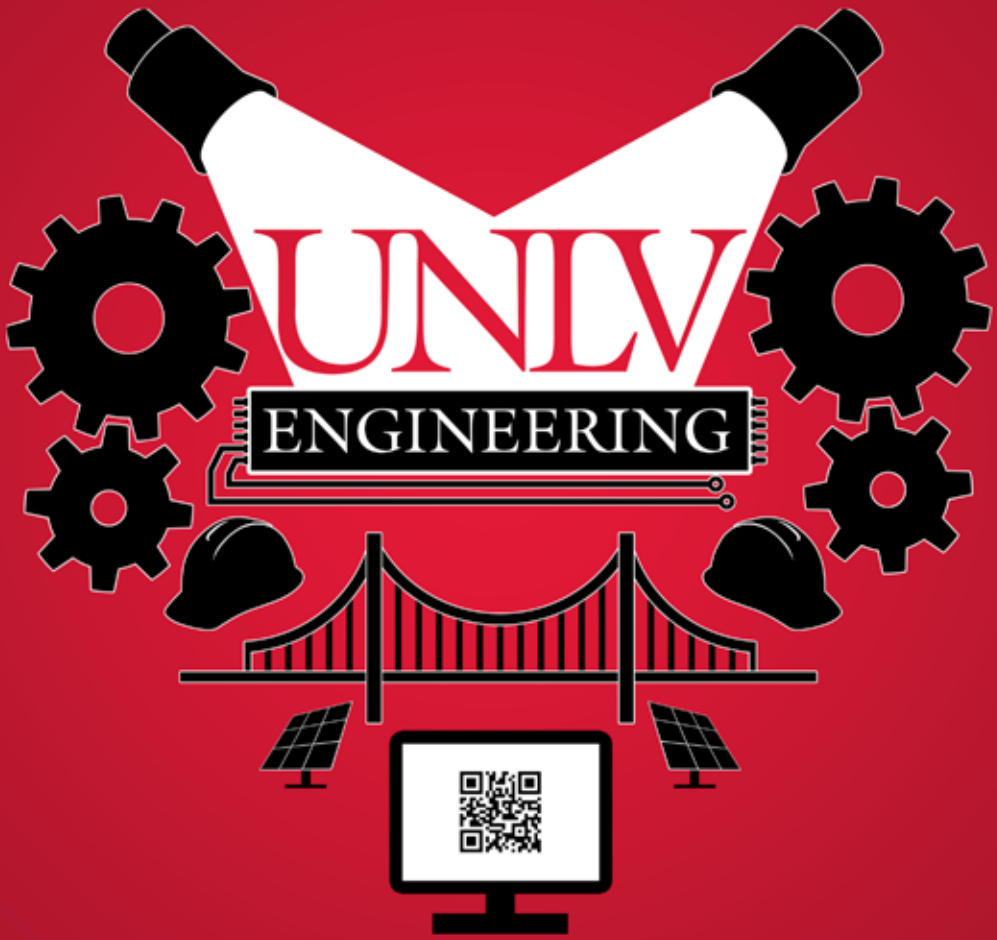
FRED AND HARRIET COX

SENIOR DESIGN COMPETITION



December 3, 2015

Fred and Harriet Cox

Senior Design Experience

Part of every UNLV engineering student's academic experience, Senior Design stimulates engineering innovation and entrepreneurship. Each student in their senior year chooses, plans, designs and prototypes a product in this required element of the curriculum. Working in teams, senior design encourages students to use everything learned in their academic program to create a practical, real world solution to an engineering challenge.

Beyond the classroom

Because of the requirement to work in teams, students also build good communication skills, presentation skills, and even business writing skills. They also have to source and purchase the materials for the prototypes themselves, giving them real-world budgeting experience.

Reward and Recognition

A team of industry judges choose winners in each category based on innovation, commercial potential, presentation quality and sustainability. Cash prizes for first and second place are given in each discipline, as well as prizes for sustainability, commercial potential, interdisciplinary and the competitions grand prize. Through the generosity of patrons Fred and Harriet Cox as well as award sponsors, the College of Engineering reimburses teams for the costs associated with creation of their prototype. This ensures that teams are not working under unfair financial constraints, but have the resources they need to excel.

Taking it Further

Senior Design teams are offered the opportunity to partner with MBA students from the Lee Business School to create a business plan as part of the MBA curriculum. This collaboration has led to great success at the Dominic Marrocco Southern Nevada Business Plan Competition, the Governor's Cup and the subsequent creation of many successful businesses.

Get Involved

Teams often get project ideas from industry partners or friends of engineering who have an interesting problem or concept they would like to submit. Teams may also be looking for an industry mentor or coach to help them throughout the year.

