Department of Mechanical Engineering
College of Engineering

Presentations of

Senior Design Projects

09:30 AM – 05:30 PM
Tuesday, May 13, 2025

Rooms 331, 339, 341, or 343, Engineering Building

ME195B Section 01   Faculty Supervisor: Dr. Winncy Du

9:30 AM – 12:00 PM and 13:00-15:30; Room E331, Engineering Building

Time	Project Title	Team Members
9:30-9:59	Design and Fabrication of Lockheed Martin Automation Pick-And-Place Subsystems **Sponsor: Lockheed Martin**	Megan Kiefer (Team Lead) Joseph Barravecchio Jonathan Lim David Virin
10:00-10:29	Integration of Mechatronic Components to Create Automation System of Lockheed Martin Solar Cell Termination **Sponsor: Lockheed Martin**	Carter Anderson (Team Lead) Joseph Fernandez Sami Kaci Savely Kolodii Megan Lee
10:30-10:59	Design and Fabrication of a Forklift Controlled by Finger Movements **Sponsor: Jabil Inc.**	Jesse Doan Jason Nguyen (Chin-Sheng Sung (EE) Rishik Reddy Dammannagari (CNSM))*
11:00-11:29	3D Printing of Foaming Thermoplastics **Sponsor: Jabil Inc.**	Timothy DeGuzman (Jair Gonzalez Landen Nguyen Moses Williams)*
11:30-12:00	Mechanical Characterization & Database of Dual Cure Adhesives for Active Alignment **Sponsor: Jabil Inc.**	Daniel Broskie (Yusef Alramahi Andy Lam Sahib Dokal)*
12-13:00	Lunch Break	
13:00-13:29	Semi-Automated Assembly Process for a Vista Robotics Product **Sponsor: Vista Robotics**	Kidus Alemu Abel Atsbaha Raymond Djoko Mary Nguyen Roshan Thomas Alexander Wiley
13:30-13:59	Design and Development of an Inside-Out Laminectomy Surgical Tool **Sponsor: Vista Robotics**	Lucy Miszewski (Team Lead) Raphael Ramos Bhavagyna Vegunta
14:00-14:29	Mobile Platform Design for Robotic-Assisted Spinal Surgery **Sponsor: Vista Robotics**	Omar Banafa Elizabeth Bremberg Adnan Chatila Hamza Iyaad Wilson Liao
14:30-14:59	Personalized Musculoskeletal Therapy Using a 6-Axis Articulated Robot **Sponsors: ME Department (SJSU), Banner Engineering, Denso Robotics.**	Ye Wint Nyan Kyaw (Team Lead), Upasana Bose, The Duy Cao

		Sam Tair
15:00-15:30	Portable EEG-Based Migraine Detection Device	Zhi Yu Goh Natalie Gutierrez

*Note: Students listed in parentheses are non-ME majors.

ME195B Section 02 Faculty Supervisor: Dr. Burford Furman

09:00-12:30 PM, Room E339, Engineering Building

Time	Project Title	Team Members
9:00-9:27	Investigation of Laser Bonding Strength for Plastics **Sponsor: Jabil Inc.**	Ernie Rosendo, Oryza Tirtawijata
9:30-9:57	Real Time Data Collection and Visualization A Solder Paste Inspection (SPI) Machine **Sponsor: Jabil Inc.**	Mohamed Truong, Joshua Zhang, Alan Enecial, Mario Esteban Cerritos
10:00-10:27	Wrist Exoskeleton ARMS Lab (Prof. Sharifi)	Sanad A. Shabbar (Team Lead) Michael Iwamiya Merlin Perez Lopez Alec Karaguezian Ron Raymundo Will Valencia
10:30-10:57	Superway Integrated Mobility Project for Logistics (SIMPL) **Sponsor: Spartan Superway**	Seth Miu (Team Lead) Antonio Torres Misael, Herrera Oscar Zavala-Solis Samuel Lopez Javier SotoTrujillo David Cabrera Karan Sethi Helen Vong
11:00-11:27	ATN Offline Charging Station **Sponsor: Spartan Superway**	Christine Pham (Team Lead) Hratch Momjian Juan Moreno Gonzalez
11:30-11:57	ATN Traffic Control **Sponsor: Spartan Superway**	Nicolas Wieczorek (Team Lead) Gabriel Gulchin Katie Gomez
12:00-12:27	Automated Wheel Chair Restraint **Sponsor: Spartan Superway**	Alan May (Team Lead) Erik Huang Kayla Mallari Francesca Ng Ethan Reysner

ME195B Section 03 Faculty Supervisor: Dr. Raghu Agarwal

13:00 – 17:00 AM, Room E341, Engineering Building

Time	Project Title	Team Members
13:00-13:29	FSAE Structural Aerodynamics Package	Abdallah, Matthew Thomas Nguyen, Kenny Huy Nguyen, Trung Repalle, Nikhil Feldsher, Ely
13:30-13:59	Formula SAE - Continuously Variable Transmission Testing/Optimization	Combalacer, Matthew Escuera, Alex Martinez, Alex Sezzi,Noah William
14:00-14:29	Application of Additive Manufacturing for Adaptive Hydro Turbine Design	Ard, Allan Dunn, Tanner Allen Fitzpatrick, Kyle Heubel, Devon Sirio, Ivan
14:30-14:59	Formula FSAE – HV Lithium Battery Charger	Alziq, Malek Nakama, Kanoa Nicholas Pan, Xiao Pena, David Ramon
15:00-15:29	Balloon Catheter Coating System	Pham Tyler Lee, Norman S Sean Hatran
15:30-15:59	SAE Baja Power Train - Right Angle Gearbox	Vartan,Anna Sanchez, Elijah Stras, Dagan Gabel Victory Wise Steven
16:00-16:29	Collapsible Cup for Beverages	Yousif, Nicholos Hernandez, Danie Superio, Edward Chaudhari, Amit
16:30-16:59	Large Area Sintering for EV Power Boxes	Maloto, Justus Tran, Kevin Leon, Joe

ME195B Section 04 Faculty Supervisor: Dr. Syed Saidi

13:00 – 17:00 AM, Room E343, Engineering Building

Time	Project Title	Team Members
13:00-13:29	Design and Development of a Plasma Hoover for Floor Bacterial Mitigation	Antonio Hueso-Fernandez, Isaac Benavidez, Elizabeth Navarro, Linh Hua, Miguel Sanchez
13:30-13:59	Power Requirements of an Ammonia-Filled Aerospace Thermosyphon	Alberto Chavez John Hart Michael Welder Adam LaBuda Riley Howden Shreya Mistry
14:00-14:29	Bifacial Solar Panel Characterization	Brendan Given Resham Pandey Zuhair Sawaged Danny Dinh Jesus Jiminez Matthew Galinski
14:30-14:59	3D Silicone Printer	Abhishek Khatri Miguel Iniguez Franco Jonathan Velasco Figueroa Eric Jimenez Anthony Bolinger
15:00-15:29	PET Bottle Recycler for 3D Printer Filament	Jimmy Le Krishna Sinjali Joal Pena Younes Moussaoui Kenny Vu
15:30-15:59	Biochair for Leg Muscle Mobility Rehabilitation	Lance Lee Timothy Mai Miguel Oribello Thomas Pham Erik Wolfl
16:00-16:29	Development of Thrust Measurement Device for Drone Blade Optimization	Leosbaldo Zurita, Anthony Ngo, John Marambire, Suarafeal Aragaw
16:30-16:59	Solar Panel Energy Harvesting With Passive Cooling	Sean McGlaughlin Micheal DiSalvo Robert Lopez Ehab Rahman Praxedo P. Gacrama III

Design and Fabrication of Lockheed Martin Automation Pick-And-Place Subsystems

Student Team Members:

Megan Kiefer (Team Lead): End Effector	David Virin (Mech. Lead): Tape Subsystem	Jonathan Lim: GD&T
Joseph Barravecchio: Invar Subsystem	Sami Kaci: Tape Subsystem	Joseph Fernandez: Invar Subsystem

Faculty Advisor:

Dr. Winncy Du

Project Objectives:

The objective of this project was to design a system that automates the assembly of terminations for Lockheed Martin solar cells, focusing on precise tolerances and reliable design implementation.

1. To design multiple subsystems capable of successfully completing various tasks and properly handling specific materials.
2. To design and fabricate all components used in the pick-and-place process according to Lockheed Martin tolerances and specifications
3. To design a system to be scalable and modular to accommodate future modifications.

Significance:

The design approach is crucial for reducing iteration times and ensuring high-quality parts. The use of 3D printing allows for faster prototyping and easier modifications, enabling the team to address design challenges promptly and optimize the system for production efficiency.

Project Results:

1. Applied GD&T principles to achieve tight tolerances and ensure the reliability of mechanical parts.
2. Utilized 3D printing and DFX (manufacturing, assembly) principles for rapid prototyping, enabling quick design iterations and refinements during testing phase.
3. Ensured ease of integration between mechanical designs of subsystems which enable smooth system operation with minimal errors.
4. Achieved a flexible design approach which reduced concept implementation time to test new configurations allowing continual refinement and iteration to achieve optimal operation performance.
5. Utilized multiple forms of 3D printing, including FDM and SLA technologies, to meet component specifications such as holding a vacuum or tight, precise tolerances.

Sponsors:

Lockheed Martin

Integration of Mechatronic Components to Create Automation System of Lockheed Martin Solar Cell Termination

Student Team Members:

Carter Anderson (Mech. Lead): Electrical Schematics, Ladder Logic	Savely Kolodii: RC8 Robot Controller Program	Megan Lee: Ladder Logic
Joseph Barravecchio: HMI	Joseph Fernandez: HMI	Sami Kaci: Cognex

Faculty Advisor:

Dr. Winncy Du

Project Objectives:

The goal of this project was to implement robust mechatronic devices into a system that integrates electrical, mechanical, pneumatic, and control components to fully automate the assembly of a Lockheed Martin termination for use in satellite solar cells.

1. Create electrical schematics to plan for seamless integration and connection of all electrical components, ensuring all components were correctly wired and efficiently routed.
2. Employ a Denso SCARA 4-axis robot to achieve precise, repeatable, and efficient pick-and-place operations.
3. Create a system that utilizes a PLC and HMI for real-time control and monitoring, coordination between subsystems and their components, as well as closed-loop feedback via computer vision.
4. Utilize safety sensors to ensure proper shutdown protocols upon fault and error occurrence.

