ENGINEERING

McMaster University

Project Three – There's A Recyclable Among Us

Design a System for Sorting and Recycling Containers

ENGINEER 1P13 – Integrated Cornerstone Design Projects

Tutorial 1P13_T10_T13

Team 18

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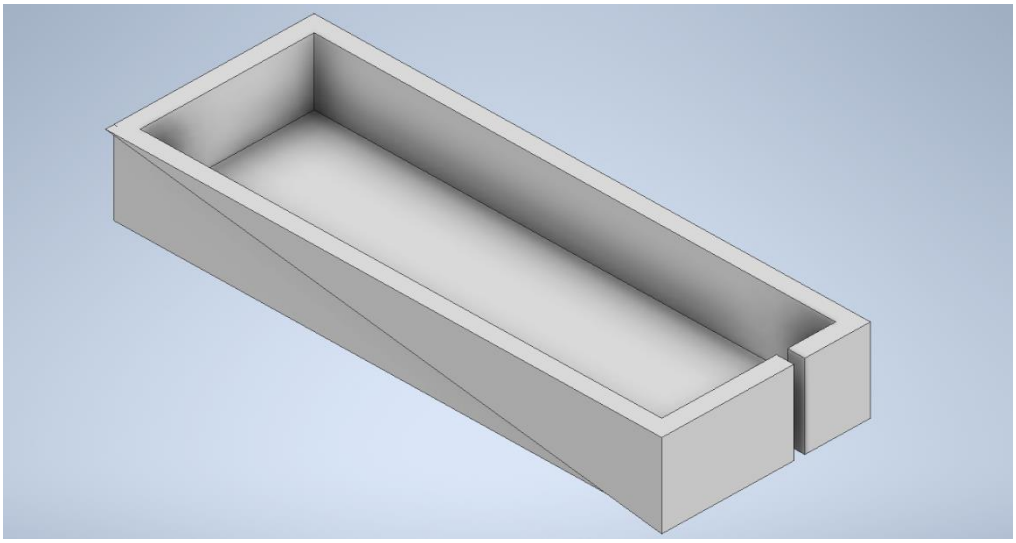
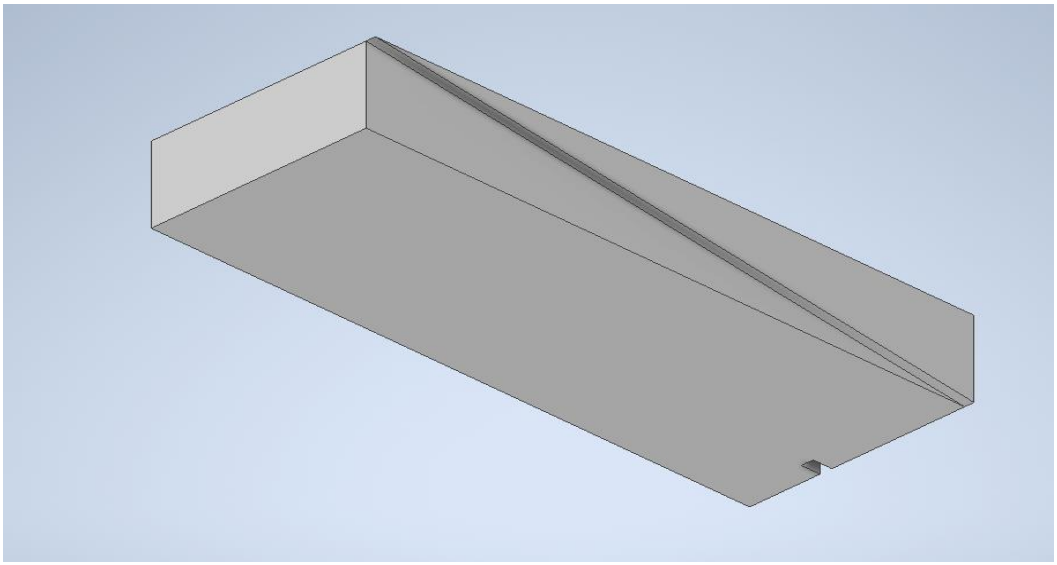
Executive Summary

