48th Annual Senior Design Conference

Engineering with a Mission

May 10, 2018
Dear students, alumni, parents, partners, and friends,

Welcome to the 48th Annual Senior Design Conference. We are delighted to have you with us for this exhibition of our students’ work.

At the School of Engineering, our goal is to transform students’ lives through distinctive engineering education that reflects both our Jesuit, Catholic tradition and Silicon Valley’s innovative, entrepreneurial ethos. We aspire to educate engineers who advance technological innovation and entrepreneurship in the service of humanity. Today’s presentations showcase the hands-on, practical experience and theoretical learning that enables our students to graduate with the knowledge, skills, and vision necessary to make a difference in their communities and in the world.

Through a wide range of capstone projects—everything from a 3D printed robotic hand to cryptographic technologies for secure digital voting and a sustainable aquaponic farming system—our students have spent their senior year applying their knowledge to complex problems for the benefit of society, putting theory into practice while working collaboratively.

As we prepare to break ground on the new state of the art home of the School of Engineering, the Sobrato Campus for Discovery and Innovation, we are mindful of the ever-growing community of Bronco engineers who bring distinction to Santa Clara University. We congratulate our seniors for bringing their projects to fruition, and we thank those of you who have contributed to their success and to that of the School of Engineering.

Sincerely,

Alfonso (Al) Ortega, Ph.D., Dean
School of Engineering
PROGRAM SCHEDULE
Thursday, May 10, 2018

12–1:30 p.m.  
**Judges’ Registration**  
California Mission Room, Benson Center

12:30 p.m.   
**Judges’ Lunch and State of the School Address**  
Alfonso Ortega, Dean  
*School of Engineering*  
California Mission Room, Benson Center

1:45 p.m.   
**Judges’ Welcome and Orientation**  
Alfonso Ortega, Dean  
*School of Engineering*

Ruth Davis, Associate Dean of Undergraduate Studies  
*School of Engineering*  
California Mission Room, Benson Center

2:10–5:30 p.m.   
**Senior Design Presentations**  
Benson Center, Engineering Center, The Harrington Learning Commons and Orradre Library, Vari Hall

5 p.m.   
**Project Demonstrations**  
Engineering Quad

6 p.m.   
**Dinner**  
Locatelli Student Activity Center

*Due to space constraints, this event is open only to Conference judges and invited guests.*
MilkGuard: A Low-Cost Paper-Based Sensor to Detect the Presence of E. Coli in Donated Human Breast Milk
2:15 – 2:45
Nicholas Kikuchi, Margaret May, Matthew Zweber
ADVISORS: UNYOUNG (ASHLEY) KIM, MARYAM MOBED-MIREMADI, MICHELE PARKER

Our device utilizes an enzyme-substrate, colorimetric assay on a paper-based platform to detect the presence of E.coli in donated human breast milk. The project aims to reduce the cost and time of traditional bacterial detection methods in human breast milk banks.

Modifying Pore Size of Alginate Microcapsules While Maintaining Structural Integrity
2:50 – 3:20
Andrea Filler, Jordan Levine, Jerard Madamba, Natalie Ploof
ADVISOR: MARYAM MOBED-MIREMADI

Alginate hydrogels provide desirable biocompatibility and material properties for various biomedical applications but are limited by the polymer’s natural pore size. This project aims to develop a methodology to increase the pore size of alginate-based hydrogels in a predictable manner without compromising their structural integrity.

3D Printed Hollow Microneedles for Transdermal Delivery of Encapsulated Cells
3:30 – 4:00
Chantell Farias, Cecilia Hemingway, Roman Lyman
ADVISOR: MARYAM MOBED-MIREMADI

Our goal is to develop a functioning hollow microneedle prototype utilizing 3D printing to create a robust, reusable device. By encapsulating cells in a structured 3D matrix and delivering them through hollow microneedles, we propose a method targeted to resist shear degradation and conducive to sustained viability in the epidermis.

Hands-Free Wearable Crutch
2:15 – 2:45
Cooper Schwabe, Marcus Kraus, TK Wasserman
ADVISOR: PRASHANTH ASURI

Traditional crutches are a physically demanding, uncomfortable, and inconvenient means of getting around with a lower-leg injury. We propose a hands-free crutch that will attach only to the leg, increasing maneuverability while preserving natural walking mechanics. Our product aims to be more customizable, comfortable and affordable than current hands-free solutions.
Active Auxetic Heel Support for Achilles Tendon Therapy
2:50 – 3:20
Anna Hinrichs, Kseniya Malukhina, Ishaan Sharma, Micaela Vierra
ADVISOR: EMRE ARACI
We are designing a force-activated support for Achilles tendinitis. It will include metamaterials that will not compress when force is applied, allowing the individual to be active and participate in daily activities without further injury.

