



SAN JOSÉ STATE UNIVERSITY

Mechanical Engineering Department

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

Date: May 13, 2022

SECTION	PROFESSOR	STUDENTS	TIME	ROOM
1	AGARWAL	25	9-12 PM	ENG 341
2	FURMAN	30	1-4 PM	SSW DESIGN CENTER Google map: 84P3+QG
3	YEE	27	1-4 PM	ZOOM
4	MOKRI	32	1-4 PM	ENG 341
5	ZAIDI	20	1-4 PM	ENG 401
6	CYDZIK	20	1-4 PM	ENG 343

Surgical Care Assistant Robot (S.C.A.R.)

Student Team Members:

Dylan Domingo, Jake Fulton, Christian Pedrigal (Team Leader), Priscilla Tatmon

Faculty Advisor: Dr. Raghu Agarwal

Project Scope and Objectives:

In hospitals across the United States as well as across the world, there is a critical shortage in staffing that is impacting the healthcare system of nearly every country as a consequence of the COVID-19 pandemic. Exacerbated by the heavy stressors placed on crucial departments such as the intensive care unit (ICU) and emergency department (ER/ED) due to the nature of the virus there has been a need for assistance. As such, the need for more nurses and general staff has reached an all-time peak, with many hospitals requesting out-of-state aid that is still unable to fill the increasing number of positions left open due to nurses retiring, falling ill, or already being overworked.

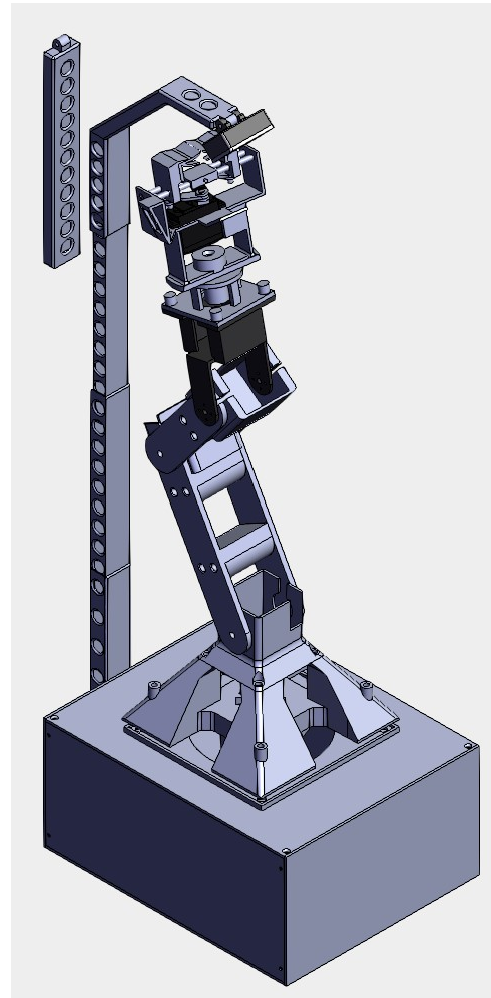
It is for these reason that our team examined the needs that were not being met in specific departments that were impacted heavily by the pandemic and drew up a number of solutions before narrowing it down to an automated assistive system; its functionality is that of a robotic surgical assistant that can be deployed in operating rooms while remaining accurate and error-free in a multitude of situations. By being able to assist across changing surgical environments, the proposed system is aimed to alleviate the manpower shortage inflicted on hospitals while maintaining the high-quality and safe environment that patients and staff alike have come to expect.

Project Results:

Titled as a Surgical Care Assistant Robot, or S.C.A.R., the proposed system will keep pace with workflow during rapid changes, have a low km, tolerance for errors yet remaining nimble, and be easy to maintain and sanitize between deployments. Some of the engineering specifications include:

1. A stabilized platform
2. Has precise actuation and quick movements
3. Has a compact footprint, and easy mounting capabilities
4. Lightweight and durable casing.

Furthermore, Surgical Care Assistant Robot (SCAR) is a medical transportation robot that uses voice recognition to react to surgeons and computer vision to identify and deliver tools to surgeons. Roughly the size of a college student's backpack, SCAR is an articulated 6 degrees of rotation robot arm that will be beneficial in the medical field and help society as in general.



Automated Dumpling Cooker for Home Application

Student Team Members:

Eulix Chiu (Team Lead), Darren Lim, Ally Zhu, Julia Gosiengfiao, Mark Hughes, Amol Sanghavi

Faculty Advisor: Raghu Agarwal

Project Scope and Objectives:

Design and build an automated culinary machine to prepare, assemble, and cook dumplings.

1. Design and manufacture mechanisms to move, fill, and fold dumplings.
2. Assemble the hardware components and all other circuitry to be properly tested and operational.
3. Implement software that should be testable and running correctly for each individual function and the apparatus as a whole.
4. Produce a thermal system that can boil water to prepare and cook the dumplings.
5. Design the thermal system materials to maintain the safety of the system and prevent overheating.

Project Results:

1. Successfully followed a semi-formal product development process to create concept designs, compare to market competition, and select concept solutions.
2. Designed full master concept CAD (Fall Semester) and performed mechanical FEA to validate designs.
3. Four unique moving mechanisms prototyped.
4. Successfully manufactured 4+ components out of HDPE plastic and aluminum rod stock, produced 2D drawings with GD&T and tolerance analysis applied.
5. Produced component bill of materials, including material choice and surface finish of components not included in the scope of the project.
6. Successfully programmed motors and hardware elements through Python and automated the dumpling preparation process based on the chronological order of functions and time of operation.
7. Successfully performed Thermal Resistance Network and Finite Difference Method Calculations on the thermal system associated with cooking the dumplings.
8. Successfully developed testing procedure to verify the validity of thermal enclosure design
9. Successfully built a working proof of concept and prototype of the thermal enclosure to facilitate the cooking process.

Sponsors:

Yes Welding, Student Funded

FSAE Carbon Fiber Wheels

Student Team Members:

Jason Do (Team Lead), Zachary Abdallah, Allegra Robertshaw, Sean Garcia, Tiago Costa

Faculty Advisor: Dr. Raghu Agarwal

Project Scope and Objectives:

Design and manufacture three-piece carbon fiber wheels to reduce the overall weight of the suspension system and improve vehicle response.

1. Develop rim contour design by adhering to wheel dimension standards set by the Rim and Tire Association, as well as benchmark wheels used in industry.
 1. Rim contour design must fit within packaging constraints of the SJSU FSAE vehicle suspension system.
2. Design a mold with optimal geometry and features that allow for easy removal of the cured carbon fiber from the mold after the curing process.
3. Perform a failure analysis study on various iterations of laminate design, optimizing for least amount of weight and greatest amount of stiffness while meeting the following specifications:
 1. Overall weight must be less than OZ racing brand wheel (1681 grams)
 2. Maintain camber deflection value less than 0.363° (Keizer wheel brand stiffness)
 3. Be able to withstand point loading during tiring mounting process
 4. Utilize existing aluminum wheel centers

Project Results as of 4/19/2022:

1. Successfully designed and analyzed rim contour per standards to fit within the wheel package and meet weight, stiffness and strength requirements.
 - a. Achieved camber deflection of approximately 0.392° based on simulations performed on designed laminate wheel, meeting Keizer wheel stiffness goal
 - b. Overall wheel weight of about 1205 grams, meeting weight requirements by significantly reducing weight to be less than the OZ wheel weight
2. Successfully designed and manufactured multiple molds for wheel shell layup.
3. Successfully laid up test wheel shell's using layup schedule with designed cutting templates.

Sponsors:

Toray Advanced Composites, Military Fasteners, Central Machine Shop, A-1 Jay's Machining, Mass Precision, PDM Metals

SJSU Spartan Racing Drag Reduction System

Student Team Members:

Josue Garcia (Team Lead)

Jie Kai Teo

Junlin Chen

Ehsan Al-Agtash

Scott Dunn



Faculty Advisor: Dr. Raghu Agarwal

Project Scope and Objectives:

Design and build an automated drag reduction system for the rear wing assembly of the FSAE cars.

