



SAN JOSÉ STATE UNIVERSITY

Mechanical Engineering Department

**ME 195B Senior Design Project
Project Summaries**

Date: May 14, 2021

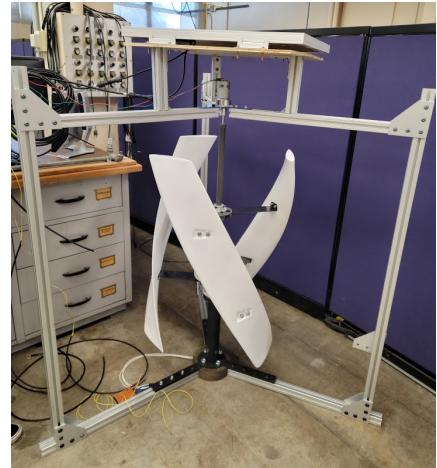
Location: Virtual via Zoom

Hybrid Renewable Power Generation and Storage System

Student Team Members:

Leonard Nguyen
Justin Huang
Benjamin Ho
Miguel Hermoso
Earl Cantillep
Yacin Chouggar
Robert Macias

Faculty Advisor: Dr. Agarwal



Project Scope and Objectives:

To improve the overall power efficiency of a vertical wind turbine by including a solar panel to harness solar energy which will theoretically allow it to generate more power. The mechanism will serve as the source of power for an LED bus stop sign that will present up to date bus schedules without being connected to the main power grid. There are three main objectives that were met:

1. Power needs:
 - 200 Watt Hours/Day
 - Storage: 1.5KWH
2. Design a system capable of providing a continuous source of power:
 - Vertical axis wind turbine
 - Solar panel
 - Anemometer implementation
 - Logic
 - Battery and charging circuit
3. Obtain energy from the wind turbine to charge the battery. Solar panel will power a motor that turns the turbine when the anemometer detects that not enough wind is present.

Project Results:

1. Successfully assembled initial hybrid wind turbine design
2. Improved upon previous project iterations to create a more concrete and comprehensive design
3. Finalized system logic into Python program

Sponsors:

San Jose State University - Department of Engineering
Baldev Krishan Ph.D.

Baja SAE Suspension & Chassis

Student Team Members:

David Michael Gilbert II, Garron Knox,
Aida Tabatabaei, Andrew Lambert

Faculty Advisor:

Dr. Raghu Agarwal

Project Scope and Objectives:

The objectives of this project were to design and manufacture an adjustable suspension setup consisting of components with multiple suspension hardpoint mounting locations. Then, to test numerous different suspension characteristics and collect data that can be used by future teams for a normal competition setup.



Project Results:

1. Frame
 - a. The team designed and ran simulations on a modified frame capable of handling different loading from an H-arm and new shock mounting locations, as well as reinforcing powertrain mounting due to a failure in a previous competition.
2. Front Suspension
 - a. Designing of the adjustable suspension system was done using SolidWorks and Lotus. A kinematic sketch was exported to SolidWorks from Lotus to have suitable mounting tab points for the double wishbone.
3. Rear Suspension
 - a. Similar process was done for the rear H-arms as was done for the front. The cars initially had trailing arms that we replaced with H-arms to accommodate for adjustability.
4. Steering
 - a. An adjustable steering rack and column was designed so that the tie rod location can be changed.
5. Manufacturing
 - a. The team completed the rebuild of the blue car, getting it running as initially designed for baseline testing. The team also assisted in the manufacturing of the 2020 Competition vehicle.

Sponsors: SJSU COE, SJSU Associated Students, COE Central Shop, Micro-Mechanics, Don Beall Foundation, Mass Precision, Pacific Heat Treating Co., Royal Brass, 2Spec Mfg., CRCmfg, Therma, SKF, Lotus, BGS, Briggs and Stratton, Polaris, Lockwood Engineering, BT Laser

Compact Reaction Control System (RCS)

Student Team Members:

Ravi Nidumolu (Team Leader)

David Ayala-Mendez

Brody Lee Yew Fei

Samya Sajidi

Aaron Lim

Faculty Advisor: Dr. Agarwal

Project Scope and Objectives:

1. Create an RCS system prototype that uses compressed air to control the roll of a flight vehicle.
2. Design a testing rig that allows for the user to induce a roll in the assembly.
3. Demonstrate functionality by inducing a roll and utilizing RCS to cancel it.
4. Deliver this functionality in a form that can work within a flight vehicle.

Project Results:

1. Successfully designed and built a functional RCS prototype
2. Created a testing rig allowing for a user to manually induce a roll in the system
3. Demonstrated roll-cancelling ability of RCS
4. Delivered this functionality in a package that will fit inside of a 10" diameter flight vehicle. However, the system is heavier than anticipated.
5. Additional functionality: adding position stationkeeping allowing RCS to maintain a constant orientation in addition to cancelling an induced roll.



Sponsor:

SPEAR (Spartan Engineering in Advanced Rocketry) Club

Autonomous Robot of Delivery

Student Team Members:

Antonio Cervantes - Team Lead
David Dias
Flossie Lau
Gabrielle Dominguez

Faculty Advisor:

Dr. Agarwal



Project Scope and Objectives:

The objective of this project is to build a robot that is able to drive fully autonomously from the Student Union to the Library. The Robot will have an enclosed capsule to deliver food and be able to avoid obstacles within a 12 meter distance. The following are the design goals of each category of the project.

1. Mechanical
 - a. Design and build a rear-wheel-drive drive system with ackerman steering
 - b. Design and build an enclosed chassis with a food compartment that can carry 0.5 m³ of cargo
2. Electrical
 - a. Design electrical schematic for all microcontrollers and sensors
 - b. Develop a breakout board to connect all devices to reduce wires
3. Controls
 - a. Develop a path following and navigation control system
 - b. Design obstacle avoidance logic to compare distances among all sensors
 - c. Use two LED matrix panels to display eyes for robot personality and friendliness
 - d. Design automatic storage compartment for contactless pickup

Project Results:

1. Successful autonomous navigation from Student Union to MLK library
2. Fully functioning obstacle avoidance
3. Secure locking compartment

Sponsors:

KJD Electronics
Tap Plastics
Matterhackers
Laser Mark's

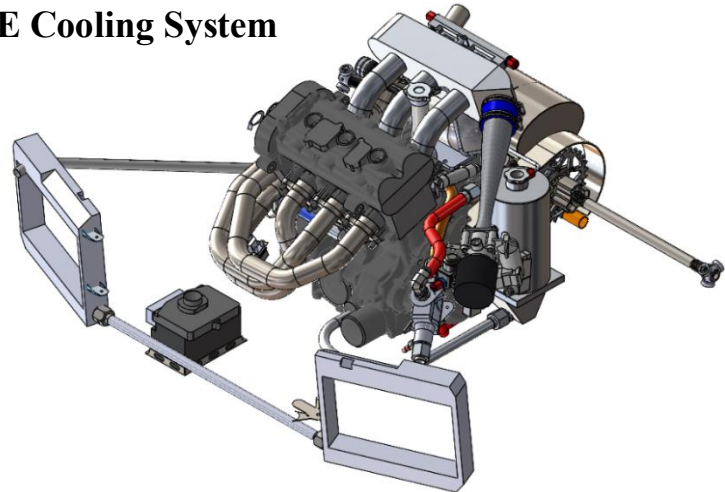
FSAE Cooling System

Student Team Members:

Jagjiwan Phul (Lead)
Chris Hylton
Mitchell Petrell
Jericko Baltazar

Faculty Advisor:

Dr. Agarwal



Project Scope and Objectives:

Develop and design a reliable, serviceable, and light weight cooling system for a Formula style vehicle. Design and engineering analysis is applicable to thermal systems and mechanical systems design; additionally DAQ is essential. The cooling system is able to maintain high load operating conditions in different race environments while keeping system integration with other vehicle components robust.

- 1) Heat rejection:
 - a. 20kW at max load
- 2) Design & manufacture system to integrate easily with all vehicle components
 - a. Oil/Water & Air/Water heat exchanger
 - b. Air/Water heat exchanger
 - c. Water pump
 - d. Overflow tank
- 3) Develop radiator model for future teams

Project Results:

1. Designed cooling system components for a single radiator configuration.
2. Developed a radiator sizing and pump selection program theoretically. Analyzed auxiliary oil cooler performance through CFD simulation.
3. Analyzed pressure losses in system
4. Designed and manufactured mounting hardware for the cooling system components.

Sponsor:

Mishimoto Automotive
Davies Craig
SPAL Automotive USA
San Jose State University – Department of Engineering

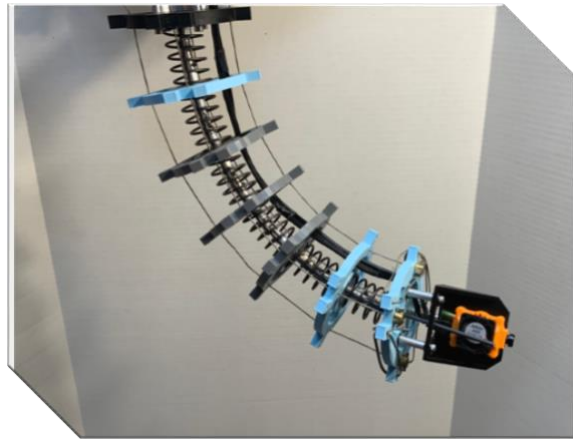
Wire Driven Continuum Robotics

Student Team Members:

Adriane Almiranez
Jeanelle Bentajado
Hung Le
Jason Tran
Peter Truong

Faculty Advisor:

Dr. Raghu Agarwal



Project Scope and Objectives:

To demonstrate the capability and versatility of continuum robotics while innovating methods to reduce costs and make the technology more accessible to more industries and applications. To achieve this, the robot and team will demonstrate the following:

1. Flexibility in motion unmatched by rigid-link robotics
2. Cost effectiveness
3. Documentation of control systems and kinematics

Project Results:

1. Designed and fabricated a functional prototype that satisfied the objectives with the following demonstration modes:
 - a. Object tracking utilizing computer vision
 - b. Pattern tracing utilizing a kinematic model
 - c. Manual control mode through an intuitive GUI
2. Documentation of lessons learned including but not limited to the following fields:
 - a. Control systems tuning
 - b. Kinematic modelling
 - c. Serial protocol and GUIs
 - d. Computer vision
3. Reduced costs in several areas when comparing competing designs

Each of these demonstration modes were designed to reflect possible use cases of continuum robotics in industries and applications such as medical surgery, search & rescue, lab work, etc.

