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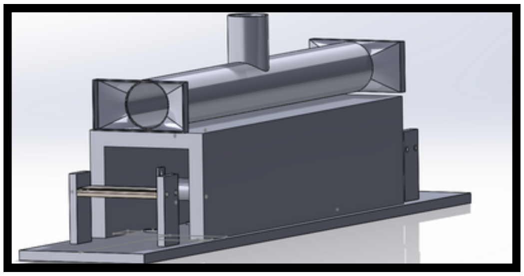
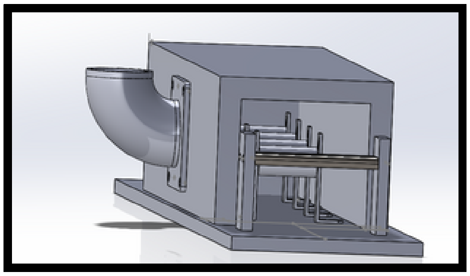
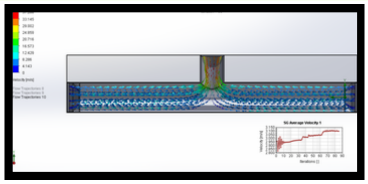
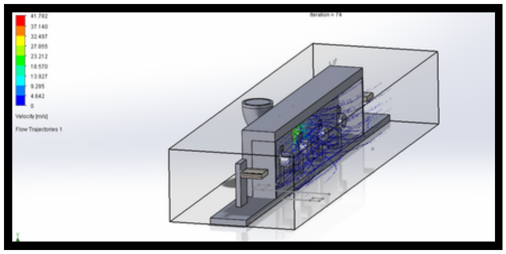
NMC VENTILATION IMPROVEMENT









What?

- Developed a permanent ventilation solution for the NMC coater used in cathode production, addressing user safety concerns caused by temporary ventilation.
- Enhance system efficiency to surpass the previous velocity rate of 2.3 m/s and achieve the lab-standard ACH rate.

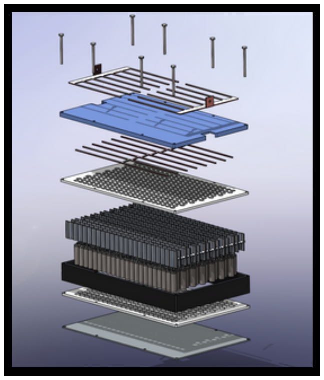
How?

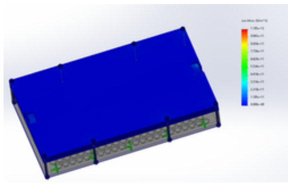
- 3D designed current coater assembly using Solidworks
- Calculated and modeled possible venting routes using **Bernoulli princples** and **CFD simulation**

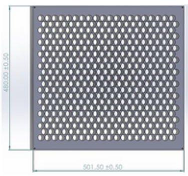
Results

- Engineered an optimized 90-degree elbow design for installation, enhancing airflow velocity to **24 m/s** and meeting ACH laboratory standards.

BATTERY MODULE DESIGN - BATTERY WORKFORCE CHALLENGE







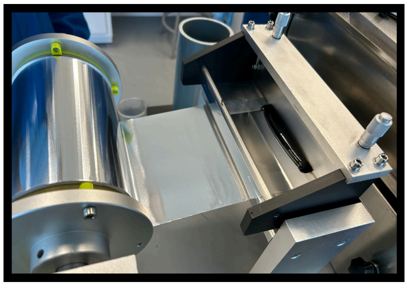
What?

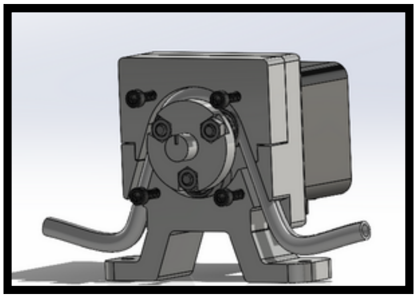
- As a mechanical design member, I worked on the conceptual and design stage of developing the battery module, cell holder, serpentine tubing and material research

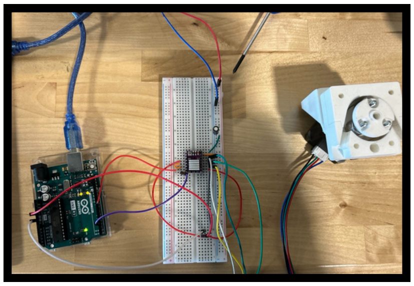
How/Results

- Used **SolidWorks** to design the module assembly, using parametrics for team accessibility
- determined PC filament selection for cell holder ensuring flammability and structural load criteria are met

COATER PUMP AUTOMATION







What?

- User has to pour 10ml chemical mixture into roller assembly manually for 3 minutes, causing quality concerns and slower production time
- Develop a method that automates pouring the mixture into assembly to reduce production time and improve quality

How?

- Research pump methods to achieve volumetric flow of 0.08ml/s
- Design and prototype using 3d printing and Ardunio
- Perform cycle testing to determine failure rate

Results

- Developed a peristaltic pump using a stepper motor and 3D printed assembly, producing a dispense of **0.1 ml/s** consistently in **1 min 30**
- Improved production time by **50%**
- quality issues have reduced by **15%**

