Leonardo Calle

Mechanical Engineering Student

- Email: lcallel593@gmail.com
- Phone: (415)-361-1341
- LinkedIn: https://www.linkedin.com/in/leonardo-calle-loor/

Arm Brace for Robo-Assisted Shoulder Rehabilitation

Objective:

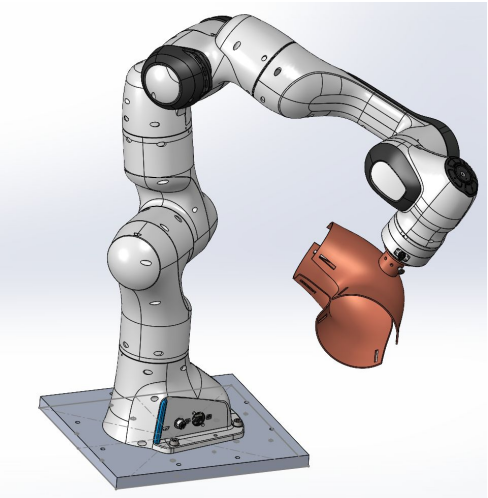
Design and produce a custom mounting solution to attach a patients arm to the franka emica robot, ensuring comfortable and safe rehabilitation experience.

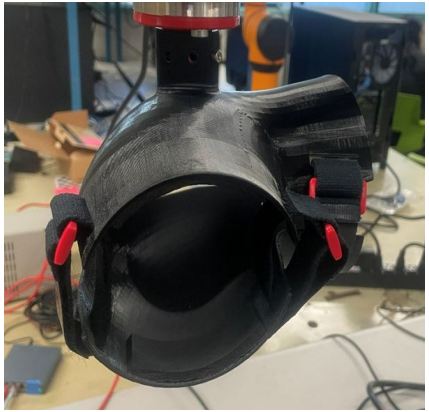
Description:

Created an ergonomic arm brace that molds to the majority of the population, while providing the necessary stiffness and safety features to allow for precise shoulder rehabilitation. The final design was optimized for ease of manufacturing by using FEA to optimize geometry.

Key Outcomes:

- The brace was successfully used during testing and it didn't fracture or cause discomfort.
- Minimal postprocessing required for assembly.

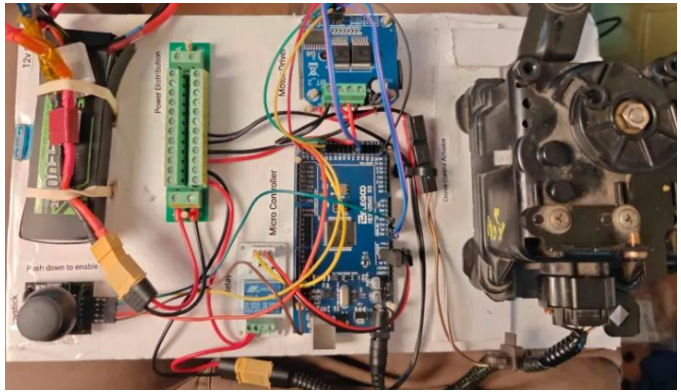




Technologies Used:

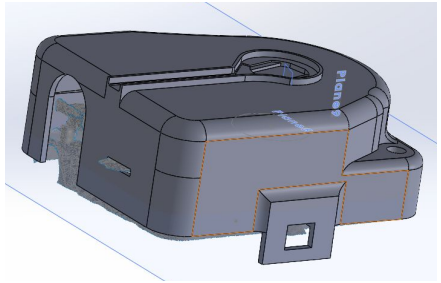
- Solidworks (CAD)
- Ansys (Simulation)
- FDM 3d printing (PLA, TPU)

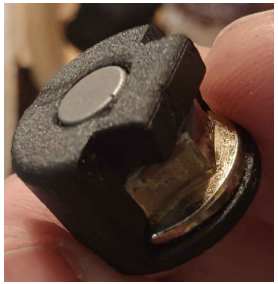
Hall Effect Sensor for Throttle Control



Objective:

Investigate the use of a Hall effect sensor for throttle position control and evaluate its effectiveness as a non-contact measurement system. The goal was to understand how sensor output correlates with position and how it can be applied in control systems.