Sponsors:

JeVois – Smart Vision Camera
Overture – 3D Printing filament

Cytek – Hardware
Jabil – Hardware

Ford Rideshare Vehicle Accommodation Device

Team Members:

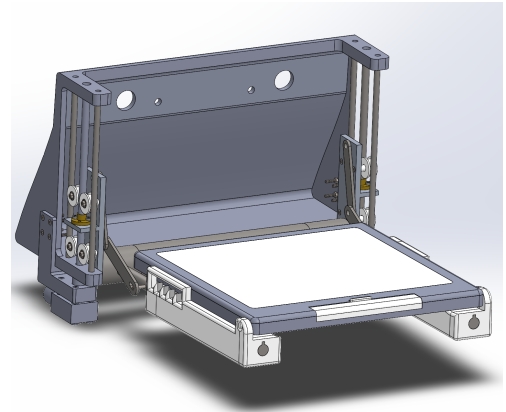
- Karina Gonzalez
- Britney Lockman
- Oscar Lopez De Leon
- Brandon Sirhan

Faculty Advisor: Dr. Raymond Yee

Project Scope and Objectives:

Create an ergonomic and safe device in rideshare vehicles for users to place and utilize their media during rides.

1. Maximum Adjustability
 - Height: the tray can be raised or lowered to fit where the user sits
 - Depth: the tray can be brought closer to the user
 - Angle: allows media to be placed at an angle without the user having to physically hold it
2. Safe for users
 - Automatic breakaway system that drops tray in the event of a collision
3. Easy to use
 - Motorized height adjustability
 - Set angles for quick adjustability
4. Media Friendly
 - Rubber top on tray so that media doesn't slide on surface when vehicle is in motion
 - Fold-out tab at the bottom of tray to keep media in place when tray is angled
 - Pull-out mouse pad



Project Results:

1. Successfully designed and manufactured a physical prototype that meets all of our design specifications
2. Successfully integrated a breakaway system in case of a collision
3. Successfully integrated two motors in order to allow for a height displacement

Sponsor: Ford Motor Company

Collapsible Cup for Hot/Cold Beverages

Student Team Members:

Yvonne De Alba (Team Leader)

Tiffany Chau

Tho Nguyen

Myung-Wha Nakamura

Faculty Advisor: Dr. Raymond Yee



Project Scope and Objectives:

1. Design a reusable, portable cup capable of containing hot and cold beverages
2. Collapsible/expandable design with guiding pins and tracks
3. Temperature insulation via air-gap design
4. Design a magnetic locking mechanism
5. Retains initial beverage temperature of 85°C within 25°C margins in 2 hours
6. Holds at least 12 fluid ounces

Project Results:

1. Designed a 3D printed prototype via HP Multi-Jet Fusion (MJF) that meets Jason Blum's patent criteria.
2. Embedded magnetic locking mechanism at the base of each cylindrical section
3. Used food-safe materials such as FDA silicone o-rings, food-grade silicone adhesive, and PA-12.
4. Reciprocal dynamic o-ring design was implemented to prevent leakage.
5. Insulation design consisting of a copper-lined air gap embedded within each cylindrical section reduced heat transfer and prevented leakage.
6. Data acquisition interface using LabVIEW and Arduino Mega 2560 to record the cup's internal and external temperature with waterproof DS18B20 and NTC 3950 100k thermistors.
7. Experimental results indicated an initial thermal dissipation of $>10^{\circ}\text{C}$ upon dispensing the beverage into the cup, making the temperature objective difficult to achieve.
8. Interim Results:
 - a. Upon dispensing 85°C water into the cup, the water instantaneously loses 12.750°C . After 2 hours, the final temperature of the water is 40.375°C . Total heat loss of water is 31.875°C . Maximum surface temperature is 45.030°C
 - b. Upon dispensing 0°C water into the cup, the temperature instantaneously increases to 3.875°C . After 1 hour, the final temperature of the water is 4.750°C . The total increase in water temperature is 0.875°C . Lowest surface temperature is 10.240°C .

Sponsor: Jason Blum

Collaboration: Multi-Jet Fusion 3D Printing by HP Labs

Test Stand and Blades (TSAB)

Student Team Members:

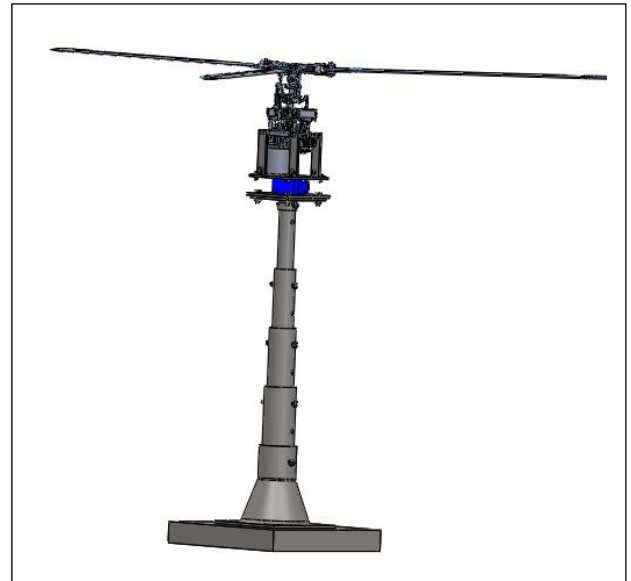
- Michelle Dominguez
- Elizabeth Bautista
- Brenda Senabria

Faculty Advisor: Raymond Yee

Project Scope and Objectives:

Create a test stand and custom rotor blades to spin at different RPMs.

1. Vertically adjustable
 - a. Minimum height of 1ft. from the ground to the blades
 - b. Maximum height of 4 ft. from the ground to the blades.
2. Have a sturdy and functional test stand to conduct load analysis on.
 - a. Use Solid works to design and obtain analysis
 - i. Conduct finite element analysis (FEA)
 - b. Manufacture the test stand through NASA Ames's Machine Shop
3. Laser scan custom rotor blades
 - a. Use computational fluid dynamics (CFD) data to optimize rotor blades.



Project Results:

1. Successfully made a CAD model
2. Conducted FEA analysis
3. Created engineering drawings to send to the shop for manufacturing
4. Successfully designed and optimized custom rotor blades using CFD
5. 3D printed the custom rotor blades

Sponsor: NASA AMES Research Center

Enclosed Avocado Cutter

Student Team Members:

Dan Nguyen (Team Lead)

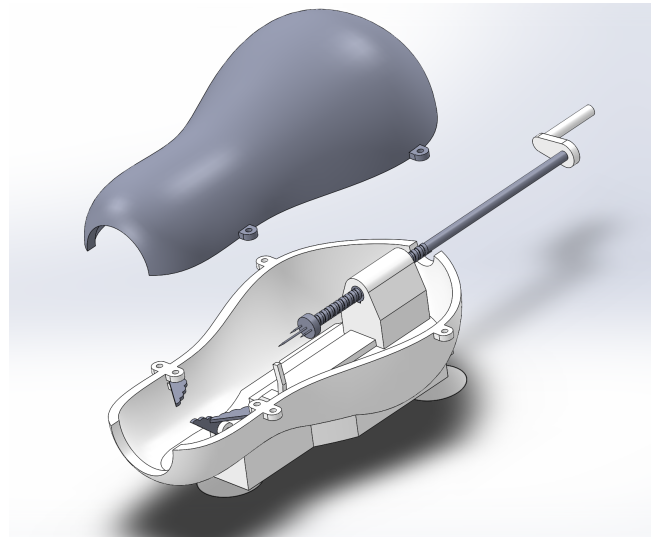
Griffin Janigian

John Vang

Alber Amaya

Faculty Advisor:

Dr. Raymond Yee



Project Scope and Objectives:

Provide a safe and simple alternative to the current avocado peeling devices on the market.

Device will be fully enclosed and accommodate varying avocado sizes.

1. Design Specifications:
 - a. Length of 10-13 in.
 - b. Lightweight (2-3 lbs.)
 - c. Handle dishwasher temperatures (130°F-170°F or 55°C-75°C)
 - d. Food safe material per the FDA
 - e. Impact resistant from average counter height (3 ft.)
2. Process:
 - a. Peel with spring loaded blade
 - b. Slice into quarters
 - c. Remove flesh from pit

Project Results:

1. Team successfully designed an enclosed avocado cutter that meets design specifications, but was unable to complete a working prototype.
2. We have analyzed what we could have done better or completed with more time.

Sponsor:

Dr. Raymond Yee

Title of the Project

Team Members:

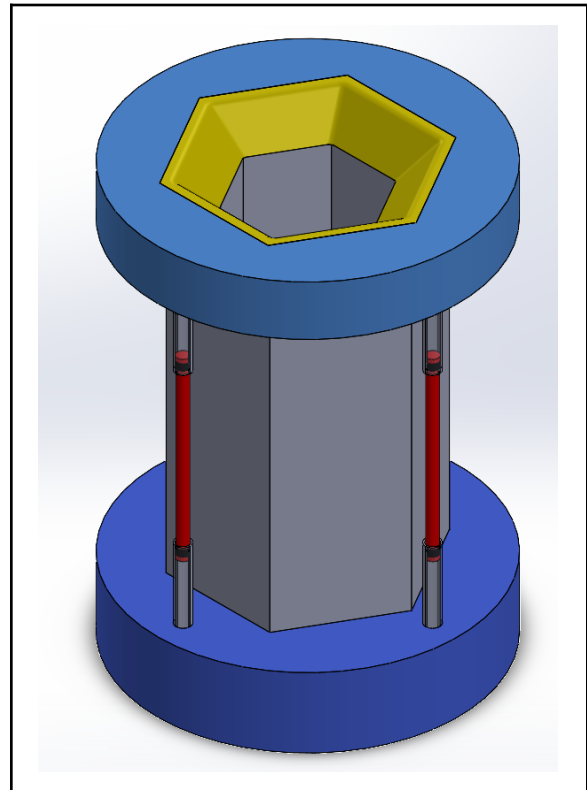
Abel Bandala
Cole Green
Alfonso Rios-Ochoa
Takeru Saigo

Faculty Advisor:

Dr Raymond Yee

Project Scope and Objectives:

1. Contains a minimum of 12 fl-oz.
2. Collapsible: desired volumetric reduction of 50%.
3. Maintain the initial temperature of a fluid at 95°C within a 25°C range for a 2-hour period.
4. Container must be leak proof.
5. To lock the cup in its collapsed position we need to use a magnetic locking mechanism (patent basis).

