Department of Mechanical Engineering

Student Conference Day Presentations
Senior Design Projects
May 13, 2016

SJSU SAN JOSÉ STATE UNIVERSITY
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<td>Lucas Petersen (Lead)</td>
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<td>Garrett Gemmel (Lead)</td>
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<td>David De Ocampo (Lead)</td>
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<td>Augustine Soucy</td>
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<td>Jaymie Zapata</td>
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| 1400-1425 | Spartan Superway – **Power Systems** | Mitch Hatfield (Lead) (EE)  
Matt Holst (EE)  
Mehnaz Mahbub (EE) | (See list below)                                      |
| 1430-1455 | Spartan Superway – **Guideway Torsion Test** | Steve Trevilyan (Lead)  
Christopher Fong  
Ian Johnsen  
Ivan Tapia  
Kriti Kalwad (External Contact – FEA modeling) | (See list below)                                      |
| 1500-1525 | Spartan Superway – **Small Scale Guideway** | David Paul Y. Sales  
Kenny Strickland  
Ali Bootwala | (See list below)                                      |
| 1530-1555 | Spartan Superway – **Small Scale Vehicle** | David Chen  
Bryan Ho | (See list below)                                      |
| 1600-1625 | Spartan Superway – **Small Scale Controls** | Henry Xie (Lead)  
Thomas Nguyen  
Kenneth Aganon  
Nasrat Haidari | (See list below)                                      |
| 1630-1655 | Spartan Superway – **Small Scale Solar** | Ivan Servin (Lead)  
Brian To  
Allan Wai | (See list below)                                      |

**List of Superway Sponsors:**  
International Institute of Sustainable Transportation (INIST), Swenson Solar,  
Beamways, Microsoft, Moal Coachbuilders, Master Metal Products, SJSU College of Engineering, Tigo Energy,  
MiaSolé, Sundraft, Syntrans, A Tool Shed, Peoples Associates, Francis de Winter & Associates, PDM Steel, Vishay  
Precision Measurements Group, Evans Energy Systems, Encitra, Stion, Vanderbend Manufacturing, Advanced  
Transit Association, DF Standler, Nor-Cal Metal Fabricators, SC Mech Solution, Big Creek Lumber, A-tech  
Manufacturing, Associated Students (SJSU), Areias Systems
Spartan Superway – Intermediate Scale Guideway

Student Team Members:
Alejandro Valenzuela

Faculty Advisor: Dr. Burford Furman

Project Scope and Objectives:
Design a Guideway
1. Must demonstrate a 17 degree incline and decline.
2. Must support the bogie, the structure that supports the entire mechanism and holds up the cabin.
3. Must be easy to disassemble and assemble.
4. Must support solar panels and wayside pickup.

Project Results:
1. Successfully provided rails that travel downward in 17 degrees.
2. Successfully designed guideway can hold the require load of the bogie, cabin and power supplies.
3. Demonstrated sections of rail can easily be disassembled, transported, and assembled.
4. Guideway can support power supplies.

Sponsor:
Master Metal Products
Spartan Superway - Solar Panel Array for 1/12 Scale Model

Student Team Members:
Ivan Servin (Team Leader)
Brian To
Allan Wai

Faculty Advisor: Dr. Burford J. Furman

Project Scope and Objectives:
Design multiple solar panel arrays to provide power for scaled model of Spartan Superway
1. Design functional solar panel array assembly to properly represent the full scale Spartan Superway.
2. Design curved solar panel frames to increase visualization and efficiency.
3. Design solar panel array mounts that are able to be adjusted to various angles.
4. Design solar panel array assembly that will provide power to bogies.

Project Results:
1. Successfully designed, fabricated, and tested curved solar panel frame.
2. Successfully created solar panel array assembly using Solidworks.
3. Successfully created on track and functional panels.
4. Demonstrated an accurate visualization of the full scale Spartan Superway.
5. Demonstrated solar panel array mount that has the ability to range from 0 to 90 degrees.
6. Measured a current of 3.1 amps and a voltage of 21 volts for each solar panel array.
7. Successfully created a DC load to power a bogie or battery charger.
Spartan Superway - Cabin

Student Team Members:
Lucas Petersen (Team Leader)
Mark Acoba
Rebecca Alvarez

Faculty Advisor: Dr. Buff Furman

Project Scope and Objective:
Design a prototype cabin for a sustainable public rapid transit system (PRT).
1. Design an aesthetically pleasing interior and exterior views in one model.
2. Design a model that will include new safety features and needs for the riders, including ADA standards and bike storage.
3. Design an aerodynamic shape to minimize overall drag.

Project Results:
1. Completed a design for a full-scale cabin for PRT system.
2. Successfully designed a cabin with drag coefficient at (1.3)
3. Successfully completed a fully detailed fourth-scale model cabin.
4. Successfully completed an intermediate scale model of the cabin to complement the intermediate model of track assembly.
Spartan Superway – Intermediate Scale Steering Mechanism / Braking System

Student Team Members:
  Thang Ngo
  Chin Ming Lui
  Jeffrey Chau

Faculty Advisor: Dr. Burford Furman

Project Scope and Objectives:
  Design an automatic steering mechanism and braking system for Spartan Superway:
  1. Design a braking system using mechanical disc brake that is programmed to an Arduino
  2. Design a steering mechanism that is powered by a stepper motor for fast and optimal performance
  3. Design the structure of bogie that synchronizes motion of upper and lower control arms for optimal switching and better overall reliability and efficiency
  4. Build a ½ scale model of the proposed personal rapid transit system (PRT)

Project Results:
  1. Successfully designed, constructed, and tested steering mechanism and brake system
  2. Successfully simulated the control of steering mechanism and brake on the guideway
  3. Demonstrated sophisticated design of the structure of the bogie
  4. Measured and optimized the steering mechanism and brake system
  5. Evaluated the power requirements for the steering mechanism and brake system
  6. Successfully and efficiently integrated the control arms and braking system into the structure of the bogie
Spartan Superway – Intermediate Scale Propulsion

Student Team Members:
Christopher McCormick (Lead)
Cassandra Acosta
Aaron Cheng
Steven Luong
Uday Ranjeet
Vicente Viqueira

Faculty Advisor: Dr. Burford Furman

Project Scope and Objectives:
Design propulsion to allow intermediate-scale bogie to traverse the sloped, suspended guideway.
1. Choose and obtain a hub motor that will propel the 350lb (approx.) bogie and cabin up a slope of 17°.
2. Design a mount to secure the motor to the bogie.
3. Design a spring mechanism to press the hub motor into the ceiling of the track with enough force to produce sufficient friction to move the bogie up the slope.
4. Interface the motor with a microcontroller to control it.

