DesignOtt Engineers Inc.

PROTOTYPE I

GNG1103, Section # F, Team # F3

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Table of Contents

Prototype I Testing Summary

Test ID	Test Objective	Description of Prototype used and of Basic Test Method	Recorded Results
1	Analyze the overall containment and drainage	Set up the containment system with the fluid and the drainage system in a small-scale model	Not all water drained out. Increase slope of bottom surface
2	Test the rotation	Run the Arduino connected to the motor and rod	Successful test
3	Analyze and test how long and how easy it is to install the sample	Generate sample containment unit top and bottom and connect to rod	Modify and reprint container lid to fit better
4	Adjust rotation speed while motor in operation	Run the Arduino connected to the motor, rod, and propellor while changing values of speed in the Arduino IDE	Motor speed changes. Improve fit of propellor on motor.

Drainage Test

The objective of this test is to analyze the overall containment and drainage.

The testing will be done by setting up the containment system with the fluid and the drainage system in a small-scale model.

The testing will be evaluated by visually observing whether all the fluid drains out without any remaining inside the container. There will also be a 3D printed filter at the bottom to catch the material while letting the liquid go through. There will also be a plug at the bottom so once the filtering is complete, all the liquid can be drained through the bottom.

The results of the testing were that not all the water drained out. The solution would be to modify the bottom part of the plastic insert, so the water drains into the funnel.

The proposed test setup was as such:

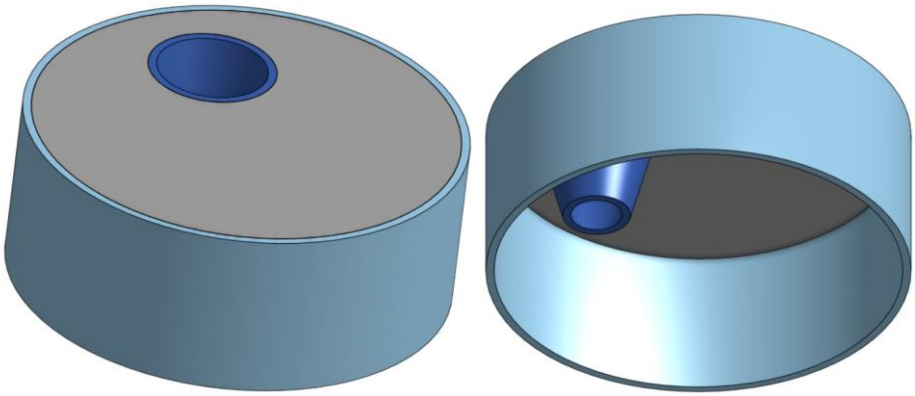


Figure 1a and 1b: container made by CAD.

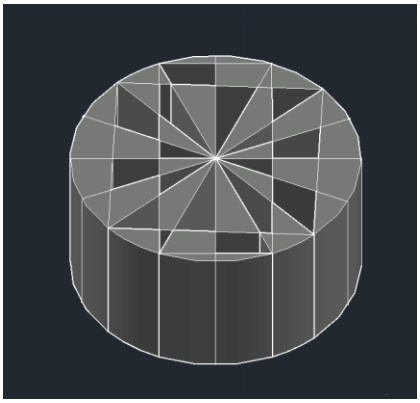


Figure 2: plastic filter.

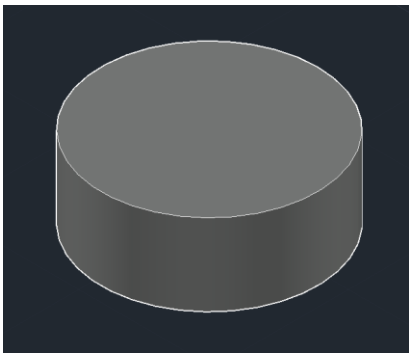
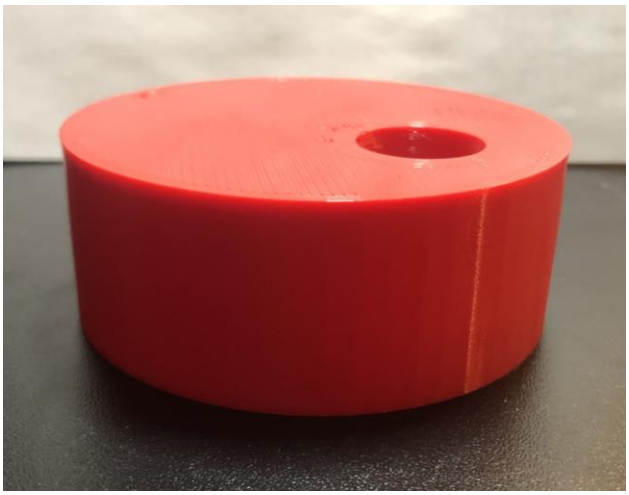


Figure 3: plug for filter.