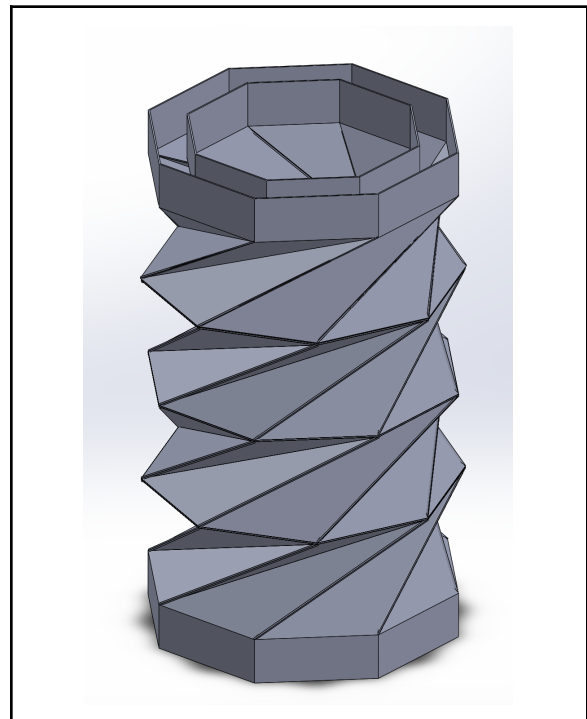


Project Results:

1. Prototype that meets or exceeds objectives 1 and 4; almost meets objective 3 maintaining 30°C range in 2.5 hours.
2. Prototype that meets or exceeds objectives 2 and 5 with a volumetric compression of approximately 90%.
3. Full solidworks model of all assembly parts for 3D printing.

Sponsor:

Jason Blum
San Jose State University - Department of
Engineering



3D Printing Recycling Machine

Student Team Members:

Marcela Puerta (Team Lead)

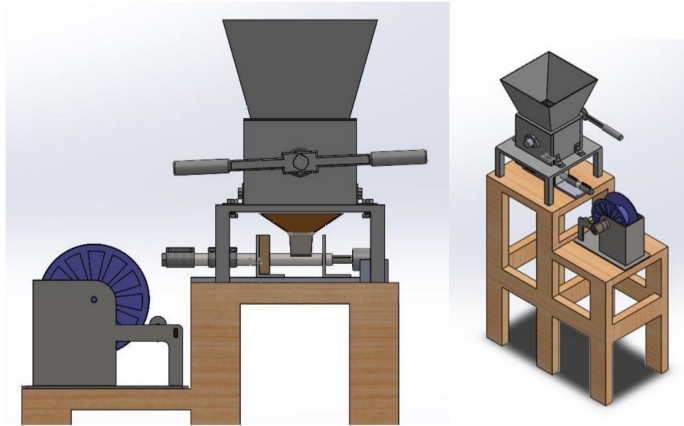
Arafat Aljabari

Kirby Luk

Jesus Saucedo

Faculty Advisor:

Dr. Raymond Yee



Project Scope and Objectives:

To build a machine capable of recycling ABS and PLA parts into usable filament. This filament would be used to repurpose plastic material to 3D print future parts.

1. Grinder shaft should:
 - a. Spin at 60 rpm to produce desired torque with a 2 hp electric motor
 - b. Break down 3D printed parts to less than 5mm
 - c. Lead shredded parts into the extruder
2. Extruder should:
 - a. Reach a temperature of 230F for ABS and 180F for PLA plastics
 - b. Spin motor continuously to crush plastic pellets
 - c. Extruder a filament diameter of 1.75mm
3. Winder should:
 - a. Wind filament at 0.067m/s
 - b. Be able to cool down filament to reduce warping
 - c. Develop a removable spool for ease of transferability into 3D printer

Project Results:

1. Successfully design and built a functional prototype that meets all the design specifications
2. With a 30:1 worm gearbox it was possible to reduce the 1800 RPM to 60 RPM.
3. Successfully incorporate all systems into one assembly

Sponsor:

Petr Khromov

C-BAND ULTRAVIOLET FOR SURFACE DISINFECTION

Student Team Members:

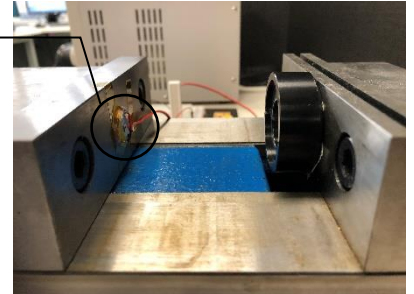
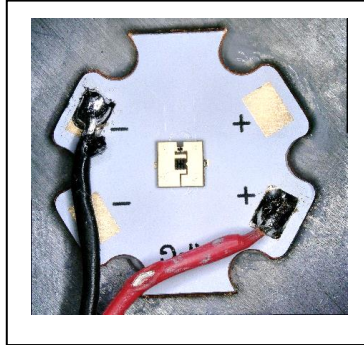
Dhonald Gatpo (Team Lead, ME)

Rupinderjit Virk (EE)

Ngoc Tu (BME)

Faculty Advisor: Dr. Raymond Yee

Jabil Advisor: Corey Smith



Project Scope and Objectives:

Develop a hardware/software add-on to a commercially available system for cleaning and sanitization.

1. Feasibility
 - 99% disinfection rate by delivering $3\text{mJ}/\text{cm}^2$ of Ultraviolet energy
 - Ability to detect humans and prevent human exposure
2. Addition of electrical and thermal components
 - Dissipate 3.5W of heat per LED to extend its life
 - Plug-in module to an existing 48V DC power supply
3. Integrate to the *Badger* robot without suppressing any of its pre-existing functions in a grocery store environment.

Project Results:

1. The team successfully created a simplified but functional model that performs Ultraviolet light treatment for surface disinfection.
2. The team determined the reasonable exposure time and target distance required to cover a grocery aisle.
3. The team successfully designed a mounting heat sink, a direct plug-in printed circuit board, and a kill switch concept to prevent human exposure from the high-intensity LED.

Sponsor:

Jabil Blue Sky

Spartan Superway 10 m Track: Passive Y-Switch (PYS) and Location Awareness

Student Team Members:

Brandon Fong (Team Lead)
Huan Le
Collin Rikkelman
David Le
Lam Nguyen
Andres Garzon

Faculty Advisor: Dr. Burford Furman

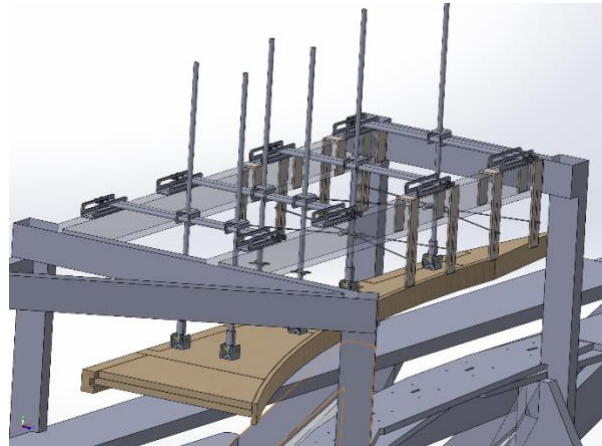
Project Scope and Objectives:

Design and implement a PYS, build and install location awareness, and design a charging station

1. The PYS should allow a bogie to traverse between the inner and outer loops of the track
2. The PYS should be able to withstand the combined impacts of a bogie (17 lbs) moving at 2 mph and a rotating switch arm
3. The PYS should also withstand the stress imposed by the switch arm
4. Location awareness should detect a moving bogie's location on the track every 2 m
 - a. The bogie's velocity should also be calculated throughout the track.
5. The sensors used to achieve location awareness should be powered with the on-site 48 V battery.
6. The charging station will be powered from the rooftop PV panels
7. The deliverables for the PYS are:
 - a. Supporting calculations
 - b. Technical drawings
 - c. Motion study
 - d. Tested and implemented PYS
8. The deliverables for location awareness are:
 - a. Wiring diagrams
 - b. Software code

Sponsors:

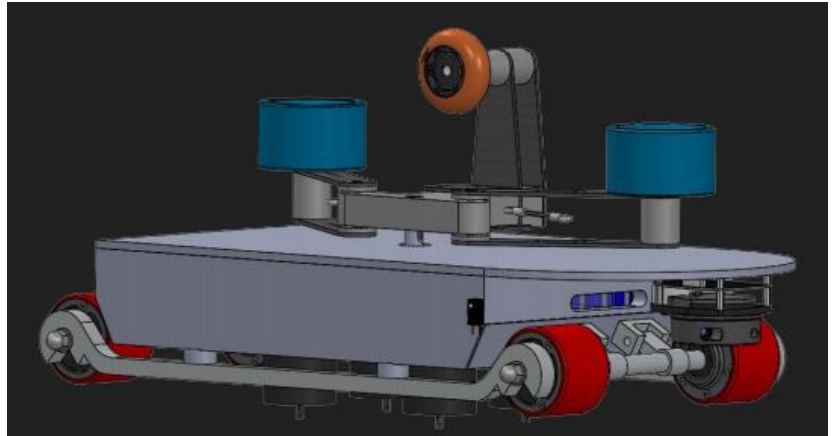
Spartan Superway, International Institute of Sustainable Transportation (INIST), and Swenson Builders



Spartan Superway Bogie Chassis Team

Student Team Members:

Andrew Alkakos
Devin Wong
Max Marinovich
Michael Gee
Alex Kraus
Carlos Nava
Husain Bootwala
Jake Bondar
Kristian Buenconsejo



Faculty Advisor: Dr. Burford Furman

Project Scope and Objectives:

Design a bogie chassis that carries its energy supply and operates under wireless control while withstanding a designated load on the 10 m scale model guideway.

1. Create a bogie chassis that allows mounting of motors, energy storage, switching mechanism, wayside power pick up, and sensors.
2. Design suspension system that dampens vibrations and provides stability to the bogie chassis while in dynamic motion.
3. Utilize sensors to continuously monitor the bogie chassis' state and position and integrate with IOT to make code compatible with user interface.
4. Manage the battery system to adequately provide power to the motor, switch arm, and control system.
5. Bogie chassis must be compatible with the track team 10-meter model guideway, switch arm design and IOT in order to integrate the Spartan Superway teams together

Project Results:

1. Successfully designed multiple iterations and assemblies of boogie chassis using CAD.
2. Successfully simulated finite element analysis and force-damper suspension model.
3. Successfully established wireless control of movement using MQTT communication.
4. Successfully designed battery packs to adequately power sensors and motors.
5. Successfully completed motion analysis incorporating multiple team's designs.

Sponsors:

San Jose State University, Spartan Superway, SJSU Facilities and Machine Shop, mentors at the Superway Design Center, International Institute of Sustainable Transportation (INIST), and Swenson Builders

Switching Mechanism for the Spartan Superway Bogie

Student Team Members (Role):

Kris Gonzalez (Team Lead / Electrical)
Jesse Kavros (CAD)
Ian Gieger (CAD)
Emilio Cruz (CAD)
Yanzhen Chen (Electrical)
Jose Bravo (Electrical)
Jingwen Tan (Programming)
Andrew Poli (Programming)
Jake Espinoza (Programming)

Faculty Advisor: Dr. Burford Furman



Project Scope and Objectives:

Design and manufacture an attachment for the Superway Bogie chassis that will allow it to switch routes automatically through a model guideway.