1. Research and design geometry/hardware of the dynamic rear wing airfoils.
2. Autonomously control the rear wing airfoil assembly through the vehicle control unit.
 - a. Granted drivers options with fully automatic modes and manual override.
 - b. Increased energy efficiency through reduction of the system's powered time needed to achieve desired performance.
3. Manufacture system components and test operation.
4. Use system in competition and place Top 5 at Michigan competition

Project Results:

1. Derived the four-bar geometry efficiency.
2. Designed an efficient pneumatic system that has low power draw.
3. Derived and calculated the ideal spring constant rate for the system.
4. Designed a complete mechatronics control system.
5. Established a variety of control options (mode) to fit driver preference.
6. Designed and built a mount for the air bottle (used for actuation).
7. Designed a sheet metal foil sleeve bracket.
8. Simulated the different control options (manual, always-off or on, auto)

Sponsors:

MoTeC, SMC Pneumatics, SJSU, TE Connectivity

Custom Loudspeaker Driver Kit + Enclosure

Student Team Members:

Jared Wang (Team Lead)
Lee Osaki
Anastacia Rodriguez
Robert Terhell
Michael Vu



Faculty Advisor: Dr. Raghu Agarwal

Project Scope and Objectives:

Design and manufacture a compact loudspeaker driver kit and create a testing enclosure for data acquisition

1. Research loudspeaker design basics, relevant equations on acoustics and vibration analysis, and market trends.
2. Decide on target values and dimension specifications which were determined to be:
 - a. Can be easily assembled by amateur audiophiles and properly function
 - b. Small enough to attach to a compact speaker enclosure
 - c. Should weigh under 3 lbs after assembly
 - d. Should produce sound with no less than 5% Total Harmonic Distortion
 - e. Capable of producing a sound level of 87-88 dB
 - f. Can handle 12-24 V and 50W external power loads
3. Design individual parts using appropriate CAD software with target values
 - a. Design a Voice Coil, Basket, Top Plate, Pole piece
4. Decide on materials based on specifications
 - a. Budget costs to a reasonable degree for a project without sponsors
5. Manufacture prototype and acquire testing data
 - a. Create/Obtain testing software for prototype testing

Project Results:

1. Successfully designed and manufactured a functioning loudspeaker driver that reached target specifications
2. Successfully created a loudspeaker kit with ease of assembly for amateur audiophiles
3. Successfully obtain relevant project data on loudspeaker driver

Sponsors/Acknowledgements:

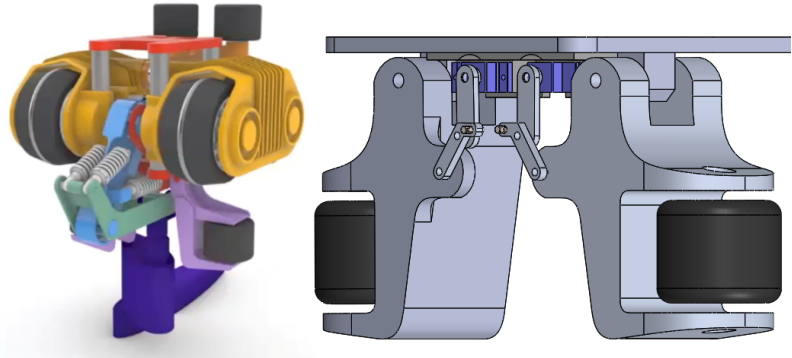
1. We would like to thank San José State University (SJSU), SJSU's Charles W. Davidson College of Engineering, and Walters and Wolf for all the support they have given for this project.

Spartan Superway Bogie System – Sub team Lateral Stabilizers

Student Team Members:

David Bruan
Ngoc Dinh
Binh Nguyen
Nick Bassett

Faculty Advisor: Dr. Burford
Furman



Project Scope and Objectives:

Design, analyze, and manufacture a lateral stabilizing system for the Spartan Superway bogie system.

1. Design a model in Solidworks and assemble it with the other components of the Bogie System.
2. Perform Finite Element Analysis (FEA) and relevant force analysis to validate the design choices.
3. Concept functionality is proven through the testing of scaled down models.
4. Components such as motors, part materials, and manufacturing techniques are carefully planned and specified.
5. Design and build a 3X-scaled motion Lateral Stabilizer with the following specifications:
 - a. Successfully interface our sub-system with the other components of the Bogie System
 - b. Provides lateral stability for the Bogie system when navigating the guideway
 - c. Maintains contact with the guideway when engaged
 - d. Disengages one side of the guideway at the Y-junction with 5- 8 degrees of rotation when switching
 - e. Motors used can move 136-142g Lateral Stabilizer with no issues

Project Results:

1. Successfully designed and assembled a 3D model in Solidworks.
2. Successfully derived FEA and force analysis to validate the design.
3. Successfully proven concepts in small-scale model.
4. Successfully selected motors, materials, and manufacturing technologies to build the system.
5. Successfully designed and built a 3X-scaled model meeting the design specifications.

Sponsors:

Spartan Superway

Spartan Superway Pod Sway Mechanism

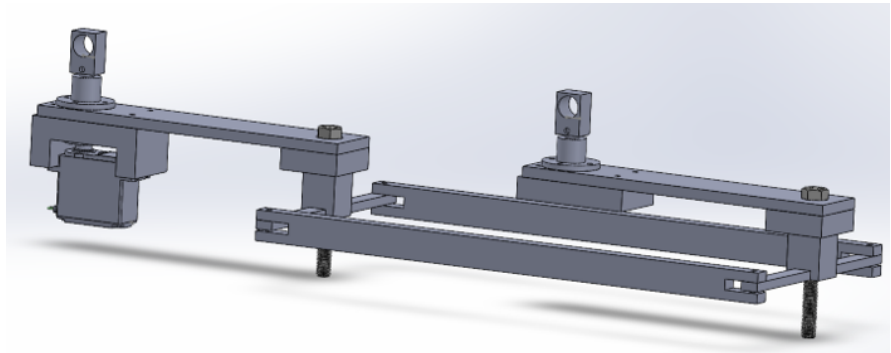
Student Team Members:

Aboubacar Traore (Team Lead)

Nghia Nguyen

Brandon Quan

Emmanuella Andjui



Faculty Advisor: Dr. Burford Furman

Project Scope and Objectives:

Design and build a pod sway mechanism to control the lateral motion and stability of the Spartan Superway Podcars.

1. Determine the motion necessary to switch tracks and load/unload passengers.
2. Identify design constraints based on dimensions and contingencies of other Spartan Superway systems.
3. Design a pod sway mechanism that achieves the desired motion within the design constraints that is compatible and synchronous with all other Spartan Superway systems.
4. Perform FEA and Topology studies to verify the mechanism's factor of safety and efficacy under realistic conditions.
5. Design and build a functional scaled prototype that meets the following specifications:
 - a. Capable of supporting 2 kg (weight of Podcar + weight of Pod sway system)
 - b. Capable of at least 80-degree range of rotational motion and 100 mm lateral Podcar translation
 - c. Capable of being driven by an electrical motor and controlled by an Arduino microcontroller
 - d. Does not interfere with other Spartan Superway systems (track supports, suspension system, podcar, etc.)

Project Results:

1. Successfully determined the necessary motion.
2. Successfully identified all applicable design constraints.
3. Successfully designed a pod sway mechanism.
4. Successfully optimized mechanism design based on FEA and Topology study results.
5. Successfully designed and built a pod sway mechanism that meets (or exceeds) all the design specifications.

Sponsors:

SJSU, Spartan Superway

Spartan Superway: Bogie Wheel Housing

Student Team Members:

Jerrod Ankeny (Team Lead)

Shrikrishna Shivakumar

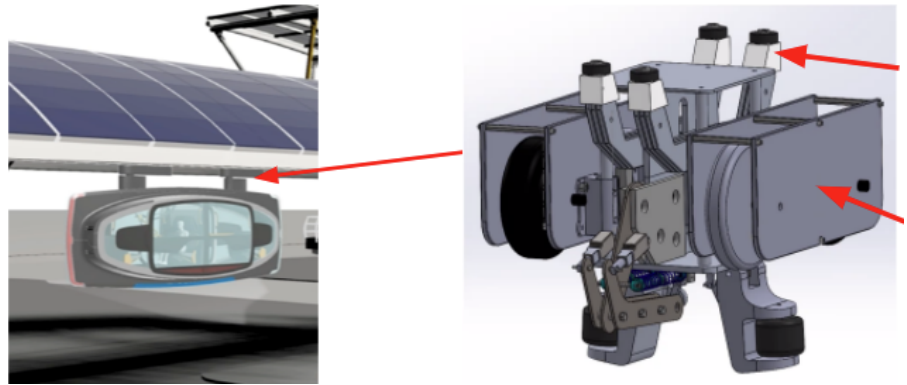
Nicholas Dang

Yann Lapnet

Justin Gualberto

Faculty Advisor: Dr. Burford

Furman



Project Scope and Objectives: Design and build a physical, working, scaled model prototype of a wheel-housing and switching mechanism for the SPARTAN Superway ATN to propel and provide guidance to the pod cars.

