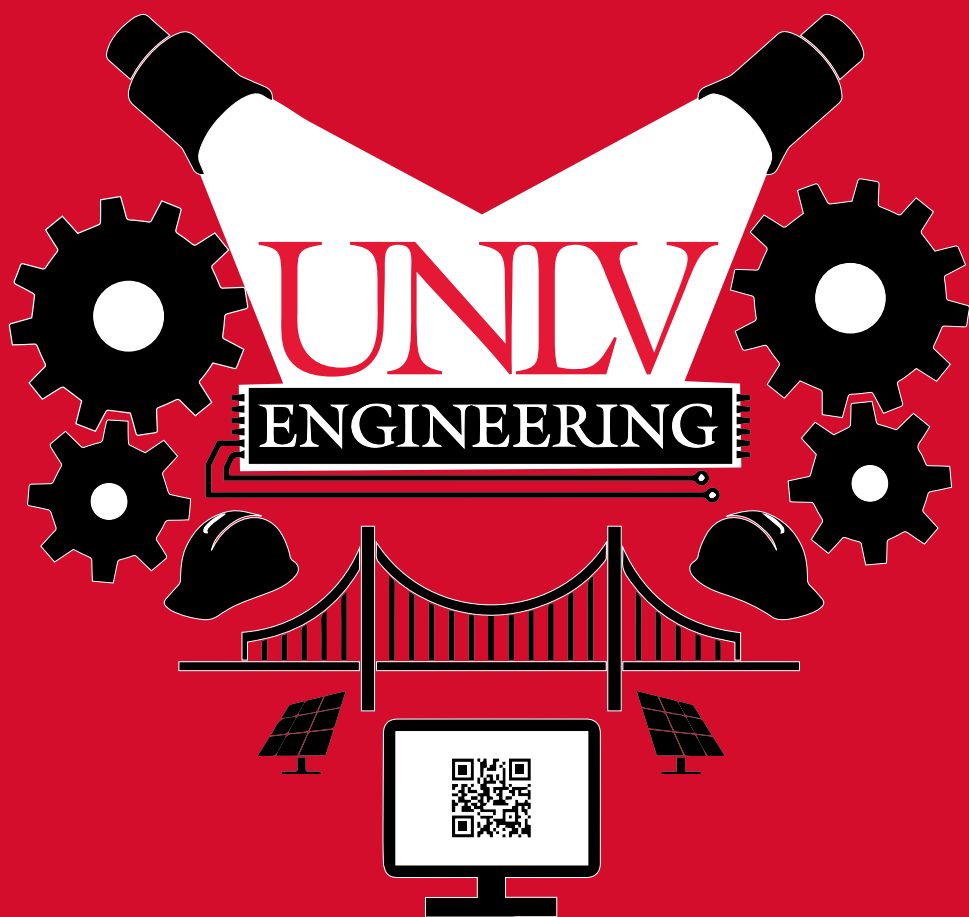


FRED AND HARRIET COX

SENIOR DESIGN COMPETITION



December 6, 2018



Fred and Harriet Cox

Senior Design Experience

Part of every UNLV engineering student's academic experience, the Senior Design project 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, the senior design project encourages students to use everything they 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. A cash first prize and second prize are given in each discipline, as well as a 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 the 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 competitions such as: the Governor's Cup, and the subsequent creation of many successful businesses.

Students wanting to take their projects to the next level are offered support from UNLV's Research and Economic Development team to pursue a patent for their prototypes. Additionally, engineering alumnus Chad Miller offers pro bono services to assist students in filing provisional patents on Senior Design projects.

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 as they work on a project.

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 Molly Marks, Director of Special Events, at molly.marks@unlv.edu or 702-895-3281.

Thank you to our Sponsors!



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WE'RE #1



Thank you, Senior Design Instructors!

**Civil & Environmental
Engineering & Construction**
Dr. David James

Computer Science
Dr. Ju-Yeon Jo

Electrical & Computer Engineering
Dr. Ming Zhu

Entertainment Engineering & Design
Michael Genova

Mechanical Engineering
Dr. Zhiyong Wang

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Fall 2018 Senior Design Judges

John Benner

As the Mission Support and Test Services LLC (MSTS) vice president and deputy site manager, John Benner works to integrate Nevada National Security Site (NNSS) operations across organizations to ensure safe, secure and consistent execution and strengthen external relationships with NNSS customers, including the National Laboratories.



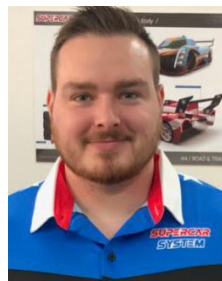
Before joining MSTS, Benner spent nearly 25 years working at Los Alamos National Laboratory (LANL) in Weapon Systems Development, Life Extension, qualification and testing, stockpile management, production, safety and security.

As the Associate Director for Weapon Engineering and Experiments, he led the organization responsible for managing all weapon systems activities, including Life Extension Projects, surveillance, weapon surety, explosive testing and development, hydrodynamic testing, LANL subcritical testing operations at the NNSS, and integration and planning of major portions of the stockpile stewardship program.

While serving as the Weapon Systems Division Leader at LANL, Benner played a key role in managing the W76-1 Life Extension Program, reinvigorating the experimental firing sites and high explosive capabilities leading to the strengthening of the company's Weapons Engineering capabilities.

Kyle Denman

Kyle is the senior engineer spearheading development of two of Las Vegas's most promising new technology companies. Boxabl a revolutionary construction technology that aims to lower housing costs by 40 percent with plans for a dedicated plant in the Apex redevelopment zone and Supercar System a heart stopping auto maker with factory facilities directly on the exciting Las Vegas Motor Speedway.



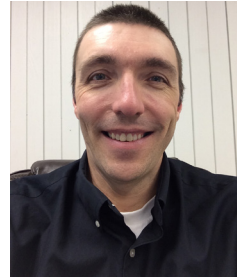
With over 20 mechanical patents already to his name in both automotive and civil engineering discipline, he brings first principals and critical thinking to the review of any creative engineering project.

Kyle is a native of Neversink New York, an alumni of Stony Brook University NY and was also the power train and control systems lead for the Stony Brook SAE Baja program.

Kyle moved from the New York area 18 mos ago and now considers himself a Las Vegas local where he lives with his brother and his pitbull-labrador, Lia.

Troy Foede

Troy Foede is the Converting Superintendent at the Clearwater Paper location in North Las Vegas. His work history includes a variety of process engineering and computer/data mining roles. Entirely focused in the paper industry, he started as a chemical supplier and then fabric supplier to the paper industry in Minnesota. From there, he dove into data mining software development focused on getting critical information from large data archives at a 100% recycle paper mill in Arizona. During his time there, he completed a Six Sigma Black Belt program. That led to Clearwater Paper and a position as Quality Engineer for the paper board division, helping improve quality for the challenging Japanese liquid packaging market. Currently, he is leading the converting department, making private label tissue products for grocery and big box stores like Walmart, Target, Kroger, and Albertson's for the Southwest region. Troy got his B.A. in Biology from St. John's University in Collegeville, MN.



Daniel Greenspun

Daniel Greenspun is the President of Greenspun.Ventures and is currently developing CityLedger.com, a blockchain Identity startup focused initially on the Las Vegas gaming and resort industry.

A pioneer in the Las Vegas online travel business, Greenspun founded Vegas.com in 1998.

Greenspun is the founder and past chairman of Greenspun Media Group, which published a variety of titles including Las Vegas Magazine, Las Vegas Weekly, Vegas Inc. and Las Vegas Life Magazine.

Under Daniel's leadership, Greenspun Media Group entered the luxury magazine market with the start of Vegas Magazine. Greenspun Media Group went on to acquire Niche Media Holdings and Ocean Drive, making the company one of the premier players in the luxury lifestyle market with titles including Los Angeles Confidential, Gotham Magazine and Hamptons Magazine among others.

In 2001 Danny was awarded the Governor's Award for Public Service in the Arts and Humanities and in 2013 Danny and Robin were inducted into the University of Nevada, Las Vegas College of Fine Arts Hall of Fame.



