College of Engineering and Computer Science
UNIVERSITY OF CENTRAL FLORIDA

Fall 2016 Senior Design Showcase

Dec. 1, 2016 8 a.m. – 2 p.m.
CFE Arena, UCF Main Campus
69 projects by 314 graduating seniors

COMPUTER SCIENCE

12 Projects, 43 Senior Design Students

SoundNStein
A mobile Android music creation app. Users can record their own sounds or choose from a list of sounds. The application then constructs a song from those sounds for the user to enjoy. Streamlines and simplifies the creation of music from seemingly random or curated sounds from across the globe. (Table #58, Indoor)

UCP Bailes Teacher Dashboard
At UCP Bailes, an Orlando school for children with disabilities, teachers use numerous online applications and iPads. This user-friendly centralized system features an online dashboard to retrieve information from the websites used by each classroom, and stores the information in a database and presents a summary to teachers/ administrators. The heart of this application is its ability to collaborate with other classrooms' systems to bring all student information together as seamlessly as possible, thus saving teachers and administrators countless hours. (Table 56, Indoor)

Polaris
A mobile web-based solution to help people find rooms and points of interest in large buildings. Includes a way to track user's current location and their destination, to make finding the target intuitive for users. Meant to be used indoors, unlike other tracking technology that relies on outdoor environments and GPS. (Table 54, Indoor)

Mobile Information Tracking System
Handles inventory tracking as a business support function. The iOS application allows end users to send notifications when inventory is needed, then administrators can use the same application to track the deployment of inventory to requested locations. A web application allows administrators to review order frequency and create reports. (Table 52, Indoor)

Heart Link
Designed to help medical professionals connect with their patients, using Apple's iOS Health system and various heart monitoring devices to record and analyze patient's heart activity. For use in a hospital's cardiovascular unit, with a goal to reduce the number of patients that require open heart surgery. By using this tool, hospitals can save approximately $17,000 per prevented surgery re-admission. This project is lower cost than similar systems. (Table 50, Indoor)

Project No A.N.G.S.T. (Automated Next-Generation Stress Tracker)
The tool uses heart-rate, sleep and activity data – and contextual weather and location data – to determine if the user is stressed. If stress is signaled, the tool sends a notification to the user's smart phone with a "stress health intervention" – such as notifying the subject to take deep breaths or take a short walk. Stress health is a facet of mental health that often goes unaddressed yet can be the root of negative symptoms and health outcomes. Could be used by professionals in high-stress jobs, such as police officers. Sponsored by Dr. Julie Hinkle of UCF College of Nursing. (Table 48, Indoor)
(continued)

Study Squirrel: Bringing People Together
A user-friendly application that assists students in creating, finding and joining study groups. Student safety is factored in with email verification so only university students with a ".edu" account can register. Leverages flexible cloud hosting environment and a lean ecosystem of supporting components. (Table 46, Indoor)

Nimble Flight Simulator Project
Provides the most true-to-life flight experience, accounting for aerodynamic and environmental factors. Nimble FS uses the advanced and popular Unreal Engine 4 allowing for cutting edge graphics and high performance. Based on an open platform, and built with extensibility in mind so that it may serve as the foundation for simulation, training, research and recreational activities. (Table 44, Indoor)

PsychVR
Virtual reality can be used to treat a number of psychological issues but is only available in research labs, and not on a consumer level. This project provides a customizable suite of therapeutic virtual reality environments for a consumer-level VR device, the Oculus Rift. This project's three modules have been built to help people with acrophobia, social anxiety, and general anxiety and stress. Each can be customized to the user's needs. Created to be available at the lowest-possible cost. (Table 42, Indoor)

V.E.D.I.C. – Virtual Environment for the Development of Interactive Code
A proof-of-concept project that adds a third dimension to improve the intuitiveness of data structure analysis in databases and object-oriented programming, with a platform for 3D object programming. The third dimension would be added through VR (Oculus DK2), and the interaction with it uses Leap Motion Controller. A person can interact with their database in ways not possible with two-dimensions, enabling users to analyze the structure of that database and its content in a visual way not currently available. From an educational standpoint, a user could program using actual objects rather than pure text. (Table 40, Indoor)