Health.ai—A Clinical Framework for Adaptive, Transparent Diagnostics by Artificial Intelligence Systems
3:30 – 3:55
Randol Spaulding
ADVISOR: YULING YAN
“health.ai” is a doctor’s machine learning interface for precision medical diagnostics. Empowered by an Inception v3 neural network trained on 13,757 images of malignant and benign melanocytic skin lesions, health.ai provides a scalable workflow for physicians to both utilize and interpret AI for consultation.

CERVIS: Cervical Cancer Early Response Visual Identification System
4:05 – 4:35
Evangelia Bouzos, Ivy Fernandes, Marina Predovic
ADVISORS: PRASHANTH ASURI, MICHELE PARKER
CERVIS is a cervical cancer diagnostic developed for use in low resource settings. Our device screens for biomarkers in the urine and provides a simple colorimetric readout that helps diagnose cervical cancer and distinguish it from the human papillomavirus infection.

Skin Graft Expansion Device
4:45 – 5:15
Maggie Alt, Josée Fournier, Madeline Krenek, Will Paton
ADVISORS: PRASHANTH ASURI, MICHELE PARKER
Skin graft meshers enable the expansion of graft surface area for the treatment of severe burns. However, current devices are expensive and time consuming. We aim to design an affordable, modular, and autoclavable meshing device that improves the overall success and quality of treatments in both high- and low-resource settings.

Engineering a Molecular Missile for Pancreatic Cancer Detection
2:15 – 2:40
Esther Bartlett, Sophia Castillo
ADVISOR: ZHIWEN (JONATHAN) ZHANG
Through the site-specific incorporation of an unnatural amino acid, we are engineering a peptide that binds to a pancreatic cancer biomarker with strength comparable to a monoclonal antibody. By targeting a sugar molecule, we will expand the potential diagnostic and therapeutic applications of this cost-effective, stable, and ethical modular design.
Engineering Synthetic Antibody for Prostate Cancer Detection
2:50 – 3:20

Kimberley Gonzalez, Tatum Prosswimmer, Cassandra Stawicki

ADVISOR: ZHIWEN (JONATHAN) ZHANG

Monoclonal antibodies, a standard in therapeutics and diagnostics, present ethical and economic challenges. Synthetic antibodies have potential to circumvent these challenges, allowing cost-effective, scalable production using E. Coli. We are engineering and quantifying the binding activity of a synthetic antibody for prostate cancer detection to improve current diagnostic techniques.

Development of a Stable Cell Line for the Production of Hematopoietic Stem Cell Targeted Exosomes
3:30 – 3:55

Anja Beard, Zach Ehlinger

ADVISOR: BILL LU

Current drug delivery systems face a broad range of limitations that can be effectively overcome with exosomes, naturally occurring nanovesicles. Using these nanovesicles tagged with the RD114 protein, we aim to develop a drug delivery system that is specific to hematopoietic stem cells.

Engineered Living Nanoparticles for the Treatment of Inflammatory Diseases
4:05 – 4:35

Annie Brown, Alex Campanelli, Adarsh Tantry

ADVISORS: BILL LU, JACQUELYN HENDRICKS

Rheumatoid arthritis is a painful autoimmune disease that results in inflammation of the synovium of the joints. Unfortunately, current treatments for the disease have significant drawbacks. Our project focuses on engineering TNF-receptors (TNFR) onto the surface of exosomes as a novel anti-inflammatory treatment.

Production of Leukemia Targeting Exosomes in Human Cells Using Integrative Technology
4:45 – 5:15

Peter Mitchell, Michael Pierotti, Matthew Piro

ADVISOR: BILL LU

Our project uses human cells to produce extracellular vesicles known as exosomes. These exosomes are engineered with CAR-T, a surface protein proven to bind to leukemia cells.
CIVIL ENGINEERING SESSION 1
Bannan Engineering 325

Cob: A Sustainable Building Material
2:15 – 2:45
Daniel Eberhard, Joseph Novara, Brandon Popovec
ADVISORS: MARK ASCHHEIM, TONYA NILSSON
Cob, a sustainable building material, has gained popularity due to its low costs and low environmental impact. This project tests the capabilities of the material through large-scale wall testing as well as small-scale sample testing.

Cob Property Analysis
2:50 – 3:20
Gabi Brunello, Jose Espinoza, Alexandra Golitz
ADVISORS: MARK ASCHHEIM, TONYA NILSSON
The goal of this project is to work alongside the Cob Research Institute to help facilitate the use of cob in the United States building code. Cob structures are needed in today’s society because they are relatively inexpensive and ecofriendly.

