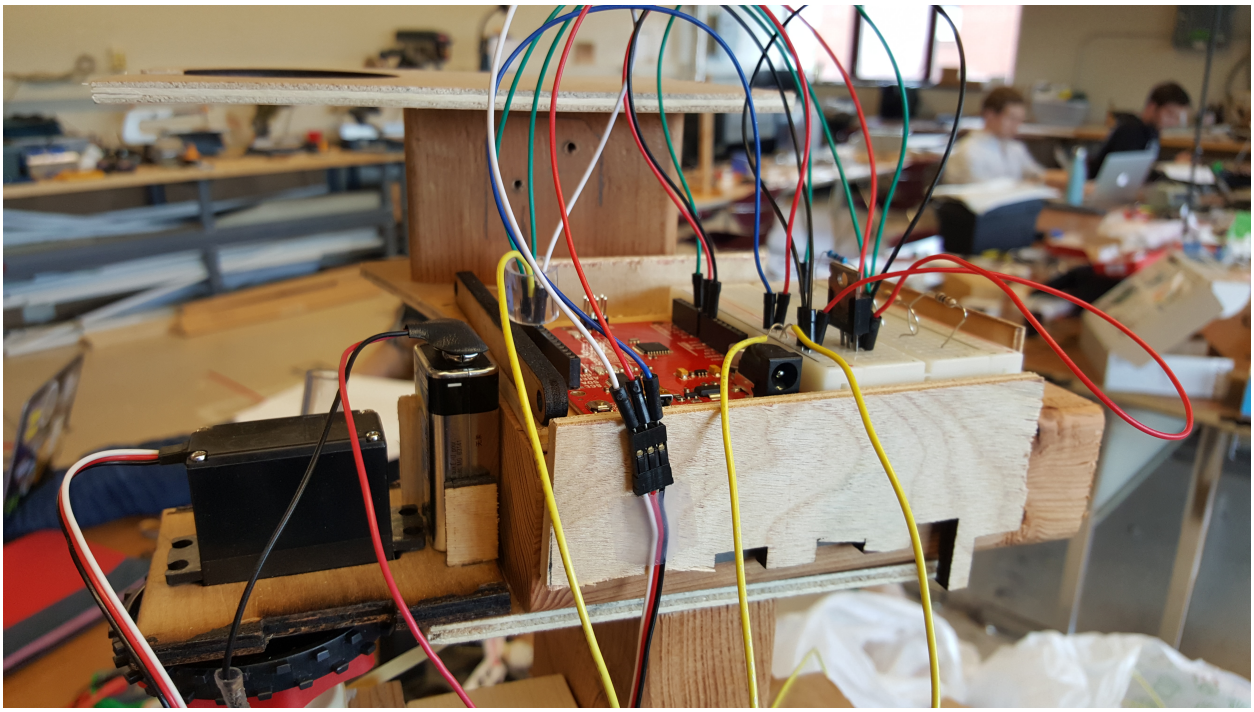

Figure 10: Enclosure

Figure 11: Watering Head at End of Arm