SpaceMate
A predictive roommate matching application employing machine learning to suggest potential matches based on user behavior. Addresses the daunting task of sorting through potential roommate matches and finding one that will be conflict-free. Improves upon current roommate finders such as RoomSurf, Facebook and Craigslist – as they have no way to sort through hundreds of potential candidates that meet roommate preferences and requirements. This system combines dynamic filters and machine learning to filter and sort the potential candidates, and uses a feedback loop to continually learn and improve results. (Table 38, Indoor)

DRONES – Damage Reporting On Necessary and Essential Structures
This project is software for drones to enable aerial inspections on infrastructures that require regular or frequent maintenance. Remote controlled drones can do the dangerous task of inspecting work areas such as construction sites. This mobile application enables engineers to set GPS markers around the sites to be inspected, and then converts the markers into route instructions for the drone. Project also features a web portal to analyze and view comprehensive reports from the data gathered. (Table 36, Indoor)

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ELECTRICAL AND COMPUTER ENGINEERING

25 Projects, 91 Senior Design Students

Fish and Chips – Automated Aquarium
Automated features include water chemical monitoring, feeding, camera stream, lighting, and temperature control . Designed for freshwater tanks but could be adapted for saltwater. (Table 30, Indoor)

Big Rig Emulator
Guitar flex pedal that provides portable, less expensive and more reliable option for the guitar player. Has three output options: playing live music, headphones for quiet practice; and digital USB output for recording. (Table 28, Indoor)

The Everything Finder
Application sends alert to the device to help locate lost items with a light or sound signal. (Table 26 Indoor)

AirBud – Automated Fixed Based Operator
Designed for smaller airports that do not have Fixed Base Operators who provide pilots with current wind information and perform transmission radio checks with pilots to ensure communications systems are working properly. Current systems in use cost $75,000. This concept can be produced under $500. Uses a Raspberry Pi interfaced with a printed circuit board (PCB), wind station and VHF radio. Tested at Apopka Airport. (Table 24, Indoor)

KittyBot
Meant to interact with pet cats to entertain them, this small spherical robot rolls on its own. A video of a cat interacting with the KittyBot will be shown. (Table 22, Indoor)

Smart Skateboard
A sensor attached to the bottom of a skateboard analyzes motion of the skateboard and sends results to user's smart phone so that user can see what tricks are being performed and other statistics such as speed and height. (Table 1, Outdoor)

S.S. Entertainment - Stand Alone Solar Entertainment
A mobile entertainment system that uses solar cells to actively collect and manage power. From this device, a person can play music via Bluetooth, cool beverages, control lighting and charge mobile devices. Designed to go anywhere and bring the party with it. (Table 2, Outdoor)

Home Secured
Home security system improves on existing technology. Features include RFID reader for easy arming and disarming, non-standard sensors such as a tilt sensor to see when people access doors, and an LCD screen so users can view data logs and system status. Allows convenience and greater control of the system. For example, it can see if your child disarms the system to sneak out. (Table 20, Indoor)

Wireless Applications of a Refactored Prosthesis (W.A.R.P.)
A control module for Limbitless Solutions' bionic arms that allows for full wireless configuration of the arm over Bluetooth via mobile application. Includes embedded EMG, accelerometer, gyroscope, servo leads with variable hardware and software thresholding, and an LED array. Made to provide tools for future development: fully functional embedded operating system, backend server for data analysis and modular hardware design. (Table 2, Indoor)

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Electrical and Computer Engineering continued

H.A.P.P.I. Systems – Home Audio Programmable Pathway Illumination Systems
A system of solar powered lawn spikes and a central hub that greets a person walking to the front door of a residence with a music and light show. Sensors detect a person within a certain distance of the spikes and sends an alert to the central hub. Increases curb appeal and also can be used in the backyard for additional entertainment value. Could also be adapted for home security. (Table 16, Indoor)