Analysis of Structural Components During Cyclical Loading of Steel Reinforced Earthbag Construction
3:30 – 4:00
Emil Huebner-Schurch, Ethan Jensen, Noah Strong
ADVISORS: MARK ASCHHEIM, TONYA NILSSON
We present a pilot method for coupling reinforcing steel in earthbag wall construction. Benefits of earthbag wall construction include use of alternative building materials, frugal cost, and ease of construction. The goal of the project is to establish predictable structural standards for eventual inclusion in residential building code.

Cyclic Testing of Reinforced Earthbag Walls
4:05 – 4:35
David Aguilar Rodriguez, Taylor Darby, Jeffrey Stein
ADVISORS: MARK ASCHHEIM, TONYA NILSSON
We present the design, construction, and testing of earthbag walls for earthquake resistance properties to support research and advance inclusion of this frugal construction method in building codes. The project required comprehensive long-term planning, designing lab tests to validate field observations, and the design of wall base, reinforcement, and connections.

Charney Hall Redesign Using Cross-Laminated Timber
4:45 – 5:15
Andrew Callens, Lauren Tetrev, Joy Yusufzai
ADVISOR: REYNAUD SERRETTE
This project involves redesigning Charney Hall at Santa Clara University using Cross-Laminated Timber as the primary material. Our goal is to demonstrate that this material can replace steel and concrete in larger structures, which is desirable because CLT weighs significantly less and requires much less water and energy to produce.
CIVIL ENGINEERING SESSION 2
Bannan Engineering 106

Design of a Green Community
2:15 – 2:40
Steven Ashe, Emelia Hamilton
ADVISOR: RACHEL HE
Our project consists of the design and analysis of a mixed use, green community near downtown San Jose. The goal is to create a healthy and enjoyable space that brings a community together and integrates sustainable practices benefiting the environment.

Rainwater Capture and Purification System for Rural Tanzania
2:50 – 3:20
Audrey Gozali, Nathan Miyashiro, Matthew Sasaki
ADVISORS: LAURA DOYLE, EDWIN MAURER
We designed a rainwater capture and purification system for a rural village located in the Buturi region of Tanzania. The project includes designs for gutters, ferroconcrete storage tank, and slow sand filter. The design team addresses the needs of the villagers by working with the nonprofit organization, The Buturi Project.

Climate Smart Farming in East Africa
3:30 – 3:55
Lauren Oliver, Cristina Whitworth
ADVISOR: LAURA DOYLE
We are working with the nonprofit organization, Collaborative Enterprise Exchange, to design and implement a climate smart farming system in rural Uganda. This sustainable system, which will include an aquaponic system for growing vegetables and raising fish, will allow the women to provide for their families and increase their monthly income.

SCU Main Parking Garage Redesign
4:05 – 4:35
Katherine Cooke, Kevin Kestekyan, Daniel Kimoto, Dean Ricasa
ADVISORS: RACHEL HE, REYNAUD SERRETTE
The objective of this project is to address the increasing need for parking at Santa Clara University. This project includes an analysis of transportation and structural elements in order to redesign the current parking structure near the main entrance of campus. Our proposed parking garage will improve efficiency and sustainability.

Redesign of the I680/SR262 Interchange in Fremont, California
4:45 – 5:10
Melissa Elian
ADVISORS: RACHEL HE, HISHAM SAID
Due to the boom of the Silicon Valley, traffic volumes for the I-680/SR-262 interchange have increased beyond the capacity of the existing four cloverleaf design. The goal is to redesign to increase the level of service with a cost-effective, sustainable, and durable solution.
COMPUTER ENGINEERING
SESSION 1
Sullivan Engineering 618

SpotMe Emergency Locator Service
2:15 – 2:45
Kunal Bhimjiyani, Arya Faili, Zain Umerani
ADVISOR: SILVIA FIGUEIRA
During or after a disaster, people are sometimes stranded and need help to be found. We are developing a system through which stranded people can ask for help and rescuers can locate them.

Menstruation Education for Rural Africa
2:50 – 3:20
Sarah Pagnani, Kelsey Pasco, Sarek Sotelo Jimenez, Brandon Smith
ADVISOR: SILVIA FIGUEIRA
Our goal is to create an Android application aimed at teaching young Kenyan women about women’s health, specifically menstruation. Our intention is to eradicate the stigma associated with menstruation as well as to provide women with resources so that they can be better equipped to handle the challenges of menstruation.