Industry partners and individuals are also offered the experience of sponsoring an award category. To find out what categories are available, or for other sponsorship information, contact Jack Aylor, Director of Development, at Jack.Aylor@unlv.edu or (702) 895-2913 or Molly Marks, Director of Special Events, at Molly.Marks@unlv.edu or (702) 895-3281.

Senior Design Clinic

Recently the College of Engineering launched the Rebel Project, a unique experience in which companies are able to partner with the students to work on specific challenges to find business solutions. To get involved in this exciting new venture, please contact Professor Pushkin Kachroo at pushkin@unlv.edu or (702) 895-4926.

Thank you to our Sponsors!

Notes

Senior Design Competition

Presentation	Time	Project Title
PRESENTATION 1	8:00 AM	Electronics for CubeSat GRAS
PRESENTATION 2	8:15 AM	Methane Sensor Module
PRESENTATION 3	8:30 AM	Wireless FPGA Node
PRESENTATION 4	8:45 AM	For the Birds
PRESENTATION 5	9:00 AM	Laser Distance Projection
PRESENTATION 6	9:15 AM	IP 1000 Pump Redesign
PRESENTATION 7	9:30 AM	Cell Phone Robot
9:40 AM - 10:00 AM BREAK		
PRESENTATION 8	10:05 AM	Cube Sat UAV Bracket
PRESENTATION 9	10:20 AM	Avalanche Victim Sonar Rescue
PRESENTATION 10	10:35 AM	Shop Box Hero
PRESENTATION 11	10:50 AM	Development of UAV Application Monitoring Nuclear Facilities
PRESENTATION 12	11:05 AM	Smart BMS (Battery Manageme
PRESENTATION 13	11:20 AM	Drill Powered Bicycle
PRESENTATION 14	11:35 AM	Tactical Trigger Trainer (3T)
PRESENTATION 15	11:50 AM	Visual-Audio Synesthesia
12:00 PM - 1:OO PM LUNCH		
PRESENTATION 16	1:05 PM	Phenix Water Pump
PRESENTATION 17	1:20 PM	Garage MaHal
PRESENTATION 18	1:35 PM	Stretch-Air
PRESENTATION 19	1:50 PM	Image Histogram Spy
PRESENTATION 20	2:00 PM	Mechanized Sock Donner

Presentation Schedule

	Department
	Electrical and Computer Engineering
	Mechanical Engineering
	Electrical and Computer Engineering
	Mechanical Engineering
	Electrical and Computer Engineering
	Mechanical Engineering
	Computer Science
	Mechanical Engineering
e Tool (AVSORT)	Electrical and Computer Engineering
	Entertainment Engineering and Design
ns for Remote Sensing of Radiation and	Mechanical Engineering
nt System) for LEV (Light Electric Vehicles)	Electrical and Computer Engineering
	Mechanical Engineering
	Electrical and Computer Engineering
	Computer Science
	Mechanical Engineering
	Civil and Environmental Engineering and Construction
	Mechanical Engineering
	Computer Science
	Mechanical Engineering

Fall 2015 Senior Design Judges

Kam Fierstine, Unilever

Kam Fierstine is the Project Delivery Manager for Unilever Ice Cream in Henderson. Unilever is the largest producer of ice cream in the world and is better known through brands such as Breyers, Popsicle, Ben & Jerry's and Magnum. Fierstine is a mechanical engineer who is responsible for large project implementation. He specializes in ammonia refrigeration and packaging.

He received his master's degree in mechanical engineering from Cal Poly San Luis Obispo and started working in the high-tech industry until he transitioned to the food industry in 2001.

Fierstine also has worked as an engineering manager for Turtle Mountain ice cream company, HJ Heinz, Leprino Foods, and The Spice Hunter, Inc. He is happily married and has two children enrolled in Henderson schools.

Gemma Guy, Tait Towers

Having trained at the Bristol Old Vic Theatre School in the UK, Gemma Guy has been involved in the theatre entertainment industry for more than 18 years. She has had extensive experience managing technical departments both onboard Carnival cruise ships and as technical coordinator in Carnival Corporation's Miami headquarters. Gemma joined Stage Technologies as a sales manager in June 2006, enjoying two years in their London headquarters before transferring to the Las Vegas office. Gemma now holds the role of senior director, business development for TAIT/ Stage Technologies and also manages the Las Vegas office.

Ron Justin, Groupgets

Ron earned his BSEE from UNLV in 2001 and treasures his time in the trenches with his study groups. His career started at the Nevada National Security Site thanks to an internship opportunity provided by Dr. Schill. His career there began with underground experimentation and transformed into years of exciting nuclear non-proliferation design and field work in eastern Europe out of NSTec's Santa Barbara, California office. California is where his entrepreneurial spirit took root after meeting founders of TrackR Inc., he led the development of their first iPhone application and other products. He conceptualized and co-founded GroupGets.com, a service that provides secure online group buys for any existing product or service. The venture was bootstrapped and profitable from its first year of operation and continues to thrive not only from group buy revenue but also from custom electronic hardware and software products that the company creates as accessories to enhance group buy targets.

