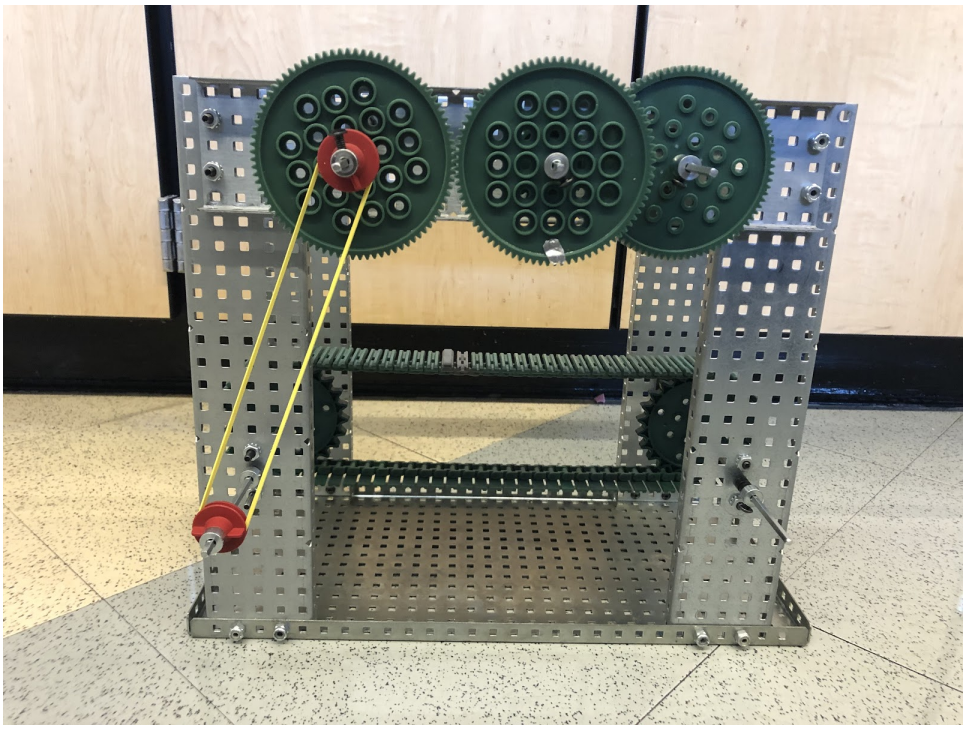
1.1.6 — Project Compound

Grocery Transporter

Team: Grocery Warriors



By: Stacy Glushchenko, Joey Huang, Sai Kolla, and Judit Kontra

Development Cycle: August 29, 2019 - September 11, 2019

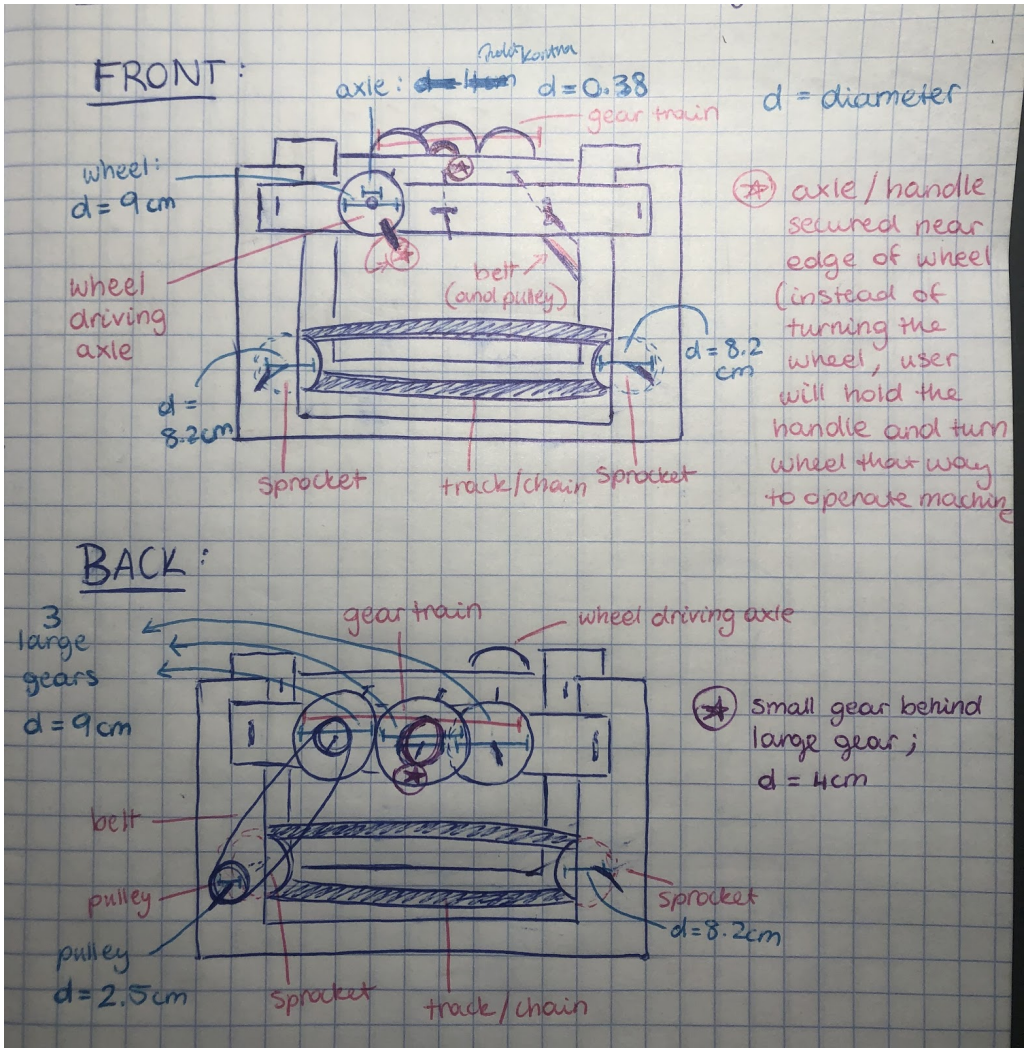
Course: Principles of Engineering 2019-2020

