Justin Li

j2352li@uwaterloo.ca
linkedin.com/in/li-justin
thejustinli.com

Skills

General: GD&T, Engineering drawings, HVAC technical drawings, Aviation, ISO 13485 for medical devices, Microsoft Excel
Fabrication: Machining, 3D Printing, Rapid prototyping, Laser cutting, CNC routing, Coordinate Measuring Machine, SmartScope, Arduino
Software: SOLIDWORKS, AutoCAD, Solid Edge, Onshape, nanoCAD, C++, HTML, Arduino, SQL Querying, MATLAB, Canva, Figma

Education

University of Waterloo - *BASc in Mechanical Engineering 2024*

- Relevant Coursework: Rapid Prototyping, Fuel Cell Technology, Aerodynamics, Engineering Biomechanics
- Engineering Ambassador **Executive Lead** to support, inform, and plan events for prospective students
- Engineering **Orientation Leader & Team Director** in 2020, 2021, and 2023

Experience

NAVBLUE
Waterloo, ON
Aircraft Performance Specialist
May - Aug 2023

- Produced new **Engine Failure Procedures** at airports where customers operate by calculating maximum aircraft performance limitations
- Created a new naming convention for Runway Arresting Gears inside the in-house performance software

Lumentum
Ottawa, ON
Process Design Engineering Intern
Jan - Apr 2023

- Designed production ready jigs for **6-axis robot arm** using **Solid Edge** and **3D printing** to reduce errors and accelerate production processes
- Built prototype devices and tools for different **optical applications** using **Solid Edge**
- Implemented **laser cutting** tech into the production process to improve mfg. efficiency and tooling accuracy with high precision and low cost
- Conducted **reliability tests** on pre-production products using thermo controllers and data loggers in order to save time and increase efficiency

Vexos
Toronto, ON
Production Engineering Intern
May - Aug 2021

- Updated **ISO 13485** documentation for **medical device mfg.** by performing equipment validation and revising company asset management
- Increased efficiency of company processes by **3D printing** custom parts for production using **SOLIDWORKS** and **Ultimaker Cura** software
- Led innovation initiatives by coordinating machine standards inspections to increase the # of certified machines used in production by 25%

International Custom Products Inc.
Toronto, ON
Manufacturing Engineering Intern
Jan - Apr 2020

- Managed **automation initiatives** within the mfg. process by designing and **machining** solutions to reduce human error by at least 50%
- Revised **technical drawings** using **AutoCAD** for use with **CNC cutting equipment**
- Performed **feasibility assessments** of energy usage by reviewing and upgrading light fixtures to save over $10 000 in annual operational costs

Projects

Goal Guard Guru (Robotic Foosball Table)

- Assembling a player versus robot foosball table using **Onshape**, **3D printing**, **laser cutting**, **machining**, and **Arduino** components

Interactive Custom Cassette Player

- Designed, prototyped, and presented an interactive box using **SOLIDWORKS**, **laser cutting**, **Arduino** components, **3D printing**, **Adobe Illustrator**, and **Figma**

Laser Cutting Template

- Measured, designed, and **3D printed** a tool mold using **SOLIDWORKS** that can be used by production to hold a custom part in place while affixing a circuit board to it and wiring it

Achievements

- University of Waterloo **Student Exchange Program** at Lund University, Sweden — Sept 2022 - Jan 2023
- Recipient of the University of Waterloo **Global Experience Certificate** degree — Apr 2024

Interests

Hobbies: Aviation & flying, Ice hockey, Travel/Portrait/Event photography, Video editing, Playing & producing music, Competitive Rubik's cubing

Justin Li

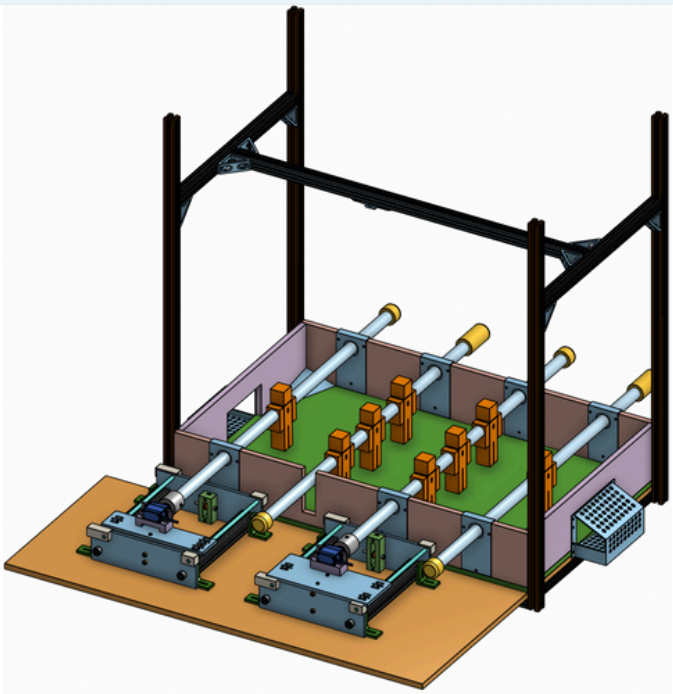
j2352li@uwaterloo.ca
linkedin.com/in/li-justin
thejustinli.com

Goal Guard Guru (Robotic Foosball Table)

Mar 2024

- **Mechanical Lead** for the **Final Year Capstone Design Project**
- Objective is to create a functional **player vs. robot foosball table** that can simulate a player vs. player experience, with two player rows controlled by a human and two player rows controlled by software
  - Ball movements can be detected by a **camera mounted** above the playing field
  - **Software/AI and hardware** to control movement of player rows to simulate gameplay
- Collaborated with a team of 5 to form different one-person subteams
  - Mechanical, Hardware, Software/AI, Computer Vision System, and Integration

Click here to see a video of the Goal Guard Guru in action during our capstone symposium!