1. Design a switch arm that can support the forces applied during the turn.
 1. Capable of supporting 5 Nm of torque.
 2. Capable of holding 543 N of force when rotate in 180 degrees.
2. Programmable to prepare and initiate turns automatically.
 - i. Successfully rotate into position in < 1 second.
 - ii. Calibrate Switch Arm to home position.
 - iii. Able to communicate with the master microcontroller on the Superway Bogie to receive data
3. Designed to be able to mount to the Superway Bogie without interfering with internal designs.
4. A custom PCB incorporates the circuit and all the electric components to realize the switch arm functionality and optimize space simultaneously.
5. The PCB must be able to operate all of our electronic hardware with the primary focus of the board being able to switch within microseconds at a moment's notice.

Project Results:

1. Successfully constructed the electrical schematics controlling the Switch Arm.
2. Successfully created a working PCB for the Switch Arm.
3. Successfully manufactured physical Switch Arm to be mounted on Superway Bogie/chassis
4. Successfully developed software to enable control of the Switch Arm hardware.

Sponsors:

Spartan Superway, International Institute of Sustainable Transportation (INIST), and Swenson Builders

SPARTAN Superway: IoT Enabled Docking Station

Student Team Members:

Phuc Tran (Lead),
Yit Voon Yap,
Pedro Serenini,
Jacob Villanueva

Faculty Advisor: Dr. Burford Furman

Industry Advisor: Ron Swenson

Sponsors: Ron Swenson, Swenson Builders,
INIST, SJSU

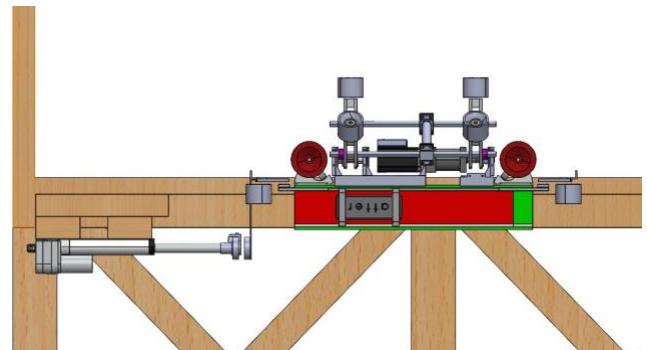
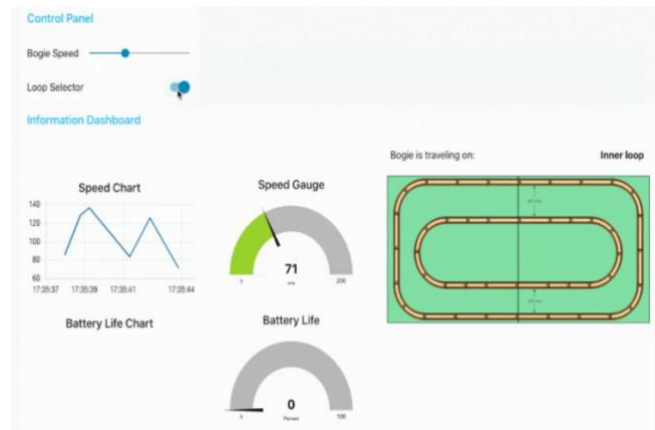
Project Scope and Objectives:

Design a charging/docking system in the run-off of the 10-meter model track that monitors and sends the bogie's location and charging information into a single dashboard. The system will include a docking solution such that when the bogie is in the charging position it will remain fixed in place with no assistance from the bogie's motors.

1. Develop a remote dashboard that displays collected data:
 - a. Must share charging statistics and bogie related information in real time
 - i. Safely monitor voltage and current of the 4 x lead acid 12V batteries that are in series used for the charging station
 - b. When the bogie is docked (in the charging position) our system tells core team's dashboard (through MQTT) that the bogie is in position to charge
 - c. System is able to run on existing wireless network with its own server
 - d. Develop backend and front end of dashboard to display collected data
2. Design a system to properly dock the bogie at the same position every time:
 - a. Must have an accuracy of +/- 1.0cm
 - b. Can monitor position of the bogie with an accuracy of +/- 2.0cm
 - c. Microcontrollers and other electronics used must be powered by either 12V or 24V line and secured to the track in an accessible location (Power through Solar Panels)

Project Results:

1. Successfully developed a functional dashboard for the charging/docking system.
2. Successfully developed and installed a docking system on the Spartan Superway 10-meter track that meets (or exceeds) all of the design specifications.
3. Successfully established a connection between charging/docking station's dashboard and bogie's dashboard to exchange data in real time.



The Design and Fabrication of an Assistive Luggage Porter (A Motorized, Stair-Climbing System)

Student Team Members:

Alessandro Tognaccini (Project Leader)

Elenna Lie

Islom Muminov

Faculty Advisor:

Dr. Vimal Viswanathan

Project Scope:

The Assistive Luggage Porter team designed and fabricated a motorized, sensor-operated, stair-climbing mechanism to transport luggage up and down staircases for the elderly and people with limited abilities.

Project Objectives:

- Climber Design
 - Design a unique climber system to navigate a U.S. standardized staircase.
- Structure Design
 - Optimize design for a maximum 50 lb. suitcase load in addition to the mechanism itself.
 - Design for portability and collapsibility to be carried around its environment.
 - Design for quick attaching and detaching to a suitcase with minimal user steps.
- Overall Design
 - Design a system to bear the majority of the suitcase load for the user.
 - Design a quick attach/detach controller box to serve as the user interface.
 - Implement an ON/OFF power switch to cut power to the system when not in use.

Project Results:

- Successfully designed and fabricated a fully collapsible, functional mechanism.
 - Circuitry and code are fully integrated and work as intended.
 - Climber wheels are able to grip and traverse steps without overloading motors.
- Confirmed that the design is feasible and achievable with available materials such as 3D printed and laser-cut components.

Sponsor:

Student Self-Funded



Design of a Lower Orthotic Assistive Device (LOAD)

Student Team Members:

Stephanie Torres (Team Lead)

Joel Maniago

Alfred Cenidoza

Dominic Scalero

Andrew Cenidoza

Faculty Advisor: Dr. Vimal Viswanathan

Project Scope and Objectives:

Design and build a lower extremity assistive device to assist the sit-to-stand motion to lessen the strain felt on the midsection, as well as the main leg muscle groups for elderly people with lower body pain, patients in rehabilitation, and amputees.

1. Derive the kinematic and force equations for an assistive portable chair to find the maximum force that can be applied to the chair.
2. Design a control system to lift the seat as the user is standing.
3. Design and build a small-scaled prototype:
 - a. Capable of supporting the two-thirds of 175lb person using exercising weights
 - b. Within one semester
 - c. Capable of being portable and being able to attach to a chair

Project Results:

1. Successfully derived the kinematics and force analysis equations.
2. Successfully designed a complete control system to assist with sitting to standing.
3. Successfully built a two-thirds small-scale prototype demonstrating the proof of concept.

Sponsors:

Professor Vimal Viswanathan



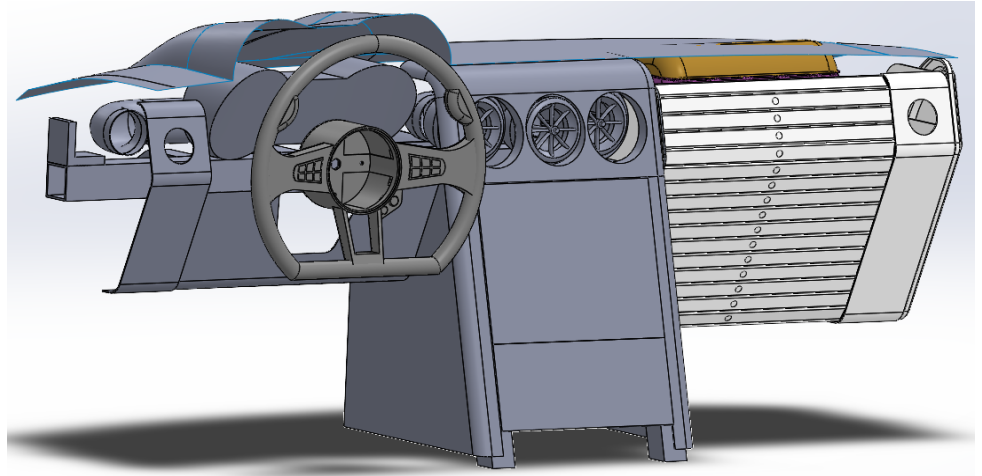
Redesign of a Complex System

Student Team Members:

Tanmay Gupta
Nishan Natt
Alex Ponce
Joseph Chun Jun Park

Faculty Advisor:

Dr. Vimal Viswanathan



Project Scope and Objectives:

Redesign the complex system of a passenger vehicle instrument panel and its inner components and implement new designs and features while meeting Ford's safety requirements.

Project Results:

1. CAD model of the complex system assembly
2. CAD drawings of individual components
3. FEA analysis of force loads and natural frequencies
4. Manufacturing methods, materials, etc..

Sponsor:

Ford Motor Co.

Design and Fabrication of a Compliant Mechanism for a Passenger Vehicle

Student Team Members:

Alvin Chu
Steven Imoek
Brian Ngo
Nicholas Phan

Faculty Advisor: Dr. Viswanathan

Project Scope and Objectives:

This project is primarily focused around creating a replacement button mechanism that involves additive manufacturing and compliant mechanisms. The purpose is to develop a cost-effective button design that reduces assembly cost and the complexity of designs.