Table of Contents

Design Brief

Client	The Compound
Designer(s)	Stacy Glushchenko, Joey Huang, Sai Kolla, Judit Kontra
Problem Statement	It is often difficult, and timely to carry groceries or other items from the car to the house or up the stairs, especially when they are heavy. In order to solve this issue, we need to build a machine that can quickly and efficiently move things around.
Design Statement	Design and build a scale prototype of our compound machine for the members of The Compound.
Constraints	• Prototype must include at least 4 unique mechanisms. • Applied force can only be provided by a single human input. • Prototype, and documentation must be completed by September 11, 2019. • Any material approved by instructor may be used to build the prototype.
Deliverables	• Scale prototype • Documentation • Brief demonstration of compound machine

Design Proposal



Signatures

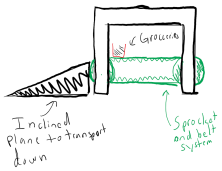
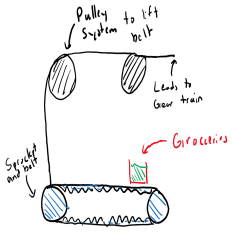
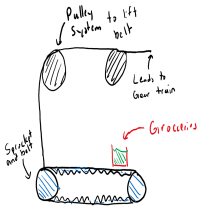
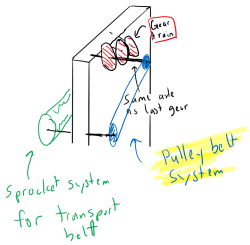
Stacy Glushchenko