Significance:

The project establishes a reliable control system that ensures safe operation and precise coordination between the PLC, HMI, and robot controller which enables fully automated, in-house assembly. A thoughtfully structured architecture allows future modifications to the system as well as ease in troubleshooting for flexibility and reliability in operation.

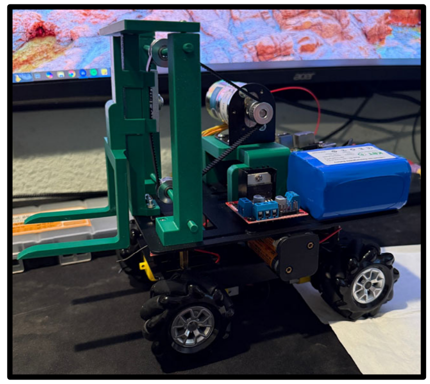
Project Results:

1. Utilized various software to program the PLC, HMI, and robot controller which allowed for seamless logic flow enabling easy testing, troubleshooting, real-time operation, and modifications if necessary.
2. Integrated safety features such as LIDAR sensor and emergency-stops into design to protect system operation and ensure operator safety.
3. Established reliable communication between control components using an industrial standard protocol, Ethernet/IP, ensuring coordinated system performance.
4. Incorporated a pneumatic manifold and computer vision with closed-loop control to implement core system functionality and augment subsystem operations.

Sponsors:

Lockheed Martin

Design and Fabrication of a Forklift Controlled by Finger Movements



Student Team Members (Interdisciplinary):
Jesse Doan (ME)
Jason Nguyen (ME)
Chin-Sheng Sung (EE)
Rishik Reddy Dammannagari (CNSM)

Faculty Advisor: Dr. Winncy Du

Project Scope and Objectives:
Develop a small-scale forklift vehicle controlled via EMG (Electromyographic) muscle signals

1. Design and conduct a study to determine the optimal position for EMG sensors on the forearm or wrist for clear and consistent detection of singular finger flexion.
2. Design and integrate a signal acquisition system using a custom PCB with amplification, rectification, and filtering to process EMG signals.
3. Map the five distinct finger flexions on the hand to forklift control functions: drive forward, rotate wheels left/right, raise forks, and lower forks.
4. Use machine learning to classify EMGs for real-time finger recognition and forklift actuation.
5. Research BioMEMS (Biomedical Micro-Electro-Mechanical Systems) technology and the possibility of their integration by future groups to miniaturize the system.

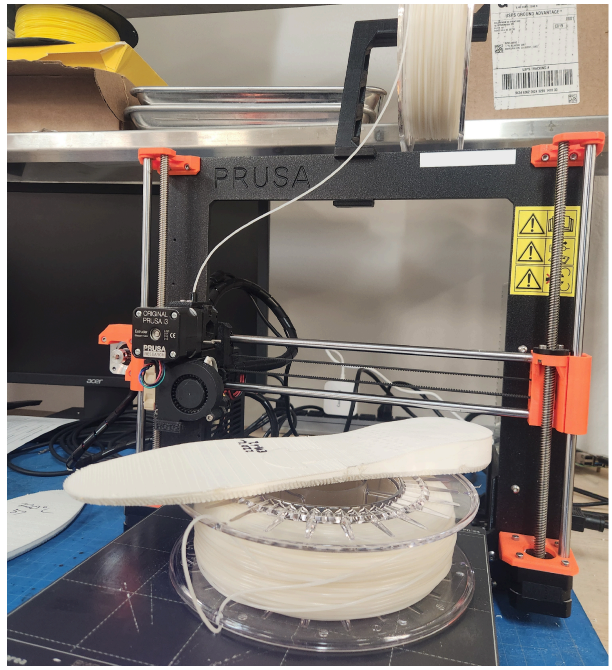
Significance:
Traditional controls relying on buttons, analog sticks, triggers, etc. are bulky and unintuitive. Emerging technologies such as Augmented and Virtual Reality (AR/VR), and robotic surgery arms call for the ability to control technology in a more natural manner. Using EMGs, body movements can be linked to device inputs. This project serves as an introduction to the development and feasibility of EMG-based controls.

Project Results:

1. Developed an efficient system to collect, organize, and process EMG signals using an Arduino Uno, Raspberry Pi, and numerous Python scripts.
2. The collection and analysis of 100+ EMG signals for three subjects across each finger on the hand and two sets of EMG sensor locations has determined the forearm optimal for EMG collection.
3. Fabricated a functional small-scale forklift prototype with the previously mentioned controls.
4. Designed a custom EMG signal capture/processing PCB (amplification, rectification, filtering) specifically catered for finger flexion EMG signal characteristics.
5. Trained a machine learning algorithm to distinguish between individual finger signals.
6. Achieved accurate and repeatable control of forklift functions through direct EMG input from forearm muscle activity.

Sponsor: Jabil Inc.

3D Printing of Foaming Thermoplastics



Student Team Members:
Timothy DeGuzman
Jair Gonzalez
Landen Nguyen
Moses Williams

Faculty Advisor:
Dr. Winncy Du

Jabil Inc. Advisor:
Ross Benz

Project Objectives:
The goal of this project is to design a custom 3D-printed insole to test and compare the compressive properties of additively manufactured foaming thermoplastic polyurethane (TPU) material. The specific objectives include:

1. Calibrating the 3D printer by adjusting temperature and extrusion multiplier to produce precise samples.
2. Conducting compression testing on foaming and non-foaming TPU samples to compare material properties.
3. Designing and 3D printing a shoe insole with the optimal level of foaming from our data.

Significance:
This project aims to create a more efficient method of producing custom insoles for consumers who do not have the time or money for normal custom insoles. Custom insoles can be applicable for orthotics, athletic footwear, and diabetic or pediatric needs. This project cuts the production time to a couple of days compared to the multiple weeks traditional custom insoles require.

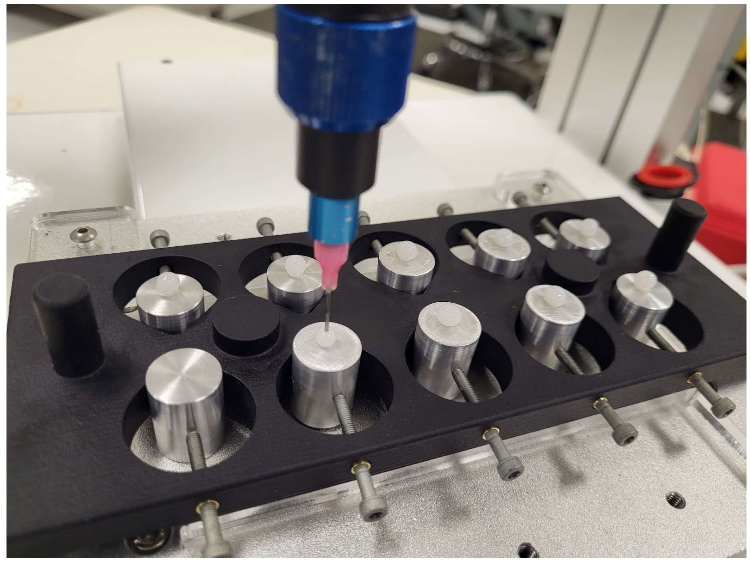
Project Results:

1. Created a custom insole model with CAD and printed it with three different materials.
2. 3D printed custom foaming TPU samples with a wall thickness of 0.8 mm.
3. The optimal printing temperature to balance support and porosity in a custom insole is 220°C.

Sponsors:

- Jabil Inc.

Mechanical Characterization and Database of Dual Cure Adhesives for Active Alignment



Student Team Members:
Daniel Broskie
Yusef Alramahi
Andy Lam
Sahib Dokal

Faculty Advisor: Dr. Winncy Du

Project Scope and Objectives:
Conduct mechanical characterization and reliability testing of dual cure adhesives

1. Design experiments and test fixtures for adhesion, reliability testing, and stress testing.
2. Prepare samples to undergo accelerated thermal cycling and humidity testing before lap shear or tensile strength testing.
3. Create user-friendly database to accept user queries to compare results of various dual cure adhesives.

Project Results:

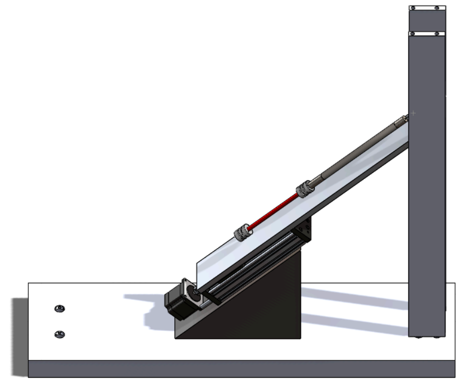
1. Successfully designed fixtures for precise and repeatable adhesion of pucks or cylinders for tensile or lap shear testing.
2. Conducted incrementally varying accelerated thermal cycling and humidity testing on test samples across several weeks.
3. Acquired data on the impact of thermal and humidity exposure on the strength of dual cure adhesives through pull testing.
4. Created a database to help engineers select optimal dual cure adhesives for various applications based on results.

Sponsor:
Jabil Inc.

Semi-Automated Assembly Process for a Vista Robotics Product

Student Team Members:
Kidus Alemu
Abel Atsbaha
Raymond Djoko
Mary Nguyen
Roshan Thomas
Alexander Wiley

Facility Advisor:
Dr. Winncy Du



Project Objectives:
The objective of this project is to design and build a semi-automated assembly system for welding a medical device from Vista Robotics.

1. Reduce assembly process time by 50% from the manual process of 8 hours
2. Improve the quality and precision of the welding process with automated translational and rotational movement
3. Design all fixtures tailored to the parts involved with the tip and tip components
4. Create holding fixtures to allow for a more straightforward assembly process

Significance:
This project addresses the CEO of Vista Robotics' concerns of cost effectiveness and repeatability in manufacturing, as well as reducing the total time manufacturing takes.
The company's current process is manual and takes an operator 8 hours. Our solution uniquely seeks to understand our customers and the manufacturing engineer's challenges and directly addresses solutions to those problems with semi-automation. This highlights the singularity of use cases for our semi-automated assembly process. Compared to developing a solution for multiple use cases, we aim to tailor the Typefit solution for this project, enabling our customer to scale their process effectively.