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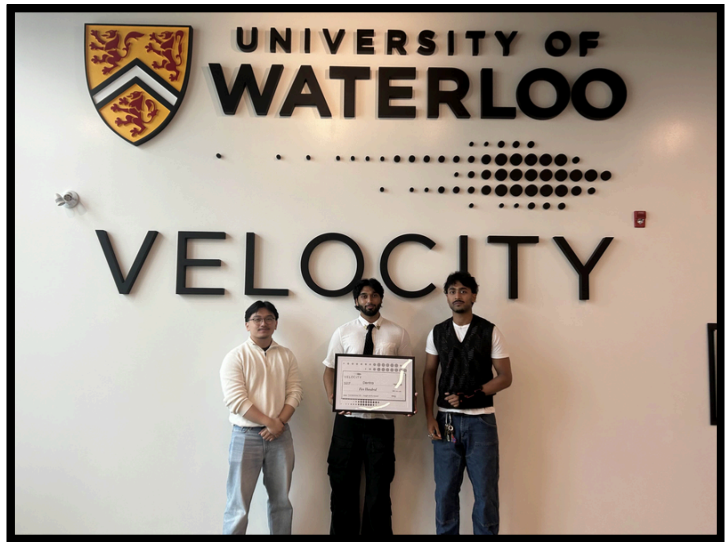
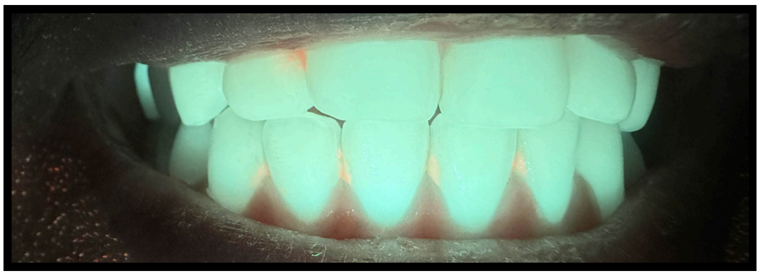
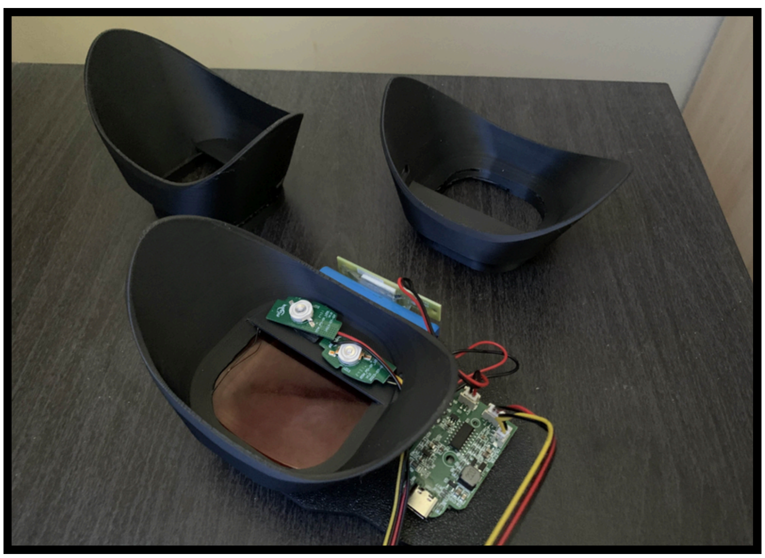
DENTRA - ORAL DIAGNOSTIC TOOL

What is it?

- Dentra began with a shared frustration: doing everything right yet still being blindsided by cavities or gum problems. Millions face the same uncertainty. Other areas of health have real time feedback, but oral health remains guesswork between cleanings. Our product is an AI powered oral health platform, giving people clarity to act early, confidence in their routines, and the power to prevent problems before they start. Dentra is making proactive oral care accessible for everyone.







How was the design journey?

- As the main founder, I was in charge of managing the hardware and software side of the development ensuring everyone stayed on target and achieved ideal deliverables for our planned out phases of prototyping
- Successfully able to complete **90% of hardware** POP by July 2025
- Successfully utilized **Quantitative light fluorescence** and optical filtration to detect levels of plaque build up, being the first of its kind to be adaptable to everyday phones
- Finalized circuit design with hardware members and prepped **PCB design allowing for full charging** capabilities with low power consumption.
- Managed software team to ensure basic app integration and deep learning model has been setup
- Led validation of dataset to ensure **CNN segmentation correctly identifies plaque**

What did I learn/Accomplishments

- Achieved grant by Conrad business school, receiving **two paid interns** for the spring term, **total of $10,000** investment from them
- Achieved **cornerstone award** for having well planned problem space and product idea, **receiving $500 in funding**
- Learned how to manage a team effectively, ensuring both interns and team leads were on task and had the correct guidance for the idea
- Learned many skills around **optical designing, casting, pcb design and crucial manufacturing processes** to ensure low cost and simplicity for the product
- Developed **product design** skills to ensure aesthetic and form factor was attracting to our demographic
- Created a business model, ran design sprints and created a valuable go to market plan to gain understanding of what it takes to create a sucessful startup

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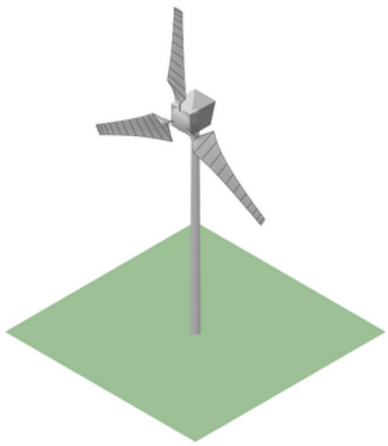
WIND TURBINE DESIGN - CASE STUDY

Objective

- Create a wind turbine design, simulating the potential power (Watts) to see if this idea is feasible