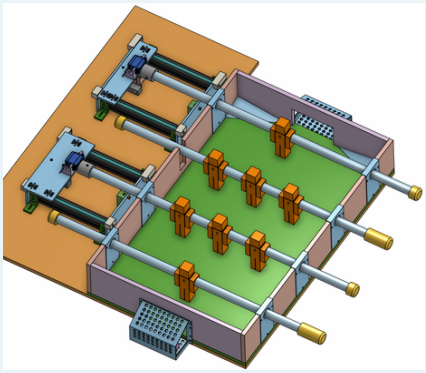


Camera Mount + Table Frame

- 1" x 1" aluminum rails and brackets
- Intel RealSense Depth Camera

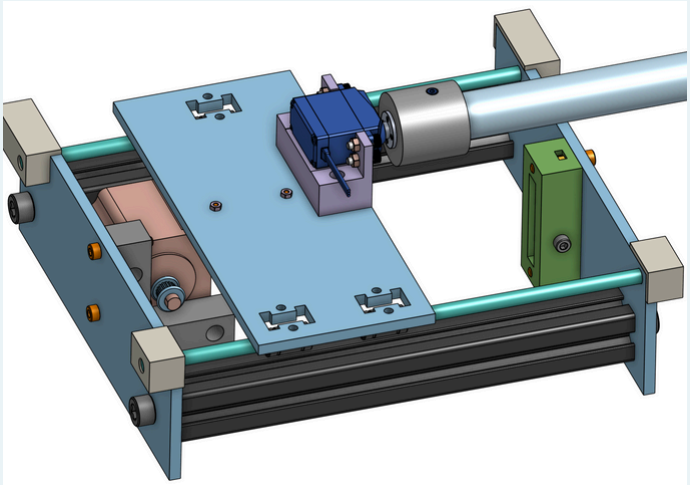
Foosball Table

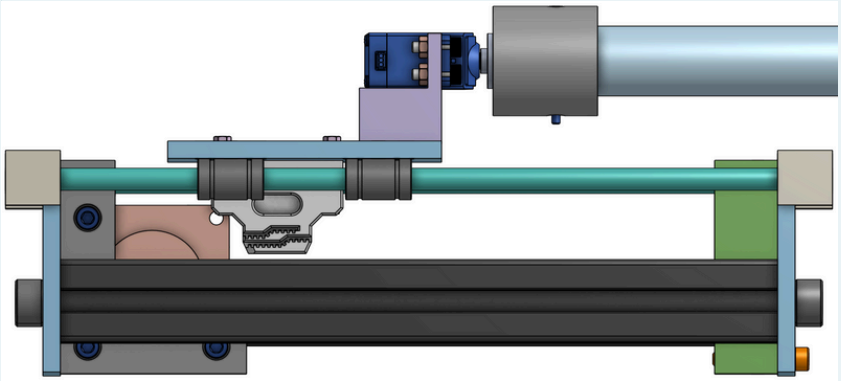
- 0.5" plywood table
- 1" aluminum rods
- 3D printed players/figurines



Actuator Assemblies

- Stepper motor for linear movement
- Servo motor for rotational movement





Justin Li

j2352li@uwaterloo.ca
linkedin.com/in/li-justin
thejustinli.com

Laser Cutting Template

Jan 2023

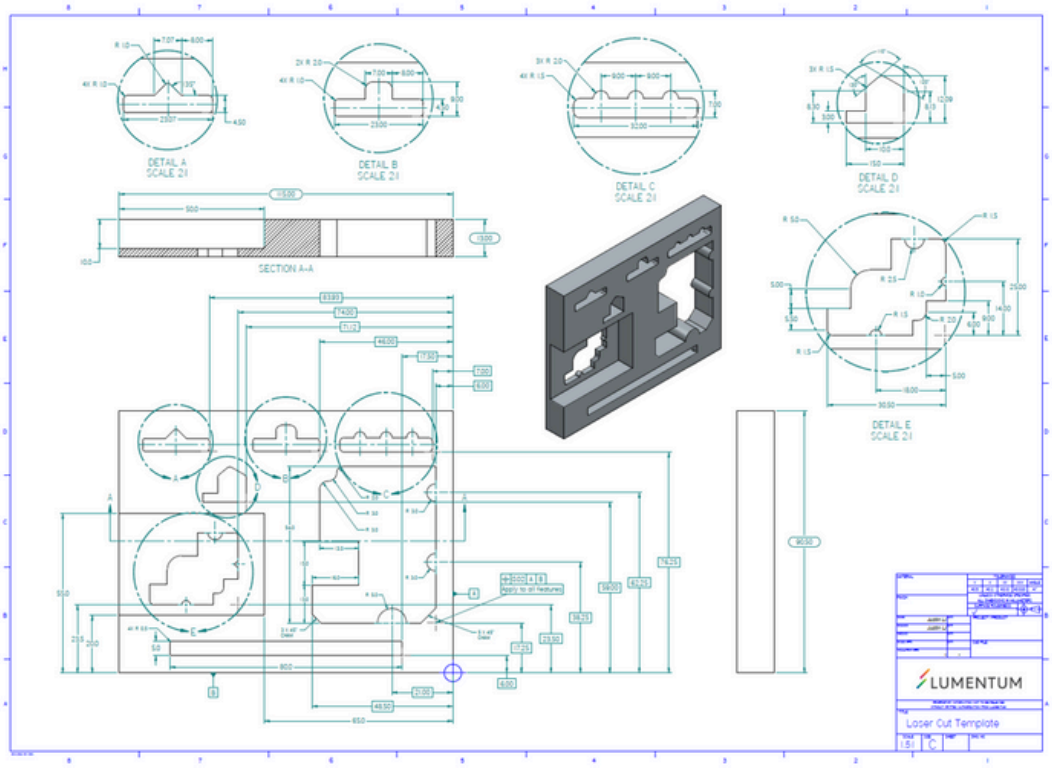
- Project objective is to implement **laser cutting technology** into the **prototyping process** at *Lumentum* in order to build low cost, high precision templates for different applications in production
- All assembly prototypes are protected by an NDA so a sample template with all the required cutting features that needed to be tested was designed and sent to many different companies selling laser cutters
- Template was designed on **Solid Edge**, **3D printed** with an industrial 3D printer, and measured using a **Coordinate Measuring Machine (CMM)** and a **SmartScope** 3D Multisensor Measurement System