The actual test setup was as such:



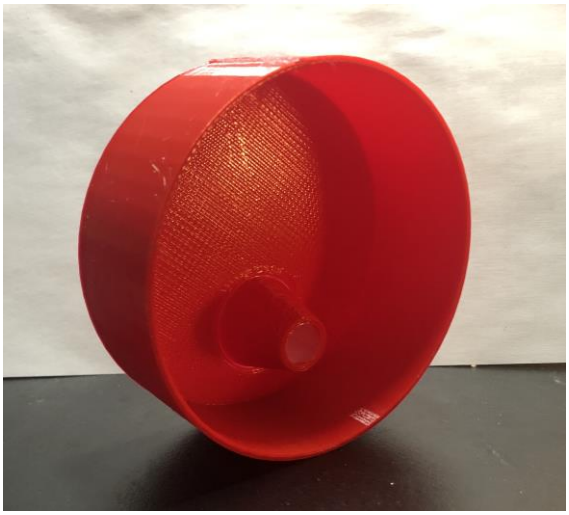


Figure 4a and 4b: 3D printed container

Figure 5a and 5b: 3D printed filter

Figure 6: 3D printed plug

Rotation Test

The objective of this test is to evaluate the Arduino code.

The testing will be done by constructing the circuit and running the code in the Arduino IDE.

The testing will be evaluated by the motor successfully rotating for 5 minutes.

The results of the testing were that the motor can rotate for 5 minutes.

The proposed test setup was as such:

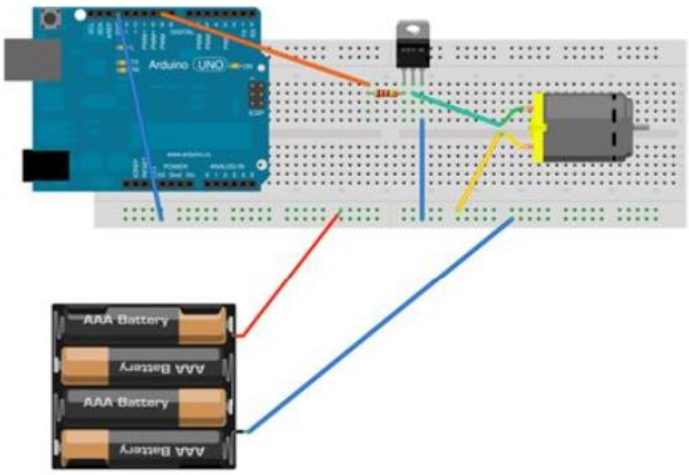


Figure 7: proposed circuit setup made via Tinkercad

The actual setup was as such:

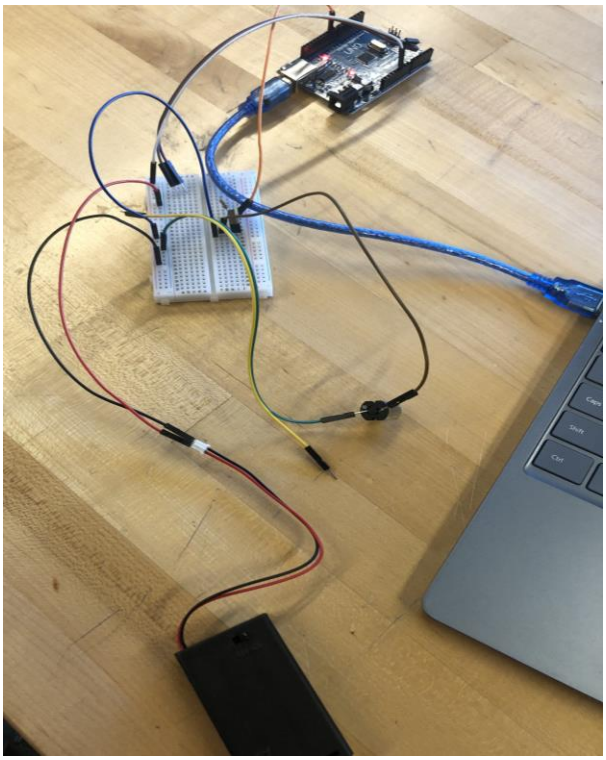


Figure 8: actual circuit setup

Sample Containment Test

The objective of this test is to analyze and test how long it takes and how easy it is to install the sample.

