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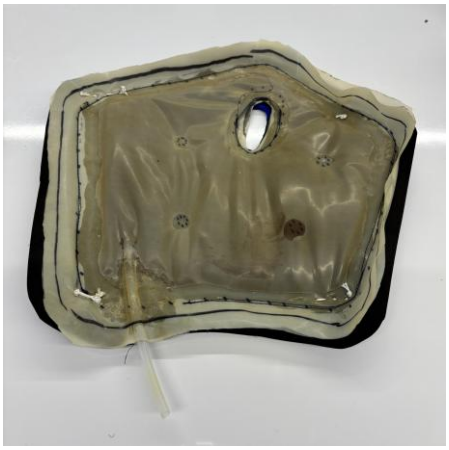
Granular Jamming Wrist Brace



What?

- Design and fabricate a wrist brace that uses **granular jamming** to improve traditional casts
- Perform initial research to **analyze** customer needs

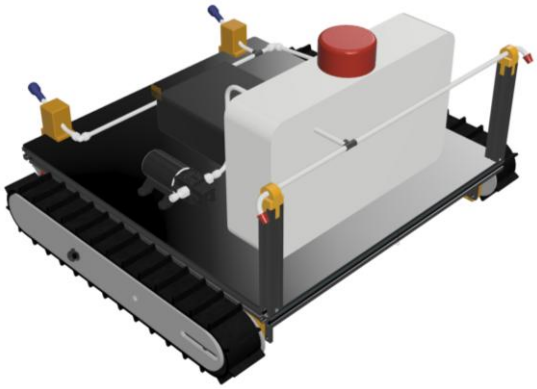
How?

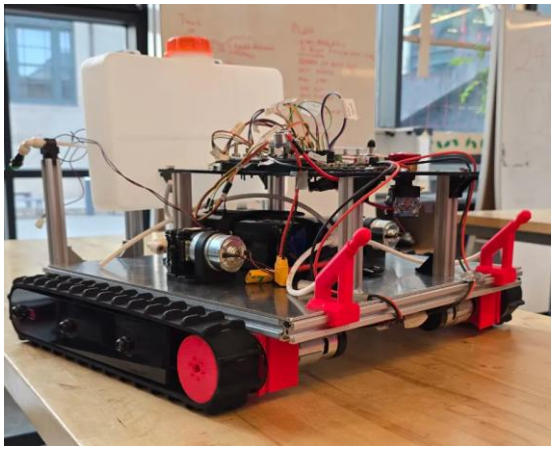
- Prototyped a **four-layer cast** to maximize user comfort
- Conducted **three-point bend tests** on jamming layer to evaluate cast properties

Results

- The **Young's modulus** of the design **increased** by approximately 47 times when in the rigid state compared to the soft state
- Rigid state demonstrated **improved impact resistance**

Semi-Autonomous Salt Spraying Robot





What?

- Develop a **mechatronic** system that addresses labor-intensive application of de-icing materials in harsh winter weather

How?

- **Translated customer needs** into product specifications to ensure final product meets expectations
- Created a decision matrix to finalize the most **optimal design concepts** to implement

Results

- Developed a semi-autonomous de-icing robot with **remote-controlled** operation through a **Bluetooth-connected** interface
- Final product **featured**: obstacle detection, stair coverage, ground coverage, ability to traverse slopes, and emergency stop

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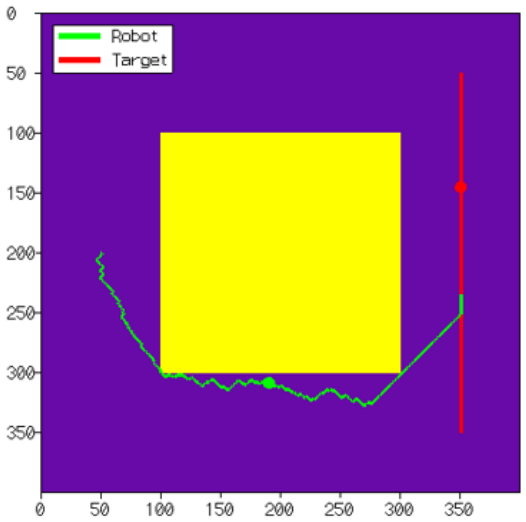
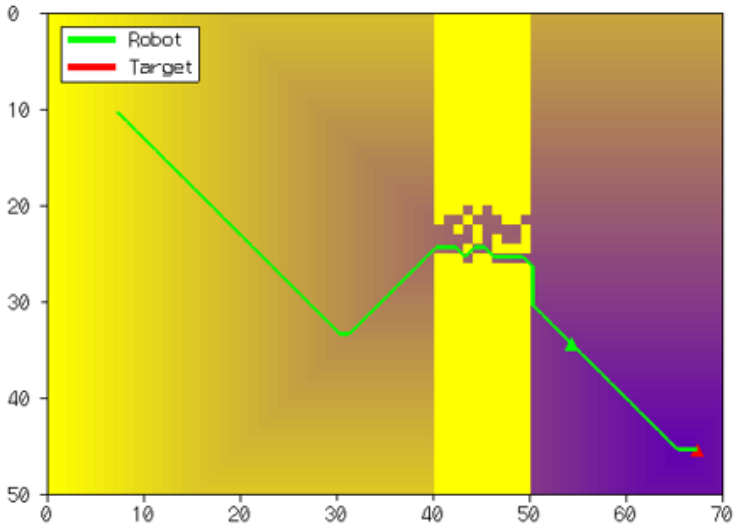
2D Robot Trajectory Visualizer





What?

