ME 195A F23 Projects for Section 03 (Furman)

2023-08-04

Title of the project: Automated Wheelchair Restraint (≈3 subteams) **Project ID: Furman-01**

Supervising Faculty: Prof Burford Furman

Project objective:

Refine a proof-of-concept prototype for an automated wheelchair restraint system. Develop the structural elements that can be retrofit on common wheelchairs that will engage with a Superway vehicle-mounted structure to securely immobilize a wheelchair without user intervention. Test the engagement under expected and extreme conditions to demonstrate its safe operation.

Project description:

Proposed driverless vehicles, including autonomous transit network (ATN) vehicles (such as those associated with Spartan Superway) will require means to secure wheelchairs from moving during normal stopping and starting or in emergency braking conditions. Wheelchair users without the strength or mobility to secure themselves in a restraint will require automated assistance. A suitable automated restraint must be amenable to the wide variety of wheelchairs in use. Prior research on this problem has produced a proof-of-concept demonstration, but additional refinement is needed for the design to be qualified for installation in a public transit vehicle. Further mechanical and mechatronic design is needed for the associated structural elements, latch/unlatch mechanism, vehicle mounting arrangement, and user interface.

Area(s) of required knowledge: Mechanical design and mechatronics

Project deliverables/Scope:

(1) Design requirements and specification document
(2) Solid model and detailed drawings of the structural components in final design
(3) Stress and deflection analysis showing that all structural components will withstand worst case loading and have adequate safety factor
(4) Prototype hardware fabricated in structural material and mounted to supplied wheelchair and mocked up vehicle cabin
(5) Mechatronic design with ergonomic, reliable wireless interface
(6) Test data that verifies that the design meets specifications and requirements

Sponsor:

Spartan Superway (materials on hand)

Title of the project: Modular Small Scale Demo Track (≈3 subteams) **Project ID: Furman-02**
Supervising Faculty: Prof Burford Furman

Project objective:
Refine a proof-of-concept prototype of a modular small scale demonstration model for the Spartan Superway solar-powered transportation system. Revisit prior work and improve on the design to: 1) Integrate vehicle charging at an offline station; 2) Integrate solar photovoltaic panels above the model guideway and battery storage that will provide the power for the 'off-line' charging system; 3) Revise the guideway structure design and expand the pool of modular elements to (at a minimum double the size of the existing track); 4) Build out the vehicle fleet; 5) Improve upon vehicle position tracking and a monitoring interface; 6) Develop an illustrated assembly and operation manual; 7) Run user studies with non-Superway affiliates to measure assembly times and observe how well the assembly and operation manual allow users to complete the assembly and operate the model.

Project description:
A proof-of concept prototype of a modular small scale demonstration model for the Spartan Superway solar-powered transportation system has been developed. The model improved on previous models in terms of ease of fabricating the elements of the model, reduction in the number of fasteners used, and speed of assembling a complete model, however the current model lacks integrated solar photovoltaic panels, energy storage, and integrated vehicle charging. The model also has not gone through extensive testing and consists of a relatively small set of elements that allow only a single loop to be constructed. The proposed project aims to improve, expand, and more fully test the functionality of the model.

Area(s) of required knowledge: Mechanical design and mechatronics

Project deliverables/Scope:
(1) Review and assessment of the current modular design
(2) Design requirements and specification document for improved model
(3) Solid model and detailed drawings/ of the structural components, energy system, and mechatronics in the improved design
(4) Expanded and organized pool of interchangeable guideway components: straights, Y-junctions, curves, stations
(5) Integrated solar photovoltaics and battery storage for the guideway
(6) Integrated vehicle charging at off-line stations
(7) Fleet of functional vehicles with battery/supercap energy storage(3 minimum)
(8) Illustrated assembly and operator manual
(9) Documentation and analysis from user study to validate design improvements

Sponsor:
Spartan Superway (materials on hand)

Title of the project: Superway Vehicle Energy Storage and Charging (≈3 subteams)

Project ID: Furman-03

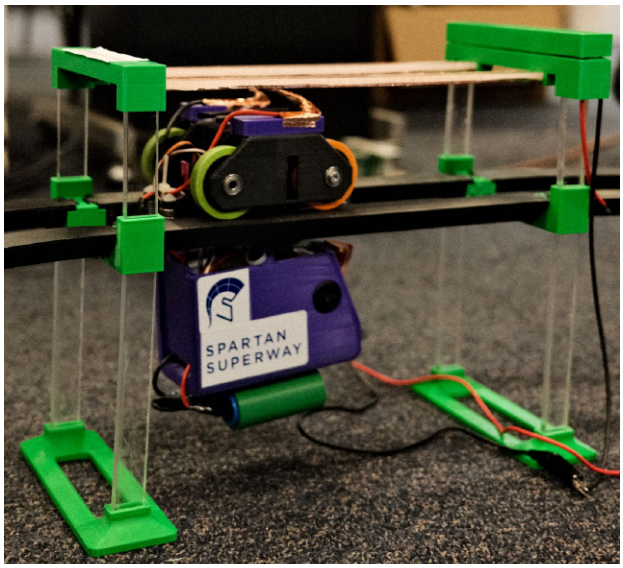
Supervising Faculty: Prof Burford Furman