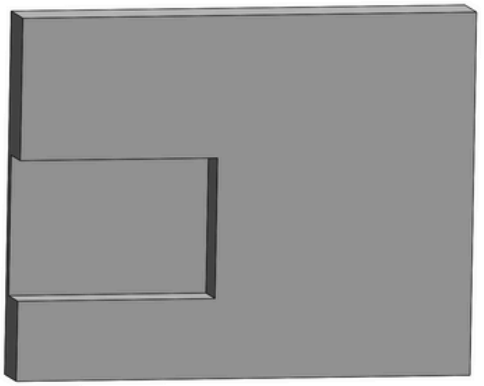
Designs and Drawings

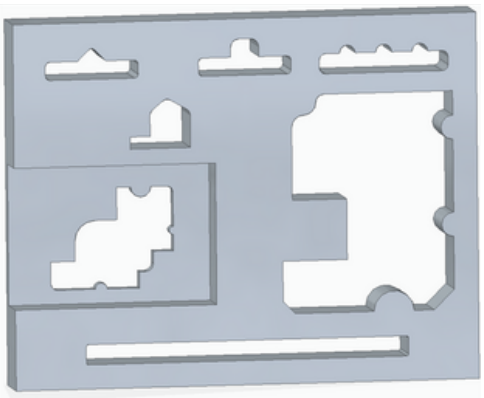
- Design was created in order to include features to test for laser accuracy, precision, and tolerances
  - Chamfers, fillets, holes, rounded edges
- Some features are extremely similar to how they look in the production-ready templates, only with different dimensions
- An **engineering drawing** following **GD&T** for the template was created in order to properly measure the accuracy of laser cutters
- Once the template was done, a design with no feature cut-outs was created in order to be used as a sample and sent to companies so that it could be laser cut and returned for measurement

Factors to consider:

- 3D printing material
  - Ultem, MC Nylon, PLA, etc.
- Types of laser cutting machines
  - CO2, Fiber, Waterjet
- Liaising with companies





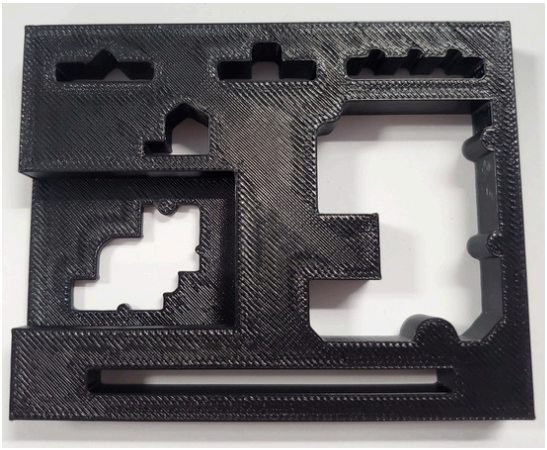


Justin Li

j2352li@uwaterloo.ca
linkedin.com/in/li-justin
thejustinli.com

3D Printing

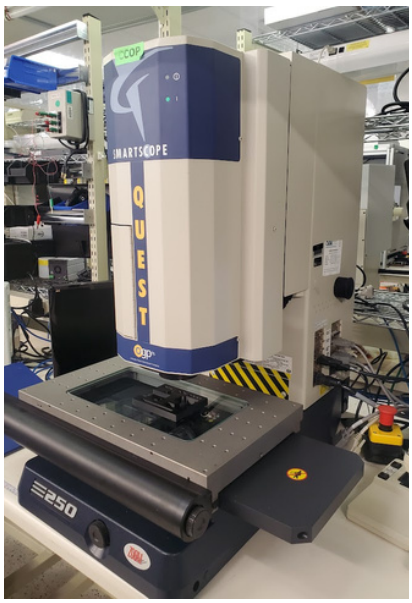
- Industrial **3D printer** was used to print templates & samples
- Different materials and thicknesses were used in order to test their how well they would be laser cut
- Black ABS sample on the right printed as a reference

