CALIFORNIA STATE UNIVERSITY, LOS ANGELES
COLLEGE OF ENGINEERING, COMPUTER SCIENCE, AND TECHNOLOGY

CAPSTONE SENIOR DESIGN PROGRAM
2018-2019 PROJECT SUMMARIES

COMPUTER SCIENCE PROJECTS ..... Pages 2 - 9

CIVIL ENGINEERING PROJECTS ..... Pages 10 - 12

MECHANICAL ENGINEERING PROJECTS ..... Page 13

ELECTRICAL ENGINEERING PROJECTS ..... Pages 14 - 17

MULTI-DISCIPLINED ELECTRICAL & MECHANICAL ENGINEERING PROJECTS ..... Pages 18 - 26

TECHNOLOGY PROJECTS ..... Pages 27 - 28

Please contact Michael Thorburn mthorbu@calstatela.edu for additional information on current projects or how to sponsor future Capstone Senior Design Program projects.
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COMPUTER SCIENCE PROJECTS

Project Title: **πnapple (Pineapple) Chatbot**
Sponsor: **Cal State LA Information Technology Services (ITS) |** Liaison: **Mike Lee**
Faculty Advisor: **Zilong Ye, Ph.D.**
Students: Juan Aquino, Erick Cilia, Jesus Gonzalez, Calvin Han, Neil Manimtim
Project Description: We are developing a Chatbot for Cal State LA students that will eventually be accessible from several Cal State LA's websites. Students can interact with the Chatbot to get common Q&A service (e.g., university map, library resources and facility resources) and assistance regarding their campus account. The Chatbot consists of a front-end UI, a backend server chat program and database, and an AI/machine learning based logic engine.

Project Title: **ACUA - Animal Care Utility Application**
Sponsor: **LA County, Animal Care and Control |** Liaisons: **Roberto Ignacio, Luis Gutierrez, and Johan Wu |** Faculty Advisor: **Huiping Guo, Ph.D.**
Students: Marco Argentieri, Francisco Gudino, Joshua Guizarnotegui, Sean Hanson, Juan Placencia Jr
Project Description: The Animal Care & Control Department in LA county is in great need to improve their existing infrastructure to facilitate serving customers. Currently, most of the provided services are asynchronous based, which is not efficient. Customers have long waits in line to get service, especially during peak time. To speed this up and to streamline serving customers, this Senior Design team developed a platform agnostic service that can interact with the existing databases, provide a user-friendly interface that make it easier for customers to navigate the website and to find the information they need, allow users to type a question and answer the question if the q/a is already stored in the database, automatically detect the user's location and generate a ticket for on-site users, manage all the generated tickets, analyze users' questions, and update the list of FAQs. An option was to add voice recognition.

Project Title: **ACWM Inventory Management**
Sponsor: **LA County, Agricultural Commissioner / Weights & Measures |** Liaison: **Leopoldo Herrera |** Liaison: **Leopoldo Herrera |** Faculty Advisor: **Chengyu Sun, Ph.D.**
Students: George Chan, Bryce DeBilzan, Asiri Siriwardena, Moises Vargas, Mario Velasco
Project Description: Agricultural Commissioner Weights and Measures (ACWM) is a Los Angeles County department whose mission is to protect the environment, the agricultural industry, consumers and business operators through effective enforcement of federal and State laws and County ordinances in the areas of health, safety, and consumer concerns of County residents. The Department's highly diverse public services include: ensuring the safe and wholesome supply of food and water; protecting consumers and businesses from fraud; preventing the misuse of pesticides; managing and excluding pests; minimizing fire hazards from weeds and brush; and providing useful consumer and agricultural information.
On our liaison's request, we are tasked to redesign their current asset management system. Some of the new features that can be found on the new application include, but are not limited to, using a barcode scanner to log assets onto the system, the ability to use the application from a desktop or tablet interchangeably, and providing a photo of an asset as a visual reference. In addition, this application will improve upon their existing application such as having a more efficient advanced search, a more robust and user-friendly life-cycle management and reporting, and overall redesigning the application to have a more modern look.

Project Title: **Data Analysis Framework for LA County Executive Managers**
Sponsor: **LA County, Auditor-Controller** | Liaisons: **Karen Loquet, Romeo Martinez, Scott Harvey, Jesse Conde, and Grace Cheung** | Faculty Advisors: **Russ Abbott, Ph.D., Jungsoo (Soo) Lim, Ph.D.**
Students: Kaylee Alfaro, Jasmine Cao, Kristen Marenco, Jiabao Shan
Project Description: The Auditor-Controller has access to a wealth of financial data. The project team developed a Power BI dashboard that allows executive managers to make critical decisions for the County. The project team worked with subject matter experts to gather user requirements, to mockup design proposals, and to present proposals to key stakeholders.

Project Title: **Augmented Reality for Hydrology (Ver 2)**
Sponsor: **JPL |** Liaisons: **Shan Malhotra, Michael Rueckert, Natalie Gallegos, George Chang, Emily Law** Faculty Advisor: **Elaine Kang, Ph.D.**
Students: Refugio Arroyo-Martinez, Leonardo Obay, Mher Oganesyan, Gilberto Placidon, Anthony Soto
Project Description: Jet Propulsion Laboratory (JPL) collects and stores hydrology data from the Western United States, using sensors out in the field and algorithms that they have developed, into their Watertrek database. One example of this is using sensors placed in the mountains to weigh snow pillows and give an approximation of the snow depth. Provided the Augmented Reality framework for Android from last year's Senior Design team, version 2 of the Augmented Reality for Hydrology application will represent the hydrology data by implementing the framework. Since the framework provided by last year's team was built from the ground up, there are limitations when implementing it into the Android application. The framework solely relies on the device's gyroscope, excluding computer visions as an aid, to place and track generated objects in the real world. When implementing a mesh for the surrounding terrain and billboards that represent the various hydrological data, it is hard to keep track of the objects and to make sure that they stay in the correct position. Since the hardware of each device varies widely, a way to check the placement, orientation, and possibly scaling of the objects may be corrected by using network calls to an algorithm provided by JPL. An algorithm called Line of Sight returns the elevation of a location provided the location and orientation of the device, and this can be used to check the placement and scaling of the terrain mesh. Another challenge is retrieving and representing the historical data for the different data types in a way that is understandable to the user. Using a line graph with respect to time is a simple and clear way to represent the historical data so the user can see change over time. In addition, a list view of the data will be provided to the user in order for them to see in greater detail the historical data.

Project Title: **Bad Area Detector (BAD)**
Sponsor: **GE |** Faculty Advisor: **John Hurley**
Students: Eduardo Gutierrez, Tanner Hoeflicker, Robert Martinez, Alex Rodriguez, KaYee Yeung
Project Description: The purpose of the Bad Area Detector (BAD) is to two-fold. Its main purpose is to increase public safety by delivering valuable crime statistics to authorized Department of Transportation (DoT) workers as well as local public safety officers. This in-turn will help to reduce traffic congestion by quickly notifying DoT workers of areas that have been blocked due to illegal activity. The drivers can then change their driving route in real time to avoid running into those areas. The second purpose of BAD is to assist the local police in analyzing crime data with machine learning. This information can help officers to plan beat routes and help determine patterns of infraction committed by local crime organizations.
The application was originally built on General Electric's "Industrial Internet of Things" (IIoT) platform called Predix.io. However, due to unforeseen circumstances we have migrated the application to run on IBM's IIoT platform called IBM Cloud. The project will use a Raspberry Pi

to simulate police dispatch data to be sent to the Watson Service in the IBM Cloud. Once in the cloud, the information is sent to a Cloud Object Storage Database where it can then be pulled by an analytical service provided by IBM which will be used to analyze the crime data. Next, the information will be sent to the web-application which will process the information and display it to a user-friendly interface running on IBM's servers.

Project Title: **Context Detection in Augmented Vision Systems**
Sponsor: **The Vodafone Group |** Faculty Advisor: **Navid Amini, Ph.D.**
Students: Pedro Angeles, Daniel Kale, Emily Pascua, Gian Tolentino, Abraham Vega
Project Description: Assistive augmented vision technologies are becoming increasingly popular among the visually impaired. To function properly and to minimize user distraction, these technologies must determine a variety of context attributes of a user's activities and his/her surrounding environment. Accurate step counting, as an important context attribute, is generally overlooked by augmented vision technologies. Due to factors such as independent movement of the head, an accelerometer located on the head presents a significantly noisier picture of the forces felt by the body when walking when compared to a more traditional location for a pedometer. As such, step counting using an accelerometer located on the head presents a unique challenge. In this project, several data processing algorithms to extract a step count from accelerometer data will be examined. Several smoothing filters will be tested to help the step counting algorithm perform well on noisy, accelerometer data. Trade-offs will be explored between false positives and false negatives, as well as performance and accuracy.

Project Title: **CubeSat**
Sponsor: **Aerospace Corporation |** Liaisons: **Denny Ly and Pablo Settecase** | Faculty Advisor: **Richard Cross**
Students: Isaac Cano, Chung Chen, Ararat Ferahyan, Giovanni Garcia, Tan Luong
Project Description: Aerospace Corporation has a need to perform various technology experiments with CubeSats such as moving around other satellites without hitting them and grappling with them to repair or attach parts. Experiments are difficult though because simulating motion in space often requires expensive and complicated rigs. Traditionally, smaller setups to simulate motion in the vacuum of space might be a vehicle floating on an air table (think air hockey). Unfortunately, the air table is large and unwieldy for its small surface area, exerts frictional forces (although reduced), and is limited to a horizontal plane. This project suggests a way to overcome the first two limitations by use of a semi-autonomous powered vehicle. The vehicle's movement is only limited to the size of the room or parking lot. Friction limits are avoided by simply moving at a steady speed. The vehicle provides a small-scale way to test out new CubeSat technologies and approaches.