Joey Huang

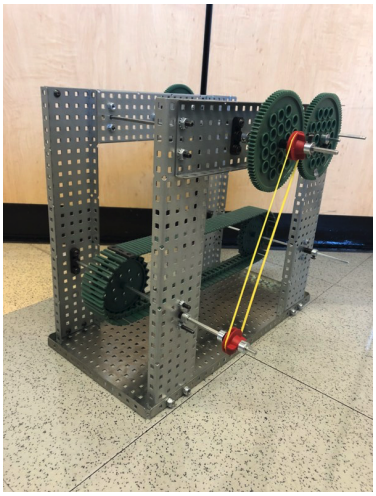
Sai Kolla

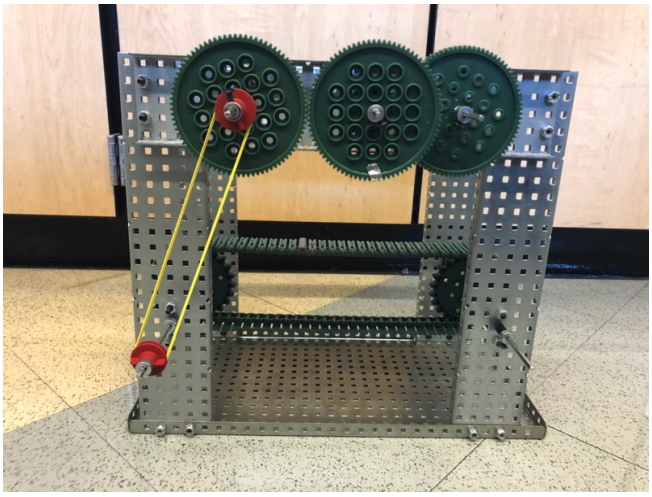
Judit Kontra

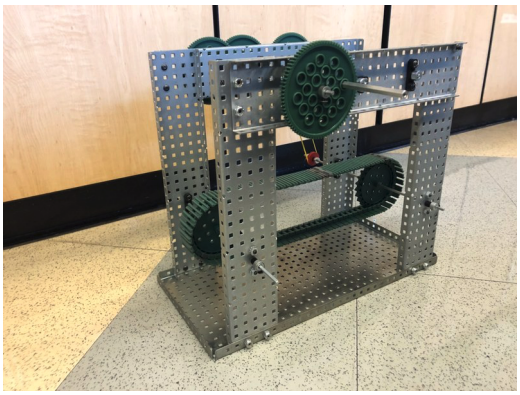
Modification Table

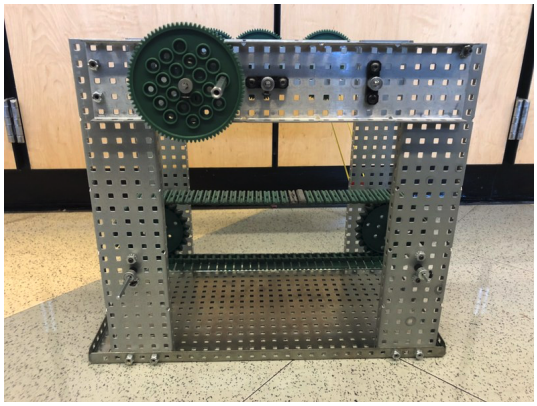
Date	Before	After	Modifications	Signatures
9/6/19			Our first four machines were going to be wheel and axle, gear train, sprocket/chain, and an inclined plane. We decided to not do the inclined plane and change the design by adding a pulley. They pulley will pull the metal base up providing an easier way to lift items.	Stacy Glushchenko Joey Huang Sai Kolla Judit Kontra
9/7/19			In our modified idea, the pulley was considered the same machine as a regular chain and sprocket system. As a result, we choose to use a pulley and belt system instead with a rubber band to add tension in order to transfer energy to the axle of the sprocket and belt system.	Stacy Glushchenko Joey Huang Sai Kolla Judit Kontra

Final Design









Our final prototype consists of four different machines — a wheel and axle, compound gear train, pulley belt system, and a sprocket belt system. Our prototype is mounted on a baseplate with 4 C channel mounted on the side and 1 C channel connected across the top. The goal of our machine was to be able to transport groceries from one point to another in the most efficient and user friendly way. We achieved this by using a wheel driving axle system that when turned results in the movement of a series of connected machines such as gear train, pulley, and

sprocket and belt system that would act as a conveyor belt to move items. The only input energy required to make the machine work is given through twisting the wheel driving axle system, which is essentially a standoff mounted to a gear that's then connected to an axle. The mechanical advantage of this wheel and axle system is 17.11. This then turns a compound gear train with a gear ratio of 0.44 in order to increase the speed of the belt so it can transport more quickly. The last axle in the compound gear train contains a pulley on the end, which is linked to another pulley connected to an axle of the sprocket belt system. The pulleys are then connected by a rubber band which helps by automatically tensioning between the two pulleys. The gear ratio of the two pulleys are 1. This then drives the sprocket, which thus turns the belt with groceries on top with a gear ratio of 1. The total mechanical advantage of our machine is 7.53.

MA Calculations

$$MA_{\,Wheel\ and\ Axle\ (wheel\ driving\ axle)} = \frac{De}{Dr} = \frac{3.25}{.19} = 17.11$$

$$GR_{\,Compound\ Gear\ Train} = \frac{Db}{Da} \times \frac{Dc}{Db} \times \frac{Dd}{Dc} = \frac{4.0}{9.0} \times 1 \times \frac{9.0}{9.0} = \frac{4.0}{9.0} = 0.44$$

$$GR_{\,Pulley\ and\ Belt\ System} = \frac{Dout}{Din} = \frac{8.2}{8.2} = 1$$

$$GR_{\,Sprocket\ System} = \frac{Dout}{Din} = \frac{2.5}{2.5} = 1$$

$$MA_{\,Total} = MA_1 \times MA_2 \times MA_3 \times MA_4 = 17.11 \times 0.44 \times 1 \times 1 = 7.53$$

References

Lira, Lucas. “Project - Conveyor Belt VEX ROBOTICS.” *VEX Forum*, Vex Robotics, 22 Oct. 2016, https://www.vexforum.com/t/project-conveyor-belt-vex-robotics/37021.

Unknown. “The VEX Belt Drive Kit.” *Online Challenges*, https://challenges.robotevents.com/challenge/48/entry/2548.

Waggoner, Ian. “Project 1.1.6 Compound Machines.” *Ian Waggoner*, https://ianwaggoner.weebly.com/project-116-compound-machines.html.