Virtual Museum for NACHA
3:30 – 3:55
Sonali Chaudhry, Alisa Hawthorne
ADVISOR: SILVIA FIGUEIRA
Art and knowledge from the country of Cameroon is in danger of being lost due to political unrest and poor artifact conservation. To prevent this, we are creating a website where people all over the world will be able to view the unique culture of the Nso people of Cameroon.

Communication System for Firefighters
4:05 – 4:35
Steven Booth, Nick Goodpaster, John-Paul Hurley, Griffin Moede
ADVISOR: SILVIA FIGUEIRA
We present a web application on Android devices for first-responders to communicate with their team and compile on-site media. The application aims to increase the efficiency and accuracy of report generation for teams of first-responders.

Diagnostic Color Strip Reader for World Health Partners Clinics
4:45 – 5:15
Steven Hu, Jisoo Park, Geminiano Yabut
ADVISOR: SILVIA FIGUEIRA
We are creating an application designed to read and analyze fluid color strips and return medical results and diagnostics.
Honest Housemate: Smart Household Management
3:30 – 3:55
Brian Cox, Ian Richard
ADVISOR: YI FANG
We are building a customer-facing application with a smart backend that will allow shared-rent households to easily communicate, split expenses and keep their house organized. Additionally, our smart backend will automatically suggest new tasks, and assign housemates to complete the tasks based on previous history.

Symptom Search
2:50 – 3:20
Isabela Figueira, Neesha Godbole, Angelina Poole, Kelly Wesley
ADVISOR: YI FANG
Symptom Search is a web-based application that uses FDA Adverse Effects Report data and machine learning to allow users to search for the root causes of their symptoms. Our system suggests products that could be triggering symptoms or reactions based on users’ interactions with the products.

Perfect Snap
4:05 – 4:35
Manoj Adhikari, Colby Harper, Sean Karstein
ADVISOR: YI FANG
Perfect Snap is an iPhone application that automates the process of photo capturing. This is accomplished with a machine learning model that analyzes the camera feed for facial features and automatically captures a photo at the opportune moment.

Kollab
4:45 – 5:15
Chloe de Guzman, Deion Graham-Long, Tasmine Hackson, Gabrielle Tordillos
ADVISOR: YI FANG
In today’s world, artists strive to work independently of record labels, agencies, etc., but lack the resources and connections to be successful. Kollab is a platform that not only helps artists find others to collaborate with, but also allows artists to gain more recognition through upfront accreditation.
COMPUTER ENGINEERING  
SESSION 3  
Sullivan Engineering 605

Sherlock: A Virtual Reality Crime Scene Reconstructor  
2:15 – 2:40  
Ellen Tseng, Ken Wakaba  
ADVISOR: DARREN ATKINSON

We are developing a VR crime scene reconstructor to tackle the issue CSI teams face of not having enough time to process the evidence taken. It enables the user to construct the scene piece by piece, allowing the user to visit the scene at a later time.

SCU Events  
2:50 – 3:15  
Kellen Bryan, Dan Mayer  
ADVISOR: DARREN ATKINSON

We are attempting to overhaul the current event registration process as well as the current UI for the Santa Clara University events calendar.

SCU Evals  
3:30 – 3:55  
Fredrik Blomqvist, Joseph Theberge  
ADVISOR: DARREN ATKINSON

We present a web application that allows verified SCU students to evaluate different aspects of courses and professors at SCU in a modern and easy-to-understand fashion.

Pet Watch  
4:05 – 4:30  
JB Anderson, Rachel Hale  
ADVISOR: DARREN ATKINSON

The Pet Watch is a collar designed to monitor a pet’s health and activity throughout the day, allowing owners to better provide for their pet’s unique needs.

Click: Social Scheduling App  
4:45 – 5:10  
Benjamin Button, Phi Lam  
ADVISOR: DARREN ATKINSON

Our project is a mobile application designed to make it easier and less stressful to schedule casual hang-outs with friends via secure schedule sharing.
vPlot—Data Visualization in Virtual Reality
2:15 – 2:45
Dante Dalla Gasperina, Kush Mahajani, Alex Martin, Collin Walther
ADVISORS: AHMED AMER, CHRISTOPHER KITTS
Current data visualization software can be ill suited for visualization of many-featured data due to lack of customization. We are designing a system that allows users to interact with real-time streaming data in a virtual reality environment.

PresentVR
2:50 – 3:20
Hamilton Coke, Reece Jackson, Gurneev Sareen
ADVISOR: AHMED AMER
Public speaking is often cited as one of individuals’ most common fears. Our solution uses virtual reality to place the user in front of an audience in a realistic environment. This allows the user to combat anxiety and, through practice, overcome any associated fear.