Ping Lee

Dr. Lee manages and leads Stockpile Stewardship, Defense Nuclear Nonproliferation and Nuclear Counterterrorism and Incident Response for the Nevada National Security Site (NNSS). In his role, he serves as the primary interface with National Nuclear Security Administration (NNSA), the national laboratories and other significant stakeholders and customers.



Dr. Lee has more than 25 years of research, leadership and senior management experience within the NNSA National Security Enterprise. Currently, he is a research professor at the Desert Research Institute, leading nonproliferation and arms control verification R&D. Prior work includes serving as the Director of the National Center for Nuclear Security (2009 – 2013) as well as the Deputy Director of Defense Experimentation and Stockpile Stewardship (2006 - 2009) at NNSS.

At Los Alamos National Laboratory, he held multiple research and management positions in the nuclear weapons, space based monitoring, and inertial confinement programs. He was the Office Director of Institutional Planning and Evaluation reporting directly to the laboratory director prior to moving to Nevada.

David Shaw

GM – North America, with RedEye Apps, one of Australia's fastest growing and well renowned scaleups now making inroads in the USA. Prior to his work with RedEye, he completed a Masters of Mechanical Engineering and worked in several operational roles across Australia with BHP Billiton.



He founded an AR gaming business in 2015, and is also the co-founder, former President, and current board member of Space Design Competitions Australia (SDCA) – part of an international consortium of education non-profits teaching STEM through the prism of space colonisation and aeronautical engineering.

Concurrently with his previous pursuits, he spent 8 years in the Australian Army Reserve. As a Lieutenant in the Royal Australian Infantry Corp, he has held both operational and strategic planning roles, being awarded the Australian Defence Medal in 2017.

Laura M. Tomlinson

Laura M. Tomlinson is the Assistant Manager for National Security (AMNS) at the U.S. Department of Energy (DOE) National Nuclear Security Administration Nevada Field Office (NNSA/NFO). As the AMNS, Ms. Tomlinson is responsible for overseeing, implementing, and managing the department's Nuclear Stockpile Stewardship, National Emergency Response, the Homeland Security and Counterterrorism programs, and all national security interagency work at the Nevada National Security Site (NNSS). These responsibilities include nuclear test readiness, dynamic plutonium experiments program, nonproliferation and counterproliferation activities, radiological/nuclear emergency national response, counterterrorism training for first responders, and other defense related science and technology development programs, including those in support of the Department of Homeland Security and the Department of Defense. The Nuclear Emergency Support and Radiological Consequence Management Response teams charged with leading the national interagency response are her direct responsibility. Ms. Tomlinson also serves as the NNSA/NFO lead for the \$450M NNSA five-year Planning, Programming, Budgeting and Evaluation process for execution at the NNSS. Ms. Tomlinson is a recipient of the 2006 DOE Federal Engineer of the Year Award.



Justin Veilleux

Justin Veilleux is a principal at FEA Consulting Engineers, a local engineering firm providing mechanical, electrical, plumbing, lighting, and low voltage services for architects on several of the largest projects in Las Vegas and the country. He is an alumni of UNLV's Engineering Department, graduating in 2004 with a bachelor's in computer engineering. He also just started the UNLV MBA graduate program, and planning to finish in 2021.



For the UNLV undergraduate program, Justin focused on a mix of computer science and electrical engineering, which further advanced his programming knowledge and introduced him to electrical fundamentals and design. Justin also had to develop a senior design project for his undergraduate requirement, which he teamed up with an electrical engineering major to develop a GPS golf ball. The intent of the design was to program a GPS chip so we could track where the ball was located after a player hit the ball using a handheld device, developing a program on a HP iPaq Pocket PC to provide distances and direction. He also completed the undergrad program with a minor in mathematics.

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING AND CONSTRUCTION PROJECTS

Department Chair
Dr. Sajjad Ahmad

Senior Design Instructor
Dr. David James

7th Street Redesign 2.0

Project Participants

Phil Aganus, Aaron Hatfield, Bryson Hirokawa & Matthew Shimabukuro

Instructor

Dr. David James

Problem Identified

7th street, between Ogden and Carson, will be redeveloped soon. Problems associated with this redesign include storm water control, updates to sewer and water lines, land management including sustainable designs, shade structures, parking redesign, traffic analysis for alternative lane designs, and pedestrian traffic analysis including foot and bike traffic.

Current Solutions

The City of Las Vegas (CLV) is currently in the process of growing and beautifying Downtown Las Vegas. Current market solutions that exist are canopy structures, street narrowing, bike lanes, and dedicated pedestrian walkways.

Team's Solution

There is much improvement to be done on the current 7th street public area between Ogden and Carson, since it is over 85 years old. Our design solution will utilize systems that have been recently created to increase efficiency and improve the functions of the area. By using up-to-date civil engineering solutions and sustainability approaches, we will be able to implement attractive and functional approaches based on a combination of current design standards, similar solutions for other urban areas and recently published studies.



Laughlin Sustainable Land Development & Pipeline

Project Participants

Bryan Cordon, Micheline Ghanem, Lisa Hagerman & Stevie Lee Parks

Instructor

Dr. David James

Faculty & Technical Advisor

Dr. Sajjad Ahmad

Community Advisors

Chris Krizmanic & Sri Kamajjala

Problem Identified

Laughlin's development must sustainably use its water allocation. Poor neighborhood design and a hot, arid climate lead to excessive water usage and waste. Current neighborhood design methods won't sustain future population growth.

Current Solutions

Current solutions include utilizing LEED and Envision concepts to develop sustainable buildings. We can also model buildings from energy and water conserving structures in similar climates, such as adobes.

Team's Solution

Our team utilizes current solutions, such as LEED and smart building design, as well as other new smart designs not generally seen in this area, such as adobes or concrete heat sinks. The potential for water reuse could be analyzed for feasibility. Different pipeline layouts and designs were explored to achieve the highest transmission efficiency.



Paradise Parking Lot and Channel Improvements

Project Participants

Jose De La Serna, Jhoana Duran, Spencer McMillan & Charles Yalung

Instructor

Dr. David James

Faculty Advisor

Dr. Moses Karakouzian

Technical Advisor

Dr. Haroon Stephen

Community Advisor

Josh Carpenter

Problem Identified

The primary users of the Paradise parking lot are the elderly, requiring a high degree of accessibility and safety. The current infrastructure cannot withstand even relatively frequent storm events, endangering its primary users. Furthermore, the inability of the current infrastructure to convey floodwater has immediate repercussions for the surrounding community, with floods resulting from the inability of the current earthen channel in place to collect the floodwater and a lack of a downstream conveyance facility.

Current Solutions

Redesigning the earthen channel and regrading, resurfacing, and restriping the parking lot will be necessary to address the current drainage problem. A new parking lot design and layout will help increase user safety and accessibility. Other possible solutions include multistory parking with elevators, putting the channel underground, or expanding parking on the nearby main campus, with an added bridge or shuttle system.

Team's Solution

In order to mitigate onsite and offsite flooding during storm events, the MPGA team will repurpose the existing landscaping area at the southwest corner of the project site for a multi-purpose detention basin. The detention basin will consolidate and detain offsite flows in order to give the downstream areas more time to properly drain. The existing parking lot will be regraded to safely discharge flows towards the adjacent regional storm drain system without causing flooding or safety hazards to the onsite buildings. The parking lot layout will also be redone to maximize the amount of parking spaces in the remaining available space. All students and faculty that use the Paradise campus will benefit from lower amounts of debris and reduced flooding. The surrounding neighborhoods will also benefit from this design, since flooding will be less severe in their respective streets.



TBE Canopy

Project Participants

Jessica Claudio & Maral Khorrami

Instructor

Dr. David James

Problem Identified

The TBE service yard does not contain suitable shelter from sun and rain for students and extracurricular projects, such as steel bridge, concrete canoe, and mini Baja. The current service yard is also too small to accommodate the needs of students.

Current Solutions

Either construct an enclosed shop in the service yard with HVAC system or cover the space with a canopy. Canopy solutions could include metal roof, composite roof, or steel roof panels.

Team's Solution

Enclose the service yard to provide shelter from sun and rain. Our solution is to both reconfigure the space and design a canopy over the TBE service yard to accommodate a more comfortable workspace for students. Professors and students who perform laboratory experiments in the yard and student organizations, such as ASCE and SAE could benefit from this solution.