Project Results:
1. Found power requirements to be approximately 0.5HP and required propulsion force to be 470N (47.8 N-m at 4in radius) to move the vehicle up the slope at 2mph.
2. Successfully obtained a motor and controller that fulfilled our power and torque requirements.
3. Modified the H-bar of the original bogie design to accommodate the size of the motor wheel and mount.
4. Programmed the Arduino microcontroller to operate propulsion, steering, and braking.
Spartan Superway - Wayside Power

Student Team Members:
Garrett Gemmel
Michael Hurst
Dianna Man
Karmjot Singh

Faculty Advisor: Dr. Burford Furman

Project Scope and Objectives:

1. Design a working power interface system for the Spartan Superway.
2. Research methods to supply power using Solar Panels.
3. Design a cost effective power interface system to supply power to the power components of the pod cars.
4. Integrate solar energy to the wayside grid to power using renewable and clean energy.
5. Design for safety and aesthetics.

Project Results:

1. Successfully researched methods for power interfaces.
2. Successfully designed a wayside system consisting of a 4th rail configuration.
3. Integrated the system to power up the Spartan Superway using wayside pickup.
4. Fabricated 80% of the components needed.
Spartan Superway - Active Suspension

Student Team Members:
Scott Garfield (Team Leader)
Tyler Broder
Matt Menezes
Dale Franklin
Enkhjin Baasandorj

Faculty Advisor: Dr. Burford Furman

Project Scope and Objectives:
Create a suspension system for the Spartan Superway that will isolate the cabin from vibration and keep the cabin in a comfortable orientation while traveling down the railway.
1. The suspension system must keep the cabin level as it traverses through up to 17 degrees of tilt.
2. The suspension system must reduce the transmitted vibrations from possible variations in the railway.
3. The suspension system must be able to support the estimated mass of the intermediate scale cabin.
4. As the pod arrives at a station, the suspension system must level the floor of the cabin with the floor of the platform to provide utmost accessibility.

Project Results:
1. Successfully designed, modeled, simulated, and fabricated a tension-to-compression suspension system.
2. Prototyped controls code implementing an IMU and a PID control algorithm.

Sponsors: Barry Swenson, Beamways, Inist, Microsoft, PDM Steel Service Inc.
Spartan Superway – Guideway Torsion Test

Student Team Members:
Steve Trevillyan (Team Leader)
Christopher Fong
Ian Johnsen
Ivan Tapia
Kriti Kalwad (External Contact – FEA modeling)

Faculty Advisor: Dr. Burford J. Furman

Project Scope and Objectives:
Confirm that the current guideway design is capable of handling the expected loads; do an ANSYS model and confirm the model with physical tests.
1. Design a torsion experiment to calibrate the torsion test machine, and note the accuracies of the machine for later analysis.
2. Design a torsion experiment that results in sufficient data to confirm a finite element analysis.
3. Create a model in ANSYS and compare the results to the physical test.

Project Results:
1. Successfully calibrated the machine using calculations for angle of twist – specimen twist found to be within an acceptable 10% error
2. Successfully completed a torsion test on a hollow square pipe. The angle of twist was within 15% error.

Sponsor:
Vishay Micro Measurements Group
PDM Steel
Spartan Superway - Intermediate Scale Solar

Student Team Members:
Augustine Soucy (Team Leader)
David De Ocampo
David Luo
Jaymie Zapata

Faculty Advisor: Dr. Burford Furman

Project Scope and Objectives:
Develop a mounting system for intermediate scale and create a performance analysis tool for planning of deployment.

The mounting system requirements are as follows:
- Modular- easy to assemble and take apart
- Design a frame that would eliminate the need a tracking system on the full scale model.
- Able to fully power the intermediate solar scale track
- Structurally sturdy and aesthetically pleasing

The performance tool analysis requirements are as follows:
- Provide performance analysis of solar panels needed for deployment

Project Results:
1. Successfully developed, constructed, and tested a mounting system that fits the requirements.
2. Successfully created performance analysis tool that provides necessary information for deployment of solar panels.
Spartan Superway - Small Scale Model

Student Team Members:
Controls Team
Henry Xie (Team Leader)
Thomas Nguyen
Kenneth Aganon
Nasrat Haidari

Vehicle Team
David Chen
Bryan Ho

Track Team
David Paul Y. Sales
Kenny Strickland
Ali Bootwala

Faculty Advisor: Dr. Burford Furman

Project Scope and Objectives:
Design and assemble a small scale Autonomous Transportation System that can be disassembled and transported easily so it can be shown to people to gain exposure and show people how it functions.

Controls Team
- Design a new control system that will provide location information for multiple vehicles using localized nodes (figure 1) and barcode sensors.

Vehicle Team
- Finalize bogie design and send out drawings for fabrication.
- Design and 3D print cabins (figure 2) to house the electronic components.

Track Team
- Design a bigger track (figure 3) that can be easily assembled and transported and can accommodate multiple vehicles at one time.

Project Results:
1. Successfully designed and constructed a bigger two-loop track made out of aluminum that can accommodate up to ten vehicles as shown in figure 3.
2. Successfully designed the new barcode scanner for the vehicles and position tracking for the vehicles.
3. In the process of building up to ten vehicles and testing the controls program on the new track.

Fig. 1: New GUI for the control system.
Fig. 2: New 3D printed cabin.
Fig. 3: New track layout design.

Sponsors:
Spartan Superway - Bogie/ Fail-safe Mechanisms

Team Members:
Cassandra Acosta (Lead)
Aaron Cheng
Christopher McCormick
Steven Luong
Uday Ranjeet
Vicente Viqueira

Faculty Advisor: Dr. Burford Furman

Project Scope and Objectives:
Re-design the bogie to be able to traverse a sloped elevated guideway. Design fail-safe mechanisms to prevent the bogie from falling off the track.

1. Re-design bogie to be able to traverse up and down a guideway sloped at ±17° (30% grade) at 1-2 mph.

2. Re-design bogie and h-bar to integrate all supporting teams (propulsion, steering, braking, guideway, suspension, wayside power, and cabin).

3. Design fail-safe mechanisms to prevent the bogie from falling off the guideway in case the switching mechanism or main support wheels fail.

Project Results:

1. Successfully designed and constructed a fail-safe mechanism with a safety factor of 4.

2. Successfully designed and constructed fail-safe mechanisms that can support 300lbs (weight of the bogie and all connected components).