Project Title: **Drawdown Interface**
Sponsor: **LA County, Regional Planning |** Liaison: **Tony Alcaraz |** Faculty Advisor: **Yuqing Zhu, Ph.D.**
Students: Pranil Dahal, Iovanni Enriquez, Wesley Hwang, Cesar Rojas, Vay Tang
Project Description: The Los Angeles County Department of Regional Planning does not have an application that can centralize all data that is related to deposit accounts. Because of this, ad hoc reports are constantly being created to track these accounts. Drawdown Interface (DDI) will allow users to run custom reports on deposit data, as well as provide as mechanism to drill into more specific data about the respective plans, case, and account. DDI will act as a central location to access account data, and provide data access to different subdivisions such as Budget and Accounting, Zoning Enforcement, and System Analysis. DDI will allow users to perform four major functions:

1) Individual Balance by Plan - DDI will list all the accounts categorized by plan. Users can select a plan, and view details about that specific plan. The details will include all the accounts related to the plan, the contact information for each of those accounts, transaction history for each account, etc.
2) Individual Balance by Contact - DDI will list all the accounts organized by contact. For each contact, users can view all the related cases, account balances, transaction history, etc.
3) Non-Matching Account Alert - All account numbers must match a case number. There are entries in the LA County Database where this constraint is not satisfied. DDI will filter out those accounts and allow users to send an email to the respective contact for each account, notifying them to change their information in the database to satisfy this constraint.
4) All Balances - DDI will also list all the accounts and the balances in the database, with various filters. Users can categorize the accounts based on LA County Regions, transactions dates, contact names, etc.

Project Title: **FEWW - Game Development**
Sponsor: **ECST and Institute for Interactive Arts, Research, and Technology |** Liaison: **Sylke Meyer |** Faculty Advisor: **Elaine Kang, Ph.D.**
Students: Adan Constanzo, Patrick Hanna, MingYang Liu, Erik Sorto
Project Description: This is an interdisciplinary game development project that implements a fully designed game named "The FEWW". The game is a single player RPG where players play as characters defined by one of four elements/races within the game. The four elements and towns are: Earth - town of Enthral, Water - town of Wulopa, Fire - town of Furburkan, and Wind - town of Whisivil. These characters live in a sci fi/fantasy dystopia during the beginnings of a revolution. Each of the four characters show a different perspective on this revolution and the player gets to choose at the end weather they join the revolution or resist it, but there is a catch. The player doesn't get to choose which character story they will follow and each character has a locked level of difficultly and will face different challenge and discrimination on their journeys. Let the stars decide as we take you into the world of Colelystal and open your eyes to what discrimination really feels like. The Goal with this project is to not only create an interesting and engaging player narrative, but to also discuss systematic racism, classicism, the prison for profit system and many other issues facing our world today. With this game we will be able to have players consider these issues as many marginalized people do by putting them in those situations.

Project Title: **Medical Record Indexing [MINE]**
Sponsor: **QTC |** Liaison: **Neil DeJesus |** Faculty Advisor: **Yuqing Zhu, Ph.D.**
Students: Walter Carbajal Bautista, Gabriel Garcia, Vincent Trau, Eduardo Vargas, Abbie Zetina
Project Description: Medical Indexing Enhancement (MINE) is a software project that creates an index tool for medical records held in QTC. Currently the records are handled purely manually. MINE will be able to manipulate a PDF document with a standardized tag that represents different specialties. These tags will be in the form of a stamp that will be placed on the page(s) selected by the user. From these tags, a bookmark feature will be created. The file will then be sorted according to the specialty indicated by the stamp placed on the pages and will also be indexed and put into the table of contents within the PDF. The index page will then summarize the range of pages for each tagged specialty. Additionally, the name of specialty will act as a link to the first page where that specialty begins. The tool should work fast for Gigabyte-sized PDF files. In summary, MINE will label pages, which allows the user to uniquely label PDF files, rearrange pages according to the labels to organize medical records better, and will generalizing the meta page and add it in the front to give summarized information.
Project Title: **Mobile-Friendly Website for LA County District Attorney**

Sponsor: **LA County, District Attorney, Bureau of Victims Services |** Liaison: **Brian Cosgrove |** Faculty Advisor: **Mark Sargent**
Students: Raymond Chen, Oz Inderbitzin, Carlos Ruvalcaba, Kevin Trang
Project Description: The Los Angeles District Attorney Bureau of Victim Services provides comprehensive victim services in Los Angeles County to help victims become survivors. This assistance is given independently of legal residency or citizenship. Services include crisis intervention; emergency assistance; counseling referrals; court escort and orientation; restitution assistance; returning of property; assistance with employers; and case status notification. The department serves victims with special needs (e.g., children, the elderly, persons with disabilities, etc.) and provides support in a variety of languages. The Bureau would like to enhance its level of service provision through the use of technology to better reach and connect with and support victims of crime in LA County. Although the Bureau posts information on its website, http://da.lacounty.gov, it would like to provide a simplified and easily accessible method of informing victims of crime with locations where service can be provided. Additionally, it would like to direct victims to external services that would be of immediate assistance to a crime victim. A mobile website and/or an app could expand the departments reach, but it can also allow Victims Services Representatives to better focus on service delivery through the provision of timely and geographically appropriate information. A mobile website could provide innovative solutions based on location of services and other mobile features that the regular website cannot. It is of particular interest that victims would be directed to services in a location near them. This project envisions students working closely with subject matter experts to define some of these innovative services that can be offered through mobile technology and to devise the mobile app and/or mobile website to deliver such services.

Project Title: **Parks and Recreation Mobile App**
Sponsor: **LA County, Parks and Recreation |** Liaisons: **Ashwini Padukone and Mohammed Al Rawi |** Faculty Advisors: **Russ Abbott, Ph.D., Jungsoo (Soo) Lim, Ph.D.**
Students: Jarly Arciniega, Sudarshan Guttula, Narciso Ramirez, Abel Salinas Jr, Luis Tejeda
Project Description: The Los Angeles County Department of Parks and Recreation oversees over 70,000 acres and manages 182 parks across Los Angeles County. To provide a better service to LA County Park visitors, the Department of Parks and Recreation partnered with Cal State LA to build the first LA County Parks and Recreation mobile app. The mobile app makes it easy for potential visitors to discover new parks. They may search for parks based on location and may filter parks to find those that offer any combination of the 83 available amenities. Users are able to download high-resolution maps of parks so that they can better understand the layout of the park and reorient themselves if they get lost. After a user visits a park, they may submit a review to Parks and Recreation staff. The review can include suggestions for improvement or issues they found in the park. Finally, visitors may opt-in for emergency alert push notifications so that staff can quickly notify users when necessary.

Project Title: **Parks Assistant Agent**
Sponsor: **LA County, Parks and Recreation |** Liaison: **Mohammed Al Rawi** | Faculty Advisor: **Keenan Knaur**
Students: Jeffry Alvarado, Christopher Carlson, Joshua Lazaro, Garin Lee
Project Description: The purpose of this project is to give users that require customer support an easier and better experience by incorporating an A.I agent that is able to answer and fill customer requests 24/7. The software to be produced is the LA County Parks and Recreation customer support A.I agent. This software will answer most commonly asked questions, provide information about a park, and provide an extensible framework for developers to add functionality to the agent. The software will be easy to use for users, and easy to maintain and upgrade by the staff which operates it. Once released, users will interact with the agent by

sending strings and the agent shall respond with strings. The client will handle the matter in which to receive the input from the user to send to the agent. Client methods include a text input field and voice recognition technology. The client will also handle how to output the string to the user.

Project Title: **Remote Home Assist**
Sponsor: **LA County, Workforce Development, Aging and Community Services** | Liaisons: **Mike Agostinelli and Edwin Cheng |** Faculty Advisor: **Mohammad Pourhomayoun, Ph.D.**
Students: Chor Cheung, Imelda Flores De Santiago, Angelo Onato, Christopher Ortiz, Andy Xie
Project Description: Remote Home Assist will bring in-home, interactive technology to older adults, helping them maintain independence and well-being. The specific functional objectives involve developing skills for the Amazon Alexa and actions for the Google Home Assistant to enable end users to interactive with services programs and supply wellness responses. The older adults will answer a set of questions on a scheduled basis to help caregivers make remote assessments. The system will also verbalize and display schedule reminders for congregate meals, doctor appointments, senior center classes and other events. It will enable the users to call for transportation, schedule activities and obtain wellness coaching. WDACS will provide scope guidance, computing infrastructure, technical support and devices. The students will provide design analysis and software development.

Project Title: **RoboSub**
Sponsor: **U.S. Office of Naval Research |** Liaisons: **He Shen, Ph.D., and Mark Tufenkjian, Ph.D. |** Faculty Advisor: **Mark Sargent**
Students: Jin Chiu, Erika Estrada Medina, Kunal Juneja, David Krystall, Jesus Lopez
Project Description: The Robosub Senior Design project is a joint project between a team of Electrical/Mechanical engineering students and Computer Science students. The purpose of the project is to build a fully autonomous underwater submarine that will compete in an international competition in Fall 2019. The Computer Science portion of the project is tasked with designing and implement the software which will pilot the submarine. The CS team is working on providing navigation, stabilization, object detection and task handling capabilities to the RoboSub. The competition is comprised of a sequence of different tasks and obstacles, which will test the RoboSub's ability to detect objects, maneuver itself, and to make decisions based upon the task which it locates. The CS team is responsible for giving the submarine all of these capabilities as well as providing documentation for the use of future teams, and as well as providing the team with a command line interface to easily change parameters and task/obstacle prioritization.