VR Parental Empathy Training Tool
3:30 – 3:55
Lok Tung (Helen) Chan, Zheqing Li
ADVISORS: AHMED AMER, BARBARA BURNS
Parental empathy is crucial for a child’s development and family relationships. Our project will allow parents to interact with a VR child and experience situations from the child’s perspective as training to empathize with their children and to stay calm when children are emotional.

Authenticated Authorship
4:05 – 4:35
Stephen Chuang, Andrew Leonard, Mikhail Smelik
ADVISOR: AHMED AMER
Authenticated Authorship seeks to authenticate the authorship of messages, increasing users’ trust of the internet. They specifically seek to tackle falsified journalism, yet build a system that can be used across sectors and mediums.

Pipeworks: An Out-of-the-Box Pipeline to Manage Computer Graphics Productions and Streamline Digital Content Creation
4:45 – 5:10
Bryson Lee
ADVISOR: AHMED AMER
Computer Graphics (CG) digital art projects (including 3D Animation, Visual Effects, and Cinematics), have highlighted the technical and logistical difficulties associated with creating professional CG content. Pipeworks is a suite of technologies that solves these issues by providing teams a comprehensive, out-of-the-box, and modular tool set to streamline CG production.
**COMPUTER ENGINEERING SESSION 5**  
Bannan Engineering 101

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**Applying Blockchain Technologies to Digital Voting Algorithms**  
2:15 – 2:45  
**Vishanth Iyer, Nathan Kerr, Justin Meeken, Alexander Seto**  
**ADVISOR: YUHONG LIU**

Voting is a fundamental part of democracy, but is often vulnerable to interference. By using blockchain technology and other cryptographic techniques, we will create a voting system where individuals can verify that their vote was properly cast and that the election results were tallied correctly.

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**Energy Conservation of Buildings Using IoT Devices**  
2:50 – 3:20  
**Jun Chang, Darence Lim, Tracy Sun, Patrick Wu**  
**ADVISOR: BEHNAM DEZFOULI**

Buildings such as apartment complexes and high-rises consume large amounts of energy, some of which are unnecessary. Our solution entails a scalable, smart home system that will help renters, homeowners, and building managers lower energy consumption and increase energy conservation while maintaining the quality of living for these stakeholders.

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**Smart Mirror**  
3:30 – 3:55  
**Thomas Nguyen, Joseph Phan**  
**ADVISOR: YUHONG LIU**

We have designed a Smart Mirror that displays all the information you need to get started on your day and is customizable to any given user’s profile.

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**Securing Facial Recognition with Machine Learning**  
4:05 – 4:35  
**Songjie Cai, Ruiwen Li, Tor Saxberg**  
**ADVISOR: YUHONG LIU**

This project aims to apply machine learning techniques to reliably distinguish user accounts by using common cameras to make facial recognition logins more accessible to website and software developers. We create a web API that recognizes a user’s face to log them in to their account.

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**Creation and Analysis of Secure IoT Test Bed**  
4:45 – 5:10  
**Alejandro Hernandez**  
**ADVISOR: YUHONG LIU**

The main objective of the project is to design a test bed for analysis of different protocols and encryption algorithms in a secure communication between an IoT device with reduced resources and a server.
Musical Casual Creator for Easy Self-Expression
2:15 – 2:40
Louis Lin, Ian Santillano
ADVISOR: MAYA ACKERMAN
Our project aims to help people with autism express themselves. It is a tool that empowers them to communicate their thoughts and feelings through songwriting.

Snap-n-Snack
2:50 – 3:20
Michael Enriquez, Steve Hoff, Patterson Jaffurs, Quintin Wilde
ADVISOR: MOE AMOUZGAR
There is a large demand for dietary tracking applications for phones, but popular methods are too slow and tedious for many consumers. We propose a system that will take advantage of image recognition and the internal camera of Android phones to identify food from a picture of a user’s plate.

Grumble
3:30 – 3:55
Keerthana Duddi, Nithya Geereddy
ADVISOR: ANGELA MUSURLIAN
Everyone loves food. People usually have trouble deciding where they want to eat. Grumble is a web-based application that facilitates a user or a group of users to reach a common decision about the type of cuisine that would best suit them in that moment.

FrontDoor
4:05 – 4:35
Nathan Amarandos, Michael Hao, Eric Van Lare
ADVISOR: RANI MIKKILINENI
Frontdoor is a web-based mobile application that helps streamline all aspects of renting. This app can improve the renting experience for both tenants and landlords by assisting with logistics such as household task management, fair rent splitting, and general communication.