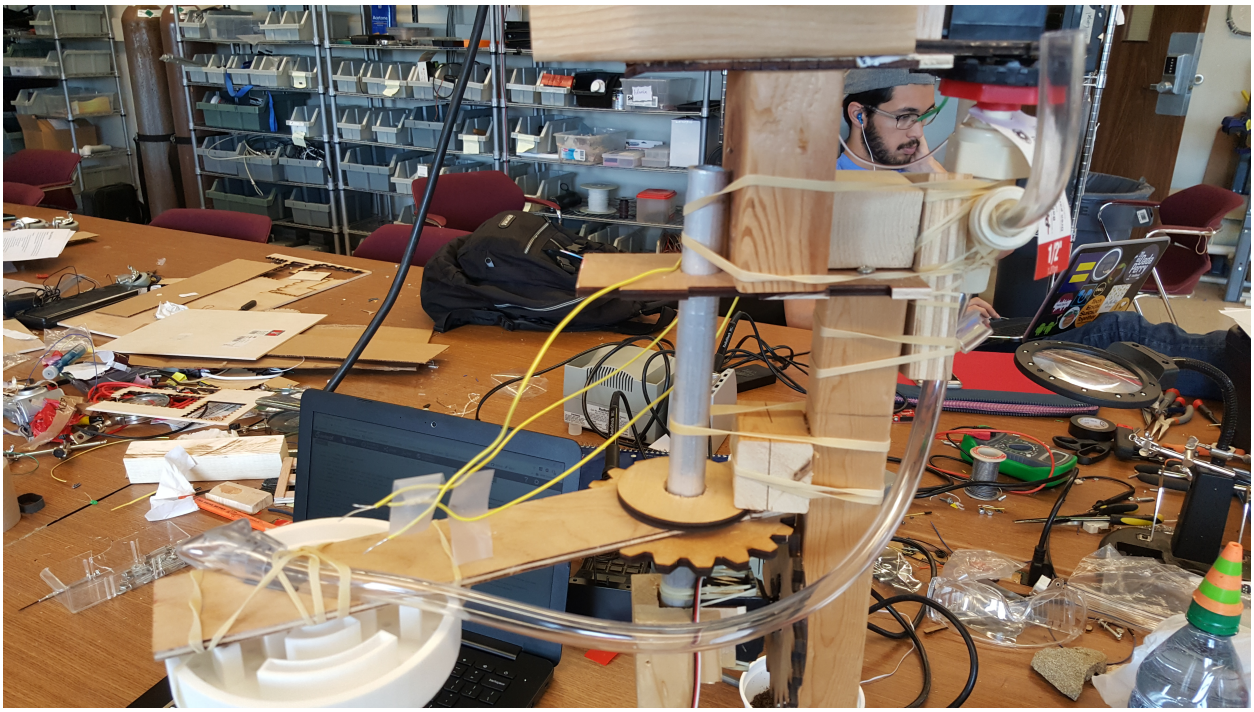

Figure 12: Tubes

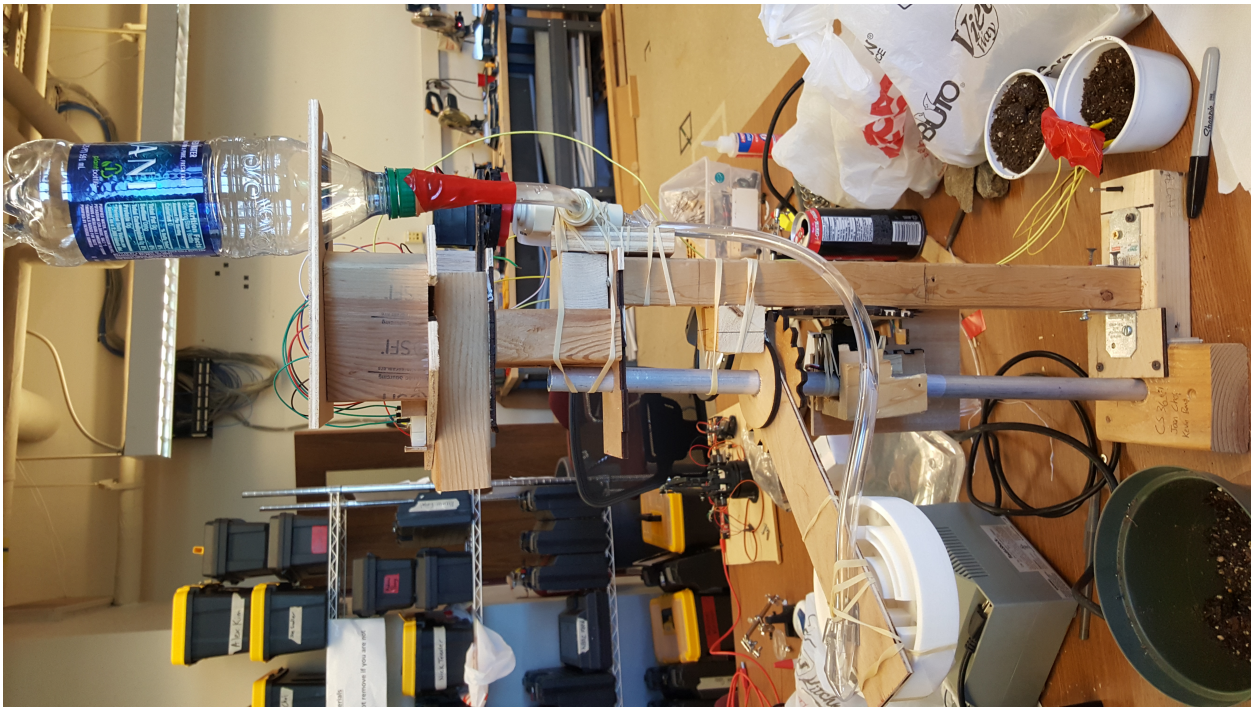