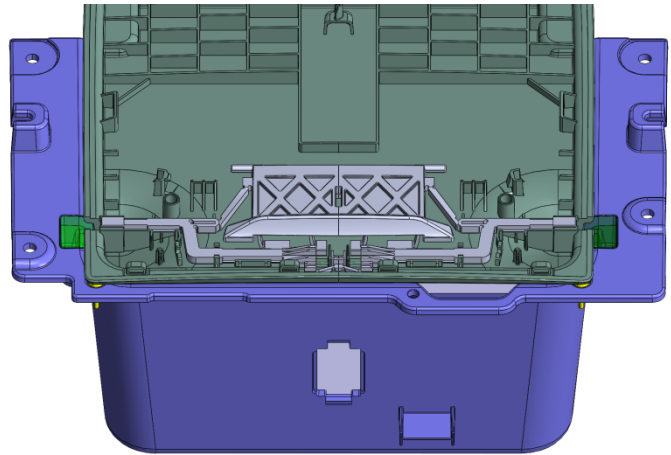
1. Button Design
 - a. Create and design a monolithic part for Multijet Fusion (MJF) printing
 - b. Satisfy all engineering and design requirements determined by Ford
 - c. Validate design using CAE analysis
 - d. Ensure design can be manufactured efficiently using MJF through nesting optimization
2. Testing
 - a. Meet all durability requirements determined by Ford
 - b. Verify the button is still functional after fatigue tests
3. Business Case
 - a. Develop a cost model that compares the injection molded design versus additively manufactured
 - b. Demonstrate the viability of the mechanism at various production volumes

Project Results:

1. Successfully created a functional prototype that meets all design requirements and close to all engineering requirements
2. Proved that additive manufacturing provides opportunity at low-to-medium production volumes

Sponsor:

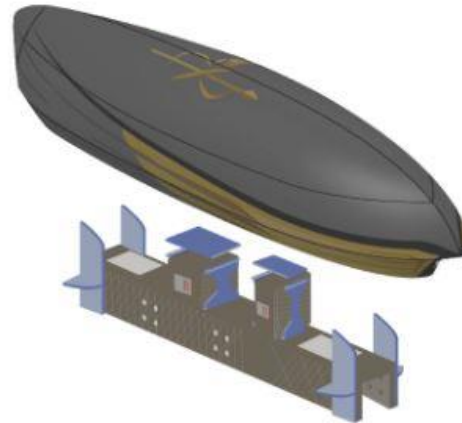
San Jose State University - College of Engineering
Ford Motor Company, Greenfield Labs - Siddharthan Selvasekar



Testing and Fabrication of an Aeroshell for the Spartan Hyperloop

Team Members:

Calvin Phan (Team Leader)
Connor Jackson
Kenneth Cai
Walker Kellog
Eddie Kuo



Faculty Advisor:

Dr. Viswanathan

Project Scope and Objectives:

Test and build an Aeroshell. Simulate performance and validate drag coefficient. Create molds to fabricate a carbon fiber Aeroshell. Create mounting attachments for shell/chassis.

1. Aeroshell
 - a. Validate Aeroshell profiles for best performance and lowest drag coefficient
 - b. Split Aeroshell into multiple parts in order to prepare for mold
 - c. Manufacture foam molds
 - d. Layer and cure carbon fiber sheets into molds
 - e. Affix multi-part shell into Aeroshell assembly
2. Mounting Mechanisms
 - a. Provide medium between chassis and Aeroshell
 - b. Machine parts from steel sheets

Project Results:

1. Determined profile that delivered best performance in simulation
2. Successfully split and readied Aeroshell for foam molds
3. Successfully machined mounting mechanisms
4. Successfully 3D printed buffer covers for steel mounts
5. Received \$12,000 in funding

Sponsors:

San Jose State University - Spartan Hyperloop
TMI

Spartan Hyperloop: Chassis

Student Team Members:

Chassis Team:

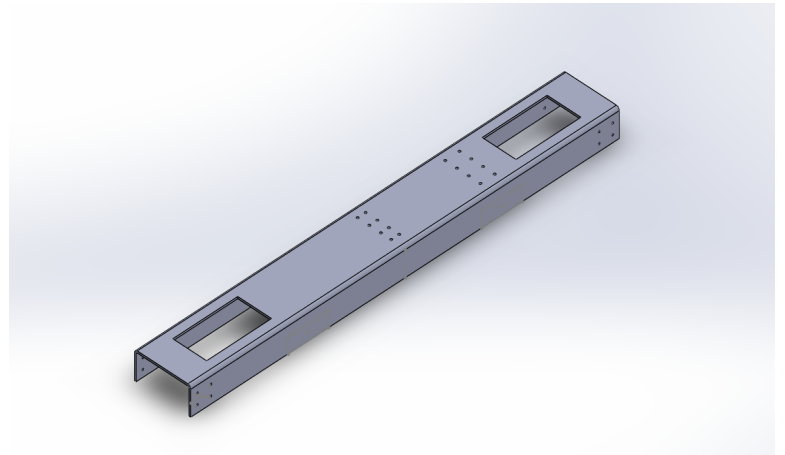
Hoang Bruno Hoang (Lead)

Tyler Miltenberger

FEA Team:

Brian Checa (Lead)

Nick Karnow



Faculty Advisor:

Dr. Vimal Viswanathan

Project Scope and Objectives:

Provide a list of objectives

1. CAD Modelling
 - a. Model that properly fits I-beam
 - b. Designed around other Hyperloop components, i.e., mounting holes, attachments, etc.
 - c. Aeroshell attachments/mounting
 - d. Battery enclosure attachment/mounting
 - e. Linear stability adjustment to fit new placement
2. FEA
 - a. Effective structural meshing
 - b. Static structural Analysis
 - c. Transient Structural Analysis

Project Results:

1. Solidworks models of the chassis
2. Solidworks master assembly that interfaces other subteams with Chassis
3. FEA simulations
4. Chassis restructure of mounting locations
5. Full documentation and analysis of project work

Sponsor:

Spartan Hyperloop

San Jose State University - Department of Engineering

Spartan Hyperloop Battery Enclosure

Student Team Members:

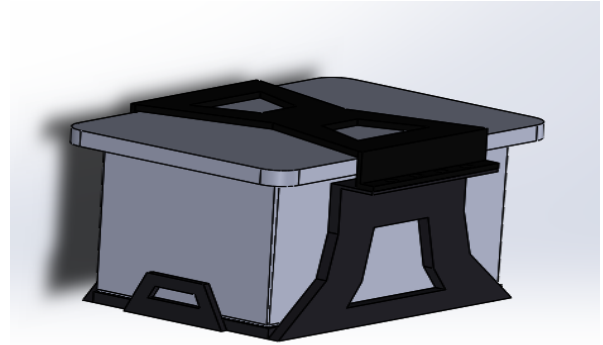
Tim Huang (Team Lead)

Phuc Do

Jose Ramirez

Faculty Advisor:

Vimal Kumar Cherickal Viswanathan



Project Scope and Objectives:

The scope was to work with the other teams of the Hyperloop project to have a functional prototype and reach the established goals. The objective of the project was to design an enclosure that will:

1. Maintain an internal operating pressure of 1 atm while also preventing ingress or pressure leakage
2. Be sufficiently mounted to the chassis in the most optimal location
3. Combat high speed and loads applied to the batteries by providing a better battery bracing mechanism
4. Have a functional electrical interface for the Hyperloop battery enclosure.

Changes that occurred during manufacturing

1. Location of the battery enclosure on to the chassis
2. Hyperloop battery enclosures were made out of wood, instead of carbon fiber.
3. Battery Holders were produced out of steel instead of Aluminum.
4. Electrical interface production was stalled due to Covid 19.

Project Results:

1. Hyperloop battery team successfully designed and manufactured a functional battery enclosure prototype that meets all the design specifications needed for the project
2. Battery Holders were manufactured to successfully brace the battery in case of heavy vibration
3. Clear documentation with GD&T, Solidworks drawings, team report, stress simulation were completed leaving a clear and concise path for next year's team.

Sponsors:

San Jose State University - Department of Engineering

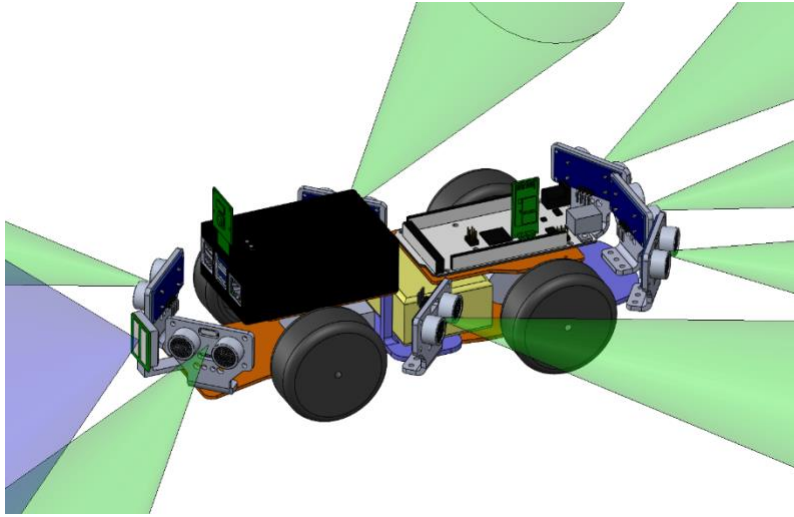
Vehicle Advanced Driver Assistance Systems Development Platform

Student Team Members:

Joshua Bevis – Team Lead
Everardo Aguilar
Ana Chang
Noah Dubois
Justin Leung
Paul Zahorsky

Faculty Advisor:

James Mokri



Project Scope and Objectives:

Design, simulate, test, and prototype Advanced Driver Assistance Systems (ADAS) for a vehicle to investigate and test sensor and control theory using an RC vehicle as a development platform.

1. ADAS Systems & Sensors
 - a. Blindspot Monitoring w/ Ultrasonic Sensors
 - b. Active Cruise Control w/ RADAR
 - c. Emergency Braking w/ RADAR and Ultrasonic Sensor Fusion
 - d. Lane Departure Assist w/ Camera
2. Simulation & Control
 - a. Simulink model of physics-based vehicle and sensor suites
 - b. Simulink model of controllers for tuning and testing
 - c. PID and Bang-Bang control methods
3. Communicate control signals and sensor data wirelessly via Bluetooth

Project Results:

1. Fully modelled MATLAB and Simulink simulations of sensors and controllers
2. Built 3D-rendered environment and vehicle to demonstrate ADAS models
3. Completed hardware prototype ADAS vehicle and sensor suite
4. Demonstrated ADAS performance in-hardware

Sponsor:

Independence High School, San Jose State University

Automated Gravel/sand Bag Handling Machine

Student Team Members:

Gregoire Labat
Louis Kwong
Juan Calderon
Nghia Nguyen (Peter)
Cory Nguyen

Faculty Advisor:

Mr. James Mokri

Project Scope and Objectives:

Design, build, and test a prototype robotic machine to open and feed bags into an existing large-scale trailer mounted system which produces filled and sewn gravel/sand bags for use on flood control projects and other applications.

Redesign the prototype bag feed assembly, built by last year's ME195 team making it more functional, faster, reliable and suited for harsh dusty environments.