Project Results:

1. Designed an automated laser welding control procedure that easily translates to programming
2. Successfully created a workspace to accommodate the automated laser welding system.
3. Received ~100% approval from the customer on a design proposal,
4. Successfully tested designs against rigorous quality control procedures such as FMEA, FEA, and GD&T

Sponsor:
Vista Robotics, Roy Chin

Design and Development of an Inside-Out Laminectomy Surgical Tool

Student Team Members:Bhavagyna Vegunta, Lucy Miszewski, Raphael Ramos

Faculty Advisor: Dr. Winncy Du

Project Objectives:

The goal of this project is to design and prototype a novel, minimally invasive surgical tool capable of performing spinal laminectomy using an "inside-out" approach. This method aims to reduce the risk of spinal destabilization and minimize surrounding tissue damage. Specific objectives include:

1. Develop an ergonomic, handheld tool that integrates a protective shroud, rotary cutter, and debris evacuation system.
2. Design a ball-joint-based articulation mechanism to allow dynamic access to the lamina while maintaining sterility.
3. Fabricate the tool using both PLA and surgical-grade stainless steel to evaluate form, function, and durability.
4. Test tool components for mechanical robustness, ergonomics, and evacuation efficiency under simulated surgical conditions.

Significance:

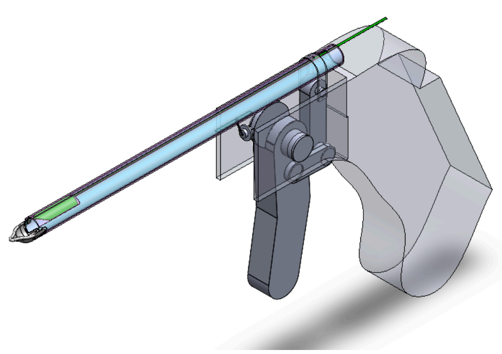
Traditional laminectomy tools follow an "outside-in" methodology, requiring significant dissection of stabilizing tissue and potentially compromising spinal integrity. This project addresses a critical need in spinal surgery: a device that protects vital structures, reduces surgical invasiveness, and enhances intraoperative visibility. The integration of cutting, protection, and debris evacuation into a single, articulating device streamlines the surgical workflow and opens the door for robotic surgical adaptation.

Project Results:

1. Developed a fully detailed CAD model incorporating a handle, sealed ball joint, spoon-shaped shroud, and spiral evacuation channel.
2. Fabricated a 3D-printed PLA prototype to validate ergonomics, ball joint articulation, and debris channel flow characteristics.
3. Transitioned to stainless steel for final fabrication, paired with a polycarbonate evacuation channel and silicone-sealed joint.
4. Conducted flow and load tests confirming over 90% debris clearance efficiency and structural resilience under surgical loads.
5. Established a modular tool design suitable for robotic integration and future sterilization compliance testing.

Sponsor:

Vista Robotics



Design and Development of Robotic Cart for Vista Robotics

Student Team Members:
Adnan Chatila
Omar Banafa
Elizabeth Bremberg
Wilson Liao
Hamza Iyaad

Faculty Advisor:
Dr. Winncy Du

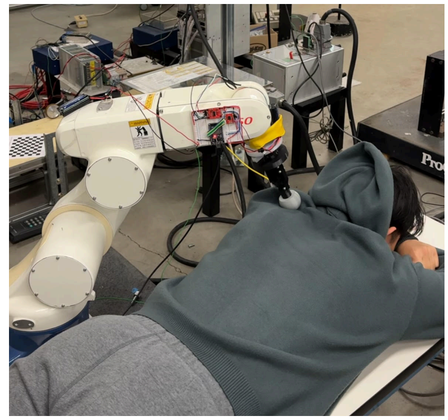
Project Overview:
The goal of this project was to design a cart that would be able to hold all components for the vista robotics surgery robot, while having a mechanism that allows for the cart to be locked in place during surgery. Our task is to come up with the design, the bill of materials, evaluate the model, and assemble the cart.

Significance:
This project aims at providing a reliable and effective way at packaging the components neatly while also providing a stabilization mechanism so that the cart won't be able to move during surgery.

Project Results:
1. Successfully designed cart with all packaging components and specced necessary materials and hardware to assemble the cart
2. Successfully ran several analysis' on the design such as FEA analysis and FMEA to make sure that it was sufficient enough to withstand real world conditions
3. Successfully 3D printed model to show Vista Robotics that model served as a good proof of concept and is ready to be fabricated.

Sponsors:
Vista Robotics

Personalized Musculoskeletal Therapy Using a 6-Axis Articulated Robot



Student Team Members:
Team Lead: Ye Wint Nyan Kyaw
Upasana Bose
The Duy Cao
Sam Tair

Faculty Advisor:
Dr. Winncy Du

Project Objectives:
The goal of this project is to design a functioning massage robot, using a 6-axis robot arm, capable of adequately massaging key areas on a patient's back and shoulders to ensure muscle relaxation and pain relief.

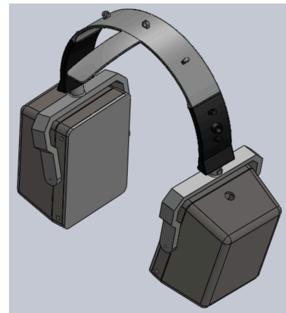
1. Sensors will ensure that the massage is always within an appropriate range of parameters such as load, temperature, vibration, and positioning.
2. Operators will be able to control heating and vibration levels wirelessly using a GUI website portal.
3. Output the real-time load cell data for human monitoring in addition to hardware failsafe systems in the robot.

Significance:
This project aimed to serve people with chronic conditions and disabilities who need access to physical therapy to ensure recovery or continued quality of life. This was done by addressing the barriers to massage therapy, such as a lack of qualified healthcare professionals in many parts of the United States. Scalable and affordable technologies were used to automate massages, making personalized massages more accessible and widespread.

Project Results:
1. Programmed a functional massage, effectively relieving stress and tension on the back and shoulders, exerting an average load of 2550 g, with a standard deviation of 302.77 g, and expected accuracy of 1 cm.
2. Developed different types of 3D printed end-effectors that can provide a combination of heating, rolling, circular, and vibrating movements.
3. Successfully implement 3D printing for manufacturing while ensuring the correct fit and strength of parts.

Sponsor:
Mechanical Engineering Department at SJSU

Portable EEG-Based Migraine Detection Device



Student Team Members:
Zhi Yu Goh
Natalia Gutierrez

Faculty Advisor:
Dr. Winncy Du

Project Objective:
Design a low-cost, portable electroencephalogram (EEG) device to detect migraine onset by analyzing alpha (8–13 Hz) and beta (13–30 Hz) neural waveforms from the somatosensory cortex (Fz) and anterior cingulate cortex (C4), using the mastoid region as the ground. Key objectives include:

1. Develop a compact circuit with Ag/AgCl electrodes that filters out unwanted signals in order to acquire accurate brainwave signals at the appropriate frequencies.
2. Design a lightweight, 3D-printed housing (<500g) optimized for wearability and durability.
3. Validate signal accuracy using MATLAB EEGLAB for time-frequency analysis and migraine pattern detection.

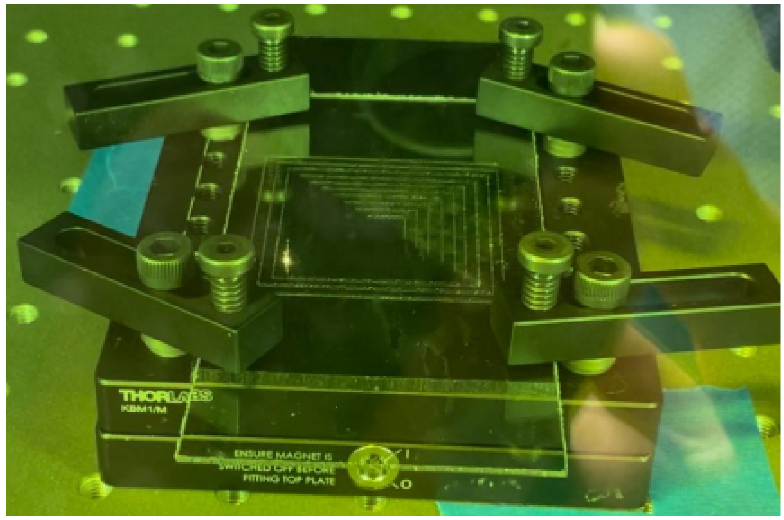
Significance:
This project helps to quantify migraine onset objectively as compared to subjective symptom reporting based on physiological data. The portable, non-invasive design makes operation of the device easy, helping to make the analysis process easier. Additionally, by prioritizing affordability and an open-source nature in the context of parts and components, this helps to improve overall accessibility to EEG devices, making it easier for migraine research to take place, which can be the catalyst for improving migraine treatment in the future.

Project Results:

1. Successfully prototyped a single-channel EEG circuit with signal amplification, band-pass filtering, and digitization for brainwave analysis.
2. Optimized 3D-printed housing using FEA simulations, ensuring durability against real-world usage.
3. Achieved modular assembly with adjustable headband and swivel ear cups for user comfort.

Sponsors:
Dr. Winncy Du

Investigation of Laser Bonding Strength for Clear onto Dark Microfluidics



Student Team Members:
Oryza Tirtawijata
Ernesto Rosendo
Sidney Licate
Nhan Pham

Faculty Advisor:
Dr. Burford Furman

Project Objective:
This project aims to identify the optimal laser welding process for microfluidic applications by evaluating the bond strength of laser-welded plastics. This will be achieved by testing various plastics and weld speeds to determine their effectiveness.

1. Produce clean, consistent welds suitable for microfluidic integration
2. Measure ultimate tensile strength using the Instron
3. Analyze weld quality through laser imaging with a digital microscope
4. Document and present findings to demonstrate the effectiveness of each welding parameter

Significance:
This project aims to establish a reliable laser welding procedure for bonding plastics in microfluidic applications by testing various plastics at different weld powers and speeds. Reliability testing will validate the bond integrity and assess the process's consistency and suitability for scalable manufacturing.