Smart Buoy
A solar-powered, data collecting buoy capable of measuring water and air temperature, wind speed, wave height and salinity level. Provides a cheaper alternative to field researchers, fishermen, surfers. Buoy connects to a phone via Bluetooth. It would be the lowest cost option available and also the first consumer-grade buoy that accurately measures salinity. (Table 3, Outdoor)

Visible Emission Near-Infrared Up-Conversion Spectrometer (VE-NUS)
Aims to give users a lower-cost option for near-infrared spectroscopy. System converts a range of near-infrared light into visible light for analysis by an inexpensive visible light detector. Works by using an electron-trapping phosphor to up-convert the light. After up-converted and analyzed, it is then correlated back to the near-infrared wavelengths. (Table 19, Indoor)

Diabetic Breathalyzer
Monitors blood glucose levels non-invasively to eliminate routine needle pricks. Project uses Volatile Organic Compound Sensors to measure the concentration of acetone in the breath. Once sensor reads acetone levels, it sends results via Bluetooth to user's smart phone for tracking and logging. Research suggests that breath acetone concentration is directly related to the increase in ketones, present in diabetics when blood glucose concentration rises. While this relationship seems simple, it has never been done before. (Table 4, Indoor)

C.O.R.E. – Controller for Organic Range of Exoskeleton
Aims to help people with Arthrogryposis Multiplex Congenita, a curvature of joints that limits a person's limb mobility. This is a control system for a joint electrical-mechanical team effort to construct an exoskeletal arm. The arm assists with mobility with a first-of-its-kind hybrid design. It will be actuated by a stepper motor and cable drive to simulate the elbow movement, and pneumatics system for hand control. Will be built for wheelchair users in first iteration, but can be upgraded to a future portable prototype. Sponsored by Limbitless Solutions. (Table 18, Indoor)

A Helping Hand – ACDC
Robotic arm that mimics the user, who is wearing an exoskeleton fitted with motion capture sensors that send data wirelessly to the arm. The arm receives the position data and mimics the user. Sponsored by Hewlett Packard. this human-controlled robot allows for an employee to fix machines remotely at the company home base instead of traveling offsite to fix the broken machine in person. Different from other systems because it uses motion capture technology (vs a joy stick or controller) to control the robotic arm. (Table 14, Indoor)

Home Interactive Notification Tracking (HINT)
A wearable device to assist parents to teach their children to do chores around the home. The user can set up notifications for every room in the house. Interactive notifications include audio, LCD screen for visual notifications, flashing light and vibration. Fun, arcade style user-response button is included so that the user can tell when a task is completed. (Table 12, Indoor)

(continued)

Solar-Powered Automatic Aerobic Composting Machine
Easily converts food waste into usable compost. Uses sensors to monitor temperature and humidity of the compost. Feedback is then used to define whether moisture needs to be added to the material inside container. If temperature gets too high, container rotate to enable air flow to cool the material. Information can be accessed through LCD display and an iOS mobile application. System is powered with a 12-volt battery that is charged with a 50W solar panel. (Table 6, Indoor)

Mirror Image
User-friendly smart mirror employs voice and gesture control to access and interact with different applications to ultimately assist user manage time. Also has a wireless phone charger. Project uses lower-cost hardware and software to make it more cost-effective than other smart mirrors available. (Table 10, Indoor)

A.S.L.A. – American Sign Language Assistant
Eliminates the need to have a translator when a deaf or hard-of-hearing person is giving a presentation. With this project, a glove and a computer serve as the translator. User wears a smart glove that registers gestures and sends it via Bluetooth to a computer that recognizes the gesture as a word or phrase and speaks it. Past projects have attempted this and achieved in translating single letters. This project aims to get words. Intended to be used at conferences, classes, meetings or, if turned into a mobile app, regular day-to-day settings. (Table 8, Indoor)

High-Performance Variable Frequency Motor Drive
Designed specifically for electric vehicles, the project incorporates an active feedback control system to manipulate the speed and power produced by an AC motor with performance on par with existing high performance systems. The electric vehicle market currently has a need for a low-cost, high performance system. Existing drives can cost $1,000+. This project aims to cut the cost in half. (Table 27, Indoor)