Project objective:
Refine a proof-of-concept prototype of an energy storage and charging system for the Spartan Superway small scale demonstration model. Revisit prior work and improve on the design to: 1) Integrate vehicle charging at an offline station in the new small scale model; 2) Collaborate with the modular small scale model team to interface and integrate solar photovoltaic panels above the model guideway and local battery storage to provide power for vehicle charging; 3) Revise the charging approach to integrate supercaps and batteries and improve how energy is transferred from the guideway to the vehicle; 4) Collaborate with the modular small scale model team to build out the vehicle fleet with a revised energy storage and charging approach; 5) Improve upon the wireless real-time charge monitoring interface.

Project description:
A proof-of-concept prototype for transferring energy from the small scale model guideway to a stationary vehicle has been demonstrated, however the charging interface was not integrated with the full small scale model, and only supercapacitors were used to store energy in model vehicle. Further development is needed to refine the charging interface, investigate how batteries *and* supercapacitors could be used together to take advantage of their unique characteristics, integrate the charging approach into the modular small scale model, and improve the upon the wireless real-time charge monitoring interface.

Area(s) of required knowledge: Mechanical design and mechatronics

Project deliverables/Scope:



(1) Review and assessment of the current charging system
(2) Design requirements and specification document for improvements
(3) Solid model and detailed drawings/ for the improved design
(4) Integration of the charging system into the revised small scale model guideway
(5) Integration of the charging solution with solar photovoltaics and battery storage for the guideway
(6) Buildout of functional vehicles with battery/supercap energy storage(3 minimum)
(7) Improved real-time wireless dashboard to monitor charging
(8) Testing of charging solution in the small scale model that validates the design
(9) Documentation of the design improvements and test results

Sponsor:
Spartan Superway (materials on hand)

Title of the project: Concentrating Solar Power with High Temperature Thermal Energy Storage

Supervised Faculty: Prof James Mokri **Project ID: Mokri-01**

Project objective:

Design, build and test a parabolic trough solar energy collector system and measure the maximum temperature at the focal point to evaluate the effectiveness of several high-temperature thermal storage materials. Optimize the major components of the system such as reducing thermal losses and accurately tracking the sun during the day. Conduct an experiment with high temperature sand to determine if it is a feasible alternative to salts and oil storage media as a "sand battery" to store sensible heat.

Project description:

Renewable energy from solar is an intermittent energy source available during daylight hours and only a short time after sunset. Concentrating Solar Power (CSP) plants with high temperature Thermal Energy Storage (TES) have several benefits over solar PV and batteries such as: 1) batteries are more costly for large scale and long duration storage, 2) the CSP steam turbine-generator provides grid dynamic stability to ride-through electrical transients, and 3) TES can use heat pumps to increase the differential temperature between the hot and cold tanks, to improve efficiency. Operating the CSP after sunset allows utilities to provide power when it has the highest demand leading to financial benefits.

Our solar lab has a parabolic trough and various components to assemble a system and collect data. The parabolic trough, actuators, controls and programming to track the sun to intensify the solar radiation with a goal of reaching 400 C. An alternate storage technology is to build and evaluate a "sand battery" to store the collected energy, also at high temperature.

Area(s) of required knowledge: Mechanical Design and Thermo-Fluid

Number of students: Five or six student team

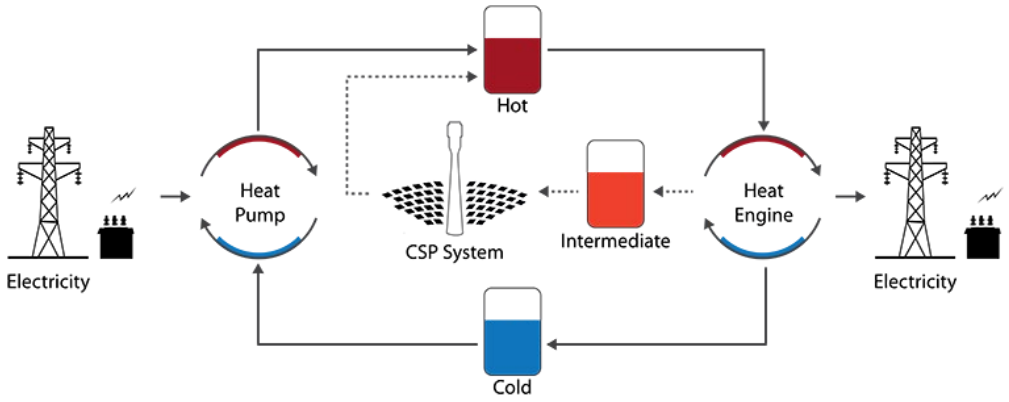
Project deliverables/Scope:

1. SolidWorks model and diagram of the trough tracking system with components specified.
2. Mechanical design of the system, actuators, linkage and controls to guide the trough to track the sun to maximize receiver temperature during the day.
3. Thermodynamic model of the system with components specified, heat transfer losses, heat exchanger size, capacity.
4. Heat transfer calculations of the predicted maximum temperature of the TES storage media.
5. Research and report on the cost and benefits of long duration energy storage using thermal materials versus batteries.
6. Final project report, periodic schedule reports, presentations and contact with sponsor

Sponsor:

SJSU ME Dept (materials on hand)

REF: https://www.rechargenews.com/energy-transition/sand-ice-and-supercritical-co2-innovative-long-duration-system-offers-cheapest-energy-storage-yet-/2-1-1011163


Hot
Heat
Pump
CSP System
Intermediate
Heat
Engine
Electricity
Electricity
Cold

Title of the project: Low Temperature Ice Energy Storage System to Reduce Peak Cooling Load

Supervised Faculty: Prof James Mokri **Project ID: Mokri-02**

Project objective:

Design, build and test a thermal energy storage system using a conventional window air conditioner or refrigerator modified to function as an ice energy storage system to time-shift the peak cooling load. This will subsequently reduce energy cost and electrical load on the utility grid. Analyze the thermodynamics of the vapor-compression system, calculate the size and performance of the components, assemble the system as you learned in ME113 and ME115, add refrigerant and collect data to validate the practicality of the ice energy storage concept taking advantage of the latent heat capacity of the water phase change.

Project description:

Air conditioning is one of the largest loads in residential and commercial applications, especially as climate temperatures increase. An ice storage system is made up of an ice production unit, an air handling unit to transfer cool air to the room, and a control system. Basically, the thermal storage system converts electricity to ice when the cost of power is low at night and later used to cool the room when the rates are highest. Typical time-of-use rates for electrical power peak between 4 pm to 9 pm and are lowest at night-time rates after 9 pm. If solar PV is generating excess power mid-day (before 4 pm), it can be used to generate ice for later use. The cooler outside temperature at night also aids in the generation of ice. The device to generate ice without fouling the icing coils will require some design work by the team. An enhancement to consider would be to add periodic water spray on the condenser coils. Interestingly, SJSU has a large Ice storge system associated with the campus power plant which we will tour and meet with the design company.

As part of the project, it may be necessary to acquire surplus components from local companies depending on other funding sources.

Area(s) of required knowledge: Thermo-Fluid, system design

Number of students: Five or six student team

Project deliverables/Scope:

1. Thermodynamic model of the system, diagram of system with components specified, heat transfer losses, evaporator and condenser size, and capacity.
2. Mechanical design of the system
3. Calculate the feasibility, and practicality of the system.
4. Research report on the cost and benefits of long duration energy ice storage.
5. Final project report, periodic schedule reports, and presentations.

Sponsor:

SJSU ME Dept (materials on hand)

https://www.greentechmedia.com/articles/read/ice-energy-will-launch-residential-thermal-storage-in-first-quarter-2017

Title of the project: Waste-heat Recovery System using an Organic Rankine Cycle Turbine to Generate Electricity

Supervised Faculty: Prof James Mokri **Project ID Mokri-03**

Project objective:

Design, analyze, build, and test a scaled down prototype of an Organic Rankine Cycle (ORC) system which in concept converts waste heat from the condenser of an existing large industrial refrigeration system to electricity. It will be necessary to calculate the performance of the system components, complete assembly of the components, and test performance of this prototype. Analyze the thermodynamics of the system using modern simulation tools and optimize system components.

Project description:

Last year, a Senior Project team obtained a 2-ton vapor-compression air conditioner unit, heat exchangers and turbine-generator from the sponsor to build a prototype for testing proof-of-concept. Currently, waste heat from condensers of large-scale industrial refrigeration systems is discharged to the atmosphere when it could potentially be used to generate electricity. Due to a unique characteristic of the temperature-entropy diagram of organic fluids, they can be used as low temperature working fluids in a conventional Rankine cycle without requiring superheat. This feature can be seen in the Ts diagram below. The sponsor is very supportive of a team to apply thermodynamic principles, assemble components and test the proof of concept.

Area(s) of required knowledge: Thermodynamics, system design

Number of students: Five or six student team

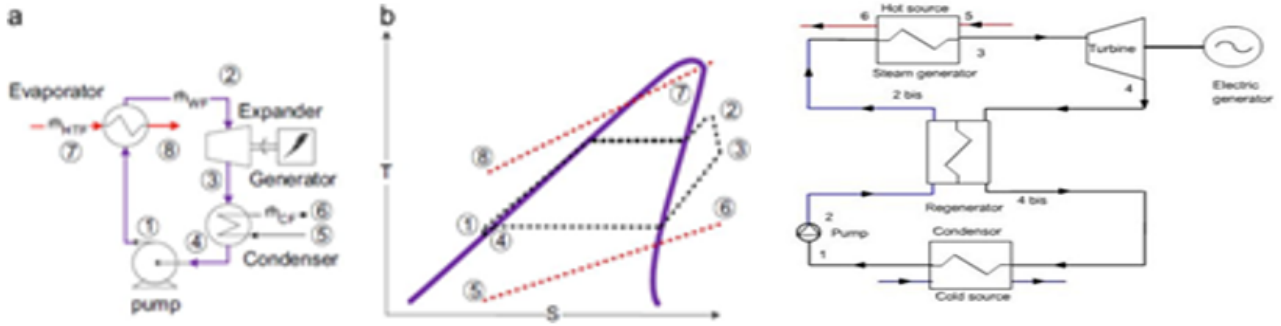
Project deliverables/Scope:

1. Thermodynamic analysis of the system with components specified, heat transfer losses, heat exchanger size, capacity.
2. System diagram with components and parts list.
3. Research and report on the cost and benefits of ORC system.
4. A functioning reduced scale prototype of ORC system
5. Documentation for fabrication and instructions for operation of system
6. Final project report, periodic schedule reports, presentations and contact with sponsor.

Sponsor:

Golden Gate Mechanical, Santa Clara

Images


a
Evaporator
Expander
Generator
Condenser
pump
b
T
S
Hot source
Steam generator
Turbine
Electric generator
Regenerator
Pump
Condensor
Cold source

Title of the project: Apparatus to Mount and Position a Sandbag Handling Machine

Supervised Faculty: Prof James Mokri **Project ID: Mokri 04**

Project objective:

The project objective is to design, build, and test an apparatus, such as linkages, to deploy an automated machine built by a previous Senior Project team which opens bags for filing. The apparatus will assist an operator lift, slide, support, and lock into position the automated machine which weighs about 20 lbs and measures about 2 ft by 2 ft.

Project description:

A previous year's Senior Project team built an automated machine to open and position an unfilled sandbag as one portion of a large mobile trailer-mounted bagging machine (BaggerBot). The machine fills empty bags with gravel or sand for use in flood control applications, see video below. This year's team needs to design and build an articulated linkage apparatus which assists in the manual mounting and positioning of previous year's machine from a stowed position for transporting to an operational position. Create a prototype which is functional, reliable, safe and suited for a harsh dusty environment on flood control projects.

Area(s) of required knowledge: Mechanical Design

Number of students: Five or six student team

Project deliverables/Scope:

1. Static SolidWorks model showing design configuration, component parts list, mechanical design, stress.
2. Animated SolidWorks model showing range of motion and function.
3. A functional proof-of-concept prototype meeting sponsors specs.
4. Documentation of project work
5. Final project report, periodic schedule reports, presentations and contact with sponsor.

Sponsor:

Golden Gate Mechanical, Santa Clara

Images

Video of Bagger Bot: https://www.youtube.com/watch?v=2seo4hAtBio

Title of the project: Articulated Arm for Electric Vehicle Charging Robot (EV Charge Bot)

Supervised Faculty: Prof James Mokri **Project ID: Mokri-05**

Project objective:

The objective of this project is to design and build a prototype Arm which is part of a system to recharge EV batteries in parking structures, such as on SJSU campus. The Arm will be mounted on a mobile platform both of which will position a transformer-type device (transmitter) at the end of the Arm. The end of the Arm should be capable of four degrees of motion and will inductively connect the transmitter to a receiver mounted under or on the front of the EV. There is a battery on the Charge Bot platform which will separately be recharged from docking stations distributed throughout the parking structure. The concept for the EV Charge Bot is to locate the EV, find the receiver mounted under the vehicle, make the connection, and initiate the charging process. The transmitter is conical in shape and must be pushed into the receiver (the inverse), it should be self-aligning and tolerate some guidance error. The navigation capability of the Charge Bot is outside the scope of the project this semester.

Project description:

Electric Vehicles (EV) are becoming an important form of transportation and require a charging infrastructure to support EV rollout. Developers have designed robots with arms to plug directly into the EVs electrical high-voltage connection which may be prone to poor connection due to dirt and contamination or misalignment. Last year, a senior project team worked on portions of the Charge Bot but did not work on the Arm or inductive coupling. The sponsor is interested in the team designing, building, and testing the prototype Arm and evaluating the feasibility, cost-benefit and practicality of the EV Charge Bot system. The primary aspects of the project divide into: 1) Arm and EV Charge Bot platform, 2) transmitter/receiver and related power electronic functions, and 3) necessary capacity of Charge Bot battery for typical EV use cases.

Area(s) of required knowledge: Mechanical Design, mechatronics

Number of students: Five or six student team

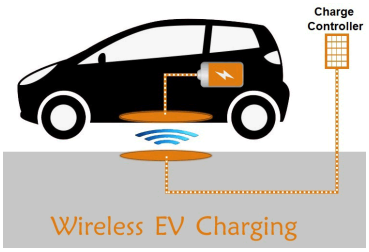
Project deliverables/Scope:

1. A functional proof-of-concept prototype Arm meeting sponsors specifications
2. SolidWorks models of EV Charge-Bot in general showing configuration, component layout, mechanical design and specifically showing the design details of the Arm.
3. Final project report, periodic schedule reports, presentations
4. Regular contact with the sponsor

Sponsor:

Kevin Cameron

Images



Design and Development of Bipedal Rechargeable Knee Exoskeleton

Supervisor: Dr. Mojtaba Sharifi

Project ID: Sharifi-01

Background:

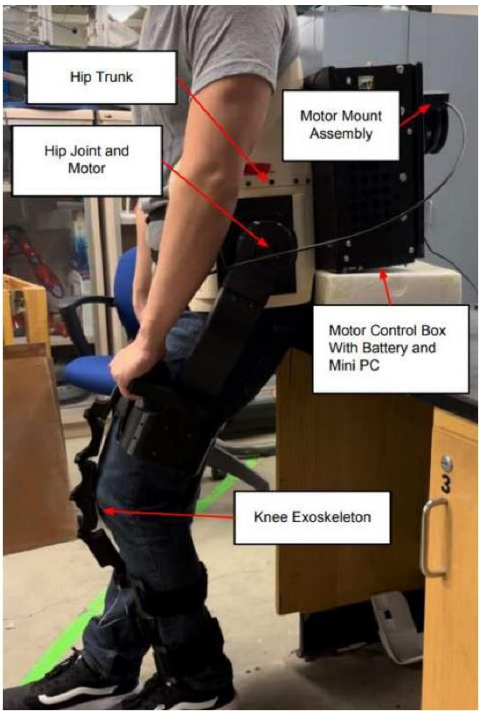
Spinal cord injury (SCI) and stroke are the two main causes of physical impairment. For this purpose, robotic systems and exoskeletons have been developed to assist and possibly rehabilitate these individuals and reduce their secondary complications. However, most of the existing exoskeletons have rigid linkages with considerable inertia/weight, which has necessitated powerful actuators and batteries being employed in the exoskeleton.

Project Goal:

To address the above-mentioned issues and for utilization in long-term care settings, a light rechargeable exoskeleton will be developed to actuate the knee joint of the impaired leg of users. The same mechanism will be connected to the knee joint of the other intact leg with a bi-directional energy harvesting system and without an actuator. This will enable it to receive motion data and synchronize the movements of both legs in locomotion. More importantly, the kinetic energy will be harvested by the passive knee mechanism on the intact leg to recharge the exoskeleton battery (for powering the motor) in real time during walking. Thus, this assistive device will be a passive-active bipedal knee exoskeleton with an energy harvesting feature that allows the power supply (battery) to be lighter.

Deliverables:

1. The CAD model for the exoskeleton links, segments, connectors, cuffs, and joints, guarantees the adjustability of the mechanism for various human users and body joints.
2. Selecting the motor, battery, recharging systems, sensors, and boards (e.g., microcontroller) to actuate this exoskeleton
3. Implementing control strategies for motion and force control by programming the motor



Preferable Skills:

1. CAD design and analysis in SolidWorks and/or other modeling software
2. Computer programming in C++ and/or Python
3. Mechatronics and circuit analysis: experience in working with actuators (motors), sensors, and boards

Title of the project: Collapsible Cup Refinement **Project ID: Yee-01**

Supervised Faculty: Dr. Raymond K. Yee

Project objective: To refine and evaluate the existing design of a portable, reusable, and collapsible cup used for hot & cold beverages (coffee) with special attention on ensuring a leak-tight seal

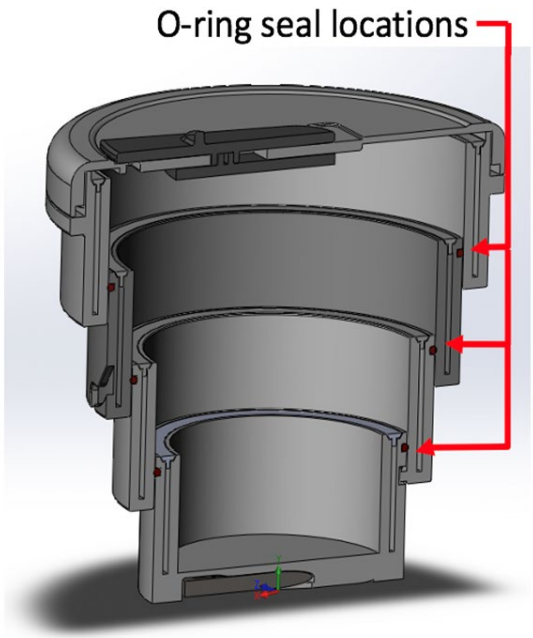
Project description & scope: Evaluate the existing design of the cup (see below) & make improved design modifications; perform fatigue evaluation of an O-ring to meet functional requirements as stated while assessing manufacturing methods/tolerances for the cup.

Indicate area(s) of required knowledge: Mechanical Design and Thermal Analysis

Number of students: three student team

Project deliverables: (1) Solutions to avoid leaking from hot and cold temperature drinks
(2) Solutions to manufacture parts with mass production
(3) Finalized CAD drawings and functional prototype to demonstrate meeting its specifications

Sponsor: Jason Blum, patent holder



Cross-sectional view of the cup

Title of the project: Golf Cart Upgrade and Refurbishment **Project ID: Yee-02**

Supervised Faculty: Dr. Raymond K. Yee

Project objective: To refurbish and upgrade an existing Ford golf cart (in E111, see photo) to make it functional.