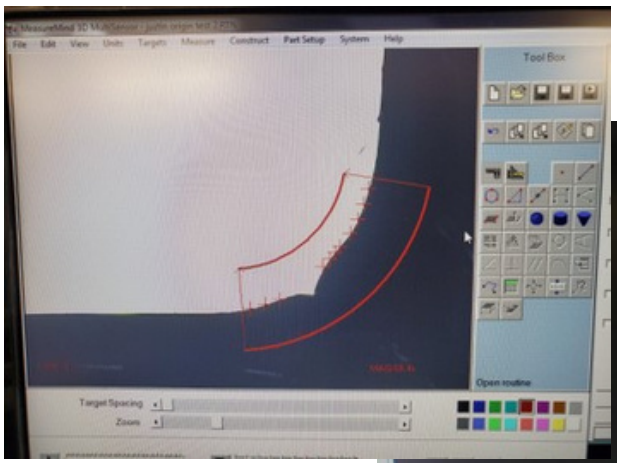


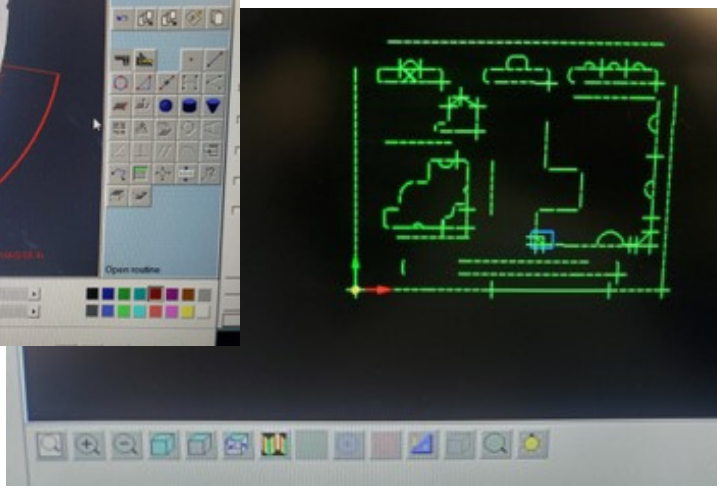
Measuring the Features

- The SmartScope is a visual inspection machine and measurement station with a microscope camera
  - Contains metrology software so routines can be created and programmed to follow specific sets of accurate measurements that are repeatable
- **Repeatable**, so that all the samples can be quickly and easily measured when returned
- **Accurate** is also important, since data can be used to compare between cuts from different companies

Click here to see a video of the SmartScope program in action!







Justin Li

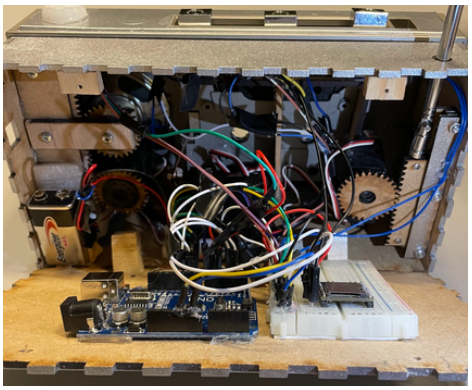
j2352li@uwaterloo.ca
linkedin.com/in/li-justin
thejustinli.com

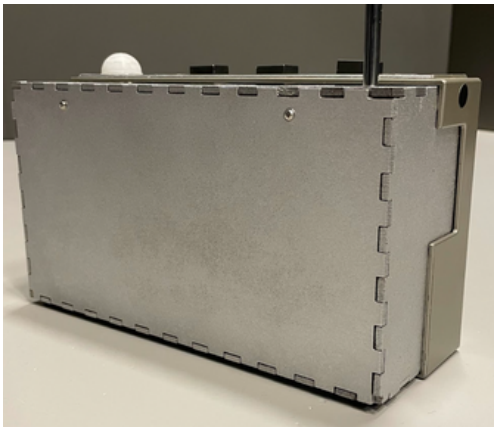
Interactive Custom Cassette Player

Dec 2022

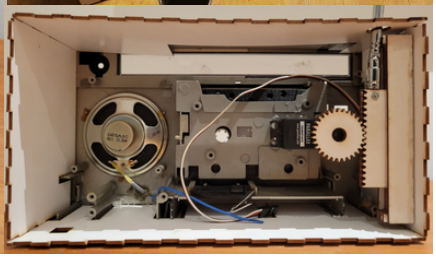
- Project completed for a **Rapid Prototyping course** while on a student exchange term in Lund, Sweden
- Collaborated with a team of 4 to create a custom interactive cassette player
- Internal and external designs were completed using **SOLIDWORKS**, **Arduino** components, **3D printing**, **laser cutting**, **Adobe Illustrator**, and **Figma**
- Final product must be a robust box that is alluring to interact with and will deliver different forms of motion and feedback in order to elicit an emotion or reaction from the user

Click here to see how it works!