DEPARTMENT OF COMPUTER SCIENCE PROJECTS

Department Chair
Dr. Sidkazem Taghva

Senior Design Instructor
Dr. Ju-Yeon Jo

Budget Buddy

Project Participants

Kevin John Bulosan, Nathan Gelman, Shawn Jenkins-Edwards,
Jack Mackey, James Parsons, Brandon Romero & Nikolay Stoynov

Instructor

Dr. Ju-Yeon Jo

Problem Identified

Now that checkbooks are a thing of the past, it's often too difficult to manage a budget and keep track of expenditures. Budgeting is more complicated than simply determining whether we have enough money to make a purchase. However, in the information age, that's what it often boils down to.

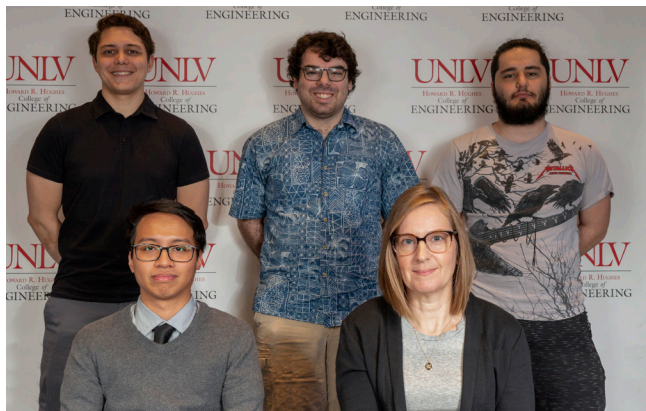
Current Solutions

Currently, there are many applications on the market that handle budgeting in their own ways, such as Mint and NerdWallet. They have visual representations of your spending, make suggestions on how to improve spending and saving, and are monetized by partnering with credit card companies.

Team's Solution

Our application will have many similarities to those available, but instead of focusing on showing the user more graphs, we hope to provide a more inviting experience. The goal is to turn boring finances into something enjoyable and highly rewarding. We aim to gamify something that most people perceive to be a chore. By adding progression bars, achievements, and giving users a sense of accomplishment in their monetary accolades, we plan to transform budgeting. In doing so, we can reach a larger demographic that empowers younger and older generations to take control of their funds in brand new ways.

Our application will encourage people to track their expenditures, so they can understand their budget fully and stay on track for their savings goals. The app's user interface will focus on being as fast and easy as possible to make keeping track of data an effortless part of the consumer's life.



Clock-It

Project Participants

Mark Constantine, Andrew Kruse, Carlos Moreno, Austin Murdock,
Aaron Podovich, Ryan Tan & Jacob Valadez

Instructor

Dr. Ju-Yeon Jo

Problem Identified

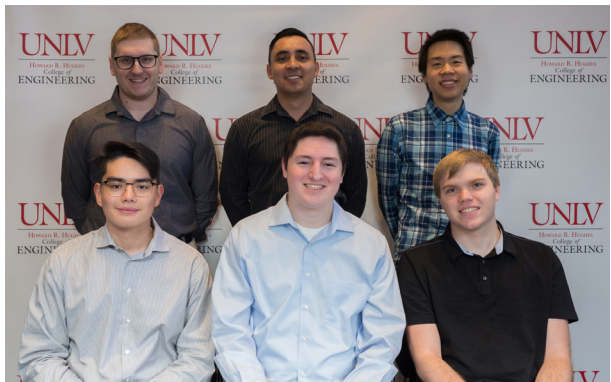
Today, small growing companies or startups may run into issues finding innovative ways to manage/log employee hours. New systems tend to be expensive and difficult to integrate into existing work environments. Old systems do not provide the flexibility of modern technology. Our platform will target these types of companies who need a simple, cost-effective, user-friendly, and reliable solution to this problem.

Current Solutions

Existing employee time clock systems come in two forms: physical devices and software applications. Physical punch card systems can be cumbersome within the workplace and tend to cost more than what they're worth. Existing software solutions are typically overpriced, even more cumbersome, and riddled with unnecessary features that employers may have to pay for.

Team's Solution

Clock-It is an employee time clock mobile application designed for small companies who are looking for an inexpensive system that is easy to integrate. This software has features to ensure that an employee can clock in or out of work only if he or she is within range of the workplace. Our software will also accommodate those who have workplaces that are constantly on the move by giving employers the ability to dynamically set the workplace location. The app will support both physical sensors and GPS tracking for positional clock in. If the employer decides that the positional clock in feature does not fit their needs, then they can turn the setting off altogether and use our app as a robust timesheet app. In any case, the app will be heavily customizable so that employers can tweak the settings per workplace to fit their particular needs.



CouponIt

Project Participants

Richie Abenoja, Jeeno Don Doria, Jennifer Lee, Michael Miranda,
Timmy Nguyen, Joshua Ramos & Jeffrey Razon

Instructor

Dr. Ju-Yeon Jo

Problem Identified

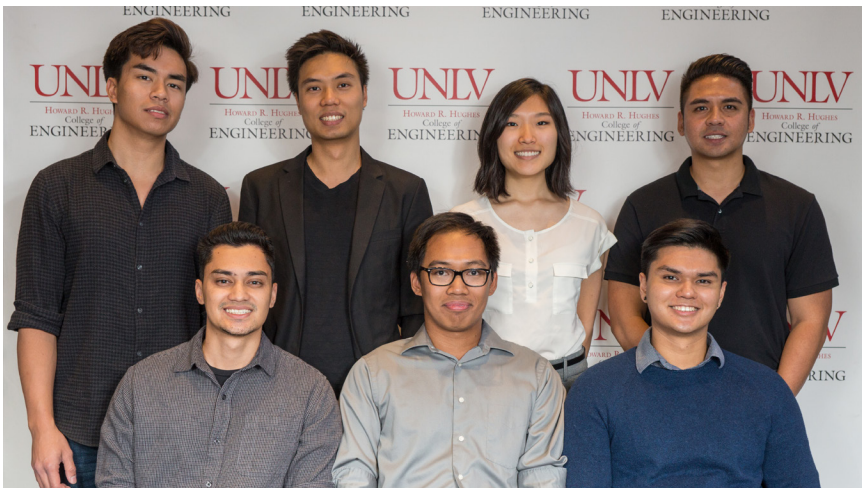
There are difficulties in finding available deals on commodities. People would either have to flip through a whole booklet, or search through the web to find a specific deal that suits their needs, which becomes time consuming.

Current Solutions

There are many other coupon mobile apps and websites. However, the user still has to manually search through sites for deals that are attractive to them. Our target audience are people who are already shopping and know what they want.

Team's Solution

Our solution is to make an app that makes finding deals more efficient and simple by making coupons readily available by allowing users to find specific items with a deal. This app would also allow users to easily share the deals they find with friends and family, which would give more exposure to businesses and their products. This would benefit the budget conscious consumers as well as businesses.



Medical ID

Project Participants

Gregory Goronson, Mike Merrill, Erica Oytas,
Erik Perez-Martinez, Matthew Sielaff & Hai Tran

Instructor

Dr. Ju-Yeon Jo

Problem Identified

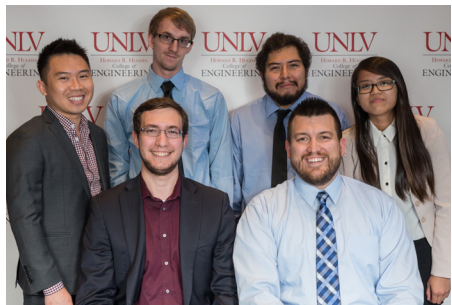
To bridge the gap that exists between different healthcare systems and patient information. Currently, if you're a patient at a hospital and move to a different location, or visit another hospital, you need to reenter all your information again. Healthcare, at this moment, does not have a solution where a patient can smoothly switch between hospitals without a tedious and long admittance procedure.

Current Solutions

1. MyID (iOS app - link): a) Pros: Medical profile (vital conditions, allergies, medications, etc.). Pill reminder notifications and medical documents. b) Cons: Monthly or yearly cost (For \$1.99/month or \$19.99/year). You can't control who has access to your information. Your info is no longer yours when it is sent to their server.
2. Medical ID (iOS built-in app – link): a) Pros: Store health information (allergies, emergency contact, medical conditions). Access information via Lock screen without need for Passcode. b) Cons: Not cross-platform and not universally accepted.