Project description & scope: An electric Ford golf cart (model: Ford Think Neighbor) whose components need replacement and battery upgrades to make driving safe. The goal is to make it functional and enhance its rideability. The focus will be on its electric power system and braking system.

Indicate area(s) of required knowledge: Mech Design and Mechatronics

Number of students: Three student team

Project deliverables: (1) Golf cart electrical and mechanical components connectivity diagram
(2) Functional and safe driving golf cart
(3) Detailed final report on its performance

Sponsor: Dr. Raymond K. Yee

Title of the project: Smart Personal Mobility Vehicle (SPMV) Front Wheels & Suspension System Upgrade

Supervised Faculty: Dr. Raymond K. Yee **Project ID: Yee-03**

Project objective: To study the existing front wheel suspension system of the vehicle and to optimize the design to satisfy the road-safe driving condition

Project description & scope: Modify and upgrade the current front wheel suspension systems and wheels of the Smart Personal Mobility Vehicle and connect them with proper readouts on the speed and distance travel.

Indicate area(s) of required knowledge: Mech Design and Mechatronics

Number of students: Three student team

Project deliverables: (1) Front-wheel suspension system upgrade to meet road safety
(2) System works appropriately in sync with the rest of the vehicle
(3) Detailed final report includes all parts and CAD drawings and vehicle performance data

Sponsor: Dr. Raymond K. Yee

Title of the project: Avocado Slicer System Design **Project ID: Yee-04**

Supervised Faculty: Dr. Raymond K. Yee

Project objective: Update the existing design (see photo below) and modify the device that cuts any size avocado into slices and removes its pit (seed) from the flesh

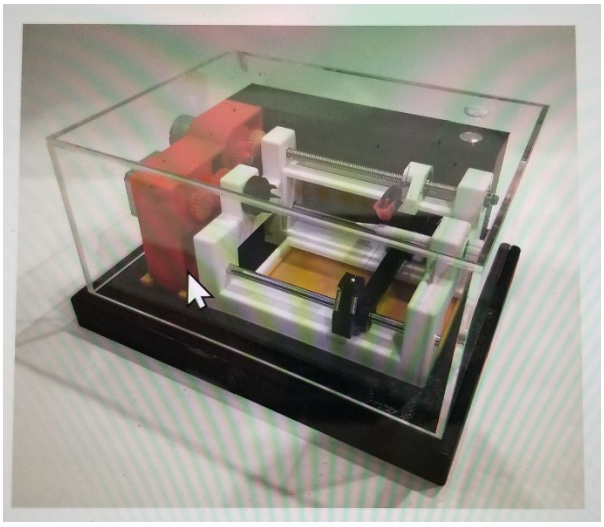
Project description & scope: The device will be able to split any size avocado into two halves and separate the seed from the edible part of the avocado. The mechanism for this project will be aesthetically pleasing and convenient for the user. The avocado cutter/slicer will have an electronic control to operate the mechanism. The device will be compact and can be stored away if needed. The device will also be designed to take into account safety measures.

Indicate area(s) of required knowledge: Mech Design and Mechatronics

Number of students: Three student team

Project deliverables: (1) An automated device that can cut/slide the avocado, remove its seed, and separate the flesh for serving.
(2) A functional prototype that demonstrates its functionalities
(3) A detailed final report documenting the device performance and CAD drawings for manufacturing

Sponsor: Dr. Raymond K. Yee



Title of the project: Smart Walker Design for the Elderly **Project ID: Yee-05**

Supervised Faculty: Dr. Raymond K. Yee

Project objective: To develop an assistive mobility device/system which provides stability, support, and mobility for elderly folks to maneuver around their home (e.g., one-floor apartment).

Project description & scope: To design a lightweight, simple, wearable/rideable optimal kinematic system for seniors to support & preserve their mobility and stability in a home environment, maintaining an acceptable quality of life.

Indicate area(s) of required knowledge: Mech Design and Mechatronics

Number of students: four student team

Project deliverables: **(1)** Detailed design with CAD and analysis
(2) Fully functional prototype with verification data
(3) Final report with literature reviews and design details

Sponsor: Dr. Raymond K. Yee

https://ae01.alicdn.com/kf/Sb8d30d52d5784bb0a117e3c67c5e86e6a/Walking-Aid-Walking-Rehabilitation-Helps-Elderly-Training-Equipment-Stroke-Hemiplegia-Exoskeleton-Lower-Limb-Walking-Leg-Lifting.jpg_50x50.jpg_.webp

https://ae01.alicdn.com/kf/Sdc01e04816224d56b3aeaeb59af4aebbG/Exoskeleton-Help-Walking-Knee-Booster-Fixed-Support-Menisci-Knee-Pad.jpg_50x50.jpg_.webp