3. Successfully constructed a bogie that incorporates all the supporting teams’ designs.

4. Demonstrated the bogie traversing the guideway slope.
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<td>Sebastien Chene (Team Lead) Cole Ingalls, Adam Robinson, Nicholas Smith, Dylwan Tinsley</td>
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<td>Harpinder Dhillon (Team Leader) Rozy Saini, Jeremy Nguyen, Clayton Haske, Trent Hughes, Reinardus Justin Halim, Marissa Ortiz</td>
<td>Charles W. Davidson College of Engineering Minigrant, San Jose State University</td>
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<td>Nessie: Multi-terrain Rover Built for Astronaut Assistance on Mars</td>
<td>Alfred Bru (Team Lead) Rocely Mati</td>
<td>Charles W. Davidson College of Engineering, Penguin Computing, Model Studio, Protocase, Mr. &amp; Mrs. Hwu, Solidworks, Teco Pneumatic ServoCity, Bay Area Circuits</td>
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<td>Vinh Ho (Team Lead), William Gao, Steven Thanh</td>
<td>Suitable Technologies (Palo Alto, California)</td>
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<td>Automatic Cardboard Box Folder for CertainTeed's Mountain Ridge 10&quot; Box</td>
<td>Kurt Foster (Team Lead), Mauricio Espinosa, Caleb Blevins, Anthony Mohn, Giovanni Zecchini, Branden Andersen, Nico Lucchese</td>
<td>CertainTeed (Fremont), Quicksilver Controls, Western Machine, Buchanan Automation</td>
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<td>Development of a Greenhouse with an Automated System</td>
<td>Ryan Thomas (Team Lead), John Plecnik, Tad Koch, Logan Dunlop, Tom Dahl</td>
<td>Santa Clara Valley Section of ASME, Dome Construction, Shimmick Construction, Four Seasons Roofing, CertainTeed</td>
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<td>1100-1125</td>
<td>Automated Home Energy Conservation Devices</td>
<td>Charles Cassarino (Team Lead), Curtis Lau, Josh Vieira, Rudy Alanis, Ryan Thomas</td>
<td>Dome Construction, Dr. Saied Bashash, Progressive Automations, Rampone Electric, Santa Clara Valley Section of ASME</td>
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Spartan Unmanned Fishing Vessel (UFV)

Student Team Members:
Sebastien Chene (Team Lead)
Cole Ingalls
Adam Robinson
Nicholas Smith
Dylan Tinsley

Faculty Advisor:
Dr. Winney Du

Project Scope and Objectives:
Design, manufacture, and test an unmanned autonomous fishing vessel capable of safely and efficiently harvesting fish from open waters.

1. Mechanical Components
   a. Build a pontoon and frame system that can float and carry up to 30 lbs.
   b. Design a dual propeller drive system that can propel and steer the vessel.
   c. Design a reel system that can raise and lower the fishing line with a fish attached.
   d. Build a hot-wire line cutting system to cut the line in case it gets caught or tangled.
   e. Create custom enclosures for the electrical components and the entire frame.

2. Electrical and Intelligence Systems
   a. Utilize central microcontroller to maintain communication and control each function autonomously.
   b. Integrate a GPS module and compass to track position and control movement.
   c. Supply power to all systems with one battery.
   d. Modify and integrate a commercial line detector to check for tugging fish.

Expected Project Results:
1. Built a pontoon vessel that can support and pull over 50 lbs.
2. Reel system can pull in a fish up to 15 lbs at which point the fishing line limit is reached.
3. Successfully demonstrated autonomous navigation of the vessel in a body of water.
4. Demonstrated the capability of the line detector system at detection tugging fish.
Stroke Rehabilitation via EEG Sensors and Robotics

Student Team Members:
Harpinder Dhillon (Team Leader)
Rozy Saini
Jeremy Nguyen
Clayton Haske
Reinardus Justin Halim
Trent Hughes
Marissa Ortiz

Faculty Advisor:
Dr. Winncy Du

Project Scope and Objectives:
Design a robotic device that aids in rehabilitation of stroke victims’ upper limb paralysis.

1. Design an interface consisting of EEG sensors, brain-computer interface, and 6-axis robot to translationally move patient’s right arm.
2. Extract patient’s neurological signals from EEG sensors, deliver signals to robot, which converts into movement of patient’s arm.
3. Program robot with translational motions corresponding to neural signals in realtime.
4. Design is safe and non-invasive.
5. Reduce cost and increase recovery time compared to traditional rehabilitation methods.

Expected and Current Project Results:
1. Completely integrated and tested EEG headset, brain-computer interface, and 6-axis robot.
2. Coded Emotiv EPOC program to:
   a. Train patient’s mental commands (push/pull)
   b. Output patient’s mental command and gyro sensor values in realtime
3. Programmed robot to move up, down, left, right, forward and back based on the signal output of the Arduino and EPOC program.
4. Designed a non-invasive and comparatively affordable rehabilitation system with patient safety in mind.
5. Performed clinical trials to determine effectiveness of this robot-assisted rehabilitation method compared to traditional rehabilitation methods.

Sponsor:
Charles W. Davidson College of Engineering Mini Grant
San Jose State University, San Jose, California
Nessie: Multi-terrain Rover Built for Astronaut Assistance on Mars

Student Team Members:
Alfred Bru (Team Lead)
Rocely Mati

Faculty Advisors:
Dr. Winnycy Du
Dr. Ping Hsu
Dr. Ken Youssifi

Project Scope and Objectives:
Our main objective is to design and manufacture a fully operational rover that can be controlled from mission control and compete at the University Rover Challenge in Hanksville, Utah following the guidelines below:
- Weigh less than or equal to 50 kilograms during the competition
- Must be able to transverse through a one-meter drop
- Must be able to pick up and retrieve objects to a given GPS location
- Must be able to achieve equipment assistance tasks, which may include attaching an oxygen tank, refueling a station, pressing a button, and flipping switches

Expected Project Results:
- Independent double wishbone suspension and swerve drive
- Five degrees of freedom arm able to interact with objects as needed
- Chassis made to switch out modules as needed and houses a pegboard for electronics
- Radio equipment equipped to have a 15 kilometer radius for communication to and from rover

Sponsors:
Charles W. Davidson College of Engineering
Penguin Computing
Model Studio
Protocase
Mr. & Mrs. Hwu
Solidworks
Teco Pneumatic
ServoCity
Bay Area Circuits
Motion-Controlled Telerobotic Arm

Student Team Members:
Vinh Ho (Team Lead)
William Gao
Steven Thanh

Faculty Advisor:
Dr. Winnce Du

Project Scope and Objectives:
Develop and implement a user-friendly telerobotic manipulator to the Beam+ smart telepresence system in order to enhance telecommunication and enable remote manipulation.
1. Design a prototype capable of handling a 1 lb. payload.
2. Design an informative and appealing GUI (graphical user interface).
3. Design a system that prevents damage to the environment and the manipulator.
4. Intuitively control the manipulator using various controllers i.e. keyboard, gamepad, motion control.
5. Design a system capable of control through the use of Wi-Fi.
6. Remotely open light-weight doors.