In 2015 he was awarded a 40 Under 40 Award from the Pacific Coast Business Times for his contributions to the startup community of the Central Coast of California. He currently serves as a technical advisor to the ECE Department of UNLV and advises other startups across the country. Still dedicated to the mission of National Security, he continues to work with NSTec on bleeding edge hardware and software applications that give him a sense of purpose mission-focus unrivaled by commercial applications.

Kevin Love, Carollo

Kevin Love, a UNLV Civil Engineering graduate, has more than 15 years of experience in the civil and environmental fields at Carollo Engineers. His experience includes construction management, water and wastewater planning, process evaluation, water system modeling, facility design, project management, and team leadership.

Love is the Chair of the UNLV Civil and Environmental Engineering and Construction Industry Advisory Board and Past President for the local chapter of the Construction Management Association of America. Kevin lives in Henderson with his wife, Teri, and their four children. He is actively involved in Boy Scouts with his two sons, where he enjoys camping and outdoor activities. With his daughters, he spends time defending his choice to grow a beard and directing neighborhood productions of a Shakespeare play every now and then.

Les Ottolenghi, Sands Corporation

As a C-level leader, Les brings 30+ years of experience as a Fortune 200 IT executive, an entrepreneur, and a creator of several of the travel and entertainment industries' most game-changing technologies. He's been lauded by top executives at many of the world's most respected technology companies including HP, Microsoft, Google, Dell, and Cisco as the best CIO they have ever seen and he's earned the distinction of a top 50 CIO by CIO Magazine. Les assumed the position of Chief Information & Innovation Officer for Sands Corporation in 2013 with a focus on modern, scalable IT network & software infrastructure, and application architectures.

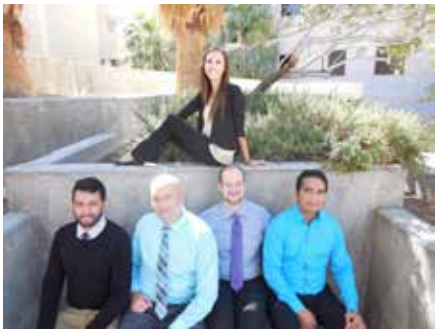
Les holds an MBA in Decision Information Analysis from Emory University's Goizueta School of Business. He received his undergraduate degree from Duke University. He has been an adjunct professor and lecturer at the Goizueta School of Business as well as Troy State College. Additionally, he acts as an advisor to several Silicon Valley venture firms. Les is passionate about social causes at the intersection of children and technology and he funded, wrote, promoted, and produced a cyberbullying documentary reviewed by HBO films, CNN, and the U.S. House of Congress and accepted at 38 film festivals. In his spare time, Les enjoys marathon and road race running.

CIVIL AND ENVIRONMENTAL ENGINEERING AND CONSTRUCTION PROJECTS

Department Chair
Donald Hayes

Senior Design Instructor
Doug Rigby

Garage MaHal



Project Participants
Katie Dudley, Carmelo Verry, Parvez Kang, Nick Karnes and Daniel Poll

Instructor
Doug Rigby

Problem Identified
Despite UNLV's recent efforts to create more parking spaces, there is still a lack of available parking spaces for students and faculty. UNLV continues to struggle with limited parking to accommodate its expanding population.

Current Solution
UNLV's master plan includes adding two to three more parking garages, including one off of Maryland Parkway that is currently under construction. UNLV has continued to grow in volume, increasing the amount of incoming freshmen every year. Futuristically UNLV plans to grow, so parking will be a growing demand. We feel our proposed location is superior because it is in the heart of the campus and will include multiple attractions.

Team Solution
Our team proposes to build a parking garage structure behind the Lied Library. This parking structure will be an efficient system that moves high volumes of traffic in a timely manner while creating three floors of parking and capacity for about 1,400 cars. We will have digital signs on each floor to show how many open spots are on each level as well as indicator lights over each parking spot to show if the spot is available or not.

This will be a 240,000 square foot structure. On its first floor there will be space for food trucks to park, sitting areas, sleeping or napping pods and a bar. These vendors were selected based on a survey sent to students. We are also trying to make our garage environmentally friendly by installing solar panels and electric car recharging stations. The solar panel will be installed above the top floor. This will create shading for vehicles that park on the top floor as well as generate more than enough power needed to run our garage.