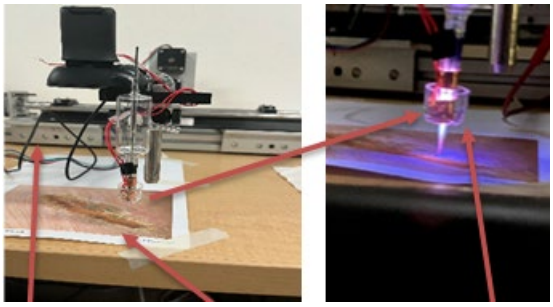
ME 195 Projects for AY 2023-2024

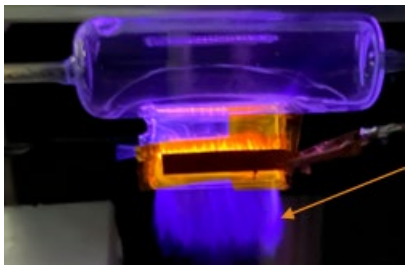
Projects Offered by S.H. Zaidi

Project Number Project Title	1 Characterization of a bifacial Solar Panel and passive techniques to cool the panel
Instructor	S.H. Zaidi (Section 06)
Project Description	"The additional gain in the energy yield of a bifacial solar photovoltaic (PV) module is mainly due to its ability to absorb the ground reflected irradiance (Albedo) through the rear surface of the module. Albedo is the critical characteristic that depends on the surface of the ground, the position of the sun, module clearance, module spacing, tilt angle, etc. The higher the value of albedo, the more is the bifacial gain and so the energy yield [Reference – Ganeson et al.]." This work investigates the performance of the PV module by designing and developing a rig that will rotate the PV modal at any angle and will be able to move the PV module vertically as well. Different kind of reflecting materials will be tested to illuminate the PV module from the backside to find the highest value of albedo. PV module output and surface temperatures will be recorded to characterize the PV module in multiple operating conditions. Methods to cool the PV module will be investigated.
Project Objective(s)	• Design and develop an experimental rig that hold the bifacial PV module and will test it. • Develop a mechanism to test various reflecting surfaces to illuminate the backside of the PV module. • Characterize a bifacial PV module by measuring the output and temperatures at various operating conditions. • Investigate possible ways to cool the PV module surface (both active and passive methods)
Project Deliverables	Functioning bifacial PV module operating remotely and providing output voltages and temperatures at various operating conditions.
Project Sponsor	IntelliScience and Hastest Solutions
Number of students	Three
Project Graphic	

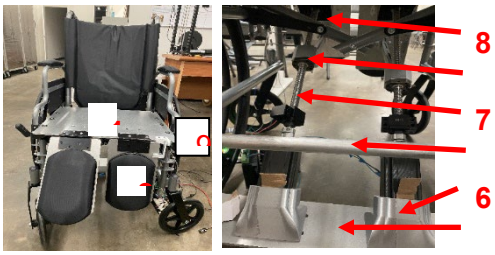
Project Number Project Title	2 Passive Cooling of a solar panel using liquid film and looking at possible energy harvesting methodologies
Instructor	S.H. Zaidi (Section 06)
Project Description	Active cooling of solar panels can enhance their performance by decreasing the surface operating temperatures. This experiment will set up an experimental rig that will incorporate a liquid cooling panel at the backside of the solar panel. The characterization of the system will be performed at various operating conditions to ensure the possible benefits by cooling the panel. Other energy harvesting strategies for the above system will be explored.
Project Objective(s)	• Design and develop an experimental rig that hold the PV module and will test it. • Develop a mechanism to attach a liquid film under the panel for active cooling • Characterize a PV module by measuring the output and temperatures at various operating conditions. • Investigate possible ways for energy harvesting for the proposed system
Project Deliverables	Functioning PV module operating remotely and providing output voltages and temperatures at various operating conditions.
Project Sponsor	IntelliScience and Hastest Solutions
Number of students	Three
Project Graphic	

Project Number Project Title	3 Impact of vibration on a 3D printed material
Instructor	S.H. Zaidi (Section 06)
Project Description	In a previous research project, a 3D-Printer nozzle design was modified to see the impact of induced vibration on the quality of fabricated parts [IMECE 2019, 2020, 2021]. Induced vibration are expected to decrease the porosity of printed parts and improve the cohesion between print beads, ultimately improving their mechanical properties. Based on the tensile test of the printed specimen, we need to investigate if the parts printed with induced vibrations had improved mechanical properties. The porosity of the printed parts as a result of the induced vibrations will be investigated. A camera will be installed to obtain the layer-by-layer image of the printing surfaces with and without vibration.
Project Objective(s)	● Use the current setup to print parts/specimens to test them on a tensile machine that has recently been obtained by the Mechanical Engineering Department. ● Install the motor to induce mechanical vibrations in the nozzle tip ejecting material. We need to characterize the induced vibrations (vibrational frequency measurements etc). ● Image layer by layer during the 3D printing with and without vibration ● Test the 3D specimen using the Tensile Machine in the department.
Project Deliverables	● Characterize and investigate impact of vibration induced 3D material on the material strength ● Visualize the layer-by-layer as the material is being printed.
Project Sponsor	IntelliScience Research LLC
Number of students	Three
Project Graphic	