Project Title: **Non-autonomous Robot to Examine City Sidewalks**
Sponsor: **City of Los Angeles, Bureau of Engineering |** Liaisons: **Ted Allen and Miguel Grajeda |** Faculty Advisors: **Russ Abbott, Ph.D., Jungsoo (Soo) Lim, Ph.D.**
Students: Juan Battini, Russell Carter, Daniel Gonzalez, Gerardo Granados, Tom Nguyen
Project Description: The City of Los Angeles, Bureau of Engineering maintains over 7,500 miles of sidewalks. When a segment of sidewalk does not settle evenly or has been raised up by tree-root growth, the sidewalk becomes uneven. This can create pedestrian hazards. In addition, the City is obligated to ensure that its sidewalks conform to Federal ADA standards, which limit the extent to which a sidewalk may slope. It is anticipated that this will be a multi-year project. The overall goal is the development of an unpowered but roll-able, cart-like vehicle with capabilities that include, measuring sidewalk slope, taking pictures of locations where the sidewalk violates the ADA standards, taking pictures of trees along the sidewalk parkway to enable City personal to anticipate possible problems, etc. Once collected, the data is to be uploaded to City servers so that it can be examined by relevant personnel. This involves

developing a web server that includes, some data visualization capabilities. It should be possible for personnel with limited training and technical abilities to operate the cart, i.e., to push/pull it over the sidewalk and turn it on and off. (Currently trained engineers are required for surveying City sidewalks.) During this first year, we explored a number of options related to the development of a digital platform to which sensors and other devices might be attached. We examined a number of sensors and algorithms for measuring sidewalk slope. We developed a mechanism to synchronize images taken from the cart with slope data so that city personnel can see the cause of slope problems.

Project Title: **Satellites Attitude and Orbit Visualization**
Sponsor: **Boeing |** Liaison: **Sen Yao |** Faculty Advisors: **Chengyu Sun, Ph.D., Zilong Ye, Ph.D.**
Students: Rolf Castro, Miguel Cayetano Jr, Alan Daniel, Allen Ma, Victor Orozco
Project Description: Boeing is responsible for manufacturing satellites for private companies and the government. Once the satellite is done and ready to be launched, Boeing needs a way to be able to see and visualize the satellite during and post-launch. The main objective of this project, to create a web application so that Boeing will be able to see at any given time where their satellites are in its orbital path. This project involves converting TLE files (Two-Line-Element), which are orbital elements, to a readable file Cesium Language file (CZML), developing a user-intuitive front-end view utilizing Cesium.js so the user at the Mission Control Center can see where the Satellite(s) is/are in current time, finally reading and interpreting real-time space telemetry data to adjust satellite attitude. In order to convert TLE files, the development team must extract the necessary data to display an orbit of a satellite (Altitude, longitude, latitude, epoch, position, velocity, and time interval) by utilizing the satellite.js library. Attitude, longitude, latitude, epoch, position, and velocity are necessary to view an orbit in space but the time interval of the satellite orbit is vital as the TLE file's information will only be accurate up to 3 to 5 days upon generation of the file. The resulting file, the Cesium Language file (CZML), is read by Cesium.js and displays the satellite name in the list of satellites table.

Project Title: **System Registration**
Sponsor: **LA County, Probation |** Liaison: **Diana Salazar |** Faculty Advisors: **Chengyu Sun, Ph.D., Zilong Ye, Ph.D.**
Students: Jaime Borunda, Kevork Gilabouchian, James Kang, Brandon Lam
Project Description: The Los County Probation Office is requesting an automated workflow system with electronic approval capabilities to facilitate system access requests, also known as, Probation Access Manager (PAM). The PAM will assist the Probation Office with documentation management and online approvals rather than the current requirement of a physical signatures. The system will also keep track of pervious approvals and save them as reports which then can be checked in the future. In addition, the current system used by the Probation Office does not provide an online approval. The system would require a physical document to be print and sent to the correct supervisor for a signature of approval. The reports that will be saved after every approval/denial will assist with possible future auditing predicaments. A major concern with the Probation Office is that paper work that requires an approval might take hours, days, or possibly weeks before a supervisor will even notice it. With paper approvals there might also be the issue of lost paperwork in which case, the person who turned it in will be sitting and waiting for an approval that will never happen due to lost paper work.

Project Title: **Traffic Monitoring and Analysis with Artificial Intelligence and Machine Learning**
Sponsor: **LA City and TOYOTA |** Liaisons: **Mony Patel and Hunter Owens |** Faculty Advisor: **Mohammad Pourhomayoun, Ph.D.**
Students: Daniel Caceres, Javier Hernandez, Vrezh Khalatyan, Hue Ngo, Grecia Zamora
Project Description: The goal of this project is to design and develop an end-to-end system based on advanced artificial intelligence, deep learning, and computer vision to monitor, track, predict, and manage traffic, particularly pedestrians and bicyclists using traffic cameras. The main objective is to improve the safety of pedestrians and bicyclists by applying self-sensed and AI-powered systems to monitor, predict, analyze, and control the traffic flow.

Project Title: **Upgrade of Tenant and Owner Portals to Housing Authority Website**
Sponsor: **LA County, Community Development |** Liaisons: **Doug Van Gelder, Steve Lo, and Michele Do |** Faculty Advisors: **Russ Abbott, Ph.D., Jungsoo (Soo) Lim, Ph.D.**
Students: Simon Bach, Ravin Bhakta, Juan Orozco, Juan Rojas, Michael Schleicher
Project Description: The Los Angeles County Community Development Commission seeks to upgrade its existing tenant and owner web portals, which were originally developed in 2010. The tenant portal allows Section 8 families to obtain, fill-out, and submit Housing Authority forms to maintain eligibility for housing programs. The owner portal enables landlords to view tenants' account information, examine current and historical results of housing inspections, and access required forms. While the system has served the needs of the commission for eight years, the current system does not meet today's data security standards and lacks a user-friendly mobile interface. It is anticipated that once completed the portal enhancement would improve operational efficiency. An upgraded web portal has been designed and is currently under review. The upgrade includes a much more user-friendly web interface, which is also mobile-friendly. Once approved and opened to the public users would be able to navigate among different forms on the site using a wide range of laptop and mobile devices. New features were added to streamline the application and to improve the user viewing experience. The portal has been re-designed with a modern web interface that improves browser compatibility and mobile responsive web pages

CIVIL ENGINEERING PROJECTS

Master Project Title: **Mobility Improvements of the Fair Oaks Avenue and the SR-110 Region**
Sponsor: **California Department of Transportation - District 7**
Liaisons: **Jerrel Kam, P.E., Anthony Ng, P.E., Derek Higa, P.E., Munshi Mohsin, P.E., Terry Martinez, P.E.**
Faculty Advisors: **Rupa Purasinghe, Ph.D., P.E.; John Shamma, P.E.; Howard Lum, P.E., S.E.; Jason Song, Ph.D., P.E.**

Master Project Description: The Arroyo Seco Parkway, part of State Route 110 (SR-110), also known as the Pasadena Freeway, is the first freeway built in the United State west of the Rocky Mountains. The Parkway runs along the Arroyo Seco, a river bed that starts along the Pasadena Foothills and joins the Los Angeles River. The Parkway was opened in 1935. State Route 110 is a historic state highway and a national scenic byway that runs from Pasadena to San Pedro in the Los Angeles County. The Arroyo Seco Parkway includes a southbound on-ramp from the Fair Oaks Avenue/State Street intersection towards SR-110, as well as, a northbound off-ramp from the SR-110 towards the Fair Oaks Avenue/Grevelia Street intersection. The rapid growth of the surrounding community and increased traffic is causing heavy congestion along both Fair Oaks Avenue on-ramp and off-ramp to State Route 110. To lessen the impact of traffic congestion and enhance road safety for the community, the California Department of Transportation (Caltrans) plans to improve the operation of the SR-110/Fair Oaks Avenue intersection.

The historic SR-110/Fair Oaks Avenue intersection is experiencing congestion throughout the day and especially during peak hours due to population growth and commercial development in the surrounding area. The increased traffic is due to unsynchronized traffic signals and outdated geometry of the interchange. Working under the direction of the Caltrans Engineering Division, students of Cal State LA Senior Design Class performed research, conducted an alternatives analysis and prepared preliminary design concepts to improve traffic flow at the interchange.

The need of this project is to relieve traffic congestion at Fair Oaks Avenue/SR-110 produced by commercial and residential development, by reducing travel time, increasing serviceability, and improving safety. Accessibility must be accounted for to allow for traffic flow throughout the construction phase of the project. Full collaboration of Caltrans, City of South Pasadena and other involved parties will be required to keep the project on schedule.

The design teams took a series of steps to come up with a solution to the problem. The process started with defining the problem, researching solution to similar problems, identifying both technical and non-technical design requirements, brainstorming solution alternatives, then choosing the best solutions that meet the design requirements for presentation to Caltrans. Seventeen design alternatives were brainstormed and evaluated against design requirements, cost effectiveness, constructability, and impacts to the surrounding community. Four of the seventeen alternatives were selected by the client for further design as listed below.

Project Title: **Urban Double Roundabout Interchange**
Students: Salvador Ponce, Daniel Serrano, Nneoma Nwosu, Rachel Ibrahim-Watkins, James Harris, Bobby Pasos, Joshua G. Garrido, Kenny Khov, Yee Hang Xiao, Kim Jaime, Ahmad Alrefai, Jedah Mosqueda, Danna Shelleh
Project Description: The design utilizes two roundabouts. The north roundabout is located at the intersection of State Street and Fair Oaks Avenue and the south roundabout is located at the intersection of Grevelia Street and Fair Oaks Avenue. A roundabout is a circular intersection where drivers travel counterclockwise around a center island. There are no traffic signals or stop signs in a modern roundabout. Drivers yield as they enter into the roundabout where they join the traffic circulating in the intersection and exit at their desired street. Studies by the Federal Highway Administration have found that roundabouts can increase traffic capacity from 30 to 50 percent compared to traditional intersections. The utilization of a double roundabout with modifications to local streets will improve mobility along the SR-110, Fair Oaks Avenue, State Street and Grevelia Street. Each roundabout has a diameter of 90 feet which includes a truck apron and a swale with a bio-retention planter. Integrating drought landscaping ideas and groundwater recharge concepts makes the double roundabout a sustainable solution.