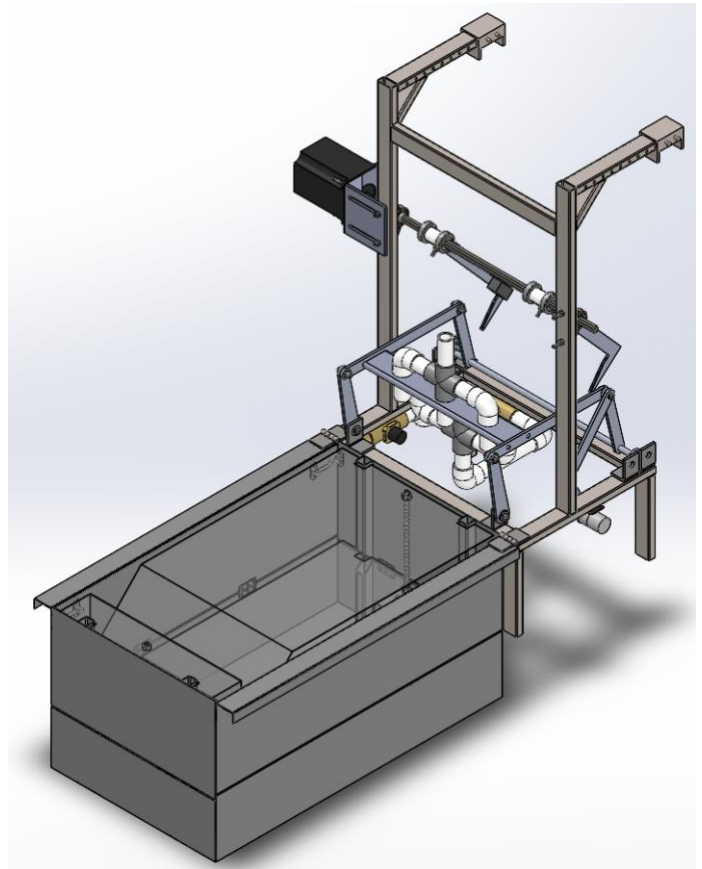
Build and test the robotic bagger prototype consisting of four sub-systems: cassette bag-feeding sub-system, automated vacuum head subsystem, finger clamping mechanism, and four-bar linkage mechanism.

Project Results:

1. Successfully built a lifting mechanism and support structure for the vacuum system using Medium Density Fiberboard (MDF).
2. Successfully built the cassette frame using MDF and currently working on the electronic hardware and software aspect of the system.
3. Successfully rebuilt the four-bar mechanism and currently working on the fixture of the top vacuum.
4. Successfully built a new concept of the finger system and currently working on the installment of the parts.

Sponsors:

Mr. Tom Burns - Golden Gate Mechanical, Santa Clara
San Jose State University - Mechanical Engineering Department



Retractable Wheelchair Shuttle Bus Ramp

Student Team Members:

Vanessa Jimenez, Tyler Seawright, Freya Start,
Andrew Leung, Emma Moyer

Team Lead: Vanessa Jimenez

Faculty Advisor: Professor James Mokri



Underside of ramp assembly in stowed position, showing important electronic and mechanical components attached to the fixture that mocks the shuttle chassis.

Project Scope and Objectives

Scope:

- Manufacture, build, and test prototype of mechanical and electrical components ensuring that they meet project specifications
- Demonstrate working prototype to sponsors
- Provide complete and full documentation of all work done for the project to the sponsor
- Complete and submit deliverables to sponsor on or before deadlines

Objectives:

- Manufacture and build a motorized wheelchair ramp assembly that deploys/retracts on one side of a shuttle bus (replicable on other side) that is ADA compliant and suitable for handicapped individuals
 - Manufacture and order all mechanical/electrical parts
 - Build electrical circuit for project, complete with source code and functional components
 - Build and demonstrate functional prototype assembly on a mock chassis
 - Complete testing throughout prototype build process and make any necessary modifications for expected functionality

Project Results

1. Successfully designed, manufactured, and assembled a ramp prototype that meets space and ADA requirements at a competitive cost
2. Demonstrated proof of concept for ramp design using lead screw actuation, stepper motor controls, and small linear actuators for deployment and retraction on mock chassis
3. Established software relationships with electrical signals and mechanical components, created safety checks, and defined calling triggers

Sponsor: Dr. Fred Barez and the Toyota Motor Corporation

Pneumatishift: Automotive Pneumatic Shift System

Student Team Members:

Logan Palmer (Team Leader)
Julian Scott
Irina Kim
Gongyu Hui

Faculty Advisor: Professor Mokri

Project Scope and Objectives:

Design and build a pneumatically shifted transmission system for a manual, vintage Porsche 911 to provide an alternative method of motorsport driving.

1. Design several subsystems within the project scope:
 - a. *Gear Selection* is the main system controlling the transmission for upshifts and downshifts using pneumatic pistons interfacing with the microcontroller.
 - b. *Clutch* design interfaces with the vehicle's lever arm to engage and disengage during induced gear shifting inputs.
 - c. *Wheel Speed Sensing* system is designed using a Hall-effect sensor to monitor speed and direction of the car during operation.
 - d. *Shift Paddle and Steering Wheel* is custom designed to interface as input to the other subsystems.
2. Meet the following specifications:
 - a. Requires no permanent vehicular modifications and is modularly implementable.
 - b. Applicable to any vehicle utilizing hand controls for the throttle and brake.
 - c. Capable of shifting conventionally or using the paddle shifter.
 - d. Able to hit a 400 ms target shifting time.
3. Perform stress analyses on the pneumatic cylinders during high-stress, brake and/or throttle application using mathematical and FMEA methods.
4. Manufacture/test all designed parts and components to produce a successful prototype.



Project Results:

1. On an ambitious schedule and scope, designed and tested successfully a system capable of shifting a manual transmission.
2. Adequately designed the system to control the clutch.
3. Met most of the outlined specification goals for the project.
 - Shifting times are more than 400 ms; however, this minor aspect is caused by inherent vehicular transmission design limitations that prevent quick shifting.
4. Utilized simulation software to analyze and predict aspects of the system.
5. Manufactured and acquired nearly all major parts and components to produce a working prototype representing the project's goal.

Sponsors:

Bimba Manufacturing
Kundensport

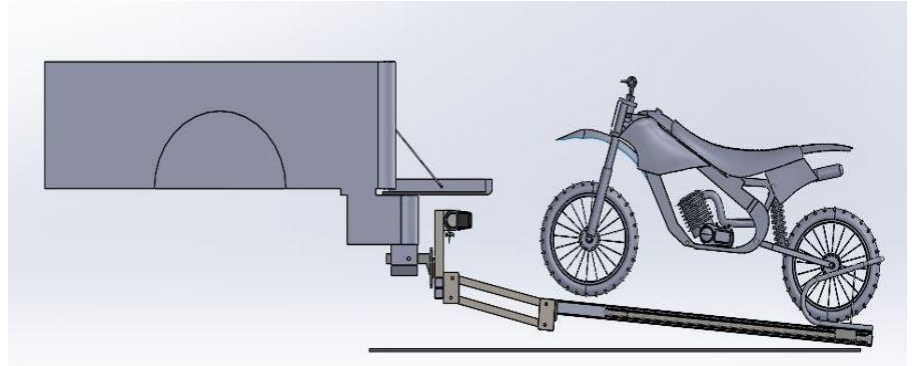
Groth Engineering
LTA Research and Exploration

Gypsy Rack

Motorcycle Lift & Load Apparatus

Student Team Members:

Ornin Akeryans
Jesus Sanchez
Marc Sanders
David Strunz
Tony Velasco



Faculty Advisor: James Mokri

Project Scope and Objectives:

Design and build a motorcycle lifting and loading apparatus that will allow the user to safely and efficiently load a motorcycle into a full-size pickup truck.

1. Design a four-bar mechanism with the capability to lift a motorcycle.
2. Conduct graphical synthesis to determine the correct length/position of the four-bar mechanism linkages.
3. Perform finite element analysis and kinematic analysis on the four-bar mechanism and ramp to determine the correct selection of material and hole locations.
4. Design and build a motorcycle lift and load apparatus that meets the following specifications:
 - a. Compatible with any full-size pickup truck
 - b. Ramp surface must be parallel to the bed of the truck
 - c. Capable of lifting a 300lb load
 - d. Maximum ramp angle of 5°
 - e. Must utilize a winch to raise/lower the ramp
 - f. Capable of being disassembled by two individuals for transportation

Project Results:

Successfully completed the following:

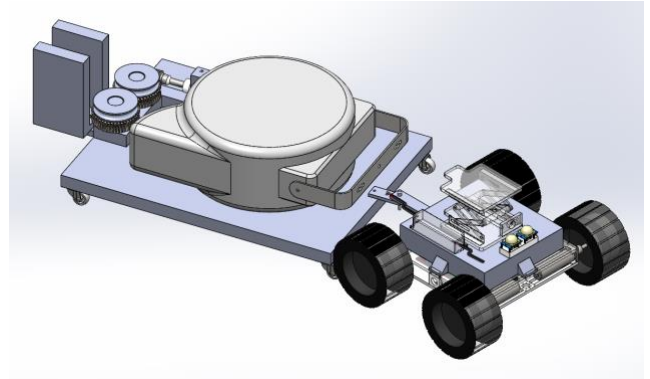
1. Designed four-bar mechanism
2. Completed necessary finite element analysis (FEA) and kinematic analysis
3. Fabricated lift and load apparatus to design specifications
4. Tested lift and load apparatus that meets/exceeds all design requirements

Sponsor(s): Steve Vergano (Motiontekv)

Automated Electric Vehicle Charging Robot

Student Team Members:

Phillip Bui
Jonathan Castro
Michelle Duong
Omar Gaona
Kenny Lu



Faculty Advisor: Professor James Mokri

Project Scope and Objectives:

Design and build an autonomous robot that detects an electric vehicle and its modified receiver at the bottom of the vehicle and lifts up a transmitter to charge the vehicle's battery.

1. Design a power supply system that would power the robot through an outlet as opposed to batteries.
2. Design a two-step navigation system to bring the robot underneath the sponsor-built receiver.
 - a. GPS Navigation
 - b. IR Navigation
3. Design a mechanical system that would raise and lower the sponsor-built transmitter.
4. Design a mechanical system that would allow for constant power to the robot without limiting its mobility.

Project Results:

Completed the following:

1. Connected the GPS and IR modules to the robot's navigation system.
2. Simulated a waypoint navigation path using MATLAB Simulink.
3. Linked the robot to a smart phone via bluetooth, giving users RC use.
4. Designed and implemented the power supply system to power the robot's functions from an AC power source and availability to charge the EV Battery.
5. Fabricated a jacking system that elevates and lowers the transmitter to engage the receiver mounted under the vehicle.