Team's Solution

[1MedID] will employ a quick check-in and checkout system utilizing QR-code technology. Patients will be able to visit a supported health clinic and scan their QR to automatically check in (no need for lengthy admittance process). Once checked in, the patient can confirm the release of information so health providers can access their information. To assure patient's data remains secure, we will utilize Blockchain technology (future implementation) to make sure it is secured and immutable. Businesses would be interested in this solution because we are removing liability from their business. Hospitals and private clinics will be interested in an app that helps expedite the patient admittance process. On the consumer end, they will have control of what information is released and when it will be taken back. A win-win solution for both sides.



Rx Helper

Project Participants

Alexis Acosta, Juan Brena, Jean-Paul Castro, Nick Graeff, Blossom Hamika, Eduardo Meza & Ajanae Williams

Instructor

Dr. Ju-Yeon Jo

Problem Identified

The problem we are looking to solve is people forgetting to take their medications on time, as well as, providing reminders of when to refill prescriptions. Negative results may occur if medications are not taken when needed. A few examples are: a longer recovery time, unwanted side effects, or having to start the medication over again.

Current Solutions

Current market place solutions are pill organizers and phone applications. Pill organizers are useful to store pills in their corresponding day, but do not provide a reminder. When it comes to phone applications, they do not provide educational information about the medications.

Team's Solution

Our solution is to build a phone application that will allow users to store prescription information on their phone. The phone application would provide users daily reminders to take their medication. It would also provide the user with refill reminders, as well as educational information of each medication. This is better than current solutions because it is a family-friendly app that will also allow the user to input their children's or pet's medications. A simple, user friendly, educational application is what we aim to create. Users who would benefit from this application would be everyone who needs to take medications. Daily reminders for medications and refills would be a great assistance to the user.



SwapBox

Project Participants

Samuel Black, Dominic Cacioppo, Jonathan Eisenstein, Christopher Goff, Antonio Guevara, James Piotrowski & Jake Raquel

Instructor

Dr. Ju-Yeon Jo

Problem Identified

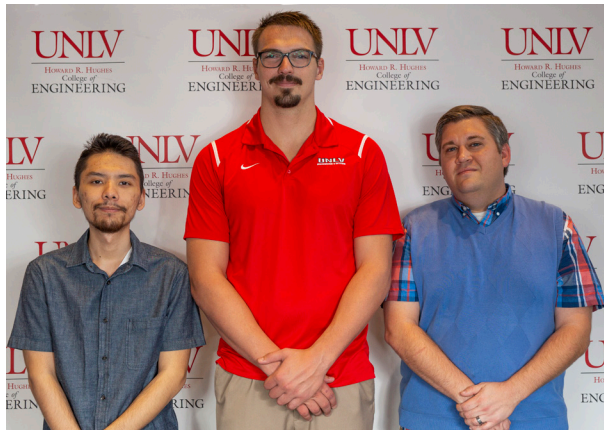
Students on fixed budgets may not always have the means to obtain supplies, clothing, and other goods to ensure their success. With SwapBox, students can safely exchange or loan their possessions to other students without the need to meet face to face. The SwapBox system allows students to place their items into a marketplace for exchange or loan. Once an agreement has been made, the students place their items in strategically placed lockers throughout the campus for anonymous and safe exchange.

Current Solutions

The current markets of Craig's List and eBay are the only two major solutions for students looking to sell items and find second hand items to purchase. However, the exchanges between the seller and buyer do not guarantee safety to either party. For Craig's List, a meeting place must be established between both parties, but cannot ensure the safety or anonymity of the students. For eBay, the buyer cannot be guaranteed the item they purchased with be the actual item they receive.

Team's Solution

SwapBox brings a service to students that allows them to effortlessly exchange and loan their possessions safely and securely. SwapBox eliminates the need for students to establish a safe trading location with a strategically located locker system throughout the campus. If one of the parties fails to place their items in the locker, the exchange is cancelled, and the student's items are returned. SwapBox also eliminates the hassles of selling items of worth at lesser values. The items in the marketplace are for exchange permanently or with time limit terms.



DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING PROJECTS

Department Chair
Dr. Biswajit Das

Senior Design Instructor
Dr. Ming Zhu

Grill & Chill

Project Participants

Ryan Dunlap, Jonathan Malta & Ricardo Mejia

Instructor

Dr. Ming Zhu

Problem Identified

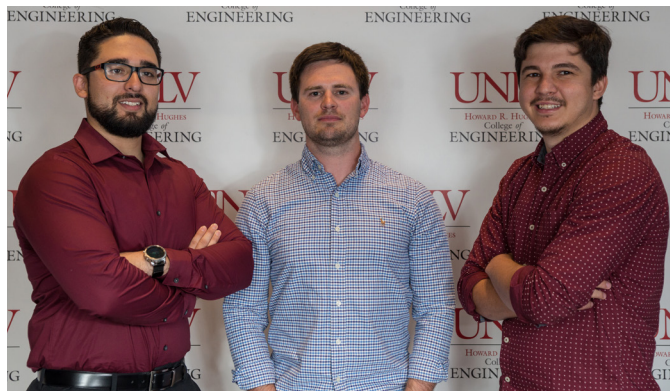
Since the 1950's, when the propane outdoor grill was first established, the evolution and design has remained stagnant. Grilling is time consuming and requires constant attention from at least one person. Grilling requires knowledge of cooking different meats and foods according to temperatures and time.

Current Solutions

Currently on the market, there are rotating rotisserie grills, temperature sensors, and Bluetooth enabled user interactions via electronic devices. The rotating rotisserie grill does not allow your meat to adequately retain the marinade for the most desired taste.

Team's Solution

The Grill and Chill will include a microcontroller, temperature sensors, and a rotating grill basket. The rotating grill basket will be queued from the microcontroller to ensure proper cooking of different types of meat and foods. Controlling the rotating grill basket will remove the constant need for attention from a user and help alleviate insufficient time. Additionally, the rotating grill basket will promote a seared and more marinated taste versus a rotating rotisserie. This grill will reduce the human error that comes from an inexperienced cook because the temperature sensors will provide optimal cooking temperatures to the microcontroller. It is important to cook various meats thoroughly to ensure what is being served is safe to consume. Lastly, the Grill and Chill will also promote optimal time with family and friends for a Sunday evening cookout. This makes the grill beneficial to individuals that enjoy grilling for home entertainment and/or sporting events.



Keyless Piano

Project Participants

Rimon Sawa, Jacob Sherman
& Trace Stewart

Instructor

Dr. Ming Zhu

Faculty Advisor

Dr. Emma Regentova

Problem Identified

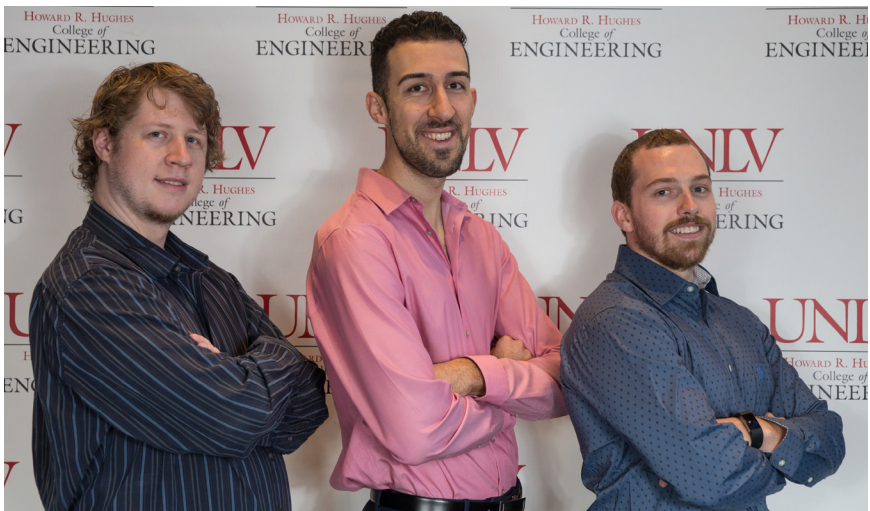
Normal piano synthesizers use samples recorded from live equipment for playback. This takes up a lot of memory (in Gigabytes of data). Our keyless piano is smaller and more convenient to carry around than other current solutions.