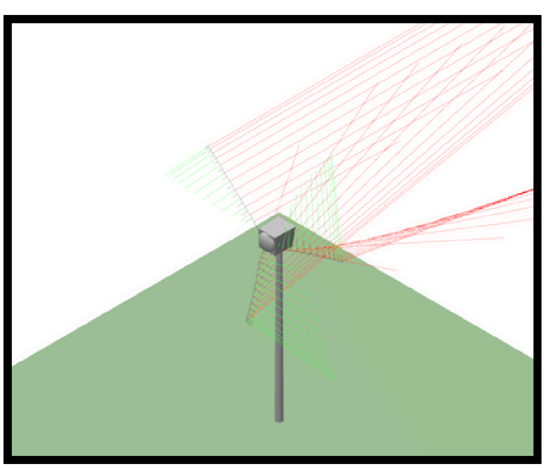
Design Criteria

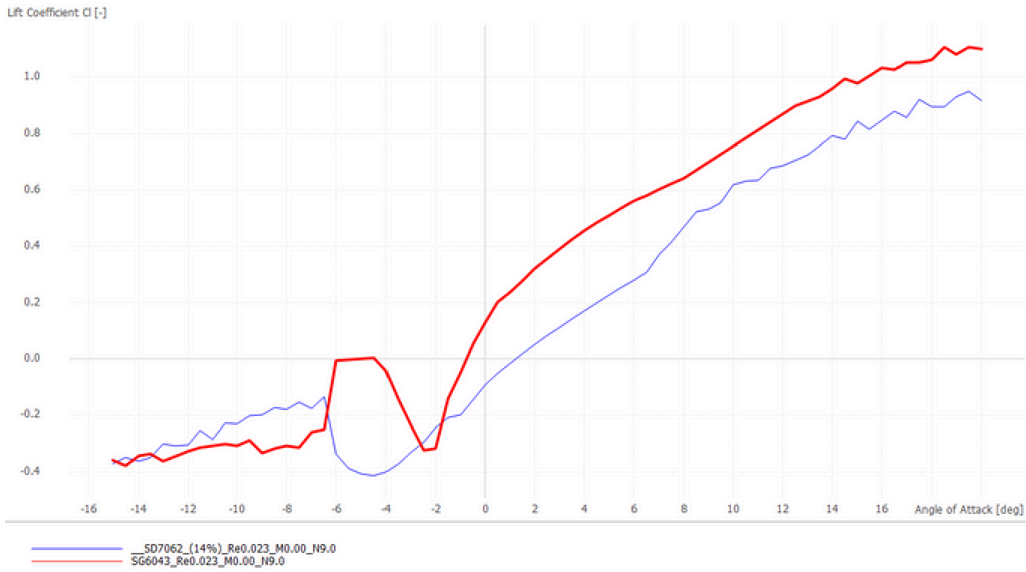
- Tip speed ratio of 5-7
- Turbine to exhbit power output > 1 Watt with wind velocites of 15 m/s
- Within restriction of 20cm rotor diameter



Problem Statement

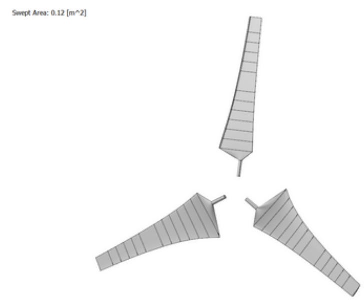
- Skateboarders have restricted access to possible electrical outlets, resulting in phone batteries being uncharged.
- Skateboarding produces high wind velocities **up to 30m/s** that are unused and I believe can be converted to electrical energy for possible trickle charging for devices.

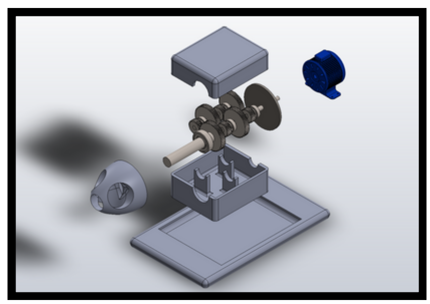




Airfoil Analysis (Research)

- analyzed 2 applicable airfoil models using **Q Blade** for wind velocities between **15-30m/s**, ensuring the design phase references the most optimal airfoil, to allow max Clift/Cdrag, power(watts), RPM and tip speed ratio.





Blade and Gear box Design

- Designed assembly with **Solidworks**, utilizing airfoil reference SG6043
- Created an assembly of the turbine hub composed of; gear assembly, housing, shaft and electrical generator
- Ensured DFM principles to allow possibility of additive manufacturing
- Total hub and rotor design followed within design criteria of 20cm for diameter and chord height of turbine blade

Testing/Results

- Achieved simulation utilizing **Qblade** for power calculation of turbine, and **ANSYS** for RPM and CFD analysis
- Achieved a theoretical power output of **3.36 Watts/second with a tip speed ratio of 5.4**

What Did I learn!

- This project exemplified the potential of further developing a device capable of utilizing wind velocities when I skateboard, providing an understanding of product design phases, aerodynamics and mechanical design.
- Next Steps are to prototype using additive manufacturing!

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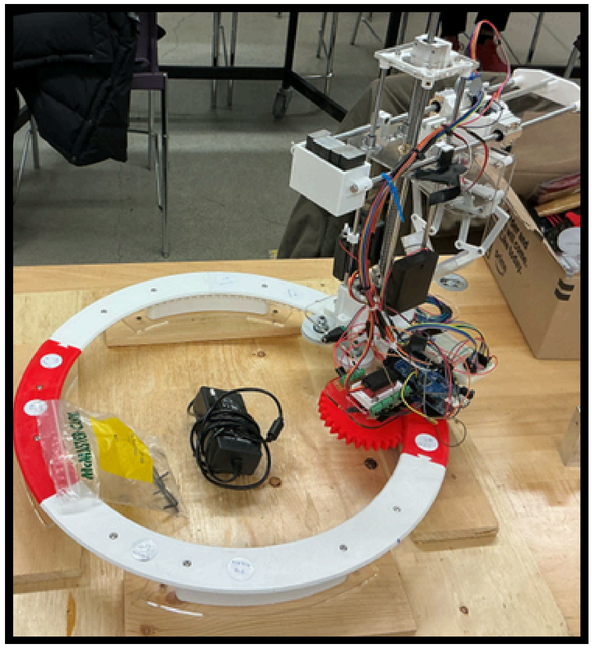
What is the Problem?