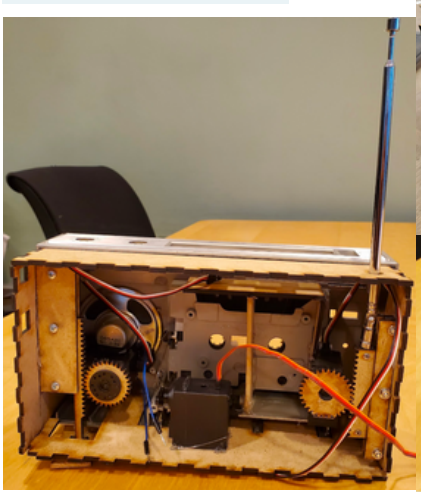




First Prototype



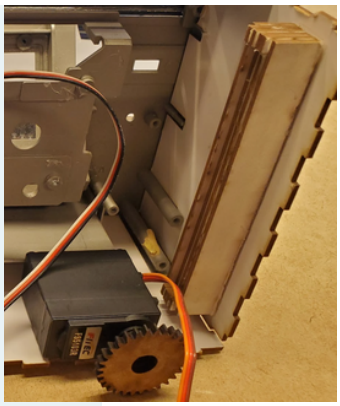
Second Prototype



Justin Li

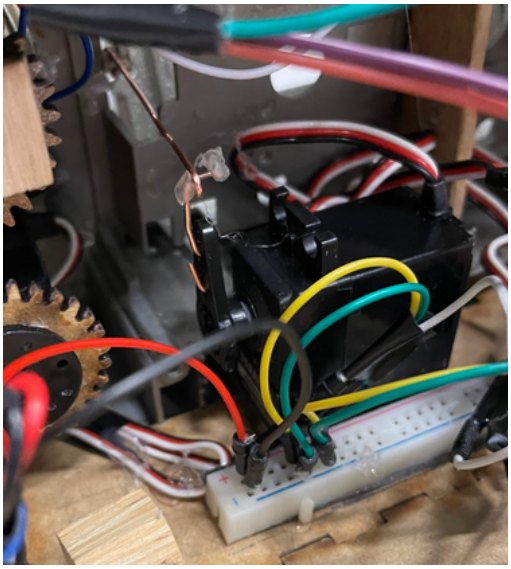
j2352li@uwaterloo.ca
linkedin.com/in/li-justin
thejustinli.com

Mechanical Functions and Internal Design



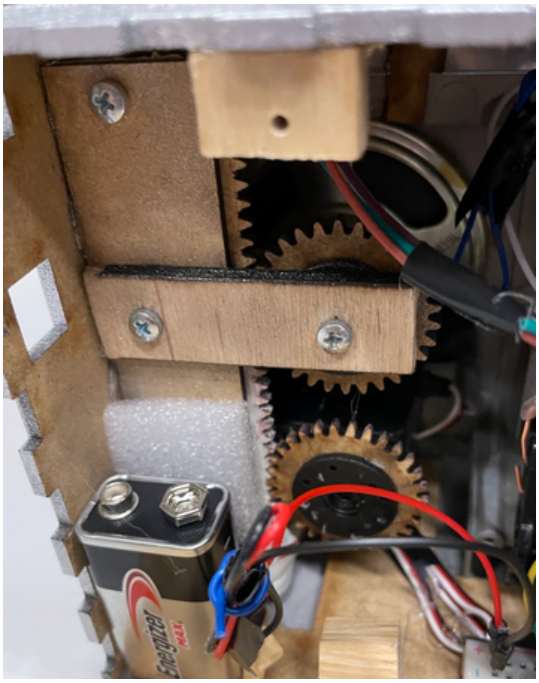
Moving Antennae

- Materials
  - 180° servo motor
  - Laser cut rack and pinion
  - Laser cut linear track
  - 2 screws
  - 3 nuts, bolts, and washers
- Laser cut parts are from a 3mm MDF board
- Rack consists of a double layer of MDF for more stability
- Linear track consists of two inner layers of MDF where the rack slides and two outer walls to keep the sliding rack from tilting side to side
- Screws and bolts hold the layers of MDF together



Flapping Cassette Door

- Materials
  - 180° servo motor
  - Paper clip linkage with hot glue
- Paper clip has been bent to form a rigid linkage and hot glued at joints to keep it secure
- Cassette door falls open with a slight push and is pulled back closed using the paper clip linkage and servo mechanism



Dancing Cassette Player

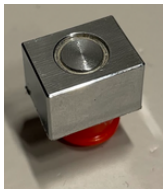
- Materials
  - 180° servo motor
  - 2 laser cut pinion gears
  - Laser cut linear gear with side extensions
  - 3 screws
- Mechanism is similar to the moving antennae, except there is now an extra driven pinion gear that is held secure in order to keep the rack from tilting side to side or misaligning with the gears

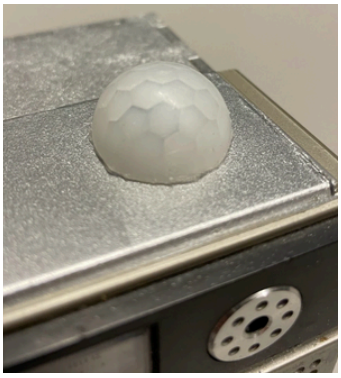
Justin Li

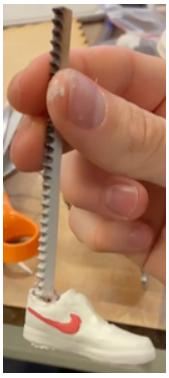
j2352li@uwaterloo.ca
linkedin.com/in/li-justin
thejustinli.com