Project Results:
1. Fabricated a robotic manipulator capable of handling a 1 lb. payload.
2. Successfully design a GUI capable of determining the method of user input.
3. Successfully implemented sensor array and system that prevents damage to the manipulator.
4. Successfully implemented motion and gesture control for the manipulator.
5. Successfully created an IoT device using an API that enables remote control of the manipulator.
6. Designed and fabricated custom PCB for motor control, motor sensing, and spatial footprint reduction.

Expected Project Results:
1. Integrate the circuitry of the manipulator with Beam+ platform.
2. Securely mount the manipulator to the Beam+ platform.
3. Remotely control Beam+ platform and manipulator system.
4. Remotely open various doors.

Sponsor:
Suitable Technologies, Palo Alto, California.
Automatic Cardboard Box Folder for CertainTeed's Mountain Ridge 10" Box

Student Team Members:
Kurt Foster (Team Lead)
Mauricio Espinosa
Caleb Blevins
Anthony Mohn
Giovanni Zecchini
Branden Andersen
Nico Lucchese

Faculty Advisor:
Dr. Winney Du

Project Scope and Objectives:
Design and create a machine that can automatically fold CertainTeed's Mountain Ridge 10" cardboard box
1. Fold boxes at a rate of two boxes per minute to keep up with factory line demand
2. Design an electrical control system using a PLC and HMI to allow for machine operation
3. Incorporate ability to add conveyor line to machine by CertainTeed if prototype is approved
4. Incorporate ability to load one pallet worth of boxes into machine loading area with accompanying pallet jack by CertainTeed if prototype is approved

Project Results (Expected):
1. Fold boxes at a rate of two boxes per minute
2. Fold boxes without damage to box beyond what is encountered by hand folding
3. Automatically fold boxes without operator intervention
4. Eject folded box below machine that remains folded during use by line operators

Sponsors:
CertainTeed (Fremont)
Quicksilver Controls
Western Machine
Buchanan Automation
Development of a Greenhouse with an Automated System

Student Team Members:
Ryan Thomas (Team Lead)
John Plecnik
Tad Koch
Logan Dunlop
Tom Dahl

Faculty Advisor:
Dr. Winncy Du

Project Scope and Objectives:
To research and design an automated conceptual home that controls its utilities to promote energy savings

1. Design of an Energy-Efficient Conceptual Home that Interacts with a Mechatronic System
   i. Build an 8’x10’x12’ structure with two windows and a door
   ii. Implement conceptual electrical, heating/cooling, subsystems
   iii. Construct the home with “Green” materials such as LEED certified carpet, R30 denim insulation, double pane windows, and energy-efficient roof shingles
   iv. Conduct testing to show differences in energy consumption (in terms of heat transfer and electricity usage).

2. Sensors and Communication
   i. Select appropriate sensors to actuate the window, illuminate the porch light, and operate the heating/cooling system
   ii. Control the home’s utilities from a central interface. In this case, Open Hab software was used to accomplish this

Project Results:
Expected results of the project consist of testing the home’s total heat transfer and electricity usage in “Manual Mode” against “Automated Mode”. Essentially, the group will test how much heat is lost via the walls when home automation is and is not powered on. In addition, the group will measure the total energy consumption of the home when the automated system is and is not in use.

Sponsors:
Santa Clara Valley Section of American Society of Mechanical Engineers, Dome Construction, Shimmick Construction, Four Seasons Roofing, Certain Teed
Automated Home Energy Conservation Devices

Student Team Members:
Charles Cassarino (Team Lead)
Curtis Lau
Josh Vieira
Rudy Alanis
Ryan Thomas

Faculty Advisor:
Dr. Winncy Du

Project Scope and Objectives:
To research and develop a sustainable green-smart home capable of using its environment to increase efficiency and limit the use of electricity.

1. A home automation system that connects and controls different home functionalities
   a. Windows, blinds, lights, and HVAC
2. Remove the need for occupants to constantly adjust windows, blinds, lights, and thermometer
   a. Independent operation optimizes conservation of energy and improves comfort
   b. Allows users to set light/temperature levels when desired
   c. Uses sensors and natural energy to improve lighting, heating, and cooling
3. Constructed using recycled and eco-friendly material
   a. Renewable/green wood and denim insulation

Expected Project Results:
1. Successfully design a home that is energy efficient
2. An automation system capable of running on its own without user interaction once desired inputs are set
3. Provide homeowners with methods of sustainability and long-term savings
4. Provide a foundation of automated methods that promote sustainability for upcoming senior project groups

Sponsors:
Dome Construction
Dr. Saied Bashash
Progressive Automations
Rampone Electric
Santa Clara Valley Section of American Society of Mechanical Engineers
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<tr>
<th>Project Title</th>
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| 0830-0855 ASHRAE HVAC Design Calculations Competition | Gaelan Dea  
Austin King  
Calvin Trang  
Ivan Ung (Project Lead)  
Yasaman Zargari | American Society of Heating, Refrigerating, and Air Conditioning Engineers |
| 0900-0925 Closed Loop Wind Tunnel and Wind Turbine Design | Stephen Choe  
Andres Garcia-Leyva  
David Jolly  
Shane Staats  
Mikeal Tadeo (Team Lead) | San Jose State University (co-advised by Dr. Kathryn Gosselin) |
| 0930-0955 Thermal Radiation Experiment: Leslie Cube | Oliver Cheng Wei Chiang  
Kevin Gaerlan  
John Kempel  
Thang Phan  
Raito Sato  
Daniel Jackson Zucker-White | San Jose State University |
| 1000-1025 Adsorption Chiller/Refrigerator | Sean Archibald (Team Lead)  
Darrel Munoz  
Richard Casas  
Daniel Aguilar (Design Lead)  
Troy Brocato  
Hugo Vargas |  |
| 1030-1055 University HVAC | Arootin Ghazarian  
Chris McElvain  
Ben Metzger (Team Lead) | PM Group |
| 1100-1125 ASHRAE HVAC Design Calculations Competition | Ryan Crist  
Sammuel Huerto (Team Lead)  
Abraham Lema  
Chris Lewis  
Jose Ochoa | American Society of Heating, Refrigerating, and Air Conditioning Engineers |
| 1130-1155 Solar Demonstration and Lab Experiment | Gannon Buss (Team Lead)  
Benito Ferreyra  
Kevin Sanchez  
Paul Vasquez  
Peter Zhong | San Jose State University |
ASHRAE Competition Team B