Posture Perfect
A chair that reminds the user to maintain good sitting posture and take regular breaks. It measures a user's posture while they are sitting in the chair and provides feedback through the chair and a companion app. (Table 29, Indoor)

Interactive Bigger Badder Beer Pong Table (IBBB)
Aesthetic LED matrix, cup sensor system, ball tracking system, sterilization system and a foul line. Centrally controlled by a Raspberry Pi that will be connected to the system. This project improves on what's now available because it creates a more efficient way of tracking rule-breaking and score keeping while providing a clean, fun environment. (Table 60, Indoor)

S.E.M.S. – Smart EV Monitoring System
This project aims to improve the electric vehicle experience at UCF. This low-cost system limits accessibility so that only UCF students, faculty and staff can use it. To start the charging station, users are required to enter their NID in a keypad and swipe their UCF ID. The station will charge the vehicle and collect data on the vehicle's state of charge and power input. Data will be sent to a smart phone application. (Table 25, Indoor)

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Smart Mirror
Provides current time, date, weather conditions and news headlines to help people get ready for the day or night. With a brief look in the mirror, users will receive information from eight unique software modules without affecting mirror visibility. User will be able to talk to the smart mirror for calendar and appointment reminders and can listen to music via an integrated music player. (Table 23, Indoor)

Wireless Energy Autonomous Robot (W.E.A.R.)
A charging apparatus for electric vehicles on the road to increase battery longevity and efficiency, to ultimately increase travel distance. Employs a wireless charging system built under the track (road). The robot (car) has a built-in receiver to gather the wireless energy being resonated from under the track. This is a new and improved way of charging a vehicle, to eliminate stopping and charging the vehicle for hours before the next use. (Table 21, Indoor)

INDUSTRIAL ENGINEERING & MANAGEMENT SYSTEMS

10 Projects, 49 Senior Design Students

I-CON - Workstation Optimization
Aims to alleviate ergonomic problems and capacity constraints through an analysis of client's current work environment. Time studies, ergonomic evaluation, simulation, and safety standards play a role in the redesign of the workstation, with an emphasis on analyzing the conversion from individual workstations to an assembly line, to reduce the strain on operators while improving throughput by reducing cycle time. (Table 4, Outdoor)

NASA Mars Base Surface Simulation
To support NASA's human-manned mission to Mars planned for the early 2030s. For this to happen, many new technologies and capabilities will need to be tested in a simulated environment before being used on Mars. This project is a 3D simulation of the Mars base, created using a simulation program called SIMIO. Simulation of the Mars base will be vital in ensuring that designs are feasible. Having this resource that can interact with other simulations will allow future technology to be designed and implemented into the simulation with the current designs. (Table 17, Indoor)

Team I-CONeering
ICON Systems, Inc., produces six different families of stainless steel fixtures. But the manufacturing processes are not standardized. This team worked to standardize each of the steps required for producing particular fixtures. (Table 1, Indoor)

New Kensington Facility Layout Improvement
Sponsored by Siemens to improve storage for a facility in New Kensington, PA. This team sought to increase efficiency of handling various kits that are assembled and received at the facility. Team sought to standardize kit locations (time to locate kits was about two hours). Team employed Lean Design method. (Table 3, Indoor)

(continued)

Radius Compound Variance Reduction
A specific chemical, radius compound, is used in the boat manufacturing process at Boston Whaler. The company experienced an increase in variance during a 20 month time period, which added cost to the company. This team led an investigation and recommended actions to mitigate the increasing use of the material to ultimately save money. (Table 5, Indoor)

Reducing Waste in Patient Registration Process at Orlando Health's Emergency Department
Project aims to analyze the process a patient access team member goes through in order to register a patient in the emergency department. This project employed industrial engineering concepts in the evolving healthcare industry to streamline human processes and understand where wasted effort takes place. (Table 7, Indoor)

MC Assembly – Doble Line
Team worked to improve the process and layout of assembly line for client. Team used the 5S approach to reduce waste – sorts, straightens and organizes the workstation so employees may be precise and effective. The team used Six Sigma tools to identify areas of the process that were Value Added and Non-Value added. Team used SIMIO computer simulations in their approach to help client. (Table 9, Indoor)