COMPUTER SCIENCE PROJECTS

Department Chair
Laxmi Gewali

Senior Design Instructor
Evangelos Yfantis

Cell Phone Robot

Project Participant
Julio B. Figueroa

Faculty Advisor
Evangelos Yfantis

Problem Identified
Personal robotics is not as wide spread today as it was hoped for when it was introduced to the consumer market because of high production costs. Improved image recognition and tracking on personal robots can make them more applicable to consumers. However unstable frames on the robot interfere with position tracking. Decreasing the vibration error would allow for object tracking to become more reliable.

Current Solutions
Contemporary solutions include introducing expensive mid-tier platforms such as the NAO or DARwIN-OP. Lower priced platforms with reduced functionality such as the mini-DARwIN or Lynxmotion hexapods can be purchased for less than $1,000. One method to dampen vibrations in image acquisition systems includes electronic circuits designed to only record a portion of a camera's light sensing chip while allocating another portion along its edge to record when a bump is sensed. Another popular option is to use image analysis to keep track of the changes in frames to decide if only the subject matter or if the entire image is moving.

Solution
Entering into the world of image processing, we find that a mechanical approach can also be used to help stabilize our personal robot. Since today's mobile phones come with accelerometers, gyroscope, Wi-Fi, RAM, and a camera; by using a user's personal cell phone, a significant reduction to cost is achieved. It brings our robot-filled utopia that much closer, and makes the entire robot owning experience more personal. To add to this, despite advances in circuitry in today's camera market, circuit methods are dependent on camera model. Since my system may be using a variety of different cameras based on phone type, in order to reduce the error in image tracking, my solution must be camera independent. The approach incorporates an automatic controlled system to physically help dampening the entire cell phone attachment. This makes the tracking/following algorithm more reliable, and thus makes the robot more versatile for the everyday consumer.

Image Histogram Spy

Participant
Michael Halopoff

Instructor
Evangelos Yfantis

Problem
It is difficult to see what is in a dark image.

Current Solution
Timed exposure photos allow for some light to be visible in a dark image.

Team Solution
The Image Histogram Spy will use computer science methods to equalize the dark pixels and the slightly brighter pixels to produce a full, viewable image. The technology will then use enhancement techniques to allow the user to view the image in detailed ways. This will benefit any consumer who wants to see what is in a dark image and could have important implications for the criminal justice system.

Visual-Audio Synesthesia

Participant
Elliot Ploutz

Instructor and Faculty Advisor
Evangelos Yfantis

Problem
Mapping and transforming one space to another is an area of active research. One interesting problem is how to map light, for example, the red, green and blue values of an image, to sound space.

Current solution
There are several commercially available tools that translate images to sound.

Team Solution
The solution will be robust, unique, and independent from the currently available solutions. The algorithm uses interpolation, expanding the image to a higher resolution, frequency spectrums and inverse Fourier transformation for mappings. Once completed, the algorithm used for this project can be incorporated into current tools.

ELECTRICAL AND COMPUTER ENGINEERING PROJECTS

Department Chair
Yingtao Jiang

Senior Design Instructor
Grzegorz Chmaj

Avalanche Victim Sonar Rescue Tool (AVSORT)

Project Participants
Samuel Tam and Yetneberk Worku

Instructor
Grzegorz Chmaj

Faculty Advisor
Peter Stubberud and Yahia Baghzouz

Technical Advisor
Melinda Bechtel

Community Advisor
Vernon Wells

Problem Identified
Avalanches cause many deaths every year. The majority of victims survive an avalanche, only to quickly die of asphyxiation. Survival is most probable if victims can be found quickly. Current methods are limited in availability and success.

Current Solutions
Non-electronic solutions currently available are: humans with sticks, rescue dogs, and shovels. Electronic solutions of limited ability and availability are avalanche transceivers and RECCO, an avalanche search technology based on harmonic radar. Shovels and sometimes sticks must still be used with the current electronic solutions.

Team Solution
Sonar can cover a larger area more quickly than humans with sticks. It is more readily available and less expensive to maintain than a dog. Sonar can find a victim without the victim carrying special equipment. The cost of the sonar unit will be comparable to that of the transceiver. A sonar unit is highly portable and could be carried with a shovel. All rescue workers in avalanche areas including ski patrols will benefit from this, as well as backcountry skiers, snowmobilers, snowshoers, etc. The sonar system will increase the survival rates of avalanche victims, and save many lives each year.

Electronics for CubeSat GRAS

Project Participants
Roman Gabriele Ocampo, Jesse Horsman and Aaron Romulo

Instructor
Grzegorz Chmaj

Faculty Advisor
Ke-Xun Sun

Problem Identified
The scientific goal for the Laser Interferometer Space Antenna (LISA) and Big Bang Observer (BBO) NASA projects will be the measurement of gravitational waves. The satellites used for these projects will require extremely high sensitivity angular sensor measurements, which would be extremely costly utilizing current solutions.

