Project Deliverable H: Prototype 3 and Customer Feedback

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1. Introduction

In this deliverable, we are using the details from prototype 1 and 2 to build a third and final prototype. This prototype will be the protective casings for the motor, sensors, and system as a whole. This prototype will use the feedback given by the client to make sure that the device is accessible and food safe. We will use the dimensions of the pieces in the first two prototypes to make sure the casings are the perfect dimensions. This will prevent damage to the device caused by unpredicted movement within the casing. Then we will include the prototyping test plan. We will use this plan to conduct tests to make sure that the casing keeps the device protected. We will know our testing is complete when the results meet the criteria defined in the test plan. Due to this testing, we will be able to prevent major problems with the prototype by refining our design.

2. Prototyping

2.1. Objectives

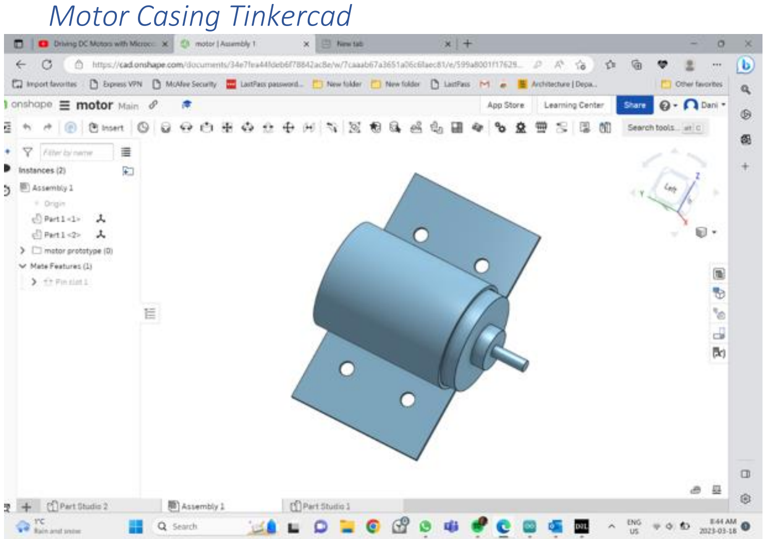
The objective of this prototype is to create casings for the motors and the entire system that will protect it from dust and other conditions. To make sure that the top and bottom parts of the pulley system line up perfectly, a replica of the motor will be 3D printed to ensure that the belt can move straight up and down. This replica needs to be the exact dimensions of the motor to make this possible. Another objective of this prototype is to create casings for the motor and replica that will attach them to the outer casing allowing the belt to remain in tension while moving the sensors. To do this, pieces will be 3D printed to hold the motor in replica directly across from each other. Lastly, a prototype for the protective casing of the entire system will be made. This will be done to fix accessibility issues and make sure that the motor subsystem fits perfectly within the casing allowing the sensors to move freely. The objective of this prototype is to ensure that the casing is large enough to fit all the components but still small enough that it is accessible.