Project Results:

1. Successfully created weld pattern and programed Amada Miyaichi to weld
2. Conducted tensile testing using the Instron to determine ultimate bond strength
3. Examine and evaluate weld cross section for quality and consistency
4. Compiled results into tables and graphs to visualize data and support analysis

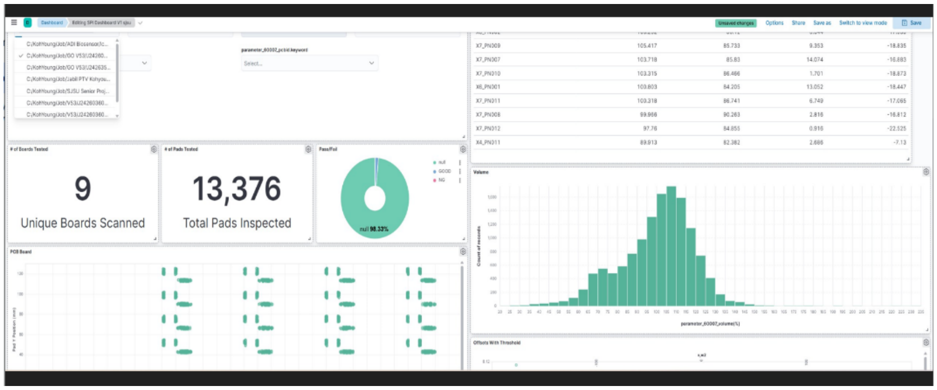
Sponsors:

- **Organizations:** Jabil
- **Individuals:** Quyen Chu, Ethan Duong and Hien Ly for guidance and mentorship

Real Time Data Collection and Visualization A Solder Paste Inspection (SPI) Machine

Student Team Members:

Mohamed Truong
Joshua Zhang
Alan Enecial
Mario Estaban Cerritos



Faculty Advisor:

Dr. Burford Furman

Project Objectives:

The objective of this project was to establish connectivity between a computer and a Solder Paste Inspection (SPI) Machine to enable real time data collection and visualization.

1. Our first objective was to establish and verify connectivity between our Host Computer and SPI utilizing the Semiconductor Equipment and Materials International Equipment Communications Standard/Generic Equipment Model (SECS/GEM) standard communication protocol

2. Our second objective was to develop a dashboard that would display key metrics from the SPI machine and provides actionable insight to machine performance.

Significance:

The significance of our project is that it will greatly accelerate the current workflow required to gather data off various machines. Currently, this process is done manually by exporting data off each individual machine via USB. With our system, data will be sent directly into 1 centralized location in near real time.

Project Results:

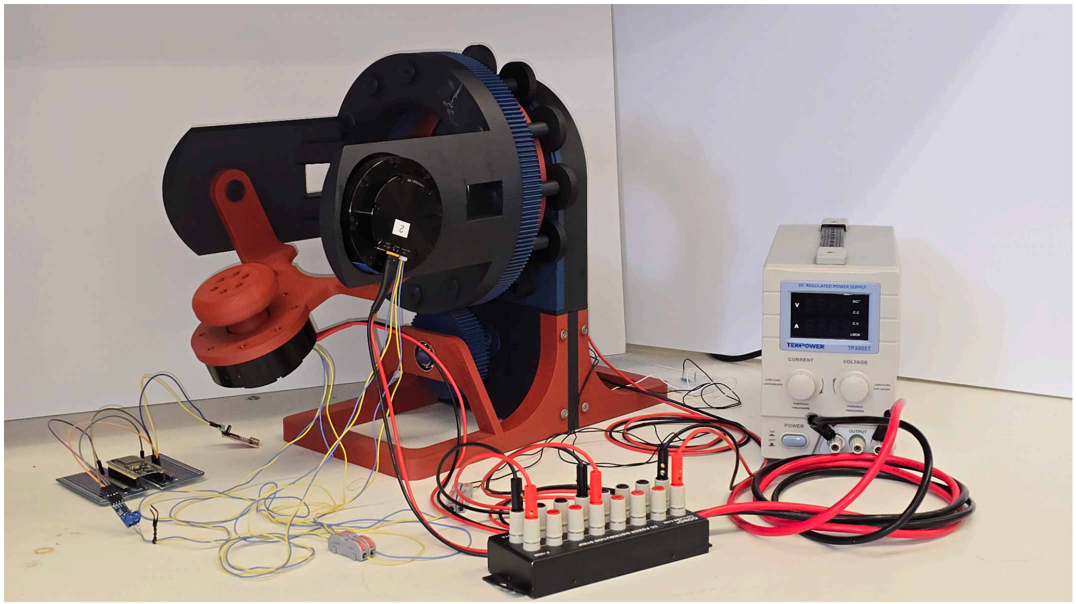
1. There is a functional connection between our Host Computer and SPI machine, however, data transmission from SPI to Host Computer still needs troubleshooting.

2. We created a working dashboard using the available data. We created visualizations to demonstrate as a proof of concept the potential for real time monitoring and future expansion of our work.

Sponsors:

Jabil Circuits

Rehabilitative Wrist Exoskeleton w/ 3 Degrees of Freedom



Student Team Members:
Sanad A. Shabbar (Team's Lead)
Michael Iwamiya
Merlin Perez Lopez
Alec Karaguezian
Ron Raymundo
Will Valencia

Faculty Advisors:
Dr. Burford Furman &
Dr. Mojtaba Sharifi

Project Objectives:
The primary objective of this project was to create a cost-efficient rehabilitative wrist exoskeleton capable of replicating all 3 degrees of freedom of the wrist.

1. Create a design that safely incorporates pronation and supination to address the market need for a wrist exoskeleton capable of performing axial rotation.
2. The desired range of motion for the 3 degrees of freedom (pronation/supination, flexion/extension, and radial/ulnar deviation) are 80-90°, 70-80°, and 15-25° respectively.
3. The total cost of the project should remain under $2000 to increase accessibility, thus parts should be able to be made cheaply.

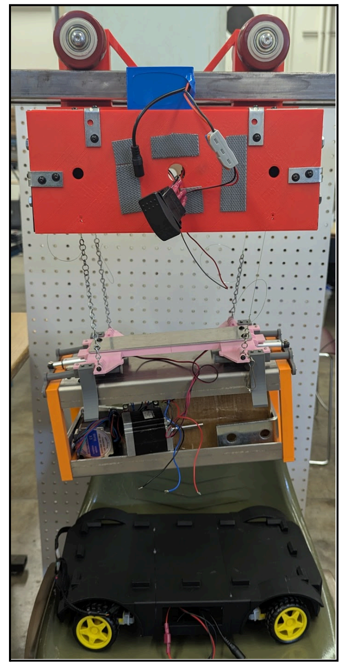
Significance:
For those who have suffered from spinal cord injuries or neurological conditions, losing wrist mobility can severely impact their independence and quality of life. Despite this need, most wrist exoskeletons on the market are limited in functionality, offering only two degrees of freedom, and their high cost further restricts accessibility. This highlights the opportunity to develop more versatile, affordable wrist exoskeletons to better meet the needs of individuals with impaired wrist mobility, improving their daily functioning and independence.

Project Results:

1. Designed and built a wrist exoskeleton capable of achieving three degrees of freedom: flexion and extension, radial and ulnar deviation, and pronation and supination.
2. Wrist exoskeleton components were fabricated using FDM technology, keeping costs below the proposed budget ensuring that the mechanism remained affordable.
3. Implemented and programmed three brushless DC motors to independently control each degree of freedom.

Sponsors:
Dr. Mojtaba Sharifi and the Assistive Robotics & Medical Systems (ARMS) Lab of SJSU

Superway Integrated Mobility Platform for Logistics



Student Team Members:

Seth Miu (Team Lead)
Antonio Torres
Misael Herrera
Oscar Zavala-Solis
Samuel Lopez
Javier Soto Trujillo
David Cabrera
Karan Sethi
Helen Vong

Faculty Advisor:

Dr. Burford Furman

Project Objective:

This project aims to provide a proof of concept for a streamlined autonomous future for port logistics and human transportation in San Jose.

1. Develop a scaled model of an Autonomous Guided Vehicle (AGV).
2. Create a hoisting system to control the lowering and lifting of shipping containers, which could later be slightly modified for a carriage for human transportation.
3. Both hoisting and AGV systems are to handle a load of approximately 6.17 kg.

Significance:

Some of the key objectives this project aims to achieve include reducing emissions through the integration of solar energy, creating an efficient and streamlined workplace, and decreasing the number of human workers on site.

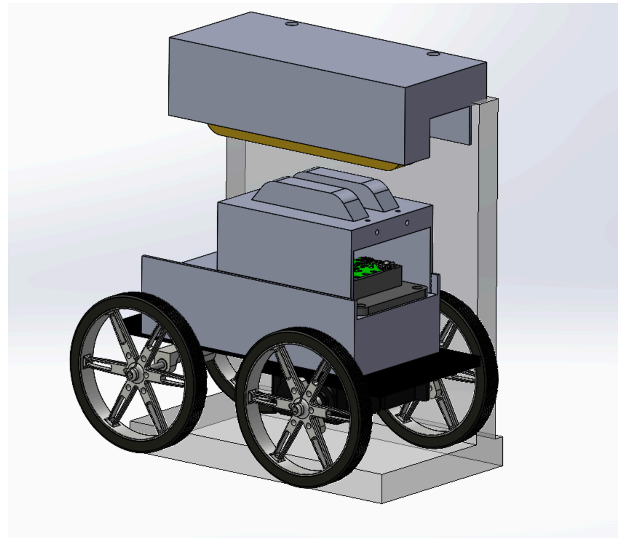
Project Results:

1. Developed and designed a CAD model of an AGV.
2. Adapted a CAD model hoisting box and spreader that collects the shipping container.
3. Fabricated and assembled the AGV, hoisting box, and spreader.
4. Both the AGV and the Hoisting system withstand the target load of 6.17 kg.
5. Completed the wiring in the AGV and the hoisting box.

Sponsors:

Spartan Superway, SJSU Dept. of ME., Dr. Burford Furman

Autonomous Battery Charging Station



Student Team Members:
Christine Pham (Team Lead)
Hratch Momjian
Juan Moreno Gonzalez

Faculty Advisor:
Dr. Burford Furman

Project Objectives:
The objective of this project is to develop an autonomous charging station for the Spartan Superway boogies. The criteria for the charging station are as follows:

1. Charge the boogie autonomously without external assistance.
2. Calculate current, voltage and power that the boogie receives.
3. Detect when the boogie goes under a predetermined battery percentage, and then route itself back to the changing station.