Current Solutions

Current piano synthesizers are expensive and/or can be downloaded, requiring large amounts of memory storage. These options are bulky, making them less mobile.

Team's Solution

Our solution is a more memory efficient and mobile piano synthesizer. People who would benefit would be musicians, hobbyists, and others who want a convenient, inexpensive, and high quality piano synthesizer.



Minim (Voice Recognition Headphones)

Project Participants

Argenis Jimenez Aguirre, Michael Miranda & Anthony Pallone

Instructor

Dr. Ming Zhu

Problem Identified

Today's headphones are missing a layer of interactivity that the rest of current technology has—voice recognition. Now that voice recognition is in our phones, our cars, and our houses it seems only natural that the device you listen to music with, should get the same treatment.

Current Solutions

Available devices in the market are prohibitively expensive. In addition to our own speech commands, the goal is to make them affordable and have that same quality sound other top headphones offer.

Team's Solution

The Minim will be capable of distributing high-quality sound and interaction via speech recognition that other headphones do not provide. It will benefit consumers looking for an inexpensive hands-free alternative.



Renewable Energy Power Pack

Project Participants
Fred Alcindor & Donato Graziano

Instructor
Dr. Ming Zhu

Faculty Advisor
Biswajit Das

Problem Identified

When going outdoors, most available products only utilize one renewable energy source for their power pack. Only utilizing one source can be a disadvantage as it requires that source, such as solar or wind, to be available at that time. Opportunities to recharge the packs are not always reliable or predictable.

Current Solutions

On the market, you can find a wind generator and the solar panel power supply separately. In that case, the customer has the choice to get one or the other. You will need to build the pack yourself if you need to use them both for your own purpose.

Team's Solution

With the “Renewable Energy Power Pack,” customers will have the possibility to use both combinations at their disposal in one pack. The pack has a Small Wind Turbine Generator that starts power production at 8 mph winds and very good prop acceleration for efficient power production. It also has 6V Solar Panel Charger for our 6V 4.5Ah battery, which is the power bank of the project. Its waterproof, rustproof, and dustproof design make it readily available for any storm Mother Nature brings. It is also easy to carry around with you.



Smart Blinds Optimized for Energy Savings

Project Participants

Gonzalo Arteaga, Jeren Dingal, Barry Lasseigne Jr. & Jesse Reek

Instructor

Dr. Ming Zhu

Faculty & Technical Advisor

Dr. Sahjendra Singh

Problem Identified

As the global energy crisis looms, demand for energy saving appliances and features in homes and businesses are in growing demand. Today, there are many commercially available options for reducing energy usage. However, not every aspect of home automation has been effectively brought into the fold. One of the more significant uses of energy in homes is air conditioning and lighting through artificial means. These issues should be at the forefront of energy conserving techniques.

Current Solutions

Our research indicates that there are various solutions in the marketplace for automatic and wirelessly controlled blinds. However, these products typically do not offer feature-rich solutions geared towards energy savings. Additionally, the cost-effectiveness of competitors is limited due to expensive products, averaging over \$150 per window.

Team's Solution

Our concept is to introduce a home appliance that is actively pursuing the most energy efficient operation and apply it to limiting air conditioning and lighting requirements. The window blinds that we are developing will be automatically controlled to optimize energy use in a space by detecting occupants and ambient light levels with an optional manual control. The intent of the design is to build an effective product under \$90, better than current solutions with more environmental considerations. Additionally, we understand that the layout of the room can impact the effectiveness of the occupancy sensor. Therefore, we have chosen to include a wirelessly connected Bluetooth element to allow it to be best located in a space by the user. Lastly, unlike current available options, we aim to have a pay-back period of energy savings less than 18 months.



The LEDActive Controller

Project Participant

Brett Smith

Instructor

Dr. Ming Zhu

Faculty Advisor

Dr. Venkatesan Muthukumar

Problem Identified

LEDs are cheap and plentiful, but good controllers are not. LEDs are not reliably dimmed by lowering the applied voltage and precise current regulation is often cost prohibitive for large LED applications. Because of this, LEDs must be controlled with Pulse Width Modulation (PWM). Very few of the available PWM LED drivers are programmable.

Current Solutions

The market is full of LED controllers, but they generally fall into two categories, cheap controllers that provide only a small set of preprogrammed sequences and decoder style controllers that require a data signal from expensive equipment with complex cable runs. Neither is desirable because they don't allow animated lighting at an affordable price. The EZ-LED will fill this hole in the market.

Team's Solution

There are a few programmable LED controllers available that have a similar feature set to the EZ-LED, but the software provided to program them is very difficult to use. Often these controllers also require the use of external SD cards, a critical component that can be lost and prone to damage when sticking out of the casing. The software for the EZ-LED presents animations to the user in a timeline-based fashion that has proved popular and easy to use in common software today like Logic and Final Cut Pro. This will allow it to be easily synchronized with music to allow experiences that include both audio and visual elements. Multiple effects can be stored on board memory so the EZ-LED can be tucked away without concern.



Wireless Electrocardiogram (ECG) Reader

Project Participants

Jose Barreto, Aaron Escobedo & Aydan Pastor Gagaring

Instructor

Dr. Ming Zhu

Problem Identified

As humans, our health is important. Anything that may help us live longer is an important thing to consider. In the United States, about 610,000 people die of heart disease, 1 in every 4 deaths, and every year 735,000 Americans have heart attacks. Several people are constantly at risk of heart problems, so monitoring heart health at convenient times will become necessary. The signals generated by ECG leads are typically done via a wired system. This can cause dilemmas for people with limited mobility as the wires may become tangled and cause an unnecessary amount of set up from the medical staff.

Current Solutions

There are several current market solutions including LifeSync wireless ECG system, Qardiacore wireless ECG system, KardiaMobile and Smartheartpro wireless ECG system. However, all of these solutions require new systems to operate.

Team's Solution

Our solution will consist of small signal filtering, which accounts for the low and high frequency noise with strategic amplification. The amplification will also allow for high resolution for our ADC converters which will provide our signal that is capable of being transmitted via Bluetooth. Our RF Bluetooth modules will establish our wireless communication channel where they will function in a receiver-transmitter relationship. Then we will display the data on a mini LCD screen. Overall, our solution is designed to work with already implemented systems to make the transition cheaper for patients and medical teams.



DEPARTMENT OF ENTERTAINMENT ENGINEERING & DESIGN PROJECTS

Senior Design Instructor
Dr. Michael Genova

Queue Wizard

Project Participant

Colbee Jones

Instructor

Michael Genova

Problem Identified

The problem that this project will address is the ineffectiveness of current queue systems. Some queues lack flexibility in their layout or require an employee to change the configuration. This can cause the line to overflow out of the queue or create inconsistencies in the flow of the line. These problems can affect the people in line as well as the employees who have to manage the queue.

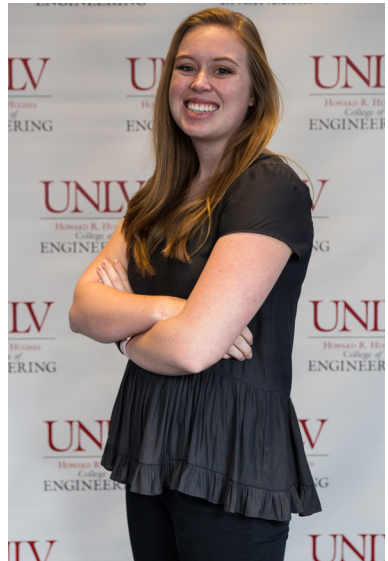
Current Solutions

Current market solutions for queue management include virtual queues and adjustable queue barriers. With virtual queues, a person's place in line is occupied within a virtual system rather than a physical place in a line. With adjustable queue barriers, the layout of the queue has flexibility, but the barriers must be adjusted manually by an employee.

Team's Solution

My solution is better than the current systems because it addresses the consistent line flow and queue overflow issues without compromising the benefits of having a physical queue system. This would allow places to update their current queue system, without changing, to a completely different style as they would have to do with a virtual system.