External Design

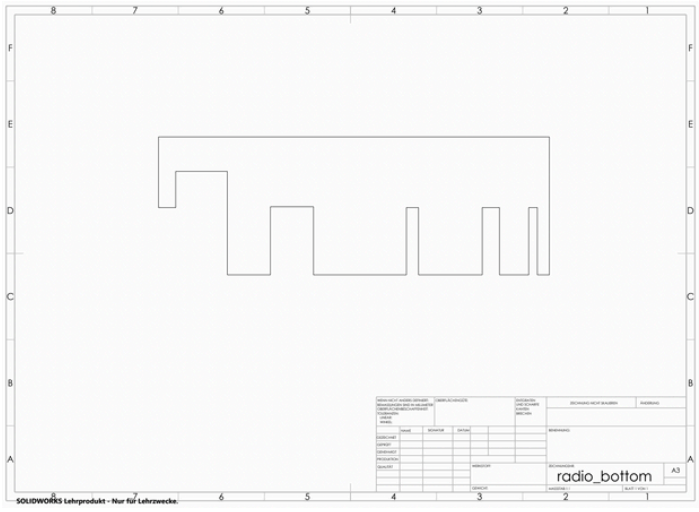
- Enhanced using a real cassette player that was purchased
- Reused parts for the final design:
  - Front half of the cassette player
  - Cassette
  - Speaker from the original cassette player
  - Antennae
  - Three radio buttons from the original button assembly

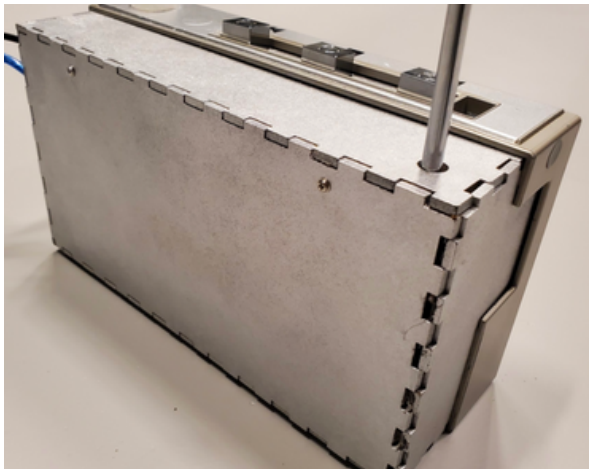


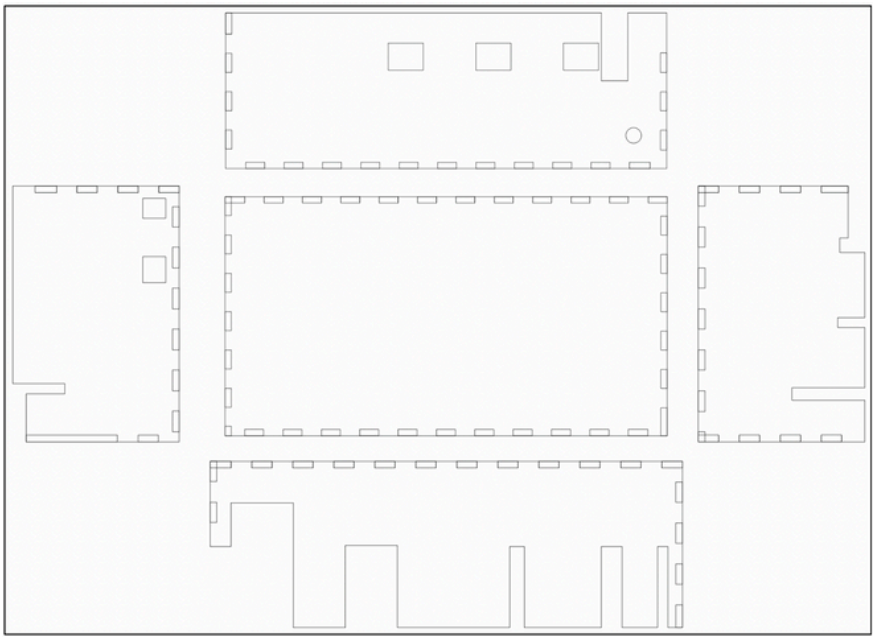




- New parts for the final design:
  - Disco ball
    - Using a sensor cover and a NeoPixel LED
  - Shoe for comedic appeal
    - **3D printed** and painted
  - Box extension
    - Drawn on **SOLIDWORKS** and **Adobe Illustrator**
    - Laser cut from 3mm MDF board using the **Epilog Legend 36EXT laser cutter**







