GNG 1103 - A Deliverable D Project Group 18

## **Introduction:**

For this deliverable, we'll be starting the prototyping process for our product. We will first attempt to create a prototype for the hinge that'll be responsible for moving the potentiometer into its different positions. Then we will assess the functionality of the hinge and then proceed based on the results obtained. We will also try and write the code for the Arduino and potentiometer functionality along with attempting to create a dashboard powered user interface and linking the two subsystems together.

#### Why are we doing this test?

The main subsystem to be tested with this prototype is the hinge mechanism which is also the trigger that alerts the arduino as to whether the printer is in use. There are 2 ideas we'd like to try. The first, is a spring loaded hinge that will open like a regular door, and the second is a gate that will open and close with gravity.

Our specific test objective is to analyze the performance of both hinge designs. The ideal hinge design is one that turns smoothly, relays information effectively, will close automatically, and doesn't interfere with the operation of the printer itself.

We also began to look at the Arduino code. Initially, we wanted to save this for prototype 2, however wanted to focus more on integrating Arduino into DashBoard so decided to move it into the first stage. We wrote a simple code which reads the value from a potentiometer, then an LED (red or green) will light up depending on the position that the potentiometer is on. In the future, the potentiometer will be attached to the hinge and instead of LEDs, it will relay the result to DashBoard. Although this is a very simple program, it acts as a great proof of concept for the Arduino end of the design.

## What is going on and how is it being done?

This is going to be a focused prototype, meaning that individual parts of the design will be focused on instead of the design as a whole. We'll start by optimizing each component of the final design on it's own before combining them. Here's a list which describes the testing process for the hinge.

- 1. Build the enclosures for the Arduino and the potentiometer and attach them according to our proposed design.
- 2. Build the hinge and attach it to the enclosures.
- 3. Move the hinge to the top position and leave it sitting there for 3 hours (average printing time)
- 4. Open and close the hinge repeatedly (50+ times) to check it's structural integrity after repeated use.

In the case of the Arduino, the only testing process is to verify whether the code actually works. For this iteration here's how it should ideally operate: The potentiometer will return a value between 1 to 1023. If the value is greater than 400 (the hinge is open) the red LED will illuminate (the machine is available). If the value is less than 400 (the hinge is closed) the green LED will illuminate (the machine is available).

For prototype 1, the only material that we needed to purchase was for the Arduino. Everything else was either free, not needed, or previously owned. Below is a table containing the materials along with their costs

Material	Cost (\$)
3D Printer material	\$0
Arduino Uno	\$17
Breadboard	\$10
Wires	\$1
Potentiometer	\$0
Red and Green LEDs	\$0
Resistor	\$0
Total	\$28

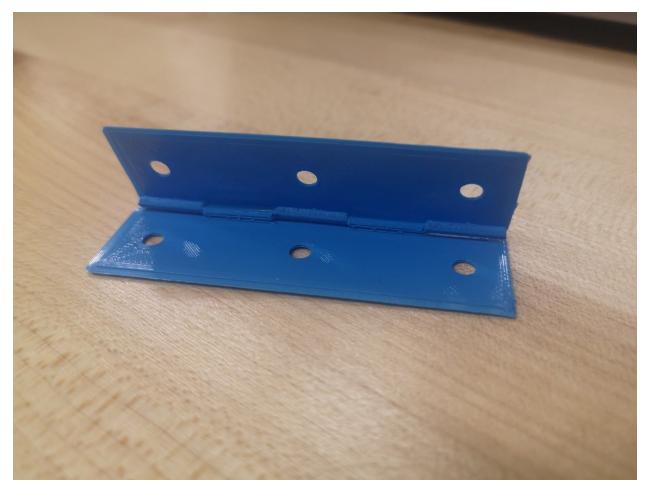
### When is it happening?

The hinge test would take between 3 to 4 hours with it staying still for the majority of that time. The Arduino would only take seconds to test. However, these tests both have several dependencies or tasks that need to be accomplished before either can take place. In the case of the hinge, it's dependant on it being designed effectively, along with the time and material it takes to print the piece itself in a 3D printer. For the Arduino, it's dependant on the acquisition of multiple materials, and most importantly the creation of the code itself. Since the code is quite simple and the materials are very easily attainable, these dependencies shouldn't hold us back whatsoever.

#### **Conclusion:**

After testing our first hinge prototype, we have realized that our initial concept of 3D printed hinge is not practical. The material is far too flimsy and can't support our needs. Instead, we're going to attempt to make our second concept, which is spring-loaded steel hinge. It would be more durable and less flimsy. The spring would also add more functionality to the device. We have also coded the Arduino and the potentiometer is functioning properly. The system we have set up is feasible and functions properly, so the next step will be integrating the Arduino into dashboard. Finally, we have created a very barebone UI interface on dashboard that's going to be what the user will see to determine what printer is available.

# Images:



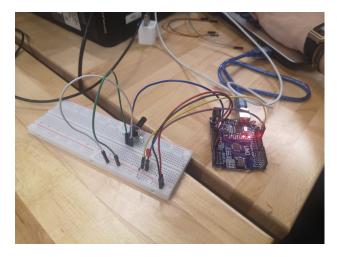
In future iterations, the hinge will contain a spring similar to that in a clothespin.



Arduino source code

7 New Cust	omPanel2.grid x		
	CEED Makerspace printer availability		
			Printer Availablity legend
	Printer 1	Printer2	Available
	Printer 3	Printer 4	IN USE
	Printer 5	Printer 6	

Initial concept for the DashBoard interface.



Arduino model