Project Title: **Freeway Access Improvements**
Students: Mario Baires, Chen Pin Chan, Kilmer Chavez, Erik Choi, Brenda Garibay, Jose Hernandez Acosta, Tommy W. Kam, Kantkaw Kyaw, Kelvin Luo, Vanessa Mauricio, Yile Tian, Joseph K. Tshiaba, Menghua Zhuang, Ana Soriano, John Triantafyllos
Project Description: The design expands northbound SR-110 Off-Ramp to four lanes and restripes Fair Oaks Avenue and surrounding streets to improve traffic circulation. Traffic from the northbound Fair Oaks Avenue that currently has access to the southbound SR-110 on-ramp will be redirected towards a new entrance half a mile east on State Street where the on-ramp to southbound SR-110 will be constructed. With an addition of the new on-ramp, the existing State Street off-ramp will be modified to allow adequate turning radius for the on-ramp.

Project Title: **Diverging Diamond Interchange (DDI)**
Students: Natalie Guillén, Jimmy Wu, Cesar Villarreal, Tadeh Asiun, Abdullah Altuwayjiri, Madai Rosas, Brandon Quintana, Maria Torres, Alejandro Lopez, Julio Peralta, Marcus Portillo, Rodolfo Gonzalez, Meshal Alamri, Ambria Vasquez, Calvin Miguel
Project Description: The DDI solution on Fair Oaks Avenue consists of a diverging diamond interchange on the bridge overpass and an expansion of the northbound SR-110 off-ramp onto Grevelia Street. DDI moves right hand traffic to the left side for a brief, intermediate period while crossing an interchange and then diverges to the right side and continues normally. This allows traffic to make a left-hand turn without crossing oncoming traffic, reducing the number of conflict points. The intersections are devoid of turns, which do not affect the duration of signal crossings and allow more efficient signal timing and reducing delay times for traffic. The elimination of the left turn lane reduces the probability of head-on and side crashes and improves safety. This design option also includes the expansion of the northbound SR-110 off-ramp merges onto Grevelia street. The existing steep off-ramp will be lengthened to reduce its slope and match the elevation of Grevelia Street to utilize the current street for a right-turn lane.

Project Title: **Fair Oaks/SR-110 Connector**
Students: Raymond Olivares, Carmelo Avila, Kevin Espinoza, Aaron Robles, Sergio Vasquez, Chris Garcia, David Lopez, Steven Santana, Steven Perez, Simon Packman, Guadalupe Packman, James Tuazon, Jesus Ventura, Abel Casillas, Joshua Youman
Project Description: The design consists of three design components to relieve traffic congestion. The first component expands the existing two-lane SR-110 Northbound off-ramp to four lanes. The second component restripes and eliminates the two left-turn lanes that merge

onto the SR-110 Southbound on-ramp, while adding a through lane heading Northbound on Fair Oaks Avenue to increase traffic capacity and improve circulation. The third component constructs a single-lane overpass above the Metro Gold Line Light Rail that originates from Fair Oaks Avenue to a new SR-110 southbound on-ramp. The new overpass will divert traffic away from SR-110 and Fair Oaks Avenue intersection to allow uninterrupted traffic flow through the congested area.

ELECTRICAL ENGINEERING PROJECTS

Project Title: **Mobile Fitness for Wheelchair Users**
Sponsor: **Cal State LA Biomedical Engineering** | Faculty Advisor: **Debbie Won, Ph.D.**
Students: Aaron Myrick, Maria Vargas, James Velasco
Project Description: Individuals who are wheelchair-dependent are at greater risk of cardiovascular disease and metabolic disorders than non-disabled individuals. A National Institute on Disability, Independent Living, and Rehabilitation Research-funded project was established at Cal State LA in order to develop an exercise monitoring system to encourage these individuals to exercise more. The project extends a mobile app-based exercise monitoring system that obtains biometrics from wireless sensors on the user. The app needs to compute and display cardiovascular fitness-relevant metrics in real-time and provide extensive metric development and self-calibration.

Project Title: **Harbor Cleaner 4 - Electrical Subsystem**
Sponsor: **Cal State LA ECST** | Faculty Advisor: **Masood Shahverdi, Ph.D.**
Students: Jacque Cabrera, Efren Hernandez, Medvin Martinez, Chris Serrato
Project Description: The scope of work for the Electrical Subsystem project is to design, develop, and prototype all the electrical components, power, guidance, navigation, and control systems for the Harbor Cleaner project in pursuit of its objective to develop a compact, durable, and inexpensive semiautonomous aquatic vessel capable of cleaning some of the massive amounts of trash that are being dumped into Long Beach Harbor every day. Additionally, this team was also to be responsible for harness, battery units, vessel propulsion and steering control for the small autonomous operating vessel.

Project Title: **Lidar/Acoustic Radar/ Object Avoiding Rescue Robot**
Sponsor: **Raytheon** | Liaisons: **John Jacobs, Ph.D.** | Faculty Advisor: **Bob Dempster**
Students: Oscar Acevedo, David Garcia Jr., Nathan Ramos, Luis Salcedo
Project Description: Natural disasters happen in a moment's notice and can cause massive amounts of damage within a small window of time. They can also cause buildings and structures to collapse. Using a robot to search inside collapsed buildings will allow search and rescue teams to look for survivors within rubble and buildings not safe to enter. This project scope was to develop an autonomous vehicle that could navigate a defined area and precisely track a specified path. The team developed an autonomous crawler and demonstrated that the system can record and navigate a prescribed area without overlapping or omitting accessible regions.

Project Title: **Preventing Electrical Explosions Underground Vaults**
Sponsor: **Southern California Edison** | Liaisons: **Herbert Martinez and John Flores** | Faculty Advisor: **Masood Shahverdi, Ph.D.**
Students: Gossaye Bireda, Stephen Doeve, Johnny Flores, Earl Hong
Project Description: Underground vault electrical explosions have become a major issue for power utilities. As electric power providers improve their technology and analytics to prevent failures, subsurface transmission facilities are vulnerable to seeping gases or combustible outgassed materials. The scope of this project was to develop a monitoring and broadcasting tool for these enclosed vault conditions. Specifically, a prototype monitoring tool was designed that could sense these hazardous underground gasses, such as those that would result in explosions triggered by ignitions sources during equipment failures or electrical faults. The monitoring system needed to be remotely located underground and needed the capability to continuously monitor and broadcast a safety status message.

MECHANICAL ENGINEERING PROJECTS

Project Title: **Motorcycle Helmet Aerodynamics Optimization**
Sponsor: **6D Helmets** | Liaisons: **Robert Reisinger** | Faculty Advisor: **Nurullah Arsian, Ph.D.**
Students: Alhassan Alajaji, Chris Mirzayan, Luis Ramirez, Juan Sanchez
Project Description: 6D designs and builds high-end motorcycle and bicycle helmets for street and off-road racing. They build the safest helmet available, that provides exceptional energy management, comfort, and must be aerodynamic. CAD models of a new helmet design need to be analyzed for drag and efficiency using predictive computational techniques with the results being experimentally correlated in a wind tunnel. Overall, wind effects must be minimized by optimizing and modifying detailed parts such as adding foils and spoilers.

Project Title: **Micro-fibrils Adhesive Development**
Sponsor: **Cal State LA Mechanical Engineering |** Faculty Advisor: **Travis Hu, Ph.D.**
Students: Jessica Corrales, Rosa Mejia, Melvin Ramos, Pablo Torres, Marilyn Zepeda
Project Description: Insects and small animals have adapted hierarchical micro/nano-fibrils as adhesive organs for securing firm attachments to a whole range of surfaces. Artificial adhesives substantially lag behind these natural counterparts and research is needed to understand micro-mechanics for developing advanced bio-inspired, switchable, dry bonding structures. This project designed and fabricated wedge-shaped adhesive arrays using micro- template assisted cast molding. These were then used with a designed and built micro-/nano-mechanical testing system that could microscopically observe de-bonding and measure normal/shear forces of these arrays.

Project Title: **Modeling of Powder Fusion Additive Manufacturing**
Sponsor: **Cal State LA Material Science** | Faculty Advisor: **Mohsen Eshraghi, Ph.D.**
Students: Rodolfo Galindo, Dea Flores Zuniga, Rafael Luna, Shuo-Jan Teng
Project Description: Laser sintering of metals has become an important technology for emerging 3D printers. More understanding is needed of processing parameters on the temperature distribution, solidification behavior, and resultant triaxial material properties. This project used multi-scale modeling to simulate powder distribution, packing, thermo-fluid dynamics, and geometry of the molten pool during powder fusion laser sintering. Results of this research will enable locating specific grain structures and properties by tuning additive manufacturing process parameters with minimal trial and error.

Project Title: **Modular Shelter for Disasters**
Sponsor: **Cal State LA Mechanical Engineering |** Faculty Advisor: **Adel Sharif, Ph.D.**
Students: Abdul Alsanousi, Enrique Chavez, Antonio Guerra, Ricardo Jimenez, TraVaughn Montgomery, Sevag Rezian
Project Description: Providing shelter to disaster victims is as important as providing food and water. Tents provide limited temporary relief, but are not suitable for long term use. A rigid structure where a warming fire could be used for heating and cooking is most suitable.
This project investigated designing and building modular lightweight cement-foam structures. The team assessed the properties of cement-foam materials (i.e. aircrete instead of concrete) and designed structural panels that could be molded and be field assembled in a way to be interlocked, ultimately to create a stable, secure dome.