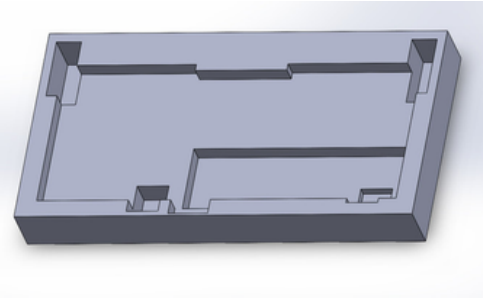
Justin Li

j2352li@uwaterloo.ca
linkedin.com/in/li-justin
thejustinli.com

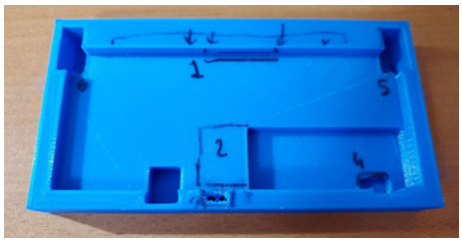
Production Part Plate Mold - Vexos

Jul 2021

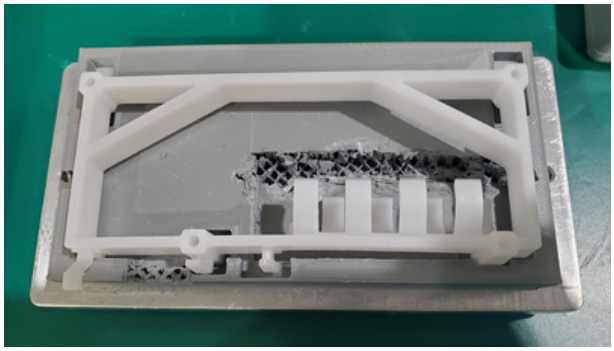
- Measured, designed, and **3D printed** a tool mold that can be used by the production team to hold a custom part in place while affixing a circuit board to it and wiring it



- Measured to precise dimensions using calipers
- Designed on **SOLIDWORKS**



- **3D printed** prototypes using Ultimaker Cura software for production to test
- Noted potential modifications and printed new prototypes

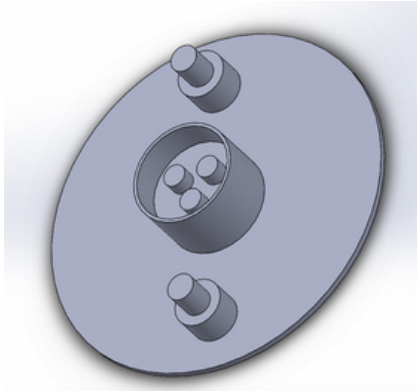


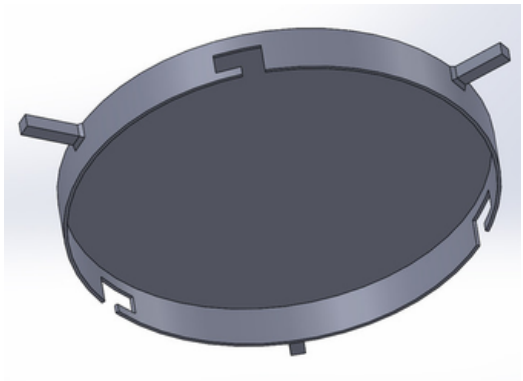
- Communicated with production to test the design and completed more modifications as necessary
- **Increased efficiency** in the production line by removing the need for workers to hold the part by hand while working on it, including attaching electronics, wiring, and soldering

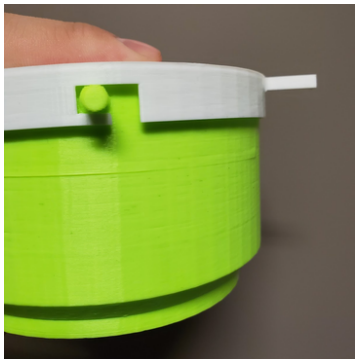
Toy Design Project

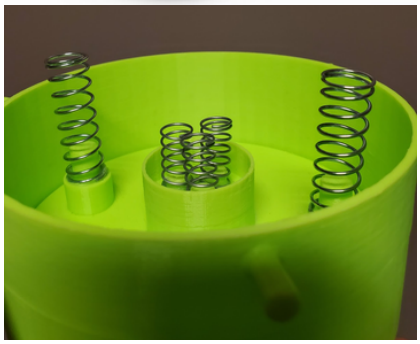
Dec 2019

- School term project to collaborate with a team of 4 and create a unique toy for pre-adolescent children
- Concept was a battery powered spinning top with a detachable lid that would reveal and eject other toys on the inside when the top came into contact with something
- Designed on **SOLIDWORKS** and **3D printed** at the university's Rapid Prototyping Centre using **GrabCAD**
- Various prototypes were designed, printed, and tested in order to maximize the success of the project