Current Solutions
Conventional Angular Sensors utilize reflective mirrors. In this system, angular sensitivity can only be improved through increasing the working distance between the sensed surface to the detector surface. Thus large independent satellites are required to achieve angular sensitivity required for NASA's LISA and BBO missions.

Teams Solution
A Grating Angular Sensor utilizes a specialized diffraction grating to amplify a system's sensitivity to angular displacement, while allowing the overall system to retain a small form factor. It is the goal of this team to incorporate a high sensitivity Grating Angular Sensor entirely within a CubeSat measuring only 10cm x 10cm x 10cm. Due to their small size, CubeSats are able to ride along as payload with other space missions, eliminating the cost of an independent satellite mission.

Laser Distance Projection

Project Participants
John Huang, Silvestre Solano, and Nha Tran

Instructor
Grzegorz Chmaj

Faculty Advisor
Ke-Xun Sun

Problem Identified
Every day thousands of people need to take measurements. These measurements can be difficult to take if the distance is large enough that you require more than just yourself and the tape measure. For example, the distance you are trying to measure could be large enough that it requires an anchor or another person to hold one end for stability. This type of scenario is inefficient because it requires more manpower or more tools.

Current Solutions
Current solutions require more than one individual or an anchor to help measure a sufficiently large distance with a tape measure. We could find no other solution similar to our design.

Team Solution
Our device allows a single person to input a desired distance, then the device's onboard laser is pointed to that distance using simple trigonometry. Our device enables the user to make measurements without another individual or anchor. Our device will simplify measuring by giving the user the freedom to move the device to any location and enter a desired measurement, compared with multiple individuals holding a tape measure and manually measuring. Current laser measurement devices cannot display a desired measurement by the user, they can only continuously read different distances from the laser point. Ultimately, our device will reduce the dependence on more people and tools.

Smart BMS (Battery Management System) for LEV (Light Electric Vehicles)

Project Participants
Noor Blum and Mary West

Instructor
Grzegorz Chmaj

Faculty Advisor
Venkatesan Muthukumar

Problem Identified
The majority of electric bicycles sold in the United States still use lead acid batteries for power. The problems with lead acid batteries are that they need to be charged in a well-ventilated area and need to be charged after each use to prevent sulfation. The lead acid batteries also need special watering requirements in case the battery becomes flooded.

Current Solution
The current solution is to use Lithium-Ion batteries. Using Li-Ion batteries requires the use of a battery management system (BMS). This BMS provides protection to the battery pack from over-voltage, under-voltage and over-current conditions. In these cases, the battery pack is shut off to protect the cells.

Team Solution
We have come up with a total protection package for flat polymer, high density lithium phosphate cells. We are using 10 cells in series with two sets in parallel for a total of 20 cells. Our protection circuitry is extensive. We have implemented passive cell balancing to maintain a constant voltage and temperature across each cell. We have also included the use of a battery gauge in host mode controlled using a microcontroller. The host mode allows us to constantly monitor the voltage, current, temperature and the overall state of the cells and battery pack. With this mode, we have also added USB capability to charge a small device while riding the bike and for future development of diagnostic software. We have added additional features for the safety of the rider including a brake light and display unit, which shows the rider how much battery life is left and the speed.

Tactical Trigger Trainer (3T)

Project Participants
Andrew Carroll, James Stadler, and Aaron Starks

Instructor
Grzegorz Chmaj

Faculty Advisor
Pushkin Kachroo

Problem Identified
During firearms training, instructors use experience and traditional motion control techniques to teach accuracy and control. While these techniques have proven useful, technological advances dictate a more precise depiction of what is happening when a firearms operator squeezes the trigger. Breathing, recoil anticipation, even near or farsightedness can impact accuracy and control.

Current Solutions
Ballistic computers have been programmed to aim rifles for accurate shots over varying distances. Trackers for handguns, however, do not allow for live ammunition firing.

Solution
Our solution, a rail mount device, will track, and log 3-dimensional motion during a firing session of live ammunition. This data will be saved to a microSD card, and then a program will allow this data to be projected in a graphical display. Our design, the Tactical Trigger Trainer, will operate on two batteries that can be readily purchased at most stores. It will be portable enough to allow for minimal storage space, i.e., storage within a handgun case.

Wireless FPGA Node

Project Participants
Alan Fortes, Victor Souza, and Andrew Tran

Instructor
Grzegorz Chmaj

Faculty Advisor
Henry Selvaraj

Problem Identified
FPGAs are versatile digital devices that can be programmed to be any digital configuration desired. Currently, in order for an FPGA to be programmed, it must be tethered to a computer, which limits the mobility and dynamic applications of FPGAs. If FPGAs could be remotely configured on the fly, we could expand the usage of FPGAs for applications that require the use of constantly changing digital analysis.

Current Solution
Currently, there are no market solutions for this problem. There have been concepts that have been tested, but have not been successfully implemented into a viable solution for on-the-fly digital analysis.