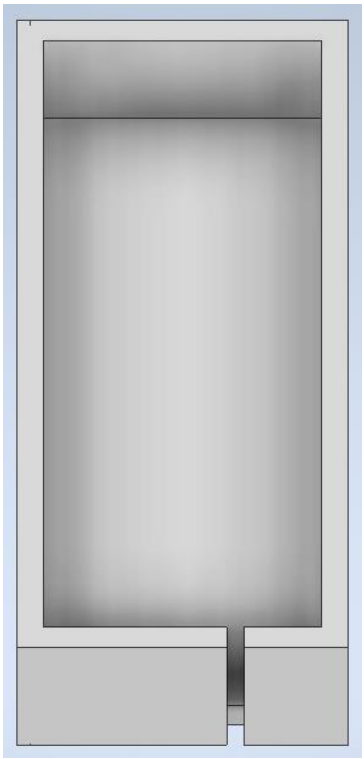
The main goal of this design project was to create a code and design a hopper, parallel to a mechanism that would be able to transfer different containers to their allocated bins. Initially, our group thought of some needs to design the desired product. We concluded that we needed a mechanism to autonomously sort recyclable waste and to streamline the recycling process altogether. This would create a refined problem statement, which was to naturally sort utilized recyclable containers for waste management companies (using software and design) to improve the viability of their recycling and prevent unnecessary waste. Henceforth, we began working on the project based on the needs. During Milestone 2, the coding team thoroughly researched different sensor types to utilize during the project. After some research, the two main sensors that were chosen for the bot in the code were the color sensor and the ultrasonic sensor. The color sensor was chosen for the recognition of the bins, whereas the ultrasonic sensor was chosen for the recognition of the proximity of these bins. As for the design team, refined sketches of the hopper were drawn trying to identify an ideal mechanism, and yet annotate the parts and the uses in detail. As we reached Milestone 3, the coding team had to create pseudocode and flowcharts that would define the algorithm for different parts of the project. The team created flowcharts for dispensing, loading, transferring, and depositing the container. These flowcharts outlined thoroughly the actions that the bot would do in the process of execution. As for the modeling team, CAD designs were made for the modified hopper, as well as a cam, and a rung that would be used in the desired mechanism. Although milestone 4 was shorter, both teams received feedback on their code and design. The coding team received a GO without a warning, whereas the modeling team received a GO with a warning. This clearly outlined that the design solutions were almost perfect and completed. For the final deliverable and the team interviews, the coding team presented their code, which was well executed. The bot completed the initial objective, which was to make recycling easier to complete. Henceforth, the arm acquired the specific containers, placed them on the bot, followed the color line to allocated bins, successfully dropped off the containers, and came back to the initial loading spot without error. As for the modeling team, the design also proved to be successful through the simulations that were created by the group. The mechanism chosen, alongside the modified hopper, worked perfectly throughout the dynamic simulation covering all 5 phases. The mechanism was based on a rotary actuator, mounted to the parent part, the baseplate. The actuator consisted of two parts, a base and an axle, where at the end of the actuator's axle a perpendicular cam was connected to it. Such assembly between the actuator and the cam allowed the modified hopper to move between its neutral position and its drop-off position successfully.

Solid Model:

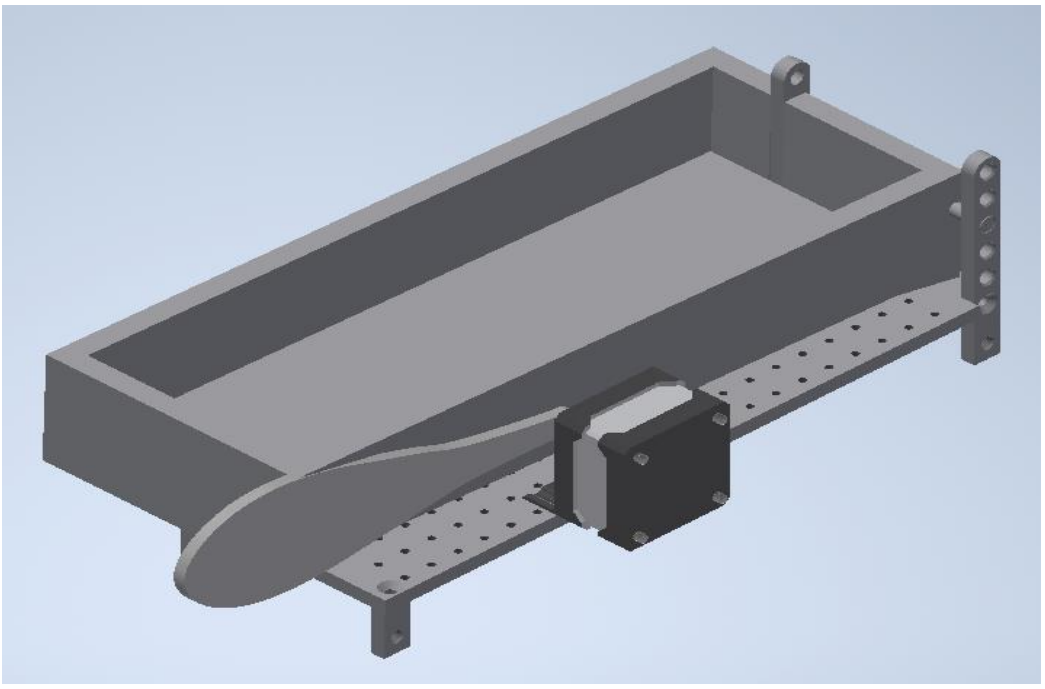
- Modified Hopper:

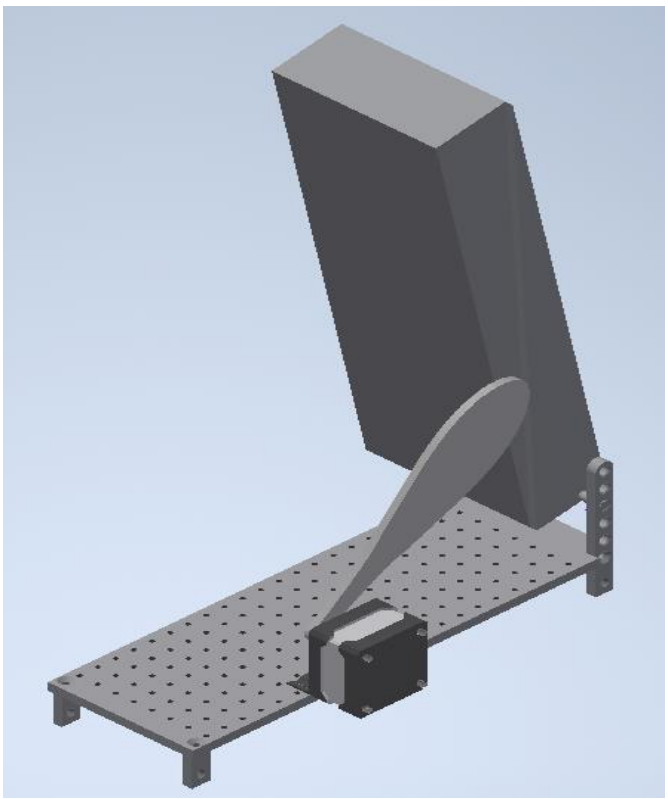


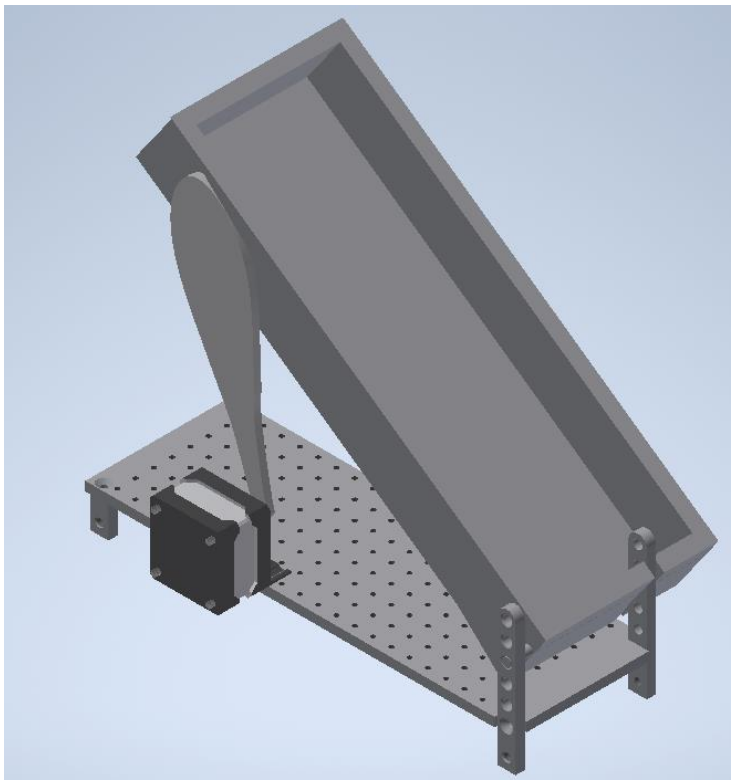




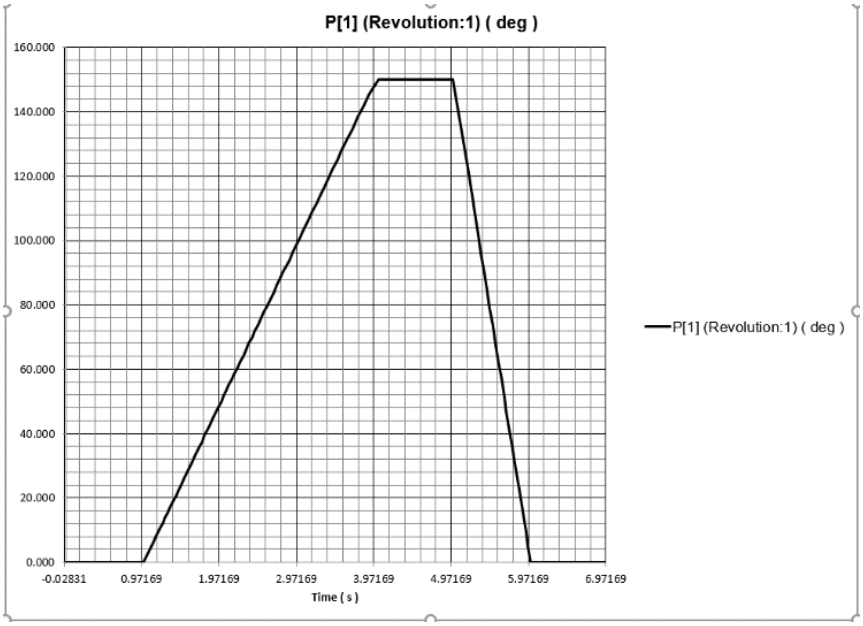