Computational Music Biofeedback for Stress Relief
4:45 – 5:15
Jason Capili, Mark Hattori, Maile Naito
ADVISOR: MAYA ACKERMAN
Current stress relieving apps can unintentionally increase users’ stress levels, also known as biofeedback anxiety. Our program makes it easier to relax by generating music and binaural beats in response to live brain wave data from the Muse Headband.
At-Home Neurofeedback Treatment
2:15 – 2:40
Frank Cannizzaro, Sanah Imran
ADVISOR: SHOBA KRISHNAN

Neurofeedback is a therapy that can be used to treat depression, anxiety, ADHD, and other disorders. It uses EEG signals to self-regulate brain function; however, it is a costly treatment. Our project is a device that allows for cheaper, home-based neurofeedback treatment.

RealSense Relay
2:50 – 3:15
Shivam Gandhi, Sean Giblin
ADVISOR: RAMESH ABHARI

Our project focuses on an aspect of signal integrity in terms of high speed PCB design and we show its capabilities using Intel RealSense Cameras.

Wireless Multi-User Communication System
3:30 – 3:55
Andrew Song, Brian Tjahjadi
ADVISOR: RAMESH ABHARI

This project’s ultimate goal is to send and receive information wirelessly from multiple unique users at once. Our design includes an antenna with beam-switching capabilities to serve multiple users at once. We are focused on providing a more compact solution along with additional uplink capability and power indication.
ELECTRICAL ENGINEERING SESSION 2
Learning Commons Training and Instruction 205

Vehicle to Everything
2:15 – 2:45
Andrew Harris, Michael Karachewski, Nick Schnabel
ADVISOR: SARAH KATE WILSON
The need for non-traditional forms of communication is constantly growing and, as such, this project looks to provide a proof of concept for the use of visible light communication to help create a better connected environment for smart vehicles.

Buturi Solar
2:50 – 3:20
Patrick Mihelic, Alfredo Munoz, Ruben Tapia
ADVISOR: TIMOTHY HEALY
Our objective is to design and implement a solar microgrid system for a school building in Buturi, Tanzania. We will harvest enough solar energy each day to power 50 light bulbs for 6 hours, a single full charge for 25 laptops, and a single full charge for 10 cellular phones.

Process Optimization for Carbon Nanotubes-on-Graphene Fabrication
3:30 – 3:55
Andrew Michelmore, Julia Shaffer
ADVISOR: CARY YANG
Our objective is to develop a process to fabricate a conductive carbon nanotube-on-graphene nanostructure (CNT/Gr) with vertically aligned CNTs and minimal damage to the graphene. This can be a building block for an all-carbon on-chip interconnect network. This fabricated structure is targeted to yield a resistance of several k or less.

MECHANICAL ENGINEERING SESSION 1
Benson Center, Parlors B & C

Phoenix Y-6
2:10 – 2:45
Sean Backes, Michael Destin, Alastair Hood, Bruce Iverson, Brian Meier, John Strong
ADVISOR: MOHAMMAD AYOUBI
Our mission is to design and fabricate a VTOL, fixed-wing drone for use by emergency first-responders. This vehicle is designed for uses that include surveying wildfires and spotting vehicular accidents. We are developing a working prototype that will be able to collect and relay this important data.
Altered Carbon
2:50 – 3:25
ADVISOR: ROBERT MARKS
This project analyzes the structural properties of 7-axis 3D printing versus traditional FDM printing. The team is working with Arevo Labs to manufacture a motorcycle helmet made from carbon fiber in a PEEK matrix to pass DOT standards as a tangible representation of the capabilities of new additive manufacturing processes.

Active Stabilized High Power Rocket (Savitar I)
3:30 – 4:00
Valeria Avila Guerrero, Angel Barranco, Daniel Conde
ADVISOR: MOHAMMAD AYOUBI
For high power rockets, flight stability is an issue. This active attitude control system, with six degrees of freedom mathematical model, will stabilize the flight path of a 6-foot tall rocket in order to deliver a 4-kg payload to a target altitude of 3 km.

3D Printed Carbon Fiber eBike Frame
4:05 – 4:40
Chris Edwards, Parker Gribb, Joseph Hurley, Fionn Ruder, Mitchell Spinelli, Micah Thomas
ADVISOR: ROBERT MARKS
Utilizing the continuous printing process offered by Arevo Labs, we have designed, printed, and assembled an electric mountain bike.