- Work **collaboratively** in a team with four other people to create individual C++ source files to generate a graphic **user interface** that could plot the movements of a single point robot

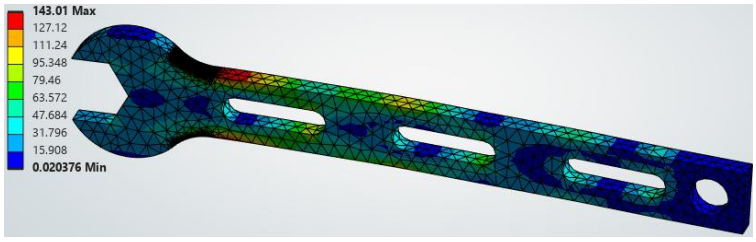
How?

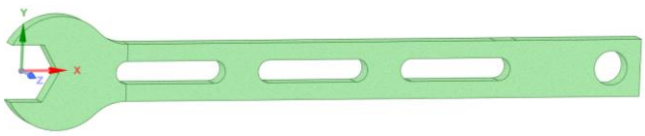
- I created the **Map Visualizer**, which inputs the 2D map data vector and dynamically sizes the grid that the map needs to be visualized on
- Team members integrated their components together

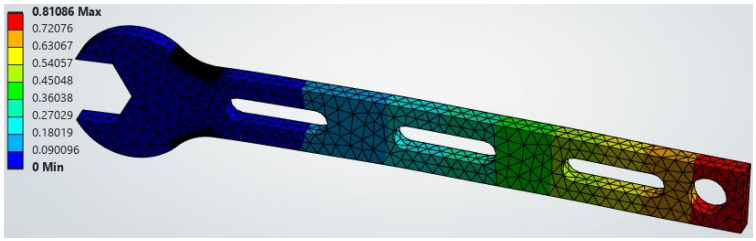
Results

- Created a program that reads a simple point robot trajectory and **visualizes** a cost map

Optimal Design of a Bike Wrench







What?

- Optimize the design of a bike wrench to minimize mass while ensuring that maximum stress remains below 160 MPa and total deformation is under 1 mm

How?

- Using Ansys, parameterized the fillet radius and thickness, then analyzed their effects on stress, deformation, and mass
- Performed **response surface optimization** and design of experiments to determine the optimal parameters

Results

- Successfully minimized weight and **met design objectives**

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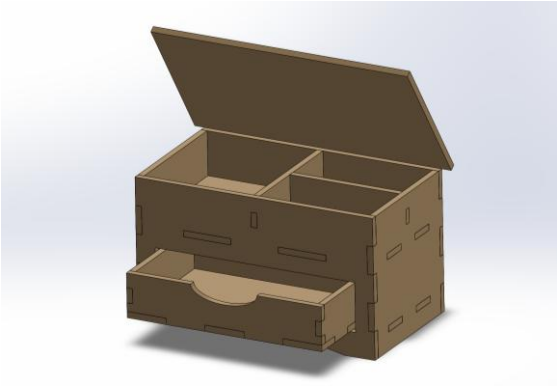
Jewelry Box



What?

- To fabricate a product of your choice that makes you or someone else happy

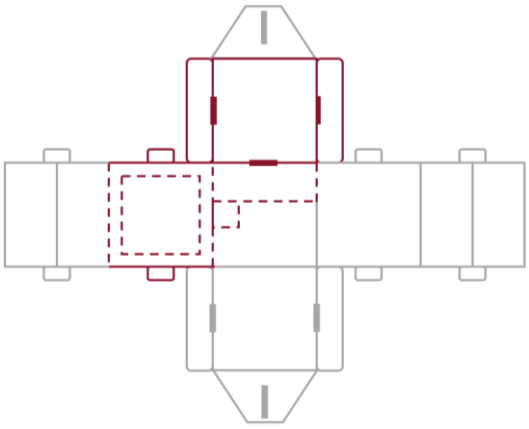
How?

- Created a cardboard prototype to test design concepts
- Developed a CAD assembly in SolidWorks to ensure pieces fit together and to create files for laser cutting

Results

- Designed a jewelry box with a multiple compartments for organization with dimensions small enough to be portable

Multi-Purpose Packaging



What?

- To design and fabricate a dual-purpose container that can transform from a takeout box (or similar container) into a secondary useful object without requiring additional tools or adhesives

How?

- Conceptualized multiple design ideas through **sketching** and **prototyping**
- Created rough prototypes from paper and cardboard

Results

- Designed a gift box than transformed into a picture frame
- Tool-free assembly utilizing a tab and slot mechanism
- Eco-friendly construction using only paper materials without adhesives