Sponsors:

Kevin Cameron, Chris Novak and Ray Shilling

Energy Analysis of Water-Cooled Photovoltaics and Waste Heat Water

Student Members:

Adonis Red Lacson

Hoang Nguyen

Tue Pham

Trinity Chao

Samuel Simmons

Advisor: Dr. Sohail H. Zaidi



Project Scope and Objectives:

- Simulate and implement a method to exchange heat energy from a solar panel to flowing water and analyze the outcome.
- The critical component of our project is the heat exchanger, referred to as the "water block", which interfaces with the back of a large size commercial solar panel.
- The water block allows water to directly contact the back of the solar panel. The water block design simplifies both the calculations and the simulation. This simplification is achieved by minimizing the interfaces for heat transfer and by keeping the geometry basic.
- The recirculation system supplies the water block with cool water by means of a pump and an aluminum radiator which is cooled by forced air.
- The system is controlled to keep the temperature of the water output from the water block at about 40 degrees C. Temperatures from 32 thermocouples are monitored by two custom, open-source printed circuit boards (PCBs) with surface mount chips (SMCs) in combination with two raspberry pi computers and python programs which record and wirelessly transmit all data.
- A control panel and the test panel are mounted on a 10-degree ground mount which was designed to simulate the common mounting practice for flat-roof, commercial arrays in Santa Clara county.
- Simulations are performed ANSYS Fluent utilizing several libraries to yield results for the steady state and transient state scenarios of the panel and water block combination. Specific parameters are also set to account for the solar conditions and fair weather conditions due to San Jose State's geographic location.

Project Results:

- Initial leak evaluation was completed. The previous epoxy solution failed and caused both separation as well as deformation of the water block.
- Mechanical seal solution using a custom made rubber gasket was identified to be the most optimal solution in order to address the bend in the water block.
- The water block is successfully leak free and the recirculation system is fully operational.
- Simulation results appear reasonable.
- Raspberry Pi remote access had to be redone using VNC Viewer
- Two custom PCBs (Thermoboards) were assembled, tested, and validated to be fully operational.
- Thermocouples are installed and calibrated for the operations.
- All components were designed, fabricated, and installed on the solar deck.

Characterization of a DBD Plasma Jet for Wound Healing & Sterilization of Chronic Wounds

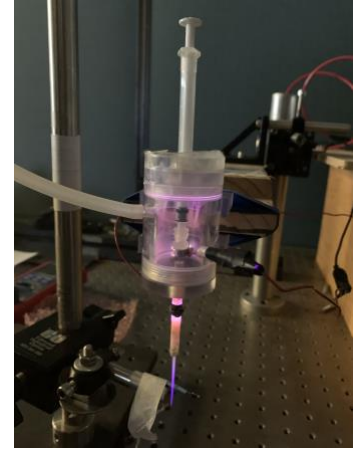
Student Team Members:

Kathy Hoang
Michael Banga
Anthony Suman

Faculty Advisor: Sohail H. Zaidi

Project Scope and Objectives:

A dielectric barrier discharge (DBD) plasma jet needs to be characterized and optimized using Helium gas at various operating conditions by measuring plasma plume temperatures, lengths, input powers, and plasma radical emission lines. A new design is needed to eliminate the limitations of the current design as well as allow for inputs of various gases.



- To characterize a DBD device at various operating conditions, such as input power and working gas flow rates, by measuring the plasma plume temperatures at different locations of the plasma exit nozzle.
- Measure the plasma plume intensities and conduct spectroscopy to identify various radicals at different operating conditions, as well as, monitor radical concentration as a function of input voltages and gas flow rates.
- Study the effects of input voltage, gas flow rates, and the working gas on the plasma plume lengths, plasma temperatures, and concentration of radicals (reactive Nitrogen and Oxygen species) in the plasma.
- A DBD plasma jet will be exposed to homegrown bacterial colonies to study the plasma effects on the bacteria.
- The wound healing and bacteria mitigation process will be optimized by selecting the optimized plasma operating conditions.

Project Results:

- Successfully characterized a dielectric barrier discharge plasma device at various operating conditions.
- Developed a new design that removes the limitations of the current design and allows for the input of various gases.
- Performed emission spectroscopy using an Ocean Optics Spectrometer and captured the spectral signatures or emission lines of the plasma plume which included nitrogen second positive system, hydroxide, helium, & oxygen lines.

Sponsor: Hastest Solutions Inc.

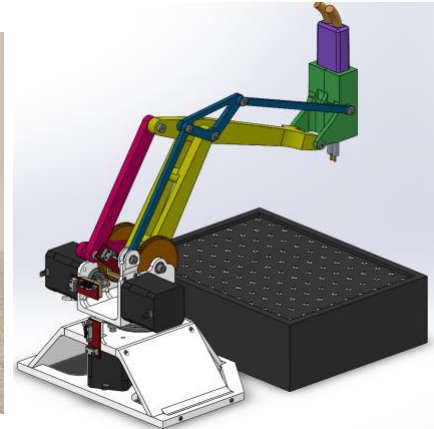
3 DOF Robotic Spot-Welding Arm with Computer Vision

Student Members:

Roberto Enriquez
Wilton Lee
Andorich Zarate Osorio

Advisors:

Dr. Syed Zaidi
Dr. Saeid Bashash
Nelson Wong



Project Scope and Objectives:

- Design and manufacture a 3 DOF robotic arm that is capable of detecting slits in nickel tabs using computer vision and spot welding them to 18650 Lithium-Ion batteries
- Arm will use a microcontroller programmed with inverse kinematic equations to precisely reach and weld valid spot welding locations
- Robotic arm is powered by a 12V 5A power supply and controlled with an Arduino Uno, three NEMA17 stepper motors, and three limit switches
- Design end-effector to interface with SUNKO spot welding pen and stay level (horizontal) during operation
- Physical prototype of robotic arm capable of reaching all possible nickel tabs in the battery module
- Computer vision will be able to recognize fuse-links slits on the nickel tabs as a spot weldable location
- Communication between Raspberry Pi and Arduino to interchange data
- Test movement resolution of stepper motors at fully extended configuration



Project Results:

- All components have been designed, 3D printed, and assembled
- Derived and programmed inverse kinematics equations for 3 DOF
- Plans to validate inverse kinematics with physical assembly
- Plans to test angular/linear resolution of stepper motors at fully extended configuration
- Programmed a filter to remove contour areas and localize smaller areas for detection
- Raspberry Pi and the camera are able to detect fuse slits and create a bounding box estimate
- Computer vision unable to differentiate between single nickel tab and nickel tab assembled with a battery, requires use of object detection software which has been difficult use
- Plans to integrate computer vision with the robotic arm

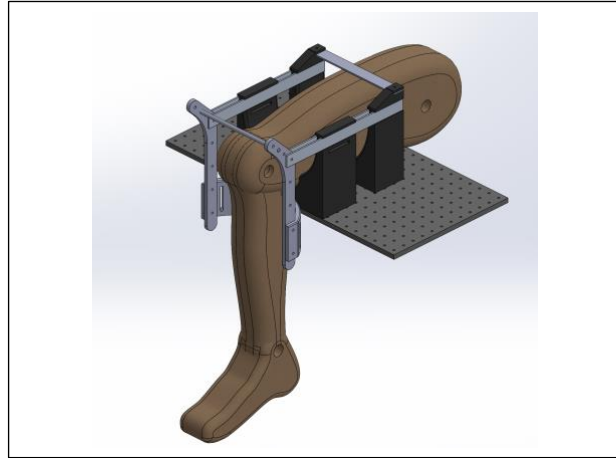
Redesign of an Assistive Knee Brace for Muscle Rehabilitation

Student Team Members:

Haadi Elahi (Team Lead)

Marvin Pablo

Faculty Advisor: Dr. Zaidi



Project Scope and Objectives:

1. Characterize the behavior of custom-built fluidic muscles under various pressures and load conditions.
2. Determine how configuring multiple muscles in parallel affects performance.
3. Use fluidic muscle data to design an assistive knee brace with a range of 90 degrees for rehabilitative flexion and extension exercises.
4. Manufacture and test a physical knee brace prototype on a mannequin leg.

Project Results:

1. Fully characterized the contraction behavior of custom-built 12-inch fluidic muscles under various loads at 60 and 80 psi.
2. Experimentally demonstrated that two muscles in parallel effectively doubles the load at which maximum contraction will occur.
3. Optimized knee brace geometry using contraction data and kinetic analysis to theoretically ensure 90 degrees of rotation.
4. Assembled and tested a physical knee brace design to verify experimental analysis of fluidic muscles.

Sponsor:

IntelliScience Training Institute

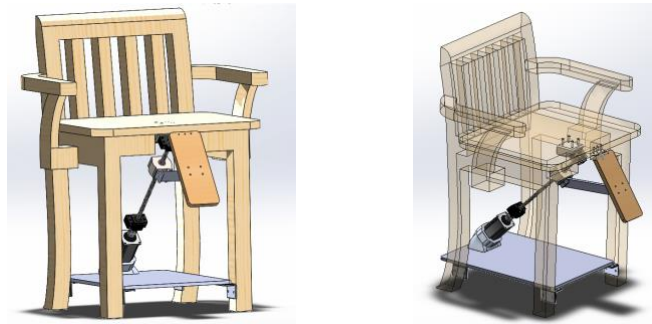
Fabrication of the Motor-based Assistive Knee Brace

Student Members:

Emmanuel Cabral

Ruijie Zhu

Advisor: Dr. Sohail H. Zaidi



Project Scope and Objectives:

- Creating a new design for the motor-based assistive knee brace to overcome the limitation of the previous design and still using similar components such as ball screw, stepper motor, and Arduino.
- Calculating the minimum length for the coupler of the mechanism using geometry.
- Calculating the force for angle displacement, consecutively the minimum torque that the stepper motor needs to drive the system.
- Understand how the Arduino code works and adjust the stepper motor's speed to work with the specification.
- Testing the system to confirm stability and improvement compared to the previous design.
- Integrating the voice-activated system.

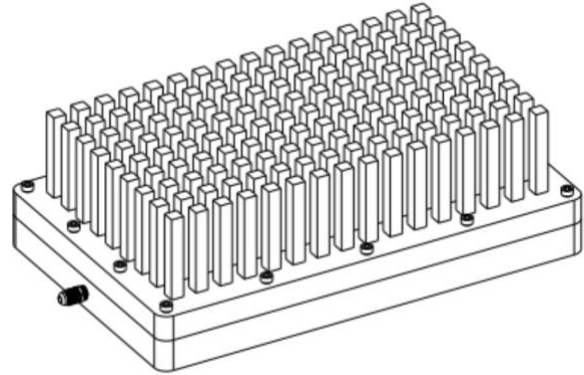
Project Results:

- A finished CAD model is produced and parts are machined and 3D printed.
- Stepper motor works properly after resolving the problem with a broken motor driver.
- The prototype is assembled and confirms that the mechanism is working properly.
- Improvements are confirmed where the prototype has more stability and the leg support has faster movement and raises higher.