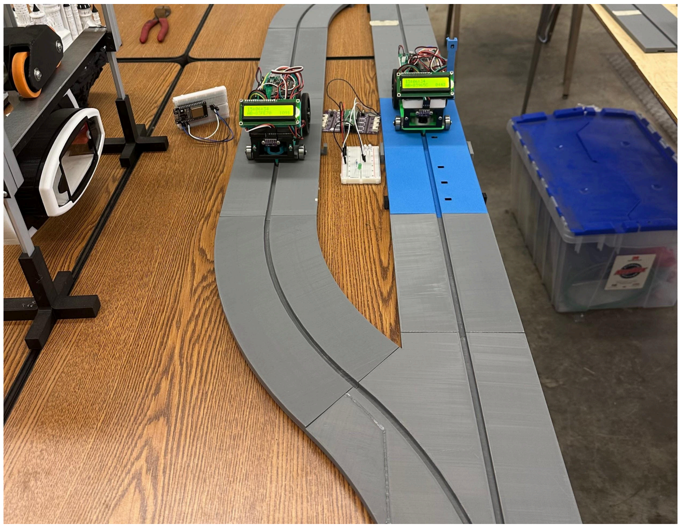
Significance:
This project promotes a reliable, autonomous and energy efficient transportation service by having the boogies endlessly go around the Spartan Superway safely. Furthermore, the Spartan Superway presents a solution to the emissions released by traditional transportation while minimally disrupting the everyday lives of commuters. Having a successful charging station to the model track of the Spartan Superway brings the project one step closer to its completion.

Project Results:
Currently, the autonomous charging station has produced the following results:

1. Passive charging (No USB Connection)
2. Calculated Power Consumption

Sponsors:
Spartan Superway
Dr. Burford Furman
Ron Swenson

ATN Traffic Control



Student Team Members:
Nicolas Wieczorek
Gabriel Gulchin
Katie Gomez

Faculty Advisor:
Burford Furman

Project Objectives:
The objective of this project is to create an autonomous collision avoidance system for the Spartan Superway model track. Specific objectives include:

1. Develop two separate and redundant communication systems to increase the safety of the superway.
2. Control the traffic flow of the system to optimize efficiency.
3. Incorporate redundant data collection systems to increase the safety of the superway.

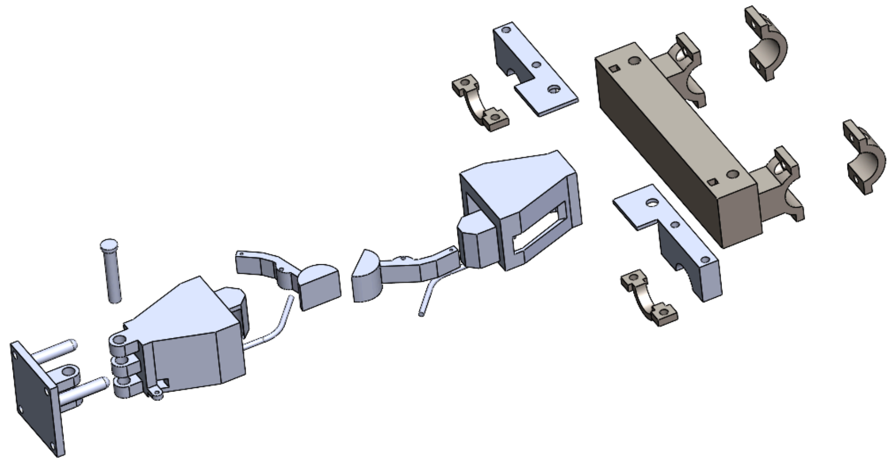
Significance:
Creating a collision avoidance system is very important to ensure passenger safety and reliability as it prevents accidents and system failures through redundant, real-time autonomous control. The project also supports the enhancement of sustainable urban transit by developing an efficient and scalable transportation system.

Project Results:

1. Used IR emitters and receivers to build the first communication system and MQTT running over WiFi as the second communication system.
2. Installed Hall Effect sensors in the track and magnets in the bogies as the first data collection system.
3. Added NFC tags in the track with readers on the bogies as the second data collection system.

Sponsors:
Spartan Superway

Automated Wheelchair Restraint Mechanism



Student Team Members:
Alan May (Team Lead)
Erik Huang
Kayla Mallari
Francesca Ng
Ethan Reysner

Faculty Advisor:
Dr. Burford Furman

Project Objective:
The overarching goal of this project is to create a safe, efficient means by which people of all abilities are able to utilize transportation services without external assistance.

1. Design a means to secure the frame of a mobility chair within a vehicle that is strong enough to withstand forces that would occur in a vehicle crash.
2. Design an engagement method, so that mobility chair users of varying levels of motor control can independently secure themselves in a vehicle.
3. Create a standard interface that can be adapted by manufacturers or applied 'aftermarket' that connect at a standard height and location to dock with a mating mechanism in the vehicle.

Significance:
The significance of our project is to increase accessibility in the Spartan Superway by reducing risk to mobility chair users using public transportation. It also offers additional autonomy to users by allowing them safety measures without the help of a second party. It encourages the use of public transportation by making it more accessible.

Project Results:

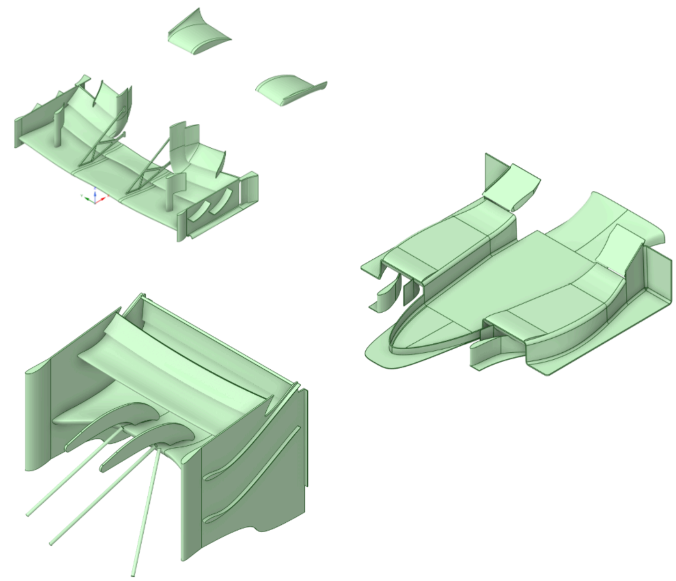
1. Designed and developed a mechanism which was subsequently prototyped
2. Implemented electronically controlled coupler release mechanism
3. Mixed success in testing, seeking to improve reliability of attachment

Sponsors:
Dr. Burford Furman
Ron Swenson
Spartan Superway
Charles W. Davidson College of Engineering

Formula SAE Structural Aerodynamics Package

Student Team Members:
Matthew Abdallah
Ely Feldsher
Kenny Nguyen
Trung Nguyen
Nikhil Repalle

Faculty Advisor:
Dr. Raghu Agarwal



Project Objectives:
The overarching goal of this project is to take aerodynamic devices designed by SJSU's Formula SAE team—consisting of a front wing, rear wing, undertray, and diffuser—and engineer the composites behind each component to ensure structural stability under track load cases.
The specific objectives are:

1. Reduce total weight by 25% using advanced composite simulations to determine ply scheduling and orientation
2. Maintain minimum Factor of Safety of 1.5 under max pressure loads
3. Validate structural stability with onboard cameras, strain gauges, and car run time.

Significance:
This project contributes to sustainable manufacturing practices by reducing material waste, advancing composite fabrication techniques, and enhancing vehicle performance through weight reduction.

Project Results:

1. Front Wing weight decreased by 27%, Rear wing weight decreased by 13%, Undertray weight to be determined
2. ANSYS simulations indicated a minimum Factor of Safety of 2.0 under max pressure load of 65 mph + 20 mph headwind
3. Tuft testing and track data to be determined from car testing

Sponsors:
SJSU FSAE Spartan Racing
Toray Advanced Composites
Ansys

Senior Project - Continuously Variable Transmission Testing/Optimization

Student Team Members:
Noah Sezzi
Alex Martinez
Matthew Combalecer
Erick Escasura

Faculty Advisor:
Prof. Raghu Agarwal

Baja
SPARTAN RACING

CVT Tuning

Project Objectives:
The overarching project goal is to optimize the performance of the Continuously Variable Transmission (CVT) to improve the powertrain efficiency and overall vehicle performance. The bigger picture is to aim for achieving better results in competition and placing higher than the Baja Team previously did last year. The goal was to test the CVT as much as we could with different variables to record and analyze the testing data.

1. Design and Fabrication: This included designing a CVT testing jig in CAD (Solidworks), and then manufacturing the jig by cutting, prepping, and welding steel tubes to ensure secured mounts for the engine and CVT testing. New sets of brass flyweights were also machined using a lathe.
2. Prototyping and Modifications: With the testing jig fully setup, we now had to modify some key components of the CVT, including flyweights and ramp angles of the primary CVT, spring stiffness of the secondary CVT, as well as belt tension.
3. Testing and Data Analysis: Used a load cell to simulate load and Race Studio 3 software to collect data, along with video analysis to evaluate torque transfer, shift performance, and the CVT's engagement efficiency under varied testing conditions. Assessed the impact and behavior of each parameter.

Significance:
This project is aimed for a more efficient off-road vehicle design by improving powertrain performance, supporting engineering innovation, system optimization, and real-world data that's simulated during testing, and brought to life in competitions shortly after.

Project Results:

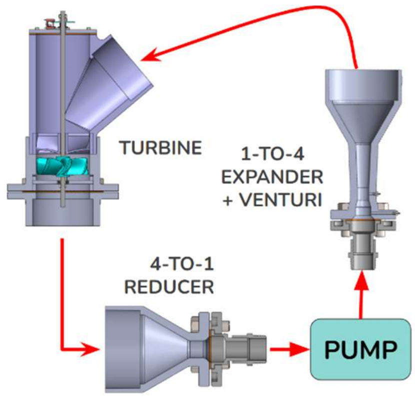
1. Successfully designed, cut, and welded a steel jig to securely mount the powertrain system.
2. Replaced multiple CVT components for controlled testing and performance behavior.
3. Collected real-world torque and RPM data with load cell and Race Studio 3; analyzed captured data to select optimal parameters for the best engagement, smoother shifting, and more torque.