Figure 13: Final Left View of Project

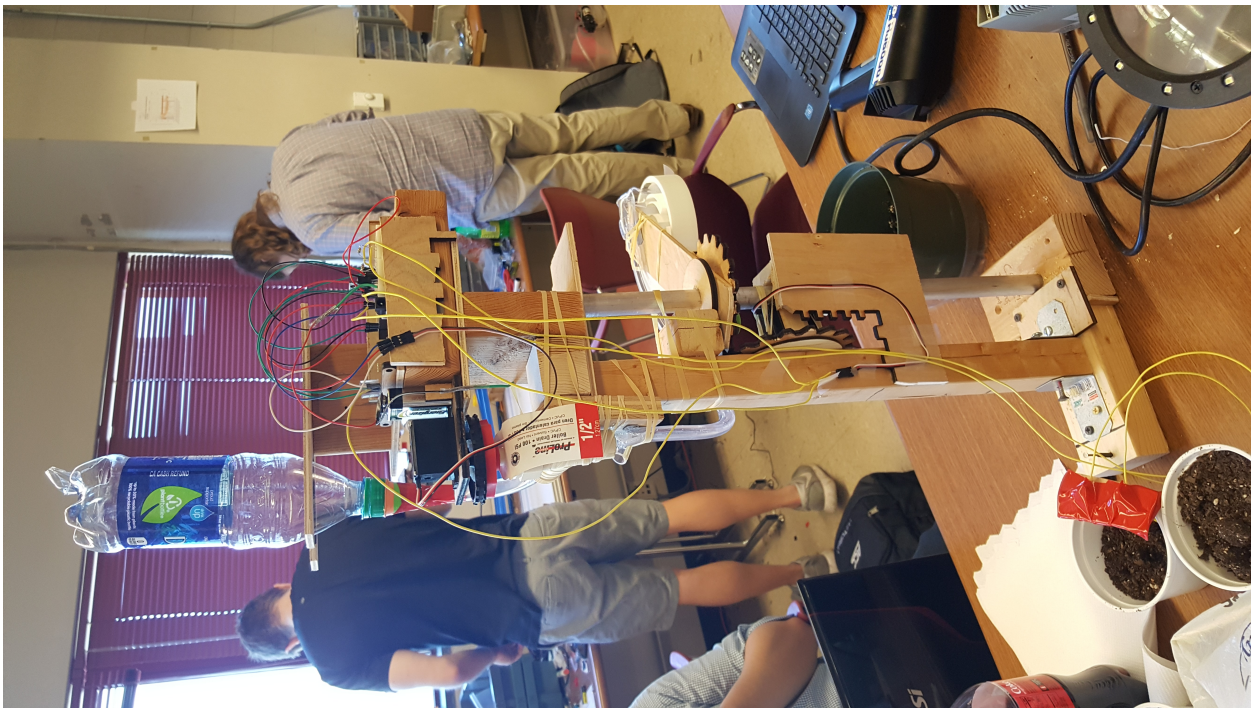

Figure 14: Final Left View of Project