The Queue Wizard will allow for immediate adjustments to be made to the queue's layout in response to the current amount of people in the line. Since these adjustments will be automatic, the employees will not have to worry about stepping away from their other duties to adjust the barriers into a new layout. This will benefit both the guests in the line as well as the employees.



S.H.E.I.L.A.

Project Participants

Kevin Schern & Rebecca Zahm

Instructor

Michael Genova

Problem Identified

As most of today's music festivals take place in untraditional venues, the bars are made to be temporary. With such unique locations, drink options are limited and the drinks that are available are prepared hastily. Festivals are losing money due to over pouring of the drinks and losing potential customers who do not like the available options.

Current Solutions

At today's music festivals, bars are typically tents that can be easily set up and taken down, with the drinks being prepared on a fold-up table. The drinks are kept in large tubs of ice, which works if the drinks are there for at least a couple of hours. Most of the time, during peak hours, the drinks are only on ice for a few minutes. Lastly, the drink menu usually consists of 2-3 types of liquor, 2-3 types of mixers (i.e. Coca-Cola, Redbull), and one type of beer.

Team's Solution

Our solution is to take the location of the drink preparation slightly "off location" and have the drinks delivered to the festival grounds via a suspended delivery system. Our primary focus is on the very popular Electric Daisy Carnival (EDC) that has been held at the Las Vegas Motor Speedway for the past seven years. The drinks would be prepared at the concession stands (where electricity and plumbing are already installed) located above the festival grounds within the seated stands. The drinks would then be delivered via S.H.E.I.L.A (Suspended High-Speed Elevated Inclined Libation Apparatus). This improved solution would allow the drinks to be made in a controlled environment, away from noise on festival grounds, and increase the quality of the drinks including the reduction of over pouring. Since concession stands are already set up with electricity and plumbing, a larger range of options of alcohol can be provided to the guests.

Finally, if the drinks are being prepared away from the festival grounds, a smaller footprint is needed for guests to order, pay, and receive their drinks and thus allow more room for stages, games, or other forms of entertainment. Our improved solution would benefit the guests as they would be receiving better quality and range of drinks, as well as benefit the festival company as they can make a larger profit on the increase of drink orders and utilize the extra space on the festival ground.



Sweat Stories

Project Participant

Emily Kistler

Instructor

Michael Genova

Problem Identified

According to a 2013 study performed by the CDC, nearly 80% of American adults are not getting the recommended amount of exercise each week. Our children are not doing much better with only one in three children being physically active every day. One of the many excuses people give for not working out is lack of interest. The average person does not find joy in spending hours on the treadmill or doing squats in front of a mirror.

Current Solutions

To rectify this problem, some companies have developed apps to try to bring an entertainment aspect to working out. Most of these apps have narrowed in on only one type of exercise—running. Apps like Zombies, Run! or BattleSuit Runner Fitness are currently the leaders in the entertainment workout app market. Both attempt to create immersive stories that the exerciser listens to while running and interacts with, at times, by either slowing down or speeding up their jog.

Team's Solution

Sweat Stories is a fun and interactive workout adventure that can be done at home. It utilizes high intensity intervals and strength training, both of which have been proven to be more effective at improving fitness and losing weight than traditional long slow runs promoted by apps currently on the market. Sweat Stories is also more interactive and immerse than anything else being used right now.

INTERDISCIPLINARY PROJECTS

Bin-Bot

Project Participants

Domerica Devora, Preston Donovan, Jeremy Morgan & Saulo Valdivia-Leos

Instructors

Dr. Ming Zhu
& Dr. Zhiyong Wang

Faculty Advisors

Dr. Ming Zhu
& Dr. Thomas Hartmann

Problem Identified

The problem we are looking to solve is the cleaning of kitchens regarding the disposal of waste. When cleaning waste, multiple tools are required such as a vacuum, broom, dustpan, trashcan, etc. We are looking to consolidate these tools into a product that can easily do-away with waste that will be easier, and also save time.

Current Solutions

Current tools for the kitchen that make it easier for the disposal of dropped waste are in-wall vacuums, but these require you to move the waste close to the wall. Currently, there is nothing that will move towards the problem or aid in the prevention of future messes. Additionally, in-wall vacuums have to be emptied separately from a regular in-home trashcan, causing another chore for the user.

Team's Solution

Our product will help dispose of waste in the kitchen in a way that is easier than using a vacuum or dustpan. It will aid in the prevention of future messes and save time in the cleaning of a kitchen. Our product consolidates the use of a vacuum into a home trashcan. When cleaning messes, such as spilled cereal or broken glass and plates, we first need to clean the large shards by disposing of them into a trashcan with a dustpan. Then, one must pick up the smaller pieces with a vacuum. This wastes time as one must use three tools and clean each one separately. Our product can dispose of any waste by feeding a suction system directly into a trashcan, eliminating the need to empty a vacuum, and saving time in the cleaning process. Our product has the additional ability to autonomously move to any mess in the kitchen with voice activation. If someone has a drippy chicken carcass at their sink, instead of having to carry the waste all the way to the trashcan, the trashcan will come to you.



DEPARTMENT OF MECHANICAL ENGINEERING PROJECTS

Department Chair
Dr. Brendan O'Toole

Senior Design Instructor
Dr. Zhiyong Wang

ASTRET

Project Participants

Nikki-Ann Bosque & Dennis Nikitav

Instructor

Dr. Zhiyong Wang

Community Advisor

Dr. Francisco Silva

Technical Advisors

Dr. Alexander Barzilov, Dr. William Culbreth & Dr. Yi-Tung Chen

Problem Identified

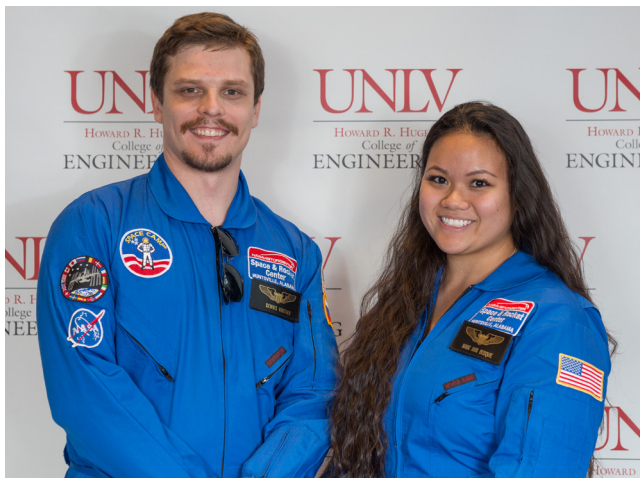
Current vehicles that access Earth's orbit are very heavy, large, inefficient, highly expensive, and often require loss of hardware (i.e. rocket stages). These vehicles currently include standard rockets and SpaceX's reusable rockets.

Current Solutions

Although SpaceX has solved part of the problem of losing expensive hardware by recovering the first stage of its rockets, its second stage is still lost in orbit. The turnaround time for certifying the recovered first stage also takes several months.

Team's Solution

ASTRET (Air and Space Thermal Rocket Engine with Turbojet) will change the way that we access orbit by reverting back to planes. In this case, a spaceplane will be used. Without having to strap an orbiter vehicle to a rocket (like the space shuttle), a spaceplane utilizing ASTRET will be able to take off and land like an airplane without the loss of ANY hardware. This results in highly reduced costs which primarily benefit the aerospace industry and the military. In fact, the costs are reduced so much that a spaceplane utilizing ASTRET also allows civilians to enjoy the view of our planet from orbit, bringing them closer to the heavens than ever before!



Automated Balloon Kiosk

Project Participant

Justin Tran

Instructor

Dr. Zhiyong Wang

Faculty Advisor

Dr. Woosoon Yim

Problem Identified

Purchasing helium balloons is inconvenient and time consuming. Many large supermarket and grocery chains do not offer helium balloon services. When they do, selection and quality is poor. Party stores will often require customers to pre-order their balloons. These shortfalls mean that customers end up not purchasing balloons even when they would like to.