Description:

An experimental setup was developed to drive a throttle module and measure its output shaft position with a hall effect sensor. The system included sensor instrumentation, data acquisition, and analysis to characterize the relationship between displacement and output voltage.

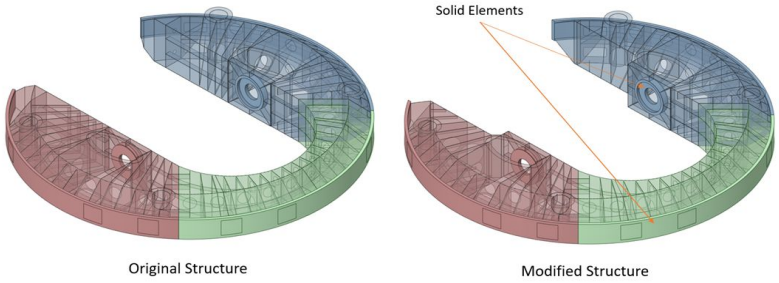
Key Outcomes:

- The experiment demonstrated that Hall effect sensors provide reliable, non-contact position sensing suitable for throttle control applications.
- All parts and components of the experimental set-up worked as intended.

Technologies Used:

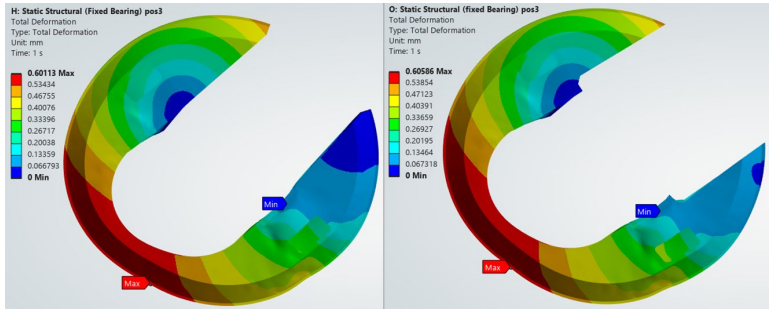
- Solidworks (CAD)
- 3D Scanner
- FDM 3d printing (Nylon)
- LabView
- Microcontroller

Mayall Telescope Support Structural Modifications Study



Objective:

Study the modification of the Mayall Telescope's horseshoe mount to fit larger optical systems. Determine whether the modified design can operate within acceptable limits of stress, deformation, and dynamic behavior.



Description:

CAD models of the original structure where created from drawings. Finite element analysis (FEA) was performed under multiple load cases and orientations. The study examined stress distribution, total deformation, and natural frequencies to assess modifications feasibility.

Key Outcomes:

- The modified geometry met all performance threshold.
- Project Poster: https://docs.google.com/presentation/d/1yCJbbKKjP-5SxGVHqIwAt00ZzEbXFqGeOqL3GxhbisI/edit?usp=sharing

Technologies Used:

- CREO
- Ansys
- Spaceclaim

Hydroelectric Power Feasibility Study

Objective:

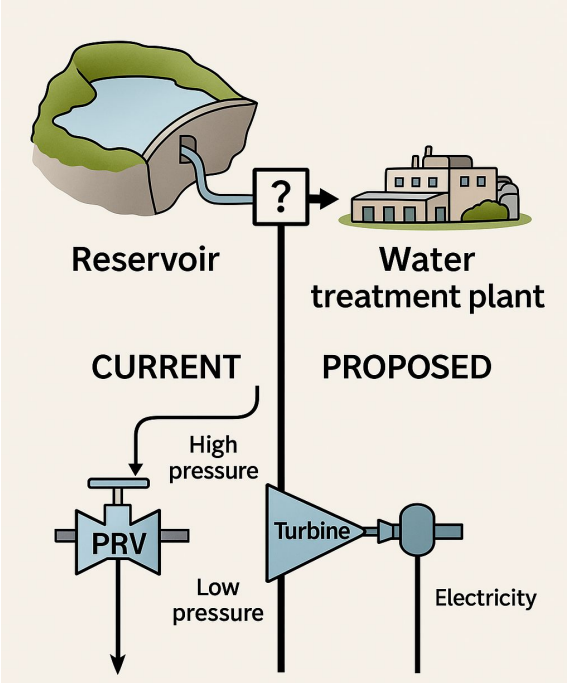
Assess the feasibility of replacing a pressure reducing valve (PRV) with a micro-hydroelectric turbine at Cayucos Water Treatment Plant. The goal is to determine whether energy recovery from pressure reduction can generate meaningful cost savings and reduce environmental impact.

Description:

One year of flow rate, pressure, and energy usage data from the plant were analysed. Calculations of potential power output, energy generation, and cost savings were performed, along with evaluation of commercially available turbine options and estimated implementation costs.

Key Outcomes:

- Low and intermittent flow rates limit power generation.
- Gap in the market, no commercially available turbines for low-flow, high-pressure.
- Project Poster: https://docs.google.com/presentation/d/12UNmdQFV5vFZQgLRK2qUbyXPfABx2S24lmH9NV-K2Xw/edit?usp=sharing



Technologies Used:

- Microsoft Excel
- Python
- Data Loggers

Force Sensitive Electromechanical Robotic Gripper

Objective:

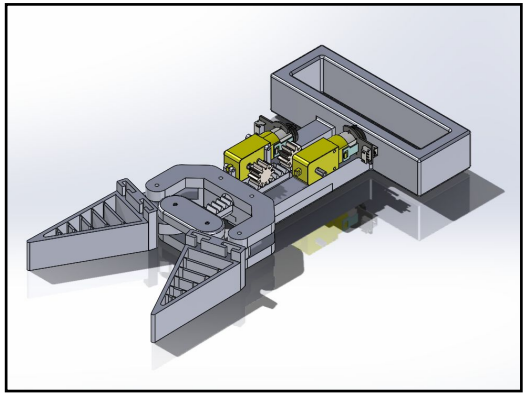
Design and build a system that integrates mechanical, electrical, and software components to solve a real-world problem. The project specifically aims to develop a gripper that can adaptively apply sufficient force to hold objects of varying sizes without causing damage.

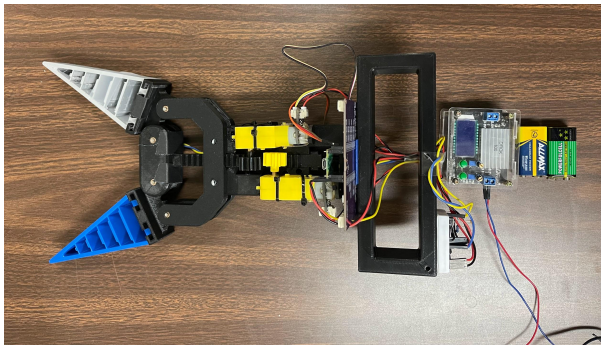
Description:

A handheld robotic gripper that uses a parallel jaw mechanism driven by a dual DC motor rack-and-pinion system. The system integrates sensor feedback (force-sensitive resistor and encoder) with microcontroller-based control logic to regulate grip force and position, enabling controlled and repeatable grasping.