Team Solution
Our solution uses a home station to send a configuration file to our FPGA to store it for further usage. Whenever a new type of configuration is desired, a command line interface allows the user at the home station to use a wireless system to communicate with the node to configure the FPGA with whichever file that had been previously transferred to the node. This solution allows for a very simplistic, cost effective, mobile, and convenient approach. It is superior to current solutions, which do not allow for mobile configuration. Those who can benefit from our solution would be individuals or organizations that need analysis and synthesis of digital logic in multiple off-site locations.

ENTERTAINMENT ENGINEERING AND DESIGN PROJECTS

Senior Design Instructor Joe Aldridge

Shop Box Hero

Project Participants
Alex Palmiotti, Carleen Saladino, Elias Haeick, Jinsil Han and Nelson Wong

Faculty Advisor
Joe Aldridge

Problem Identified
Accessibility to carpentry tools and a work station can be critical for the repair of scenic elements throughout the duration of an event or touring show. However, the mobility of carpentry equipment for touring shows/outdoor venues is limited because of the size and cumbersome shapes of machine tools.

Current Solutions
Road cases for hand tools are available. However, there are no good means to transport larger machine tools such as a table saw, drill press or welder. Currently, carpenters fashion their own work space using items such as plywood and sawhorses.

Team Solution
Our solution to these problems is the “Shop Box Hero.” This solution provides not only storage for tools and large equipment like a table saw and drill press, but also provides a mobile work station that is easily erected and accessible. This box allows for easy transportation between multiple locations. The thoroughly planned layout and design provide a convenient and user friendly workstation.

MECHANICAL ENGINEERING PROJECTS

Department Chair
Brendan O'Toole

Senior Design Instructor
Zhiyong Wang

Cube Sat UAV Bracket

Project Participant
Damiano Vilt

Instructor
Zhiyong Wang

Faculty Advisor
Ke-Xun Sun

Problem Identified
The Cube Sat sensors are meant to be used in space to measure minuscule angular displacements through the optical grating to allow for better alignment of satellites, eventually allowing satellites to be improved enough to detect gravitational waves that may date back to the Big Bang. However, getting into space is very expensive and ground tests do not really do them justice.

Current Solution
The only current solutions are ground tests on rotating platforms, however they lack the movement range that will be encountered in space.

Team Solution
My solution is to perform atmospheric testing of the Cube Sat by having it attached to the underside of an Unmanned Aerial Vehicle (drone). The goal is to keep the drone aligned with a fixed laser source to simulate the job it will do in space. It allows for full three dimensional movement of the sensor, whereas current solutions can only offer two dimensional movement, and thus match the conditions encountered in space more accurately than any ground tests.

Drill Powered Bicycle

Project Participants
Jung Kim, Yu (Jay) Wang, and Brett Yee

Instructor
Zhiyong Wang

Faculty Advisor
Darrell Pepper

Problem
To design and build a universal kit to incorporate the use of a power drill to assist in the movement of a bicycle.

Current Solution
DPX Systems currently has a drill powered electric bicycle that is similar in the idea to use a power drill to assist the bike in motion, using a drastically different concept.

Team Solution
DPX Systems is promoting a bicycle that they offer as their own design as a whole package that is very costly to the consumers. Our concept enables the consumer to have more flexibility at an affordable price and the universal kit may be used on other bicycles as well, unlike the DPX Systems. Our design concept also allows the user to pedal the bicycle when the charge of the battery runs low. The DPX Systems bicycle does not allow for this option.

IP 1000 Pump Redesign

Project Participants
Sean Devore and Matthew Pedraza

Instructor
Zhiyong Wang

Faculty Advisor
Mohamed Trabia

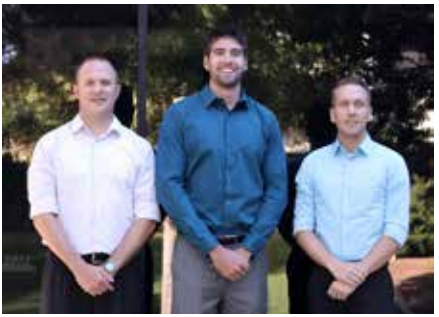
Technical Advisors
Brian Sweeney and
Kumar Gettamaneni

Problem Identified
Our team was commissioned by IMI Precision Engineering to improve the value of the IP 1000 Inline Syringe Pump by lowering its manufacturing costs through component redesign. The market performance of the product is limited by its high cost of production.

Current Solutions
An IMI internal design team's recommendations included some short-term and long-term recommendations. All of these were constrained by retaining the existing means of manufacturing, such as working from rod stock.