Auxetic Metamaterial Design for Expanding Backpack Straps
2:10 – 2:45
Bethany Hsu, Derek Lau, Jamie Sahlberg, Titus Whitehead, Leslie Yang, Alexander Winter
ADVISOR: MICHAEL TAYLOR
This project designs a metamaterial to improve backpack strap comfort and safety for Nepalese porters in the extreme working conditions of the Himalayan Mountains. Auxetic metamaterials have a negative Poisson’s ratio due to their geometric structure. The strap will widen under increased load, spreading the forces over a larger area.

6U CubeSat Platform for Disaster Relief Communications
2:50 – 3:25
Uche Agwu, Duncan Bradley, Corey Brown, Mani Gnanasivam, Grant Mishler, Steven Parks
ADVISORS: CHRISTOPHER KITTS, MICHAEL TAYLOR
Natural disasters often devastate communications infrastructure, impeding relief efforts. The SCUCube mission aims to re-establish communications between locals and emergency responders via amateur radio. We have developed and verified the mechanical subsystems of a 6U nanosatellite platform for this continuing mission.
Soft Robotic Hand
3:30 – 4:00
**Zachary Kisner, David Leonardo, Christopher Szigeti**

ADVISORS: PANTEHA SEPEHRBAND, MICHAEL TAYLOR

Our team has designed a 3D printed, soft robotic hand controlled via a pneumatic control system.

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SCU BAJA 2018
4:05 – 4:50
**Felicia Frans, Alexa Giralamo, Mahina Kamoku, Hannah LeBlanc, Justyn Li, Jean Moore, Kelsey Petersen, Kamilah Prentice, Marieden Totanes**

ADVISORS: DRAZEN FABRIS, MICHAEL TAYLOR

For the first time, nine female mechanical engineering seniors are designing and manufacturing an all-terrain vehicle that will compete in the SAE (Society of Automotive Engineers) Baja Collegiate Design Series in June. The competition consists of five events: acceleration, hill climb, maneuverability, rock crawl and endurance.

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MECHANICAL ENGINEERING SESSION 3
Benson Center, Conference Room 21

Frugal Clay Press for Nicaragua
2:15 – 2:45
**Milan Copic, Kevin Ellis, Rafael Guerrero, L. Isaac Marcia**

ADVISOR: TIMOTHY HIGHT

The Frugal Clay Press for Nicaragua is a human-powered device that allows clay brick makers in Ciudad Dario, Nicaragua, to more densely compact and rapidly produce bricks. This design is composed of sustainable and locally accessible materials that make the clay press especially appropriate for implementation in rural communities.

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Dehydr8
2:50 – 3:25
**David Kim, Nicholas Lurie, Catherine Murray, Logan Smith, Ian Tierney**

ADVISORS: ON SHUN PAK, WALTER YUEN

Dehydr8 is an alternative method of food preservation for off the grid communities. The system relies on solar energy to dehydrate fruits and vegetables.

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Vibration Attenuating Medical Platform (VAMP)
3:30 – 4:05
**Cameron Fisch, Noah Friedman, Tyler Gambill, David Harris, Kelek Olais**

ADVISOR: GAETANO RESTIVO

Emergency response vehicles are often traveling at high speeds and over uneven terrain, causing vibrations, discomfort.
or even further injuries to patients. Our platform is designed to attenuate part of the vertical motion, and it can be retrofitted into existing vehicles.

INTERDISCIPLINARY SESSION 1
Bannan Engineering 326

Pressure Ulcer Prevention System
2:15 – 2:40
Rey Palomares, Ojus Rao
ADVISORS: DANIEL LEWIS, SALLY WOOD
P.U.P.S. is designed to prevent injuries such as pressure ulcers from bed-bound patients. Based on information collected from on-body sensors, it will provide automated actions such as notifying a caregiver. It will then display the information on an easy to understand interface.

The Human Keyboard
2:50 – 3:20
Derek Char, Thomas Chung, Alex McKee, Allen Pai
ADVISORS: AHMED AMER, SALLY WOOD, YULING YAN
The objective of our project is to demonstrate the validity of mapping precise arm and hand muscle movements through the use of EMGs. We also strive to demonstrate a software library that can accurately track hand and finger movements.

BOGGLES: Boundary Optical GeoGraphic Lidar Environment System
3:30 – 4:00
Miguel Chapa, Evan Hoerl, Isaac Jorgensen, Carl Maggio
ADVISORS: AHMED AMER, SARAH KATE WILSON
We are creating a proof of concept system that scans the general layout of a room and superimposes the rendering of the scanned space onto a mixed reality headset. This will provide first responders with better spatial awareness in life or death situations.