1. Design a small scale prototype to ensure that the fundamental mechanics of the mechanism are realized and necessary components are implemented to achieve basic functionality.
2. Conduct finite element analysis studies onto critical components of the mechanism and determine the materials necessary.
3. Create a 3X upscaled design of mechanism introducing motors, actuators, controls and optimized design of components.
4. Design and manufacture a scaled, working prototype that meets the following design specifications:
 - a. Capable of reliably supporting, propelling, and guiding a “bogie” with a weight of 28 pounds.
 - b. Capable of raising the wheel housing 10mm to cross a y-junction within 1-3 seconds.
 - c. Capable of limiting the maximum vertical and lateral acceleration variation of the bogie across junctions to 20% to ensure a comfortable ride.

Project Results:

1. Successfully designed small scale prototype.
2. Successfully conducted finite element analysis studies.
3. Successfully created a 3X upscaled model and introduced actuating devices and controls.
4. Successfully designed and built a working prototype that meets all design specifications

Sponsors: San Jose State University, SPARTAN Superway core team, Ron Swenson

Active / Passive Suspension System for Spartan Superway

Student Team Members:

Eric Vu (Team Lead)

Adrian Cruz

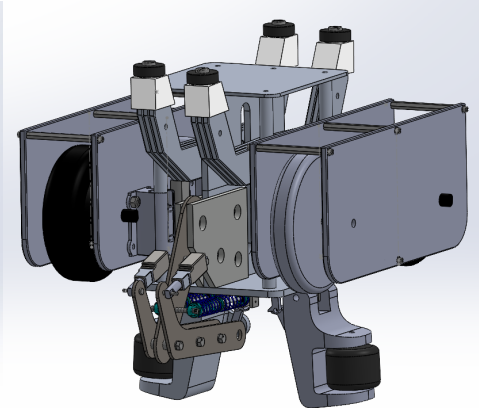
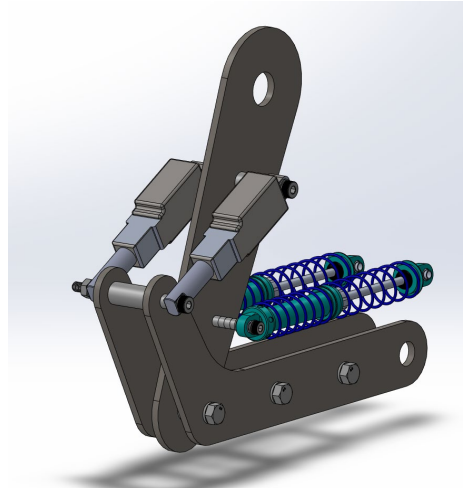
Brian Gough

Cameron Mew

Salman Saeed

Faculty Advisor:

Dr. Burford Furman



Project Scope and Objectives:

Design, analyze, and manufacture a damping system for the Spartan Superway bogie to reduce forces felt by passengers in the vertical and fore/aft directions of travel.

1. Design a suspension system that dampens forces and vibrations felt by passengers in the longitudinal and traverse axes of travel.
2. Develop a control system to adjust and maintain the pitch of the podcar such that it remains parallel to the ground during travel.
3. Ensure suspension system achieves proper fitment with the chassis and pod-sway mechanism.
4. Implement a dual active/passive suspension system using actuators and spring dampers
5. Design and fabricate a medium-scale model of the suspension system that meets the following specifications:
 - a. Bring the bogie to a parallel position on a gradient travel of +/- 15 degrees within 2 to 3 seconds
 - b. Able to level with boarding platform within 5 to 10 seconds
 - c. Support podcar and pod sway assembly with a combined weight of 20-45 lbs in 2 degrees of freedom

Project Results:

1. Successfully designed and fabricated a small-scale, 3D-printed model to validate proof-of-concept and feasibility.
2. Successfully iterated multiple designs in Solidworks prior to fabrication and validated these designs through Finite Element Analysis and Topology studies.
3. Successfully fabricated a functional medium scale model of the suspension system.
4. Successfully created a program to track podcar pitch and acceleration.

Sponsors:

San Jose State University, Swenson Solar, INIST

Spartan Superway Track Profile Design

Student Team Members:

Aaron Keh

Andrew Truong

Trang Dang

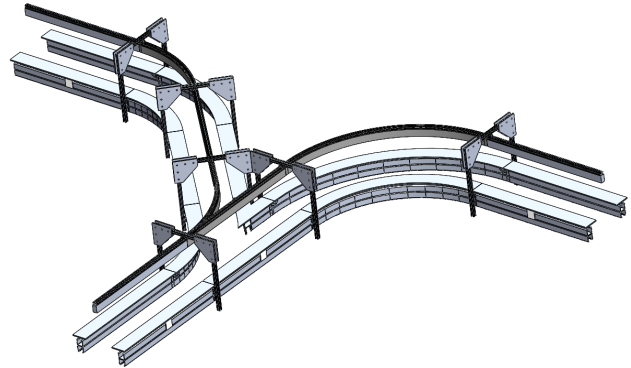
Kyle Yuke

Faculty Advisor: Dr. Buford Furman

Project Scope and Objectives: Design

the track profile

1. Design track profile to meet the following specifications:
 1. Have the ability to support a 15kg bogie
 2. Main surface wheels must deflect less than 1 mm
 3. Consist of modular sections: straights, curves (45° and 90°) , Y-junction
 4. Ensure all wheels of bogie make contact with track
 5. Guideway network (Y-junction, 45°, 90°) must fit within a 2.5 m X 1.25 m area
2. Perform FEA studies to determine if design is feasible
 1. Check for deflection to be less than 1 mm and F.o.S greater than 2



Project Results:

1. Designed a track for the bogie to navigate on
2. Designed a track while meeting design specifications

Sponsors:

SJSU, Spartan Superway

Spartan Superway Suspended ATN

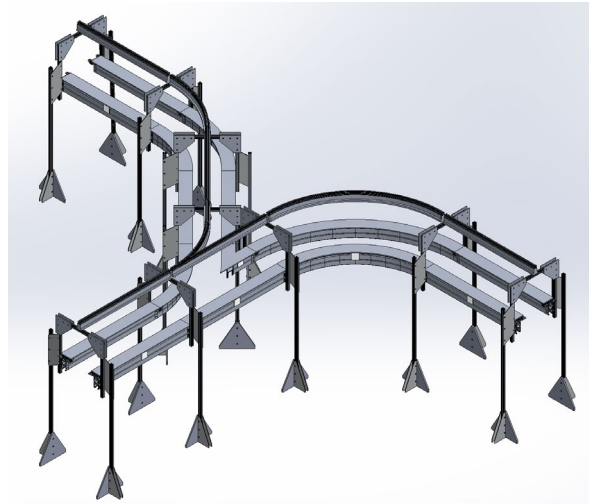
Student Team Members:

Simon He (Team Lead)

Cory Cai

Jeremiah Nguyen

Matthew Means



Faculty Advisor: Dr. Burford Furman

Project Scope and Objectives:

Design and construct modular freestanding vertical supports and attachment method for Spartan Superway's prototype track and bogie system

1. Determine the commercial parts and attachment method to interface the supports and the track
2. Design parts to be fitted on the column
3. Perform static simulation and topology optimization on custom parts
4. Design and build 17 freestanding vertical supports that meet the following specifications:
 - a. Capable of supporting 60kg (4 bogies)
 - b. Distance from center of track to supports should be 290mm to avoid pod contacting the supports
 - c. Height should be 900mm to avoid bogie from contacting the ground

Project Results:

1. Successfully derive the beam calculations
2. Successfully perform static simulations
3. Successfully perform topology/optimization study
4. Successfully design and construct the prototype supports that meets the design specifications

Sponsors:

Spartan Superway, K&A Precision

Six Degree-of-Freedom Robotic Motion Simulator

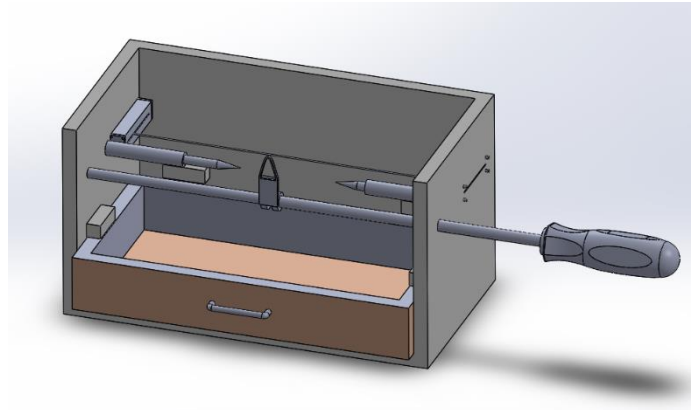
Student Team Members:

Daniela Buendia

Kim Hutain

Donghyun Yi

Faculty Advisor: Dr. Raymond Yee



Project Scope and Objectives:

Design and manufacture a device that cuts an avocado in slices, removes the seed, and separates the flesh from the skin.