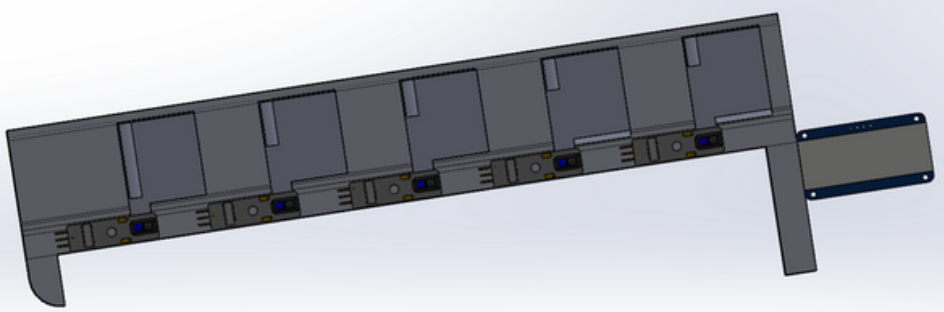
Justin Li

j2352li@uwaterloo.ca
linkedin.com/in/li-justin
thejustinli.com

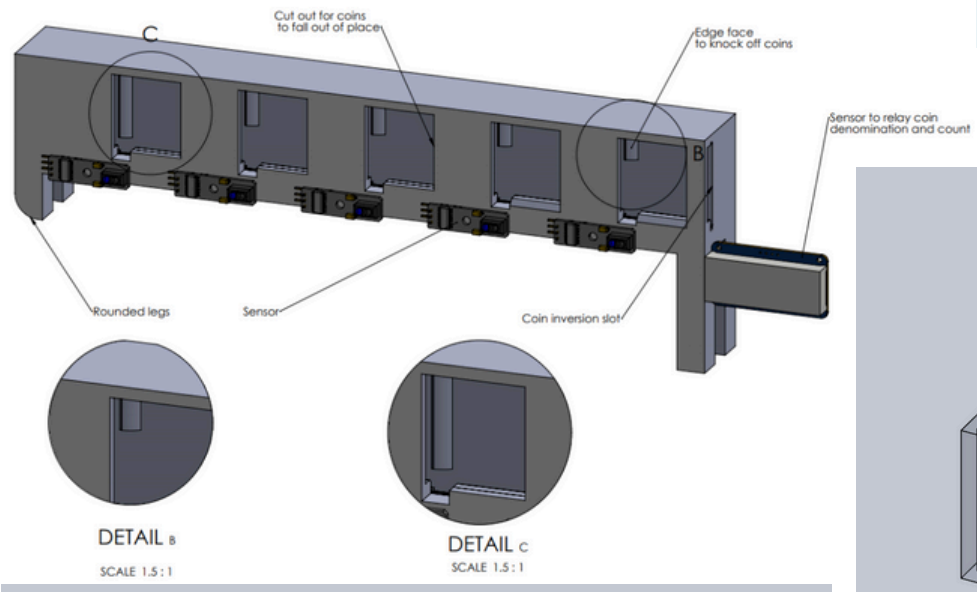
Coin and Bill Sorting Machines

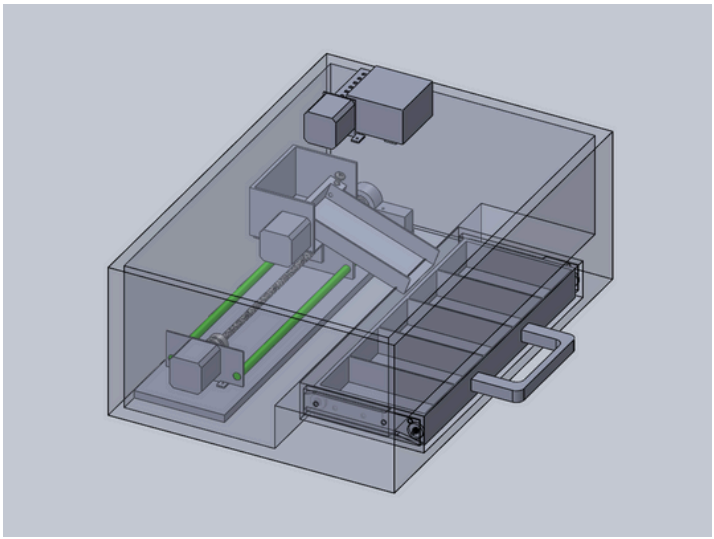
Aug 2020

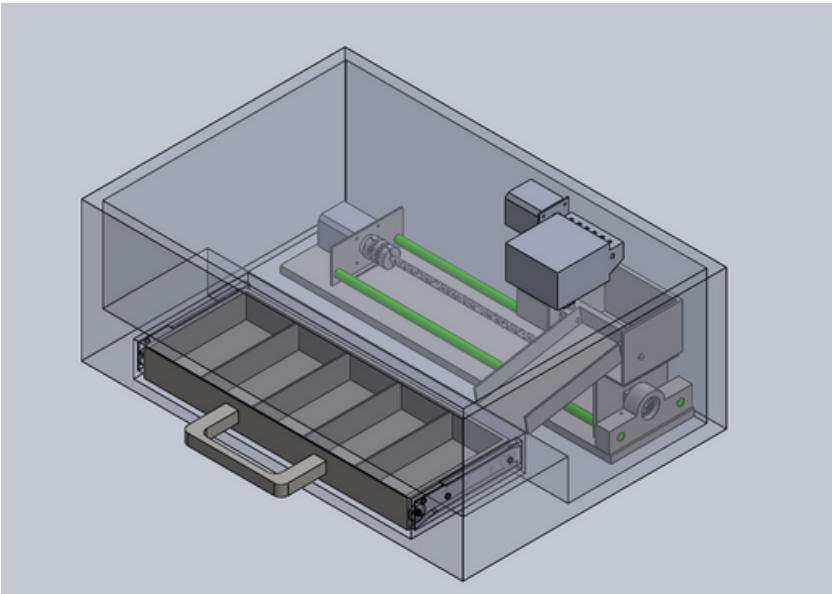
- Designed on **SOLIDWORKS** as a solution to a COVID-19 related problem to minimize the chance of transmission between cashier workers and customers through physical contact with Canadian currency
- Created as an idea for a two person **design challenge** during the school term when the global pandemic was initially declared



- **Fully mechanical** coin sorting machine
- Basic function is to sort the inserted coins from largest to smallest diameter
- Auxiliary function is to add up the total value using sensors and an **Arduino** seven-segment display







- Mechanical bill sorting machine with some **electrical components**
- Basic function is to sort the inserted bills using a colour sensor, a motor powered tray assembly, and a motor powered linear motion track
- Auxiliary function is to allow for a quick method of removing bills after storage compartments are full