In modern manufacturing settings, a recurring challenge lies in creating a mechanism capable of gripping and handling objects of various shapes, sizes, and orientations from different storage locations.



Design Objective

1. Design for range of motion to pick up objects from multiple storage areas
2. Design for compliance to pick up difficult to grasp objects

Supplementary Criteria

- Cost < $300
- Project Size > 2500cm^2
- Start Up time < 30 seconds
- Grip 3 different materials
- At least 4 locations for range of motion

KEY CONTRIBUTIONS

Rail System Development

Mechanical Design of Rail gear system, including gear stress analysis, CAD assemblies and manufacturing the system through STL files

Adaptive Gripper Design

Designed gripper tips able to pick up any type of material, through the use of resin elastic printing. Completed the CAD and manufacturing of the tips to complete design objective 2.

RFID System and Code Integration

Completed research and development of RFID System, implementing a prototype board. Designed the electrical configuration and coded the logic sequence to effectively apply to the design, completing design objective 1.

Cart Integration and Design

Designed the wheel alignment method and calculated correct dimensions for accurate cart to rail interfacing. Sourced and assembled the cart to interface to rail assembly.

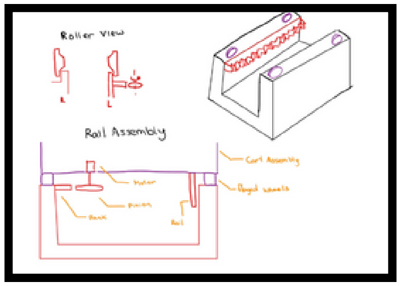
IMPACT ON PROJECT OUTCOME

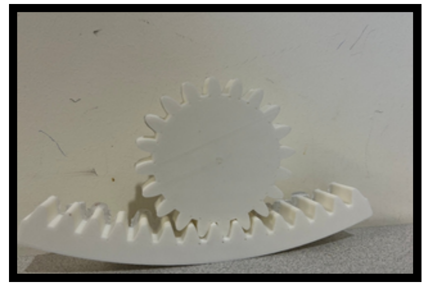
- My detailed designs of the rail and RFID system allowed for an easily integrated assembly to control the rest of the arm and gripper. Without an efficient rail system, the mechanism will not be able to reach design objective 1
- My design of the gripper tip allowed for the edge on picking up any object material, which is an aspect that achieved distinction for the "Swiss Army Knife Award" for adaptability.
- By quickly manufacturing majority of parts for assembly, I ensured the team stayed on track and reached successful integration.

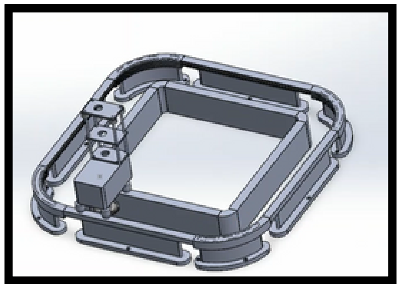
TECHNICAL SUMMARY

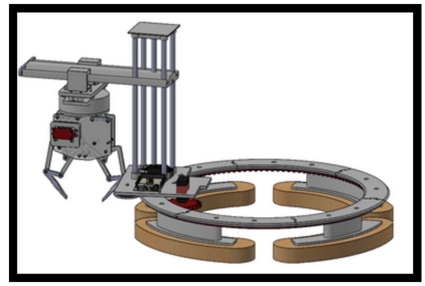
Detailed Design of Rail System

- Utilized first principles to develop methods to effectively move the gripper to designated storage locations effectively.
- Used mechanical design textbooks to understand the correct gear system to use and evaluate gear mesh and stress analysis to ensure load capacity is met. Ensuring **9kg of load** is able to be held.
- Created multiple variations of the design, effectively 3d printing final design for team within set timeline for integration.