1. Aims for Working Process:
 - a. Peel with rotating rods and manual operation of moving the peeler
 - b. Cut with rotating of the avocado and wire moving in automatically to slice
 - c. Wire will reach the pit for one final rotation for the separation of the flesh and the seed
2. Design specifications:
 - a. Size: 18" x 7" x 7"
 - b. Material: Aluminum and ABS
 - c. Cutting Operation
 - i. Aluminum Music wire: 0.04 thick

Project Results:

1. Team successful developed a CAD model for the design
2. Team made CAD drawings for components involved in design
3. Team built a prototype to verify its functionality

Sponsors:

Raymond Yee

Solar-Assisted Personal Mobility Vehicle



Student Team Members:

Eric Zhang (Team Lead)

Austin Truong

Paras Kumar

Jose Garcia Horta

Duong Nguyen

Andy Sanchez

Kendell Ayson

Trevin Aguilar

Abubakr Abushanab

Bernard De Castro

Viet Nguyen

Iqbal Singh

Faculty Advisor: Dr. Raymond Yee

Project Scope and Objectives:

Design and develop a personal mobility vehicle (PMV) for urban areas.

1. Vehicle can be driven using human pedal power or by electric motor and will include solar charging.
2. Vehicle must be road legal.
 - a. Built-in safety features for the driver and rider, such as seatbelts.
3. Vehicle will achieve a top and sustained speed of 25 mph with a range of 40 miles.
 - a. Safe braking, be able to stop from 25-0 in under 12 feet.
 - b. Acceleration of 0-25 mph in 6 seconds.
 - c. Lightweight and easy to maneuver on the road, less than 400 pounds.
4. Vehicle dimensions will be, width under 4 feet, length under 7 feet.
5. Able to carry a single occupant + cargo weighing up to 250 pounds.

Project Results:

1. Successfully modified a preexisting chassis to suit requirements and house new systems.
2. Successfully designed a pedal-motor hybrid powertrain system to move the vehicle.
3. Successfully designed the vehicle circuit schematics to deliver power to all subsystems.
4. Successfully designed solar panel frame and connections that meets (or exceeds) all of the design specifications.

Sponsors:

Lockheed Martin, SJSU ME Dept., Boeing.

Collapsible Cup Design Project - Team 1

Student Team Members:

Jordan Malagon, Travis Southerland, Anthony Talingdan

Faculty Advisor: Professor Raymond Yee

Project Scope and Objectives:

Redesign and improve upon a collapsible cup made by last year's senior design project.

The collapsible cup shall meet the following specifications:

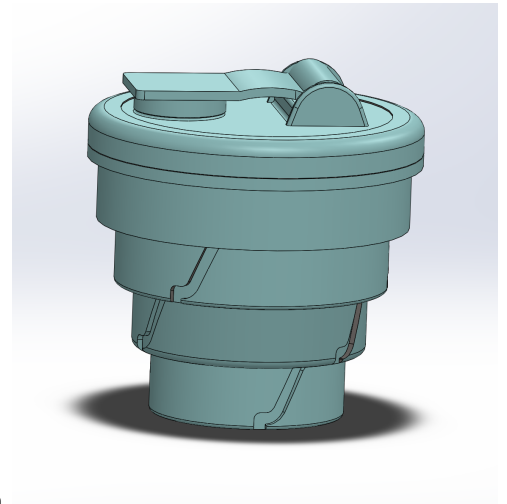
1. Cup can hold at least 12 fluid ounces
2. Easily extendable and collapsible with magnets to hold them in place
3. Maintain a constant inside temperature for 2 hours with a tolerance of 20 degrees
4. The cup shall be leakproof

These specifications shall be simulated in Solidworks with thermal simulation, flow simulations, and kinematic studies.

Project Results:

1. Successfully designed cup to have an inside volume that holds 12 fluid ounces
2. Successfully designed and assembled cup made from 3-D printed parts and silicone spray
3. Successfully simulated thermal study of the cup in Solidworks with the material used for assembly
4. Successfully simulated leakproof cup using flow simulation

Sponsors: Jason Blum (patent holder)



Collapsible Cup with Silicone Lining for Hot/Cold Beverages

Student Team Members:

Manuel Aguilar

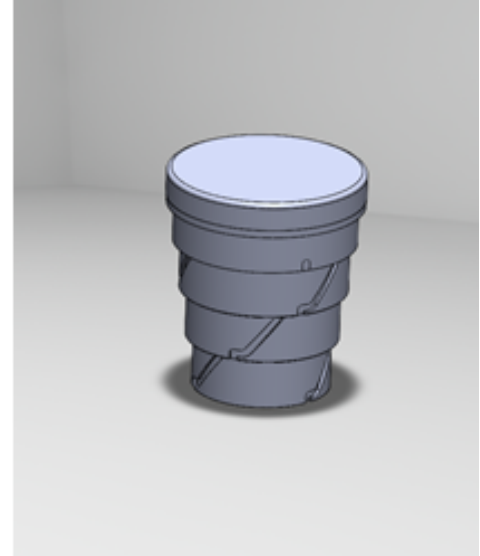
Kameron Hsiung

Dat Tran

Faculty Advisor: Prof. Raymond K.

Yee **Project Scope and Objectives:**

1. Design a reusable, portable cup capable of containing hot and cold beverages
2. Collapsible design with guiding pin and tracks
3. Temperature insulation via inner silicone layer
4. Magnetic locking mechanism
5. Retain the liquid temperature within 20 degrees different within at least 2 hours
6. Able to hold 12 fluid ounces
7. Improvement on previous design backed up by temperature and stress analysis
8. Testing Results that correspond to the specification criteria



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 material such as FDA silicone rubber, PA-12.
4. Heat insulation and leak-proof design using an inner silicone layer
5. Thermal analysis of the fluid contained in the cup approved by a difference in temperature of 4 to 6 degrees.
6. Stress analysis of the silicone layer shows the predetermined folding lines and equivalent stresses as the cup collapses and also the hydrostatic pressure of the fluid.

Sponsor: Jason Blum

3D Printed Tuned Mass Damper

Student Team Members:

Jack Weaver, Antonio Huete, Christopher Mendoza

Faculty Advisor: Dr. Raymond Yee

Project Scope and Objectives:

Design and fabricate three tuned mass dampers that meet the following specifications:

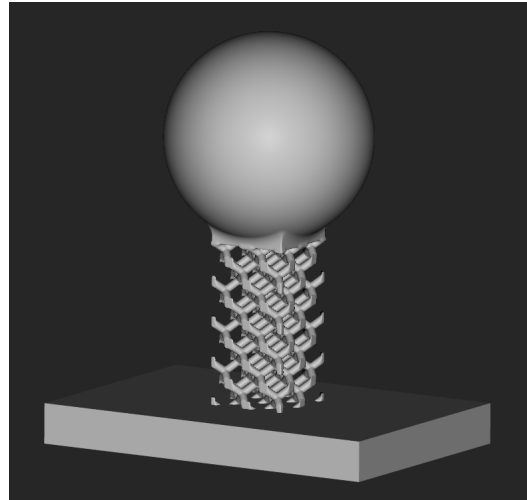
- a. Are able to be printed on an industry grade 3D printer in Thermoplastic Polyurethane.
- b. Capable of securely holding a 124g steel mass at the end.
- c. Can dampen vibrations at frequencies of 14Hz, 15Hz, and 16Hz respectively.