Key Outcomes:

- Successfully gripped and held a variety of objects while limiting excessive force through sensor feedback.
- Project Video: https://youtu.be/kk2ST8BHnS8
- Project Report: https://docs.google.com/document/d/1g9FOCFbWMOiDaqvG4qeEpHexXhgp4UcMGnWWuO1Qvs8/edit?usp=sharing





Technologies Used:

- Solidworks (CAD)
- FDM 3D Printing (PLA/TPU)
- MycroPython (Programming)
- KiCad (Circuit)
- DC Motor
- Force Sensitive Resistors
- Crimping
- Power supply, Multimeter

Four-Bar Electromechanical Robotic Gripper

Objective:

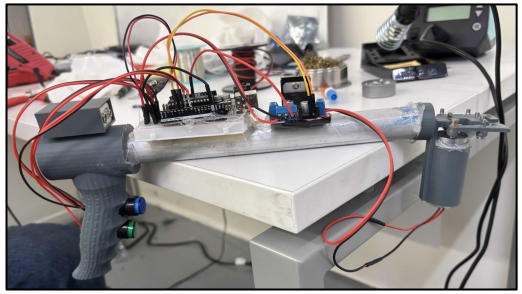
Design a compact mechanical gripper inspired by surgical systems that can precisely grasp small objects (e.g., a needle) using a four-bar linkage mechanism. The goal is to achieve reliable motion and force transmission while minimizing size and staying within design constraints.

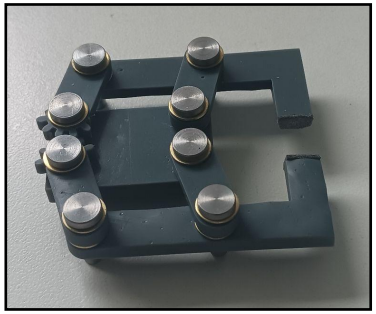
Description:

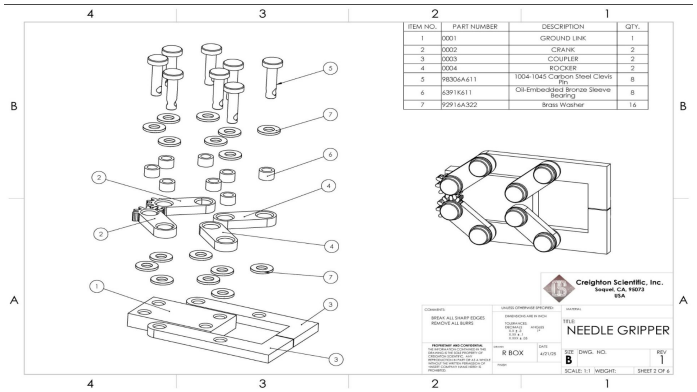
The system consists of two symmetrical four-bar mechanisms that actuate a pair of gripper jaws through crank rotation. Kinematic synthesis and analysis (position, velocity, and acceleration) were performed to ensure proper motion, while detailed design included force analysis, material selection, and fabrication using high-resolution resin 3D printing.

Key Outcomes:

- Controlled opening and closing motion with the coupler remaining parallel, enabling precise gripping
- Analytical results validated proper motion transmission and feasible force behavior
- Project Report: https://docs.google.com/presentation/d/1gBWW6HSDZp9izYv7qJNd8HJpA1dvse1DUnVJD1oc7qY/edit?usp=sharing







Technologies Used:

- Solidworks (CAD)
- SLA 3d Printing
- Matlab (Analysis)
- MicroPython (Programing)
- DC Motors
- Microcontroller

Mouse-Trap Powered Race Car

Objective:

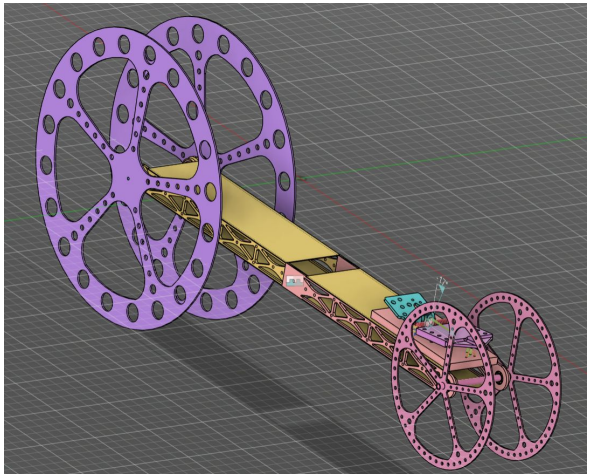
Design a mousetrap-powered vehicle to maximize travel distance by improving energy transfer, minimizing losses, and refining mechanical advantage. The goal was to iteratively develop a high-performance design through prototyping and testing.

