Mechanical Engineering

Acoustics Biomechanics Gait Analysis (2023)

GROVE CITY COLLEGE

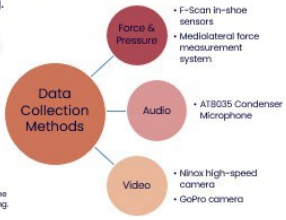
OVERVIEW

The goal of this project is to provide clinically useful gait parameters exclusively through acoustic measurements to determine a subject's health, predict injury, and provide insight into the recovery process if an injury has already been sustained.

METHODOLOGY

A post-operative knee brace is used on a subject to simulate a lower-body injury and restrain the motion of a subject's leg.

Figure 1 Post-operative knee brace used in subject testing.



MEDIOLATERAL FORCE MEASUREMENT SYSTEM

The designed system consists of four load cells that measure the mediolateral, or side-to-side, forces applied by the subject. The load cells are mounted underneath the treadmill and an Arduino microcontroller records the output data.

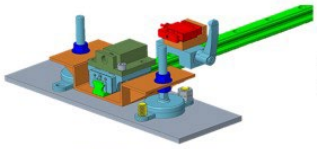


Figure 2 CREO model of load cell design.

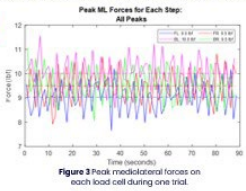


Figure 3 Peak mediolateral forces on each load cell during one trial.

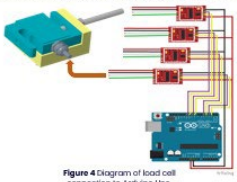


Figure 4 Diagram of load cell connection to Arduino Uno.

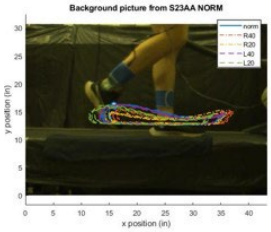


Figure 6 Position tracking of foot in MATLAB from high-speed video data.

Mechanical Engineering

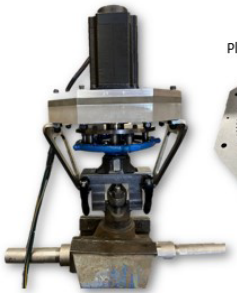
BPMI Valve Control (2023)

Problem Statement:

Tasked by BPMI to design an operator for a manual valve that can be automatically actuated.

Requirements:

- Use a Human-Machine Interface (HMI).
- Able to engage and disengage easily.
- As small as possible in both height, width, and depth.
- The operator must be transportable.



Planetary Gear System

Mechanical Design:

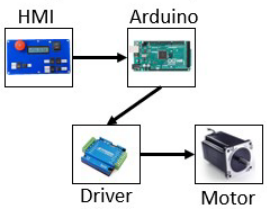
- Utilizes a planetary gear system to achieve torque and size requirements.
- Arms with handles connect to valve yoke to improve ergonomics.
- Yoke clamp design attaches to the valve yoke holding the operator above the handwheel.
- The yoke clamp also provides stability in the X, Y, and Z directions.

HMI Pendant:

Electrical Design:

To achieve control over the operator, a Human-Machine Interface (HMI) design allows for user input via buttons and switches.

High-Level Block Diagram:



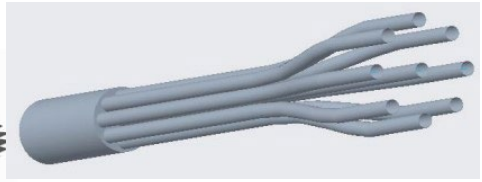
Mechanical Engineering

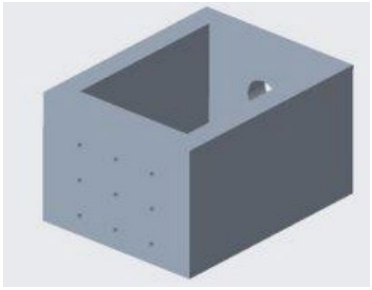
Cool Containers (2023)

GROVE CITY COLLEGE

Overview

- Batteries catching on fire is a significant problem in industries/products that require them.
- One innovation on fire prevention in lithium-ion batteries is immersion cooling using mineral oils.
- Our goal is to analyze the benefits of immersion cooling in mineral oil compared to air cooling.
- Lithium-ion batteries store renewable electricity and power electric vehicles
- Enhanced battery cooling may enable rapid charging and prevent battery fires
- GCC students are measuring advantages of novel "immersion cooling"

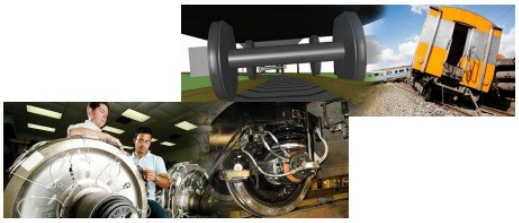




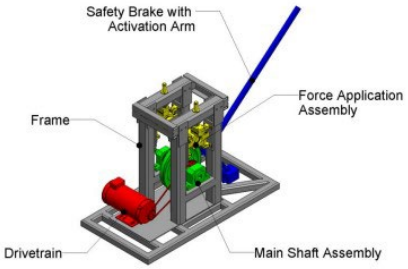
Mechanical Engineering

Instrumented Wheel Set Redesign (2023)

ENSCO Rail



2022-23 Team
Back Row: Joshua Thomson, Levi Marasco, Bergen Weiner (Team Lead)
Middle Row: Zachary Stalker, Caleb Husovich
Front Row: Caroline Jensen, Devin Freed, Joseph Knight



Mechanical Engineering

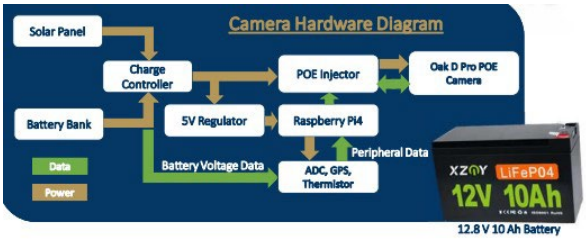
Standalone Security Camera Network (2023)

Objective

Create a camera network that can communicate multiple camera feeds to one Hub station from different locations around a laydown yard. Each camera must be able to function for 30 days continuously via battery and solar power.