Team Solution
We can reduce the cost of parts significantly through savings in scrap material using injection molding for the pump manifold. Further savings in machining time can be achieved through extrusion of the pump body. Consolidation of parts, optimization of geometry, and streamlining of features all refine the product's functional objectives while minimizing organizational costs. IMI Precision Engineering and their client base will benefit through preserving the existing product's performance at a significant price advantage.

For The Birds



Project Participants
Matt Giza, Tim Martin, and Ben Borden

Instructor
Zhiyong Wang

Faculty Advisor
Brendan O'Toole

Technical Advisor
Jonathan Chan

Community Advisor
Michael Martin

Problem
Collisions with windows is one of the biggest threats to birds in America. It is second only to habitat destruction in mortalities, killing nearly a billion birds every year. Birds fail to recognize transparent or reflective glass, and this lack of recognition causes severe injuries or deaths. Many organizations and government agencies are addressing this issue, with varied success. In some cities with a high population of native and/or migratory birds it has been mandated that buildings nearby bird sanctuaries, such as parks and wooded areas, have some form of anti bird-strike measure.

Current Solution
Current commercial solutions for bird collisions in urban areas are ineffective and in some cases extremely costly. Semi-transparent window decals and glass etchings are common, restricting the view from the inside of the window, but making the structure more visible to birds. Changing the originally intended design, and reducing the amount of glass features is another option, but would be infeasible for a building already constructed. No current solution exists that would deter birds, while maintaining excellent visibility through a glass window.

Team Solution
Ultra violet (UV) reflective and absorbing stripes, visible to birds but invisible to humans create a patterned appearance to deter birds from flying into glass. The reflective layer is composed of alternating High-Low-High Refractive indices which create a bandpass filter for visible light and a peak reflectance between 360 and 380 nm. The absorptive layer is applied in a patterned fashion such that it absorbs UV light where applied and where it is not applied the metallized substrate reflects the UV light. Additionally, a considerable portion of Infared (IR) energy is reflected as well making the product an energy saving product in places with abundant sunlight. Finally, the entire product has a layer of adhesive with UV absorber in it so no UV light enters the building and thus no fading occurs.

Methane Sensor Module

Project Participants
Monia Kazemeini, Christopher Rising, and Marcos Handabaka

Instructor
Zhiyong Wang

Faculty Advisor
Alexander Barzilov

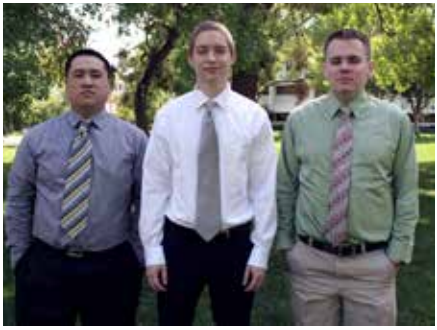
Technical Advisor
Skyworks Aerial Systems

Problem Identified
Provide an accurate, mobile detection system for methane emissions. A methane sensor will be protected inside a module that will be able to mount onto a Skyworks QUARK drone. The concentration measurement data of methane will be sent wirelessly to a central computer for further investigation and analysis.

Current Solutions
Current solutions utilized are ground based units, which are either mobile or fixed in location. These units allow for plume tracking in a two-dimensional space. With methane having a lower density than air, ground based units can have difficulty in leak detection. The aerial solutions developed rely on laser spectroscopy, which can be costly.

Team Solution
Low cost chemiresistor methane sensors can be used as an alternative to laser spectroscopy, should the fluid flow characteristics of an aerial vehicle be properly utilized. Fluid flow properties were tracked through computer simulation and experimental test procedures to locate viable sensor placement. The use of these sensors decreases both the cost and weight of the unit. The reduction in weight allows for the units to be functionally applied to lower cost aerial systems due to a lower lift demand. This can decrease the cost of units making their use more prevalent across multiple industries, resulting in lower global greenhouse emissions.

Mechanized Sock Donner



Project Participants
Kyle Cummings, Felix Huahng, and Robert Deike

Instructor
Zhiyong Wang

Faculty Advisor
Mohamed Trabia

Problem Identified
As people age, they develop problems such as arthritis, which affect their flexibility and independence. Some people do not have the flexibility required for putting on their socks, so someone must help them, or they wear sandals and go without socks. Unfortunately, help is not always available, and going outside without socks in climates with freezing weather is not an option. Therefore, a machine to assist people in putting on their socks is needed.

Current Solutions
Several products that help people put on their socks are currently on the market. These products have the user attach the sock to the bottom of the device, and manually pull the sock up from the top. However these devices require a fair amount of flexibility in the ankle, which some people simply do not have.

Team Solution
We have designed a mechanized sock donner, which will put the sock on for the user, with minimal flexibility and effort required from the user. It will consist of two four-bar mechanisms, one on each side of the foot. Clamps are attached to each coupler link, and they pull the sock along the designed path around the foot and ankle. This solution is better than the currently available solutions, because the user does not need flexibility or strength in their ankle to use it.