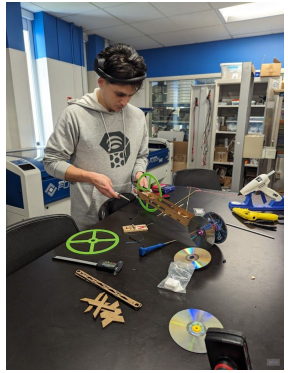
Description:

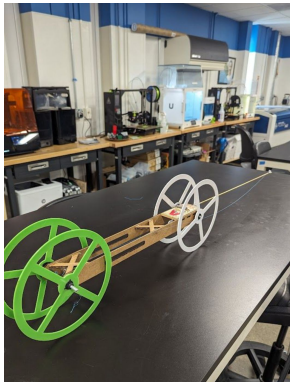
The project involved multiple prototype iterations using a lever-arm driven drivetrain. Design variables such as wheel size, axle diameter, lever arm length, bearings, and chassis rigidity were systematically tested and refined to improve efficiency, reduce friction, and maintain straight-line motion.

Key Outcomes:

- The final car achieved record-level performance, winning the competition and traveling 220ft (second place was 40ft).
- Project Website: https://sites.google.com/my.smccd.edu/engr-210-csm-2024?usp=sharing







Technologies Used:

- Fusion360 (CAD)
- FDM 3d Printing
- Laser Cutting
- Miro

Room Ocupancy Monitor

Objective:

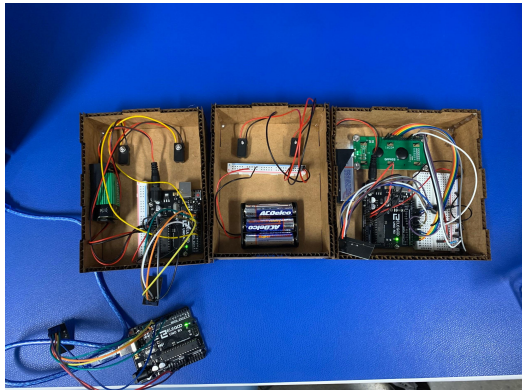
Design a mousetrap-powered vehicle to maximize travel distance by improving energy transfer, minimizing losses, and refining mechanical advantage. The goal was to iteratively develop a high-performance design through prototyping and testing.

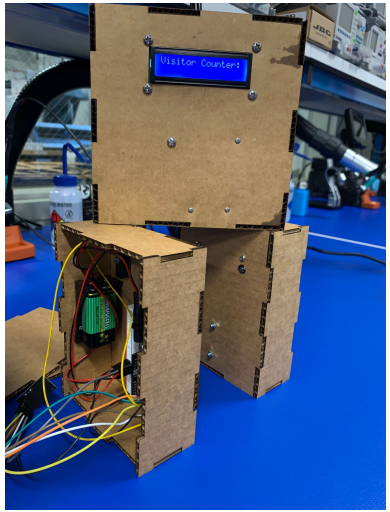
Description:

The project involved designing a sensor array using IR break-beam sensors to detect movement, direction, and speed. Data was processed through microcontrollers, transmitted wirelessly via transceivers, displayed on an LCD, and logged to CSV files for further analysis.

Key Outcomes:

- The system successfully captured and transmitted real-time movement data with impressive accuracy.
- Project Presentation: https://docs.google.com/presentation/d/1TFeeXcCjC38W4EKqU2QKHsFaFOjP2mp47yv0CG2GIIo/edit?usp=sharing





Technologies Used:

- Coreldraw (CAD)
- Laser Cutting
- GitHub
- Microcontroller
- IR Sensors
- Wifi Connectivity