Project Number Project Title	4 Improved design for a 2D traversing stage and MATLAB based Image processing to map the Wound for Plasma Torch scanning.
Instructor	S.H. Zaidi (Section 06)
Project Description	Scanning of a wound surface using a plasma torch requires a 2D traversing stage that can hold the torch and can scan the wound surface. A camera mounted on the stage arm will take the picture and will use MATLAB image processing to make a boundary around the wound, will allocated coordinates of the boundary, and will provide this information to a microprocessor that will drive the motors of the traversing stage for scanning the wound. Current 2D system will be fully characterized and a third-dimension movement will be introduced to make this system three dimensional (3D-SYSTEM).
Project Objective(s)	Design and develop a smart 3D traversing stage that is capable of holding the plasma troch and a camera to identify the wound surface. Use MATLAB image processing to capture the wound pictures and provide information on its coordinates for scanning purposes Develop a software that will operate the 3D stage in the required directions to scan the wound surface
Project Deliverables	Design and develop a fully operational automated 3D traversing system to hold the plasma torch and scan the wound surfaces without human intervention.
Project Sponsor	IntelliScience Research LLC
Number of students	Four
Project Graphic	

Project Number Project Title	5 Improve the Robot to carry DBD plasma Torches for Surface bacteria Mitigation and Sterilization (Plasma Hoover)
Instructor	S.H. Zaidi (Section 06)
Project Description	Dielectric Barrier Discharge plasma is used as a non-intrusive tool for rapid wound healing and sterilization. This is achieved by exposing the wound surface. The same plasma torches can be used to mitigate bacteria on wet and dry surfaces. For this purpose, a special torch is designed and tested for its operation. A preliminary robot is also designed to hold the torch and move along the surface to scan and inactivate bacteria on it. The new project will provide an improved design that can be used and programed remotely. The robot should carry all the accessories necessary for the operation of the plasma torch.
Project Objective(s)	• Operate plasma sheet generator and optimize it by mitigating bacteria on the agar surface • Provide an improved robot design and operate it with the live plasma scanning the surface • Automation of the robot for its operation
Project Deliverables	• Plasma hoover design, development, and characterization
Project Sponsor	IntelliScience Research LLC
Number of students	Four
Project Graphic	

Project Number Project Title	6 Impact of blade design on a toy helicopter performance: Measurement of Thrust and laser sheet flow visualization
Instructor	S.H. Zaidi (Section 06)
Project Description	Helicopter performance heavily depends on its blades design. In this project, a toy helicopter will be used to evaluate its performance. A test rig will be developed to measure the thrust in an automated fashion by incorporating Aduino and a remote control for the operation. A laser sheet will be generated to visualize the flow across the rotating blades. 3D printing will used to design various blades that will be then mounted on the helicopter to investigate the blade design impact on the overall performance of the helicopter.
Project Objective(s)	• Design a test rig for measuring the thrust • Use a microprocessor to record the rpm, and thrust values at different operating conditions. • Print various blades using 3D printing method and mount the blades to see the impact on the thrust generated by the system • Use laser based diagnostics to capture the flow images across the rotor blades.
Project Deliverables	• Fully operated test rig for monitoring a toy helicopter performance
Project Sponsor	IntelliScience Research LLC
Number of students	Three
Project Graphic	

Project Number Project Title	7 Testing and Characterization of the current Biochair/Bioleg system using multiple sensors for rehabilitation exercises
Instructor	S.H. Zaidi (Section 06)
Project Description	Recent activities in our department are looking various ways to design and develop devices for leg muscle rehabilitation. The final design included multiple motors based automated system and various sensors to characterize the performance of the device. This project will investigate ways to develop a prototype biochair and will analyze its functioning.
Project Objective(s)	• Use the current design of the biochair to develop a prototype system • Investigate methods to make it user friendly • Analyze the operation and set a working protocol for the machine • Incorporate multiple sensors and develop a pcb board to operate the system
Project Deliverables	• Functioning prototype
Project Sponsor	IntelliScience Training Institute
Number of students	Three
Project Graphic	

Project Number Project Title	8 Characterization of a heat sink with embedded fin thermosyphons along with ANSYS modeling
Instructor	S.H. Zaidi (Section 06)
Project Description	High power LED panels are being used for indoor agriculture. One direct application is related to space technology. LED panel's performance is adversely affected by temperature. In this project we will be looking for passive techniques to cool down the LED panels. A special heat sink embedded by fin thermosyphons is recently designed. Full characterization of this system is required. Along with the experimental work (measurement of temperatures), theoretical calculations and ANSYS modeling will be adopted.
Project Objective(s)	• Assemble the experimental rig for operation • Develop experimental methodology to characterize the system by measuring temperatures at various operating conditions • Conduct calculations by using ANSYS modeling to validate the experimental data.
Project Deliverables	Functioning test rig. Full characterization by operating at various operating conditions.
Project Sponsor	IntelliScience Training Institute
Number of students	Three
Project Graphic