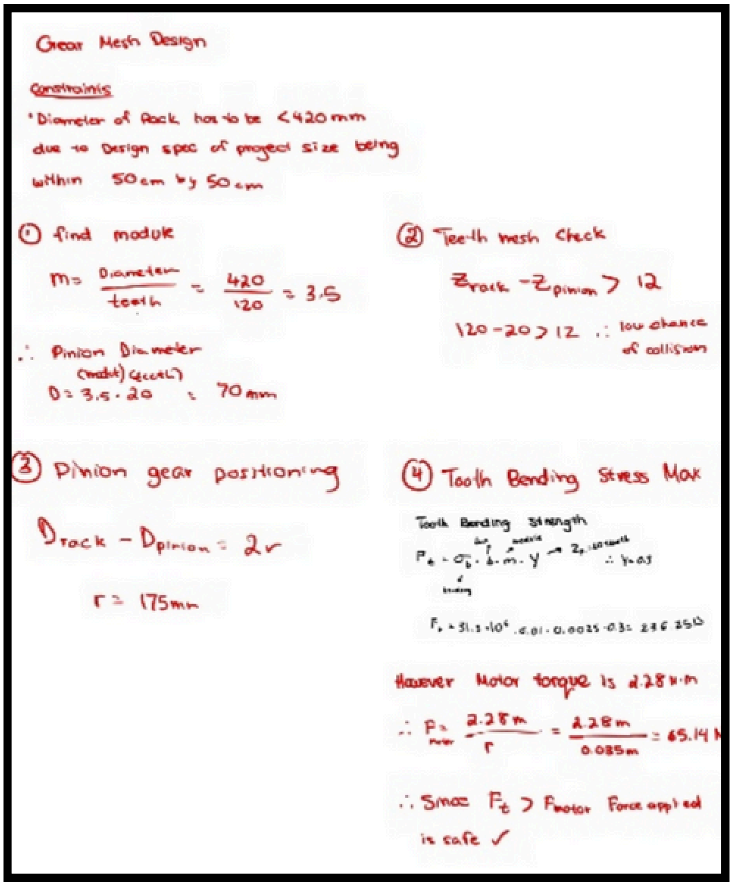




Old Design

Current Design

Gear Analysis

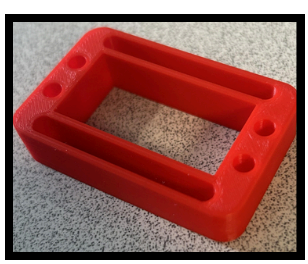


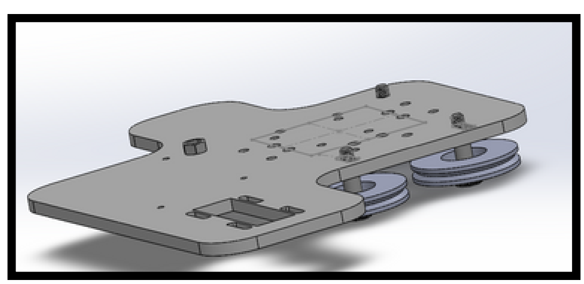
Adaptive Gripper Design

- Designed adaptive gripper through resin elastic 3d printing (bottom right image). Allowing for ability to pick up to 4 different materials
- Designed the gripper component in a way for manufacturability and adjustability through interference tolerancing
- Redesigned for final product to allow wider widths for ensured surface contact and improved grip (old design to the left), allowing for additional sand filling to create cushion grip ability.

Cart Mount Design and Integration

- Designed shoulder bolt slots and servo mount for adjustability of cart to rail integration
- Sourced and assisted with manufacturing, ensuring dimensioning and tolerancing is correct for wheel to rail connection.

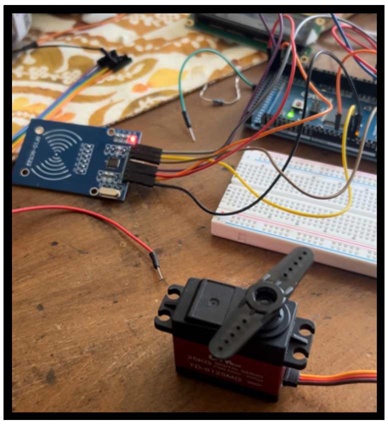




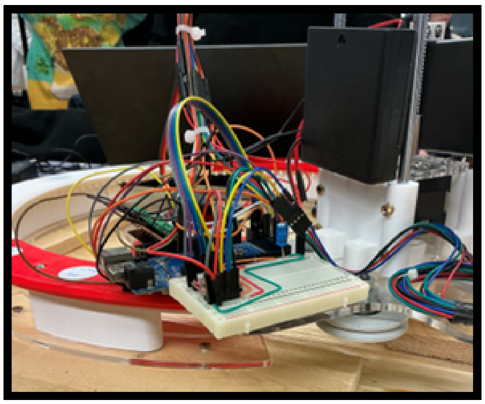
TECHNICAL SUMMARY CONTINUED

RFID Development and Software Integration

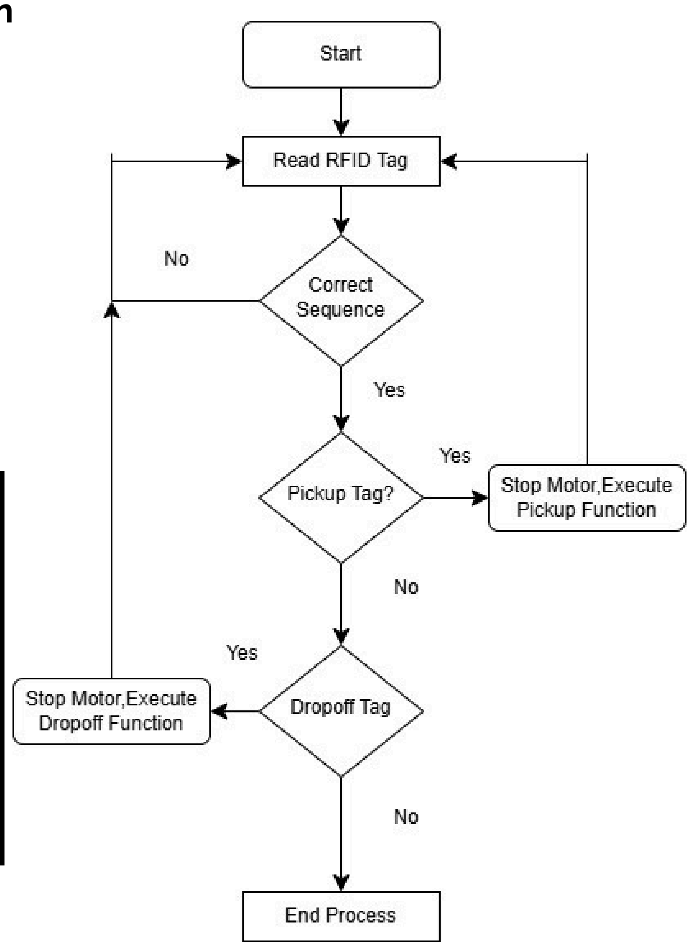
- Researched and sourced RFID scanners, implementing a RC522 module into the Arduino microcontroller.
- Implemented a sequence code to ensure correct pickup and drop off based on coded tags that are placed around the rail system.
- Integrated sequence code into overall gripper and various assemblies code, to ensure smooth and efficient function