The testing will be done by using CAD to design the sample containment unit top and bottom, then 3D printing it and testing the physical model.

The testing will be evaluated by the sizing of sample container top and bottom. If it doesn't fit together, the CAD model will be modified. As well, the time required for sample installation is a factor in determining the feasibility. If it takes more than 2 minutes, the CAD model will be simplified

The results of the testing were that the container does not yet fit together properly, but the time taken to snap the lid on the container would be about 10 seconds at maximum.

The proposed test setup was as such:

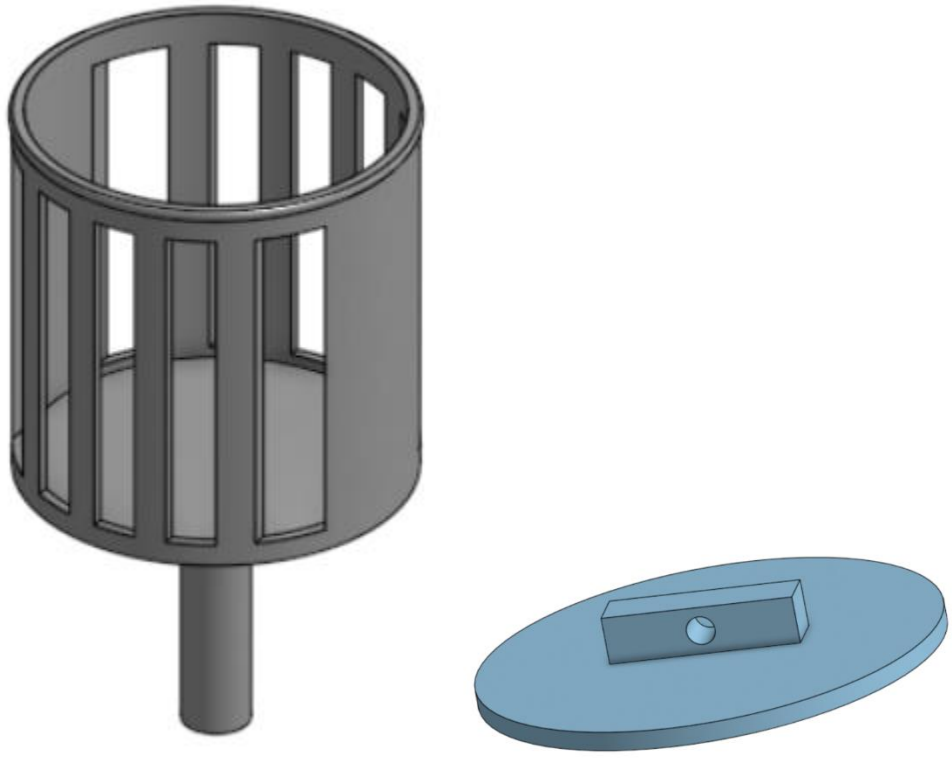


Figure 9: CAD model of sample containment unit

The actual test setup was as such:

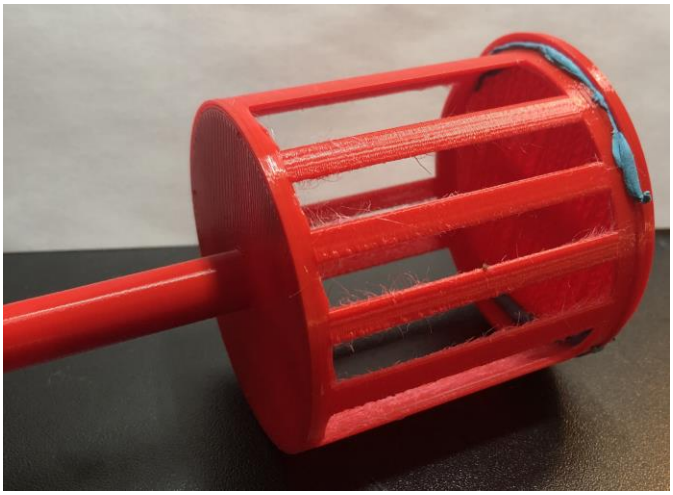


Figure 10a and 10b: 3D printed sample containment unit with lid, held together by blue tack.

Rotation Speed Test

The objective of this test is to change the value of the rotation of the propellor while the code is running.

The testing will be done by constructing the circuit with the propellor connected.

The testing will be evaluated by observing if the rotation of the blade changes as expected when the speed is varied on a 0-255 scale.

The results of the testing were the propellor successfully spin faster or slower based on the inputted value.