Project Results:

1. Successfully generated a suitable model, hitting all three frequency targets.
2. Successfully printed the model, base and all, in TPU on an HP Jet Fusion printer.
3. Models sent off for testing, results expected in the coming weeks

Sponsors:

The Ford Motor Company



Semi-Automatic Avocado Preparation System with Two Degree-of-Freedom Cutting Mechanism

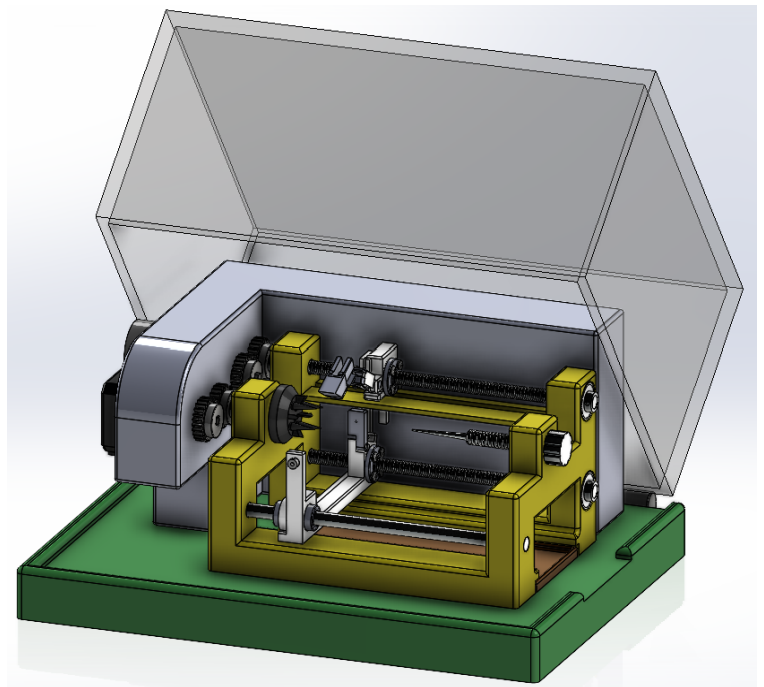
Student Team Members:

David Pokras (Team Lead)

Nikolaus Robillos

Anh Nguyen

Faculty Advisor: Dr. Raymond K. Yee



Project Scope and Objectives:

Conceptualize and construct a system to prepare avocado fruits for consumption.

1. Theorize and actualize a semi-automated process involving minimal user input controlled by a custom mechatronic solution.
2. Separation of the avocado into three homogeneous components in the following order:
 - a. Remove the exocarp (skin of the avocado) from the mesocarp.
 - b. Remove the mesocarp (flesh of the avocado) from the tree seed.
 - c. Leave the tree seed detached from the mesocarp and ready for disposal.
3. Integrate a protective cover to ensure no physical harm to the user during operation.
4. Ensure the design is space and cost efficient while remaining simple to use.

Project Results:

1. Successfully created a modular assembly using CAD to demonstrate functionality
2. Conducted finite element analysis to confirm no system failures under normal operation.
3. Performed analytical evaluation on relevant forces needed to complete cutting actions.
4. Successfully created a safety-centered design that significantly reduces the risk of injury when compared to the traditional manual avocado processing method.
5. Designed and built an semi-automated system that provides the following features:
 - a. 32 x 26 x 17 cm³ volume footprint
 - b. 28 - 40 second cutting process time
 - c. Enhanced single button control with system status indicator
 - d. Straightforward modular disassembly procedure for cleaning and maintenance.

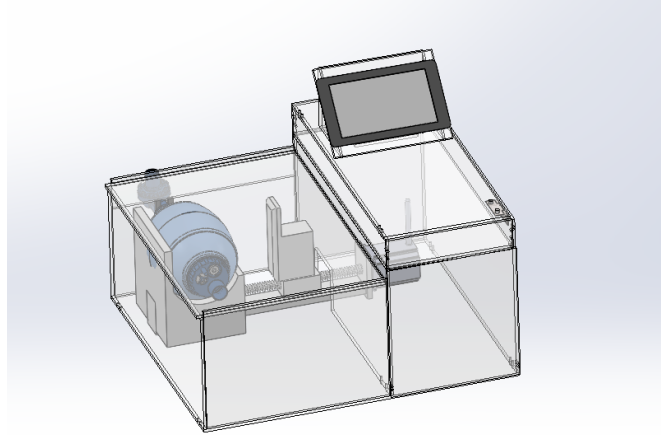
Sponsors:

Raymond K. Yee, Charles W. Davidson College of Engineering at San Jose State University

Low-Cost Medical Ventilator

Student Team Members: Marcus Salazar (Team Lead) Tara Joshi
Jacky Guan
Sofiane Hamama
Jeremy LaPenes

Faculty Advisor: James Mokri



Project Scope and Objectives:

Design and build a low-cost medical ventilator to support hospitals across the globe.

1. Design an easily manufacturable and low-cost case.
2. Allow for complete automation of bag valve mask compression or connection to oxygen tank.
3. Design a ventilation system that includes:
 - a. Correct oxygen concentration and flow for adult, pediatric, and neonate sized BVMs.
 - b. A cost-effective and safe method of BVM compression
 - c. Easily readable real-time data of oxygen flow, and user-friendly interface
 - d. An emergency stop button and automatic shut off feature.

Project Results:

1. Successfully designed entire case and mechanism to be under \$1000
2. Successfully programmed linear ball screw mechanism to compress BVM.
3. Successfully fabricated parts using multiple manufacturing techniques.
4. Successfully configured sensors to provide accurate, real-time data.

Sponsors:

Ricardo Barbaran, SJSU

EV Charge Bot Mechatronics System Design Team

Student Team Members:

Tan Nguyen (Team Lead)

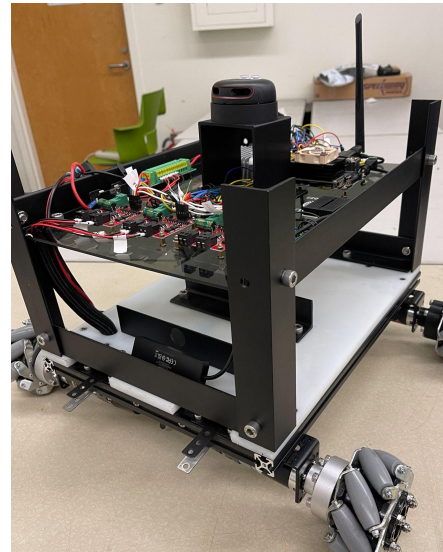
Kyle Cueto, Joseph Lacey, Sepehr Pazoki, Isaac Ramirez, Dylan Robinson, Mason Sage, Joshua Tung

Faculty Advisor: Mr. James Mokri

Project Scope and Objectives:

Design and develop an autonomous robot to inductively charge the battery of an electric vehicle.

1. Develop a macro-navigation software stack for navigation methods that meet the following requirements:
 - a. Utilize RFID technology for state machine code and to determine turning
 - b. Utilize OpenCV through RGB webcams to follow a straight line
 - c. Utilize LiDAR scanning technology for 2D environment mapping and object detection
 - d. Utilize motor encoder counts and mecanum drive for omnidirectional motion
2. Develop a micro-navigation software stack for navigation methods that meet the following requirements:
 - a. Utilize OpenCV through RGB webcams and retroreflective tape for line following and pixel sum distancing
3. Design circuit schematics and wiring diagrams for the overall mechatronic system
4. Design and spec out circuit components capable of meeting the following requirements:
 - a. Must be capable of Level 1 charging, 120VAC
 - b. On the fly localization of the robot
 - c. Less than 50A total current draw through all components, not including charger



Project Results:

1. Successfully designed a system capable of autonomously charging an electric vehicle, including all mechatronic systems
2. Successfully designed and programmed omnidirectional motion control with a mecanum drive
3. Successfully designed and programmed OpenCV processes to follow lines and determine distances

Sponsors:

Kevin Cameron and Chris Novak, Lockheed Martin

EV Charge Bot: Mechanical Design Team

Student Team Members:

Hoang-Truc Nguyen

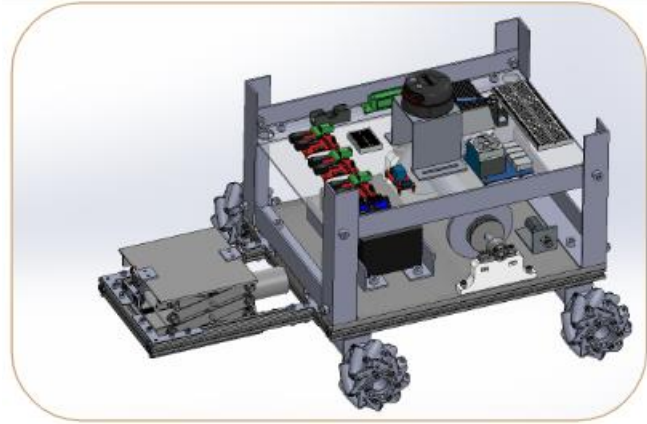
Hao Zhe Chan

Jose Torres Gonzalez

Nobumatsu Kozakai

Neeraj Nair

Dontario Beverly



Faculty Advisor: James Mokri

Project Scope and Objectives:

Design and build robot that autonomously charges electric vehicles.