MC Assembly – Neptune Line
Team was tasked with improving the client's manufacturing lines for Neptune. Currently parts are manufactured in a batch process, which means that as each part is made, it must wait for other parts to catch up to it and then the parts are completed as a batch. Team recommended improving the process with a single piece flow method that ensures each part is constructed by the next step in the manufacturing line as it is received, reducing wait time. Team also recommended a redesign of the actual manufacturing line. (Table 11, Indoor)

MC Assembly 1 – Thales Product Flow
This team was tasked with improving the Thales production line within the Melbourne production plant. The team recommended a change in flow of production from its current batch process and integrate a single piece flow production that will function more like a pull system. Ultimately the client should see cost savings, and the client's customers will benefit by having constant product availability.
(Table 13, Indoor)

United Launch Alliance
The team is working with United Launch Alliance to revamp their current scheduling models and tools. To help ULA remain at the top of its industry, UCF industrial engineering students have designed an all-encompassing scheduling program that factors-in client's personnel, space, and time constraints. The program will then be implemented in the spring by the computer science students as they perform maintenance and quality assurance checks throughout the final stages. (Table 15, Indoor)

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MECHANICAL AND AEROSPACE ENGINEERING

22 Projects, 131 Senior Design Students

Soft Shell Assistive Exo-Hand
Low-cost robotic glove to assist wheelchair users with upper-limb disabilities. Glove is detachable from the rigid frame/whole system. Intended for use as a medical or rehabilitative device. (Table 59, Indoor)

Ocean Wave Power Generator (Green Team)
Harnessing the power of ocean waves, this project captures the rise and fall of waves that turns a generator for power output. Lightweight, portable that could be used by most beach-goers. Could be used by multiple users to charge personal electronics. (Table 31, Indoor)

Wave Power Generator (Red Team)
Multiple water turbines exist at the head of a long cylindrical piston attached to an anchor. As a wave pulls on a floating pad, a weighted scoop inside the piston rises, forcing water in the piston up and into the water turbines to generate electricity. The charge is then held in a battery inside the system. This is a concept that is easily scalable to any size, and is only restricted by the budget. (Table 9, Outdoor)

Flow Monitoring Device
A system for Guard Dog Valves that is capable of monitoring water flow rates through the valve. Also saves water flow rates for specific units. Can aid in buildings getting LEED certification.
(Table 57, Indoor)

Solar Thermal Water Heater – Blue Team
Used to directly heat a home's water with the sun's energy. An easy and understandable system that can be built and installed as a DIY project by the average user in a weekend. (Table 5, Outdoor)

Solar Domestic Hot Water System
Designed to provide hot water to a building. This system is projected to provide a reasonable return on investment and be relatively inexpensive compared to other renewable energy installations.
(Table 6, Outdoor)

Solar Thermal Hot Water Project
A solar thermal collector which can replace a traditional electric/gas powered water heater by providing the close to the same amount of hot water with none of the daily cost. System provides 40 gallons of hot water for a household of three to use. (Table 7, Outdoor)

Universal Leak Detection and Monitoring System – Blue Team
A detection system for any type of business or residential plumbing system to prevent leaks or disastrous floods. This system monitors in-line changes in pressure over specified time periods. Uses two pressure transducers, a microcontroller, and a custom built algorithm, this system can detect leaks as accurately as several milliliters, and provide water waste statistics for each unit it is applied to. (Table 8, Outdoor)

LEASH (Leak Evaluation and System Housing)
Provides quantitative volumetric flow rate data and visual representation of a toilet leak rate. Sponsor is Guard Dog Valves. Flow rate measurement system uses a continuous fluid level sensor to measure volumetric flow over time. The sensor measures the fluid level based on the change in resistivity as the water height increases. (Table 55, Indoor)

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Micro Unmanned Aerial Vehicle
Provides a solution to rapid local payload transportation and surveillance. A lightweight unmanned aircraft that fits into a 6" diameter tube to allow for ease of transportation and rapid assembly of components. Allows minimally trained personnel to transport, deploy and reliably deliver a task. (Table 53, Indoor)