Student Team Members:
Ivan Ung (PM)
Calvin Trang
Austin King
Yasaman Zargari
Gaelan Dea

Faculty Advisor: Dr. Nicole Okamoto

Project Scope and Objectives:
Design and preform proper calculations for an HVAC system for a two-story, municipal building, based in Beijing, China.
1. Provide correctly sized heating, ventilation, and air conditioning system.
2. Calculate both heating and cooling loads for desired system.
3. Demonstrate compliance with current ASHRAE Standards 55, 62.1, 189.1, and 90.1.
4. Make sure building design complies with the Owner’s Project Documents
5. Build a curing tank for ASCE that meets the desired temperature and size needed.

Project Results:
1. Successfully zoned building and completed load calculations for heating and cooling.
2. Demonstrated compliance with the ASHRAE Standards as load calculations were completed.
3. Successfully designed a system that met Owner’s Project Guidelines.
4. Designed a curing tank that was able to hold a large concrete canoe.
5. Successfully held the water in the curing tank to desired temperature of above 60 °F per ASCE request.
6. Complied with water system for curing tank.
Closed-Loop Wind Tunnel

Team Members:
- Mikeal Tadeo (Team Leader)
- Stephen Choe
- David Jolly
- Andres Garcia-Leyva
- Shane Staats

Faculty Advisors:
- Dr. Nicole Okamoto, Dr. Kathryn Gosselin

Project Scope and Objectives:
1. Repair the closed-loop wind tunnel
2. Design an experiment for future students
3. Create generator housing and support structure for wind turbine
4. Create three varying wind turbine blade designs
5. Simulate power output of three turbine blade designs in ANSYS

Project Results:
1. Successfully repaired the closed-loop wind tunnel
2. Successfully designed a wind turbine experiment
3. Successfully designed and printed wind turbine blades with three varying airfoil profiles
4. Successfully modeled the turbine blades in ANSYS to simulate power output
5. Compared simulated power outputs to live models
Thermal Radiation Experiment: Leslie Cube

Student Team Members:
Oliver Cheng Wei Chiang
Daniel Jackson Zucker-White
Thang Phan
Raito Sato
John Kempel
Kevin Gaerlan

Faculty Advisor: Dr. Nicole Okamoto

Project Scope and Objectives:
1. Create an affordable lab experiment for San Jose State’s Thermal Engineering Lab
2. Design a thermal radiation source with multiple emissivities
3. Design a system to display the inverse square law pertaining to intensity
4. Demonstrate the fundamental concepts of thermal radiation
5. Create comprehensive lab instructions and report guidelines

Project Results:
1. Successfully designed, constructed, and tested the thermal radiation lab experiment
2. Demonstrated the use of a Leslie Cube to exhibit the effects of varying emissivities
3. Measured the emissivities of $w$, $x$, $y$, and $z$ to be $W$, $X$, $Y$, and $Z$.
4. Evaluated that the heating coil system efficiency of the NiChrome wire to be $X\%$. 
Adsorption Chiller/Refrigerator

Student Team Members:

Sean Archibald (Team Leader)
Darrel Munoz
Richard Casas
Daniel Aguilar (Design Leader)
Troy Brocato
Hugo Vargas

Faculty Advisor: Dr. Nicole Okamoto

Project Scope and Objectives:
Design and build a portable adsorption refrigeration system for developing countries who lack a stable electric grid, and can’t provide adequate food and vaccine preservation. The proposed chiller should meet the following requirements:
1. Be of comparable size of an average household ice cooler (36” x 18” x 16”).
2. Weigh 100 lbs to allow for effortless transportation between two people.
3. Contain a cooling chamber volume of approximately 2 cubic feet.
4. Optimal chiller temperature should be in the range of 0.5°C to 4°C.
5. Entire cycle should run for a period of 1 day using a battery pack.

Project Results:
1. Successfully designed a portable unit with all system components.
2. Used small scale testing of each component of the cycle.
3. Measured pressure and temperature at all stages of the cycle.
4. Evaluated the pressure needed in the evaporator in order to vaporize the water to be 5.3 mmHg.
University HVAC

Student Team Members:
Ben Metzger (Team Leader)
Arootin Ghazarian
Chris McElvain

Faculty Advisor: Dr. Nicole Okamoto

Project Scope and Objectives:
Design a sustainable HVAC system for a university building that does not have adequate room for a conventional HVAC system. Radiant cooling was the option that best suited the building’s needs.

- Design the system in 3D using the architectural drawings for the building.
- Provide 2D construction drawings that are of professional quality.
- Compare the radiant cooling system energy usage with a conventional HVAC system.
- Ensure system is easily serviceable and flexible to other university buildings.

Project Results:
1. Successfully designed a radiant cooling system which used passive chilled beams on the first floor and active on the second floor.
2. Controlled humidity was added to optimize cooling. This required under floor ventilation, which makes the construction and service more difficult.
3. Produced the 3D model and professional quality 2D drawings to supplement.
4. Completed energy analysis and found that our system provided a 20% energy savings over a conventional system.
ASHRAE HVAC Design Calculations

Student Team Members:
Sammuel Huerto (Team Leader)
Ryan Crist
Abraham Lema
Chris Lewis
Jose Ochoa

Faculty Advisor: Dr. Okamoto

Project Scope and Objectives:
Design a complete HVAC system for a two story municipal government building in Beijing, China.
1. Design a low life cycle cost system.
2. Design a system with low environmental impact.
3. Design a system that promotes comfort and health.
4. Design a system that promotes green design ideologies while creating synergy.