1. Collaborate with the EV Charge Bot: Mechatronics team
 - a. Design and build electrical frame
 - b. Design and build mounts for electrical components
2. Design and build a full-size motion robot that meets the following specifications:
 - a. Capable of reaching underneath the vehicle (about 6" clearance)
 - b. Durable enough to not get crushed by a car
 - c. Capable of moving at any direction
 - d. Capable of containing 25-30ft of power cord (Cable reeling system)
 - e. Capable of adjusting the height of transmitter to accommodate majority of vehicles by creating a mechanism

Project Results:

1. The arm of the robot can reach under majority of electric vehicles.
2. Successfully design and built
 - a. the chassis,
 - b. lifting mechanism
 - c. cable reel
 - d. electrical housing frame
 - e. electrical component mounts

Sponsors: Kevin Cameron

Baggerbot Sandbag Feeding System for Flood Control Projects

Student Team Members:

Abner Vadil
Adriel Quilatan
Dilsher Singh
Jake Suba
Nicholas Lee
Niels Hofmeijer
Thuan Nguyen

Faculty Advisor: Prof James Mokri

Project Scope and Objectives:

Design, build and implant a bag feeding system into an existing Baggerbot machine.

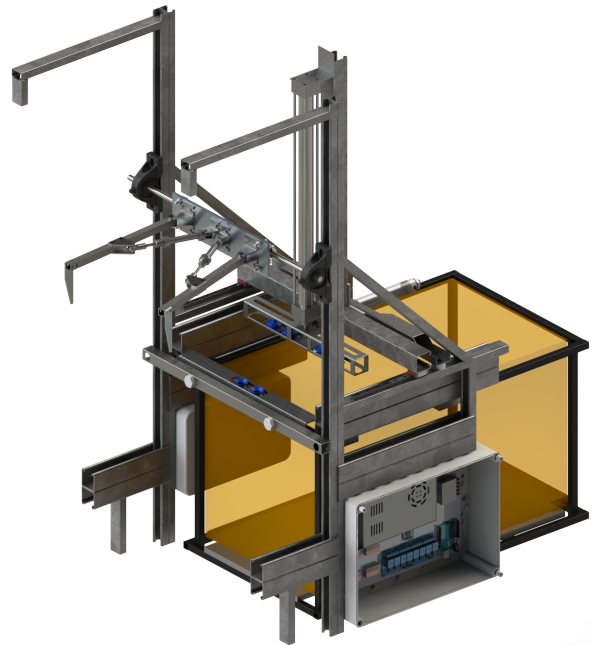
1. Achieve an operation speed of 9 bags per minute.
2. Design and build a frame capable of interfacing with the Baggerbot for completing the automation process.
3. Design and build a removable cassette which could adhere to these configurations:
 - a. Capable of supporting up to 600 bags.
 - b. Capable of keeping bags into specific and accurate positions for loading.
4. Design an electronic and pneumatic control system that is suited for a harsh and dusty environment.

Project Results:

1. Successfully designed an automatic pneumatic and electromechanical machine to open and feed empty sand bags.
2. Successfully fabricated a robust and functional prototype, demonstrating proof-of-concept while meeting design specifications.
3. Successfully integrated prototype onto existing Baggerbot machine.
4. Successfully incorporated a waterproof electronic and pneumatic control system.

Sponsors:

Golden Gate Mechanical (GGM), Santa Clara - Tom Burns & Ginger Burns

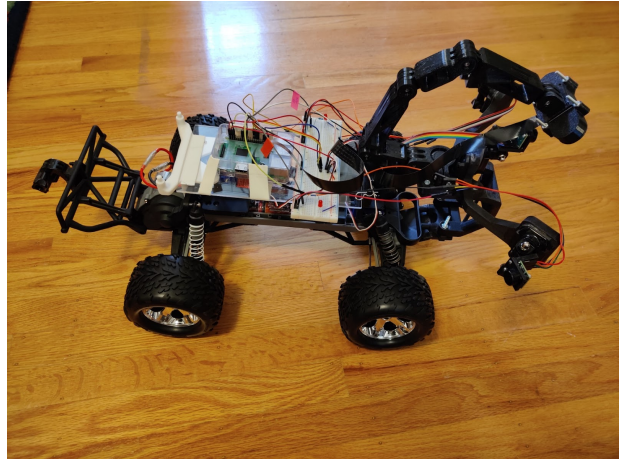


ADAS RC Car Teaching Aid with Independence High School

Student Team Members:

Matan Blum (Team Lead)
Han Huynh
YuJen Chen
Isaac Tello
John Hong
Andy Luong

Faculty Advisor: Professor James Mokri



Project Scope and Objectives:

Design and build an ADAS RC Car System to act as a teaching aid to high school students.

1. Implement a working Lane Departure detection system
2. Implement a working proximity sensor to alert when objects are approaching too closely
3. Include the ability to control the car remotely via PC.
4. Implement a LiDAR system that can show a point cloud
5. Implement all of the above onto a Traxxas RC Car
6. Give three presentations to students at Independence High School about the path to becoming an engineering student at SJSU and general engineering concepts

Project Results:

1. Successfully Implement a Lane departure detection system
2. Successfully implement a working proximity sensor to allow the operator to avoid collision.
3. Successfully implement a method to control the RC Car remotely from a PC.
4. Successfully implement the LiDAR system that can generate a point cloud
 - a. Note that due to the design of the RC Car, it is not practical to have the LiDAR on the car due to its size and that the of the LiDAR module would be too high to collect any information that would be of value.
5. Successfully implement everything in a portable manner to fit onto one RC Car.
6. Presentations Cancelled due to Sorin Neagu's illness.

Sponsors:

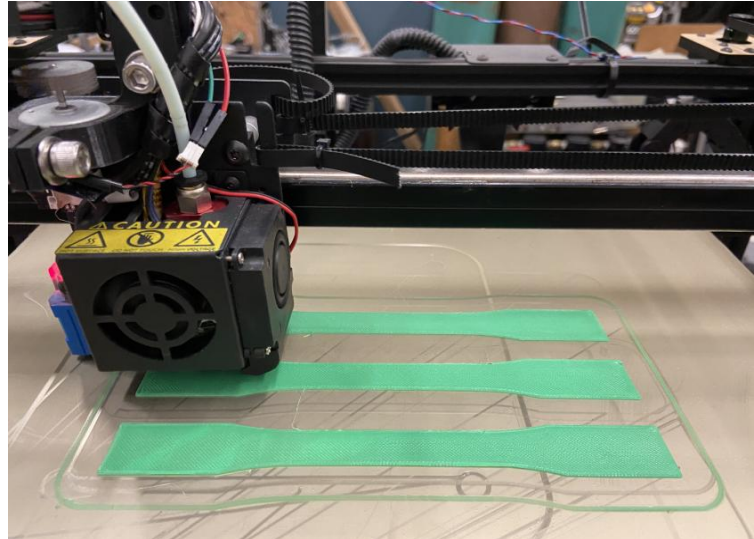
Independence High School – Withdrawn from project due to Sorin Neagu's illness.

Investigation of a Novel Technique to Improve the 3D-printed Parts Quality

Student Team Members:

Justin Nyam
Bridgette Carpiz
Zachary Kok
Grabiell Rodriguez
Hassaan Mahmood

Faculty Advisor: Dr. Syed Zaidi



Project Scope and Objectives:

Identify the effect of induced vibration on a 3D printed sample's tensile strength properties.

1. Determine the optimal print settings, controlled variables, and materials.
2. Create a standardized process to create the ASTM standard dog bones for tensile strength testing.
3. Perform porosity tests on each sample to determine porosity of each sample.
4. Design tensile testing procedure on Bluehill to specify test specifications and instructions.
5. Perform tensile testing on each dog bone sample and record tensile properties.
 - a. Properties include: tensile yield strength, ultimate yield strength, and modulus of elasticity.

Project Results:

1. Successfully determined an optimal process for rapidly printing standardized samples with consistent quality.
2. Completed 2 sets of 27 dogbones with various materials, vibrations, and infill percentages.
3. Found that vibrations increase the average porosity to each dogbone.
4. Derived optimal printing configuration for high tensile strength with less material usage.

Sponsors:

IntelliScience Research, LLC

Robotic Floor Sterilizer Utilizing Dielectric Barrier Discharge Plasma

Student Team Members:

Dani Habtom
Emmanuel Acosta
Justin Ramos
Marcus Hernandez

Faculty Advisor: Dr. Syed Zaidi

Project Scope and Objectives:

Design and build a sanitation robot which uses nonthermal plasma to sterilize floors.