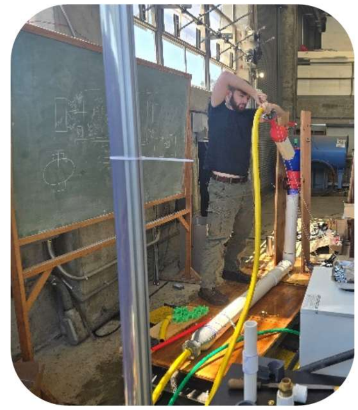
Sponsors:
We would like to thank the SJSU Baja SAE team for reimbursements of needs and materials during the project. Esabo Vo, the business lead of Baja, was able to help us smoothly navigate and request reimbursements. We also want to thank Gaged CVT for their support and assistance with the CVT, and any tips that they were able to give us.

Application of Additive Manufacturing for Adaptive Hydro Turbine Design

Student Team Members:
Kyle Fitzpatrick
Allan Ard
Tanner Dunn
Devon Heubel
Ivan Sirio

Faculty Advisor:
Prof. Raghu Agarwal





Project Objectives:
The goal of this project is to design a modular hydro turbine system for power generation that optimizes blade geometry using a custom MATLAB program and manufactures turbines with 3D printing.

1. Make a MATLAB program that generates optimized blade designs based on user input
2. Create a Solidworks model that automatically updates based on MATLAB program outputs and can be used for additive manufacturing
3. Test turbine designs under different flow conditions using a test loop

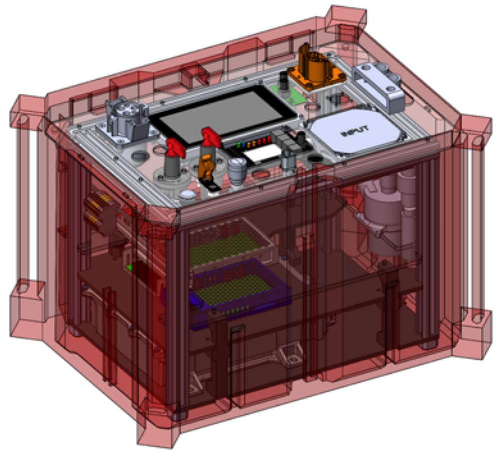
Significance:
Turbine designs are specifically optimized for certain flow conditions. By making a modular system with easily interchangeable turbine blades, hydro power can now be utilized for a much wider range of consumers. This project aims at making hydro power a more economical option for households to reduce the worlds reliance on “dirty” power sources such as natural gas.

Project Results:
1. MATLAB program was successfully made and accurately changes blade parameters based on user input
2. Solidworks model was linked to MATLAB program and updates automatically with optimized blade designs
3. Several blades were made with 3D printing based on varying flow conditions
4. Test loop was built and used to verify design of multiple blades

FSAE HV Battery Charger

Student Team Members:
Kanoa Nakama
Malek Alziq
David Pena
Stefano Sandoval
Xiao Pan

Faculty Advisor:
Prof. Raghu Agarwal



Project Objectives:
This project aims to design a compact, portable, high-power battery charger for SJSU’s Formula SAE electric race car battery pack. The specific objectives are as follows:

1. Safely charge the HV battery pack’s 8.9 kWh in under 1.5 hours using 6.6 kW charging power.
2. Maintain portability by packaging within a Millwalkee packout tool case.
3. Establish a capability interface for future batteries, eliminating the need for charger modifications.
4. Interface with common charge stations found in parking lots and charge points.
5. Communicate with the battery's onboard safety systems to ensure safe charging, monitor charging, and log data.

Significance:
Following the design philosophy of Formula 1, every gram counts in a race car. By eliminating the weight of an onboard charger unit (typically ~40lb) from the vehicle, the mass onboard is solely dedicated to performance. As a team constantly on the move, the charger's portability is paramount. Packaging in a Millwalkee packout allows the charger to be easily stored, transported, and deployed like any other tool. Charge time is extremely limited at our competition; fast charging speeds ensure we are fully charged before our next race. Our team is constantly improving. Logging all charging data allows us to analyze key contributors to better charge times and greater power delivery.

Project Results:

1. Decreased charge times significantly from 5 hours to 1.5 hours. With 6.6kW charging power
2. Improving charger efficiency by replacing high-power fans with water cooling, reducing the cooling power consumption by 80%
3. Successfully packaged the charger within a 22in IP65-rated Millwalkee Packout.
4. Voltage and temperature data of the battery are logged and plotted locally and remotely.

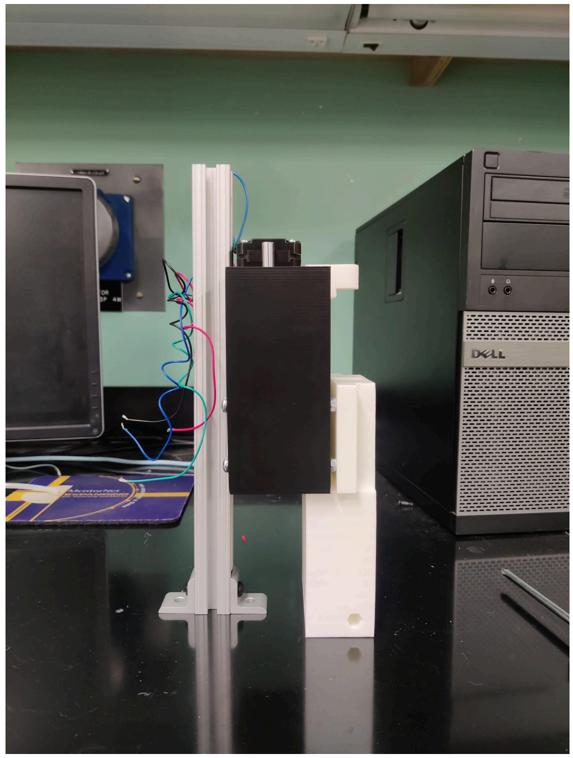
Sponsors:

- Spartan Racing, Quando Solutions

Balloon Catheter Coating System

Student Team Members:
Norman Lee
Sean Hatran
Tyler Pham

Faculty Advisor:
Dr. Raghu Agarwal



Project Objectives:

1. Create a prototype of a device that will efficiently drug coat a catheter balloon for intravenous surgery
2. Create a prototype that is lighter, smaller, and more affordable than available drug coating devices
3. Help advance drug coated balloon catheter technology

Significance:
Creating a more affordable and smaller coating device helps progress R&D and development of drug coated balloons. Hopefully, the advancement of the technology will help to treat and alleviate cardiovascular and ENT diseases.

Project Results:

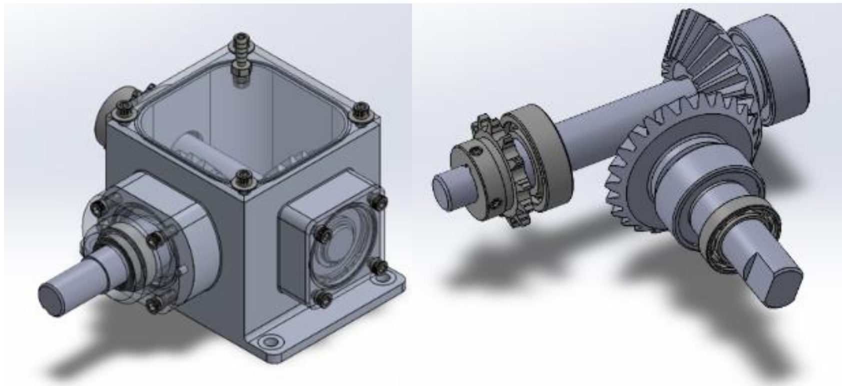
1. Created a working prototype of a drug coating system.
2. Created a prototype that is lighter and smaller than currently available systems, as well as more affordable.

Sponsors:
Hydrovascular LLC.
KNT Manufacturing

Right Angle Gearbox for SAE Baja

Student Team Members:
Elijah Sanchez
Dagan Stras
Ana Vartan
Steve Wise

Faculty Advisor:
Prof. Raghu Agarwal



Project Objectives:
The overarching goal of this project is to design a gear system and housing that provides power transfer for a competitive, off-road vehicle. The specific objectives are as follows:

1. To design, manufacture, and assemble a gear system capable of withstanding at least 132.9 ft-lbs of torque for a 4 hour race time.
2. To design, manufacture, and assemble a rigid housing to protect the gear system and properly seal the lubricants and oils.
3. Sufficiently test the final assemblies to ensure a factor of safety of 1<.

Significance:
The previous design shattered upon use with no housing. This project aims to reduce the risk of failure, as well as to provide safety against any failure that may occur. Additionally, a more efficient design reduces material waste, manufacture times, and necessary transportation of parts which reduces fossil fuel use and aids in sustainability.

Project Results:

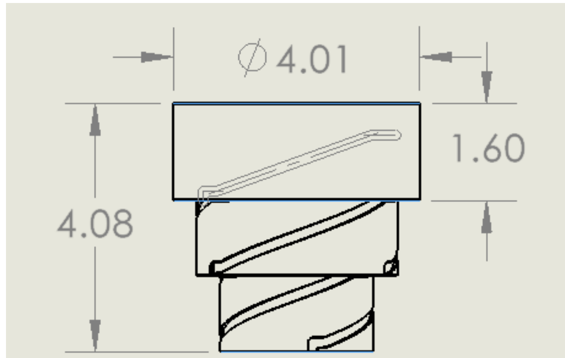
1. Withstood the 4-hour endurance race at the competition and is continuing to perform without failure.
2. The housing is performing without failure or leaks during competition currently.
3. 1.17 minimum FOS for the gears, tested at 132.9 ft-lbs for 20 hours.

Sponsors:
John Scheckel from Thermo-Fusion in Hayward, CA sponsored our gear hardening processes.
Nick Marello, TAG Manufacturing, and the SJSU Baja SAE club team are also notable sponsors.

Collapsible Cup for Beverages

Student Team Members:
Daniel Hernandez
Edward Superio
Nicolas Yousif

Faculty Advisor:
Prof. Raymond Yee



Project Objectives:
The goal of our project was to create and design a cup that is able to collapse open for drinking and be easily carried or stored away when not in use.

1. Functional collapsible cup that can hold its initial temperature for extended periods of time. This will be made easy for travel and storage with a temperature drop less than 20°C within the first two hours.
2. The collapsible cup must be leak-proof. No liquid should leak out from the individual sections or from the lid of the cup.
3. Achieving practical use for an everyday lifestyle. Product will have a 12 oz capacity making it suitable for carrying a variety of beverages.
4. The exterior surface temperature of the cup must remain below 40°C to prevent hand burns.