Project Title: **Aerodynamic Package for Formula SAE**
Sponsor: **Cal State LA Mechanical Engineering** | Faculty Advisor: **Armen Pazouki, Ph.D.**
Students: Randy Bui, Jeffrey Chow, Miguel Cisneros, Fernando Covarrubias, Andy Hernandez, Randy Perez
Project Description: Formula SAE is a college engineering design and racing competition. The Cal State LA team has been involved in this for nearly a decade with improvements occurring in nearly every major mechanical portion of the vehicle. One neglected area has been the car aerodynamics (i.e. drag, handling, and tire friction). For this project, a computational-fluid-dynamics-based model of a Formula vehicle with aerodynamic enhancements was created. These enhancements included a nose cone to cover the vehicle front, an undercarriage floor pan or diffuser, and a rear spoiler. The team needed to evaluate the airfoils at the front and rear of the vehicle, then use rapid prototyping technology to fabricate an aerodynamic package that could be tested in a real, high speed environment.

Project Title: **Bending Beam Tester**
Sponsor: **Cal State LA Mechanical Engineering** | Liaison: **Armen Pazouki, Ph.D.**| Faculty Advisors: **Bob Doll, Ph.D. and Stephan Felszeghy, Ph.D.**
Students: Michael Coronado, Norberto Garcia , Manuel Frausto, Erik Morales
Project Description: Bending beams are common in everyday structures and their deflections be easily predicted with closed form solutions or finite element models. It is important for students to observe and understand differences between math predictions and actual measurements, and why there might be differences. A small, bench top beam bending tester is needed to study various load and boundary conditions. This project designed and developed a beam bending tester that could statically apply precise and measurable loads, using a non-contact, electronic method to measure displacements. The machine was adjustable for beams of various lengths, cross sections, and boundary/loading conditions.

Project Title: **Low Cost Stirling Engine Experiment**
Sponsor: **Cal State LA Thermal Lab** | Liaison: **Jim Kuo, Ph.D.** | Faculty Advisor: **J. David Scholler, Ph.D.**
Students: Allan Asturias, Hugo Carreño, Vinesh Raj, Abraham Rav-Noy, Marco Rios
Project Description:
The Cal State LA Thermal Systems Lab's objective is to give students hands on learning where they can observe principles learned in heat transfer class as well as thermodynamics class and apply reasoning. Currently the lab is mainly composed of heat transfer lab experiments and is lacking thermodynamic lab experiments. The purpose for the project is to develop, design, and test an experiment for the thermal systems lab in which students utilize a Stirling engine to demonstrate and test thermodynamic properties. The engine is to run under normal conditions and produce the Stirling Cycle's pressure-volume diagram. Students will then collect the data from the engine and analyze it and apply thermodynamic principles and theories to better understand thermodynamic concepts.

Project Title: **Harbor Cleaner 3 - Mechanical Subsystem**
Sponsor: **Cal State LA ECST** | Faculty Advisor: **Ron Sobchik**
Students: Chen Garces, Edgar Marroquin, Bryan Medeiros, Josue Mier, Yvens Pina
Project Description: The scope of work for the Mechanical Subsystem project is to design, develop, and prototype all the mechanical structure and floatation system for the Harbor Cleaner project in pursuit of its objective to develop a compact, durable, and inexpensive semiautonomous aquatic vessel capable of cleaning some of the massive amounts of trash that are being dumped into Long Beach Harbor every day. Additionally, this team was to oversee

all the design issues related to loads, weight properties, corrosion concerns, and hosting equipment for the small autonomous operating vessel.

Project Title: **Fuel Cell Exhaust Condenser**
Sponsor: **Metropolitan Water District** | Faculty Advisor: **David Blekhman, Ph.D.**
Students: David Armas, Luis Contreras, Jesus Perez
Project Description: Fuel cell technology is the centerpiece of hydrogen-powered vehicles. A key feature of the technology is that the fuel cell converts hydrogen and oxygen to electricity is used to power the engine of the vehicle with the only byproduct being water vapor. The objective of this project is to design and manufacture a system that will have the ability of capturing and condensing the water vapor out of the exhaust of a fuel cell and storing it on the vehicle for later consumption or use. The system needed to have minimal impact on the performance of the fuel cell vehicle all the while extracting the maximum amount of liquid water out of the exhaust. The goal was to design and assemble a makeshift system for emergency applications and then use the learned knowledge and experience to improve the system so that could be commercially viable.

Project Title: **Arctic Ice Satellite Damper**
Sponsor: **NASA-Jet Propulsion Laboratory** | Liaison: **Charles Dandino** | Faculty Advisor: **Stepan Simonian, Ph.D.**
Students: Ian Akiyama, Martin Cholico, Edgar Farias, Eduardo Molina
Project Description: The scope of this project is to develop a rotary motion damper for a satellite boom deploying a magnetometer. The rotational damper must function in conditions encountered in deep space, while providing a smooth, slow, and repeatable motion. Design concepts accounted for this with particle interactions (successful use of particle impact dampers in structural vibration attenuation was referenced), and strain energy of bending a metallic beam. Prototypes were designed and fabricated as was a simple experimental testbed. Data roughly showed conceptual designs would be capable of removing adequate amounts of kinetic energy from a rotating system. The design goal was to be lighter and employ new methods of slowing rotational motion than what is currently used.

Project Title: **Venus Wind Harvester**
Sponsor: **NASA-Jet Propulsion Laboratory** | Liaison: **Jonathan Sauder, Ph.D.** | Faculty Advisor: **Jim Kuo, Ph.D.**
Students: Zinrry Bravo, Charles Chhun, Levon Ghabuzyan, Jose Vega
Project Description: Venus has a sulfuric gas atmosphere, temperatures of over 450ºC, and surface pressures of 92 bar - is one of the most hostile planet environments in the solar system. Electronics systems are only able to survive for a short time. Electromechanical systems that use wind power to wind a mechanical spring for locomotion and mechanisms is thought to be a more pragmatic, constant approach for exploring the surface of Venus. The scope of this project is to evaluate, design and test a vertical wind mill capable of extensive operation above 450ºC. The task required the assessment of designs for efficiency in Venusian environment and the optimization of the design for minimum mass, surface area and ruggedness.

Project Title: **Robotic Tool Docking and Development**
Sponsor: **Northrop Grumman Aerospace Systems** | Faculty Advisor: **Ted Nye**
Students: Yliana Chavez, Michael Gamble, Jovanny Santana, Michelle Tang, Justin Torres
Project Description: In the aerospace industry, billions of dollars and countless man hours are spent in the designing, production, assembly, and testing of spacecraft and satellites prior to being sent into space to accomplish their mission. However, problems as simple as a loose wire can render the entire mission as a failure. The use of telerobotic, surgical robots for minor

space repairs would provide the clients of large satellites a form of insurance against full mission failures. In this project, students design and produce operable prototypes of mechanical end-effectors for CubeSats. The idea is to take the design from the Da Vinci surgical end effectors and repurpose them to perform various tasks that may be useful in small-repair scenarios remotely and wirelessly. These tasks are to include gripping small or thin objects such as small parts or multi-layer insulation, cutting and manipulating said insulation, detecting continuity in wiring, point heating certain areas that freeze in the conditions of space, and cleaning surfaces that are vital for mission progression such as optics or solar panels.

Project Title: **Development of a Low-NOx Cooking Burner**
Sponsor: **Southern California Gas Company** | Liaison: **Steve Simons** | Faculty Advisor: **Jeff Santner, Ph.D.**
Students: Amar Alhelali, Isai Cortez, Mark Garcia, Edgar O Valenzuela
Project Description: The purpose of a low NOx burner is to provide natural gas flame heat while producing less harmful emissions than in a conventional heating system. This is important for air quality control in sensitive regions such as Southern California. The scope of this project was to construct a laboratory set-up that was instrumented to measure pollutants under various combustion controlled conditions. The team also created several burner designs and manufactured them. Each contained complex internal structures and cavities to promote controlled-uniform flow rates and promote mixing with re-circulated air. The burners were evaluated and compared for cleanliness, efficiency, and overall performance over a range of conditions.

MULTI-DISCIPLINED
ELECTRICAL & MECHANICAL ENGINEERING PROJECTS

Project Title: **Automated Honeycomb Router Upgrade**
Sponsor: **Boeing** | Liaisons: **Teo El Masri, Jonathan Fish, Jeff Iwasaki, and Jonathan Sanabria** | Faculty Advisor: **Lih-Min Hsia, Ph.D.**
Students: Robert Abbey, Oscar Basurto, Jacqueline Martinez, Kevin Yoo
Project Description: Honeycomb panels are typically used on satellites for solar arrays and for structural equipment mounting. A panel is considered in need of repair if it contains a dent on its facesheet that surpasses strict tolerances. Typically this repair process takes approximately four to six hours to complete by hand and consists of several operations that include drilling, core picking, vacuuming, and foam-filling the affected area. This project was required to develop an automated machine that was portable and could do these types of repairs more predictably and within minutes.

Project Title: **Inertial Instrument Package for Deployable Testing**
Sponsor: **Boeing** | Liaisons: **Cameron Massey, Ph.D., Mackenzie Mason, and Jesse Villegas** | Faculty Advisor: **Lih-Min Hsia, Ph.D.**
Students: Aadit Pujara, Miguel Ramirez, Pedro Rodriguez
Project Description: Satellite appendages such as antennas must undergo extensive operations testing before being sent into space. Boeing needs a lightweight sensor package to ensure the safe operation of these deployables during mechanical ground testing. The instrumentation must provide detailed, real-time data on the position, rate of acceleration, instantaneous velocity, and angle of the system. This data must be captured in real time, stored for future analysis, and must sound alarms to alert a test conductor if a limit has been exceeded.

Project Title: **CubeSat Deorbiting Vehicle**
Sponsor: **Aerospace Corporation** | Liaisons: **Edgar Herrera** | Faculty Advisor: **Airs Lin, Ph.D.**
Students: Christian Canedo, Ramon Huerta Jr, Casey Ledbetter, Oscar Muneton, Oscar Ponce
Project Description: The objective of this project is to create a CubeSat test platform with the simulated capability to approach an ailing satellite, fly around it, and grapple with it for repair or deorbiting. To emulate motion in space, instead of an air table, the CubeSat would be attached to an autonomous vehicle that will move in response to CubeSat thrust commands or when it contacts with objects. It requires proximity sensors, a video camera, a gripping mechanism, and deployable device to simulate deorbiting. Machine learning techniques will eventually be used to teach the vehicle and CubeSat how to move and perform its functions.