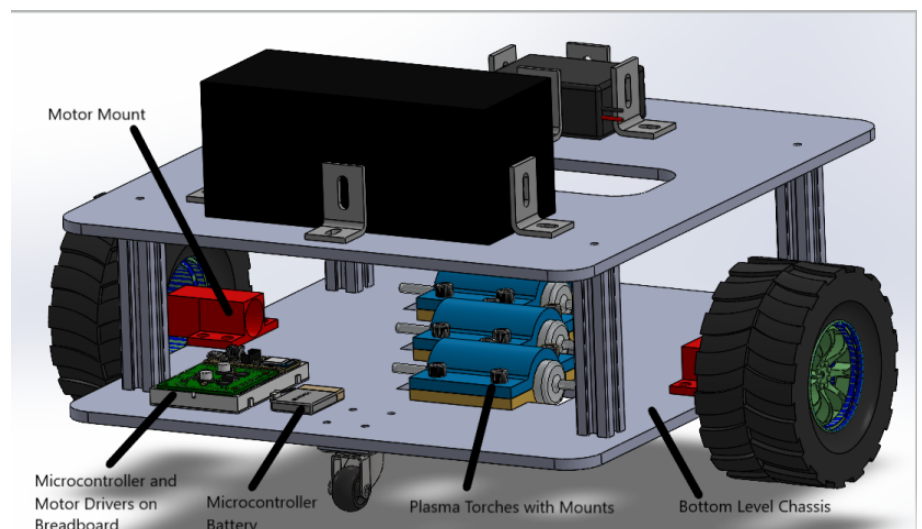
1. Characterize the plasma to understand it. Perform spectroscopy analysis to determine the radicals present in the plasma, and perform temperature measurements of the plasma
2. Design and build a gas delivery system which can supply helium and or nitrogen gas to the torches on the mobile robot.
3. Design and build a remotely operated mobile robot which can carry the plasma torches to strike the ground the robot passes.
4. Perform tests with the prototype, measuring bacteria concentrations before and after exposure to plasma

Project Results:

1. Successfully designed sanitation robot capable of carrying three plasma torches
2. Successfully assembled a functional prototype of the robot capable of following predetermined paths driven with DC motors with encoder feedback
3. Successfully characterized plasma to determine concentrations of radicals
4. Successfully designed and assembled gas delivery system that provides helium to all three torches
5. Did not yet perform bacteria experiments; but set up testing plan for future work

Sponsors:

HATEST Solutions,
Intelliscience



Design Analysis and Development of a Bionic Chair for Knee Rehabilitation Exercise

Student Team Members:

Faizan Nomani (Team Lead)

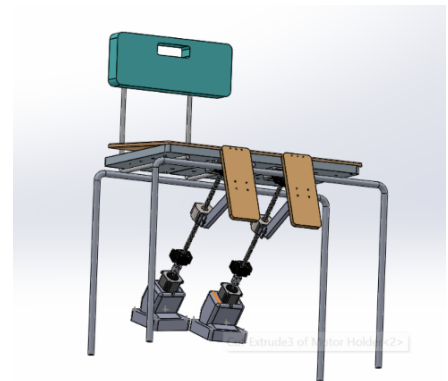
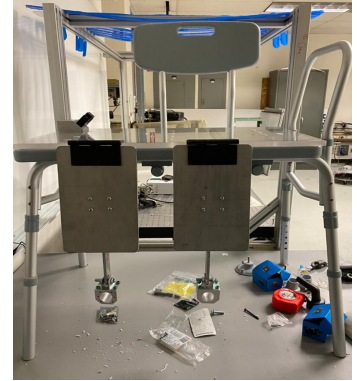
Linh An

Faculty Advisors: Dr. Syed Ziadi, Dr. Vimal Viswanathan

Project Scope and Objectives:

Design and build a Bionic Chair for Knee Rehabilitation Exercise

1. Derive the kinematic equations for two holders to balance and position two ball-screw linear actuator motor systems
2. Design and machine two holding leg plates that move from a vertical to a horizontal position and back
3. Implement a microcontroller system to control the motors with a push button
4. Construct a PCB board to control the machine using speech sensors
5. Design and build a full-size bionic chair that satisfies the following specifications:
 1. Both leg plates complete a 90-degree rotation range of motion
 2. Capable of supporting and withstanding a patient weighing over 90lbs
 3. An operation time of 30 minutes, which is equivalent to one session of rehabilitation



Project Results:

1. Successfully derived the kinematic equations
2. Successfully designed two holding leg plate systems capable of a 90-degree rotation range of motion
3. Constructed a PCB board to control the machine using speech sensors

Sponsors: San Jose State University

Design of Low-Cost Medical Ventilator (Team B)

Student Team Members:

Keian Castro (Team Lead) Omar Abdelhadi
Elaine Buron Kenny Luong
William Ly Brandon
 Visitacion

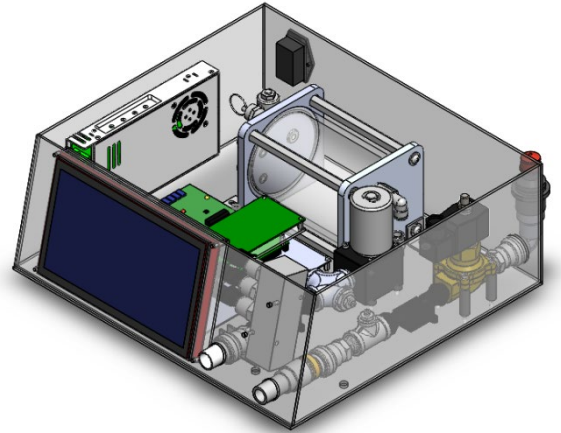
Faculty Advisor:

Professor Syed Zaidi, PhD

Project Scope and Objectives:

Design and prototype an affordable mechanical ventilator to address the supply issue that was caused by Covid-19.

1. Further development of a low-cost medical ventilator previously designed by 'SmithVent' for the Covent19 challenge using principles of design for manufacturing (DFM) and design for assembly (DFA).
 - a. Reduce costs for custom parts in the initial design with off-the-shelf (OTS) parts.
 - b. Reduce costs for pressure sensors by signal conditioning general purpose pressure sensors.
 - c. Reduce number of parts for enclosure and improve structural support by ordering a sheet metal frame for all the components to be held in.
 - d. Condense the wiring of the electrical components with a printed circuit board (PCB) that has all the leads/terminals for the required. solenoid valves, sensors, LEDs, relays, etc.
 - e. Optimize the location and the placement of electrical and mechanical parts.
2. Write and organize technical documentation inside of a Google Drive for the ventilator that later groups can reference.
 - a. Write testing procedures that we used to test the various sub-assemblies within the medical ventilator.
 - i. Pressure decay testing
 1. Inspiration/expiration lines, mixing reservoir, pressure manifold
 - ii. Volume control functionality validation
 - iii. Signal conditioned pressure sensor validation
 - b. Manufacturing process information (MPI) for assembly of ventilator
 - c. Theory of operation
 - d. Uploading process for Nextion display user interface (UI) and Arduino code



Project Results:

1. Performed cost-analysis between first and current iterations of the ventilator.
 - a. Demonstrated that new design is optimized for DFM relative to initial design, reducing costs per unit from \$4,586.83 to \$2,510.43 (45.3% reduction).
2. Translated initial state machine code to new design and tuned PID constants for target flow rate.
3. Successfully prototyped the optimized design of the low-cost medical ventilator.
 - a. Replaced all the custom 3D-printed parts with OTS parts mostly from McMaster-Carr.
 - b. Assembled all the ventilator components (mechanical and electrical) inside of the sheet metal enclosure using SolidWorks.
 - c. Performed required testing (pressure decay, signal conditioning, etc.) on the previously mentioned subassemblies.
 - d. Used stress calculations to ensure that the screws holding the mixing reservoir will provide support to withstand the pressure from air and oxygen (up to 35psi).
4. Successfully condensed the electrical wiring diagram created by the previous team into a PCB.
5. Verified the location of all the mounting holes that are required to fix all the components in place and updated the SolidWorks assembly (sheet metal enclosure) accordingly.

Sponsors:

Ricardo Barbaran (Global Electric Transport LLC)

Solar Powered Automated Hydroponic Grow System

Student Team Members:

Summer Selness (Team Lead)

Gustavo Garay

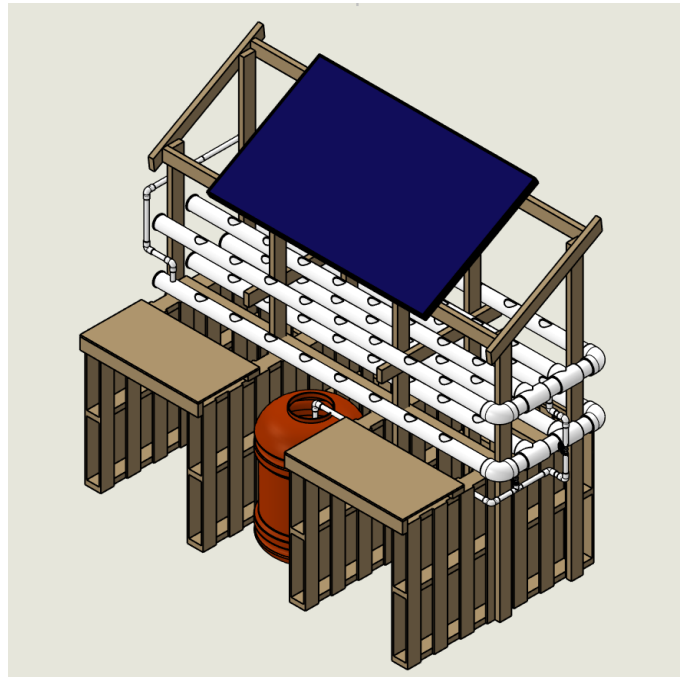
Ryan Sands

Faculty Advisor: Dr. Edward Cydzik

Project Scope and Objectives:

Design and fabricate a self-sufficient hydroponic grow system to be used in an urban environment.