Halo
4:05 – 4:35
Benjamin Lampe, Taylor Mau, Samantha Morehead, Naeem Turner-Bandele
ADVISORS: BEHNAM DEZFOULI, SHOBA KRISHNAN
Our project aims to create a device powered by energy harvested from its environment that can monitor and log air pollution levels. This device can be used in homes and cities regardless of current infrastructure to promote awareness of individuals’ exposure to harmful particulates.
Unsupervised Parkinson’s Disease Assessment
2:15 – 2:45
Alexander Adranly, Senbao Lu, Yousef Zoumot
ADVISORS: BEHNADEZFOULI, YULING YAN

Our goal is to create a device that will utilize a patient’s daily actions, instead of choreographed actions, to monitor and quantify Parkinson’s disease based on part of the motor control section of the UPDRS scale.

Powering a Biosensor Using Wearable Thermoelectric Technology
2:50 – 3:25
Anneliese Bals, Noah Barnes, Rafael Bravo, Nicolas Garcia, Joseph O’Bryan, Dylan Santana
ADVISORS: PRASHANTH ASURI, HOHYUN LEE

Using our wearable device, thermoelectric modules placed in contact with the skin convert body heat to electrical current, which charges a battery for use in a biosensor. This technology improves users’ quality of life and offers a clean, renewable power source for biosensors when grid power is not available.

Enhancing Mobility and Independence of Wheelchair Users
3:30 – 3:55
Briar Blake, Paul Nauleau
ADVISORS: PRASHANTH ASURI, CHRISTOPHER KITTS

Our design for wheelchair seat and armrest modification to improve user mobility and independence uses an electric scissor jack mechanism to raise the seat and a track system to slide it past the wheels. These modifications help users achieve daily tasks such as accessing chairs, beds, toilets, and car seats.

Urinalysis Screening for Rural Communities
4:05 – 4:35
Dana Bren-Cardali, Lilian Dao, Jeff Destruel, Ryan Fernandez
ADVISORS: SILVIA FIGUEIRA, UNYOUNG (ASHLEY) KIM

The Urinalysis Screening for Rural Communities Project uses urine strip tests to perform health screenings for patients and communicates results with the mobile application.
RF Roaming System Locator: A Modular Omnidirectional Antenna System
2:15 – 2:45
Christian Ayscue, George Stathakis, Josh Sullivan
ADVISORS: RAMESH ABHARI, AHMED AMER
We present a 3 sector antenna location tracking system. This system will track a 915 MHz signal and display the location on a GUI.

Camera-Based Distance Sensor
2:50 – 3:15
Evan Holmes, Kai Schmidt
ADVISORS: ANGELA MUSURLIAN, SALLY WOOD
Our team has designed an electrical component that uses a camera and laser point to sense distance up to 10 meters.

CryptKi: Cryptocurrency Hardware Wallet
3:30 – 4:00
Derrick Chan, Rowan Decker, William Nguyen, Yuya Oguchi
ADVISORS: AHMED AMER, SALLY WOOD
Cryptocurrency technology is growing at a rapid pace and security needs to be in place to protect users from malicious actors. The goal of this project is to provide a portable device built to withstand cyber-attacks and maintain the integrity of a user’s funds.

The Vessel for Autonomous Research UNderWATER (The VARUNA)
4:05 – 4:40
Tyler Briles, Shae Connor, Erin Guthrie, Anthony Jackson, Madeleine Peauroi
ADVISORS: CHRISTOPHER KITTS, SALLY WOOD, WALTER YUEN
We present a low-cost Autonomous Underwater Vehicle for collection of volumetric water data. VARUNA is equipped with conductivity, depth, and temperature sensor payload, autonomous heading and depth control, and is capable of reaching 100 foot depth. This is the first year of a multi-phase project through the Robotic Systems Laboratory.
We wish to thank the following alumni, friends, and industry partners whose participation as judges contributes greatly to the success of the Senior Design Conference.

Jasper Adamek-Bowers '14
Boston Scientific

Jason Adkins '01
Martha’s Corp Taxes and Insurance

Mujda Alamzai '16
Guardant Health, Inc.

Gabriel Alcantar '08
Kleinfelder

JP Allport '15
Super Micro Computer, Inc.

Charles Asaah '14
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Andres Bergeret '11
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Cisco Systems

Brian Janjic '89
IBM

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Bigge Crane and Rigging Co.

George Kaldas '17
Lockheed Martin

Elham Kaviani '12, '13
Applied Materials

Brady Knowles '10, '12
Intuitive Surgical

Chip Koehler '83
SSL

Nonda Kozas '14
BKF Engineers

Rahul Krishnakumar '13
Certain, Inc.

Kristen Kristich-Madar '03, '06
Verso nx

Robert Lathrop '94, '01
Lathrop Engineering

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