Project Title: **Motorized Sit-Stand Device**
Sponsor: **Cal State LA Biomedical Engineering** | Faculty Advisor: **Ramon Garcia**
Students: Juan Benitez, Shanique Davis, Mario Mendoza Jr, Adrian Pena Mata, Hector Ramos
Project Description: Cal State LA is working with a young client who suffered a stroke, has lower limb impairment, and lacks normal core/torso strength. He requires a device that could assist him to stand from a seated position, and enable him to do work on a desk surface which has adjustable height. The project is tasked with developing an ergonomic lift to enable the user to stand from a seated position or work sit/standing. The device must fit the user appropriately, be self-powered, be re-chargeable, portable, and not be too heavy and cumbersome.

Project Title: **Two-Axis Earthquake Simulator**
Sponsor: **Cal State LA Geoenvironmental Research** | Faculty Advisor: **Welson Kwan, Ph.D.**
Students: Angelina Baroy, Kevin Chen, Christopher Luengas, Yanet Martinez
Project Description: A large (11-foot diameter) overhead-payload centrifuge was acquired by Cal State LA through a National Science Foundation grant to study the behavior of soils. For this project, the specific investigations involve simulating soil transport under dynamic conditions such as in earthquakes or road traffic. The objective of this project was to develop the soil sample shaker system capable of operating while mounted on the centrifuge. It was required to record displacement, water pore pressure, acceleration, and static loads for a 2-D shaking while under high acceleration loads with an automated data acquisition system.

Project Title: **Wave Measurement System**
Sponsor: **Cal State LA Geoenvironmental Research** | Faculty Advisor: **Gustavo Menezes, Ph.D.**
Students: Hui Chen, Lorena Nava, Cecilia Pena, Kyle Petchsaiprasert
Project Description: Soil erosion is a common natural phenomena in water reservoirs and natural lakes that leads to economic and natural losses. An important variable for erosion control techniques is the wave energy, measured in terms of the wave amplitude and water velocity. This project was tasked with developing a wave measurement device to measure water height and wave period using pressure sensor technology. The device would be attached to the waterway floor, encapsulated in a water tight structure, and would measure and record wave action. Periodically, the device would be retrieved and the collected data downloaded for calculating wave speed and wave energy from the measured wave height and length.

Project Title: **Gun Zone Disabler**
Sponsor: **Cal State LA Criminalistics** | Liaison: **Don Johnson** | Faculty Advisor: **Marina Mondin, Ph.D.**
Students: Cyrel Alvarado, Jorge Gutierrez, Jonathan Ponce, Claudio Rodriguez
Project Description: Mass shootings have gained national attention with no reasonable solutions proposed in policy or technology. This project is investigating the feasibility of GPS-governed gun that becomes inoperative when it is within a defined geographical area, such as a school campus. Also studied was a local, jam-proof, secure broadcasting system that could inactivate slaved-guns within its range. The work included developing a prototype and demonstrating a system that could be compatible with restricting a weapon firing using a simple actuation scheme within the constraints of a modern firearm.

Project Title: **RoboSub Competition**
Sponsor: **U.S. Office of Naval Research** | Liaison: **Mark Tufenkjian, Ph.D.** | Faculty Advisor: **He Shen, Ph.D.**
Students: Daniel Bautista, Abel Haile, John Linares, Andrew Lopez, Dara Ly, Kenneth Traquena, Guillermo Villanueva
Project Description: RoboSub is a competition that consists of student teams designing and building autonomous robotic submarines that must complete a difficult series of underwater visual and acoustic-based tasks. For this international competition, the tasks simulate the work required of robotic submarines in many facets of ocean activity. The fundamental goal of the underwater vehicle is to demonstrate its autonomy by navigating through an underwater course, touch buoys, navigate a channel, drop a marker, fire torpedoes, and retrieve an object. The vehicle must then surface and position/release the object. The Senior Design team portion of this project was to build upon last year's design and implement a number of both mechanical and electrical enhancements.

Project Title: **Crystal Growth Furnace**
Sponsor: **Cal State LA Material Science |** Faculty Advisor: **Adel Sharif, Ph.D.**
Students: Chung Wah Lai, Bang Ta, Javier Tellez, Felipe Valdovinos
Project Description: The purpose of this project is to design, develop, and build a float-zone crystal growth furnace. A crystal growth furnace is used to manufacture large, single crystals primarily used for research purposes. The uniform crystals help to understand special properties and produce possible compounds which do not exist naturally. In a float-zone furnace, a polycrystalline (metallic or oxidized) material is heated using a concentrated heat source, converting the solid material into a molten liquid, which allows the reduction of pre-existing impurities. To form a single crystal, a solid seed crystal will touch the polycrystalline melt material after the heat source is introduced. The crystal is then formed by extracting the growing seed while controlling angular speed, vertical motion, temperature, and pressure.

Project Title: **CubeSat Deployables Design**
Sponsor: **Cal State LA Mechanical Engineering** | Faculty Advisor: **Ni Li, Ph.D.**
Students: Benjamin De La Torre, Salla Kim, Jason Lin, Vimal Patel, Andrew Wong
Project Description: Sailing is a concept that has been around for thousands of years, yet knowledge of how solar wind in space would work for steering satellites is very limited. Most often in today's space community, solar sailing is referred to as a type of propulsion system. The goal of this project was to develop a deployable "sail" portion of a small satellite that can meet very limited launch volume constraints, but yet provide the necessary deployed surface area. The team was required to determine potential actuation schemes for both the deploying and deployed configurations, as well as develop the ground test equipment to allow preliminary functional testing.

Project Title: **Design and Implementation of a Driving Simulator**
Sponsor: **Cal State LA Mechanical Engineering |** Faculty Advisor: **Armen Pazouki, Ph.D.**
Students: Angelica Baroy, Jose Barron, Seyedsoroush Karimi, Walter Padilla, Ian Tran
Project Description: Modern driving simulators can combine virtual reality with haptic motion feedback to provide a truly realistic driving experience. These simulators contain a dynamic field of view, physical steering wheel, pedals, and have seat-base motion that transfers apparent vehicle accelerations back to the driver. The goal of this project was to design and build a virtual reality driving simulator that could that capture these vehicle dynamic motions. Accelerations and road feedback were synchronized with the perceived windshield view and were transferred back to the driver to create a synthetic driving environment. The experience provides the operator with simulated, but seemingly “real” driving situations.

Project Title: **Design of an Efficient Heating and Cooling System**
Sponsor: **Cal State LA Mechanical Engineering |** Faculty Advisor: **Arturo Pacheco-Vega, Ph.D.**
Students: Francisco Barrios, Dominick Brown, David Huang, Erick Palma
Project Description: Residential energy usage for heating and cooling is highly suboptimal with inefficient control and distribution. A subscale testbed at Cal State LA is being used for experiments to determine the effectiveness of HVAC (Heating Ventilation, and Air Conditioning) innovations and architectures. The objective of this project is to upgrade the current testbed cooling and heating system, implement additional sensors, and improve measurement and distribution of airflow throughout the subscale testbed eight rooms. The goal is to better control heat and cooling loads with ventilation ducts that are easily accessible and configurable.

Project Title: **3D Printing of Graphene-Piezoelectric Composites**
Sponsor: **Cal State LA Material Science** | Faculty Advisor: **Mohsen Eshraghi, Ph.D.**
Students: Jose Cisneros, Patrick Martinez, Andrew Rivera, Jeff Tran
Project Description: Piezoelectric ceramics are key components in a range of devices. Graphene has attracted great attention due to its important applications, owing to its extraordinary physical properties. It is nearly impossible with current techniques to shape brittle ceramics into 3D structures, with limited research on applying Graphene in Piezomaterials in 3D shapes. The project objective was to design and build an affordable 3D printing system for fabricating 3D piezoelectric composite materials that relies on piezoelectric nanoparticles and Graphene sheets. This included testing and optimizing process parameters by fabricating a variety of specimens.

Project Title: **Low-Cost Solar Desalination Device**
Sponsor: **Cal State LA Mechanical Engineering** | Faculty Advisor: **Claudia Espinosa, Ph.D.**
Students: Jacob Gutierrez, Edwin Hernandez, Luis Lizarraga, Rafael Renteria, Katherine Roizen
Project Description: Some 1.1 billion people worldwide lack access to water, and a total of 2.7 billion find water scarce for at least one month of the year. Climate change is altering patterns of weather and water around the world, causing shortages and droughts in some areas and floods in others. A low-cost way to purify sea water could be one way to help mitigate this.
This project was required to design, develop, and prototype a system that could convert salt water into desalinated drinking water. The device needed be passive, with no input power other than solar radiation.

Project Title: **Small Engine Dynamometer**
Sponsor: **Cal State LA Mechanical Engineering |** Faculty Advisor: **Chris Bachman, Ph.D.**
Students: Ahmed Abualhamayel, Abdul Aldossary, Sean Ashcraft, Brian Berrios, Cody Ising, Jhovany Ortiz, Jason Padilla, Jesse Robles
Project Description: A dynamometer is a device used to measure power and torque at the output shaft of an engine. Cal State LA's SAE Baja and Formula race teams have been at a disadvantage in previous years by only being able to performance tune their engines by driver feel or by parking lot driving evaluations. This project was tasked with designing, building, and testing a small engine dynamometer that would support a variety of multi-horsepower engines. The dyno needed sustained and transient loading features for various custom loading situations and that also addressed engine heat, noise, air quality, and vibrations.