Project Results:
1. Successfully applied all of the required ASHRAE standards.
2. Successfully stayed within the building owner’s budget.
3. Implemented high efficiency filters to provide cleaner air to the building occupants.
4. Used multiple systems in order to keep them running at optimum, efficient conditions.
5. Modeled all heating and cooling loads accurately with Trace 700.
6. Successfully created a lab for ME 182 as our physical build.
Solar Demonstration and Lab Experiment

Student Team Members:
Gannon Buss (Team Leader)
Benito Ferreyra
Kevin Sanchez
Paul Vasquez
Peter Zhong

Faculty Advisor: Dr. Nicole Okamoto

Project Scope and Objectives:
Design and construct a photovoltaic system with battery storage using parts from a previous senior project

1. Create a lab experiment to accompany ME 170: Solar Energy Engineering demonstrating technical aspects of solar photovoltaic systems.
2. Develop a way to perform the lab indoors if needed.
3. Produce a functional, safe, and robust system.

Project Results:

1. Replaced faulty and inadequate equipment to make the system operational.
2. Wrote a lab manual containing several experiments that utilize the PV system.
3. Designed and built an indoor lighting system that resembles natural sunlight.

Sponsor:
Department of Mechanical Engineering, Charles W. Davidson College of Engineering, San Jose State University
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<td>Spartan Hyperloop</td>
<td>Gerardo Garcia, Jaimie Kumar, Marco Leung, Daniel Powell, Asad Wasi, Abhishek Yellapragada</td>
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<td>1030-1055</td>
<td>Gearbox Driven Mountain Bike</td>
<td>Anthony Guerrero, Marshall Hoagan, Nobby Tozer</td>
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<td>1100-1125</td>
<td>PolyScribe 3D</td>
<td>Zach Peters, Zach Smith, Greg Toland, David Vigil</td>
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<td>1130-1155</td>
<td>3D Creation Station</td>
<td>Jonathan Carlson, Scott McLaughlin, Alexander Tanner, Brian Wilson</td>
<td></td>
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</tbody>
</table>
Student Team Members:
Abhishek Yellapragada (Team Leader)
Gerardo Garcia
Asad Wasi
Daniel Powell
Jaimie Kumar
Marco Leung

Faculty Advisor: Dr. Raymond Yee

Project Scope and Objectives:
1. Design and build a subscale functional prototype of the Hyperloop Pod and Tube
2. Test the Aerodynamic and Levitation sub-systems of the Spartan Hyperloop 1.0 Pod
3. Complete a successful run of Spartan Hyperloop 1.0 Pod in SH 1.0 Test Track
4. Gather wind tunnel and Spartan Hyperloop 1.0 control systems data
5. Present vision for Spartan Hyperloop 2.0

Project Results:
1. Successfully designed and built a 60 ft. long flat acrylic test track in 5 ft. sections
2. Aligned consecutive sections of test-track to micron-level precision using laser interferometry
3. Performed flow simulation to measure the drag coefficient of the Pod to be 0.43
4. Successfully completed a test-track run by levitating the Pod at a height of 10 microns
5. Built a 40 member team and started work for Spartan Hyperloop 2.0

Sponsors: Associated Students, SJSU Office of Annual Giving, ASME Santa Clara Valley Section
2016 ME 195B Senior Design Project II
Gearbox Driven Mountain Bike

Student Team Members:
Anthony Guerrero (Lead Designer)
Marshall Hoaglan (Lead Fabricator)
Nobby Tozer (Procurement Lead)

Faculty Advisor: Dr. Raymond Yee

Project Scope and Objectives:
Design and fabricate a downhill mountain bike frame with an integrated gearbox drivetrain.
1. Design a prototype downhill mountain bike frame with 200mm of rear travel competitive with modern commercial designs in suspension and handling performance.
2. Demonstrate the advantages of an integrated 3-speed gearbox design over a conventional derailleur while minimizing or eliminating the disadvantages realized by previous gearbox-driven designs.
3. Fabricate, weld, and assemble frame to specification while achieving proper alignment and component interfacing.
4. Perform an on-trail riding test to evaluate and compare the effects of a gearbox drivetrain against commercial derailleur driven bikes.
5. Perform a frame torsional stiffness test to measure the static deflection of the frame and compare to commercial bikes and our FEA results.

Project Results:
1. Successfully designed the full suspension frame and drivetrain and performed a FEA on the front and rear triangle, and suspension linkage to analyze the effects of a static impact load.
2. Successfully performed a FEA on the gearbox mounts to simulate and evaluate the effects of a power stroke on a descending trail ride.
3. Successfully notched, aligned, and welded the front and rear triangle tubing.
4. Successfully turned down all precision fit bores for proper bearing interface.
5. Successfully modified the gearbox hub flanges to accept an output chainring.
6. Suspension linkage to be CNC milled (expect to have by next week).
7. Drive-side swingarm junction and gearbox mounts to be waterjet (expect to have by next week).
8. Currently preparing and constructing frame torsional stiffness test jig.

![Gearbox Driven Mountain Bike Frame Image]
2016 ME 195B Senior Design Project
PolyScribe Delta 3D Printer

Student Team Members:
Zach Peters
Zach Smith
Greg Toland (Team Lead)
David Vigil

Faculty Advisor: Dr. Raymond Yee

Project Scope and Objectives:
Design and create a functional delta style 3D printer
1. Large print volume (15” Diameter x 24” Height)
2. Design a printer capable of print speeds up to 150 mm/s
3. Design a low backlash and reduced friction joint system
4. Design a thermally efficient hotend for avoiding clog-failure
5. Design an aesthetically pleasing printer

Project Results:
1. Successfully designed, constructed, and tested our delta 3D printer under various operating conditions.
2. Successfully simulated hot end heat exchanger and mechanism movement.
3. Successfully printed several unique objects with dimensional accuracy within roughly 0.1%.
4. Built an aesthetically pleasing product within budget.
5. Failed to take into account neodymium failures in heated environments requiring enclosure temperature to be less than ideal.

Sponsors:
1. PowerPlus- 1500 watt DC power supply.
2. Deltron- Custom Linear Slides
4. Lin Engineering - Stepper motors
2016 ME 195B Senior Design Project II

Plasma Torch Mechanical Manipulator

Student Team Members:
Hugo Tupac (Team Leader)
Kyle Thomas
Abdullah Al-shehabi
Omar Awad
Jamil Elbanna
Chris Alvarez

Faculty Advisor: Dr. Raymond K. Yee

Project Scope and Objectives:
Design a mechanical mechanism that can manipulate a plasma torch in the x, y, & z directions.
1. Limit unintended motion and provide predictable control over the system.
2. Amplify the forces of the linear actuators present in the design to limit the stresses acting on the motors and extend their functional life and reduce cost of the mechanism.
3. Provide simple user controls.
4. Select system hardware capable of providing quick system response.