Significance:
This collapsible cup is aiming to reduce the amount of waste created by billions of disposable cups. With an estimated 25 billion disposable cups discarded each year in the U.S., that results in over 6.25 billion pounds of carbon dioxide being released into the atmosphere.

Project Results:

1. The cup can collapse with relative ease, but has a temperature drop higher than 20°C within the first two hours
2. The cup has no leaks inside or outside of the surfaces, along with the food-grade material sealing the insulation
3. The cup has a volume capacity of about 13 fl oz.
4. The exterior surface of the cup never had a temperature above 32°C

Sponsors:
Jason Blum

Large Area Sintering Characterization

Student Team Members:
Justus Maloto
Kevin Tran
Joe Leon

Faculty Advisor:
Prof. Raghu Agarwal

Industry Advisors:
Rod Mapanao
Muhammad Irsyad

Project Objectives:

1. Characterize the large area sintering process.
2. Compare wet and dry process sintering.
3. Determine the maximum area for efficient wet process sintering.

Significance:
Large area sintering is an alternative bonding method for power modules in electric vehicles (EV) that offers higher performance than traditional soldering methods. As power demand in EVs grows, sintering has the potential to boost the reliability of these components.

Project Results:

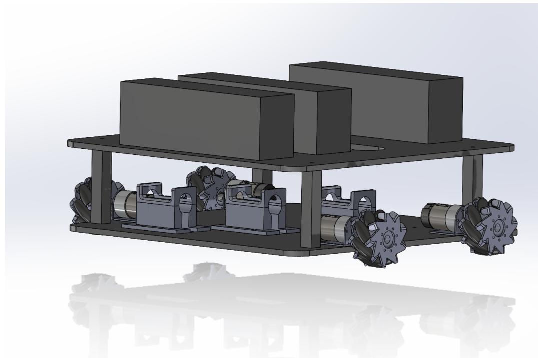
1. Further developed and acquired knowledge on key sintering parameters for surface uniformity, bond strength, and minimal void formation.
2. Through various forms of mechanical testing, we determined that the wet process offers more mechanical performance and bond integrity.
3. A 60mm x 60mm sintering area was successfully processed with relatively no critical thermal and mechanical defects.
4. Despite manually printing, we observed similar performance to machine printed counterparts indicating a robust process flow tolerant to variability.

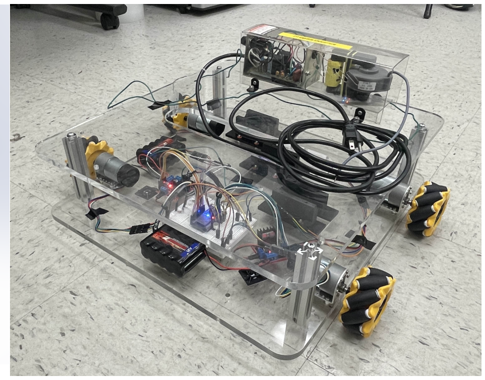
Sponsors:
Jabil, Inc.

Design and Development Plasma Hoover for Floor Bacterial Mitigation

Student Team Members:
Isaac Benavidez
Linh Hua
Antonio Hueso-Fernandez
Elizabeth Navarro
Miguel Sanchez

Faculty Advisor:
Prof. Syed Zaidi





Project Objectives:

The purpose of the plasma hoover project is to incorporate the use of medical-grade gas plasma and a robot to automate the safe and thorough disinfecting of sensitive environments via automated and manually controlled movements.

1. Device must be able to be controlled by a bluetooth controller to traverse the floor with varying speeds and movement patterns.
2. Device must create plasma sheets from torches mounted on the chassis to eliminate bacteria.
3. Device must possess omnidirectional capabilities.

Significance:

With the Plasma Hoover system you would be able to not just sterilize the floor via automated paths, but through a joystick. This system interface allows for various ways of controlling the system's sterilization paths, as you have the option to set it to an automated path and then manually go over any spots again with the joystick. This agility is critical for us since it allows the system to be used in tighter spaces that require more precise movement.

Project Results:

1. The plasma hoover robot is equipped with four precise and strong gear motors with built-in encoders which are being controlled by an ESP32-WROOM microcontroller.
2. The device possesses three plasma torches that are suspended to an optimal distance by carriers and powered by drivers on the top chassis.
3. The device is then capable of maneuvering effectively with 80mm omnidirectional wheels, in multiple areas of a desired space in order to perform its sterilization processes.

Sponsors:

This project was sponsored by the IntelliScience Institute, who worked with us along the way to purchase the material needed to produce this system.

Power Requirements of an Ammonia-Filled Aerospace Thermosyphon

Student Team Members:
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John Hart
Michael Welder
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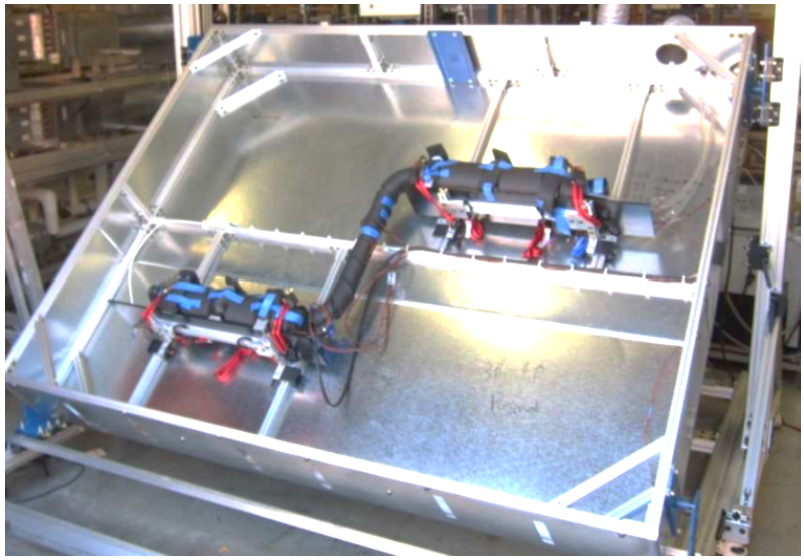
Shreya Mistry

Faculty Advisor:
Prof. Syed Zaidi

Date: May 02, 2025



Project Objectives:
The main goal of this project is to study how tilt angles and working fluid saturation temperature affect the start-up heat input of an S-shaped axial grooved ammonia thermosyphon.

1. Restore and improve the original design of the thermosyphon by adding additional thermocouples.
2. Rerun the previous experiments at additional tilt angles to gain more data.
3. Design a more compact version of the experiment that can be run in a vacuum.

Significance:
This project is important because it helps us understand how a special cooling device called a **thermosyphon** works in different positions and temperatures. Thermosyphons move heat without moving parts, making them useful for space missions where things need to be lightweight and reliable. By studying how much power is needed to start the system, especially with ammonia inside it, we can help improve designs for future spacecraft cooling systems. Our project brings us one step closer to using these systems in real space environments.

Project Results:
Initial testing of the restored thermosyphon produced results that closely match data previously collected by former researcher Erik, confirming the reliability of our setup. We have successfully graphed and calculated key performance metrics such as temperature trends and startup power at various tilt angles. In addition, we developed a more compact–vacuum compatible–thermosyphon design and performed ANSYS simulations and theoretical calculations to evaluate its thermal performance and structural behavior under vacuum conditions.

Sponsors:
This project was funded by the San Jose State University Department of Mechanical Engineering. No further financial or work contributions to mention.

Bifacial Solar Panel Characterization

Student Team Members:
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Resham Pandey
Zuhair Sawaged
Danny Dinh
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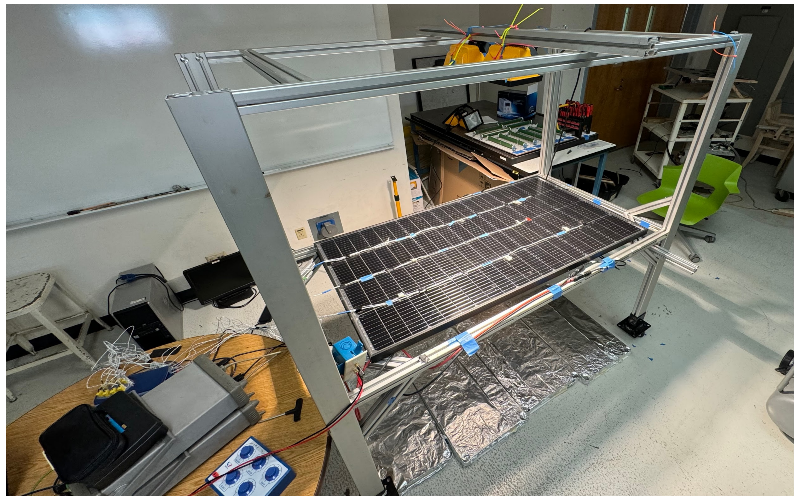
Faculty Advisor:
Prof. Syed Zaidi



Project Objectives:

1. Determine the optimal reflective material beneath a bifacial solar panel to maximize energy generation
2. Identify the most effective tilt angle of the solar panel for optimal energy output
3. Enhance solar panel efficiency and promote renewable energy use

Significance:

Bifacial solar panels significantly enhance energy generation by capturing sunlight reflected from surfaces beneath the panel. Increasing the efficiency of solar panels without enlarging the installation area contributes to sustainability and can lead to substantial economic and environmental benefits. Our research supports the global transition toward renewable energy by improving the practical viability and output of solar installations.

Project Results:

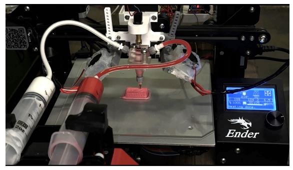
1. Tested reflective materials included aluminum foil, turf, and rock, with aluminum yielding the highest albedo (reflectivity) value of approximately 0.94
2. Implemented a CAD-designed adjustable steel frame to precisely measure energy generation at multiple tilt angles.
3. Conducted Indoor and Outdoor experiments using a controlled, replicable setup to gather reliable baseline data, achieving up to 30% increased energy output over a monofacial panel.