Project Title: **Super Refrigerator Star Energy**
Sponsor: **Cal State LA Mechanical Engineering** | Faculty Advisor: **Usama Tohid**
Students: Vazre Ab, Abdul Alzamel, Christopher Gomez, William Gonzaga, Ricardo Vargas
Project Description: Modern Star appliances minimize electricity by using many energy efficiency enhancements. Some utility companies are offering electrical energy at less than half price during off-hours of the day. A concept was proposed to add local “cold-reservoir" storage capability, which can be used for passive refrigeration when electricity is at its premium cost. The objective of this project was to design, develop, and demonstrate a small refrigerator with a cold reservoir and smart controller that would know the 24-hour electricity utility rates, and when to be active and passive. The team needed to assess the "before" and "after" system - taking into account modification costs/complexity, door opening/closing, content capacity, and environmental temperatures.

Project Title: **Wind Tunnel Motorized Flow Sensing**
Sponsor: **Cal State LA Mechanical Engineering** | Liaison: **Jim Kuo, Ph.D. |** Faculty Advisor: **Xavier Talbot-Thiebaux**
Students: Sandy Coreas, Aileen Han, Fabian Lucarelli, Derrick Maldonado, Aldair Romero Arenas
Project Description: Wind tunnel tests rely on uniform, laminar flow fields, with predictable boundary conditions. Upstream imbalance or mixing conditions can cause non-uniformity in flow. Thus, a method was needed to measure flow profile across an X-Y sectional wind tunnel area. This project is tasked with creating a motorized X-Y probe positioner that could autonomously locate a pitot tube across a wind tunnel flow area to measure a flow speed profile. It needed to electronically collect flow information and produce a planar velocity profile from 1 m/s to 60 m/s.

Project Title: **Humanoid Robotic Home Organizer**
Sponsor: **Cal State LA Mechanical Engineering** | Faculty Advisor: **He Shen, Ph.D.**
Students: Ashar Ali, Raul Arrioja, Rudy Jovel, Francisco Mireles, Susan Niu, Josch Pontiveros, Edgar N Valenzuela
Project Description: Robotic platforms can be helpful in domestic environments for some of the most mundane tasks such as cleaning, laundry, and putting things away. A prototype robot was developed as a test platform by previous students. This project objective was to study the dynamics of robotic manipulation used for performing movements like a wheeled humanoid. A key effort was to improve the capable of recognizing and sorting objects by incorporating artificial intelligence, communication, and new electrical hardware. All the new components needed to be integrated to implement autonomy in the robot to better enable working in common household cluttered environments.

Project Title: **Bomb Calorimeter**
Sponsor: **Cal State LA Thermal Lab** | Liaison: **Jeff Santner, Ph.D**. | Faculty Advisor: **Everardo Hernandez.**
Students: Guillermo Castro, Omar Lopez, David Mateos, Yinghau Wang
Project Description: Calorimeters measure the amount of heat that is released or absorbed by a chemical reaction and can be used for fuel testing, metabolic studies, propellant/explosive testing, and thermodynamic studies. They are essential to scientific and theoretical thermodynamic studies. Since calorimeters at its most basic form is the study of thermodynamic processes, these devises can help students further understand heat of combustion produced in a chemical reaction, as well as reaction enthalpy, heats involved in formation, heats involved in the reaction, and even the enthalpy change throughout the combustion reaction. The purpose of this project is to design, build, and test a bomb calorimeter for the ECST Thermal Systems Laboratory.

Project Title: **Harbor Cleaner 1 - Systems Engineering**
Sponsor: **Cal State LA ECST** | Faculty Advisor: **Karl Salinas**
Students: Ramy Azer, Parsa Barhaghi, Michael Estrada, Eloy Martinez
Project Description: The Harbor Cleaner project is to develop a compact, durable, and inexpensive semiautonomous aquatic vessel capable of cleaning some of the massive amounts of trash that are being dumped into Long Beach Harbor every day. The System Engineering team oversees the whole project and maintains communication with local sponsors on a regular basis. Their responsibility is to coordinate the overall design budgets, build the dock and charge station for the vessel, set position of authority over the command and control of the vessel and publish the communications and actuations schemes involved.

Project Title: **Harbor Cleaner 2 - Collection and Debris Handling Subsystem**
Sponsor: **Cal State LA ECST** | Faculty Advisor: **Ray Manning, Ph.D.**
Students: Raymundo Alvarez, Peter Jahja, Carlos Ruiz, Alexander Williams
Project Description: The Collection and Debris Handling System must be capable of collecting debris from the Long Beach Harbor waterways as a part of an integrated vessel development team. To fulfill its task of removing the debris from the waterways, the design must be able to collect the debris by the use of a linear conveyor belt system that can gather up to 8 pounds of debris per hour and place the debris in a receptacle unit, where it is accumulated until the receptacle approaches full capacity, at which the unit is to be removed with ease, emptied, and moved towards to an appropriate waste treatment location.

Project Title: **Project Mexico: Coyuche Solar Power System**
Sponsor: **Engineers for Sustainable World** | Faculty Advisor: **Don Baxter**
Students: Oscar Antonio, Rudy Barbosa, Jesus Fernandez, Salvador Hernandez Jr, Nick Martinez, Ulises Ramirez
Project Description: Coyuchi Solar Power System is an off grid solar power system that provides a remote classroom in the State of Oaxaca, Mexico with enough power generation to power a small computer lab with four desktop computers, a laptop, a printer, and a projector. It is the third system sponsored by Engineers for a Sustainable World successfully developed by Cal State LA for deployment to these rural schools. The system design ensures functionality and longevity and incorporates safety measures including fuse/circuit breaker implementation, weatherproofing, and surge protection. It is also designed to be transported easily through the rough terrain, and completely self-contained and fully operational once assembled on site.

Project Title: **Meteorite Imaging System**
Sponsor: **NASA-Arizona State University** | Liaison: **Cassie Bowman, Ph.D.** | Faculty Advisor: **Ofelia Quintero**
Students: Edwin Ho, Xiaodong Huang, Joseph Misch, Gracia Sestoso
Project Description: Psyche is the name of the asteroid between Mars and Jupiter and also the name of the NASA space mission spearheaded by Arizona State University. The mission is to orbit the asteroid and identify the bulk composition by taking optical images of the asteroid. The purpose of the meteorite imaging system is to facilitate scientists in cataloging their meteorite inventory and determine its bulk composition. The scope of this project is to build an imaging system that can accommodate meteorite samples of varying sizes and shapes, from flat ones to round ones and take images with consistent lighting and quality for analysis. The system will be used in a lab setting, therefore the system must be user friendly and easily assembled and robust for transport purposes.

Project Title: **Exoplanet Finder Spectral Flattener**
Sponsor: **NASA-Jet Propulsion Laboratory** | Liaison: **Steph Leifer, Ph.D.** | Faculty Advisor: **Hagop Injeyan, Ph.D.**
Students: Anthony Aziz, Raheel Chaudhry, Justin Fuller, Ahmed Sallam
Project Description: The purpose of the Exoplanet Finder calibration source spectral flattener is to enhance the capability of radial velocity (Doppler shift) exoplanet observation techniques used by the Jet Propulsion Laboratory. The project instrument will utilize a spatial light modulator (SLM) to provide flattening of the power of the spectrum of a laser generated frequency comb. A spectrograph will monitor the output signal of the SLM and through a feedback algorithm in communication with the SLM, maintain the desired flatness of the power of the frequency comb spectrum. The project team was tasked with producing the algorithm and demonstrate its ability to modulate and flatten the broadband laser source spectrum across the desired wavelength.

Project Title: **Persistent Sensor Network for Under Ice Environments**
Sponsor: **NASA-Jet Propulsion Laboratory** | Liaisons: **Evan Clark, Daniel Limonadi, Rebecca Castano** | Faculty Advisor: **Ann Nye**
Students: Arthur Balyan, Mitchmond Chau, Sean Heineman, Richard Lam, Miray Ouzounian
Project Description: The Earth's polar ice caps are melting due to global warming which leads to global sea level rise. There is potential for an event to occur in our polar regions that can cause rapid sea level rise. An understanding of the polar regions is necessary to grasp the mechanism that causes this event. JPL wants to perform research in the oceans under the ice shelf. They need to deploy various sensors to collect long term data on temperatures, conductivity, pressure, and water current so they can create models that can help predict the phenomena. The goal of this project is to design an ice pod to collect science data from the under ice environments of Antarctica because of the melting polar ice caps.

Project Title: **Autonomous Vehicle Tracking & Collision Avoidance**
Sponsor: **Rain Systems** | Liaison: **Elaine Sibert** | Faculty Advisor: **Michael Thorburn, Ph.D.**
Students: Khalid Almulhim, David Flores, Julio Leon, Kevin Yeh
Project Description: Rain Systems has developed a process that reduces lawn turf irrigation requirements over 50% by injecting small polymer grains called Hydrogel to the ground. This is done with a custom-designed precision injection machine. The goal of this project is to develop a vehicle control system that can precisely track the machines location to ensure the turf is covered and prevent overlapping coverage paths. Additionally, the project implemented an ability to detect fixed or moving objects in its path. The system was implemented on a testbed developed by the team based on an electric wheelchair provided the customer.

Project Title: **Obstacle Avoidance by a 2 Wheel Balancing Robot**
Sponsor: **Raytheon** | Liaison: **Bob Dempster** | Faculty Advisor: **John Jacobs, Ph.D.**
Students: Brahnden Chavez, Arin Keshish, Daniel Moreno, Ellie Tajra
Project Description: For this project, a two-wheeled Zippy Robot was to be built and programmed to balance in an upright position, both while in motion as well as when stationary. It was required to move upon command from a radio controller or infrared controller and needed to autonomously avoid objects while following a controlled course. Finally, it was designed to deliver a 16 oz. bottle of water through an open door and not crash into walls or any obstacles in its path. The bottle of water is to be balanced on top of the robot and not secured. A self-balancing two-wheeled robot that autonomously avoids obstacles would be valuable in disaster response operations by delivering goods to destinations, especially in environments with tight spaces or low light conditions.