Project Results:
1. Successfully designed, constructed a prototype model for SJSU proof of concept.
2. Design has been implemented by MolyWorks Materials Corporation in their materials development process.
3. Demonstrated full control over the mechanism in 3D space.
4. Successfully Tested the plasma torch manipulator and implemented sensor controls

Sponsor:
MolyWorks Materials Corporation
2016 ME195B Senior Design Project II

3D Creation Station

Student Team Members:

Scott McLaughlin (Team Leader)
Alex Tanner
Jonathan Carlson
Brian Wilson

Faculty Advisor: Dr. Raymond Yee

Project Scope and Objectives:

1. Develop a single workstation that is capable of 3D printing, CNC milling, and laser etching
2. Incorporate a user friendly interface to facilitate learning for inexperienced users
3. Create a three axis of motion mechanism to control the application heads
4. Produce a unique head module for each intended application
5. Create a bed that can be heated and held at an elevated temperature to aid 3D printing

Project Results

1. Successfully designed, built, and tested the three axis motion mechanics and frame
2. Developed three unique modules that could be used on the single movable head
3. Implemented physical limit switches to prevent over travel and emergency shut off
4. CNC capable of milling soft materials
5. Laser can cut thick card stock and cardboard
6. 3D printer capable of printing in ABS with a developed heated bed insert

Donations or Discounts offered by:

SOC Robotics, Kennametal, Dan Mars
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<td>Portable Heating Thermos</td>
<td>Adam Zamudio Andy Doan Cari Geldreich</td>
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<td>Alejandro Valle David Araujo Jeff Chow Thomas Clemmer Thien Dihn</td>
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<td>Alex Hatcher James Alens Mark Villanueva</td>
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<td>Hank Pabley Chad Nijim Matthew Ramirez Darren Tang</td>
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<td>1600-1625</td>
<td>Sunscreen Shower</td>
<td>Eric Hagstrom Paul May Vincent Kyi</td>
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</tbody>
</table>
Wireless Charging for EVs

Student Team Members:
Sino Gulchinov (Team Lead)
Vanessa Gutierrez

Faculty Advisor: Dr. Raghu Agarwal

Project Scope and Objectives:

Design and build an autonomous device that can wirelessly charge an electric vehicle. The goal is to make a wireless charging device that will sense when your vehicle approaches a charging station and when it does, a small mobile device will align itself with a receiver coil that is underneath the vehicle. Through inductive coupling, the transmitter coil will produce an oscillating magnetic field which in turn induces a current in the receiver coil which charges the battery of the car.

Specifications:

1. Can be used in home garage environment.
2. Transmit enough power to charge a 72 V lithium ion battery pack.
3. Incorporate the control module and transmitter coil into one device.
4. Transmitter robot does not exceed 20 kg in mass
5. Transmitter robot does not exceed 7 inches in height
6. Strength of the magnetic field is below 6.25 mT 30 cm away from transmitter

Project Results:

1. Built fiberglass base with wheels and motors attached
2. Built outer casing shell out of fiberglass
3. Conducted several alignment testing to assure alignment
Valence Motors Electric Dirt Bike Kit

Team Members:

Chris Perez (Team Lead)
Cody Webb
Kevin Cederwall
Andrew Davis
Garrett Serrato

Senior Project Advisor: Dr. Agarwal

Project Objective:

To design and produce an electric drive conversion kit that can be directly installed into a pre-existing dirt bike frame in order to decrease the environmental impact of the motorcycle, increase the overall reliability, as well as offer a more cost effective option for electric transportation.

Specifications and Goals:

1. Incorporate an electric powertrain capable of 25hp, with a range of 25 miles.
2. Keep overall cost of conversion kit below $4,000.
3. A Zero ZForce electric motor will be used in place of the combustion engine.
4. A Sevcon Gen 4 controller will be paired to the electric motor.
5. Power will be supplied by Lithium Polymer batteries.
   a. 16 x Turnigy 6s 22.2V 4000mAh 20-30c Discharge
   b. Four packs in parallel to supply 16,000mAh capacity
   c. Four batteries in series to provide necessary voltage
6. Robust motor mounts will be designed and constructed to utilize existing frame mounting points.
7. Jackshaft transmission system will be designed and constructed to maintain optimal drive sprocket location, and provide a higher gear ratio.
8. Cycle Analyst will be integrated for use as an interface to see on board vitals.
9. Battery enclosures will be constructed of 1008 carbon steel sheet metal and contain 3D-printed battery mounts.
10. Safety bash guard will be constructed of 1026 carbon steel sheet metal.

Project Results:

1. Integrated an electric motor into a gasoline powered dirt bike frame.
2. Mounted and geared the drivetrain properly using a jackshaft.
3. Batteries wired and safely stored in high strength air cooled battery boxes.
4. Programmed motor controller to safely and efficiently utilize battery pack.
5. Cycle Analyst accurately displays critical information such as vehicle speed, battery state of charge, and current draw.
6. Overall cost was kept below $4,000 for a from-the-factory quality product.
Portable Heating Thermos

Student Team Members:

Adan Zamudio
Andy Doan
Cari Geldreich

Faculty Advisor: Dr. Agarwal

Project Scope and Objectives:

Design and build a portable thermos that uses a wall plug for a power source and heats the water within ten minutes. The use for the thermos is to create greater accessibility to having hot water for drinking and to reduce the paper waste in landfills caused by disposable paper cups purchased at coffee shops and convenience stores. To make the thermos marketable, the thermos is to be made affordable.

Engineering Specifications:

1. Will heat up water to 80°F within 10 minutes
2. Power supplied by wall outlet
3. Heat supplied by heat wire
4. Cutoff power when the temperature reaches 80°F with a cutoff switch
5. Portable; Light weight
6. Safe to drink out of and safe to hold
7. Cost effective; affordable enough to compete with existing thermos
8. Keep the beverage warm-hot for at least 2 hours
9. Environmentally friendly

Project Results:

1. Printed the outer casing with the 3D printer in Prof. Youssefi’s lab.
2. Designed effective heating coil
3. Designed safety features to prevent overheating; cut-off switch, LED temperature indicator
4. Conducted tests to make sure the wire worked to design specifications and that the thermos heated the water in under ten minutes.
Hydrogen Internal Combustion Engine

Student Team Members:

Alejandro Valle
David Araujo
Jeff Chow
Thomas Clemmer
Thien Dihn

Faculty Advisor:
Dr. Raghu B. Agarwal

Project Scope and Objectives:
Design a system or kit that will convert a gasoline engine into a hydrogen engine. This is a proof of concept project. This type of conversion is ideal to reduce emissions and recycle existing engines into a renewable future.