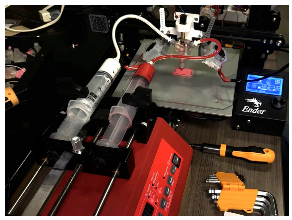
Sponsors:
Our project was funded by IntelliScience Training Institute, San Jose, CA. as well as individual contributions from team members.

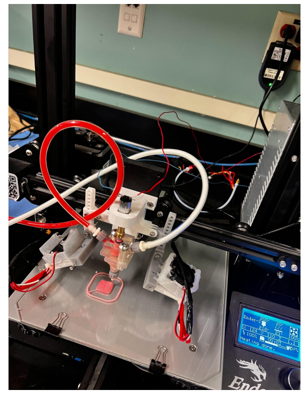
3D Silicone Printer

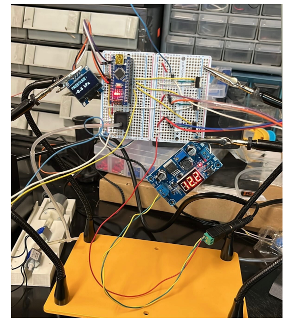
Student Team Members:
Abhishek Khatri
Miguel Iniguez Franco
Jonathan Velasco Figueroa
Eric Jimenez
Anthony Bolinger

Factory Advisors:
Dr. Syed Zaidi
Dr. Lin Jiang









Project Objectives:
The main goal of this project is to develop and construct a 3D printer capable of manufacturing silicone artificial muscles via an extrusion and mixing system for a silicone mixture. To demonstrate the elastic properties of the silicone prints, we also created a pump system to expand and contract the muscle based on internal air pressure.

1. The printer must be able to extrude and cure the silicone mixture simultaneously to ensure that the printed artificial muscles solidify with their designed features, such as internal air channels that enable precise control by the pump system.
2. The silicone printed parts must exhibit sufficient flexibility and mechanical strength to retain their shape while still being able to be manipulated by the pump system.
3. The printer must include an embedded control system that manages printer operation through user inputs for fan speed and temperature to ensure a repeatable and optimized process.

Significance:
This device offers a meaningful impact across healthcare, sustainability, and manufacturing. It enables the production of safe, flexible, customizable medical devices. 3D printing offers many advantages over the current method of creating silicone parts, molding. Developing printing as a viable construction method allows those parts to be larger and more complex, and for them to be developed more rapidly.

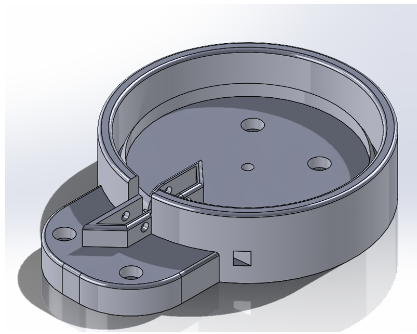
Project Results:

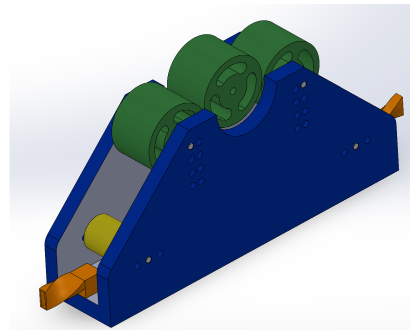
1. Using the customized printer, we successfully created multiple small silicone parts. The size of the prints is limited by a problem with the syringe pump stalling, leading to a lower flow rate after about 7 minutes of printing.
2. The silicone parts, printed with a hollow tube inside them, were inflated and deflated with the pump mechanism, resulting in a controlled motion.
3. Aside from dealing with the pump issue, the process was fully automated once the print began. We believe that 3D printing as a method for constructing silicone parts is fully viable with some improvements in the future, such as an easier way of cleaning the inside of the extruder.

Sponsors:
This project was funded by individual contributions from Dr. Syed Zaidi, Dr. Lin Jiang, and members of the group, as well as the San Jose State University Department of Mechanical Engineering.

PET Bottle Recycler for 3D Printer Filament

Student Team Members:
Jimmy Le
Krishna Sinjali
Joal Pena
Younes Moussaoui
Kenny Vu





Faculty Advisor:
Prof. Syed Zaidi

Objective:

This project aims to transform discarded PET plastic bottles into high-quality 3D printing Filament, offering an eco-friendly and cost-effective alternative to all types of filaments like PLA and ABS. This project was initially the group's before us, so by addressing and improving their inefficiencies in previous iterations, our team was able to finish the system, redesigning the bottle cutter, high-torque strip extractor, and optimized extruder, giving us a significant improvement in filament consistency and system reliability.

Significance:

This device gives a new life to plastic bottles that would otherwise be wasted. By turning them into 3D printer filament, it helps reduce pollution and makes good use of something people usually throw away. It also helps make filament more affordable, which means more students, hobbyists, and innovators can access 3D printing without the high cost. It is a small step towards sustainability that will help extend the life of plastic water bottles.

Key Innovations:

- **Redesigned Bottle Cutter:** Originally, it was a very complex cutting system with many moving parts that attempted to strip the bottle. However, we have since simplified it, creating a simplified version for more precise and repeatable cuts.
- **High Torque Strip Extractor:** The original bottle cutter used a spooling mechanism to strip the bottle. Since then, we have realized that our cutter needs a significant amount of torque, so we created a stripping mechanism capable of pulling the strip with a high amount of torque.
- **Temperature-Controlled Extruder:** Our extruder is repurposed from an Ender Pro 3 filament extruder. We realized it as our heating element, which is used to turn the strips of PET into an 8mm strand of filament. We have figured out that 230 degrees Fahrenheit has been our optimal temperature.
- **Modular Spooling System:** We reutilized an Ender Pro 3 stepper motor found inside the 3D printer to drive our spooling mechanism. With this, we are able to successfully extrude filament from the extruder and spool it onto a spool that can be used on a 3D printer.

Sponsors: This project was fully funded through out-of-pocket contributions from group members and support from the Mechanical Engineering Department at San José State University. No additional financial or labor contributions were involved.

Biochair for Leg Muscle Mobility Rehabilitation

Student Team Members:
Lance Lee
Timothy Mai
Miguel Oribello
Thomas Pham
Erik Wolfl

Faculty Advisor:
Prof. Syed Zaidi

Project Objectives:
The goal of this project is to develop a prototype wheelchair with automated motorized leg braces for leg muscle rehabilitation.

1. The range of the leg brace angles for the user shall not exceed 75 degrees from 0 degrees vertical.
2. Device will be equipped with 1 electromyography (EMG) sensor attached to the patient's leg while sitting in the chair
3. Device will have 2 operating modes: an auto mode where the leg braces move independently for the patient, and an EMG mode which will move leg braces based on the patient's leg muscle nervous system response.

Significance:
This device offers another method of physical mobility rehabilitation without requiring as much new technology and resources. Unlike currently existing suspension harness walkers or other assistance-dependent medical devices that require a second-able user (i.e. a caretaker) to help the patient into the device, the wheelchair is envisioned to make the mounting and dis-mounting process easier or even independently by the patient.

Project Results:

1. Combine the mobility of a wheelchair wheelchair with the precision of a medical device in one package
2. Leg brace angle mobility range (0 to 75 degrees) makes it so patient is comfortable while sitting in the chair without experiencing strain or harm
3. Sensors, switches, motors, code software, and other electronics ensure the process is virtually hands-free

Sponsors:
This project was funded by the Intelliscience Research Institute and the San Jose State University Mechanical Engineering Department. Any additional funding was provided by the student team members' personal contributions totalling no more than $300.

Development of Thrust Measurement Device for Drone Blade Optimization

Student Team Members:

Leosbaldo Zurita-Romero
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John Marambire
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Faculty advisor:
Prof Syed Zaidi

Project Objectives:
The goal of this project was to develop a thrust measurement device that can help with testing various 3D printed blade designs. Once the measurement device has been adapted to our drone's landing gear, we can begin interchanging blades and recording the various thrust measurement readings.

Significance:
This project has significance because of the increasing use of drones. Optimizing thrust and efficiency of drones can greatly improve delivery of items and increased payloads. Drones can deliver life saving medical supplies to remote areas and conduct search and rescue.

Project results:

- A test bench created using an optical breadboard, load cell, drone landing gear and a 3D printed mounting apparatus.
- Calibrated using known weights. Load cell outputs a voltage which can be used to find thrust
- 10 different blade configurations with varying chords, pitch angle, and camber.

Sponsors:
This project was funded by Intelliscience Labs and the group members.

Solar Panel Energy Harvesting With Passive Cooling

Group Members:
Sean McGlaughlin
Micheal DiSalvo
Robert Lopez
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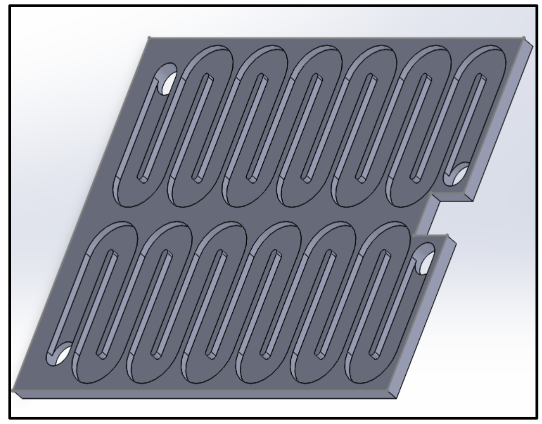
Faculty Advisor:
Prof. Syed Zaidi



Project Objective:

Our primary goal is to actively perform data-taking on our selected solar panel with and without cooling to measure its performance capabilities in energy production. We intend to rig the panel with a custom-machined water cooling block to the backside.

Key goals of our project include:

- Successful implementation of custom cooling block that attaches to the PV module and is testable without leakage issues.
- Testing and data results in various operating conditions including both no cooling and active water cooling.
- Successfully harness energy by creating a heated water by-product.

Project Significance:

The project design and implementation is significant due to the ever-emerging change towards cleaner renewable energy sources when compared to traditional coal-based energy solutions. Clean energy is constantly exploring new optimizations; Therefore, we have an opportunity to help test impactful solutions with an emerging energy source that can show potential use-cases for increased performance alongside greater cost reductions for end users and manufacturers.

Sponsors:

Our project is sponsored by IntelliScience Institute Research Labs and San José State University. Funding for our project is entirely contributed by individual contributions of group members and San José State's Mechanical Engineering department.