The proposed test setup was as such:

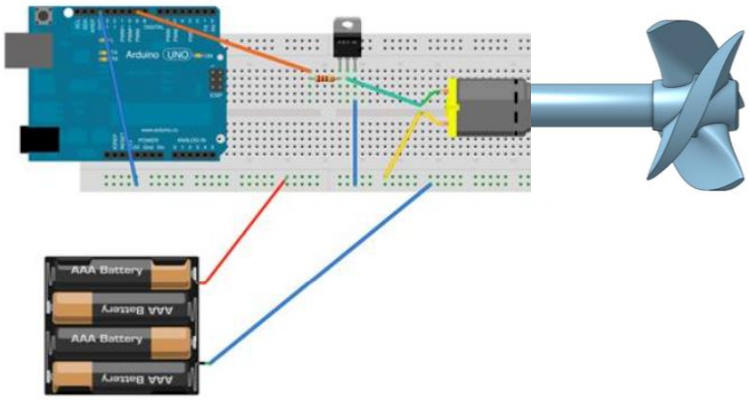


Figure 11: circuit built in Tinkercad with propellor attached.

The actual test setup was as such, but with the propellor attached to the rotating part of the motor:

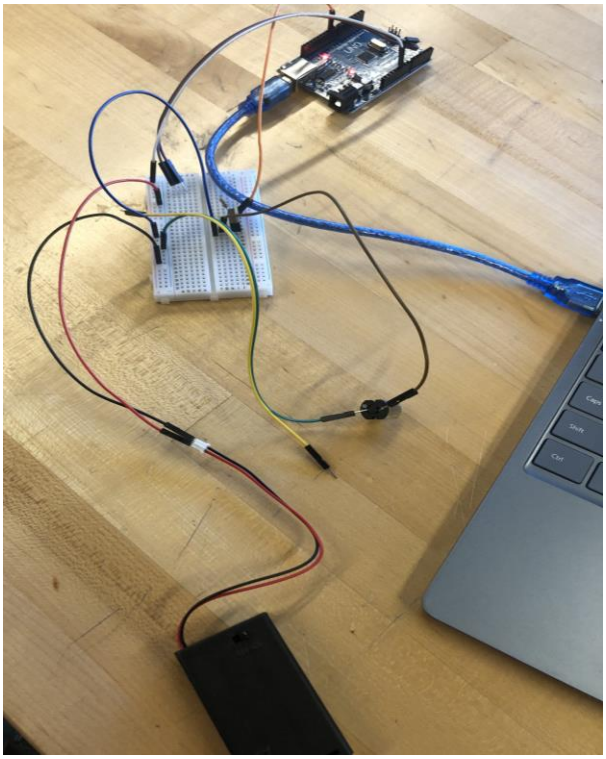


Figure 12: propellor test setup.

Prototype II Outline

Test ID	Test Objective	Description of Prototype	Test Method
1	Assess the physical components of the thermoelectric cooling system and temperature measurement abilities of Arduino	Connect components to an Arduino and set up the components as per the prototype, in a somewhat insulated environment. Test when all cooling components are engaged, 50% of cooling components are engaged, and 0% are engaged	Over the course of 20 minutes, measure temperature every 5 minutes (5 measurements in total per sub-test). Recorded temperature values will be analyzed. If fluid temperature continues to increase when all components are engaged, add more cooling coils to the final design.
2	Analyze and test how long it takes and how easy it is to install the sample using a revised design	Generate sample containment unit lid	Time how long it takes to take out a sample, then place another in over multiple trials, and calculate the average expected time.
3	Analyze and test how easy it is to install and remove the plug	Scale model of plug and drainage system	Generate plug and connect to drainage system while filled with water, then pull the plug and time how long it takes to drain
4	Analytical model: calculate amount of time to decrease volume of sample by 10%	Evaluation of 3% loss of volume, graph using y=mx (y=volume lost, m=erosion rate, x=time) or equation of best fit	Run the test until 3% of the volume is lost, then solve for the erosion rate and find the time at which 10% of the volume would be lost using extrapolation

Appendix A: DC Motor Code

```
int pinMotor = 9; //pin number which motor is connected to in the arduino
int userInput = 1; //default value
int speed = 10; //between 0 and 255

void setup(){
	Serial.begin(9600);
	pinMode(pinMotor,OUTPUT); //setting pin 9 as the output pin
	}

void loop () {
	analogWrite(pinMotor, speed);
	delay (300000); //runs for 5 minutes at the given speed

	printf("Do you want to continue test?");
	scanf("%d",&userInput);

	if (userInput==0)
	{
		speed=0;
		analogWrite(pinMotor,speed);
	}
	//if user does not enter 0, the test will run for another 5 minutes
}
```