Project Title: **Ultrasonic Smart Water Meter**
Sponsor: **Saya.Life** | Liaisons: **Sanjay Poojary** | Faculty Advisor: **Michael Thorburn, Ph.D.**
Students: John Misch, Enrique Molina, Andres Puga, Michael Zhang
Project Description:
The purpose of a smart water meter is to detect and report widely varying flow rates, pressures, and temperatures in order to manage water consumption and prevent leaks ranging from micro drips to catastrophic. The device is intended for use in residential or leak sensitive buildings. Damaging water leaks can potentially occur anytime in one's home, often without the knowledge of the homeowner. In fact, the average family can waste 180 gallons per week, or 9,400 gallons annually from household leaks. This project developed a water meter testbed to compare various meters, sensors, and remote shut off valves. The project also investigated alternative technologies to provide remote, stand-alone electrical power to a smart meter.

Project Title: **Seismic Structural Design – Spring/Damper Development**
Sponsor: **Southern California Edison** | Liaisons: **John Dai, Roderick dela Cruz, and Alex Lee** | Faculty Advisor: **Austin Park, Ph.D.**
Students: Wilfredo Garcia, Rene Guzman, Mark Maldonado, Shady Tawfik
Project Description: Edison manages various substations throughout earthquake prone Southern California. These substations are equipped with large towers that use insulated line-drop systems. The objective of this project was to design and analyze energy absorbing dampers that could be implemented into these types of structures to help prevent damages from seismic disturbances. Techniques using various materials, spring configurations, and travel limits were investigated using finite element analysis and verification/characterization testing.

Project Title: **Development of a Modernized Gas Meter**
Sponsor: **Southern California Gas Company** | Liaisons: **Walton Lee, Daniel Bellers, Jim Eubanks**| Faculty Advisor: **Everardo Hernandez**
Students: Amar Alhelali, Isai Cortez, Mark Garcia, Edgar O Valenzuela
Project Description: The scope of this project was to design a new and modern gas meter with advanced monitoring and manufacturing technology. The team investigated electronic functions such as trending for leak detection, correlation of gas use with weather, remote shut-off and measurement of gas use, plus integrated an automatic shut off in case of earthquakes. A new mechanical structure was proposed to be made out of modern, high volume, corrosion resistant materials with long life provisions to resist abuse, and leaks. The end product was intended to be mass produced with embedded electronics.

Project Title: **Home Bio Gas System**
Sponsor: **Southern California Gas Company** | Liaisons: **Regina Lugani, Leonella Baudino, Matt Gregori** | Faculty Advisor: **Arezoo Khodayari, Ph.D.**
Students: Danny Baires, Onik Hakopian, Samuel Martinez, Cynthia Santana
Project Description: New technologies are emerging to bring cleaner and more sustainable energy into the homes of Southern California customers. The objective of this project involved investigating and establishing a bio gas system that used E. Coli to breakdown common food waste. The goal was to generate methane gas in a residential situation that could in turn be cleaned with an activated carbon filter. The system was located in a safe, secure, and accessible location with appropriate sun exposure to encourage natural heating. The team designed and installed instrumentation to monitor internal temperature and pressure, and sampled the gas output. Evaluation of the system design included tests that used controlled and documented food scraps digested under various environmental temperature conditions, with the goal of the bio-system to be an alternative, sustainable energy source.

Project Title: **Automated Small Package Sort - System Control**
Sponsor: **United Parcel Service** | Liaisons: **Isauro Ramirez, Kevin Thompson, Marcus Gluck, and Benjamin Gardner** | Faculty Advisor: **Khosrow Rad, Ph.D.**
Students: Kimberly Cuchilla, Sergio Gamiz, Carlo Ricci, Juan Sanchez
Project Description: UPS has partnered with Cal State LA to create an automated bag handling system for their Southern California facilities. These bags would contain quantities of sorted small packages bound for multiple destinations throughout the world. The System Control team had the responsibility to manage the overall system operations consisting of all bag handling and bag restocking global operations, including command/control interfaces. The primary development from this team consisted of designing and developing the system master controller and the electrical power management elements. This included developing intrusion sensing, monitoring various synchronized command sequences, and providing feedback to monitor power usage.

Project Title: **Automated Small Package Sort - Bag Handling**
Sponsor: **United Parcel Service** | Liaisons: **Rigo Gutierrez and Jim Bailey |** Faculty Advisor: **Ted Nye**
Students: Raid Albagami, Amanda Arakelian, Denise Cabrera, Achit Enkhbat, Abel Luis Reyes, Thant Oo
Project Description: As a critical component of the UPS project, the Bag Handling team was responsible for the design of direct bag handling steps which include all major bag operations currently done manually by employees. The automated system was required to have the ability to detect when a bag was full, close and zip the bag, transport the bag off of its holding tusks, label the bag on the appropriate side, and place the bag onto a conveyor belt. The system then needed to go back and prepare a new bag to receive sorted boxes. Progress this year consisted of developing 3 major axis of gantry movement with closed-loop feedback control and developing the physical layer of the command/control and power infrastructure.

Project Title: **Automated Small Package Sort - Bag Restocking**
Sponsor: **United Parcel Service** | Liaisons: **Kalena Fitzpatrick** | Faculty Advisor: **Ted Nye**
Students: Cristian Guzman, Jesus Martinez, Blossom Mastro, Jhonathan Mendez
Project Description: A complement operation of the UPS bag handling system is the bag restocking portion. This team was responsible for fetching a quantity of 10 bags from a remote loading station and re-supplying them to the sort line. This was done by creating an autonomous vehicle called a Mobile Restocking Unit. When it received a wireless "go" signal from the system master controller, it begins a series of restocking sequences. It does this by travelling to a location where a person would put 10 bags on its holding bars, then would travel back to the sort line, take the bags to the corresponding station, and finally perform the restocking insertion. All along, the restocker must avoid obstacles and navigate its path to the proper locations. The electric restocker would then return to its parking position/recharging port, until receiving another signal, and then repeating the cycle.

TECHNOLOGY PROJECTS

Project Title: **Fire Dragon Water Drone**
Faculty Advisor: **Paul Liu, Ph.D.**
Students: Karran Singh Berg, Edgar Manzano, Blake Andrew McCarron, Alexis Guadalupe Munguia (Leader), Abdullah Shafiq Shahnawaz, & Nelson Anthony Valladares
Project Description: Design and assemble a drone that can take up some payload of water and release it to distinguish a candle flame.

Project Title: **In-Arm Tray Table Attachment**
Faculty Advisor: **Paul Liu, Ph.D.**
Students: Amelia Gandarilla Terrones, Noel Rosario Jaraba, Daniel S. Kuk, Andy Quan Quang Mai, Luis Angel Mota, Lerika May Polangcus Sales, & Joshua Alexander Riggs (Leader)
Project Description: Design and fabricate a folding tray surface that can be attached to a wheelchair and/or chair.

Project Title: **Blindfold Maze Navigation**
Faculty Advisor: **Paul Liu, Ph.D.**
Students: Kyle M. Frelow (Leader), Rodrigo Maranon, Michael W. Pilart, Omar Alejandro Ramos, Alexander Alcala Rodriguez, & Valdivia, Salvador B.
Project Description: Design and program an obstacle navigation device that allows user to walk through a simple man-made maze blindfold.

Project Title: **Tree Climbing Robot**
Faculty Advisors: **Jason Vierra and Paul Liu, Ph.D.**
Students: Jose Guadalupe Castanon, Michael Lagrun Dunn, Francis Xavier Liri, Wayne Robert Mackey, Carlos Manuel Marin (Leader), Adrian Ortiz-Silva, Bryan Rosas, & Pierce Ra Sann
Project Description: Design and manufacture a device that can climb up a tree/pole, pick up an object from top, and climb down to the ground with control mechanism.

Project Title: **Emoji/Sticker Design and Sales I**
Faculty Advisor: **Jason Vierra and Paul Liu, Ph.D.**
Students: Miriam Garcia, Karen Natalya Gutierrez Ching, Rong She, & Maria Linda Toledo (Leader)
Project Description: Design and upload emoji/sticker sets, related to PAC-12 and BIG Ten colleges, on social media ready for download.

Project Title: **Emoji/Sticker Design and Sales II**
Faculty Advisor: **Jason Vierra and Paul Liu, Ph.D.**
Students: Erik Cerezo (Leader), Moises Dominguez, Jason Huang, Jiaming Lin, & Luis Eduardo Lopez Jr.
Project Description: Design and upload emoji/sticker sets, related to SEC and ACC colleges, on social media ready for download.

Project Title: **K-Brush**
Faculty Advisors: **Juan Pena and Paul Liu, Ph.D.**
Students: Ruben Aguilera, Joseph Ballas, Christopher Chafin, Gabriel Gallegos, Robert Garcia (Leader), & Cristian Navarrete
Project Description: A self-dispensing, custom designed, mechanical toothbrush.

Project name: **Project Elevate**
Faculty Advisors: **Juan Pena and Paul Liu, Ph.D.**
Students: Carlos Garcia, Hagop (Jack) Khachatryan, Malik Malone, Carlos Ortiz (Leader), & Johnny Tovalin
Project Description: Portable step stool with adjustable steps to aid a person with disabilities reach for objects at high locations.

Project Name: **The Eagle's Talon**
Faculty Advisors: **Juan Pena and Paul Liu, Ph.D.**
Students: Kevin-William Cortez, Tammi Louie, Fermin Anguiano Maldonado, Edward Medina (Leader), Christopher Morales, & Hector Wallace
Project Description: A grabbing/reaching tool created to increase accessibility for wheelchair users through a modular, upgradeable design, with a door-opening component.

Project Title: **EZ-Push Pill Dispenser**
Faculty Advisors: **Juan Pena and Paul Liu, Ph.D.**
Students: Hazem Aljehani, Rakan Alyami, Carl Bonifacio, Josh Jeters, Noel Torres, Schajan Sharmahd (Leader)
Project Description: Table top pill dispenser for users with limited mobility and motor skills.