Current Solutions

Customers can purchase balloons from grocery stores, but they have to find a store associate trained to fill their balloons. Another solution is party stores, but they are out of the way and require pre-orders. Another current solution is for customers to purchase their own helium tank, but this is inconvenient and more expensive.

Team's Solution

Our solution is to create a 'Redbox' for balloons. This automated helium balloon kiosk can be placed in common shopping locations. This will make purchasing balloons fast and convenient. It also allows the possibility for customers to see the available balloons and order them before arriving to the kiosk. This also benefits the stores because it means they don't have to spend money on training associates and offer a greater shopping experience for their customers. This will benefit parents who want to buy balloons for their kid's parties but are too busy to use current solutions.



Cam-O-Lock

Project Participants

Dustin Burd, Richard Hadden Wilkens & Eljabari Khalid

Instructor

Dr. Zhiyong Wang

Faculty Advisor

Dr. Thomas Hartmann

Problem Identified

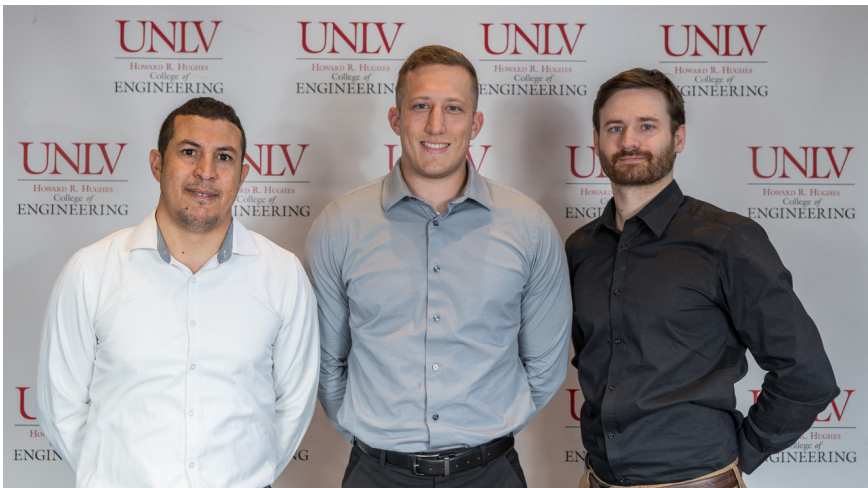
When rock climbing there is an abundance of tools needed to conquer a mountain. This can be cumbersome. The cracks in the rock come in different shapes and sizes, so different size rock climbing cams are needed. These cams wear over time and must be bought as a whole versus changing a part out.

Current Solutions

Special cams with extra joints are used to fit in different size cracks. There are cams with composite material to make them lighter.

Team's Solution

The goal is to create easily interchangeable parts. Changing worn or broken parts will be possible. The different size cam lobes could change with respect to the size of the crack. Using composite material as the stem will make the product lighter compared to the steel counterparts while keeping the strength properties. Locking capability will help to reduce snagging when climbing. These features will benefit the casual climber who does not want to break the bank buying different cams.



Knee Implant

Project Participants

Karl Michael J. Castillo, Emily Decker & Arrel Frederick Dy

Instructor & Faculty Advisor

Dr. Zhiyong Wang

Technical Advisor

Maria Ramos

Problem Identified

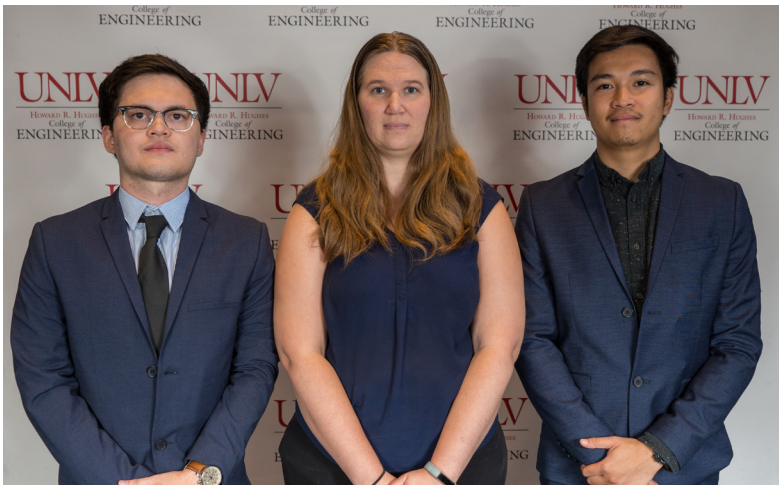
The knee meniscus helps to protect and cushion the knee joint. Throughout a person's life, the meniscus undergoes wear and cannot repair itself. Torn menisci and menisci wear lead to knee pain and decreased physical activity.

Current Solutions

Depending on the severity of the tear, the current treatment options are surgery or physical therapy. The current surgical treatments are a meniscectomy, where the meniscus is removed, or a total knee replacement, where the entire knee is replaced.

Team's Solution

Our solution is to create a 3D-printed mold and inject a biostable material (Chronoflex AR) into the mold to create a knee implant that would protect the knee. The implant can then replace the meniscus after a meniscectomy. It would cushion the knee and dissipate the forces in the knee to protect the joint from further damage. It can lower the likelihood of needing a total knee replacement, allowing the healthy bone to stay in the knee.



Knee Join Simulator

Project Participants

Kathryn Cuento & Alexander Hopper

Instructor

Dr. Zhiyong Wang

Problem Identified

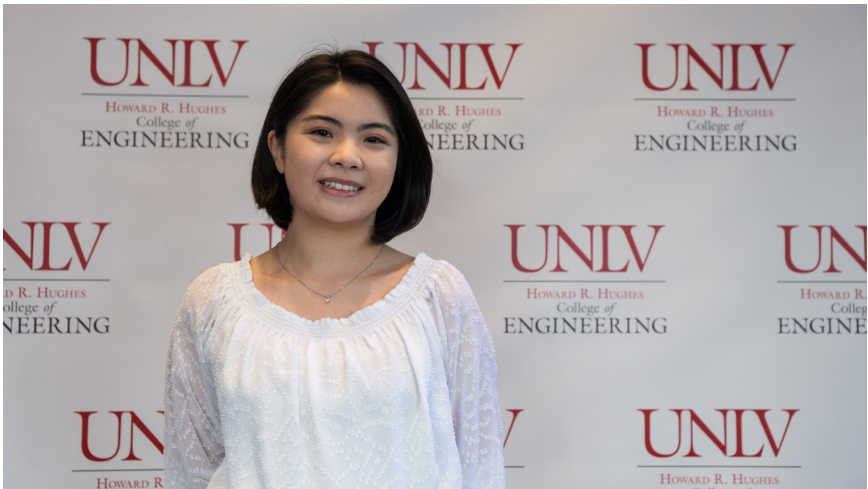
Total knee replacement surgery is a significant undertaking. A testing platform is needed to conduct abrasion testing on biomaterials being explored for alternative knee surgery methods.

Current Solutions

There are services that do provide joint testing, such as AMTI Force and Motion, Orthopedic Innovation Center and Endo Lab. Test standards vary from company to company.

Team's Solution

Our solution focuses on the fundamental research of biomaterial abrasion testing as the first step towards developing an alternative to total knee replacement surgery. The testing goals allow for a simpler approach to machine design, significantly reducing cost. On top of that, testing can be done “in-house” and therefore does not require a professional technician to conduct a simple process. This can also allow for other universities and companies to perform research in this field since the apparatus is inexpensive compared to similar products on the market.



Motorcycle Black Box

Project Participants

Nir Herscovici & Francois Van Wynsberghe

Instructor

Dr. Zhiyong Wang

Faculty & Technical Advisor

Dr. Alexander Barzilov

Problem Identified

Too many individuals experience motorcycle accidents and the fault is difficult to assess. Insurance claims become complicated because there is no real-time videography to prove someone at fault.

Current Solutions

There is currently no solution to this market. Insurances claim fault based on the dynamic of the accident, however, it is well proven that generalizing accidents result in claims that are simply wrong.

Team's Solution

Motorcycle Black Box is an excellent solution because it is a device that allows for real-time videography of the accident moments before the actual accident occurs. A sensor monitors incoming vehicles and their behavior. When a vehicle is behaving aggressively, and a potential accident is discerned, a video camera is triggered and stored in the internals of the box where it is kept safe even after an accident.