LED Panel Passive Cooling

Student Team Members:

Alexian Lin
Jose Esquivel
Bobby Zhu



Faculty Advisor: Dr. Zaidi

Project Scope and Objectives:

Improving the previous design of thermal syphon embedded heatsink for LED in order to be used for commercial use. Application will be drilling holes into the fins of the heatsink to act as thermosyphons to cool the temperature of LED panels.

Will be conducting tests to measure the temperature profile of only LED, LED + heat base, LED + Heat fins, and LED + Heat fins + refrigerant. Comparisons will be done after receiving results of all the tests to see how this design reduces the temperature of the overall system.

Project Results:

Through our passive cooling method, the LED panel temperature was reduced from roughly 120C to 60C. This was accomplished by utilizing a heatsink base and a condenser top consisting of an array of fins with embedded thermosyphons. A vacuum was created between the heat sink base and the condenser top, and refrigerant was injected to assist in the LED panel cooling.

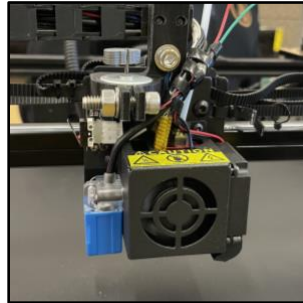
Sponsors:

San Jose State University - Department
Hastest Solutions

Analysis on the Quality of 3D-Printed Parts with the Introduction of Induced Vibrations

Student Members:

Andrew Marquez
Jesus Marquez
Justin Luu
Mark Mateo



Advisor: Dr. Sohail H. Zaidi

Project Scope and Objectives:

- Theorize and implement a solution to induce controlled vibrations to improve the print quality of 3D printed specimens
- The project goal and objective are to prove that induced vibrations are able to improve the strength and overall quality of 3D printed parts.
- Fabricate a mount to secure a vibration motor to the head of the 3D printer.
- Print rectangular specimens (4" x 1" x 1/4") at varying densities (infill 20%-100%, at increments of 20%) with no vibrations, to use as our baseline.
- Print the same rectangular specimens with varying speeds of vibration (3V, 4V, 5V, 6V)
- Obtain similar specimens with different types of 3D printing materials (PLA, TPU, ABS, PETG).
- Document the corresponding nozzle and bed temperatures needed to print the different types of 3D printed materials.
- Compare the porosity between the specimens printed with induced vibrations to the corresponding specimens printed with no vibration.
- Compare the tensile strength between the specimens printed with induced vibrations to the corresponding specimens printed with no vibration.

Project Results:

- Vibration mount was designed to fit perfectly on the extruder head backplate while housing the vibration motor securely.
- Successfully sliced (digitally prepare the model by creating instructions of the printing path for the printer) rectangles based on different material properties to print dimensionally accurate specimens.
- Plots of the data comparing the porosity and tensile strength between all specimens.
- Increased levels of induced vibration produced specimens that are stronger and can withstand more tensile stresses.
- Increased levels of induced vibration produced specimens with lower porosity levels resulting in specimens that contain fewer gaps of air through each layer of extrusion.

Evaluation of Solid-State Battery use in Flexible settings

Student Team Members:

Devon Turgeon
Simone Caruso (BME)
ZiHao Fan (ChemE)

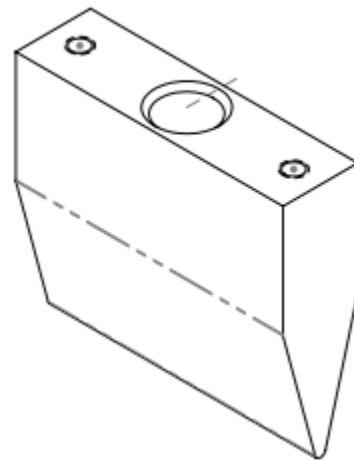
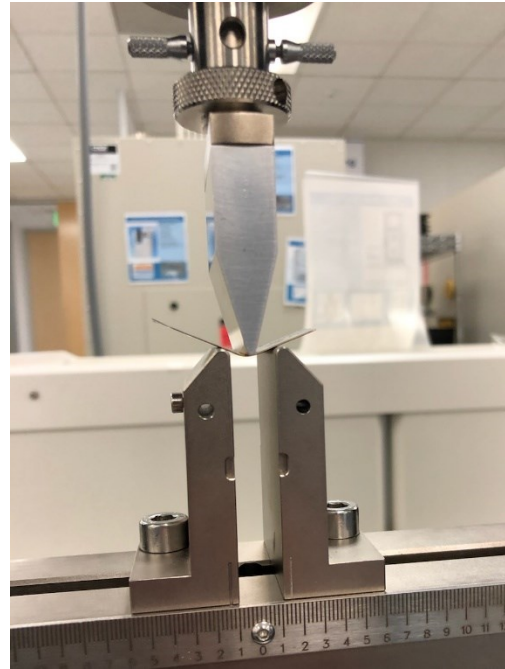
Faculty Advisor: Syed Zaidi

Jabil Advisor: Harjeet Hansi

Project Scope and Objectives:

Evaluation of current solid-state battery technology as a replacement for traditional aqueous lithium-ion batteries in flexible settings.

1. Research current state of solid-state battery technologies.
2. Down select pool of available battery vendors for testing.
3. Design testing scenario for solid-state batteries performance against a baseline lithium-ion.
 - a. Thermal testing of high temperature storage life of batteries for relative expected lifetime.
 - b. Flexural performance of battery using three-point bend test.
 - c. Design and machine custom anvil for Instron force tester to apply a 30-degree acute angle bend on battery.
4. Evaluate solid-state performance in comparison testing against baseline lithium-ion.



Project Results:

1. Identified solid-state batteries with intrinsic flexibility.
2. Manufactured custom anvil that can be installed directly into Instron force tester.
3. Tested performance under flexure of baseline and two solid-state batteries
4. Evaluated performance against out of specification elevated temperatures.

Sponsors:

Jabil Inc.

Pathogen Mitigation: Plasma Activated Water

Members:

Nathaniel Dejan (Mechanical Engineering Student)

Veronica Romo (Biomedical Engineering Student)

Christopher Valdivia (Biomedical Engineering Student)

SJSU Advisors:

Dr. Sohail H. Zaidi, Dr. Yun Wang, Pamela Ong, Anthony Babasa

Project Scope and Objectives:

Plasma Activated Water (PAW) is a solution that contains Reactive Oxygen Species (ROS) and Reactive Nitrogen Species (RNS) making it a viable tool to enhance several industries. PAW is currently used in agriculture, manufacturing, and medicine, but can be expanded to hospitality and household disinfection. In agriculture, there are many advantages in using PAW such that it reduces the need for aggressive pesticides and maintains the attractiveness of the produce. PAW replaces the need for harmful chemicals by creating a naturally aggressive solution that attacks the virus or bacteria on a microbial level. PAW has the potential to revolutionize the way pathogens are mitigated on surfaces in an environmentally sustainable way.

Plasma is mainly produced in a vacuum chamber with external gas tanks filled with Helium, Argon, or other elemental gases. In contrast, atmospheric pressure plasma is created without a low-pressure vacuum by energizing ambient air to create a non-thermal atmospheric pressure plasma. High amounts of energy are necessary to convert to a plasma state which in turn produces high-temperature plasmas¹. Non-thermal atmospheric pressure plasma has a low temperature due to the increased electron-electron collisions leading to a faster thermodynamic equilibrium compared with electron-neutron, or electron-ions collisions¹. Ionized gas is converted into a plasma state at atmospheric pressure to create a unique plasma created without a necessary chamber¹.

The process of atmospheric plasma treatment is a versatile solution for pathogen mitigation. Although PAW has been proven to be effective, there are still unknowns in using atmospheric pressure plasma systems for activating water. PAW is generally produced in controlled environments, whereas an atmospheric pressure plasma jet would restrict the plasma treatment to only the water's surface.

Factors that will be examined include: the time duration of the plasma treatment of the water, tap water and DI water, temperature of the water during plasma treatment, and distance of the water from the nozzle (of open-air plasma device).

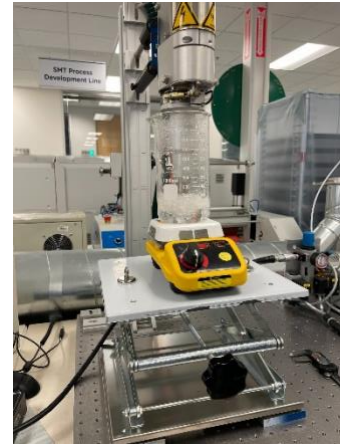
The PAW will be tested using test strips at specific time intervals to measure the reactive species and pH levels. PH levels indicate a solution's ability to produce reactive species. Higher acidity, meaning lower pH, creates a more desirable atmosphere for ROS and RNS species to be formed.

Project Results:

Test Fixture will be designed and made to hold the Plasma device at certain heights for a period of time.

Plasma Activated Water will be tested and analyzed over a period of time

The optimal conditions will be determined to produce the most reactive oxygen species and reactive nitrogen species.



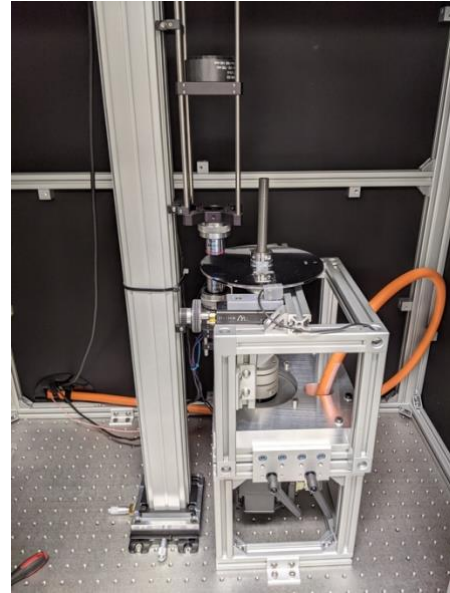
Microfluidics Chip - Fluid Behavior Characterization

Student Team Members: Ralion Herzog & Swetha Kandiyil

Faculty Advisor: Dr. Syed Zaidi

Project Scope and Objectives:

- Identify the effects of Aquapel and RainX on COP (Cyclic Olefin Polymer) chip hydrophobicity
 - Analyze contact angle of untreated and coated blanks
 - Analyze contact angle of untreated and coated separated layers of chips
 - Investigate effects of annealing on contact angle for untreated and coated blanks/chips
- Design coating procedure to ensure stable droplet formation and prevent coalescence
 - Perform fluid behavior test to identify efficacy of coatings on bonded chips
 - Compare droplet size, number, and time-to-coalescence



Project Results:

1. Successfully determined effect of RainX, Aquapel, and Annealing on blanks and chips
2. Determined optimum temperature range for curing of RainX and Aquapel on chips
3. Designed coating procedure for significantly improved droplet stability for microfluidics chip
4. Provided suggestions for further investigation of coatings

Sponsor: Jabil