Initial Prototype



Final Integration



LEARNING OUTCOMES

1. **Manufacturing Methods:** Learned to effectively apply the correct manufacturing methods from SLA resin printing to Laser cutting and machining. Understanding the benefits and factors for each helped me to correctly design and understand when to use each method as an engineer.
2. **Design Methods:** I learned the importance of designing for manufacturing, as most of our project utilized some form of 3d printing or machining, which contains constraints to building. Applying the correct tolerances and adjusting for factor of safety is crucial in the design phase and something I gained further knowledge in over the course of this project

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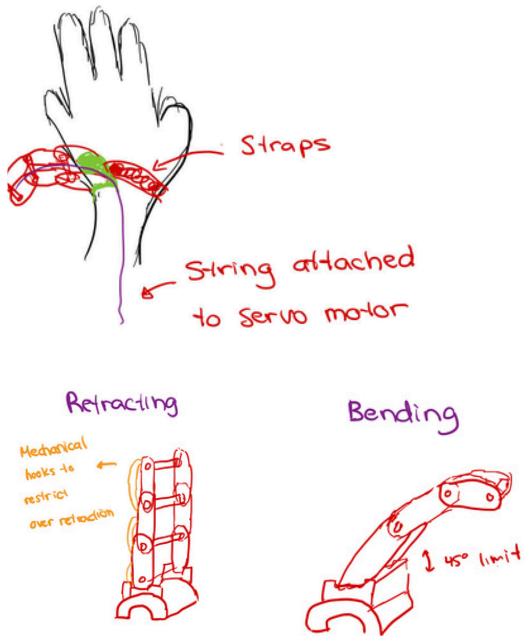
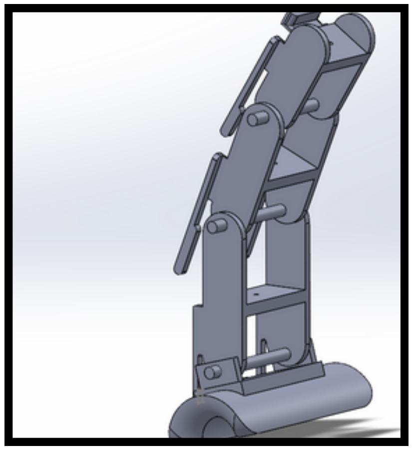
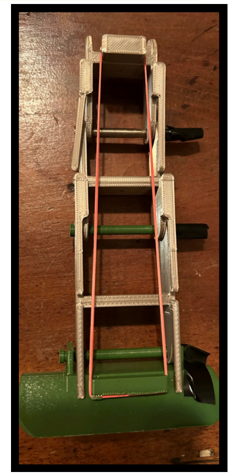
MECHAFINGER - PERSONAL PROJECT







What?

- I have a family member who is unable to firmly grip objects due to their hand injury, I wanted to design a robotic prosthetic to assist grip strength and add dexterity

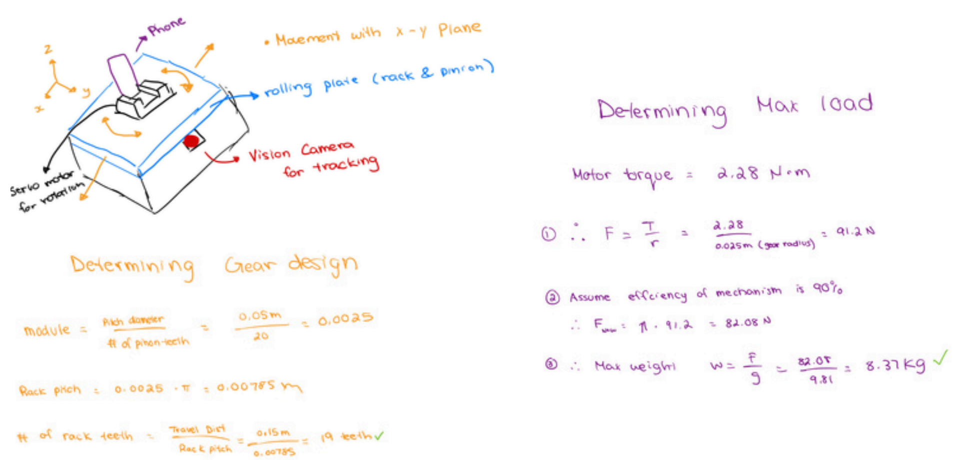
How?

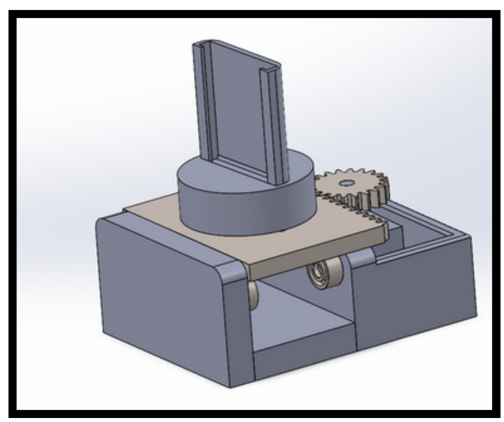
- Research and sketched possible linkage designs with **1 DOF**
- Designed linkage design with Solid works, with the criteria being, **lightweight, feasible for 3D printing and ergonomic**
- Utilized Arduino for a servo motor based ligament system

Results

- Successfully able to aid in picking up **objects within 1kg**
- Next steps would be to improve grip strength through selecting materials with higher yield strength and testing new manufacturing methods

MOTIONMATE - PRODUCT DESIGN (WORK IN PROGRESS)





What?

- People using social media, or involved with content creation depend on people to film for them, tracking there movement within a set frame. This product resolves this issue of human aid by creating an automated system to track yourself when recording

How?