Phenix Water Pump

Project Participants
Curtis Flores, Gustavo Barbosa and Weslley Menezes Guimaraes

Instructor
Zhiyong Wang

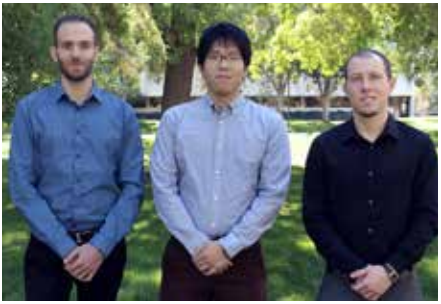
Faculty Advisor
Darrell Pepper

Problem Identified
In many third-world countries, ground water is not accessible. These communities do not have the funds or the access to technology to bring ground water to the surface. Current technology is expensive, heavy, and difficult to transport with all of the individual parts required to construct a pump that will run on its own.

Current Solutions
Steel pumps that can be fitted to perform this action exist, but are heavy and expensive to transport.

Team Solution
To solve this problem, we are building a portable pump jack that is 40 percent lighter than a typical steel pump, using fiber glass to reduce the weight, thereby reducing the energy required to operate and the cost of shipping. This pump will be powered by thin-film solar energy and I gave a kit primed for simple construction at the time of arrival. Product applications include use by ranchers, groundwater testers, and also can be sold to philanthropists and non-profit entities, such as the United Nations, Red Cross, and more that work to provide water for those who don't have access, especially tribal communities across Africa.

Stretch-Air



Project Participants
David Chu, Westley Davis and Richard Saroukhanoff

Instructor
Zhiyong Wang

Faculty Advisor
Brendan O'Toole

Problem Identified
Our team is working to minimize the risk of work-related injuries for nurses during the loading procedure of a patient into a fixed wing aircraft.

Current Solution
The current solution is a portable, storable ramp with adjustable legs that can be attached to the Life Support Module. This requires two in-flight nurses to help push and pull the patient into the fixed-wing aircraft and position the patient securely onto the Life Support Module. Medical personnel still can be harmed during this current procedure.

Team Solution
The team's solution is an electronic patient loading system that will alleviate the physical strain endured by the nurses during the loading process. This is accomplished by implementing an electronic lifting mechanism that will allow the nurses to raise the ramp to the desired height, such that the patient can be easily positioned within the aircraft with minimal physical effort. The versatility of this electronic patient loading system makes it compatible for use in any fixed wing aircraft. Such design will appeal to any air medical transport companies seeking faster, improved loading procedures of patients.

Development of UAV Applications for Remote Sensing of Radiation and Monitoring

Project Participants
Kressha Ereno, Kent Buenaventura and Tina Roque

Faculty Advisor
Alexander Barzilov

Technical Advisors
Jeff Markle and Terrance Kell

Problem Identified
Nuclear power plants do not have efficient monitoring systems to detect leaking radiation within their confines. The amount of radiation leaking could lead to dangerous exposure to humans and may even cause catastrophic events similar to that of the Fukushima disaster and Chernobyl.

Current Solutions
These days, nuclear facilities monitor radiation readings manually. The workers of these facilities physically scan for unwanted radiation sources, which can lead to dangerous amounts exposed to humans.

Solution
Our solution is to provide an autonomous method of radiation monitoring. We plan to attach a radiation sensor to a UAV, which will enable nuclear facilities to monitor unwanted copious amounts of radiation with a safer approach. The radiation sensor will be mechanically and electrically integrated onto the UAV and programmed to relay locations of radiation sources to a computer ground unit. The UAV and the sensor, will be utilized in monitoring radiation levels in order to prevent radiation failure along with catastrophic failures.

UNLV appreciates the leadership and support of our Nevada System of Higher Education Board of Regents.

Rick Trachok, Chair

Michael B. Wixom, Vice Chair

Andrea Anderson, Ph.D.

Cedric Crear

Robert Davidson

Mark W. Doubrava, M.D.

Jason Geddes, Ph.D.

Trevor Hayes

James Dean Leavitt

Sam Lieberman

Kevin C. Melcher

Kevin Page

Allison Stephens

Howard. R Hughes College of Engineering Leadership

Rama Venkat, *Dean*

Mohamed Trabia, *Associate Dean of Research, Graduate Programs and Computing*

Georg Mauer, *Associate Dean, Undergraduate Programs*

Donald Hayes, *Chair of Civil and Environmental Engineering and Construction*

Laxmi Gewali, *Chair of Computer Science*

Yingtao Jiang, *Chair of Electrical and Computer Engineering*

Brendan O'Toole, *Chair of Mechanical Engineering*