- Mechanism / Solid Model

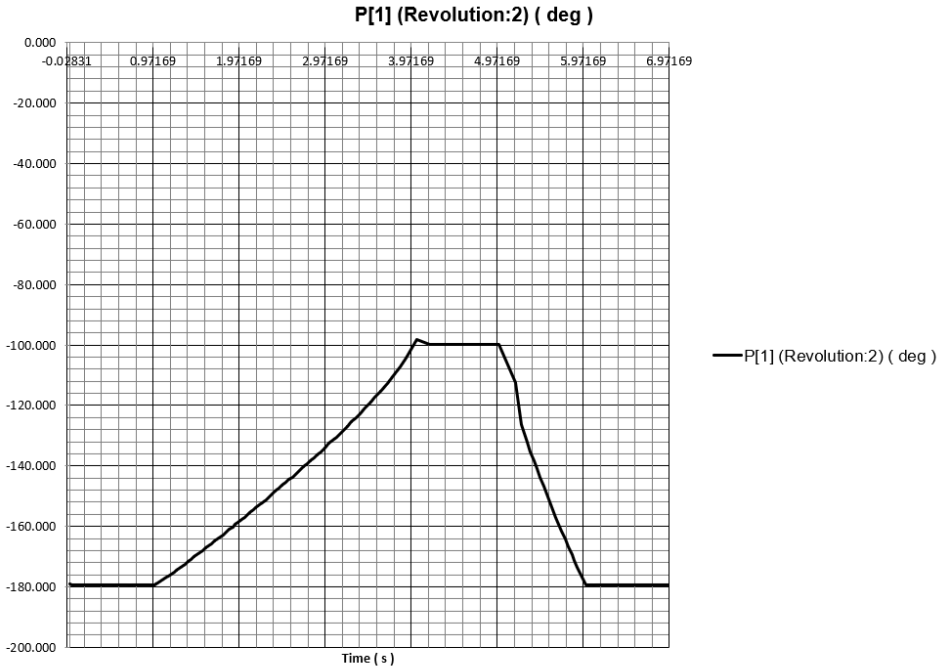






Dynamic Simulation Graphs





Fully Dimensioned Engineering Drawings