- Researched methods of linear and rotational movement through motors
- Complete **gear analysis** to determine necessary torque required to complete both rotations within the X-Y plane
- Design and 3d print protype using **Solidworks**
- Develop code for integrated **computer vision system**

Results

- Developed prototype design for 3d printing
- Calculated a feasible servo motor torque and gear pitch to handle a **maximum of 8.6kg**

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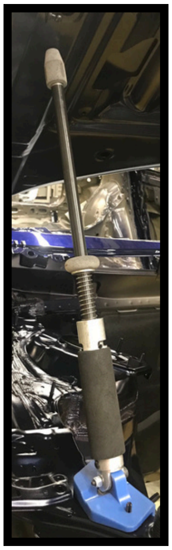
HOOD JIG DESIGN - TOYOTA MOTORS



What?

- Hood jigs are utilized for the assembly line, Team members place the jig in to access the hood of the vehicle in the production line
- Every month, **15 of the 40 hood jigs are needed to be repaired**, causing downtime
- Design a modification to reduce failure rates

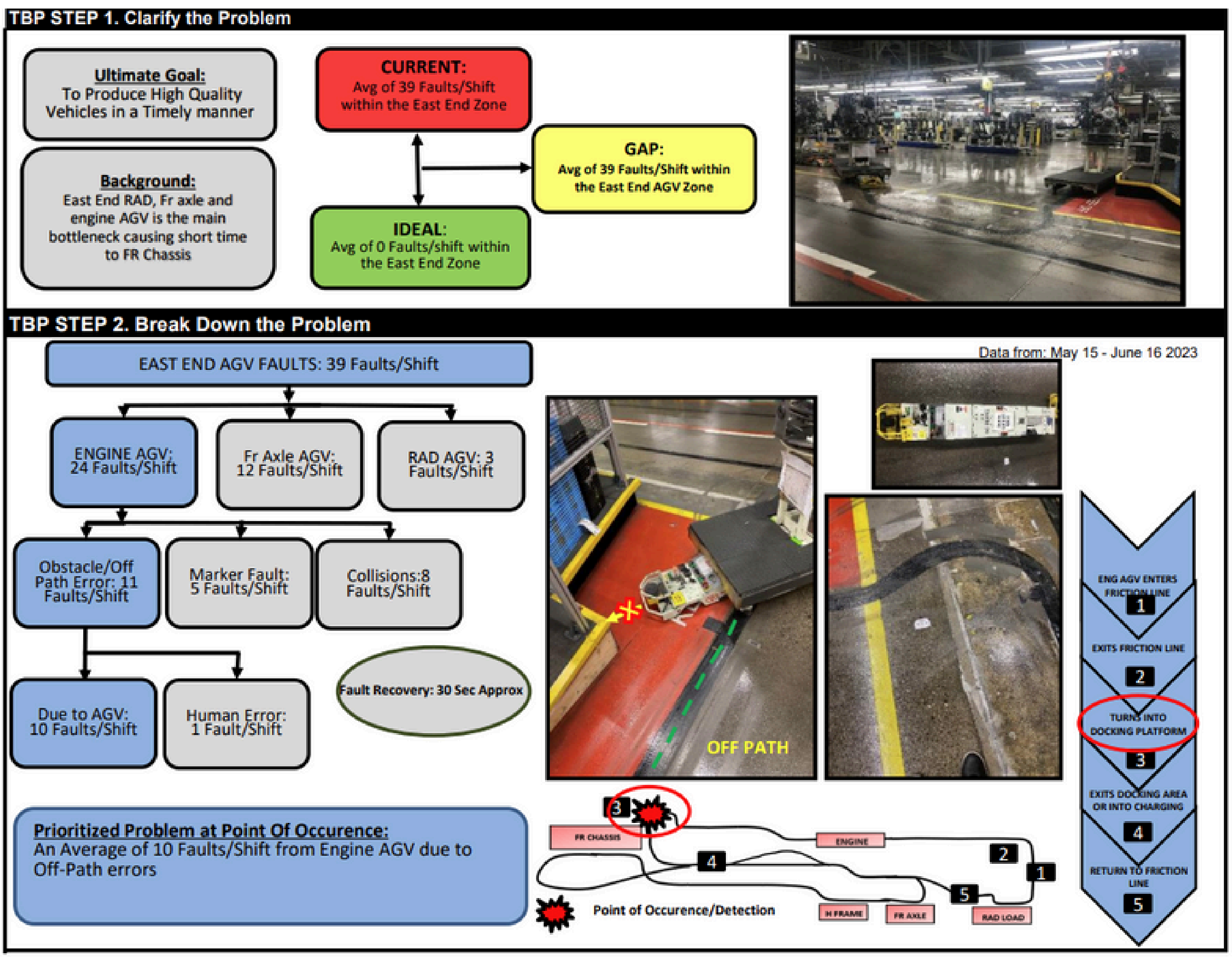
How?

- 3D modeled a hood jig tip that is replaceable, instead of a fixed shaft that is needed to be machined
- Simulated and tested tips to ensure material selection is durable for stress conditions and impact overtime

Results

- Successfully implemented and standardized a 3d printed hood jig tip that can be replaced continuously during production, with a 50% reduction on failure rates per month
- Achieved cost savings of **$5,000** by optimizing existing jigs, eliminating the need for new purchases