1. Design a mechatronic system for complete automation of nutrient and flow solution
2. Incorporate solar energy to fully power the system
3. Create a filtration system to prevent pathogen growth and sediment build-up in nutrient solution
4. Design and build an operational ebb and flow hydroponic system that meets the following specifications:
 - a. Capable of supporting a combined water and pipe weight of an est. 250 lbs
 - b. A yield capacity of over 60 plants
 - c. Capable of being operated with minimal user input / monitoring
 - d. Designed to be used in an outdoor environment – without the use of additional lighting
 - e. Ebb and flow parameters customizable by user for different plants



Project Results:

1. Successfully designed mechatronic system.
2. Successfully integrated solar as power source.
3. Successfully created a multi-step filtration system.
4. Successfully designed and built an ebb and flow hydroponic system that meets (or exceeds) all of the design specifications.

Sponsors:

Garden to Table Silicon Valley, Gustavo Garay, Ryan Sands, and Summer Selness

Hydroponic Urban Garden

Student Team Members:

Haider Allawi (Team Lead)

Bella Schmidt

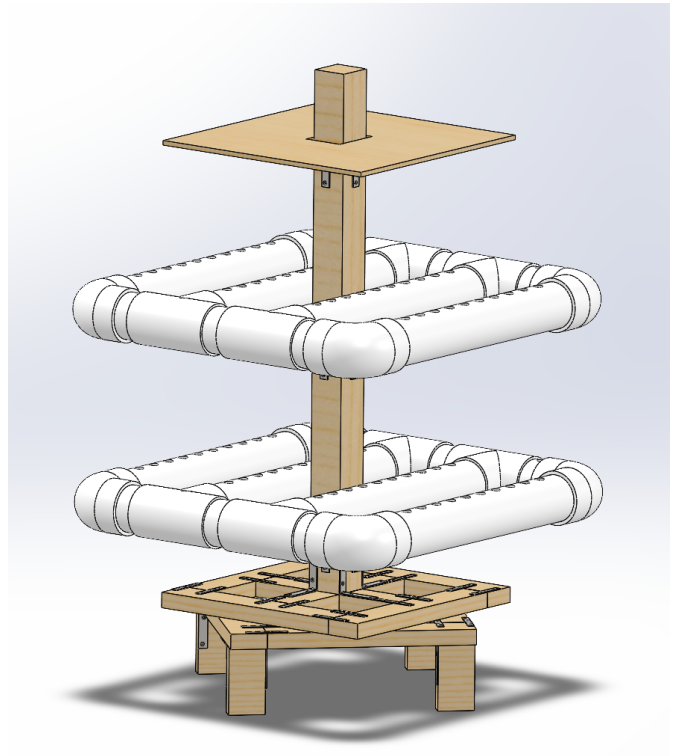
Caroline Bowman

Rajan Uppal

Faculty Advisor: Dr. Ed Cydzik

Project Scope and Objectives:

1. A student proposed project to design and build an urban garden which can fit into a home environment and utilities water instead of soil.
2. Grow and harvest plants such as basil and lettuce.
3. Design and build a compact frame allowing a high density of plants.
4. Calculate pump requirements to size for the system.
5. Optimize growing conditions to improve yields compared to soil.



Project Results:

1. Designed and built a rotating wooden structure that was compact and strong enough to support the hydroponic system.
2. Designed and built a hydroponic system allowing plant produce to grow.
3. Sized a pump that can maintain continuous operation.
4. Grew plants successfully leading to the harvesting of basil and lettuce.
5. Demonstrated that hydroponics is a faster, more effective way to grow produce when compared to soil.

Sponsors:

N/A

Chain Drive to Belt Drive Conversion

Student Team Members

Andrew Ackley (Team Lead)

Evelyn Olazaba

Germain Munoz Campos

Zhaobin Yu

Joshua Tambauan



Faculty Advisor

Ed Cydzik

Project Scope and Objectives

Design and build a belt drive system to install on a chain drive bicycle to create a long-lived and low maintenance bicycle.

1. Obtain a chain drive bike.
2. Select the best gear ratio optimized for daily use.
3. Split the frame in the rear triangle of the bike in order to fit the belt in.
4. Design a coupler to join the split frame after fitting the belt in.
5. Design two chainrings for both the front and rear of the belt drive.
6. Determine the type of material needed for the chainrings using the theory of gear bending and pitting to find the maximum stress applied to the sprockets.
7. Build a working belt drive system that meets the following specifications:
 - a. Capable of supporting a 200 lb driver
 - b. Capable of being ridden without failure.
 - c. Capable of removing and replacing the belt.

Project Results

1. Successfully obtained a chain drive bike to convert.
2. Successfully selected a gear ratio that was efficient for daily use.
3. Successfully split the frame in the rear triangle to slip the belt in.
4. Successfully designed a coupler to join the split frame after fitting the belt.
5. Successfully designed two chainrings custom fit for the belt purchased.
6. Successfully determined the type of material needed to avoid failure during use.
7. Successfully built a working belt drive system capable of supporting a 200 lb driver without failure.

Sponsors

None

Autonomous Nutrient Analyzer

Student Team Members:

Andrew Silva (Team Lead)

Cameron Hayes

Timothy Ly

Tracy Hunter

Faculty Advisor: Edward Cydzik, Dr. Crystal Han, Dr. Farzan Kazemifar, Dr. Maxime Grand

Project Scope and Objectives:

Design and construct an autonomous Nutrient Analyzer for measuring chemical composition of water samples.

1. Implement and integrate provided equipment including pump motors, valve motor, communication board, spectrophotometer, tubing, flow cells, auxiliary pump, holding coils, and Raspberry Pi.
 - a. Developed communication protocol between microcomputer and communication board to control pumps and selector valve through communication board.
 - b. Establish control of the auxiliary pump and light source using GPIO pins.
 - c. Create a program that controls analyzer through developed assays for various chemical assays.
 - i. Sequence involves synchronization of pumps, mixing two different chemicals, as well as repeating at desired time intervals.
 - d. Integrate spectrophotometer for data collection
 - i. Connect essential hardware and program for sample prep and data collection.
2. Create a housing for the components
 - a. Design and build a watertight enclosure for all components.
 - i. Allow for instrument to be operated in the lab and in the field.
 - b. Storage container for chemical bags
 - i. Container must be able to be flooded to reduce contamination from oxygenation.

Project Results:

1. Successfully integrated components in splash proof enclosure.
2. Successfully designed a program for the required chemical assays
3. Designed and modified container for chemical storage.

Sponsors:

SJSU Moss Landing Marine Lab

Spartan GreenHouse

Student Team Members:

Melad Faizi (Team Lead)

Edgar Quiroz

Erik Chavez-Lopez

Jovanie Parra

Faculty Advisor: Dr. Edward Cydzik

Project Scope and Objectives:

Design and build a self-sustaining Greenhouse.

1. Build Greenhouse frame and cover.
2. Build Greenhouse safe tables.
3. Perform an ergonomics study to determine the ideal temperature, humidity, and watering system for the highest plant growth rates.
4. Design and build an irrigation system with the following specifications:
 - a. Capable of watering both seedlings and plants in primary growth.
 - b. Decrease water usage by 25%
 - c. Increase Seedling success by 40%
5. Design and Build a ventilation system that meets the following specifications:
 - a. Capable of keeping the greenhouse at an ideal temperature of 70°F during the day.
 - b. Small enough to not take up room inside the Greenhouse.
 - c. Prevents seedlings from burning out

Project Results:

1. Successfully selected and assembled a Greenhouse.
2. Successfully designed and installed an irrigation system.
3. Successfully constructed a autonomous seedling watering system
4. Successfully established a autonomous recycling water system for plants
5. Successfully installed a autonomous ventilation system keeps greenhouse at a desirable temperature

Sponsors:

César E. Chávez Community Action Center, ex-Garden Coordinator : Kaitlyn Meyer, New Garden Coordinator: Matthew Spadoni