Specifications:
1. Engine will run on pure hydrogen with air
2. Proof that engine will not overheat
3. Go-Kart Chassis constraint (4ft x 3ft)
4. #35 Chain; 12 tooth input gear; 22 tooth output gear

Project Results:
1. 3-D CAD models of individual parts a plan sheets for fabricated parts
2. Built a functional, driveable go-kart with engine, fuel tank and drivetrain packaged into a single chassis.
3. Engine includes: microcontroller, injector, crankshaft position sensor, fuel lines, throttle body
4. Conducted tests on engine and drivetrain to ensure fully functional running and driving conditions with lowered emissions while engine is at idle and running RPM.
Robotic Assistant

Student Team Members:

Alex Hatcher (Team Lead)
James Alens
Mark Villanueva

Faculty Advisor: Dr. Raghu Agarwal

Project Scope and Objective:

The project's objective is to design and build a robotic platform that can follow a person and Suitable Technologies' Beam robot. The robotic assistant is designed to operate in a warehouse environment and able to transport various materials at a person's walking pace. The structure will have multiple shelves for placing equipment, have a height of at least three feet, and a reasonable footprint for easier navigation. The robot will be equipped with sensors for obstacle avoidance and made of materials to increase structural integrity.

Specifications:

1. Robot will be handle a load up to 125 lbs (Weight of robot will be neglected)
2. Chassis utilizes rubber tracks for maximum adaptability to warehouse environment
3. Equipped with two motors that move at the speed of 4 ft/s under load
4. Features modular shelving for easy storage
5. Utilizes ultrasonic sensors for obstacle avoidance
6. Able to maintain a distance between 2 - 3 ft between the user
7. Guidance provided via an infrared tracking system for user position

Project Results:

1. Designed a CAD model of the robotic assistant using SolidWorks
2. Performed stress analysis on points of interest to verify structural integrity
3. Assembled robotic structure, as well as incorporated controller and sensors
4. Built a prototype infrared emitter source for the navigation system
5. Incorporated wireless communication system using VNC to upload code and retrieve live serial communication data from the Raspberry Pi microcomputer
6. Conducted the following tests:
   a. Obstacle avoidance trial-and-error tests with the ultrasonic distance sensors
   b. Infrared navigation signal strength, reliability, and field of view
   c. Speed while under maximum load
Glass Analysis Device

Team Members

Hank Pabley (Team Lead)
Chad Nijim
Matthew Ramirez
Darren Tang

Faculty Advisor: Dr. Raghu Agarwal

Project Scope and Objectives:

Design and build a device that measures the heat transfer and inductance values of single pane glass. Primary design parameters are that the device will be able to produce the heat and light necessary to test the glass, be able to use battery power for the duration of the testing.

Specifications:

- Measure U-value to ± 0.2
- Measure shading coefficient to ± 0.1
- Utilize both sides of the glass to test performance
- Not require any user input during the testing
- Take data within 120 seconds of testing initialization
- Weigh a total of less than ten pounds
- Take up a volume of less than 0.5 cubic feet of space

Project Results:

- Built a full 3D model with scaled electronic components
- Built a fully-functioning version utilizing AAA and 9V battery power with regulating boards, Raspberry Pi microcomputers, PTC heating elements, ultra-bright LEDs in a custom array, Adafruit light and heat sensing breakout boards, and other custom circuit boards
- Performed a variety of initial testing, including light shock/durability testing, performance testing using known glass data of architectural single-pane glass samples, testing on similar single-pane glass as is currently in use, and initial testing on dual-pane glass
Sunscreen Shower

Student Team Members:

Eric Hagstrom
Paul May
Vincent Kyi

Faculty Advisor: Dr. Raghu B. Agarwal

Project Scope and Objectives:

Design and build a portable sunscreen application booth that will provide ample sunscreen dispersion to the user, while employing solar panels as a form of renewable energy. This project will be able to be transported to different locations by one or two people, with minimal effort. Primary design parameters are that the sunscreen booth will be able to operate continuously throughout a 10 hour period without an outside power source, and be constructed out of materials which will make setup and disassembly easy, while still being lightweight.

Specifications:

1. The entire assembly must weigh under 100 lbs.
2. The base must support up to 300 lbs.
3. Assembly time to take no more than 10 minutes for 1-2 people
4. Solar panels to provide enough power to keep unit running continuously for up to 10 hours
5. Height dependent to reduce waste from running unnecessary nozzles
6. Mechatronic means to provide even fluid dispersion and coverage.

Project Results:

1. Constructed a 3D computer model of sunscreen application booth utilizing SolidWorks software.
2. Built a fully functioning prototype utilizing a photovoltaic system connected to the battery to produce power throughout the day. Prototype provides a proper dispersion of sunscreen to the user and has sensors employed which adjust the system depending on the height of the user.
3. Conducted tests on the booth to verify functionality. Tests included fabricating a small scale model in which an ultrasonic sensor was utilized to determine the height of the user and adjust the spray distribution accordingly. A full scale model was built to determine a proper fluid dispersion for the user and load bearing capability. A solar panel setup was incorporated into the system and tested to verify that it could keep the system running throughout the day.
Water Brake Engine Dynamometer

Student Team Members:

Eduardo Arellano (Team Lead)
Brett Gorham
Vincenzo Donatini
James Teeter

Faculty Advisor: Dr. Raghu Agarwal

Project Scope and Objectives:

Design and build a working engine test and dynamometer stand. The design must be able to accept multiple engine configurations, be reliable and consistent, and be compact and portable. The dynamometer must collect torque and horsepower data.

Specifications:

1. The stand and dynamometer must be capable of withstanding continuous 80 HP engine output
2. Dynamometer water temperature must be below 150 °F during engine running
3. Pumps must provide a minimum of 40 PSI of water pressure to the water brake
4. Electronics collect engine RPM and torque output to produce horsepower

Project Results:

1. Built 3-D computer model of dynamometer stand
2. Built a working dynamometer engine stand that collected critical data such as engine RPM and torque to calculate horsepower.
3. All systems, i.e.: hoses, power cords, electronics, fuel, are contained within the stand and the stand is fully mobile with minimal setup and cleanup time.
4. Dynamometer was calibrated using known calibration weights to retrieve accurate results
5. Tests were conducted with a Briggs and Stratton World Formula engine to measure functionality. The tests resulted in a successful engine pull which produced horsepower and torque curves that closely matched accepted and published curves for the engine within 10%.