MTN Security Hinge

Project Participants

Mark Bongolan, Connor Neilsen & Hidero Takagi

Instructor

Dr. Zhiyong Wang

Faculty Advisor

Dr. Thomas Hartmann

Problem Identified

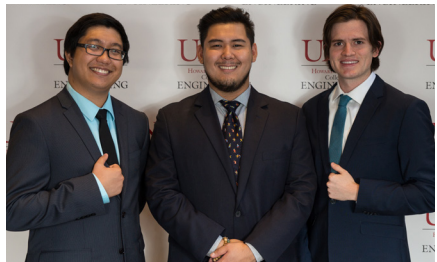
Home safety and security are two essentials for living a comfortable life. Today, criminals are making a career out of burglarizing homes and apartments. The standard deadbolt is not always effective as career criminals break into homes by breaking the deadbolt with targeted kicks to the small surface area. Home security alarm systems are costly and not always available to apartment tenants and low-income housing. While they alert the authorities, they do not always prevent break-ins.

Current Solutions

The most widespread solutions on the market involve replacing the pre-installed deadbolt with a stronger and more expensive deadbolt along with thicker and more robust screws. In addition to replacing the deadbolt, there is a product similar to one used in the Middle Ages that goes across the door to prevent it from opening. Another solution is a doormat-like attachment that is placed near the bottom of the door to prevent break-ins. These current solutions are cumbersome, easily tampered with and targeted, not user-friendly, and may cause wear and damage to the door.

Team's Solution

To address the growing problem of burglaries and home invasions, we came up with a unique and effective solution to physically prevent criminals from breaking and entering. Our product, the MTN Security Hinge, is a mechanical door locking mechanism to build upon the universal door hinge. The product utilizes the hinge itself but uses a custom pin that will allow the locking mechanism to be housed and mounted on most standard doors. Our team's target market are apartment and home tenants, which is why we wanted to create a security device on the door that does not involve any permanent modifications or damage to the rented space through the use of screws or extra holes in the wall. Our product provides an added layer of security at a low one-time cost and should prevent home invasions and burglaries even when the deadbolt fails. The product is designed to be easily assembled by the customer, user friendly, concealed from outside perpetrators, and able to withstand attempted break-ins.



Muon Detector

Project Participants

Getachew Ashenafi, Christian Dresch & Jarett Sullivan

Instructor

Dr. Zhiyong Wang

Faculty Advisor

Dr. Ke-Xun Sun

Problem Identified

The illegal movement of radioactive materials within and across the border is a main concern for national security. Cargos can be setup to conceal high density nuclear materials from detection at checkpoints.

Current Solutions

A company called Decision Sciences is currently the leading manufacturer of applied muon detection systems that primarily use drift tubes. The only advantage in using drift tube detectors is their cost effectiveness when scanning large volumes. Otherwise, the technology is hardly accessible and too bulky to adapt to new applications. In addition, accurate tracking of muon particles requires the implementation of complex algorithms.

Team's Solution

Currently, there are two models of muon detection being implemented for research. The first model, which uses drift tubes, is large and impractical for field use. Also, the technology is difficult to integrate into new applications. The second model was first launched by MIT with the intention of being portable and practical for field use. However, the design consisted of a single photomultiplier which limits its scope of detection. The team will take MIT's design a step further and attempt to create a hand-held detector capable of broader reading as muons pass through it. With these readings, the trajectory of a muon can be mapped out. This advancement will allow the detector to be both portable and practical. Potential applications will benefit archaeological, national security, and geographical sectors.



Optic Fiber Manipulator

Project Participants

Robert Bulan, Mark Moretto II & Alexis Sanchez

Instructor

Dr. Zhiyong Wang

Faculty Advisor

Terry Kell

Technical Advisor

Dr. Ke-Xun Sun

Problem Identified

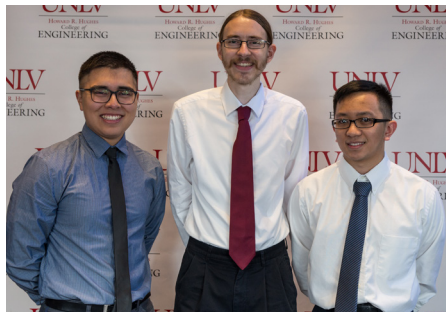
Currently, very little research has been done on the effects that simultaneous mechanical deformations have on the output light signal of an optical fiber. The goal of the project is to create a manipulator system that can simultaneously and independently put an optical fiber in the mechanical deformations of tension, bending, and torsion with high-level precision. The effects that these deformations have on the output light signal will be studied in order to further research the field of fiber optics.

Current Solutions

While there are existing products that specifically test the individual mechanical properties of optical fibers, these devices are often single purpose devices, quite large in size, expensive, and not directly designed for output signal measurement. Nevertheless, there are companies such as Thorlabs that manufacture optical equipment as “building blocks” for larger optical systems. Many of these products—if adapted properly—could be used in conjunction with each other to achieve the project’s desired mechanical deformations and output signal measurements.

Team's Solution

By combining existing products as well as designing custom parts, the team has created a relatively compact and inexpensive fiber optic manipulator system that is quite modular. Each mechanical deformation is a separate subsystem which enables the freedom to expand or rearrange the manipulator system. The incorporation of existing products means separate experiments can be conducted using components of the manipulator system. The experimental data gained using this manipulator device will benefit the optics field and the knowledge gained could lead to developments in photonics and its applications in subfields such as telecommunications, medical devices, and sensor technology.



Railway Corrosion Prevention

Project Participants

Kyle Randall, Connor Turpin & Andrew Walton

Instructor

Dr. Zhiyong Wang

Faculty & Technical Advisor

Dr. Hualiang Teng

Problem Identified

Many parts of the railroad assembly that secure the rail track to the railroad tie are not afforded any protection from the environment—namely rust protection.

Current Solutions

Currently, some manufacturers offer galvanized parts for pieces of the railroad assembly that experience high stresses. Other high-performance rust protection technologies are rarely offered, and even more rarely chosen for installation due to contractors being unfamiliar with those technologies.

Team's Solution

This project identifies and tests different zinc coatings/protectations. The goal is to highlight how the performances of older versus newer zinc protections compare. It is expected that newer zinc diffusion technologies will outperform older galvanization/electroplating technologies. This project could bring awareness to railroad contractors or owners about newer, more efficient zinc protections. Railroad owners stand to receive the greatest benefit. Maintenance costs would be reduced by experiencing fewer failures over time due to rust and a railroad contractor might offer greater protection of the railroad assembly to gain a competitive edge during bidding.



Shock ‘N Awe

Project Participants

Dorian Diaz-Banuelos, Austin Grooms, Apolonio Roblero & Anthony Tully

Instructor

Dr. Zhiyong Wang

Technical Advisor

Terry Kell

Community Advisor

James Delisse

Problem Identified

A cheaper alternative for aftermarket adjustable shock absorbers is not currently on the market. Price is always a factor when making purchases.

Current Solutions

The adjustable shocks available on the market are expensive compared to regular stock shocks. A needle and hole adjustable method and an external reservoir solution are currently available, but they are also expensive alternatives.

Team's Solution

Our solution is to simplify the complex designs of current single adjustable shock absorbers, reducing the price, while allowing for an adjustable range for their application. The design allows for the consumer to fine tune their shock due to the high resolution design.



Spot Buddy

Project Participants

Brylle Egil Magbanua, Edgar Matienzo & Jordyn Penniman

Instructor

Dr. Zhiyong Wang

Faculty Advisor

Miles Boulton

Technical Advisor

Dr. William Culbreth

Problem Identified

In a gym, a human spotter is required when performing a Bench Press exercise. There is no equipment that allows for a free-range Bench Press exercise while protecting the user.

Current Solutions

There are machines that allow for similar exercises, but none provide free range of motion.

Team's Solution

Our solution is to design a system that will attach to existing Bench Press bars and lock when detecting the bar falling, thus protecting the user from injury/death. Current solutions include machines that limit the range of motion of the workout. Our design will allow using the equipment without obstructing the workout and only engage in an emergency. This will benefit gym goers, as well as people working out at home who do not have access to an extra person ("spotter").



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