Micro Unmanned Aerial Vehicle – Team Blue
Can easily be disassembled to fit inside a six-inch diameter tube and can hold a small payload. Modular design allows the wings to be split into different sections that will fit together and be held in place by neodymium magnets. The fuselage and the wings can be put in the tube separately. Design allows for quick assembly of the UAV. (Table 47, Indoor)

Micro Unmanned Aerial Vehicle (Society of Automotive Engineers) – Team 12K Gold
Team was tasked to design a plane as light as possible while carrying maximum amount of payload weight. This project is a 4 foot x 4 foot plane that weighs under five pounds, and fits inside a six-inch diameter tube. (Table 41, Indoor)

Human Powered Vehicle Cargo Attachment (Kenya project)
Solves the cargo carry problem experienced by farmers in Kenya. Efficient way of transporting fruits and vegetables over rough terrain. Employs a hanging system of "hammocks" where produce will be safeguarded from damage when traveling through rough terrain by use of flatbed or bicycle attachment. (Table 51, Indoor)

Human Powered Vehicle (Water Delivery System for Kenya)
Provides an effective means for an individual to transport water above current attainable limits. This system is a hand cart that can carry 30 gallons of water from a local water source to a nearby settlement. Can carry a liquid load plus has an additional cargo rack that can carry 100 pounds. (Table 33, Indoor)

Human Powered Vehicle Tow Behind Water Filtration System (Kenya project)
A tow-behind cart system that can attach universally to any black mamba style bicycle, while being able to hold and filter up to 30 gallons of water. Target cost of project is under $175. (Table 49, Indoor)

Powerless Removable Assistive Therapeutic System (P.R.A.T.S.)
Assists people with clenched hand symptom. Allows person to open their hands to be able to grab objects. Rehabilitates defective muscles. Employs springs, rods and bands to provide an opposing but flexible force to the constant force that causes a hand to clench. Sponsored by Limbitless Solutions. (Table 45, Indoor)

Hybrid Powered Arm Carapace
A powered assistive device for users who have limited to zero upper limb mobility. Sponsored by Limbitless Solutions, whose previous projects have assisted people with missing limbs, this project helps people who have limbs that are mobility impaired. Produced primarily through 3d printing to allow design to be fitted to anyone at a fairly inexpensive production cost. (Table 41, Indoor)

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Distributed Electric Propulsion – DEP Red Team
NASA design challenge aims to outperform aircraft that use turboprop engines. DEP aircraft use a "blown wing," where propulsive output is distributed over the span of the wing rather than at one or two points found in existing turboprop aircraft. This project design is a Turboelectric Distributed Propulsion system to transmit power from turbomachinery to an electrical generator that powers electrical motors to spin propellers mounted across the span of the wing. The increase in velocity over the wing improves lift and drag characteristics. The concept is intended to lower cost of transportation, reduce fuel consumption, and reduce emissions. (Table 61, Indoor)

Distributed Electric Propulsion Aircraft – DEP Green Team
Distributed Electric Propulsion (DEP) technology aims to eliminate the use of turbines and increase lift while reducing drag. Could also mitigate noise, provide better ride quality for passengers, and more. DEP uses multiple sources of propulsion on each wing to distribute propulsion along the wing.
(Table 35, Indoor)

Distributed Electric Propulsion (DEP)
This project designed a 19-passenger aircraft that uses DEP as its method of power and propulsion. DEP uses multiple sources of propulsion on each wing (normally propellers) to distribute propulsion along the wing, thereby increasing lift over the entire wingspan. (Table 43, Indoor)

Mitsubishi Hitachi Power Systems Shaped Tube Electrochemical Machining Electrode Redressing Machine
Client's stated problem was outside vendor quality and lead-time issues. Client wants to be able to redress electrodes in-house and also redress all types of electrodes. This project is designed to hold the electrodes without causing harm to them while refinishing their proper geometry. The solution will save the client money and provide a way to redress in short periods of time to keep production flowing.
(Table 39, Indoor)

Design of a Roller Coaster Component for Local Theme Park
Will not be included in showcase.