Design

A 60 Ah battery bank powers the system overnight after which a solar panel recharges the system during the day. A Raspberry Pi4 handles communication between the hub and each camera while adding AI detection tracking. Peripherals such as an ADC and GPS were added for extra functionality and data recording.



Results

The system has been deployed and proven to function while transmitting both peripheral and video data back to the hub station. The discharge of each camera is consistent with our predictions and the system can function overnight with sunlight during the day to recharge. Multiple camera rigs have been deployed and function together on one Hub

Engineering Team Members

Ben Craig
Dean O'Toole
Riley Truitt
Logan White
Advisor: Dr Rumbaugh

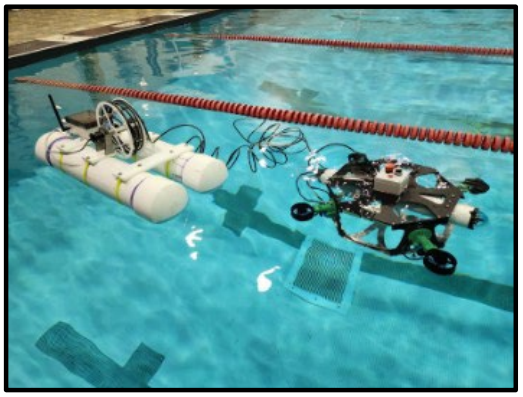
Special thanks to Robby Frantz and David Timczyk for sponsoring the project!

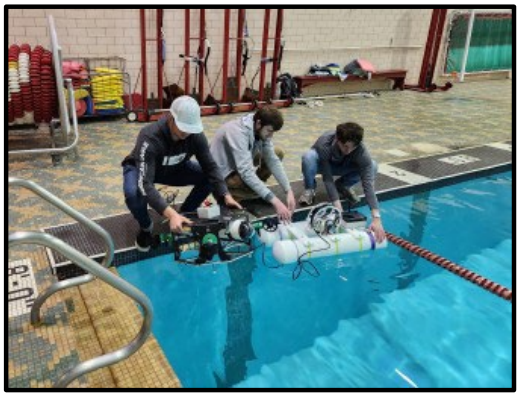
Mechanical Engineering

RoboSub: GUAVA (2023)

Grover Underwater Autonomous Vehicular Apparatus

GROVE CITY COLLEGE

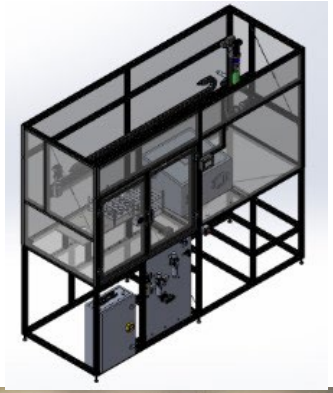




The goal of the RoboSub project (also known as GUAVA) was to create a fully autonomous vehicle for lake exploration and data recording. This data is primarily in the form of video footage of dams and fish habitats that can be used by PA DCNR and the Fish and Boat Commission. This project was a collaborative effort between our senior design team, consisting of both mechanical and electrical engineers, as well as a computer science senior design team.

Mechanical Engineering

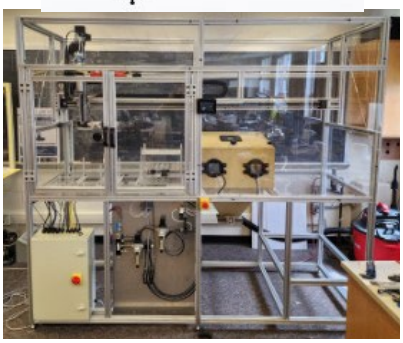
Yates Automated Machine for Sandblasting (YAMS) Project (2023)



The goal of the project was to design, fabricate, and test a new automation system for the sandblasting process of safety razor components for Yates Precision Manufacturing.

At the conclusion of the project, students were able to:

- Create and analyze various designs in SolidWorks
- Successfully test and run the completed automation system.
- Identify problems and issues with design along the way and improve upon them in order to be successful.

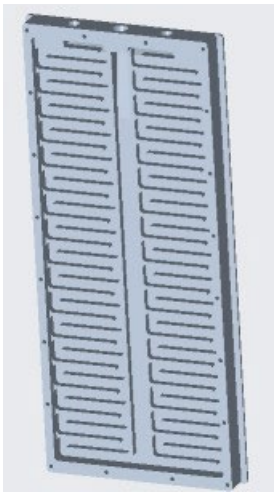


This project was sponsored by Yates Precision Manufacturing

Yates Precision Manufacturing

Mechanical Engineering

Scrubgrass Water-Cooled Heat Sink (2023)



- The goal of the project was to design a water -cooled heat sink for a bitcoin miner
- At the conclusion of the project, students were able to:
  - Design prototype heat sink and heat sink in CREO
  - Fabricate and test a prototype that is under budget and can be manufactured using CNC mill or casted
  - Heat sink fits into current housing and requires little to no maintenance
- This project was sponsored by Scrubgrass