ENGINE LINE DEVELOPMENT - TOYOTA MOTORS



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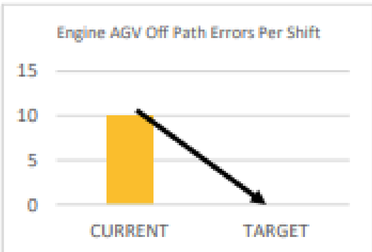
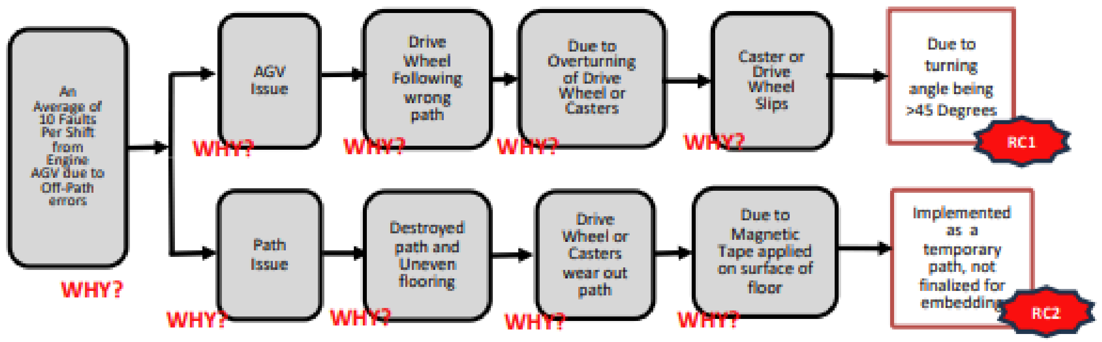
ENGINE LINE DEVELOPMENT - TOYOTA MOTORS

TBP STEP 3. Set Target

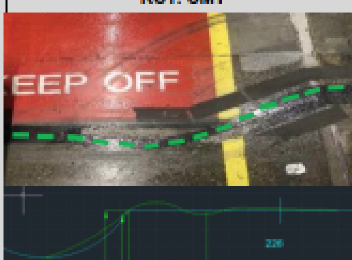
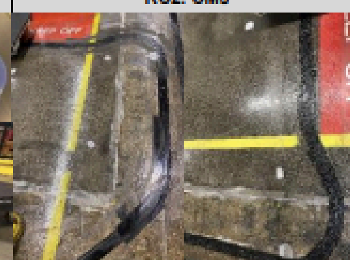
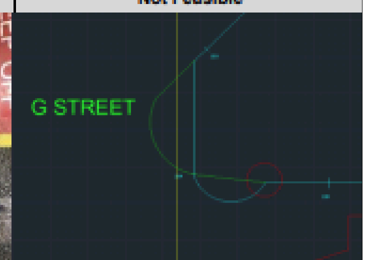


Target: Eliminate the 10 Faults Per shift by August 25th 2023

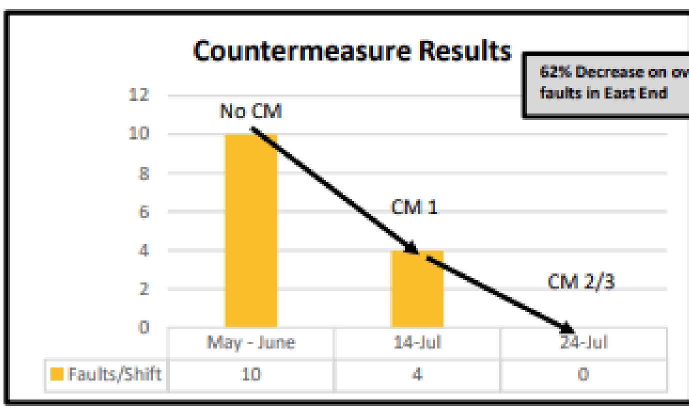
TBP STEP 4. Root Cause Analysis



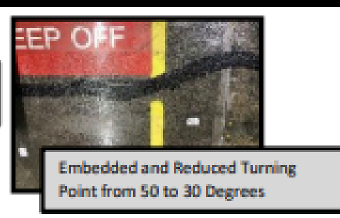
TBP STEP 5/6. Develop/Implement Countermeasures

	RC1: CM1		RC1: CM2		RC2: CM3		Not Feasible	
Countermeasure Images								
Description	Reduce the Turning angle from 50 to 30 Degrees		Upgrade Casters from single to double wheeled set		Embedding magnetic path and leveling floor.		Redesign Pathway further into G Street to remove the turn transitioning into platform	
Productivity/Safety	-Reduces off path occurence - Does not interfere with G Street Traffic	O	- Reduces offsets and wheel jams - Improves Stability and Traction	O	- Protect Magnetic Tape -Strengthen Magnetic Signal -Levels flooring out	O	-Resolves overturning -Gradual turn for dolly and AGV, **-Interrupts Conveyance Process**	X
Lead Time	2 Weeks	O	3 Weeks	O	1 Week	O	2 Weeks	O
Cost/Manpower	$300/No added Manpower	O	$850(For New Casters)/Maintenance	O	$2010/Gryphon	O	$300(additional $2010 if embedding by Gryphon)/No added Manpower	O
Overall	Implementation done July 14th	O	Caster trial completed July 24	O	Implementation Done July 24th	O	Not Feasible	X

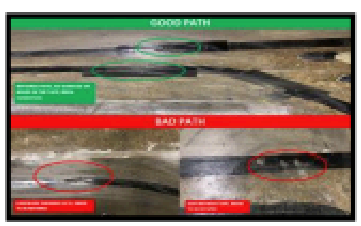
TBP STEP 7. Results and Process Evaluation with TBP Step 8. Standardization and Yokoten



62% Decrease on overall faults in East End



Embedded and Reduced Turning Point from 50 to 30 Degrees



Standardization + Yokoten

1. Maintain weekly PFS with Engineering,Production and Maintenance - Track AGV faults, marker location and AGV number.

2. Regular magnetic tape Inspection per shift.

3. Documentation on good vs No good path conditions, share with stakeholders.

Analysis of Personal Objectives	Eval.
1. Utilize and improve my critical thinking, through various projects in assembly and production	O
2. Aim to improve communication skills and effectively express solutions	O
3. Further improve my understanding of the manufacturing processes in assembly	O