2.2. Prototype 3

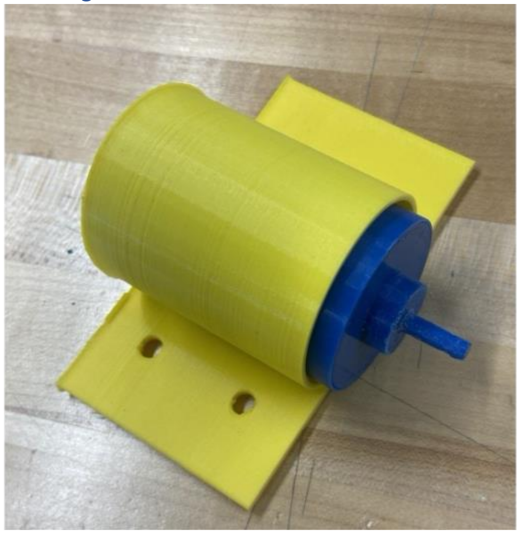
2.2.1. Images

2.2.1.1. Protective Casing

2.2.1.2. Motor Casing Tinkercad



2.2.1.3. Motor Casing 3D Printed



2.2.2. Explanation

We created a prototype for the top part of our pulley system, and we started it by importing another motor on OnShape so we can 3D print it. Moreover, this means that both the top and bottom part of the pulley system will sit in line with each other.
During 3D printing, we created a way to attach the printed "motor" and the real motor to the protective casing which is our next subsystem.
The OnShape designing took a significant time for us to make sure we got the exact same dimensions of the real motor and then print it, but the testing went easier.
Lastly, we made the protective casing and made sure all the 3D printed objects fit perfectly within the casing so that it would function optimally.
Furthermore, this test plan went over so many steps which led us to ensure that it will work for our final design.

3. Analysis and Feedback

3.1. Protective Casing

Dimensions	Restrictions	Measurements
Height	The box has to be at a perfect height so that the belt can be at full tension when attached to the motor and replica motor at the top and bottom of box	25cm
Width	The box has to be wide enough so that it can fit the length of the motor	15cm

Depth	The box has to be deep enough so that it can hold the Arduino board, breadboard and motor.	10cm

3.2. Motor Casing

Dimensions	Restrictions	Measurements
Diameter	The diameter of the casing has to slightly larger than the diameter of the motor so that it is able to slide inside but must be small enough that the motor is held tightly in place and does not move.	4.2cm
Width	The width of the motor casing must be the diameter of the motor casing plus additional material on each side for the bolts to hold it into place	8cm
Length	The length of the casing must be the same length of the motor so that it fits perfectly within the case.	8cm

3.3. Replica Motor

Dimensions	Restrictions	Measurements
Diameter of Narrow End	The diameter has to be the same of the actual motor so that the piece that holds the belt is able to spin freely without falling off	0.5cm
Diameter of Wide End	The diameter has to be the same width of the motor so that the two ends of the belt line up perfectly and it fits in the motor casing.	4cm
Length	The length of the motor replica has to be the exact same as the actual motor to that the two spinning pieces line up perfectly one on top of the other.	8cm

3.4. Client Feedback

The client's main concern about our design was that it was accessible and food safe. This prototype allows us to make sure that the device is accessible because we figured out what dimensions would allow the device to sit on the L brackets while in the silo and be able to be removed from the silo using the hole at the top. Also, to make sure the device is food safe, aluminium and acrylic would be used in the actual product, but due to time constraints and budgeting, our prototype was made of plastic, acrylic, and wood. In the final pitch presentation, the client mentioned that the best way to attach the L brackets into the silo would be to weld them, but since we are not using aluminium in the prototype, we will be bolting them together. In the actual device this would be welded instead.

4. Transfer of Knowledge

In this deliverable, we prototyped, and 3D printed an attach for the motor. This attach will allow us to stick the motor to the casing. The prototype was made on Onshape which was time-consuming, this showed that experience and practice is needed. However, spending this much time on the prototype allowed for it to be made only once and showed that patience is sometimes required while working on a project.

We also laser cut a case for our sensors and a box that will act as the silo. This case and box were first designed on Inkscape and were then cut on MDF. During our first cutting we realised that the dimensions of the box shrunk. This shows that attention to every detail and skills are required when laser cutting.

5. Wrike

https://www.wrike.com/frontend/ganttchart/index.html?snapshotId=wYJJeJ25qOx2h66e929iWnr5OY3wuIHw%7CIE2DSNZVHA2DELSTGIYA

6. Conclusion

This is the final prototype where we made sure the subsystems worked together and created the casing that would protect the pieces from the dust and malt in the silo. This prototype included laser cutting and 3D printing to ensure the casing fit perfectly. Through these applications, we were able to finalize our design and ensure it met the design criteria.